

# Design of Occupational Health and Safety Management System Based on ISO 45001, for a Company that Manufactures and Commercializes Low Voltage Electrical Boards

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Many companies in the search for to make themselves known and increase visibility, which involves the transmission of confidence in the products offered, and in the execution of processes in a safe way, resort to the implementation of management systems. In this contribution, is proposed the design of the Occupational Health and Safety Management System for a company that manufactures and markets low voltage electrical panels. The main is to improve the working conditions of its employees and the productivity of the organization. All work carried out was supported both in ISO 45001: 2018 and in Colombian legislation. The actions will allow the growth of the company internally, will contribute to the development of logical processes, and in stages for improvement, continues having as a principle the PHVA cycle. It is essential to mention that, during the operational phase, tools such as preventive medicine, hygiene, and industrial safety programs were developed, as well as alternatives that involve verification of compliance with the established requirements of the standard, and thus achieve the results desired management system. Designed solutions were based, in analysis and development of identification of risks and hazards as the first instance, this was essential for the documentary design of the Management System, where it intends the standardization of the processes and the increase in the effectiveness in the company.

## 1. Introduction

The problems that develop within the companies that are associated with the changes of demographic nature, technological, environmental, and the changing organizational, have generated much concern in terms of occupational health and safety (OHS). The main concern is everything that may cause risk labour or operational, or that can cause an occupational disease, and besides, both the risks and the diseases that have a result moments of disabilities temporary or partial, and even to episodes where the consequence is the death, which can lead at the detriment to the detriment to the workers, companies and society in general (Rachid et al., 2015). The importance has given to the protection of health and safety of workers, as processes, brought during the last decades the development norms and standards to protect the workers. (Gholami et al., 2015). In the case of Colombia developed through the Ministry of Labour, a series of laws, decrees, and resolutions to regulate and support the OSH. It is essential to mention that the country is not only applying to standards national, but there are also standards international of which serve the foundation for the formulation of the standards for the development of occupational health and safety management system (OHSMS), such as the case of the standard international ISO 45001. The standard ISO 450001 is an instrument useful for the organizations in for improvements proactive in health and safety occupational, independent of the size, type, and nature of the organization (Darabont et al., 2017). When the companies follow the standards regulated by the ISO 45001, they may provide places of work safe and healthy for workers, and so it will not affect their processes productive. These actions contribute to be more competitive, which leads to having a good reputation and confidence in the products and services offered. According to the statistics delivered by the ILO (International Labour Organization), annually is estimated that about 2.3 million

women and men around the world die from accidents or diseases related to work (which corresponds to 6,000 deaths a day). Also, annually in the different sectors of the economy, there are about 340 million accident labour and 160 million victims of diseases related to the work (ILO, 2019).

In Colombia, the metal-mechanic sector is one of the sectors where it corresponds to 15% of the jobs industrial of the country. In this sector, there is one variety of risks (physical, chemical, ergonomic, among others), because of the constant contact of workers with tools sharp, sanders, and welding machines that can produce different types of risk. Similarly, depending on the process, the material source and the conditions of operation also will be produced to several risks (Marmo & Danzi, 2018), which at the end of accounts can influence the process productive due to interruptions (Bayonne et al., 2019). Based on the above, the companies have worried about minimizing the risks derived from its activity, and it needs the organization to define and implement strategies both to improve productivity and to reduce the risks and accidents associated. Therefore, this work, it has developed the design of the OHSMS for a company of the sector metal-mechanic that as the main activity is dedicated to the Manufactures and Commercializes Low Voltage Electrical Boards. This design is made by applying ISO 45001, which will allow the company to acquire great importance and domain in the market both domestic and international since the adoption of the system represents a strategic decision and operational in pro of the improvement and fulfilment of its objectives.

## 2. Methods

The company studied corresponds to the metal-mechanic sector and is in the city of Bogotá (Colombia). For the development of the design of the OHS system management, it used the international standard ISO 45001. The development of the study was carried in four stages. Figure 1 shows a diagram of the methodology employed by stages.

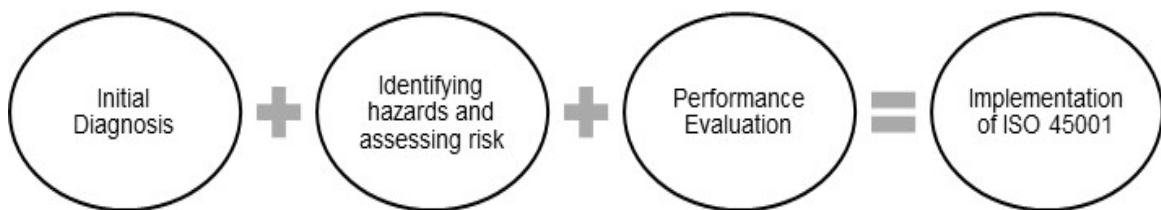


Figure 1: Methodology by stages

### 2.1 Initial diagnosis

This first stage reflected the current condition in which it found the organization. It will help to develop the guidelines necessary to give compliance to the annual work plan to be developed, and it will allow identifying the priority areas that should intervene. The determination of the accident rate through a health diagnosis divided into two sections was made. In the first section, the conditions sociodemographic of workers and, in the second section, the occupational characteristics were identified. Also, a documentary review of diagnosis that is currently working on was carried out to verify the level of compliance for standard, and that is the structure that will allow taking the decisions necessary for the planning of OHSMS.

### 2.2 Identifying hazards and assessing risk

In the second stage, it is performed the identifying hazards and assessing risk, in which is valued the risks on the basis the existing controls, identifying any action or characteristic of any situation or tasks that can cause damage to personnel, equipment, or the environment, which will allow knowing the significant risks at the operational and administrative level. A matrix was used for risk assessment, considering the likelihood (L) and severity (S) parameters, where the level of risk and intervention (RL) is determining from the product of the two parameters evaluated ( $RL = L \cdot S$ ). This matrix is taking from ICONTEC (2012). Table 1 shows the risk assessment matrix, considering the levels of likelihood and levels of severity, and in Table 2 are presented the parameters that define the likelihood of events where the failures occur.

### 2.3 Performance evaluation

In the third stage, an evaluation of the effectiveness of the OHSMS is carried out that is currently implemented in the company to determine the compliance that exists, considering the standard ISO 45001. Methods for monitoring, measuring, and analysis will be established to verify valid results.

## 2.4 Implementation of standard ISO 45001: 2018

Finally, considering the stage above is carried out the verification of the data obtained and proceeds to plan activities in which they will implement the elements missing in order to comply with this standard.

Table 1: Risk matrix

Severity(S)		Likelihood (L)				Risk Level (RL)	
Level	Description	40-24	20-10	8-6	4-2	Level	Description
100	Death	I 4000 -2400	I 2000-1200	I 800-600	II 400-200	I 4 000 - 600	Critical situation. Suspend activities until the risk is under control. Urgent intervention.
60	Irreparable serious injuries or illnesses (Partial permanent disability or invalidity)	I 2400-1440	I 1200-600	II 480-360	II 240 - III 120	II 500 – 150	Correct and take control measures immediately. Nevertheless, suspend activities if the risk level is above or equal to 360.
25.	Injuries or illnesses with temporary incapacity to work (ILT)	I 1000-600	II 500-250	II 200-150	III 100-50	III 120 – 40	Improve if possible. It would be appropriate to justify the intervention and its profitability.
10	Injuries or illnesses that do not require disability.	II 400-240	II 200 - III 100	III 80-60	III 40 - VI 20	IV 20	Maintain existing control measures but should be considered solutions or improvements, and regular checks should be made to ensure that the risk is still acceptable.

Table 2: Likelihood parameters definition]

Code	Definition
40-24	The unfortunate situation with continuous exposure, or very poor with exposure frequent. Typically, risk materialization occurs frequently.
20 y 10	The unfortunate situation with frequent or occasional exposure, or deplorable situation with occasional or sporadic exposure. Risk materialization may occur several times in working life.
8 y 6	The unfortunate situation with sporadic exposure, or situation that can be improved with continuous or frequent exposure. Damage may happen sometime.
4 y 2	The improbable situation with occasional or sporadic exposure, or situation without remarkable anomaly with any level of exposure. It is not expected that the risk will materialize, although it may be conceivable.

## 3. Results and discussion

In the initial diagnosis, the survey conducted at 20 employees (10 operational, 10 administrative ), which make part of the company staff, allows observing that at the demographic level, 75% of the population of the company is young (21-40 years), there is male dominance (55%). The highest level of education (professional) correspond to the staff in the administrative area. Within the occupational characteristics, it is seen that the company has all its staff registrant to a health regime. Also, the company has high employee turnover, because 40% of the employees are less than 12 months seniority, and the main movement of personnel occurs in the operational area. The above findings are shown in Table 3.

Table 3: Characteristics of the surveyed employees

Variable	Description	Operational	Administrative	Total		
Sociodemographic	Sex	Male	5	6	11	20
		Female	3	6	9	
	Age	21 – 30	4	6	10	20
		31 – 40	3	2	5	
		41 – 50	3	2	5	
		None	0		0	
	Education	Primary	4	0	4	20
		High school	4	0	4	
		Technical	2	2	4	
		Technologist	2	2	4	
Professional		0	4	4		
Seniority	Less than 12 months	5	3	8	20	
	Between 24 and 36 months	1	3	4		
	Over 37 months	5	3	8		
Occupational	Health	Contributory insurance	14	6	20	20
		Subsidized insurance	0	0	0	
	Working hours	8 hours	3	6	9	20
		9 hours	6	2	8	
	Overtime	10 hours	1	2	3	20
		YES	6	4	10	
	NO	6	4	10		

Besides, the information collected from sociodemographic and occupational characteristics, it was obtained information from the statistics of diseases that caused absenteeism in the company during 2019. Table 4 reflected the results categorized for the different diseases that reported the staff of the company.

Table 4: Statistics by the disease year 2019 (20 people evaluated)

Disease	Operational	Administrative	Total	Percentage
Diseases of the system nervous	0	0	0	0%
Diseases of the respiratory system	2	0	2	22%
Certain diseases infectious and parasitic	0	1	1	11%
Diseases of the genitourinary system	0	0	0	0%
Diseases of the musculoskeletal system and2 connective tissue		1	3	33%
Injuries, poisonings and some other consequences of0 an external cause		0	0	0%
Diseases of the eye and its annexes	0	1	1	11%
Diseases of the digestive system	2	0	2	22%
Unclassified	0	0	0	0%
Total	6	3	9	100%

According to the study carried out, be inferred that 33% could be related to work activity, while the remaining 77% could not. However, it founded that the company does not have enough controls when regulating activities that can affect the health of workers. The routine is one of the most influential factors. Currently, the company has managed every situation in the same way, and fortunately, no serious accident has occurred. It does not consider any intervention necessary as there have been no adverse consequences.

A risk assessment in the different areas of the company (administrative and operational) was carried out. However, Table 5 shows the risk assessment in the area of production for those with higher values. It is essential to mention that most of the risks assessed correspond to activities that are routine within the operation of the company.

Table 5: Evaluation of the risk of the area of production

Process	Tasks	Hazards	Effects possible in the health	Existing controls	Risk Assessment				
					Source	Medium	Individual	L	S
Cutting	Measuring, cutting, checks the cutting, transfer material	Improper handling of machines and equipment	Possible injuries that generate in deep cuts or injuries	N / A	None	Individual	8	25	200
Bending	Enlist material, bending, measure, check the bending	Repetitive movements	Low back problems, lumbar injuries	None	None	None	8	25	200
Welding	Align metals with weld spots, translate to polishing area	Exposure to gases and vapors	Generation of fires, burns, respiratory tract irritation, eyes, and skin	Inspections, Maintenance of the equipment	None	Personal Protection Elements, Studies of manipulation of chemical	8	25	200
Polishing	Polishing the surfaces of the metal box for painting activities.	Noise: Impact continuous and intermittent produced by other processes and the same. Particulate Material: Detachment of particulate matter generated by the process. Effort: Application of force when polishing. Natural phenomena: Wave, Precipitation, Earthquake.	Headache, stress, hearing loss, irritability.	Inspections, Maintenance of the equipment	None	P.P.E., Training, Medical Exams.	24	25	600
			Skin and eye injuries, burns	None	None	P.P.E.	24	10	240
			Wounds, hernias, falling and breaking a bone	None	None	Training in force management in work activities	18	25	450
			Respiratory diseases, death.	None	None	Emergency drills	6	100	600
Punching	Change matrix, graduate, measure, and punching	Improper handling of machines and equipment the parts to work	Mechanical Risk	Upper limb entrapment	None	None	24	10	240
Painting	Mix paint with anticorrosive in the tray, mixing, paint and inspect each product performed	Exposure to gases and vapors	fires, personal burns, and burns third parties	Anticorrosive with less toxic material	Specific area with various ventilation filters	Use of double filter mask, nitrile gloves, and P.P. E.	12	25	300
Assembly	Assembly and verification of the process	Repetitive movements	Skeletal hand injuries	None	None	Keep track of the time of active breaks corresponding to the work	24	10	240

In general, it is concluding that the risks are associate with inappropriate positions, monotonous tasks, and repetitive movements. It is suggesting improvements related to the distribution of positions; all this associated with a redesign of the production plant. The processes need to enlarge the zone. Additionally, the finished

product needs a specific storage location. It is also suggesting an extension of the corridors due to the product is invading the spaces. Regard to the part postural is recommending performing exercises to warm up and stretch during the day work, as well as the take a break from work and perform other activity that to help to relax the body.

#### 4. Conclusions

In the research, the different problems existing in the metal-mechanic company, which are related to the lack of safety and health, were evaluated. The respective activities of prevention, protection, and promotion of workers' health are also presented. The shortcomings in the plant distribution were found. Likewise, it is essential to recognize that a company consists of interactions of several components on a socio-technical system, including people, work situations, technical systems, and organizational structure that, when combined with a sequence of events, can generate an occupational accident. It is intended that companies take measures to prevent such accidents, and where these measures include improvements in the organizational structure, through analysis to properly manage resources, and this also involves monitoring study, among others. Finally, it should be noted that the use of P.P.E. and its training can help mitigate some of these problems.

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