



Importance of Quality Control in the Assembly Process of Auto parts for USA Exportation.

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Abstract

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<p>This thesis aims to demonstrate the importance that quality control has in the auto parts industry during the assembly process for then exporting them to the United States. The document describes the different types of quality inspections, the main requirements for exporting the auto parts, and what would be the possible consequences if they appear to be defective.</p> <p>Ensuring quality in auto parts when they are exported is crucial for developing customer loyalty, avoiding legal problems, and standing out among other strong companies. This research aims to explain clearly to everyone interested in the topic why companies should procure quality in every operation before exporting the final product to the client.</p> <p>As this document is research-based research, the author used qualitative and quantitative methods to recover valuable information and write a deeper analysis of the topic. The author did desktop research with important information she recovered from trusted websites, and she complemented the theory of the investigation with the answers of a survey applied to 21 quality control workers in the automotive industry additional with interviews to the experts on the topic who were a quality control manager, mechanical engineer, and the logistics coordinator.</p> <p>After all the information recovered from the different sources, the author explains in which way quality is the most important feature that customers look for in the vehicles they purchase and what are the key factors to maintain an effective operation inside the automotive companies to procure quality as one of the most important requirements for exporting them to the United States.</p>
Key words Quality, assembly, commercial partnership, exportation, quality standards, auto parts.

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1 Introduction

This research-based thesis for the International Business degree with Supply Chain specialization is a tool for any person interested in the topic in order to have a better understanding of how quality control is an essential part of the automotive industry and a primary requirement for exporting vehicles to the United States and maintaining a good reputation for any company. This work focuses on exploring the quality control process, its requirements, and standards, including a theoretical framework with an overview of the automotive industry and its commercial relationship with the United States, a non-detailed description of the process, and an investigation conducted with people specialized in the topic for a further understanding. The demarcation will cover information about the main quality standards and requirements for ensuring the quality of the vehicles. It will not include detailed information on the quality control process or detailed export steps to the United States. Finally in the analysis, the investigation results will be presented and the research question will be answered.

1.1 Background

This thesis seeks to understand further and inform the reader of the importance of good quality control in the assembly process of auto parts for their exportation to the United States. The thesis will cover several relevant points, such as the importance that the commercial relationship between Mexico and the United States in the automotive industry has for both nations and which are the main standards and requirements that the autoparts need to accomplish in order to be exported to the United States. The author will provide a brief explanation of destructive and non destructive testing methods and in which cases they are mainly used, some difficulties during these processes will be presented and why it is important to make sure all the auto parts are in good quality and meet the requirements for then, exporting them.

1.2 Research question

The objective of the thesis is to analyze and demonstrate the importance of quality control in the auto parts assembly process for exportation to the United States, in order to do it, the research will answer the next question.

RQ: Why it is essential to have quality control in the assembly process of auto parts for their exportation from Mexico to the United States?

In order to have clear information for this study, the thesis will include these four investigative questions that with the support of people with expertise on the topic will answer.

Investigative questions:

IQ 1. What are the requirements and standards in quality control for assembling the auto parts?

IQ 2. What is the main quality problem that auto parts present before leaving the assembly plant?

IQ 3. How is the process of the final quality control supervision for exporting the auto parts?

IQ 4. Why ensuring quality control in the assembly process of auto parts is one of the most important requirements before exportation?

Table 1. Overlay matrix (Author, 2023).

Investigative Questions (IQs)	Theoretical Framework ¹	Methods	Interview/Survey Questions	Data Analysis/ Results
IQ 1. What are the requirements and standards in quality control for assembling the auto parts?	Main standards and requirements in the quality control process of auto parts. Analysis of the quality control process for assembling auto parts.	Qualitative re- search: Interview with an engineer who works in the as- sembly process of auto parts. Quantitative re- search: Webropol survey.	Appendix p.45, p.47	p.25-p.29
IQ 2. What is the main quality problem that auto parts present	Difficulties and problems with auto parts quality before leaving the plant.	Qualitative re- search:	Appendix p.45,p.46, p.48	p.30-p.33

before leaving the assembly plant?		<p>Interview with quality control manager.</p> <p>Quantitative re-search:</p> <p>Webropol survey.</p>		
<p>IQ 3. How is the process of the final quality control supervision for exporting the auto parts.</p>	<p>Quality control as a primary requirement for exportation to the United States.</p>	<p>Qualitative re-search:</p> <p>Interview with the person in charge of the exportation of auto parts to the United States.</p> <p>Webropol survey.</p>	<p>Appendix</p> <p>p.46, p.49</p>	<p>p.34-p.36</p>
<p>IQ 4. Why ensuring quality control in the assembly process of auto parts is one of the most important requirements before exportation?</p>	<p>Automotive industry in Mexico and its commercial relationship with USA.</p> <p>Quality control as a primary requirement for exportation to the United States.</p>	<p>Qualitative re-search:</p> <p>Interview with the person in charge of the exportation to the United States.</p> <p>Quantitative re-search:</p> <p>Webropol survey.</p>	<p>Appendix</p> <p>p.46, p.49</p>	<p>p.37-p.39</p>

1.3 Demarcation

The purpose of this thesis is to inform the reader of the importance that quality control has for automotive parts in the assembling process stage before exporting them to the United States. The author aims to provide transparent information about the primary quality standards in the assembly stage, a brief description of the quality supervision process, and the main requirements for ensuring the quality of the vehicles. However, the thesis will not include detailed information on the quality control process or the manufacturing steps for the auto parts, it will not cover the detailed steps for exportation to the United States, and it will not include the case of any automotive company. The author will focus on explaining the most critical factors to ensure quality in the automotive industry without exposing confidential information or rigorous manufacturing steps.

1.4 International Aspect

The thesis will have an international focus talking about the commercial relationship between Mexico and the United States. It is important to address the importance of this commercial partnership for the economic growth of both countries. Likewise, the document will expose the relevance of quality control in the automotive industry for maintaining a commercial relationship with other industries worldwide. The author will conduct an in-depth investigation of the topic, with the information support of experts in the topic in Mexico and the United States; the author will be presenting the main quality standards and requirements that auto parts need to have so they can be assembled and exported to this country for final distribution to customers.

1.5 Benefits for Stakeholders

The thesis will serve as a primary source for the author and people interested in the topic to expand their knowledge about quality control in the automotive industry and its importance for the commercial industry. The reader will benefit by having relevant information on the term "quality in the automotive industry and some important points that it involves. The automotive industry will benefit from this document by having a perspective of what aspects are essential to take care of in terms of quality control, requirements needed to export auto parts to the United States, and the effect it can have worldwide if any auto part is defective after is launched to the market.

1.6 Risk and Risk Management

For this research, the author wrote about some possible risks that could happen and affect the development of the thesis during the recompilation of information and elaboration of it on a scale of occurrence from 1 to 5. Which "1" is never, "2" is almost never, "3" probably, "4" most probably, and "5" certainly will happen. The author wrote some management methods to avoid these risk situations and deliver the thesis successfully.

Table 2. Risk Matrix (Author, 2023)

The following table shows the possible risks the author could face while elaborating the final thesis until it is delivered.

RISK	SEVERITY	OCCURRENCE	MANAGEMENT METHOD
Timelapse to deliver the thesis	High	2	Make a planning of the thesis and work on it every week. Check the advances of the thesis and do not postpone the work for later.
Inconsistence of the information	High	3	Look for information in reliable sources such as books, google academic and scientific articles. Look for several information sources and compare the information.
Grammar and format of the thesis	Medium	4	With the help of Grammarly check the spelling and grammar inconsistencies. Check the thesis format with the teacher and classmates.
Insufficient sources for the study	High	3	Look for people with exoertise on the topic or people who can apport valuable information with anticipation. Contact several people related with the thesis topic with anticipation.

1.7 Key concepts

Assembly: It is a process in which individual parts are joined in a specific order until the final product is completed. Car assembly is a long process that requires a dependable supply chain to carry out uninterrupted production on the assembly line. In a car assembly line, various workstations install parts in sequence. The concept of an assembly line is to speed up the manufacturing process and increase the efficiency and overall resulting output. (Carsblog, 2023).

Quality control: Quality Control ensures vehicles are free of defects and operational issues. The process usually involves putting vehicles through rigorous testing routines to achieve excellent engineering, safety, and comfort for the end user (ProProfs Editorial Team, 2023).

Commercial Relationship: This is a link between enterprises that make up the functionality of commerce in running any business. The relationship is enhanced by stakeholders such as employees, employers, business associates, and other business partners involved in the running of commerce. From the above description, it can therefore be argued that a business relationship comprises various partners that collectively participate in creating an internal or external relationship for example between two countries, not necessarily from the same organization. (Study.com, 2023).

Quality Standards: These are sets of good management practices, methods, systems, requirements, and specifications established by industry advisory groups to help manufacturers achieve and demonstrate consistent production and product quality (Siemens, 2023).

Exportation: This is the practice of producing a good or service in one country and selling it to consumers in another country. Goods and services produced in one country but supplied to buyers in another are known as exports and International trade is made up of these exports and imports. The two main types of exporting are direct and indirect exporting. Direct exporting is a type of exporting where the company directly sells products to overseas customers. Indirect exporting is a type of exporting practiced by companies that sell products to other countries with the help of an intermediary. (StudySmarter, 2023).

2 Quality Control in the automotive industry

In this chapter, the author will explain the concept of quality control in the automotive industry and what this term involves. It is important to understand clearly the definition of quality control because is the basis for this research. The document will present what quality control is, what it involves, and why it is important to maintain the quality in every operation for the vehicle's final assembly.

2.1 Definition

Quality control ensures that vehicles are free of defects and operational issues. "The process usually involves putting vehicles through rigorous testing routines to achieve excellent engineering, safety, and comfort for the end user" (ProProfs Editorial Team, 2023). As this statement mentions, this process is important to ensure vehicles are free of any operational defect and they can be sold successfully.

Quality control consists of several aspects that companies have to take into account to achieve it in the best way. The chart below shows the main topics the study will talk about.

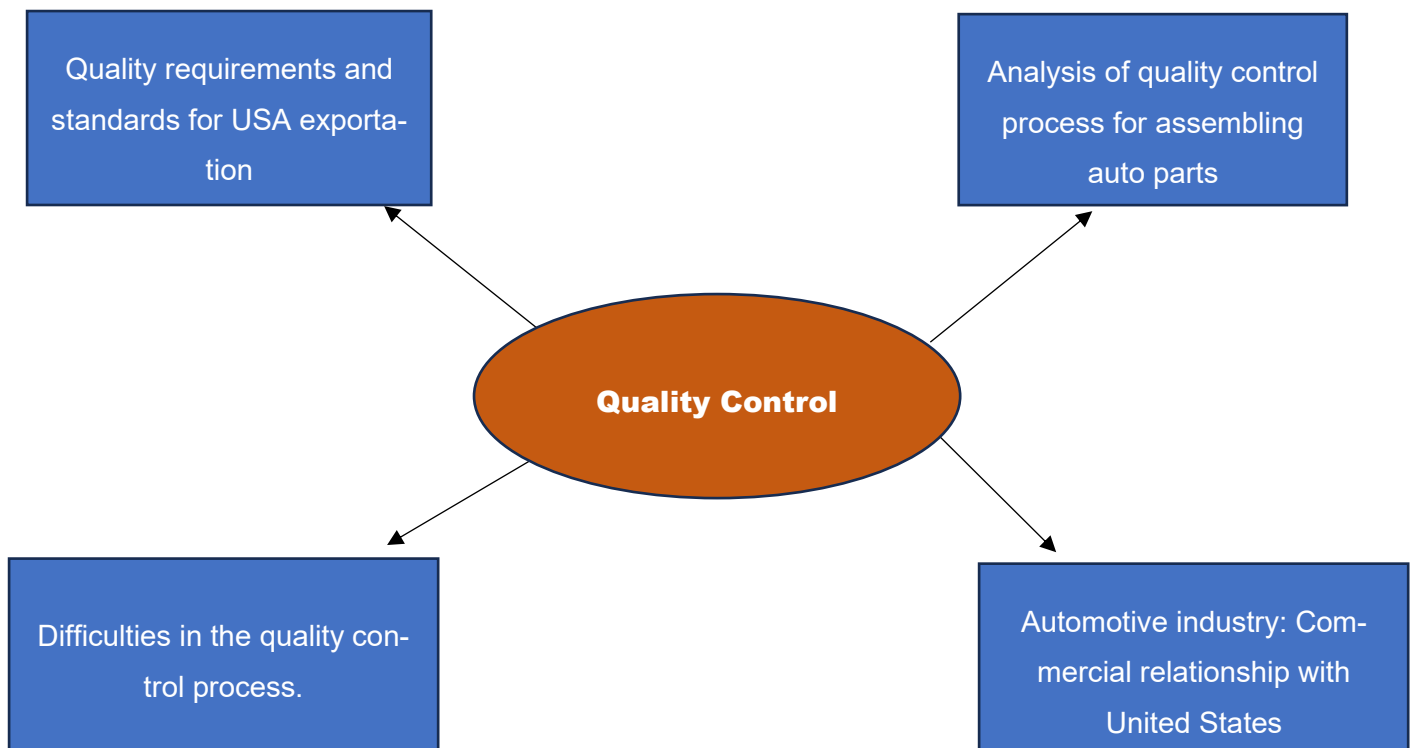


Figure 1: Theoretical Framework (Author, 2023)

When discussing manufacturing and production, the term "quality" describes the level of perfection or superiority of a good or service. It includes a range of qualities like performance, dependability, safety, longevity, and client satisfaction. In the automotive industry, quality is directly related to the safety and good performance of the vehicle that the company produces, and it is the most important factor in increasing the brand value and reputation of the car company. As mentioned before, there are several factors that companies have to consider to make their vehicles of "good quality" compared to others in the market.

In the automotive sector, safety is one of the most important factors when the client buys the vehicle, and quality control is essential to guaranteeing that car parts fulfill or surpass safety regulations. Components undergo extensive testing, such as environmental simulations, impact tests, and stress tests, to evaluate how well they function under different circumstances. Since adherence to safety laws immediately affects the safety of motorists, passengers, and pedestrians, it is legally and morally required. Early detection and correction of deviations reduce the number of accidents and guarantee that parts fulfill the highest quality requirements, which is of great importance to manufacturers. From the first operation to the final assembly, several procedures and actions are intended to track and test the quality of the parts until they are exported to the United States for the final assembly. This proactive strategy not only builds consumer faith in the durability of automotive systems but also improves the quality of the final vehicle and, therefore improves brand reputation.

Building consumer trust and a positive reputation for a company is very important and it mostly depends on how good the vehicle is and how many years it can function correctly. Auto parts that fulfill quality control standards are guaranteed to be dependable, long-lasting, and of the highest caliber. Good word-of-mouth recommendations, a rise in customer loyalty, and eventually a competitive advantage in the market can all result from having a solid reputation for quality. This is crucial because it promotes accuracy, dependability, safety, creativity, and consumer trust. Strong quality control procedures must be put in place by manufacturers to guarantee that every part satisfies strict requirements and adds to the overall brilliance of automobiles. Companies may maintain the highest levels of excellence and promote ongoing innovation in the automotive industry by placing a strong priority on quality control.

2.2 Main standards and requirements for USA exportation

For the exportation of auto parts, there are several considerations that people in charge of the area have to consider during the whole process to finally export the auto parts to the United States to different assembly plants in order to join the parts and create the final vehicle. The automobiles in the United States are built from high levels of imported auto parts; this means this country makes many importations from different countries. Mexico is one of its most important commercial partners because of the distance between them and the low-cost investment for the United States. As the distance between these two countries is relatively short, the United States has several manufacturing and assembly plants in Mexico where they produce auto parts, assemble them, and then, export the auto parts to the United States. Whether an auto part is entering the United States as an export or as an import, it must meet some standards and regulations as any other product, besides all the documentation and taxes.

When exporting or importing into the United States, entering the country will include inspections at the international border crossing and customs. Auto parts will need to comply with some protocols such as duties, tariffs, and documentation. In the United States, auto parts manufacturers are subject to regulatory control by the National Highway Transportation Safety Board (NHTSB), the Federal Trade Commission (FTC), the California Air Resources Board (CARB), the Environmental Protection Agency (EPA), and other agencies. Quality control is a primary requirement for exportation to the United States at all stages of the operation because the minimum defect in production or assembly can lead to severe losses for the company and even international demands. "Any product brought into the United States for use in the manufacture of a vehicle must meet the U.S. government's rigid standards for performance and quality." (Purolator International, 2015).

In recent years, some American automotive companies have had defective problems with their vehicles because of quality errors, and as a result, their reputation has been affected globally. The companies suffered significant economic losses that cost millions of dollars; they lost clients, and the situation took some years for the companies to recover. For this reason, every time the USA makes an importation, it strictly monitors the standards of quality and safety for auto parts imports, and the manufacturing companies have to strictly follow the quality standards of the auto parts before they export them. The U.S. government uses two leading agencies to regulate auto parts imports and exports. The first one is the National Highway Traffic Safety Administration (NHTSA), which sees everything related to safety issues, and the second one is the Environmental Protection Agency (EPA), which regulates vehicle emissions and other environmental impacts.

The National Highway Traffic Safety Administration (NHTSA) is in charge of various laws related to motor vehicle safety. This organization has a list of Federal Motor Vehicle Safety Standards (FMVSS) that establish quality and safety standards for several auto parts such as rims, Seat belts, lighting, gas containers, platform lift systems, brake hoses, brake fluid, and many others.

The Federal Motor Vehicle Safety Standards list is divided into four main categories (Purolator International 2015):

- Crash Avoidance (Rearview mirrors, Brake systems, and Windshield wipers).
- Crashworthiness (Head restraints, Seat belts, Rear and Side impact protection).
- Post-crash standards (Fuel system integrity, Flammability of interior materials).
- Other Regulations (Fuel economy standards, Automobile parts content labeling, Defect reporting, and Uniform Tire Quality Grading Standards).

The Environmental Protection Agency (EPA)

The mission of this agency is to protect the environment and the health of the American people. They are concerned about the environment, the use of natural resources, energy waste, water pollution, industry contamination, and many other environmental aspects. One of their activities related to the automotive industry is regulating the carbon emissions that vehicles produce in the United States, so any auto part that enters the United States must accomplish the environmental standards that the EPA establishes.

The automotive sectors that EPA regulates are the following ones (United States Environmental Protection Agency 2024):

- NAICS 336 Transportation Equipment Manufacturing
- NAICS 4231 Motor Vehicle and Motor Vehicle Parts and Supplies Merchant Wholesalers
- NAICS 8111 Automotive Repair and Maintenance.

The Clean Air Act is an official document of this agency that prohibits any auto part importation to the United States that does not meet the EPA emission standards and requirements. On their official website, there is a list of the main standards and requirements that each auto part has to meet to meet the environmental goal. These requirements are related to quality control and environmental safety, which must be accomplished by automotive companies entering the United States.

Customs and Border Protection Agency (CBP)

U.S. Customs and Border Protection is one of the world's largest law enforcement organizations and is charged with keeping terrorists and their weapons out of the U.S. It is an important party in any exportation to the United States, as this agency promotes, encourages, and makes sure the commercial laws and regulations the CBP dictates are accomplished. This agency ensures the fees and duties are paid, all the necessary documentation is in order, and all the import or export processes are done legally and in the right way. Customs and Protection Agency has an official list of the requirements the auto parts have to accomplish to complete the exportation successfully.

The requirements for the exportation of auto parts to the United States according to the Customs and Border Protection Agency are (Purolator International 2015) :

- EPA Form 3520- Importation of Motor Vehicles and Motor Vehicle Engines Subject to Federal Air Pollution Regulations.
- Department of Transportation Form HS-7- Declaration for Importation of Motor Vehicles and Motor Vehicle Equipment Subject to Federal Motor Vehicle Safety, Bumper, and Theft Prevention Standards.
- CBP Form 7501 – Customs Entry.
- Commercial Invoice
- Manufacturer's Certificate- This letter states that the parts conform to EPA and DOT standards.
- Parts-Specific Requirements: Engines must bear a sticker, written in English, with appropriate emissions control information.
- Tires must have a "tire identification number" permanently molded into each tire.
- Child restraint system manufacturers must provide a registration form to purchasers that, upon completion, is maintained by the manufacturer for at least six years.
- Certification that applicable parts meet FVSS standards. This is generally accomplished via a label certifying such compliance that is permanently affixed by the manufacturer.

2.3 Analysis of the quality control process for assembling auto parts

The word "assembly" means joining two parts either by welding, screwing, or any other process. For the assembly of auto parts, it is essential to pay attention that each component of the vehicle is manufactured correctly, with the correct quality for its correct functionality. Each industry has different processes to ensure decent quality in their products, but referring to the automotive industry, there are several processes that companies must follow to monitor quality in the different auto parts. There are two types of quality testing, the destructive test that affects physically the component, and the non-destructive that doesn't. Some destructive test examples are:

Aggressive environment testing: This is used to test the fatigue and fracture points of a component when it is exposed to corrosive environments at different pressures and temperatures.

Typical examples of test types include the following (TWI 2024):

- Fatigue crack growth, tensile and fracture tests in environments with pressures up to 450 bar, at temperatures between -50°C and +80°C.
- Exposure to temperatures up to 300°C, at pressures up to 1400 bar.
- Corrosion testing in oxygen and chlorine at up to 80°C.
- Permeation testing at temperatures up to 250°C and pressures up to 650 bar.

Corrosion testing: Products including metals, coated materials, plastics, and woods are primarily assessed to corrosive conditions using the Accelerated Corrosion test. The specimens are subjected to continuous salt spray exposure for a predetermined duration as part of the test procedures. ASTM B117 and ISO 16151 are two examples of standards for accelerated testing. The primary goal of the cycling corrosion test is to speed up actual corrosion failures. These tests assess the suitability of materials such as metals, wood, polymers, and coated materials for use in various natural conditions. SAE J2334 is the standard for the cycling corrosion test.

Fracture and mechanical testing: It is employed at several strain rates and test temperatures for fracture toughness, tensile, large-scale, and pressure testing. All mechanical testing in a saltwater environment is also conducted using it.

Fatigue Testing: To ascertain the endurance of welded joints, base metals, and heat-affected zones under variable- or constant-amplitude loading, fatigue testing is carried out in salt water or open-air settings. Welds, base metals, and heat-affected zones can all be tested for fatigue fracture formation using this destructive testing technique.

Hardness testing: Establishes if a component experiences permanent deformation under stress. The hardness of a material is determined by how much it resists indentation. Through this test, the longevity and overall performance of a component are tested.

Tensile testing: In tensile testing, the strength of the material is ascertained by compressing or elongating a component. Measurements of tensile strength, breaking strength, maximum elongation and compression, and other physical parameters are used to identify materials that can bear high loads.

On the other hand, non-destructive tests used in quality control in the automotive industry are:

- UT Ultrasonic flaw detection.
- UTM Thickness measurement by ultrasound.
- VT Visual inspection.
- PT Liquid penetrating test.
- X-Ray and CT scan.

UT Ultrasonic Flaw Detection: This method is very useful to find defects in metals such as gaps, tiny cracks, corrosion and other flaws in materials that are very small and difficult to analyze by other methods. Some auto parts that are commonly tested using this procedure are wind turbines, flare stacks and tanks. The way this procedure works is that the person who inspects the component uses a transducer to send sound waves through the component they want to test. If the component is free of any defect, the sound waves will pass through the transducer, but if the sound waves hit a defect the waves will bounce off of it, meaning the component is defected.

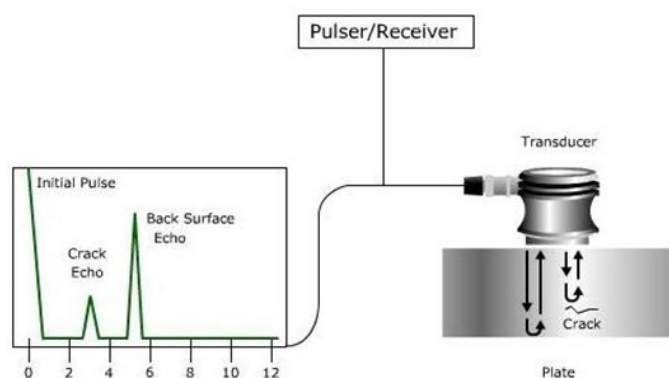


Figure 2: Ultrasonic testing (UT) Handbook (Inspecti 2021).

UTM Thickness measurement by ultrasound: This testing method is used to detect corrosion, erosion, and any other damage in the material that is inspected. The inspection of the possible defects caused by erosion or corrosion gives the necessary information to determine if the tested component has adequate metal thickness and if not, the structure has to be replaced or repaired. It is important to mention that just not metal can be tested using this method, plastic, ceramic, glass, and other materials can be tested too.

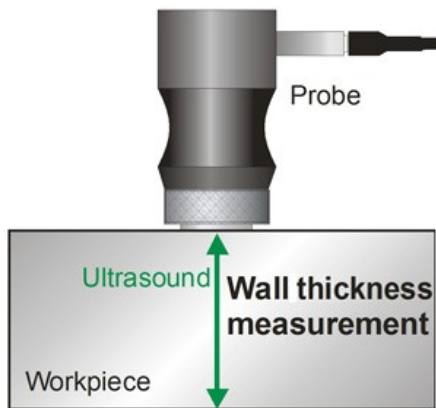


Figure 3: Basic knowledge about ultrasonic testing (Karl Deutch 2024).

VI Visual Inspection: This method is one of the less complex ones because no equipment is needed. It can go in hand with the use of technology such as scanners and is very useful to know if any auto part has its parts placed exactly where they should be, if the components are assembled correctly or if any part is missing in the structure, the failure of any component can affect the vehicle performance seriously. This quality control process is performed by different areas in the manufacture plant according to the auto part that is inspected and the factors that are verified.

PT Liquid Penetrating test: Another nondestructive examination technique, is liquid penetrating test. Compared to other non-destructive techniques, it is less expensive, more flexible, and requires less training. By injecting an extremely thin liquid into the fault and then extracting the liquid with a developer, liquid penetrant tests detect material flaws that are visible to the human eye. Several materials such as rubber, glass, ceramics, and metals use this procedure to detect any flaw. In the automotive sector, this testing method can be employed in a wide range of materials to locate defects such as porosity, fissures, seams, breaches, joint defect, unfinished fusion, intergranular corrosion and more.

MPT Magnetic Particle Testing: Inspectors utilize this inspection method to search for defects in magnetic materials as it allows them to identify small flaws before they become bigger and more complex. Regarding inspectability, the only prerequisite is that the component under examination must be composed of a ferromagnetic material as it can become sufficiently magnetized to facilitate a successful inspection. The process can be used to inspect castings, forgings, and weldments, among other product types.

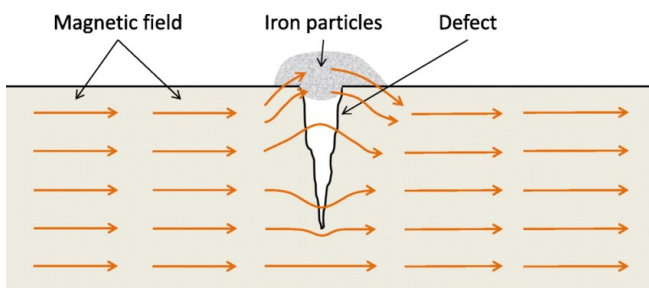


Figure 4: Principle of the magnetic particle testing technique (ResearchGate 2024).

X-Ray and CT scan: The automotive industry makes use of a number of well-known testing technologies to improve assembly, validate manufacturing processes, ensure dependability, and inspect quality. They all Accurate findings can now be obtained in a matter of seconds because to X-Ray CT's exceptional ease of use in looking into components without damaging, opening, or even touching them. Because X-Ray CT can penetrate a wide range of materials, it is useful for a variety of applications related to the automotive quality process, including as metrology, retro engineering, assembly verification, and the examination of porosities and inclusions Electro-mechanical assemblies can be easily inspected using X-ray CT without destroying them, and it is usually helpful to look for misaligned or broken parts.



Figure 5: Radiografía de auto (Shutterstock 2024).

2.4 Difficulties and problems with auto parts quality before leaving the assembly plant

One of the most important steps in the production of automobiles is ensuring the quality of the parts before they leave the assembly line. To maintain high levels of quality, manufacturers must solve several obstacles and issues that arise at this point. In this chapter, the author will talk about some difficulties and problems the company can face regarding quality before the component leaves the plant.

The complexity of modern automobiles is one of the main obstacles to guarantee the quality of auto parts. Each of the pieces that make up an automobile nowadays are all essential to its general functionality, safety, and performance that is why it is an enormous responsibility to ensure the quality of each of these parts, requiring strict testing protocols and close attention to detail. The dependence on suppliers presents another challenge to guaranteeing the quality of auto parts. To obtain the parts and pieces required to assemble a car, many automobile companies rely on a network of suppliers. The degree of complexity caused by this reliance on outside suppliers may hurt the parts' quality because variations in production methods, interruptions in the supply chain, and disparities in supplier quality standards can be some of the problems that can lead to inconsistent quality in auto parts.

As there are so many components in the automotive industry that need to be inspected, quality control procedures are complicated. Manual inspection is not possible in an assembly plant because to the sheer volume of parts that are passed through regularly. Because of this, manufacturers are forced to rely on automated inspection methods to find flaws and guarantee the parts' quality. These systems are not perfect, though, and occasionally they fail to pick up on flaws that could compromise the car's functionality or safety. The possibility of flaws going unnoticed before an auto part leaves the production line is one of the main issues with its quality. Even with the greatest efforts on the part of manufacturers to put quality control procedures in place, errors in design, equipment malfunctions, and human error can still lead to problems. These flaws, which can range in severity from small cosmetic problems to major safety hazards, can result in expensive recalls and harm to the manufacturer's reputation if they are not discovered.

Before auto parts leave the assembly line, quality control is a difficult and intricate process that calls for exact attention to detail and stringent testing protocols. Many challenges and problems face manufacturers today, such as the intricacy of contemporary automobiles, their dependence on suppliers, and the requirement for automated inspection systems. Notwithstanding these obstacles, automobile companies need to make an effort to uphold strict quality standards to guarantee the dependability and safety of their vehicles.

2.5 Main standards and requirements in the Quality control process of auto parts

Assuring the performance, dependability, and safety of automobiles during the production process of auto parts requires strict quality control. The quality control process in the car parts sector is governed by a number of rules and regulations, which make sure that manufacturers adhere to strict quality standards. Some of the most important guidelines and specifications in the auto parts quality control process will be covered in this chapter.

The ISO 9000 is a series of standards from the International Organization for Standardization that outlines the specifications needed for quality management systems (QMS) in several industries, including the automotive industry. These guidelines are intended to assist enterprises in making sure that they satisfy the legal and regulatory requirements of their products and services while also fulfilling the demands of consumers and other stakeholders. Meeting client criteria and continuously enhancing customer satisfaction are key components of ISO 9000. When it comes to auto parts, this involves making sure that the components function correctly in cars and that they adhere to the quality standards and criteria established by manufacturers. Additionally, ISO 9000 assists auto parts manufacturers in enhancing the effectiveness of their internal procedures, locating and removing inefficiencies and flaws in the production process, and saving waste and production costs while also improving the quality of the items. It is essential because it guarantees quality, boosts productivity, and assures regulatory compliance.

Some of the characteristics that ISO 9000 incentives automotive companies to have are:

1. *Quality assurance*: ISO 9000 guarantees that cars are continuously made to high-quality standards for export, reducing the possibility of problems and enhancing customer satisfaction.
2. *International compliance*: Countries need ISO 9000 certification for importing or exporting goods.
3. *Consumer confidence*: The ISO 9000 accreditation raises consumer assurance about the dependability and quality of autos. Vehicles that have earned an ISO 9000 certification are more likely to be bought by consumers.
4. *Competitive advantage*: Having ISO 9000 certification might provide the company a competitive advantage among others in the international car industry.
5. *Continuous improvement*: The ISO 9000 standards place a strong emphasis on the value of ongoing development in quality control. Car manufacturers may find opportunities for improvement, streamline their operations, and eventually provide customers with better quality.

ISO 9001, in particular, sets out the criteria for a quality management system and is used by organizations to demonstrate their ability to consistently provide products and services that meet customer and regulatory requirements. ISO 9001 emphasizes the need for a strong customer focus, the involvement of top management, and a process approach to quality management. ISO 9001 certification is essential for exportation since it guarantees that suppliers and manufacturers fulfill the essential quality requirements required to produce vehicles that are both dependable and safe.

The standards based on ISO 9001 are IATF 16949, AEC-Q100, and AEC-Q200. In order to export auto parts to the United States, they must accomplish with the established requirements that these standards dictate. There is an extensive description of the requirements for each standard, but as in this document we are referring to auto parts in a general way, the most important aspects of each quality standard are the following (Qorvo 2018):

IATF 16949. The global automotive industry standard for quality management systems. The automotive industry generally expects parts to be manufactured, assembled, and tested in IATF 16949-qualified facilities. It encourages waste reduction, fault prevention, and continual improvement in the assembly and supply chain processes.

During the qualification phase before the release of the device, each component must survive a battery of industry-standard tests:

- AEC-Q100- it is for integrated circuits and defines the standard tests for active components such as switches and power amplifiers. (PAs).
- AEC-Q200 -it is for passive components and covers similar tests for passive devices such as RF filters used in Wi-Fi and cellular communications.

Automotive companies carry out some tests to evaluate the quality of the vehicles. "Examples are the test for early life failure rate (ELFR), which subjects multiple samples of 800 components to temperatures of at least 125°C, and the power temperature cycling (PTC) test, which repeatedly cycles between extremely high (125°C) and extremely low (-40°C or even lower) temperatures. Other tests are conducted under harsher conditions such as higher temperatures when testing commercial parts, or using larger lot sizes to provide greater statistical confidence in the reliability of production components" (Qorvo 2018).

Before the auto parts leave the plant, there are some final evaluations to make sure everything is correct and they can be exported. These tests are the following:

- Wafer level and assembly test: To find any hidden flaws that could cause failure after components are assembled into vehicle electronic systems, each die undergoes four optical inspections.
- Final test, tape, and reel: Even with the most carefully thought-out semiconductor production methods, anomalies that cause early part failure can occasionally arise from uncommon and unanticipated circumstances (such as issues with raw materials or manufacturing tools). Additional screening is done during the automobile component production process to locate these "outlier" components and batches before they are incorporated into final products.
- Reliability test and documentation: Advanced Product Quality Planning (APQP) is a product quality program that component manufacturers are required to follow, creating a comprehensive documentation package that includes test records, design, and process failure mode and effect analysis (FMEA). It also covers the full manufacturing process. A component of this APQP program is the Production Part Approval Process (PPAP).

Following these quality standards is vital for success in the competitive automobile business. It guarantees that products fulfill legal requirements and consumer expectations, building a foundation of devoted clients. In addition to these standards, auto parts manufacturers are also required to follow industry-specific rules and guidelines, such as those established by the Automotive Industry Action Group (AIAG) and the Society of Automotive Engineers (SAE). These standards address many different topics, including requirements for quality control, testing protocols, and material specifications.

The establishment of quality management systems for auto manufacturers is one of the main goals shared by SAE and AIAG. Advanced Product Quality Planning, Production Part Approval Process, Failure Mode and Effects Analysis, Measurement System Analysis, and others are some tools that AIAG has developed. In contrast, SAE has created a number of standards for quality management systems, including ISO 16949 for the manufacturing of automobiles. These standards offer instructions for creating and sustaining quality management systems that satisfy the particular requirements of the automobile sector. These standards are essential for auto parts exportation because they provide quality control, global conformity, customer trust, and ongoing development. Automakers who comply with ISO 9000 standards are more likely to be successful in the global market and satisfy the requirements of consumers and regulatory bodies across the globe.

2.6 Mexico and its commercial relationship with the USA in the automotive sector

The automotive industry in Mexico plays an important role in the global market. The country ranks fourth in the world for automotive parts exports and eighth for automobile exports globally.”The automobile industry has had a huge impact on the economic growth of Mexico. This sector is one of the most significant industries for the country as it comprises 3.5 percent of the GDP for the country, 20 percent of the manufacturing GDP, and employs over one million people nationwide. The ninety percent of vehicles produced in Mexico are exported and 76 percent are destined for the United States” (International Trade Administration, 2023). “Mexico is the largest export market for United States automotive parts and the fourth-largest producer of automotive parts worldwide generating USD 94 billion in annual revenues” (The National Institute of Statistics and Geography, 2023).

It is well known that Mexico has a strong commercial relationship with the United States and one of the most important factors is the North American Free Trade Agreement (NAFTA), which was signed in 1992 by Mexico, the United States, and Canada. NAFTA quickly removed tariffs on most items manufactured by the member countries upon its signature. As long as the materials comply with NAFTA Rules of Origin, Mexico does not impose any substantial limitations on the entry of machinery and replacement parts for the automotive industry. The economic relationship between the United States and Mexico has strengthened as a result of this agreement, contributing to increased industry growth, cultural impact, economic success, and international trade. With the automotive industry development, “Mexico became the world’s 7th largest vehicle producer and the most important in Latin America. More than 80 percent of the production of vehicles is devoted to export, which makes it the world’s 4th largest automobile exporter, behind Germany, Japan, and South Korea” (Flippo Biondi, 2017). Mexico has become the 2nd most important supplier of the United States after Canada and has increased auto parts production by 13.5 percent year by year giving a total of 107.617 billion dollars of auto parts production in 2022.

Both Mexico and the United States benefit from this trade partnership which gives them a competitive advantage in the world automotive industry. Mexico and the United States can increase their competitiveness globally by producing high-quality auto parts more economically and efficiently by combining their respective strengths in manufacturing and innovation.

The next table shows information about the total production, exportations, importations, and market size of Mexico with the United States.

Table 4. Total market size (International Trade administration 2023)

	2018	2019	2020	2021	2022 (Est.)
Total Local Production	97.0	97.8	78.4	94.7	101.2
Total Exports	79.3	81.0	64.8	78.5	83.9
Total Imports	59.3	60.8	44.2	53.4	62.4
Imports from the U.S.	32.4	33.0	21.8	28.1	34.1
Total Market Size*	77.0	77.6	57.8	69.6	79.7
Exchange Rates	19.22	19.26	20.00	20.28	20.40

Another reason that the United States decided to invest and expand the automotive industry in Mexico is because of the term “Nearshoring”, which means expanding businesses or making commercial relations because of the closeness between the countries. The reason of this, is because assembly plants prefer suppliers who are located close in order to facilitate exportations, minimize inventory costs and volumes, and to facilitate just-in-time deliveries. The customer demand for auto parts in Mexico from the United States is very high as Mexico is the most important supplier of auto parts for the United States, even more than Japan and Canada. As a result of this, the companies have the responsibility of supervising the quality of the different auto parts they manufacture for then exporting them to the assembly plant and delivering the final vehicle. The minimum production error can lead to great economic losses for the company and affect the social reputation of the company, that is why it is important to make sure the auto parts comply with the correct quality.

3 Research methodology

In this chapter, the author will explain how the information needed to answer the research question of the study will be collected and how the respondents will be contacted. The way this study will be conducted is divided into two parts, in the first one, the author presented information about the main processes for ensuring quality in auto parts and the main standards and requirements needed to accomplish this from the desktop research. In the second part, the author will collect data from experts and present a final conclusion about the study research. For this research, the approach will be qualitative and quantitative as the author will gather information from 15 to 20 people who work in automotive companies with different professional roles related to the topic to collect valuable information for the study.

This chart shows the different stakeholders whom the author will interview to gather information and the way this information is expected to answer the research questions RQs.

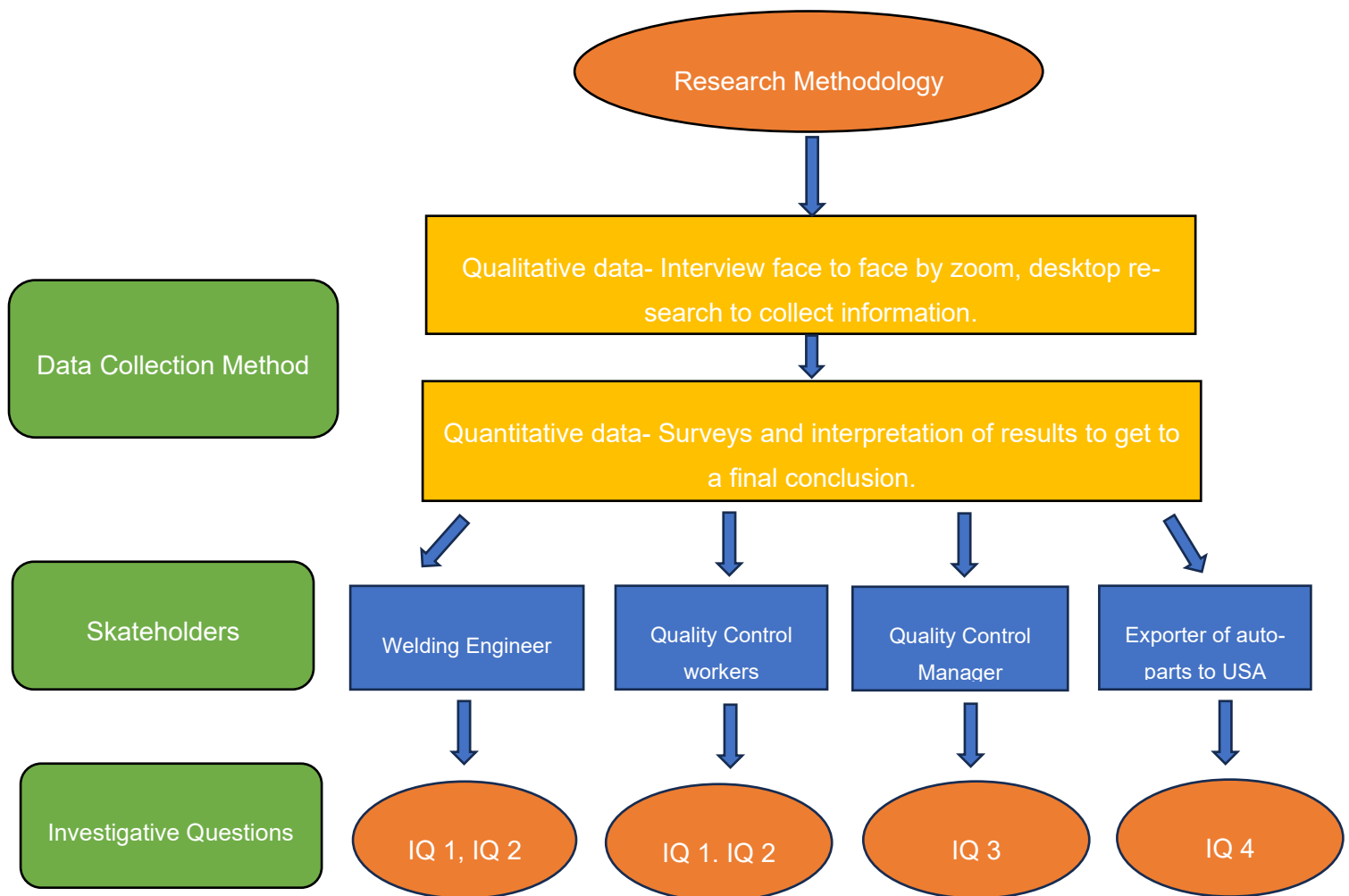


Figure 6: Research Methods chart (Author, 2023)

3.1 Data collection.

The author will collect information for this research in two different ways. The first research tool that the author will use is a survey in Spanish with 10 questions that will be applied to Mexican workers who work in the control quality area for automotive companies that export auto parts to the United States. For terms of confidentiality, the companies and the names of the respondents will not be mentioned in the document. It is important to add, that the questions of the survey will be attached in English version at the end of the document.

The second research tool will be by having interviews via Zoom with the control quality manager, a mechanical engineer, and the person in charge of the exportations to the United States who work in automotive companies. The respondents will be contacted by email in this way, they will have access to the link to answer the survey in Webropol and the Zoom link to have the interviews. In the end, with the collected answers from the survey and the interviews, the author will present the results that will be helpful to have a clear perspective of the importance of quality control and answer the research question of the study.

3.2 Research design

The author will interview people with a domain in the topic to collect valuable information about quality control in auto parts based on their professional experiences by using the research tools mentioned before. Investigative questions and important information related to quality control are sought to be answered in the research.

The way investigative questions are expected to be answered by the stakeholders in the interviews are divided into the following questions:

Table 6. Research structure (Author 2024)

Investigative question	Survey / Interview questions
<p>IQ 1. What are the requirements and standards in quality control for the assembly of auto parts?</p>	<ul style="list-style-type: none"> • How do you ensure that the auto parts meet the applicable technical specifications and regulations? • What are the main requirements that auto parts must meet to be assembled? • What non-destructive and destructive inspection technologies do you use to evaluate the quality of auto parts?

<p>IQ 2. What is the main quality problem that auto parts present before leaving the assembly plant?</p>	<ul style="list-style-type: none"> • What actions are taken to prevent the production of defective auto parts? • What is the main problem detected in defective auto parts? • How does your company approach identifying and correcting defects in auto parts before the auto parts leave the assembly plant?
<p>IQ 3. What is the process of the final quality control supervision for exporting the auto parts?</p>	<ul style="list-style-type: none"> • Before auto parts are exported, is there any final quality inspection carried out within the plant? • What is the process for exporting auto parts to the destination country? • What are the main documents or certificates needed to export auto parts to the United States related to quality? • How do you ensure that auto parts meet the standards and documentation necessary for export?
<p>IQ 4. Why ensuring quality control in the assembly process of auto parts is one of the most important requirements before exportation?</p>	<ul style="list-style-type: none"> • How do you relate the impact of quality control in auto parts exported to the United States to customer satisfaction and the competitiveness of your company in the international market? • What measures has your company implemented to guarantee high-quality standards in its auto parts? • How does quality control in auto parts affect the reputation and competitiveness of your company in the market?

4 Data and results

This chapter will present the information the author recovered from each of the stakeholders who supported the investigation with information in order to answer the investigative questions of the study. The webropol survey was answered by 21 quality workers from different companies that work in the assembly of auto parts, additionally the author interviewed via zoom a mechanical engineer, a quality control manager, and a logistic operations coordinator who work in different automotive companies to recover additional information. The research aims to demonstrate the importance of having quality in the auto parts assembly for exporting them to the American market based on the interviews and the survey the respondents answered. To explain the information clearly, each of the investigative questions will be answered with the support of the results collected.

4.1.1 What are the requirements and standards in quality control for assembling the auto parts?

Before starting to answer this question, it is important to note that for any company, quality is the most important aspect for surviving in a competitive environment, maintaining a good reputation, and standing out from other companies that produce the same product or service. The author could verify this idea because most of the respondents agreed with this in the survey applied. The question was, "Do you think quality is the most important aspect for maintaining a good reputation for the company?" and almost 80% of the respondents answered "Yes".

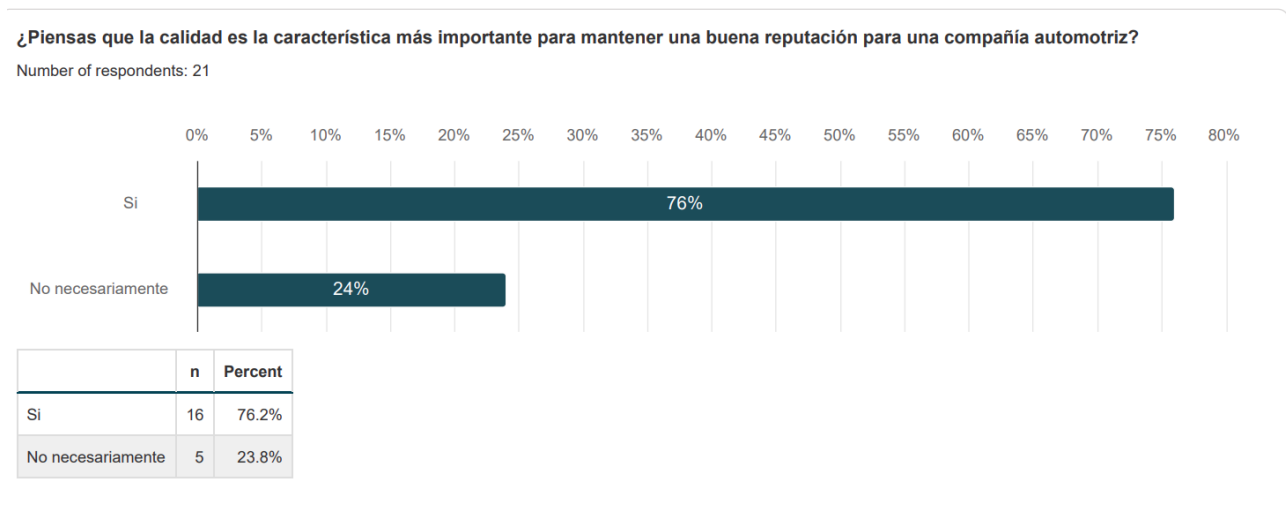


Figure 7. Question 1, Importance of quality control in auto parts (Webropol survey, 2024)

The next question was, "On a scale from 1 to 10, how important is for the company where you work to have strict quality control in their operations?"

The minimum value for this answer was 7 and the maximum value was 10 with an average of 9.2, and the median for this answer was 10.

En una escala del 1 al 10, ¿que tan importante es para la compañía en que trabajas tener un control de calidad estricto en sus operaciones?

Number of respondents: 21

Min value	Max value	Average	Median	Sum	Standard Deviation
7.0	10.0	9.2	10.0	194.0	1.0

Table 7. Question 2, Importance of quality control in auto parts (Webropol survey, 2024)

According to this fact, the majority of the respondents answered that in the company where they work, it is extremely important to have strict quality control in their daily operations. But, what actions do the companies take to make sure the processes and auto parts accomplish the correct quality?

One of the key factors for accomplishing quality in every operation is directly related to the employers who work for the company because they are the ones who are in direct contact with the components and who need to supervise the operation in every step to make sure the components are produced and assembled correctly. All companies must offer correct training for all their employees so their performance inside the workplace is satisfactory and the company obtains the desired results. Every area of the company is crucial for developing the final product, so to make all the operations of each department function correctly, companies have to establish precise standards and procedures at each phase of the operation that the workers must follow to maintain order, make the operation more effective, and make sure the final product will comply with the needed standards and requirements.

The International Organization for Standardization is an international organization that created certain rules and guidelines to help companies manage their operations properly. The ISO has some standards that are directly related to the automotive industry serving as a guide for companies to develop their objectives in a long and consistent way ensuring safety, efficiency, and quality in the production of the final vehicle. In the survey, the author asked the respondents which were the main ISO standards that the companies where they work followed in their daily operations and these were the main answers:

¿Cuáles son las principales normas ISO que tu empresa aplica en sus operaciones diarias? (ejemplo ISO 9001)

Number of respondents: 21

Responses
ISO9001 ISO14001
Iso 14000, iso 9001
ISO 16949 ISO 9001
ISO9001 ISO14001
Norma IATF 16949, es la especificación técnica global y la norma de gestión de la calidad para el sector automotriz. Está basada en ISO 9001:2015, fue publicada en octubre de 2016 y reemplaza a la norma ISO/TS 16949.
ISO 16949 e ISO 9001
La principal es ISO 9001 y TS 16949
ISO 9001 para gestionar la calidad de las auto partes ISO/TS 16949 requisitos particulares de la norma ISO 9001 ISO 45001 para la seguridad y salud en el trabajo
ISO 9001, IATF 16949 e ISO 26262
ISO 9001, ISO 16949
Iso 14000, iso 9001, iso 1649
ISO 14001- gestión ambiental ISO 26262- gestión de riesgo en sistemas electrónicos
ISO 9001, ISO 45001, ISO/TS 16949
ISO 45001, ISO 26262, ISO 9001
iso 9001 / ISO 26262 /TS 16949
ISO 9001, TS 16949

Table 8. Question 5, Importance of quality control in auto parts (Webropol survey, 2024)

The answers were very similar and that makes sense because all the respondents work in the same area of the automotive industry. The main standards they mentioned were ISO 9001, ISO 14000, ISO 14001, ISO 26262, ISO 45001 and IATF 16949.

ISO 9001 lays out the requirements for a quality management system. This standard is frequently used by manufacturers to guarantee consistent quality in their operations and components. To receive the ISO 9001 certification, a set of requirements must be fulfilled. A quality policy must be established, quality targets must be defined, risks must be identified and managed, procedures must be designed and controlled, internal audits must be conducted, and the results must be analyzed. This certification can give companies a competitive advantage by proving their quality commitment and ongoing development. Furthermore, putting in place a quality management system that complies with ISO 9001 can lower expenses, boost productivity, and raise customer satisfaction.

ISO 14000 is a series of global standards that covers a wide range of aspects related to environmental management. The most known standard that is part of this series is ISO 14001 which gives companies a framework for sustainably managing their operations. This standard lays out the conditions for the implementation and certification of an environmental management system. It involves defining an environmental policy, identifying and assessing important environmental factors, setting environmental goals and objectives, putting management programs into action, and carrying out internal audits and reviews. ISO 14001 certification can offer several advantages, such as enhanced environmental performance, decreased legal and regulatory risks, cost savings through resource and energy efficiency, and enhanced company reputation.

ISO 26262 lays out several specifications for the secure operation of electronic systems and electronic components in automobiles. Its main objective is to identify and minimize risks related to functional safety and guarantee security in automotive electronic systems.

ISO 45001 outlines health and safety management systems. Its primary goal is to identify and manage possible risks related to the safety and health of the people working in the company. By putting this standard into practice, organizations may lower the number of accidents and illnesses, and enhance employee health and well-being.

IATF 16949 is the worldwide technical standard and quality management guideline for the automotive industry. It was released in 2016 and replaces ISO/TS 16949. Although IATF 16949 includes additional standards primarily related to the automobile industry, it is based on the principles of ISO 9001. Some of the topics that cover this standard are related to customer satisfaction, process management, and improvement, and supply chain risk management. Implementing the IATF 16949 standard helps automotive organizations meet the requirements for assembling auto parts, improving product quality, and making the processes more efficient. Additionally, certification to this standard is a contractual requirement for exporting auto parts.

Now that the main standards that most automotive companies follow have been described, let's talk about what are the main requirements for assembling the auto parts. For a better analysis of this question, the author interviewed a mechanical engineer that one of his daily activities at the company is the quality inspection of auto parts for their assembly. The mechanical engineer mentioned that quality inspection is done before assembly, during assembly, during welding, and after making the welded joint, to ensure that materials, welding processes, and workmanship meet the requirements of internal standards and specifications to the clients.

”Speaking in particular of welded auto parts, each of our clients has their own specifications with each of the requirements that we as their manufacturers and suppliers must meet. For example, for General Motors' specification for welded parts is GMW14058 (Weld Acceptance Criteria and Repair Methods: Arc Welded and Arc Brazed Joints) and for Ford, it is WSBCPA-1B310-AA (Global Gas Metal Arc Weld, Hybrid Laser-GMAW, and Brazing)” he said.

Once taking into account the client's specific requirements, welders must ensure that the auto parts meet the specific characteristics to be assembled. The author asked the mechanical engineer in which way they ensure that the manufactured auto parts comply with the specifications and regulations and his answer was the next one: “We ensure that the auto parts comply with the dimensional characteristics specified in the drawings, through dimensional verification devices (gages or checking fixtures) used in each of the manufacturing stages. On the other hand, we ensure that the welds meet all of our client's requirements, carrying out visual inspections and macrographs (Cut and Etch) at the beginning of each shift”. The Macro cut and etch test is a destructive test method in which the auto part is cut in half to evaluate the characteristics of the weld, by cutting the piece in half, it is easier to locate possible porosity or cracks in the structure. Finally, when the components have successfully passed the quality tests, they can be assembled.

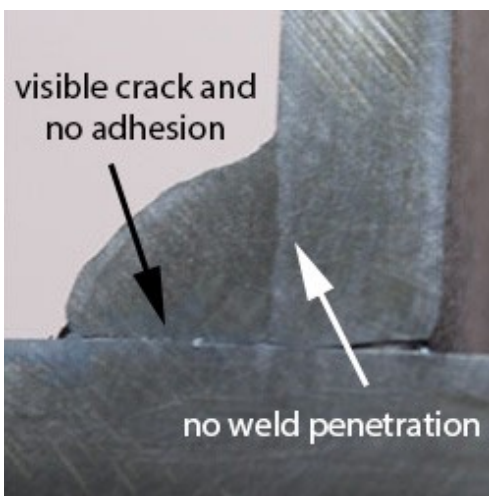


Figure 8. Cut and Edge Weld Testing (Westberg Sheetmetal, 2020)

4.1.2 What is the main quality problem that auto parts present before leaving the assembly plant?

Quality inspections that automotive companies apply in their daily operations are crucial to determine if the auto parts have the correct characteristics to be assembled and exported to the United States. During quality inspections, any problem or inconsistency can emerge and companies need to know what should they do in case the component is defective. Automotive companies use different types of testing methods to inspect the components effectively and enhance day-to-day operations. In order to know which type of testing methods either destructive or non-destructive, companies mainly use to inspect quality in the auto parts, the respondents answered the next question:

"In the company where you work, which type of testing methods do you use to inspect quality in the auto parts?" 15 of the 21 workers answered they use both methods to test quality, 4 answered they only use destructive methods and 2 workers answered they mainly use non-destructive methods. With these responses, the author can conclude both types of testing methods are very helpful and important in determining if the components comply with the needed requirements.

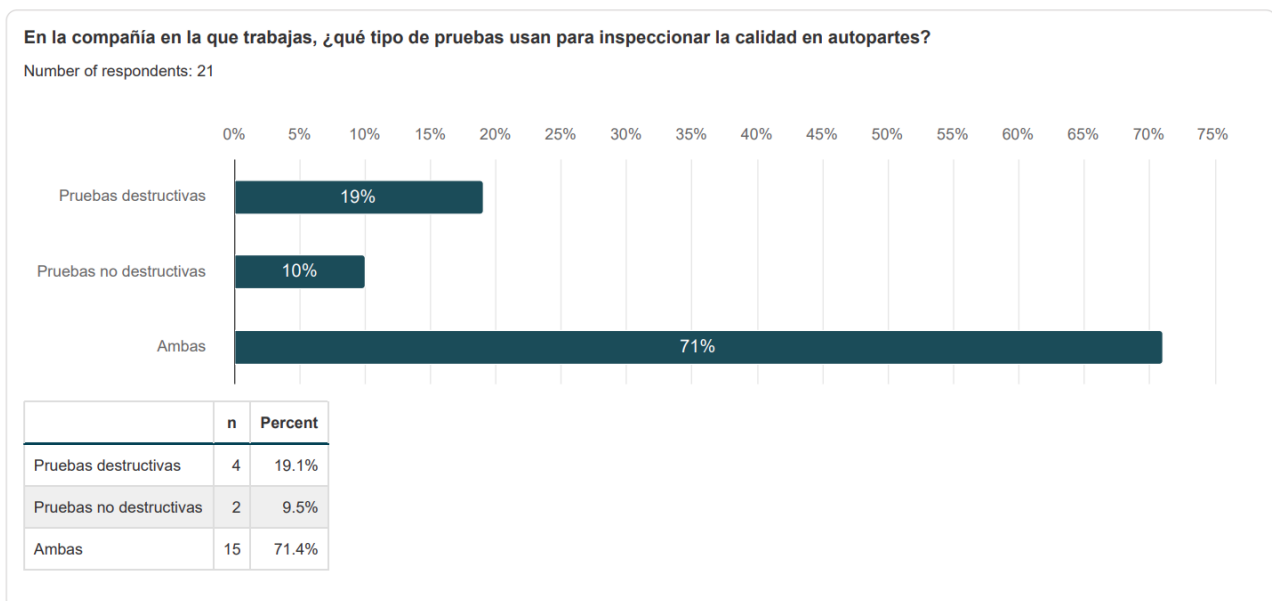


Figure 9. Question 4. Importance of quality control in auto parts (Webropol survey, 2024)

Both types of testing methods are important to identify any inconsistency that the inspected component could present. By applying several testing methods, companies can find recurring problems and patterns that could affect the quality of the final vehicle and take the appropriate corrective actions to optimize and improve quality in the operations. These inconsistencies can occur at any step of the manufacturing process which is why quality inspections must be applied at every stage of the operation.

There are important factors that need to be considered for a good-quality production. In the interview the author had with the quality control manager, she mentioned that is important to count with the correct equipment to make the process more efficient. "Vision systems help to ensure traceability and correct assembly, automated poka yoke systems avoid the use of raw materials or microwire (welding process), and quality tools such as problem-solving help to analyze the main problems and ensure there is no recurrence," she said. Also, she mentioned that adequate training and constant capacitation to the employees is a fundamental aspect of maintaining a successful system in auto parts production. "In each induction, the employee is aware of the 10 Basics of quality and the explanation of how each of these should be carried out in the training center, which are leadership, engagement, focus on customers, process approach, approach to management, relationship management, decision making, continuous improvement, and commitment." These 10 Basics of quality are one of the most important aspects for avoiding quality errors in the auto parts produced.

Counting with adequate equipment and qualified workers, quality inspections should be very precise in detecting any inconsistency that the inspected component could present. In the interview the author had with one of the quality control workers, he mentioned that the company where he works, the company focuses its strategies based on the Six Sigma methodology in order to improve its production system, minimize defective components, and have better quality control. He mentioned, "In the automotive sector, auto parts must fulfill strict quality standards and the Six Sigma methodology can help assure this. Based on this methodology, we place a strong emphasis on minimizing errors in the manufacturing processes of the components we produce and discovering areas of inconsistency to design strategies and improve the operation". By following the Six Sigma steps, the company defines what it wants to achieve, measures and analyses the process and characteristics of the auto parts, looks for areas of improvement, and designs new strategies to make the operations more effective. Finally, it controls every step of the operation to make sure the final auto part complies with the established requirements and characteristics.

Besides these very important factors and recommendations to avoid inconsistencies in the production, any defect could be presented. The author asked the quality manager which were the main inconsistencies that auto parts present during quality inspections and she mentioned the primary ones were:

- Dimension inconsistencies
- Corrosion
- Deformation
- Porosity
- Assembly problems
- Sealing problems
- Operation problems
- Problems with the exterior coating

To find out what is the process when an irregularity is detected, the author asked in the survey "What is the process if during a quality inspection, a defective component is detected?" and these were some of the main answers:

Responses
Se establece la ventana sospechosa Notificación al cliente Acción de contención inmediata (En sitio y con cliente) Limpieza del sistema (clean point) Difusión de alerta de calidad Análisis de causa raíz Acción correctiva definitiva Acción de detección Acción sistémica Validación de acciones Despliegue horizontal de acciones
El componentes es enviado a retrabajo, si no se puede retrabajar se envía a scrap o cuarentena
Se hace un registro de las características que el componente presenta y se regresa al área de manufactura para arreglar el defecto o si no tiene arreglo, desecharlo.
El componente es enviado a cuarentena para que después se mande al área de producción correspondiente para que se retrabaje, o si no se puede retrabajar se manda a la zona de scrap o chatarra.
1. El componente puede ser retrabajado o recuperado siempre y cuando la especificación del cliente lo permita. 2. El componente es enviado al scrap (se desecha) si la especificación del cliente no permite su retrabajo o recuperación.
Este se manda al área de chatarra si no tiene arreglo
El componente se envía a cuarentena para que luego se envíe al área de producción correspondiente para que se retrabaje; si no se puede retrabajar, se envía a la zona de chatarra o desechos.
En primer lugar, el componente defectuoso se aísla y etiqueta para evitar su uso accidental. Luego, se registra las características del defecto, a continuación, se lleva a cabo un análisis de causa raíz para identificar las causas de éste. Basándose en este análisis, se implementan acciones correctivas para prevenir la recurrencia del problema en el futuro.
Se le notifica al cliente y si tiene arreglo, se manda a cuarentena para que pueda ser arreglado, si no tiene arreglo se desecha.
Cuando se detecta un componente defectuoso durante una inspección de calidad, se activa un proceso integral diseñado para abordar y resolver el problema de manera efectiva y que de esa manera prevenir de que no se vuelva a repetir en el futuro
Si el cliente autoriza retrabajarlo de acuerdo a las características que presenta, se retrabaja. Si no hay arreglo, se manda al área de scrap.
La ventana sospechosa se abre. Aviso al cliente Acción inmediata de contención (tanto en el sitio como con el cliente) limpieza del sistema distribuir alertas de calidad Análisis de la causa principal Acción final para corregir accesibilidad de detección Acción en el sistema La validación de las acciones Acciones deslizantes horizontales
Se manda al área de chatarra si no puede ser retrabajado
Se aísla y se etiqueta, se registran las características del defecto y si las características del defecto lo permiten, se retrabaja.

Table 9. Question 7, Importance of quality control in auto parts (Webropol survey, 2024)

Some of the answers mentioned several steps, first, the suspicious window is established, and the component is isolated, then a notification is made to the client, an immediate containment action is carried out (on-site realized, corrective action is planned and finally a validation of these actions is made to execute it. After more research to complement this response, the author found that the defective component is isolated and labeled as "defective" to avoid any use of it, then all the irregularities are documented with specific detail and the notification of the defect is made to the client, next in the cause analysis the causes of the defect are identified for implementing corrective actions to avoid this error in the future, now depending if the defect can be fixed or not, it can be repaired or send to the scrap area. Finally, workers monitor the effectiveness of the corrective actions by quality audits and additional inspections.

The rest of the answers to this question were shorter and similar because they all mentioned that if a defect or inconsistency is presented in the component, it can be reworked as long as the customer specification allows it. If it cannot be reworked anymore it is sent to the scrap area for giving another use to the material.

In the interview with the quality manager, she mentioned that if the auto part sent to the customer has some type of defect, two things can happen:

a) The customer detects that the auto part does not fit into the vehicle correctly or does not work properly. The parts are not assembled in the vehicle and are segregated. The customer makes an official claim to the supplier or manufacturer of the auto part.

b) The client does not detect any assembly or functionality problems with the auto part in the vehicle. The parts are assembled in the vehicle, apparently without any problems. The vehicle is sold to the dealership and finally to the private customer. The auto part fails in the field and is detected by the private customer. The private customer makes a "warranty" claim to the distributor and in turn, the distributor makes a "warranty" claim to the assembly plant. The assembly plant makes an official claim to the supplier or manufacturer of the auto part.

Both situations imply discredit for the auto part manufacturer as well as for the vehicle assembly plant so is critical to act quickly and appropriately to resolve any irregularity found during a quality inspection in order to guarantee the product's quality and safety. This is important to increase customer satisfaction, safeguard the company's reputation, and help avoid serious legal problems. After several quality inspections and resolution of irregularities, the components of the auto part are ready to be assembled and exported but, is there a final quality inspection before exporting them to the United States to make sure they comply with the client's specifications? In the next research question, this topic will be discussed.

4.1.3 How is the process of the final quality control supervision for exporting the auto parts?

In order to know if there is a final quality inspection before exporting the auto parts, the author asked this question in the survey "In the company where you work, do you realize a final quality inspection before exporting the auto parts?"

15 of the 21 respondents answered they realize a final quality inspection before exporting them even if there was a quality inspection before in other stages of the production process and 6 respondents answered that they do not realize a final quality inspection because it was made before in other stages of the production process.

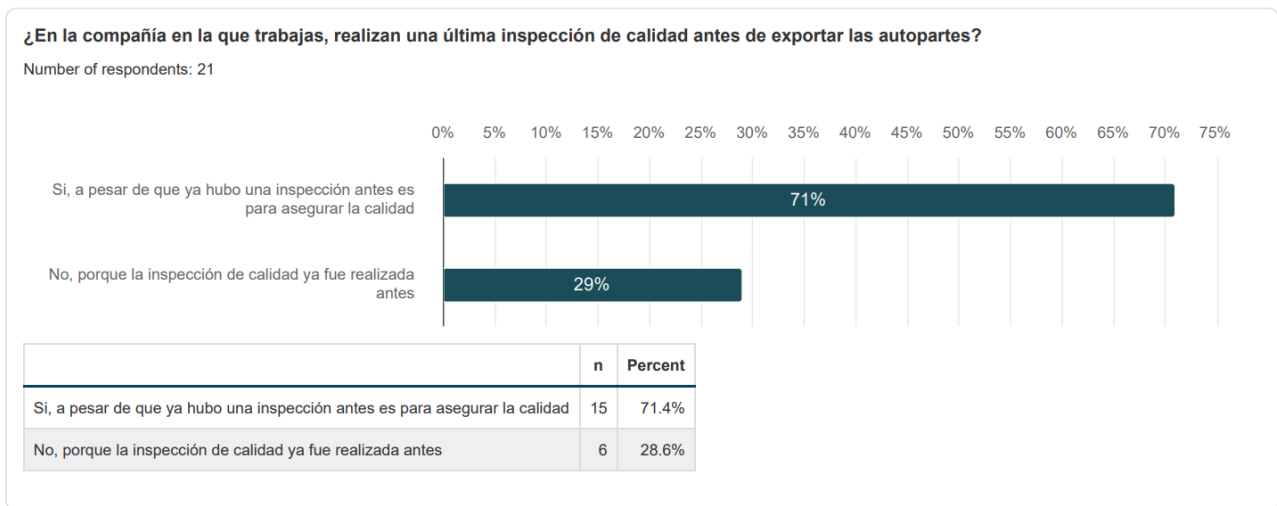


Figure 10. Question 10, Importance of quality control in auto parts (Webropol survey, 2024)

With these answers, the author can mention that in most companies, a final quality inspection is done before sending the auto parts to the customers, in this case, the United States. Realizing a final inspection depends on the auto part the company produces, if it is an electronic component, a metal structure, or other material that needs final testing according to the manufacturing process each company has. But to know in detail how this process is realized, the respondents answered the following question:

"Can you describe briefly the steps of the quality control process for the auto part that the company where you work produces before it is exported out of the assembly plant?"

¿Podrías describir brevemente los pasos del proceso de control de calidad para el componente que tu compañía produce antes de ser exportado fuera de la planta?

Number of respondents: 21

Responses
Liberación de proceso (set up) Liberación y validación de error proofing Liberación de producto (Salud de soldadura, Evaluación Dimensional, Prueba funcional) Safe launch Dock audit Auditorías de producto (Full lay-out)
Liberacion de prueba destructiva, Liberacion de primera pieza,
Etapas de materia prima Inspección del producto y control del proceso Inspección y control del producto final
Liberación de prueba destructiva Prueba de error (pruebas no destructivas) Evaluación de soldadura Prueba funcional y dimensional Auditorías de producto para su liberación final
Se asegura la calidad del producto en cada etapa del proceso de producción, desde inspección recibo, producto en proceso hasta convertirlo en producto terminado (sistemas de escape de acero inoxidable). Para asegurar la calidad del producto éste deberá cumplir con las especificaciones del cliente.
Los sistemas de escape de acero inoxidable garantizan la calidad del producto en cada etapa del proceso de producción, desde la inspección del producto recibido hasta el proceso de fabricación. Las características deben cumplir con las especificaciones del cliente para garantizar la calidad del producto.
Descarga de pruebas destructivas Pruebas no destructivas de errores Análisis de soldadura Test de funcionalidad y dimensionalidad Auditorías de producto para su liberación
Primero, se lleva a cabo una inspección visual para detectar defectos visibles, luego se realiza una inspección dimensional, a continuación, se someten a pruebas funcionales para asegurar su correcto funcionamiento. Además, se realiza un análisis de materiales para verificar su composición y calidad. Finalmente, se revisa la documentación asociada y se emite un certificado de conformidad si las partes cumplen con los estándares de calidad requeridos.
Se lleva a cabo una inspección visual del componente, a continuación se somete a una última revisión final y si no se detecta ninguna anomalía, puede ser exportado.
El procedimiento de aseguramiento de calidad para los componentes fabricados por nuestra empresa antes de su exportación se rige por un protocolo estricto que busca mantener altos estándares en todas las fases. En primer lugar, se efectúa una minuciosa inspección visual con el fin de detectar posibles defectos visibles. A continuación, los componentes son sometidos a pruebas funcionales y de dimensiones para verificar su correcto desempeño y garantizar que cumplan con las especificaciones técnicas requeridas. Seguidamente, se realiza un análisis de los materiales con el objetivo de asegurar su calidad y resistencia.
Se hace un registro con las características del componente, se somete a una prueba de funcionamiento, se etiqueta y se exporta finalmente.
Liberación del proceso (configuración) Confirmación y validación de errores (estado de soldadura, evaluación dimensional, prueba funcional). Auditoría de lanzamiento seguro y auditorías de producto (diseño completo)
Etapas de preparación de materiales, Inspección del producto y supervisión del proceso, Inspección y supervisión del producto terminado

Table 10. Question 6, Importance of quality control in auto parts (Webropol survey, 2024)

After reviewing each of the answers, the author noticed the process was very similar for any auto part. At each stage of the process, the quality of the product is assured. First, a visual inspection is carried out to detect any possible visible defect in the auto parts such as cracks, porosity, or dents, and verify the dimensions of them comply with the characteristics specified by the customer. In addition to this, measuring instruments are used to measure the dimension of the component with precision. After this, some destructive tests may be taken depending on the manufactured component. In most cases, if they are metal structures that need to be assembled, destructive tests such as cut and edge, tension, hardness, compression, and impact tests are realized to evaluate the quality of the component. Then, the auto parts are subjected to functional tests to verify their correct performance and mobility, environmental tests carried out to prove their resistance under different temperatures and conditions are an example of this.

In order to ensure that the auto parts do not present any possible risk to the safety of the driver or the condition of the vehicle, security tests are also conducted. Some examples are durability, resistance, environmental, and anti-theft testing. Furthermore, companies must ensure that the auto parts fulfill all regulatory standards about driver safety and security set forth by the National Highway Traffic Safety Administration.

The next step is the material analysis in which quality workers realize a precise analysis to ensure that the materials used in the production of the auto part are manufactured with the correct quality and adhere to the established standards. They guarantee the materials' strength, durability, and suitability for the assembly of the components. Before the exportation, all the documentation related to the auto parts such as test reports, technical sheets, certifications, and any other important document to demonstrate regulatory and quality compliance is validated and a conformity certificate is emitted. This is important to guarantee that the auto parts comply with the laws and regulations imposed by the importer and exporter nations. To have precise information about which is the necessary documentation for exporting the auto parts to the United States, the author asked the logistic operations coordinator and she mentioned, " The necessary documentation for exporting the auto parts to the United States is the bill of lading, commercial invoice, certificate of origin, packing list with the specified characteristics of the auto parts, certification and special licenses related to quality such as quality compliance certificate, material certificate and SO 9001 Certification.

The last step before exporting the auto parts is the final authorization decided in the product audits for final exportation. Product audits are thorough procedures that ensure the products' quality, safety, and compliance before they are exported. This helps ensure customer happiness and promotes the products' success in foreign markets. When all these aspects are discussed and approved, the exportation can be done. The main aspects discussed in the product audits for the liberation of the final product are:

- Compliance with technical specifications
- Regulatory compliance
- Manufacturing process audits
- Validation of functionality tests to verify that the auto parts have the quality and specific characteristics of the client
- Needed documentation and certifications required to do the exportation

When all these aspects are discussed and approved, the exportation can be done successfully.

4.1.4 Why ensuring quality control in the assembly process of auto parts is one of the most important requirements before exportation?

To answer this question properly it is important to know what features customers look at the time they are willing to buy a car. Some of them just care about the design or the brand of the car but for others, the quality and durability of the vehicle is the most important factor at the time of the purchase. To have an answer to which is the most important feature customers look at the time of purchasing a car, one of the survey questions was "Which is the most important feature you consider before buying a car?" The first option was price with a 23.8% rate of response, secondly, design with 23.8% as well, and then quality with a 52.4% rate of response. These answers varied according to the respondent's preferences but the author could notice that quality was the most selected answer.

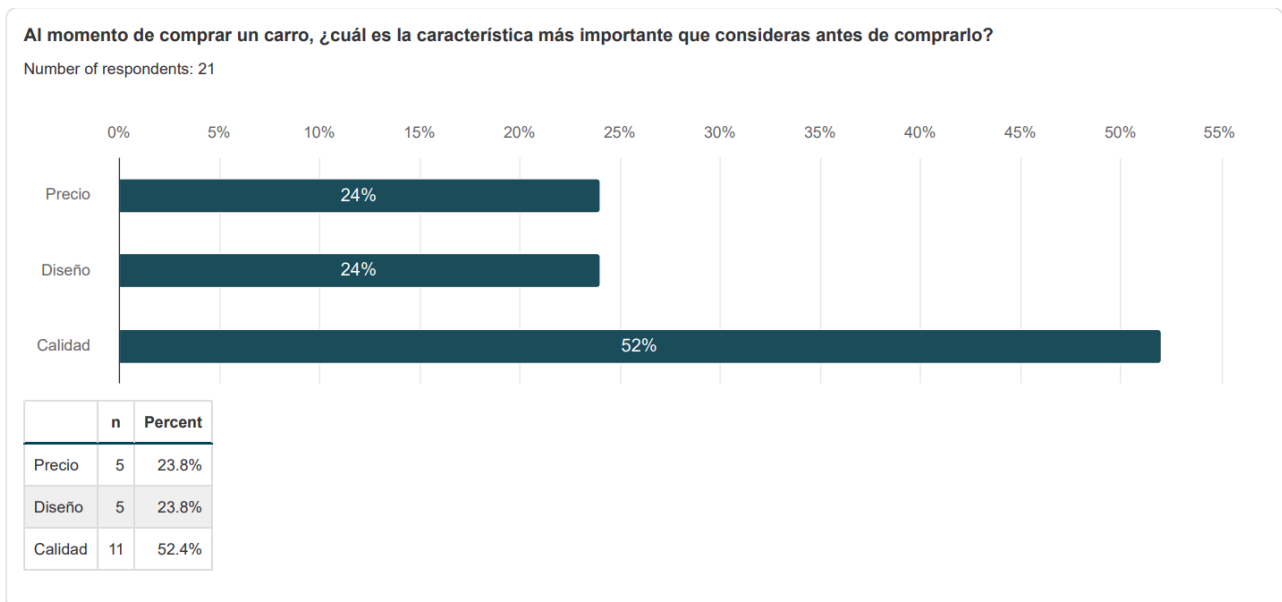


Figure 11. Question 3, Importance of quality control in auto parts (Webropol survey, 2024)

Based on these answers it is important to highlight that quality is the most important characteristic that customers look for. They want a vehicle with reliability and durability, with good performance that there is no need to subject the vehicle to constant repairs due to technical failures. They want a safe car that isn't going to stop in the middle of the road and put the driver's life in danger. Because of this, all the auto parts must meet the quality standards and requirements by the time that they are exported to the United States and the final vehicle is assembled, there are no defects and the vehicle's performance is satisfactory. This will increase the company's reputation and stand out in the global market among other strong companies.

Avoiding these irregularities is very important for the companies to maintain profitability, and reputation and avoid any legal problems. Another question of the survey was " Do you think the company could have serious implications if the manufactured auto part is detected to be defective after the vehicle is already on the market?"

12 of the 21 respondents answered it could bring severe consequences to the company if there is a defective component when the vehicle is already in the market and 9 respondents answered it could bring implications but not very severe.

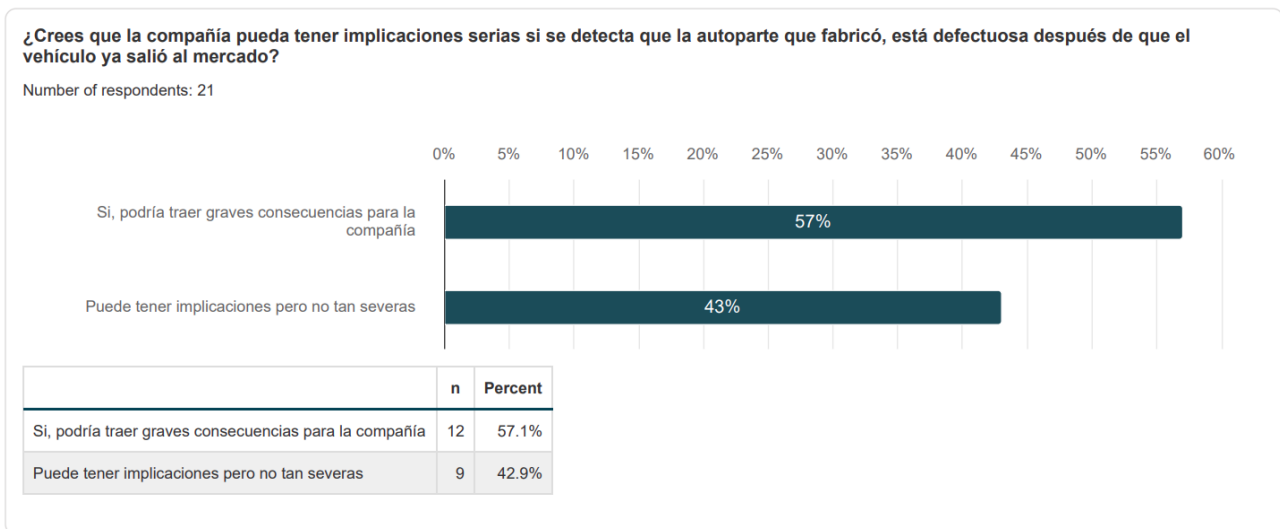


Figure 12. Question 8, Importance of quality control in auto parts (Webropol survey, 2024)

This answer may be subjective according to the auto part that the different quality workers who answered the survey produce in their company, if it is a critical element for the vehicle performance or if it is just an accessory, but certainly it will bring consequences. In the interview the author had with the logistic operations coordinator, she said " It is important that at the time of launching the final vehicle on the market, it has already gone through the necessary tests and quality inspections to ensure its correct performance and safety of the driver. In the case that a component is defective, there could be various consequences such as withdrawing the vehicle from the market, a legal demand by the client, a huge loss of money and profitability and of course, it directly would affect the reputation of the company.

But to ensure quality in the production of auto parts for their assembly, what actions do companies have to apply in their operations to achieve this? To answer this question properly, the author asked the quality workers in the survey, "In your experience, which is the most important factor to ensure the quality of auto parts?"

The answers vary between them according to their perspective and experience but some of the answers that repeated the most were the validation of quality in every stage of the operation before moving to the next one, recurrent quality inspections during the manufacturing and assembly process, discipline and constant training for the workers of the company, organization and precise attention in every detail of the operation and customer specifications and having collaborative work for a successful production.

Responses
La validación del proceso previa a a cada arranque La validación del producto continua en vase al control estadístico del proceso Implementación de dispositivos a prueba de error
Disciplina de la mano de obra
Organización en cada paso del control de calidad y atención a los detalles en cada proceso.
validación correcta en cada paso antes de continuar con la siguiente etapa
El factor mas importante es el cumplimiento de todas y cada una de las especificaciones del cliente.
Pruebas de inspección en cada etapa de la operación
Organización y control en cada operación hasta elaborar el producto final
Identificar un solo factor como el más importante para asegurar la calidad en autopartes puede ser difícil, ya que la calidad resulta de una combinación de varios elementos interrelacionados.
El trabajo colaborativo bien realizado de cada uno de los integrantes del área.
Validación de calidad en cada etapa y de que se cumplan las características específicas del cliente
Disciplina y atención a los detalles.
Inspección del producto en cada etapa para verificar que se cumplan las especificaciones requeridas
Validación correcta de las características del producto antes de avanzar a la siguiente fase
Que cada uno de los trabajadores dentro de la empresa, realice su trabajo correctamente para asegurar la calidad del componente.
Precisión del diseño y fabricacion
La inspección de calidad adecuada en cada etapa del proceso antes de avanzar a la siguiente fase.
Son una serie de diversos factores como responsabilidad del empleado, inspecciones y auditorías constantes y capacitación.
Constante capacitación y mejora en el plan de trabajo
Materiales de excelencia y seguir correctamente el proceso de manufactura.
Cumplimiento de todas las características establecidas por el cliente
Constantes pruebas de calidad en cada etapa del proceso.

Table 11. Question 9, Importance of quality control in auto parts (Webropol survey, 2024)

After analyzing the different responses the quality workers answered to the question, the author will describe in more detail some of the factors mentioned in the previous answers. First, when any employee incorporates to a company, it is crucial that the company offers to their employees a correct induction with all the relevant information of the company, remarking its mission and values so there exist a sense of inclusion between the company and the employee. For maintaining the level of quality in the production processes it is important to offer constant training and courses to the employees so they can manage new technologies or innovation ideas for the company's improvement.

Organization, discipline, and collaborative work were important factors some quality workers mentioned in their answers. In order to make any process successful, there is a sequence that has to be followed with certain steps and requirements, by following the established indications and making sure the auto parts are produced correctly, they can be assembled. In any automotive company there exist collaborative work because each of the areas that conform it, are essential to produce the final vehicle and distribute it. Inside each team, there has to be respect between the members, discipline to comply with their daily tasks in the best possible way and organization in every step of the operation putting precise attention to any detail that can occur at any stage of the operation process. Attention to detail must be put in practice during the whole process until the components are assembled and the final vehicle is exported. Through observation, inspections and testings, any irregularity must be detected on time so the production cycle and quality of the auto part don't seem affected because of the non detection of the anomaly.

As the production process consists of several stages until the auto parts are manufactured and assembled, quality control workers say it is important to validate quality in every stage before moving to the next one. Destructive and non destructive tests are carry out during the operation to validate the auto part complies with the customer specifications and the necessary characteristics to be assembled until the final vehicle is ready to be sold. If there is no validation of quality in every step of the process, it is more probable that an irregularity with the performance or physical stage of the auto part can be presented and be detected very late, which can be a serious problem for the driver's life and the reputation of the company as well.

Applying these factors into the daily operation of any company will give positive results in short and long term, bringing performance optimization, consistent labour and more important, quality in the product the company produces, which consequently will increase the profitability and customer loyalty for the company.

5 Conclusions

In this chapter, the author will present a conclusion about the importance of quality control for the assembly of auto parts. In this way, the author will answer the study's research question based on the key findings and the desktop research the author has made. The research question of the study was **"Why it is essential to have quality control in the assembly process of auto parts for their exportation from Mexico to the United States?"**

To answer this question, it is important to mention the principal reasons for maintaining quality control in the operations of any automotive company. One of the most important reasons to procure quality in the manufacture of auto parts is to develop customer loyalty and maintain the company's reputation. If the vehicle performs correctly when it is used and does not have recurring mechanical failures, the customer is more likely to become loyal to the brand and the next car he or she is going to buy will probably be from the same company as the previous one. On the other hand, if one of the vehicle's auto parts fails repeatedly, the customer will feel disappointed and will probably not buy a vehicle from the same company anymore. It is important to mention that if the driver suffers an accident or inconvenience that could threaten his life due to a defective auto part, the company could be involved in a serious legal problem that could force it to leave the market or lose a large amount of money. A defective auto part can affect the company's reputation but also compromise the safety and trust of the customer.

A mechanical failure in the vehicle is due to some defective auto part that did not meet ISO quality standards and was probably not detected during the quality inspection or there was a problem during the assembly of that component that caused the vehicle to not function properly. Problems that occur during component assembly can lead to vehicle faults, highlighting the necessity of paying close attention to detail at every level of production. Some of the key factors in developing high-quality vehicles are the validation of quality by applying tests and inspections in every stage of the process until quality control workers make sure the auto parts comply with the quality specifications and customer characteristics before moving to the next stage of the operation. Both destructive and non-destructive testing methods are essential to validate if the manufactured auto parts comply with the specifications of the client and achieve the correct quality.

In addition to the quality inspections, constant qualification of the workers of the company is essential for the correct development and performance of the operation. By offering courses on different topics related to the automotive industry, workers acquire a broader perspective and therefore greater knowledge on the subject, avoiding inconsistencies with the production of auto parts. Likewise, experts mention that it is important to encourage collaborative work and good communication between the different areas that make up the company for a successful production. These mentioned factors joined with important values like responsibility, discipline, honesty, punctuality, and respect are fundamental for making the operation work correctly and as a consequence, boost the profitability of the company.

Once the auto parts have passed through the necessary quality and performance validations and have been approved in the final audits for the liberation of the product, they can finally be exported to the United States. The exported auto parts are guaranteed to fulfill the strict requirements and standards needed to be admitted into the American market and be sold to the customers. At the time of launching the automobiles to the market, is important for the company that the vehicle is made of high-quality components to perform correctly on the road, distinguish from competitors, and cultivate a loyal customer base. Delivering automobiles with high-quality components demonstrates the company's commitment to their customers which helps it establish a strong position in the automotive market.

Furthermore, in the automobile industry, quality control is essential for promoting innovation and constant progress. Manufacturers can identify areas for innovation and optimization by closely monitoring manufacturing processes and evaluating performance data. Quality control is essential for bringing about good change and remaining ahead of the curve in a field that is always changing, whether it is by improving product longevity or increasing efficiency. In conclusion, The automotive manufacturing industry relies heavily on quality control to drive innovation, ensure regulatory compliance, and protect consumer safety. In an increasingly competitive market, automotive companies may not only produce better products but also build long-term trust, loyalty, and success by adopting a culture of quality excellence and investing in strong quality control procedures.

5.1 Learning Reflection

This thesis represents an important achievement for the author because by delivering the thesis, it concludes the most important stage of her academic development. These 4 years of studying at Haaga Helia University of Applied Sciences have been full of exciting challenges, memorable moments, and lessons learned that had a positive impact on the author's life. During these years of study, the author developed writing, leadership, research, and communication skills that were applied during the thesis development. To graduate satisfactorily from the degree in International Business, the author wrote this document with relevant information about the importance of quality control in the assembly of auto parts for their exportation to the United States in order to have a clear perspective of the topic. In the beginning, choosing this subject was a bit complex for the author because it is a very extended and methodic topic, besides there was a lot of information on different platforms that was very useful for answering the research question of this study.

While investigating about this topic, the author came across concepts and methodologies about the types of quality inspection that were difficult to understand for someone who is not related to the industry; however, with the help of graphics and the interviews the author had with the experts on the subject, the doubts were clarified and consequently, there was a better understanding. The writing of the document lasted approximately 8 months in which the author organized her time accurately to deliver the advances of the document on time and have the Zoom sessions with the thesis advisor. Finding a balance between personal and professional life was not very difficult as the author established a certain number of hours per week for writing the thesis and in that way, it didn't get overwhelming.

Finally, after the author finished writing the document, all the information learned and recovered was very enriching in a way that she acquired significant knowledge that will be very useful to apply in the supply chain and logistics work field. The thesis writing not only represents a significant intellectual effort but also is an opportunity for the author to reflect on all the lessons learned during the study path and all the challenges that were overcome. All the effort and dedication the author put into the development of the thesis was worth it because it is not only an individual achievement, but also an achievement for all the people who supported the author during all these years of study and an important step for the author's professional career.

Appreciations

After finishing writing this document, I feel very satisfied and proud of the effort and dedication I have put into this work for several months. It wouldn't have been possible without the support of important people in my life and I feel very grateful with them.

I want to thank my parents Francisco Bahena Salgado and Belinda Ramírez Vargas for their patience and dedication to me, for always supporting me and believing in my capacity, for always motivating me to succeed, and make me feel very proud of the person I am becoming. Without them, the completion of my studies wouldn't be possible and I will always be grateful to them.

Additionally, I am deeply thankful to my thesis advisor Maria Angeles de la Vega Villa for allocating valuable time of her agenda in the revision of my thesis. Her guidance, support, and meaningful feedback throughout all this process were a key factor for shaping the direction and quality of this work.

Furthermore, I would like to thank all the stakeholders and experts who participated in the research for this study, thanks to their contributions the research was enriched and the research became easier. Without their time and cooperation, the investigation would have been very challenging.

Finally, I would like to thank my friends for supporting me and letting me know I can always count on them. They always listened to me and encouraged me to not give up and to become the best version of myself every time I felt unmotivated. They certainly were an important factor in making college a wonderful experience for me.

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Appendices

Appendix 1. Survey questions

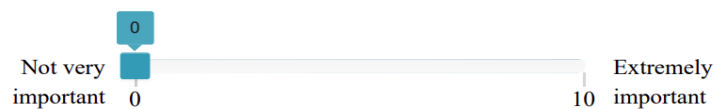
Quality control in the automotive industry

This survey aims to collect information about the quality control processes in the automotive industry and the importance it has to ensure customer safety and satisfaction. This survey is mainly directed to workers in the quality control area who have direct contact with these processes in their workplace.

1. Do you think quality is the most important feature for maintaining a company's reputation?

- Yes
- Not necessary

2. In a scale of 1 to 10 how important is for your company to have strict quality control in their operations?



3. When you buy a car, which is the most important characteristic you consider before buying it?

- Price
- Design
- Quality

4. In your company, what type of test methods do you use to inspect quality in auto parts?

- Destructive methods
- Non destructive methods
- Both

5. What are the main ISO standards that your company follows in its daily operations?

6. Can you describe briefly the stages of the quality control process for the component your company produces before it leaves the plant?

7. What is the process if during an inspection you detect a defective component?

8. Do you think the company can have severe implications if there is a defective auto part after the vehicle is sold?

Yes

No

9. In your experience what is the most important factor for ensuring quality in the auto part?

10. Do you make a final quality inspection before exporting the auto parts?

No

Sometimes

Appendix 2. Interview Questions

Mechanical engineer

Questions:

1. What role do you play in the quality control process of auto parts in your company?
2. Explain the general process of quality inspection of auto parts to be assembled.
3. What quality control techniques or processes do you use to ensure the dimensional accuracy of auto parts?
4. What are the main requirements and standards that auto parts must meet to be assembled?
5. How do you ensure that auto parts comply with the applicable technical specifications and regulations?
6. What measures are taken to prevent the appearance of defective auto parts during the manufacturing process?
7. How are defects identified in auto parts addressed and corrected during the production process? In what cases is it discarded and in which cases is it fixed? Explain the process.
8. What technologies or tools does your company use to improve quality control in auto parts manufacturing?
9. What non-destructive and destructive inspection technologies do you use to evaluate the quality of auto parts?
10. What happens if there is a defective auto part when it has already been sent to the United States? Or what would happen?
11. For you, what is the crucial factor to ensure quality in the assembly of auto parts?
12. What actions does the company take to continually improve quality control processes in auto parts manufacturing?

Quality control Manager

Questions

1. What is the role it plays within the quality control process in auto parts?
2. What measures has your company implemented to guarantee high-quality standards in its auto parts?
3. How does quality control in auto parts affect the reputation and competitiveness of your company in the market?
4. How do you ensure that material and component suppliers meet established quality standards?
5. What technologies or tools does your company use to improve quality control in auto parts manufacturing?
6. What actions are taken to prevent the production of defective auto parts?
7. What is the main problem detected in defective auto parts?
8. How does your company approach identifying and correcting defects in auto parts before they leave the assembly plant?
9. How do you train employees to carry out the quality control process in auto parts properly?
10. What difficulties has your company faced in implementing and maintaining a solid quality control system in auto parts manufacturing?

Exporter of auto parts

Questions

1. What is the role you play in your company?
2. What measures does your company take to ensure that auto parts meet the quality standards required by the US market?
3. What regulations and quality standards must auto parts meet to be successfully exported to the United States?
4. What are the main documents or certificates needed to export auto parts to the United States related to quality?
5. How do you ensure that auto parts meet the standards and documentation necessary for export?
6. Before auto parts are exported, is any final quality inspection carried out within the plant?
7. What is the process for exporting auto parts to the destination country?
8. What happens if there is a defective auto part when it has already been sent to the United States? Or what would happen?
9. How do you relate the impact of quality control in auto parts exported to the United States to customer satisfaction and the competitiveness of your company in the international market?