**Full title of Report**

**Audi Safety Recall 24DP**

**Full name of Student**

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Abstract

This Abstract offers a summary of the study, what will be covered in this article, what is the report's learning result, the report's motivation, and conclusions.

The issue chosen for this report is a safety recall on the market of "Common rail fuel leakage" which is one of the components of the gasoline injection system, one of the best fuel systems available on the market, most of the current generation fuel economy vehicle and performance could only be achieved by these innovative technologies. But when the system fails, consequences are very serious in society that can destroy society leads to many other dangerous situations, when dealing with this type of situation as a solution provider, to achieve systematic step by step from the beginning to provide a solution.

Introduction: problem in the market “fuel leaking from the common rail” largely affected vehicles in the market.

Root cause analysis: The root cause of the problem is “fuel system common rail defective” leaking over the period with extreme temperatures conditions, customer can notice order, causing catching fire.

Technical solutions: Developed solution for root cause found “Improved materials” to the existing part can give a permanent solution to this problem

Production: After the Production part approval process (PPAP), a Modified product is manufactured based on the facility. The number of products to produce simultaneously without affecting current product production, JIT / Kanban with 2 bin system adapted bet best TPM and TQM requirement of the supplier.

Finance and costing: Calculated process cost, damage cost, and final price of the product cost after the negations, given details in the results section.

Management solution: Assigned role and responsibility matrix with deadlines to employees to succeed in the project. Implemented KPI to achieve the goals

FMEA (Failure mode effect analysis): Analysis was done based on the result of why the product reached the market with defective, Identified technical and management issues. Initiated Audit to fill up the gaps and lapses in the process or system

Advantages of this whole analysis are increasing analysis skills, handling product in the market when safety issues popups, systematically doing thins, using appropriate tools to identify the root cause and technical solutions, understands how important is to test the product before launch, the importance of quality tests.

Disadvantages: Losses in the business, increasing stress, leading to many other dis-advantages affect humans and society

Statement of originality

‘I hereby declare that this submission is my work and that, to the best of my knowledge and belief, it contains no material previously published or written by another person nor material which to a substantial extent has been accepted for the qualification of any other degree or diploma of a university or other institution of higher learning, except where due acknowledgment is made in the acknowledgments.’

Full name: Rajesh Jasti

Signature

Date:30/08/2020

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Nomenclature, glossary, symbols

# Introduction

This introduction offers a summary of the study, what will be covered in this article, what is the report's learning result, the report's motivation, and conclusions. Going to cover seven parts of this article, every section provides a brief on the subject, **1. Abstract** gives a brief description of the report's conclusion, **2.Introduction** gives a brief description of the issue identified in the market that affects society, a brief description of what is covered in this report, **3.** **Root cause analysis** provides a quick overview of the root cause of the problem chosen for the report, by using different tools **4. Technical solutions** offer a brief about providing technical solutions to the selected problem after determining the root cause, **5. Finance and Costing** includes an overview of the value of the product to be released into the market, expenses, income, time to recover the expenses, preparing budgets, **6. Management solutions** offer a brief overview of why the product is faulty and the involvement of management in reaching the market in this case, **7. Discussion and conclusions** offer an overview of what is the report's outcome for the problem chosen. Here the chosen problem in the market which affects the society and company.

**Introduction to a problem chosen:**

Audi is reporting more than 74,881 SUV, A6, and A7 cars from 2016 to 2018, and Audi A8 cars from 2015 to 2018, as one of the systems that power a motor will create leaks that could result in a crash.

Fuel leakage may result over time from improvements in the supplier's welding process. The car supplier claims the amount of fuel leakage is small, and if this situation occurs the consumer will smell fuel in the vehicle.

The business is aware of no accidents or accidents associated with this issue, a representative of Audi told CR.

injection is also projected to be driven by the increasing demand for passenger vehicles and commercial vehicles.

The Asia Oceania demand for direct injections of gasoline is expected to be by volume the fastest rising during the projected period. Gasoline industry growth has been observed in the region due to increased emphasis on fuel economy, CO2 emissions reduction, and increasing demand for high-performance vehicles. The largest market is estimated in North America by volume over the forecast era. CAFE regulations, a downsizing trend without lowering engine power and strict emission regulations which ultimately enhance the introduction of gasoline direct injection into vehicles are responsible for North America's market growth. At the same time increasing complexity in the fuel systems leading to many problems in the market this is one of the cases largely affected in the market

When the problem is identified in the market forecast of the vehicle affected

According to the road transport agencies data, Audi is reporting more than 74,881 SUV, A6, and A7 cars from 2016 to 2018, and Audi A8 cars from 2015 to 2018, as one of the systems that power a motor will create leaks that could result in a crash.

|  |  |
| --- | --- |
| Year | Sales |
| 2015 | 10000 |
| 2016 | 20000 |
| 2017 | 30000 |
| 2018 | 40000 |

**What’s a safety recall:** If an alert is made a manufactured determines that any equipment, vehicle or any consumer product an undesirable risk for health or lack of compliance with basic safety requirements, the manufactures are recalled fixing the problem by replacing, reimbursement, or in rear cases offering a new product.

Motor vehicle safety as the performance of motor vehicles or parts in a way that protects the public from unintended incident threats because, construction, or performance of a motor vehicle, and against un-reasonable Build risk of death or harm in an accident that shall protect motor vehicle non-operative protection. A defect includes any A fault is commonly defined as a safety defect in the output structure, part or component of a car, or motor vehicle equipment as a problem in the car or in motor vehicle machinery that occurs. as a concern.

When vehicle equipment, like car seats, A safety concern has been identified that affects consumers or tires are subject to a recall. According to safety act and regulations owners receives an effective remedy from manufactures, if a safety recall is made, the supplier must free of charge repair the issue

If the product is registered with manufacturers will notify owners if there’s safety recall by emailing you details. Manufacturers must seek to contact the consumers of the goods recalled. for motor vehicles, manufacturers merge their purchase vehicle records with vehicle registration information. For product, where registration records do not exist, manufactures are obligated to notify their distribution network and know purchasers of the recalled product, However, if don’t receive a notification, if your vehicle airbag or another item of part is involved in a safety recall the manufactures are obligated to provide a cost-free remedy.

What will cover in Root Cause Analysis:

Root Cause Analysis is a standard approach that allows the issue to be solved. This attempts to determine the root of a problem utilizing a certain series of measures and associated methods, to locate the key explanation for the question:

What will cover in Technical Solutions:

The field of a technical solution refers to all product design and each lifecycle product, product part, and product phase. Its planned relevance also encompasses utilities, service structures, and modules in the production areas where the terms 'product' and 'product component' are used.

What will cover in Finance and Costing:

The cost accountant is responsible for raising and growing income of the financial loss of business. Duty involves assessing the real manufacturing or utility prices, analysis of associated market activities, performance analyzes, and organizational budget management. Cost accountants must collaborate closely with management to achieve financial goals effectively.

What will cover in Management solutions:

In the case of product failures management role, causing the product to launch in the market, how it is related to management. Total corporate risk assessment mechanism that involves an overview of the financial impacts of risks on the enterprise

What will cover in Discuss and conclusions:

Overview of observations, highlight the key statistic observations from the results section, briefly outline the general conclusions of the report and the purpose of the research.

## Timeline (Gantt Chart)

What is a Gantt chart: Gantt chart shows a list of activities is shown on the bottom of the chart and an appropriate time scale is presented on the top. The size and duration of the bar indicate the start and end date of the activity of each task. Each task is represented by a circle. You can see this at a glance.

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## Defect replacement product development cycle

Recall/Defect replacement product development cycle shows each step by step to since the problem is identified in the market to launch the product in the market.



# Root cause Analysis

**Root cause analysis:**

Root Cause Analysis is a standard approach that allows the issue to be solved. This attempts to determine the root of a problem utilizing a certain series of measures and associated methods, to locate the key explanation for the question:

Determine what happened. Determine what happened.

Determine the explanation for this.

Find out what to do to avoid the risk of it happening again.

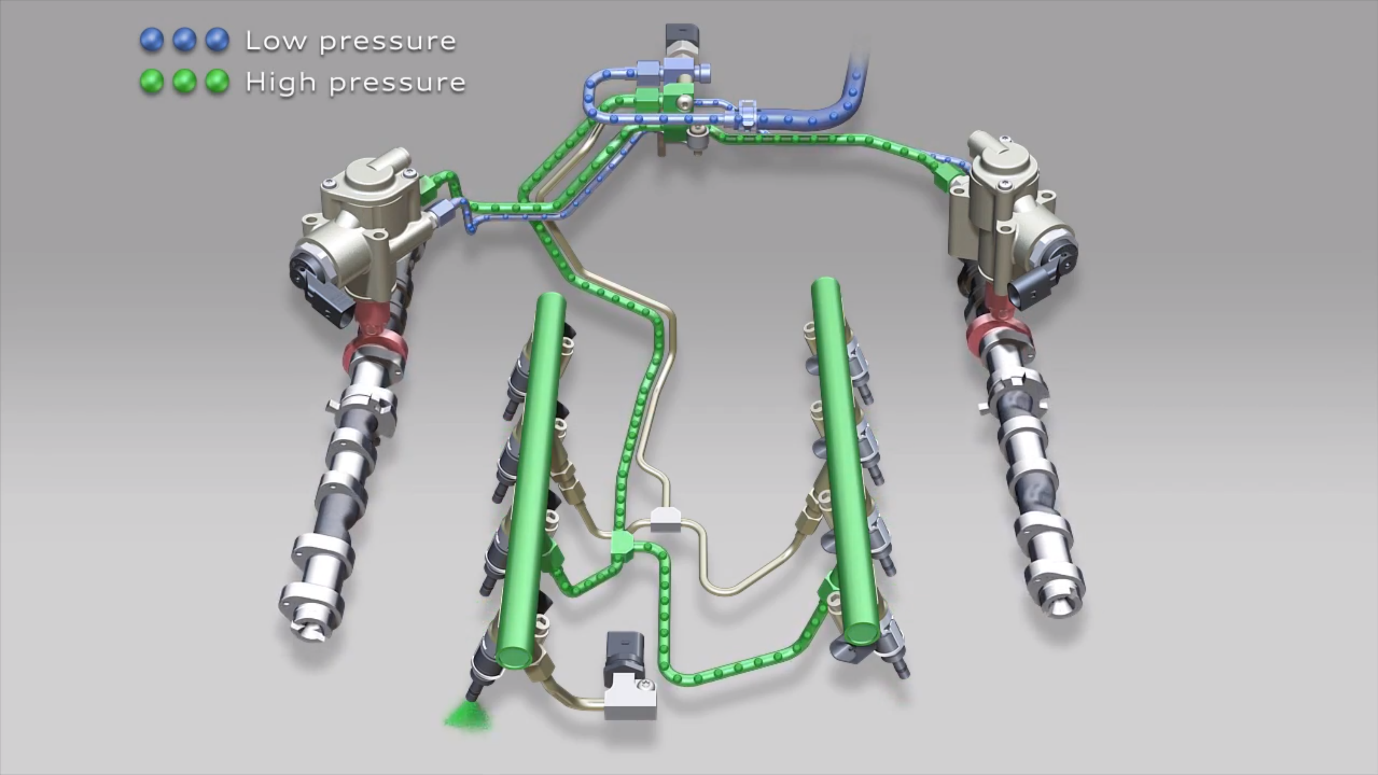
RCA recognizes the interrelationship of processes and events. An action in one region triggers an action in the other and so on. By tracing these acts, you will figure out when the trouble originated and how it was your symptom.

All three kinds of factors are investigated by RCA. This involves the study of negative impact dynamics, detecting secret device weaknesses, and recognizing other behavior that has led to the crisis. Sometimes this ensures that RCA discloses many underlying factors.

The fuel rail is one of the most important components in the diesel and gasoline direct injection system. The main difference between standard and direct injection is the delivery of fuel and the way how this one combines with intake air. In the common rail injection system, the fuel is directly injected into the combustion chamber avoiding the waiting period in the intake manifold. Controlled by the engine control module, fuel is directly injected in the combustion chamber, which makes burn more evenly without any rich mixture.

The main advantages of a common rail direct injection system can be defined in the reduction of exhaust and environmental pollutions, better fuel-saving, and performance of the engine is improved, fuel high-pressure system contains a high-pressure pump, fuel rail, injectors, and engine control unit.

The common rail is long cylindrical geometries shaped made with metal, modern vehicles same made with plastic to improve fuel economy and performance. Common rails received fuel from a high-pressure pump and distribute it to the injectors. Better fuel economy which is increases the fuel pressure and sets entirely new standards for the manufacturing of a high-quality common rail.



After the product has been launched in the market after a certain period or immediately consumers reported problems at the service centers, some problems solutions readily available which can rectify immediately at the stage of maintenance or service center level. Some problems which solutions not available readily and safety concerns treated as a higher priority, immediately escalate to next level to research, here all the all samples will be collected and starts an investigation to finding the root cause for the problem in the mark

**The problem in the market:** Fuel escaping from one or both rails, as result there maybe smell of fuel and catching fire

Affected vehicles reported to respective dealerships, discovered fuel smell in the engine compartment, started checking components in fuel systems from the fuel tank located in the rear of the vehicle by checking visually leak marks by splitting parts one by one, leak found at engine compartment at fuel rail parts. To confirm to leak exactly fuel pressure tests has been conducted and found fuel leak at the fuel rail, finalized fault causing part

Fuel rail holds the required pressure in the high-pressure system to inject into the cylinder combustion chamber, this is continuing process of the injection system, required pressure always maintains in the fuel rails even after turning off the engine still it maintains pressure and pressure will reduce slowly over the long period.

Most of the vehicles fuel rail made with metal, ultimately newer generation vehicle focusing to reduce engine weight for better performance and fuel economy, the largest automotive industry is coming up with new inventions introducing to the modern world

The analysis shows that variations in plastics, supplier welding process of fuel rail components effected for a certain period of production of vehicles, due to these variations, fuel leaks end cap of the fuel rail occur over the period. A minor amount of fuel leaks in the area customer may notice fuel smell, in this condition for safety reasons immediately need to report to the nearest Audi service center.

Detailed investigation of field cases and simulation tests to understand the root cause and possible contributing causes, the additional testing influence of the temperature and climate as well as different fuel qualities as well as impact and probabilities. Test results showed that long term bench testing did not match requirements during real-life customer driving.

It is a single component made with plastic depends on the pressure it maintains, it has output ports to injector based on the engine design or no of cylinders, fuel rail input connected to fuel pressure pump output.

Fuel rail welding causing the fuel to leak, which is part of materials at the initial stage of the design.







Figure 2‑1: Apparatus

# Technical Solutions

**Technical Solutions:**

Overview of Technical solutions: The field of a technical solution refers to all product design and each lifecycle product, product part, and product phase. Its planned relevance also encompasses utilities, service structures, and modules in the production areas where the terms 'product' and 'product component' are used.

Such practices typically help one another interactively. A degree of design may be required to choose solutions, at times very detailed. A test or pilot may be used to build a technological modification or a detailed set of specifications to obtain adequate information. For further knowledge about the properties of possible design approaches that aid choosing approaches, feature models, tests, samples and pilots can be hired. For project engineering systems-of-systems, simulations may be especially useful. Similar activities apply to the product and its parts as well as product lifecycle Technical Solution

Product and feature part requirements are fulfilled by the design management processes aligned with the Technical Solution service area. Management processes of requisites place the specifications resulting from the creation of standards, under the correct continuous delivery, and retain their traceability to previous requirements.

**Material selection:**

The common rail itself has stored fuel and is exposed to heat and pressure permanently. Therefore, if the raw materials haven’t been selected wisely, the quality problem can occur. Larger product life and reduced accumulation volume are the common problems in the rail selection of materials.

Shorter product life means that the common rail will break sooner then expected especially if it has been made of a material with a low resistance to conditions that cause fatigue and wear. Those conditions include cyclic loading/unloading, under peek operating internal pressure, and the fuel cavitation implosions. Eventually, fatigue and wear may fail or crack the material. Difference and breakage are avoided by selecting material that best balances strength and hardness, and product fatigue life is extended.

The small amount of accumulation of fuel due to the uneven hardness of the metal selected is another major common problem in material selection. The metal should be heat-treated and heat-forged to achieve greater rigidity. Unbalanced grain structure distribution results in non-uniform diesel volume along the pipe, affecting the injections. They start injecting not the correct fuel amount to each cylinder heads on each injection event.

Different burning events also caused unparalleled and deviated fuel volumes.

The selection of the best common rail fiber with a reliable heat treatment reaction and the correct thickness and rigidity and evenly dispersed portion was shown to ensure that the fuel volume was accurately pressurized.

Set forge possesses excellent expertise providing better design for good common rail performance, adapted to the requirement of the client.

Common petrol and diesel engine rail are one part of heated forged components that avoid any risk of splitting or leakage.

For this case fuel rail leaking bad material selection at the point of design causing leakage over the period.

## Kaizen (continuous improvement process)

Solution 1.

Make changes to existing product which is currently in use, Because when a part is made with metal no problem occurred, this part is made with plastic over the period causing the fault, plastic has properties which can change extreme environment temperature conditions or engine temperature conditions, the problem found to be properties of materials, by improving current part with robust materials can rectify this problem permanently.

Solution 2.

By shifting component material from plastic to metal, it will rectify the problem permanently can affect engine weight it depends on the requirements of the customer, if no weight concern this will be 2nd solution to rectify the problem quickly and long-lasting durability.

Which we developed alternate parts to replace the current part in case of failures. This can full fill the requirements of the primary part.

Recommended solution:

Technical solutions recommended to go for solution 1 which is better and by making changes to materials that can solve the problem permanently, there are many advantages with the plastic fuel rail. The world automotive industry is particularly susceptible to fuel savings in cars. The high weight of cars has a significant effect on FE. For designers, research on ideas for weight loss up to a single part point is therefore of vital importance. Another of such elements with strong potential is the gasoline pipe (Gasoline Rail). Gas rail is part of and is mounted on the engine of an automobile fuel network. It primarily functions as a gasoline delivery conduit from tanks of petrol to the fuel injectors, which stream more petrol through high-pressure ports. Pulses are generated in fuel lines through the opening and closing of injectors, so that fuel rail serves both as a float tank and as an impeller. All these considerations render it very important and special for an engine to build a fuel line. Also, fuel rail production is produced using products such as titanium, plastic, and sheet metal. Model criteria for plastic fuel rails are described in this technical report. 1Design consideration during the selection of raw material2Factors of fuel rail design3Fortune explanations of other significant design parameters4Benefits of the new design.

Remedy component: New part developed with robust material quality improved, effected part numbers are left fuel rail:06E133681L, right fuel rail:06E133682C, the replacement for recall are fuel rail kit set of both fuel rails: 06E198201B, apart from that additional parts need to replace as part of the repair process

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## Product Development Cycle



**Concepts:** People come up with ideas where a group of people comes to gather and develop to the idea into reality, customer analysis, all the background analysis will take place before developing stage

**Development:** The product development state is the first state of the product life cycle. This stage not only entails the manufacture of the product, but also the execution of analysis and testing.

The core part of the research for the development phase is a market research and comparative analyses. This is done to gain an idea of the product's potential growth and to create a business case for confirming the product. Feedback obtained from end-users and product research is both important for product growth.

**Prototype:** A prototype is an early version, layout, or product development intended to evaluate an idea or procedure. There was a misunderstanding. Usually, a sample is used to test a product concept for device designers and customers to improve accuracy. Prototyping offers criteria for a practical, rather than a theoretical operating method. One of the key early phases of inventing a concept is to construct a three-dimensional representation of the dream that is easily presented. Developing a project may also be one of the most exciting and worthwhile moves. This is because developing a prototype allows you to take advantage of the skills that inspired your invention first in creativity. You will check and improve your concept features. The proposal fits in principle well. You can find flaws in your reasoning even if you start actively constructing it. Therefore, another excellent justification for creating a prototype is to test the function

**Manufacturing:** At this stage raw materials with the use of manual labor or machinery, and which is typically done systematically with manufacturing In a more restricted way, parts are made or installed in fairly large-scale finished goods.

**Use:** This is a place where sales and will take place and users get involved in the product, Experiences good or bad share with the whole over the places, any problems with the product they report to service centers.

**Service:** Any customer after-sales experiences reflect in service centers, depending on d customer complaint type of problem repairs, maintenance or replacement will be done at this stage, the primary analysis will take place for safety-related concerns. In case of remedy, not available or safety concerns will escalate to the next level of technical support or research centers depending on organization structures.

**Recycle:** This is a place where the product life cycle ends after service life is finished product goes to recycle the materials with different ways types of materials, this will become raw materials or new product production use.

## Production Part Approval Process

What is PPAP: The PPAP is a powerful resource to create trust in the manufacturers of products and their methods of manufacturing. Costs and management at a high standard of quality have become important to the performance of a business in a dynamic manufacturing world today. The growth in the outsourced components has culminated in the increasing cost of machinery, supplies, and jobs along with the growing global markets. Most components are outsourced to suppliers from abroad. It also contributes to longer lead times and higher instructions. Therefore, it has become essential, once and for all, to supply quality components to full fill customer requirements.

Approval procedure for new or revised parts or parts provided by new or significantly revised manufacturing processes is specified by PPAP. The PPAP procedure requires 18 items that may be appropriate for production-level parts clearance. For through application not all elements are available. Five PPAP application rates are commonly approved. The comprehensive material, instructions, and review materials that satisfy the specifications of the procedure. The resulting PPAP presentation shows that the provider has met or exceeded the customer's requirements and can reproduce quality parts consistently.

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Production part approval process (PPAP) documents required from the supplier;

This is involved with a new part or revised part production process.

1. Design Documentation

In this case, the part is designed by the customer, design and purchase order received from the customer

1. Engineering change documentation.

Due to a request for modification of a part or component, engineering change supplied by the customer

1. Customer engineering approval.

A copy of temporary derivation is normally required to submit parts to the customer before a PPAP Approval.

1. Design failure modes and effects analysis.

Review and signed by both parties supplier and customer

Possible failure modes and their effects on the product or customer and their probability to occur. Failure modes can include

Product malfunction

The reduced performance or product life

Safety and regulation issues

1. Process flow diagram

The process flow diagram shows the entire process to identify any potential process quality risk and the documents including material ln assembly, test, rework, and shipping.

1. Mode of process failure and analysis of the effect.

PFMEA, both development process measures to define possible process quality threats and documentation for the controls applied.

1. Control Plan.

The management plan for product distribution is consistently by consumer service expectations.

1. Measurement system analysis studies

MSA studies will include (GR&R) studies on measuring equipment used during assembly or control checks. Calibration records for gauge and measurements.

1. Dimensional results

To validate a component, the layout of the sample part must comply with the print requirements. Draw 30 pieces at least, final drawing measurements.

1. Records of material/ performance tests

Design verification plan and report This section comprises a summary of the validations of all materials specified in the prints, including the certification of documents.

1. Initial process studies

Initial process studies are carried out and will include (SPC) production processes

1. Qualified laboratory documentation

Consists of an industry certificate for any laboratory that has participated in the validation test.

This may be in the house test laboratory or any other off-site contract testing facility used or testing for validation or certification of materials.

1. Appearance approval report

AAI only applies to appearance-affected components, not for this

1. Sample production parts

Test parts usually submitted to the customer for consumer or supplier approval after product creation has been completed

1. Master Sample

A master sample is a final sample of the product which the customer inspects and signs.

1. Checking Aids

All devices that are used to inspect, check or measure parts should be included in the manufacturing phase

1. Customer-specific requirements

All special requirements of the customer are included. Specific customer requirements are recorded on the bulk material requirement check sheet for bulk materials

1. Part Submission warrant

The full PPAP application is a PSW form description. Unless otherwise specified by the customer, a PSW is required for each part number.

## Process Flow chart for defect deduction or Quality plant for the part

**Overview of the process flow chart**



**Detailed Process flow chart for defect deduction or Quality plan for the part**



## JIT / Kanban for Supplies

**What is SMED:**

SMED (Single minute exchange of Dies) system reduces the time it takes to complete equipment changeovers. The essence of the SMED is to convert as many changeover steps as possible to external (Performed while equipment is running) and specify and streamline the remaining steps. The single minute exchange dies name comes from the coal of reducing changeover time to the single-digit (less than 10 minutes).

A good SMED program will have the following benefits:

Lower manufacturing cost (Fast changeover means less equipment downtime)

Smaller lot size (Faster changeover enable more frequent product changes)

Improved responsiveness to customer demand (Smaller lot sizes enables more flexible scheduling)

Lower inventory levels (Smaller lot sizes result in lower inventory levels)

Smoother start-ups (standardized changeover processes improve consistency and quality)

In our case takt time = 320 sec, there are 2 modules produced in a day each changeover takes 10 minutes, shit hours 8.5, break time of 110 minutes

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sl no | Description | hours | Minutes | seconds | final |
| 1 | Shift Time | 8.5 | 510 | 30600 | 30600 |
| 2 | Break time | 1.83 | 109.8 | 6588 | 6588 |
| 3 | Changeover time for 2 dies (No of dies) | 0.3 | 18 | 1080 | 1080 |
| 4 | Available time | 6.37 | 382.2 | 22932 | 22932 |
| 5 | Takt time | 0.088889 | 5.333333 | 320 | 320 |
|  |  |  |  |  |  |
|  |  |  |  |  |  |
| 6 | **Max Possible production number of units** | **71.6625** | | | **71** |

**What is JIT/ KANBAN:**

Importance of Inventory Management

Inventory is parting in production facility has in stock at any given time. This includes raw materials, goods, work-in-progress. It is important to have on hand because if there aren’t enough raw materials to use In the production process, not enough parts to transport to buyers, the company can losing money or can lead to stopping the production process and huge productivity losses.

Just in time inventory system (JIT)

This is the production process that could minimize the amount of inventory they had, it would save space and money. So, this method of tracking and forecasting when certain parts and inventory would be needed. So that it was small orders and stocked as the production process required it, the vendor was able to supply it. This process became known as just in time inventory management. As other company’s leaner this concept, it took some practice to make it effective. One risk of JIT is having stock out, running out of a product of material. While the goal of JIT is to minimize the amount of inventory a company has to store and hold. That means that if they don’t forecast demand correctly, they may not have a product when the customers are ready to buy, or it may freeze the production line. That costs money as customers will go elsewhere to buy their products. The successful JIT inventory management requires accurate and timely forecasting.

JIT Kanban

This is a scheduling system for lean manufacturing, originating from the Toyota production system, Toyota introduced just in time manufacturing to its production. The approach represents a pull system. This means that production is based on customer demand, rather than the standard push practice to produce the number of goods and pushing them to the market. Its core purpose is minimizing waste activities without scarifying productivity. The main goal is to create more value for the customer without generating more costs.

JIT is an inventory management method proven to improve manufacturing firm's return on investment, efficiency, and quality of work by fundamentally reducing inventory. JIT is advocates viewing inventory as cost incurring instead of value-adding. It focuses on having the right material, at the right time, at the right place, and in the exact amount.

Multi-BIN: where container quality is fixed, multi bins (Containers), needed is circulated based on daily demand lead-time container quality and safety stock

Kanban QTY= (Daily usage(D) x Lead time (LT)) + (Safety stock(ss)

Container capacity

2-BIT: Where only two bins(containers) with standard quantity are circulated, the standard quantity is calculated based on daily demand, lead-time, and safety stock.

Here we adapted 2-BIN system

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 2-BIN Kanban | | | | |
| No of Bins | Demand QTY | lead time | safety stock in % | Final per bin |
| 1 | 71 | 5 | 20% | 426 |
| 2 | 71 | 5 |

## TPM and TQM Requirements of the supplier

**What is TPM:**

TPM is a maintenance strategy aimed at reducing production losses due to equipment status, or in other words, maintaining equipment in a position to deliver at full efficiency, the planned quality goods, with no unscheduled stops.

Zero failures

Zero Downtimes

Null failures due to poor equipment condition

This equipment is not deficient inefficiency or output capability

Total production or maintenance which offers maximum or full production output.

TPM is based on a 5-S structure of eight pillars. A 5-S scheme is an organizational form focused on five words of the Japanese language

The eight foundations of overall production maintenance concentrate on constructive and protective technologies to improve the reliability of equipment. Eight foundations are the following: independent maintenance; concentrated (kaizen) improvement; scheduled maintenance; quality control; control of early equipment; education and training; health and safety; and TPM management. Let any pillar below break down.

**What is TQM:**

TQM is a management ideology aimed at incorporating all of our organizational roles, such as marketing, accounting, architecture, technology and development, customer service, and more.

TQM treats an entity as a process set. They maintain that organizations must strive, by integrating the expertise and experiences of workers, to continually develop these processes. The basic aim of TQM is "Do the right things every time, correct the first time." TQM is variable and adaptable indefinitely. While originally used in manufacturing, TQM is now known as a generic management tool for several years and is used primarily in this field, just as it is used in service organizations and the public sector organizations. There are a variety of evolutionary pathways that have their copies of the shared ancestor from various fields.

**TPM and TQM Supplier requirements:**

* The suppler appreciates and respects the organization's management approach.
* The company has a reliable structure of management
* The supplier maintains a high quality of manufacturing and is prepared to cope with future technical advances
* The supplier meets customer requirements for raw materials and parts and complies with quality standards
* The supplier should be able to deliver the required output quantity
* The provider does not infringe on business secrets
* In terms of transport and contact, the supplier should be conveniently accessible
* The provider should enforce the contractual conditions more honestly
* The supplier should have reliable control controls and product changes
* The history of customer satisfaction and the reputation of the company should be trusted
* Certification of the supplier selection process identified by the technical committee of the supplier
* For a substantial period, the supplier does not have commodity-related lot refusal
* No non-product rejections may occur for a state period such as miscounting or billing error (Six months-five years)
* Should not include negative events or problem associated with non-products, even if the inspection and tests have shown adherence to the requirements during the given duration (6 months to 10 years)
* The supplier should have a fully documented system of quality (e.g. ISO 9000)
* The site system assessment supplier should have been successful
* Provider inspection and testing should be carried out
* The provider should be able to provide inspection data on time.

## Ethical and Sustainability consideration for the suppliers

Ethical procurement means ensuring the responsible purchasing of our goods. It is about ensuring that the people who produce our goods are equally compensated. The company is liable to run. This refers to people in particular. Ensure that the paying price makes the wages of employees over the minimum permissible wage. Ensure fair working hours are fewer than the maximum permissible. Make sure the safety requirements of your manufacturer are above acceptable levels. Staff will ultimately be safe and earn decent livelihoods.

Please refer the requirements mentioned in the above TPM and TQM requirements

# Finance and Costing

## Process Cost sheet of the defective component

**Finance and Costing:**

The cost accountant is responsible for raising and growing income of the financial loss of business. Duty involves assessing the real manufacturing or utility prices, analysis of associated market activities, performance analyzes, and organizational budget management. Cost accountants must collaborate closely with management to achieve financial goals effectively.

Process cost sheet of the defective component identified in the technical issue

There are a variety of main things that you have to take into account when setting the purchasing negotiation objectives. This may include:

* Identify participants
* Develop objectives
* Analyze strengths and weaknesses
* Gather Information
* Recognize other party's need
* Identify facts and issues
* Establish positions
* Develop strategies and tactics
* Brief [ersonnel
* Practice the negotiations

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Process cost sheet includes raw meterial** | | | | | | |
| Sl no | Activity | Description | Hour rate/Piece rate (NZD) | Hour Rate (NZD) | Piece rate | Process Cost |
| 1 | Raw materials | Out sourced | Piece rate |  | 50 | 50 |
| 2 | Raw materials Inspection | Quality check | Hour rate | 50 |  | 0.5 |
| 3 | Mould setup | Physically need to setup, one-time setup | Piece rate |  | 100 | 1 |
| 4 | Raw materials | Quality Inspection | Hour rate | 30 |  | 0.3 |
| 5 | Plastic Extrusion | Automation Process, 50 pieces in hour | Piece rate |  | 90 | 90 |
| 6 | moulding |
| 7 | Cooling and release |
| 8 | Post -Processing |
| 9 | Quality check | After production process | Hour rate | 30 |  | 0.3 |
| 10 | Transport | 100 pieces a batch | Hour rate | 50 |  | 0.5 |
| 11 | Inward Inspection | Out sourced,100 pieces a batch | Hour rate | 10 |  | 0.1 |
| 12 | Part number stamping | Out sourced,100 pieces a batch | Piece rate |  | 2 | 2 |
| 13 | Quality check | 100 pieces a hour | Hour rate | 100 |  | 1 |
| 14 | Transport | Out sourced,100 pieces a batch | Hour rate | 50 |  | 0.5 |
| 15 | Inward Inspection | Out sourced,100 pieces a batch | Hour rate | 10 |  | 0.1 |
| 16 | Packing | Out sourced,100 pieces a batch | Piece rate |  | 3 | 3 |
| 17 | Part number on packing | Out sourced,100 pieces a batch | Piece rate |  | 2 | 2 |
|  | **Total** | | | | | **151.3** |

## Damage Cost Analysis

|  |  |  |
| --- | --- | --- |
| Damage Cost Analysis | | |
| Standard Cost | | |
| 1 | Parts with customer | 100000 |
| 2 | Parts under transit | 190000 |
| 3 | Parts in stock | 1000 |
| 4 | Parts in semi-finished condition | 20000 |
| 5 | The Product sales cost in (NZD) Per Item | 300 |
| 6 | Transport cost (NZD) Per Item | 5 |
| 7 | Distribution COST (NZD) Item | 5 |
| 8 | Profit (NZD) Item | 10 |
| 9 | Cost of product to the Company (NZD) Item | 261 |
| 10 | Semi-finished part average cost (NZD) Item | 100 |
| 11 | Collection cost (NZD) Item | 4 |
| 12 | Destroying cost (NZD) Item | 4 |
| 13 | Cost of arranging alternate part from the second source (NZD) Item | 300 |
| 14 | Differential cost needs to be paid till supplied resume. | 0 |
| 15 | Number of days to organize from an alternate supplier | 20 |
| 16 | Consumption per day | 1000 |
| 17 | No of working days | 5 |
| 18 | The lost production cost of the customer (NZD) | 100000 |
| 19 | weekly penalty for missing supplies (NZD) | 25000 |
| 20 | Time for resupply | 12 |
|  |  |  |
| Cost Of The Damage | | |
|  | Recall Cost In (NZD) | 31800000 |
| 60420000 |
| 304000 |
| 2080000 |
| Total Recall Cost In (NZD) | 94604000 |
|  |  |  |
|  | Diferential Cost In (NZD) | 1560000 |
|  |  |  |
|  | Penalty In (NZD) | 300000 |
|  |  |  |
|  | Losss of Profit In (NZD) | 600000 |
|  |  |  |
|  | Loss of Production Cost In (NZD) | 2000000 |
|  |  |  |
|  | Liability Cost | 3860000 |
|  |  |  |
|  | Total Damage Cost In (NZD) | 99064000 |
|  |  |  |
| Time to recover the damage by supplying the product (weeks ) | | 1981.28 |

## Expected Negotiations with supplier and final cost

|  |  |  |  |
| --- | --- | --- | --- |
| Final Cost | | | |
| Sl no | Particulars | In% | Price |
| 1 | Materials | 12.50% | 37.5 |
| 2 | Direct labour | 17.50% | 52.5 |
| 3 | Prime cost | 30.00% | 90 |
| 4 | Factory Overheads1/3 | 0.1 | 30 |
| 5 | Factory Cost | 40.00% | 120 |
| 6 | Admin Overheads | 40.00% | 120 |
| 7 | Total Production cost | 80.00% | 240 |
| 8 | Selling and Distribution cost | 5.00% | 15 |
| 9 | The total cost of sales | 85.00% | 255 |
| 10 | Profit | 15.00% | 39 |
| 11 | **Final Price** | 100.00% | **300** |
|  |  |  |  |
|  |  |  |  |
|  |  |  |  |
| 1. Direct material- 12.5% of selling price | |  |  |
| 2. Direct labour -17.5 of selling price | |  |  |
| 3. Production over heads-1/3 of prime cost | | |  |
| 4. Administration overheads-50% of production cost | | | |
| 5. Profit (39 per unit)-15% sales | |  |  |
| Calculation of administration overheads | |  |  |
| Administration overheads=50% of production cost | | | |
| Administration overheads=50% of [factory cost + Admin overheads] | | | |
| Production Cost=[Factory cost + Admin cost] 1:1 ratio, 50%=50% | | | |

# Management Solutions

## Role / Responsibility Matrix

**Management Solutions:**

In the case of product failures management role, causing the product to launch in the market, how it is related to management. Total corporate risk assessment mechanism that involves an overview of the financial impacts of risks on the enterprise

**Roll/responsibility matrix:**

A RACI matrix is the easiest, most efficient means in which project roles and responsibilities are described and recorded. Your chances of project success will increase dramatically by understanding who is responsible, who is accountable, who needs to be consulted, and who has to be kept updated with each phase.

The RACI matrix includes a responsibility assignment map that describes any mission, milestone, or key decision involved in the project execution and points out which positions are responsible for each action item, which workers are accountable, and who needs advice or information, if applicable. The RACI acronym represents the four roles played in any project by stakeholders.

A screenshot of a cell phone

Description generated with very high confidence

## Key Performance Indicators

**Key Performance Indicators:**

A key performance metric is a tangible attribute indicating how successfully an organization meets its business goals. To measure the performance of the organizations, the different KPIs are used. High-level KPIs may concentrate on the company's overall performance, while low-level KPIs may concentrate on departmental processes.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **KPI for Scorecard** | | | | | | | | | | |
| **SI No** | **Description** | **KPI** | **Reporting Frequency** | **Weightage** | **Target** | **Actual** | **Cumulative** | **Achieved%** | **Weighed%** | **Remarks** |
| 1 | New product lanuch | After sales customer complaint capcture for new product launched in 2020 | monthly | 35% | 50% | 30% | 40% | 70% | 30 | Expectations were slow, actively monitored |
| 2 | Safety problems | Root cause analysis time reduced to 20% 2020 | weekly | 40% | 100% | 80% | 90% | 80% | 50 | Good results, able to achieve results |
| 3 | Providing solutions to safety recall | New Project manager appointed for improvement of this area 2020, performance review | monthly | 50 | 200% | 150% | 180% | 200% | 70% | last safety recall solution time has reduced 20% |

## FMEA

**FMEA (for Technical and Management Issues:**

Failure mode and effects (FMEA) is a systematic method to identify possible failures in a product/process design. Modes for failure are the ways a process may fail. The consequences are ways in which these errors may affect customers' loss, faults, or adverse results. Analysis of failed mode and impacts is designed to recognize these failure modes, prioritize and restrict them.

A screenshot of a cell phone

Description generated with high confidence

## Audit Recommendations

**Audit Recommendations:**

Audit report recommendations outline activities that, when adopted, are intended to increase agency efficiency. The correct and effective execution of management's approved audit findings is an essential step in achieving the full value of an audit.

Audi has conducted in fallowing areas

* Review of after-sales process and operations
* Review of research department operation procedures and documentations
* Review of design process and procedures
* Review of handling of products, operation of the facility
* Review of System management and reporting within the manufacturing department
* Review of testing/Quality department procedures and documentations
* Review of InProgress inspection and documentation procedures
* Review content and understanding of SOP’s, KPI’s standards
* Provide recommendations for all the above-mentioned areas

Key risk controls were identified and documented based on process understanding, site surveys, and interviews conducted.

Detailed examination of key documents related to the process and sub-process was conducted based on the identified risks.

This report's findings and recommendations are focused on documents and infrastructure analysis, site evaluation, prior production audit expertise, and industry practices, including reports by the facility owner and senior management.

Recommendations

Identified after systematic evolution and analysis of the root cause of the non-performance, product failure of the quality management, or misinterpretation of written instructions to carry out work.

The business and individuals that provide raw materials and services to an organization are considered its vendors, process that helps select the right vendors, categorize vendors to ensure the correct arrangement, calculate risk in the use of vendors, and set up a vendor management company that suits the company best. This makes it easier for companies to create, maintain and monitor interactions, relationships, and efficiency of the provider and provide contract goods and services efficiently., this can help meet business objectives, minimize potential business disruption.

## Formulae

|  |  |
| --- | --- |
|  | Equation 1 |

Inserting numbered equations in MS word is not straightforward. For the above example the process was:

* Insert table (1 row, 2 columns)
* Type (or paste) equation into the first cell.
* Insert equation caption in the second cell
* Format cells as desired (citation is right-justified)
* Set border to “no border”

The result is an equation with a number with the correct layout. If you have an equation list, the captions for any equations will be inserted automatically when you insert the equation list. Likewise, equations may be cross-referenced as see Equation 1.

# Discussion and Conclusion

highlight the key statistic observations from the results section, briefly outline the general conclusions of the report and the purpose of the research.

Why, where, when, and what discussed and concluded, reason for product failed, what causing product to fail in the market, how many products are affected in the market, what are consequences of the failure product, outcome of the hole analysis.

Introduction: problem in the market “fuel leaking from the common rail” affected vehicles in the market more than 75000 as per the official data available, when problem encounter forecast of the product in the market, 100000.

Root cause analysis: The root cause of the problem is “fuel system common rail defective” leaking over the period with extreme temperatures conditions, customer can notice order, causing catching fire.

Technical solutions: Developed solution for root cause “Improved materials” to existing part because exiting materials has got many advantages, modified existing product and tested with the prototype model.

Production: After the Production part approval process (PPAP), a Modified product is manufactured based on the facility. The number of products to produce simultaneously without affecting current product production, JIT / Kanban with 2 bin system adapted bet best TPM and TQM requirement of the supplier.

Finance and costing: Calculated process cost, damage cost, and final price of the product cost after the negations, given details in the results section.

Management solution: Assigned role and responsibility matrix with deadlines to employees to succeed in the project. Implemented KPI to achieve the goals

FMEA (Failure mode effect analysis): Analysis was done based on the result of why the product reached the market with defective, Identified technical and management issues. Initiated Audit to fill up the gaps and lapses in the process or system

Advantages of this whole analysis are increasing analysis skills, handling product in the market when safety issues popups, systematically doing thins, using appropriate tools to identify the root cause and technical solutions, understands how important is to test the product before launch, the importance of quality tests.

Disadvantages: Losses in the business, increasing stress, leading to many other dis-advantages affect humans and society

Text

## Results subsection 1

Text

|  |  |  |
| --- | --- | --- |
| 1 | Sales forecast | 100000 |
| 2 | Process Cost including raw materials | **151.3** |
| 3 | Recall Cost In (NZD) | **94604000** |
| 4 | Differential Cost In (NZD) | 1560000 |
| 5 | Penalty In (NZD) | 300000 |
| 6 | Losses of Profit In (NZD) | 600000 |
| 7 | Loss of Production Cost In (NZD) | 2000000 |
| 8 | Liability Cost | 3860000 |
| 9 | Time to recover the damage by suppling the product (weeks) | 1981.28 |
| 10 | Final cost of product each | 300 |

Table 1: Blank table

# Conclusion

Discuss your results in the light of

* Your experimental work
* Comparison with the literature
* Consistency with your hypothesis
* Consistency with computer models or simulations

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Appendices

Appendix 1

The style for the “Appendix 1” heading is Title and is numbering is applied manually.

Appendix 2