

PARTICIPANT HANDBOOK



QC INSPECTOR- LEVEL 3





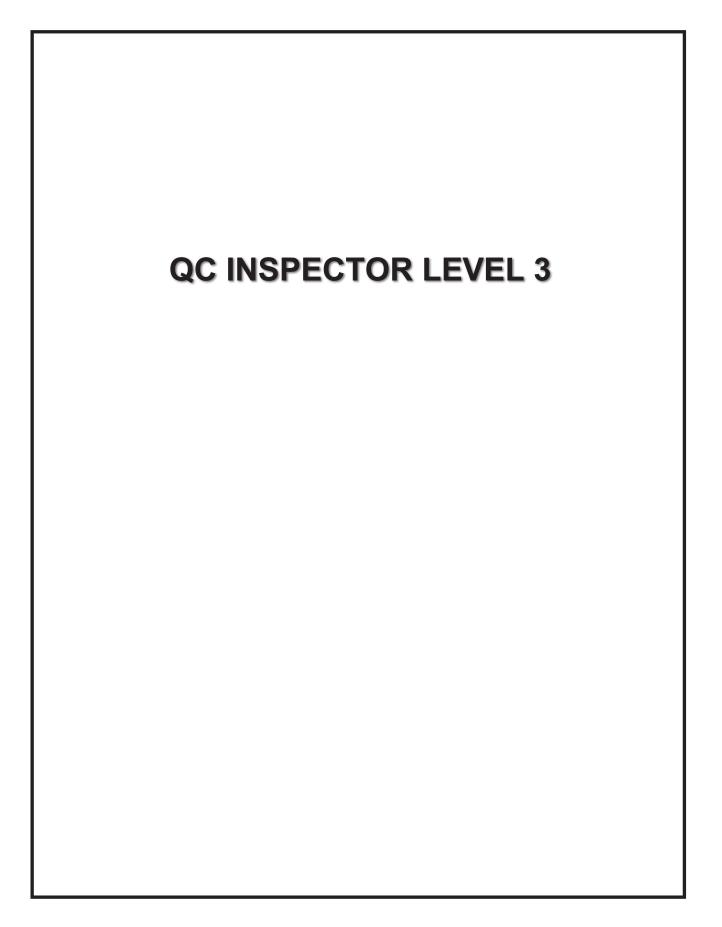


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Chapter - 1 Inspect And Maintain The Product Quality

(ASC/N6301)

Key Learning Objectives

After attending this session, the trainees would be able to -

- Practice a proper pre- delivery inspection of the manufactured product
- Prepare for the manufacturing processes that are followed for each product
- Evaluate the inspection checkpoints NPD, Production, Dock Audit etc.
- Manage the coordination needed between R&D / Quality Manager CAPA , CI
- Conclude with inspection of final manufactured product

Unit 1.1: Pre- Delivery Inspection of The Product

Unit Objectives

After attending this unit, the trainees would be able to -

- Evaluate the Job Role of a QC Inspector
- Examine the concept of Pre Delivery Inspection (PDI)
- Explain the stepwise PDI procedure

Introduction to the Job Role

The general meaning of the term 'inspection' means the activity of checking and verifying. Such checks are done in order to maintain and improve the quality of the manufactured products. The task of a Quality Check (QC) Inspector is to do checks and audits to analyze the manufacturing procedures and manufactured products. The QC Inspectors generally follow a pre-decided checklist that is based on the specifications of each product. The products that falls under inspection can be anything from components that are used for production, semi-finished goods, finished goods that re going to be shipped etc. Most often the finished goods that are going to be shipped are inspected thoroughly before shipment in order to ensure the delivery of first class products to the potential customers.



Overview of Pre Delivery Inspection

A pre-delivery inspection (PDI) is a kind of vivid inspection, carried out by the Quality Check (QC) Inspector, prior to the final delivery of the manufactured product. In case of the automotive industry, a predelivery inspection is the final check carried out by the QC Inspector on various manufactured products before handing it over to the customers. This includes various checks to ensure that the product is up to a certain standard before it is presented in front of the purchaser.

In many cases, the person who completes the PDI checklist becomes responsible for future improvements of the product. Therefore, the expertise of a QC Inspector typically is less than that of a mechanic, but the person needs to have a basic working knowledge of the components of the vehicle and will perform basic maintenance and troubleshooting.



The PDI Checklist

The table given below shows the step-wise procedure of PDI that is meticulously followed by the QC Inspectors.

	Pre-Delivery Inspection
1. Engine Compartment	 All fluids such as washer, coolant, brake, power steering, transmission and engine, are topped up.
	 The hood latch is lubricated to ensure smooth operation.
	 The battery is tested for full charge and everything else is examined for visual defects and abnormal noises.
2. Underside	Associated oils for all-wheel drive vehicles are checked.
	 Hoses, lines, the exhaust system and suspension components are visually inspected, and the brakes are serviced.
3. Interior	 The pedals are operated, looking for free play, and the brakes checked for correct operation.
	 The steering wheel is aligned, and fuses installed for the radio and other electronic accessories.
	 Every individual component of the interior is scrutinized.
	 Locks, latches and hinges are lubricated, and the clock.
	 Radio station pre-sets are adjusted accordingly.
4. Exterior	All lighting is turned on and the headlights are aimed.
	 Tire pressures, including the spare tire, are set to manufacturer- suggested specifications.
	 Windshield wipers and washer fluid level are examined, as well as all body panels and components (i.e. Weatherstrips, bumpers, mouldings).

5. Road Test	 The vehicle is driven for the recommended 10 kilometres on both city and highway roads, listening and feeling for any issues. The engine, transmission, clutch, brakes, steering, cruise control, lane departure warning and air suspension, if applicable,
	are all inspected, as is the alignment and steering wheel for shimmying/pulling.
	 The computer is scanned for any diagnostic trouble codes.
6. Final Preparation	 All protective coverings are removed, and floor mats are put in place.
	 Wheel covers and wheel locks are installed, if required (locks are only used on alloy wheels). Paint condition and emblems are checked.
	 The jack, wheel nut wrench, owner's manual, service passport, warranty booklet and guides are verified to be in their proper spots.
	 Finally, if needed, a license plate bracket and open-road plate frames are outfitted.

Unit 1.2: Manufacturing Process Being Followed For Each Product

Unit Objectives

After attending this unit, the trainees would be able to -

- Evaluate the concept of manufacturing processes
- Examine basic manufacturing processes
- Formulate the manufacturing procedure related to the Automotive Industry

Overview Of Manufacturing Processes

Basically the process of manufacturing refers to the procedure of converting the raw materials into useful products. This is normally accomplished by carrying out a set of activities such as product design, selection of raw materials, material processing and so on.

There are large number of manufacturing procedures that are generally followed in various industries. In case of automotive industry, the manufacturing processes are generally categorized based of certain characteristic traits and common features.



Basic Manufacturing Processes

Primarily, the process of manufacturing can be broadly divided into four categories. They are :

- **1. Molding :** If the products that are supposed to be created start out as liquid, chances are there that manufacturer will use the technique molding. One popular type of molding is casting, which involves heating plastic until it becomes liquid, then pouring it into a mold.
- **2. Machining :** It is difficult to make products like metal parts without the use of few machines. Tools like saws, sheers and rotating wheels are used to achieve the desired results. There are also tools that use heat to shape items.
- **3.** Joining : After molding and machining, multiple parts of a particular product are supposed to be put together to make one whole product. Joining uses processes like welding and soldering to apply heat to combine materials. Pieces can also be joined using adhesive bonding or fastener as well.
- **4. Shearing and Forming :** When dealing with sheet metal, shearing comes into the scenario. Shearing uses cutting blades to make straight cuts into a piece of metal. Another metal-shaping process is forming, which uses compression or another type of stress to move materials into a desired shape.



Manufacturing Procedure – Automotive Industry

The automotive industry has its own specific set of rules related to the manufacturing of products. Let us have a look into the stages that are included in the manufacturing procedures :

 Initial Planning Stage Product Development Phase 	 The product plans and quality specifications are received, proposal for a product is drawn up. Cost estimate is calculated based on the proposal. The feasibility of manufacturing the proposed product on a commercial scale is considered. Specification details are decided and design of the product is selected. The necessary manufacturing tools and materials are selected.
3. Prototype Production and Evaluation	 A prototype of the product is developed according to the pre-decided specifications. Checks are performed to make sure that the new product meets the desired end and match the standardized levels. In case the products fails to match up to the standards, whole process is repeated again.
4. Commercial Prototype Production Planning	 In order to build a manufacturing line that can efficiently produce high quality products, a forging simulation is carried out. A proposal is made regarding a pertinent manufacturing design and layout.
5. Commercial Prototype Production and Evaluation	 Based on the manufacturing design and layout proposed in the Commercial prototype production planning stage, a manufacturing line and a commercial prototype is produced. Checks are performed to see whether the product meets the required commercial manufacturing line quality standards.
6. Commercial Production	 When all the preparations are complete, commercial production begins. Even at this stage, modifications and improvements are made to the manufacturing line, if and when needed. The whole team actively cooperates to make high quality products as efficiently as possible.
7. Quality Check/Inspection	 The completed goods are closely inspected manually and by machine to make sure there are no defects or flaws.
8. Shipment and Delivery	 The goods that pass the inspection are delivered to the customer. The products are packed carefully to prevent contamination or damage.

Unit 1.3: Inspection checkpoints NPD, Production, Dock Audit etc.

Unit Objectives

After attending this unit, the trainees would be able to -

- Evaluate inspection checkpoints that are used for the automotive industry
- Analyze the concept of NPD : New Product Development
- Recognize the checkpoints of Production
- Analyze the concept of Dock Audit

Inspection Checkpoints

Generally, there are certain checkpoints which are taken into consideration while the quality check of a product is conducted. In case of the automotive industry as well, there are certain checkpoints that help the QC Inspector to go ahead with his/her work. In this particular unit we are all going to discuss about those particular checkpoints.



NPD : New Product Development

Every new product that is developed in the automotive industry goes through certain predetermined stages in order to become a product that can be delivered to the customers. Such stages of New Product Development are described below :

Step 1	 Concept, styling and development of a package
Step 2	Construction design
Step 3	Calculation and simulation
Step 4	Checking and testing
Step 5	Industrialization and marketing

Production

When inspecting general consumer products, most companies classify defects and checkpoints in these four main categories:

- 1) Aesthetics and appearance
- 2) Conformance to specifications (including measurements)
- 3) Function, usability and endurance
- 4) Safety & regulatory

Again, these categories can be divided into various sub-categories. they are discussed below -

Aesthetics And Appearance	
Surface defects	
Colour inconsistency	
Burns	
Flow marks	
Haze	
Sink marks	
Knit or weld lines	
Flash	
Texture	

Conformance to Specifications
Critical parameters
Defect rates
Weight
Tensile strength (if needed)
Impact strength (if needed)
Material hardness (if needed)
Chemical composition
Corrosion resistance(if needed)
Environmental tests(if needed)
Packaging and labeling

	Function, Usability And Endurance
Form	
Fit	
Function	

Safety & Regulatory
Sharp edges
Pinch point
Weight
X-Ray requirements

This way of categorizing checkpoints may not be the most perfect procedure. There is some overlap — for example, many Conformance attributes might be subjected to safety and regulatory requirements. However, this approach is very useful for writing a list of checkpoints and thinking of potential defects. It is logically organized. This will be very helpful for a person who wants to be a trained QC Inspector in his/her life.

Dock Audit

An audit is a systematic yet independent and documented process for obtaining the evidence that are required to verify the quality of the work that is done and evaluating it objectively. Also, an audit is a written document that determine the extent to which the criteria for the given work are fulfilled.

A dock audit is sometimes categorized as a product audit. The very last opportunity to check and verify customer specific requirements is basically known as dock audit. In the automotive industry, the dock audit is an essential part of the whole manufacturing procedure. The final quality of the manufactured product depends on this final check that is conducted by the QC Inspector.



Conduct A Dock Audit Of A Sample Batch From The Production Lot Of The Ready To Dispatch Final Products

The specific steps for conducting a dock audit by a QC Inspector are given below :

Checkpoints
 Product in good shape with no visible damage – The QC Inspector has to make sure that the appearance of the product is in accordance with the specification with no signs of damage or distress.
 Presence of sharp edges in the product – It is the duty of the QC Inspector to make it a point that there are no sharp edges of the product that can possibly cause a damage or injury to the customer.
 Wear and tear of the product – Wear and tear is damage that naturally and inevitably occurs as a result of aging. The QC Inspector is supposed to look after the quality of the manufactured product and make sure the product is in good condition.
 Presence of any physical defects – It is the duty of the QC Inspector to make sure that the product is undamaged and is deliverable to the customers. In case of any physical defects, it has to be at once reported to the concerned authorities.
 <u>Packaging of product according to customer specification</u> – Following customer specifications is extremely important while dealing with the automotive industry. The responsibility of the QC Inspector includes talking care of the customer specifications as specified for each product.
 <u>Packaging boxes as per the requirement for preservation</u> – Every product has certain preservation procedure. During an audit, the QC inspector has to make sure that the manufactured products are being preserved properly in appropriate packaging boxes.
• <u>Customer PO number on the shipping labels</u> – The QC Inspector should check and verify whether the PO numbers of the customers are properly put on the shipping labels. This is also a part of the responsibility of the QC Inspector.
 Boxes labeled correctly with packer name – The QC Inspector should check and see whether the boxes are labeled correctly with appropriate packer names on the boxes. This is also a part of the duty of the QC Inspector.
• <u>Count on the bill of lading match the count on the pallet</u> – This is another important duty of the QC Inspector. Counting the bill of landing and matching it to the count that is there on the pallet is to be done by the QC Inspector in this stage of work.
• Boxes stacked neatly in case of pallet arrangement – The QC Inspector should check and verify whether the packaging boxes are stacked neatly in case of pallet arrangement. This is also a part of the responsibility of the QC Inspector.
• Damages of the pallet like nails sticking out, broken boards, etc. – The QC Inspector has to make sure that the appearance of the pallet is in accordance with the specification with no signs of damage or distress like nails sticking out, broken boards, etc.

Review The Effectiveness Of Implementation And Repeat The Process Till The Discrepancies Are Resolved

In case of the automotive industry, generally the dock audits take place after the whole process of manufacturing is complete but before the product actually reaches the customer. If a product doesn't meet standard requirements or specifications after the QC inspection, the QC Inspector documents the findings and logs a non-conformance. These non-conformance are the discrepancies, errors or faults that the inspector finds out during the audit process.

The discrepancies are usually resolved by QC Inspectors in the following way :

Step 1	Identifying the problems, errors or faults during the audit.
Step 2	Containing the non-conformance.
Step 3	Reworking on the manufactured products or repairing the products, if possible.
Step 4	Disposing of nonconforming products if you can't rework or repair them.
Step 5	Determining the necessary counter-measures for preventing recurrence.
Step 6	Conducting the audit process once again from the beginning.

Product audits or dock audits can help a manufacturer improve quality, profits, customer satisfaction, and loyalty. Therefore, such audits are very important. A trained QC Inspector should take the process seriously and conduct such audits as meticulously as possible.

The QC Inspector must do them consistently and effectively, taking steps to identify process errors that are the root cause of defects. If such an inspection in not done properly, there shall be an abnormal increase in the internal failure rates and an increased likelihood of defects going undetected until they reach the customer.

Document The Observations Of Dock Audit And Maintain Records

Please refer to the Sample Dock Audit form given below for maintaining records :

R.		Item Name	Frequency of			Samp	ling Plan		
0	Customer	& No.	Audit	Resp.Person	No. of Pieces	No. of Method 1	Pieces Method2	Acceptance Criteria	Reaction Plan
					FIECES	Method 1	Methodz	enterna	
+									
_									
+									
_									

stome	er :		6	Audit Date:
t Nos	i.:			Auditor:
t Nan	nes:	Auditee:		
.NO	CHECK POINT	C*	NC*	REMARKS
1	Whether packing standard available?			
2	Whether packing done as per the standard?			
3	Whether packing label available?			
4	whether traceability evidenced?			
5	Whether current drawing revision level shown on the packing?		5 - 50 (Sr	
6	Whether sampling plan followed?			
7	Whether inspection standards are available?			
8	Whether final inspection reports are available?			
9	Any other additional points: I)			
	II)			
	III)			
	Investigation & Corrective /	Action Pro	posed (In c	ase of any NC):
				Signature of Auditee
	Follow	-up Verifio	ation:	
	NC Closed		Approved E	

Unit 1.4: Coordination with R&D / Quality Manager CAPA , CI

Unit Objectives

After attending this unit, the trainees would be able to -

- Manage the coordination needed between R&D / Quality Manager CAPA , CI
- Evaluate the necessary steps needed for the coordination

Overview of Coordination

The term 'coordination' has a great significance. Coordination means the unification, integration, synchronization of the efforts of the group members so as to provide unity of action in the pursuit of common goals. It is a hidden force which binds all other functions of management and all the workers and employees who work under the same umbrella.

Good coordination between the employees of the organization leads to better understanding and a smoother flow of work. Also, the team spirit is enhanced as a result of good coordination between the members of a particular team.



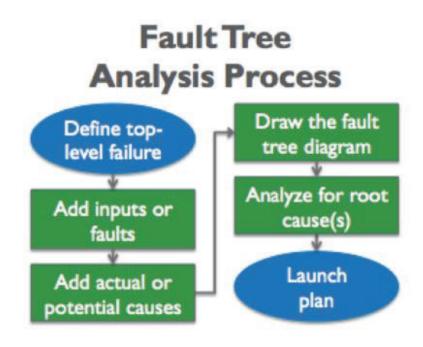
- **R&D** R&D stands for Research and Development. In the automotive industry, there is a separate team that looks after the research and development procedure that takes places before the launch of every new product. But not only that, research and development is needed in every phase of a product's design, construction, launch and post-launch.
- **Quality Manager** The person who is responsible for judging the quality of the newly launched products and the existing products is known as a Quality Manager. Any needed rectification of a manufactured product is generally suggested by the Quality Manager.
- **CAPA** CAPA stands for Corrective and Preventive Action. Generally there is an entire team dedicated for the purpose of corrective and preventive actions. They are responsible for the remedial actions that are required in case of any of the organization that falls under the automotive industry.

Participate for preparation of Fault tree, conducting simulation and implementation of actions

Fault Tree analysis is a top-down deductive system of failure analysis in which an undesired state of a system is analyzed using Boolean logic to combine a series of events of the lower lever. This method of analysis is generally used in case of safety engineering and reliability engineering to actually understand how systems can fail, to point out best methods to reduce risks and to determine event rates of an occurred accident or a particular system level failure.

Fault Tree Analysis Process :

- Define top-level failure
- Add inputs or faults
- Add actual or potential causes
- Draw the fault tree diagram
- Analyze for the root causes
- Launch a plan for removing the cause of the problem



Necessary Stages of Coordination

Please follow the table below to understand the various aspects of coordination that is supposed to be looked after by a trained QC Inspector :

Necessary Stages	What Needs to be Done
1. Work as a CFT member of the team formed for solving a problem pertaining to the products handled. Collect data regarding the problem as decided in the team discussions	 The term 'CFT' refers to Customer Focus Team. It is a part of the duty of the QC inspector to coordinate with the CFT that is always present within the organization. The QC Inspector has to work as a team member and look after the problems pertaining to the manufactured products that are handled by the organization. The QC Inspector has to collect data regarding the problem as decided in the prior team discussions.

3. Participate for updating relevant documentation	 It is the duty of a QC Inspector to keep updating relevant documents according to the progress of the inspection procedure. The updates should be made in accordance with the date and time of the latest inspection session.
4. Assist the NPD department in efficient development of the new product by sharing all the problems related to QCD observed in the existing products	 The responsibility of the QC Inspector includes coordination with the New Product Development (NPD) department and assisting them to develop new designs and new products. The QC Inspector is supposed to do the validation of the newly designed products. Also, if any faults or defects are reflected in already existing products, the QC inspector is supposed to make sure that the similar faults are not present in the newer products.
5. Coordinate with the respective process owners/Stores, seniors and implement CAPA for discrepancies identified in the dock audit on immediate basis	 The coordination has to be maintained with the respective process owners or stores in order to ensure the smooth flow of operations. If any discrepancies are tracked during the dock audit, that has to be reported as soon as possible to the respective authorities. The QC inspector has to make sure that these discrepancies are solved immediately.

Unit 1.5: Inspection Of Final Product

Unit Objectives

After attending this unit, the trainees would be able to -

- Evaluate the inspection of the final product
- Analyze the handling of the inspection equipment and instruments
- Examine the effectiveness of implementation of the final inspection procedure

Basically there are four phases in the process of quality check. They are :

- 1. Pre-Production Inspection
- 2. During the Production Inspection
- 3. Final Random Inspection
- 4. Final Inspection

Inspection of the Final Product

The final inspection is a kind of inspection that is a part of the manufacturing processes. It refers to the inspection performed in the final stage of the manufacturing process. This test or assessment determines whether the completed goods meet the required standards or not. Such an inspection is done in order to prevent the loss in customer service or other relevant issues and errors.

The manufacturing processes includes Acceptance Inspection and Inspection between Processes, both of which are performed for such constituent items as purchased raw materials, processed parts, and assemblies, and they are not done for complete goods. In the Final Inspection, the whole of the product, including the requests from customers, is inspected.



Conduct The Process Of Inspection At The Stages :

1. Complete dimensional /Layout Inspection at development stage & later as per the periodicity such as annual for re- validation

Follow the steps mentioned below for a proper layout inspection :

- Layout Inspection shall involve full dimensional inspection as per applicable or approved drawing, specifications, customer approved master sample etc.
- Layout Inspection shall be performed as per quality system procedure that is specified for layout inspection.
- the result that comes out after the layout inspection must be noted in the written form in the layout related inspection report or in print form.
- The specific layout inspection plan shall be maintained to keep track of the progress.



• Repeat the whole Layout Inspection process, in case re-validation is needed in case of any product or process.

2. In the Production phase as per the CP/ Quality plan/ sampling Plan/Stage inspection plans/ First off IR

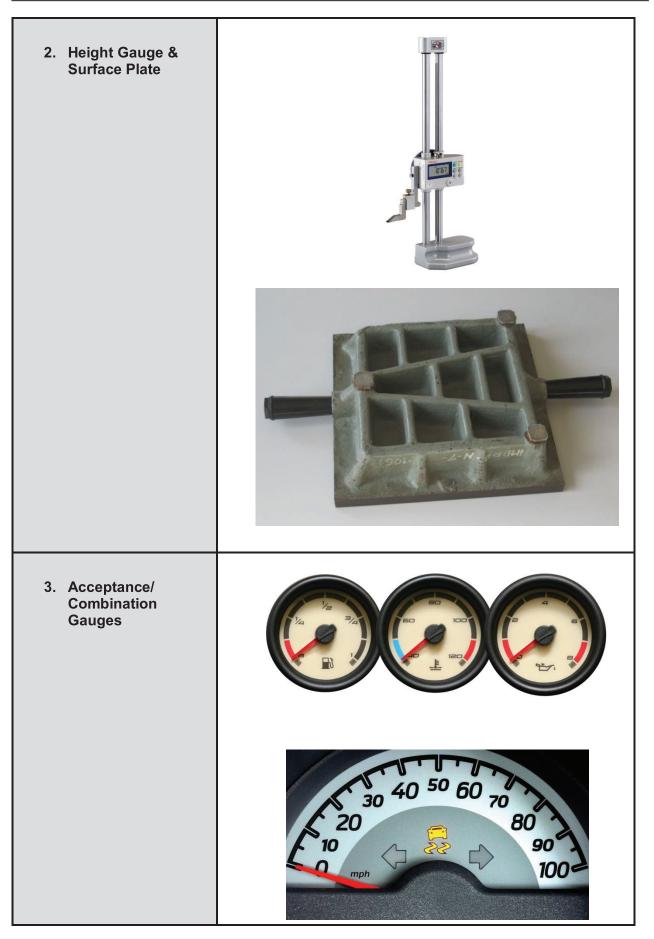
The following points are the stages of inspection during the final production phase :

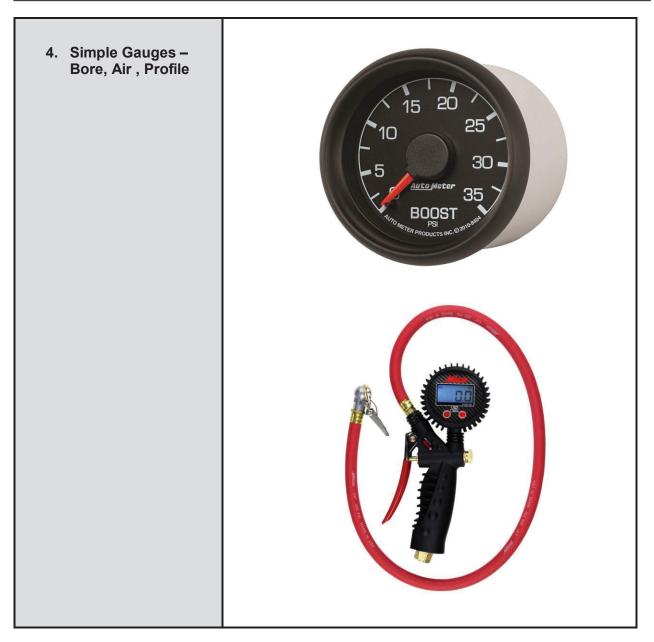
- Quality control plan
- Failure mode effects analysis
- Statistical process control plan
- Measurement system analysis
- Production part approval process

Handle Inspection Equipment And Instruments Such As :

The table below shows the inspection equipment and instruments that are supposed to be taken care of by a QC Inspector :

Inspection Equipment And Instruments	Relevant Images
1. Vernier, Micrometers	BAKER 0 1 2 2 0 2 2 00 10 0 0 0 0 0 0 0 0 0 0





For Safe Storage, Calibration At Pre-Decided Frequency And Have An Acceptable Level Of R & R As Per SOP Of The Organization

The QC Inspector should emphasize the following factors that will contribute to reducing workplace hazards regarding the safe handling of inspection equipment and instruments :

- Alerting the employee to the dangers of lifting equipment and instruments without proper training.
- Showing the employee how to avoid unnecessary physical stress and strain.
- Teaching workers to become aware of what they can comfortably handle without undue strain.
- Instructing workers on the proper use of equipment and instruments that are used in the automotive industry.

- Teaching workers to recognize potential hazards and how to prevent or correct them.
- Awareness of health risks to improper lifting.
- Knowledge of the basic anatomy of the spine, the muscles, and the joints of the trunk, and the contributions of intra-abdominal pressure while lifting.
- Awareness of individual body strengths and weaknesses— determining one's own lifting capacity.
- Recognition of the physical factors that might contribute to an accident and how to avoid the unexpected.
- Use of safe lifting postures and timing for smooth, easy lifting and the ability to minimize the load-moment effects.
- Use of handling aids such as stages, platforms, or steps, trestles, shoulder pads, and handles.
- Knowledge of body responses—warning signals—to be aware of when lifting.

Conduct Inspection Of The Product Covering The Following Checkpoints:

Suggested Checkpoints	What Needs To Be Done
1. Visual Inspection of the part for scratches, dents , damages, packings per the norms etc.	• A trained QC Inspector is supposed to make sure that the visual inspection of the manufactured products are done in an appropriate manner. Any part that is tampered or damaged like scratches, dents, damages, packaging defaults etc. are supposed to be reported to the authority at once.
2. Special inspection co- ordinated with other agencies e.g. Lab: Material, Lab: Standards Room, assembly / performance trials etc.	 Apart from visual inspection, conducting special inspection is also the duty of the QC Inspector. Coordinating with other agencies for conducting a special inspection of Standards Room, assembly / performance trials etc. are supposed to be conducted by the trained QC Inspector.
3. Identification sticker/number/label placed on the product	• A trained QC Inspector should be able to verify whether the sticker, number, label etc. of the product is properly placed or not. In case they are not placed properly, it should be reported at once.
4. Functioning of the product and its components	• A part of the QC Inspector's duty is to see whether all the manufactured products are functioning properly as per specifications or not. In case they are not functioning properly, it should be reported at once.
5. Documentation pertaining to the Quality	• At the end of every inspection, documenting the reports related to the quality errors and faults are supposed to be submitted by the QC Inspector. Future changes related to the quality of the product generally depends on these reports that are presented by the QC Inspector.