

Quality & Reliability Work shop

Q&R Workshop

- ☐ **Identify experienced persons having good knowledge of the process. Manufacturing, Quality Assurance, Process planner, Designer, Operators.**
- ☐ **Arrange samples of Product**
- ☐ **Arrange Drawings of Product and Child Parts**

Q&R Workshop

**Step 1 : Team members to brainstorm and identify
What can go wrong with product and process.
Suggestions to improve the product / process.
List down the issues**

Small Car Engine : Reliability and Quality Brochure					Status
#	Suggestions/Issues	Root Cause	Action plan		
			Design	Process	
1	Requirement of additional collar/step on balance shaft for axial location of impellar				
2	Piston ring circlip as per 4DL piston circlip. Operator can understand on plier if it is soft.				
3	Connecting rod: Ensure draft angle at big end is having enough clearance. Across corners dimensions of connecting rod to check with bore clearance. Control dimensions to be changed. (Refer fig) Angle torquing is required.				
4	Check possibility of removing one dowel on cylinder block surface - (Refer 4DL design)				
5	Connecting rod: Option1 : Joint machining on bolt (both connecting rod and Cap together) Option 2: Bolt hole machining seperately and see the concentricity				
6	Head gasket thickness selection should not be specified. (Indica)				
7	Hexagonal screw with locking plate for reed valve since exisitng screw falling down will damage engine. Positive locking to be ensured				
8	Non return valve in place of reed valve				
9	Hole location on cover plate should not overlap cam lobe to avoid excess oil in the intake system				
10	Requirement of locking plate for flywheel mounting				

- List down what can go wrong with the product / Process?
- Suggestions to improve the product / Process.

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List down the issues**

**Step 2 : Collection and list down quality issues from various areas
as mentioned below.**

Collection of Data on Quality Issues

- ✓ **52 Quality Issues – Generic Quality issues identified on TML products , issues related to the particular aggregate will be shared by VDQ team.**
- ✓ **JD Power Issues – Issues related to particular aggregate appearing in JD power survey will be shared by VDQ team.**
- ✓ **Warranty Issues – Warranty Data on similar aggregate on TML products will be shared by VDQ team.**
Data on Warranty issues on similar product to be collected by supplier (supplied to other OEM's & for all supplier plant locations) e.g. if supplier is having plants in chennai, gurgaon, pune, bangalore – collect warranty data from all plants faced by all customers.
- ✓ **Line Rejection / Incoming quality issues at customers:- Data on similar aggregate on TML products will be shared by VDQ team.**
Data on Incoming quality issues on similar product to be collected by supplier (supplied to other OEM's & for all supplier plant locations) e.g. if supplier is having plants in chennai, gurgaon, pune, bangalore – collect warranty data from all plants faced by all customers.
- ✓ **Line Rejections / Incoming quality issues at suppliers end. – Data on similar products produced by the supplier for TML and other customers to be captured.**

Q & R Workshop

Sl no	Issues / Suggestion
1	Noise Due to Loose piston assembly (piston nut torquing and staking missing)
2	Leakage - Damage Outer end Cap
3	Noise Contamination Metallic
4	Noise Contamination - Loctite
5	Paint Appearance (Damage during transit trolleys)
6	Different bkt welding failed
7	Peripheral assy. Component Missing
8	Peripheral assy. Top nut torquing missing / less
9	Leakage - Poor rod finish
10	Leakage - Rod dents / scratched
11	Leakage - Oil Seal Damaged
12	Leakage - Outer tube seam / spring crack

•Listing of Issues

Q&R Workshop

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Suggestions to improve the product / process.
List down the issues**

**Step 2 : Collection and list down quality issues from various areas
as mentioned above.**

**Step 3 : After compilation of issues (1&2) categorise the issues as
product or process Related.**

Q & R Workshop

Sl no	Issues / Suggestion	Who?	Shock Abrorber	Strut	Area	
					Process	Design
1	Noise Due to Loose piston assembly (piston nut torquing and staking missing)	Supplier	Y	Y	Y	N
2	Leakage - Damage Outer end Cap	Supplier	N	Y	Y	N
3	Noise Contamination Metallic	Supplier	Y	Y	Y	N
4	Noise Contamination - Loctite	Supplier	N	Y	Y	N
5	Paint Appearance (Damage during transit trolleys)	Supplier	Y	Y	Y	N
6	Different bkt welding failed	Supplier	N	Y	Y	N
7	Peripheral assy. Component Missing	Supplier	Y	Y	Y	N
8	Peripheral assy. Top nut torquing missing / less	Supplier	N	Y	Y	N
9	Leakage - Poor rod finish	Supplier	Y	Y	Y	N
10	Leakage - Rod dents / scratched	Supplier	Y	Y	Y	N
11	Leakage - Oil Seal Damaged	Supplier	Y	Y	Y	N
12	Leakage - Outer tube seam / spring crack	Supplier	Y	Y	Y	N

•Identify the issue as product or process related

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**Step 3 : After compilation of issues (1&2) categorise the issues as
product or process Related.**

Step 4 : Identify actions / possible solutions.

Small Car Engine : Reliability and Quality Brochure

Status

Action plan

Design

Process

Tolerance stack study to be set up to decide on the requirement of collar or step.
Tolerance values to be obtained from supplier.

WIP

Existing circlip to be maintained. Cost comparison between lug and existing circlip to be done.

•Identify actions / possible solutions

Minimum two dowel holes are required to obtain the required tolerance band for fitment.
Joint machining of both connecting rod and cap is possible. The process flow to be called for the same.

Tolerance study for Piston stand off to be conducted. Supplier has confirmed for not having selection of head gasket.

Process flow to call for assembly of philip screw while head assembly itself.

Non return valve for gas application to be studied and decide on the values.

The suggestion will be incorporated in new engine design.

Study on existing TML engine assembly to be done for evaluating cost effective solution.

Q&R Workshop

**Step 1 : Team members to brainstorm and identify
What can go wrong with product and process.
Suggestions to improve the product / process.
List down the issues**

**Step 2 : Collection and list down quality issues from various areas
as mentioned above.**

**Step 3 : After compilation of issues (1&2) categorise the issues as
product or process Related.**

Step 4 : Identify actions / possible solutions.

**Step 5 : Highlight issues for which solutions are not available
currently – Areas where work needs to be done.**

Small Car Engine : Reliability and Quality Brochure

•Identify Areas
where work needs
to be done

Action plan		Status
Design	Process	
Tolerance stack study to be set up to decide on the requirement of collar or step. Tolerance values to be obtained from supplier.		WIP
Existing circlip to be maintained. Cost comparison between lug and existing circlip to be done.		
Minimum two holes are required to obtain the required tolerance for fitment.		
Joint machining of both connecting rod and cap possible. The process flow to be called for.		
Tolerance study for stand off to be conducted. Supplier has been asked for not having selection of head gasket.		
Process flow to call for assembly of pin screw while head assembly itself.		
Non return valve for gas application to be studied and decide on the values.		
The suggestion will be incorporated in new engine design.		
Study on existing TML engine assembly to be done for evaluating cost effective solution.		

POKA – YOKE WORKSHOP

Poka – Yoke Workshop

What is required?

Standard Operating Procedure.

Operations to be split to the last possible element. (as in MOST)

Foolproof System																			
Section: Cylinder Head Sub-Assembly		Sources of Errors										Activities performed		Positioning of Cyl head on pallet; Valve seat positioning; Valve guide seal pressing; Valve insertion; Oil gallery plug fitment					
Operator No.: 1																			
Station/Machine / Equipment Name / No.: 1,2,3																			
Sr. No.	Activity Description / MOST Elements	What Can Go Wrong	Omitted Processing	Processing Errors	Errors setting WIP	Missing Parts	Wrong Parts	Processing wrong WIP	Mis operation	Adjustment Error	Equipment set improper	Improper tool & jigs	Prevent Cause					Prevent Effect	
													Eliminate	Alternate/Automate	Guide/ Assist	Attract Attention	Detect Abnormality	Complicate	Absorb Effect
1	Pick up pallet within reach & place over conveyor.																		
2	Pull head within reach from washing conveyor behind & place over pallet with 2 stages																		
3	Lock the head in the pallet SIDE CLAMPS SIMO																		
4	Pick up simo handfull of spring seats @ 4-6 nos at a time & place inside valve port																		
5	Walk 1-2 steps, Pickup handful of valve guide seals @ 4 nos and insert in mandrel of seal pressing m/c																		
6	Locate head in the seal pressing m/c																		
7	Actuate the valve seal pressing m/c																		
8	Auto pressing cycle																		
9	Auto Actuation of work complete switch by up stroke of ram																		
10	Walk 1-2 steps, Insert the head inside rotator																		
11	Rotating by 180 deg																		
12	Pickup simo inlet & exhaust valve & place them in locations																		
13	Rotating by 180 deg																		
14	Pick up oil gallery plug & place in location																		
15	Get nut runner within reach & place over plug																		
16	Tightening of the plugs																		
17	Release the Nut runner																		
18	Unload head from rotator, walk back 3-4 steps to station 1																		

List down all the elements for assembly sequence in detail.(Activities from Most / Standard Operating Procedure)

Foolproof System																			
	Section: Cylinder Head Sub-Assembly		Sources of Errors									Activities performed		Positioning of Cyl head on pallet; Valve seat positioning; Valve guide seal pressing; Valve insertion; Oil gallery plug fitment					
	Operator No.: 1																		
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Sr. No.	Activity Description / MOST Elements	What Can Go Wrong	Omitted Processing	Errors	Errors setting WIP	Missing Parts	Wrong Parts	Processing wrong WIP	Mis operation	Adjustment Error	Equipment set improper	Improper tool & jigs	Prevent Cause					Prevent Effect	
													Eliminate	Alternate/ Automate	Guide/ Assist	Attract Attention	Detect Abnormality	Complicate	Absorb Effect
1	Pick up pallet within reach & place over conveyor.	1. Wrong Placement of pallet on convey 2. Pallet can fall down																	
2	Pull head within reach from washing conveyor behind & place over pallet with 2 stages	1. Damage of dowel holes 2. Wrong placement of head 3. Cleanliness of the head resting surface of pallets																	
3	Lock the head in the pallet SIDE CLAMPS SIMO	1. Improper locking																	
4	Pick up simo handfull of spring seats @ 4-6 nos at a time & place inside valve port	1. Reverse fitment 2. Missing 3. Extra fitment																	
5	Walk 1-2 steps, Pickup handful of valve guide seals @ 4 nos and insert in mandrel of seal pressing m/c	1. Missing																	
6	Locate head in the seal pressing m/c	1. Improper location																	
7	Actuate the valve seal pressing m/c	1. Accident 2. Improper pressing																	
8	Auto pressing cycle	1. Improper alignment of seal 2. Damage of seal																	
9	Auto Actuation of work complete switch by up stroke of ram																		
10	Walk 1-2 steps, Insert the head inside rotator	1. damage due to mismatch of height																	
11	Rotating by 180 deg	Accident																	
12	Pickup simo inlet & exhaust valve & place them in locations	1. Mispalcement of valves 2. Damage of valve guide																	
13	Rotating by 180 deg	Accident																	
14	Pick up oil gallery plug & place in location	1. Cross fitment 2. Improper anabond application																	
15	Get nut runner within reach & place over plug																		
16	Tightening of the plugs	Thread damage																	
17	Release the Nut runner																		
18	Unload head from rotator, walk back 3-4 steps to station 1																		

Identify what can go wrong while performing the operation.

Identify what can go wrong while performing the operation.

Foolproof System																	
	Section: Cylinder Head Sub-Assembly		Sources of Errors									Activities performed		Positioning of Cyl head on pallet; Valve seat positioning; Valve guide seal pressing; Valve insertion; Oil gallery plug fitment			
	Operator No: 1																
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Sr. No.	Activity Description / MOST Elements	What Can Go Wrong	Omitted Processing	Processing Errors	Errors setting WIP	Missing Parts	Wrong Parts	Processing wrong WIP	Mis operation	Adjustment Error	Equipment set improper	Improper tool & jigs					
1	Pick up pallet within reach & place over conveyor.	1. Wrong Placement of pallet on conveyor 2. Pallet can fall down											Eliminate	Alternate/ Automate	Guide/ Assist	Attract Attention	
2	Pull head within reach from washing conveyor behind & place over pallet with 2 stages	1. Damage of dowel holes 2. Wrong placement of head 3. Cleanliness of the head resting surface of pallets	✓	✓	✓								By providing a		Arrow mark	Detect Abnormality	
3	Lock the head in the pallet SIDE CLAMPS SIMO	1. Improper locking									✓	✓			Complicate	Absorb Effect	
4	Pick up simo handfull of spring seats @ 4-6 nos at a time & place inside valve port	1. Reverse fitment 2. Missing 3. Extra fitment		✓		✓										Mitigate Effect	
5	Walk 1-2 steps, Pickup handful of valve guide seals @ 4 nos and insert in mandrel of seal pressing m/c	1. Missing				✓											
6	Locate head in the seal pressing m/c	1. Improper location								✓							
7	Actuate the valve seal pressing m/c	1. Accident 2. Improper pressing			✓						✓						
8	Auto pressing cycle	1. Improper alignment of seal 2. Damage of seal			✓					✓							
9	Auto Actuation of work complete switch by up stroke of ram																
10	Walk 1-2 steps, Insert the head inside rotator	1. damage due to mismatch of height			✓												
11	Rotating by 180 deg	Accident									✓						
12	Pickup simo inlet & exhaust valve & place them in locations	1. Mispalcement of valves 2. Damage of valve guide		✓					✓								
13	Rotating by 180 deg	Accident									✓						
14	Pick up oil gallery plug & place in location	1. Cross fitment 2. Improper anabond application		✓													
15	Get nut runner within reach & place over plug																
16	Tightening of the plugs	Thread damage		✓							✓	✓					
17	Release the Nut runner																
18	Unload head from rotator, walk back 3-4 steps to station 1																

Identify Source of Error

Identify Source of Error

Sources of Error

Omitted Processing

Processing Errors

Errors setting up workpieces

Missing parts

Wrong parts

Processing wrong workpiece

Misoperation

Adjustment error

Equipment not set up properly

Tools and Jigs improperly prepared

Step: 4



Step 4

Foolproof System

Section: Cylinder Head Sub-Assembly		Sources of Errors											Activities performed		Positioning of Cyl head on pallet; Valve seat positioning; Valve guide seal pressing; Valve insertion; Oil gallery plug fitment					
Operator No.: 1																				
Station/Machine / Equipment Name / No.: 1,2,3																				
Sr. No.	Activity Description / MOST Elements	What Can Go Wrong	Omitted Processing Errors	Processing Errors	Errors setting WIP	Missing Parts	Wrong Parts	Processing wrong WIP	Mis operation	Adjustment Error	Equipment set improper	Improper tool & jigs	Prevent Cause						Prevent Effect	
													Eliminate	Alternate/Automate	Guide/ Assist	Attract Attention	Detect Abnormality	Complicate	Absorb Effect	Mitigate Effect
1	Pick up pallet within reach & place over conveyor.	1. Wrong Placement of pallet on conveyor 2. Pallet can fall down											By providing a (A)		Arrow mark on pallet					
2	Pull head within reach from washing conveyor behind & place over pallet with 2 stages	1. Damage of dowel holes 2. Wrong placement of head 3. Cleanliness of the head resting surface of pallets	√	√	√								Providing PTFE dowels	Provide air jet to clean dowel before head placement				By assymetric design of pallet		
3	Lock the head in the pallet SIDE CLAMPS SIMO	1. Improper locking									√	√	By providing guard in pallet							
4	Pick up simo handfull of spring seats @ 4-6 nos at a time & place inside valve port	1. Reverse fitment 2. Missing 3. Extra fitment											Reverse fitment OK	Auto dispensing			Camera check			
													Integral design of Valve guide seal & spring seats				If the seal is not placed properly cycle will not start			
																	Cycle will not start if it is not properly located			
														Limit switch for proper travel				Operator needs to actuate the press by 2 hands		
																	Camera check			
9	by up stroke or ram																			
10	Walk 1-2 steps, Insert the head inside rotator	1. damage due to mismatch of height			√								Rotation on a pallet							
11	Rotating by 180 deg	Accident									√					While rotation alarm will ring				
12	Pickup simo inlet & exhaust valve & place them in locations	1. Mispalcement of valves 2. Damage of valve guide		√					√						1. Diff colour identification of inlet and exhaust valves (silver and black) 2. Instruction sheet					
13	Rotating by 180 deg	Accident									√					While rotation alarm will ring				
14	Pick up oil gallery plug & place in location	1. Cross fitment 2. Improper anabond application		√									Pre-coated anabond		Proper work instructions					
15	Get nut runner within reach & place over plug																			
16	Tightening of the plugs	Thread damage		√							√	√			Proper work instructions		Indicators for correct torque appl in TCNR			
17	Release the Nut runner																			
18	Unload head from rotator, walk back 3-4 steps to station 1																			

Qualify the need of error proofing for each possibility of error occurance.
Identify the type of Poka-yoke for the each and every error.

Poka Yoke- Types							
Prevent Cause (Control Methods & Warning Methods)						Prevent Effect	
Eliminate	Replacement/Automate	Guide / Facilitation	Attract Attention	Detect Abnormality	Complicate	Absorb Effect	Mitigate Effect
Elimination seeks to eliminate the possibility of error by redesigning the product or process so that the task or part is no longer necessary.	Replacement substitutes a more reliable process to improve consistency	Facilitation employs techniques and combining steps to make work easier to perform.	Attract attention employs method to alert the user of the error caused	Detection involves identifying an error before further processing occurs so that the user can quickly correct the problem	Complicate involves designing the product or process making it difficult to cause the error	Absorb / Mitigate seeks to minimize the effects of errors.	

Elimination : seeks to eliminate the possibility of error by redesigning the product or process so that the task or part is no longer necessary.



Source: www.mistakeproofing.com

3.5 inch diskette cannot be inserted unless diskette is oriented correctly.

This is as far as a disk can be inserted upside-down.



Source: www.mistakeproofing.com

The beveled corner of the diskette pushes a stop in the disk drive out of the way allowing the diskette to be inserted.

This feature, along with the fact that the diskette is not square, prohibit incorrect orientation.

Elimination : seeks to eliminate the possibility of error by redesigning the product or process so that the task or part is no longer necessary.



Source: www.mistakeproofing.com

Fueling area of car has three mistake-proofing devices:

Filling pipe insert keeps larger, leaded-fuel nozzle from being inserted

Gas cap tether does not allow the motorist to drive off without the cap

Gas cap is fitted with ratchet to signal proper tightness and prevent over-tightening.

Elimination : seeks to eliminate the possibility of error by redesigning the product or process so that the task or part is no longer necessary.



Antilock Braking Systems (ABS) compensate for drivers who stomp on the brake.

What used to be a driving error is now the proper braking procedure.

Source: www.mistakeproofing.com

Replacement / Automate substitutes a more reliable process to improve consistency

Absorb / Mitigate seeks to minimize the effects of errors.



Source: www.mistakeproofing.com

Circuit breakers prevent electrical overloads and the fires that result.

When the load becomes too great, the circuit is broken.

Attract attention employs method to alert the user of the error caused



Source: www.mistakeproofing.com

Warning lights alert the driver of potential problems. These devices employ a warning method instead of a control method.

Replacement substitutes a more reliable process to improve consistency



Source: www.mistakeproofing.com

Both the sink and the urinal are fitted with light sensors.

These sensors insure that the water is turned off in the sink and that the urinal is flushed.



Source: www.mistakeproofing.com

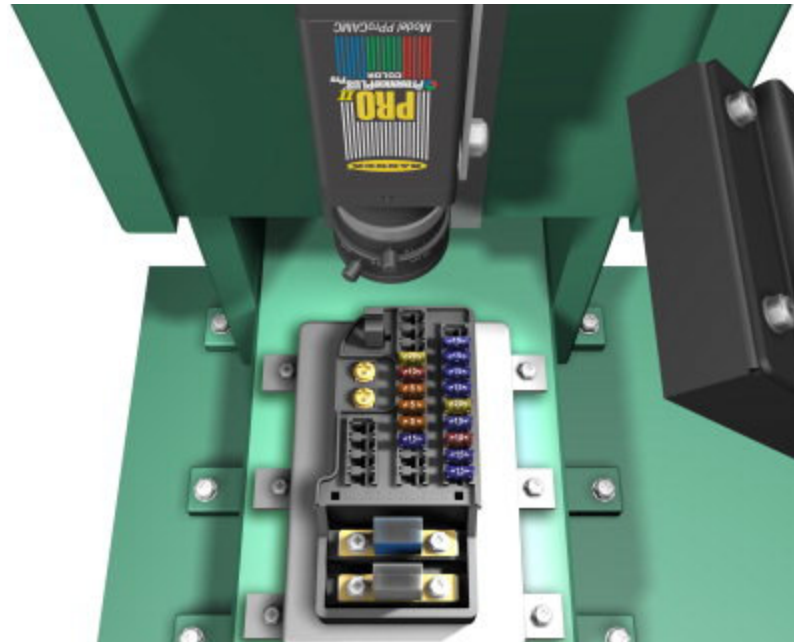
Facilitation employs techniques and combining steps to make work easier to perform.



Source: bannerengineering.co.in

To indicate whether the operator is picking from the correct bin or wrong bin

Detection involves identifying an error before further processing occurs so that the user can quickly correct the problem



To verify that fuses of the specified amperage are in the correct location in a fuse box

Poke - Yoke Workshop

1	Standard operating procedure with detailed breakup of each operation (Stage wise)
2	Facility for Assembly and Disassembly along with relevant tools And/OR
3	Video film the assembly process for discussion during the event.
4	Samples of Assembly and Child Parts.
5	Team members to be identified from the each of the following areas for full time participation. Production / Quality/ Design / Operators from respective areas / Planning / logistics / Customer Interface representative
6	Training / Conference room with provision to display the Product / Samples
7	LCD Projector / White Board / Markers.
8	PC's / Laptops.
9	Availability of all team members during the workshop as per schedule