

# AMTEK AUTO LTD, HOSUR

## POTENTIAL FAILURE MODE AND EFFECT ANALYSIS (PROCESS FMEA)

FMEA Number: IP/ FM / 052

FMEA Issue no: 0

F/PD/05-00

Item: GEAR-M2

Model Year(s) / Vehicle(s): 2-WHEELER ENGINE PART

Part Number: 23431-KONA-D000

Core Team: Mr.D.B. SINGH (FORGE), Miss.PRIYADHARSHINI (D.S. ENGG) Mr. SELVARAJ (HEAT TREATMENT), Mr. N.SRINIVASAN (QA), Mr.SIVAPRAKASAM (PPC), Mr. GIRISH (M.S.HOP)

Process Responsibility: Production Unit

Key Date: 08.10.2018

Prepared By: C.SELVAM

FMEA Date (Orig.): 08.10.2018 (Rev): 20.10.2018

Process Function Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Severity	C l a s s	Potential Cause(s) / Mechanism (s) of Failure	Occurrence	Current Process Control		Detection	R P N	Recommendation Action(s)	Responsibility & Target Completion Dates	Action Results				
							Prevention	Detection					Action Taken	Severity	Occurrence	Detection	R P N
10. Receive Material	Material Section Not Within Specification & Material Received Without Supplier Test Certificate	Billet Will Not Properly Sit Into Die & Material Specification Change	7		Supplier Failure	2		Check Section Of Material With Vernier Calliper & Verify The Incoming Material Along With Supplier Test Certificate	6	84							
20. Bar Storage	Mix Up Of Different Material Bars	Metallurgical Properties i.e., Hardness & Microstructure May Not Be Achieved	7		No Proper Separation In Between Different Racks	2	Rack With Heat Code Identification System For Different Types of Material	Heat Code Painted On Racks For Visual Identification	6	84							
30. Laboratory	Deviation In Chemical Composition	Hardness Out Of Specification, Problem In Machining	7		Supplier Failure In Their Operation	2	Chemical Analysis Of Each Heat Code	Testing Chemical Composition Through Vendor & Testing Physical Characteristics In InHouse Laboratory & Matching Results With Supplier Test Certificate For Each Heat Code	6	84							
	Physical / Metallurgical Deviations	Problem In Heat Treatment	7			2	Physical / Met.Inspection For Each Heat Code		6	84							
	Visual Surface Defects	Poor Apperance Of Product	4			2	Each Heat Code Tested For Surface Defect As Per Zero Defect Sampling		6	48							
	Piping,Slag, Seams,Lap, Internal Discontinuity	Poor Apperance, Product May Break At Customer End.	4			1	Each Heat Code Tested For Internal Defect		6	24							
40. Bar Storage	Mix Up Of Different Material Bars	Metallurgical Properties i.e., Hardness & Microstructure May Not Be Achieved	7		No Proper Separation In Between Different Racks	2	Rack With Heat Code Identification System For Different Types of Material	Heat Code Painted On Racks For Visual Identification	6	84							

### RECOMMENDED ACTIONS WHEN :

RPN> 10 and S = 10

RPN> 50 and S = 8~9

RPN> 100 and S=4~7

### LEGENDS:

Ma-Major Characteristics

Mn-Minor Characteristics

Cr-Critical Characteristics



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													Action Taken	Severity	Occurrence	Detection	R P N
50 & 60 Billet	Variation In Billet Weight - More Or Less Than Specified	Material Wastage, Job Rejection Due To Underfilling	5		Stopper Setting May Be Distrubed, Conveyor May Not Be Working Properly, Oily Bar	4	Reset The Stopper & Carefully Monitor	Check Billet Weight of 2 Pieces Per Hour	4	80							
	Visual Defects, Burr, Undercut	Difficulty In Induction Heating	4		More Clearance Between The Blades, Blunt Blades, Oil On Blades	3	Work Instruction For Operator	Check 5 Pieces Per Hour	7	84							
	Mix Up Of Billets Of Different Types Of Billet Materials During Billet Cutting	Metallurgical Properties & Microstructure May Not Be Achieved.	7		Unidentified Billets Are Available Near The Billet Cutting Machine	2	Lot Identification By Using Tag	Job Setup Guideline For Operator & other products are with different sizes on OD	6	84							
	Variation In Billet Weight Due To Taper Cutting Of Billets	Material Wastage, Job Rejection Due To Underfilling	5		Worn Out Blades	3	Replace Blades as per the frequency of the tool history card	Visual Observation & Check Billet Weight Of 2 Pieces Per Hour	5	75							



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													Action Taken	Severity	Occurrence	Detection	R P N
70. Billet Heating	Over Billet Temperature Than Specified	Poor Appearance, Product May Break After Forging, Die Wear, Material Wastage	7		Voltage Fluctuation, Temperature Controller Not Working Properly	3	Accept & Reject System Are Installed In All Lines To Segregate Overheated or Low Temperature Billets	Digital Temperature Indicator Is In Operation In All Lines	4	84							
					Pyrometer Focus Disturbed, Sensors & Pneumatic Valves Not Working Properly, Pneumatic System For Opening Gate Of Rejected Billets Is Not Working Properly, Temperature Setting Mistake	3	To Re Verify The Billet Temperature By Portable Optical Pyrometer Once Daily In Each Line	Through The Reading Of Digital Temperature Indicator & Portable Optical Pyrometer, Monitoring The Air Pressure For Proper Functioning Of Pneumatic System Of Billet Separator Equipment	4	84							
	Lower Billet Temperature Than Specified	Underfilling On The Product, Die Wear, Material Wastage	7		Voltage Fluctuation, Temperature Controller Not Working Properly	3		Poka Yoke provided on the machine	4	84							



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80. Forging a) Pre Form	Using Induction Heater Coil Of Incorrect Size	Process Delay, Heat Loss,Poor Surface Finish	5		Unavailability Of Induction Heater Coil Of Correct Size	3	At Time Of Die Setting Use Induction Heater Coil Of Specified Size	Check By Shift Supervisor	5	75							
	Setting Incorrect/Unclean Wear Plate	Preform & Finishform Dies Will Not Properly Match, Flatness & TIR Will Be More.	5		Inadequate Stock Of Clean Wear Plates Of Standard Sizes In Forge Shop	3	Stock Of At Least Four Number Clean Wear Plates Of All Standard Sizes In Forge Shop Are Maintained	Checked By Operator During Die Setting	5	75							
	Ejector Depth More / Less As Per Specification	Total Height Of Component More / Less As Per Specification	5		Ejector Height Is More Or Less Than Specified	3	Ejector Depth Checked by Operator Before Die Tightening	Total height of Comp. are checked after forging of 5 Pieces	5	75							
	Bolster Face & Die Face Not Matching	Flatness & TIR Will Be More, Tool Holder Will Be Broken	5		Bolster Face & Die Face Are Not Cleaned Before Die Setting	3	Check Die Face Before Die Despatch from Tool Room & Check Visually The Matching of Both Faces	Check Flatness & TIR Of Components After Forging Five Pieces	5	75							
	Underfilling In Stem	Underfilling In Finish Forging	5		Billet Weight Less Than Specified	4	Check Billet Weight In Weighing Scale In Case Of Stem Underfilling	Forging Setup Inspection	4	80							
					Low Die Temperature	4	Work Instruction For Forging	Check Die Temperature by Temperature Gauge	4	80							
					Improper Placement Of Billet	4	Visual Checking	Set up Inspection	4	80							
					Improper Lubrication In Die	4	Visual Checking	Set up Inspection	4	80							
	Weight Of Flange Of Pre Form Forging Is More Than Specified	Stem Underfilling / Lapping In Flange Of Finish Forging	4		Excessive Wear Of Pre Form Top Die	4	Check Weight Of Pre Form Forging	Weight Of Pre Form Forging To Be Max. 100 gm. More Than Finish Forging	5	80							

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Production Unit

Model Year(s) / Vehicle(s)

2-WHEELER ENGINE PART

Key Date

08.10.2018

Prepared By C.SELVAM

Part Number: 23431-KONA-D000

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													Action Taken	Severity	Occurrence	Detection	R P N	
80. b) Finish Form	Incorrect Dimensions, Visual Defect- Underfilling, Pitting,Dents, Improper Engraving, Lap / Fold, TIR more than specification	Line Rejection During Machining, Poor Appearance, No Traceability, Problem In Assembly At Customer End	7		Low / High Temperature Of Billet, Low Die Temperture	3	Forging Operation Check List	1st Off Inspection, Continuous Inspection As Per Process Control Chart	4	84								
			7		Improper Scale Blowing / Lubrication Of Die	3			4	84								
			7		Bend Due To Sticking In Die	3			4	84								
			7		Die / Tool Damaged / Worn Out	3			4	84								
			7		Forging die FF clearance between top and bottom die may be more than 0.5 mm	3	Blue Matching done in FF Top & Bottom		4	84								
			7		Poor Handling Of Forging	3	Conveyors are Installed In All Forging Lines for Proper Handling Of Forging		4	84								
			7		Improper Die / Tool Setting	3	Forging Operation Check List		4	84								
			7		Die / Tool Setting Disturbed During Run	3			4	84								
			7		Forging Method As Defined In Work Instruction Is Not Followed	3	Work Instruction For Forging		4	84								
	Poor Surface Finish Of Flange Surface	Pitting, Rust & Customer Dissatisfied	7		Die Surface Containing Heavy Scale/Rust & Lubricant Concentration Incorrect	3	Scale / Rust are Removed by Air Blowing on Die Surface During Forging	Visual Checking	3	63								



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90. Normalizing	Hardness Higher/ Lower Than Specification	Customer Requirement Not Fulfilled	7		Variation In Temperature Of Tempering / Hardening Furnace - Lower / Higher Side	2	Monitoring Of Temperature, Time & Control Parameters Sheet	Initial Check & Continuous Check	5	70							
			7		Variation In Soaking Time In Tempering / Hardening Furnace - Lower / Higher Side	2	Setting Of Timer	Initial Check & Continuous Check	5	70							
			7		Inadequate Stacking OF Forgings In Heat Treatment Tray	2	As Per Process Sheet	Initial Check & Continuous Check	5	70							
	Bainite, Banding, Widmannstatten Structure, Non Uniform Grain Size, Abnormality In Structure	Problem at Customer End	5		Variation In Soaking Time In Hardening / Tempering Furnace - Lower / Higher Side	3	Initial Check & Continuous Check	Monitoring Of Temperature, Time & Control Parameters Sheet	5	75							
	Defective Microstructure / Decarb Layer, Bainite		6		Inadequate Fuel / Air Ratio In Hardening Furnace	2	Setting Of Burner	Monitoring Of Temperature, Time & Control Parameters Sheet	5	60							



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# AMTEK AUTO LTD, HOSUR

## POTENTIAL FAILURE MODE AND EFFECT ANALYSIS (PROCESS FMEA)

FMEA Number: IP/FM/052

FMEA Issue no: 0

F/PD/05-00

Item GEAR-M2

Model Year(s) / Vehicle(s)

2-WHEELER ENGINE PART

Process Responsibility

Production Unit

Key Date

08.10.2018

Prepared By C.SELVAM

Part Number: 23431-KONA-D000

Core Team Mr.D.B. SINGH (FORGE), Miss PRIYADHARSHINI (D.S. ENGG) Mr. SELVARAJ (HEAT TREATMENT), Mr. N.SRINIVASAN (QA), Mr.SIVAPRAKASAM (PPC), Mr. GIRISH (ALSHOP)

FMEA Date (Orig.) 08.10.2018 (Rev) 20.10.2018

Process Function Requirements	Potential Failure Mode	Potential Effect(s) of Failure	Severity	C l a s s	Potential Cause(s) / Mechanism (s) of Failure	Occurrence	Current Process Control Prevention	Current Process Control Detection	Detection	R P N	Recommendation Action(s)	Responsibility & Target Completion Dates	Action Results				
													Action Taken	Severity	Occurrence	Detection	R P N
90b. Metallurgical Inspection	Hardness Variation - More / Less As Per Specification	Promblem at Customer End	7		Hardness Testing Machine Not Calibrated As Per Scheduled Date	2	Calibration Schedule	100% Re Inspection	5	70							
	Defective Microstructure		7		Setting Of Microscope Is Disturbed	2	Visual Check	Re Inspection	5	70							
100. Shot Blasting	Visual Defects - Scale Deposition, Silver Grey Finish Not Achieved, Poor Surface Finish	Promblem At Customer End	6		More Quantity Of Product Loading In One Charge	2	Guidelines For Shot Blasting Process	Continuous Visual Inspection	6	72							
			7		Inadequate Quantity Of Steel Shots In Machine	2			6	84							
			6		Less Cycle Time	2			6	72							
			6		Exhaust System Of Dust Collection Not Working Properly	2			6	72							
			6		Steel Shots Size Less Than Specified	2			6	72							
	Surface Damaged	Poor Appearance, Problem In Machining At Customer End	7		More Cycle Time Than Specified	2	Guidelines For Shot Blasting Process	Continuous Visual Inspection	6	84							
			7		Steel Shots Size More Than Specified	2			6	84							



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110. Forge Final Inspection	Dimensional Variations More / Less Than Specified	Problem In Machining	7		Gauges Worn Out / Damaged / Setting Disturbed	3	Calibration Of Gauges As Per Schedule,Gauge R&R Study	Final Inspection	2	42								
			7		Mix Up Of Different Defective Components	2	Proper Identification Tag Is Put On The Bin After Shot Blasting	100% Inspection Of Lot	3	42								
	Visual Defects - Scale Deposition, Silver Grey Finish Not Achieved, Poor Surface Finish, Lap, Dent, Pitting, Underfilling	Poor Apperance of Product, Problem at Customer End	7		Inadequate Light At Work Station	2	Overhead Lamps In Operation	Final Inspection	2	28								
			7		Mix Up Of Different Defective Components	3	Proper Identification Tag Is Put On Bin After Shot Blasting & Also Refer End Control Operation	Final Inspection	2	42								
110. Forge Final Inspection	Physical / Metallurgical / Hardness Deviations	Problem In Machining, Customer Dissatisfied	7		System Failure In Process / Operation	2		Final Inspection	5	70								
	Dimensional Variations, More / Less Than Specified		7			2			5	70								
	Visual Defects - Poor Surface Finish, Scale, Residual Flash More Than Specified, Mix up Of Different Heat Code & Die Number	Poor Appearance, Problem In Machining At Customer End	6		System Failure In Process / Operation	3		Final Inspection	4	72								
	Visual Defects - Forging Profile Damaged, Underfilling, Pitting,Improper Engraving	Poor Appearance, Problem In Machining At Customer End	5		System Failure In Process / Operation	3		Final Inspection	5	75								

RECOMMENDED ACTIONS WHEN :  
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RPN> 100 and S=4-7

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140. Final Inspection	Parameters out of Specification	1) Fitment Problem in assy	7		1) Unskilled Operators. 2) Gauge Wear Out. 3) Instruments Not Ok.	2	1) Training to Operator Regarding Instrument & Gauge Handling. 2) Gauge & Instruments Recheck Freq.		5	70							
	Bore Diameter O/S & U/S	Fitment Failure	7		Air plug gauge not checking through our the inner diameter	3	Air gauge seating checked by the supervisor	Operator trained to check through out the inner diameter 100%	3	63							
150. Oiling	Rust on Forging	Poor Appearance	4		Improper Dipping / Pouring Of Oil On The Product	2	Work Instruction For Oiling & Packing	Visual Inspection	6	48							
			4		Oil Quality Deteriorated During Process	2			6	48							
			4		Material Kept In Packed Condition For Long Duration	2			6	48							
			4		Leakage In The Roof During Rainy Season	2			6	48							
160. Packing & Despatch	Quantity as per the trolley packing standard	Qty miss match	6		Qty not verified by the despatch persons	2	As per the standard	Visual Inspection	6	72							



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