

University of Wales Trinity Saint David
School of Engineering



Undertaking a Green Belt Project

ACMA 5005

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3 Introduction

3.1 Aston Martin

Aston Martin, a prestigious British automaker founded in 1913 by Lionel Martin and Robert Banford in London. Known for its blend of elegance and performance, the brand has long been associated with exclusivity, making its mark in both automotive history and popular culture. From its Iconic DB series- including the legendary DB5 featured in the James Bond movie franchise to collaborations with Red Bull Racing on its innovative hyper cars. Aston Martin continues to push the boundaries of design and engineering.

3.2 Report introduction

In a high-precision automotive manufacturing environment like Aston Martin's, Quality is not just a benchmark, it's an expectation. Every component must meet the highest standards of craftsmanship and engineering excellence, ensuring that the final product reflects the brands legacy of performance and luxury. However, persistent glass damage during production has led to increase costs, rework, and potential delays, highlighting a critical area for process improvement.

This report applies Six Sigma DMAIC (Define, Measure, Analyse, Improve, Control) methodology to systematically identify the root cause of glass damage within the production facility. In the manufacturing sector the DMAIC methodology has been employed to reduce process variability and improve product quality. A case study in the bearing manufacturing industry showcased how the methodology led to a decreased standard deviation and reduced the number of parts falling out of specification limits (Bhargava & Gaur, 2021).

By using data driven analysis and process optimisation techniques, the objectives are to minimise defects, reduce waste and enhance overall production efficiency. The structured approach of DMAIC ensures that the improvements are not only effective but also sustainable, aligning with Aston Martin's commitment to precision engineering and operational excellence. Throughout the project the aim is to enhance process reliability, improve first-time quality and drive continuous improvements.

The DMAIC Process



Figure 1- The DMAIC process (Six Sigma Online, 2025)

4 Define

4.1 Problem statement.

With Aston Martins aim to be the market leader in the ultra-luxury vehicle manufacturing sector. Crucial to delivering the highest quality of product to the market is of prime concern. The trim and final department in Aston Martins manufacturing facility is where the painted body of the vehicle is fitted with all the required components to transform into a completed vehicle.

During this process targets are set to deliver RFT (right first time) and target zero DPV (defects per vehicle). Vehicles are thoroughly inspected throughout assembly, and it is these inspections that have raised issues with damage/defects to window glass.

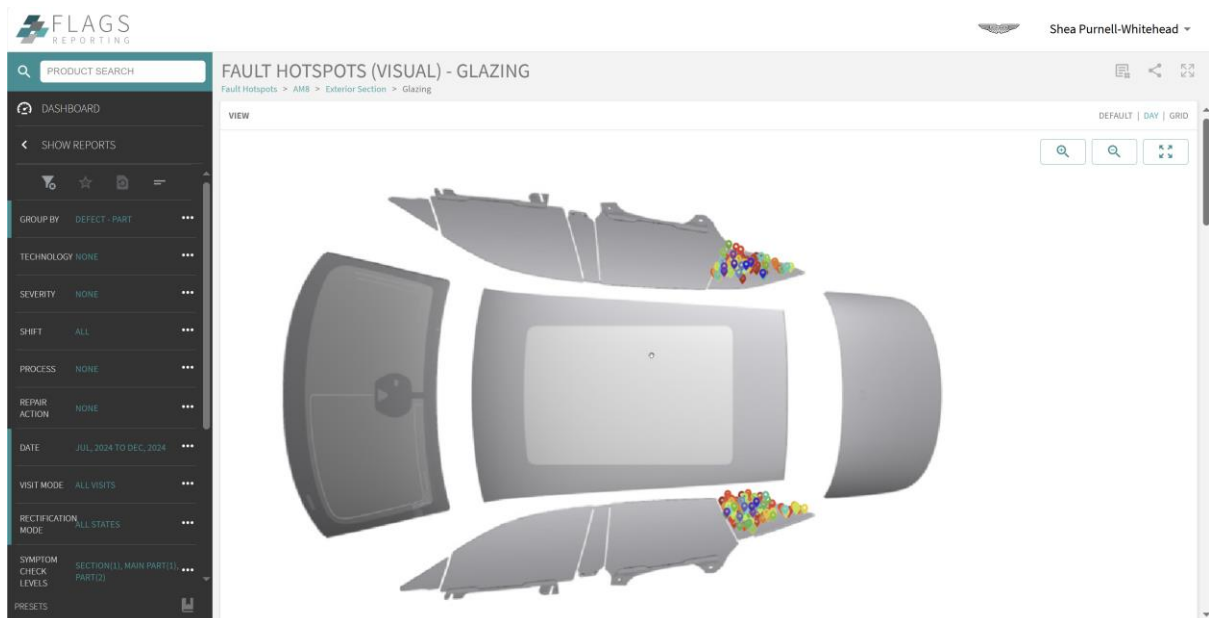


Figure 2-Flags reporting software showing defects showing Quarter glass defects (Purnell-Whitehead, 2025).

Figure 2 shows Aston Martins internal reporting software. Here damage is reported giving an accurate description and location of defects. Figure 3 shows eighty-six instances in a six-month period. The defect leads to a loss in time due to rework. (Moore, 2011) Says that it's a common misconception in manufacturing that time can be "made up" but when time is lost, its lost forever.

The process for repair is managed by the Vehicle confirmation (VC) rectification team who are the customer of production. This causes disruption to the process flow of the VC department due to the rework to rectify the issue.

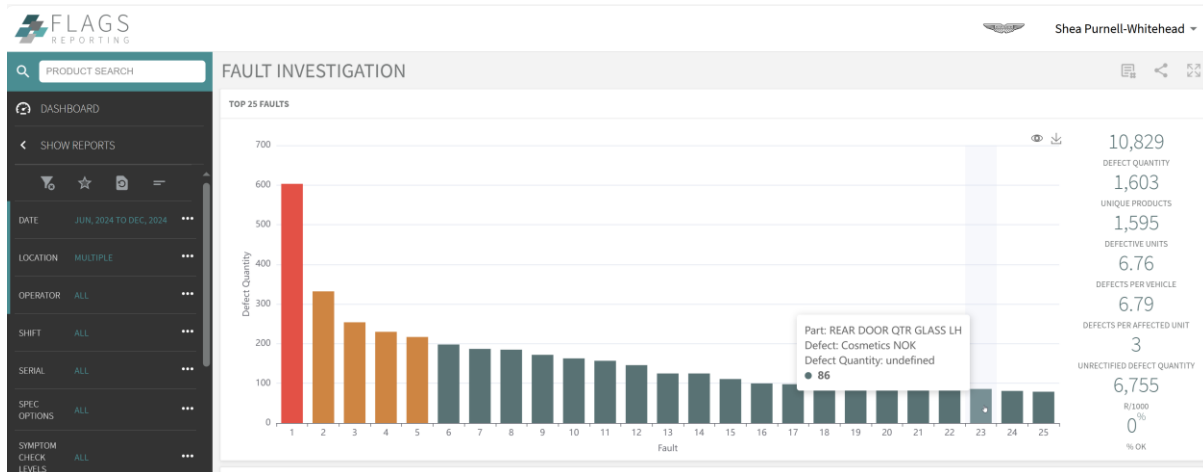


Figure 3-Flags reporting. Fault investigation occurrences (Purnell-Whitehead, 2025).

4.2 SIPOC study

The six sigma SIPOC tool used to help map processes of an organisation, often applied in the define stage of DMAIC approach. SIPOC which is made up of five elements. Supplier, Input, Process, Output, and customer (Marques & Requeijo, 2009). Completing a SIPOC study will help with root cause analysis, process mapping and help gather valuable data to assist in investigation.

1. Suppliers:

Pilkington: The glass manufacturer and assemble all windows used in the production of Aston Martin DBX including the rear quarter glass being investigated.

Design Specification: Rear quarter glass designed using Aston Martin's design specifications Figure 4.

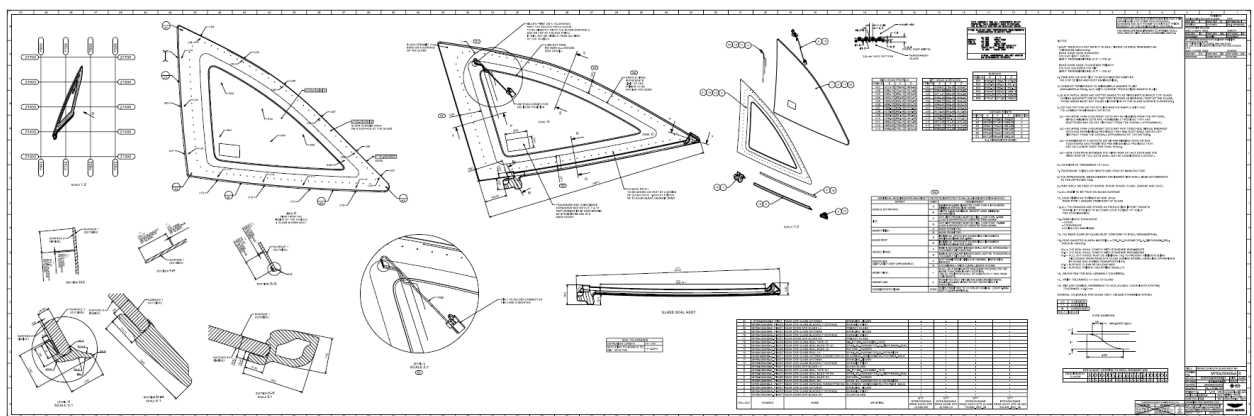


Figure 4-Aston Martin design specification drawing (Aston Martin, 2025).

2. Input:

Quality Documentation: Parts quality standard given by Aston Martin to Pilkington specifying cosmetic requirements Figure 5 supplied to plant.

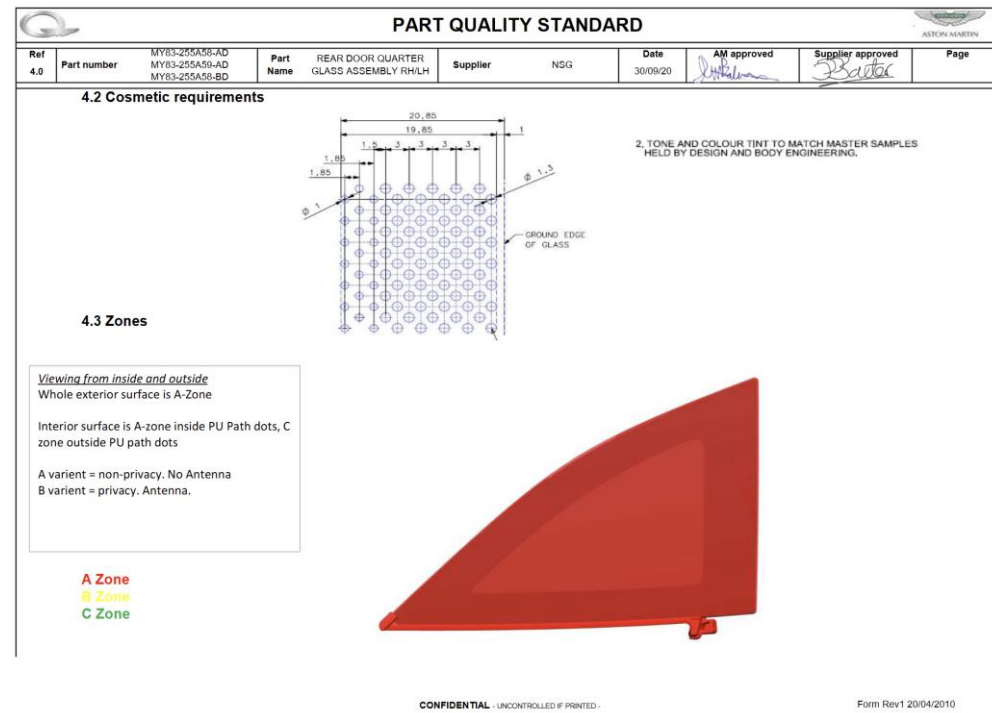


Figure 5:Aston Martin cosmetic requirements standards (Aston Martin, 2025).

Installation guide: Process documentation describing the installation procedure of the rear quarter glass Figure 6.

UNCONTROLLED WHEN PRINTED			
 Desc Rev# Status		PSS_AM800_57089 4 Un-Release,	
Released		George Griffiths	
ID		23703	

			
Step:		Key point icon	Key point / why:
Profile LHS Rear Quarter Glass to Setting Jig		◆	Ensure the front end of the LHS Rear Quarter Glass is located fully up to the setting jig (Fig. 1 & Fig. 2).
Apply Pressure			Apply pressure to the perimeter of the glass. This will ensure the glass is fully depressed against the <u>Bumpers</u> .

 Safety	 Quality	 Critical	 Knock	 Environment	 Sequence	4
--	---	--	---	---	--	---

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Figure 6: Aston Martin Process document (Aston Martin, 2025).

3. Process

Glass installation: Procedure to fit component as per guidelines in Figure 6 in the trim and final assembly department.

Quality control: Inspection and confirmation of correct fitment that adhere to the correct standards. Evaluated at multiple stages of production to ensure no in plant damaged/defects are captured.

Attribute testing: As well as cosmetic confirmation. Vehicles completely evaluated for wind noise and water leaks to ensure no defects.

4. Outputs.

Completed Aston Martin DBX with all glazing fitted, ready for delivery into the dealer network.

Completed vehicle with all inspection and quality assurance documentation that satisfies quality control, with all attribution tests completed.

5. Customer.

Aston Martin dealer network: Dealers take delivery of the vehicles and prepare for distribution.

End customer: End customers are organisations or individuals that purchase from the dealer network and would be the user of the product where the high standards set by Aston Martin are expected to satisfy.

4.3 Project Charter.

The DMAIC projects final output of the first phase is to create a project charter. This will include the required information required needed for the next stage which is defining Critical-to- quality (QTC) specifications, creating a process map (Tenera & Pinto, 2014). A project charter is created to record what is known and what is planned for the project. This document has been made printable and accessible for all relevant team members. This document is a live document that can be updated/amended as the project develops.

Below is a standardised format that Aston Martin uses for projects. The contents are briefed to all the relevant parties involved and review at regular weekly meetings and amendments are made as required.

Project Name	<i>DBX rear quarter glass damage and defects</i>	Business / Location	St Athan
Engineer	<i>Shea Purnell-Whitehead</i>	Telephone Number	<i>07386687717</i>
Start Date:	<i>01/01/2025</i>	Target End Date:	<i>01/02/2025</i>
Project Details			
Project Description	Detect cause and prevent defects in rear quarter glass.		
Business Case	The increase in damage components is leading to rework, process disruption, scrap and delivery targets not being met at an excessive cost to the business.		
Process/Part and Owner	Rear quarter glass fit. Owner: Exterior trim dept		
Expected Business Results	Reduction in scrapped parts and rework time associated.		
Expected Customer Benefits	Less process disruption, scrap, and overall cost		
Team members	Josh Selway, Luke Evans, Shea Purnell-Whitehead, John Griffiths, Nathan Jenkins		
Support Required	Pilkington, CME dept, Part quality dept, Production dept		
Risks or Constraints	Production disruption, cost of improvements,		

Figure 7:Project Charter for quarter glass damage and defects (Purnell-Whitehead, 2025)

4.4 Voice of the Customer (VOC) / Critical to Quality (CTQ).

The term Voice of the Customer (VOC) refers to a method commonly used to gather and understand customer requirements. It's a market research approach that captures a detailed, structured list of what customers need and expect, ranking these elements based on their significance and how well they're currently being met. VOC combines both qualitative and quantitative research and is often carried out at the start of a new product, process, or service development project. It plays a key role in understanding customer expectations, supporting tools like Quality Function Deployment (QFD), and shaping accurate design specifications (Tahir, 2010). In this step, the project team will identify who is directly impacted by the problem. Those identified will then be prioritise those most affected.

VOC include:

- "Glass keeps arriving with minor chips or scratches." (Technician on station)
- "It's hard to handle the glass without tools." (Technician on station)
- "Customers expect flawless glass on delivery." (Customer perception audit team)

Translate VOC into CTQs:

- Zero visual defects on glass
- Reliable handling and installation process
- On-time delivery with no rework

In this case the project team have identified two departments most affected by the problem. The production team and the vehicle confirmation team.

It is then determined that then production team are the most affected due to being the direct customer from supplier and it is the production team that is responsible for the fitment of the component and aligns with Aston Martins RFT strategy. Correcting the issue at this stage would generate the largest benefit.

4.5 Process Map

In the Define phase of the DMAIC framework, process mapping is employed to illustrate the current process flow, setting the stage for in-depth analysis. By integrating process mapping into Six Sigma initiatives, organizations can systematically dissect their processes, leading to more informed decision-making and sustainable improvements. This approach not only enhances process efficiency but also contributes to higher customer satisfaction by delivering quality products and services (Six Sigma Online, 2025)

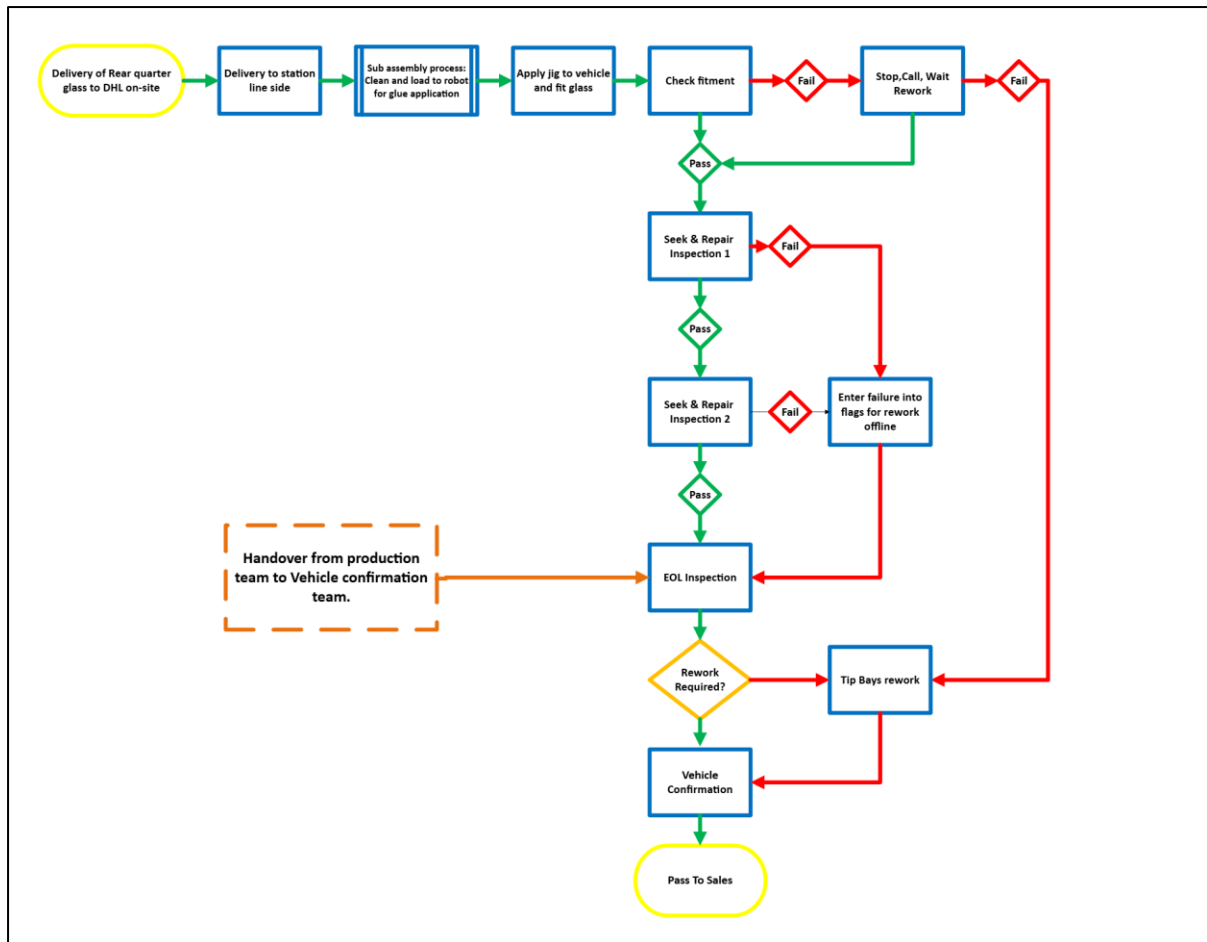


Figure 8-High level process map (Purnell-Whitehead, 2025)

Using the SIPOC study shown in 3.3 a high-level process map has been made (figure 8) to see the current production process that the problem part follows from its arrival into plant to the completed vehicle at pass to sales. Using the process map we can highlight potential areas to capture and/or rectify the issue in hand.

Immediately after mapping out the process, the inspection is at seek and repair station one. This raises concern as the fitted part passes through a significant amount of production stations before being flagged. Looking at Figure 9 there are no detection points for twenty-four stations between the first fit and first inspection. The second immediate concern is that there is no inspection at point of fit leading to the possibility of incoming damage.

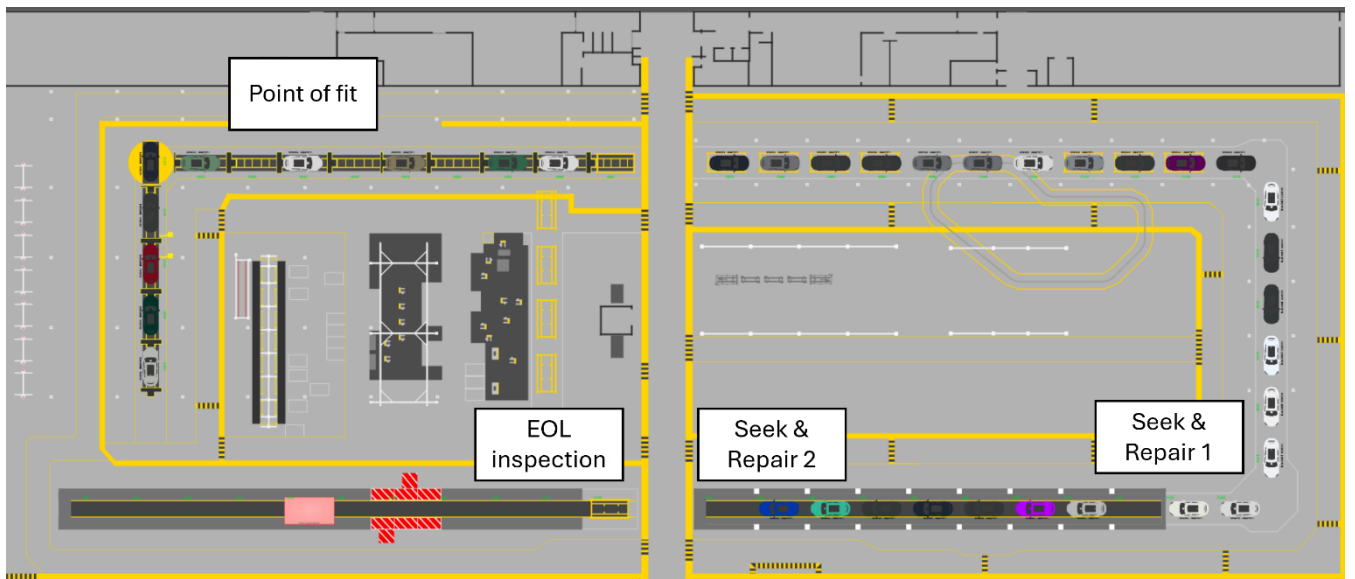


Figure 9:Map of Trim and final production hall (Purnell-Whitehead, 2025).

5 Measure

5.1 Identify Measurement Variation

Identifying the measurement and how consistently the glass damage is being detected and reported. Briefly described as a lack of consistency throughout production (Hessing, 2023). Some sources of variation are as follows:

- **People:** Different operators or inspectors may judge damage severity differently (Plausible in this case).
- **Methods:** Visual checks vs. light-based inspection techniques (Plausible in this case).
- **Environment:** Lighting, cleanliness of glass, and viewing angles affect visibility (Plausible in this case).
- **Materials:** Differences in glass quality or coatings (Will not affect this case as there is no differing material).

Acknowledging that subjective visual inspections may introduce operator-based variation.

People: Technicians inspect to VIS (Visual inspection standards) set by the quality department. The specifications in figure 10 lists the defect that would result in defect call into the flags system against that vehicle. Due to the process being a visual operation this means that variation from one inspector to another is possible.

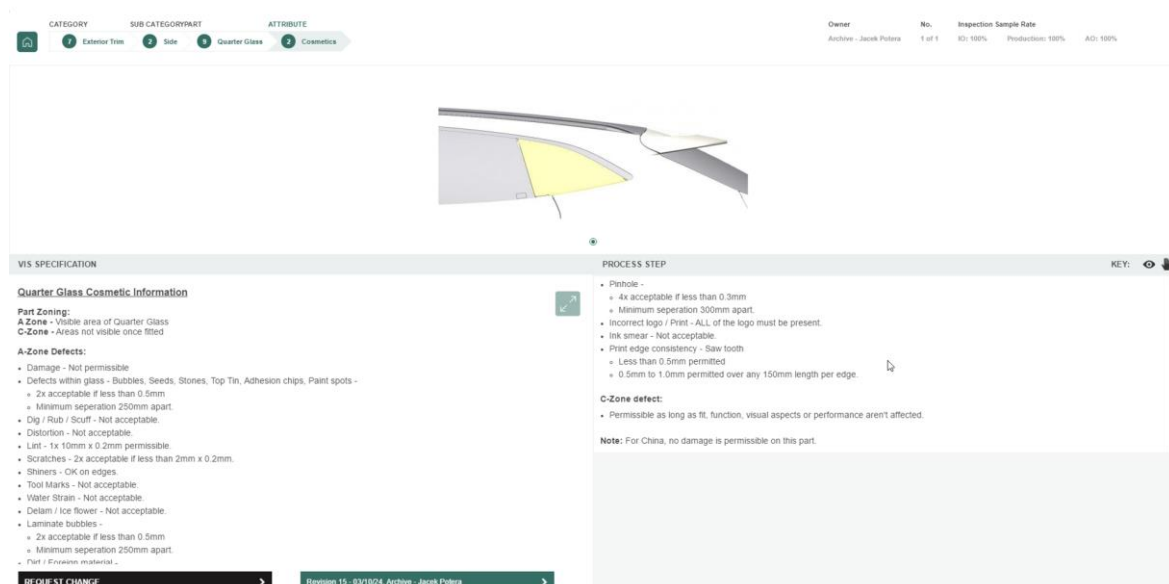


Figure 10: VIS specification for rear quarter glass (Aston Martin, 2025)

To alleviate the chances of variation, the inspectors are given a measurement gauge supplied direct from the glass manufacturer to help to determine legitimate calls.

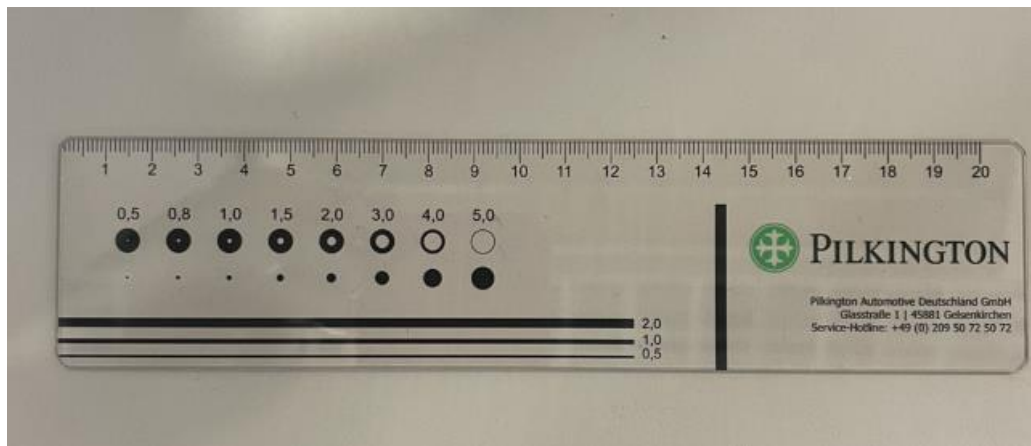


Figure 11: Pilkington glass defect gauge. (Purnell-Whitehead, 2025)

Environment: At EOL inspection there are lighting bays installed which are not at point of fit.

Method: Inspectors are given torches and measurement gauges whilst POF conduct a visual inspection during fitment with no aid.

5.2 Determine Data Type

5.2.1 Flags Data defect count

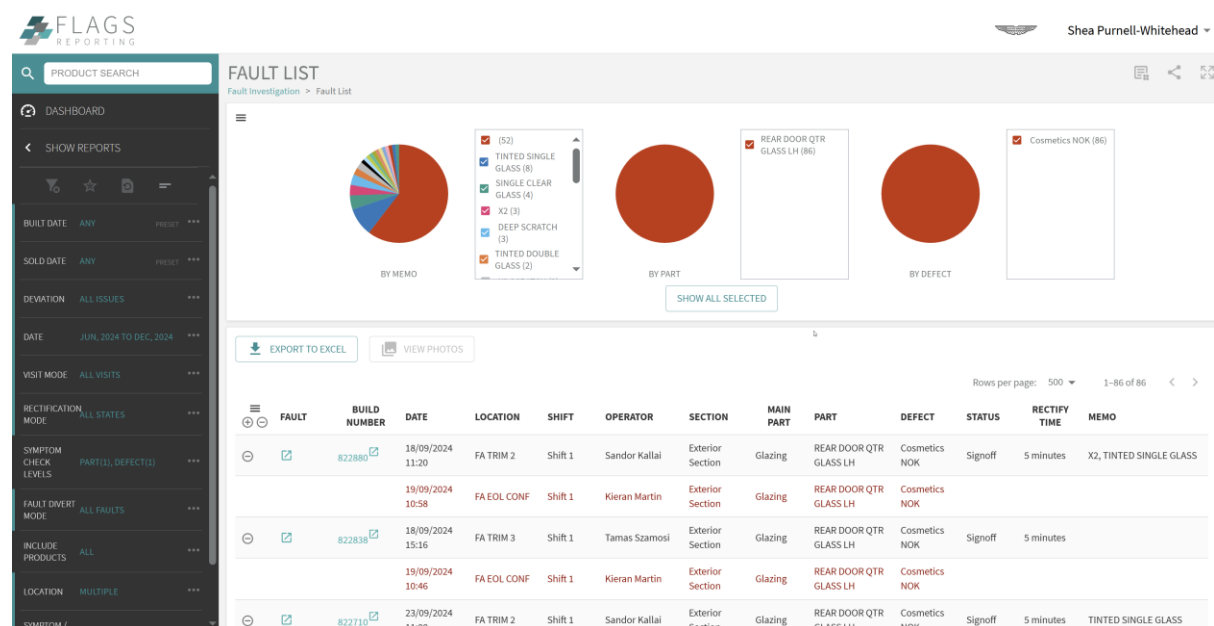


Figure 12: Flags inspection reporting software (Purnell-Whitehead, 2025)

Figure 12 shows that in the six-month period between July 2024 and December 2024 a total of eighty-six defects have been reported across the three-inspection station throughout trim and final. The reporting software also gives the inspector to label the exact location and type of defect that is being reported (Figure 13). The damage reported is in the same proximity of the glass. Repeated damage in the same proximity could be a sign of a process issue.

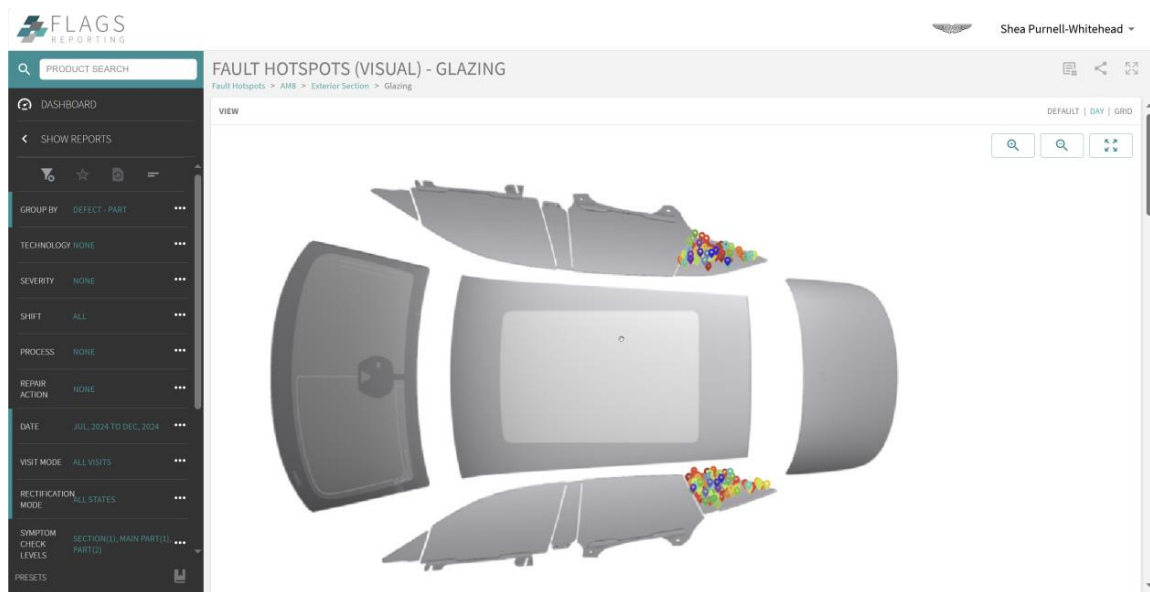


Figure 13:Flags inspection reporting software (Purnell-Whitehead, 2025)

5.2.2 Type of Defect

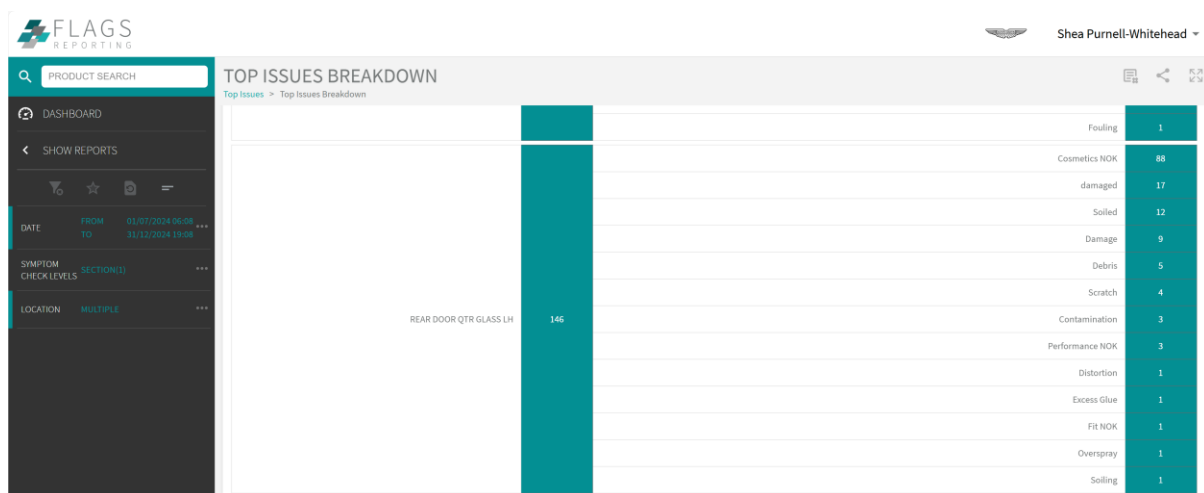


Figure 14:Flags top issue breakdown (Purnell-Whitehead, 2025)

5.3 PFMEA (Process Failure Mode and Effect Analysis)/Control Plan

The first FMEA were performed in mid-1960. Initially used specifically for safety issue in the aerospace industry. Now used as a systematic method to detect and prevent problems in process before the occur. FMEAs are performed in product design and process development (McDermott, et al., 2009). Listed below some benefits.

1. **Prevent Process Failures:**
 - Catch problems early, before they impact production or customers.
 - Reduce downtime, scrap, rework, and warranty issues.
2. **Improve Product Quality**
 - Ensure the process consistently delivers outputs that meet requirements.
 - Identify weak points where defects may occur.
3. **Increase Customer Satisfaction**
 - Deliver reliable, high-quality products or services.
 - Reduce the risk of delivering defective items to customers.
4. **Enhance Team Understanding**
 - Brings cross-functional teams together to analyse the process deeply.
 - Promotes a culture of continuous improvement.
5. **Prioritize Improvements**
 - Uses the Risk Priority Number (RPN) to rank potential failures by risk and decide which issues to tackle first.

One process in which the glass is passed through and an opportunity for the defect to occur is the glazing cell, In the process the glass is placed into a jig in the glazing cell where a robot applies the bond in preparation for fitment to the vehicle.

In figure 15 shows the PFMEA for this process has been carried out and includes entries for potential causes of damage. It also shows that there is an inspection point to check damage after the process of the glue is applied. This gives an early detection point should any defects be found.

FMEA										Number:											
Process										Page:											
Item: Glazing Cell Machine				Process responsibility: CME Depart				Prepared by: Phil Moreton													
Model year(s)/vehicle(s): MY2021 AM800				Completion date: 05/08/2020				Created: 01/04/2020													
Team: Phil Moreton, Adam Hill, George Griffiths, Alex Doveston																					
Function	Potential failure	Potential effect(s)	S/C	Potential cause(s)	O	Current preventive action	Current detection action	D	RPN	Recommended action	R/D	Action taken	S	O	D	RPN					
of failure												of failure	action	action	action						
System element: GLAZING CELL																					
Load Glass into Robot Cell Fixture	Panel priming exceeded time limit	[GLAZING CELL]	7	Line stoppage	2	Technician training and awareness	Offtracks - Water test	7	98	P: Add note to EASE to raise technician awareness of 4 hour time limit on Betaprine product. Add rework process to EASE if line stoppage of more tha 4 hours	Griffiths, George,		7	-1	7	-98					
	Glass not held accurately in fixturing	[GLAZING CELL]	7	Technician loaded glass into fixture incorrectly	1	Technician training and awareness	Automated fixturing with limit switches to ensure part is in place - error if not	2	14												
	Major Disruption-Loss of Primary Function		1	Fixturing worn or out of adjustment	1	FLM maintenance	Automated fixturing with limit switches to ensure part is in place - error if not	2	14												
	Part damaged during loading	[GLAZING CELL]	6	Technician catches glass on fixturing during loading	2	All fixturing and adjacent lift assists protected	Technician visual detection & Post build inspection	7	84												
Apply adhesive	Incorrect adhesive applied	[GLAZING CELL]	7	Maintenance team fit incorrect product to robot feed system	1	Adhesive supplied by UNIVAR to point of fit.	None	9	63	P: Investigate improved prevention controls to ensure correct adhesive is supplied	Griffiths, George, CME		7	-1	9	-63					
	Major Disruption-Loss of Primary Function																				
	Adhesive in incorrect position	[GLAZING CELL]	7	Contaminated feed nozzle	2	Nozzle cleaned by wire every cycle. Nozzle cleaned by technician	Technician visual inspection	7	98												
	Major Disruption-Loss of Primary Function		1	Robot program incorrect	1	Commissioning and sign off of adhesive position	Technician visual inspection	7	49												
				Glass not in fixture correctly	1	Technician training and awareness	Automated fixturing with limit switches to ensure part is in place - error if not	2	14												

Figure 15:Glazing Cell process PFMEA document (Aston Martin, 2025) (see appendices for full document)

Looking at the process map in 4.5. large amount of opportunity for glass damage from point of fit to the first inspection point.

Aston Martin have control plans for each process where potential issue has a corresponding control method. Figure 16 shows control plan for glazing that include the potential for glass damage. The control method here is a 100% inspection. Meaning that all parts should inspected upon completion of process. Walking the process will determine if this control method is being carried out.

Prototype:			Prelaunch:			Production: X			Control Plan				Created:		Modified:												
Control Plan number:						Key contact/Phone:						06/09/2022		21/09/2023													
Glazing Cell Machine						Core team:						Customer engineering approval/date (if required):															
Part number:						Luke Huzzey-Evans, Josh Selway, Nicole Angove						Customer quality approval/date (if required):															
N/A						Supplier/Plant approval/Date:						N/A															
Part name/Description:						N/A						Date/Other approval (if required):															
GLAZING CELL						N/A						N/A															
Supplier/plant:						Supplier code:																					
St Athan						N/A																					
Part/		Process		Machine,		Characteristics				Classi-		Methods															
element/		Operation		device,						fifi-																	
description		for Mfg.																									
Process																											
number						No.		Product characteristic		Process characteristic		ca- tion		Specification		Inspection equipment		Responsible		Samples		Control method		Reaction plan			
																				Size		Frequency					
1.2.1.		Glazing Cell Machine		Glazing Robot		1.2.1.		Betaseal 1949-1F Urethane Adhesive		PU Application		Betaseal 1949-1F Urethane Adhesive is Used		Visual inspection		Technician/ Maintenance		1		Every Barrel Change		Technician 100 % visual inspection that the correct product supplied by Univar on barrel change, and use-by date not exceeded		Operator = Stop - Call - Wait			
1				1.a		8mm ± 2																				Technician visual inspection.	
						(base width)																				Bead Gauge Check at specified frequency	
						12mm ± 2						Calibrated Bead Gauge		Technician		1		Start of Every Shift & After Every Barrel Change									
						(Height)																					

Figure 16:Glazing Cell Control plan (Aston Martin, 2025) (Full document in appendices)

6 Analyse

6.1 Process Analysis Tools.

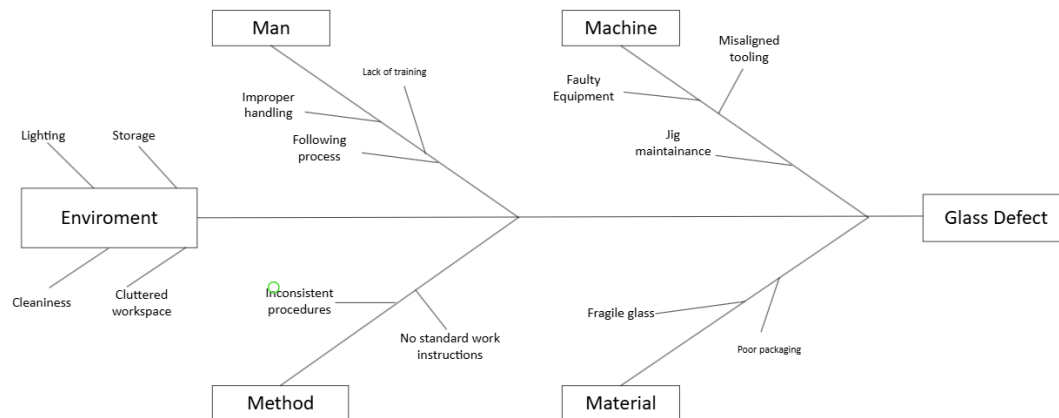


Figure 17: Ishikawa fishbone analysis (Purnell-Whitehead, 2025)

Kaoru Ishikawa introduced seven fundamental quality tools. Among these tools is the cause-and-effect diagram (CED), commonly referred to as “The Fishbone” or “Ishikawa diagram.” Delving into this inquiry can illuminate the initial evidence supporting the claims of Ishikawa that the primary issues faced by companies lie within their processes and possibly, at a deeper level, in some of the essential root causes related to organizational management (Suárez-Barraza & Rodríguez-González, 2019). The Ishikawa fishbone analysis (figure 17) has been carried out. This analysis helps identify and categorize potential root causes of the glass defect.

Pilkington the glass supplier has a 100% inspection before shipment. Aston Martin supply foam line stillages. The stillages are packaged at suppliers and are not open again until the stillages reach lineside ready for fitment (Figure 18).



PART QUALITY STANDARD							
Ref 1.0	Part number MY83-255A58-AD MY83-255A59-AD MY83-255A59-BD	Part Name REAR DOOR QUARTER GLASS ASSEMBLY PNLH	Supplier NSG	Date 30/09/20	AM approved [Signature]	Supplier approved [Signature]	Page 7 of 18
No	Inspection Item	Specification/Criteria	Method				
1.7.2	PACKAGING REQUIREMENTS	TO BE PACKAGED IN DEDICATED PALLET AS SUPPLIED BY AML	VISUAL CHECK	EVERY DELIVERY	NSG MANUFACTURING		

Box Details: 1200mm x 1000mm x 760mm Big Box Pallet

Sample Number: 10595
Date of issue: 07/11/2018

Net Weight: 45kg Pack Factor: 32

Company: Aston Martin
Contact: Jon Hegarty
Component: Rear Qtr Glass LVRH
Project: AML 817M 8197

Originator: [Signature]
Drawn By: [Signature]

Figure 18: Parts quality standard and image of stillage for glass storage and shipment (Aston Martin, 2025)

6.2 Five whys analysis

Using root cause problem solving (RCPS) techniques within lean manufacturing, including the 5-whys analysis from the Toyota Production System can examine the sources of waste, leading to the development and execution of corrective measures. Using the 5-whys analysis in the manufacturing sector offers a systematic and evidence-based method for identifying and addressing problems (Benjamin, et al., 2010).

1. **Why** is the rear quarter glass getting scratched?
Because it's getting damaged during production.
2. **Why** is it getting damaged during production?
Because the glass is being exposed to rough handling and sharp edges during the installation of the cant rail.
3. **Why** is the glass being exposed to rough handling and sharp edges?
Because there is no protection on the cant rail or glass.
4. **Why** is there no protection on the cant rail or glass?
Because the installation process does not include protective padding or guards for the glass during assembly.
5. **Why** does the installation process does not include protective padding or guards for the glass?
Because there has been no standard operating procedure (SOP) established for ensuring protection of sensitive components like glass during installation.

Root Cause Identified: Lack of Standard Operating Procedure (SOP) for protecting sensitive components like glass during installation.

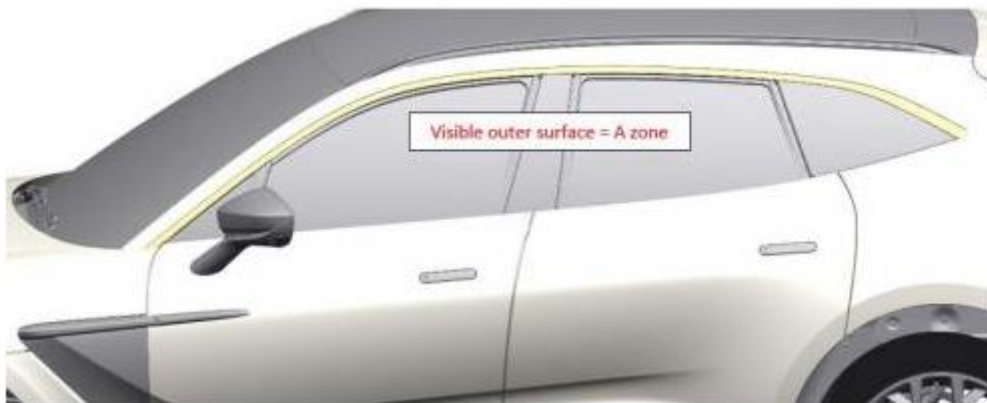


Figure 19:DBX cant rail (Aston Martin, 2025)

After applying the 5 why method, it was found on the installation of the cant rail highlighted in yellow in figure 19, the metal component was damaging the glass. Whilst observing the process it was not that this is a one-man operation, and that no protection is applied neither cant rail nor glass leaving both parts exposed to damage.

6.3 Graphical analysis

6.3.1 Pareto analysis

With the aid of the graphical data provided by the flags reporting software a breakdown in defects being called are highlighted. Figure 20 shows the varying defects. Using the graphical analysis, it can be said that there is more than one root cause and not solely a damage. Defects such as bubbles in glass would indicate be a parts supply issue.

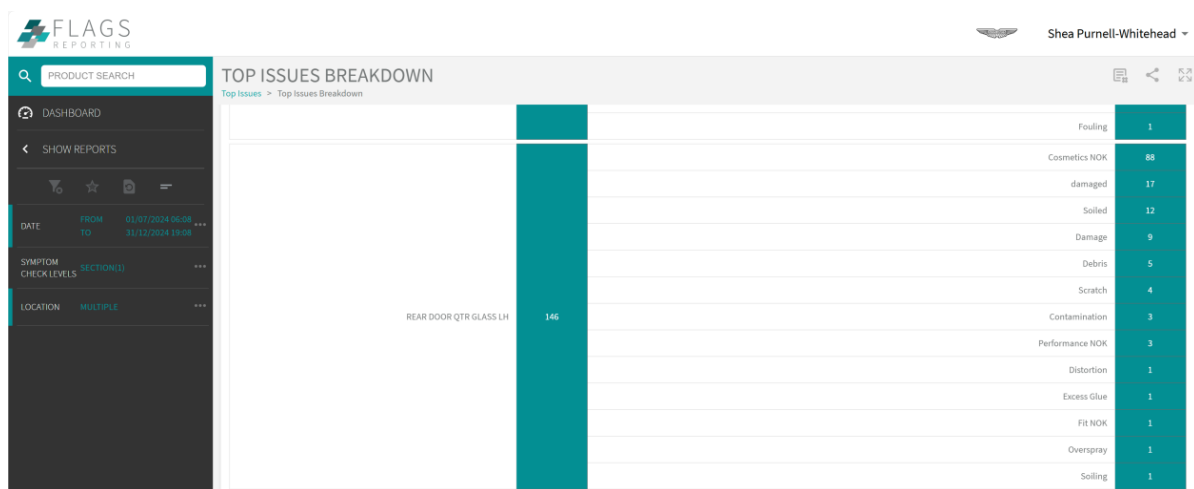


Figure 20:Flags top issue breakdown of defects (Purnell-Whitehead, 2025)

This is based on the Pareto Principle: 80% of problems come from 20% of causes. You analyse defect data to figure out which issues are most frequent and impactful (Dunford, et al., 2014)

A breakdown of defects are as follows:

- Scratches – 50%
- Chips – 35%
- Soiling – 10 %
- Misalignment – 5%

Scratches are the major problem, so your improvement efforts should focus there first. Pareto to causes can also apply, not just types of damage:

- Poor handling – 45%
- Inadequate storage – 30%
- Supplier defects – 15%
- Installation errors – 10%

6.3.2 Rework

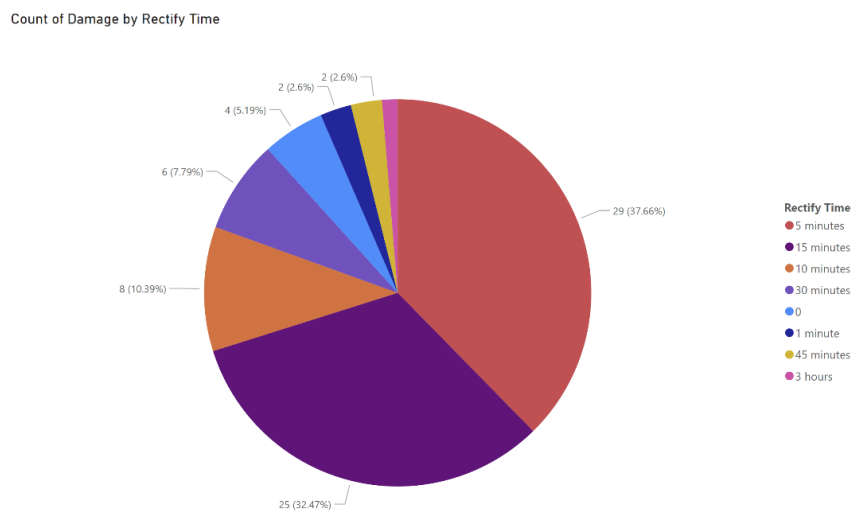


Figure 21:Flags rectification time data (Purnell-Whitehead, 2025)

After the defect is entered into Flags, it is then the responsibility of the rework team who are the customer of the production team, to determine the rectification required. Some minor scratches and imperfections can be repaired with minor polishing which can be carried out in the rework stations online, these vehicles would then not fail the RFT target set. Others that damaged cannot be reworked would require glass replacement. This is an intrusive repair that can lead to secondary defect/damage. After the correct method of repair is carried out the technician clears the flags data and enters the time taken. This is shown in (figure 21).

2024 Hourly Costs Per Area Calculator										
Area	Direct Labour Rate	Overhead Rate	Fully Loaded Rate	Fully Loaded/ Min	Fully Loaded/ Second	Enter Mins/ Area	Mins Cost	Enter Seconds/ Area	Secs Cost	Total Cost
BodyShop	£32.05	£84.96	£117.01	£1.95	£0.0325		£0.00		£0.00	£0.00
Paint	£34.46	£75.09	£109.55	£1.83	£0.0304		£0.00		£0.00	£0.00
T&F	£30.26	£72.02	£102.28	£1.70	£0.0284		£0.00		£0.00	£0.00
VC	£34.64	£84.96	£119.60	£1.99	£0.0332	1052.00	£2,096.99		£0.00	£2,096.99

Figure 22:Hourly cost calculator (Aston Martin, 2025)

Using the defect repair time data in figure 21 and multiplying by the cost per area calculator in figure 22 will give a total cost of preventative labour costs.

6.3.3 Inventory

Below in Figure 23 is the cost of the part should a replacement be needed.

Note Type:

Note Number:

Originator: Purnell-Whitehead, Shea

☐ Trim and Final ☐ BW/Tubs/Paint

Build Number: Production Order: Build Number for Non-Backflushed Item:

Item:

Line Station:

Handling Unit:

Serial Number:

Line Side Warehouse:

Location:

Quantity: ea Quantity On Hand: 18.0000

Reason Code:

Cost Per Unit: 37.6200

Total Scrap Cost: 0.0000

Inspection Order:

Quarantine ID:

Non-Conformance Report: ☒ **Print Option**

Printer:

No. of Copies:

Text:

☐ Processed

Figure 23:Replacement glass cost (Purnell-Whitehead, 2025)

6.3.4 Hidden factory,

Should the part require replacement there is hidden factory to be considered.

Inventory- Should a replacement part be required; this could result in stock loss and further disruption with parts supply.

Waiting- Vehicles would be placed on hold until the issue is resolved causing process disruption. Waiting for a replacement part to be delivered.

Motion- Replacement parts are stored in the parts warehouse.

Defect- Working out of process the likelihood of defects is increased.

6.4 Root cause analysis

Aston Martin have a procedure for root cause analysis and escalation. Should problems arise, what is known as a level 0 problem identification and conformity check is to be carried out. This is a high-

level standardised check with the aim to identify any issues in process, tooling and/or parts. If a resolution is not found after the completion of the level 0, the issue is then escalated to level for further investigation.

Level 0 - Problem Identification and Conformity Check									
Problem Statement:	Rear Quarter Glass scratches								
Date / Time:	03/03/2025								
Originator:	Shea Purnell-Whitehead								
Point of Detection:	EOL inspection, Seek & Repair 1 & 2								
Point of Fit:	Station 4045								
Full Part Number(s):	(MY83-255A58-AD and MY83-255A57-AD)								
Vehicle(s) affected:	(Multiple builds AM888)								
Technician on Process:	James Price								
Operation Number:	23703								
a. Process					b. Tooling				
Is EASE process present?					Y / N	Are tools listed on EASE?			Y / N (NA)
Is process clear and understandable?					Y / N	Are tools used correct to EASE?			Y / N (NA)
Are quality standards accessible?					Y / N (NA)	Are the tools referenced in the PSS?			Y / N (NA)
Are process knacks documented?					Y / N (NA)	Is tooling in good working condition?			Y / N (NA)
Date EASE/PSS released:	16/11/2018					Are tools calibrated and within date?			Y / N (NA)
Is technician trained?					Y / N	Are fixtures listed on EASE?			Y / N (NA)
Date technician trained:						Are fixtures used correct to EASE?			Y / N (NA)
Does technician follow process?					Y / N	Are fixtures referenced in the PSS?			Y / N (NA)
Is the regular technician on process?					Y / N	Is there a fixture TPM record present?			Y / N (NA)
Does technician have sufficient time to complete process?					Y / N	Are all FLMs completed?			Y / N (NA)
						Is error proofing present and working?			Y / N (NA)
c. Parts					d. Problem Resolution / Next Steps				
Are parts listed on EASE?					Y / N	Issues identified in Level 0?			Y / N
Are full part numbers correct (inc. suffix)?					Y / N	PCMs raised:	N/A		
Are the part numbers correct on materials rack / kit list?					Y / N				
Is barcode/QRcode scanning operational?					Y / N (NA)				
Does barcode/QRcode scan show correct part number?					Y / N (NA)				
Are there any obvious defects present?					Y / N	Have all PCMs been rectified?			Y / N
Does defect occur after fitment?					Y / N	Does problem still exist after level 0?			Y / N
						If no, root cause:			
e. Problem Definition (to be completed prior to escalation)									
What is the specific concern?	Scratches and defects found on inspection leading to DPV at EOL								
Where is the problem found?	EOL inspection, Seek & Repair 1 & 2								
How many defects have been found?	86								
Over what time period has that quantity of defects been found?	6 months								
Is this a new problem or just a new priority?	New Problem								
Is the defect visible at point of fit?	No Check In Place								

Figure 24: Level 0 report (Purnell-Whitehead, 2025)

After reviewing the data provided in the graphical analysis, a level 0 will be carried out at the cant rail fit station due to the root cause being located for the damage defects.

7 Improve

7.1 Generate Improvement Alternatives

To address the root causes identified during the analysis phase, several improvement alternatives were considered to minimise rear quarter glass damage during production. These alternatives aim to ensure the glass is handled carefully, and that potential damage during the installation of the cant rail is mitigated. The following solutions were proposed:

1. Introduce Protective Padding/Guards:

- Install soft, impact-absorbing materials such as foam pads or leather covers created from offcuts of leather from the trim shop on cant rails and body protection surrounding installation areas. This will prevent direct contact between the glass and sharp edges during installation.
- Application of glass protection after the inspection and confirmation of acceptable condition (figure 25)



Figure 25:Glass protection (Purnell-Whitehead, 2025)

2. Upgrade Handling Equipment:

- Implement vacuum lifting devices and other ergonomic handling tools to reduce reliance on manual handling, thereby reducing the chance of rough handling and accidental damage.

3. **Implement Standard Operating Procedures (SOPs):**

- Develop and implement clear SOPs for handling and installing the rear quarter glass, with a strong focus on protection during the installation of the cant rail. This should include step-by-step guidance on the proper techniques, use of protective gear, and handling procedures.

4. **Training for Operators:**

- Provide comprehensive training programs for operators, emphasising the importance of handling the glass with care, using proper tools, and following safety protocols.

5. **Redesign Workstation Layout:**

- Review and improve the workstation layout to ensure adequate space around the installation area. A well-organized and spacious environment can help minimize accidental glass damage caused by tight working conditions.
- Installation of equivalent lighting to the point of fit inspection area to align with that fitted at EOL.

7.2 **Improve FMEA phase.**

Each improvement was assessed through an FMEA to evaluate the potential risks and the severity of the impact of each failure. The following steps were taken:

- **Likelihood:** How likely is the issue to occur after implementing the solution?
- **Severity:** What is the impact of the issue on glass damage or production delays?
- **Detection:** How easily can the issue be detected before causing further damage?

Solutions like protective padding and glass protection scored highly in reducing both the likelihood and severity of glass damage.



Figure 26: improved foam jig for glass preparation (Purnell-Whitehead, 2025)

7.3 Cost/Benefit Analysis

A cost/benefit analysis was performed to assess the financial impact of each improvement. For example:

- **Protective Padding/Guards:** The initial investment in padding and installation was estimated to be low as the covers are made internally by recycling offcuts of leather from the trim shop. Compared to the potential savings from reduced rework and scrap.
- **Reducing rework time-**

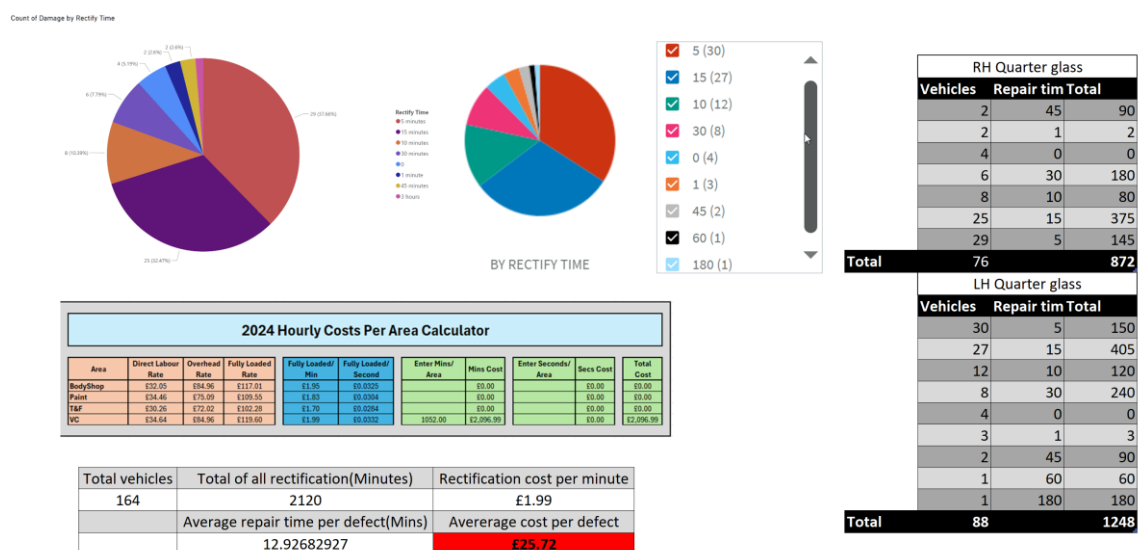


Figure 27: Calculation of rework cost (Purnell-Whitehead, 2025)

Over the six months period in which the data has been gathered. Using the calculations in figure 27 at a cost of £1.99 per minute of rework and a total of 2120 rework time, a total cost of £4218. Giving and average cost of £25.72 per defect.

- **SOP Implementation & Training:** The costs associated with developing SOPs and training were minimal, but the benefits would lead to better compliance and reduced variation in handling. Reminding the technicians to follow and not deviate from VIS standards.

7.4 Validate improvements.

Before implementing a change, a thirty-car line trial was carried out and monitored before the permanent release. With the addition of the glass protection and covers fitted to the cant rail where the damaged was identified. From January to April 2025 a significant reduction can be seen. In the four-month period a total of four defects were found. Data from the improved period (figure 28) was collected and compared with baseline damage rates. Statistical analysis confirmed that the improvements led to a statistically significant reduction in rear quarter glass damage with a total of four defects found.

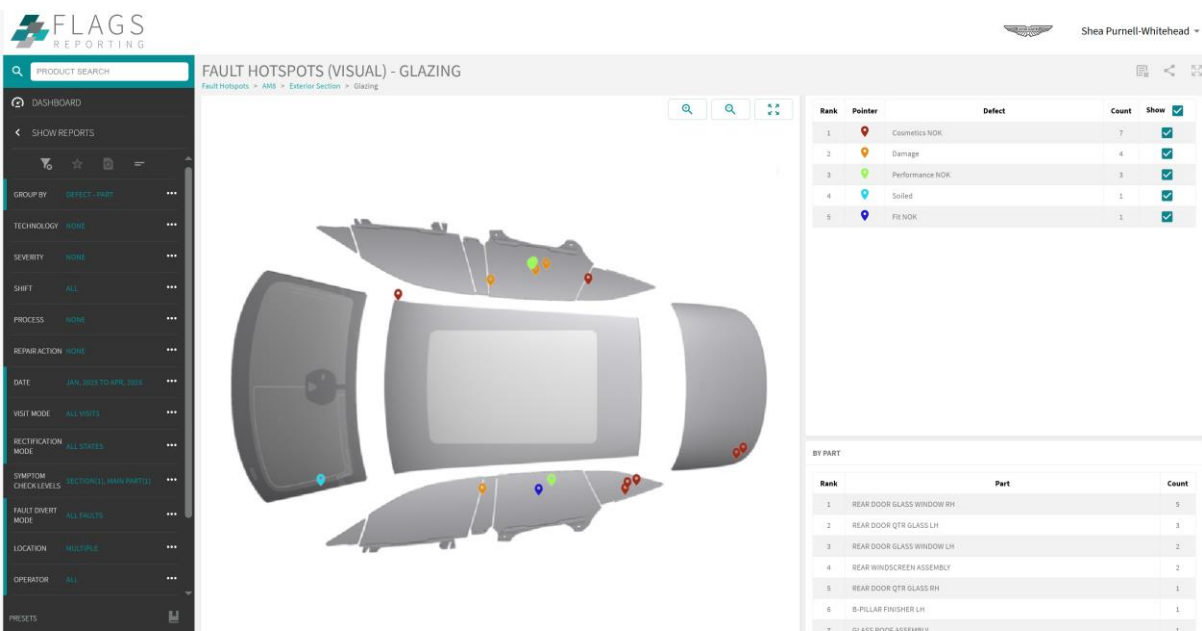


Figure 28:Flags data after improvements (Purnell-Whitehead, 2025).

8 Control

8.1 Control Measures to Sustain Gains

To ensure that the improvements are maintained over time, several control measures will be put in place:

1. **Ongoing Monitoring and Data Collection:**

A system will be established for continuous data collection on rear quarter glass damage rates, with regular tracking of defects. A control chart will be used via flags to monitor any fluctuations in the process over time.

2. **Standard Operating Procedures (SOPs):**

The newly developed SOPs will be integrated into daily operations, ensuring that every operator follows the standardised procedures for handling and installing glass. Regular audits will be conducted to verify adherence to these procedures.

3. **Visual Management:**

Visual cues such as posters, diagrams, and checklists will be displayed at critical points in the production line. This will reinforce the proper techniques and remind operators to use protective equipment when installing glass.

4. **Regular Training and Refresher Training:**

Ensure that new employees are adequately trained and that existing employees receive refresher training on proper handling techniques and the importance of protecting the glass.

5. **Key Performance Indicators (KPIs):**

KPIs related to glass damage rates, handling errors, and production downtime will be tracked and reported to management. These KPIs will be regularly reviewed.

6. **Ownership and Accountability:**

Specific team members will be assigned responsibility for overseeing the glass installation process, ensuring that the controls are maintained. They will be tasked with addressing any emerging issues and ensuring compliance with the new process.

8.2 Handover to Process Owners

Once the improvements have been validated and the control measures have been established, the process will be handed over to the process owners in the production department. Regular check-ins will be conducted to ensure continuous monitoring and improvement.

These improvements and controls should help reduce the rear quarter glass damage rate significantly and ensure the process remains efficient and defect-free in the long term.

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10 Appendices

10.1 Appendix A-Aston Martin PFMEA occurrence ranking.

PFMEA - OCCURRENCE RANKING						
Probability of Failure	Rank	Failure Rate		Production of 5 Per DAY		AML Statement
VERY HIGH	10	≥ 100 per thousand > 1 in 10	10%	2.5 Failures / WEEK	Very High	New process / technology without any existing preventive controls. Approximately 100% NOK. Process failure is inevitable
HIGH	9	50 per thousand 1 in 20	5%	1.25 Failures / WEEK		New process / technology with unproven preventive controls. Approximately 50% NOK. Process is likely to fail.
	8	20 per thousand 1 in 50	2%	2.2 Failures / MONTH	High	Process with problematic history. Approximately 25% NOK. Process inconsistency.
	7	10 per thousand 1 in 100	1%	1.1 Failures / MONTH		Current process / technology applied to new commodity with uncertainty about effectiveness of preventive controls. Approximately 15% NOK. Generally
MODERATE	6	2 per thousand 1 in 500	0.2%	2.61 Failures / 1 YEAR	Moderate	New process / technology using proven preventive controls. Approximately 5% NOK. Generally associated with similar processes that have experienced occasional
	5	.5 per thousand 1 in 2,000	0.05%	1.305 Failures / 2 YEARS		Current process applied to existing commodities with unproven preventive controls. Approximately 1% NOK. Associated with similar processes that have
	4	.1 per thousand 1 in 10,000	0.01%	< 1 Failures / 5 YEARS		New process / technology using proven preventive controls. Less than 1% per model. Associated with similar processes that have experienced isolated failures.
LOW	3	.01 per thousand 1 in 100,000	0.001%	< 1 Failures / 5 YEARS	Low	Minor changes to current processes with positive production experience under comparable conditions. Isolated failures associated with almost identical processes.
	2	≤ 0.001 per thousand 1 in 1,000,000	0.0001%	< 1 Failures / 5 YEARS	Very Low	Minor changes to current processes with positive production experience under comparable conditions. Isolated failures associated with identical processes.
VERY LOW	1	Failure is eliminated through preventive control.			Remote	No failures associated with identical processes. Failure is eliminated through preventive controls i.e. Poke yoke process / assembly.

10.2 Appendix B-Aston Martin PFMEA Severity Ranking

T&F PFMEA - SEVERITY RANKING					
Effect on Product/Customer	Rank	Effect on Process/Manufacturing		AML Statement	
SAFETY and/or REGULATORY REQ not met - NO Warning [CPA '300' Safety no Warning]	10	May ENDANGER OPERATOR (machine or assembly) - NO Warning	Hazardous	Extremely severe failure that affects the safe vehicle operation of the vehicle / non-compliance with legal requirements. May endanger machine / operator. High risk to company's production capability long term, which will affect financial stability. CPA 300 call due to VIS spec or performance failure	Without warning.
SAFETY and/or REGULATORY REQ not met - WITH Warning [CPA '300' Safety With Warning]	9	May ENDANGER OPERATOR (machine or assembly) - WITH Warning			With warning.
LOSS of PRIMARY Function - vehicle inoperable, does not affect safe vehicle operation [CPA '70' Walk Home no Warning]	8	MAJOR DISRUPTION - scrap 100% of product, line shut down, or stop shipping. - Yard Hold/Ship Hold - 4 hours or more - Scrap Vehicle - Mainline / Shop Hold - Excessive down time greater than 4 hours	Very High	Vehicle is inoperable. Loss of primary function. Unscheduled dealer visit. Major disruption to the production line / extended line stop / stop vehicle shipment. 100% of the process related product made in station to be scrapped. CPA 70: Customer extremely dissatisfied. Damaged, incorrect or missing part. Complaint expected by >70% of customers due to VIS spec or performance failure. Tool wear / damage is high.	
DEGRADATION of PRIMARY Function - vehicle operable, but at reduced level of performance [CPA '70' Walk Home with Warning]	7	SIGNIFICANT DISRUPTION - scrap some product, deviation from primary process (decreased line speed or added manpower) - Added manpower Outside Station/Group Team Lead: example 100% Contain, Mark, etc for a shift - Loss of Trace - Scrap Major Component/Assembly -Example:Frame, Engine, Trans, etc - Mainline stopped for (3) Hours - Repair likely to cause collateral damage to nearby KCSS/PQC/Electrical parts.	High	Vehicle is operable, but at a reduced level of performance. Degraded primary function or loss of secondary function. Unscheduled dealer visit. Deviation from primary process with significant disruption to the production line. Delayed delivery or Tool wear. Decreased line speed or added manpower. Product may have to be sorted and a portion scrapped (<100%). CPA 70: Customer extremely dissatisfied. Damaged, incorrect or missing part. Complaint expected by >70% of customers due to VIS spec or performance failure.	
LOSS of SECONDARY Function - vehicle operable, but comfort / convenience functions inoperable	6	MODERATE DISRUPTION - 100% of product reworked off-line - Standard / Procedure is offline repair - Mainline Stopped for (60) Minutes or More - Repair likely to cause collateral damage to nearby parts - Primary process followed.	Moderate	Vehicle is operable, but comfort / convenience features are inoperable. Degraded secondary function. Constant squeaks & rattles. Unscheduled dealer visit. Moderate disruption to the production line which delays delivery. A portion (<100%) may have to be scrapped. CPA 70: Customer extremely dissatisfied. Damaged, incorrect or missing part. Complaint expected by >70% of customers due to VIS spec or performance failure.	
DEGRADATION of Secondary Function - vehicle operable, but comfort / convenience functions at reduced level of performance	5	MODERATE DISRUPTION - some product reworked off-line - Standard Repair done online and downstream - Mainline Stopped for more than (30) Minutes	Low	Vehicle is operable, but comfort / convenience features operate at a reduced level of performance. Intermittent squeaks & rattles. Repaired at scheduled dealer visit. Moderate disruption to the production line whereby 100% of the product may have to be re-worked off-line. CPA 30: Defect noticed by average customer. Major cosmetic item / Poor appearance. Complaint expected by >30% of customers / VIS spec, performance or cosmetic defect.	
ANNOYANCE (vehicle is still operable) - appearance or audible noise - noticed by >75% of customers	4	MODERATE DISRUPTION - 100% of product reworked in-station - Line Stop Repair (In Station) - Andon Pull ; Less than "two cycles" (30) Minutes	Very Low	Minor disruption to the production line. The product may have to be sorted and a portion (<100%) and re-worked on-line after the station / operation. CPA 30: Defect noticed by average customer. Major cosmetic item / Poor appearance. Repaired at scheduled dealer visit. Complaint expected by >30% of customers / VIS cosmetic defect.	
ANNOYANCE (vehicle is still operable) - appearance or audible noise - noticed by 50% of customers	3	MODERATE DISRUPTION - some product reworked in-station - Line Stop Repair (In Station) - Andon Pull ; Less Than "one cycle" / (15) Minutes	Minor	Minor disruption to the production line. The product may have to be sorted and a portion (<100%) has to be re-worked prior to station / operation.	
ANNOYANCE (vehicle is still operable) - appearance or audible noise - noticed by <25% of customers	2	MINOR DISRUPTION - slight inconvenience to process, operation, or operator - Repair (In station) - No Line Stop	Very Minor	CPA 30: Defect noticed by average customer. Major cosmetic item / Poor appearance. Repaired at scheduled dealer visit. Complaint expected by >30% of customers / VIS Very minor disruption to the production line. The product may have to be sorted and a portion (<100%) can be reworked within station / operation TAKT. Slight inconvenience to process or operator. CPA 10: Defect noticed by discriminating customer / VIS cosmetic defect	
NO EFFECT	1	NO EFFECT	None	No discernable effect	

10.3 Appendix C-Aston Martin Detection Ranking

T&F PFMEA - DETECTION RANKING									
Opportunity for Detection	Rank	Detection Control	Line Stop	In Station	Subsequent Operation	100%	Sampling	AML Statement	
NO DETECTION OPPORTUNITY	10	NO DETECTION - There is no detection method or the defect cannot be detected in the assembly plant						Absolute Uncertainty	Control will not end/or cannot discover the potential failure cause or subsequent failures (in-house). No current detection method in place.
NOT LIKELY TO DETECT AT ANY STAGE	9	SINGLE SENSORY CHECK - PERIODIC <i>Examples:</i> visual check OR touch RANDOM AUDIT <i>Examples:</i> CPA, drive audits, random audits, random torque checks, random visual inspection	MANUAL		X		X	Very Remote	Very remote likelihood the detection control will detect the potential failure cause or subsequent failures (in-house). Very low detection potential (e.g. Random audits).
PROBLEM DETECTION POST PROCESSING	8	ATTRIBUTE GAUGING - PERIODIC <i>Examples:</i> Squeak & rattle track, CPA water test inspection SINGLE SENSORY CHECK - 100% SUBSEQUENT OPERATION <i>Examples:</i> visual check OR touch, CARE line, functional test (without gauge, not automatic), verification station	MANUAL		X		X	Remote Discovery	Remote likelihood the detection control will detect the potential failure cause or subsequent failures (in-house). Unproven detection method.
PROBLEM DETECTION AT SOURCE	7	ATTRIBUTE GAUGING - SUBSEQUENT OPERATION <i>Examples:</i> go/no go, manual torque check, length of socket, click wrench, functional test (with gauge, not automatic), squeak & rattle track, water test inspection (100%) VARIABLE GAUGING - PERIODIC <i>Examples:</i> torque audit - once/shift, body leak tester (BLT) SINGLE SENSORY CHECK - 100% IN STATION <i>Examples:</i> visual check OR touch MULTIPLE VISUAL INSPECTIONS - first check is in station DOUBLE SENSORY CHECK - 100% SUBSEQUENT OPERATION <i>Examples:</i> (visual AND tactile) visual with paint mark or visual with pull test	MANUAL		X	X		Very Low	Uncertainty in the ability of the detection measures. No previous experience with the proof procedures. Detection of the failure cause post-process. Failure detection in-station using visual/tactile/audible means post process (go/no go, manual torque checker)
PROBLEM DETECTION POST PROCESSING	6	DATA RECORDING that notifies the operator of a discrepant part (pass/fail) without line lock-out ATTRIBUTE GAUGING - IN STATION <i>Examples:</i> go/no go, manual torque check, length of socket, click wrench VARIABLE GAUGING - SUBSEQUENT OPERATION <i>Examples:</i> auto functional test (such as door closing tool) DOUBLE SENSORY CHECK - 100% IN STATION <i>Examples:</i> (visual AND tactile) visual with paint mark or visual with pull test Kitting or Sequencing using positional pick, and marking each line on the run sheet.	MANUAL		X	X		Low	Detection of the failure cause post-process or failure detection at next station (go/no go, manual torque checker). Reliable inspection procedures from comparable processes under new conditions (machines, materials)
PROBLEM DETECTION AT SOURCE	5	CANNOT COMPLETE SUBSEQUENT OPERATION NOTIFICATION ONLY - IN STATION <i>Examples:</i> pick lights (part picks without line lock-out), fixturing or tooling, hoist scaling, bar code reader, torque controlled tools with lights, break away tools, any test that notifies the operator of a discrepant part without line lock-out. Kitting or Sequencing using Operator Assist Technology, with Self Acknowledgement. <i>Examples:</i> Voice Pick, Projector Pick, etc. VARIABLE GAUGING - IN STATION <i>Examples:</i> hand held laser gap and flush gauge	MANUAL		X	X		Moderate	Reliable test procedures from comparable processes under new conditions (machines, materials). Possible detection of the failure cause in-station by operator using automated controls that will detect discrepant part and notify the operator (light, buzzer...). Gauging performed on set-up or checks made on first-in-first-out.
PROBLEM DETECTION POST PROCESSING	4	AUTO LINE STOP - SUBSEQUENT OPERATION <i>Examples:</i> scanning (bar code readers), vision system, error proofing tied to the vehicles (not pick bins) such as pressure mats, limit switches, fixturing or tooling, counter, PLC controls. VECTS, DVT, or VAST (when shipping holds are in place). PART PICK w/Feedback - IN STATION, or in kitting/sequencing (with notification and line lockout)	AUTO		X	X		Moderately high	Moderately high likelihood the detection measure(s) will detect the failure cause. Detection of the failure cause at next station using automated controls, which will prevent part from being processed further. Low detection of the failure cause in-station. Reliable test procedures from comparable processes under new conditions (machines, materials)
PROBLEM DETECTION AT SOURCE	3	CANNOT COMPLETE CURRENT OPERATION AUTO LINE STOP - IN STATION <i>Examples:</i> scanning (bar code readers), vision system, error proofing tied to the vehicles (not pick bins) such as pressure mats, limit switches, fixturing or tooling, counter, PLC controls or torque tools (low torque, high torque, no torque; angle monitoring for cross-threading), garage doors	MANUAL	X		X		High	High likelihood tried & tested detection measure(s) will detect the failure cause. High detection of the failure cause in-station using automated controls that will detect the discrepant part and prevent it from being processed further. The required measuring equipment has been confirmed.
ERROR DETECTION AND/OR PROBLEM PREVENTION	2	DEFECT PREVENTION - IN STATION (cannot assemble with defect) <i>Examples:</i> scanning with part lock prior to assembly (cannot continue to assemble), vision system with part lock prior to assembly	AUTO	X		X		Very High	Very high likelihood that tried & tested detection measure(s) will detect the failure cause. Detection of the failure cause in-station using automated controls that will detect the discrepant part from being made. The required measuring equipment has been confirmed.
DETECTION NOT APPLICABLE; ERROR PREVENTION	1	ERROR PROOFED - the defect cannot happen	AUTO	X		X		Almost Certain	Failure cause will almost certainly be detected using reliable controls. Discrepant parts cannot be made due to error prevention by process design, machine, jig, fixture design. Failure cause has been eliminated through preventive measures, thus no detection action is required.

10.4 Appendix D-Aston Martin Control Plan

			Control Plan														
Prototype:		Prelaunch:		Production: X				Key contact/Phone: Luke Huzzey-Evans				Created: 06/09/2022				Modified: 21/09/2023	
Control Plan number:								Core team:				Customer engineering approval/date (if required):					
Glazing Cell Machine								Luke Huzzey-Evans, Josh Selway, Nicole Angove									
Part number:								Supplier/Plant approval/Date:				Customer quality approval/date (if required):					
N/A								N/A				N/A					
Part name/Description:								Date/Other approval (if required):				Date/Other approval (if required):					
GLAZING CELL								N/A				N/A					
Supplier/plant:				Supplier code:													
St Athan				N/A													
Part/	Process	Machine,	Characteristics				Clas- sifi-	Methods									
Process	Operation	device, jig, tools for Mfg.															
number			No.	Product characteristic	Process characteristic	ca- tion	Specification	Inspection equipment	Responsible	Size	Samples Frequency	Control method	Reaction plan				
1.2.1.	Glazing Cell Machine	Glazing Robot	1.2.1.	Betaseal 1949-1F Urethane Adhesive	PU Application		Betaseal 1949-1F Urethane Adhesive is Used	Visual inspection	Technician/ Maintenanc e	1	Every Barrel Change	Technician 100 % visual inspection that the correct product supplied by Univar on barrel change, and use- by date not exceeded	Operator = Stop - Call - Wait				
1			1.a						8mm ± 2	Calibrated Bead Gauge	Technician	1		Start of Every Shift & After Every Barrel Change	Technician visual inspection.		
									(base width)						Bead Gauge Check at specified frequency		
									12mm ± 2								
									(Height)								
									4mm ± 2								
								(upper width)									
			1.2.1.			PU Appearance		Continuous bead with no gaps or damage	Visual inspection	Technician	1	Every Application	Technician 100% visual inspection.	Operator = Stop - Call - Wait			
			1.b														
	Surface Cleaner	Equipmen t / Part Labeling	1.2.1.2.a		Betaclean 3900	Clean surfaces		Free from debris and contaminant	N/A	Technician	1	Every	Technician 100% process confirmation with IPC.	Operator = Stop - Call - Wait			
												Vehicle					
	Chemical primer	Equipmen t / Part Labeling	1.2.1.	Beta Prime 5404	Prime panel effectively		Within Product Expiry Date	Visual inspection	Technician	1	Start of Every Shift	Consumable Expiry Control - Date on Bottle	Operator = Stop - Call - Wait				
		Andon Board	2.b		Primer Flashed Off Correctly	HI	>= 15mins	Andon Board / Poka Yoke	Technician	1	Every	Check Application time vs current time displayed on Andon board, calculate open time.	Operator = Stop - Call - Wait				
											Vehicle						
					Primer Max Open Time Within Limits	HI	<= 4Hours	Andon Board / Poka Yoke	Technician	1	Continuous	Record time and date of opening on the bottle, and record on check sheet	Operator = Stop - Call - Wait				
					Primer applied less than 2 times	HI	<= 2 Times	Visual inspection	Technician	1	Every	Check application time scribe on tub,	Operator = Stop - Call - Wait				
											Vehicle	check for 1 or 2 time scribes.					
		Product Expiry / Use By Dates			Primer within Tool is of Quality Standard	HI	<6 Days Old From Open Date of Bottle	Visual inspection of product label	Technician	1	Start of Every Shift	Technician 100% Visual Inspection of Primer Bottle Open Date written on the bottle	Operator = Stop - Call - Wait				
	Chemical activator	Product Expiry / Use By Dates	1.2.1.2.c	Beta Wipe VP4604	Activator Flashed Off Correctly		Dry surface	Visual inspection	Technician	1	Every	Wipe surface with clean binder-free felt, tissue, or cloth.	Operator = Stop - Call - Wait				
											Vehicle						
					Activator Max Open Time Within Limits	HI	<= 24Hours	Andon Board	Technician	1	Every	Check Application time vs current time displayed on Andon board, calculate open time.	Operator = Stop - Call - Wait				
											Vehicle						
					Activate surface prior to Primer application			Activated surface	Visual inspection	Technician	1	Every	Ref. Bead Path Visuals/Dimensions on Station.	Operator = Stop - Call - Wait			
											Vehicle						
					Activator within product expiry date	HI	Activator within product Expiry Date	Visual inspection of product label	Technician	1	Start of Shift and Every New Bottle	Consumable Expiry Control - Date on Bottle	Operator = Stop - Call - Wait				
				Activator within Tool is of Quality Standard	HI	<1 Day Old From Bottle Fill	Visual inspection of product label	Technician	1	Start of Every Shift	Technician 100% Visual Inspection of Activator Bottle Open Date written on the bottle	Operator = Stop - Call - Wait					
	Damage Check		1.2.1.		No damage caused to Glass	HI	No physical damage to the glass	Visual inspection	Technician	1	Every	Technician 100% visual inspection.	Operator = Stop - Call - Wait				
			3.a									Vehicle					
											Vehicle						

10.5 Appendix E-Aston Martin Glazing Cell FMEA

													F M E A		Number:			
													Process		Page:			
Item: Glazing Cell Machine					Process responsibility: CME Depart						Prepared by: Phil Moreton							
Model year(s)/vehicle(s): MY2021 AM800					Completion date: 05/08/2020						Created: 01/04/2020			Modified				
Team: Phil Moreton, Adam Hill, George Griffiths, Alex Doveston																		
Function	Potential failure	Potential effect(s)	S	C	Potential cause(s)	O	Current preventive	Current detection	D	RPN	Recommended	R/D	Action taken	S	O	D	RPN	
		of failure			of failure		action	action			action							
System element: GLAZING CELL																		
Load Glass into Robot Cell Fixture	Panel priming exceeded time limit	[GLAZING CELL]	7		Line stoppage	2	Technician training and awareness	Offtracks - Water test	7	98	P: Add note to EASE to raise technician awareness of 4 hour time limit on Betaprim product. Add rework process to EASE if line stoppage of more tha 4 hours	Griffiths, George,		7	-2	7	-98	
	Glass not held accurately in fixturing	[GLAZING CELL]	7		Technician loaded glass into fixture incorrectly	1	Technician training and awareness	Automated fixturing with limit switches to ensure part is in place - error if not	2	14								
		Major Disruption-Loss of Primary Function			Fixturing worn or out of adjustment	1	FLM maintenance	Automated fixturing with limit switches to ensure part is in place - error if not	2	14								
	Part damaged during loading	[GLAZING CELL]	6		Technician catches glass on fixturing during loading	2	All fixturing and adjacent lift assists protected	Technician visual detection & Post build inspection	7	84								
		Moderate Disruption - Appearance/Noise (>75% customer complaint)																
Apply adhesive	Incorrect adhesive applied	[GLAZING CELL]	7		Maintenance team fit incorrect product to robot feed system	1	Adhesive supplied by UNIVAR to point of fit.	None	9	63	P: Investigate improved prevention controls to ensure correct adhesive is supplied	Griffiths, George, CME		7	-1	9	-63	
		Major Disruption-Loss of Primary Function																
	Adhesive in incorrect position	[GLAZING CELL]	7		Contaminated feed nozzle	2	Nozzle cleaned by wire every cycle. Nozzle cleaned by technician	Technician visual inspection	7	98			30/09/2022 in progress					
		Major Disruption-Loss of Primary Function																
					Robot program incorrect	1	Commissioning and sign off of adhesive position	Technician visual inspection	7	49								
					Glass not in fixture correctly	1	Technician training and awareness	Automated fixturing with limit switches to ensure part is in place - error if not	2	14								
	Adhesive applied in excess	[GLAZING CELL]	5		Adhesive viscosity incorrect	1	Adhesive supplied by UNIVAR to point of fit to correct spec	None	8	40								
						Machine pressure set too high												2
		Adhesive applied below required volume	[GLAZING CELL]	7		System pressure set too low	1	Set at commissioning phase with password protection	Software alarm	2	14							
			Major Disruption-Loss of Primary Function			System flow rate set too low	1	Set at commissioning phase with password protection	Software alarm	2	14							
						Incorrect nozzle diameter	1	Maintenance technician training and awareness	Technician detection through use	7	49							
					Nozzle damaged	3	Nozzle alignment check	Robot collision monitoring	2	42								
	Adhesive bead size incorrect	[GLAZING CELL]	7		Incorrect nozzle diameter	1	Maintenance technician training and awareness	Technician visual inspection	7	49								
		Major Disruption-Loss of Primary Function																
	Prime flash time below required limit	[GLAZING CELL]	7		Technician error	3	Technician training and awareness	None	8	168								
		Major Disruption-Loss of Primary Function																
Remove Glass from Fixture	Adhesive bead damaged during glass removal	[GLAZING CELL]	7		Technician error	3	Technician training and awareness	Water leak test in Off tracks	7	147								
		Major Disruption-Loss of Primary Function																
	Glass damaged during removal from fixture	[GLAZING CELL]	6		Technician error	3	Technician training and awareness	End of line visual inspection	7	126								
		Moderate Disruption - Appearance/Noise (>75% customer complaint)																