

In addition to this summary, this report includes the following forms:

- 1 RATING CRITERIA AND CLASSIFICATIONS
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- 3 FMEA SPREADSHEET REPORT
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Xfmea Report Sample – Process FMEA

This report was generated with ReliaSoft's Xfmea software in Microsoft Word. Similar reports can also be generated in Microsoft Excel. You can easily replace the Xfmea logo graphic with your own company logo. Within Word and Excel, reports can be edited/annotated, if necessary, and generated in PDF and/or HTML format for easy distribution.

This report includes:

- A summary of the rating criteria (Severity Scale, Occurrence Scale, Detection Scale) and classifications that were used in the analysis.
- A summary of the project and analysis properties that were defined for the analysis.
- The Process FMEA (PFMEA) spreadsheet report in the AIAG FMEA-3 reporting format.
- A summary list of the potential causes of failure that were identified through the analysis, ranked by Initial Occurrence rating.
- A summary list of the recommended actions identified during the analysis.
- A summary list of the current controls identified during the analysis.

The report is based on the sample analysis provided in the AIAG FMEA-3 guidelines, on page 36.



RATING CRITERIA AND CLASSIFICATIONS

Date: 3/26/2003

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RPN Calculation Method: Cause RPN = Severity x Occurrence x Detection **Mode RPN** = Sum of Cause RPNs **Item RPN** = Sum of Mode RPNs plus Sub Item RPNs

Severity Rating Scale

| # | Description | Criteria |
|----|---------------------------|---|
| 1 | None | Slight inconvenience to operation or operator or no effect. |
| 2 | Very Minor | A portion (less than 100%) of the product may have to be reworked, with no scrap, on-line but in-station. |
| 3 | Minor | A portion (less than 100%) of the product may have to be reworked, with no scrap, on-line but out-of-station. |
| 4 | Very Low | The product may have to be sorted, with no scrap, an a portion (less than 100%) reworked |
| 5 | Low | 100% of product may have to be reworked, or vehicle/item repaired off-line but does not go to repair department. |
| 6 | Moderate | A portion (less than 100%) of the product may have to be scrapped with no sorting, or vehicle/item repaired in repair department with repair time less than half an hour. |
| 7 | High | Product may have to be sorted an a portion (less than 100%) scrapped, or vehicle/item repaired in repair department with repair time between half an hour and an hour. |
| 8 | Very High | 100% of product may have to be scrapped, or vehicle/item repaired in repair department with a repair time greater than one hour. |
| 9 | Hazardous with warning | May endanger operator (machine or assembly) with warning. |
| 10 | Hazardous without warning | May endanger operator (machine or assembly) without warning. |

Occurrence Rating Scale

| # | Description | Criteria |
|----|--------------------------------|---|
| 1 | Remote: Failure is unlikely | <= 0.01 per thousand pieces; Ppk => 1.67. |
| 2 | Low: Relatively few failures | 0.1 per thousand pieces; Ppk => 1.30. |
| 3 | Low: Relatively few failures | 0.5 per thousand pieces; Ppk => 1.20. |
| 4 | Moderate: Occasional failures | 1 per thousand pieces; Ppk => 1.10. |
| 5 | Moderate: Occasional failures | 2 per thousand pieces; Ppk => 1.00. |
| 6 | Moderate: Occasional failures | 5 per thousand pieces; Ppk => 0.94. |
| 7 | High: Frequent failures | 10 per thousand pieces; Ppk => 0.86. |
| 8 | High: Frequent failures | 20 per thousand pieces; Ppk => 0.78. |
| 9 | Very High: Persistent failures | 50 per thousand pieces; Ppk => 0.55. |
| 10 | Very High: Persistent failures | => 100 per thousand pieces; Ppk => 0.55. |

Detection Rating Scale

| # | Description | Criteria |
|----|-------------------|--|
| 1 | Very High | Discrepant parts cannot be made because item has been error proofed by process/product design. |
| 2 | Very High | Error Proofed or Gauging Inspection. Error detection in-station (automatic gauging with automatic stop feature). Cannot pass discrepant part. |
| 3 | High | Error Proofed or Gauging Inspection. Error detection in-station, OR in subsequent operations by multiple layers of acceptance: supply, select, install, verify. Cannot accept discrepant part. |
| 4 | Moderately High | Error Proofed or Gauging Inspection. Error detection in subsequent operations, OR gauging performed on setup and first-piece check (for setup causes only). |
| 5 | Moderate | Gauging Inspection. Control is based on variable gauging after parts have left the station, OR Go/No Go gauging performed on 100% of the parts after parts have left the station. |
| 6 | Low | Gauging or Manual Inspection. Control is achieved with charting methods, such as SPC (Statistical Process Control) |
| 7 | Very Low | Manual Inspection. Control is achieved w/ double visual inspection only. |
| 8 | Remote | Manual Inspection. Control is achieved w/ visual inspection only. |
| 9 | Very Remote | Manual Inspection. Control is achieved w/ indirect or random checks only. |
| 10 | Almost Impossible | Manual Inspection. Cannot detect or is not checked. |

Classification Options

| Abbreviation | Description |
|--------------|------------------|
| C | Critical |
| KI | Key Intermediate |
| KLd | Key Leading |
| KLg | Key Lagging |
| S | Significant |

Non-proprietary and non-confidential information.



PROJECT PROPERTIES AND ANALYSIS PROPERTIES

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Project Properties

| | |
|---|-------------------------|
| Project Name | Based on Profile |
| Process FMEA | AIAG PFMEA |
| Project Description | |
| This sample project was prepared based on the Process FMEA (PFMEA) on page 70 of the AIAG FMEA-3 guidelines. | |
| Remarks | |
| The information in this project could also be used to prepare a sample PFMEA like the one on page 42 of the SAE J1739 guidelines. To do this, the J1739 PFMEA profile must be applied to the project. | |

Analysis Properties

| | | | | | | |
|-------------------------------|----------------------------|--|--------------------------|-------------------------|-------------------------|----------------------|
| ITEM | 3 - Front Door L.H. | | | | | |
| FMEA Number | Prepared By | Key Date | FMEA Date (Orig.) | FMEA Date (Rev.) | Primary Approval | Approval Date |
| 1450 | J. Ford - X6521 - Assy Ops | 3/31/2003 | 3/10/2003 | 3/21/2003 | | |
| Product | | Model Year(s)/Vehicle(s) | | Mission | | |
| | | 199X/Lion 4dr/Wagon | | | | |
| Process Responsibility | Release Date | Core Team | | Others Affected | | |
| Body Engineering | | A. Tate Body Engrg, J. Smith - OC, R. James - Production, J. Jones - Maintenance | | | | |

**POTENTIAL
FAILURE MODE AND EFFECTS ANALYSIS
Front Door L.H.**

System 1 - Automobile
 Subsystem 2 - Closures
 X Component 3 - Front Door L.H.
 Model Year(s)/Vehicle(s) 199X/Lion 4dr/Wagon
 Core Team A. Tate Body Engrg, J. Smith - OC, R. James - Production, J. Jones - Maintenance

Process Responsibility Body Engineering
 Key Date 3/31/2003

FMEA Number 1450
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 Prepared By J. Ford - X6521 - Assy Ops
 FMEA Date (Orig.) 3/10/2003 (Rev) 3/21/2003

| Item | Potential Failure Mode | Potential Effect(s) of Failure | Sev | Class | Potential Cause(s)/Mechanism(s) of Failure | Occur | Current Process Controls Prevention | Current Process Controls Detection | Dete | RPN | Recommended Action(s) | Responsibility & Target Completion Date | Action Results | | | | |
|---|---|---|-----|-------|--|-------|---|--|--------------------|-----------------------|--|---|--|-----|-----|-----|-----|
| | | | | | | | | | | | | | Actions Taken | Sev | Occ | Det | RPN |
| 3 - Front Door L.H. | | | | | | | | | | | | | | | | | |
| Manual application of wax inside door. To cover inner door, lower surfaces at minimum wax thickness to retard corrosion. | Insufficient wax coverage over specified surface. | Deteriorated life of door leading to: - Unsatisfactory appearance due to rust through paint over time. - Impaired function of interior door hardware. | 7 | | Manually inserted spray head not inserted far enough. | 8 | | Visual check each hour - 1/shift for film thickness (depth meter) and coverage. | 5 | 280 | Add positive depth stop to sprayer. | Mfg Engrg - 3/10/2003 | Stop added, sprayer checked on line. | 7 | 2 | 5 | 70 |
| | | | | | | | | | Automate spraying. | Mfg Engrg - 3/10/2003 | Rejected due to complexity of different doors on same line. | | | | | | |
| | | | | | Spray head clogged - Viscosity too high - Temperature too low - Pressure too low. | 5 | Test spray pattern at start-up and after idle periods, and preventive maintenance program to clean heads. | Visual check each hour - 1/shift for film thickness (depth meter) and coverage. | 3 | 105 | Use Design of Experiments (DOE) on viscosity vs. temperature vs. pressure. | Mfg Engrg - 3/10/2003 | Temp and press limits were determined and limit controls have been installed - control charts show process is in control Cpk = 1.85. | 7 | 1 | 3 | 21 |
| | | | | | Spray head deformed due to impact. | 2 | Preventive maintenance program to maintain heads. | Visual check each hour - 1/shift for film thickness (depth meter) and coverage. | 2 | 28 | | | | 7 | 2 | 2 | 28 |
| | | | | | Spray time insufficient. | 8 | | Operator instructions and lot sampling (10 doors/shift) to check for coverage of critical areas. | 7 | 392 | Install spray timer. | Maintenance - 3/10/2003 | Automatic spray timer installed - operator starts spray, timer controls shut-off - control charts show process is in control Cpk = 2.05. | 7 | 1 | 7 | 49 |



FAILURE CAUSES

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| Cause RPN (Init) | Cause RPN (Rev) | % Reduction in RPN | Potential Cause(s)/Mechanism(s) of Failure | Occ (Init) | Occ (Rev) | Det (Init) | Det (Rev) | Class | Item | Process Function/Requirements | Potential Failure Mode | Potential Effect(s) of Failure |
|------------------|-----------------|--------------------|--|------------|-----------|------------|-----------|-------|-----------------|---|---|---|
| 280 | 70 | 75 | Manually inserted spray head not inserted far enough. | 8 | 2 | 5 | 5 | | Front Door L.H. | Manual application of wax inside door. To cover inner door, lower surfaces at minimum wax thickness to retard corrosion. | Insufficient wax coverage over specified surface. | Deteriorated life of door leading to: - Unsatisfactory appearance due to rust through paint over time. - Impaired function of interior door hardware. |
| 392 | 49 | 87.5 | Spray time insufficient. | 8 | 1 | 7 | 7 | | Front Door L.H. | Manual application of wax inside door. To cover inner door, lower surfaces at minimum wax thickness to retard corrosion. | Insufficient wax coverage over specified surface. | Deteriorated life of door leading to: - Unsatisfactory appearance due to rust through paint over time. - Impaired function of interior door hardware. |
| 105 | 21 | 80 | Spray head clogged - Viscosity too high - Temperature too low - Pressure too low. | 5 | 1 | 3 | 3 | | Front Door L.H. | Manual application of wax inside door. To cover inner door, lower surfaces at minimum wax thickness to retard corrosion. | Insufficient wax coverage over specified surface. | Deteriorated life of door leading to: - Unsatisfactory appearance due to rust through paint over time. - Impaired function of interior door hardware. |
| 28 | 28 | 0 | Spray head deformed due to impact. | 2 | 2 | 2 | 2 | | Front Door L.H. | Manual application of wax inside door. To cover inner door, lower surfaces at minimum wax thickness to retard corrosion. | Insufficient wax coverage over specified surface. | Deteriorated life of door leading to: - Unsatisfactory appearance due to rust through paint over time. - Impaired function of interior door hardware. |



**RECOMMENDED ACTIONS
(Summary Report)**

Date: 3/26/2003

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| # | Recommended Action(s) | Target Completion Date | Responsibility | Actions Taken | Item | Potential Cause(s)/Mechanism(s) of Failure | Priority |
|---|--|------------------------|----------------|--|-----------------|--|----------|
| 1 | Add positive depth stop to sprayer. | 3/10/2003 | Mfg Engrg | Stop added, sprayer checked on line. | Front Door L.H. | Manually inserted spray head not inserted far enough. | |
| 2 | Automate spraying. | 3/10/2003 | Mfg Engrg | Rejected due to complexity of different doors on same line. | Front Door L.H. | Manually inserted spray head not inserted far enough. | |
| 3 | Use Design of Experiments (DOE) on viscosity vs. temperature vs. pressure. | 3/10/2003 | Mfg Engrg | Temp and press limits were determined and limit controls have been installed - control charts show process is in control Cpk = 1.85. | Front Door L.H. | Spray head clogged - Viscosity too high - Temperature too low - Pressure too low. | |
| 4 | Install spray timer. | 3/10/2003 | Maintenance | Automatic spray timer installed - operator starts spray, timer controls shut-off - control charts show process is in control Cpk = 2.05. | Front Door L.H. | Spray time insufficient. | |



CURRENT CONTROLS

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| # | Current Process Controls | Control Type | Item | Process Function/Requirements | Potential Failure Mode | Potential Effect(s) of Failure | Potential Cause(s)/Mechanism(s) of Failure |
|---|---|--------------|-----------------|---|---|---|--|
| 1 | Visual check each hour - 1/shift for film thickness (depth meter) and coverage. | Detection | Front Door L.H. | Manual application of wax inside door. To cover inner door, lower surfaces at minimum wax thickness to retard corrosion. | Insufficient wax coverage over specified surface. | Deteriorated life of door leading to: - Unsatisfactory appearance due to rust through paint over time. - Impaired function of interior door hardware. | Manually inserted spray head not inserted far enough. |
| 2 | Test spray pattern at start-up and after idle periods, and preventive maintenance program to clean heads. | Prevention | Front Door L.H. | Manual application of wax inside door. To cover inner door, lower surfaces at minimum wax thickness to retard corrosion. | Insufficient wax coverage over specified surface. | Deteriorated life of door leading to: - Unsatisfactory appearance due to rust through paint over time. - Impaired function of interior door hardware. | Spray head clogged - Viscosity too high - Temperature too low - Pressure too low. |
| 3 | Preventive maintenance program to maintain heads. | Prevention | Front Door L.H. | Manual application of wax inside door. To cover inner door, lower surfaces at minimum wax thickness to retard corrosion. | Insufficient wax coverage over specified surface. | Deteriorated life of door leading to: - Unsatisfactory appearance due to rust through paint over time. - Impaired function of interior door hardware. | Spray head deformed due to impact. |
| 4 | Operator instructions and lot sampling (10 doors/shift) to check for coverage of critical areas. | Detection | Front Door L.H. | Manual application of wax inside door. To cover inner door, lower surfaces at minimum wax thickness to retard corrosion. | Insufficient wax coverage over specified surface. | Deteriorated life of door leading to: - Unsatisfactory appearance due to rust through paint over time. - Impaired function of interior door hardware. | Spray time insufficient. |