Manufacturing Monitoring & In shop Inspection
Alternative Approach to the EDF Doctrine

Charles WADJOU
EDF / DIPNN / DI
AGENDA

1. Context
2. Purpose
3. EDF Manufacturing surveillance doctrine
4. Alternative approach based in work done by EPRI
5. Potentials Components
6. Summary
1. Context

Due to the evolution of component suppliers for nuclear power plant, EDF adapts its manufacturing monitoring to keep a high quality of his procurements.

**Difficulty to perform in shop inspection**
Some suppliers do not allow inspectors to attend to specific manufacturing steps.

**Documents Confidentiality**
Documentation not available for EDF review.
Suppliers do not share manufacturing documentation.

**PARTS manufacture without EDF surveillance**

Solution is to find an alternative approach to EDF manufacturing surveillance.
2. Purpose

Provide components with high quality level to avoid defect during operating phases

FRENCH LAW “Arrêté INB” 07/02/12
That requires the operator to exercise on its suppliers monitoring to ensure that the operations they perform meet the requirements defined

QUALITY INSURANCE On parts ordered
Give to EDF an assurance of the conformity of the ordered product with the technical and quality requirements specified in the contract.

FEEDBACK For improvement
To provide the elements of feedback for improving the technical doctrine and / or the doctrine of supervision and inspection of achievements.

Those Elements allow to build EDF Manufacturing Monitoring Doctrine

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3. EDF Manufacturing surveillance doctrine

**Manufacturing documentation surveillance**

- QRA List
  - Follow up documents
  - Manufacturing documents
  - Tests & control documents

**In shop inspection**

**Contract**

**Delivery**

High number of documents reviewed - hold point or notification point in manufacturing processes

*QRA: Quality Related Activities*
4. Alternative approach based in work done by EPRI
Procurement of diesel engine power components

1\textsuperscript{st} Step – Demonstration of the commercial grade

<table>
<thead>
<tr>
<th>EDF requirements</th>
<th>Supplier requirements</th>
</tr>
</thead>
</table>

EDF requirements move to supplier requirements

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4. Alternative approach based in work done by EPRI

Procurement of diesel engine power components

2nd Step – Identification of critical characteristics with acceptance criteria

- Part reference
- Chemical Composition
- Rm, Rp0.2, E, A% (Room temp & op. temp)
- Impact strength (20°C)
- Hardness
- Surface defects
- Volumique defects
- Dimensional
- Roughness
- Mass
- Oil supply channels
4. Alternative approach based in work done by EPRI

Procurement of diesel engine power components

3rd Step – Choice of verification method for critical characteristics

<table>
<thead>
<tr>
<th>Verification Method</th>
<th>1 – Part reference</th>
<th>2 – Chemical Composition</th>
<th>3 - Rm, Rp0.2, E, A% (Room temp &amp; op. temp)</th>
<th>4 – Impact strength (20°C)</th>
<th>5 - Hardness</th>
<th>6 - Surface defects</th>
<th>7 - Volumique defects</th>
<th>8 - Dimensional</th>
<th>9 - Roughness</th>
<th>10 - Mass</th>
<th>11 – Oil supply channels</th>
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<td>Méthode 1</td>
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<td>Méthode 1 ou 2</td>
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</table>
4. Alternative approach based in work done by EPRI

Procurement of diesel engine power components

4th Step – Define type of tests and inspection

- Method 2
  - Audit of metrological function
  - Inspection of dimensional control

- Method 1
  - Dimensional control perform by inspectors

Dimensional case
4. Alternative approach based in work done by EPRI

Procurement of diesel engine power components – Conrod results

CONNECTING ROD SHAFT – CHEMICAL COMPOSITION

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<tr>
<th>Serial No.</th>
<th>C [%]</th>
<th>Si [%]</th>
<th>Mn [%]</th>
<th>P [%]</th>
<th>S [%]</th>
<th>Si [max. 0.025]</th>
<th>Mn [max. 0.8]</th>
<th>Cr [%]</th>
<th>Mo [%]</th>
<th>V [%]</th>
<th>Result</th>
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<td>0.20</td>
<td>0.28</td>
<td>0.71</td>
<td>0.009</td>
<td>0.002</td>
<td>1.64</td>
<td>0.28</td>
<td>1.68</td>
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<td>0.27</td>
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<td>607-2-2</td>
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<td>0.28</td>
<td>0.71</td>
<td>0.010</td>
<td>0.002</td>
<td>1.63</td>
<td>0.28</td>
<td>1.67</td>
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<td>607-3-30</td>
<td>0.21</td>
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<td>0.71</td>
<td>0.009</td>
<td>0.002</td>
<td>1.65</td>
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<td>1.70</td>
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<td>0.28</td>
<td>1.67</td>
<td>Conform</td>
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TEST EQUIPMENT: OPTICAL EMISSION SPECTROSCOPE
MODEL: AMTEK SPECTROMAXX LUNAS (ST VERSION)
SERIAL NO: 34000408
EXPRESS DATE: 03/29/17

CONNECTING ROD SHAFT – TENSILE TEST

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TEST EQUIPMENT: TENSILE TEST MACHINE
MODEL: GALDINI QUASAR 290
SERIAL NO: V913
EXPRESS DATE: 04/05/17

CONNECTING ROD SHAFT DIMENSIONAL MEASUREMENT

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</table>
4. Alternative approach based in work done by EPRI

Procurement of diesel engine power components – Conrod results
4. Alternative approach based in work done by EPRI

Procurement of diesel engine power components – Conrod results

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Requirement</th>
<th>Test</th>
<th>Specification</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Analyse chimique/Chemical analyses</td>
<td>Oui/Yes</td>
<td>Oui/Yes</td>
<td>Spectromètre à émission optique - optical emission spectrometer</td>
<td>Oui/Yes</td>
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<tr>
<td>2</td>
<td>Résistance à la traction/Tensile strength</td>
<td>Oui/Yes</td>
<td>Oui/Yes</td>
<td>Essai de traction/Tensile test</td>
<td>Oui/Yes</td>
</tr>
<tr>
<td>3</td>
<td>Résilience/Impact test</td>
<td>Oui/Yes</td>
<td>Oui/Yes</td>
<td>Essai Charpy KV à l'ambiance/Charpy test KV room temperature</td>
<td>Oui/Yes</td>
</tr>
<tr>
<td>4</td>
<td>Contrôle dimensionnel/Dimensional measurement</td>
<td>Oui/Yes</td>
<td>Oui/Yes</td>
<td>Mesure 3D/3D measurement</td>
<td>Non/No</td>
</tr>
<tr>
<td>5</td>
<td>Magnétoscopie (surface)/Magnetic (surface) control</td>
<td>Oui/Yes</td>
<td>Oui/Yes</td>
<td>Banc de magnétoscopie/Magnetic test bench</td>
<td>Non/No</td>
</tr>
<tr>
<td>6</td>
<td>Test par ultrason (volume)/Ultrasonic (volume) Test</td>
<td>Oui/Yes</td>
<td>Oui/Yes</td>
<td>Essai par ultrason/Ultrasonic test</td>
<td>Non/No</td>
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<tr>
<td>7</td>
<td>Rugosité/Roughness</td>
<td>Oui/Yes</td>
<td>Oui/Yes</td>
<td>Rugosimètre/visual Roughness meter/visual</td>
<td>Non/No</td>
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<td>8</td>
<td>Durée/Hardness</td>
<td>Oui/Yes</td>
<td>Oui/Yes</td>
<td>HB - HRC selon la zone/profileAPON/HR - HRC depending on area/profile</td>
<td>Oui/Yes</td>
</tr>
</tbody>
</table>
4. Alternative approach based in work done by EPRI

Overview of the approach

- Manufacturing
- Critical characteristics verification
- Contract
- Delivery
- Commercial Grade demonstration
- Critical characteristics Identification
5. Potentials Components

Only Component non submitted to RCC-M & RCC-E Code can be elected to this approach

Parts subject to RCC-M & RCC-E Code

Parts subject to EN, ISO, API or other standards
6. Summary

- Standard Doctrine

- Alternative to standard Doctrine
THANK YOU!