Supplier Product Quality Life Cycle

Quality Requires Frozen Process & Design

Today: Frozen Process Focus ...No Design Change Control
- Special Processes Focus – Welding, brazing, casting, heat treat...
- Supplier to obtain GE approval for process & mfg location change

2011: Frozen Design...Leverage Industry Std Supplier Control
- Vendor must have Config Management Implemented
- Design (BOM) Frozen @ FPQ, Request for Design Change (RDC) to be submitted to GE for Approval

Candidates: Valves, Pumps, Torque Converter, Load Coupling, Clutch, Fuel Nozzles...
1. High impact on plant reliability or safety
2. “High volume” component...not project specific design
3. History of field issues
What is Supplier Engineering Change Control?

Drives Closer GE/Supplier Collaboration – “Frozen” Design

Defined in 398A1729 and requires:

- Supplier shall establish a Configuration Management System to ensure control of product (drawings, parts lists & specifications).
- Baseline configuration (Bill of Material) will be approved as part of qualification.
- Changes to drawings, BOM’s require GE Engineering approval via a Request for Design Change (RDC).
- Supplier to provide BOM for every purchase order...shall match BOM approved @ Qual

Follows industry standards including:


ASME Y14.100-2004 Engineering Drawing and Related Documentation Practices
# Associated Documents

Supplier is responsible to obtain documents & establish configuration management procedure.

## Document License Required – Not Supplied by GE

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
<th>Document Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Implementation Guide for Configuration Management</td>
<td>GEIA-HB-649</td>
</tr>
<tr>
<td>2</td>
<td>Revision of Engineering drawings &amp; Associated Documents</td>
<td>ASME Y14.35</td>
</tr>
<tr>
<td>4</td>
<td>Engineering Drawing and Related Documentation Practices</td>
<td>ASME Y14.100-2004</td>
</tr>
</tbody>
</table>

## Documents Supplied by GE

<table>
<thead>
<tr>
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<th>Description</th>
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<tbody>
<tr>
<td>5</td>
<td>Supplier Engineering Change Control</td>
<td>398A1729</td>
</tr>
<tr>
<td>6</td>
<td>DIS – 150 Supplier Bill of Material Documentation Requirement</td>
<td>101T8049</td>
</tr>
<tr>
<td>7</td>
<td>Supplier Quality Requirements</td>
<td>P28A-AL-0002</td>
</tr>
</tbody>
</table>
Where is Requirement Defined on GE Dwg?

Ordering Dwgs Shall Contain the Following Notes:

- “Design Change Control. The Supplier shall implement the requirements of change control as specified in 398A1729.”

- Data Requirement (“Vendoc”)
  - “DIS - 150 Supplier Bill of Material Documentation Requirements (101T8049)”
What is a Bill of Material (BOM)?

Definition – List of items required to completely define and make a product.

Bill of Material Contains:
✓ Unique part numbers, defined by engineering dwgs
✓ Lists Qty for each part
✓ Item #, Find #, Significant Ident Number (SIN) – Associated with location on assembly dwg
What is a Bill of Material (BOM)?

Supplier BOM shall be to the nut, bolt level

Sample Bill of Material Structure

<table>
<thead>
<tr>
<th>ITEM</th>
<th>PART DESCRIPTION</th>
<th>PART NUMBER</th>
<th>QUANTITY</th>
<th>BASELINE REV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Valve, Compressor Bleed</td>
<td>358A8063G002</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Valve Body</td>
<td>142A1422P001</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>Limit Switch</td>
<td>N8832-42</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Stem, Valve</td>
<td>182A4399P001</td>
<td>1</td>
<td>BASELINE REV</td>
</tr>
<tr>
<td>2</td>
<td>Seal Assembly</td>
<td>192A8822G001</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Ring Seal</td>
<td>134A1322P001</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>3</td>
<td>Gasket</td>
<td>N321-42</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

Sample Bill of Material Structure:

1. 358A8063G002 Comp Bleed Valve
   - 142A1422P001 Valve Body
   - N8832-42 Limit Switch
   - 182A4399P001 Valve Stem
   - 192A8822G001 Seal
   - N321-42 Gasket
   - 134A1322P001 Ring
What is a Bill of Material (BOM)?
Supplier BOM shall include sub-tier supplier component assemblies AND:
✓ Ensure sub-tiers meet 398A1729 Supplier Engineering Change Control
✓ Submit changes via RDC’s prior to implementing change

Sub-tier component assemblies
BOM with More Than One Sub-Tier Supplier
Alternate Suppliers may be listed on BOM with the approval of GE Design Engineer

Alternate Sub-tier component assemblies

* Alt = Alternative Supplier of part with demonstrated equivalence in form, fit and function
Exploded BOM Can Aid Understanding

Ref: http://www.designthatmatters.org/k2/pubs/K2_delta_explod_bom.pdf
Sample Completed BOM

- Included in Qual Package Retained by GE
- Supplier to Keep BOM & Dwgs on File for Audits
- Audits will compare mfg BOM to “Frozen” BOM

### Baseline Configuration Record

<table>
<thead>
<tr>
<th>Supplier Name:</th>
<th>Nirvana Mfg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address &amp; Contact Number</td>
<td>777 Perfection Road, Lucast, SC 29680</td>
</tr>
<tr>
<td>BOM Prepared By/Date:</td>
<td>A. Einstein, 3/12/2011</td>
</tr>
<tr>
<td>Supplier Approval/Date:</td>
<td>A. Boss 3/14/2011</td>
</tr>
</tbody>
</table>

#### GE Energy Part Nomenclature & Revision

<table>
<thead>
<tr>
<th>GE Energy Part No.:</th>
<th>GE Energy Part Nomenclature</th>
<th>Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>100T1462G005</td>
<td>Valve, 6” Compressor Bleed</td>
<td>A</td>
</tr>
<tr>
<td>35848063G002</td>
<td>Valve, Compressor Bleed</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Baseline Detail/Assembly/Sub-Assembly Drawings and Parts Lists

<table>
<thead>
<tr>
<th>Item #</th>
<th>Part Description</th>
<th>Part Number</th>
<th>Quantity</th>
<th>Baseline Rev</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Valve, Compressor Bleed</td>
<td>35848063G002</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Valve Body</td>
<td>142A1422P001</td>
<td>1</td>
<td>A</td>
</tr>
<tr>
<td>2</td>
<td>Limit Switch, ACME Mfg</td>
<td>N8832-42</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Limit Switch, Road Runner Mfg</td>
<td>S399X1429G001</td>
<td>2</td>
<td>Alt* 0</td>
</tr>
<tr>
<td>2</td>
<td>Stem Valve</td>
<td>182A4399P001</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>Seal Assembly, ACME Mfg</td>
<td>192A8822G001</td>
<td>1</td>
<td>Alt* 0</td>
</tr>
<tr>
<td>2</td>
<td>Seal Assembly, Road Runner Mfg</td>
<td>482A1827G005</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>3</td>
<td>Ring Seal</td>
<td>134A1322P001</td>
<td>4</td>
<td>A</td>
</tr>
<tr>
<td>4</td>
<td>Gasket</td>
<td>N321-42</td>
<td>4</td>
<td>0</td>
</tr>
</tbody>
</table>

*Alt = Alternative Supplier of part with demonstrated equivalence in form, fit and function
Establishing the Baseline – “Frozen” Design

Establish Baseline: New Design or Supplier

Ordering Dwg-
Design Adds Supplier Change
Control Requirement

PO Placed

Design
Review &
Approval

FPQ Complete

• Supplier BOM & Dwgs Available for Review

SQE Adds Approved BOM to eSMS

FPQ Requirements Defined per P28A-AL-0002

Establish Baseline: Existing Design & Supplier

Ordering Dwg-
Design Adds Supplier Change
Control Requirement

Capture BOM @ Next PO

Design
Eng, CCB
BOM Approval

SQE Adds Approved BOM to eSMS

• Supplier BOM & Dwgs Available for Review

• BOM & Dwgs Maintained @ Vendor for GE Audits

• BOM & Dwgs Maintained @ Vendor for GE Audits

GE Company Proprietary
When Does a BOM Need to Change?

Planned Changes to Engineering Dwgs or Bills of Material will be Categorized as Class 1 (Major) or Class 2 (Minor) as follows:

**Class 1 Change…Basically Form, Fit, Function Change**

- Safety
- Deliverable operational, test, or maintenance computer software associated with the configuration being changed
- Compatibility or specified interoperability with interfacing components, support equipment and software, spares, trainers or training devices, equipment and software
- Configuration to the extent that retrofit action is required
- Delivered operation and maintenance manuals where funding is required
- Preset adjustments or schedules affecting operating limits or performance to such extent as to require assignment of a new identification number
- Interchangeability, substitutability, or replaceability of assemblies, subassemblies and detail parts. Changes to the pieces and parts of non-repairable subassemblies are considered Class II
- Sources of replaceable or repairable piece parts at any assembly level defined by specification or source control drawings
- Skills, manning, training, biomedical factors or human engineering design.

**GE Approved RDC Required**

**Class II Engineering Changes.**

Any Engineering Change not falling within Class I as defined above shall be designated as a Class II change. A Class II change shall not re-identify the item in any manner.

**Class II Change...Administrative**

Changes to correct documentation errors such as typos, non-dimensional changes such as symbols, adding clarification views...

Change does not impact design.

**GE Approval Not Required**

Note: BOM should not change due to mfg error or unplanned deviation.

Uncertain on Class? Send the RDC to GE.
How to Change an Approved BOM - RDC

Control Baseline

Supplier Request for Design Change (RDC) Submitted Via SDR*

GE Design Owner Concurs?

Yes

Change Req'd to GE Design?

Yes

Design Eng, Submit CID/ECO

No

Stop

No

CID/ECO Approved?

Yes

Stop

No

Future State: Design Eng, Loads Supplier BOM In PLM

* Change must be approved by GE prior to implementation
How to Write a Quality Change Request

The Basics

1. SDR # or Assigned by GE CCB Chair
2. RDC Author, phone # may be contacted with questions
3. Part # & Nomenclature should match BOM submitted
4. 398A1729 Section 3.2 Defines Class 1, Class 2 Changes
How to Write a Quality Change Request

What are you doing?

9. Title of Change

10. Description of Change

Brief summary of change, unique description of that change request

Brief summary of change proposed

- What is this Change Doing?
  
  *Keep it brief, include source/trigger of change*

- How does this change improve component/system?
How to Write a Quality Change Request

How are you doing it?

BOM changes must be consistent with approved BOM
Drawing changes should include enough info to understand the change.
How to Write a Quality Change Request

Why is the change ok?

12. Substantiation for Change
Substantiation should contain some proof that the design after the change will perform its required function as well as or better than the design prior to the change. If testing is complete give results. If testing is not required, explain why.

13. Proposed Effectivity
Effectivity refers to change cut in plan date, job, requisition.

14. Estimated Cost Impact

15. Recommended RDC Approver(s):

- Technical rationale on why the change is acceptable. Proof of acceptability may include analysis, testing, comparison with successful configurations in similar environmental conditions.
- Proposed implementation plan
- Cost impact if applicable
How to Write a Quality Change Request

Checklist must be filled out to address key questions?

<table>
<thead>
<tr>
<th>Check Points</th>
<th>Applicable</th>
<th>Explanation (If answer is Yes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Is there a change in either materials, material specifications, material</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>properties, material joining, material coatings, lubrication or plating?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Is maintainability, performance, reliability or durability of the part</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>adversely affected compared to the presently authorized production part?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(if yes, circle criteria affected)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Is there a change in air, lube oil, fuel flow, hydraulic flow rate,</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>pressure level, electrical current flow, voltage or resistance?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Does this change alter component or system capacity such as in filters,</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>Oil tanks, heat exchanger, actuator travel, etc.?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Is there a change in actuator force level?</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>6. Is the intent of this change to fix a field problem?</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>7. Is the intent of this change to fix a problem on [1 ] parts in process,</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>or [2 ] parts to be delivered?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Is this change to address a non conformance that has been accepted by</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>the GE Energy Design engineering?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Does this change propose a part number or quantity change to any item of</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>data?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Is this a change which significantly alters the appearance of the part?</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>11. Is part interchangeability affected, physically or functionally, including</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>part envelope?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Is specification performance affected by this change?</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>13. Is there a weight change between present and proposed parts?</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>14. Does this change create a different electromagnetic characteristic or</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
<tr>
<td>change any electrical properties or characteristics?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Does the change comply with Purchaser’s specification requirements with</td>
<td>&lt;Select From List&gt;</td>
<td></td>
</tr>
</tbody>
</table>
**RDC Response**

Change shall not be implemented prior to receiving GE’s Approval!

- Response will use format shown and be sent via SDR
- Approval may require additional clarification, testing, or analysis
Supplier Change Process Templates

- Suppliers with Configuration Management process in place currently may use their own forms, if required content satisfied.
- Templates available from GE

![Supplier RDC Form](image1)
- Supplier RDC Form
- Supplier Checklist
- GE Response
- Bill of Material
“Frozen Process” Verification

Supplier Audits

a) Approved BOM maintained in qual in GE Energy Sourcing records (eg. eSMS or equivalent)

b) Approved BOM retained by Supplier (P28A-AL-0002, sec 4.2.3, 5.4)

c) GE SQE/Design Engineer will compare current product to approved BOM & approved RDCs.

d) Unapproved change will be considered non-conformances and the supplier non compliant to the dwg requirement.
“Frozen Process” Verification

Project BOM Comparison

✓ “DIS - 150 Supplier Bill of Material Documentation Requirements (101T8049)”
  - Requires delivery of BOM for each Purchase Order

Frozen BOM = Project BOM

✓ Unapproved differences are considered non-conformances
  1. Disposition using SDR
  2. Supplier will be subject to audit and maybe disqualified for future orders.
Frequently Asked Questions

1. **Does the Request for Design Change replace the “Frozen Process Change Request”?**
   Response: No. It is expected that any special process requirements are on the face of the drawing and a change would be submitted via an RDC. However, many special process qualifications involve furnace temp charts or coating spray parameters for example, which may not on the face of the drawing and those will continue to require PSSQMF-0160 change forms.

2. **If a sub-tier supplier changes their part number does the top level group number need to change?**
   Response: If the sub-tier supplier change impacts the form, fit, function of the final shipped product then the suppliers top level part number should be changed as well.
Questions?