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Space Administration

MSFC-STD-555  
REVISION: J  
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**George C. Marshall Space Flight Center**  
Marshall Space Flight Center, Alabama 35812

EE12

MSFC TECHNICAL STANDARD

MSFC ENGINEERING  
DOCUMENTATION  
STANDARD

Approved for Public Release; Distribution Unlimited

CHECK THE MASTER LIST— VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 2 of 80</b>

## DOCUMENT HISTORY LOG

Status (Baseline/ Revision/ Cancelled)	Document Revision	Effective Date	Description
Revision	D	10/6/2000	General Revision – Deleted document preparation requirements excluding drawings and parts lists. Data included in MWI 7120.4. Previous history retained as part of superseded or cancelled MSFC Documentation Repository files.
Revision	E	1/8/2002	Para 2.j Replaced CM-INST-002 with “MSFC Forms, All MSFC forms are accessible at <a href="http://starbase.msfc.nasa.gov:8000/forms">http://starbase.msfc.nasa.gov:8000/forms</a> .” Para 4.2.2, deleted “or CM-INST-002”. Para 5.1.2.1 deleted and renumbered subsequent paragraphs. Para 5.2.2 deleted last sentence, “Forms and preparation instructions can be found in CM-INST-002.” Para 5.2.3 deleted “per CM-INST-002” in last sentence. Tables I, II, III, and IV, deleted references to “CM-INST-002.” Para 5.4.1.b deleted “(see CM-INST-002)”.
Revision	F	5/13/2002	CONTENTS added “4.4.4. ICMS Database Reports.” Deleted paragraph 2.l and paragraphs k., l., and m. and renumbered paragraphs accordingly. 4.1.c., deleted “that is authorized for release.” 4.1.d. deleted 2 <sup>nd</sup> sentence. 4.2.2.a. deleted 2 <sup>nd</sup> sentence. 4.3.2.2, replaced “in accordance with MIL-STD-130 and MIL-STD-129, part and bulk marking, respectively.” with “as shown below.” To satisfy RCAR 177, paragraphs 4.3.3.3 a. through c. are changed to read: “4.3.3.3 <u>Matched Set Dash Numbers</u> . Dash numbers shall be assigned to two or more matched or machined parts that are not interchangeable. The following rules apply: a. When an assembly is created having matched parts, each part must be identified with a dash number and a separate EPL. b. The next higher assembly(s) will identify each matched part in the drawing(s) and the EPL(s) until they are reassembled as a matched set. The assembling drawing will have a note stating “Matched Set” next to the find numbers. This note number will also be added to the EPL. c. Matched parts drawing requirements shall be per MSFC-STD-2806.” 4.4.2 Replaced sentence with “The Release Desk shall be the single point of release for MSFC in-house projects' flight and flight-related ground support equipment (GSE) configuration documentation in accordance with the documentation approval matrix contained in each project's configuration management plan.” 4.4.2.a., replace text with “The Release Desk may release non-configuration documentation as defined in the project's data management plan. ”Delete “NOTE: Manufacturing must sign all FEO’s and FEPL’s.” Added new paragraphs 4.4.4 through 4.4.4.5. ICMS Database Reports. 4.5.1, deleted “according to the requirements of MIL-STD-100 and.” 4.5.2 Replaced text with: “A complete set of original drawings and parts lists and a listing of all specifications and standards and ancillary documents used for the design definition shall be obtained and placed in the MSFC Repository. When available, drawing trees, indentured part lists, and/or associated listings shall also be placed in the MSFC Repository. MSFC Form 2896 shall accompany the package.” 4.5.3.b, 2 <sup>nd</sup> para, add “and documented in the configuration management plan” after “systems engineer” 5.2.2, delete “MSFC Form 421-1,” in first sentence and added “shall be prepared according to the format specified in MSFC-STD-2806 and”

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<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 3 of 80</b>

Status (Baseline/ Revision/ Cancelled)	Document Revision	Effective Date	Description
			<p>5.3.4, 1<sup>st</sup> sentence changed to read “Although the Secretariat is responsible to review the package, the Release Desk also reviews each approved package to ensure that all the required forms are included and properly completed.”</p> <p>Change 2<sup>nd</sup> sentence to read: “If corrections are required, the Release Desk shall return the package to the Secretariat who in turn will forward to the OPR designee.”</p> <p>5.3.7, 1<sup>st</sup> sentence changed to read: “Although the Secretariat is responsible to review the package, the Release Desk also reviews each approved change package to ensure that all the required forms are included and properly completed.” Change 2<sup>nd</sup> sentence to read as follows: “If corrections are required, the Release Desk shall return the package to the Secretariat who in turn will forward to the OPR designee.”</p>
Revision	G	7/25/2002	<p>Paragraph 3 - deleted duplicate definitions contained in cited documents (2.c and 2.d); deleted forms from definitions (2.e, 2.f, 2.g, 2.i, 2.j, 2.k, 2.l, and 2.n) and added form numbers to form titles when used in the text.</p> <p>5.2.1.f., Added 2 new sentences at the end of paragraph: “ An EO shall not be written to delete parts that were added by a previous EO that has not been incorporated. The EO must be canceled and reissued in accordance with paragraph 5.2.1.g.”</p>
Revision	H	9/9/2009	<p>Updated language to utilize “shall” for requirements in accordance with the Rules Review. General - Updated document to current requirements and applicable documents. Added definition for Effectivity Code. Para 4.1.6 Updated ED03 to ED11. Para 4.2.1 clarified procedure for drawing revisions (RCAR 235). Added Para 4.3.2 Establishing Effectivity Codes. Para 4.3.3.1, renumbered 4.3.4, added requirements for serial/lot numbering format and re-use. Para 4.3.3.2.1, renumbered 4.3.6, clarified use of new and previous CAGE Codes. Para 4.3.3.4, renumbered 4.3.7, added requirements for part number re-identification. Added Para 4.5.5 Preparation of an Envelope Drawing (RCAR 235). Added Para 4.6, Software and Firmware Identification Requirements. Added Para 5.1.1.3 and Para 5.1.1.4 to describe update of the component drawing revision on assembly Engineering Parts Lists (EPLs) when component drawings are revised (RCAR 259). Para 5.1.3 Changing Effectivities – clarified title and contents. Updated Figure 1 to better describe EPL revisions. Updated Para 5.2.1 to describe EO incorporation by drawing revision and Revised and Redrawn procedure (RCAR 235). Para 5.2.2 added Engineering Order (EO) numbering requirements and use of the EO Number Request and Trending System. Para 5.3 combined initial and release package processing into the same paragraphs. Para 5.4 Updated document cancellation sections.</p>
Revision	J	6/17/2013	<p>Revision J release was authorized by the MSFC Technical Standards Document Control Board (DCB) through the Multiprogram Document Management System (MPDMS). Document was restructured to include requirements and guidance that are applicable to release of MSFC configuration documentation from the following documents which are being cancelled: MPR 8040.1, MSFC Configuration Management, MPR 8040.2, Product Identification and Traceability, MWI 8040.5, Floor Engineering Order and Floor Engineering Parts Lists (FEOs/FEPLs), and ED-OWI-005, MSFC Engineering Release, Use of the ICE Windchill system as the release database is incorporated as new scope. Both ICMS and ICE Windchill are now identified as valid release systems for MSFC Release.</p>

CHECK THE MASTER LIST--VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 4 of 80</b>

## FOREWORD

This standard specifies the requirements, instructions, and guidance for releasing Marshall Space Flight Center (MSFC) configuration documentation through the MSFC Release Desk using the Integrated Configuration Management System (ICMS) or the Integrated Collaborative Environment (ICE) Windchill system. This standard shall be used only for MSFC programs/projects.

The intent of this standard is to achieve a high level of configuration traceability for release and change of documents, parts, engineering parts lists (EPLs), drawings, and computer-aided design (CAD) models. The change processes defined in this standard allow change of parts-EPLs separate from the drawing-model and utilize engineering orders (EOs) to release auxiliary changes to parts and drawings. These mechanisms focus change documentation on only the elements that are changing, and aid in expediting changes while maintaining traceability. Traceability and responsiveness are critical when communicating the configuration requirements and configuration changes to personnel who build or procure the hardware/software and those who verify that configuration requirements have been met.

The ICMS and ICE Windchill release databases are described in this standard because both systems are utilized by the MSFC Release Desk to release data at MSFC.

ICMS is a part and release database that captures part data through EPLs and captures the relationship between the parts, EPLs, drawings, EOs, and effectivities. ICMS identifies the official released data, produces the official released EPL and EO reports, provides indented parts list (IPL) reports by effectivity, and maintains part history for all released parts.

ICE Windchill is a product data management system and a part and release database. ICE Windchill captures part data in Windchill Technology (WT) Part objects, CAD drawing and CAD model data in CAD Document objects, and non-CAD drawings, EPLs, EOs, and other data types in document objects. ICE Windchill captures the relationships between WT Parts, EPLs, drawings, CAD models, EOs, and effectivities, and identifies the official released data and authorized configurations by effectivity. ICE Windchill captures linkages between WT Part-WT Part, CAD drawing-CAD model, CAD model-CAD model, and WT Part-CAD-documents. Release and change control of the inter-related part, drawing, and CAD model objects drive specific part, drawing, and CAD model identification and structuring requirements, which enable more flexible change processing while maintaining a high level of traceability.

For both ICMS and ICE Windchill, the MSFC Release Desk transmits released data to the MSFC Documentation Repository who serves as the official record custodian and distribution point.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 5 of 80</b>

**TABLE OF CONTENTS**

<u><b>PARAGRAPH</b></u>	<u><b>PAGE</b></u>
DOCUMENT HISTORY LOG .....	2
FOREWORD.....	4
1. SCOPE .....	7
2. APPLICABLE AND REFERENCE DOCUMENTS .....	7
2.1 Applicable Documents .....	7
2.2 Reference Documents.....	8
3. DEFINITIONS AND ACRONYMS.....	8
4. GENERAL REQUIREMENTS .....	9
5. DETAILED REQUIREMENTS .....	13
6. NOTES .....	13
 <u><b>APPENDICES</b></u>	
A. Definitions.....	14
B. Acronyms .....	19
C. Project Code, Board Code, Program Control Number (PCN), Change Request (CR), Deviation-Waiver Approval Request (DAR), Control Board Directive (CBD), and Configuration Item (CI) and Effectivity Identifiers.....	21
D. Technical Approval Matrix.....	26
E. Part, Drawing, CAD Model, and Document Numbering and Version-Revision Identifiers.....	28
F. Software, Firmware, and Configurable Logic Device Identification .....	34
G. Serial and Lot Number Requirements and Guidance .....	38
H. Material Traceability Level Requirements and Guidance .....	42
I1. Engineering Parts List (EPL) Preparation, Numbering, and Versions in ICMS .....	44
I2. WT Part and Engineering Parts List (EPL) Preparation and Numbering in ICE Windchill.....	47
J. Drawing Preparation .....	50
K. CAD Model Preparation in ICE Windchill.....	53
L. Release-Change Rules to Maintain Relationships between WT Parts, Drawings, and CAD Models in ICE Windchill .....	54
M1. Engineering Order (EO) Preparation and Numbering in ICMS .....	56
M2. Engineering Order (EO) Preparation and Numbering in ICE Windchill .....	60
N1. Effectivity Application and Change in ICMS .....	63

CHECK THE MASTER LIST--VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 6 of 80</b>

N2. Effectivity Application and Change in ICE Windchill .....65

O. Initial Release, Change, and Cancellation Process .....66

P. Floor EO/Floor EPL (FEO/FEPL) Process .....70

Q. Guidance on Part Number Re-identification .....72

R. Requirements for Design Responsibility Transfer.....74

S. MSFC Release Desk Functions, Reports, and Release Records .....76

TABLES

I. Drawing, Engineering Parts List (EPL), and Engineering Order (EO) Package  
Preparation for ICMS Initial or Change Release .....10

II. Document Package Preparation for ICMS Initial or Change Release .....10

III WT Part, Drawing, EPL, EO, and CAD Model Package Preparation for  
ICE Windchill Initial or Change Release.....11

IV. Document Package Preparation for ICE Windchill Initial or Change Release .....12

V. Technical Approval Matrix.....27

VI. Number and Name of ICE Windchill Part, Drawing, and CAD Model Objects .....32

VII. EPL Re-identification Steps for Effectivity Changes in ICMS .....46

VIII. Records Related to MSFC Release Processes.....79

FIGURES

1. Serial and Lot Traceability in Drawing Hierarchy (Guidance).....40

2. Change Request and Release Process .....66

3. Part Number Re-identification Decision Tree (Guidance).....73

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 7 of 80</b>

## 1. SCOPE

### 1.1 Scope and Purpose

This standard specifies the requirements, instructions, and guidance for releasing MSFC configuration documentation through the MSFC Release Desk. This standard identifies the requirements for preparing, releasing, and changing part data and engineering parts lists (EPLs), engineering drawings, computer-aided design (CAD) models, specifications, and interface control documents (ICDs). Other types of documentation may be released by the MSFC Release Desk if the release requirements in this standard are met.

NOTE: Within this standard, the term “project” is used to refer to programs, projects, or activities.

### 1.2 Applicability

1.2.1 This standard applies to documentation produced by MSFC or for MSFC, where MSFC is the designated point of release, and the documentation is released through the MSFC Release Desk.

1.2.2 The requirements in this standard are applicable to use of the Integrated Configuration Management System (ICMS) or the Integrated Collaborative Environment (ICE) Windchill as the release system. Sections in the standard are identified with the system name when system-specific applicability exists.

1.2.3 The following terms are applied in this standard: “shall” denotes a requirement, “may” or “can” denote discretionary privilege or permission, “should” denotes a good practice and is recommended, but not required; “will” denotes expected outcome, and “are/is” denotes descriptive material.

## 2. APPLICABLE AND REFERENCE DOCUMENTS

### 2.1 Applicable Documents.

The following documents of the revision listed (or latest revision if no revision is listed) form a part of this document to the extent specified herein.

- |    |                  |  |
|----|------------------|--|
| a. | ASME Y14.35-1997 | Revision of Engineering Drawings and Associated Documents                        |
| b. | GDRM             | Global Drawing Requirements Manual Tenth Edition                                 |
| c. | MSFC-STD-2806    | MSFC Tailoring Standard for the Global Drawing Requirements Manual Tenth Edition |
| d. | MSFC-STD-3528    | MSFC Computer-Aided Design (CAD) Standard  |
| e. | MWI 2210.1       | MSFC Documentation Repository Input/Output and Data Management Project Requests  |

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 8 of 80</b>

## 2.2 Reference Documents.

The following documents of the revision listed (or latest revision if no revision is listed) are referenced within this standard as a source of supplemental information or for optional use as specified herein.

- |    |                     |  |
|----|---------------------|--|
| a. | ASME Y14.24-1999    | Types and Applications of Engineering Drawings                   |
| b. | ASME Y14.100-2000   | Engineering Drawing Practices                                    |
| c. | IEEE Std 12207-2008 | Systems and software engineering — Software life cycle processes |
| d. | MPR 7123.1          | MSFC Systems Engineering Processes and Requirements              |
| e. | MSFC Form 420       | Engineering Parts List (EPL)/Floor EPL (FEPL)                    |
| f. | MSFC Form 420-5     | Document Release List (DRL)                                      |
| g. | MSFC Form 421       | Engineering Order (EO)/Floor EO (FEO)                            |
| h. | MSFC Form 847       | Deviation/Waiver Approval Request (DAR)                          |
| i. | MSFC Form 2312      | Control Board Directive  |
| j. | MSFC Form 2327      | Engineering Change Request (ECR)                                 |
| k. | MSFC Form 3209      | Specification Change Notice/Document Change Notice (SCN/DCN)     |
| l. | MSFC Form 3418      | Documentation Package/Routing Slip (DP/RS)                       |
| m. | MSFC Form 2896      | MSFC Repository Document Input Record                            |
| n. | MSFC Form 4229      | Interface Revision Notice (IRN)                                  |
| o. | MSFC Form 4341      | Effectivity Sheet  |
| p. | MSFC-STD-3012       | EEE Parts Management and Control for MSFC Space Flight Hardware  |
| q. | MSFC-STD-3663       | MSFC Standard for Configurable Logic Device Development          |
| r. | NPR 1441.1          | NASA Records Retention Schedules                                 |

## 3. DEFINITIONS AND ACRONYMS

### 3.1 Definitions

See Appendix A.

### 3.2 Acronyms

See Appendix B.



<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555 Effective Date: June 17, 2013</b>	<b>Revision: J Page 9 of 80</b>

#### **4. GENERAL REQUIREMENTS**

Projects and organizations utilizing this standard shall meet the following requirements.

##### 4.1 Project Code, Board Code, Program Control Number (PCN), Change Request (CR), Deviation-Waiver Approval Request (DAR), Control Board Directive (CBD), and Configuration Item (CI) and Effectivity Identifiers

4.1.1 Establish Project Codes, Board Codes, PCNs, CBD numbers, and CI and effectivity identifiers in accordance with Appendix C.

4.1.2 Assign CR numbers in accordance with Appendix C.

4.1.3 Assign DAR numbers in accordance with Appendix C or establish project-unique requirements.

##### 4.2 Technical Approval Matrix

Utilize the Technical Approval Matrix in Appendix D or establish a project-unique Technical Approval Matrix in accordance with Appendix D.

##### 4.3 Part, Drawing, CAD Model, and Document Numbers and Version-Revision Identifiers

Assign part, drawing, CAD model, and document identifiers and version-revision levels in accordance with Appendix E.

##### 4.4 Software, Firmware, and Configurable Logic Device Identifiers

Assign software, firmware, and Configurable logic device identifiers in accordance with Appendix F.

##### 4.5 Product Traceability Utilizing Serial Numbers, Lot Numbers, and Material Traceability Levels

4.5.1 Specify serial, lot, and material traceability requirements in parts/EPLs, drawings, and CAD models (as applicable) in accordance with Appendix G and Appendix H.

4.5.2 Request serial and lot numbers from the MSFC Release Desk for MSFC-designed parts in accordance with Appendix G.

##### 4.6 Preparation of Data, Changes, and Release Package

###### 4.6.1 ICMS Release

Prepare the initial release package or change package for submittal to the MSFC Release Desk for ICMS release in accordance with the requirements in Table I for drawings and EPLs, and Table II for documents. The "Data Released" column identifies engineering data that will be released for use. The "Data Released" items will vary per release package according to the scope of the release or change. All other items listed are required to be included in each release

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 10 of 80</b>

package. The “Record Location” column identifies the location of each record in the release package. Additional records information is identified in Appendix S.

<b>TABLE I. Drawing, Engineering Parts List(EPL), and Engineering Order (EO) Package Preparation for ICMS Initial or Change Release</b>				
	<u><b>Title</b></u>	<u><b>Preparation</b></u>	<u><b>Data Released</b></u>	<u><b>Record Location</b></u>
a.	Engineering Change Request (ECR)	MSFC Form 2327*		Change Package
b.	Engineering Parts List (EPL)	MSFC Form 420* and Appendix I1	X	MSFC Repository
c.	Drawing (initial release or revision)	MSFC-STD-2806 and Appendix J	X	MSFC Repository
d.	Engineering Order (for drawing change)	Appendix M1	X	MSFC Repository
e.	Document Package Routing Slip (DP/RS)	MSFC Form 3418*		MSFC Repository
f.	Control Board Directive (CBD)	MSFC Form 2312*		Change Package
g.	Repository Distribution List	N/A		Change Package
h.	Document Input Record	MSFC Form 2896*		MSFC Repository

\*or equivalent

<b>TABLE II. Document Package Preparation for ICMS Initial or Change Release</b>				
	<u><b>Title</b></u>	<u><b>Preparation</b></u>	<u><b>Data Released</b></u>	<u><b>Record Location</b></u>
a.	Engineering Change Request (ECR)	MSFC Form 2327*		Change Package
b.	Document Release List (DRL)	MSFC Form 420-5*		MSFC Repository
c.	Document Package Routing Slip (DP/RS)	MSFC Form 3418*		MSFC Repository
d.	Baseline Document/ICD/SVD or Revised Document/IRN/SCN/DCN	Per project requirements; MSFC Form 4229* (IRN); MSFC Form 3209* (SCN/DCN)	X	MSFC Repository
e.	Control Board Directive (CBD)	MSFC Form 2312*		Change Package
f.	Repository Distribution List	N/A		Change Package
g.	Document Input Record	MSFC Form 2896*		MSFC Repository

\*or equivalent

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 11 of 80</b>

#### 4.6.2 ICE Windchill Release

Prepare the initial release package or change package for submittal to the MSFC Release Desk for ICE Windchill release in accordance with the requirements in Table III for detailed design data, and Table IV for specification or interface documentation. The “Data Released” column identifies engineering data that will be released for use. The “Data Released” items will vary per release package according to the scope of the release or change. All other items listed are required to be included in each release package. The “Record Location” column identifies the location of each record in the release package. Additional records information is identified in Appendix S.

<b>TABLE III. WT Part, Drawing, EPL, EO, and CAD Model Package Preparation for ICE Windchill Initial or Change Release</b>				
	<u>Title</u>	<u>Preparation</u>	<u>Data Released</u>	<u>Record Location</u>
a.	ECR or project Change Request (CR)	MSFC Form 2327* or Project format		Change Package
b.	WT Part for each part or WT Part revision for EPL change	Appendix I2	X	ICE Windchill
c.	CAD drawing with dynamic relationship to CAD model, or PDF drawing and CAD model used to generate PDF	Appendix J and MSFC-STD-2806	X	MSFC Repository
d.	CAD models (if applicable) with “As-Stored” configuration	Appendix K and MSFC-STD-3528	X	MSFC Repository
e.	Engineering Order (for drawing changes)	Appendix M2	X	MSFC Repository
f.	Product Structure relationships between WT Parts, CAD models, and CAD drawings, next higher and child WT Parts	Appendix L		ICE Windchill
g.	Engineering Parts List Report (NOTE: The EPL report is created from the released WT Part information by the MSFC Release Desk at release.)	Appendix I2	X	MSFC Repository
h.	Control Board Directive (CBD)	MSFC Form 2312*		Change Package
i.	Repository Distribution List	N/A		Change Package
j.	Document Input Record (NOTE: The DIR information is extracted from ICE Windchill by the MSFC Release Desk and transferred electronically to the MSFC Repository.)	Electronic Transfer of MSFC Form 2896 information		MSFC Repository

\*or equivalent

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 12 of 80</b>

<b>TABLE IV. Document Package Preparation for ICE Windchill Initial or Change Release</b>				
	<b><u>Title</u></b>	<b><u>Preparation</u></b>	<b><u>Data Released</u></b>	<b><u>Record Location</u></b>
a.	ECR or Project Change Request (CR)	MSFC Form 2327* or Project format		Change Package
b.	Baseline Document/ICD/SVD or Revised Document/IRN/SCN/DCN	Per project requirements; MSFC Form 4229* (IRN); MSFC Form 3209* (SCN/DCN)	X	MSFC Repository
c.	Control Board Directive (CBD)	MSFC Form 2312*		Change Package
d.	Repository Distribution List	N/A		Change Package
e.	Document Input Record (NOTE: The DIR information is extracted from ICE Windchill by the MSFC Release Desk and transferred electronically to the MSFC Repository.)	Electronic Transfer of MSFC Form 2896 equivalent information		MSFC Repository

\*or equivalent

#### 4.7 Effectivity Application and Change

4.7.1 Apply effectivity to EPLs and EOs for ICMS release in accordance with Appendix N1.

4.7.2 Apply effectivity to WT Parts for ICE Windchill release in accordance with Appendix N2.

#### 4.8 Initial Release, Change, and Cancellation Processes

Utilize the initial release, change, and cancellation processes to obtain technical approvals, evaluation, and CCB authorization of data prior to release or cancellation in accordance with Appendix O.

#### 4.9 Floor EO (FEO)/Floor EPL (FEPL) Processes

Utilize the FEO/FEPL processes defined in Appendix P to allow manufacturing to implement changes after minimum approvals in advance of CCB authorization.

#### 4.10 Part Number Re-Identification

Apply a new part number to a changed part to maintain configuration traceability. Appendix Q provides guidance on when it is appropriate to re-identify a part with a new part number.

#### 4.11 Design Responsibility Transfer

Transfer design responsibility from an external design activity to MSFC in accordance with Appendix R.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 13 of 80</b>

#### 4.12 MSFC Release Desk Functions, Reports, and Release Records

The MSFC Release Desk shall release data in accordance with the requirements of this standard, maintain records associated with Release Desk functions, and ensure released data is transmitted to the MSFC Documentation Repository as records in accordance with Appendix S.

### **5. DETAILED REQUIREMENTS**

Detailed requirements are included in Appendix C through Appendix S.

### **6. NOTES**

None.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 14 of 80</b>

## **Appendix A. Definitions**

The following definitions are related to terms utilized in this standard, with additional information that defines any unique implementation of these definitions related to the MSFC Release Desk processes, the MSFC Integrated Configuration Management System (ICMS), or the ICE Windchill release system.

Altered Item Drawing. An altered item drawing delineates the physical alteration of an existing item under control of another design activity [other than MSFC] or defined by a nationally recognized standard. An altered item drawing establishes a new item identification for the altered item. (Reference ASME Y14.24) NOTE: An altered item drawing is not used to modify an MSFC part.

Alternate Part. An alternate part is designated on the EPL as a potential replacement part for another part on the EPL. Both the primary part and the designated alternate part are acceptable for use within the assembly, so the two parts should be interchangeable. NOTE: In the ICE Windchill system, the MSFC alternate part definition correlates to the “substitute part” functionality, which allows designation of a replacement part for another part within a specific assembly usage.

Assembly Drawing. An assembly drawing defines the configuration and contents of the assembly or assemblies depicted thereon. The assembly drawing establishes item identification for each assembly. (Reference ASME Y14.24) An assembly drawing depicts the assembled relationship of two or more parts, a combination of parts and subordinate assemblies, or a group of assemblies required to form an assembly of higher order. (Reference GDRM).

Baseline. A baseline is the authorized and identified data that defines an item (e.g., configuration item, schedule) at a specific point in time where changes from that point forward are controlled through a traceable approval and implementation process. (Reference MPR 7123.1)

CAD Drawing-Model Set. The CAD drawing object plus the CAD model object(s) that are used to create graphic views within the drawing, where the drawing object and model objects are dynamically related to each other within the ICE Windchill system. The native CAD drawing content cannot be fully viewed without the related CAD model(s).

Change Package. The consolidated record, assigned a unique number, of all pertinent information associated with requesting, processing, and implementing of a baseline, change or deviation/waiver. The typical change package includes the CR or deviation/waiver, supporting documentation, change evaluations (CEs), change board directives with authorized implementation actions, and action closure data. NOTE: Sometimes called PCN File.

Commercial and Government Entity (CAGE) Code. The CAGE Code is a five-character code listed in Cataloging Handbook H4/H8 that is assigned to commercial and Government activities that manufacture or develop items, or provide services and/or supplies for the Government.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 15 of 80</b>

When used with a drawing or part number, the CAGE Code designates the design activity to which the drawing or part number is assigned. NOTE: The CAGE Code was previously called manufacturer's code, code identification number, or Federal Supply Code for Manufacturers (FSCM).

Configurable Logic Device (CLD). A CLD is an integrated circuit with a common internal structure, the functionality of which is determined by a using design organization. CLD terminology is used to describe Field Programmable Gate Arrays (FPGAs) and Application Specific Integrated Circuits (ASICs). (Reference MSFC-STD-3663).

Configuration Item (CI). An aggregate of hardware, software, or any of its discrete portions, which satisfies an end-use function and is designated for CM. CIs may vary widely in complexity, size, and type.

Detail Assembly Drawing. A detail assembly drawing shows the assembled relationship of items, one or more of which is detailed on the assembly drawing. Separate engineering drawings are not required for items so delineated. Detail assembly drawings are particularly useful for inseparable assemblies. (Reference GDRM)

Detail Drawing. A detail drawing provides the complete end-product definition of the part or parts depicted on the drawing. A detail drawing establishes item identification for each part depicted thereon. (Reference ASME Y14.24)

Document Release List (DRL) (MSFC Form 420-5). The DRL is used in a document release package to record and maintain status information (SPEC, STD, and ICD).

Documentation Package/Routing Slip (DP/RS) (MSFC Form 3418). The DP/RS is used as part of an ICMS release package to itemize the data items that are being submitted for release (e.g. drawings, EPLs, EOs, DRLs), and to track those documents through release and submittal to the MSFC Documentation Repository. The DP/RS is assigned a unique number either by the originating organization or the MSFC Release Desk. The DP/RS number can be referenced on the ECR, Control Board Directive (CBD), work orders, etc., to specify the documentation numbers involved instead of listing the individual data items.

Effectivity. Effectivity defines the as-designed configuration where the design or change is authorized to be applied. MSFC designates effectivity by alpha-numeric identifiers that represent the CI and units of the CI. The effectivity unit identifiers may correlate to an event or range of events (flight(s), mission(s), test(s), etc.) where those unit configurations are planned to be applied. Effectivity is NOT equivalent to as-built serial numbers, lot numbers, or calendar dates. Effectivities for subordinate components of an assembly are assigned to be equal to or greater than the effectivity of each applicable assembly where the component is used.

Effectivity Identifier. The alpha-numeric identifiers used to express effectivity in the release system. In ICMS, the effectivity identifier is made up of the Project Code plus Effectivity Unit

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 16 of 80</b>

Number. In ICE Windchill, the effectivity identifier consists of the CI Number plus the Effectivity Unit Number.

Envelope Drawing. An envelope drawing discloses the basic technical data and performance requirements necessary for development or design selection of an item. It specifies a configuration and performance envelope, without details of internal construction. All features other than those shown on the drawing are left to the producer to meet the specified design and performance data. The envelope drawing establishes a control number for use in engineering documentation until development is complete or until vendor item identification is established. When item development is completed, envelope drawings normally evolve into detail drawings, specifications, vendor item control drawings, or source control drawings. (Reference ASME Y14.24 and GDRM)

EPL Notes. EPL notes provide additional requirements or instructions related to the child parts within an assembly usage. The EPL notes are displayed on the EPL with correlation to the child parts to which the notes apply.

Find Number. The Find Number is the numbered item on the EPL that corresponds to the numbered callout on a Drawing.

Firmware. The combination of a hardware device and computer instructions or computer data that reside as read-only software on the hardware device. (Reference: IEEE Std 12207-2008)

Inseparable Assembly Drawing. An inseparable assembly drawing delineates two or more parts, subordinate assemblies, or a combination of these items, which may be separately fabricated and are permanently joined together (as in welded, brazed, riveted, sewed, glued, or other processes) to form an integral unit (part) not normally capable of being disassembled for replacement or repair of individual pieces. It establishes item identification for the assembly. An inseparable assembly drawing may be prepared in lieu of individual detail drawings for the parts of an inseparable assembly. Example: a welded or riveted bracket, a metal chest riveted together, or a canvas case sewed together may be covered by an inseparable assembly drawing without separate detail drawings. Individual pieces may be detailed in the assembled condition in lieu of separate detail views or drawings. The drawing establishes a unique identifier for all items which become a part of the inseparable assembly. (Reference ASME Y14.24)

Installation Drawing. An installation drawing provides information for properly positioning and installing items relative to their supporting structure and adjacent items. This information may include dimensional data, hardware descriptions, and general configuration information for the installation site. An installation drawing is prepared to provide detailed installation information for functionally related items (such as a control system, electrical system, or hydraulic system) that cannot be effectively shown on an assembly drawing of the item to which it belongs. (Reference ASME Y14.24)

Interchangeable. A criterion met when two parts possess such physical and functional characteristics as to be equivalent in performance, safety considerations, and are capable of being



<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 17 of 80</b>

exchanged one for another without alteration of the items themselves or adjoining items. Fully interchangeable parts have the same adjustments, testing, operations, and maintenance requirements and design to the extent that the same test procedures, specifications, and operating procedures may be utilized.

Kit Drawing. A kit drawing identifies an item or group of items with instructions for their use. The kit does not necessarily define a complete functional assembly. A kit drawing establishes item identification for the kit, not for the items in the kit. A kit drawing is prepared when it is desired to identify all of the items required to perform a specific operation in kit form (maintenance, overhaul, modification, installation, conversion, or similar operations). (Reference ASME Y14.24)

Layout Drawing. A layout drawing depicts design development requirements. It is similar to a detail, assembly, or installation drawing, except that it presents pictorial, notational, or dimensional data to the extent necessary to convey the design solution used in preparing other engineering drawings. A layout drawing does not establish item identification, except when it is used as an interim assembly drawing. (Reference ASME Y14.24)

Lot Number. A lot number is a unique number assigned to identify a group of identical parts that are produced concurrently by a common process. Lot number requirements apply to procured parts and parts manufactured in-house.

Mono-detail Drawing. A mono-detail drawing is a detailed drawing which delineates a single part. (Reference ASME Y14.24)

Multi-detail Drawing. A multi-detail drawing delineates two or more uniquely identified parts in separate views or in separate sets of views on the same drawing. A multi-detail drawing is prepared to describe parts usually related to one another. (Reference ASME Y14.24)

Part Identification Number (PIN). The MSFC PIN consists of the CAGE Code, part number, and serial/lot number.

Program Control Number (PCN). The PCN is a unique number assigned to a change package. The PCN is recorded on change forms to indicate that the change forms are related to the same change package.

Project Code. The Project Code is a unique alphanumeric code assigned by the MSFC Release Desk to each project which has a Configuration Control Board (CCB). The Project Code allows identification within the Integrated Configuration Management System (ICMS) database and is used as part of the PCN, Effectivity Identifiers, CI numbers, and Board Codes.

Release. Release is the authorization to disseminate for use or implementation approved information and/or products subject to configuration management. In MSFC Release Desk procedures, it is the point at which the MSFC Release Desk personnel identify a package as released in ICMS or ICE Windchill.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 18 of 80</b>

Serial Number. A serial number is a permanent number assigned sequentially to selected hardware which, in conjunction with the part number, permits isolation of the item and facilitates hardware allocation, traceability, accountability, location determination, and identification of design change effectivity.

Source Control Drawing. A source control drawing provides an engineering description, qualification requirements, and acceptance criteria for commercial items or vendor-developed items procurable from a specialized segment of industry, that provide performance, installation, interchangeability, or other characteristics required for critical applications. The drawing provides a list of approved sources of supply and the vendor’s item identification for the item(s) that have been qualified and approved for use in the critical application(s). The source control drawing number establishes the source control item identification. (Reference ASME Y14.24)

Substitute Part. Substitute part is the functionality in ICE Windchill that is equivalent to an Alternate Part. See Alternate Part definition.

Tabulated Drawing. Any drawing type may be tabulated to delineate similar items which, as a group, have some common characteristics and some variable features. Tabulated drawings are prepared to avoid preparation of individual drawings for each similar item tabulated. Each item included in the tabulation is assigned a part number. (Reference ASME Y14.24)

Vendor Item Control Drawing. (Formerly Specification Control Drawing) A vendor item control drawing provides an engineering description and acceptance criteria for commercial items or vendor-developed items that are procurable “off-the-shelf” or from a specialized segment of industry. The manufacturer’s (vendor’s) part or identifying number is the item identification. The drawing provides a list of suggested source(s) of supply, the vendor’s item identification, and sufficient engineering definition for acceptance of interchangeable items within specified limits. (Reference ASME Y14.24)

WT Part. A version controlled object in ICE Windchill that contains attributes (e.g., number, name, CAGE Code, material, mass) and usage attributes (e.g. quantity, find numbers) for a part item (e.g., detail part, assembly, bulk item) that will be released and/or utilized on the EPL and Product Structure-IPL. Data (e.g., CAD models, drawings, EPLs, EOs, documents) are related to the WT Part to capture a complete design definition of the item. Relationships (i.e., component, assembly, next higher assembly) are created between WT Parts to create the Product Structure-IPL.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 19 of 80</b>

## Appendix B. Acronyms

AFS	Agency Filing Scheme
ASME	The American Society of Mechanical Engineers
CAD	Computer-Aided Design
CAGE	Commercial and Government Entity
CBD	Control Board Directive
CCB	Configuration Control Board
CE	Change Evaluation
CI	Configuration Item
CLD	Configurable Logic Device
CM	Configuration Management
CPIN	Computer Program Identification Number
CR	Change Request
CSCI	Computer Software Configuration Item
DAR	Deviation/Waiver Approval Request
DCN	Document Change Notice
DIR	Document Input Record
DP/RS	Documentation Package/Routing Slip
DRL	Document Release List
ECR	Engineering Change Request
EO	Engineering Order
EPL	Engineering Parts List
FEO	Floor Engineering Order
FEPL	Floor Engineering Parts List
FSCM	Federal Supply Code for Manufacturers
GDRM	Global Drawing Requirements Manual
GSE	Ground Support Equipment
ICD	Interface Control Document
ICMS	Integrated Configuration Management System
IRN	Interface Revision Notice
IWG	Interface Working Group
OPR	Office of Primary Responsibility
OPRD	OPR Designee
MSFC	Marshall Space Flight Center
MWI	Marshall Work Instruction
NPR	NASA Procedural Requirements
P/N	Part Number
PCN	Program Control Number
PIN	Part Identification Number
PIRN	Preliminary Interface Revision Notice
S&MA	Safety and Mission Assurance
SCN	Specification Change Notice
SOCD	Source Control Drawing
SPEC	Specification

CHECK THE MASTER LIST--VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 20 of 80</b>

STD      Standard  
 SVD      Software Version Description  
 VICD     Vendor Item Control Drawing  
 WT        Windchill Technology

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 21 of 80</b>

## **Appendix C. Project Code, Board Code, Program Control Number (PCN), Change Request (CR), Deviation-Waiver Approval Request (DAR), Control Board Directive (CBD), and Configuration Item (CI) and Effectivity Identifiers**

C.1 Project Code, Board Code, and CI and Effectivity Identifiers. The CCB Secretariat shall reserve the following identifiers from the MSFC Release Desk.

### C.2 Project Code

C.2.1 Project Code for ICMS. The Project Code shall be assigned as 2 alpha characters when ICMS is utilized for MSFC Release (e.g., AX, BI, ET, WR, XX, etc.). Project Codes are assigned by the MSFC Release Desk to be a unique code.

C.2.2 Project Code for ICE Windchill. The Project Code shall be assigned as 2-8 alphanumeric characters, with the last character in the Project Code required to be alpha when ICE Windchill is used for release (e.g., WR, WRS, WRSR, 1X, A1X, AR1X, 6A, 67A, 679A, etc.). A unique Project Code is assigned by the MSFC Release Desk for each Program, Project, Element, or Activity.

C.2.3 Use of Project Code. The Project Code is used as part of the PCN and as part of the Board Code (which is also used as part of the control board directive (CBD) number). The Project Code is part of the ICMS and ICE Windchill effectivity identifiers. Use of the Project Code in these numbers aids visibility of the project/product identification on the change package data and within the release database.

C.3 Board Code. The Board Code shall be assigned in the following format: *ProjectCode* defined in C.2 plus a 1-digit number representing the board level, a dash, then a 2-digit sequential number assigned to each project board existing at that board level (e.g., *ProjectCode3-01*, *ProjectCode3-02* represents two Level 3 boards for the same Project; *ProjectCode4-01*, *ProjectCode4-02*, *ProjectCode4-03* represents three Level 4 boards for the same Project). A unique Board Code is assigned to each Board by the MSFC Release Desk.

C.4 Control Board Directive (CBD) Number. The CBD number shall be assigned in the following format: Board Code as defined in C.3, a dash, then a 4-digit sequential number. The sequential number begins at 0001 and increments by one for each CBD issued under a specific board code (e.g., *BoardCode-0001*, *BoardCode-0002*). CBD numbers are assigned from a log maintained by the project CM function.

C.5 PCN. The PCN shall be assigned in the following format: *ProjectCode00001* where *ProjectCode* is as defined in C.2 and "00001" is a 5-digit numeric sequence number. The sequence number begins at 00001 and increments by one for each PCN assigned for that project code. PCN numbers are assigned from a log maintained by the project CM function.

C.6 Change Request (CR) or Engineering Change Request (ECR) Number. Projects or organizations shall utilize the CR-ECR numbering scheme in C.6.1 or establish a numbering

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 22 of 80</b>

scheme for CR-ECR numbers and document the numbering scheme in the project CM Plan or organizational document. CR/ECR numbers are assigned from a log maintained by project CM or the originating organization.

C.6.1 Standard CR/ECR Numbering Scheme. The CR/ECR number is assigned as Project Acronym-sequential number or Org Code-sequential number, where the sequential number increments by one for each CR/ECR number assigned per Project Acronym or Org Code (e.g., EE12-0001, SLS-00001).

C.7 Deviation/Waiver Approval Request (DAR) Number. The Deviation-Waiver number is assigned by the MSFC Release Desk in the following format D or W - 2 digit year - 4 digit sequence number (e.g. W-12-1376). The sequence number is assigned by the MSFC Release Desk from a continuous sequence. The sequence number is not dependent on the D-W or year prefix.

C.8 Effectivity Identifiers in ICMS.

C.8.1 Effectivities in ICMS shall be assigned for each CI or top assembly number.

C.8.2 Effectivity identifiers in ICMS shall consist of the Project Code plus a 3-digit sequential number for each effectivity unit number assigned for that Project Code (e.g., XX001, XX002, XX100, XX203).

C.8.3 Effectivity unit number 001 is typically utilized as the effectivity code for documentation release.

C.8.4 One effectivity identifier may be assigned to multiple top assembly part numbers.

C.8.5 Where multiple units are being produced, an effectivity unit number may be assigned to represent each individual planned unit.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 23 of 80</b>

Example Effectivity Code Assignments:

<b>Top Assembly Part No.</b>	<b>Description</b>	<b>No. of Units</b>	<b>Effectivity Identifier</b>
n/a	Project XX Documentation	n/a	XX001
96MXXXXXX-001	Project XX Flight 001	1	XX002
96MXXXXXX-003	Project XX Flight 002	1	XX003
n/a	Project XY Documentation	n/a	XY001
97MXXXXXX-001	Project XY Flight Unit	1	XY002
97MXXXXXX-003	Project XY Ground Unit	1	XY003
97MXXXXXX-005	Project XY Flight Unit On-Orbit Configuration	1	XY004
n/a	Project XZ Documentation	n/a	XZ001
97MXXXXXX-001	Project XZ Flight Unit	2	XZ101, XZ 102
97MXXXXXX-003	Project XZ Ground Unit	2	XZ 201, XZ 202
97MXXXXXX-005	Project XZ Flight Unit On-Orbit Configuration	1	XZ 301

### C.9 Effectivity Identifiers (CI and Effectivity Unit Numbers) in ICE Windchill

Effectivities in ICE Windchill shall be assigned for each CI.

The table below shows the formats for CI-End Item Part and effectivity assignment in ICE Windchill. These formats are further described in specific C.9 subsections.

<b>Item</b>	<b>ICE Windchill Field</b>	<b>Required Format</b>	<b>Example</b>
<b>CI Number</b>	End Item WT Part Number	<i>ProjectCode</i> -CI Acronym- CI Usage (40 characters maximum)	SLS-LVSA-FLT
<b>CI Name</b>	End Item WT Part Name	Descriptive Name (60 characters maximum)	SLS Launch Vehicle Stage Adapter (LVSA) Flight
<b>Effectivity Unit Numbers</b>	NOTE: Effectivity unit numbers are not entered into ICE Windchill in advance, they are entered into the Effectivity Range field per CBD release package	NN (6 characters)	000001, 000002

#### C.9.1 Identify CIs

For each item identified as a CI where configuration documentation will be released in accordance with the processes of this standard (e.g., flight units, qualification units, GSE, development test units), the CI shall be included in the CI-Effectivity List described in C.10.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 24 of 80</b>

### C.9.2 Create CI Object in ICE Windchill (End Item WT Parts)

An End Item WT Part shall be created in ICE Windchill for each CI so that releases may be made effective against the CIs. The End Item WT Part representing the CI is either created by the MSFC Release Desk, or the MSFC Release Desk verifies that the End Item Part was created correctly.

C.9.2.1 CI Number/End Item WT Part Number. The CI Number/End Item WT Part number is requested by project CM and assigned and logged by the MSFC Release Desk. The End Item WT Part number must be a unique number. The following format is recommended:

*ProjectCode* -CI Acronym-CI Usage with a maximum of 40 characters. NOTE: CI Usage is typically FLT for flight, QUAL for qualification, GND for ground, etc.

C.9.2.2 CI Name/End Item WT Part Name. The CI Name/End Item WT Part name shall be a descriptive name with a maximum of 60 characters that contains the type of CI (i.e. Flight, GSE, STE, Qualification Test or Qual Test, Development Test or Devel Test, Integrated Test, etc.) plus other descriptive text.

### C.9.3 Assign Effectivity Unit Numbers

Effectivity unit numbers shall be assigned to represent planned as-designed units and included in the CI-Effectivity List described in C.10. Effectivity unit numbers are assigned in the following format: NN where the NN consists of 6 characters, and NN is assigned as a unique number within the CI Number/End Item WT Part Number. The numeric sequence per CI Number/End Item WT Part Number is recommended to start at 000001, 000101, 001001, 010001, or 100001. Numbers may be assigned non-sequentially if desired, but each assigned number should be recorded in the CI-Effectivity List.

NOTE 1: ICE Windchill effectivity format will allow alpha characters as well as numeric, but a fully numeric string is recommended.

NOTE 2: ICE Windchill effectivity format will accommodate entry of an open ended range of effectivity unit numbers (e.g., “100001-“ means 100001 and all subsequent units). But manufacturing and quality forms and systems that record effectivity from the released EPLs may not correctly interpret open ended ranges. For this reason, individual effectivity unit numbers or closed number ranges should be planned and recorded to ensure the exact unit numbers are understood.

C.9.3.1. The effectivity unit number shall not be included in the part configuration identification information.

C.9.3.2. The effectivity unit number does not represent the specific serial number assigned to an as-built unit. Correlation between a planned unit’s effectivity unit number and an actual serial numbered unit has to be documented external to the release system (e.g., in a document).

C.10. CI-Effectivity list. The CCB Secretariat shall document CI/top assembly and effectivity information on MSFC Form 4341 or equivalent format identified in the CM Plan and provide a



<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 25 of 80</b>

copy of the latest authorized CI-Effectivity List to the MSFC Release Desk. The CI-effectivity list information specified in C.10.2 may be included in a form or in a document which includes a tabular format.

C.10.1. Authorization of CI-Effectivity list. The CI/top assembly and effectivity list information shall be approved by the CCB or other Approval Authority which has baseline authority over the CIs included in the CI-effectivity list. The CI-effectivity list should be approved prior to the first release which is made effective against the CIs listed in the effectivity list.

C.10.2. Content for CI-Effectivity list. A CI-effectivity list shall contain the following minimum information.

C.10.2.1 The following information shall be provided per CI-effectivity list form/document.

- a. CBD/Approval Authorization Number
- b. Date of CI-effectivity list form/document
- c. Project Name and acronym
- d. CCB Codes authorized to release against CIs/effectivities listed in effectivity list form/document

C.10.2.2. The following information shall be provided for each CI line item.

NOTE: Where “ICMS” is specified, the required data is unique to effectivity implementation in ICMS. Where “ICE Windchill” is specified, the data is unique to effectivity implementation in ICE Windchill.

- a. CI Number (ICE Windchill)
- b. CI Name-Description
- c. Effectivity Identifier (ICMS)/Effectivity Unit Numbers (ICE Windchill)
- d. Number of Units
- e. Top Assembly Part Number (ICMS)
- f. Application (e.g., Flight, Development)
- g. Design Activity Organization

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 26 of 80</b>

## **Appendix D. Technical Approval Matrix**

D.1 The project CM Plan shall identify the technical approvals to be applied to configuration documentation prior to CCB authorization/release using the method in D.1.1 or D.1.2.

D.1.1 Reference the Technical Approval Matrix in Table V.

D.1.2 Establish a project-unique technical approval matrix in the project CM Plan or separate document referenced from the CM Plan.

D.1.3 Section D.2 and Table V may be used as the starting point for CM Plan text and a project-unique technical approval matrix. When creating the project-unique matrix, other engineering or project-level approvals may be designated in addition to these technical approvals.

NOTE related to Document approvals: The discipline approvers in the technical approval matrix are primarily utilized for detailed design data such as parts, EPLs, drawings, CAD models, and EOs. Documents such as specifications and ICDs are usually reviewed through the CCB's CR evaluation process instead of applying technical approvals in advance of the CR submittal. Therefore, Checking is the only technical approval listed in Table V for Documents, with the function of checking the document format prior to release.

D.2 The Technical Approval Matrix defines the technical approvals required to be applied to parts/EPLs, drawings, CAD models, EOs, and documents prior to change request (CR) submittal to the project CCB for evaluation, disposition, and release through the MSFC Release Desk. The technical approvals help ensure that engineering products are technically correct prior to evaluation and authorization by the project CCB.

D.2.1 The technical approvals defined in Table V are obtained by the organization that prepares the detailed design data prior to CR submittal to the Project CCB process.

D.2.2 The CCB Chairperson can waive technical approvals for a specific CR by submitting in writing the technical approvals being waived and the CR number to the CCB Secretariat.

D.2.3 The CCB Secretariat verifies that approvals from the functions designated in the technical approval matrix have been obtained prior to CCB evaluation and disposition.

D.2.4 The Floor Engineering Order (FEO)/Engineering Parts List (FEPL) is used to expedite a change to a drawing or EPL at the MSFC in-house manufacturing service provider's shop floor or test area prior to processing a CCB-authorized EO or EPL change for release. Approval of the FEO/FEPL authorizes manufacturing-test to implement the change immediately. If the CCB determines that the EO/EPL change already implemented by the FEO/FEPL is not needed, a new change will be required to return to the original condition. Therefore, the Project Manager's (or designee's) approval on the FEO/FEPL is critical because the FEO/FEPL authorizes work which may incur cost.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 27 of 80</b>

<b>TABLE V. TECHNICAL APPROVAL MATRIX</b>									
<b>Approvals required prior to change request (CR) submittal to the Project CCB for evaluation, disposition, and release through the MSFC Release Desk</b>									
<b>Document Type</b>	<b>Checking and Release Desk (Precheck)</b>	<b>Manufacturing (Producibility)</b>	<b>Quality (Inspectability)</b>	<b>Stress</b>	<b>Materials</b>	<b>Next Higher Assembly</b>	<b>Branch Chief*</b>	<b>Project Manager**</b>	<b>Project CCB</b>
Advance Engineering Parts List (EPL) (parts only, drawing-model not ready for release)	x	x	x		x		x		x
Drawing, EPL, CAD Model, or Engineering Order (EO) releasing new content for procurement or manufacturing - initial release, EPL version update, drawing revision, CAD model revision, or EO	x	x	x	x	x		x		x
Drawing revision or EPL version update incorporating only previously approved EOs (no new content)	x						x		x
Supporting CAD model release (supporting model not used to manufacture and not dynamically linked to released drawing)	x						x		x
Envelope Drawing - Initial, Revision, or EO	x		x			x	x		x
Schematic - Initial, Revision, or EO	x		x				x		x
Drawing Tree - Initial, Revision, or EO	x						x		x
EPL effectivity only change	x						x		x
Records Correction EO/EPL	x						x		x
Non-part Drawing (document-form A-size drawing)	x						x		x
Document	x								x
Floor EO/Floor EPL (FEO/FEPL)		x					x**	x**	***

**Approvals to left are applied prior to CR submittal to the CCB process**

\*NOTE 1: The Branch Chief and Project Manager may delegate their approval to another role. The primary role will identify the designee's role to the CCB Secretariat in writing prior to the designee approving for the primary role. This delegation may be identified to apply to all changes, or on a per change basis.

\*\*NOTE 2: The Branch Chief and Project Manager approval on the FEO/FEPL may be obtained by email. The email should state the approver's name, approval date, and the FEO/FEPL number being approved. The originator will attach the email to the FEO/FEPL form.

\*\*\*NOTE 3: The FEO/FEPL are not authorized by the Project CCB. See section D.2.4.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 28 of 80</b>

## **Appendix E. Part, Drawing, CAD Model, and Document Numbering and Version-Revision Identifiers**

E.1 Drawing Numbers. Base drawing numbers shall be assigned by the Release Desk per the format in paragraph E.1.1. The Release Desk, upon request, can assign blocks of base drawing numbers to organizations. The organization requesting the block of numbers shall be responsible for tracking and assigning the specific base drawing numbers within the assigned number block.

### E.1.1 MSFC Base Drawing Number Format.

MSFC base drawing numbers shall be assigned in the following format:

YZMXXXXX, where

YZ = 2-digit number

M = "M"

XXXXX = 5-digit number assigned sequentially starting at "00001" for each combination of YZ

The following YZ combinations have been reserved as specified:

"10" - "89", "91" - "94" = assigned to previous projects or organizations

"90" = Special Test Equipment (non-flight)

"95" - "99" = current series assigned by the MSFC Release Desk

E.1.2 Drawing Number Assignment for Drawings Released in ICMS. For drawings released through ICMS, the base drawing number may be utilized as the drawing number for all types of drawings (e.g., 9XMXXXXX for mono-detail and multi-detail drawings). The numbering rules defined for use in ICE Windchill may also be used in ICMS (optional).

E.1.3 Drawing Number Assignment for Drawings Released in ICE Windchill. The rules in this section shall be utilized for assignment of drawing numbers for drawings released in ICE Windchill. These numbering rules may also be utilized for drawings released in ICMS (optional).

E.1.3.1 For mono-detail drawings, the drawing number shall match the part number (e.g., 9XMXXXXX-00X).

E.1.3.2 For tabulated drawings, the drawing shall be numbered with the base drawing number (e.g., 9XMXXXXX).

E.1.3.3 For drawings with a shown configuration (e.g. 9XMXXXXX-001) and an opposite configuration (e.g., 9XMXXXXX-002 that is referenced only with no view), the drawing shall be numbered with the shown part number (e.g. 9XMXXXXX-001).

E.1.3.4 For inseparable assembly drawings, the drawing shall be numbered with the part number of the inseparable assembly. See E.5.5 for inseparable assembly part numbering requirements.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 29 of 80</b>

E.2 Part Numbers (P/N). Each MSFC part or assembly part number shall include a base drawing number and a unique dash number. The MSFC part/assembly procurement specification number shall not be used as a part number. The procurement specification, which may be used to procure more than one part, is referenced on the part drawing

E.3 Unique Part Identification Numbers (PIN). The MSFC part/assembly PIN consists of the CAGE Code, part number, and the serial or lot number. The part number provides a path to the "as-designed" configuration data which describes the part. The part and serial number provide a path to the "as-built" configuration data.

E.3.1 Part Configuration Information in ICMS. For parts released in ICMS, the part number and EPL dash number and revision (which includes the drawing revision) are needed to trace to the part configuration documentation. The part configuration documentation includes the drawing, EPL, and unincorporated EOs. These identifiers are needed because more than one drawing revision and EPL number may be active for an assembly part, which could result in multiple non-interchangeable configurations for the same part number.

E.4 Use of Previous CAGE Code Versus New CAGE Code. The previous CAGE Code used for MSFC design documentation was 14981. The objective during the transition from using the old CAGE Code to the new CAGE Code is for the CAGE Code marked on the hardware to match the CAGE Code on the drawing. Apply the following rules when identifying the CAGE Code:

E.4.1 Where the drawing was initially released using CAGE Code 14981 and there is existing hardware marked with 14981, drawing revisions should continue to use CAGE Code 14981.

E.4.2 Where the drawing was initially released using CAGE Code 14981 but there is no existing hardware marked with 14981, drawing revisions shall use the new CAGE Code 339B2.

E.4.3 All new drawings shall use CAGE Code 339B2.

E.5 Dash Numbers. A dash number system shall be used to identify parts, assemblies, or installations, which are completely described on drawings. Such part numbers shall consist of the base drawing number with a dash number suffix.

E.5.1 Odd and Even Dash Number Suffix Assignment. Odd dash numbers, (e.g., -001, -003, -005, etc.; -101, -103, -105, etc.; -201, -203, -205, etc.) shall be assigned to the shown part on the drawing. Even dash numbers, (e.g., -002, -004, -006, etc.; -102, -104, -106, etc.; -202, -204, -206, etc.) shall be assigned to the opposite part (not shown) on the drawing.

E.5.2 The use of dash numbers is classified as follows:

E.5.2.1. To denote the shown and opposite-hand part of details, assemblies, or installations.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 30 of 80</b>

E.5.2.2. To designate a part detailed on a detail, assembly, or installation drawing, including parts or bulk material (e.g., the pieces that make up a window of laminated glass, molded rubber parts with metal weldments, tape, wires, adhesives, etc.)

E.5.2.3. To provide part numbers for the variations shown on tabulated and non-tabulated drawings.

E.5.2.4. On tabulated detail drawings utilizing tabulation blocks, no other listing is required. For other non-tabulated versions, list the tabulated part numbers above the title block thus:

97MXXXXXX-005     NOTED  
97MXXXXXX-003     NOTED  
97MXXXXXX-001     SHOWN

E.5.2.5. To visibly show a connectivity between parts through the part number, though the parts may be defined in different drawings.

E.5.3 Odd Dash Number Assignment for Drawings released in ICMS. The first part shown on a multi-detail drawing shall be assigned the part number “base drawing number -001.” The -001 shall also be assigned as the part number to the first total version shown on an assembly or installation drawing. The identification shall be so noted immediately above the title block thus: 97MXXXXXX-001 SHOWN or 97MXXXXXX-001 ASSY SHOWN. Detail parts defined on a “detail assembly” drawing shall be dash numbered with consecutive odd numbers, beginning with -003, i.e., -003, -005, -007, etc., if only one assembly is anticipated. If more than one assembly is anticipated, numbering of the detail parts should start with -009 or higher.

E.5.4 Even Dash Number Assignment for Drawings released in ICMS. Even dash numbers shall be used to denote opposite-hand (mirror image) parts, assemblies, or installations to those shown.

E.5.4.1. The opposite part shall be assigned the next consecutive even dash number. For example: -002 would be the opposite of -001, -006 the opposite of -005, etc. The opposite part need not be pictured but shall be noted. Where the opposite part is noted for a total version of an assembly, installation, or detail drawing, it shall be so noted above the title block thus:

97MXXXXXX-002     OPPOSITE  
97MXXXXXX-001     SHOWN

E.5.4.2. Opposites of details completely described on detail assembly or installation drawings shall be noted in the callout on the body of the drawing. A part that is difficult to visualize as an opposite shall require a new drawing and drawing number. Dash numbered assemblies may share a drawing but shall have separate EPLs. Multiple assemblies (-001, -003, -005, etc.) may be shown on the same drawing, but each shall have its own separate EPL.

E.5.5 Dash Number Assignment for Inseparable Assemblies released in ICE Windchill. For inseparable assemblies released in ICE Windchill, the assembly and parts shall be numbered in

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 31 of 80</b>

accordance with E.5.5.1. For inseparable assemblies in ICMS, the numbering requirements in E.5.5.1 are optional but may be used.

E.5.5.1 The inseparable assembly shall be numbered as -101, and the parts that make up the assembly that are detailed in the same drawing shall be numbered as -103, -105, -107, etc. If the inseparable assembly requires part number re-identification, the new assembly may be numbered as -201, and the parts on the same drawing may be numbered -203, 205, -207, etc.

E.6 Matched Set Dash Numbers. Dash numbers shall be assigned to two or more matched or machined parts that are not interchangeable. The following rules apply:

E.6.1. When an assembly is created using matched parts, each part shall be identified with a different dash number and a separate EPL.

E.6.2. The next higher assembly(s) shall identify each matched part on its drawing(s) and its EPL(s) until the matched parts are reassembled as a matched set.

E.6.3. Matched parts drawing requirements shall be per MSFC-STD-2806.

E.7 Alternate Parts. When a part is an alternate part to another part on the EPL, the two parts shall share a Find number.

E.8 Numbering and Naming of Parts, Drawings, and CAD Models in ICE Windchill  
Table VI outlines the policy for assigning unique identification to CAD models, drawings, and WT Parts in ICE Windchill.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 32 of 80</b>

**Table VI. Number and Name of ICE Windchill Part, Drawing, and CAD Model Objects**

<b>ICE Windchill Object</b>	<b>3-D CAD Model</b>	<b>Drawings</b>	<b>WT Parts</b>
<b>Number</b>	Part number (9XMXXXXX-XXX)	See drawing numbering requirements in E.1.3 to determine whether drawing base number (9XMXXXXX) or part number (9XMXXXXX-XXX) is used as the drawing number.	Part number (9XMXXXXX-XXX)
<b>Name</b>	Assign name using the Drawing Title requirements in the GDRM Sec 8.0 procedures or ASME Y 14.100 Section 5.0/Appendix C plus additional description specific to that part	Assign name from Drawing Title requirements in the GDRM Sec 8.0 Procedures or ASME Y 14.100 Section 5.0/Appendix C	Assign name using the Drawing Title requirements in the GDRM Sec 8.0 procedures or ASME Y 14.100 Section 5.0/Appendix C plus additional description specific to that part
<b>Filename</b>	Part number plus file extension (.prt or .asm)	Drawing number plus file extension (.dwr)	n/a (no content)

## E.9 Document Numbers

E.9.1 Documents Released through ICMS. Project documents that are released by the MSFC Release Desk utilizing ICMS shall be numbered with unique “MSFC–” numbers.

E.9.2 Documents Released through ICE Windchill or Project Release. Project documents that are released by the MSFC Release Desk utilizing ICE Windchill or released by the Project may be numbered with unique “MSFC–” numbers or may utilize a project-unique numbering scheme. The project-unique numbering scheme shall be documented in a project-controlled document (e.g., Project Plan, CM Plan, or Data Management Plan). To help ensure document number uniqueness, it is recommended to utilize the project acronym or other project identifier as the first part of the project-unique numbering scheme.

E.9.3 MSFC Document Number Assignment. MSFC document numbers are assigned by the MSFC Release Desk upon request in accordance with the following numbering scheme:

MSFC–XXXX–NNNN, where “MSFC” indicates a MSFC document, “XXXX” is the abbreviation of the document type (three or four characters), and “NNNN” is a sequentially assigned number, regardless of the type of document prepared (e.g., MSFC-SPEC-1234, MSFC-STD-2345, MSFC-HDBK-3456).

Common abbreviations for document types; others may be documented by the Project:

BDGT	Budget
HDBK	Handbook



<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 33 of 80</b>

ICD	Interface Control Document
MNL	Manual
PLAN	Plan
PROC	Procedure
RPT	Report
RQMT	Requirements
SCHE	Schedule
SPEC	Specification
STD	Standard
SVD	Software Version Description

#### E.10 Revision Scheme for WT Parts, Drawings, CAD Models, and Documents

The following revision scheme shall be utilized for drawings, CAD models, WT Parts, and documents released by the MSFC Release Desk through ICMS or ICE Windchill.

##### E.10.1 Numeric Revision Used Pre-Release

The numeric revision scheme (1, 2, 3, etc.) may be used prior to initial release or for organization release.

##### E.10.2 Dash or Baseline Revision for Release

The dash (-) revision shall be used to indicate the initial revision for parts, drawings, CAD models, and associated documents (e.g., EPLs, EOs) that are submitted for release. For textual documents (e.g., specifications, standards, plans, etc.), the term “Baseline” shall be used within the document to indicate the initial revision.

##### E.10.3 Revision Letters After Initial Release

In accordance with ASME Y14.35, drawings, CAD models, WT Parts, and documents shall utilize the following revision scheme:

E.10.3.1 Alpha characters shall be assigned in alphabetical sequence for release revisions, starting with A, skipping the letters I, O, Q, S, X, and Z.

E.10.3.2 After the letter Y, the revision scheme shall use 2 alpha characters, AA, AB, etc., still skipping the letters I, O, Q, S, X, and Z whether in the first or second letter of the revision identifier.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 34 of 80</b>

## **Appendix F. Software, Firmware, and Configurable Logic Device Identification**

F Software, Firmware, and Configurable Logic Devices Identification and Marking. The developing organization shall uniquely identify and mark software, firmware, and configurable logic devices (CLDs).

F.1 Software Identification and Marking. Each release of software shall be identified. When physically possible, software identification data shall be evident at boot-up, at request of a user, or as part of transmitted telemetry information. The software identifier and version number shall also be noted in the log book of the item in which the software is loaded. Software programs and media shall be identified with the following information:

- a. Software identifier
- b. Version or build number
- c. Software Version Description (SVD) document number
- d. Project Name
- e. CSCI
- f. The date of software release
- g. Notice of availability (e.g., SBU, export controlled – see NPR 1600.1)
- h. Contract number, if applicable
- i. When software is issued in hard media format such as discs, the following additional requirements apply:
  1. Disc number for multiple disc sets (e.g. Disc 1 of 2, 2 of 2, etc.)
  2. If software developer requires distribution controls of discs, each issued disc shall be numbered sequentially, (e.g. 001, 002, etc.) and software configuration management shall record who receives each copy as an official record

### F.2 Firmware Identification and Marking.

F.2.1 Firmware shall be identified under a single part number defining both the hardware device and the embedded software code. The single part number makes the software an integral part of the configuration definition.

F.2.2 The part number shall be marked or labeled on the firmware device, or if the device is too small, on the next higher assembly.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 35 of 80</b>

F.2.3 The part number of the hardware device and the embedded code identifiers shall be specified on the drawing.

F.2.4 The drawing shall be assigned to the level of assembly (e.g. chip level, board-level, or box-level, as appropriate) at which the programming of the firmware into the hardware is accomplished.

F.2.5 The drawing shall contain or reference the following information:

- a. Firmware identifier (part number)
- b. Version or build number
- c. Identification of Software Design Specification if software being loaded is a CSCI
- d. Project Name
- e. Notice of availability (e.g., SBU, export controlled) – mark drawing in accordance with MSFC-STD-2806
- f. Contract (if applicable)
- g. Hardware (e.g. Chip, board, box) identifier – (hardware vendor’s part number)
- h. Design of software (code, compiler instructions, resulting data files) being loaded into device
- i. Labeling requirements (part number and serial number) re-identifying the chip per the drawing.

F.2.6 The firmware shall be replaced if the part number changes, and the new firmware shall be noted in the log book.

F.2.7 The change action shall be accomplished by incorporation of EOs or drawing revisions, or installation of a modification kit

F.3 Configurable Logic Devices (CLD). CLD is a generic term describing an integrated circuit that can be programmed to perform complex logic functions. For labeling purposes, CLDs are classified as follows:

F.3.1 Non-reconfigurable (One-Time Programmable). Labeling for non-reconfigurable chips is like firmware and controlled by drawing and parts identification. When issuing a change, the developer shall issue a drawing revision, and EO, or a mod-kit for field replacement of the obsolescent chip. The drawing for the device shall include or reference the following information.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 36 of 80</b>

- a. Design identifier functional name or description
- b. Version or build number
- c. Chip identifier – hardware vendor’s part number
- d. Identification of design for logic programming (the code, compiler instructions, and resulting data files)
- e. Project Name
- f. Notice of availability (e.g., SBU, export controlled – mark drawing in accordance with MSFC-STD-2806)
- g. Contract (if applicable)
- h. Labeling requirements (part number and serial number) re-identifying the chip per the drawing.

F.3.2 Reconfigurable. A reconfigurable CLD is distinct from an in-circuit reconfigurable device (see below) in that the device must be removed from the assembly in which it is installed in order to change the programmed configuration. The following requirements apply:

- a. The initial configuration of the device shall meet the requirements for a Non-Reconfigurable CLD
- b. Subsequent reconfigurations, once removed from the assembly in which the chip has previously been installed, if any, shall meet the requirements of a Non-Reconfigurable CLD, plus
  1. It shall include instructions for removal of the previous design.
  2. It shall include instructions, if required, for removing previous labeling that is obsolete and applying new labeling per the new design.

F.3.3 In-Circuit Reconfigurable. The initial configuration of the component at the time the device is installed into the next higher assembly, if configured other than in the configuration shipped from the original manufacturer, shall be recorded on a drawing and identified with a part number at the level of assembly (e.g. chip, board, box) at which the initial configuration is made.

- a. The drawing shall include the following information:
  1. Firmware identifier (part number)
  2. Version or build number – (subject to iteration)

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 37 of 80</b>

3. Chip identifier – (hardware vendor’s part number)
4. Project Name
5. Notice of availability (classification sensitivity of software (SBU, export controlled)) – mark drawing in accordance with MSFC-STD-2806
6. Contract (if applicable)
7. Method of documenting additional configurations
8. Labeling requirements (part number and serial number) re-identifying the chip per the drawing.
  - b. The loaded configuration shall be reconfigured if the part number changes and the new design load shall be noted in the log book. The change action shall be accomplished by incorporation of EO’s or drawing revisions, or installation of a modification kit.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 38 of 80</b>

## **Appendix G. Serial and Lot Number Requirements and Guidance**

G.1 Serial Numbers: Serial numbers shall be assigned to all complete units of a Configuration Item (CI) and to critical parts and components when traceability is necessary. Section G.7 provides guidance on application of serialization requirements. Serial numbers shall be permanently assigned in consecutive and non-duplicating numerical sequence for a particular part number and shall not be changed even though the component, assembly, or part has been identified by a new part number. To ensure traceability, all assemblies containing a serial numbered item should also be serialized. Section G.8 provides guidance on including traceability requirements in drawing notes.

G.2 Lot Numbers: Lot numbers shall be assigned for non-serialized items that require traceability where all items have been fabricated from a particular batch of material, have undergone a particular process, or have been manufactured/tested in a group with each item in the group having an identical history.

G.3 Design organizations shall specify product identification and traceability in design documentation. Design engineers shall recommend traceability levels to the ~~program~~/project. If traceability is required, the design organization shall specify serialization or lot numbering on the design documentation for the hardware and the hardware's next higher assemblies.

G.4 When MSFC-designed equipment is to be procured, the MSFC personnel submitting the purchase request shall do one of the following:

G.4.1 Obtain the required serial or lot numbers from the MSFC Release Desk and include them in the purchase request. NOTE: A range of numbers may be requested to cover both delivered items and non-delivered items (e.g., traceable items destroyed during manufacturing or testing at the supplier location).

G.4.2 Identify the part number and quantity of parts being procured to the MSFC Release Desk concurrent with the purchase request. Upon receipt of the parts, report the supplier-assigned serial numbers to the MSFC Release Desk.

G.5 MSFC personnel shall obtain serial numbers and lot numbers from the MSFC Release Desk for in-house items or items procured to MSFC design where the design was released by the MSFC Release Desk. The following information shall be provided to the MSFC Release Desk at the time of the request:

- a. Drawing number of the parts for which serial/log numbers are required
- b. Part number(s) for which serial/lot numbers are required
- c. If the part for which serial numbers are being requested has been re-identified from a previous part number, provide the previous part number and existing serial numbers.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 39 of 80</b>

- d. Quantity of parts for each part number that require serial numbers
- e. Number of lots required per part number
- f. Unique serial or lot number construction, if required

G.6 Serial/Lot Number Log and Format. Serial/lot numbers shall be assigned and logged by the MSFC Release Desk when requested. The MSFC Release Desk shall assign serial/lot numbers consecutively per part number in the following format, 001, 002, 003, etc., unless a unique serial or lot numbering format is specified by the requester.

G.7 Serial and Lot Number Traceability Guidance

When determining traceability requirements for a project, the Fracture Control Plan, EEE Parts Control Plan, Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL), and Limited Life Items List should contain information which aids the project in identifying the parts which require traceability, and therefore require serialization and lot numbering.

G.7.1 Serialization. The following types of equipment/hardware and their next higher assemblies typically require traceability and should be considered for serialization. Figure 1 shows an example of a product-drawing structure where serial number traceability may be required in the hierarchy.

G.7.1.1 Electro-mechanical, Electrical, Electronic (EEE), and mechanical assemblies and subassemblies which are replaceable or repairable such as valves, actuators, pressure vessels, batteries, telemetry multiplexers, amplifiers, transducers, modules, printed circuit boards, etc.

G.7.1.2 Structural items having critical design significance which are controlled and for which test and inspection records are required and maintained (e.g., fracture-critical parts, pressure vessel assemblies, forgings, castings, extrusions, etc.).

G.7.1.3 Articles or assemblies subject to time-cycle variation limitations, periodic checkout, calibration, servicing and maintenance, and re-inspection.

G.7.1.4 Articles requiring selective fits for matched sets of functional assemblies.

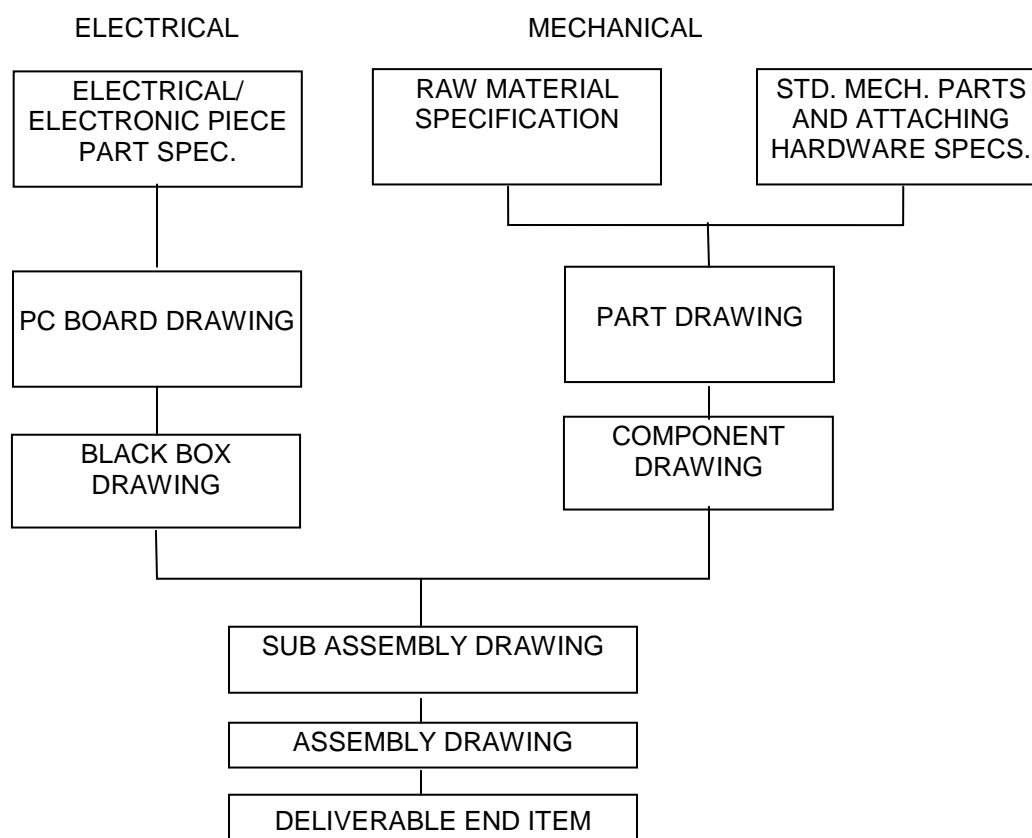
G.7.2 Lot Number and/or Date Codes. The following types of equipment/hardware typically require traceability and should be considered for assignment of lot number and/or date codes and applicable manufacturer's Commercial and Government Entity (CAGE) Code:

G.7.2.1 Electronic parts, such as transistors, resistors, diodes, capacitors, switches, connectors, and relays. Additional traceability requirements for electronic parts are addressed in MSFC-STD-3012.

MSFC Technical Standard EE12		
Title: MSFC Engineering Documentation Standard	Document No.: MSFC-STD-555	Revision: J
	Effective Date: June 17, 2013	Page 40 of 80

G.7.2.2 Items fabricated from a common lot of raw material, heat, batch, or process, such as non-critical forgings and castings, fittings, or items which are subjected to destructive acceptance sampling such as fasteners and pyrotechnic devices.

G.7.2.3 Raw materials such as plastic molding powder and molded parts, electrical potting compounds, paints, greases, adhesives, welding rod or wire, and gasket materials.



**Figure 1. Serial and Lot Traceability in Drawing Hierarchy (Guidance)**

**G.8 Guidance on Recording Traceability Requirements in Drawing Notes**

Engineering drawings should include traceability identification requirements in the drawing notes. Notes should address the following:

G.8.1 Serialization, lot/date traceability, and materials traceability as required per MSFC-STD-555 and project documentation. For material traceability, traceability levels are defined in Appendix H. It is recommended that the full text of the material traceability level requirements are included in the drawing notes instead of referencing back to MSFC-STD-555. This is because MSFC-STD-555 applies to MSFC in-house, and suppliers working to the drawing may not have access or be required to adhere to MSFC-STD-555. It is acceptable to reference the material traceability level number (1, 2, 3, or 4) in the EPL if the drawing note text includes a



<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 41 of 80</b>

reference to the material traceability level number in addition to the material traceability requirement text.

G.8.2 The Part Identification Number (PIN) to be used (CAGE code/ MFG's name, part number, and associated serial number, lot number, date code, etc.).

G.8.3 The method of applying the Part Identification Numbers (metal stamp, ink stamp, paint, etch, etc.).

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 42 of 80</b>

## **Appendix H. Material Traceability Level Requirements and Guidance**

The material traceability levels defined below apply primarily to mechanical parts, but may also be applied to electrical parts. MSFC-STD-3012 defines traceability requirements that are specific to electrical parts. See Appendix G for guidance related to calling out material traceability requirements in drawing notes.

H.1 Level 1: Requires (a) records containing actual chemical and physical material verification test results, (b) Certificates of Conformance (COCs), (c) detailed process, inspection, and discrepancy records traceable to the material from which fabrication originated, and (d) in-house chemical and physical verification testing.

Level 1 material traceability requirements should be applied for hardware whose failure could result in loss of life, overall mission, Class A/B payload, or “launch vehicle.” Level 1 material traceability requirements provide the highest degree of traceability confidence by requiring in-house chemical and physical verification testing in addition to other stringent traceability documentation requirements.

H.2 Level 2: Requires (a) records containing actual chemical and physical material verification test results, (b) COCs, and (c) detailed process, inspection, and discrepancy records traceable to the material from which fabrication originated.

Level 2 material traceability requirements should be applied for hardware whose failure could result in loss of life, overall mission, Class A/B payload or launch vehicle (the same class of hardware as level 1), and for which in-house testing is not justified. Level 2 traceability requirements provide a high degree of material traceability confidence without the added cost of in-house chemical and physical verification testing.

H.3 Level 3: Requires (a) COCs and (b) limited in-house chemical and physical verification testing or typical chemical and physical material verification test results. In-house chemical and physical testing, as determined by the design organization, shall be used to ensure that material is in compliance with material/drawing specifications in the event that a COC is unavailable.

Level 3 material traceability requirements should be applied for hardware whose failure would not result in loss of life, overall mission, Class A/B payload or launch vehicle (i.e., hardware within a Class C/D payload whose failure affects only that C/D payload). Limited in-house testing on test specimens (i.e., hardness testing, conductivity testing, portable mass spectrometry testing) is appropriate at this level of traceability.

H.4 Level 4: Requires a COC, mill marking, or trace number.

Level 4 material traceability requirements should be applied for hardware for which it is not feasible or not deemed necessary to require detailed raw material traceability (i.e., computer chips traceable by lot number/or date code only; raw material traceability is limited to mill markings, etc.) and whose failure would not result in loss of life, overall mission, Class A/B

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 43 of 80</b>

payload, or launch vehicle. Level 4 material traceability is also appropriate for use in addressing traceability for commercial parts and off-the-shelf hardware for which no formal traceability exists.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 44 of 80</b>

## **Appendix II. Engineering Parts List (EPL) Preparation, Numbering, and Versions in ICMS**

11.1 General. The EPL shall be used to: (1) list all components of an assembly; (2) release detail parts concurrent with or prior to release of their using assembly drawing; and (3) release "nonpart" documents referred to on the assembly drawing (e.g., schematics, etc.).

11.2 Engineering Parts List (EPL). The EPL identifies part(s) information including release authority, part(s) numbers, quantities, weights, traceability requirements and part(s) descriptions required to build the respective assemblies and subassemblies. MSFC separates the EPL from the drawing to allow it to be expeditiously prepared and changed separately from the drawing. In many cases, the drawing does not have to be changed if the find (item) number only (no part number) appears on the assembly drawing.

11.2.1 All parts called out in the assembly drawing shall be listed by find (item) number on the EPL for the drawing. Exceptions to this requirement: Multiple electrical parts from the assembly drawing may be listed under one Find Number when reference designators are used. Also, materials required by a specification or standard referenced in a drawing note are not required to be listed by Find Number on the EPL.

11.2.2 The EPL shall pass a manual and electronic edit before release.

11.2.3 For additional preparation information, refer to the official MSFC forms preparation instructions located in the MSFC Integrated Document Library (MIDL).

11.3 When an EPL is entered in the ICMS through the online system, confirmation data sheets are created. After the transaction is entered, a confirmation edit is run. If there are no errors, the transaction is locked and a confirmation data sheet printed. This sheet shall be used to obtain the approval signatures. These data sheets serve in the same capacity as MSFC Form 420 for approval purposes. When the on-line system is not used, the EPL, MSFC Form 420, shall be utilized for appropriate signatures for all EPL transactions.

11.4 Release approval signature on the EPL being revised and the approved CBD authorize the release of all sub-tier EOs and EPLs being automatically adjusted. The following message shall automatically appear in the revision description of each EO and EPL data sheet being revised: "This revision issued to accomplish effectivity adjustment authorized by EPL/DRL (actual part number, drawing revision, dash number, and dash number revision appear here)."

11.5 The EPL may be revised independently or in conjunction with a drawing change.

11.5.1 When a drawing is revised and the effectivity of the previous revision and new revision are the same, a new EPL (101- ) shall be required which supersedes the previous drawing revision EPL.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 45 of 80</b>

11.5.2 When a drawing is revised and the effectivity of the new revision is not the same, an active EPL shall exist for each drawing revision.

11.5.3 To revise an EPL, only new or changed information shall be entered on the input form.

11.6 The EPL for a detail assembly drawing shall meet the following requirements.

11.6.1. A part number shall be assigned to each part configuration on a detail assembly drawing. For example: Detail assembly drawing 96M00044 has the following part numbers 96M00044-001 and 96M00044-003. Part 96M00044-003 is on the EPL for 96M00044-001.

11.6.2. When the detail assembly drawing is revised, the drawing revision of the detail assembly part listed on the assembly EPL shall be updated to reflect the new release drawing revision.

11.7 EPL Preparation. The confirmation data sheets shall be used to obtain the approval signatures when using the ICMS online system. When the on-line system is not used, MSFC Form 420 shall be used to obtain the approval signatures.

11.8 EPL Identification. The EPL identification consists of the assembly drawing number, dash number, and drawing revision letter plus an EPL dash number (101 to 199) and revision letter(s). The following rules apply to EPLs:

11.8.1 Only one EPL shall exist per assembly dash number/drawing revision.

11.8.2 A configuration definition change to the EPL shall be noted by changing the EPL dash number, regardless of a change or no change to the associated effectivity. Any "revision" to the body of the EPL, shall result in an EPL number change which supersedes the previous EPL number and letter, i.e., 102- supersedes -101B.

11.8.3 An effectivity-only change shall be made by changing the EPL dash number revision letter(s), e.g., 96M12345-101- would go to 96M12345-101A. Any "revision" that only changes the user information shall result in an EPL revision letter change, which supersedes the previous letter, i.e., 101B supersedes 101A.

11.8.4 Each EPL dash number and dash number revision is superseding. Only the numerically highest dash number (i.e., 103 vs. 102) is active, and only the alphabetically highest revision letter (i.e., B vs. A) is active.

11.8.5 Table VII illustrates typical EPL re-identification steps resulting from various types of changes for effectivities that have not flown.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 46 of 80</b>

<b>TABLE VII. EPL Re-identification Steps for Effectivity Changes in ICMS</b>						
Assembly Drawing No.	Dash No.	Drawing Rev.	EPL Dash No.	EPL Dash No. Revision	Effectivity	Type of Change
<b>First EPL (Initial Release)</b>						
97M00005	-1	-	101	-	AA007	New EPL
97M00005	-1	-	102	-	AA007	EPL Chg
97M00005	-1	-	102	A	AA007, AA009	Eff. Only
97M00005	-1	-	103	-	AA007, AA009	EPL Chg.
<b>Second EPL (Drawing Revised, EPL “made from” 97M00005-1-103-</b>						
97M00005	-1	A	101	-	AA010	New EPL
97M00005	-1	A	102	-	AA010	EPL Chg
97M00005	-1	A	102	A	AA010, AA011	Eff. Only
97M00005	-1	A	103	-	AA010, AA011	EPL Chg.
<b>Third EPL (Drawing Revised, EPL “made from” 97M00005-1A-103-</b>						
97M00005	-1	B	101	-	AA008	New EPL
97M00005	-1	B	102	-	AA008	EPL Chg
97M00005	-1	B	102	A	AA008, AA012	Eff. Only
97M00005	-1	B	103	-	AA008, AA012, AA013	EPL Chg.

CHECK THE MASTER LIST--VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 47 of 80</b>

## **Appendix I2. WT Part and Engineering Parts List (EPL) Preparation and Numbering in ICE Windchill**

### I2.1 WT Part Creation

A WT Part shall be created in ICE Windchill for any part or item that needs to be listed on the EPL and included in the product structure. This includes:

- a. Detail parts
- b. Assembly parts
- c. Bulk item parts
- d. Software
- e. Schematics (optional)
- f. Wiring Diagrams (optional)
- g. Drawing Trees (optional)

I2.2 A WT Part shall be assigned a part number as defined in Table VI.

I2.3 A WT Part description, or name, shall be assigned as defined in Table VI.

### I2.4 WT Part Attributes

I2.4.1 WT Parts shall contain the following data:

- a. Part Number
- b. Part Name
- c. Part Version (Revision/Iteration)

I2.4.2 WT Parts may contain the following data:

- a. CAGE Code
- b. Mass
- c. Material
- d. Material Traceability Level
- e. Fracture Critical
- f. Separate Parts List
- g. Drawing-Model Available

I2.4.3 WT Parts may capture the following data related to a part's usage within an assembly:

- a. Find Number
- b. Reference Designators
- c. Quantity
- d. EPL Notes

I2.5 Top Assembly parts/CI parts or any subassembly that requires a separate effectivity application, shall be defined in ICE Windchill as an End Item part.

I2.6 WT Parts shall be submitted for initial release and released at dash revision (-) with the following exceptions.

CHECK THE MASTER LIST--VERIFY THAT THIS IS THE CORRECT VERSION BEFORE USE

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 48 of 80</b>

I2.6.1 WT Parts added within a drawing family (i.e., new parts created from the same base drawing number like 97M70000-001, -003, -005, etc.) on the same drawing (i.e., Revision A or subsequent drawing revision) shall be initially released at the current drawing revision level being released. This applies to new detail parts on a detail assembly drawing, new parts in a tabulated drawing, or new part configurations added to a drawing.

I2.6.2 WT Parts representing bulk, vendor items, or standard parts shall be marked as “Vendor Released” and shall be in a numeric revision (e.g., 1, 2, etc.)

I2.7 Each WT Part revision and iteration is superseding for a specific effectivity. For a specific effectivity, only the highest alpha revision (i.e., A, B) is active, and only the numerically highest iteration (i.e., .1, .2) is active.

I2.8 An effectivity-only change shall be proposed by CR, and if approved, the Release Desk shall update the effectivity on the affected WT Parts, and re-issue the EPL report with a new issue date. The previous iteration of the Engineering Parts List shall be superseded or cancelled.  
NOTE: The WT Part iteration is not an element of the part identification that is marked on a finished part.

I2.9 Detail WT parts shall be released concurrently with a using assembly WT part. This ensures that a relationship has been established in ICE Windchill between the detail WT part, a using assembly WT part, and the CI/end item on which the assembly/detail parts are effective.

I2.10 To enable long lead procurement, an “advance” EPL may be released. The advance EPL release shall consist of an assembly WT Part, the relevant child WT Parts objects, and an EPL that lists the assembly and child parts. As an exception, a MSFC-designed component WT Part with an EPL may be released as an advance EPL, but at the time when the component WT Part is included in an assembly EPL, the component EPL shall be cancelled. The WT Parts included in an advance EPL should have no relationships to CAD models or drawings. The advance EPL should be used when CAD model and drawing information is not mature enough for release, but part information is needed to be released and controlled in support of part procurement.

I2.11. A configuration definition change to a WT Part shall either result in a WT Part revision or establishment of a new WT Part number in accordance with the part number re-identification guidance in Appendix Q.

#### I2.12 EPL Report

I2.12.1 An EPL-report shall be created for assembly WT Parts that are being released, or for a component in an advance EPL that is released without an assembly. In both cases, the Separate Parts List (SPL) attribute for the part shall be marked “Yes”.



<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 49 of 80</b>

I2.12.1.2 The EPL report displays WT part(s) information including part(s) numbers, quantities, mass, and part(s) descriptions required to build the respective assemblies and subassemblies. The EPL report also displays the WT Part relationships for the chosen assembly part.

I2.12.2 An ICE Windchill EPL document object shall be created/ revised to house each EPL Report. The EPL report file is made primary content of the ICE Windchill EPL document object. An EPL document object and draft EPL report may be created by the CR initiator to include with the CR package. The MSFC Release Desk will create the official released EPL report in pdf format and will load that EPL report as primary content into an ICE Windchill EPL document.

I2.12.3 The EPL document object shall be released at the same version letter as the WT Part that it represents.

NOTE: The EPL report is generated from the ICE Windchill product structure view utilizing a configuration specification. The configuration specification, such as effectivity, dictates which versions of each part are displayed. The EPL Report displays the parts structure in an indented format and lists all parts called out in the assembly drawing by find (item) number. NOTE: Multiple electrical parts from the assembly drawing may be listed under one Find Number when reference designators are used.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 50 of 80</b>

## **Appendix J. Drawing Preparation**

Scope. This appendix describes drawing preparation requirements and guidance for drawings released through ICMS or ICE Windchill.

J.1 Drawing Preparation. Drawings shall be prepared in accordance with MSFC-STD-2806, which requires use of the Global Drawing Requirements Manual (GDRM). For flight-qualification parts where the CAD drawing-model set is being released, the requirements of MSFC-STD-3528, section 14, also apply. NOTE: The GDRM is in compliance with the requirements of ASME Y14.100.

J.1.1 Mono-Detail Drawings. For flight-qualification parts where the CAD drawing-model set is being released, drawings shall be mono-detail (one part-one drawing) except for tabulated drawings, drawings with opposite parts, and inseparable assembly drawings. See MSFC-STD-3528 section 14.3.8.

J.1.2 Tabulated Drawings. For flight-qualification parts where the CAD drawing-model set is being released, tabulated drawings shall be prepared in accordance with MSFC-STD-3528 section 14.2.3 and 14.5.

J.1.3 Inseparable Assembly Drawings. For flight-qualification parts where the CAD drawing-model set is being released, inseparable assembly drawings shall be prepared in accordance with MSFC-STD-3528 section 13.14.

J.1.4 Composite Drawings. For flight-qualification parts where the CAD drawing-model set is being released, composite drawings shall be prepared in accordance with MSFC-STD-3528 section 14.3.11.

J.1.5 Kit Drawings. For flight-qualification parts where the CAD drawing is being released, kit drawings shall be prepared in accordance with MSFC-STD-3528 section 14.3.13.

J.1.6 Design Layout Drawings. For flight-qualification parts where the CAD drawing-model set is being released, design layout drawings shall be prepared in accordance with MSFC-STD-3528 section 14.3.14.

J.1.7 Envelope Drawings, Source Control Drawings, and Vendor Item Control Drawings. For flight-qualification parts where the CAD drawing-model set is being released, envelope drawings, source control drawings, and vendor item control drawings shall be prepared in accordance with MSFC-STD-3528 section 14.3.15, MSFC-STD-3528 section 7.2.2.4 for drawing notes on source control drawings, and MSFC-STD-3528 section 7.2.2.5 for drawing notes on vendor item control drawings.

J.1.7.1 To Be Determined (TBD) Usage. TBDs may be used in envelope drawings, source control drawings, or vendor item control drawings prior to vendor selection. After vendor selection, TBDs shall be deleted and updated with vendor information.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 51 of 80</b>

J.1.8 Reference Parts. Parts that are shown on a drawing and not assigned a find number, but are identified by part number shall be noted as “REF”. Such parts should be shown in phantom. Repeated find numbers and part numbers (except those defining a specific quantity of a part not covered by any other call-out) shall also be noted as “REF”.

J.2 Find Numbers. Drawings shall contain Find numbers for each part shown on the drawing which correlate to Find numbers on the EPL.

J.2.1 It is recommended that one Find number is used to correlate to all usages of a specific part on a drawing. For example, Find number 7 correlates to part number 97M47100-001 in all usages on drawing 97M47000. This may occur when there are multiple dash assemblies on a drawing that have common component parts.

J.3 Drawing Notes. For flight-qualification parts, where the CAD drawing is being released, drawing notes shall be added to the drawing in accordance with MSFC-STD-3528 section 7.2.

J.4 Drawing Parameters. For flight-qualification parts, where the CAD drawing is being released, drawing parameter values shall be completed in accordance with MSFC-STD-3528 section 6.5.4.2.

J.5 Drawing Revision Preparation. Drawing revisions are only created to incorporate Engineering Orders (EOs).

J.5.1 Revision With No Previous EOs. If a drawing requires revision when there are no previously authorized but unincorporated EOs, the reason for revision and description of changes shall be documented on an EO. The EO is immediately incorporated into the drawing revision and is processed and authorized with the drawing revision package as described in Appendix M1 for ICMS and Appendix M2 for ICE Windchill.

J.5.2 Revision With Additional Changes. When a revision is being prepared to incorporate previously authorized EOs, and additional changes are needed in the revision, an EO will be prepared to describe the additional changes using the process described in the previous paragraph.

J.5.3 Retain Initial Release Approval and Release Date Information. When a drawing is revised, the drawing approvals and release date from the revision of the drawing that was initially released (i.e., "dash" revision) shall be retained in the drawing title block.

J.6 Change Request (CR), Technical Approvals, and Authorization

J.6.1 Each drawing shall be included as part of a CR as defined in Tables I and II for ICMS and Tables III and IV for ICE Windchill.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 52 of 80</b>

J.6.2 The technical approvals defined by the Technical Approval Matrix in Appendix D or project-unique matrix shall be obtained.

J.6.3 The CR package is processed and authorized by CCB as defined in Appendix O.

J.7 Drawing Release.

J.7.1 Drawings shall be submitted for initial release and released at dash revisions (-).

J.7.2 Drawings revisions shall be released in sequential order per revision sequence by the MSFC Release Desk.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 53 of 80</b>

## **Appendix K. CAD Model Preparation in ICE Windchill**

K.1 CAD models shall be prepared in accordance with MSFC-STD-3528.

K.2 CAD model revisions shall be prepared to implement changes. A CAD model revision may contain single or multiple changes.

K.3 CAD models shall be submitted for initial release and released at dash revision (-), with the following exception.

K.3.1 When new instances (parts) are added into a family table CAD model, the new instance shall be created and released at the same revision level as the rest of the family table parts.

K.4 CAD model revisions shall be released in sequential order per revision sequence.

K.5 Changes made as part of a CAD model revision that need to be communicated to users and are not captured within drawing or EPL changes in the same release package shall be documented on an Engineering Order and included with the CAD model revision release package.

K.6 For assembly CAD model release, the designer shall create an “As-Stored” configuration immediately prior to submittal or re-submittal of a release CR.

K.6.1 The “As-Stored” configuration shall consist of the assembly to be released along with the latest version of the assembly components that comprise the assembly.

K.6.2 The “As-Stored” configuration provides the capability to retrieve historical versions of released CAD drawings and CAD models.

K.7 When skeleton models are used, they should be released before or concurrently with the CAD models that have relationships to the skeleton model.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 54 of 80</b>

## **Appendix L. Release-Change Rules to Maintain Relationships between WT Parts, Drawings, and CAD Models in ICE Windchill**

L.1 Product structure shall be built in ICE Windchill to document and control the relationship between WT Parts (i.e., child parts of an assembly, used on higher assemblies), and the relationship between WT Parts and related design data (i.e., CAD models and drawings) prior to release.

L.2 The released product structure for a WT Part shall include all related WT Parts needed to capture a complete design definition and to represent the EPL.

L.3 Prior to release, digital data sets shall be associated to each WT Part which include all required dependencies to CAD models and drawings needed to fully capture and maintain the WT Part's design definition.

L.4 Other data such as analysis documents may be associated to a WT Part object on ICE Windchill to further define the design definition of the WT Part.

L.5 When a 3D CAD model is part of the release package, a WT Part shall have an association to the CAD model that represents the as-designed "master" definition of the part.

L.6 A WT Part shall have an association to the drawing for that part.

L.7 Additional CAD models and drawings shall be associated to the WT Part as required by MSFC-STD-3528.

L.8 Each CAD model revision shall be associated to at least one WT Part revision.

L.9 Each drawing revision shall be associated to at least one WT Part revision.

L.10 WT Parts and the related EPL Document may be revised separately from the drawing or CAD model. When a drawing is revised, at least one WT Part/EPL shall be revised concurrently with the drawing revision.

L.11 WT Parts/EPL, the associated drawings, and the associated CAD models may be released at different revision levels.

L.12 Assembly parts shall only be released if all the assembly components are being released concurrently or if the component parts were previously released.

L.13 The product structure shall capture the definition of the following items:

- a. Part Number
- b. Part Description

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 55 of 80</b>

- c. Part Quantity
- d. Substitute Parts
- e. Reference Designators
- f. Find Number for each WT Part in an assembly which correlates to the Find number on the assembly drawing

#### L.14.1 Objects and Relationships in ICE Windchill

##### L.14.1.1 ICE Windchill Functions

ICE Windchill provides a secure, electronic environment to manage and control data. ICE Windchill supports the design management and MSFC Release processes described in this document. Functions that are key to providing these processes include:

- a. Application of automatic version control and retention of previous versions
- b. Locking of objects in specified approval states
- c. Managing the relationship between data objects and processes

#### L.14.2 ICE Windchill Object Relationships

##### L.14.2.1 ICE Windchill Relationships Built Through CAD Structure

The following relationships shall be created through the building of CAD Structure:

- a. CAD model to CAD model
- b. CAD model to CAD drawing

##### L.14.2.2 ICE Windchill Relationships Built Through Product Structure

The following relationships shall be created through the building of Product Structure:

- a. WT Part to WT Part
- b. WT Part to CAD model
- c. WT Part to CAD drawing or Drawing Representation Document
- d. WT Part to EPL document
- e. WT Part to EO document

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 56 of 80</b>

## **Appendix M1. Engineering Order (EO) Preparation and Numbering in ICMS**

M1.1 Engineering Order (EO). The EO describes changes to a physical part/assembly. EOs shall be released in sequential order. Additional changes made during a revision, in addition to the incorporation of outstanding EOs, shall be documented on a “none” effectivity EO. (NOTE: “none” is indicated in ICMS by an empty field.) Changes to an assembly that affect the EPL only shall be made by EPL revision in lieu of an EO, with the exception of adding new parts or deleting find numbers. The EO itself does not change the drawing or the EPL; it shall be incorporated to effect the drawing change. Floor EOs (FEOs) are processed in accordance with Appendix M.

M1.2 General. The EO shall serve as an auxiliary to a previously released drawing to provide advance notice of a design or documentation change or correction to be made to the drawing.

M1.2.1 An EO is applicable to all next assemblies of the part/assembly to which it applies for the effectivity specified.

M1.2.2 The EO shall list all parts being affected.

M1.2.3 An EO shall always be written against (identified to) and describe changes to a physical part/assembly except in those cases where the drawing itself is documentary or procedural in content. In these cases, the drawing does not identify hardware, and the EO shall be written against the drawing number.

M1.2.4 When changes are similar and/or related in content, two or more EOs may appear on the same input form. The use of multiple EOs shall be confined to the following:

M1.2.4.1. To describe an identical change for several parts or documentary drawings.

M1.2.4.2. To describe simple changes to several parts or documentary drawings which pertain to related overall system change.

M1.2.5 The use of one EO per input form is preferred when changes are complex or lengthy.

M1.2.6 An EO can modify a condition created by a previously issued EO. The new EO shall state: “This EO supersedes the configuration established by EO \_\_\_\_.” An EO shall not be written to delete parts that were added by a previous EO that has not been incorporated. The previous EO shall be canceled and reissued in accordance with paragraph M1.2.1.7.

M1.2.7 If changes to existing EOs are to be accomplished by taking the current EO effectivity to “none” and reissuing the EO under a new number, with the change incorporated, the new EO shall contain the following statement: “This EO cancels and supersedes EO \_\_\_\_ in its entirety.

M1.2.8 An EO can be created by an organization other than the design activity controlling the drawing. In all cases, the EO shall be approved by the controlling activity.



<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 57 of 80</b>

M1.2.9 A released EO shall be revised only to change the CBD, PCN, project code, or effectivity.

M1.2.10 The physical incorporation of the drawing change(s) detailed in an EO is usually accomplished at a later date. During the interim period, the EO is utilized as the revised portion of the drawing.

M1.2.11 Higher numbered EOs or later dated EOs do not take precedence in the event of conflict with previously issued EOs unless so stated. Such conflict (where no precedence statement exists) is an engineering error, which requires correction.

M1.2.12 In the event of conflict, drawing and EPL revisions do not take precedence over previously issued EOs which were not incorporated and which have effectivities common to the revised drawing and/or EPL. Such conflict is an engineering error that requires correction.

M1.2.13 The only revisions allowed to a drawing shall be to incorporate EOs.

M1.2.13.1 EO to Identify Additional Changes in a Drawing Revision. When a revision is prepared to incorporate released EOs, and additional changes are identified which need to be incorporated into the revision, a new EO shall be initiated describing the additional changes in detail, and this EO shall be immediately incorporated into the revision, taken to effectivity "none", and approved in the same package as the drawing revision. This "none" effectivity EO should include sufficient detail for the reviewers and users of the drawing revision to identify the additional changes that are being incorporated into the revision. This is especially important after the drawings are provided to manufacturing to ensure that design changes are clearly communicated and incorporated in the hardware/software.

M1.2.13.1 Revised and Redrawn. If the changes are extensive so that it is necessary to revise and redraw the entire drawing, a "none" effectivity EO shall be written to describe the revisions in detail as described in M1.2.13.1. If changes are extensive enough to change the configuration of the part, the part number re-identification guidance in Appendix Q should be utilized to determine whether a revision is appropriate, or whether a new part number is advised. If a new part number is advised, a new drawing should be prepared. If it is determined to proceed with the revised and redrawn revision, enter the statement "Revised and Redrawn" in the description block of the EO and the drawing's revision block. The revision description entered in the "none" effectivity EO and the drawing's revision block shall address each EO being incorporated and whether the EO content is being incorporated as originally approved, or whether the EO is being cancelled because the EO content is either fully or partially superseded by new content. Partially incorporated EOs should be cancelled and the portion being incorporated in the drawing revision should be described in the "Revised and Redrawn" EO description.

M1.2.14 Changes to assemblies wherein both the drawing and EPL are affected shall be accomplished simultaneously. Drawing changes shall be documented on an EO. EPL changes shall be documented in an EPL revision or on the back of the EO, MSFC Form 421.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 58 of 80</b>

M1.2.15 Changes to assemblies wherein only the EPL is affected shall be accomplished by EPL revision (i.e., not by EO). This applies only when no drawing change of any type is necessary. A complete, definitive revision description shall be provided on the EPL revision input form.

M1.2.16 Outstanding EOs shall be incorporated into drawing revisions when their quantity or complexity becomes such that correct and ready interpretation of the intended or designed definition becomes difficult or questionable. It is recommended that outstanding EOs be incorporated into the drawing within 90 days and/or when more than 6 EOs are outstanding.

M1.2.17 Signatures, organizations, and approvals shall be defined by the Technical Approval Matrix in Appendix D, or the matrix defined in the specific ~~program~~project CM Plan.

M1.2..18 The EO, MSFC Form 421, shall be used to obtain appropriate signatures for all EO transactions, or if the ICMS online system is utilized, the EO confirmation data sheet shall be used to obtain the approval signatures. The confirmation data sheets are created when an EO is entered into the ICMS through the online system. After the transaction is entered, a confirmation edit is run. If there are no errors, the transaction is locked and a confirmation data sheet printed.

M1.3 Preparation and Identification. The forms to be used for the EO system are the input form for Engineering Order (computer-prepared application data sheet), MSFC Form 421, hereinafter referred to as the “A” sheet, and the Engineering Order (Graphic Data Sheet), hereinafter referred to as the “B” sheet. The “B” sheet shall be prepared according to the format specified in MSFC-STD-2806, and is mandatory for initial release. EO numbers shall be assigned in sequential order (1, 2, 3, etc.) for each part, or for each drawing for drawings that do not describe hardware and contain documentary or procedural content only (as described in M1.2.1.3). The sequence shall be continuous for each part (or drawing per N.2.1.3) and therefore is not restarted after EO incorporation into a drawing revision. EO numbers shall be requested from the MSFC Release Desk through the EO Number Request and Trending System at <https://masterlist.msfc.nasa.gov/eo>.

M1.4 Add New Parts. New parts may be added on the EO by specifying the part number, quantity, description, etc., on the back of the “A” sheet. If the EO initiator can identify the appropriate find number and ensure no duplication of find number assignment (potential if other EOs are being concurrently initiated against the same assembly), then the find number shall also be added with the part information on the back of the “A” sheet, and the find number shall be referenced in callouts on the EO graphic data sheet. If there is potential of duplicate find number assignment for new parts added on the EO, then no find number shall be assigned, and the graphic data sheet of the EO shall show a callout bubble with no find number and the part number shown in parenthesis at the bubble.

M1.5 Create New MSFC Parts. Standard or vendor parts can be added by EO. An MSFC part number can be “created” on an existing MSFC detail drawing by an EO and called for on the EO to the next higher assembly and be released on the same EO form.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 59 of 80</b>

M1.6 Correcting Effectivities of Incorporated EOs. EOs incorporated into a drawing shall, concurrent with release of the incorporating revision, be revised to delete the effectivities included in the effectivity of the new revision.

M1.7 Revising/Cancelling EOs. An EO shall be revised only to change the CBD, PCN, project code, or effectivity. Technical changes shall be made by issuing a new EO. The latest revised issue of an EO supersedes all previous issues. To cancel an EO, the effectivity shall be changed to "None". Once an EO has been cancelled, it cannot be reinstated. All revisions shall be submitted on the "A" sheet only. For all revisions to an EO subsequent to the initial issue, only the computer printout shall be distributed. The words "RETAIN INITIAL GRAPHIC DATA SHEET" shall appear in the upper right corner of the printout. Graphic data sheets from the initial issue shall be retained by the recipient for use with subsequent revisions.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 60 of 80</b>

## **Appendix M2. Engineering Order (EO) Preparation and Numbering in ICE Windchill**

**M2.1 Engineering Order (EO) Purpose.** The EO describes changes to a physical part/assembly. The EO shall serve as an auxiliary to a previously released drawing to provide advance notice of a design or documentation change or correction to be made to the drawing. An EO is applicable to all next assemblies of the part/assembly to which it applies. Floor EOs (FEOs) are processed in accordance with Appendix M.

**M2.2. EO Application.** An EO shall always be written against (identified to) and describe changes to a physical part/assembly except in those cases where the drawing does not identify hardware and is documentary or procedural in content (referred to as a “non-part drawing”). For non-part drawings, the EO shall be written against the drawing number.

**M2.3 EO Inherits Effectivity of WT Part.** An EO released in ICE Windchill will be associated to the current released WT Part. The EO will “inherit” the same effectivity as the WT Part. EOs do not have independent effectivity assignment within ICE Windchill.

### **M2.4 When to Create an EO**

**M2.4.1 Change Affects Drawing and EPL.** Changes to assemblies wherein both the drawing and WT Part-EPL are affected shall be accomplished through an EO to the drawing and a revision to the WT Part-EPL. If the WT Part-EPL revision adds new parts that are not already referenced on the drawing, the EO graphic sheet shall add callouts to the new find number on the EPL revision. The EO itself does not change the drawing; it shall be incorporated to effect the drawing change

**M2.4.2** Changes to assemblies wherein only the EPL is affected shall be accomplished by EPL revision (i.e., not by EO). This applies only when no drawing change of any type is necessary

**M2.5 EO Preparation.** An EO is documented on MSFC Form 421, Engineering Order. The Engineering Order has 2 parts, MSFC Form 421, also referred to as the “A” sheet, and the MSFC Form 421-1, Engineering Order (Graphic Data Sheet), also referred to as the “B” sheet.

**M2.5.1** Each EO shall identify changes for one part only.

**M2.6 EO Identification Numbers.** EOs shall be identified with the following numbering scheme:

Part Number-EO-XX (e.g., 9XMXXXXX-XXX-EO-XX, 97M12345-001-EO-01)

- a. Part Number = part number or drawing number for non-part drawings
- b. EO = static identifier indicating an engineering order

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 61 of 80</b>

c. XX = EO sequence number (01, 02, 03, etc.) assigned per Part Number. The sequence shall be continuous for each part or non-part drawing and therefore is not restarted after EO incorporation into a drawing revision.

M2.7 EO Number Assignment. EO numbers shall be requested from and assigned by the MSFC Release Desk. The MSFC Release Desk will “reserve” the EO number in ICE Windchill by creating an Engineering Order document object with assigned EO number.

#### M2.8 Change Request (CR), EO Technical Approvals, and Authorization

M2.8.1 Each EO shall be included as part of a CR as defined in Table IV.

M2.8.2 The technical approvals defined by the Technical Approval Matrix in Appendix D or project-unique matrix shall be obtained.

M2.8.3 The CR-EO package is processed and authorized by CCB as defined in Appendix O.

M2.9 EO Release. EOs shall be released in sequential order. The MSFC Release Desk shall set each EO Document object to “Released” within ICE Windchill.

M2.10 EO Revision. A released EO shall be revised only to change the CBD or PCN. Technical changes shall be made by issuing a new EO. The latest revised issue of an EO supersedes all previous issues. All revisions shall be submitted on the “A” sheet only. For all revisions to an EO subsequent to the initial issue, only the “A” sheet shall be distributed. The words “RETAIN INITIAL GRAPHIC DATA SHEET” shall appear in the upper right corner of the printout. Graphic data sheets from the initial issue shall be retained by the recipient for use with subsequent revisions.

#### M2.11 Changing Status of a Previously Released EO

M2.11.1 Superseding a Previous EO. An EO can modify a condition created by a previously issued EO. The new EO shall state: “This EO supersedes the configuration established by EO \_\_\_\_.” An EO shall not be written to delete parts that were added by a previous EO that has not been incorporated. The previous EO shall be canceled and reissued.

M2.11.2 Cancelling a Previous EO. To cancel an EO, the status shall be changed to “Cancelled”. Once an EO has been cancelled, it cannot be reinstated. If changes to existing EOs are to be accomplished by cancelling and reissuing the EO under a new number, with the change incorporated, the new EO shall contain the following statement: “This EO cancels and supersedes EO \_\_\_\_ in its entirety.”

#### M2.12 Incorporation of EOs into a Drawing Revision

M2.12.1 Outstanding EOs shall be incorporated into drawing revisions when their quantity or complexity becomes such that correct and ready interpretation of the intended or designed

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 62 of 80</b>

definition becomes difficult or questionable. It is recommended that outstanding EOs be incorporated into the drawing within 90 days and/or when more than 6 EOs are outstanding.

## M2.12.2 EO for Additional Changes to a Drawing Revision (i.e., Immediately Incorporated EO)

M2.12.2.1 Additional changes made during a revision, in addition to the incorporation of previously released EOs, shall be documented on an EO. This EO will be associated to the new WT part revision, and the EO state will be changed to “Incorporated”. NOTE: The “Incorporated” EO is similar to the “none” effectivity EO in ICMS.

a. EO to Identify Additional Changes in a Drawing Revision. When a revision is prepared to incorporate released EOs, and additional changes are identified which need to be incorporated into the revision, a new EO shall be initiated describing the additional changes in detail. This EO’s content shall be immediately incorporated into the revision and the EO included in the same release package as the drawing revision. This EO should include sufficient detail for the reviewers and users of the drawing revision to identify the additional changes that are being incorporated into the revision. This is especially important after the drawings are provided to manufacturing to ensure that design changes are clearly communicated and incorporated in the hardware/software. The MSFC Release Desk will set the EO state to “Incorporated”

b. EO to Describe a Revised and Redrawn Drawing Revision. The Revised and Redrawn drawing revision approach is not the preferred method and should be used rarely. If the drawing changes are extensive, the configuration of the part is likely to be changed. The part number re-identification guidance in Appendix Q should be utilized to determine whether a revision is appropriate, or whether a new part number is advised. If a new part number is advised, a new drawing shall be prepared to define the new part. If a new part number is not advised, the revised and redrawn revision may proceed. An EO shall be written to describe the revisions in detail as described in M2.2.1.15.a. Enter the statement “Revised and Redrawn” in the description block of the EO and the drawing’s revision block. The revision description entered in the EO and the drawing’s revision block shall address each EO being incorporated and whether the EO content is being incorporated as originally approved, or whether the EO is being cancelled because the EO content is either fully or partially superseded by new content. Partially incorporated EOs should be cancelled and the portion being incorporated in the drawing revision should be described in the “Revised and Redrawn” EO description.

## M2.13 Precedence

M2.13.1 Higher numbered EOs or later dated EOs do not take precedence in the event of conflict with previously issued EOs unless so stated. Such conflict (where no precedence statement exists) is an engineering error, which requires correction.

M2.13.2 In the event of conflict, drawing and EPL revisions do not take precedence over previously issued EOs which were not incorporated and which have effectivities common to the revised drawing and/or EPL. Such conflict is an engineering error that requires correction.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 63 of 80</b>

## **Appendix N1. Effectivity Application and Change in ICMS**

**N1.1 Effectivity Changes.** Effectivities relate to a top assembly and represent a configuration. When an effectivity is specified for an EPL or EO, this is specifying which configuration/top assembly part number that the EPL or EO is being applied against.

**N1.1.1** To obtain the full Indentured Parts List (IPL) of a top assembly, all the parts in the assembly must have an effectivity which matches the top assembly effectivity.

**N1.1.2** Typically, when an EPL is revised, the effectivity of the previous EPL revision becomes “none”, meaning that it is no longer effective on any configuration, and the newly approved EPL revision becomes effective for the specified effectivities. Similarly, when EOs are incorporated into a Drawing revision, the EO effectivities become “none” and the Drawing revision becomes effective.

**N1.1.3** Only one assembly drawing revision and one EPL can exist for a specific effectivity. When a new or revised EPL is issued with effectivities that duplicate some or all of the effectivities of previously released EPLs of the same assembly part number, the effectivities of the previously released EPLs shall be changed to avoid any duplication. This shall be done concurrent with release of the new or revised EPL.

**N1.1.4 Updating Effectivities of Incorporated EOs.** EOs incorporated into a drawing shall, concurrent with release of the incorporating revision, be updated to delete the effectivities included in the effectivity of the new revision. Check Incorporated EO Effectivities block, on the B sheet of the EPL being revised and list on sheet D the incorporated EOs. These EOs are automatically revised and reissued to delete the effectivities included in the effectivity of the new drawing revision.

**N1.1.5 Automatic Method.** Enter code AA in “EFF ADJ” block, sheet “A”, MSFC Form 420 of the EPL to automatically accomplish the action indicated. The affected “made from” EPL and/or other existing EPLs (of the same part number as the new or revised EPL) are automatically revised and reissued by the Integrated Configuration Management System (ICMS) to eliminate duplication with the effectivity of the new or revised EPL.

**N1.1.6 Adjusting/Matching the Effectivities of EOs and EPLs affected by Revision to the Effectivity of an Assembly.** To maintain the effectivities of the releasing EPLs of parts/assemblies consistent with the effectivity of their using assembly and the effectivity of EOs consistent with the effectivity of the part/assembly to which they apply, these related EPLs and EOs shall be revised to correct their effectivity. This shall be done concurrent with release of the EPL being revised utilizing the following rules and methods as applicable:

**N1.1.6.1.** The effectivities for which an assembly is released shall include all of the effectivities called for by its using assemblies.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 64 of 80</b>

N1.1.6.2. The effectivities of an EO shall match an effectivity within the effectivity range of the part/assembly to which it applies.

N1.1.6.3. When the effectivity of the EPL of any assembly in the hierarchy is changed, the effectivity of all related (both sub-tier and higher) assembly EPLs shall be revised accordingly. Exceptions: When the part/assembly has usage in other next assemblies for some or all of the effectivities being deleted.

N1.1.6.4. The effectivity of all outstanding EOs against these assemblies and their detailed parts shall contain only the effectivity of the part/assembly to which it applies. Exceptions: (1) When the part/assembly has usage in other next assemblies for some or all of the effectivities being deleted; and (2) when it is not intended that the EO apply to some or all of the added effectivities.

N1.1.7 Semiautomatic Method. Check “Effectivity Action Last” block on the EPL B sheet being revised, and list on sheet C the part number and drawing revision of the EPLs and the part number and EO dash number of the EOs to be revised. Those items listed are automatically revised and reissued by the ICMS to match the effectivity change of the EPL revision being released. This method is applicable to both sub-tier and higher-level assemblies.

N1.1.8 Fully Automatic Method. Enter “FA” in “Eff Adj” block of MSFC Form 420 for the EPL being revised. On the reverse side of MSFC Form 420, enter an “X” in Full Auto-Adjust, block, and enter the target Project Code and Effectivity in Full Auto-Adjust PC and Full Auto-Adjust Eff blocks for effectivity increases. Effectivity changes are automatically applied to (1) EOs to this assembly and sub-tier assemblies/parts, and (2) EPLs for sub-tier assemblies. The configuration of the added effectivity shall be the same as the configuration of the Project Code/Effectivity.

N1.1.8.1. No auto-adjust action is taken on EPLs and EOs of subassemblies being added or deleted in conjunction with the auto-adjust transaction, if the package also contains other transactions to the deleted subassemblies EPLs. The following rules apply in this situation:

N1.1.8.2. If subassemblies are being added, they shall have the matching top assembly/project code/effectivity, or the package shall include input forms for establishing the top assembly/project code/effectivity match; otherwise, the entire package is rejected.

N1.1.8.3. If subassemblies are being deleted, the designer shall determine if the top assembly/project code/effectivity of the deleted subassemblies require revision and subsequently, shall take action to delete any top assembly/project code/effectivity applications that are no longer valid after the auto-adjust action, either by current or anticipated future usage. This action shall be accomplished manually according to paragraph N1.1.2, with the exception that EOs to the deleted assemblies and their sub-tier assemblies/parts and EPLs for their sub-tier assemblies may be corrected by auto-adjust action against the deleted assemblies.



<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 65 of 80</b>

## **Appendix N2. Effectivity Application and Change in ICE Windchill**

N2.1 Effectivity shall be proposed on the design release CR and assigned and authorized on the Change Directive.

N2.2 Effectivity shall be applied to each WT Part by the Configuration Control Board (CCB) secretariat or the MSFC Release Desk in accordance with the Change Directive and verified by the MSFC Release Desk.

N2.3 Where the same effectivity is applied to multiple revisions of a WT Part, the latest revision of the WT Part supersedes the earlier revision for the latest effective configuration.

N2.4 All the WT Parts in the assembly shall have an effectivity which matches the top assembly effectivity. This enables retrieval of the full product structure/IPL of a top assembly by effectivity.

N2.5 To maintain the effectivities of the WT Parts consistent with the effectivity of their using assembly, the effectivity of the related WT Parts shall be changed. This shall be done concurrent with release of the WT Part being revised utilizing the following rules and methods as applicable:

N2.5.1. The effectivities for which an assembly is released shall include all of the effectivities called for by its using assemblies.

N2.5.2. The effectivities of a WT Part shall match an effectivity within the effectivity range of the part/assembly to which it applies.

N2.5.3. When the effectivity of any assembly WT Part in the hierarchy is changed, the effectivity of all related (both sub-tier and higher) assembly WT Parts shall be changed accordingly. Exceptions: When the part/assembly has usage in other next assemblies for some or all of the effectivities being deleted.

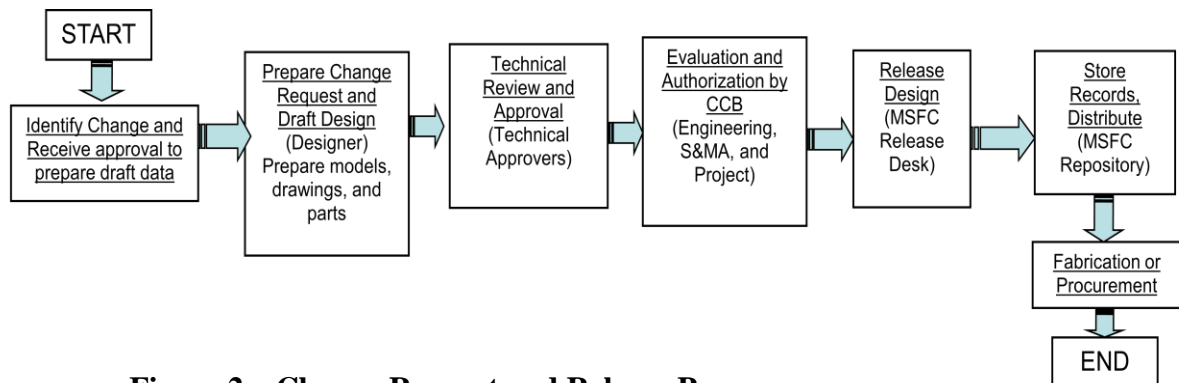
N2.5.4. If subassemblies are being added, they shall have the matching top assembly effectivity, or the package shall include changes to make the top assembly effectivity match; otherwise, the entire package is rejected.

N2.5.5. If subassemblies are being deleted, the designer shall determine if the top assembly effectivity of the deleted subassemblies requires revision and subsequently take action to delete any top assembly effectivity applications that are no longer valid either by current or anticipated future usage.

MSFC Technical Standard EE12		
Title: MSFC Engineering Documentation Standard	Document No.: MSFC-STD-555	Revision: J
	Effective Date: June 17, 2013	Page 66 of 80

## Appendix O. Initial Release, Change, and Cancellation Process

Figure 2 provides a high level flowchart of the steps involved in the initial release, change, and cancellation processes described in the following sections.



**Figure 2 – Change Request and Release Process**

O.1 Initial or Revision Package Disposition by CCB and Processing. The OPR designee (OPRD) prepares the release package data as defined in Table I, Table II, Table III, or Table IV, obtains the technical approvals required by the Technical Approval Matrix, and obtains any other project-specific approvals. The technical approvals may be obtained external to the system and entered into the approval attributes within ICMS or ICE Windchill, or the electronic CR workflow in ICE Windchill can be used to obtain approvals which are electronically transferred to the data object approval attributes. The OPRD forwards the completed package to the appropriate CCB secretariat for processing through the CCB. The CCB Secretariat verifies that approvals were obtained for the functions required by the Technical Approval Matrix, and routes the package for any additional evaluation required by the CCB. The CCB disposes the package as approve as written, approve with changes, or disapprove and issues a CBD documenting the disposition, implementation actions, and action suspense dates.

The following actions shall occur for each disposition:

O.1.1 Disapprove (document or drawing/EPL/EO package): The CCB secretariat shall notify the OPR designee.

O.1.2 Approve as written:

O.1.2.1. Drawing/EPL/EO Package: The CCB secretariat shall add the CBD to the package, obtain a distribution list from the OPR designee for the MSFC Documentation Repository (for initial release), and forward the package to the MSFC Release Desk for release.

O.1.2.2. Document Package: The CCB Secretariat shall provide the OPR designee implementation actions (e.g. updating the document Effective Date to match the CBD disposition date, updating the Document History Log, providing a distribution list for the MSFC

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 67 of 80</b>

Documentation Repository (initial release)) and either the OPR designee or CCB secretariat shall deliver the updated document to Documentation Checking for verification that the document meets project format requirements and is in agreement with the CBD. After the document is verified by Checking, the Secretariat will forward the package to the MSFC Release Desk for release.

### O.1.3 Approve with changes:

O.1.3.1. Drawing/EPL/EO package: The package and the CBD describing the changes shall be returned to the OPR designee to make data updates. The OPR designee shall make the CCB-directed changes, re-obtain technical approvals if the directed changes affected technical content, and deliver to Drawing Checking for verification that the package is in agreement with the CBD. Go to O.1.3.3.

O.1.3.2. Document package: The CCB Secretariat shall provide the OPR designee direction to update the document in accordance with the changes specified in the CBD and other implementation actions (e.g. updating the document Effective Date to match the CBD disposition date, updating the Document History Log, providing a distribution list for the MSFC Documentation Repository (initial release)) and either the OPRD or CCB Secretariat shall deliver the updated document to Documentation Checking for verification that the document meets project format requirements and is in agreement with the CBD. Go to O.1.3.3.

O.1.3.3. If corrections are required, Checking shall return the package to the OPR designee or CCB Secretariat. If no corrections are required, Checking shall forward the package to the OPR Designee/CCB secretariat who shall deliver to the MSFC Release Desk for release.

O.2 Package Release and Distribution. Although the Secretariat is responsible for reviewing the package, the Release Desk also reviews each approved package to ensure that all required forms are included and are properly completed. If corrections are required, the Release Desk shall return the package to the Secretariat who in turn shall forward to the OPR designee. If corrections are not required, the package is released and forwarded to the MSFC Documentation Repository for distribution.

O.3 ICD Changes and Revision. All ICD changes shall be proposed by a CR. ICD changes may be captured in the CR, or the CR may be accompanied by a Preliminary Interface Revision Notice (PIRN) which defines the ICD changes. The CR or CR-PIRN should be coordinated with all interfacing parties to obtain technical agreement.

#### O.3.1 CCB Disposition of Interface Changes

The CCB disposition on the CBD should utilize one of the following options:

O.3.1.1 ICD Changes in CR. Authorize the From/To wording in the CR. Direct incorporation of the From/To wording into a specific revision of the ICD. (e.g., "CR No. \_\_\_\_\_ is approved. Incorporate the CR from/to changes into ICD No. \_\_\_\_\_ Revision \_\_\_\_\_.")

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 68 of 80</b>

O.3.1.2 ICD Changes in PIRN that is Authorized as an IRN. Approve the PIRN as an IRN, direct incorporation of the IRN into a specific ICD revision. (e.g., "PIRN No. \_\_\_\_\_ is approved as IRN \_\_\_\_\_. IRN \_\_\_\_\_ shall be incorporated into ICD No. Revision \_\_\_\_.")

O.3.1.3 ICD Changes in PIRN that is Directly Incorporated in ICD. Approve the PIRN, and authorize the PIRN to be incorporated directly into a specific ICD revision. (e.g., "PIRN No. \_\_\_\_\_ is approved. PIRN \_\_\_\_\_ shall be incorporated into ICD No. Revision \_\_\_\_.")

O.3.2 The OPR designee shall organize the ICD package for each CCB-approved change in accordance with section 3.1.6 and forward it to the Release Desk for release and subsequent routing to the MSFC Documentation Repository for distribution.

O.4 Cancellation of Documents. A document cancellation shall be authorized by the CCB which originally approved the document, or if that CCB has been deactivated then by the organization having current authority for the work related to the document. Once a document is cancelled, reissuance shall be approved by the CCB that authorized cancellation, by the CCB that plans to utilize and control the document, or by the Director, Engineering Directorate.

O.4.1 Responsible Office. To initiate document cancellations for documents released through the Release Desk, the responsible organization shall do the following:

O.4.1.1 Prepare an ECR to the CCB which approved the document requesting document cancellation; the CCB shall produce a CBD which disposes the request which shall be provided to the MSFC Release Desk for processing. If there is no active CCB, the OPR Directorate/Office Director shall prepare a letter requesting the document cancellation and provide it to the MSFC Release Desk. The letter shall be forwarded to the appropriate Directorate/Office Director responsible for the work related to that document or the Engineering Director for cancellation approval. The ECR/letter shall include the document title and number to be cancelled, the cancellation need date, and a brief statement of why the document is being cancelled.

O.4.1.2 The OPR designee shall submit a DRL, supporting documentation, and the document to be cancelled.

O.4.2 MSFC Release Desk. To process the cancellation, the Release Desk shall do the following:

O.4.2.1 Receive the CBD approving cancellation or receive the letter requesting cancellation and obtain authorization for the letter request, document the cancellation in ICMS, and forward the documentation package to the MSFC Documentation Repository.

O.4.3 MSFC Documentation Repository. Upon receipt of the above document package, MSFC Documentation Repository personnel shall:

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 69 of 80</b>

O.4.3.1 Maintain the cancellation notice (DRL or cancellation letter) with the latest revision of the cancelled document.

O.4.3.2 Provide to requesters only copies of the revision that shows the cancellation notice.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 70 of 80</b>

## **Appendix P. Floor EO/Floor EPL (FEO/FEPL) Process**

P.1 Floor Engineering Order (FEO) (MSFC Form 421). The FEO may be used to expedite a change to a drawing (or EPL) at the MSFC in-house manufacturing service provider's shop floor or test area prior to processing a drawing change for release. Final quality inspection shall not be implemented using FEOs; FEOs shall be routed for additional technical approvals and released as CCB-approved EOs prior to final inspection of the hardware.

P.1.1 An FEO may create a new part/assembly dash number (i.e., -003, -005, etc.) only for a tabulated drawing. If a new dash numbered part is required, the creation of the new dash number shall be written against the -001 assembly/part and contain all information required for manufacturing the assembly.

P.2 Floor Engineering Parts List (FEPL) (MSFC Form 420). The FEPL may be used to expedite a change to an EPL at the MSFC in-house manufacturing service provider's shop floor or test area prior to processing an EPL change for release. New parts (find numbers) may be added by a FEPL only when a corresponding FEO creates a new dash number to a drawing. FEPLs shall be released in sequential order. Final quality inspection shall not be implemented using FEPLs; FEPLs shall be routed for additional technical approvals and released as CCB-approved EPLs prior to final inspection of the hardware.

P.3 The key elements of the FEO/FEPL are:

P.3.1 The originator requests an EO number from the MSFC Release Desk.

P.3.2 The originator creates the FEO/FEPL utilizing the MSFC Form 420.

P.3.3 The originator obtains the FEO/FEPL approvals specified in the Technical Approval Matrix.

P.3.4 Manufacturing implements the approved FEO/FEPL.

P.3.5 The originator obtains approvals for a full EO or EPL update and submits the EO or EPL in a CR package for CCB authorization and release.

P.3.6 Manufacturing replaces the FEO/FEPL in the work order package with the released EO/EPL.

P.3.7 Manufacturing and Quality inspect to the released EO/EPL.

P.3.8 Manufacturing and Quality do not use in the next higher assembly a part/assembly that has an FEO/FEPL against it until inspected to the released EO/EPL.

P.3.9 Quality places a hold on the hardware and notifies the Project if the released EO/EPL is not available when required.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 71 of 80</b>

P.3.10 The originator cancels and/or replaces the original FEO/FEPL, notify the organization performing the modification, and reinitiate this entire process if a technical change to the signed FEO/FEPL is required.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 72 of 80</b>

## **Appendix Q. Guidance on Part Number Re-identification**

Part number re-identification is required to ensure unique identification of different configurations. This is important so that differing parts are not identified with the same number, which could lead to safety or performance issues with no traceability of differences between parts.

Part re-identification guidance is shown in Figure 3.

Q.1 After a part has been released, and the released design data has been used in a procurement or provided to manufacturing, a new part number shall be assigned:

Q.1.1 If the change is required for flight safety. Existing part versions shall be discarded or reworked and re-identified to the new part number. Existing parts dispositioned for rework shall be immediately marked “for restricted use for reasons of safety or malfunction” to ensure the parts are not used prior to rework and re-identification.

Q.1.2 If the part being changed is no longer interchangeable (see Interchangeable definition) with the previous version and:

Q.1.2.1. There are multiple existing units of the part being changed, including in process, spares, and installed parts.

Q.1.2.2. Or, there is only one existing unit of the part being changed, but the existing part is not within MSFC control so that it may be reworked, tested, or inspected to the new requirements.

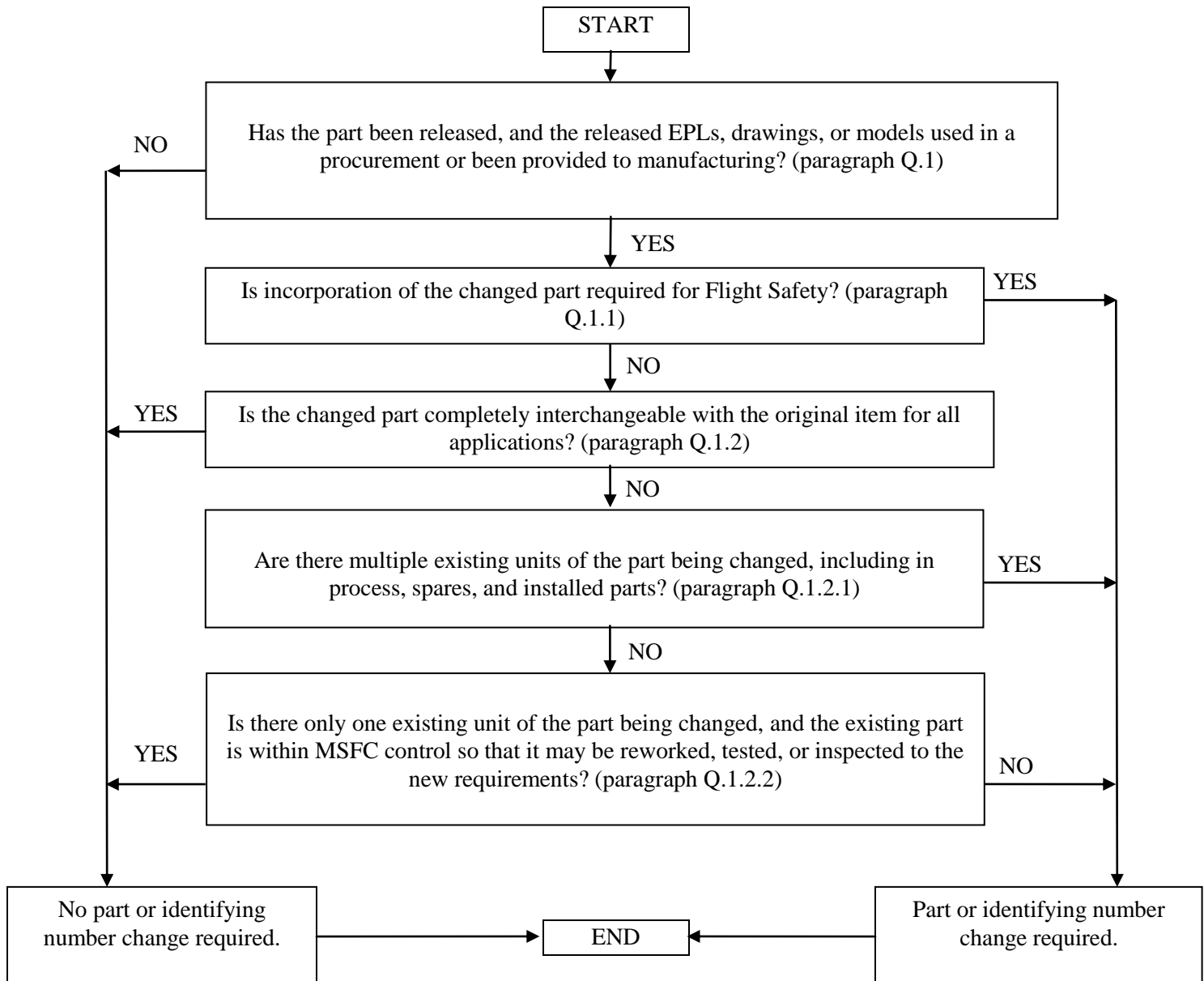
Q.1.3 If Engineering determines that other technical considerations require a new part number to define co-existing configuration items, assemblies or parts to preclude interchange or to provide additional protection from inadvertent use of prior items.

Q.2 If a new part number is assigned in accordance with Q.1, a new part number shall also be assigned to all subsequent higher assemblies up to and including the level at which interchangeability is re-established. NOTE: When parts are interchangeable both the previous and re-identified part could be listed on the next higher assembly EPL as alternate parts. When interchangeability is re-established, the next higher assembly may be revised to incorporate the new part number.

Q.3 If none of the conditions above apply the part may be changed through revision or EO without altering the part number.



<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 73 of 80</b>



**NOTE: Repeat the logic flow for each level of assembly to determine if part or identifying number change is required. (paragraph Q.2)**

**Figure 3. Part Number Re-Identification Decision Tree (Guidance)**

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 74 of 80</b>

## **Appendix R. Requirements for Design Responsibility Transfer**

R.1 ICMS Requirements for Design Responsibility Transfer.

R.2 Transfer of Design Responsibility to MSFC. The transfer of design responsibility from a contractor or other design organization shall be accomplished as specified herein.

R.3 Requirements for Design Documentation. A complete set of original drawings and parts lists and a listing of all specifications and standards and ancillary documents used for the design definition shall be obtained and placed in the MSFC Repository. When available, drawing trees, indented part lists, and/or associated listings shall also be placed in the MSFC Repository. MSFC Form 2896 shall accompany the package.

R.4 Documenting MSFC Changes to the Design Documentation. Two methods are available to document MSFC design changes to contractor or other design activity drawings:

R.4.1 An altered item drawing can be prepared when changes are expected to be simple and few, affecting less than 30% of the drawing (as a guideline). When changes are complex or numerous, affecting 30% of the drawing or more (as a guideline), conversion of the drawing set shall be accomplished in accordance with paragraph R.6.

R.4.2 If all or most of the changes are expected to be to a defined area of the contractor's design, a combination of the two methods is possible, utilizing the conversion method for the portion requiring extensive change and the "altered item drawing" method for the remainder. Sub-tier parts and assembly drawings for the affected assembly are not converted.

R.4.3 The decision of which method to use, or whether to use a combination of the two, shall be made by the project manager or systems engineer and documented in the configuration management plan.

R.5 Preparation of an Altered Item Drawing. An altered item drawing shall be prepared in accordance with MSFC-STD-2806.

R.6 Conversion of Contractor or Other Design Activity Drawing to MSFC Drawings. The following actions are required for conversion to an MSFC drawing:

R.6.1 Change the Cage Code, the drawing and part numbers, and design activity identification (logo) from contractor to MSFC.

R.6.2 State in the revision description field, "Made from drawing XXXXXXXX, Cage Code No. XXXXX." Also, describe any additional changes made.

R.6.3 Prepare EPLs utilizing MSFC Form 420 or equivalent for all assemblies. Also prepare DRLs to release specifications and other documentation.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 75 of 80</b>

R.6.4 After release, changes shall be made by EOs and drawing revisions to incorporate outstanding EOs.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 76 of 80</b>

## **Appendix S. MSFC Release Desk Functions, Reports, and Release Records**

### **S.1 MSFC Release Desk and ICMS**

S.1.1 ICMS Release. Drawing/document release is the point at which an initial issue or revision of a document becomes part of the official “as designed” baseline in ICMS.

S.1.1.1 An EPL or EO shall accompany each drawing being processed through the release system for release. A DRL shall accompany each document being processed through the release system. A DP/RS shall accompany every drawing or document change package that is processed through the release system.

S.1.1.2 A part shall be released only once for the same top assembly and effectivity, i.e., only one configuration can exist for each effectivity and drawing revision.

S.1.1.3 A part that was released by another design activity may be released by MSFC as an MSFC drawing or MSFC altered item drawing in accordance with paragraph R.4 once design activity responsibility has been transferred to MSFC.

S.1.2 MSFC Release Desk Functions. The MSFC Release Desk shall be the single point of release for MSFC in-house projects' flight and flight related ground support equipment (GSE) configuration documentation when the in-house project requires use of MSFC-STD-555.

S.1.2.1 The MSFC Release Desk may release non-configuration documentation. NOTE: Release of non-configuration documentation through the MSFC Release Desk is optional.

S.1.2.2 A MSFC Release Desk stamp shall be applied on hardcopy data products that are not reports generated from ICMS. These products include drawings and EO graphic sheets. The stamp is applied above the title block of the drawing or graphic sheet of the EO for initial releases. For revisions, the stamp is applied beside the drawing revision block. The MSFC Release Desk personnel executing the release apply the stamp to the data product and then write their initials and the release date within the stamp outline.

S.1.3 ICMS Database Reports. Various reports and lists are generated to assist manufacturing, assembly, and inspection of flight hardware. Manufacturing and quality inspection may use the following reports in the build and inspection process. NOTE: This list does not include all the reports available in ICMS.

S.1.3.1 Generation Breakdown. This is an indented parts list reflecting the specific top assembly configuration.

S.1.3.2 Engineering Master Parts List. This reflects the summation of parts and the identification of usage in a prescribed assembly. The information is tallied by the database based upon the release of drawings, EPLs, and EOs. This report is useful in (1) allowing shops to order parts

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 77 of 80</b>

based upon the quantity of vendor parts or materials, and (2) allowing a quick search of the configuration to identify the location of a specific part.

S.1.3.3 Periodic Activity. This identifies all the activities (released drawings, EPLs and EOs) that have occurred against a project based upon the project code within a specific time period.

S.1.3.4 Release Record List. This identifies all the EPLs and EOs released against a project.

S.1.3.5 As-designed/As-built Report. This identifies the differences between the as-designed configuration and the as-built configuration.

## S.2 MSFC Release Desk and ICE Windchill

S.2.1. Elements of MSFC Release. The MSFC Release Desk shall do the following tasks as part of ICE Windchill release (i.e., those tasks applicable to the specific package being released).

S.2.1.1 Ensure that relationships between WT Parts/Product Structure, CAD models, CAD drawings, pdf drawings in document objects, EO documents, and EPL Reports exist for released objects.

S.2.1.2 Ensure that effectivity is applied to the WT Parts/Product Structure.

S.2.1.3 Verify that technical approvals were captured in the release object attributes.

NOTE: Approvals may be captured through the electronic workflow or entered manually by the originator of the release data.

S.2.1.4 Verify traceability between the CR and CBD that authorized release and the released data (documents, drawings, CAD models, WT Parts, EPLs, and EOs).

S.2.1.5 Release native format CAD models and CAD drawings contained in CAD objects which have dynamic relationships within the release system.

S.2.1.6 Ensure the released CAD model has a lightweight viewable in hpgl format, and the released CAD drawing has a lightweight viewable in pdf format.

S.2.1.7 Where the CAD drawing and CAD model objects do not have dynamic relationships within the release system, release a pdf file of the drawing as content of a document object (Drawing Representation Document type), and release the native CAD file as the content of a separate document object (Drawing Representation Document type).

S.2.1.8 Verify that the pdf drawing created from the CAD drawing displays the initial release approvals and the release date (data in ICE Windchill object approval and release date attributes automatically display in drawing). For the pdf drawing released as a document object, enter the release date into the pdf file.

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 78 of 80</b>

S.2.1.9 Release WT Parts and create the released EPL Report from the released WT Parts for WT parts marked for separate parts list (SPL).

S.2.1.10 Release EPL document object (EPL Document type) that contains released EPL Report file as primary content.

S.2.1.11 Release EO document object (EO Document type) that contains the released EO form file as primary content. Enter the release date in the EO form file.

S.2.1.12 Provide released data as records to the MSFC Documentation Repository. The MSFC Documentation Repository is the record custodian of all records released by the MSFC Release Desk.

S.3 Distribution of Released Data (ICMS and ICE Windchill). The MSFC Documentation Repository shall be the single point for distribution of released documents in accordance with the distribution list prepared by the originating organization. The originating organization shall provide the distribution list and shall provide distribution list updates to the Repository as changes in personnel occur. The Repository requires completion of MSFC Form 2896 or the equivalent Repository Electronic Document Submittal Interface in accordance with MWI 2210.1.

S.4 Records Related to MSFC Release Processes (ICMS and ICE Windchill)

Table VIII identifies the records related to the MSFC Release process and MSFC Release Desk activities. Table VIII provides the records description, the NPR 1441.1 Agency Filing Scheme (AFS) number, NPR 1441.1 Schedule/Item number, NPR 1441.1 record disposition, and the suggested Records Custodian assignment.

**MSFC Technical Standard  
EE12**

<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 79 of 80</b>

**TABLE VIII. RECORDS RELATED TO MSFC RELEASE PROCESSES**

<b>Record Description</b>	<b>Projects Meeting Criteria in Note 1 (below): NPR 1441.1 AFS Number, Schedule/ Item, Record Disposition</b>	<b>Projects Not Meeting Criteria in Note 1 (below): NPR 1441.1 AFS Number, Schedule/ Item, Record Disposition</b>	<b>Record Custodian (typical)</b>
Documentation released by the MSFC Release Desk (specifications, drawings, EPLs, CAD models, EOs, other project data)	8000. 8/101. Permanent. Cut off records at close of program/project or in 3-year blocks for long term programs/projects. Transfer to records center storage. Transfer to National Archives 7 years after cutoff.	8000. 8/107. Temporary. Destroy/delete between 0 and 30 years after program/project termination. (see Note 2 below)	MSFC Repository
Change Package data from MSFC Release packages (Class I changes that affect form, fit, or function)	8000. 8/101. Permanent. Cut off records at close of program/project or in 3-year blocks for long term programs/projects. Transfer to records center storage. Transfer to National Archives 7 years after cutoff.	8000. 8/107. Temporary. Destroy/delete between 0 and 30 years after program/project termination. (see Note 2 below)	Project CCB Secretariat or designee
Change Package data from MSFC Release packages (Changes that <i>do not</i> affect form, fit, or function)	8000. 8/103. Temporary. Cut off records at close of program/project or in 5-year blocks. Destroy/delete between 0 and 30 years after cutoff. (see Note 2 below)	8000. 8/107. Temporary. Destroy/delete between 0 and 30 years after program/project termination. (see Note 2 below)	Project CCB Secretariat or designee
ICMS and ICE Windchill Part and Release Accounting meta-data	2420. 2/15/D. Temporary. After program/project termination, delete when no longer needed for administrative, legal, audit, or other operational purposes.	2420. 2/15/D. Temporary. After program/project termination, delete when no longer needed for administrative, legal, audit, or other operational purposes.	Project CCB Secretariat or designee

<b>MSFC Technical Standard EE12</b>		
<b>Title: MSFC Engineering Documentation Standard</b>	<b>Document No.: MSFC-STD-555</b>	<b>Revision: J</b>
	<b>Effective Date: June 17, 2013</b>	<b>Page 80 of 80</b>

<b>TABLE VIII. RECORDS RELATED TO MSFC RELEASE PROCESSES (continued)</b>			
<b>Record Description</b>	<b>Projects Meeting Criteria in Note 1 (below): NPR 1441.1 AFS Number, Schedule/ Item, Record Disposition</b>	<b>Projects Not Meeting Criteria in Note 1 (below): NPR 1441.1 AFS Number, Schedule/ Item, Record Disposition</b>	<b>Record Custodian (typical)</b>
Logs Maintained by MSFC Release Desk <ul style="list-style-type: none"> <li>• “MSFC-“ Document Numbers</li> <li>• “Base” Drawing Numbers</li> <li>• Project Codes</li> <li>• Board Codes</li> <li>• CI Numbers</li> <li>• DP/RS Numbers</li> <li>• Deviation-Waiver Numbers</li> <li>• Serial Numbers</li> </ul>	1442. 1/78/C. Temporary. Destroy or delete when 2 years old, or 2 years after the date of the latest entry, whichever is applicable.	1442. 1/78/C. Temporary. Destroy or delete when 2 years old, or 2 years after the date of the latest entry, whichever is applicable.	MSFC Release Desk
CCB Charters and CI-Effectivity Lists – Reference Copies	8000. 8/104. Temporary. Destroy/delete when no longer needed.	8000. 8/108. Temporary. Destroy/delete when no longer needed.	MSFC Release Desk

**Note 1: Project Criteria.** Programs/Projects relating to both manned and unmanned space flight, aerospace technology research, and basic or applied scientific research AND meeting one or more of the following criteria: are "first of a kind," establish precedents, produce major contributions to scientific or engineering knowledge, integrate proven technology into new products, or are/have been subject of widespread media attention or Congressional scrutiny. (Excerpt from NPR 1441.1, Schedule 8, Item 101).

**Note 2: Choose Years From 0 to 30 Range.** The intent of the “0 to 30 years” range is for the project office that owns the record to choose the appropriate number of years that the record is retained after project termination from within the “0 to 30 years” range. The specific number of years chosen per record type is recorded in the record plans specific to that project.