

**NOT MEASUREMENT-
SENSITIVE**

**KSC-GP-435, Volume I
Revision H**

**ENGINEERING DRAWING PRACTICES
VOLUME I OF II
AEROSPACE AND GROUND SUPPORT EQUIPMENT**

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Engineering Directorate

National Aeronautics and
Space Administration

John F. Kennedy Space Center

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**ENGINEERING DRAWING PRACTICES
VOLUME I OF II
AEROSPACE AND GROUND SUPPORT EQUIPMENT**

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RECORD OF REVISIONS/CHANGES

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		Basic issue	August 1, 1973
A		General revision	December 18, 1978
	A-1	Changed revision 18, Interface Control Documents	July 2, 1979
	A-2	Changed paragraph 10.5.3.1(f); Changed section 16, Reference Designations	October 31, 1980
B		General revision	May 31, 1984
	B-1	Changed paragraph 10.6.5.4	January 9, 1987
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	C-1	Miscellaneous changes to sections I, II, III, IV, VII, and IX	March 30, 1992
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	E-1	Changed paragraphs 9.2.1.3 and 9.2.1.4	December 3, 1997
	E-2	Change Notice to make pen-and-ink change to page 9-5, paragraph 9.2.1.3 (blocks)	September 11, 1998
	E-3	Change Notice to make pen-and-ink change to page 9-2, paragraph 9.2.1.3 (block 1)	March 23, 1999
	E-4	Change Notice to make pen-and-ink changes to page 8-1, paragraphs 8.2 and 8.3	July 2, 1999
F		General revision to incorporate changes E-1 through E-4, update references, drawing format changes, drafting practices, drawing and part identification	February 28, 2001
G		General revision to replace all previous revisions and changes	April 18, 2014
	G-1	Updated signature authority. Updated applicable documents and revision levels throughout. Removed reference to obtaining hard copies from Foreword. Added section 1.2.1.2, Drawings, to accommodate format of reference. Added requirement to provide drawing media as digital data in 2.2.a. Stated applicable appendices of ASME Y14.35-2014 in 2.2.s. Added lettering height requirements in 2.3.d, 2.4.d, and 2.5.d. Specified note/reference to be placed on drawings in 2.3.e. Simplified Figure 5.	March 26, 2015
H		General revision to replace all previous revisions and updates addressing Agency model/digital based initiatives	August 11, 2020

FOREWARD

The Kennedy Space Center (KSC) *Engineering Drawing Practices, Volume I of II, Aerospace and Ground Support Equipment*, is the official source for the requirements and interpretations to be used in the development and presentation of engineering drawings and related documentation for the KSC.

The Engineering Directorate is delegated the responsibility for interpretation, periodic updates, and distribution of the *Engineering Drawing Practices, Volume I of II, Aerospace and Ground Support Equipment*.

Note: See [KSC-GP-435](#), *Engineering Drawing Practices, Volume II of II, Facilities*, for the conventions applicable to engineering and drafting personnel in the preparation, revision, and completion of engineering drawings and digital product definition data sets for real property, facility, and related collateral equipment. Volume II applies to drawings used to construct, test, operate, maintain, and otherwise utilize facilities at KSC.

All KSC Engineering organizations and contractors shall adhere to the requirements of this manual when preparing KSC engineering documentation (i.e., CAGE Code 22264). This document and its requirements in its entirety or specific sections shall be levied via contract for work being performed for KSC Ground Systems (as defined in [KSC-DE-512-SM](#)).

Requests for information or for making corrections or additions to this manual should be directed to the Engineering Directorate, Kennedy Space Center, Florida 32899.

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ABBREVIATIONS, ACRONYMS, AND SYMBOLS

2D	two-dimensional
3D	three-dimensional
AES	advanced electrical schematic
ASME	American Society of Mechanical Engineers
CADD	computer-aided design and drafting
CAE	computer-aided engineering
CAGE	Commercial and Government Entity
CI	Configuration Item
DAI	Design Activity Identification
DOD	Department of Defense
EES	elementary electrical schematic
EO	Engineering Order
FEO	Field (or Floor) Engineering Change
GIS	ground integrated schematic
ISO	International Organization for Standardization
KSC	John F. Kennedy Space Center
NASA	National Aeronautics and Space Administration
NPR	NASA Procedural Requirement
ODA	Original Design Authority
PIN	Part Identification Number
PDM	Product Data Management
PLM	Product Lifecycle Management
STD	standard

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1. INTRODUCTION

KSC-GP-435, *Engineering Drawing Practices, Volume I of II, Aerospace and Ground Support Equipment*, establishes the conventions to be adhered to by engineering and drafting personnel in the preparation, revision, and completion of engineering digital product definition data sets. This manual sets forth the minimum requirements acceptable at Kennedy Space Center (KSC) for the preparation of model-only, model and dependent drawing, and drawing-only digital product definition data sets based on the engineering drawing and model requirements in the ASME Y14 series.

The engineering drawings prepared by KSC design personnel or contractors in the KSC drawing format using KSC issued drawing numbers shall be known as *government design activity drawings*.

Although generally in accordance with industry practices and procedures, this manual does contain specific differences and exceptions. This manual, while not intended as a manual of instruction in the basic principles of drafting, does set forth the minimum requirements acceptable at KSC. One of those requirements is that persons engaged in the preparation of digital product definition data sets shall have a thorough understanding of the fundamentals of modeling, drafting and geometrical dimensioning and tolerancing in order to produce interpretable product definition data sets.

The widely accepted use of computer-aided design and drafting (CADD) and computer-aided engineering (CAE) software and numerous packages thereof has necessitated the abandonment of legacy manual drafting practices so long maintained by this manual at KSC. Typically resulting from the use of these various CADD and CAE software packages is the existence of software-package-provided or internally generated supplemental documents, such as design manuals, computer-generated modeling manuals, and drawing manuals, that comply with industry standards and may further define and standardize the creation of consistent digital product definition data sets within the respective companies and organizations where they are used.

The expectation now rests within the various companies or organizations producing government design activity drawings to provide consistent product definition data sets that comply with the industry standards discussed in this document. Tailoring of industry standards and additional requirements in this manual are specific to the KSC needs and are assumed CADD-software-independent and not to cause undue burden or customization of CADD software.

Tailoring is permitted where unique contractor practices meet the intent of this standard. Approval of tailoring is the responsibility of the lead discipline engineer for this manual as identified in [KSC-PLN-5400 LDE-LIST](#).

1.1 Scope

This manual establishes the essential requirements and reference documents for the preparation and revision of digital product definition data sets prepared for or by NASA at KSC. This volume is only applicable to KSC in-house programs/projects. These requirements do not apply to the preparation of illustrations, artwork, or figures in technical publications. Certain design material has been included as guidelines and aids for the design work as KSC.

1.2 Applicable Documents

The following documents form a part of this document to the extent specified herein. When this document is used for procurement, including solicitations, or is added to an existing contract, the specific revision levels, amendments, and approval dates of said documents shall be specified in an attachment to the Solicitation/Statement of Work/Contract.

1.2.1 Governmental

National Aeronautics and Space Administration (NASA)

NPR 1600.1A	NASA Security Program Procedural Requirements
NPR 2190.1C	NASA Export Control Program

1.2.1.1 Standards

John F. Kennedy Space Center, NASA

KNPR 8040.1B	KSC Configuration Management Procedural Requirements
KSC-DE-512-SM	Facility Systems, Ground Support Systems, and Ground Support Equipment General Design Requirements

1.2.1.2 Drawings

John F. Kennedy Space Center, NASA

75M50393	Identification Plate, Ground Support Equipment, Kennedy Space Center
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1.2.1.3 Publications

Military

DOD 5220.22-M National Industrial Security Program Operating Manual

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specified procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

1.2.2 Non-Governmental

American Society of Mechanical Engineers (ASME)

ASME B46.1-2009	Surface Texture (Surface Roughness, Waviness, and Lay)
ASME Y14.1-2012	Decimal Inch Drawing Sheet Size and Format
ASME Y14.1M-2012	Metric Drawing Sheet Size and Format
ASME Y14.2-2014	Line Conventions and Lettering
ASME Y14.3-2012	Orthographic and Pictorial Views
ASME Y14.5-2018	Dimensioning and Tolerancing
ASME Y14.6-2001	Screw Thread Representation
ASME Y14.8-2009	Castings, Forgings, and Molded Parts
ASME Y14.24-2012	Types and Applications of Engineering Drawings
ASME Y14.31-2014	Undimensioned Drawings Engineering Drawing and Related Documentation Practices
ASME Y14.34-2013	Associated Lists
ASME Y14.35-2014	Revision of Engineering Drawings and Associated Drawings
ASME Y14.38-2007	Abbreviations and Acronyms for Use on Drawings and Related Documents
ASME Y14.41-2019	Digital Product Definition Data Practices
ASME Y14.42-2008	Digital Approval Systems

ASME Y14.44-2008	Reference Designations for Electrical and Electronics Parts and Equipment
ASME Y14.47-2019	Engineering Product Definition and Related Documentation Practices
ASME Y14.100-2017	Engineering Drawing Practices

American Welding Society (AWS)

AWS A2.4:2012	Standard Symbols for Welding, Brazing, and Nondestructive Examination
AWS A3.0M/A3.0:2020	Standard Welding Terms and Definitions; Including Terms for Adhesive Bonding, Brazing, Soldering, Thermal Cutting, and Thermal Spraying

Institute of Electrical and Electronics Engineers, Inc. (IEEE)

IEEE/ASTM SI 10-2016	American National Standard for Metric Practice
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International Standards Organization (ISO)

ISO 14617-1	Graphical symbols for diagrams - Part 1: General information and indexes
ISO 14617-2	Graphical symbols for diagrams - Part 2: Symbols having general application
ISO 14617-3	Graphical symbols for diagrams - Part 3: Connections and related devices
ISO 14617-4	Graphical symbols for diagrams - Part 4: Actuators and related devices
ISO 14617-5	Graphical symbols for diagrams - Part 5: Measurement and control devices
ISO 14617-6	Graphical symbols for diagrams - Part 6: Measurement and control functions
ISO 14617-7	Graphical symbols for diagrams - Part 7: Basic mechanical components
ISO 14617-8	Graphical symbols for diagrams - Part 8: Valves and dampers – First edition

ISO 14617-9	Graphical symbols for diagrams - Part 9: Pumps, compressors and fans – First edition
ISO 14617-10	Graphical symbols for diagrams - Part 10: Fluid power converters – First edition
ISO 14617-11	Graphical symbols for diagrams - Part 11: Devices for heat transfer and heat engines – First edition
ISO 14617-12	Graphical symbols for diagrams - Part 12: Devices for separating, purification and mixing – First edition

National Institute of Building Sciences

United States National CAD
Standard – V6

Society of Automotive Engineers (SAE)

SAE EIA-649 Configuration Management Standard

1.3 Definitions

For the purpose of this document, the following definitions are obtained from specifications and standards listed in 1.2 Applicable Documents and are referenced in parentheses (.....).

Configuration: (1) The product attributes of an existing or planned product, or a combination of products, i.e., product requirements, the product, and associated product configuration information; (2) one of a series of sequentially created variations of a product. (SAE EIA-649)

Configuration change: a change to the product configuration information and the product. (SAE EIA-649)

Change classification: categorizes the impact of a requested change and indicates the appropriate approval authority required to make the approval or disapproval decision. The use of change classification varies depending on the environment the change is occurring in. (SAE EIA-649)

In some environments change classification is determined by conditionally evaluating some or all of the attributes contained on the request for change and using this information in order to determine the appropriate levels of impact analysis and review, as well as the appropriate change approval authority.

In other environments, the use of change classification categorizes the impact of a proposed change to a deliverable or end item (i.e., CI, CLIN, Product, service, etc.) after the item has achieved a formal baseline status (Functional, Allocated, Product) and indicates the appropriate

approval authority required to make the approval or disapproval decision. Major, Minor, and Administrative change categories communicate the severity and impact of a change between the Acquirer and Supplier, including changes within an Enterprise. In simple terms:

- A **Major** classification indicates that the configuration change has impacted the function, performance and/or interchangeability characteristics of the item such that the Acquirer will need to take action. A configuration change, after establishment of the product baseline, (i.e., baseline for implementation of the product design, post CDR, etc.) that affects compatibility with interfacing products (e.g. test equipment, support equipment, software, or products furnished by others). A Major change may affect one or more of the following:
 - delivered operation or servicing instructions,
 - required calibration to the extent that product identification should be changed,
 - interchangeability or substitutability of replaceable products, assemblies, or components,
 - change to add a previously non-qualified supplier, where supplier selection is specified,
 - user skills or user physical attributes,
 - operator or maintenance training,
 - requires rework/retrofit of delivered products; e.g., by product recall, modification kit installation, attrition, replacement during maintenance using modified spares.
- A **Minor** classification indicates that the configuration change has no impact to the performance and/or interchangeability characteristics of the item and that the change is transparent to the Acquirer requiring no action on the Acquirer's part.
- An **Administrative** classification indicates a basic documentation correction that has no impact on the delivered item and is transparent to the Acquirer (fixing spelling errors, grammar corrections, updating an address, etc.).

Design Activity: an organization that has responsibility for the design (hence change authority) of an item or system. The activity may be a government entity, contractor, vendor, or other organization such as a university.

Design activity — current: the design activity currently responsible for the design of an item. This may be the original design activity or a design activity to which the design responsibility has been transferred. (ASME Y14.100)

Design activity — original: the design activity originally responsible for the design and identification of an item whose drawing number and activity identification and address (city and state), or CAGE Code is shown in the title block of the drawings and associated documents. (ASME Y14.100)

Engineering Action Request (EAR): a documented means of requesting design agency engineering assistance in answering questions or resolving drawing interpretation problems for hardware/software.

Engineering Instructions/Time Compliance Technical Instruction (EI/TCTI): an EI is an issuance, [KSC Form 21-122](#), comprised of instructions, drawings, and other documents as required to direct and/or to document work in house. A TCTI includes all elements of an EI, and also includes parts and material lists.

Engineering Order (EO): an official document used to describe changes to released drawings, lists, or other related engineering documents.

Engineering Support Request (ESR): [KSC Form 21-319](#), used to request Engineering Support that requires more than incidental Labor and Materials.

Field Engineering Change (FEC): [KSC Form 14-129](#), Field Engineering Change, is used to document changes that require immediate implementation and for which the responsible design organization cannot release formal engineering in time to meet the required schedule. Implementing change objects must remain open until released engineering is received and verified that the engineering matches the work accomplished.

Graphic Symbol: a representation of a physical component used in diagrams such as overview diagrams, flow diagrams, and circuit diagrams.

Government Design Activity Drawings: drawings furnished or prepared as Government agency drawings by a Government design activity or a contractor and for which the Government agency retains or assigns responsibility for the preparation and/or maintenance. These drawings are assigned Government identification code and Government drawing numbers from a block of numbers issued by a Government activity.

Maintained Drawing: a drawing that contains design data that must be kept up to date in order to meet an operational need.

Make Operable Change: a condition where a drawing error or design deficiency exists and or a modification cannot be implemented per released engineering drawings and a corrective type design change is required to resolve the condition immediately to avoid missing milestone constraints.

“may”: an expression of an exception allowance, preference, or best practice.

Product configuration information: information about a product consisting of product definition information and product operational information. (SAE EIA-646 C)

Product Definition Information: information that defines the product’s requirements, documents the product attributes including the process information, and is the authoritative source for configuration management of the product. (SAE EIA-646 C)

Product Operational Information: information developed from product definition information used to test, operate, maintain and dispose of a product. (SAE EIA-646 C)

Revision: refers to any changes made to add, change, or delete information on a CAD object after the drawing has been released.

Change Authorization Object: refers to a Product Data Management (PDM) object (e.g. Change Notice, Variance, etc.) or a change authority's document (e.g. CCBD) recognized as the authority for making a change to a drawing or associated documentation.

“shall”: an emphatic form of the verb that is used whenever a requirement is intended to express a provision that is binding and mandatory.

“should”: an expression of strong recommendation of a non-mandatory provision.

Symbology: drawing symbols that convey information for the interpretation of markings on drawings.

2. GENERAL PRACTICES

2.1 General

The preparation and revision of KSC engineering drawings and associated lists shall be in accordance with ASME Y14.100 unless otherwise stated or refined in the following sections. The preparation and revision of digital product definition data shall be in accordance with ASME Y14.41 unless otherwise stated or refined in the following sections. References to electrical and electronic parts shall be in accordance with ASME Y14.44 unless otherwise stated or refined in the following sections.

Words, when not instructional or a format like “date” or “dash number”, encased by quotes indicate that the words as written are to be used without the quotes.

Cross-reference of standards in text with or without a date following the standard designator are interpreted as follows:

- a. Reference to other standards in the text without a date following the standard designator indicates that the issue of the standard identified in the Applicable Documents section are used to meet the requirement.
- b. Reference to other standards in the text with a date following the standard designator indicates that only that issue of the standard are used to meet the requirement.

Invocations of referenced standards when specified in the Applicable Documents section and referenced in the text of this document are interpreted as follows:

- a. When a referenced standard is cited in the text with no limitations to a specific subject or paragraph(s) of the standard, the entire standard is invoked. For example, “Dimensioning and tolerancing shall be in accordance with ASME Y14.5” is invoking the complete standard because the subject of the standard is dimensioning and tolerancing and no specific subject or paragraph(s) within the standard are invoked.

- b. When a referenced standard is cited in the text with limitations to a specific subject or paragraph(s) of the standard, only the paragraph(s) on that subject is invoked. For example, “Assign part or identifying numbers in accordance with ASME Y14.100” is invoking only the paragraph(s) on part or identifying numbers because the subject of the standard is engineering drawing practices and part or identifying numbers is a specific subject within the standard.
- c. When a referenced standard is cited in the text without an invoking statement such as “in accordance with,” the standard is for guidance only. For example, “For gaging principles see ASME Y14.43” is only for guidance and no portion of the standard is invoked.

2.2 ASME Y14.100-2017 Tailoring

The drawing requirements defined by ASME Y14.100 have been tailored for this manual as follows. *Contractor’s option* implies that the choice of options to follow in ASME Y14.100 is the contractor’s decision and does not imply that the contractor has the option to not follow the ASME Y14.100 standard.

- a. Drawing Media shall be produced and provided as digital data. (The order of preference for drawing media is as follows: native file; DXF file, and PDF file) (The order of preference for Model Based Definition Data Sets is as follows: fully annotated native file and fully annotated STEP AP242 file or STEP AP214, AP214IS, or AP214DIS file)
- b. Drawing format shall be Government (forms supplied by the Government contractor or by the Government).
- c. Drawing sheet sizes shall be in accordance with ASME Y14.1. ASME Y14.1M may be used for international work.
- d. Application data shall be provided per the contractor’s option, and general use or multi-use application data is allowed.
- e. Drawing detail shall be produced as monodetail, multidetail, or tabulated. Drawing detail may be produced as a detailed assembly drawing to preserve legacy types, and drawing types should be combined only if this will result in a significant advantage over using separate drawings of a single type.
- f. Dimensioning and tolerancing shall be in accordance with ASME Y14.5.
- g. Drawing notes shall be provided as contractor’s option. It is preferred that reference to a separate document be used.
- h. Types of drawings (ASME Y14.24) shall be the contractor’s selection.
- i. Multi-sheet drawings shall be maintained such that all sheets reflect the drawing revision level.
- j. In a redrawn drawing (a redrawing without a change), the revision level shall not be advanced.

This might occur when switching software products or converting a hand-drawn drawing to a CAD maintained drawing.

- k. The revision history shall be maintained in accordance with one of the following methods, in order of preference: remove all details in the revision history but retain the line entry for revision authorization and date of revision, remove all previous revision history, remove one or more revision records as required, remove all revision history except that for the revision preceding the current one, or maintain the revision history in its entirety.

Preference for manual drawings is to remove all revision history except that for the revision preceding the current one.

Preference for drawings watermarked by a PLM or PDM system is to remove all details in the revision history but retain the line entry for revision authorization and date of revision.

- l. When sheets are added, the drawing shall be renumbered using consecutive whole numbers or, for manual CAD sheet numbering, an alphanumeric sequence.
- m. The method for deleting sheets (ASME Y14.35) shall be to renumber all affected remaining sheets or, for manual CAD sheet numbering, affected remaining sheets not renumbered (revision status of sheets block is updated with notations such as CANC or DEL).
- n. Marking on engineering drawings shall include applicable symbols and notes for special items and processes.
- o. Associated lists shall be provided as digital data or as part of the KSC Product Lifecycle Management (PLM) functionality, such as Parts Lists. (Native files are preferred over PDF files.)
- p. Types of associated lists shall include a parts list per the contractor's option, an application list, data list, index list, indentured data list, and wire list. Separate Parts Lists are preferred.
- q. Third-angle projection shall be used in drawings.
- r. The English language shall be used in drawings.
- s. Drawings shall be titled in accordance with Appendix C of ASME Y14.100, with changes requiring a new Part or Identifying Number (PIN) identified as specified in Appendix D, section D-13. Materials, processes, and protective treatment shall be identified as specified in Appendix D, section D-14. When using the KSC Product Lifecycle Management (PLM) system, D-9.8

2.3 Drawing Elements

- a. The CAD model set used to generate drawing views and annotations shall be identified on the drawing by filename (including extension) and as appropriate, software application (including version) on government design activity (KSC's CAGE Code 22264) drawings.
- b. The required number of drawing views necessary to convey the required characteristics of the part required for fabrication, assembly, and inspection.

Drawings need not have three views, (i.e., one or two views are permissible for objects that can be completely defined). Complementary notes or dimensions are acceptable in place of the additional views.

- c. Views, dimensions, etc., shall not extend into or outside the borders of the drawing.
- d. Each part listed in the List of Materials (Parts List) must be identified at least once by an Item (Find) Number on the body of the drawing (except Single Item drawings and Shown and Opposite Item drawings) with zone number.
- e. Parts shall be bracketed, indicating reference, when they are identified by number or name and are not noted in the List of Material.
- f. Reference parts shown in views are shown in phantom.
- g. Repeated item numbers (items initially called out elsewhere) shall be indicated as reference either within brackets or by the word “REF.”
- h. Symbology used on government design activity drawings that is not defined in accordance with ASME Y14.100, a referenced standard in this document, or defined Appendix A, Nonmandatory Symbols of this document shall be shown in a legend located on the drawing sheet where the drawing symbol is used or in a legend located on the first page of the drawing.
- i. Minimum letter and number lettering height shall be in accordance with [Table 1](#).

Table 1. Minimum Letter and Number Height

Item on Drawing	Minimum Letter or Number Height	
	Drawing Size	
	A and B inch (mm)	C, D, E, F, and J inch (mm)
Drawing number	.25 (6)	.25 (6)
Title	.18 (5)	.18 (5)
Subtitle and view titles	.09 (2)	.12 (3)
List of notes (heading)	.12 (3)	.18 (5)
Field of drawing notes and revisions	.06 (1.5)	.12 (3)
Title block entries	.09 (2) .12 (3) preferred	.09 (2) .12 (3) preferred
Parts list	.06 (1.5)	.12 (3)
Find number	.06 (1.5)	.12 (3)

- j. Drawings or data sets based on this standard should contain a note or reference as follows: “THIS DRAWING SHALL BE INTERPRETED IN ACCORDANCE WITH ASME Y14.100.”
- k. The scale under a drawing view shall take precedence of the drawing sheet scale no matter how views are on the drawing sheet.
- l. The drawing shall completely identify or define and describe or reference the material requirements; including but not limited to applicable type, grade, class or conditions.

- m. The drawing shall completely identify or define and describe or reference the applied finish.
- n. The drawing shall completely identify or reference machine finishes on surfaces requiring finish control.
- o. Inseparable Assembly drawings that provide fabrication control may be prepared in lieu of individual detail drawings for the parts of an inseparable assembly.
- p. Machined parts and assemblies (including "sheet metal" parts) shall be dimensioned and toleranced using decimals per ASME Y14.5 using positional tolerances for all features of size.

Symmetric parts should use centerline datums (as opposed to edges).

Centerline datums should be defined from features of size, typically at MMC.

Positional tolerances and runout should be used to avoid circularity, concentricity, and cylindricity tolerancing.

- q. Sheet metal parts shall be dimensioned in the formed condition.
A dimensionless flat pattern should be included on the drawing for reference.
- r. Mechanical/structural weldments shall be dimensioned and toleranced per ASME Y14.5.
Positional tolerancing with datums is typically not applicable.
- s. Where post-weld machining is required;
 - (1) Datums should be defined (typically using datum targets)
 - (2) Positional tolerancing should be used.
- t. For "facilities" type structures;
 - (1) Nominal, fractional inch dimensioning may be used
 - (2) The AISC code of standard practice may be used control tolerances as applicable based on design intent.
Large piping and ECS duct weldments or assemblies can usually be dimensioned with nominal +/- 1/16" tolerances.
- u. Useful reference dimensions should be included on all drawings.
Useful reference dimensions provide additional information that will preclude the need to perform calculations or measure during fabrication or inspection.
- v. The weight of an assembly or detail part shall be entered on the drawing in the appropriate place in the title block. The number of significant figures that will represent the weight shall be in accordance with [Table 2](#).

Table 2. Weight Representation Significant Values

Calculated Weight (Units)	Entry on Drawing, X Indicates Number of Significant Figures
Less than 0.05	--
0.05 to 0.15	0.1
0.15 to 10.0	X.X
10.0 to 100	XX
100 to 1000	XX0
More than 1000	XX00

2.4 Legacy Drawing and Part Identification Number

- a. The drawing number prefix, the first portion of a complete part number, shall be the drawing number of the drawing for the part or assembly.
- b. The suffix, the last portion of a complete part number, shall be a numeric suffix separated from the drawing number by a dash.
- c. The part identification suffix is shall be assigned in numeric sequence, for example, (-1) (-2) (-3) etc., by drafting during the preparation of the drawing.
- d. The drawing number prefix and the part identification suffix together shall constitute the complete part number, e.g., 75MI2345-1.

In many cases, part numbers referenced on various documents, such as parts or material lists, EO's, etc., are prefixed with a "drawing size letter"; for example, J75MI2345-1, D75MI2345-1, etc. This letter is used to indicate drawing size for convenience only and has no further significance.

2.5 Part Identification Numbers Using the PDM System

- a. The part number shall be or shall include the design drawing number, and may include a dash number suffix.
- b. Part numbers with no "Dash Number" shall be also interpreted as the drawing number.
- c. Part numbers with a "Dash Number" shall follow the Legacy Complete Part Number Schema.

Tabular parts and Mirror parts are examples of part numbers that will follow the legacy Complete Number Schema.

2.6 Associated Lists and Drawing Data

- a. Notes shall be located on sheet 1 of a drawing, or a reference shall be included on sheet 1 indicating location, drawing sheet, of notes.

- b. When notes are included on a separate parts list, a note placed above the title block should contain the following: “SEE SEPARATE PARTS LIST FOR PARTS AND NOTES.” When notes are continued beyond a given drawing sheet, information to that effect shall be inserted in the next note position of the applicable sheet, e.g., “NOTES CONTINUED ON SHEET 4.”
- c. Separate Lists and Drawing Data identifier shall be suffixed by the letters PL (for Parts List and Parts List with Notes), NL (for Note List only), DL (Data List), or WL (Wire List). List identification is established through the associated drawing number or Part or Identifying Number (PIN).

Separate Parts List and Notes List are preferred.

- d. Part Identifying Numbers that serve as a numeric representation of textual descriptions or as only internal PDM identifier shall be supplemented with appropriate notes to ensure clear requirements for procurement.
- e. PDM systems that manage product definition data may be used to provide access to product definition data in lieu of creating separate associated lists.
- f. Associated lists shall be prepared in accordance with this Standard and made available when users of the product definition data do not use the PDM system.
- g. Preprinted formats need not be utilized when the automated operation can provide product definition data in similar format.
- h. The arrangement of the notes shall not be interpreted as an order of precedence or sequence in manufacturing, assembly, etc., unless so specified.

Drawing notes are pertinent data used to complement the delineation of other given data.

- i. Note numbers of deleted notes shall not be reused.

When a note is deleted, do not delete the identifying number/letter or renumber/alphabetize the notes.

- j. Notes shall be numbered consecutively from the top down as a single listing starting with Note 1 and may be grouped and contain additional characters, i.e. 1A, 1B, 2A. Headers for groupings may also be used.
- k. When a note pertains to a particular portion of a part or group, it shall be considered a specific note.

Specific drawing notes may be referenced by placing a note number within a flag located on the field of the drawing where the specific note applies.

- l. Design activity PDM systems that manage product definition data may be used to provide access to product definition data in lieu of creating separate associated lists.
- m. Associated lists not defined by the design activity PDM system shall be prepared in accordance with this ASME Y14.34.

- n. Associated lists shall be made available when users of the product definition data do not use the PDM system.

Preprinted formats need not be utilized when the automated operation can provide product definition data in similar format.

- o. Notes should not duplicate information specified elsewhere.
- p. Drawing notes must be clear and specific in wording to avoid misinterpretation.
- q. Common shop trade terms and words should be used to the extent practicable.
- r. Notes should be as brief and concise as possible.
- s. Notes which are repeated on similar or related drawings should be identical in wording.
- t. Notes should not include references to specific manufacturing or machining methods or references to Intermediate steps in the production process.

2.7 Single, Multiple, and Sectional Views

- a. Multiviews and sectional views shown on drawings shall be in accordance with ASME Y14.3.
- b. Isometric, pictorial, or other views may be shown on the drawings provided there is some particular advantage and clarity is not degraded.
- c. Isometric and pictorial may be used to identify components.
- d. Linear dimensions may be shown in an isometric view only if along or parallel to any one of the three axes of the isometric view.
- e. Linear dimensions not along or parallel to an axis of the isometric view are not shown.
- f. Cross-reference zoning shall be used on drawings to indicate the location of an indicated section, view, or detail and to refer back to the viewing location for that section, view, or detail. Reference ASME Y14.3 or use Sheet/Zone Locator Symbol shown in Appendix A of this document.
- g. Views located on different sheets of drawings shall include the sheet number as well as the zone. Reference ASME Y14.3 or use Sheet/Zone Locator Symbol shown in Appendix A of this document.
- h. An identifying letter shall only be used for one section, view, or detail on the same drawing (e.g., if section A exists, there shall be no view A or detail A).
- i. Pictorial views may be shaded to enhance viewing ease when shading does not negatively impact legibility.
- j. Pictorial views generated from models or design models are direct representations of the geometry. When supplemental geometry is included for any purpose as part of a model, the model geometry that represents the product shall be clearly delineated from any supplemental geometry. See ASME Y14.41.

- k. Lines of variable width may be used to improve the visualization quality of the view and vary the emphasis on individual details.
- l. When the relationship between mating parts is important, the relative position of the detailed part to the related part may be shown in constructed views by using phantom lines to outline the related part. Notes may be added to indicate the functional relationship of these parts.

2.8 Drawing Titles and Item Nomenclature

ASME Y14.100 Drawing Titles section establishes procedures for creating titles for engineering drawings and names for items detailed thereon. Some of the general rules are listed below but the entire section in ASME Y14.100 applies. See ASME Y14.100 Non-Mandatory Appendix C Drawing Titles for further references.

- a. The first part shall be the item name and shall consist of a basic name and modifiers as required. The basic name shall be a noun or noun phrase. This identifying noun or noun phrase shall establish the basic concept of an item. An example would be CABINET and PUMP.
- b. A modifier may be a single word or a modifying phrase. The first modifier shall serve to narrow the area of concept established by the basic name and succeeding modifiers must continue a narrowing of item concept by expressing a different type of characteristic. An example would be CABINET, ELECTRICAL EQUIPMENT and PUMP, LO2 TRANSFER.
- c. The second part of the title shall consist of such additional modifiers, modifying phrases, or government-type designators as required. Modifiers indicating what an item is (its shape, structure, or form) or what the item does (its function) are preferable to modifiers indicating the application (what it is used for) or location of the item (where it is used). An example would be CABINET, ELECTRICAL EQUIPMENT – FUEL TRANSFER and PUMP, LO2 TRANSFER – 1000 GPM.

To insure proper item identification, a quick check is to read the assigned nomenclature backwards from the last modifier to the next modifier to the name. Example: Cabinet, Electrical Equipment· Fuel Transfer; Would Read: Fuel Transfer Electrical Equipment Cabinet

- d. Reference to major assemblies or end items shall not be used except when necessary to differentiate similar items.
- e. Non-part drawings, such as schematic diagrams, shall include the drawing type as part of the title. For example: TRANSFORMER ASSY — SCHEMATIC DIAGRAM

2.9 Graphic Symbols, Designations, Letter Symbols, and Abbreviations

- a. Graphic symbols shall be in accordance with ASME Y14.100. Additional requirements are as follows.

- b. Mechanical and piping and fluid power graphic symbols shall be in accordance with ISO 14617-1 through 14617-12, as applicable.
- c. KSC-unique graphic symbols not defined in this manual shall be in accordance with [KSC-STD-152-2](#).
- d. Graphic symbols, designations, letter symbols, and abbreviations not covered by the standards referenced in this manual may be used provided they are shown in a legend located on the drawing sheet where used or in a legend located on the first page of the drawing or referenced by drawing note to an explanatory document.
- e. Graphic symbols and inclusive lettering for A- and B-size drawings may be reduced to half-size, i.e., a minimum letter height of 1/16 inch.

2.10 Types and Application of Drawings

Types and application of drawings shall be done in accordance with ASME Y14.24. Additional applications and requirements are defined in the following sections.

2.10.1 Electrical/Electronic Diagrams (ASME Y14.24-2012, Sec. 12)

2.10.1.1 System Block Diagram or Functional Block Diagram

- a. The system shall be laid out from left to right where possible.
- b. The electrical flow shall be depicted from top to bottom where possible.

2.10.1.2 Advanced Electrical Schematic (AES)

An advanced electrical schematic illustrates and defines electrical signal and power paths, detailed electrical connections, and functions of component items used within a specific circuit or system of circuits by means of graphic symbols. Complete and formal titles, part numbers where available, and reference designators of each component are identified. Indication of physical size, shape, or relative location of components is not required.

2.10.1.3 Elementary Electrical Schematic (EES)

An elementary electrical schematic contains much of the same information as an advanced electrical schematic except that wire routings and most of the detailed wire connections of the component items are omitted. These diagrams show all black boxes that are on the advanced schematic with sufficient detail to identify components and black-box functions. The schematic shows components in their functional relationship and is not restricted to drawing location by black-box outlines. Cross-reference information between the elementary electrical schematic and the electromechanical control diagram is shown. Hydraulic/pneumatic control circuits may also be shown.

2.10.1.4 Ground Integrated Schematic (GIS)

A ground integrated schematic combines a system block diagram with its related advanced electrical schematic, cable interconnect diagram, and system mechanical schematic/electro-mechanical control diagram. Used in conjunction with interfacing schematics, a ground integrated schematic is an analytic tool for program engineering and operational functions.

- a. A ground integrated schematic shall give end-to-end system visibility and definition in various levels of detail and display formats.

2.10.1.5 Electrical Power Riser Diagram (United States National CAD Standard – V5, Sheet Type 6)

Electrical AC power riser diagrams represent multiconductor power circuits as a single line. The various devices in the circuit (such as transformers, motor starters, and switches) and the connected loads are shown in simplified schematic form. This diagram locates power equipment and loads within a structure. Each AC power panel shall have a panel schedule, which is to be a part of the drawing.

2.10.1.6 Electrical Panel Schedule (United States National CAD Standard – V5, Sheet Type 6)

An electrical panel schedule is a tabulated drawing of the internal configuration of an AC power panel.

- a. A panel schedule shall be a part of the single-line power riser diagram.
- b. The panel schedule shall contain the panel location and its identification, the type of panel, associated circuit breakers, panel capacity and feeder source, breaker trip settings with the loads being supplied, spare breakers, and empty spares.

2.10.2 Modification Drawing

A modification drawing delineates changes to items after they have been delivered. When required for control purposes, a modification drawing shall require re-identification of the modified item. All of these requirements shall be met (tasks completed) prior to any program or project being considered finished or otherwise closed.

In addition to the requirements in ASME Y14.24:

- a. Engineering changes shall be incorporated into the original drawings to the extent that future production, operations, maintenance, and sustainment is to reflect the modifications.
- b. For all drawings directly affected by the modification drawing (e.g., installation, assembly, etc. drawings), a note on the affected drawing shall be added to state **THIS DRAWING HAS BEEN CHANGED BY MODIFICATION DRAWING “insert drawing number”**.

- c. If the affected drawing is not a maintained drawing, an engineering order to the drawing with the reference note shall be added to state THIS DRAWING HAS BEEN CHANGED BY MODIFICATION DRAWING “*insert drawing number*” and released.

2.10.3 Layout and Proposal Drawings

A layout drawing presents the investigation and study of design, and a proposal drawing conveys its features to the customer. The drawings are identified and prepared by the same requirement as production drawings.

In addition to the requirements in ASME Y14.24:

- a. Layout and proposal drawings shall contain the word LAYOUT or the word PROPOSAL, as applicable, placed in the drawing title block preceding the drawing title and a note DO NOT USE FOR FABRICATION.

2.10.4 Space and Weight Allocation Drawing (ASME Y14.24)

A space and weight allocation drawing sets forth dimensional information for an item in terms of area, space, weight, sway and access clearance, and pipe and cable attachment that are required when the item is to be installed and to function with related items, and represents the as-built configuration.

2.10.5 Limited Dimension Drawings

A limited dimension drawing delineates a single part and establishes item identification for the part (akin to a detail drawing). The complete end product definition data set is provided by a combination of information on the drawing and in the digital product definition in accordance with ASME Y14.41.

- a. A limited dimension drawing, together with an accurate, clean model product definition, shall delineate all features of the part including, as applicable: configuration, dimensions, tolerances, materials, mandatory processes, surface texture, protective finishes and coatings, inspection requirements, and markings.
- b. A limited dimension drawing shall include all basic datums, dimensions that describe the overall size of the part, dimensional details of holes/threads, surface finish and notes that depict additional information needed to finish and inspect the final product.
- c. The following note shall be included in the general notes:

“THIS IS A LIMITED DIMENSIONED DRAWING USED FOR IDENTIFICATION AND INSPECTION PURPOSES. FEATURES OF THE PART NOT SHOWN SHALL BE OBTAINED FROM THE CORRESPONDING CAD MODEL, (DRAWING NUMBER AND DASH NUMBER). MEASUREMENTS NOT DEPICTED ON THE FACE OF THE DRAWING SHALL BE MEASURED FROM THE PRIMARY CAD MODEL’S DATUM "A", SECONDARY DATUM "B" AND THE TERTIARY DATUM "C".”

2.10.6 Sketch

- a. A sketch is an informal drawing by an engineer or designer. The sketch should be prepared on a standard size format to facilitate storage and reproduction.
- b. All sketches shall be identified by a number assigned by the design section originating the sketch
- c. The recording of the drawings shall be the responsibility of the originating design section.
- d. Sketches should not be prepared in place of engineering drawings for procurement of mockups, models, preproduction hardware, or associated equipment.

2.11 Tags and Plates

- a. Assemblies should use identification plates and labels in accordance with 75M50393 where practical.

3. DIGITAL PRODUCT DEFINITION DATA FORMAT

3.1 Title Block

- a. Government design activity data shall use 22264 for the KSC CAGE Code.
- b. Government design activity data shall use “*John F. Kennedy Space Center*” for the name and “*NASA Kennedy Space Center, Florida*” for the address.
- c. Government design activity data shall not contain specific contractor identification, such as names or logos.

3.2 Security Classification and Notation

- a. Security classifications and notations shall be shown on all digital product data warranting such classifications.

All export-controlled information must be marked prior to dissemination to a foreign person or foreign destination. Export Control Determination is provided after review by the NASA Export Control Office or the contractor’s respective Export Control Office

- b. Drawings shall be marked as described in the NASA Export Control Program Operations Manual – NAII 2190.1 or as shown in [Figure 1](#).
- c. The Export Control Notice shall appear on the front sheet. See [Figures 1](#) and [2](#).
- d. Each subsequent sheet shall be marked with the export jurisdiction and category in the top and bottom border or near the border. See [Figures 1](#) and [2](#).
- e. Digital product Security Notation shall be updated to newest Security Notation at time of revision.

3.3 Data Sensitivity Notation

- a. Sensitive but Unclassified (SBU) or Controlled Unclassified Information (CUI) information in any form shall be marked on all digital product data warranting such control. See Figures [1](#) and [2](#).
 - (1) Limited, restricted, copyrighted, or otherwise non KSC (CAGE Code 22264) etc. Intellectual Property Rights shall also be noted if the drawing or data contains such information in accordance with its respective owner(s) and agreements.
- b. Digital product Data Sensitivity Notation shall be updated to newest Data Sensitivity Notation at time of revision.

3.4 Notice

The following notice shall appear in the upper left corner of all sheets or views of government design activity digital definition product data. See [Figure 1](#).

Notice: When government drawings, specifications, or other data are used for any purpose other than in connection with a definitely related government procurement operation, the United States government thereby incurs no responsibility or obligation whatsoever; and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

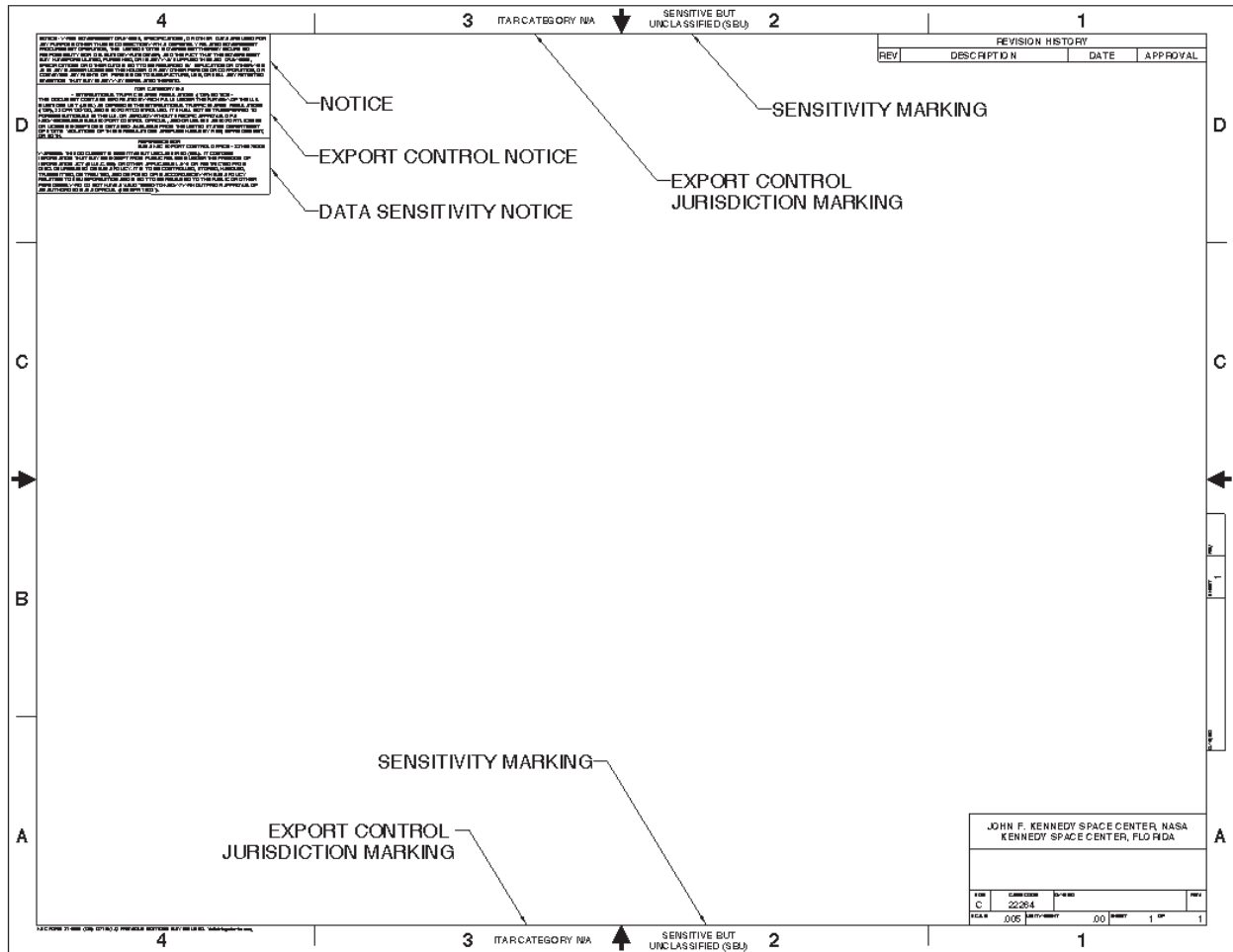


Figure 1. Drawing Security and Sensitivity Marking

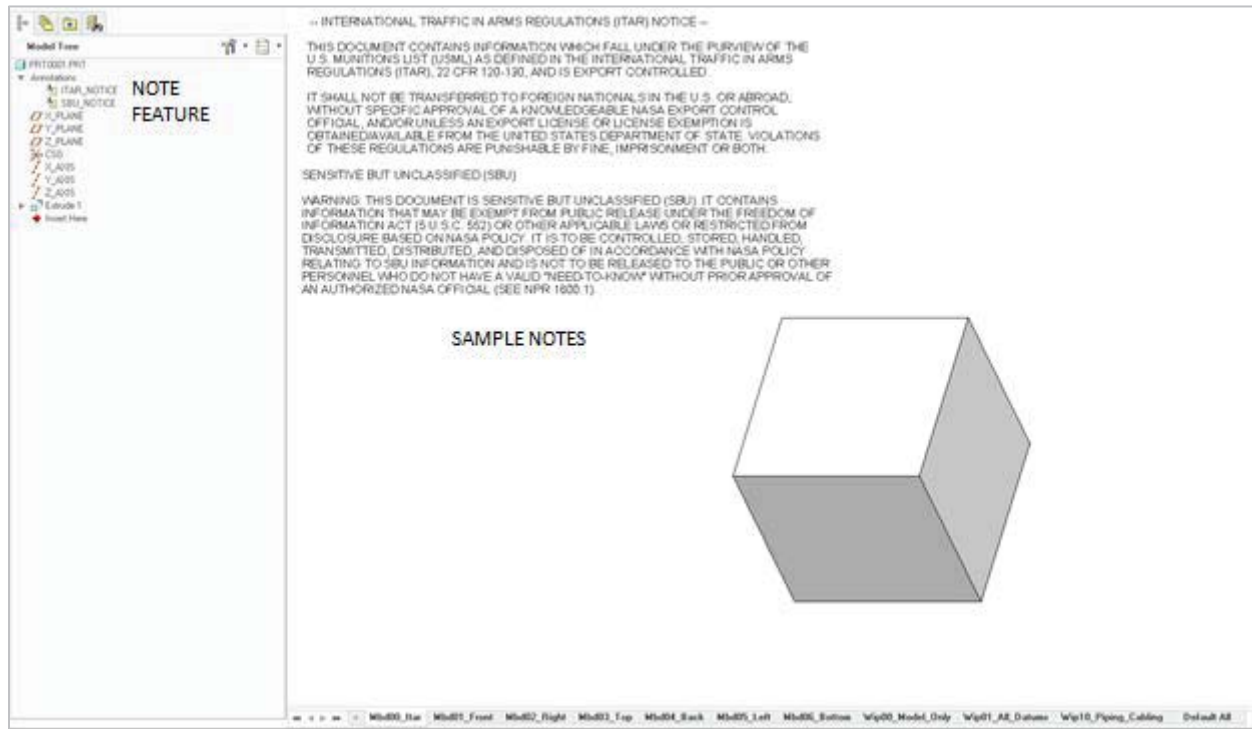


Figure 2. Model Security and Sensitivity Marking

4. DIGITAL PRODUCT DEFINITION DATA

When models are used in place of 2D drawings for the purpose of design, analysis, manufacture, test, and/or inspection, ASME Y14.41 and ASME Y14.47, shall be used in close conjunction with ASME Y14.24, ASME Y14.34, ASME Y14.35, and ASME Y14.100 being followed. Additional applications and requirements are defined in the following sections.

5. REVISION (CHANGE) AUTHORIZATION OBJECTS

5.1 Change Methods

There are various methods to authorize and/or temporarily document product configuration changes that ultimately require a revision prior to affected equipment being placed in service. Processes typically used to solicit engineering changes are Engineering Support Request, Make Operable Change, Floor Engineering Change, and/or Field Engineering Change.

Engineering Action Request and the Contractor Request for Information are used to request assistance or information and are accompanied or followed with revised engineering or Engineering Orders to document authorized departures from released engineering. The implementation of these changes should be initiated using a revised Statement of Work for external work performed by non-KSC support contractors or using an Engineering Instructions/Time Compliance Technical Instruction (EI/TCTI) for work done internally by KSC contractors.

- a. Any changes to engineering drawings shall be recorded by Engineering Order (EO) or drawing revision.

An Engineering Order is not used on documents.

- b. Changes made by EOs shall be incorporated into the drawing when the drawing is revised.
- c. EO changes should be used as an alternate method of making drawing changes only when a revision to the drawing is not feasible.

The Answer/Recommendation from a Request for Information form is used to communicate intent or clarify existing information and is not considered a permanent part of an engineering drawing and drawing changes must be incorporated through an EO or Drawing Revision.

Redline Master Drawings are used to communicate intent or clarify existing information in the manufacturing setting and is not considered a permanent change to an engineering drawing and drawing changes must be incorporated through an EO or Drawing Revision.

5.2 Changes by Engineering Order

An EO is used for Class I Changes to an engineering drawing and only when it is impractical to revise the drawing. When an EO is released, it becomes a permanent part of the drawing to which it is applicable. Any change required to correct errors on a released EO requires the preparation of a new EO. A new EO may cancel a preceding EO in its entirety only if no other subsequent EOs are affected by the cancellation. A portion of an EO cannot be cancelled. All EOs are accounted for in the drawing revision block at the next revision release, up to and including the last release. An EO against one drawing number cannot be incorporated in another drawing number.

- a. All EOs that are incorporated into the drawing shall be listed as *INC* or *Incorporated* in the revision table.
- b. If EO numbers were reserved and not subsequently used, the unused numbers shall be accounted for as *Not Used* in the revision table.
- c. All EOs that have been released but have been cancelled by revision or subsequent EO shall be listed as *Cancelled* in the revision table.
- d. An EO can be prepared on [KSC Form 21-34](#) or an approved equivalent.
- e. Changes made by EO shall be incorporated into maintained drawings as soon as practical, when a major update is required, or when the number of unincorporated EOs exceeds 10.
- f. An EO shall be prepared using [KSC Form 21-34](#) or approved equivalent. [KSC Form 21-34A](#) or approved equivalent may be used for continuation sheets when necessary. Other forms of documentation may also be used as continuation sheets, including full-size drawing sheets.

- g. All continuation sheets shall contain the EO number and the sheet number of the EO package.
- h. Continuation sheets that are B-size through F-size drawing formats shall have the title block x-ed out and the EO number and sheet number enclosed within a box above the title block.
- i. The Engineering Order form shall be completed in accordance with the following instructions.

5.3 Revisions of Engineering Drawing and Associated Lists

- a. A revision block on a manually created drawing shall be completed, starting at the basic revision, in accordance with ASME Y14.1, and include the zone on drawing sizes C, D, E, and J.
- b. If a PDM Revision Authorization Object is used for revision, the following applies to the drawing Revision Block: See [Section 5.4](#) for further requirements.

Rev	Description	Date	Approval
-	INITIAL RELEASE	“date”	See “Authorization”

Figure 3. Initial Release

Rev	Description	Date	Approval
“Letter”	REDRAWN WITH CHANGE	“date”	See “Authorization”
“Letter”	REDRAWN WITHOUT CHANGE	“date”	See “Authorization”

Figure 4. Notations for a Redrawn Drawing

Rev	Description	Date	Approval
“Letter”	REPLACES WITH CHANGE DRAWING “Drawing Number” REV “Letter”	“date”	See “Authorization”

Figure 5. Notations for a Superseding Drawing

Rev	Description	Date	Approval
“Letter”	REPLACED WITH CHANGE BY DRAWING “Drawing Number” REV “Letter”	“date”	See “Authorization”

Figure 6. Notations for a Superseded Drawing

- c. The “crossing-out” method of revision shall not be used.
- d. When revising an existing drawing, the graphic symbols, designations, lettering style and size, material and method of application, and drawing practices used in creating the original drawing may be followed for changes/revisions, unless otherwise directed by the responsible design organization.
- e. KSC Drawing titles may be changed upon revision to provide clarification, such as adding modifiers, or accuracy in scope of the current definition of the engineering.

5.4 Revisions Using PDM Revision (Change) Authorization Objects

- a. When a using a Revision Authorization Object that describes the specific drawing changes, the changes may be identified by simply referencing the authorization in the Revision History block.

This practice may be supplemented by using revision symbols on the field of drawing.

The description of the changes are to be made available when users do not have access to the PDM system.

- b. When the Revision Authorization Object does not describe each change, the changes shall be itemized either in the Revision History block, as an attachment to the published drawing or document, or as an appended page to the PDM drawing viewable.

The description of the changes are to be made available when users do not have access to the PDM system.

- c. When minor changes not affecting form, fit, or function, such as correction of misspelled words or addition of reference dimensions, are required on the drawing, the changes may be incorporated at the same time as other Revision Authorization Object without updating the original authorization object.

5.5 System Administrator Initiated Changes to Digital Data

Digitally prepared product definition data maintained in a product data management system may be changed without advancing the revision level to facilitate manufacturing and logistics systems when initiated by a system administrator per the following requirements:

- a. System administrator initiated changes address a common change applied to a large volume of product definition data sets.
- b. System administrator initiated changes shall not affect existing released end item configurations and requirements that when applied would affect form, fit, or function and thereby would require item re-identification in accordance with ASME Y14.100.
- c. System administrator initiated changes do not apply to individual drawing corrections or other general drawing changes.
- d. System administrator initiated changes may apply, but are not limited to the following examples: adding future applications or effectivities, updating digital drawing graphic sheet templates, application of distribution statements and delivery contract numbers, standard part supersession, and adding unique database attributes.
- e. When system administrator initiated changes are used, internal process control documentation shall be issued.

6. CHANGING PART NUMBERS

- a. The part number shall be changed, or not changed, as required by the following subparagraphs.

6.2 Initiation of Part Number Changes

Engineering changes may be Incorporated and documented (without changing part number) by drawing change letter control only, up to the cut-off date established for the incorporation of changes in hardware on the first unit of a CI mission-design series, or component thereof, and providing that all such changes are made effective on CI serial number one and on. Thereafter, drawing change letter control shall continue and, in addition, part numbers shall be changed, or not changed, as required by the paragraphs below. See [Figure 7](#) for additional information.

6.3 Changing an Item into a Standard Part

- a. A part or component may be established as a standard and identified by a standard specification identification number when all of the following apply:
 - (1) The part or component has a multiple usage and is expected to have a design application in more than one end item.
 - (2) The part or component is non-repairable (throw-away) and will not be provisioned below the level identified by the standard specification identification number.
 - (3) The part or component is completely specified in a specification document with respect to performance, durability, reliability, Form, Fit, qualification, and inspection requirements.
 - (4) One or more alternate sources is approved and qualified to supply the item.

6.4 Change in Higher Level Assembly Part Numbers

- a. When an end item contains a non-interchangeable item, the part number of the non-interchangeable item, of its next higher level assembly, and of all progressively higher assemblies shall be changed only up to and including the assembly where interchangeability is re-established.
- b. Part numbers shall not be changed above the level where interchangeability is re-established for any reason.

6.5 Changes Requiring Part Re-Identification

- a. The part number for an end item or subassembly, component or part thereof, shall be changed whenever one or more of the following non-interchangeable conditions exist:
 - (1) Safety, performance, or durability is affected to such an extent that superseded items must be discarded for reasons of safety, malfunctioning, or reliability.
 - (2) Parts, components, subassemblies, or complete end items are changed to such an extent that the superseded and superseding items are not directly and completely interchangeable with respect to installation and specified performance.
 - (3) When superseded parts, components, subassemblies, or end items are limited for use in specific units of an end item and the superseding parts, components, subassemblies, or end items are not so limited to use.
 - (4) When a part, component, subassembly, or end item, which has been identified and documented by a design activity other than KSC, is altered or selected, a new part number shall be assigned to the altered or selected item.
 - (5) When a material, process, or protective treatment is changed to such an extent that any of the conditions in a, b, or c exist.
 - (6) When a physical part, component, sub-assembly, or end item is reworked in production or retrofit by a kit into a later part number version of the item, and is completely interchangeable with all items identified by the later part number, the physical part shall be re-identified to the part number of the later version.

6.6 Changes Not Requiring Part Re-Identification

- a. The part number shall not be changed when:
 - (1) A new usage is found for an existing part.
 - (2) None of the conditions in paragraph 6.5 are met.
 - (3) A commercial, vendor, subcontractor, or Government-furnished item is used (or new usage is found for the item) without alteration or selection.

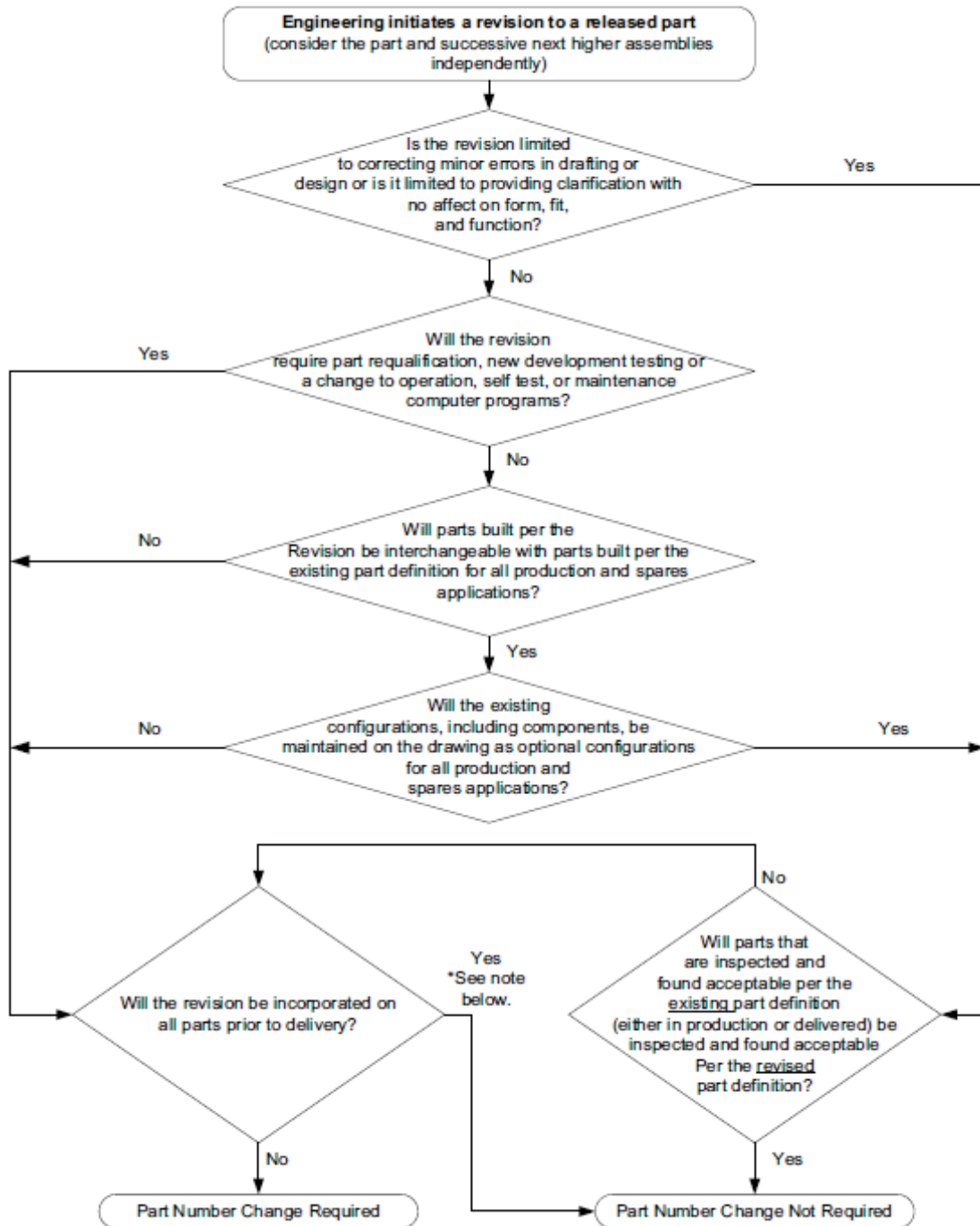


Figure 7. Product Identifier (Part Number) Change Decision Tree

Caution – Use of this “YES” decision path is only valid early in the life cycle of the affected parts and requires a rigorous control system at both the enterprise and at any affected contractor/suppliers to ensure there are no escapes.

7. CONFIGURATION IDENTIFICATION

- a. All contract end items, engineering critical components, and logistic critical components should be serialized.
- b. Each end item shall be identified with a nameplate arranged as shown in [Figure 8](#) and contain the information shown thereon.
- c. A note shall be associated to the configuration identifying engineering, such as a document, drawing, model, etc., that explains when to apply the information, what information is applied, and who provides the information.

NOMENCLATURE			
NASA PN	PART NUMBER	MFR PN	MRF PART NUM
REF DES	REF DES	ACCEPT DATE	ACCEPT DATE
CONTR. NO.	CONTRACT NUMBER	WT.(LB)	WGT
SERIAL NO.	SERIAL NUM	MODEL NO.	MODEL NUM
MFD FOR JOHN F. KENNEDY SPACE CENTER			
OFFICE SYMBOL		OFFICE SYMBOL	
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION			
BY	MFR NAME AND ADDRESS		

Figure 8. 75M50393, Identification Plate, Ground Support Equipment

8. EXTERNAL PART OR IDENTIFYING NUMBER (PIN)

- a. The Supplier shall assign a discrete PIN number to each CI and its subordinate parts and assemblies in accordance with ASME Y14.100.
- b. The PIN shall be the same as or based on the controlling drawing number and, in conjunction with the Design Activity Identification (DAI), shall uniquely identify a part or item from all dissimilar products or CIs.
- c. Unique item identifiers (UIIs) shall include the Original Design Authority (ODA)'s assigned PIN and DAI (CAGE Code) and other information as deemed necessary or required by the Customer in accordance with ASME Y14.100, ASME Y14.24, and [MIL-STD-130](#).

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APPENDIX A. NONMANDATORY SYMBOLS

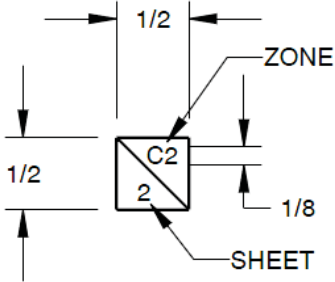


Figure A1. Sheet/Zone Locator Symbol

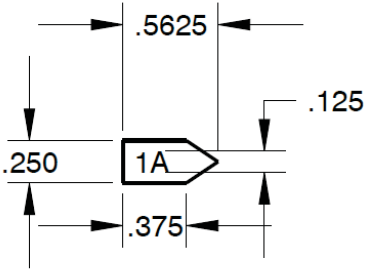


Figure A2. Flag Note Symbol

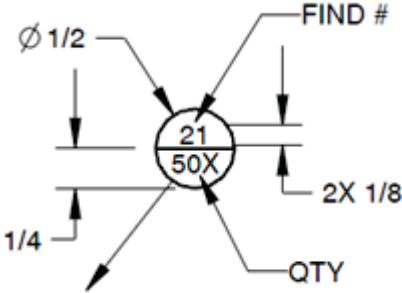


Figure A3. Find Number/Quantity Symbol

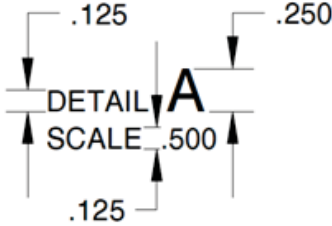


Figure A4. View Title

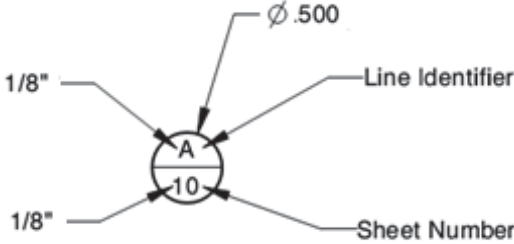


Figure A5. Continuation Symbol

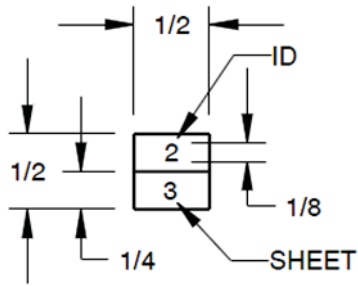


Figure A6. Alternate Continuation Symbol

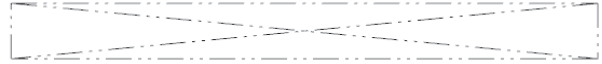
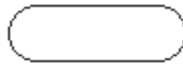
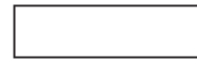


Figure A7. Part Marking Symbol



**Figure A8. Mechanical Find
Number/Reference Designator Symbol**



**Figure A9. Electrical Reference Designator
Symbol**

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