Mechanical Drafting Standards for the Mechanical Engineering Team

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Mechanical Drafting Standards for MET

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Mechanical Drafting Standards for MET

1.0 Introduction and Scope

This manual has been developed to provide a set of standard guidelines to be followed for mechanical drafting in the Mechanical Engineering Team of the Facility Systems Engineering Division. All mechanical drawings for the Mechanical Engineering Team shall be completed in accordance with this manual.

The intent of this manual is to supplement the Drawing Requirements Manual[1] (MIL-STD-100E) by addressing the topics that are specific to mechanical drawings; highlight exceptions to the manual; and identify a standard format when options are presented in the manual.

In case of difference between the Drawing Requirements Manual (MIL-STD-100E) and the Mechanical Drafting Standards, the Mechanical Drafting Standards shall govern.

This standard is written for drawings to be generated in English units. Requirements for metric drawings will be defined in a future revision of the Mechanical Drafting Standards.

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[1] Jerome H. Lieblich, Drawing Requirements Manual for Departments of Defense & Industry, 7th Ed., Global Engineering Documents, 1990

2.0 Drafting Practices

2.1 Principals of Projection

All drawings (including metric drawings) shall be developed using the third angle projection method.

2.2 New Drawings

New drawings shall be in accordance with this manual and with the following:

a. Do not show unnecessary views.

b. All drawings shall be on D size (22" x 34") sheets.

2.3 Scale of Drawings

Drawings shall be shown full size whenever possible. When it is not practical to show a drawing full size, the ratio of the size of the object as drawn to its full size shall be expressed as follows:

Scale	Scale Entry
Full Size	1/1 (FULL)
Half Size	1/2
Quarter Size	1/4
Eighth Size	1/8
Sixteenth Size	1/16
Double Size	2/1
Four Times Size	4/1
Eight Times Size	8/1
Ten Times Size	10/1

2.4 Out-of Scale Dimensions

When dimensional changes are made on released drawings, and it is not practical to change the detail to agree with the new dimension, the dimension is underscored with a straight line to indicate the out-of scale condition.

2.5 Print Size, Fonts, & Layers for AutoCAD Drawings

All lettering shall be upper case. The font used in AutoCAD drawings shall be ROMANS. Print size and layers shall conform to the following specifications as shown on Example 1:

Title Block

	Size	Layer
Project Title	.15	BOLDTXT
Drawing Title	.15	BOLDTXT
Building Number	.15	BOLDTXT
Sheet Number	.15	BOLDTXT
Drawing Number	.25	BOLDTXT
Latest Revision	.25	BOLDTXT
Surface Finish	.15	BOLDTXT
Angular Tolerance	.15	BOLDTXT
Approvals	.10	TXT

Parts List

	Size	Layer
"PARTS LIST" Heading	.15	BOLDTXT
Other Headings	.10	BOLDTXT
Parts List Information	.15	TXT

Revision Block

	Size	Layer
Revision Block Information	.10	TXT

Part Identification - Fabricated Parts

	Size	Layer
Part Number	.20	BOLDTXT
Part Name	.20	BOLDTXT
Scale	.15	TXT
Number Required	.15	TXT
Material	.15	TXT
Next Assembly	.15	TXT

Part Identification - Commercial Items

	Size	Layer
Part Number	.20	BOLDTXT

Sections and Views (Taken)

	Size	Layer
Section (View) Letter	.20	BOLDTXT
Sheet Numbers	.15	BOLDTXT

Sections and Views (Shown)

	Size	Layer
Section (View) Letter	.20	BOLDTXT
Sheet Numbers	.15	BOLDTXT
"SECTION" ("VIEW") Label	.20	BOLDTXT
Scale	.15	TXT

Notes

	Size	Layer
"NOTES" Heading	.20	BOLDTXT
"GENERAL NOTES" Heading	.20	BOLDTXT
Note Text	.15	TXT
Note Number	.15	TXT
Indexed Notes	.15	TXT

Revision Callouts

	Size	Layer
Revision Letter	.15	BOLDTXT
Number of Occurrences	.10	BOLDTXT

Note: Revision letter and subscript enclosed in hexagon.

Cover Sheet

	Size	Layer
Project Title	.75	BOLDTXT

2.6 Arrowheads

Arrowheads for dimensions, leaders, sections and views shall be as shown in Example 1.

2.7 Leader Lines Used with Notes

Leaders terminate at the lettering beginning or end with a line not less than .125 inches long, parallel to the lettering of the note and are extended at a constant angle to the part or portion affected by the note.

2.8 Leader Lines That Cross Dimension Lines

Leader lines should not cross dimension or other leader lines. When it is unavoidable that a leader cross a dimension line, the leader line shall be broken at the point of intersection.

2.9 Sections

Section callouts shall be as shown in Example 1.

2.10 Section Crosshatching

Sections shall be crosshatched in accordance with the material specification.

Crosshatching for materials shall be in accordance with Example 2.

2.11 Views

View callouts shall be as shown in Example 1.

2.12 Metric

Requirements for metric drawings will be defined in a future revision to the Mechanical Drafting Standards.

3.0 Types of Engineering Drawings

3.1 Assembly Drawings

An assembly drawing shows the assembled design, with all detailed parts and/or subassemblies shown in their functional positions.

An assembly drawing depicts the assembled relationship of: (a) two or more parts; (b) a combination of parts and subordinate assemblies, or (c) a group of assemblies required to form an assembly of higher order. The drawing shall show sufficient detail to show the relationship between each subordinate assembly and part. The assembly drawing shall include: (a) identification of commercial parts which are specified in detail in the parts list; (b) transportation to the drawing on which the fabricated parts are detailed. Assembly drawings may include overall system and interface dimensions or other relevant information.

The distinction between an assembly and a subassembly is determined by the individual application. An assembly in one instance may be a subassembly in another where it forms a portion of an assembly.

3.2 Subassembly Drawings

A subassembly drawing depicts one or more parts which form a portion of an assembled unit.

3.3 Detail Drawings

A detail drawing depicts all necessary information for fabrication of a complete end item ready for application in an assembly or subassembly.

Detail drawings contain all information necessary for fabrication, finish, marking, and inspection.

Parts shall be identified by a dash (-) number for each separate part.

Weldments are considered a part and shall be designated with a dash (-) number.

Detail drawings shall have a minimum of 1" space between details.

3.4 Installation Drawings

An installation drawing shows the installed and assembled position of an item relative to its supporting structure or to associated items.

An installation drawing shall contain the following items:

a. List of items to be installed.

b. Locating dimensions and associated tolerances.

c. Types and quantities of attachment.

d. Process and special installation requirements.

e. Adjustment data.

f. Special test or inspection requirements.

g. Detail definition of special installation parts.

h. Installed items shall be shown in solid lines; existing items shall be shown in phantom lines.

i. Interface definition to existing components.

j. An installation drawing shall contain a parts list to establish the requirements for the installation hardware.

k. Interface mounting and mating information (i.e. dimensions for location of attachment hardware).

l. Information necessary for preparation of foundation plans, including mounting hardware details.

m. Identification of applicable assembly drawings.

n. Demolition requirements.

3.5 Envelope Drawings

An envelope drawing depicts an item which specifies a configuration and performance envelope, without details of internal construction. All features other than those shown on the drawing are left to the fabricator to meet the specified design requirements and performance data.

An envelope drawing shall define all interface requirements in exact detail.

Typically, an envelope drawing would be used for an ASME code stamped pressure vessel.

3.6 Cover Sheet

The cover sheet shall include the project title and the NASA logo as shown in Example 3.

3.7 Drawing Index and General Notes

The drawing index and general notes sheet shall include a drawing index for all drawings in the project, legends, site location, and general notes pertaining to the entire drawing package.

3.8 Drawing Package Organization

The mechanical drawing package shall be assembled as follows:

a. Demolition and Site Preparation Drawings
b. Installation Drawings
c. Assembly Drawings
d. Subassembly Drawings
e. Detail Drawings

The entire project drawing package shall be assembled as follows:

a. Cover Sheet
b. Drawing Index and General Notes
c. Mechanical drawings
d. Structural drawings
e. Process Systems drawings
f. Electrical & Controls drawings

4.0 Dimensions & Tolerances

4.1 Basic Dimension

A basic dimension is a numerical value used to describe the theoretical exact size, shape, or location of a feature. It is the basis from which permissible variations are established by tolerances on other dimensions, in notes or by feature control symbols. Basic dimensions are shown on the drawing enclosed in a rectangle. The use of basic dimensions shall be limited to essential dimensions.

4.2 Reference Dimension

A reference dimension is a dimension that has been specified elsewhere on the same drawing or on another drawing. Reference dimensions shall be enclosed in parentheses.

4.3 Fit

Fit dimensions shall be specified on the drawing. The fit designation (e.g. LC1, RC5) shall be included as a reference.

Example: ϕ1/2 NOM MACHINE FOR .0001-.0008 INTERFERENCE (FN1) FIT WITH MATING PART

4.4 Material Condition

The material condition "Regardless of Feature Size" (RFS or S) is the default material condition. The material condition callout is not required.

4.5 Units of Measure

Dimensions and tolerances shall be expressed in inches and decimal parts of an inch or in angular units. Fasteners and welds shall be expressed in fractions.

4.6 Rules Applicable to Units of Measure

a. Zeros shall not be used before the decimal point for values less than one inch.

b. All decimals shall have a minimum of two digits following the decimal point.

c. A dimension and its tolerance shall have an equal number of digits following the decimal point.

d. Both tolerances shall be specified when using unilateral tolerances.

e. Unilateral and bilateral tolerances used with dimension lines shall show the tolerance following the dimension. Tolerances shall be shown with the plus tolerance above the minus tolerance.

f. When tolerances are specified in general notes, the tolerance may be shown on the same line with the plus tolerance preceding the minus tolerance.

4.7 Rules Applicable to Angular Units

a. Angular dimensions and tolerances shall be expressed in degrees (°) and when necessary, in minutes (') and seconds ("), or in decimal parts of a degree.

b. An angular dimension and its tolerance shall be held to the same unit of measure.

4.8 Standard Tolerances

Dimensions shown without tolerance are controlled by the standard tolerances in the title block, except for stock materials, dimensions on welding symbols, undimensioned angles between lines drawn at 90°, dimensions labeled REF, MAX, MIN, BASIC, and similar dimensions that are otherwise controlled.

4.9 Fundamental Rules of Dimensioning

Dimensioning shall conform to the following rules:

a. Dimension, extension, and leader lines should not cross each other unless absolutely necessary. When it is unavoidable, the leader line shall be broken at the point of intersection.

b. Dimensions are shown in a view that most clearly represents the form of the feature.

c. Sufficient dimensions shall be shown to clearly define size, shape, and position of each feature.

d. A feature shall not be located by more than one toleranced dimension in any one direction.

e. Reference dimensions shall be enclosed in parentheses.

f. Dimensions shall be shown outside the outline of the part.

g. Dimensions shall be selected and arranged to minimize the accumulation of tolerances between related features.

h. Each dimension shall be expressed clearly so that it can be interpreted in only one way.

i. Chain dimensions should be avoided.

j. Center lines, object lines, or extension lines should not be used as dimension lines.

k. Dimensioning to hidden lines shall be avoided.

l. Maximum and minimum limits must be such that parts will assemble and function under all dimensional conditions that are within limits.

m. The word "TYPICAL" or the abbreviation "TYP" may be used when the number of places the dimension applies is indicated.

Example: TYP (2) PLACES

n. Dimensions shall be placed such that there is a minimum of ½" between the part and the dimension.

o. Parts which contain critical alignment dimensions shall be dimensioned as matched parts in lieu of high precision tolerances on individual part details."

4.10 Form Tolerances

Form tolerances shall apply regardless of feature size.

4.11 Metric

Requirements for metric drawings will be defined in a future revision to the Mechanical Drafting Standards.

5.0 Engineering Drawing Format

5.1 Drawing Size

All drawings shall be on D size (22" x 34") sheets.

5.2 Drawing Media

AutoCAD drawings shall be on paper.

5.3 Drawing Scale

Drawings shall be shown full size whenever possible. When it is not practical to show a drawing full size, the ratio of the size of the object as drawn to its full size shall be expressed as follows:

Scale	Scale Entry
Full Size	1/1 (FULL)
Half Size	1/2
Quarter Size	1/4
Eighth Size	1/8
Sixteenth Size	1/16
Double Size	2/1
Four Times Size	4/1
Eight Times Size	8/1
Ten Times Size	10/1

5.4 Continuation Sheets

Continuation sheets of multi-sheet drawings shall have a unique sheet number and a unique drawing number.

5.5 Border

The standard border to be used on all drawings is shown on Example 4.

5.6 Title Block Format

The title block shall be as shown in Example 4.

5.7 General Note Location

Notes shall be located in the upper right hand corner of the drawing as shown in Example 5. Notes shall be numbered consecutively starting with 1 and numbered downward. Notes may be located in the upper left hand corner on drawings containing only notes and a parts list.

5.8 Standard Tolerance Block

This block contains the standard tolerances that apply to specific dimensions as stated in SECTION 4. An angular tolerance shall be entered when required.

5.9 Finish Block

Enter the surface finish required for machined parts.

5.10 Parts List Format

The parts list shall be located in the lower right hand corner of the drawing above the title block. Dimensions for the parts list shall be as shown on Example 5. Specific information on completing the parts list shall be as stated in SECTION 8.

5.11 Revision Block Format

The revision block shall be as shown in Example 4.

5.12 Metric

Requirements for metric drawings will be defined in a future revision to the Mechanical Drafting Standards.

6.0 Drawing & Part Number System

6.1 Sheet Number Assignment

All drawings shall contain a unique sheet number. Mechanical drawing sheet numbers shall be designated with an "M." (Example: M13 = Mechanical drawing, sheet 13)

6.2 Drawing Number Assignment

All drawings shall contain a unique drawing number. Completed drawings shall have a NASA drawing number for drawing file records. NASA drawing numbers will be assigned when the drawings are ready for final sign-off. Transportation between drawings shall be by sheet number.

6.3 Part Numbering System

Each commercial item shall be designated by an item number enclosed in a ½" diameter circle.

Each fabricated part (including subassemblies & weldments) shall be designated by the sheet number followed by a dash number (Ex: M18-5 = Part -5 on sheet M18)

Detail drawings shall identify the first part with -1.

Reference drawings shall be identified by the NASA drawing number.

The part numbering system is shown in Example 5.

7.0 Drawing Notes

7.1 General Notes

General notes are those which apply to the drawing in general and would become repetitive if placed at each point of application.

7.2 Indexed Notes

Indexed notes are those which apply to specific areas of the drawing or parts list. Indexed notes shall be enclosed in a triangle as shown in Example 5.

7.3 Local Notes

Local notes are those which apply directly to a particular portion of a drawing, indicated by local characteristics.

7.4 Project Notes

Project notes are those which apply to the entire project package. Project notes shall be placed on the Drawing Index and General Notes sheet.

7.5 Position and Alignment of Notes

Notes should be positioned horizontally on the drawing. The left end of all lines of a note should be in alignment, except when an opening statement applies to several succeeding incomplete phrases. In this case, the phrases shall be indented.

7.6 Local Notes That Specify Method of Fabrication

Local notes which specify fabrication operations (e.g., DRILL, REAM, TAP, PUNCH, OR BORE) are acceptable when specifying the fabrication technique is critical to the final product.

7.7 Symbols for Local Notes That Describe Features

Symbols for local notes that describe features shall not be used. Acceptable abbreviations for features are as follows:

COUNTERBORE	CBORE
COUNTERSINK	CSK
SPOTFACE	SF
DEEP	DEEP
RADIUS	R
DIAMETER	ϕ

7.8 Location of General Notes

General notes shall be located in the upper right hand corner of the drawing. Notes shall be numbered consecutively starting with 1 and numbered downward. General notes may be placed in the upper left hand corner on drawings containing only general notes and a parts list.

8.0 Parts List Preparation

8.1 Parts List

The parts list shall contain information for commercial components. The parts list shall be located on the assembly and/or subassembly drawing if space permits. If space is limited, the parts list may be shown on a separate sheet immediately following the assembly or subassembly. Each subassembly shall have a separate parts list. The parts list shall contain the item number, material specification, description, part identification number, quantity required per unit, and total quantity required.

8.2 Item Number

The item number block shall contain the item number.

8.3 Material Specification

The material specification block shall contain the material specification for the commercial item.

8.4 Description

The description block shall contain the description of the commercial item and the manufacturer's name of the commercial item.

8.5 Part Identification Number

The part identification number block shall contain the complete catalog part number for the commercial item.

8.6 Quantity Required per Unit

The quantity required per unit block shall contain the quantity required per assembly or subassembly.

8.7 Total Quantity Required

The total required block shall contain the total quantity of items required for all assemblies or subassemblies. This column required for multiple assemblies.

9.0 Thread Representation

9.1 Thread Designation

The designation of standard series threads consists of the following information: nominal size, number of threads per inch, thread series, and thread class.

Nominal size shall be expressed as a fraction for commercially available fasteners.

Example:

1/4-20 UNC-2A

Where:

1/4 = Nominal size
20 = Number of threads per inch
UNC = Thread Form and Series
2A = Thread Class

9.2 Hand Designation

Screw threads are interpreted to mean right hand unless LH, for left hand, is included in the callout.

9.3 Threaded Inserts

Thread inserts shall be specified as follows:

"DRILL & TAP FOR "X" THREADED INSERT"

Where:

"X" is replaced with the appropriate nominal thread size and length

9.4 Abbreviations and Symbols

Abbreviations and symbols for features shall be as follows:

COUNTERBORE..... CBORE
COUNTERSINK.....CSK

SPOTFACE.....SF
DEEP.....DEEP
RADIUS..... R
DIAMETER.....ϕ

9.5 Tap Drill Size and Depth

Except when required by specific design considerations, neither the size nor the depth of the tap drill is included in the thread callout.

9.6 Metric Threads

Requirements for metric threads will be defined in a future revision to the Mechanical Drafting Standards.

10.0 Welding

10.1 Standard Location of Elements of a Welding Symbol

The welding symbol provides the means of placing complete welding information on the drawing. The standard location of elements of a welding symbol is shown in Figure 1.

10.2 Standard Size of a Welding Symbol for Drawing Application

The welding symbol shall be consistent in size on all drawings. The weld size shall be expressed as a fraction for welds less than one inch. The welding symbol shall be in accordance with Example 5.

10.3 Basic Size of Weld Symbols

The dimensions for basic weld symbols are shown in Figures 2 & 3.

10.4 Metric

Requirements for metric drawings will be defined in a future revision to the Mechanical Drafting Standards.

11.0 Drawing Change Procedures

11.1 Revision Status

The revision status of a drawing is identified by an uppercase letter. The first revision issued is identified by the letter "A." Each successive change uses the next letter of the alphabet in sequence, except the letters "I", "O", "Q", "S", and "Z" are never used.

11.2 Drawing Revisions

A revision note shall be placed on every drawing which is revised after the drawing has been approved. The location of the change on the part shall be indicated by the revision letter in a hexagon as shown in Example 5. The revision shall be noted in the revision block as shown in Example 4. Descriptions in the revision block shall be descriptive, but brief. Revision A shall be located in the upper left corner of the revision block. The latest revision to the drawing shall be shown in the "Latest Revision" block of the title block.

11.3 Multiple Changes

Multiple changes to the same drawing incorporated at one time shall be identified by the same revision letter with a numerical subscript as shown in Example 5.

11.4 Changes in General Notes

A general note may be changed if the original purpose is maintained.

11.5 Removing General Notes

When a general note has been removed, the word "REMOVED" shall appear in its place. Once a general note has been removed, the number for that note shall not be reused.

11.6 Revisions to AutoCAD Drawings

The approval signatures and dates on the original drawing shall be replaced with the typed name of the original approver and the typed dates. Original signatures and dates shall appear on the latest revision in the revision block.

12.0 Abbreviations

12.1 Use of Abbreviations

Abbreviations shall be avoided whenever possible. If abbreviations are used, they shall be uniform throughout the drawing package.

12.2 List of Abbreviations

The following list identifies the abbreviations which are acceptable for use on drawings:

Acme Screw Thread	ACME
American Wire Gage	AWG
And	&
As Required	AR
Assembly	ASSY
Basic	BSC
Bearing	BRG
Bolt Circle	BC
Cap Screw	CAP SCR
Center Line	CL
Center of Gravity	CG
Chamfer	CHAM
Class	CL
Clearance	CLR
Clockwise	CW
Counterbore	CBORE
Counterclockwise	CCW
Countersink	CSK
Cylinder	CYL
Deep	DEEP
Diameter	ϕ
Diameter Bolt Circle	DBC
Drawing	DWG
Drill	DRILL
Each	EA
Equal	EQ
Equally Spaced	EQ SP
Existing	EXST
Fahrenheit	F
Foot	FT
Gage	GA

Government	GOVT
Government Furnished Equipment	GFE
Grade	GR
Hexagon	HEX
Hexagonal Head	HEX HD
Inside Diameter	ID
Left Hand	LH
Long	LG
Material	MATL
Maximum	MAX
Nominal	NOM
Not to Scale	NTS
Outside Diameter	OD
Places	PLCS
Plate	PL
Quantity	QTY
Radius	R
Reference	REF
Required	REQD
Right Hand	RH
Root Mean Square	RMS
Screw	SCR
Sheet	SH
Socket Head Cap Screw	SHCS
Spotface	SF
Stainless Steel	SS
Standard	STD
Steel	STL
Stock	STK
Spherical	SPH
Symmetrical	SYM
Thick	THK
Threads Per Inch	TPI
Through	THRU
Tolerance	TOL
Total Indicator Reading	TIR
Typical	TYP
Unified Coarse (thread)	UNC
Unified Extra Fine (thread)	UNEF
Unified Fine (thread)	UNF

13.0 Project Drawing Package

13.1 Project Coordination

The Technical Project Engineer (TPE) and/or Systems Engineer is responsible for coordinating the entire project package including drawings and specifications.

13.2 Sheet Number Assignment

All drawings shall contain a unique sheet number as follows:

Cover sheet numbers shall be designated with a "T."
Mechanical drawing sheet numbers shall be designated with an "M."
Structural drawing sheet numbers shall be designated with an "S."
Process System drawing sheet numbers shall be designated with a "P."
Electrical & Controls drawing sheet numbers shall be designated with an "E."

13.3 Drawing Number Assignment

All drawings shall contain a unique drawing number. Completed drawings shall have a NASA drawing number for drawing file records. NASA drawing numbers will be assigned when the drawings are ready for final sign-off. Transportation between drawings shall be by sheet number.

13.4 Drawing Package Organization

The entire project drawing package shall be assembled as follows:

a. Cover Sheet
b. Drawing Index and General Notes
c. Mechanical drawings
d. Structural drawings
e. Process Systems drawings
f. Electrical & Controls drawings

13.5 Cover Sheet

The cover sheet shall include the project title and the NASA logo.

13.6 Drawing Index and General Notes

The drawing index and general notes sheet shall include a drawing index for all drawings in the project, legends, site location, and general notes pertaining to the entire project package.

14.0 AutoCAD Requirements

AutoCAD is the CAD system used by FSED and shall be used to document all mechanical drawings. The release number of AutoCAD used to generate the drawings shall be listed in the general notes on the first sheet of the mechanical drawing package (M1).

The AutoCAD requirements defined in this section are intended to provide people with limited AutoCAD experience the ability to open, edit, and plot a drawing.

14.1 Entities

Drawing generation shall be limited to the following type of entities: lines, arcs and circles, text, blocks, dimensions and polylines.

Part geometry definition shall be with single lines, circles and arcs. Polylines shall be used only when defining a contour or a part break-away.

Blocks may be generated with or without attributes. The standard blocks listed in Example 6 have been generated with attributes. A disk containing the standard blocks will be provided. During drawing generation, the draftsman may use as many blocks as needed, however, block names should be descriptive such that the part may be easily identified by the block name. The part name or commercial part number should be used as the block name.

Example:

The block name for a bracket detailed as item 3 on sheet M6 might be saved as a block "BRACKET_M6-3."

The block name for a Duff-Norton Actuator part number DM-9811 might be saved as a block "DUFF_NORTON_ACTUATOR_DM-9811."

All text shall be generated using the following text style definition via the "style" command :

Style name:	standard
Font file:	romans
Height:	0
Width factor:	1
Obliquing angle:	0
Backwards:	No
Upside-down:	No
Orientation:	Horizontal

All text shown in regular print shall be placed in the layer named "txt". All text shown in bold print shall be placed in the layer named "boldtxt".

14.2 Entity Properties

All entities shall have the following properties, unless otherwise noted:

Variable	Setting
CECOLOR	Bylayer
CELTYPE	Bylayer

The dimensioning variables listed below shall be set as follows:

Variable	Setting
DIMCLRD	Bylayer
DIMCLRE	Bylayer
DIMCLRT	Bylayer

14.3 Layers

Layer assignments for layers other than those listed in Table 1 shall be listed on the "README" layer of the AutoCAD file. Layer descriptions must adequately describe the entities in each layer.

The following layers shall be used as a minimum:

Table 1

Layer Name	Color	Line Type	Description
BORDER	3 (Green)	Continuous	Border (w/Logo)
CEN	1 (Red)	Center	Centerlines
DIM	2 (Yellow)	Continuous	Dimensions (Dimension lines, Extension Lines, Arrows & Text); Leader Lines; Leader Lines with Text; Weld Symbols
HATCH	9	Continuous	Crosshatching
HID	3 (Green)	Hidden	Hidden Lines
OBJ	4 (Cyan)	Continuous	Object Lines
PHAN	8	Phantom	Phantom Lines
TXT	2 (Yellow)	Continuous	Parts List Table; Standard Blocks; Text
BOLDTXT	6 (Magenta)	Continuous	Bold Text; Cutting Plane Lines & Arrows
README	7 (White)	Continuous	Readme information
HDWR	5 (Blue)	Continuous	Bolts; Nuts; Commercial items
VP	7 (White)	Continuous	Viewport lines in paper space

If necessary, assembly drawings may contain additional layers named by part name. Identifying the object lines of parts on separate layers of an assembly will be helpful when editing adjacent parts in assemblies. Additional layers for object lines shall conform to the colors and line types listed in Table 2. Layer assignments for additional layers shall be listed on the "README" layer of the AutoCAD file.

Example: A part called a pump mount might include the following layers:

pump_mt-obj
pump_mt-objo
pump_mt-hidden
pump_mt-hardware
pump_mt-left-bracket
pump_mt-baseplate

Table 2	
Color	Line Type
7 (White)	Continuous
11	Continuous
13	Continuous

14.4 README Layer

A layer named README shall be added to each drawing file. The information on the README layer shall be placed at drawing coordinates X=0, Y= -1. The status of the README layer shall be "FROZEN" when the drawing has been completed. The README layer shall include the following information:

Brief (1-2 line) description of drawing
List and description of drawing layers for layers other than those listed in Table 1
Information about plotting the drawing (i.e. scale factor required)
Information regarding construction of the drawing
- x-refs if used
- dim styles if used
- viewports in paper space if used

14.5 File Names for AutoCAD Drawings

AutoCAD drawing files shall be identified by drawing number.

14.6 Revisions to AutoCAD Drawings

When a revision is made to a drawing, the electronic file shall be saved as a new file. The file name for the revised drawing shall be the drawing number with the appropriate revision letter.

Example:

File Name:	548621	(Original Drawing)
File Name:	548621A	(Revision A)

The approval signatures and dates on the original drawing shall be replaced with the typed name of the original approver and the typed date. Original signatures and dates shall appear on the latest revision in the revision block.

14.7 Plotting Configuration

For a particular plotter, each pen number is associated with a line weight or thickness. In the plotting configuration, pen assignments for each color shall be in accordance with the following line weights and the attached FSED Line Weight/Color Standard:

Color	Line Weight
8	.25 mm
9	.25 mm
1 (Red)	.35 mm
2 (Yellow)	.35 mm
3 (Green)	.35 mm
5 (Blue)	.35 mm
4 (Cyan)	.50 mm
7 (White)	.50 mm
11	.50 mm
13	.50 mm
6 (Magenta)	.70 mm

Line Weight/Color Charts (A2)

Versatec 8836 LASER PLOTTER (HP-GL 7585)

COLOR	0.25mm pen#5 (04 width)	0.35mm pen#3 (05 width)	0.50mm pen#6 (07 width)	0.70mm pen#7 (10 width)	1.00mm pen#8 (15 width)
	#8 #9 #15	#1(RED) #2(YELLOW) #3(GREEN) #5(BLUE)	#4(CYAN) #7(WHITE) #11 #13	#6(MAGENTA) #10 #12	#14

Versatec 8510 TURBO CADMATE (400 DPI)

COLOR	0.25mm pen# 1	0.35mm pen# 2	0.50mm pen# 3	0.70mm pen# 4	1.00mm pen# 5
	#8 #9 #15	#1(RED) #2(YELLOW) #3(GREEN) #5(BLUE)	#4(CYAN) #7(WHITE) #11 #13	#6(MAGENTA) #10 #12	#14

QMS860P PRINTER / PLOTTER (CEAT)

COLOR	0.25mm pen# 1 (.005)	0.35mm pen# 2 (.007)	0.50mm pen# 3 (.010)	0.70mm pen# 4 (.014)	1.00mm pen# 5 (.020)
	#8 #9 #15	#1(RED) #2(YELLOW) #3(GREEN) #5(BLUE)	#4(CYAN) #7(WHITE) #11 #13	#6(MAGENTA) #10 #12	#14

COMPAQ PRINTER / PLOTTER (EESB)

COLOR	0.25mm pen# 1 (.005)	0.35mm pen# 2 (.007)	0.50mm pen# 3 (.010)	0.70mm pen# 4 (.014)	1.00mm pen# 5 (.020)
	#8 #9 #15	#1(RED) #2(YELLOW) #3(GREEN) #5(BLUE)	#4(CYAN) #7(WHITE) #11 #13	#6(MAGENTA) #10 #12	#14

HPIII SI POSTSCRIPT- NOVELL PRINTER/PLOTTER (MET)

COLOR	0.25mm pen# 1 (.005)	0.35mm pen# 2 (.007)	0.50mm pen# 3 (.010)	0.70mm pen# 4 (.014)	1.00mm pen# 5 (.020)
	#8 #9 #15	#1(RED) #2(YELLOW) #3(GREEN) #5(BLUE)	#4(CYAN) #7(WHITE) #11 #13	#6(MAGENTA) #10 #12	#14

LWPRO 810 PRINTER / PLOTTER (MET)

COLOR	0.25mm pen# 1 (.005)	0.35mm pen# 2 (.007)	0.50mm pen# 3 (.010)	0.70mm pen# 4 (.014)	1.00mm pen# 5 (.020)
	#8 #9 #15	#1(RED) #2(YELLOW) #3(GREEN) #5(BLUE)	#4(CYAN) #7(WHITE) #11 #13	#6(MAGENTA) #10 #12	#14

FSED LINE WEIGHT/COLOR STANDARD FOR DIVISION RESOURCES

(A1)

WEIGHT	COLOR #	CIVIL	ARCHITECTURAL	HVAC	STRUCTURAL	MACHINE DESIGN	PROCESS SYS.	ELECTRICAL	AUTOMATION
.25MM	#8 #9 #15	EXST. COND. HATCH PATTERN	HATCH PATTERN	BLDG. BKGRND EXST. PIPING EXST. DUCT EXST. EQUIP. NEW FLEX DUCT	EXST. COND. HATCH PATTERN	HATCH PATTERN PHANTOM LINE	EXST. STRUCT.	EXST. BLDG.	EXST. AUTOMATION
.35MM	#1(RED) #2(YELLOW) #3(GREEN) #5(BLUE)	TEXT DIMENSION COLUMN GRID CENTER LINE HIDDEN LINE	TEXT DIMENSION EXST. CONST. CENTER LINE HIDDEN LINE	TEXT DIMENSIONS DIFFUSERS PIPE FITTINGS	TEXT DIMENSION COLUMN GRID CENTER LINE HIDDEN LINE	TEXT DIMENSION EXT. LINE LEADER LINE HIDDEN LINE CENTER LINE PUR. HARDWARE BORDER	TEXT DIMENSIONS NEW STRUCT. EXST. STRUCT	TEXT DIMENSIONS EXST. E. E. WK.	TEXT EXST. AUTOMATION
.50MM	#4(CYAN) #7(WHITE) #11 #13	NEW CONCRETE NEW STEEL NEW COLUMNS CIVIL DETAILS	OBJECT LINE NEW WORK HIDDEN LINE	NEW EQUIPMENT NEW DUCT NEW PIPING SCH. BORDER	NEW CONCRETE NEW STEEL NEW COLUMNS CIVIL DETAILS	OBJECT LINE	EXST. PIPING EXST. EQUIPMENT		
.70MM	#12 #10 #6(MAGENTA)	GFE	SECT. OUTLINE	SANITARY PIPING VENT PIPING DEMOLITION	GFE	CUT PLANE LINE BOLD TEXT	NEW PIPING NEW EQUIPMENT	NEW E. E. WORK	NEW AUTOMATION
1.0MM	#14		SPEC. BOLD LINE						

EXHIBIT M - MECHANICAL DRAFTING STANDARDS

REVISIONS

DATE	LTR	FIND	DESCRIPTION	BY	CHECK	APPD
11/28/95	A	2	UPDATED TO CORRECT MACHINE DESIGN INFO. & PLOTTER/PRINTER INFORMATION	M.S.W		

REVISIONS

DATE	LTR	FIND	DESCRIPTION	BY	CHECK	APPD

LANGLEY RESEARCH CENTER

APPROVALS

NAME	ORGANIZATION	DATE		DATE
			DRAWN C. A. RAMLS	12/11/91
			DESIGNED	
			CHECKED	
			APPROVED	
			TECH PROJ ENG	
			RES PROJ ENG	

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA 23681-0001

PROJECT TITLE

DRAWING TITLE: FSED LINE WEIGHT & COLOR STANDARDS

BUILDING NO.

SHEET NO.

SIZE: D

DRAWING NO.

REV NO.: A

15.0 Drafting Standard Examples

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789

ABCDEFGHIJKLMNOPQRSTUVWXYZ0123456789

REGULAR PRINT, LAYER: TXT

BOLD PRINT, LAYER: BOLDTXT

TEXT HEIGHT = .10

TEXT HEIGHT = .15

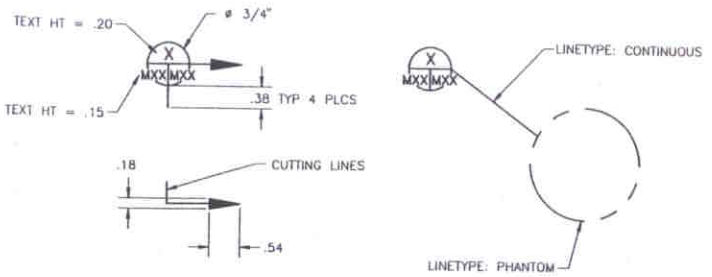
TEXT HEIGHT = .20

TEXT HEIGHT = .25

TEXT HEIGHT = .75

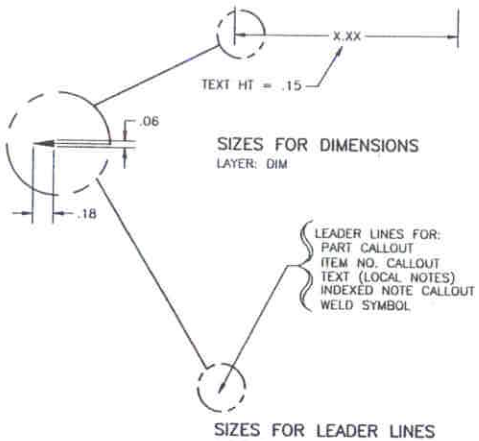
TEXT SIZES

FONT FILE: ROMANS



SIZES FOR SECTIONS AND VIEWS TAKEN

LAYER: BOLDTXT



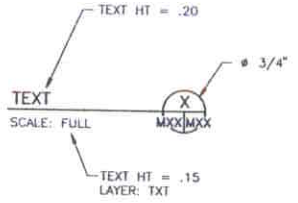
SIZES FOR DIMENSIONS

LAYER: DIM

LEADER LINES FOR:	LAYER:
PART CALLOUT	BOLDTXT
ITEM NO. CALLOUT	BOLDTXT
TEXT (LOCAL NOTES)	DIM
INDEXED NOTE CALLOUT	TXT
WELD SYMBOL	DIM

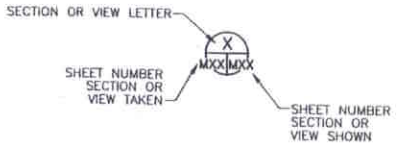
SIZES FOR LEADER LINES

LAYER: DIM UNLESS OTHERWISE NOTED



SIZES FOR SECTIONS AND VIEWS SHOWN

LAYER: BOLDTXT, UNLESS OTHERWISE NOTED



LEGEND

REVISIONS

DATE	LTR	FREQ	DESCRIPTION	BY	CHECK	APPD

REVISIONS

DATE	LTR	FREQ	DESCRIPTION	BY	CHECK	APPD

LANGLEY RESEARCH CENTER

APPROVALS

NAME	ORGANIZATION	DATE

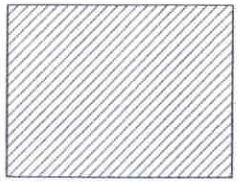
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA 23681-0001

PROJECT TITLE: MECHANICAL DRAFTING STANDARDS

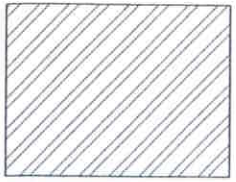
DRAWING TITLE: EXAMPLE NO 1 – TEXT HEIGHT DIMENSION, SECTION & VIEW CALLOUTS

BUILDING NO. | SIZE: D | DRAWING NO.: XXXXXX | SHEET NO.

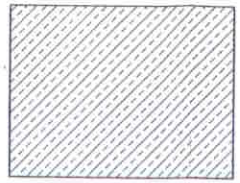
EXHIBIT M - MECHANICAL DRAFTING STANDARDS



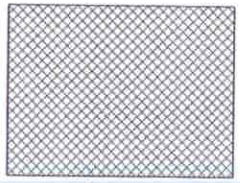
FOR: CAST IRON OR GENERAL USE
AUTOCAD NAME: ANSI31



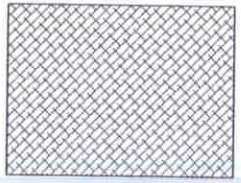
FOR: STEEL
AUTOCAD NAME: ANSI32 OR STEEL



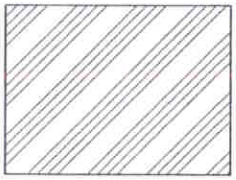
FOR: BRONZE, BRASS, COPPER AND COMPOSITIONS
AUTOCAD NAME: ANSI33 OR BRASS



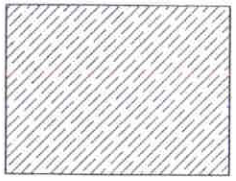
FOR: ZINC, LEAD, MAGNESIUM AND ALLOYS
AUTOCAD NAME: ANSI37



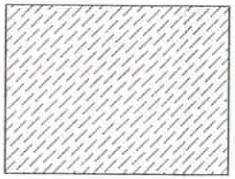
FOR: ALUMINUM AND ALLOYS
AUTOCAD NAME: ANSI38



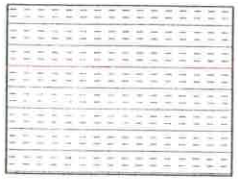
FOR: RUBBER AND PLASTIC
AUTOCAD NAME: ANSI34



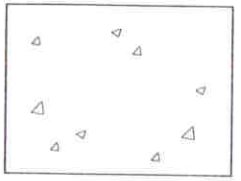
FOR: REFRACTORY MATERIAL
AUTOCAD NAME: ANSI35



FOR: GLASS, PORCELAIN, ETC.
AUTOCAD NAME: ANSI36



FOR: INSULATION
AUTOCAD NAME: INSUL



FOR: CONCRETE
AUTOCAD NAME: ARCONC

STANDARD HATCH PATTERNS

REVISIONS

DATE	LTR	FREQ	DESCRIPTION	BY	CHECK	APPD

REVISIONS

DATE	LTR	FREQ	DESCRIPTION	BY	CHECK	APPD

LANGLEY RESEARCH CENTER

APPROVALS

NAME	ORGANIZATION	DATE

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA 23681-0001

PROJECT TITLE: MECHANICAL DRAFTING STANDARDS

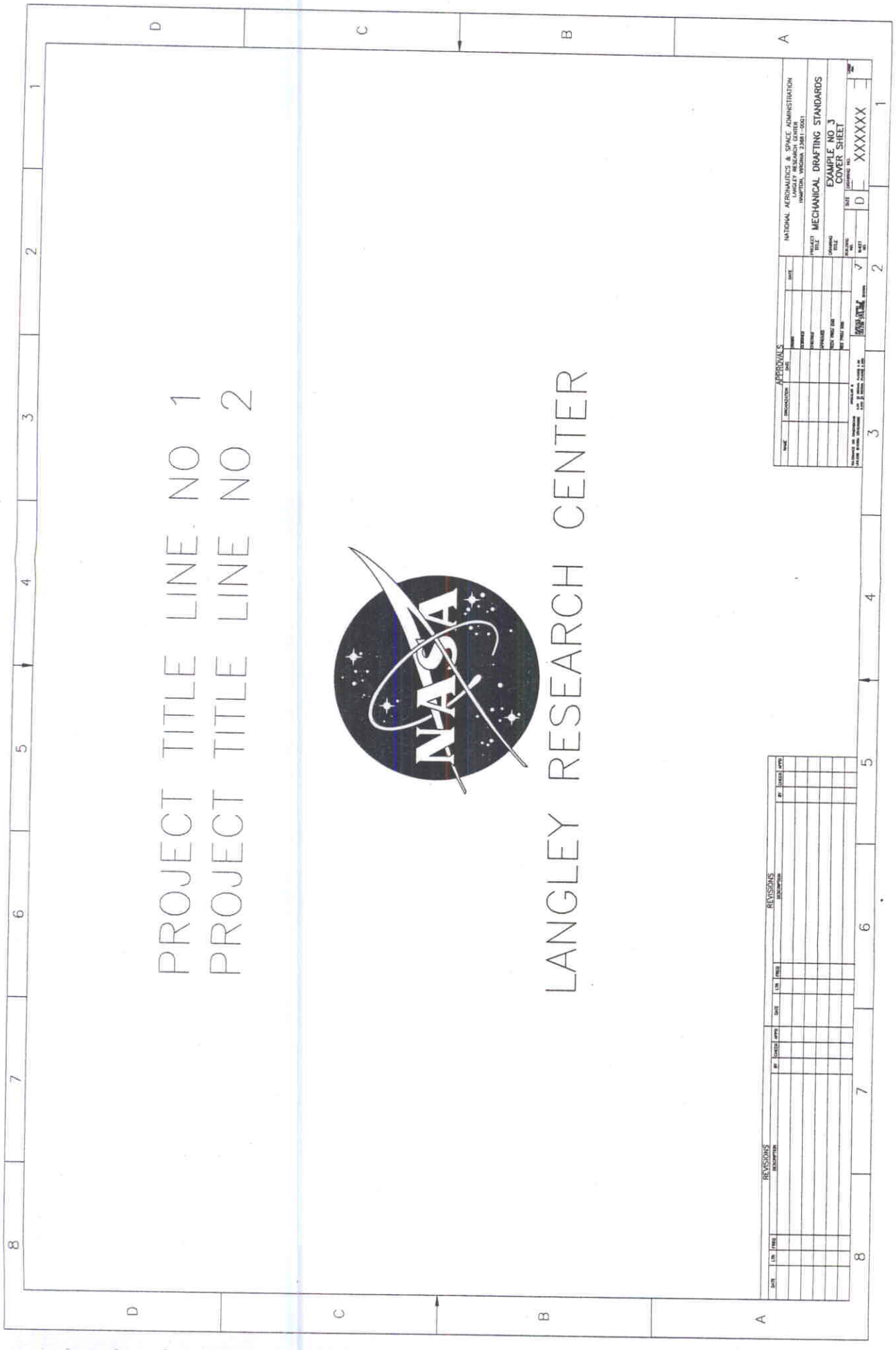
DRAWING TITLE: EXAMPLE NO 2
STANDARD HATCH PATTERNS

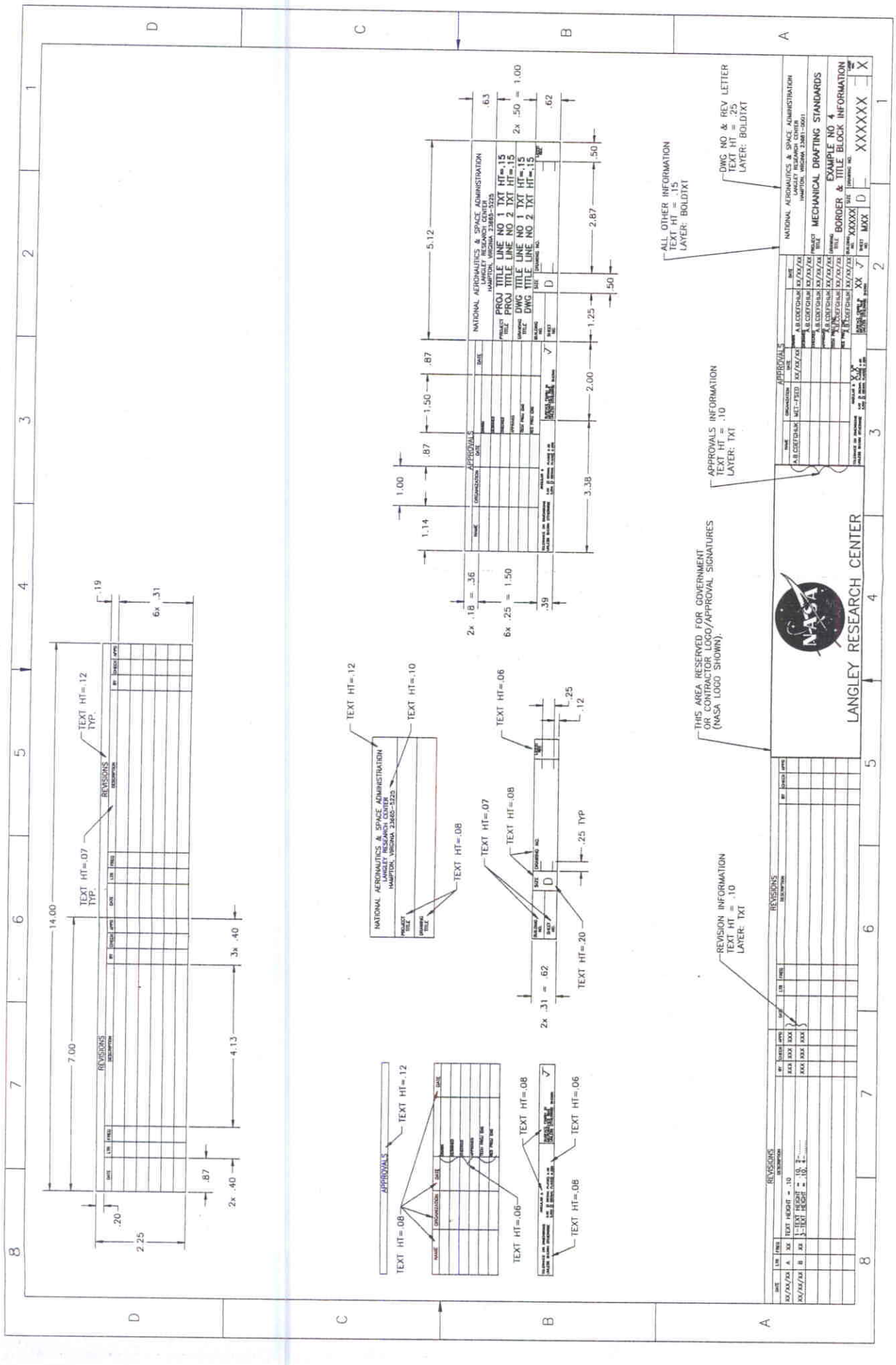
SIZE: D

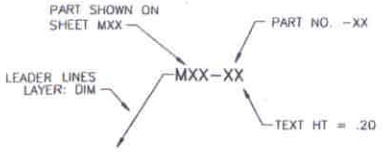
DRAWING NO.: XXXXXX

SHEET NO.:

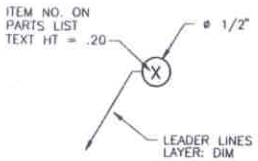
EXHIBIT M - MECHANICAL DRAFTING STANDARDS


PROJECT TITLE LINE NO 1
PROJECT TITLE LINE NO 2
LANGLEY RESEARCH CENTER
NASA
APPROVALS
REVISIONS
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA 23681-0001
MECHANICAL DRAFTING STANDARDS
EXAMPLE NO. 3
COVER SHEET
XXXXXX

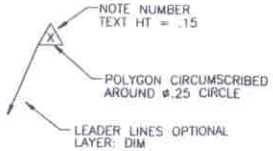

LANGLEY RESEARCH CENTER
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA 23681-0001
MECHANICAL DRAFTING STANDARDS
EXAMPLE NO 4
BORDER & TITLE BLOCK INFORMATION
XXXXXX
XX
MXX
REVISIONS
APPROVALS
TEXT HT=.12 TYP.
TEXT HT=.07 TYP.
TEXT HT=.19
TEXT HT=.10
TEXT HT=.08
TEXT HT=.07
TEXT HT=.06
TEXT HT=.20
TEXT HT=.25 TYP
TEXT HT=.08
TEXT HT=.06
TEXT HT=.08
TEXT HT=.06
14.00
7.00
4.13
3x .40
2x .40
.87
.20
2.25
6x .31
2x .31 = .62
2x .18 = .36
6x .25 = 1.50
1.00
1.14
.87
1.50
.87
5.12
.63
2x .50 = 1.00
.62
.50
2.87
.50
1.25
2.00
3.38
.39
REVISION INFORMATION
TEXT HT = .10
LAYER: TXT
APPROVALS INFORMATION
TEXT HT = .10
LAYER: TXT
THIS AREA RESERVED FOR GOVERNMENT
OR CONTRACTOR LOGO/APPROVAL SIGNATURES
(NASA LOGO SHOWN).
ALL OTHER INFORMATION
TEXT HT = .15
LAYER: BOLDTXT
DWG NO & REV LETTER
TEXT HT = .25
LAYER: BOLDTXT



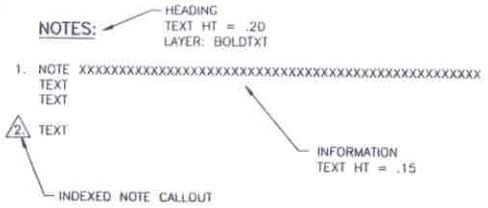
PART CALLOUT
LAYER: BOLDTXT, UNLESS OTHERWISE NOTED



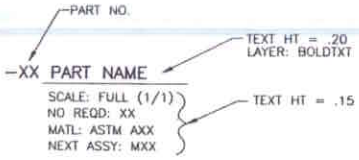
ITEM NO. CALLOUT
LAYER: BOLDTXT, UNLESS OTHERWISE NOTED



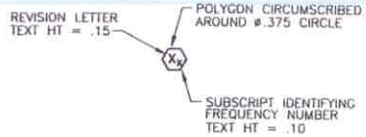
SIZES FOR INDEXED NOTE CALLOUT
LAYER: TXT, UNLESS OTHERWISE NOTED



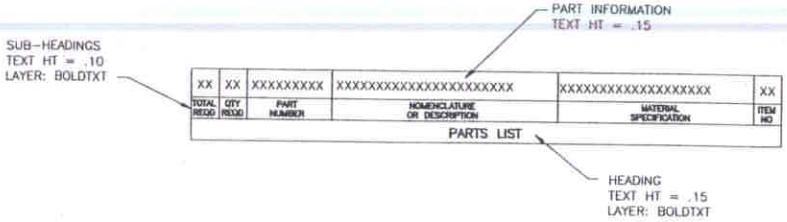
SIZES FOR NOTES
LAYER: TXT, UNLESS OTHERWISE NOTED



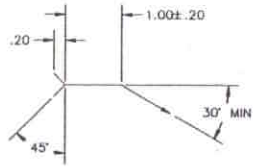
DETAILED PART INFORMATION
LAYER: TXT, UNLESS OTHERWISE NOTED
() OPTIONAL



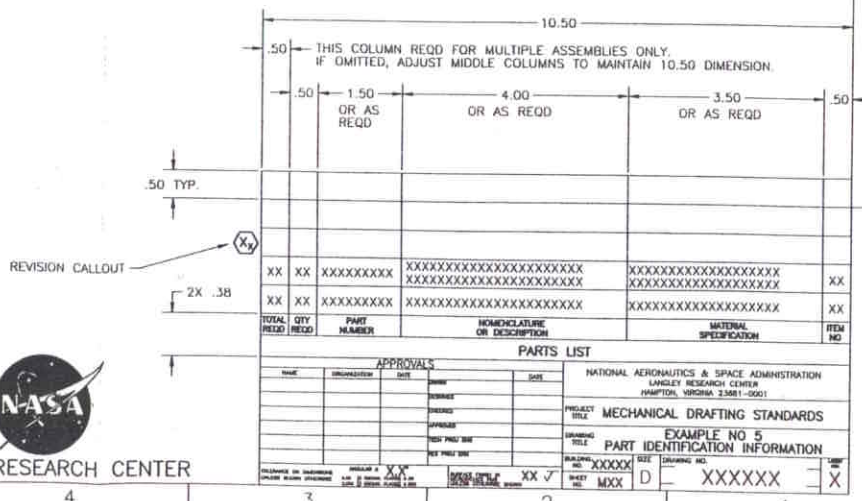
REVISION CALLOUT
LAYER: BOLDTXT



SIZES FOR PARTS LIST
LAYER: TXT, UNLESS OTHERWISE NOTED



WELDING SYMBOL CALLOUT
LAYER: DIM



REVISIONS

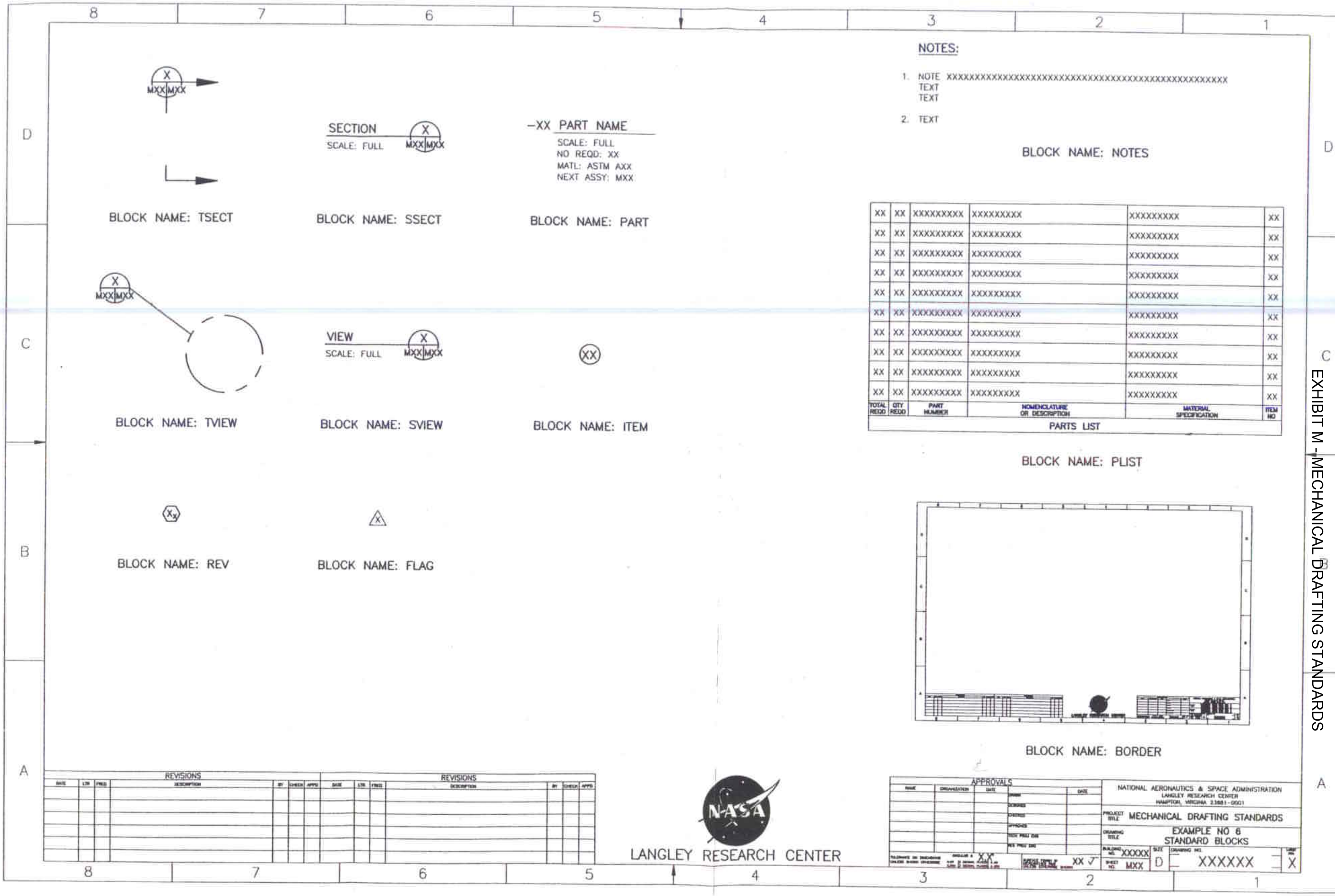
DATE	LTR	FREQ	DESCRIPTION	BY	CHECK	APPD

REVISIONS

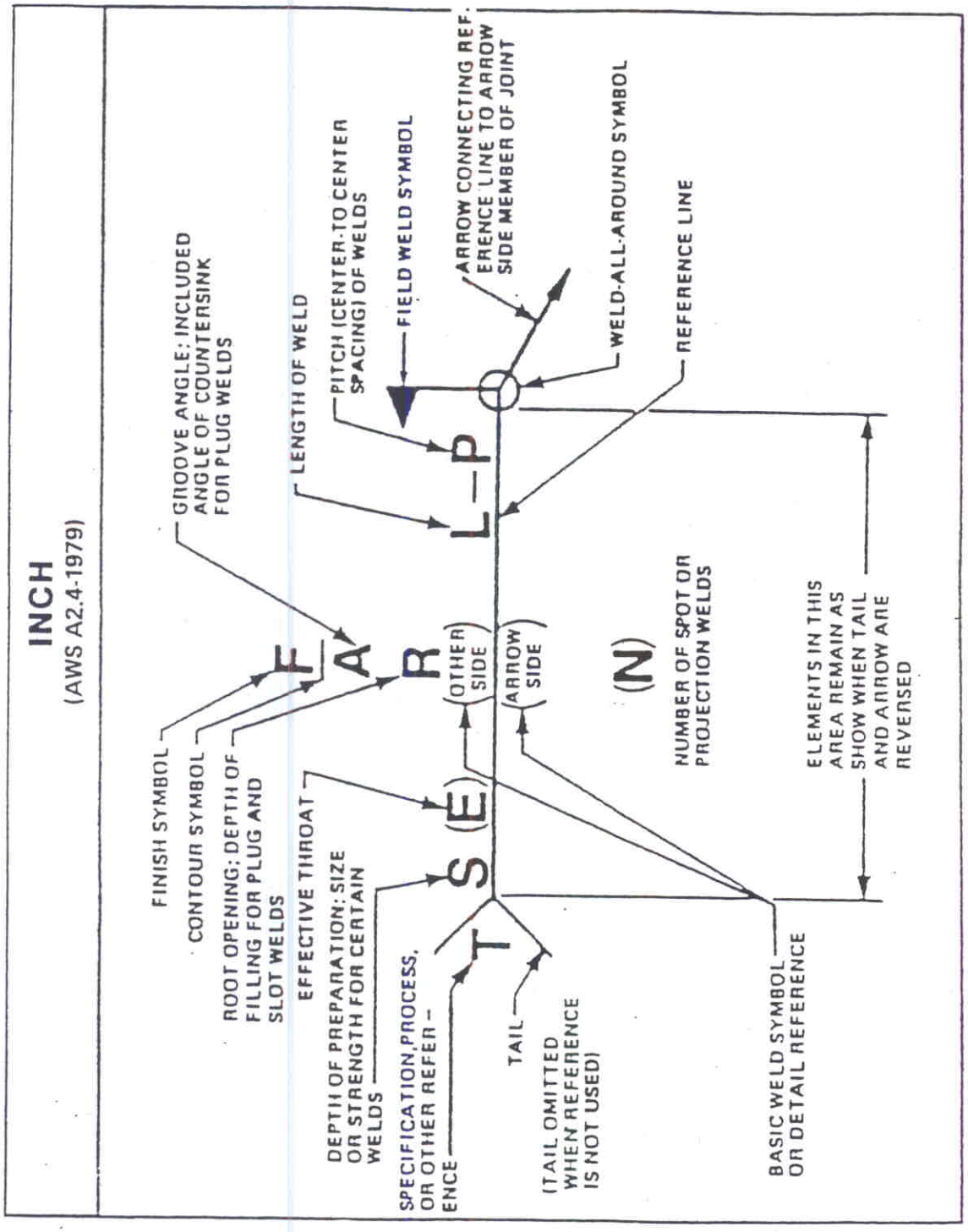
DATE	LTR	FREQ	DESCRIPTION	BY	CHECK	APPD

LANGLEY RESEARCH CENTER

EXHIBIT M - MECHANICAL DRAFTING STANDARDS

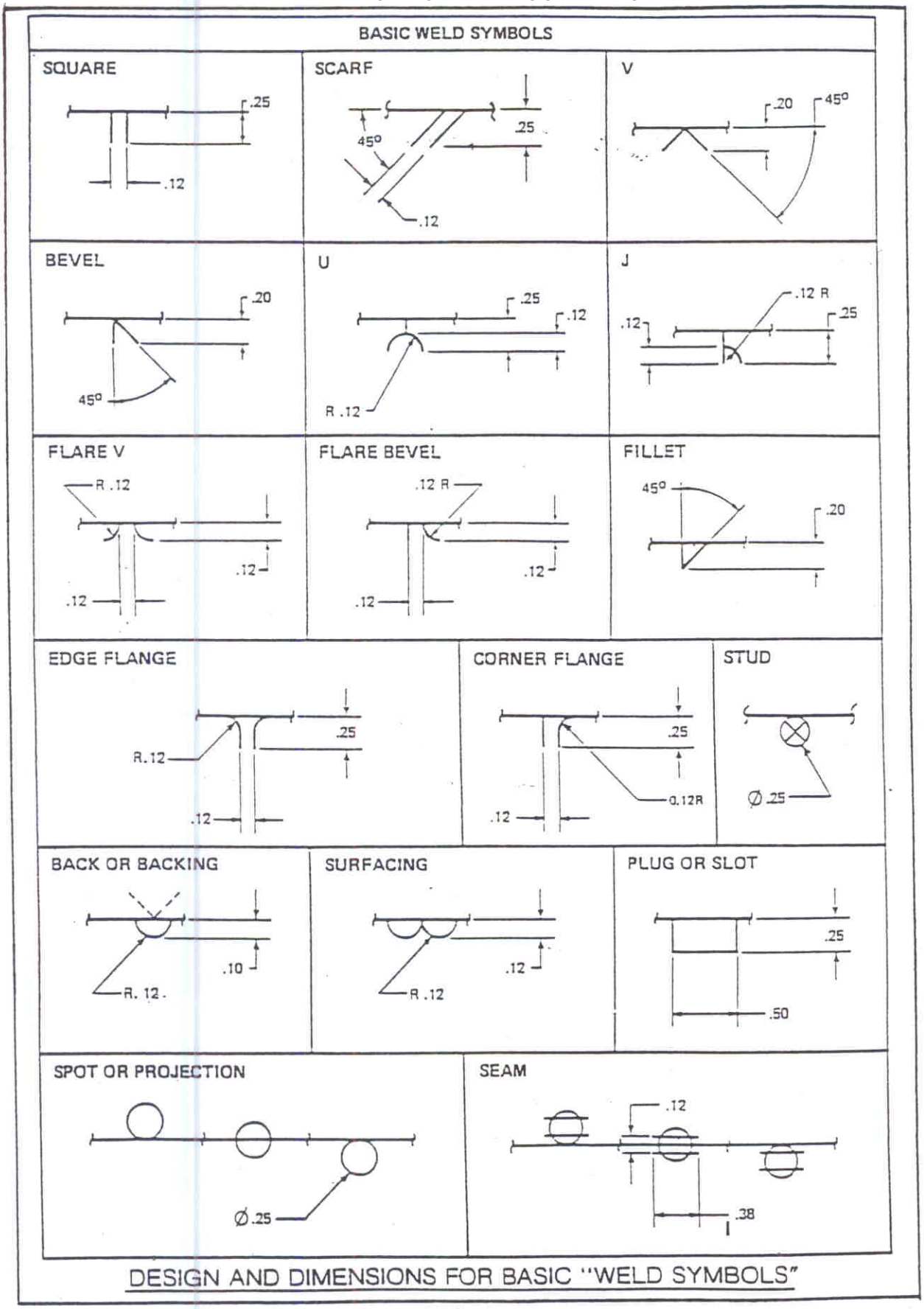

NOTES:
1. NOTE XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
TEXT
TEXT
2. TEXT
BLOCK NAME: NOTES
BLOCK NAME: TSECT
SECTION
SCALE: FULL
BLOCK NAME: SSECT
-XX PART NAME
SCALE: FULL
NO REQD: XX
MATL: ASTM AXX
NEXT ASSY: MXX
BLOCK NAME: PART
TOTAL REQD
QTY REQD
PART NUMBER
NOMENCLATURE OR DESCRIPTION
MATERIAL SPECIFICATION
ITEM NO
PARTS LIST
BLOCK NAME: PLIST
VIEW
SCALE: FULL
BLOCK NAME: TVIEW
BLOCK NAME: SVIEW
BLOCK NAME: ITEM
BLOCK NAME: REV
BLOCK NAME: FLAG
BLOCK NAME: BORDER
REVISIONS
LANGLEY RESEARCH CENTER
APPROVALS
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA 23681-0001
MECHANICAL DRAFTING STANDARDS
EXAMPLE NO 6
STANDARD BLOCKS
XXXXXX

16.0 Figures



STANDARD LOCATION OF ELEMENTS OF A WELDING SYMBOL

FIG. 1



DESIGN AND DIMENSIONS FOR BASIC "WELD SYMBOLS"

FIG. 2

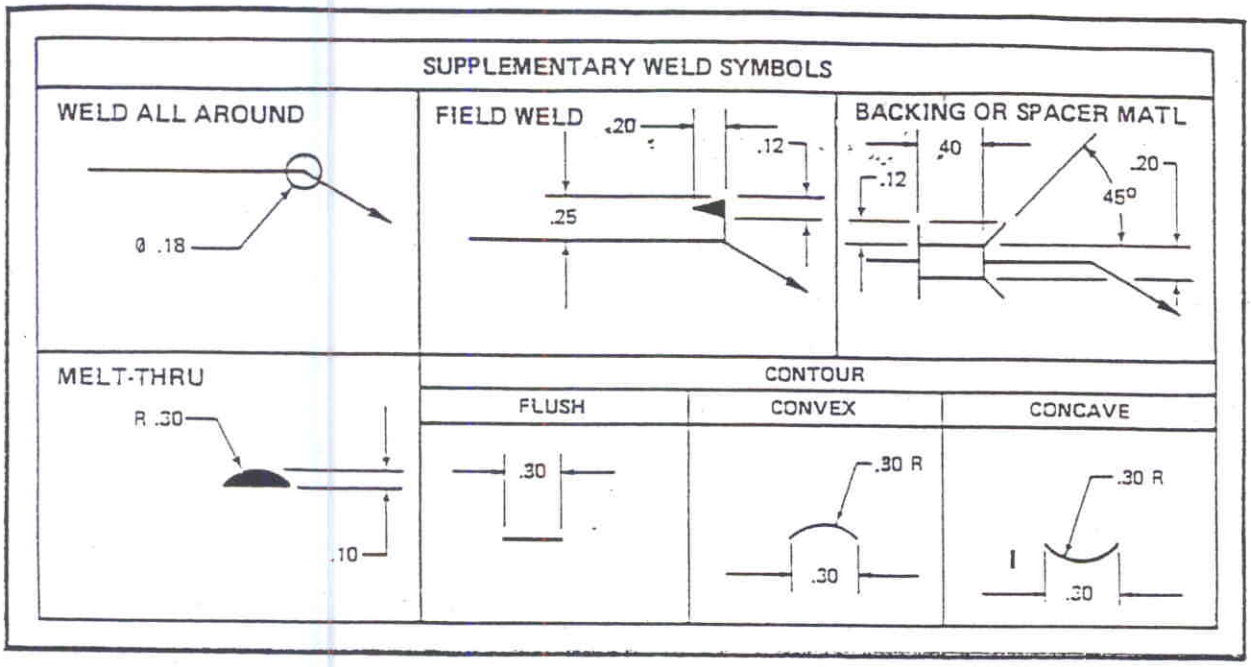
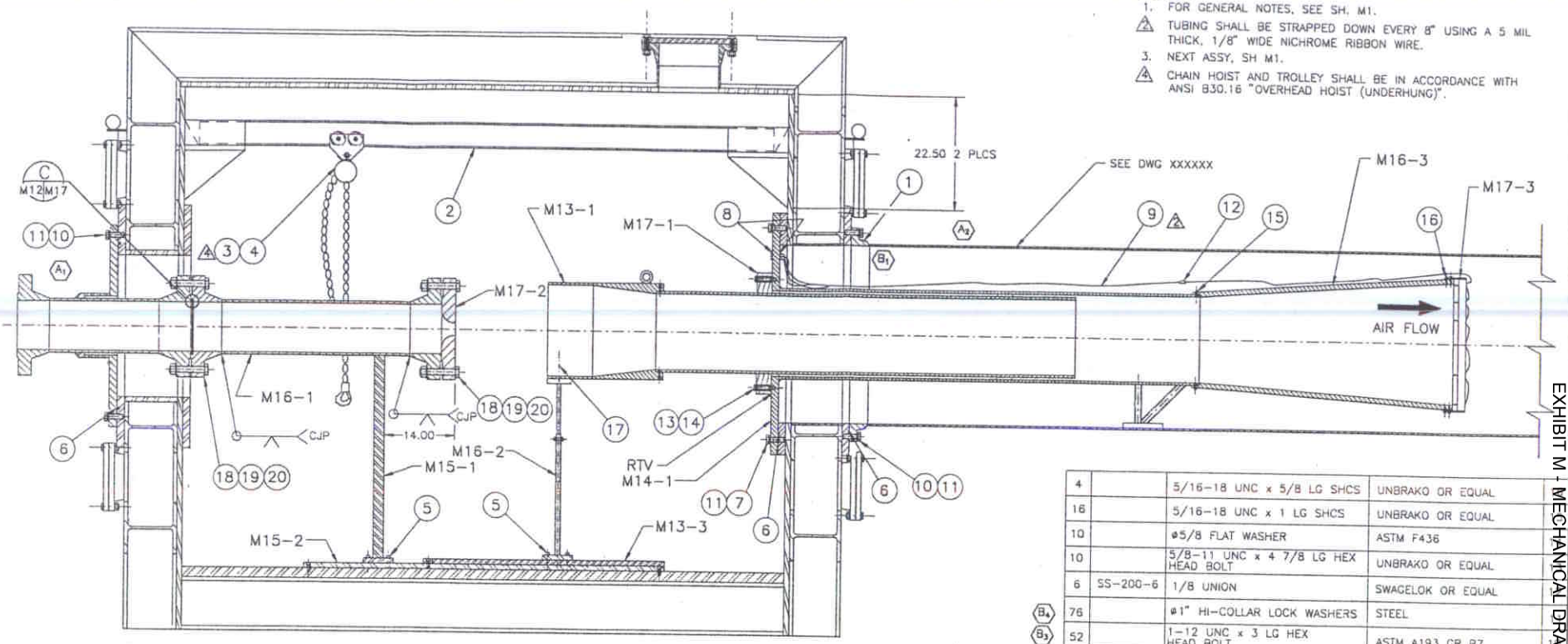

SUPPLEMENTARY WELD SYMBOLS
WELD ALL AROUND
Ø .18
FIELD WELD
.20
.12
.25
BACKING OR SPACER MATL
.40
.12
.20
45°
MELT-THRU
R .30
.10
CONTOUR
FLUSH
CONVEX
CONCAVE
.30
.30 R
.30
.30 R
.30

FIG. 3

17.0 Sample Drawings

NOTES:

1. FOR GENERAL NOTES, SEE SH. M1.
2. TUBING SHALL BE STRAPPED DOWN EVERY 8" USING A 5 MIL THICK, 1/8" WIDE NICHROME RIBBON WIRE.
3. NEXT ASSY, SH M1.
4. CHAIN HOIST AND TROLLEY SHALL BE IN ACCORDANCE WITH ANSI B30.16 "OVERHEAD HOIST (UNDERHUNG)".



SECTION A
SCALE: 1/8 M1 | M12

4		5/16-18 UNC x 5/8 LG SHCS	UNBRAKO OR EQUAL	
16		5/16-18 UNC x 1 LG SHCS	UNBRAKO OR EQUAL	
10		ø5/8 FLAT WASHER	ASTM F436	
10		5/8-11 UNC x 4 7/8 LG HEX HEAD BOLT	UNBRAKO OR EQUAL	
6	SS-200-6	1/8 UNION	SWAGELOK OR EQUAL	
B4	76	ø1" HI-COLLAR LOCK WASHERS	STEEL	
B3	52	1-12 UNC x 3 LG HEX HEAD BOLT	ASTM A193 GR B7	
AR		1/8 OD x .018 WALL TUBE	347 SS	
12	SS-200-1-2	1/8" MALE CONNECTOR	SWAGELOK OR EQUAL	
24		1-12 UNC x 3 LG HEX HEAD BOLT	ASTM A193 GR B7	
AR		ø1/4 NOM O-RING	VITON	
8		1/2-13 UNC X 1 3/4 LG SHCS	UNBRAKO OR EQUAL	
4	1	#622	HAND CHAIN HOIST	CM OR EQUAL
4	1	#3924	PLAIN ROLLER BEARING TROLLEY	CM OR EQUAL
	1		S5x10 x 9'-6" LG BEAM	ASTM A36	2
B2	1		ø36" 150# WNF FLANGE	ASTM A105	1
QTY REQD	PART NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO

PARTS LIST

32		ø1 1/4 HARDENED FLAT WASHER	ASTM F436	20
32		1 1/4-7 UNC HEX NUT	ASTM A194 GR 2H	19
32		1 1/4-7 UNC x 7 LG HEX HEAD BOLT	ASTM A193 GR B7	18
3		1/4-20 UNC x 7/8 LG FLAT HEAD SCREW	ASTM A193 GR B7	17
QTY REQD	PART NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION	ITEM NO

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REVISIONS

DATE	LTR	PRED	DESCRIPTION	BY	CHECK	APPD
3/22/94	A	2	1. MODIFIED-ADDED "HEAT RELIEF" FIXTURE			
			2. REMOVED 4.50 WNF CONNECTION			
1/15/95	B	4	1. CHANGED PLATE TO WNF			
			2. CHANGED ITEM INFO			
			3. CHANGED QTY TO 52 WAS 48.			
			4. CHANGED QTY TO 76 WAS 72.			

REVISIONS

DATE	LTR	PRED	DESCRIPTION	BY	CHECK	APPD

LANGLEY RESEARCH CENTER

APPROVALS

NAME	ORGANIZATION	DATE		DATE
			DRAWN	
			DESIGNED	
			CHECKED	
			APPROVED	
			TECH PROJ ENG	
			RES PROJ ENG	

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA 23681-0001

PROJECT TITLE: MECHANICAL DRAFTING STANDARDS

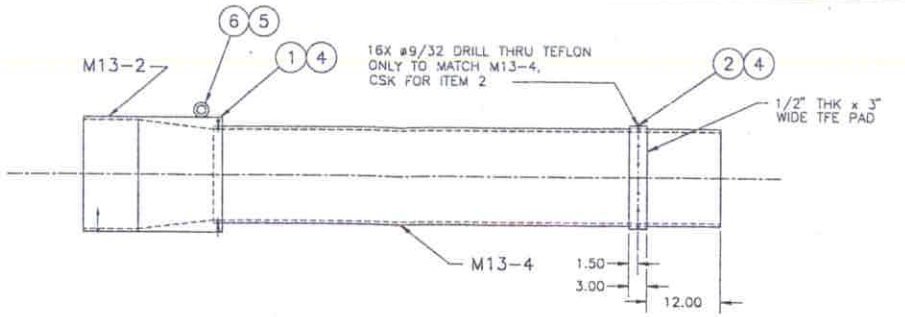
DRAWING TITLE: SAMPLE DRAWING 1 - ASSEMBLY

BUILDING NO.

SHEET NO. M12

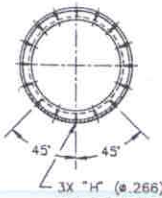
SIZE D | DRAWING NO. XXXXXX | REV B

EXHIBIT M - MECHANICAL DRAFTING STANDARDS



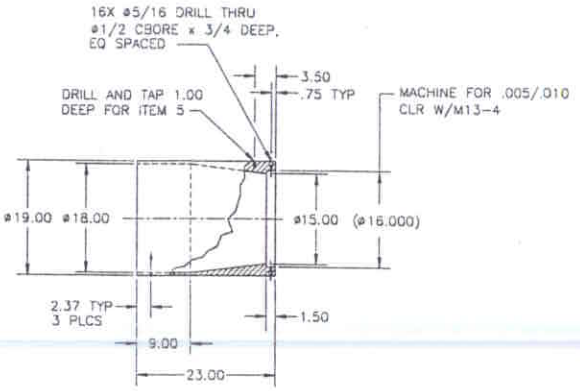
-1 TELESCOPING CYLINDER SUB ASSEMBLY

SCALE: 1/8
NO REQD: 1
MATL: NOTED
NEXT ASSY: SH M12



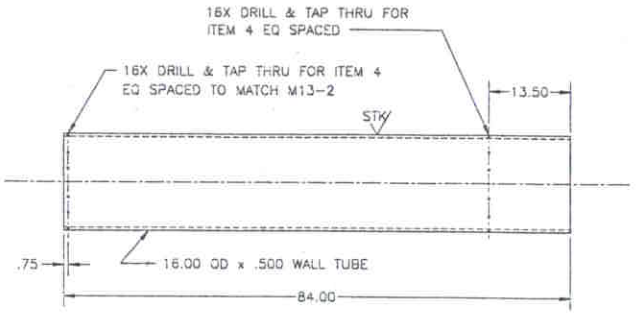
NOTES:

1. FOR GENERAL NOTES, SEE SH M1.



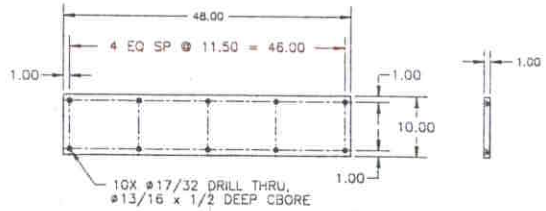
-2 INLET CONE

SCALE: 1/8
NO REQD: 1
MATL: 6061-T6 ALUM
NEXT ASSY: SH M13



-4 TELESCOPING CYLINDER

SCALE: 1/8
NO REQD: 1
MATL: E6061-T6511 ALUM
NEXT ASSY: SH M12



-3 SUPPORT MOUNTING PLATE

SCALE: 1/4
NO REQD: 1
MATL: ASTM A36
NEXT ASSY: SH M12

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ITEM NO	QTY REQD	PART NUMBER	NOMENCLATURE OR DESCRIPTION	MATERIAL SPECIFICATION
5	1	#9900208	ø3/8 x " 1/4 SHOULDER TYPE FORGED MACHINERY EYEBOLT	CROSBY OR EQUAL
4	1		3/8-16 UNC x 2.50 SELF LOCKING THREAD INSERT	HELICOIL OR EQUAL
3	32		1/4-20 UNC x 1.50 SELF LOCKING THREAD INSERT	HELICOIL OR EQUAL
			NOT USED	
2	16		1/4-20 UNC x 3/4 LG FLAT HEAD SCREW	UNBRAKO OR EQUAL
1	16		1/4-20 UNC x 1 1/4 LG SHCS	UNBRAKO OR EQUAL

PARTS LIST

REVISIONS

DATE	LTR	DESCRIPTION	BY	CHECK APPD

REVISIONS

DATE	LTR	DESCRIPTION	BY	CHECK APPD

APPROVALS

NAME	ORGANIZATION	DATE	
			DRAWN
			DESIGNED
			CHECKED
			APPROVED
			TECH PROJ DVP
			PROJ PROJ DVP

LANGLEY RESEARCH CENTER

NATIONAL AERONAUTICS & SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA 23681-0001

PROJECT TITLE: MECHANICAL DRAFTING STANDARDS

DRAWING TITLE: SAMPLE DRAWING 2 SUBASSEMBLY & DETAILS

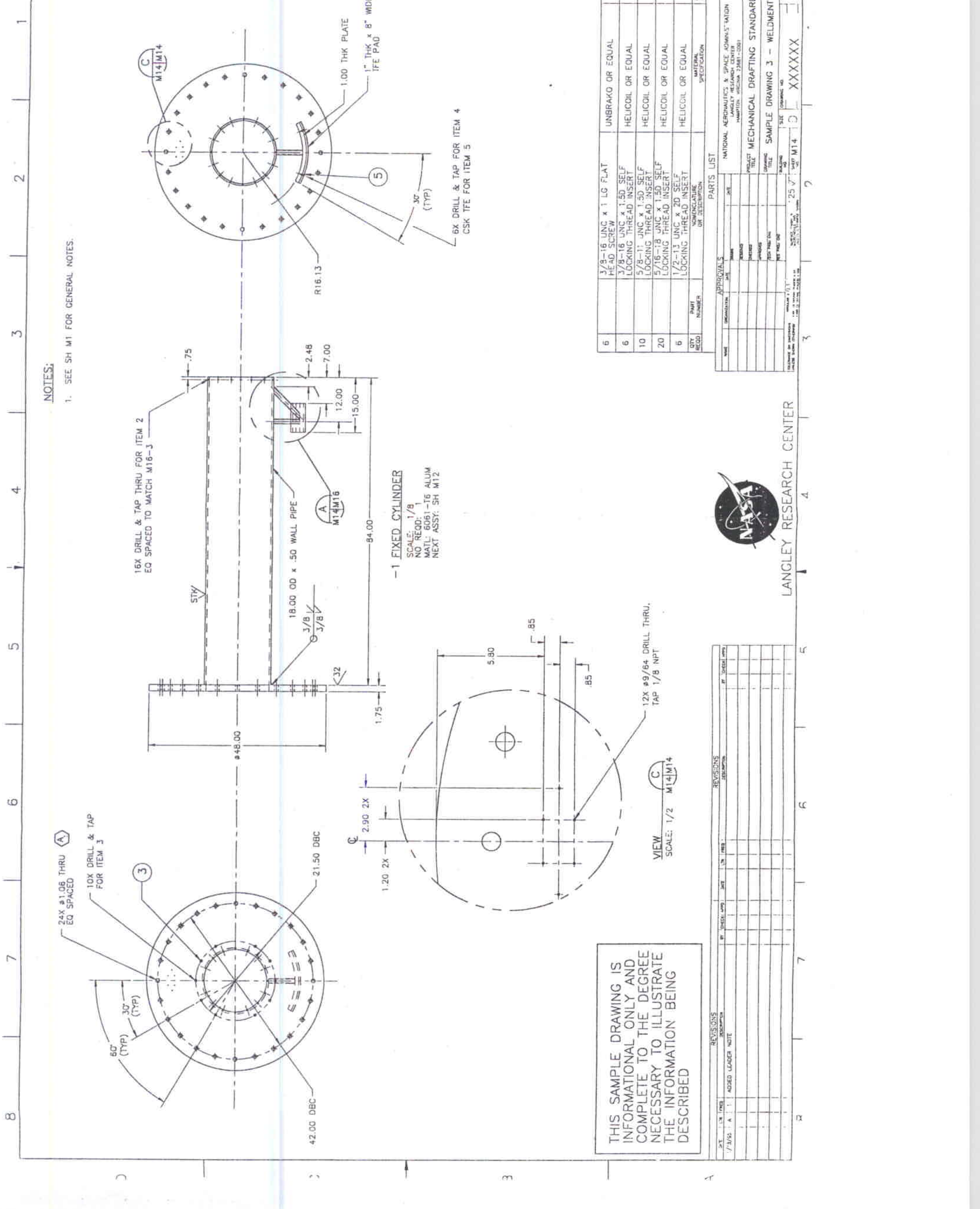
SIZE: D | DRAWING NO.: XXXXX | REV:

SCALE: 1/8 | WEIGHT: | SHEET M13 OF

TOLERANCE ON DIMENSIONS UNLESS NOTED OTHERWISE: .X ±.1 .XX ±.03 .XXX ±.010 ANGLES ±1°

SURFACE FINISH 125 √

EXHIBIT M - MECHANICAL DRAFTING STANDARDS


NOTES:
1. SEE SH M1 FOR GENERAL NOTES.
24X ø1.06 THRU EQ SPACED
10X DRILL & TAP FOR ITEM 3
60° (TYP)
30° (TYP)
42.00 DBC
21.50 DBC
16X DRILL & TAP THRU FOR ITEM 2 EQ SPACED TO MATCH M16-3
18.00 OD x .50 WALL PIPE
ø48.00
84.00
1.75
15.00
12.00
7.00
2.48
.75
-1 FIXED CYLINDER
SCALE: 1/8
NO REQD: 1
MATL: 6061-T6 ALUM
NEXT ASSY: SH M12
R16.13
1.00 THK PLATE
1" THK x 8" WIDE TFE PAD
6X DRILL & TAP FOR ITEM 4 CSK TFE FOR ITEM 5
30° (TYP)
12X ø9/64 DRILL THRU. TAP 1/8 NPT
5.80
.85
2.90 2X
1.20 2X
VIEW
SCALE: 1/2
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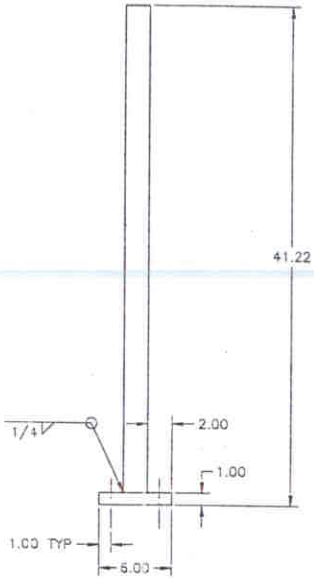
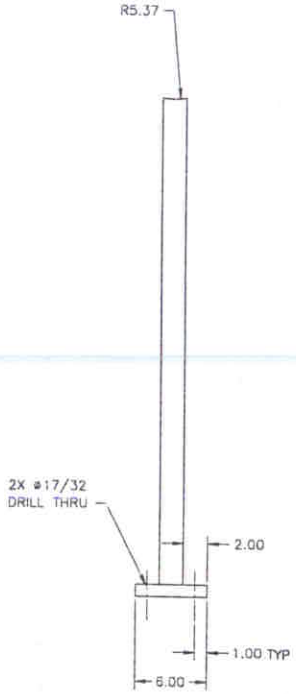
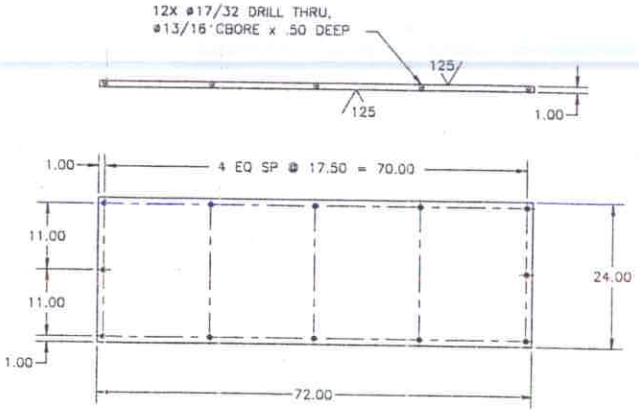
LANGLEY RESEARCH CENTER
REVISIONS
ADDED LEADER NOTE
PARTS LIST
6 | 3/8-16 UNC x 1 LG FLAT HEAD SCREW | UNBRAKO OR EQUAL
6 | 3/8-16 UNC x 1.5D SELF LOCKING THREAD INSERT | HELICOIL OR EQUAL | 5
10 | 5/8-11 UNC x 1.5D SELF LOCKING THREAD INSERT | HELICOIL OR EQUAL
20 | 5/16-18 UNC x 1.5D SELF LOCKING THREAD INSERT | HELICOIL OR EQUAL | 2
6 | 1/2-13 UNC x 2D SELF LOCKING THREAD INSERT | HELICOIL OR EQUAL | 1
QTY REQD | PART NUMBER | NOMENCLATURE OR DESCRIPTION | MATERIAL SPECIFICATION | ITEM NO
APPROVALS
NATIONAL AERONAUTICS & SPACE ADMINISTRATION
LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA 23681-0001
MECHANICAL DRAFTING STANDARDS
SAMPLE DRAWING 3 - WELDMENT
SHEET M14
XXXXXX
A





-1 VERTICAL S JPPORT

SCALE: 1/4
NO REQD: 1
MATL: ASTM A36
NEXT ASSY: SH M12



-2 NOZZLE/MODEL MOUNTING PLATE

SCALE: 1/8
NO REQD: 3
MATL: ASTM A36
NEXT ASSY: SH M12

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REVISIONS

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LANGLEY RESEARCH CENTER
HAMPTON, VIRGINIA 23681-0001

PROJECT TITLE: MECHANICAL DRAFTING STANDARDS

DRAWING TITLE: SAMPLE DRAWING 4 - DETAILS

SIZE: D | DRAWING NO.: XXXXXX

SHEET NO.: M15

EXHIBIT M - MECHANICAL DRAFTING STANDARDS