

Process Specification for Part Marking

Engineering Directorate

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Process Specification for Part Marking

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REVISIONS		
VERSION	CHANGES	DATE
--	Original version	5/15/97
A	Various	7/6/97
B	Various, including deletion of electric arc etching	1/30/98
C	Changed EM2 references to ES4, added white and red ink to Table 2, permits engraving plastic by Table 1, removed MMPTD references, added Sharpie marker for silicone rubber parts	3/26/02
D	Expanded scope of PRC to include general, non-identification markings, such as arrows, words or numbers, alignment marks, etc.	3/30/04
E	Added use of Sanford 13501 and 13401 markers for marking of Ground Support Equipment, added 3.3.12	9/17/04
F	Corrected Sharpie marker part numbers. Added use of Sharpies for marking softgoods. Added use of Sharpie markers for container markings, provided markings are covered by approved clear adhesive tape.	4/4/05
G	Added references to SSP 57000 Appendix C and JSC 27260, removed reference to SC-D-0001. Updated Table 2 of approved marking materials.	2/16/06
H	Updated Table 2 to add Lord Corporation Chemglaze AO74 with P-line pigments for EVA applications, updated sections 3.2 and 3.3.6, and 6.5.3 to include these new materials. Removed specific references to ES4 in sections 3.3 and 5.0.	4/24/07
I	Minor grammatical changes	06/2010
J	Updated Table 1; replaced JPG 8500.4 with JPR 8500.4 under REFERENCES section; updated Table 2 and section 6.5.3, <i>Filled Impressions</i>	07/2012
K	Redefined scope to include requirements for selectable marking methods, except for laser marking and laser engraving covered by NASA/JSC PRC-9003; minor changes to the first note on Figure 1; deleted all mention of "laser"; referenced Section 6.5.3 in Section 6.5.6 to fill engravings.	10/2012
L	Updated revision, date, and <i>Approved by</i> signature; deleted additional marking requirements for Space Station Payloads per SSP 57000, Appendix C under Section 3.0 Usage ; deleted SSP 57000, Appendix C and JSC-SPEC-M1 from Section 4.0 References ; added Section 10.0 Definitions ; minor grammatical corrections.	12/2019

1.0 SCOPE

This process specification establishes requirements for identification marking and general marking of flight and non-flight hardware manufactured by JSC or outside vendors. In addition, this process specification establishes the requirements for selectable marking methods. The scope of this process specification does not cover the requirements for identification marking and general marking by a laser. NASA/JSC PRC-9003 establishes the requirements for laser marking and laser engraving.

2.0 APPLICABILITY

This specification shall be applicable whenever marking for part identification or general marking (such as arrows, words or numbers, alignment markings, etc.) is invoked per Section 3.0, "Usage."

3.0 USAGE

This section gives the requirements for the proper design usage of this process specification.

The marking process shall be invoked by a process note on the engineering drawing. The process note shall indicate the marking method and reference this PRC as a minimum. Character height and depth shall follow (when required), along with any additional requirements. Several example drawing notes are shown in Figure 1 below:

PART NUMBER SHALL BE MARKED BY {specific marking method} PER NASA/JSC PRC-9002. CHARACTER HEIGHT SHALL BE {specify character height; 1/8 default if not specified} INCH. CHARACTER DEPTH SHALL BE {as required per selected marking method}. LOCATE APPROXIMATELY AS SHOWN.

PART NUMBER SHALL BE MARKED BY STEEL STAMP OR DIE PER NASA/JSC PRC-9002. CHARACTER HEIGHT SHALL BE 3/16 INCH. CHARACTER DEPTH SHALL BE 0.01 INCH. LOCATE APPROXIMATELY AS SHOWN.

PART NUMBER SHALL BE MARKED BY RUBBER STAMPING USING 73X BLACK INK PER NASA/JSC PRC-9002. CHARACTER HEIGHT SHALL BE 3/16 INCH. LOCATE APPROXIMATELY AS SHOWN.

ENGRAVE PART WITH {words, numbers, arrows, alignment marks, etc.} PER NASA/JSC PRC-9002. IMPRESSIONS SHALL BE FILLED WITH {material}.

BAG AND TAG TO IDENTIFY PART NUMBER PER NASA/JSC PRC-9002.

DECAL WILL BE USED FOR MARKING AND SHALL MEET THE DECAL REQUIREMENTS OF NASA/JSC PRC-9002.

Figure 1: Examples of process notes for identification marking.

3.1 LOCATION AND LEGIBILITY OF MARKING

The location of the marking shall be specified on the engineering drawing. The marking location shall be indicated on the drawing with a box, which is flagged. The general configuration for a flag note to specify marking location is shown in Figure 2 below:

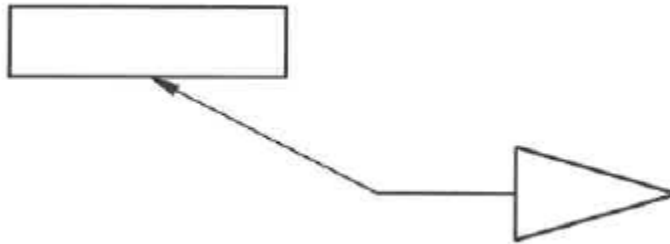


Figure 2: Sketch of the configuration for a flag note designating marking location.

Specific information on the marking format for part and serial numbers, and how to write the flag note to indicate marking placement may be found in Section 3.4. Factors that shall be considered when specifying a location include:

- whether damage could occur to a critical surface due to stamping or etching
- whether a detailed part number should be visible at the next assembly, top assembly, or installation level
- whether total or partial obliteration of the marking could be caused by the assembly process
- whether verification of an assembly will depend upon visibility of component part numbers

Assembly markings shall be visible under conditions of normal vision in daylight, or in equivalent illumination. Parts and assemblies having unsuitable or insufficient surfaces (i.e., small springs, glass or plastic optical elements, etc.) or drawings which specify "No Marking Permitted" shall be identified by Container Marking (see Sections 3.3.9 and 3.4.7). NHB 5300.4 (1D-2), paragraph 1D502, shall be complied with in all instances.

3.2 SIZE AND COLOR OF MARKING

Marking size shall be specified on the engineering drawing. The choice of character height shall be in increments of 1/32 inch, from 1/16 to 1/2 inch inclusive, with 1/8 inch being the default if no size is specified. Character size in accordance with the point value system is acceptable, with 12-point being preferred. The size of characters shall be proportioned to the area available for marking. The size of

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markings shall be uniform from part to part within the practical limits of readability. An example of the character size callout is as follows:

CHARACTER HEIGHT SHALL BE 3/16 INCH.

Character depth is applicable only for certain marking methods. Unless called out by the process note, the manufacturing organization may select a character depth, as long as it is consistent within a marking and does not exceed the maximum depth allowed for the specific marking process. An example of the character depth callout is as follows:

CHARACTER DEPTH SHALL BE 0.01 INCH.

In terms of color, the preferred color for rubber stamping, stenciling or filled impressions shall be black or white, as appropriate for maximum contrast. Markings of other colors having contrast to the part are also acceptable. The product name and color of the marking ink or paint shall be specified on the engineering drawing in the parts list. Acceptable products and their colors/pigments are listed in Table 2.

3.3 MARKING METHOD

The marking method chosen shall be selected to preclude damage or degradation of part quality. The default sequences for marking during part finishing are shown in Table 1 below:

Table 1: Default Sequences for Marking during Part Finishing

	CRES: Class C (austenitic corrosion resistant) and Class D (15-SPH, 17-4PH & 17-7PH ONLY)	Alum	Brass	Foil Labels	Painted Brass or CRES	Plastic
Diamond Drag	before passivation	before anodize or chemfilm	after all finishing	n/a	after all finishing	n/a
Steel Stamp or Die	before passivation	before anodize or chemfilm	after all finishing	before application	n/a	n/a
Electro- Chemical Etch	before passivation	before anodize or chemfilm	after all finishing	n/a	n/a	n/a
Electric Vibrating Pencil	before passivation	after anodize or chemfilm	after all finishing	n/a	n/a	n/a
Engraving	before passivation	after anodize or chemfilm	after all finishing	n/a	n/a	before or after all surface finishino

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Rubber Stamping	after passivation or paint	after anodize or chemfilm	after all finishing	n/a	after all finishing	after all surface finishing
Stenciling	after passivation or paint	after anodize or chemfilm	after all finishing	n/a	after all finishing	after all surface finishing
Insert	n/a	n/a	n/a	n/a	n/a	during layup
Decal or Nameplate	after passivation or paint	after anodize or chemfilm	after all finishing	n/a	after all finishing	after all surface finishing

3.3.1 Diamond Drag (Impression Marking)

Diamond Drag markings are formed by a pantograph system using an industrial diamond stylus. Diamond drag marking is unsatisfactory (illegible) where a thick finish (e.g., hard anodize) would subsequently be applied. This method shall not be specified when it will be harmful to the finished part. Character size may range from 0.040 to 3/16 inch, with a depth necessary to obtain reasonable legibility, but not to exceed 0.015 inch.

3.3.2 Steel Stamp Or Die (Impression Marking)

These markings are formed by pressing or stamping by hand or machine with character shaped steel stamps or dies.

Steel stamps shall normally consist of characters 1/16 to 3/16 inch high. The depth of the impression shall be no greater than is necessary to obtain reasonable legibility, but shall not exceed 0.015 inch.

Impression stamping (steel stamp or die) of parts shall not be used on the following items without prior approval of the cognizant materials engineer:

- a. Ferrous parts heat-treated above 160 ksi ultimate tensile strength and metallic parts work-hardened above one-fourth harder than the normal annealed condition.
- b. All metallic materials 0.040 inch thick or less.
- c. All magnesium alloys except castings provided with a raised pad for marking purposes.
- d. Surfaces contoured to a dimension.
- e. Areas where subsequent metal removal will obliterate the marking.
- f. On a surface less than 1/2 inch from the edge of a part or less than 3/8 inch from the edge of a finished hole or recess, or less than 1/4 inch from the tangent lines of bends or fillets.

- g. Less than 1/4 inch from weld beads.
- h. Metal tank skins.
- i. Pressure tubing and push-pull control tubing.
- j. Pressure vessels.

3.3.3 Hot Impression Stamping

Hot impression stamping is intended for use where a permanent type of marking is required on insulation sleeving. The markings shall be in proportion to the size of the space to which they are applied.

3.3.4 Electrochemical Etching

Electrochemical etching shall be used for permanent marking of bare metallic or conductive surfaces when preferred over rubber stamping, or where impression stamping is unsuitable. Electrochemical etching is used where a quick, permanent, and non-injurious method is required on an area which will not be covered with paint. This method shall not be applied to dynamic bearing surfaces or used for instruction markings. The location of the marking shall be selected to preclude the accidental trapping of the electrolytic solution in crevices. The minimum material thickness which shall be etched by this method is 0.010 inch.

3.3.5 Electric Vibrating Pencil

Marking by this method is not recommended for use on flight hardware. This method is subject to the same restrictions as Steel Stamp or Die marking (see Section 3.3.2). Marking shall not cause disfigurement on the opposite surface of thin materials.

3.3.6 Engraving

The minimum thickness of the base materials to be engraved shall be 0.030 in. for all metals (except nameplates) and for all molded or sheet plastics. However, for multi-layer or reinforced laminates, the minimum thickness shall be 0.060 in. Engraving is subject to the same restrictions noted in Section 3.3.2, a through j.

If desired, impressions can be filled with a permanent coating in a contrasting color from Table 2. This is specified by addition of one of the following process notes, depending on whether or not primer is required:

IMPRESSIONS SHALL BE FILLED WITH *{material}*
 or
PRIME WITH *{primer}* AND FILL IMPRESSIONS WITH *{material}*

Primer must be used for filled flight hardware engravings but is not necessary for ground support hardware. Both the primer (if used) and the filling material shall be

added to the drawing parts list. Additional details regarding materials requirements for filled engravings are given in Section 6.5.3.

3.3.7 Rubber Stamping

Rubber stamping shall be applied on painted, plastic, ceramic, anodized, and other nonmetallic surfaces where impression stamping and electrochemical etching are not suitable. Identification markings shall not be placed on teflon-coated surfaces without prior approval by the cognizant materials engineer.

3.3.8 Stencil Marking

Stencil marking is used where the volume of marking is large. Terminal boards of epoxy laminate may be marked by stenciling. The location of the marking shall in no way interfere with the electrical functions of the board. Identification markings shall not be placed on teflon-coated surfaces without prior approval by the cognizant materials engineer.

3.3.9 Container (Bag and Tag) Marking

Container marking may be used for small electrical and electronic parts, attaching hardware, parts having dielectric properties, and parts and assemblies which cannot be marked by other means or where individual tagging is not practical. Parts and assemblies shall be identified according to the requirements of section 6.5.8. Parts and assemblies in this category that require serialization shall be placed with only one item per container.

3.3.10 Insert Markings

As an optional method of marking transparent or translucent laminate parts (i.e., polyester/glass fabric), an ink-stamped insert may be used. A piece of glass fabric is stamped with the required information using black marking ink. The marked piece is inserted between the outer two plies of laminate during lay-up. The insert shall be placed near an edge of the part as specified on the engineering drawing.

3.3.11 Decals or Nameplates

Decals or nameplates of various types may be used for identification marking of hardware. The decal detail drawing shall indicate that the decal will be utilized for marking and meets the applicable requirements of this specification. The assembly drawing shall also indicate that the decal application process meets the requirements of this specification.

Decals shall conform to MIL-STD-1472 (*Human Engineering Design Criteria for Military Systems, Equipment and Facilities*). Decals that are known to emit corrosive vapor shall not be used in closed packages. Protective coatings (i.e., lacquer) shall not be

applied on decals unless chemical compatibility has been established. All decal materials used for flight hardware shall be in accordance with Section 5.0 of this specification. The minimum character size on decals shall be 8 point. Certified ink ball-point pen markings on decals are acceptable. JSC 27260E contains a list of approved decals.

3.3.12 Use of Sharpie Markers

Sharpie markers are easy and convenient to use, but do not always constitute a form of permanent marking, since the ink can be removed by the application of solvents. However, they may be used to mark silicone rubber parts that are not easily markable by alternate methods. Also, the use of Sharpie markers for marking softgoods is permissible. The appropriate part numbers for these applications are Sanford 35001 to 35004 for extra fine point markers of various colors. Fine point (30001 to 30004) markers are acceptable as well. In addition, specialized Sharpie markers that are called Trace Element Certified (TEC) may be used to mark aluminum and other metallic components that are for GSE only. These are not normal Sharpie markers, since they contain a special ink. Before use, it must be verified that the part number of the marker is either Sanford 13501 or Sanford 13401. Marking should be done after all metal finishing has been completed.

3.4 FORMAT FOR PART AND SERIAL NUMBERS

Each part or assembly shall be marked, except those parts which are permanently attached to other parts or assemblies (i.e., welding, brazing, or soldering). Parts which do not require marking may be marked for production convenience, provided the marking methods conform to the requirements of this specification. Any item marked per this specification shall include, as a minimum, the complete part number.

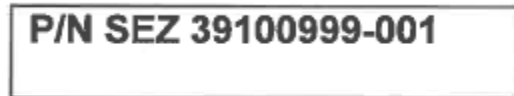


Figure 3: Example of identification marking consisting of a complete part number.

Additional information to be included in the marking, such as the serial number, may be indicated on the engineering drawing in the drawing flag note. The information may be located below the part number or adjacent to it. Figure 4 shows an example of how to specifically indicate that the information shall be placed adjacent to the part number:

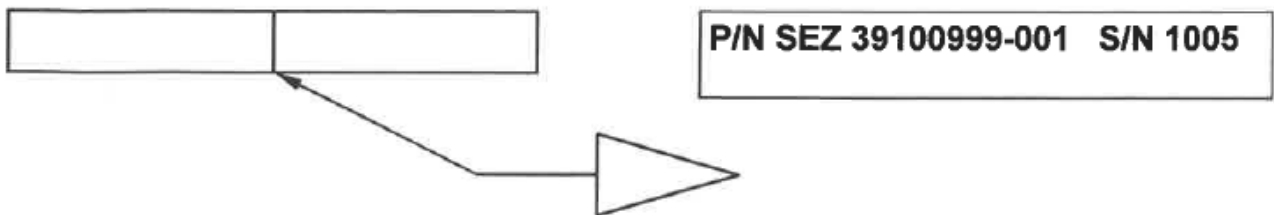


Figure 4: Example of symbol to be used if information is to be located adjacent to the part number.

Figure 5 shows an example of how to mark the additional information below the part number:

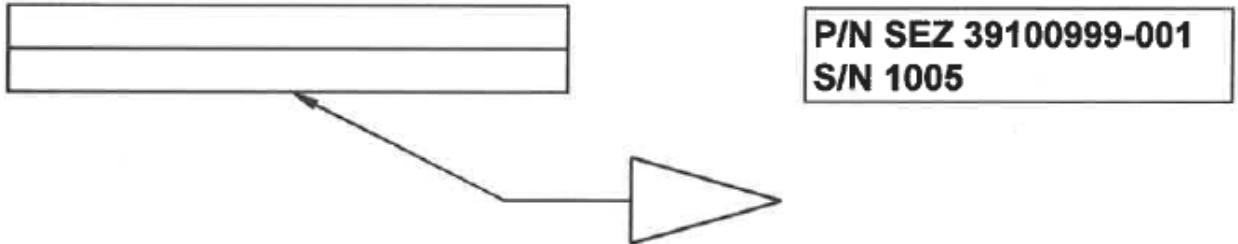


Figure 5: Example of symbol to be used if information is to be located beneath the part number.

In addition, placement of the marking may be at the discretion of the marking technician. An example of the notation to be used in this instance is shown in Figure 6.

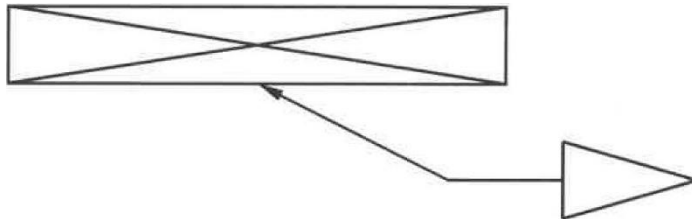


Figure 6: Example of symbol to be used when placement is at the discretion of the marking technician.

3.4.1 Serial Numbers

Batch or lot controlled parts do not require serial numbers if a mandatory traceable batch lot system is used. All other parts or assemblies shall have serial numbers as specified in JPR 8500.4. A general example of the marking format for part and serial numbers is indicated in Figures 4 and 5.

3.4.2 Assemblies

Assemblies not identified with a nameplate that includes nomenclature of the part shall have the word "assembly" or "assy" placed immediately below the part number and serial number, as shown in Figure 7:



Figure 6: Example of identification markings on hardware that is part of an assembly

3.4.3 Equipment

Equipment (i.e., valves, pumps, electronic equipment, etc.) shall be marked with the following minimum information, in the order noted: Nomenclature, Part Number, Serial Number, Contract Number, Manufacturer, NASA-JSC-USA.

3.3.1 Explosive Devices

Explosive devices shall be marked with the following minimum information: Nomenclature, Contractor, Manufacturer, Part Number, Lot Number, Serial Number, Date of Manufacture, ICC Classification.

3.3.2 Non-Flight Hardware

Hardware or equipment which is not suitable for use in flight and which could be accidentally substituted for flight articles shall be marked as either "Class III Not For Flight" or "Class II Controlled Equipment," as shown in Figures 8 and 9.



Figure 7: Example of one options for marking the non-flight hardware described in 3.5.5



Figure 8: Example of one options for marking the non-flight hardware described in 3.5.5

3.3.3 Rejected Flight Hardware

Flight equipment which is not acceptable for flight shall be striped with a compatible contrasting paint, red being the most desirable color unless contrast is not sufficient. Equipment too small to be so marked shall be tagged with an appropriate red tag which is conspicuously marked: "Class II Controlled Equipment" or "Class III Not For Flight" per JSCM 5312 (*Safety, Reliability and Quality Assurance Manual*).

3.3.4 Container (Bag and Tag) Markings

Container markings for non-serialized parts shall include the quantity of parts in the container, per section 3.3.9. For example:

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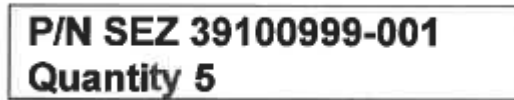


Figure 9: Example of container markings for non-serialized parts.

Container marking for serialized parts or assemblies shall include only one item per container, per section 3.3.9. The marking format shall include the part number and serial number as a minimum, as shown in Figure 11 below:



Figure 10: Example of container markings

4.0 REFERENCES

The following references were used to develop this process specification:

SOP-007.1 *Preparation and Revision of Process Specifications*

The following documents are called out as an extension of the requirements given in this specification and should be used in the current version, unless a revision is specified:

- | | |
|-----------------------|---|
| Federal Spec TT-T-266 | <i>Thinner, Dope, and Lacquer (Cellulose- Nitrate)</i> |
| JPR 8500.4 | <i>Engineering Drawing System Manual</i> |
| JSC 27260 | <i>Decal Process Document and Catalog</i> |
| JSCM 5312 | <i>Safety, Reliability and Quality Assurance Manual</i> |
| MIL-STD-1472 | <i>Military Specification, Human Engineering Design Criteria for Military Systems, Equipment and Facilities</i> |
| NHB 5300.4 (1D-2) | <i>Safety, Reliability, Maintainability, and Quality Provisions for the Space Station Program</i> |

5.0 MATERIAL REQUIREMENTS

Materials other than those listed in Table 2 must be approved by the cognizant materials engineer prior to use for marking flight hardware. All materials used for the marking process shall be included on the engineering drawing.

Table 2: Approved Materials for Hardware Marking

*Not to be used to mark silicone rubber material

Manufacturer	Manufacturer's Designation	Marking Process
Independent Ink, Inc.	73X black marking ink*	Rubber stamping and stenciling
Independent Ink, Inc.	73X white marking ink*	Rubber stamping and stenciling
Independent Ink, Inc.	73X orange marking ink*	Rubber stamping and stenciling
Independent Ink, Inc.	73X red marking ink*	Rubber stamping and stenciling
Sanford	Sharpie Extra Fine Point 35001 to 35004	Marking and stenciling, silicone parts and soft goods
Sanford	Sharpie Fine Point 30001 to 30004	Marking and stenciling, silicone parts and soft goods
Sanford	TEC Marker Broad Point 13501	For use on Ground Support Equipment only
Sanford	TEC Marker Fine Point 13401	For use on Ground Support Equipment only
Dexter Corporation	Hysol Epoxy M-0-N with catalyst	Filled Impressions
Nusil Technologies	CV-1144-1 or CV3-1144-1 (white RTV) with SP-120 silicone primer	Filled Impressions
Nusil Technologies	CV-1146-2 (black) with SP-120 silicone primer	Filled Impressions
Lord Corporation	Aeroglaze A276 (white/gloss polyurethane)	Filled Impressions
Lord Corporation	Chemglaze A382 (black/gloss polyurethane)	Filled Impressions
Lord Corporation	Chemglaze A074 (clear polyurethane)	Filled Impressions
Lord Corporation	Chemglaze 9986 (Catalyst)	Filled Impressions
Lord Corporation	Chemglaze 9958 (Thinner)	Filled Impressions
Preservo Paint & Coatings	Preserve 11105 (red polythaneJ <i>CP-500 Series</i>)	Filled Impressions
Preservo Paint & Coatings	Preservo 15187 (blue polythaneJ <i>CP-500 Series</i>)	Filled Impressions
Preservo Paint & Coatings	Preserve 13655 (yellow polyurethane) <i>CP-500 Series</i>	Filled Impressions
Preservo Paint & Coatings	Preservo 14260 (green polythaneJ <i>CP-500 Series</i>)	Filled Impressions
Courtaulds Aerospace	Super Koropon 515-700	Filled Impressions

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	(Epoxy Base)	
Courtaulds Aerospace	Super Koropon 910-704 (Epoxy Catalyst)	Filled Impressions
Kingslev Machine Co.	KT-26 marking foil	Hot Impression Stamping
Mystic Tape Inc.	Tape, number 7300	Decals
Metal Cal Company	A1 foil labels PS-9 heat activated adhesive	Decals
Horizons Imaging Systems Group	Metalphoto ID plates	Decals
3M	Scotch Brand tape #465	Decals
3M	Scotch Brand tape #468 MP permanent adhesive	Decals
3M	Scotchcast #221 (5095 adhesive)	Decals
3M	Scotchcast #8 encapsulant	Decals
3M	Scotchcast 220	Decals

6.0 PROCESS REQUIREMENTS

6.1 WORK INSTRUCTIONS

Written work instructions shall be generated for implementing this process specification. These work instructions shall contain sufficient detail to ensure that the manufacturing process produces consistent, repeatable products that comply with this specification.

6.2 CLEANING PRIOR TO MARKING

The affected area of parts shall be thoroughly cleaned prior to marking, with non-injurious solvent such as a liquid detergent or lacquer thinner (Federal Spec TT-T-266). Precaution shall be taken to avoid the use of solvents, which may adversely affect the material being cleaned.

6.3 COLOR OF MARKING

The color of markings shall be uniform from part to part within the practical limits of readability and contrast with background color. Certified ball-point pen markings may be utilized when all other marking methods are impractical.

6.4 CHARACTER HEIGHT

Character height shall be measured from center-line to center-line of each character, as shown in Figure 12:

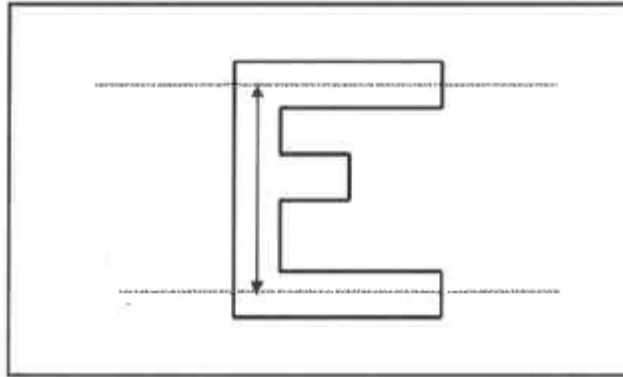


Figure 11: Example of center-line measure of character height.

6.5 APPLICATION OF MARKING

In applying markings, care must be taken to ensure that the markings do no damage or in any way downgrade the quality of the articles. The markings shall be applied to clean surfaces after final surface finishing, unless otherwise noted by this specification or the engineering drawing. The surface finish, if applied over the markings, shall not impair the legibility of the marking.

6.5.1 Diamond Drag (Impression Marking)

Diamond Drag markings are formed by a pantograph system using an industrial diamond stylus. Diamond drag markings shall be applied prior to final finish unless otherwise specified on the drawing. This method shall not be deleterious to the finished part. The markings shall have a depth necessary to obtain reasonable legibility, but shall not exceed 0.015 inch.

6.5.2 Steel Stamp or Die (Impression Marking)

Impressions shall not cause detrimental or induced stresses, impair the proper function of the surfaces to be marked, or cause cracking, crushing, distortion, delamination or visible marks on the reverse side of the surface being marked. Metal nameplates, tags, and similar items shall be exempted from the latter requirement and shall be stamped before attachment to the part. Steel stamp or die marking shall be applied prior to final surface finishing. Stamping shall be performed in a manner which will leave uniform impression. Characters shall have all sharp corners rounded to a radius of 0.005 inch, +.005 /-.000 inch on 1/16-to-3/32-inch characters, and a radius of .010 inch, +.005/-.000 inch on 1/8 to 3/16 inch characters.

6.5.3 Filled Impressions

If specified on the engineering drawing, impressions shall be filled with a permanent paint selected from Table 2. For non-flight and other ground support hardware, it is not

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necessary to use a corrosion-resistant primer, such as Super Koropon, prior to filling with a polyurethane paint or other coating. However, for flight hardware, the Super Koropon primer shall be applied prior to application of material for filling.

6.5.4 Hot Impression Stamping

The stamping shall be applied by the Kingsley Stamping Machine, Model No. KW-7, or NASA approved equivalent, in accordance with the manufacturer's recommendations. When marking sleeving, the tools and fixtures of the marking machine shall be properly matched with the contour of the surface to be marked. The markings shall be in proportion to the size of the space to which they are applied. Impression stamped markings may also be applied to thermoplastic surfaces (nameplates) by use of heated dies. The maximum temperature of the dies used to mark acrylic plastics is 300°F.

6.5.5 Electrochemical Etching

The etchings, and the area around them, shall be thoroughly cleaned to remove corrosive chemicals after marking. Electrochemical etching shall be accomplished by use of Electro Chem Etch Co. "Producer" power unit, or NASA approved equivalent, in accordance with the manufacturer's recommendations.

6.5.6 Engraving

Characters shall be engraved to a depth necessary to obtain the required width of mark. The depth of groove shall be 0.003 minimum and shall not exceed 50 percent of the base material thickness. If specified on the engineering drawing, engravings shall be filled as specified in section 6.5.3.

6.5.7 Stencil Marking

The manufacturer's procedure for applying on a teflon-coated item must be known in order to determine the method required to stencil the part identification with teflon enamel. The enamel shall be fused to the base surface with the proper process determined by the manufacturer. Ink markings shall be applied according to the manufacturer's recommendations. The drying time recommended shall be the minimum drying time before handling and/or determining the permanency of the marking. Permanent ink markings shall be impervious to solvents and ultrasonic cleaning processes. The use of ball-point pen markings is acceptable on decals and metallic foil tape. Care should be taken to make markings legible. Application of certified ink ball-point pen markings shall comply with Section 5.0 of this process specification.

6.5.8 Container (Bag and Tag) Markings

Parts and assemblies shall be identified by affixing a completed JSC Form 1106 to, or by rubber stamping the container, bag, envelope, etc. It is very convenient to use Sharpies to mark containers, such as ziplock bags, but the numbers are easily removed

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by contact such as rubbing or the incidental application of solvents. Thus, it is only permissible to use Sharpie markers for container marking, provided the markings are covered by an approved clear adhesive tape, such as 3M 800 for protection. Parts and assemblies that require serialization shall be placed one to a container.

6.5.9 Insert Markings

As an optional method of marking transparent or translucent laminate parts (i.e., polyester glass fabric), an ink stamped insert may be used. A piece of glass fabric is stamped with the required information using black marking ink. The marked piece is inserted between the outer two plies of laminate during lay-up. The insert shall be placed near an edge of the part as specified on the engineering drawing.

6.5.10 Metal Nameplates

Metal nameplates shall be completed with all available information before attaching to the article to be identified. Nameplates shall be marked by any of the methods specified in this process specification. Certified ball-point pen marking of metal foil is acceptable. Nameplates of an aluminum foil type shall be legibly marked by impression stamping, typing and/or permanent ink marking with non-serif characters, 8-point minimum in size, of the Gothic or Futura style. Masking with heavy, clean paper, or with tape compatible with surfaces being marked shall be employed to provide for extending the clear acrylic coating beyond the nameplate edge a maximum of 1/4 inch. The manufacturer's recommended drying time shall be the minimum drying time before inspecting the nameplate.

6.5.11 Decals

Decals shall be legibly marked by typing with non-serif characters, 8-point minimum in size, of the Gothic or Futura style. Certified ball-point pen markings on decals are acceptable. Decals attached to the surface shall be legible and not exhibit any tears, bubbles, wrinkles, or other defects, which may affect identification and/or adhesion.

7.0 PROCESS QUALIFICATION

Not required. However, work instructions shall be generated for implementing this process specification. The work instructions shall contain sufficient detail to ensure that the manufacturing process produces consistent, repeatable products that comply with this specification.

8.0 PROCESS VERIFICATION

All markings applied in accordance with this specification shall be visually inspected for legibility, definition, and uniformity. The location of the marking shall meet the requirements on the engineering drawing. Failure to meet any of the requirements specified herein shall be cause for rejection and must be documented in accordance

Verify current version before use.

with NASA/JSC SR&QA manual procedures (JSCM 5312).

9.0 TRAINING AND CERTIFICATION OF PERSONNEL

No formal training is required for marking technicians. However, personnel shall be certified by their supervision to perform work to this process specification.

10.0 DEFINITIONS

Chemical Etching: The dissolution of the material of a surface by subjecting it to the corrosive action of an acid or an alkali.

Laser: Light Amplification by Stimulated Emission of Radiation

Laser Engraving: Laser engraving is where the laser's beam is physically removing the surface material to expose a cavity which at eye level reveals an image. There are 3 types of Laser Engraving; etching, deep laser engraving and laser ablation. Each type is removing or vaporizing the surface material, the only difference is what's being removed and the depth you are going down into the material.

- *Deep Laser Engraving* is a deep mark, often a requirement for either regulatory reasons or for parts that will be exposed to harsh conditions either physically or environmental, for example identification marks on parts exposed to corrosive chemicals.
- *Laser Ablation* is engraving where we remove a surface coat, like paint or anodizing, to expose either another layer underneath or the bare surface material. This is a process common on ID Tags and Plates, automotive parts, switches, knobs and backlit buttons.
- *Laser Etching* is a shallower type mark, .001" for example.

Laser Marking: Laser marking is where the beam is interacting with the surface of the material and slightly altering its properties or appearance. Laser marking is an option for bar coding, UID codes, QR Codes, Logos and other identification needs.

Surface Integrity: A technology that involves the specification and manufacture of unimpaired or enhanced surfaces through the control of the many possible alterations produced in a surface layer during manufacture. Surface integrity is achieved by the proper selection and control of manufacturing processes and the ability to estimate their effects on the significant engineering properties of work materials.

Topography: The configuration of a surface including its relief and the position of its natural and man-made features.