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RDT F 7-3T

Hanford Engineering Development Laboratory

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AMENDMENT CONTROL SHEET FOR RDT F 7-3T

The changes incorporated in the June 1975 issue of RDT F 7-3T are identified by the following marginal notations:

C Change
D Delection
E Editorial
N Addition

The number suffix following the letter code on amendment pages corresponds to the number of the amendment in which the change was approved.

Amendment 1 (10-23-78) replaces pages of the June 1975 issue as follows:

<u>Old Pages</u>	<u>New Pages</u>
i, ii	i*, ii
1, 2	1, 2*
5	5, 6
-	7, 8

* This page not amended

RDT STANDARD

U.S. DEPARTMENT OF ENERGY
OFFICE OF NUCLEAR ENERGY PROGRAMS

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DATE June 1975

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MARKING OF COMPONENTS AND PARTS

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U.S. DEPARTMENT OF ENERGY
OFFICE OF NUCLEAR ENERGY PROGRAMS

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MARKING OF COMPONENTS AND PARTS

1. SCOPE

This standard covers surface marking of components and parts purchased in accordance with RDT standards. The standard covers permanent identification marking and temporary marking for interim identification, layout, instructional, or control purposes during manufacture or installation that are placed directly on the surface of the item. This standard does not cover the marking of mill material purchased to RDT standards.

2. DEFINITIONS

2.1 Marking. Letters, numbers, directional arrows, or symbols intentionally placed on the surface of an item for purposes of identification, instruction, or control.

2.2 Permanent Marking. Marking which is intended to remain integral with an item throughout its life.

2.3 Temporary Marking. Marking which is intended to remain integral with an item for limited time only.

2.4 Low-Stress Stamp. A die stamp or interrupted-dot impression tool which produces a round-bottom impression.

3. REQUIREMENTS FOR PERMANENT MARKING

3.1 Permanent Marking Methods. Permanent marking of components and parts shall be applied by one or more of the following methods:

1. Vibrating marking tool.
2. Die-stamping.
3. Raised marking forged or cast into the surface.
4. Indentation marking forged or cast into the surface.
5. Electrochemical etch.
6. Nameplate.
7. Self-adhesive label.
8. Special marking, other than the above, approved by the purchaser.

3.2 Location of Marking. When the location of permanent markings has not been specified in the applicable drawings or specifications, the contractor may select the marking locations, subject to the requirements of this standard.

3.3 Vibrating Marking Tools. Vibrating tools shall be fitted with a carbide marking point, or equivalent, and shall be adjusted to provide a shallow rounded impression at least 0.003 inch deep and not exceeding 0.010 inch in depth. The marking tool tip minimum radius shall be 0.005 inch.

3.4 Die Stamps. Die stamps shall be of the low-stress type that produce an indentation conforming to the requirements of Table 1. Impression depth shall be limited to 0.010 inch.

Table 1. Die Stamp Requirements

Character Size (In Inches)	Minimum Tip Radius (In Inches)	Min. Impression Width For 0.010 Inch Depth (In Inches)
1/16	0.005	0.020
3/32	0.006	0.021
1/8	0.007	0.022
3/16	0.008	0.026
1/4	0.010	0.031

3.4.1 Die-stamp marking on components and equipment shall be applied to a flange rim, an integrally-cast or forged boss or pad, the base or support of the item, or to another low-stress area shown to be satisfactory as the result of a stress analysis of the item.

3.4.2 The wall thickness of an item to be marked shall not be reduced by die-stamping to less than that specified in the drawings or specifications.

3.5 Integral Markings. Raised or depressed identification markings that are cast or forged integrally with the item are acceptable. Depressed markings shall not reduce the wall thickness of an item to less than that specified in the drawings or specifications of the item.

3.6 Electrochemical Etching. The electrolyte and neutralizer shall be compatible with the material to be marked and shall meet the requirements of Section 5. The depth of etching shall be sufficient to be clearly legible after neutralization, but shall be no greater than 0.5 percent of the thickness of the material or 0.003 inch whichever is less, unless otherwise specified by the purchaser.

4.7 Self-Adhesive Labels and Tape. The adhesives of self-adhesive labels and tape used for temporary marking shall meet the contaminant restrictions of Section 5.

5.8 Special Temporary Marking. Special marking methods that are exceptions to the requirement of this standard shall be submitted to and approved by the purchaser prior to use. Materials used for special marking shall meet the requirement of Section 5 unless otherwise approved by the purchaser.

5. CONTAMINANTS IN MARKING MATERIALS

5.1 Marking Materials Used on Stainless Steels and Corrosion-Resistant Alloys. Marking materials used for stainless steel and corrosion-resistant alloys shall:

1. Contain less than 300 ppm aggregate of iron, copper, lead, zinc, mercury, and sulfur as determined by the reference analysis methods in Appendix A, or by equivalent methods approved by the purchaser.
2. Contain less than 200 ppm total halogens (free and chemically combined) as determined by the reference analysis methods in Appendix A, or by equivalent methods approved by the purchaser.

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Unless a certified lot analysis is required by the purchaser, marking materials or inks may be accepted based on type-qualification or a supplier's certification based on routine quality control tests.

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5.2 Marking Materials Used on Carbon and Low-Alloy Steels, Aluminum, and Copper Alloys. Marking materials shall be compatible with the base metal and shall provide a distinct, legible mark with good contrast relative to the background of the metal.

APPENDIX A

N1

ANALYSIS ON INKS AND OTHER SIMILAR MATERIALS FOR HALIDES,
SULFUR, AND SOME METALS

A.1 APPLICABLE DOCUMENTS

ASTM C 698	Chemical, Mass Spectrometric, and Spectrochemical Analysis of Nuclear Grade Mixed Oxides[(U, Pu)O ₂]
ASTM D 129	Sulfur in Petroleum Products (General Bomb Method)
ASTM D 516	Sulfate Ion in Water and Waste Water
ASTM D 808	Chlorine in New and Used Petroleum Products (Bomb Method)
ASTM D 2576	Metals in Water and Waste Water by Atomic Absorption Spectrophotometry
ASTM D 3223	Total Mercury in Water
EPA-625/6-74-003a	Methods for Chemical Analysis of Water and Wastes

A.2 PROCEDURE

To determine impurities in inks which usually have a high organic composition, the inks are first decomposed and the analyses are made on aqueous solutions. The decomposition for the halides and sulfur determinations is accomplished by combustion in an oxygen bomb, and for the metals analysis by wet-ashing in sulfuric acid. The following discussion summarizes the sampling, decomposition, and measurement procedures.

A.3 SAMPLING

Before an ink sample is taken from a can, bottle, or any container allowing the ink to flow free, it must be well shaken. The general procedure for obtaining samples from marking pens is as follows:

1. Clean all components used for sampling including pen, tubing cutter, syringe, forceps, and vials in deionized water and reagent grade acetone.
2. Handle all components with clean white gloves.
3. Cut the back off of a sample pen with a tubing cutter.
 - a. If pen contains a felt piece, remove the felt with clean forceps; do not touch with fingers. Place the felt piece

in a clean 30 or 50 cm³ hypodermic syringe and squeeze the ink out into clean sample vials.

N1

- b. If pen is a tank type and does not contain a felt piece, pour the contents into clean sample vial.

A.4 DETERMINATION OF CHLORIDE AND FLUORIDE

Determine the chloride by constant current coulometry and the fluoride by specific ion electrode potentiometry following sample decomposition in a Parr oxygen bomb. The decomposition procedure is similar to ASTM D 808, except as defined below. These exceptions are critical to achieving the necessary sensitivity.

- a. Quickly weigh up to 1 g of sample (the amount depends on the expected halide concentration) into the sample cup of the bomb, add 10 ml of 3 g/l sodium citrate and assemble and ignite the bomb.

- b. Transfer the solution from the bomb to a volumetric flask or graduated cylinder and dilute to 50 ml volume. Transfer 4 ml from this solution to the chloride titrator cell (constant current coulometric titrator with amperometric end point, ASTM C 698, Section 58.2) and measure the chloride.

- c. To determine the fluoride, mix equal volumes of the solution and TISAB buffer (see Environmental Protection Agency (EPA) 625/6-74-003a or Orion manuals). Compare the measured electrode potential to a standard curve (see the EPA manual) for the fluoride-reference electrode couple in this solution. Spike the test solution with a known amount of fluoride (in an amount approximately equal to that found) to correct for low recovery due to potential complexation of the fluoride with metal from the bomb.

A.5 DETERMINATION OF SULFUR

Sulfur is determined by a turbidimetric procedure following sample decomposition in a Parr oxygen bomb. The procedure is very similar to ASTM D 129 and ASTM D 516 except as given below. These exceptions are critical to achieving the necessary sensitivity.

- a. Quickly weigh up to 1 g of a sample (amount depends on expected sulfur and halide concentration) into a sample cup, add 5 ml of 50 g/l sodium carbonate solution to the bomb, and assemble and ignite the bomb.

- b. Transfer the solution to a 100 ml beaker and acidify with hydrochloric acid. Add 4 drops of bromine water to ensure all sulfur is oxidized to sulfate, boil the solution briefly, cool, and dilute the solution with deionized water to 50 ml. Add 10 ml of a glycerin solution (126 g glycerin, 190 ml absolute ethanol, and 10 ml distilled

water). Measure the absorbance of this solution in a 5 cm cell at 450 nm. Add 0.3 g of barium chloride and stir the solution 3 min. Discontinue stirring and after 4 min measure the absorbance again in a 5 cm cell at 450 nm. Compare the difference in the two absorbance values to a calibration curve obtained from standard sulfate solutions prepared in the same way.

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c. In order to improve linearity of the curve at the low concentrations (to improve sensitivity), the reagents used in the procedure are made up with deionized water which has been saturated with barium sulfate.

A.6 DETERMINATION OF IRON, COPPER, ZINC, LEAD, AND MERCURY

The determination of these metals is by atomic absorption spectrophotometry (AAS) following a wet-ashing decomposition procedure.

a. Weigh 0.5 to 1.0 g of the ink into each of two 250 ml Erlenmeyer flasks. Spike one of the samples with known quantities of the metals to be determined. Add 7.0 ml of Ultrex grade concentrated sulfuric acid and fit an air condenser to the flasks. Add one drop of 30% hydrogen peroxide to each sample and heat (less than boiling). Continue drop additions of the hydrogen peroxide to maintain the reaction until all samples have decomposed. It may be necessary to also add some nitric acid (Ultrex grade) to complete the decomposition. The samples are then transferred to volumetric ware and diluted to 25 ml with deionized water.

b. Analyze for iron, copper, zinc, and lead by flame AAS and for mercury by cold vapor AAS. Follow the procedures recommended in the instrument application manuals or in ASTM D 2576 and ASTM D 3223. Calculations shall include a spike recovery correction.

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RDT F 7-3T

SUPERSEDES
RDT F 7-3T NOVEMBER 1974

RDT Standard

MARKING OF COMPONENTS AND PARTS

JUNE 1975

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FOREWORD

This standard supersedes the November 1974 issue of RDT F 7-3T and incorporates changes that were approved for publication in this revision. These changes are identified by the following marginal notations:

C Change

RDT STANDARD

U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
DIVISION OF REACTOR RESEARCH AND DEVELOPMENT

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MARKING OF COMPONENTS AND PARTS

1. SCOPE

This standard covers surface marking of components and parts purchased in accordance with RDT standards. The standard covers permanent identification marking and temporary marking for interim identification, layout, instructional, or control purposes during manufacture or installation that are placed directly on the surface of the item. This standard does not cover the marking of mill material purchased to RDT standards.

2. DEFINITIONS

2.1 Marking. Letters, numbers, directional arrows, or symbols intentionally placed on the surface of an item for purposes of identification, instruction, or control.

2.2 Permanent Marking. Marking which is intended to remain integral with an item throughout its life.

2.3 Temporary Marking. Marking which is intended to remain integral with an item for a limited time only.

2.4 Low-Stress Stamp. A die stamp or interrupted-dot impression tool which produces a round-bottom impression.

3. REQUIREMENTS FOR PERMANENT MARKING

3.1 Permanent Marking Methods. Permanent marking of components and parts shall be applied by one or more of the following methods:

1. Vibrating marking tool.
2. Die-stamping.
3. Raised marking forged or cast into the surface.
4. Indentation marking forged or cast into the surface.
5. Electrochemical etch.
6. Nameplate.
7. Self-adhesive label.
8. Special marking, other than the above, approved by the purchaser.

3.2 Location of Marking. When the location of permanent markings has not been specified in the applicable drawings or specifications, the contractor may select the marking locations, subject to the requirements of this standard.

3.3 Vibrating Marking Tools. Vibrating tools shall be fitted with a carbide marking point, or equivalent, and shall be adjusted to provide a shallow rounded impression at least 0.003 inch deep and not exceeding 0.010 inch in depth. The marking tool tip minimum radius shall be 0.005 inch.

3.4 Die Stamps. Die stamps shall be of the low-stress type that produce an indentation conforming to the requirements of Table 1. Impression depth shall be limited to 0.010 inch.

Table 1. Die Stamp Requirements

Character Size (In Inches)	Minimum Tip Radius (In Inches)	Min. Impression Width For 0.010 Inch Depth (In Inches)
1/16	0.005	0.020
3/32	0.006	0.021
1/8	0.007	0.022
3/16	0.008	0.026
1/4	0.010	0.031

3.4.1 Die-stamp marking on components and equipment shall be applied to a flange rim, an integrally-cast or forged boss or pad, the base or support of the item, or to another low-stress area shown to be satisfactory as the result of a stress analysis of the item.

3.4.2 The wall thickness of an item to be marked shall not be reduced by die-stamping to less than that specified in the drawings or specifications.

3.5 Integral Markings. Raised or depressed identification markings that are cast or forged integrally with the item are acceptable. Depressed markings shall not reduce the wall thickness of an item to less than that specified in the drawings or specifications of the item.

3.6 Electrochemical Etching. The electrolyte and neutralizer shall be compatible with the material to be marked and shall meet the requirements of Section 5. The depth of etching shall be sufficient to be clearly legible after neutralization, but shall be no greater than 0.5 percent of the thickness of the material or 0.003 inch whichever is less, unless otherwise specified by the purchaser.

3.7 Nameplates. The name plate material, method of attachment, and location on the component shall be as specified in the drawings or specifications. The attachment method and location on the component shall be established on the basis of a stress analysis of the item and shall take into consideration the possibility of crevice corrosion between the nameplate and the surface of the item. Nameplates, when welded, shall be welded in accordance with a procedure meeting the welding requirements applicable to the item. Nameplates shall be attached only upon completion of fabrication.

3.8 Self-Adhesive Labels. Self-adhesive labels (except metallic self-adhesive labels approved for nameplates) may be used only for identifying the contents of installed pipe or tubing. The label and adhesive shall meet the requirements of Section 5.

3.9 Special Permanent Marking. For certain marking applications, such as the serializing of internal component parts, the use of permanent marking methods not permitted by the above requirements may simplify marking procedures and may not adversely affect the integrity of the parts if such markings are applied in areas of low stress. Such special marking methods shall be specifically shown on the design drawings or in the fabrication procedures and shall be submitted to and approved by the purchaser prior to use. Materials used for special marking shall meet the requirements of Section 5 unless otherwise approved by the purchaser.

3.10 Electric-Arc Marking. Electric-arc welding and marking pencils shall not be used for marking.

3.11 Marking of Hardened Alloys. Hardened materials and alloys strengthened by quenching, aging, or cold-working shall be permanently marked only by electrochemical etching, integral raised or depressed marking cast or forged into the surface, or nameplates.

3.12 Marking of Thin Sections. Base materials of pressure boundary items less than 1/8 inch thick shall be marked only by electrochemical etching or by a special marking method approved by the purchaser. (3.9).

3.13 Marking of Carbon and Low-Alloy Steels. Electrochemical etching and vibrating marking tools shall not be used for marking non-hardened carbon or low-alloy steel components or surfaces.

4. REQUIREMENTS FOR TEMPORARY MARKING

4.1 Temporary Marking Methods. Temporary marking of components and parts shall be applied by one or more of the following methods:

1. Rubber stamp and ink.
2. Rubber roller or wheel and ink.
3. Felt-tip marking pen.
4. Removable self-adhesive label or tape.
5. Label attached with removable tape.
6. Removable tag.
7. Scribing tool or center punch.
8. Special marking, other than the above, approved by the purchaser.

4.2 Removal of Temporary Marking. Unless otherwise specified or approved by the purchaser, all temporary marking shall be removed from material surfaces prior to fabrication operations which render markings inaccessible, prior to final heat treatment, and prior to post-manufacturing acceptance or post-installation acceptance, as appropriate. Ground-out areas shall be inspected by the same method (liquid penetrant or magnetic particle) and to the same acceptance standards as previously used to accept the base material. Ink markings and residue from removable tapes shall be removed using new or redistilled technical grade alcohol, acetone, or a purchaser-approved alternate. The removal of temporary markings shall assure the cleanliness of the material to be in accordance with applicable documents.

4.3 Indentation Marking. Center punches and scribes may be used for temporary identification, instructional, or layout markings during fabrication or construction providing the depth of marking does not exceed 0.010 inch and the markings are subsequently removed by a method which blends the area of metal removal smoothly into the surrounding base metal of the finished surface. The depth of metal removal shall not reduce the wall thickness of the item to less than the minimum thickness specified in the drawings or specifications.

4.4 Marking of Hardened Stainless Steel and Corrosion-Resistant Alloys. Only etchants, inks, or felt-tipped marking pens meeting the requirements of Section 5 may be used for marking hardenable stainless steels and corrosion-resistant alloys in the hardened condition.

4.5 Tags. Metal tags and wires used for temporary marking shall be of the same material as that which is being marked or shall be of a material, approved by the purchaser, which is electrochemically compatible with the material being marked.

4.6 Inks. Inks used for marking or layout, including felt-tipped marking pen inks, shall meet the requirements of Section 5.

4.7 Self-Adhesive Labels and Tape. The adhesives of self-adhesive labels and tape used for temporary marking shall meet the contaminant restrictions of Section 5.

4.8 Special Temporary Marking. Special marking methods that are exceptions to the requirements of this standard shall be submitted to and approved by the purchaser prior to use. Materials used for special marking shall meet the requirements of Section 5 unless otherwise approved by the purchaser.

5. CONTAMINANTS IN MARKING MATERIALS

5.1 Marking Materials Used on Stainless Steels and Corrosion-Resistant Alloys. Marking materials used for stainless steel and corrosion-resistant alloys shall:

1. Contain less than 300 ppm aggregate of iron, copper, lead, zinc, mercury, and sulfur as determined by spectrographic methods.
2. Contain less than 200 ppm total halogens (free and chemically combined) as determined by combustion-pyrohydrolysis treatment of the sample, or use of an equivalent combustion technique, and quantitative analysis of the product by titration or specific ion electrode methods.

Unless a certified lot analysis is required by the purchaser, marking materials may be accepted based on type-qualification or a supplier's certification based on routine quality control tests.

5.2 Marking Materials Used on Carbon and Low-Alloy Steels, Aluminum, and Copper Alloys. Marking materials shall be compatible with the base metal and shall provide a distinct, legible mark with good contrast relative to the background of the metal.