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COMPLIANCE IS MANDATORY

John C. Stennis Space Center Identification of Piping Systems and Above-Ground Markers

Approved by:

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<u>ISSUED CEF</u> Central Engineering Files	<u>5-13-19</u> Date
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Document History Log

Revision	Date	Originator	Description
Basic	6/9/03	Glen Liebig ext. 8-2219	Initial release – supersedes SSC STD 80-005 Rev A, and STD 80-001, Rev B, with the following major changes: New document number and format per SPG 1400.1; New document title; Reclassification of Paint Standard as Identification Code (broader scope includes paint color codes for piping and associated markers); change to requirements for commercial tape and complex configurations; 1.0 revised to include SSC Piping Systems, including Special Test Equipment (per Section 2.0); 2.0 added new; subsequent sections renumbered; 3.0 modified to delete obsolete documents; 4.0, 7.0 and 8.0 added new; 5.1 (was 3.1) rewritten and reorganized; 6.0 (was 3.0, 3.2, 3.3 and 4.0) rewritten and reorganized.
A	8/15/08	Amy Rice 8-2972	Reclassification of Paint Standard as Identification Code (broader scope includes paint color codes for piping and associated markers); change to requirements for commercial tape and complex configurations; 3.0 modified to delete obsolete documents; 5.0 rewritten and reorganized; Color codes rewritten; 7.0 and 8.0 modified to delete obsolete documents and acronyms;
B	07/06/2014	D. Dike/ 8-2803	Regular five (5)-year review. Updated references.
C	04/23/2019	D. Dike / 8-2803	Five-year review. Updated cover sheet to reflect approval/concurrence requirements per SSTD-8070-0005-CONFIG. Updated references and acronyms.

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1.0 PURPOSE

This John C. Stennis Space Center (SSC) standard (SSTD) establishes the methods and color codes for identification of underground and aboveground piping systems and their associated aboveground markers at SSC in accordance with ASME A13.1, ANSI Z535.1, and FED-STD-595.

2.0 APPLICABILITY

- 2.1 This SSTD applies to all SSC facilities' piping systems, including Special Test Equipment.
- 2.2 This SSTD is not applicable to electrical units; ventilation units; storage vessels; supports, brackets or other accessories; or pipelines installed in missiles, spacecraft, or aircraft.

3.0 REFERENCES

Referenced documents are assumed to be the latest version unless otherwise specified.

ASME A13.1, *Scheme for the Identification of Piping Systems*
ANSI Z535.1, *Safety Colors*
FED-STD-595, *Colors Used in Government Procurement*
NPR 1441.1, *NASA Records Management Program Requirements*
SPR 1440.1, *SSC Records Management Program Requirements*
SSTD-8070-0005-CONFIG, *Preparation, Review, Approval and Release of SSC Standards*

4.0 RESPONSIBILITIES

This SSTD shall be maintained and controlled in accordance with the responsibilities and requirements of SSTD-8070-0005-CONFIG.

5.0 PIPING SYSTEMS IDENTIFICATION

5.1 DEFINITIONS

- a. Piping Systems. Piping systems are defined as conduits for the transport of gases, liquids, semi-liquids, or fine particulate dust. For the purpose of this SSTD, piping systems shall include tubing and pipes of any kind, as well as fittings, valves, and pipe coverings.

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- b. Color Warning. A color warning is the color assigned to the class into which a material is from a safety standpoint. These colors appear as a circular band and as legend backgrounds.
- c. Legend. A legend is any lettered identification classified in accordance with its hazard required on a piping system. Legends identify the contents (by complete names or by generally recognized abbreviations, symbols, letters, numbers, or combinations thereof) and the flow direction.

5.2 COLOR CODES

Exact identification of material in any SSC piping system is mandatory and shall be made by means of color codes and legends as specified herein.

Attention shall be given to visibility with reference to pipe markings.

Color-coding of piping systems provides accurate and immediate visual and written identification of the contents and hazards within the piping system, which provides greater safety and lessens the chances of confusion during work in areas with numerous piping systems.

Hazard classes for all piping system contents are identified by colors, the appearance of any of which on a piping system shall provide a danger warning for the hazard in the system (refer to Table 5-2). Where the application of a warning color will blend in with the background or onto the unpainted surface of a pipe or tubing, that area of the system will be painted white or black as required to provide adequate contrast and visibility.

Piping systems that do not require warning colors may be painted to match their surroundings, if not in conflict with other color designations in this SSTD, or such systems may be painted aluminum, black, or remain unpainted. This exception does not apply to any material, harmless or otherwise, specifically identified and listed in this SSTD.

Piping identification is broken down into color code markings on the outside of the pipe to identify the pipe contents hazard, flow direction, and legend (contents name and pressure). This identification may be accomplished by using commercially available ANSI A13.1 approved tape or direct painting. All paint shall be lead free. Where paint will not adhere to piping (e.g., systems constructed of stainless steel, galvanized carbon steel, special alloys), use commercially available tape or wrap-around banding. In systems comprised of tubing, the use of commercially available tape is encouraged. The inspection and replacement of tape on systems should be addressed in a regular maintenance cycle, as the tape will deteriorate over time faster than paint. On non-vacuum jacketed pipe where the internal fluid can reach below -50°F, the material for markings shall be rated for -423°F temperatures or shall be thermally insulated from the outer pipe wall. Color code applications for common SSC systems are identified in Section 5.3.

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5.2.1 Contents Hazard

The first set of markings (primary color warning) identifies the content of the pipe by using a specific color per Table 5-2 to identify the hazard. The entire piping system may be painted or color bands may be used at specific intervals along the piping system. The use of color bands is encouraged as the appearance of the bands will attract the attention of personnel and will serve as an indication of a hazardous system to personnel who are colorblind. If color bands are used, the spacing shall be frequent enough to provide identification throughout the system.

NOTE

Under no circumstances shall the distance between color bands exceed forty (40) feet inside a building or test stand, and no more than two hundred (200) feet on cross-country lines.

5.2.2 Flow Direction Arrow

The second set of markings (secondary color warning) is shown as the flow direction arrow, which is color coded per Table 5-2. The flow arrow is taped or painted on the outside of the pipe and shall be formatted and proportionally sized to the piping system per Figure 5-1. Commercially available ASME A13.1 approved tape with directional arrows, diamonds, or arrowheads may be used on piping and tubing systems. If the content can flow in either direction, a double-headed arrow shall be used.

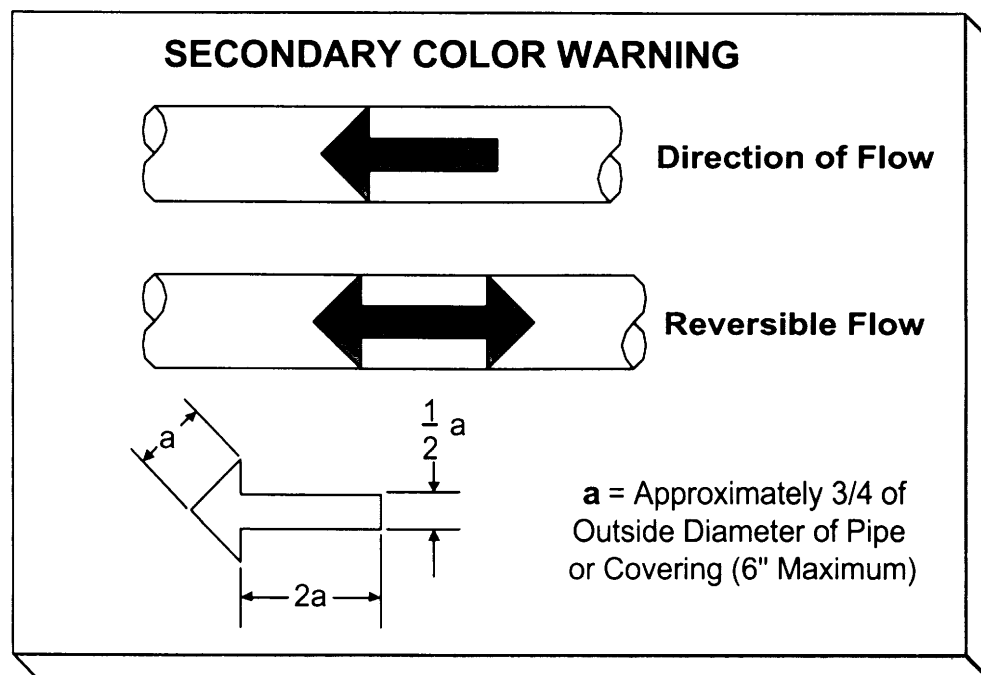


Figure 5-1. Flow Direction Arrow Markings

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5.2.3 Legend

The third set of markings is the legend, which consists of the contents, by name or recognized abbreviations, and the contents pressure rating. The legend may be taped or stenciled onto the sides of the pipe. Legends shall be prominently displayed in black or white lettering on a background of color warnings (See Table 5-2) to reduce errors by operating personnel. Where the view is unobstructed, it is recommended the legend be located on the two (2) lower quarters of the pipe or covering. Lettering in this position is unlikely to be obscured by dust collection or mechanical damage; however, legends should be clearly visible from operating positions, especially those adjacent to control valves. Where pipelines are located above or below the normal line of vision, lettering shall be placed below or above the pipe horizontal centerline. Legends shall be applied close to valves or flanges; adjacent to changes in direction, branches, and where pipes pass through walls or floors; and at intervals on straight pipe runs sufficient for identification.

Note: For configurations of extreme complexity or limited accessibility, alternate techniques may be used per ASME A13.1.

Legend lettering and background shall be sized per Table 5-1 and colored per Table 5-2.

TABLE 5-1. LEGEND LETTERING AND BACKGROUND SIZES

Outside Diameter of Pipe or Covering *		Background Length		Letter Size	
Inches	Millimeters	Inches	Millimeters	Inches	Millimeters
¾ to 1 ¼	19 to 32	8	200	½	13
1 ½ to 2	38 to 51	8	200	¾	19
2 ½ to 6	64 to 150	12	300	1 ¼	32
8 to 10	200 to 250	24	600	2 ½	64
Over 10	Over 250	32	800	3 ½	89

*For pipe sizes smaller than ¾ inch, commercially available ANSI A13.1 approved tape may be used. Arrow sizes shall be in proportion to the pipe size per Figure 5-2; background color shall be as specified in Table 5-3, and background length shall be as specified above for ¾" pipe or as practicable in proportion to the length of the pipe.

5.3 SSC SYSTEMS APPLICATIONS

Common materials in SSC piping systems and their associated color markings are listed in Table 5-2.

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TABLE 5-2. SSC PIPING SYSTEM COLOR CODES

System (contents/service), abbreviations	Legend Background Color	Legend Lettering Color
Air (>60 PSI), HA	Blue	White
Helium (Gas) compressed, HE	White	Black
Hydrogen (Gas), GH	Yellow	Black
Hydrogen (Liquid), LH	Yellow	Black
Hydrogen Peroxide, H2O2	Yellow	Black
Hydrocarbon Fuels	Yellow	Black
Hydraulic Oil, HD	Yellow	Black
Isopropyl Alcohol, IPA	Yellow	Black
Methane, LM/GM	Yellow	Black
Natural Gas, NG	Yellow	Black
Nitrogen (Gas), GN	White	Black
Nitrogen (Liquid), LN	White	Black
Oxygen (Gas), GO	Green	Black
Oxygen (Liquid), LO	Green	Black
Triethyl aluminum/ Triethyl boron, TEA/TEB	Purple	White
Water (>50 PSI or >150F) (Industrial, IW)	Green	White
Water (Potable), PW	White	Green
Water (Fire Protection)	Red	White

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6.0 MARKER REQUIREMENTS

All underground piping systems at SSC require above ground markers. This section defines how markers are constructed, where they shall be placed, and how they shall be labeled and colored.

6.1 TYPES AND COLOR CODES

Markers are of two (2) different types: flat and upright. Flat markers (Figure 6-1) are the preferred markers due to the ease of maintenance around them. Upright markers are the original style markers used at SSC; however, they shall be replaced with flat markers when new pipe lines are installed or when maintenance is performed on existing underground piping. (The upright marker is illustrated in Figure 6-2 for reference only.)

The marker shall identify the exact content of the underground line, including the primary and secondary color warnings per Section 5.2. The marker shall also identify any directional and elevation changes in the pipe line. Refer to Figure 6-1.

6.2 DESIGN AND INSTALLATION

All new markers for underground pipe shall be constructed of concrete and conform to the SSTD marker design sketch in Figure 6-1. Lettering and line symbols for pipe contents and directional changes are also illustrated in Figure 6-1.

6.3 PAINTING

All markers shall be painted with lead free paint. The flat marker surface area shall be painted with the secondary color according to Section 5.2. The letters (abbreviations) and line symbols for pipe (contents flow direction and changes in pipe elevation) shall be engraved or chiseled into the concrete and shall be painted the primary color according to Section 5.2 and as illustrated in Figure 6-1.

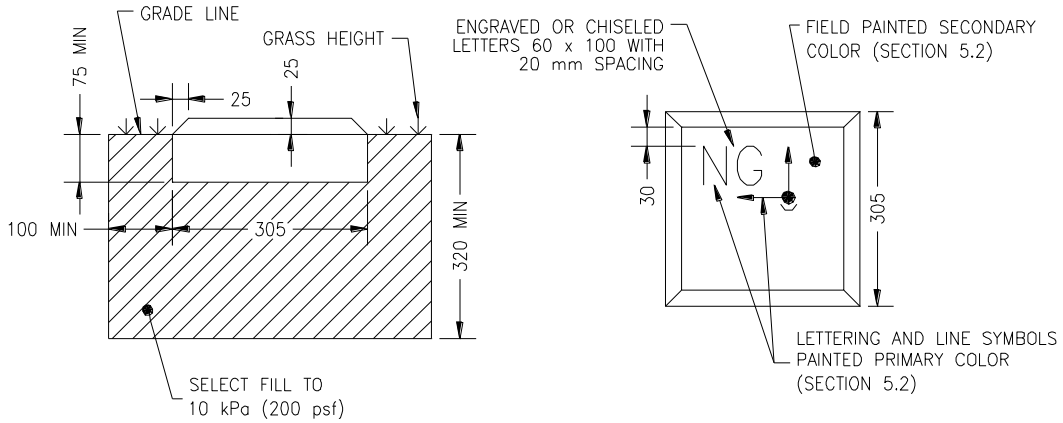
6.4 LOCATION

Permanent flat markers for underground piping shall be located directly above the pipeline to indicate any and all changes in direction or elevation of the pipe line. Markers shall be maintained at each major bend, changes in line direction, line splits, take-offs and on each side of all railroad and road crossings. When a line changes direction or elevation, a marker shall be placed directly above the change. Additional marker locations shall be selected to give adequate warning to prevent accidental damage to the system. On long straight runs of pipe, markers shall be placed strategically close enough such that they can be located when performing maintenance or modification work. The distance between markers for straight runs of pipe shall be a maximum of 100 m (330 ft), measured from marker to marker.

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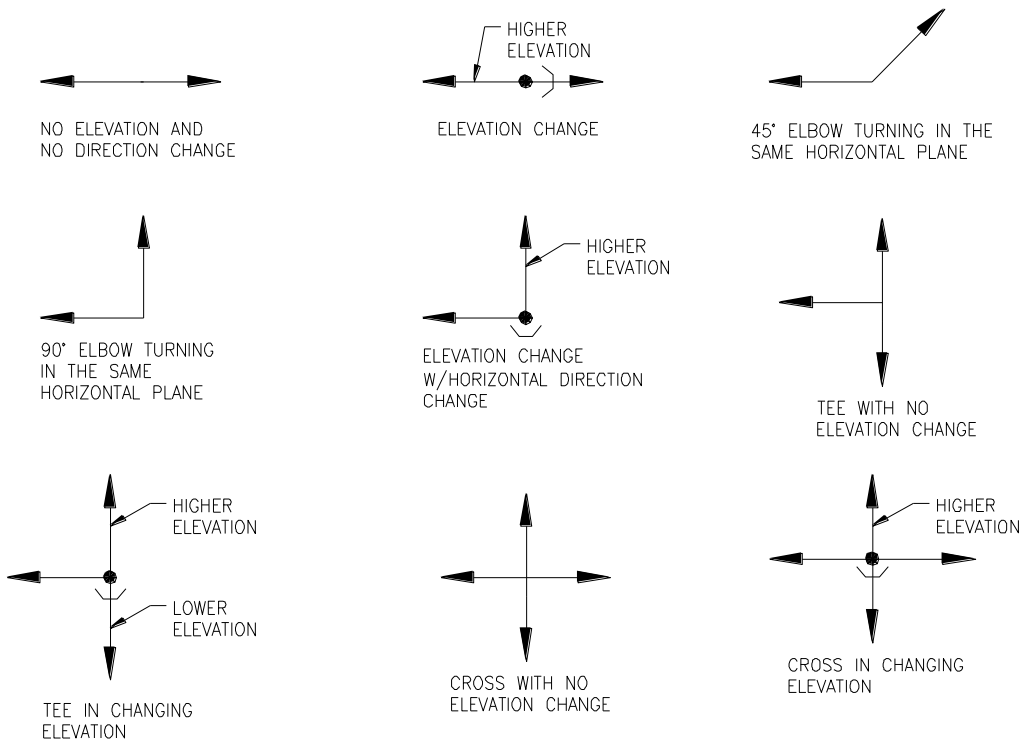
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NOTE: All dimensions are shown in mm, but may be translated into equivalent standard English units.

(a) Configuration



(b) Line Symbol Examples
Figure 6-1. Flat Marker

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(TO BE PHASED OUT AS UNDERGROUND PIPE AND THEIR MARKERS ARE REPAIRED AND/OR MAINTAINED)

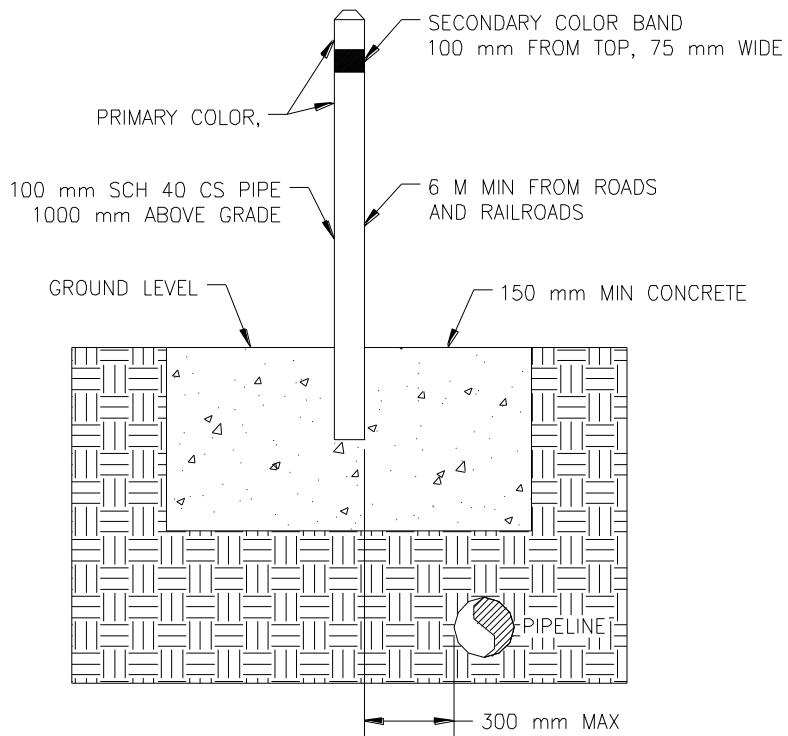


Figure 6-2. Upright Marker

(FOR REFERENCE ONLY)

7.0 RECORDS

Records required by the performance of this SSTD shall be maintained in accordance with NPR 1441.1 and SPR 1440.1.

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8.0 ACRONYMS

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
CS	Carbon Steel
FED	Federal
H2O2	Hydrogen Peroxide
HA	High (Pressure) Air
HD	Hydraulic Oil
HE	Helium
GH	Gaseous Hydrogen
GM	Gaseous Methane
GN	Gaseous Nitrogen
GO	Gaseous Oxygen
IPA	Isopropyl Alcohol
IW	Industrial Water
LH	Liquid Hydrogen
LM	Liquid Methane
LN	Liquid Nitrogen
LO	Liquid Oxygen
NG	Natural Gas
NPR	NASA Procedural Requirement
psi	pounds per square inch
PW	Potable Water
SPR	Stennis Procedural Requirement
SSC	Stennis Space Center
STD	Standard
SSTD	Stennis Standard
TEA	Triethyl Aluminum
TEB	Triethyl Boron

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