



Department of the Air Force  
HQ AEDC (AFMC)  
Arnold AFB, TN 37389

## Safety, Health, and Environmental Standard

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**Title:** IDENTIFICATION OF PIPING SYSTEMS

**Standard No.:** D3

**Effective Date:** 08/29/2014

**Releasability:** There are no releasability restrictions on this publication.

The provisions and requirements of this standard are mandatory for use by all AEDC personnel engaged in work tasks necessary to fulfill the AEDC mission. Please contact your safety, industrial health and/or environmental representative for clarification or questions regarding this standard.

Approved:

Contractor/ATA Director  
Safety, Health, and Environmental

Air Force Functional Chief

## SHE Standard D3 Identification of Piping Systems

### Record of Review/Revision

(Current revisions are highlighted in yellow and marked with a vertical line in the right margin.)

Date/POC	Description
08/01/14 J.P. Mihigo	Scheduled review: Administrative changes only – corrected paragraph references in paragraphs 4.4.2 and 4.7.1 (changed 4.8.2 to 4.7.2) and in paragraph 4.7.2 (changed 4.8.3 to 4.7.3).
01/25/13	Added NFAC supplement; no other change.
04/11/12 G. Sterling	Two-year review: Revised to improve clarity/consistency. Added reference to T-1 in Identification (4.1.2). Added bundle exclusion language to item in Color Band (4.2.1). Changed “shall be” to “is” in NOTE in Color Band (4.2). Added item to cover additional material/color combinations that are covered in Annex A (4.2.6). Changed “Flow” section title (4.5) to “Flow Arrows” for better description. Added item for electrical conduits with respect to flow arrows (4.5.3). Changed “operating contractor” to “base operating contractor” throughout per AEDC/SE instructions. Added reference for T-1 (7.0). Added superscript to Content Identification table linking CO2 row to the NOTE (Annex A). Removed repetitive/redundant items covered by other subsections or Standards. Adjusted numbering and corrected minor typos throughout.
05/10/10	Two-year review: Administrative reformatting; expanded Section 1 for clarity; added definitions for Operating and Outside Contractor.
01/15/09 A. Jennings And R. Tate	Annual review. Updated references as appropriate. Incorporates requirements of MIL-STD-161G, Identification Methods For Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels into the standard. Added comments to Requirements/ Responsibilities, Color Bands, Identity of Contents, Flow, Lettering and Numbering Specifications, and added Annex C.
12/13/07 A. Jennings	Annual review. Verified that references were current. No other changes required.
01/26/07 A. Jennings	Annual review. Made minor format changes (i.e., consistency in use of <i>shall</i> ). Reworded introduction and basic hazards. Replaced references to MIL-STD-1247 (now obsolete) with references to MIL-STD-101B in Para 4.1.1 and 4.1.3. Added reference to Engineering Standard T2 in Para 4.1.4. Deleted Para 4.1.6. Added reference to Annex A in Para 4.3.1. Deleted Para 4.9.3; renumbered subsequent paragraphs. Deleted references to obsolete documents: AFTO 36-1-3 and CE-250. Revisions are highlighted in yellow.
09/07/05 R. Tate	Reviewed; no change required.
03/01/05 Jones/Fitzgerald	Made minor editorial changes. Updated the annex references as appropriate. Added “uncontrolled copy” statement in footer.
09/30/02	Reformatted according to COI 91-5. Added reference to OSHA 1910.119 and titles to various references. Reformatted Content Identification Chart in Annex A, page 1, for easier reading. Turned Annex A, page 2, layout to portrait. Converted Tag and Band Location drawing to Annex B.



# Safety, Health, and Environmental Standard

## IDENTIFICATION OF PIPING SYSTEMS

### 1.0 INTRODUCTION/SCOPE/APPLICATION

- 1.1 Introduction – This standard addresses the identification of piping or tubing of any kind, including fittings, valves, and pipe coverings. Rigid electrical conduit is considered piping.
- 1.2 Scope – When there are any conflicts noted between this standard and industry or national codes, standards or regulatory requirements, the base operating contractor shall notify the government.
- 1.3 Applicability – This standard applies to all personnel at AEDC and the identification of piping systems at AEDC. Buried or covered piping is excluded.

### 2.0 BASIC HAZARDS/HUMAN FACTORS

- 2.1 Piping systems that are not identified could pose hazards to employees who otherwise would take precautions. Hazards include flammable or toxic materials (natural gas or jet petroleum fuels), temperature extremes (steam or hot engine exhaust), asphyxiation (gaseous nitrogen and other inert gases), high pressures, and electrical hazards such as exposure to high voltage. Additionally, identification of piping systems assists in the correct identification of materials, correct routing and securing of lines and allows the on-going integrity of the system to be verified throughout the expected life of the system.

### 3.0 DEFINITIONS

Base Operating Contractor – A base contractor directly accountable to the Air Force for the AEDC mission.

Piping Systems – Piping or tubing of any kind or size including fittings, valves, and pipe coverings.

Outside Contractor/Subcontractor – An organization employed by a contractor or the Air Force to do construction, maintenance, repair or other work at AEDC; also referred to as the construction contractor.

### 4.0 REQUIREMENTS/RESPONSIBILITIES

#### 4.1 Identification

- 4.1.1 Piping systems shall be identified uniformly based on this standard; ASME-A13.1 Scheme for the Identification of Piping Systems; or MIL-STD-101B, Color Code for Pipelines and for Compressed Gas Cylinders; or MIL-STD-161G Identification Methods For Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels.
- 4.1.2 Each valve shall bear the manufacturer's name or trademark and the reference symbol to indicate the service conditions for which the valve was designed. (See SHE Standard D2, Pressure Vessels and Systems, and Engineering Standards; T-1, Pressure Vessels; T-2, Pressure Piping; and T-3, Engineering Design and Drafting Practices, for identification of components of pressure systems.)
- 4.1.3 Piping that presents a bumping or tripping hazard shall be marked with black and yellow stripes at the point of hazard. (See SHE Standard B3, Control of Hazardous Areas Using Safety Signs, Tags, and Barricades.) As a bumping hazard reference, OSHA defines 7 feet as the vertical clearance required above stair treads on fixed industrial stairs (29 CFR 1910.24).

#### 4.2 Color Band

- 4.2.1 Every pipe shall be marked with a color band as listed in accordance with Annex A, excluding bundles (see note below):

**NOTE:** Where many tubes are routed in a bundle, a single identification band around the bundle or a tag wired to the bundle is sufficient if all lines in the bundle contain similar materials and pressures.

- 4.2.2 Fire Protection (Red) – Piping systems that convey fire protection and like materials, including sprinkler systems and all other fire-fighting systems,
- 4.2.3 Dangerous Materials (Yellow) – Piping systems that convey dangerous materials that are in themselves hazardous to life or property by virtue of pressure, temperature, flammability, toxicity, or asphyxiating properties.

- 4.2.4 Safe Materials (Green) – Piping systems that convey safe materials that involve no hazard in their handling and are of no extraordinary value.
- 4.2.5 Electrical Wiring (Orange) – Piping systems that convey electrical wiring such as light, power, telephone, alarm, and signal conduits.
- 4.2.6 Other (Various) – Refer to Annex A for additional material/color information.

### 4.3 Band Location

- 4.3.1 Color bands should be located at conspicuous places, preferably adjacent to valves, point of exit or entrance to areas, and on long runs at distances sufficient to identify contents readily. Color bands shall be applied to the outside cover of insulated piping.
- 4.3.2 When a color band placed on the piping will be obscured by frost or other material, a metal tag shall be substituted, mounted above or below the piping, whichever is most conspicuous (See Annex B). The tag should meet color, legend, and width requirements of a color band.
- 4.3.3 Paint, tape, or decal identification markings shall not be placed directly on stainless steel or aluminum piping unless specified by the manufacturer to be compatible (non-corrosive) with piping material. Tygon, or metal tags fastened by wire, may be used.

### 4.4 Identity of Contents

- 4.4.1 Each color band, excluding jet fuels, must bear the name of the material or its abbreviation as shown in Annex A. For abbreviation of materials not listed, consult AEDC contractor safety.
- 4.4.2 Identification of jet fuel systems shall be via a title band, independent of the color band, consisting of a black background with white lettering. The black background will have a minimum border three-fourths inch wider than the lettered area. The lettering size shall be as specified in Paragraph 4.7.2. The title band shall bear the name of the material or its abbreviation as shown in Annex A.

### 4.5 Flow Arrows

- 4.5.1 At each color band (except for jet fuels and conduit), the fluid's direction of flow must be indicated by an arrow (see Annex B).
- 4.5.2 For jet fuel systems, a yellow arrow to indicate flow direction will appear adjacent to the title and color bands (see Annex C).
- 4.5.3 For conduit, no directional arrows are required.

### 4.6 Pressure

- 4.6.1 Where desirable for tracing or other purposes, the working pressure in pounds per square inch (psi) shall be shown below or beside the identity word.

### 4.7 Lettering and Numbering Specifications

- 4.7.1 Letters and numbers placed on color bands shall conform to the following.  
(See Annex B for typical band installation):

Outside Diameter of Pipe or Covering	Minimum Size of Legend, Letters, and Numerals
Less than 3/4"	See Par. 4.7.2 below
3/4" to 1-1/4"	1/2"
1-1/2" to 2"	3/4"
2-1/2" to 6"	1-1/4"
Over 6"	2"

**NOTE:** Width of color band shall be sufficient to accommodate lettering with a minimum of 6 inches.

- 4.7.2. Letters and numbers placed on title and color bands for jet fuels. (See Annex C for typical band installation):

Outside Diameter of Pipe or Covering	Width of Bands	Space Between Bands	Length of Bands	Title Letter Size
<2"	3" or per Paragraph 4.7.3	3" or per Paragraph 4.7.3	Encircle	Apply Paragraph 4.7.3
2" to 3"	3"	3"	Encircle	1/2"
>3" to 6"	3"	3"	Encircle	1"
>6" to 9"	3"	3"	Encircle	2"
Over 9"	3"	3"	Encircle	3"

- 4.7.3 Color band width and spacing for piping under 2 inches can be proportionally narrower in width and spacing, but not to be narrower than 1-inch bands and 1-inch spacing. Abbreviations for the content word for piping under  $\frac{3}{4}$ -inch outside diameter must be stamped or stenciled on a nonferrous tag securely fastened at each color band or an equivalent method must be used.
- 4.7.4 The lettering must be placed below the horizontal centerline of the pipe where pipelines are located some distance above the normal line of vision.
- 4.7.5 Lettering should be in the color combination listed below.

Lettering Color	Band Color
White (17875)	Red (11105)
Black (17038)	Yellow (13655), Orange (12246), Green (14110)

- 4.7.6 In shops, offices, laboratories, or other areas where the interior is painted in accordance with company standards, piping colors may match walls, ceiling, etc., to which the pipelines are affixed or are run adjacent thereto, but must be color-banded as above.
- 4.7.7 In test areas where interiors are not painted, piping colors may match the color of the machine, tank, or equipment from which piping leaves when on operating floors; or piping colors may match the dueling or general color scheme in auxiliary areas. But in both cases, piping must be color-banded as above.

#### 4.8 Responsibilities

- 4.8.1 The asset owner/manager is responsible for ensuring that the requirements of this standard are complied with.
- 4.8.2 The base operating contractor is responsible for implementing the requirements contained in this standard.

#### 5.0 TRAINING

Not applicable.

#### 6.0 INSPECTIONS/AUDITS

Not applicable.

#### 7.0 REFERENCES

##### AEDC Engineering Standards (T Standards)

- T-1, Pressure Vessels
- T-2, Pressure Piping
- T-3, Engineering Design and Drafting Practices

##### AEDC Safety, Health, and Environmental Standards (SHE Standards)

- B3, Control of Hazardous Areas Using Safety Signs, Tags, and Barricades
- D2, Pressure Vessels and Systems

##### American Society of Mechanical Engineers (ASME)

- ASME A13.1- 2007 – Scheme for the Identification of Piping Systems

##### Military Standard (MIL-STD)

- MIL-STD 101B – Color Code for Pipelines and for Compressed Gas Cylinders
- MIL-STD-161G – Identification Methods for Bulk Petroleum Products Systems Including Hydrocarbon Missile Fuels

##### Occupational Safety and Health Administration (OSHA)

- 29 CFR 1910.24 – Fixed Industrial Stairs

#### 8.0 ANNEXES

- A. Content Identification
- B. Band and Tag Locations
- C. Title Band and Color Band for Jet Fuels

#### 9.0 SUPPLEMENT

- NFAC A321-0801-XSP D3 Identification of Piping Systems

**ANNEX A**  
**CONTENT IDENTIFICATION**

Material in Pipe	Abbreviation	Band Color
Air Compressed	AIR	Yellow
Alcohol	ALCOHOL	Yellow
Alcohol-Water Mix	ALCOHOL-Water	Yellow
Alkalis	ALKYL	Yellow
Ammonia	AMMONIA	Yellow
Ammonia Anhydrous	AMMONIA GAS	Yellow
Aniline	ANILINE	Yellow
Argon	ARGON	Yellow
Backwash Water	WATER, BW	Brown
Brine	BRINE	Green
Carbon Dioxide <sup>1</sup>	CO <sub>2</sub>	Red
Chlorine Trifluoride	CLF <sub>3</sub>	Yellow
Contaminated Groundwater	GW CONT	Light Green
Drainage	DRAINAGE	Green
Electricity	ELECTRIC	Orange
Ethylene Glycol	ETHYL-GLYCOL	Yellow
Ethylene Glycol and water	ETHYL-GLYWATER	Yellow
Ethylene Oxide	ETHYLOXIDE	Yellow
Exhaust Gas	EXH-GAS	Yellow
Finished Water	WATER, FW	Dark Blue
Fluorine	FLUORINE	Yellow
Freon (11, 12, etc.)	FREON (II, 12, etc.)	Yellow
Gasoline	GASOLINE	Yellow
Halon	HALON	Red
Helium, Gaseous	GHe	Yellow
Helium, Liquid	LHe	Yellow
Hydraulic Oil	HYD-OIL	Yellow
Hydrazine Hydrate (45%); Ethyl Alcohol (50%); Water (5%)	C-stoff	Yellow
Hydrazine, Unsymmetrical Dimethyl Hydrazine	UDMH	Yellow
Unsymmetrical Dimethyl Hydrazine (50%) Mix	AZ-50	Yellow

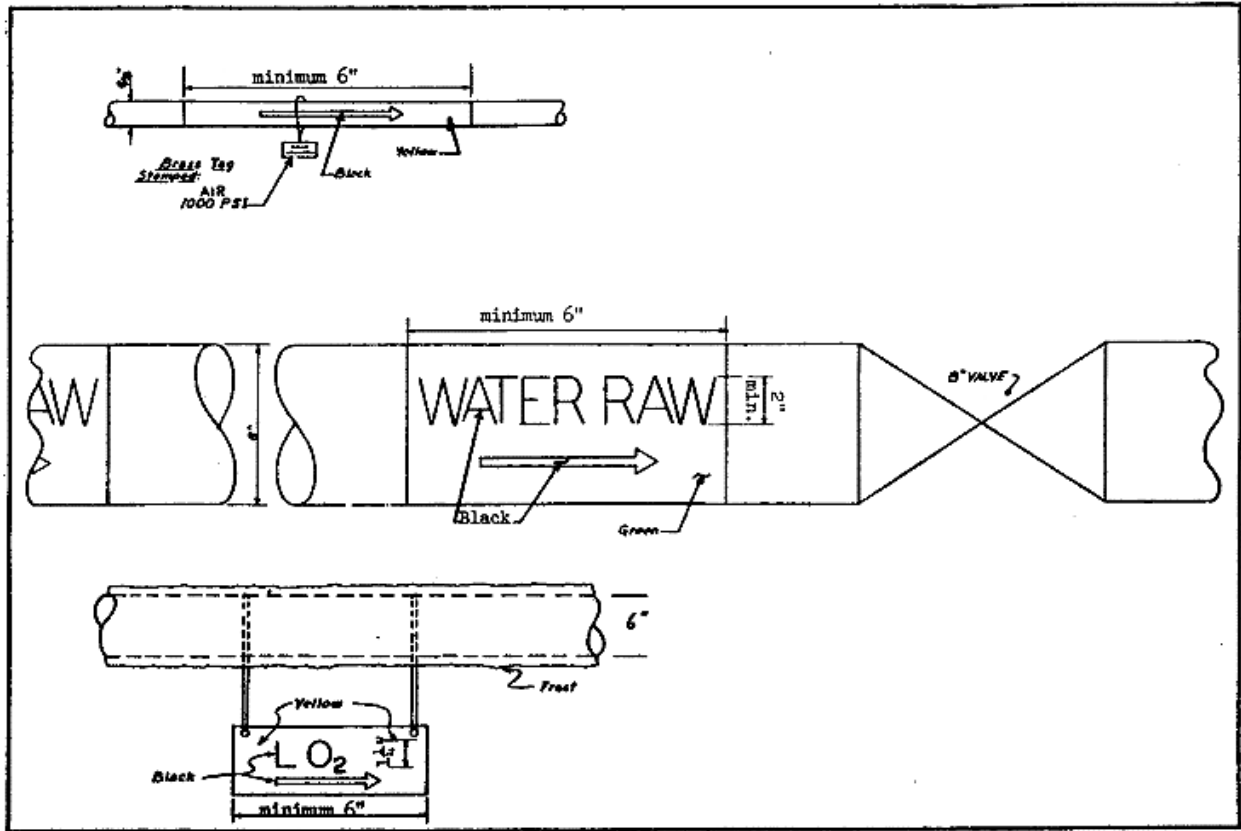
<sup>1</sup>**NOTE:** For other than fire protection purposes (for example, pressurization for transfer of fluid), CO<sub>2</sub> lines must be color-banded yellow, in view of asphyxia hazard.

## ANNEX A (cont)

## CONTENT IDENTIFICATION

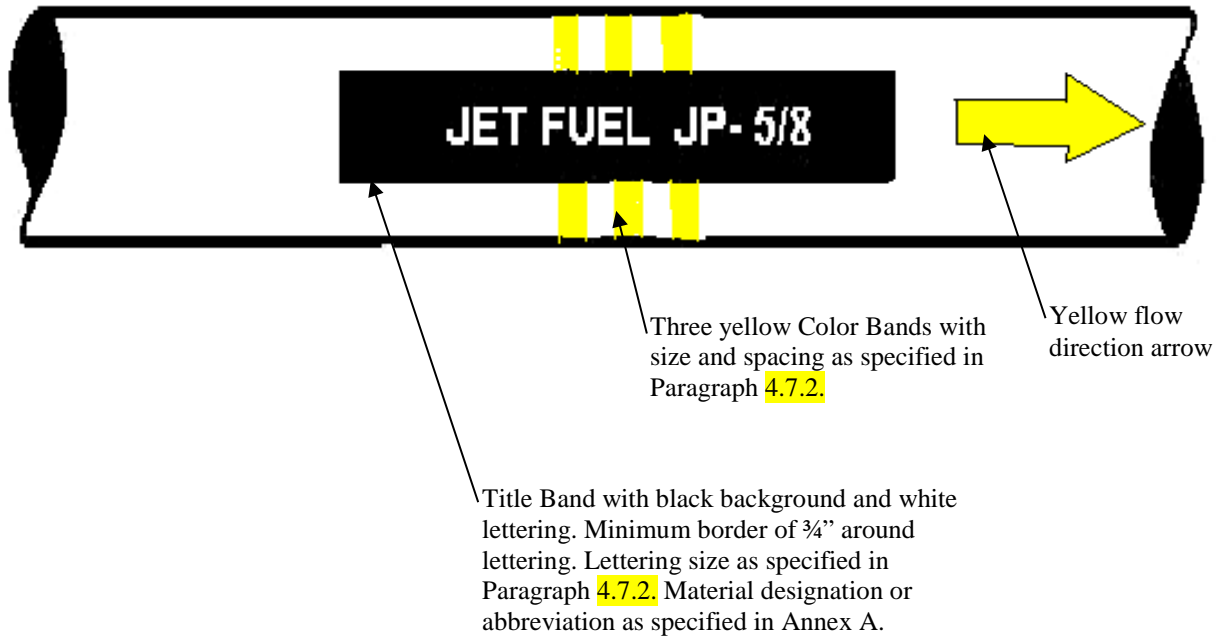
Material in Pipe	Abbreviation	Band Color
Hydrogen, Gaseous	GH <sub>2</sub>	Yellow
Hydrogen, Liquid	LH <sub>2</sub>	Yellow
Hydrogen Peroxide	HYDR-PEROX	Yellow
JP Fuel	JP (No.)	Yellow
Kerosene Liquefied Petroleum Gas	KEROSENE	Yellow
Lubricating Oil	LUB-OIL	Yellow
Monomethyl-hydrazine	MMH	Yellow
Natural Gas	NAT-GAS	Yellow
Nitric Acid, Inhibited Red Fuming	IRF NITRIC ACID	Yellow
Nitric Acid, Inhibited White Fuming	ACID	Yellow
Nitric Acid, Red Fuming	RF NITRIC ACID	Yellow
Nitric Acid, White Fuming	ACID	Yellow
Fuming Acid	ACID	Yellow
Nitrogen, Gaseous	GN <sub>2</sub>	Yellow
Nitrogen, Liquid	LN <sub>2</sub>	Yellow
Nitrogen Tetroxide	N <sub>2</sub> O <sub>4</sub>	Yellow
Oxygen Difluoride	OF <sub>2</sub>	Yellow
Oxygen, Gaseous	GO <sub>2</sub>	Yellow
Oxygen, Liquid	LO <sub>2</sub>	Yellow
Propane	PROPANE	Yellow
RP Fuel	RP (No.)	Yellow
Sewage	SEWAGE	Yellow
Sodium-Potassium	NaK	Yellow
Alloy Solvents	Specific chemical name	Yellow
Steam Toluene	STEAM TOLUENE	Yellow
Treated Water	WATER TREATED	Light Blue
Trichloroethylene	TRICHLOR-ETHY	Yellow
Triethylaluminum	TEA	Yellow
Water Demineralized	WATER-DEM	Green
Water, Fire Line	WATER FIRE	Red
Water, Potable Cold or Hot	WATER POT (Cold or Hot)	Green
Water, Raw (Cooling), Cold or Hot	WATER,RAW (Cold or Hot)	Green
Xylidine (50%)	TONKA	Yellow

ANNEX B  
BAND AND TAG LOCATIONS





ANNEX C  
TITLE BAND AND COLOR BAND FOR JET FUELS



# A321-0801-XSP D3 Identification of Piping Systems Supplement

This supplement has been approved for the NFAC Site.

**Review:** This supplement will be reviewed and updated using the same cycle as the AEDC Safety, Health, and Environmental (SHE) Standard C5 D3 Identification of Piping Systems.

**References:** AEDC SHE Standard D3 – Identification of Piping Systems

NASA Ames APR8715.1, Chapter 42, Lanes, Barricades, Hazard Labeling, and Posting, section 42.3.3

ASME A13.1 2007 Scheme for the Identification of Piping Systems

## **Scope:**

This supplement addresses the identification of piping or tubing of any kind, including fittings, valves and pipe covering. Rigid electrical conduit is considered piping.

When there are any conflicts noted between this standard and industry or national codes, standards or regulatory requirements, the operating contractor shall notify the government. If not applicable, write N/A.

This supplement applies to all personnel conducting operations, maintenance, testing and support at NFAC, NASA AMES.

## **NFAC Worksite Application:**

This supplement is to ensure that the piping systems are in compliance with the provisions of NASA Ames APR8715.1, Chapter 42, Lanes, Barricades, Hazard Labeling, and Posting, section 42.3.3, Pipe Labeling, as well as federal, state, and local laws. Because of the potential hazards associated with pipe transfer systems, piping shall be labeled accurately as to the contents and intended direction of flow per the 2007 edition of ASME A13.1.

## **Requirements/Responsibilities:**

- I. NFAC Site Management shall
  - Ensure all employees follow this supplement.
- II. NFAC Supervisors and Test Directors shall
  1. Ensure all facility piping systems within their assigned areas have the appropriate labels, rings, or markings.
  2. Ensure all test article-defined piping is labeled in accordance with ASME A13.1.
- III. NFAC Safety Engineer/Management Designee shall
  1. Ensure compliance during monthly safety inspections.
  2. Ensure labeling and marking are correct and indicate the correct hazard level.
- IV. NFAC Staff shall ensure employees follow this supplement.