

# Engineering Standard

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SAES-H-102

31 July 2004

## Safety Requirements for Coating Applications

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## Saudi Aramco DeskTop Standards

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## 1 Scope

This Standard prescribes the minimum mandatory safety requirements applicable during shop or field coating applications for construction, maintenance, and/or coating maintenance programs of Saudi Aramco industrial facilities and equipment.

## 2 Conflicts and Deviations

- 2.1 Any conflicts between this standard and other applicable Saudi Aramco Engineering Standards (SAESs), Materials System Specifications (SAMSSs), Standard Drawings (SASDs), or industry standards, codes, and forms shall be resolved in writing by the Company or Buyer Representative through the Manager, Consulting Services Department of Saudi Aramco, Dhahran.
- 2.2 Direct all requests to deviate from this standard in writing to the Company or Buyer Representative, who shall follow internal company procedure [SAEP-302](#) and forward such requests to the Manager, Consulting Services Department of Saudi Aramco, Dhahran.

## 3 References

The selection of material and equipment, and the design, construction, maintenance, and repair of equipment and facilities covered by this standard shall comply with the latest edition of the references listed below, unless otherwise noted.

### 3.1 Saudi Aramco References

#### Saudi Aramco Engineering Procedure

[SAEP-302](#)

*Instructions for Obtaining a Waiver of a Mandatory Saudi Aramco Engineering Requirement*

#### Saudi Aramco General Instruction

*GI-0002.100*

*Work Permit System*

*GI-0006.021*

*Safety requirements for abrasive blasting*

### 3.2 Industry Codes and Standards

#### American Society of Mechanical Engineers

*ASME SEC VIII D1*

*Unfired Pressure Vessels*

*NEC Article 500*

*Hazardous (Classified) Locations*

Occupational Safety & Health Administration (OSHA) - Construction Industry  
Safety & Health Standards

*29 CFR 1926*

*U. S. Department of Labor, Chapter XVII, Section  
1926.105*

## **4 Safety Requirements**

### **4.1 Fire and Explosion Prevention**

4.1.1 Smoking and/or the use of open flames, shall be permitted only in designated safe areas and never inside vessels. Welding and the use of heating coils are prohibited in areas where coating is in progress.

4.1.2 All electrical lighting, equipment, and connections shall conform to National Electric Code, Class I, Division 1, Group D explosion proof requirements (NEC Article 500).

4.1.3 Solvents and paints shall not be applied to surfaces warmer than 80°C if practical alternatives exist.

4.1.4 Work Permits for hot work, cold work, and confined space entry shall be obtained in accordance with GI-0002.100.

### **4.2 Ventilation**

4.2.1 Forced ventilation shall be used in confined spaces whenever abrasive blasting, solvent cleaning, and/or painting are in progress. ||

4.2.1.1 Forced ventilation shall continue until the coating is fully cured and ready for service.

4.2.1.2 Natural ventilation (through opened manholes, etc.) shall not be substituted for forced ventilation in confined spaces.

4.2.2 Ventilation shall ensure good air circulation with no dead air pockets in the confined space.

4.2.2.1 The fresh air inlet shall be located near the top of the confined space whenever practical.

4.2.2.2 The discharge opening shall be located near the bottom of the confined space.

4.2.2.3 Supplementary fans shall be used if necessary to ensure adequate air circulation in low spots or dead spaces.

- 4.2.3 Ventilation requirements for various sizes of confined spaces are given in Table 4-1.
  - 4.2.4 Respirable air-fed hoods shall be worn by all personnel inside confined spaces whenever:
    - 4.2.4.1 Blasting or spray painting is in progress.
    - 4.2.4.2 Solvent cleaning or brush painting is in progress in a confined space having a volume of less than 16 m<sup>3</sup>.
  - 4.3 Health Hazards
    - 4.3.1 If alkaline catalysts (such as used in many epoxy paints) come in contact with the skin, they shall be immediately washed off with water to avoid chemical burns.
    - 4.3.2 The appropriate personnel protection equipment listed in Table 4-2 shall be worn. In addition, safety belts and lines shall always be used by personnel working from unguarded platforms or in confined spaces where a manhole accessed by a ladder is the only exit.
    - 4.3.3 Adequate washing facilities shall be readily available so that paints and solvents splashed on the body or in the eyes can be immediately removed.
    - 4.3.4 Safety shoes and coveralls shall always be worn and safety hats shall be worn as required by proponent organizations.
    - 4.3.5 Air hoses shall not be used by personnel for cleaning or cooling themselves.
    - 4.3.6 Solvents shall not be used by personnel for washing up.
    - 4.3.7 Materials Safety Data Sheets for all coatings, solvents, and cleaners in use shall be readily available on-site.
  - 4.4 Equipment Hazards
    - 4.4.1 Power tools
      - 4.4.1.1 Electrically driven power tools shall be properly grounded to prevent shock.
      - 4.4.1.2 Power equipment shall be operated at the speeds recommended by the manufacturer and shall have proper safety guards.
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- 4.4.1.3 Hearing protection shall always be worn whenever chipping guns or pneumatic hammers are in use.
- 4.4.1.4 Vessels such as air receivers that are used as a surge tank between the compressor and the blasting pot shall be manufactured and stamped in accordance with ASME SEC VIII D1, Unfired Pressure Vessels. They shall be hydrotested at a pressure of at least 1.73 Mpa (250 psig) at ambient temperature using clean water. These vessels shall be revalidated by hydrotesting at least annually and the test certificates shall be submitted to the Saudi Aramco Inspector for verification.
- 4.4.1.5 All pressure relief valves, gauges, and devices shall be tested annually and tagged with the expiration date. The test certificates shall be submitted to the Saudi Aramco Inspector for verification.
- 4.4.1.6 All blasting and coating equipment and associated attachments shall be adequately earthed to avoid electrostatic discharges.

#### 4.4.2 Abrasive Blasting

- 4.4.2.1 Blasting shall be equipped with a remote control shut-off "deadman".
- 4.4.2.2 The blast nozzle shall be electrically connected to an external ground in order to prevent static electrical discharges or shocks to operating personnel. Grounding wire shall be AWG-4 or larger.
- 4.4.2.3 The blasting hose shall be the static dissipating type with external couplings.
- 4.4.2.4 Respirable air-fed abrasive blasting hoods and OSHA-approved in-line respirable air filters shall be utilized at all times by abrasive blasting personnel.
- 4.4.2.5 Compressor hoses, air lines, and blast hoses shall be safety wired at each coupling using proper safety pins.
- 4.4.2.6 Hearing protection shall be worn in confined spaces where abrasive blasting is in progress.

#### 4.4.3 Solvent Cleaning

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Benzene, gasoline, carbon tetrachloride, and chlorinated hydrocarbons with low threshold limit values (less than 20) shall not be used.

#### 4.4.4 Paint Preparation and Equipment Cleaning

4.4.4.1 Coatings shall be mixed outside or in an adequately ventilated area. Use eye protection (goggles) and protective gloves. ||

4.4.4.2 Electrically driven power mixers shall be grounded.

4.4.4.3 Avoid splash or spillage during mixing. Clean spilled paints immediately using proper cleaning solvent. ||

#### 4.4.5 Airless Spray Paint Application

4.4.5.1 Airless spray guns shall never be pointed at anyone or at any part of the body.

4.4.5.2 The tip guard shall always be in place on the airless gun while spraying.

4.4.5.3 Leather gloves shall be worn by the operator whenever the airless spray gun is in use.

4.4.5.4 The trigger safety catch shall be engaged whenever the airless gun is left unattended.

4.4.5.5 Hoses, pumps, and accessories shall never be operated at pressures exceeding their rated pressure. In no case shall the working pressure in the paint line exceed 34.5 MPa (5000 psi). Safety pressure relief valves shall be used on outbound side of the pressure pump(s).

4.4.5.6 The pump shall be shut down and the fluid pressure in the system relieved before servicing or cleaning any components, including clogged spray tips.

4.4.5.7 Hoses shall be grounded, anti-static type.

4.4.5.8 Airless spray equipment shall not be operated unless all grounds (earths) are in place, connected, and in good condition. Grounding wire shall be AWG-4 or larger.

4.4.5.9 Airless spray equipment shall not be operated if any of the pressure system components is not in good condition.

4.4.5.10 Solvents shall not be flushed into containers that are hotter than 50°C.

4.4.5.11 Emergency medical care shall be obtained immediately if any high pressure fluid from the airless equipment penetrates the skin. (High pressure fluid injection injuries can be extremely serious, including the need for amputation).

**Revision Summary**

31 July, 2004

Revised the "Next Planned Update". Reaffirmed the contents of the document, and reissued with editorial changes.

**Table 4-1 - Ventilation Requirements for Confined Spaces**

<b>Volume of Confined Area</b>		<b>Required Air Mover Capacity</b>	
<b>m<sup>3</sup></b>	<b>BBL</b>	<b>L/s</b>	<b>cfm</b>
16	100	472	1000
80	500	1180	2500
160	1000	2360	5000
800	5000	4720	10000
1600	10000	7080	15000
4000	25000	9440	20000



**Table 4-2 - Personal Protective Equipment to be Worn or Used During Surface Preparation & Paint Application**

Key: O = Outdoors  
 C = Confined Spaces

Type of Work to be Performed	OSHA-Approved Respirable Airfed Hood and Filter 21-444-934 21-443-500		Respirator; Chemical Cartridge 21-370-800 21-370-810 21-370-820		Dust Respirator 21-370-500		Face Shield <sup>(1)</sup> 21-426-121 21-426-125 21-426-142	
	O	C	O	C	O	C	O	C
<u>Surface Preparation</u>								
Wire Brushing, Chipping, Scrapping & Grinding					X	X	X	X
Sandblasting								
- operator	X	X						
- other workmen		X			X		X	
Paint Removing				X			X	X
Solvent Cleaning				X			X	X
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Paint Application	Brush		Brush		Brush		Brush	
	O	C	O	C	O	C	O	C
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Epoxy and Coal/Tar Epoxy		X	X				X	X
Alkyd			X	X				
Inorganic Zinc		X					X	
Chlorinated Rubber			X	X				
Bituminous			X	X				
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**Note:** <sup>(1)</sup> Face shields shall always be used when working overhead.

**Table 4-2 - Personal Protective Equipment to be Worn  
 or Used During Surface Preparation & Paint Application (Cont'd)**

Key: O = Outdoors  
 C = Confined Spaces

Type of Work to be Performed	Goggles Safety Impact 21-434-249		Gloves; Leather 21-432-353		Gloves; Rubber 21-432-630	Hearing Protection 21-327-100/105/110/272		
	O	C	O	C		O	C	
<u>Surface Preparation</u>								
Wire Brushing, Chipping, Scrapping & Grinding	X	X	X	X				
Sandblasting - operator - other workmen - in vicinity			X	X			X	
Paint Removing					X			
Solvent Cleaning					X			
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Paint Application	Brush Spray O C O C		ALL					
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Epoxy and Coal/ Tar Epoxy					X			
Alkyd	X	X			X			
Inorganic Zinc	X	X			X			
Chlorinated Rubber	X	X			X			
Bituminous	X	X	X					
Polyurethane	X	X			X			