

GENERAL INSTRUCTION MANUAL

6.021

ISSUING ORG. LOSS PREVENTION DEPARTMENT

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SUBJECT ABRASIVE BLASTING OPERATIONS

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REFERENCES

- (1) U.S. Code of Federal Regulations Title 29, Occupational Safety and Health Administration, Labor, Part 1910, Section 1000, Air Contaminants (29 CFR 1910.1000)
- (2) Saudi Aramco Construction Safety Manual (CSM)
- (3) Saudi Aramco Safety Handbook
- (4) ANSI/ASC Z9.4, *Abrasive Blasting Operations - Ventilation and Safe Practices*
- (5) GI 1780.001, *Atmosphere-Supplying Respirators*
- (6) SAES-H-102, *Safety Requirements for Coating Applications*
- (7) GI 2.100, *Work Permit System*
- (8) SAES-A-105, *Noise Control*
- (9) NFPA 77, *Recommended Practice on Static Electricity*
- (10) API RP 2003, *Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents*
- (11) ANSI/API Publication 2015, *Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks*
- (12) API Publication 2026, *Safe Access/Egress Involving Floating Roofs of Storage Tanks in Petroleum Service*
- (13) SAEP-316, *Performance Qualification of Coating Personnel*
- (14) GI 150.001, *Asbestos Hazard Management*
- ** (15) SAES-H-102, *Safety Requirements for Coating Applications*
- ** (16) GI 2.709, *Gas Testing Using Portable Gas Monitors*
- ** (17) API RP 2027, *Ignition Hazards and Safe Work Practices for Abrasive Blasting of Atmospheric Storage Tanks in Hydrocarbon Service*

1.0 INTRODUCTION

This General Instruction outlines Saudi Aramco safety requirements for abrasive blasting operations. It includes requirements for operators, assistants, and other personnel in the blasting area. Mandatory safety requirements for surface and work site preparation, and painting/coating operations shall be per the Saudi Aramco *Construction Safety Manual (CSM)* and SAES-H-102, *Safety Requirements for Coating Applications*.

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2 OF 6**2.0 GENERAL SAFETY REQUIREMENTS**

- * 2.1 Abrasive blasting operations require a hot work permit as it has the potential to generate static electricity that can ignite flammables. Therefore, combustible gas testing shall be carried out prior to commencing abrasive blasting operations in accordance with GI 2.709, *Gas Testing Using Portable Gas Monitors*. Other hot work requirements shall be adhered to as stipulated in GI 2.100, *Work Permit System*.
- 2.2 Where abrasive blasting is to be carried out in a confined space, confined space entry procedures must be followed (see GI 2.100 and the CSM).
- 2.3 SAES-A-105, *Noise Control*, shall be referred to for details about allowable noise levels and exposure durations for workers.
- 2.4 All abrasive blasting operators shall be trained in the correct use and hazards associated with abrasive blasting equipment and abrasive materials.
- 2.5 Abrasive blasting operators for industrial coatings applications shall be tested and certified by a Certified Coatings Inspector in accordance with SAEP-316, *Performance Qualification of Coating Personnel*.
- 2.6 Nearby surfaces other than those being blasted shall be protected from damage due to abrasive blasting operations.
- 2.7 An abrasive blasting gun must never be pointed at any person or part of the body as a serious injury could result.
- * 2.8 Areas where abrasive blasting is in progress shall be barricaded to keep unauthorized personnel out of the hazardous area. Warning signs shall be posted at the hazardous areas with suitable warnings of the potential dangers (e.g., "No Entry-Abrasive Blasting in Progress"). Signs shall be provided in Arabic and English, as well as the languages of the contractor's workforce.
- 2.9 Before abrasive blasting any in-service equipment (piping, tanks, vessels, etc.), ensure that non-destructive testing has been carried out or other methods used to determine that the equipment wall thickness is adequate for abrasive blasting.
- ** 2.10 Abrasive blasting shall not be conducted in windy conditions in order to prevent the spread of any hazardous materials.
- ** 2.11 Drinking water stations and smoking shelters shall be well away from the abrasive blasting area. Workers shall not eat, drink, or smoke in blasting areas.

3.0 MEDICAL EXAMINATIONS

- * Saudi Aramco supervisors shall contact the Johns Hopkins Aramco Healthcare, Occupational Medicine Unit, Preventive Medicine Services Division to arrange for a pre-placement medical examination for their employees assigned to abrasive blasting operations, including a chest X-ray and a pulmonary function study. These examinations shall be repeated at least every two years. Contractors shall establish equivalent bio-monitoring programs (using non-Saudi Aramco medical facilities) for their employees who conduct abrasive blasting for Saudi

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Aramco. The results of the medical examinations shall be available if requested by relevant Saudi Aramco organizations.

4.0 BREATHING AIR SUPPLY

- 4.1 Breathing air shall meet the requirements and be tested in accordance with GI 1780.001, *Atmosphere-Supplying Respirators*.
- * 4.2 Abrasive blasting breathing air equipment shall include a U.S. National Institute for Occupational Safety and Health (NIOSH)/ Mine Safety and Health Administration (MSHA) (or equivalent organization as determined by Loss Prevention Department) approved particulate filter for breathing air and water/oil traps before the filter in the breathing air delivery system to remove moisture, oil mist and particulates. Continuous inline carbon monoxide (CO) monitoring with an audible alarm shall be provided for oil lubricated breathing air compressors, as the filter does not remove CO.
- * 4.3 Breathing air filters shall be periodically checked and replaced as recommended by the manufacturer, but not less than every three months, or sooner if objectionable odors become noticeable or if the filter begins to pass moisture. Water/oil traps shall be checked and drained daily.
- ** 4.4 Air compressors supplying breathing air shall be tested quarterly by an independent SA approved third party testing facility to ensure that the air quality supplied by the compressor meets Compressed Gas Association Grade 'D' air quality requirements. See GI 1780.001.
- * 4.5 Air compressors supplying breathing air shall be inspected, tested, maintained and used in accordance with the CSM and the manufacturer's requirements.
- 4.6 The concentration of air contaminants being inhaled by operators or other personnel within the area shall not exceed Permissible Exposure Limits (PELs). Since PELs are normally exceeded at abrasive blasting operations, the Personal Protective Equipment (PPE) for respiratory protection described in Section 5 shall be worn.

5.0 PERSONAL PROTECTIVE EQUIPMENT

- * 5.1 Abrasive blasting operators shall wear an air supplied hood, type "CE" supplied-air respirator, approved for abrasive blasting by NIOSH/MSHA (or equivalent organization as determined by the Loss Prevention Department).
- * 5.2 Other workers in or near the work area shall wear a particulate respirator approved by NIOSH/MSHA (or equivalent organization) for the airborne contaminants likely to occur from abrasive blasting operations and handling of abrasive blasting media (i.e., grit).
- * 5.3 Abrasive blasting operators shall wear other needed personal protective equipment (PPE) including leather or neoprene gloves, leather or neoprene apron, hearing protection (see Section 5.4), safety glasses, safety shoes and coveralls. Abrasive blasting assistants may need all of the above PPE, dependent on their proximity to the abrasive blasting. Special PPE may be required depending on the work being carried out and the location. Refer to the CSM or Area Loss Prevention Division.

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- ** 5.4 Hearing protection shall be used by abrasive blasting operators and by all personnel in the areas near abrasive blasting operations where noise levels exceed 85 decibels (dBA).

6.0 ABRASIVE BLASTING EQUIPMENT

- * 6.1 An electrical bonding system that bonds nozzle, hose, blasting equipment (e.g., blast pot) and the material/equipment being cleaned shall be provided. The blast pot and material/equipment being cleaned shall be grounded to prevent a buildup of static electricity. Grounding wire shall be 21 mm² (AWG-4) or larger. Ground continuity tests shall be conducted by an electrician to ensure proper grounding (resistance one megaohm or less). Bonding and grounding connections shall be inspected before each job is started and whenever equipment is repositioned.
- * 6.2 Hoses and nozzle fittings shall be securely fixed to prevent unplanned disengagement during abrasive blasting operations. All twist-lock fittings ("Chicago" fittings) shall have a safety pin or wire installed to prevent disengagement. Hose connections shall be equipped with whip arrestors (whip checks) to restrain the hose in case of accidental disconnection.
- * 6.3 Abrasive blasting equipment shall be equipped with a properly functioning constant pressure handle or control switch that will automatically shut off the flow of abrasive and propellant when the handle or control switch is released (i.e., a "dead-man" switch).
- 6.4 Abrasive blast cleaning equipment shall only be operated with all protective guards and controls in place and working properly.

7.0 ABRASIVE BLASTING THE EXTERIOR OR TANKS/VESSELS IN SERVICE

- 7.1 Tanks/vessels shall be considered in-service when they are pressurized or contain hydrocarbons, other flammable or combustible products, or if any inlet, outlet or overhead piping connected to the tank is not blinded.
- ** 7.2 If the tank is not emptied due to facility operations or other reasons, it shall be filled as close as possible to its maximum normal working capacity.
- ** 7.3 The product level inside the tank shall remain at least one meter (3.3 feet) above the level where abrasive blasting is occurring on the external shell of the tank. Abrasive blasting shall not be conducted closer than 1.8 meters (6 feet) from side wall and roof vents, gage hatches and other openings, including small, uncovered rust holes above the liquid level. The remaining area within 1.8 meters (6 feet) around the openings shall be cleaned by wire brushing or hand scraping.
- * 7.4 During abrasive blasting operations, tanks/vessels shall not be receiving or discharging product.
Exception: Abrasive blasting the exterior of in-service floating roof tanks receiving or discharging product is allowed only on the tank's exterior below the wind girder. No abrasive blasting shall take place above the wind girder, on the roof, or interior tank wall of an in-service floating roof tank.
- * 7.5 Cone roof atmospheric storage tanks can be externally abrasive blasted while in service provided that the roof is structurally sound and will support the weight of workers and abrasive blasting equipment, periodic

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gas test results indicate that there are no flammables present, connections and instrumentation are protected against damage, and all general safety requirements have been met. See Section 7.10 for additional cone roof tank precautions.

7.6 The Work Permit System shall be used and gas tests shall be carried out in the area to be abrasive blasted, in addition to areas where abrasive blasting hoses, equipment and compressors are located.

7.7 The amount of abrasive blasting equipment inside dikes shall be minimized. The abrasive blasting machine shall be located at grade level and upwind from the tank.

7.8 The abrasive blasting machine and hose couplings shall be grounded at grade level or bonded to the storage tank. The abrasive blasting nozzle shall be bonded to the work surface or both the nozzle and the work surface shall be effectively grounded.

7.9 To prevent overloading, the abrasive material shall not be allowed to accumulate on items that could be damaged, such as the roof or scaffolding.

7.10 For cone roof tanks additional precautions shall be taken:

* 7.10.1 Gauge hatch covers shall be securely closed, roof drains shall be plugged and covered, and roof vents and other similar appurtenances are covered or protected in order to prevent vapors from being discharged in the vicinity of abrasive blasting operations. At least one vent depending on tank capacity and product handled, located as far away from the area of abrasive blasting as possible, shall be fitted with a 2.4 meter (8 feet) vertical vent stack to permit atmospheric tank breathing.

Note: When abrasive blasting is completed at the end of the day or when abrasive blasting is suspended for any period of time over 2 hours, vents shall be uncovered to prevent a vacuum condition in the tank as it cools at night and to provide for pressure relief during sunlight.

** 7.10.2 Incoming, withdrawing and vapor recovery lines shall be isolated or controlled in order to assure vapor control. All sewer, vents drains, and catch basins in the area of the tank shall be covered or protected to prevent vapors from entering the abrasive blasting area and to prevent a flashback through these lines into other process or storage areas in the event of an ignition.

* 7.10.3 Work shall be carried out upwind of the functional tank vent(s). The presence of flammable vapors in the working area, such as vapors resulting from filling a nearby storage tank, shall be avoided.

7.11 The abrasive blasting of refrigerated LPG dome roof atmospheric storage tanks shall be treated on a case-by-case basis and the abrasive blasting procedure shall be reviewed by the Chief Fire Prevention Engineer, Loss Prevention Department.

**7.12 Special abrasive blasting restrictions apply for roofs, shells and internals according to the type of tanks and the NFPA Class Type of liquids (I, II or III). See Reference API RP 2027 for further details.

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- 8.1 Silica sand and combustible abrasives are prohibited at all Saudi Aramco facilities and construction sites.
- 8.2 The type of coating to be removed by abrasive blasting shall be evaluated for hazards from residue. Where uncertainty exists, tests shall be carried out to determine the potential health or environmental hazards as well as required additional protective measures.
- 8.3 Abrasive blasting residue shall be cleaned up regularly and disposed of in accordance with the recommendations of the Environmental Protection Department.
- 8.4 If the work entails removal or disturbance of asbestos containing materials, all requirements in GI 150.001, Asbestos Hazard Management, shall be complied with.

APPROVED:

MANAGER

Loss Prevention Department

DATE: _____