



Abu Dhabi Occupational Safety and Health System Framework (ADOSH-SF)

Code of Practice
CoP 48.0 – Spray Finishing

Version 4.0
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1. Introduction

- (a) This Code of Practice (CoP) applies to all employers within the Emirate of Abu Dhabi that perform spray finishing activities. This CoP is designed to incorporate requirements set by UAE and Abu Dhabi Regulatory Authorities. If requirements of this document conflict with requirements set by another regulatory authority, employers are required to follow the more stringent requirement.
- (b) This CoP sets requirements for spray finishing operations to include spray painting.
- (c) Definitions applicable to this CoP:
 - (i) Absolute Pressure: Based on a zero pressure reference point, the perfect vacuum. Measured from this point, standard atmospheric pressure at sea level is 14.7 pounds per square inch (psi) or 101.325 kilo Pascal's (kPa). This is usually expressed as psia where the 'a' indicates an absolute measurement or kPa.
 - (ii) Airless spraying: is a method by which pressure is applied directly to the paint, which is forced out of a nozzle.
 - (iii) Atmospheric monitoring: Atmospheric monitoring is the sampling of workplace atmospheres to obtain an estimate of inhalation exposure to hazardous substances. Monitoring indicates whether the recommended exposure standards are being exceeded or approached.
 - (iv) Electrostatic spray-guns: have electrically charged nozzles which transfer the electric charge to droplets of paint which are then attracted to the edges and back of the work piece, an effect known as the "wrap-around effect". In some automatic painting processes the objects to be painted are charged. Direct current sources are used and hand guns may be designed with safe nozzles carrying a very low current at high voltage. Automatic guns carry much higher currents which are potentially lethal.
 - (v) Hazardous Area: An area where flammable or explosive gas or vapor-air mixtures (often referred to as explosive gas-air mixtures) are, or may be expected to be, present in quantities which require special precautions to be taken against the risk of ignition.
 - (vi) Lower explosive limit (LEL) of a combustible gas is the smallest amount of the gas that supports a self-propagating flame when mixed with air (or oxygen) and ignited. In gas-detection systems, the amount of gas present is specified as a percentage (%) LEL. Zero percent (0%) LEL denotes a combustible gas-free atmosphere. One hundred percent (100%) lower explosive limit denotes an atmosphere in which gas is at its lower flammable limit. The relationship between percent LEL and percent by volume differs from gas to gas.
 - (vii) Spray finishing / painting: refers to the process by which a liquid coating substance, such as paint, is converted into a mist or aerosol in order to apply a coating onto an object or surface. Spray painting is used in a variety of industries and by a variety of employees. It is used in industrial operations, to paint motor vehicles, buildings (inside and outside), structures, furniture, white goods, boats, ships, aircraft and machinery.
 - (viii) In Spray Painting Process air is driven across the mouth of a small outlet under such pressure as to draw the paint out and produce an air-paint mist from the

jet of the spray-gun. In addition, the paint may be fed under pressure to the gun. Spray painting may be carried out by hand or automatically.

- (ix) There are three classes of hazardous area or zone: zone 0, zone 1 and zone 2. A zone is an area around a process or activity where a flammable atmosphere may be present. The definitions of the three hazardous zones are given in Table 1 below. It is advisable to exclude electrical equipment from the spray area. Any electrical equipment that has to be inside the spray area shall be designed and constructed for use in a zone 1 or zone 2 according to the hazardous area classification. All other sources of ignition shall be removed from the hazardous area.

Zone	Definition
Zone 0	An area in which an explosive gas mixture is continuously present or present for long periods.
Zone 1	An area in which an explosive gas mixture is reasonably foreseeable to occur in normal operation.
Zone 2	An area in which an explosive gas mixture is not reasonably foreseeable to occur in normal operation, and, if it does occur, is reasonably foreseeable to do so only infrequently and will exist for a short period only.

Table 1: Hazardous Zones

2. Training and Competency

- (a) Employers shall ensure that OSH training complies with the requirements of:
 - (i) *ADOSH-SF - Element 5 - Training, Awareness and Competency.*
 - (ii) *ADOSH-SF - Mechanism 7.0 - Occupational Safety and Health Practitioner and Service Provider Registration.*
- (b) Employers shall ensure all relevant employees and contractors that perform tasks that spray finishing operations are trained, but not limited to:
 - (i) physical hazards associated with spray finishing operations;
 - (ii) design specification, capabilities and limitations of spray finishing systems and their uses at the work site;
 - (iii) methods and procedures that will prevent exposure to hazards associated with spray finishing operations;
 - (iv) safe storage and handling procedures;
 - (v) safe work practices;
 - (vi) required use, maintenance and storage of PPE;
 - (vii) emergency response procedures;
 - (viii) health hazards associated with chemical used in spray finishing at the work site;
 - (ix) signs and symptoms of exposure to spray finishes used at the work site; and
 - (x) operator maintenance requirements spray finishing systems.
- (c) Employers shall ensure managers and supervisors of spray finishing operations shall be trained on:
 - (i) requirements listed in Section 2(a);
 - (ii) maintenance requirements of spray finishing system to ensure they are working appropriately and within specifications;
 - (iii) how to recognize unsafe work practices when performing spray finishing operations; and
 - (iv) how to identify when spray finishing systems are not working appropriately.
- (d) After an employee receives training on spray finishing operations, a competent person shall evaluate the employee performing spray finishing operations to ensure they have understood the training and are following safe work practices.
- (e) All training shall be conducted prior to an employee performing any spray finishing operations and annually thereafter. Retraining shall also be conducted if an employee is not following safe work practices.

3. Requirements

3.1 Roles and Responsibilities

3.1.1 Employer

- (a) Employers shall undertake their roles and responsibilities in accordance with the general requirements of *ADOSH-SF - Element 1 - Roles, Responsibilities and Self-Regulation* Section 3.2.5.
- (b) Employers shall be responsible for performing a risk assessment in accordance with *ADOSH-SF - Element 2 - Risk Management* to determine the risks associated to identify areas where control measures and safe work practices are required to reduce employee's exposures to hazards associated with spray finishing operations and hazardous materials/chemicals.
- (c) Employers shall implement the Occupational Health and Safety hierarchy of controls, *ADOSH-SF - Element 2 - Risk Management*, when developing control measures to remove or reduce employee exposure to hazards associated with spray finishing operations.
- (d) Employers shall ensure that protective equipment or other control measures shall be used to keep the exposure of employees to hazards associated with spray finishing and hazardous materials/chemicals within limits prescribed by *ADOSH-SF - Occupational Standards and Guideline Values*.
- (e) Employers shall develop an inspection, testing and preventative maintenance plan to ensure spray finishing systems are safe and working efficiently and according to manufacturer's specifications and applicable legal requirements.
- (f) Employers shall ensure maintenance is performed on spray finishing systems as per the preventative maintenance plan.
- (g) Employers shall ensure spray finishing systems are tested and inspected regularly (at a minimum annually) to ensure the system work in accordance with manufacturer's specifications and other applicable legal requirements.
- (h) Employers shall monitor spray finishing operations to ensure employees are using equipment, safety devices and personal protective equipment appropriately.

3.1.2 Employees

- (a) Employees shall undertake their roles and responsibilities in accordance with the general requirements of *ADOSH-SF - Element 1 - Roles, Responsibilities and Self-Regulation* Section 3.2.7.
- (b) Employees shall report any activity or defect relating to spray finishing operations which they believe is reasonably foreseeable to endanger their safety or that of another person.
- (c) Employees shall comply with safe work practices and standard operating procedures.

- (d) Employees shall use appropriate equipment or safety devices provided by the employer in accordance with any training or instruction received in the use of the work equipment or device concerned.
- (e) Employees shall not perform any task requiring training until they have received the required training and it is documented.
- (f) Employees shall not operate any piece of equipment that they are not familiar with, competent to operate and/or appropriately trained on its use.

3.2 Safety Requirements

- (a) When performing risk assessments in accordance with *ADOSH-SF - Element 2 - Risk Management*, the following shall be considered:
 - (i) the chemicals used in the spray finishing operation and their impact on the health of employee(s) and any impact they may have on the environment;
 - (ii) the condition of the spray finishing equipment being used (compressors, hoses, couplings etc.) and if they are rated by an appropriate International Standard for their intended use;
 - (iii) the type, frequency and duration of spray finishing operations;
 - (iv) the environment in which the spray finishing operations is to be undertaken;
 - (v) the level of experience of the personnel involved in the work; and
 - (vi) other identified hazards associated with the work.
- (b) When using compressed gas systems, including pressurized air, as part of the spray finishing system, the requirements of *ADOSH-SF - CoP 49.0 - Compressed Gases and Air* shall be complied with.
- (c) All spray finishing operations shall be performed in spray booths that meet the requirements of this CoP except when:
 - (i) where, by reason of its shape, size or weight, an article cannot readily be moved or cannot fit into a booth and must be sprayed where it has been assembled, e.g. boilers, structural steel fabrications, ships, boats, aircraft;
 - (ii) for infrequent spraying of heavy or bulky equipment; or
 - (iii) for minor operations such as spotting or touching up.
- (d) For spray finishing operations that cannot be performed inside a booth, a risk assessment shall be performed for the operation and alternative control measures are implemented to limit employee exposure to the lowest level feasible. Employers shall ensure compliance with exposures limits set by *ADOSH-SF - Occupational Standards and Guideline Values*.

3.3 Paint Booths / Spray Finishing Booths

- (a) Booths shall provide a continuous, uniform and evenly distributed supply of air flow throughout the spray painting area to the exhaust outlets. There shall be no pockets of still air in the booth.
- (b) The source of air supply shall be located in an appropriate area to ensure a clean and uncontaminated primary source.
- (c) Employees (eg. spray painters) shall not be positioned between the spray gun and the ventilation exhaust duct.
- (d) Booths shall maintain an internal negative pressure during operation to prevent leakage of contaminants into surrounding work areas. Booths shall be equipped with a negative pressure gauge.
- (e) Booths shall be equipped with a gauge or alarm to indicate if airflow drops below the minimum set air flow rate to capture contaminants.
- (f) Booth ventilation system shall remain on for five (5) minutes after completing spraying operations to purge the chamber.
- (g) Booths shall provide a level of air velocity at any point within the booth that complies with the following requirements:
 - (i) minimum air velocity for downdraft booths and cross-draft booths where drafts from outside the booth is equal to or less than 0.2 meters per second: 0.5 meters per second;
 - (ii) minimum air velocity for downdraft booths and cross-draft booths where drafts from outside the booth is more than 0.2 meters per second: 0.8 meters per second; and
 - (iii) minimum air velocity for electrostatic spray painting and spray finishing without operator: 0.4 meters per second.

3.4 Spray Finishing Operations outside a Booth

- (a) Where it is not reasonably practicable to do the spray finishing in a booth and it is carried out in a building or structure other than a confined space, the building or structure shall be of open construction or a mechanical exhaust system shall be used to prevent the buildup of flammable or toxic fumes.
- (b) Appropriate control measures shall be implemented to protect the spray finisher, other employees or persons in the vicinity, and the environment, from hazards associated with spray finishing operations. A spray finishing exclusion zone, with restrictions on entry, shall be designated around the area where the spray finishing is being carried out. An exclusion zone in itself will not provide appropriate protection and shall be used in conjunction with other appropriate control measures.
- (c) All spray finishing operations shall be conducted in an isolated location, "exclusion zone." A spray finishing process is not effectively isolated from other operations if paint from the spray finishing operation can be inhaled by any persons engaged in work near the area. Neither is it effectively isolated from plant, machinery or

equipment if there is danger of the plant being ignited by a source of ignition associated with the plant, machinery or equipment.

- (d) In general, the exclusion zone shall be at least 6 metres horizontal and 2 metres vertical clearance above and below the place where the spray finish is being applied; however, in determining the size of the exclusion zone, the following factors shall be considered:
 - (i) the nature of the substance being sprayed;
 - (ii) the work environment, including wind speed, ambient temperature and humidity;
 - (iii) fire and explosion hazards;
 - (iv) the location and physical conditions of the site; and
 - (v) whether other people are reasonably foreseeable to be in the vicinity. Relocation of employees not involved in spray finishing activities to other parts of the workplace may be necessary.
- (e) Greater vertical clearance may be required when spray finishing in stairwells and other areas which allow vertical movement of vapors.
- (f) Once a spray finishing exclusion zone has been established, a number of procedures shall be implemented to control risks. These include:
 - (i) physical barriers and warning signs to prevent unprotected persons from entering the exclusion zone;
 - (ii) shrouding of the area where spraying is to occur;
 - (iii) restricted entry of unprotected persons into the exclusion zone for a time period that ensures airborne concentrations of hazardous substances have reduced to below the relevant exposure standards;
 - (iv) removal of hazardous substances that are not immediately needed for spray finishing work, to reduce unnecessary exposure and fire or explosion risks;
 - (v) removal of stored wastes such as solvent-soaked rags and waste paint from within the exclusion zone to control fire or explosion risks;
 - (vi) removal of electrical and ignition sources, including smoking, from within the exclusion zone to control fire and explosion risks;
 - (vii) restriction of spraying when wind speed is greater than 15 kilometers per hour; and
 - (viii) restriction of spraying within 50 meters of the boundary to adjacent premises or a greater separation where car parks and other sensitive property is located.
- (g) Consideration shall be given to ensure spray drift in walkways, public areas and air conditioning intake vents is controlled. Persons other than the spray painter shall not enter the exclusion zone during a spray painting operation unless equivalent personal protective equipment is worn. A sign stating "SPRAY PAINTING AREA - AUTHORISED PERSONNEL ONLY" shall be prominently displayed at the exclusion zone.

- (h) Where spray finishing using two-pack paints containing isocyanates is carried out in the open air, all persons within 15 meters of the spraying operation shall wear respiratory protection.

3.5 Spray Finishing Operations in a Workroom

- (a) When it is not reasonably practicable to use a booth to contain the spraying operation, for example when spraying large items of steelwork or equipment. In this case, spraying may be carried out in a workroom provided appropriate control measures are implemented.
- (b) If the room to be used for spraying is within a building, there shall be half-hour fire separation between the spray room and the rest of the building. If the spray area is part of a larger room (for example, a hangar), employers shall divide the room with fire-resistant curtains to define the spraying area and provide fire protection.
- (c) Before spraying, all potential sources of ignition shall be removed. Unprotected electrical equipment shall be removed or isolated. If there has to be any electrical equipment in the spray room, a risk assessment and hazardous area classification shall be carried out to decide the level of protection required.
- (d) Employers shall conduct continuous atmospheric monitoring / air sampling to ensure compliance to permissible LEL.
- (e) Ventilation shall be provided to maintain the concentration below 25% at any point of time (occasional peaks) and shall be maintained below 10% of the LEL on a continuous monitoring basis. Monitoring using an explosimeter is required. The use of a spray system, that reduces the quantity of solvent used and the overspray produced, is recommended. Care shall be taken to ensure that the ventilation system is effective at low level and anywhere vapors could accumulate.
- (f) Applicable controls listed in other relevant sections of this document shall be followed.

3.6 Spray Finishing in Confined Space

- (a) Spray finishing operations that are conducted in confined spaces shall be performed in accordance with the requirements of *ADOSH-SF - CoP 27.0 - Confined Spaces and ADOSH-SF - CoP 21.0 - Permit to Work Systems*.
- (b) Employers shall consider if it is reasonably practicable that a flammable liquid is be ignited at a temperature lower than the stated flash point when the paint is atomized. Ignition sources identified as a part of risk assessment shall be eliminated prior to the commencement of spraying.
- (c) Sources of ignition inside the confined space shall be prohibited and any lighting used shall be protected to a standard appropriate for flammable and explosive atmospheres.
- (d) Any unprotected equipment used, such as fan motors, compressors, switches and alarms shall be sited in safe areas outside the confined space where they cannot be exposed to flammable concentrations of vapor.

- (e) Ventilation within the confined space until the coating is dry and there is no further risk of a flammable atmosphere.

3.7 Mixing and Pouring

- (a) During any mixing and pouring of spray finishing materials, the employer shall ensure:
 - (i) appropriate ventilation is maintained;
 - (ii) all containers are appropriate, grounded, bonded and labelled;
 - (iii) Safety Data Sheets are available;
 - (iv) appropriate protective equipment is worn (refer to the relevant SDS);
 - (v) mixing and pouring shall be conducted by mechanical means where reasonably practicable;
 - (vi) appropriate spill kits and equipment are available; and
 - (vii) spills are cleaned up immediately.
- (b) If spray painting substances are splashed on clothing or the body, the contaminated clothing shall be immediately removed and the skin thoroughly cleaned with soap and water.
- (c) Solvents and thinners used to clean work areas shall not be used to clean employee's skin.
- (d) Unused or surplus liquid shall be returned to the container designated for that liquid.

3.8 Atmospheric Monitoring / Air Sampling

- (a) When hazardous materials are used for spray finishing, the work atmosphere shall be monitored through air sampling to assess the employee exposures.
 - (i) air sampling results shall be compliant to ADOSH-SF - Occupational Standards and Guideline Values; and
 - (ii) if air sampling results exceed the permissible exposure limits set by ADOSH-SF - Occupational Standards and Guideline Values, then controls shall be implemented to reduce / prevent employee exposures.
- (b) If monitoring results indicate that control measures are required to reduce / prevent employee exposures, air sampling shall be used to assess the effectiveness of the control measures.
- (c) Air sampling records shall be maintained that include:
 - (i) who performed the sampling;
 - (ii) procedures used for air sampling;
 - (iii) location of air sampling;
 - (iv) date and time of sampling;
 - (v) serial number of equipment used for sampling;
 - (vi) calibration data for sampling equipment;

- (vii) analytical methods used for sampling;
 - (viii) laboratory used to analysis of samples;
 - (ix) laboratory certifications;
 - (x) chain of custody for the samples;
 - (xi) sampling results; and
 - (xii) report of findings and corrective actions.
- (d) Laboratory analysis shall be conducted by laboratories approved by the Emirates Standardization and Metrology Authority (ESMA).

3.9 Storage and Labelling of Spray Finishing Materials

- (a) Materials shall be labeled, handled, stored and segregated as per the manufacturer's requirements and that of *ADOSH-SF - CoP 1.0 - Hazardous Materials*.
- (b) Labels shall be securely attached to containers so that they cannot be inadvertently or accidentally detached during use, transport and storage.

3.10 Maintenance and Cleaning

- (a) When spray finishing equipment is in use, it shall be cleaned daily or at the end of each shift.
- (b) Employers shall develop a maintenance program that ensures equipment is working appropriately and provides early detection of any defect in control measures that could result in a reduced level of protection.
- (c) Spray finishing equipment shall be inspected prior to use on each shift. Examination of the equipment shall include:
 - (i) visual inspection of equipment looking for worn equipment, damaged equipment, integrity of joints / connections / hoses and any leaks;
 - (ii) personal protective equipment shall be inspected to ensure it is clean and is not damaged; and
 - (iii) if a local exhaust ventilation system is used, it shall be inspected to ensure it is working appropriately and filters are in good condition.
- (d) Service records shall be maintained that include:
 - (i) equipment and control measures which require servicing;
 - (ii) nature of the servicing needed;
 - (iii) frequency of the servicing;
 - (iv) who is responsible for the servicing;
 - (v) documentation of defects and how they were corrected; and
 - (vi) performance testing and evaluation.

3.11 Occupational Health

- (a) Employees shall not be allowed to eat, drink, or smoke in the vicinity of spray finishing operations. No open containers of food or drink shall be stored within or close to spray finishing operations where contaminants could enter the open container.
- (b) Changing rooms and showers shall be provided at the worksite for employees working in spray finishing operations, as per the requirements of *ADOSH-SF - CoP 8.0 - General Workplace Amenities*.
- (c) Employers shall have a first program in compliance with *ADOSH-SF - CoP 4.0 - First Aid and Medical Treatment*.
- (d) Employers shall have a medical surveillance program in compliance with *ADOSH-SF - CoP 5.0 - Medical Surveillance*.

3.12 Emergency Response

- (a) Emergency Response procedures compliant to *ADOSH-SF - Element 6 - Emergency Management* shall be developed for all spray finishing operations. Requirements for emergencies involving spray finishing operations include medical emergencies, chemical spills, leaks, fire, explosions etc. as identified through the Risk Assessment as required by Section 3.1(a) of this CoP.
- (b) First aid procedures in accordance with *ADOSH-SF - CoP 4.0 - First Aid and Medical Treatment* shall be developed.

4. References

- *OSHA Ventilation Standard for General Industry (29 CFR 1910.94)*
- *Work Safe Western Australia Commission- Code of Practice on Occupational Safety and Health Act 1984 and Occupational Safety and Health Regulations 1996*
- *UK HSE Book HSG 178- The Spray of Flammable Liquid*
- *UK HSE Book HSG 188- Health Risk Management- Guide to working with solvents*

5. Document Amendment Record

<i>Version</i>	<i>Revision Date</i>	<i>Description of Amendment</i>	<i>Page/s Affected</i>
4.0	1 st Jan 2024	<i>System acronym updated from OSHAD-SF to ADOSH-SF to accurately reflect document title</i>	Throughout
		<i>Change from OSHAD to ADPHC</i>	
		<i>Change of Logo</i>	
		<i>Minor editorial changes throughout the document without changing requirements.</i>	
		<i>Title of Mechanism 7.0 updated to ADOSH-SF - Mechanism 7-Occupational Safety and Health Practitioner and Service Provider Registration</i>	
		<i>OSHAD-SF - Mechanism 8.0 - OSH Practitioner Registration deleted</i>	



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