

SSPC: The Society for Protective Coatings

PAINT APPLICATION GUIDE NO. 3

A Guide to Safety in Paint Application

NOTE: SSPC-PA Guide 3 is currently being revised and updated. This version is provided for reference purposes. Although much of the general information it contains is still relevant, references to regulatory information and requirements may be dated. The user is cautioned to obtain the latest versions of regulations and requirements.

1. Scope

1.1 All necessary precautions should be taken to protect personnel and property from accidents due to falls, fumes, fire, explosion, or other dangers. Recommendations made herein are not all-inclusive and do not supplant or replace other measures covering unusual conditions. They are not intended to conflict with or supersede any federal, state, or local statute or regulation or the controls listed in Section 2.

1.2 This guide defines methods and practices which are most practical in maintaining safety during application of protective coatings on steel structures. Complete coverage of all aspects is not presented. The objective of this guide is to itemize basic actions and care that should be considered while working in or on access facilities, using professional tools to apply materials having potential hazards.

1.3 All personnel involved in the application of protective coatings should be aware constantly of the several hazards with regard to access facilities, specialized tools, and toxic or flammable materials. Many workers have some knowledge of one or two of these categories, but each should be advised of all precautions necessary and trained to prevent or eliminate dangerous conditions in all three areas.

1.4 Areas not included herein which appear in other SSPC documents:

- safety in surface preparation;
- pretreatment methods;
- removal of existent coatings;
- specialized areas of coil and appliance ceramics, container high bake coatings, and powder coatings; and paint manufacturing plants.

2. Regulating Controls

2.1 Federal laws should govern all works. Most of these are defined in the rulings of OSHA.

2.2 State safety requirements should exert control in relevant areas whenever federal law does not cover projects.

2.3 Municipal or township ordinances should be followed whenever specific rulings impose restrictions beyond the federal and state controls.

2.4 Safety practice and rulings may come from area labor groups. Such should control actions for improved personnel relations.

2.5 Some contract specifications may contain requirements for safe methods of practice for specific areas.

2.6 Rules of safety by individual contractors should be adhered to since such are based on previous experiences.

2.7 All safety instructions received from the paint manufacturer should be followed.

2.8 Safe storage regulations should control all work regardless of source: civil law, contractor rule, labor rule, designer specifications.

3. Sources of Safety Information

The following list is by no means all-inclusive. For a list of internet safety resource addresses, see SSPC-Guide 17.

3.1 National Safety Council, 1121 Spring Lake Drive, Itasca, IL 60143

3.2 Occupational Safety and Health Administration (OSHA) Standards, Superintendent of Documents; U.S. Government Printing Office, Washington DC 20402.

- 29 CFR 1910 Occupational Safety and Health Standards for the General Industry
- 29 CFR 1926 Occupational Safety and Health Standards for the Construction Industry

3.3 American National Standards Institute (ANSI), 14 Broadway, New York, NY 10018.

- ANSI A14.1 Ladders – Portable Wood – Safety Requirements
- ANSI A14.2 Portable Metal Ladders
- ANSI Z87.1 Practice for Occupational and Educational Eye and Face Protection
- ANSI Z88.2 Practices for Respiratory Protection
- ANSI Z9.3 Exhaust Systems – Spray Finishing Operations – Ventilation and Safe Practices for Fixed Location Enclosures

3.4 Associated General Contractors of America, 333 John Carlyle Parkway, Alexandria VA 22314.

3.5 Fire Protection Guide to Hazardous Materials (HAZ01), National Fire Protection Association, 1 Batterymarch Park, Quincy, MA 02169-7471.

3.6 Industrial Ventilation—A Manual of Recommended Practice, American Conference of Governmental and Industrial Hygienists, 1330 Kemper Meadow Drive, Cincinnati OH 45240.

3.7 Federal Specification BB-A-1034 (inactive, but available.)

4. Definitions

4.1 Personnel includes all people who may have reason to spend time on the jobsite. All classes of painters, helpers, foremen, inspectors, managers, and owners of items involved should be considered.

4.2 Coating includes all liquid materials which may be applied to any surface for purposes of protection or decoration of that surface. Application may be with brush, roller, air gun, airless gun, trowel, and hand mitten.

4.3 Solvents are those liquids which dissolve coatings and reduce their viscosity to that suitable for application. They have a wide range of both volatility and flammability and evaporate from the applied film to leave the solids base for protection and decoration of the substrate.

4.4 Access means include all staging scaffolds, ladders, ropes, and other equipment to be used to place paint and painter in position for applications.

4.5 Preventives include both equipment and actions which may in any way increase a margin of safety for all persons at the jobsite during any phase of the operation.

5. Coatings

5.1 HANDLING COATING MATERIALS: Coatings materials should be stored in safe, well ventilated areas where sparks, flames, and the direct rays of the sun can be avoided. Containers should be kept tightly sealed until ready for use. Warning tags should be placed on toxic materials.

Recommended safety rules for mixing operations include the following:

- Use eye protection (goggles, etc.).
- Use protective gloves.
- Keep the face and head away from the mixing container.
- Use protective face cream.
- Avoid splash and spillage, and inhalation of vapors.

- Mix all materials in well ventilated areas away from sparks and flames.
- Use low-speed mechanical mixers.
- Clean up spillage immediately.
- Avoid excessive temperatures.

Protective devices and equipment required for application of coatings materials are determined by the type of coating as well as by the environment. The coatings manufacturers should provide Material Safety Data Sheets on each product. Unless definite information regarding explosion and toxicity hazards inherent in the material are provided by the manufacturer, a written request for such data should be made before starting the coatings application. Records of previous applications using similar materials also should be examined.

5.2 HEALTH HAZARDS OF COATING MATERIALS:

A coating material may be considered a health hazard when its properties are such that it can either directly or indirectly cause injury or incapacitation, either temporary or permanent, from exposure by contact, inhalation, or ingestion. (Refer to Threshold Limit Values for Chemical Substances in Workroom Air.)

Degrees of health hazard are ranked according to the probable severity of injury or incapacitation, as follows:

5.2.1 Materials that, on very short exposure, could cause death or major residual injury even though prompt medical treatment was given. Types of these materials are:

- Materials that can penetrate ordinary rubber protective clothing
- Materials which, under normal conditions, give off gases which are extremely toxic or corrosive through inhalation or through contact with or absorption through the skin

5.2.2 Materials that, on short exposure, could cause serious temporary or residual injury even though prompt medical treatment was given. Types of these materials are:

- Materials giving off highly toxic combustion products
- Materials corrosive to living tissue or toxic by skin absorption

5.2.3 Materials that, on intense or continued exposure, could cause temporary incapacitation or possible residual injury unless prompt medical attention is given. Types of these materials are:

- Materials giving off toxic combustion products
- Materials giving off highly irritating combustion products
- Materials which, under either normal conditions or fire conditions, give off toxic vapors lacking warning properties

5.2.4 Materials that, on exposure, can cause irritation but only minor residual injury even if no treatment is given. Types of these materials are:

- Materials that, under fire conditions, give off irritating combustion products
- Materials that cause irritation to the skin without destruction of tissue

5.2.5 Materials which, on exposure to fire conditions, offer no hazard beyond that of ordinary combustible material.

5.3 FLAMMABILITY HAZARDS OF COATING MATERIALS:

A coating material may be considered a flammability hazard when it will burn under normal conditions.

Virtually all solvent solution coatings are highly flammable in liquid form, and vapors released in the process of application are explosive in nature if concentrated in sufficient volume in closed or restricted areas. Even vapors from ordinary enamels and oil paints may be accumulated in such density as to result in explosive reaction if a source of ignition is present. Generally speaking, however, solvents used in solvent solution coatings are more volatile and dangerous than those used in conventional paints or coatings.

Degrees of hazard are ranked according to the susceptibility of materials to burning, as follows:

5.3.1 Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature, which are readily dispersed in air, and which will burn. Types of these materials are:

- Any liquid that is liquid under pressure and having a vapor pressure greater than 14.7 psig (101 kPa) at 38 °C (100 °F)
- Materials which may form explosive mixtures in air, such as mists of flammable or combustible liquid droplets

5.3.2 Materials that can be ignited under almost all ambient temperature conditions. These materials produce hazardous atmospheres with air under all ambient temperatures and are readily ignited. Types of these materials are:

- Materials having a flash point of 38 °C (100 °F) or below and having a vapor pressure not greater than 14.7 psig (101 kPa) at 38 °C (100 °F)
- Materials that ignite spontaneously when exposed to air

5.3.3 Materials that should be moderately heated or exposed to relatively high ambient temperature before ignition can occur. Materials of this type are those having a flash point above 38 °C (100 °F) but not greater than 93 °C (200 °F).

5.3.4 Materials that should be preheated before ignition can occur. These materials are those that will support combustion for five minutes or less at 815 °C (1,500 °F).

5.3.5 Non-combustible materials.

5.4 TOXICITY OF COATING MATERIALS: Some of the pigments used in organic coating materials are toxic. Lead compounds and chromates are particularly dangerous, whether ingested or inhaled. Some paint additives, such as the mercurial compounds used to impart fungicidal properties, may be toxic if ingested.

The epoxies used in epoxy coatings and compounds are particularly irritating to the skin, and some persons are seriously affected by allergic reactions if proper hygiene is not practiced. Common reactions include swelling around the eyes or lips, rashes of the skin, etc. Some epoxy coatings have polyamides as curing agents that react much like a mild acid on tender mucous membranes.

The following basic safety precautions should govern the use of ALL coatings:

- Know the material with which you are working.
- Read and follow the precautions on the label. Always provide adequate ventilation (OSHA Standard 29 CFR 1910.94).
- Guard against fire, flames, and sparks, and do not smoke while working.
- Avoid breathing of vapors or spray mist.
- Use protective skin cream and other protective equipment.
- Avoid ingestion of toxic materials.
- Wash hands carefully before eating or smoking.
- Change clothing that has soaked up toxic materials
- Practice good personal hygiene.

6. Solvents

6.1 A wide variety of solvents are used in the formulation of modern coatings. Many of these solvents are highly flammable and must be handled with extreme care. In addition, these solvents are toxic to varying degrees and may cause serious effects to those working with them. Excessive breathing of concentrated solvent vapors may cause dizziness or nausea, excessive drying or irritation of the mucous membranes, and in rare cases, allergic reactions to the skin.

6.2 Even common solvents that are ordinarily considered innocuous may be harmful if inhaled in high concentrations or for prolonged periods. For example, turpentine can cause narcotic poisoning and kidney damage when excessive amounts are inhaled. Systemic damage may also result from an acute dose (sufficient to produce unconsciousness), or from repeated excessive inhalation of such common solvents as acetate esters, alcohols, or ketones. Solvents such as toluene, xylene, ethyl ether, cyclohexanone, butyl alcohol, and the nitroparaffins have a relatively low chronic toxicity, but their narcotic effect in high concentrations can lead to unconsciousness followed by respiratory failure and death unless the victim is promptly restored to fresh air. Even the least toxic of the common paint and lacquer solvents can be dangerous in very high concentrations because of their narcotic effect, excepting the alcohols

which are irritants (to the eyes and upper respiratory tract) rather than toxicants.

6.3 Some common solvents usually not used directly in paints but often encountered in paint removers and cleaning liquids are dangerously toxic even at relatively low concentration; for example, methyl alcohol when inhaled or ingested repeatedly or to the point of unconsciousness may cause death or permanent blindness. Benzene is a dangerous, cumulative poison that causes severe damage to the liver and blood-forming tissues of the body. Many chlorinated solvents, particularly chlorinated aliphatic hydrocarbons, are toxic; chloroform, for example, has poisonous after-effects, while carbon tetrachloride and seldom used tetrachloroethane are dangerously toxic with severe chronic, cumulative effects on the kidneys, liver, and lungs. Since solvent-type paint removers frequently contain highly toxic solvents, they should be used only with adequate ventilation controls and/or respiratory protection.

6.4 The toxic systemic effects of organic solvents can be produced by absorption through the skin as well as by inhalation. Acute or chronic dermatitis or systemic poisoning may result from repeated or prolonged contact of toxic solvents with the skin. Sometimes, the vehicle resin itself may be irritating or toxic to the skin while the resin is in the uncured state. The catalysts or hardening agents (e.g., organic amines) used in two-component coating systems are frequently volatile and toxic materials until they have been incorporated into the resin.

6.5 Avoid unnecessary or prolonged contact with the skin; the use of protective clothing and skin creams can eliminate the need for scrubbing the skin with toxic solvents. If the maximum allowable concentration of solvent in the air is exceeded, then fresh air masks should be supplied for the workmen.

7. Airless Sprayers

7.1 As far as practicable, the recommended safety precautions of the National Safety Council as published in their Industrial Data Sheet No. D-296, "Bridge Painting" should be followed, particularly when working outdoors or on elevated structures.

7.2 Particular care should be exercised when working in closed spaces, especially when spraying.

- Equipment and work should be grounded.
- Use only nonsparking tools.
- Keep matches, smokes, and open flame away from the area.

7.3 Airless guns of the type which atomize paints and fluids at high pressure—1,000 pounds or more to the square inch (6900 kPa)—should be equipped with automatic or visible manual safety devices which cannot permit the operator to

pull the trigger and release the fluid until the safety is manually released.

If the gun has no safety control, it should have a diffuser nut which will prevent high velocity release while the nozzle tip is removed, plus a nozzle tip guard which will prevent the tip from coming into contact with the operator.

7.4 In airless spraying, an unpressurized reservoir is used, as pressure is applied only to the paint in the pump, line, and spray gun. This type of spray represents a hazard of hypodermic injection of paint into persons who accidentally contact the stream.

The extremely high fluid pressure developed in airless spray painting equipment causes a powerful stream of paint to be discharged for some distance. **THIS PRESSURE REMAINS IN THE SYSTEM EVEN THOUGH THE PUMP HAS BEEN SHUT OFF AND CAN BE RELIEVED ONLY BY BEING DISCHARGED THROUGH THE GUN.**

The pressure is also dangerous when the nozzle has been removed. Some equipment is provided with a device that will prevent a hypodermic stream whenever the tip has been removed and the trigger squeezed.

Extreme care should be taken when pressure is being relieved from the system, and manufacturer's recommendations should be followed.

7.5 SAFE OPERATING PRACTICES: If safe operating practices are followed, reasonable care exercised by the operator, and equipment maintained in good order, the airless spray painting method is as safe as conventional methods. The following precautions should be part of every operator's training and should be strictly observed and rigidly enforced:

7.5.1 Check all hose connections and fittings to ensure that they are tight and not leaking. The fluid hose should be designed to withstand the high pressure to which it is subjected. The hose, gun, and pressure vessel should be equipped with special fittings not interchangeable with low pressure fittings.

7.5.2 Check the fluid hose to be sure that there are no weak or worn spots. Make certain the hose does not contact moving parts of machinery, or lie over and around sharp edges and corners, or come near objects that would damage it. Check for deterioration due to the exposure to chemicals or ordinary wear and tear. High pressure leaks from the hose or from the connections can cause hypodermic injections just as the gun tip can.

7.5.3 Do not disconnect the gun from the fluid hose or the hose from the pump until the pressure has been released from the hose. This is accomplished by first closing off the main line air pressure to the pump and then bleeding off the pressure in the fluid hose by triggering the gun.

7.5.4 When handling the gun but not actually spraying—for example, while changing piece parts or work position—hold the gun by the grip and remove the fingers from the trigger.

7.5.5 NEVER POINT AN AIRLESS GUN AT ANY PART OF THE HUMAN BODY—YOUR OWN OR ANYONE ELSE'S!

7.5.6 Airless spray guns cannot be cleaned with the same methods used for conventional air-operated guns. It is hard to force waste material out of the gun except through its head, and material released at such high pressures can be driven into the fingers or hand if they are held over the spray cap or head of the gun.

7.5.7 The gun should have a guard which completely protects the trigger. When the gun is under pressure but not being used, the safety latch should be kept in the non-operating position.

7.5.8 If production rates or paint usage rates are to be increased, or solvent changes made, existing controls should be reviewed to maintain safe conditions.

7.6 RULES FOR SAFETY WITH PRESSURIZED EQUIPMENT: The following safety rules apply to conventional and airless spray equipment, sandblasting equipment, and water blasting equipment that operate under pressure.

7.6.1 Use only pressure equipment that has been constructed as specified by the National Board Code and the ASME Code for Unfired Pressure Vessels.

7.6.2 Test safety relief valves used on pressure equipment daily.

7.6.3 Use remote control deadman valves with pressure equipment. Be sure that the deadman valves are a pneumatic type that use the same air for activation that is used for blasting or spraying.

8. Ladders

8.1 GENERAL SAFETY RULES:

8.1.1 See that all ladders conform to ANSI A14.1, "Ladders - Portable Wood - Safety Requirements" and ANSI A14.2, "Portable Metal Ladders, Safety Requirements."

8.1.2 Inspect ladders frequently. Look for loose steps or rungs; loose screws, bolts, metal braces, and rods; split or broken side rails or rungs; and loose or bent hinge spreaders.

8.1.3 When ladders are found to be lacking in any safety device or to be defective in any manner, they should not be used. Ladders found to be too defective for repairs should be destroyed.

8.1.4 Protect ladders with clear protective coatings so that cracks, splinters, or breaks will be readily visible.

8.1.5 Store ladders in a warm, dry place protected from contact with the ground.

8.1.6 Equip all straight and extension ladders with safety shoes, unless special conditions prohibit their use.

8.1.7 Do not use portable ladders greater than 60 feet in height. If greater heights are to be reached, provide intermediate landing platforms and use separate ladders.

8.1.8 Single ladders not constructed for use as sectional ladders should not be spliced together to form a longer ladder.

8.1.9 Extension ladders should not be taken apart in order to use either section separately.

8.1.10 Extension ladders should have a minimum of 15% overlapping of each section.

8.1.11 Ladders made by fastening cleats across a single rail should not be used.

8.1.12 Do not use stepladders over 20 feet in height.

8.1.13 Never use a stepladder as a straight ladder.

8.1.14 Never use the platform of a stepladder as a top step on which to stand.

8.1.15 In placing portable ladders, be sure that the horizontal distance from the top support to the foot of the ladder is one quarter of the working length of the ladder.

8.1.16 Straight and extension ladders should be "tied-off" when in use. A helper should hold the ladder while it is being tied or untied at the top.

8.1.17 When it is necessary to place a ladder over a doorway, the doorway should be roped off and signs should be erected to warn users of the door of the ladder's presence.

8.1.18 Ladders should never be used as skids, braces, scaffold members, or for any other purpose than that for which they are intended.

8.1.19 DO NOT USE METAL LADDERS OR STAGES IN AREAS WHERE CONTACT WITH ELECTRIC POWER LINES IS POSSIBLE.

8.1.20 Use hand lines, not ladders, to raise or lower materials and tools.

8.1.21 Do not reach too far in any direction while working from a ladder. Frequent changes in a ladder's position can forestall accidents from this source.

8.1.22 Always face the ladder when ascending or descending.

8.2 All ladders should be supported so that they are level at the base and given sufficient bearing so that they cannot sink into the supporting surface. Both hands should be free when climbing ladders. It is preferable that the hands hold the sides of the ladder, rather than the rungs, when going up or down.

8.3 The following table is the minimum for the construction of wood ladders.

8.4 The following table is the minimum for the construction of a double wood ladder. Double ladders over 24 feet in length should not be used.

9. Scaffolding

9.1 Scaffolds should be provided for all work that cannot be done from the ground or from solid construction, except such work as can be done safely from ladders.

9.1.1 Scaffolds, platforms, runways, etc., should be kept free from loose sand, mud, grease, or other materials, any one of which could cause slipping, tripping, or overloading.

9.1.2 Stairs, ladders, or other safe means of access should be provided to all work areas. The use of cross members or framework as a means of access to working areas should not be permitted.

9.1.3 All rolling scaffolds should be equipped with a positive locking device to prevent accidental movement of the scaffold.

9.1.4 The sections of metal scaffolds should be securely connected together using the regular patented and manufactured connections. Improvised connections, such as a turn or two of rope, should not be permitted.

9.1.5 Runways, ramps, platforms, and scaffolds over six feet in height should be effectively guarded by the careful and workmanlike installation of guard or hand rails of 36 inches to 42 inches from the deck, with an intermediate rail and toe boards, not less than six inches in height, or side screens, as necessary, to protect workmen or property below from falling objects.

9.1.6 All metal ladders, scaffolds, towers, and similar equipment should be erected in accordance with manufacturer's specifications and load limits should not be exceeded.

9.1.7 Discarded packing boxes, barrels, piles of loose lumber, or other makeshift or "jury" rigging, should not be used for scaffolds or as supports.

TABLE 1
DIMENSIONS FOR WOOD LADDERS

Cross-section Length in feet	Inside Width in inches		Uprights	Cleats
	Bottom	Top		
10 to 12	20	17	2 x 4 in	7/8 x 3 in
12 to 16	21	10	2 x 4 in	7/8 x 3 in
18 to 20	23	20	2 x 7 in	7/8 x 3 in

TABLE 2
DIMENSIONS FOR DOUBLE WOOD LADDERS

Inside Wide Left Side	Right Side	Cross-section Uprights	Cleats
18 in	18 in	2 X 4 in (to 12 ft.) 2 x 6 in (12 to 24 ft.)	1 x 3 in

9.2 GENERAL SAFETY RULES FOR SCAFFOLDING:

9.2.1 Inspect all equipment before using. Never use equipment that is damaged or deteriorated in any way, especially rusted.

9.2.2 Inspect erected scaffolding regularly to make sure it is maintained in safe conditions. Consult the scaffolding supplier when in doubt.

9.2.3 Provide adequate sills for scaffold posts and use baseplates.

9.2.4 Plumb and level all scaffolds as the erection proceeds. Use adjusting screws instead of wood blocks to adjust for uneven grade conditions. Do not force braces to fit—level the scaffold until proper fit can be made easily.

9.2.5 Fasten all braces securely. Do not climb across braces.

9.2.6 On wall scaffolds, place and maintain anchors securely between structure and scaffold at least every 30 feet of length and 25 feet of height.

9.2.7 When scaffolds are to be partially or fully enclosed, specific precautions should be taken to assure the frequency and adequacy of ties attaching the scaffolding to the building. This is because of increased load conditions resulting from wind and weather. The scaffolding components to which the ties are attached also should be checked for additional loads.

9.2.8 Freestanding scaffold towers should be protected against tipping by guying or other means.

9.2.9 Equip all planked or staged areas with proper guard rails and add toeboards as required.