Designation: D3091 – 72 (Reapproved 2016)

Standard Practice for Safe Filling of Low-Pressure Pressurized Products[1]

This standard is issued under the fixed designation D3091; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the filling of low-pressure pressurized products, either in the laboratory or in production.

1.2 The values stated in inch-pound units are to be regarded as standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements, see Section 2.

2. General Safety Precautions

2.1 Suitable storage should be supplied, both in the plant and laboratory, for toxic or flammable substances. Manufacturers' labels should be observed for toxicity or flammability information.

2.2 Adequate fire extinguishers should be located at vital points in the plant and laboratory. For small laboratory fires an extinguisher such as carbon dioxide is probably more suitable, since it is cleaner in operation.

2.3 Suitable first aid equipment should be available in both the plant and laboratory. Personnel should be instructed in proper first aid treatment to be used for different types of injuries that may occur.

2.4 Safe practices should be encouraged by lectures and constant reminders, such as posters, on the value of safety procedures.

2.5 New operations should be inspected closely for any possible hazards, and necessary means should be devised to guard against such hazards.

3. Laboratory Research and Experimental Work

3.1 *Storage of Propellants and Chemicals:*

3.1.1 *Propellants*—Cylinders should be stored in cool, dry, accessible places. Care should be exercised in handling cylinders so that they do not drop or strike each other violently. When cylinders are tapped, all connectors should be leak-free.

3.1.2 *Chemicals*—Suitable storage for flammable chemicals and concentrates should be available. Any glass containers should be handled with care to avoid breakage.

3.2 *Handling Propellants and Concentrates :*

3.2.1 *Propellants*—Laboratory personnel should be carefully instructed in preventing burns and freezing when handling propellants with low boiling points. Precautions should be taken for the possible accumulation of propellants to a point where the normal oxygen content is decreased. Adequate vents should be supplied. When venting the propellants from pressure burets or cold filling lines, precautions should be taken to prevent over accumulations of propellant vapors, and to minimize flammability hazards.

3.2.2 *Concentrates*—Proper ventilation should be provided for the handling of highly toxic liquids. Manufacturers' instructions should be observed for toxicity information concerning the raw materials used. Personnel should be instructed not to smoke or have any burners working in the vicinity of the use of flammable liquids.

3.3 *Handling of Sealing Machinery :*

3.3.1 All laboratory machinery, such as crimpers and seamers, should have adequate protection at those portions where accidents may occur. For example, all moving belts on seamers should have guards or protective shields, or a device should be installed on crimpers to eliminate the possibility of getting hands caught between the crimping head and the can.

3.3.2 When sealing valves onto glass containers, care should be taken so that the machinery does not damage the bottle, thereby causing possible future hazards when the bottle and contents are examined at elevated temperatures. All crimps and seams should be carefully inspected before the units are brought to higher temperatures, thereby minimizing future accidents due to defective containers.

3.3.3 All crimping of both glass and metal containers should be measured in accordance with industry standards as to depth, diameter (in the case of cans), and depth and run-out (in the

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case of glass), to assure adequacy of the crimp prior to the insertion of the unit in a hot-water bath or high-temperature storage program.

3.4 *Handling of Containers:*

3.4.1 All aerosol containers can be hazardous in laboratory work, regardless of whether the containers are of plain glass, safety-coated glass, or metal. The following precautions should be observed:

3.4.1.1 Guard against overfills. When using a new type of container, determine what is a safe fill before packing it.

3.4.1.2 Guard against defective containers. Inspect all glass containers before use. Inspect all can seams for visible flaws. Take care not to damage the containers during the pack, as such defects can cause serious accidents later on in the tests. Inspect and discard empty containers for defects such as dirt and rust, to prevent their use for samples and subsequent stability programs.

3.4.1.3 When examining containers in a hot-water tank, provide adequate protection such as safety shields.

3.4.1.4 Always wear protective face shields when working with any container under pressure.

3.4.1.5 Always handle glassware under pressure carefully, regardless of the pressure. All glassware under pressure should be covered with a protective screen or coating.

3.4.1.6 Guard against excessive pressure in all containers.

3.4.1.7 Check storage oven mechanisms periodically to prevent the possibility of overruns in temperature that may cause explosions with the containers under heat storage tests. Appropriate types of electrical equipment should be utilized when the oven is used for the storage of products containing flammable solvents or vapors. The ovens should be equipped with adequate ventilation to prevent the build-up of vapors due to leakage.

3.4.1.8 Perform all spray testing of valves in an adequately vented hood.

3.4.1.9 When conducting open- and closed-drum tests, place the drum in a well-vented atmosphere, such as outdoors or inserted in a hood, or both, to adequately vent the contents of the drum at the completion of the test. The fumes from such tests can be toxic, and should be handled accordingly.

4. Commercial Refrigeration Filling

4.1 *Handling of Propellant:*

4.1.1 Safe methods for unloading propellant cylinders are as follows:

4.1.1.1 If the cylinders are shipped by truck, it is advisable to build a platform that will be level with the tailgate of the truck and the building floor. A fork lift can then go into the truck and not have to raise its platform more than 6 in. (152 mm) to unload the cylinders. Provisions should be made so that the cylinders can not slip off the fork lift.

4.1.1.2 When using a hoist to lift the cylinders off of trucks or railroad cars, employ the proper equipment. The hoist, chains, hooks, and runner beams should be selected to handle the mass of the cylinders plus a safety factor. The equipment should be periodically checked for flaws, and personnel should be instructed in its proper use. It should be impressed upon those unloading the cylinders that all grabbing hooks and chains are to be secured before unloading.

4.1.2 Safe methods for storing and tapping cylinders are as follows:

4.1.2.1 Cylinders are protected from excessive pressures due to heat by fusible plugs in the container and valves that melt at 157°F (69°C). Never permit live steam or direct flame to be applied to any part of the container.

4.1.2.2 Store the containers in a cool, dry, accessible place, keeping them away from salt or other corrosive chemicals or fumes as rusting will damage the containers and cause the valve hoods to stick. The containers must not be dropped or permitted to strike each other violently. To avoid this, securely block the containers.

4.1.2.3 Do not tamper with the safety devices in the valve or container.

4.1.2.4 Replace the brass on plastic protective caps on the valves of the cylinders to prevent dirt from entering the valves and damage to the threads on the valve connections. Secure the valve hoods after the container has been emptied.

4.1.2.5 If heat must be applied to propellant containers proceed using one of the following: either (*1*) Apply hot air heat from steam coils, steam space heaters, or electric resistance heaters but, do not immerse the container in a hot water bath or under any circumstances apply a blow torch or open flame, or (*2*) Heat by the use of infrared lamps, using a clamp-on thermocouple on the container surface to control the lamps. An additional precaution against overheating is having a cut-out switch on the lamp circuit that is actuated by the pressure of the propellant by means of a direct connection to the container outlet line during the heating period.

4.1.2.6 The excessive accumulation of propellant vapors at various points in the plant is another factor to be considered in the handling of propellants. Although the vapors themselves are relatively nontoxic, the tendency is for a decrease in the oxygen content of the atmosphere. Excessive vapors will probably accumulate on the floor around the filling line, due to the high vapor density of the propellants. If care is not exercised, the accumulation of propellant vapors may exceed a tolerable amount. The normal oxygen content of the air is 21 %. When the oxygen content is less than 16 %, life cannot be supported. A possible solution to this would be the installation of an exhaust system along the floor.

4.2 *Handling of Concentrates:*

4.2.1 If the concentrate ingredients are blended at the filling plant, precautions should be taken when handling and mixing. If the ingredients are toxic, adequate ventilation should be provided (for example, an exhaust system). Regardless of what the ingredients are, mixing should be done in an enclosed tank to prevent splattering of the material.

4.2.2 Concentrate tanks should be equipped with safety valves, especially if the concentrate is highly volatile. Safety valves set to open at a designated pressure, relative to the concentrate being used, will prevent excessive build-up of the pressure.

4.2.3 Appropriate precautions should be taken if the concentrate is flammable or toxic.

4.3 *Can Unscrambler*—Safety devices should be installed if the possibility of injury to the operator setting the cans onto the unscrambler exists. An automatic shutoff should be installed in the case of jam-ups.

4.4 *Point of Filling:*

4.4.1 Precautions should be taken to prevent the splattering of concentrates and propellants by the installation of a closed-in area with a clear plastic or glass shield in front of the operators.

4.4.2 Exhaust hoods should be installed over the point of filling to evacuate harmful vapors.

4.5 *Filling Point to Valve Crimper :*

4.5.1 *Liquid Fill*—Overfilled cans are dangerous and should be avoided. The following checks should be installed:

4.5.1.1 Constant checking of metering devices on filling units, and

4.5.1.2 Some type of check for the liquid contents of the cans. The checking of can mass (probably the most widely used system for checking can contents) should be in use if no automatic equipment is available. These checks should be made as often as possible.

4.5.2 *Dangerous Vapor Protection*—An exhaust hood should be installed to eliminate dangerous vapors.

4.5.3 *Valve Crimper*—Constant monitoring of the valve-crimping phase should be maintained to ensure adequacy of the crimp depth and diameter measurements. Any indication that the measurements are out of specification should result in the immediate shutting down of the line to correct and prevent improperly crimped cans from passing into the hot-water bath.

4.6 *Hot-Water Tanks*—Take the following precautions at this, the most important point of the aerosol filling operation:

4.6.1 Shields should be installed over the hot-water tanks to provide protection against units that may explode, or the personnel should wear face shields. For added protection, the operators should be supplied with safety glasses.

4.6.2 A dependable thermostatic control should be installed to keep the bath temperature at the desired level. The heating apparatus, as well as the heat control apparatus, should be periodically checked.

4.7 *Spray Testing*—All spray testing should be conducted in an exhaust hood. The operators should be instructed to determine the direction of the spray from the valve, depending on the valve being used, to prevent spraying on themselves.

4.8 *Storage of Finished Units:*

4.8.1 The finished units should be stored in a cool, dry place, if they are to be retained at the filling plant for any length of time before shipment.

4.8.2 Suitable cartons and stacking methods should be employed to prevent unnecessary damage to the units.

5. Commercial Pressure Filling

5.1 Safety shields should be installed in front of the filler to safeguard against the possibility of container explosion.

5.2 Safety guards should be installed on all exposed parts of the machinery where it is possible for an operator to be injured.

5.3 A close check should be kept on all metering devices to prevent the possibility of dangerous overfills.

5.4 The units should be checked for overfills after the filling by either an automatic checker or the weighing of the cans.

5.5 If flammable propellants are handled, the following precautions should be taken:

5.5.1 Constant monitoring of the vapor concentration should be maintained by an automatic gas analyzer. These controls should be part of a system that would allow the immediate shut-off of the propellant flow should the vapor concentration approach a critical point (that is, a maximum of 25 % of the low explosive limit). Explosion-proof equipment is mandatory.

5.5.2 All personnel operating in areas utilizing flammable propellants should take the following precautions:

5.5.2.1 Non-sparking tools should be used. The tools should be made of metals such as aluminum or beryllium copper.

5.5.2.2 Rubber-soled shoes should be worn.

5.5.3 The area surrounding the propellant handling should be designed for spark-free control.

5.6 All pressure lines handling high-pressure liquids should contain pressure switches for automatic relief of high pressures developed during the pumping operations.

5.7 All other safety measures concerning the handling of the propellant and concentrate, the can unscrambler, the point of filling, the valve crimper, and after filling procedures should be in accordance with Section 4.

6. Keywords

6.1 aerosol containers; aerosol products filling; low pressure aerosol packaging; aerosol containers; pressure filling; propellants; safety hazards