

Operating Procedures and Risk Analysis

	HEADING	OBSERVATIONS	ACTION TO AVOID
1.1	Dropping a pallet	When loading, unloading or moving pallets, they could be dropped or fall over resulting in injury to personnel and severe damage to the gas cylinders	Correct and appropriate training for fork lift truck operators.
1.2	Dropping bundles	Due to the geometry of some of the bundles of gas cylinders, it is possible that during carrying, one or two of the gas cylinders may become loose resulting in all the gas cylinders cascading out.	Carry the bundles on their side and try to avoid carrying them by their straps.
1.3	Stacking bundles	When bundles are being stacked on top of each other, it is possible to damage the top face/sealing area of the lower bundle, as a bundle is placed on top.	Never stack bundles directly on top of each other. Separate bundles with cardboard and stack gently.
1.4	Exterior damage to gas cylinders	If individual gas cylinders are not handled carefully, it can result in denting and damage to the sealing face, damage to the thread, damage to the main body and scuffing of the paintwork.	Correct operator training, with an emphasis on careful handling.
2.1	Valve design	If the pressurised extinguisher were to be dismantled for any reason by a less than competent person, who has forgotten to vent the extinguisher first, as the valve reaches the last thread or two, it is likely that the thread will fail and the valve will be fired from the gas cylinder.	The valve should be manufactured with a vent cut into the thread, through which the gas can escape as it is unscrewed and correct operator training.
2.2	Valve and gas cylinder corrosion	It is possible that under certain circumstances to do with the nature of the environment, that an electric circuit may be created between the valve and the gas cylinder, resulting in galvanic corrosion.	E.C.S. (Midlands) recommends, to eliminate the risk of this occurring, that all the valves assembled into the gas cylinders be nickel plated. Refer to E.S.R 2.8 of the E.C.S. (Midlands) Technical File No. 3, revision 4.
2.3	Valve assembly	Cross threading, resulting in damaged threads. Undertightening would result in loss of pressure and a severe risk of creep failure of the sealing ring. Overtightening would result in stripping of the thread of the gas cylinder.	Correct operator training and particular caution when "starting" the valve. Suitable lubrication of the sealing area, compatible with the seal and the filling medium. Before using it is advisable to contact E.C.S. (Midlands) for suitability. The tightening torque should not exceed 67 N/m.
2.4	Clamping the gas cylinder during valve torquing	Excessive pressure used to hold the gas cylinder could result in denting the body and the grippers could scuff the paintwork.	Ensure correct design of clamp appropriate to the gas cylinders.

2.5	Contents	The aluminium gas cylinders do not have any internal protection against corrosion.	Before filling the gas cylinder with any medium, the filler should undertake tests, that he feels suitable, to verify that the contents he intends to use will not corrode the inside of the gas cylinder to an unacceptable level, within the specified life of the fire extinguisher. As a minimum, the filler should carry out the corrosion tests specified in BS EN 3-7. Refer to E.S.R, 2.6 of the E.C.S. (Midlands) Technical File No. 3, revision 4.
3.1	Filling	It is essential that whatever medium is put inside the cylinder, that the developed pressure at 60°C does not exceed the maximum that the gas cylinder is designed for, which is 18.8 bar.	Only personnel qualified and capable of doing such calculations shall determine the filling specification. The filler should also perform a practical experiment to verify the calculations. Refer to E.S.R 2.10 of the E.C.S. (Midlands) Technical File No. 3, revision 4.
3.2	Filling and developed pressures	It is essential that the gas cylinder is filled within the design specifications.	It is recommended that the valve used is fitted with a pressure gauge. Ideally the gauge should comply with BS EN 3-7, having a maximum centre line of 15.3 bar. In the event of the media being liquefied gas, reference should be made to BS 5355 to ensure that the maximum developed pressure does not exceed 18.8 bar, excepting cylinder F0605 which does not exceed 23.0 bar at 60°C. Refer to E.S.R 2.9 of the E.C.S. (Midlands) Technical File No. 3, revision 4.
3.3	Pressure due to chemical reaction	It is essential that the filled contents do not react with each other or the internal aluminium surface of the cylinder.	The filler should perform a practical experiment to ensure the chemical stability of the contents once filled.
3.4	Incorrect filling	Failure to operate correctly	Regular calibration of scales, correct operator training, with an emphasis on careful monitoring of tare and full weights.
3.5	Incorrect gassing	Undercharging and overcharging will result in a failure to operate correctly. When the valve used does not contain a safety relief valve, overcharging, when the product is subject to heat, could result in catastrophic explosion.	Correct operator training. If there is a risk of the product being subject to heat, use valves with safety relief valves. Any gas cylinder which is overfilled should be destroyed. Refer to E.S.R. 2.10 of the E.C.S. (Midlands) Technical File No. 3, revision 4.

3.6	Safety margin	To reduce the risk of overfilling.	E.C.S. (Midlands) suggest that the filler uses filling pressures lower than the maximum calculated filling pressures to give a safety margin and a margin for accuracy errors during filling, to reduce the risk of over-pressurisation. Refer to ESR 2.10 of the E.C.S. (Midlands) Technical File No. 3, revision 4.
4.1	Fire	Whilst in service the product could be engulfed by fire.	The product is not designed to withstand temperatures of more than 100 ⁰ C and should be destroyed if it is subject to temperatures greater than this for any duration Refer to ESR 2.1.2 of E.C.S. (Midlands) Technical File No. 3, revision 4.
4.2	Damage	The product could be subject to all types of damage in the field, such as dents, paintwork scratches, etc.	The product is designed to withstand small dents. It is very difficult to quantify the size of an acceptable dent. Reference should be made to BS 5306-3, which specifically defines dents and it is really a matter for the competent person carrying out the inspection to decide, from his experience, whether the dent is too severe or acceptable. As a general rule, an unacceptable dent is any dent greater than 2 mm deep or when the distance across the minor axis of the dent is less than 30 times its depth. Refer to BS 1802 Guidance on Rejection Limits. In the case of unacceptable dents, the product should be scrapped. Cylinders with acceptable dents may continue in service, provided there is no actual cut to the metal. Paint damage is subjective and down to the customer.
4.3	External corrosion	This should only occur if the paint has been damaged and the product is subjected to severe condition, such as a damp environment, at sea, etc.	The product will not look very nice and the customer may wish to replace it. It can withstand a small amount of uniformed external corrosion, provided the layer is slight and there is no localised pitting. It cannot withstand localised corrosion and should be destroyed in such circumstances. Refer to BS 1802, Guidance on Rejection Limits.

4.4	Internal corrosion whilst in service	This can occur if the filling medium is corrosive when in contact with aluminium.	It is possible to determine if the internal corrosion has reached an unacceptable level, without emptying the product. If small bumps can be felt under the paint, when the exterior of the gas cylinder is felt very gently by fingertip, the product should be emptied and the gas cylinder destroyed.
4.5	Internal corrosion at refilling	A uniform white deposit can occur on the inside of the cylinder which is acceptable	If any localised internal corrosion is noticed at the time of refilling, the product should be destroyed.
4.6	Surge pressurisation	It is allowable for pressure equipment to experience a momentary pressure surge during filling, up to a maximum of 10% of the filling pressure, provided a suitable protection device is fitted.	It is recommended that all valves used with the gas cylinders be fitted with a safety relief valve, set at approximately 1.1 x PT. However, this device is not intended to act as a surge protector and it is recommended that operator training be sufficient, so that momentary pressure surges do not occur during filling.
5.1	Non fire extinguisher use	It is possible to use the gas cylinders for applications other than fire extinguishers. The temperature constraints and maximum developed pressure constraint must be applied. The fill ratios should be calculated by the filler, depending upon the application.	In all cases, prior to other use, for the suitability or otherwise of the gas cylinders, the filler should contact E. C. S. (Midlands).
5.2	Use	The intended use for the gas cylinder is as part of a portable fire extinguisher. It should be installed to an appropriate code of practice.	It is recommended that installation be in accordance with the requirements of BS 5306-8 and that regular training be given to staff in the correct use of portable fire extinguishers in accordance with BS 5306-3..
5.3	Mis-use	The intended use for the gas cylinder is as part of a portable fire extinguisher. It should not be used for any other applications.	The filler should issue a warning to all his customers that this is a pressurised fire extinguisher and it should only be used for extinguishing fires.
5.4	Maintenance	The gas cylinder is designed in such a way that very little maintenance is possible. It cannot be repaired if the sealing face is damaged, the thread is damaged or the body is dented and must be scrapped. It is possible to repaint the body.	When repainting, it may be necessary to remove all the old paint. The chemical used to do this must be selected so that it does not corrode the aluminium during stripping, it must be totally rinsed off after stripping and the gas cylinder must be dried. It is only possible to use paints that require a stoving temperature of less than 90°C for a maximum duration of 15 minutes.
5.5	Wear	The base of the gas cylinder has a small additional thickness for wear	The complete fire extinguisher should be

		and abrasion. The gas cylinder has no allowance in the design for erosion and abrasion.	mounted in the intended wall mounting bracket and should remain in that bracket at all times, except when needed to tackle a fire. For information as to whether the gas cylinder can continue in service after erosion or abrasion has occurred, reference can be made to BS 5306-3 or consult E.C.S. (Midlands). Refer to E.S.R. 2.7 of the E.C.S. (Midlands) Technical File No. 3, revision 4.
5.6	Operating instructions	If these operating instructions are not used, the filler or user could be put at risk.	A copy of these Operating Procedures is available on the E.C.S. (Midlands) website at www.ecsmidlands.com . These procedures should form part of the users formal documentation and be used in operator training.