



**AZERBAIJAN BUSINESS UNIT
(AzBU)**

**Procedure for:
Welding and Cutting**

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1 INTRODUCTION

1.1 DOCUMENT PURPOSE

This document provides the information necessary to ensure that welding, burning and associated activities are carried out in a safe and efficient manner, without harm to personnel or damage to equipment and the environment.

1.2 DOCUMENT SCOPE

This document applies to all welding, burning and associated activities carried out on sites managed by BP in Azerbaijan and Georgia. The activities covered by this document include the:

- storage and maintenance of welding and burning equipment
- preparations and precautions to prevent fire and explosion (including the safe storage and handling of equipment)
- preparations and precautions to be taken during specific welding and burning activities, e.g., welding in confined spaces, welding on tanks, etc.

1.3 ASSOCIATED PROCEDURES

Depending upon the nature and circumstances of the activity, this procedure should be used in conjunction with:

- *UNIF-HSE-PRO-103 Permit to Work*
- *UNIF HSE-PRO-108 Confined Space Entry*

Note: Welding, burning, grinding or any other operation that generates heat or sparks, e.g., abrasive cutting, shall be carried out under the control of the Permit to Work System.

The conditions laid down on the permit to Work will be adhered to at all times.

2 RESPONSIBILITIES

2.1 SITE MANAGER

Site Managers have overall responsibility for the safe use of welding and burning equipment on their sites and shall:

- use only welding and burning contractors who employ suitably competent and experienced personnel
- advise all welding and burning contractors with regard to flammable materials and hazardous conditions
- establish approved areas for burning and welding
- establish approval procedures for burning and welding.

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2.2 AREA AUTHORITY

The Area Authority is responsible for the safe execution of burning and welding within his area of authority and shall:

- inspect the work site before welding or burning is permitted and at least once per day during the work
- ensure that welding and burning equipment is maintained in satisfactory operating condition and in good repair
- ensure that welding and burning activities are carried out under the appropriate supervision.

2.3 PERFORMING AUTHORITY

The Performing Authority is responsible for:

- the safe use of the burning or welding equipment
- determining the nature and quantity of combustible materials and hazardous areas present at the work site
- obtaining a Permit to Work from the Area Authority
- ensuring that fire protection and extinguishing equipment are properly located at the site
- ensuring fire watches are available at the site when required
- making a final check of the work site 30 minutes after the completion of burning or welding operations
- ensuring that combustibles are safe from ignition by:
 - moving the work to a location free from dangerous combustibles
or...
 - having the combustibles moved to a safe location
or...
 - having the combustibles properly shielded against ignition
- ensuring wherever possible that any operation that might expose combustibles to the risk of ignition is not scheduled during burning or welding activities.

2.4 WELDER

The Cutter and / or Welder shall:

- have approval by the Performing Authority before starting to cut or weld
- cut or weld only where conditions are safe
- stop working if conditions change from those under which the Permit to Work was granted
- after finishing work, ensure nothing is burning or smouldering near the work site.

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2.5 FIRE WATCHER

A fire watch shall be maintained for at least 30 minutes after the completion of burning or welding operations, in order to detect and extinguish smouldering fires.

Fire Watchers shall:

- have fire extinguishing equipment readily available and be trained in its use (including practice on test fires)
- be familiar with the facilities and procedures for sounding an alarm in the event of a fire
- watch for fires in all exposed areas, and shall:
 - sound the alarm immediately

and...

 - try to extinguish them (only when obviously within the capacity of the equipment available).

3 GAS WELDING AND BURNING EQUIPMENT

3.1 IDENTIFICATION OF CYLINDERS

3.1.1 Cylinder Markings

All cylinders shall be permanently and legibly labeled or stamped with the following:

- trade symbol of manufacturer
- serial number
- calculated quantity (tare) of empty mass
- manufacturing date (month, year)
- next inspection/test date, adjacent to the previous one (month, year)
- service pressure (psi/bar)
- test pressure (psi/bar)
- capacity (cubic feet/litres).

All markings shall be stamped on the shoulder of cylinders near valves.

Note: Do not remove or change any numbers or marks stamped on cylinders.

3.1.2 Cylinder Colour Coding

Compressed gas cylinders are painted in accordance with the National Color Coding System to properly identify their contents. The required color codes for Azerbaijan and Georgia are listed in *Table 1*.

Note: Where the cylinders cannot be identified in accordance with this colour coding standard, they shall not be used, and shall be returned to the supplier.

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Gas	Bottle Colour	Label Text	Label Colour
Propane	Red	PROPANE	White
Acetylene	White	ACETYLENE	Red
Butane	Red	BUTANE	White
Air	Black	COMPRESSED AIR	White
Oxygen	Blue	OXYGEN	Black
Carbon dioxide	Black	CARBON DIOXIDE	Yellow

Reference: Regulation of "Structure (working principles) and Safe Operation of Pressure Vessels" – Moscow 1976

Table 1 Compressed Gas Cylinder Identification

3.2 CYLINDER STORAGE

3.2.1 All Cylinders

All cylinders **shall be stored** in a cool, well ventilated area preferably in the open air. They should be chained or otherwise secured and valve caps should be kept in place when cylinders are not in use.

Cylinders **should not be stored** in enclosed spaces such as workshops, accommodation or enclosed modules on offshore installations.

All cylinders **shall be stored away from**:

- the direct rays of the sun or from radiant heat, e.g., flares
- locations where the temperature may exceed 45°C (113°F)
- locations exposed to adverse weather

Note: Weather protection shall be provided if required

- possible sources of ignition
- flammable materials
- corrosive liquids
- any direct contact with soft or damp ground, or any other location where water can accumulate, thereby increasing exposure to the possible effects of corrosion.

Empty cylinders shall be marked with "EMPTY" or "MT", and stored separately from full cylinders.

Note: Regardless of whether or not cylinders have been marked, all cylinders shall be handled and treated as if they were full.

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3.2.2 Oxygen Cylinders

Warning: Oils and greases are spontaneously combustible in the presence of oxygen.

Oxygen cylinders and their fittings, including hoses, **must not** be stored or used where they can come into contact with oil or grease. This includes handling the equipment with oily hands, gloves or rags.

Oxygen cylinders must be stored apart from fuel gas cylinders by a minimum distance of 3 metres (10 feet). Separation by using cylinders of non-flammable gases is acceptable. This separation must be maintained.

The preferred practice is to store oxygen cylinders vertically, valve end up. However, it is acceptable to store oxygen cylinders horizontally provided that:

- the stacks shall not exceed a maximum height of three cylinders
- the largest cylinders must be at the bottom
- the row must be securely wedged.

3.2.3 Acetylene and Propane Cylinders

Warning: Acetylene cylinders **must not** be stored or used in a horizontal position. All acetylene cylinders, full or empty, shall be stored and used in the vertical, valve end up position.

3.2.4 Damaged Cylinders

Cylinders that may have been damaged in any way shall be returned to the supplier.

Leaking cylinders shall immediately be moved to a freely ventilated area away from any source of ignition or places where leaking gas will become trapped.

3.2.5 Cylinders Exposed to Fire

In the event of gas cylinders being involved in a fire, they must be kept cool with water spray, e.g., a fog nozzle, and where possible, removed to a safe area. Such cylinders must be returned to the manufacturer for checking prior to re-use.

In the case of acetylene cylinders that have been so exposed, prolonged cooling is necessary for several hours after the incident to prevent exothermic decomposition.

3.3 CYLINDER HANDLING

3.3.1 Lifting

If cylinders are lifted by crane, a suitable cradle or similar device should be used. If a trolley is used as a cradle during lifting, care should be taken to ensure that its base is strong enough to take the weight of the cylinders.

Cylinders **shall not** be lifted using:

- the cylinder valves
- chain or wire rope slings (these can allow the cylinder to slip during lifting).

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3.3.2 Movement of Cylinders on Site

Note: Cylinders **shall not** be dropped, dragged, rolled, or used as supports.

In addition, the cylinder valves must be protected from damage at all times.

Cylinders should be transferred to, and moved within, the working area on trolleys specifically designed for that purpose, or in suitable containers providing stable and secure positioning of the cylinders.

All valves must be closed before a cylinder is moved and, if the correct trolley is not being used, regulators and hoses should be detached from the cylinders.

3.3.3 Electric Cables

Cylinders and gas hoses shall not be allowed to come into contact with current carrying wires. Therefore:

- special attention should be paid to the places where electro-welding and gas burning of metals are carried out simultaneously
- the distance from oxygen or fuel gas cylinders to electro-welding cables shall be not less than 1 m.

3.4 CYLINDER FITTINGS

3.4.1 Acetylene Fittings

Warning: Wherever copper comes into direct contact with acetylene, the explosive compound Copper Acetylide may be formed.

Only approved alloys of less than 70% copper shall be used for acetylene fittings.

Where approved fittings are silver soldered, the solder should contain no more than 40% silver and 20% copper.

3.4.2 Regulators

Only automatic pressure regulators and pressure gauges as recommended by the gas cylinder supplier shall be fitted to oxygen and fuel gas cylinders. These pressure regulators provide the following safety features:

- provision of a filtered supply of gas at a constant delivery pressure
- safety diaphragms that burst before the bonnet is blown off
- pressure gauges with safety backs that deflect the venting gas.

Note: The adjustable screw on the regulator must always be released before the cylinder is opened.

3.4.3 Valves

To avoid leaks and possible dangerous gas build-up, valves and fittings shall be kept scrupulously clean, and care taken to ensure that no grit or foreign matter is allowed to remain on them.

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Note: The use of any kind of packing in the valve joints is strictly forbidden. Packing, particularly lead or copper, can easily be forced into the orifice, causing a blockage.

3.4.4 Valve Keys

Only standard valve keys shall be used, and cylinder valves shall always be opened slowly by gently tapping the key.

Keys with long leverage should never be employed to force a valve shut.

3.4.5 Blowpipes

Only high pressure blowpipes may be used with high pressure equipment.

All blowpipes shall be dismantled and cleaned internally at regular intervals. During use, accumulated slag should be frequently removed from the blowpipe tip during operation. To avoid severe blockage, care should be taken to avoid dipping the blowpipe tip into molten metal.

Only the manufacturer's recommended tip clear should be used for cleaning or altering the blowpipe tip.

Note: Hard metal reamers shall not be used to clear the blowpipe tip.

3.4.6 Hoses

Unnecessarily long lengths of hose should be avoided. Oxygen and fuel gas hoses should be the same length.

Only good quality hoses fitted with check valves (to prevent gas flowing back from the blowpipe) are acceptable for use. Faulty or damaged hoses **must not** be used.

Hoses are supplied with connections suitable for standard regulators and blowpipes. If required, hose lengths should be joined by the use of crimped connecting fittings, not hose clips.

In order to identify and / or prevent possible blockage, hoses should be blown through with air before being connected to regulators and blowpipes.

Warning: Under no circumstances shall oxygen be used for ventilation or to blow through acetylene hoses. Explosions can occur when acetylene gas is present in air in any proportion between 2.5% and 80% by volume.

When in use, hoses should be protected from damage, and laid out in such a manner as to avoid being a tripping hazard.

3.4.7 Flashback Arrestors

Flashback arrestors, which quench flashback flames and cut off the gas flow automatically, must be incorporated in all oxygen lines and fuel gas lines.

3.4.8 Damaged / Faulty Cylinders and Fittings

Cylinders with faulty outlet valve connections, e.g., damaged threads, seized valve spindles, etc., must be returned immediately to stores with a note stating the cylinder

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number, the nature of the fault and whether the cylinder is charged.

Note: Under no circumstances may the user of the cylinder attempt any repair whatsoever.

Cylinders with leaking valves that cannot be shut off must be removed to a safe area away from any possible source of ignition and drainage, where they shall be allowed to vent off slowly until empty. Stores shall be advised of the fault.

Note: Propane and Butane are heavier than air and may accumulate in dips and hollows.

4 ELECTRIC ARC WELDING AND BURNING EQUIPMENT

4.1 WELDING SETS

All welding sets must be maintained in good condition, and be of adequate capacity.

Where stationary transformers or generator sets are used, a suitable switch must be mounted adjacent to the equipment to provide isolation from the supply main.

Diesel driven welding sets shall not be used except with the formal agreement of the Site Manager for each occasion of use. If used, the sets must be approved for the area in which they are sited.

Note: The engine must not be refuelled whilst in operation.

In order to protect the trailing leads and the equipment, portable transformers or generator sets with trailing leads, must be provided with interlocked fused switch sockets and plugs.

Under no circumstances shall the welder:

- connect and disconnect the welding device from the electricity supply network when the connection is anything other than a plug and socket
- repair electro-welding machines (such repairs shall be carried out by a competent electrician only).

4.2 CABLES AND CONNECTIONS

All cables, connectors and terminators must be maintained in good condition, and be of adequate capacity. To avoid long lengths of power cables the machine must be sited as close as possible to the workplace.

All supplies for welding equipment must be made of approved cables and connections, and must be controlled from a circuit which includes protection sensitive to earth fault currents.

Welding leads and returns shall comprise flexible, tough rubber covered cables, using approved cable couplers where necessary. Leads shall be properly terminated and cable couplers and terminations must be of adequate carrying capacity.

Welding leads must be inspected daily for any damage. In the case of worn or torn cable sheaths, or flattened or kinked cables, the affected part should be removed.

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Welding return leads must always be used to prevent uncontrolled welding currents passing back from the work-site to the generator through the structure and/or plant items. This could give rise to sparks or cause damage to bearings in machines, etc. Particular attention should be paid to welding returns when welding on pedestal crane booms, so that currents cannot pass through main slew bearings.

Note: It is prohibited for the welder to commence or continue welding operations with faulty cables, starting devices or electrode holders.

4.3 ELECTRODE HOLDERS

Electrode holders shall be provided with a handle of tough, insulating non-ignitable material with a guard disc of similar material between the hand of the operator and the projecting line portion.

A fully insulated holder or hook should be provided for the live electrode holder when not in use. Laying live electrode holders on gloves, face screens or handing them up by the electric cable where it could come in contact with other equipment etc., is discouraged.

Warning: Electrode holders under voltage **must not** be left unattended.

4.4 EARTHING AND BONDING

For all AC welding transformers, the transformer low voltage winding must not be earthed but the transformer case must be effectively bonded to an earthing system adjacent to the equipment.

The DC welding output of all AC driven DC welding generators must not be grounded. The machine frame must be effectively bonded to ground.

For engine driven DC welding generators, no earth connection must be applied to the generator output terminals.

The work piece must be bonded to earth by means of a heavy section conductor having suitable clamped or bolted connections.

Under no circumstances shall pipelines or structures be used for grounding purposes. The ground connection shall be directly into the work piece.

5 WELDING AND BURNING - HAZARDS AND PRECAUTIONS

5.1 PERSONAL PROTECTION EQUIPMENT

Personnel engaged in, or working in close proximity to, welding, burning, chipping and grinding operations must use the appropriate protective clothing/equipment, e.g., goggles, face shields, welding helmets, welding screens, gloves, leather aprons, etc.

The necessity for protective clothing against sparks and pieces of hot metal, depends upon the position of the arc in reference to the welder's body.

For some classes of welding, e.g., where the welder is standing at a bench, the head screen and gauntlets may well provide sufficient protection.

A thick apron of leather or other suitable material may be needed if the welder is

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sitting at his work position, where molten metal may fall upon his thighs and legs.

If the arc is above the level of his shoulders or overhead, complete protection for the head, arms and upper part of the body is necessary.

5.1.1 Welding Helmets, Welding Shields and Flip-Front Goggles

The specifications for welding helmets, welding shields and flip-front goggles shall comply with:

- *EN 169 "Specification for filters for PPE used in welding"*
- *EN 175 "PPE for eye and face during welding"*
- *EN 166 "Eye protection".*

5.1.2 Wide Vision Welding Goggles

The lenses of wide-vision welding goggles shall conform to *BS 679* and their frames to *BS 1542*.

5.1.3 Coveralls

Flame retardant welders coveralls shall be approved to:

- *BSEN 470*
- *BSEN 531*.

5.1.4 Gauntlets

Note: For gauntlets used for electric arc welding, see *Additional Protection for Electric Arc Welding* below.

Gauntlets used for welding, brazing and burning shall conform to:

- *BSEN 407*
- *BSEN 388 (Mechanical Risk)*
- *BSEN 420 (General Requirements)*.

5.1.5 Additional Protection for Electric Arc Welding

Gloves or gauntlets made of non-ignitable material are required for shielding the hands and arms from sparks and heat radiation of the welding arc. Leather gloves and gauntlets give no protection against electrical hazards. In particular, for electric arc welding, oiled or greased clothes and gloves shall not be worn.

As well as normal protective clothing, while performing electric arc-welding in hazardous conditions (welding of wet structures) electric welders shall use:

- dielectric gloves (*BSEN 388*)
- overshoes (*BSEN 345*)
- rubber mats.

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5.2 FUMES AND GAS RISK

Welding, burning, and brazing operations, etc., can produce toxic fumes and gases, the composition of which depends on welding temperature, arc intensity, electrode material and the gas mixture being used. Therefore, it must be ensured that:

- any organic coatings are removed prior to any welding and burning
- gases/fumes are removed either by natural ventilation or forced mechanical ventilation
- a suitable respiratory system should be available as a back up if the ventilation system is inadequate.

Warning: Respiratory protection must be worn where the welding or burning of cadmium alloys or a cadmium-coated material takes place.

5.3 FIRE AND EXPLOSION PREVENTION

Note: Welders and helpers must always be alert to the danger of fire and explosion.

5.3.1 Restrictions on Welding and Cutting

Cutting or welding is only permitted in areas that are fire safe.

Note: Cutting or welding **is not** permitted:

- in areas not authorised by the Area Authority
- in buildings where sprinkler systems have been inhibited
- in the presence of explosive atmospheres, e.g., mixtures of flammable gases, vapours, liquids, or dusts with air
- on pipelines where mechanical seal plugs are to be used, or where "hot tapping" procedures are to be employed on live lines, without written authorisation from the Site Manager.

Welding or burning shall not take place in restricted areas without a Hot Work (Naked Flame) Permit. In addition, the conditions laid down on that permit must be strictly observed.

5.3.2 Approved Welding and Cutting Areas

Within the confines of an operating plant or building, the burning and welding work area shall be either:

- a specific area designed or approved for such work, i.e., a maintenance shop
- or...**
- a detached outside location of non-combustible or fire-resistive construction, essentially free of combustible and flammable contents, and suitably segregated from adjacent areas.

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Where work cannot be moved practically, as in most construction work, the area shall be made fire safe by removing combustibles or protecting combustibles from ignition sources.

5.3.3 Area Preparation

Fully charged and operable fire extinguishers, appropriate for the type of possible fire, shall be available at the work area. Where hose lines are available, they shall be connected and ready for service.

Work must be screened to prevent sparks from flying outside the immediate welding area and all combustible material must be removed or covered with fire resistant material. Combustible materials such as paper clippings, wood shaving, or textile fibres on the floor shall be swept clean.

If welding is to be carried out on a metal wall, partition, ceiling, or roof, precautions shall be taken to prevent ignition of combustibles on the other side due to conduction or radiation. The preferred precaution is to relocate combustibles. However, where it is not possible for the combustibles to be relocated, a fire watch on the opposite side from the work shall be provided.

Any drains in the area must be plugged, gullies cleaned and if possible water filled and finally covered with fire blanket.

Openings or cracks in walls, floors, or ducts within 11m of the site shall be tightly covered to prevent the passage of sparks to adjacent areas.

Conveyor systems that might carry sparks to distant combustibles shall be protected.

Combustible floors shall be kept wet, covered with damp sand, or protected by fire-resistant shields.

Warning: Do not wet down floors where electric arc welding or burning equipment is to be used.

5.3.4 Removal of Slag

Slag shall not be cleaned from newly welded joints until it has had time to cool.

Safety goggles must be used for slag removal.

5.3.5 Welding on Tanks and Vessels

Note: Before welding on tanks and vessels may take place, inspection by the Area Authority will be necessary to decide on the precautions to be taken.

All tanks, vessels and equipment on which welding, cutting, burning, brazing and soldering work is carried out, must be either free from flammable gases and vapours and cleaned of all traces of liquid, wax or solid hydrocarbons, or provision made for excluding oxygen, e.g., filled with nitrogen, high expansion foam or similar product.

The space between double plates or wear plates, where flammable material may be found, must be considered. Work on a main deck forming the roof of an in-deck tank must be given special consideration.

Before cutting the bottom plates of any tank, test holes must be drilled and a gas test taken, to ensure that conditions are safe under the tank floor.

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5.3.6 Unattended Welding Equipment

Blowpipes and hoses, if not in use, must not be left in vessels or enclosed spaces. If blowpipes and hoses cannot be removed from the space, the connections must be disconnected at the cylinders.

Note: Closing the cylinder valves is not classified as a disconnection.

Whenever equipment is to be left unattended, gas cylinder valves shall be shut, hoses de-pressurised and disconnected.

Electrical power supply for welding machines shall be switched off and disconnected. Any diesel driven welding sets shall be shut down.

5.3.7 Work Using Scaffolding

Gas cutting or welding operations involving the use of scaffolding is allowed only after taking measures to prevent the scaffold boards from ignition and molten metal falling on people below.

Maximum height of gas cutting point above lower located tier (metres)	0	2	5	7	10
Radius of sparks scattering (metres)	6	8	10	12	14

5.3.8 Fire Watchers

An active fire watch shall comprise at least one nominated person, whose sole duty consists of fire watching. This person shall be provided with suitable portable fire extinguishing equipment. In addition fire blankets and a pressurised fire hose may be provided depending on location/site conditions.

The fire watch shall ensure that the areas are left in a safe condition by inspecting the work area and any adjacent areas that may be affected 30 minutes after welding or burning work ceases.

Trained and competent personnel to act as fire watch shall be required by the Area Authority whenever burning or welding is performed in locations where:

- fire and gas detection systems have been inhibited to permit burning or welding to take place
- appreciable combustible material in building construction or contents is closer than 11 metres to the point of operation
- appreciable combustible materials are more than 11 metres away but are easily ignited by sparks
- wall or floor openings are within an 11 metre radius and give access to combustible material in adjacent areas, including concealed spaces in walls or floors
- combustible materials are adjacent to the opposite side of metal partitions,

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walls, ceiling, or roofs and are likely to be ignited by conduction or radiation.

5.4 CONFINED SPACES

All personnel involved in welding and burning operations in confined spaces must comply with the requirements of this procedure and the requirements defined in:

- UNIF-HSE-PRO-103 Permit to Work
- UNIF-HSE-PRO-108 Confined Space Entry.

In particular, when welding or burning in a confined space:

- **forced ventilation** shall be maintained in the space at all times
- **organic coatings** shall be removed prior to any welding and burning
- **gas cylinders** shall not be taken into the space at any time; they shall be sited outside the space with the hoses laid through suitable transits and protected from damage
- **welding transformers** shall not be placed inside the space; they shall be sited outside the space with the cables laid through suitable transits and protected from damage
- where work in confined spaces takes place over several days, welding hoses and equipment shall be removed from the space overnight in case of gas build-up due to leakage
- **lighting** inside the confined space during welding operations shall be provided by mobile light fixtures with a voltage of no more than 25V. Lights shall be fitted with wire protection cages

5.5 WELDING AND BURNING ON SMALL CONTAINERS

Before any hot work is carried out on any container that may have been used to store petroleum products or other flammable or combustible materials the following guidelines must be followed, and the Safety Adviser must certify the container free of gas and chemicals.

1. Drain the container of all contents.
2. Steam out the container thoroughly **or** submerge the container in boiling water for at least one hour.

Note: Compressed air purging or washing out with hot / cold water may not sufficiently clean the vessel of flammable materials and therefore **shall not** be used as methods of preparation for repair purposes.

3. Blow through the container with compressed air until the container is dry.

During repairs, air (**not oxygen**) must be blown through the vessel to prevent the

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build-up of unburned gases.