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**Safety in welding and allied
processes**

Part 1: Fire precautions

This Australian Standard was prepared by Committee WD/4, Welding Safety. It was approved on behalf of the Council of Standards Australia on 11 July 1997 and published on 5 September 1997.

The following interests are represented on Committee WD/4:

Australasian Railway Association
Australian Institute of Occupational Hygienists
Australian Institute of Steel Construction
Australian Manufacturing Workers Union
Australian Stainless Steel Development Association
Master Plumbers Australia
Metal Trades Industry Association of Australia
Welding Technology Institute of Australia
WorkCover New South Wales

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AS 1674.1—1997

Australian Standard[®]

**Safety in welding and allied
processes**

Part 1: Fire precautions

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PREFACE

This Standard was prepared by the Standards Australia Committee WD/4 on Welding Safety to supersede AS 1674.1—1990.

The term 'informative' has been used in this Standard to define the application of the appendix to which it applies. An 'informative' appendix is only for information and guidance.

This edition includes general improvements as well as the following specific technical changes:

- (a) Clause 1.2 and some of the Preface of the superseded edition are now included in Clause 1.1.
- (b) Minor changes have been made to the list in Note 1 of Clause 1.3.2.
- (c) 'Grinding' has been added to Clause 1.3.3.
- (d) Clause 3.6 on firewatching was Appendix A10 in the superseded edition.
- (e) The advice given in the Note to Clause 4.5 used to be expressed in mandatory terms.
- (f) Item (b) of Section 6 has been amended.
- (g) The following new requirements have been added:
 - (i) Items (a) and (b) of Clause 2.1.
 - (ii) Clause 2.13.
 - (iii) Clause 3.4.
 - (iv) Item 3.5(1).
 - (v) The third paragraph of Clause 5.2.
 - (vi) Item 10 in Appendix B.
 - (vii) Appendix C4.1.
 - (viii) The third paragraph of Appendix C4.3.

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STANDARDS AUSTRALIA

Australian Standard

Safety in welding and allied processes

Part 1: Fire precautions

SECTION 1 SCOPE AND GENERAL

1.1 SCOPE This Standard specifies precautions to be taken prior to and during hot work (including welding and allied processes), to prevent the possibility of fire or explosion, which may result in harm to persons or property. In particular, such precautions apply to hot work during manufacturing, construction, maintenance, repairs, demolition and where plant or equipment has contained flammable, combustible or explosive material.

Measures for the protection of operators against electric shock, asphyxiation, poisoning and other hazards are not covered by this Standard, which also does not deal with protective clothing.

NOTES:

- 1 Although primarily oriented to hot work that is related to welding and allied processes, this Standard can generally be applied to other forms of ignition sources in hazardous areas.
- 2 General information on safety in welding is covered in WTIA Technical Note 7.

1.2 REFERENCED DOCUMENTS The following documents are referred to in this Standard:

AS

- | | |
|--------|---|
| 1596 | LP Gas—Storage and handling |
| 1674 | Safety in welding and allied processes |
| 1674.2 | Part 2: Electrical |
| 1851 | Maintenance of fire protection equipment |
| 1851.1 | Part 1: Portable fire extinguishers and fire blankets |
| 1851.3 | Part 3: Automatic fire sprinkler systems |
| 1940 | The storage and handling of flammable and combustible liquids |
| 2118 | Automatic fire sprinkler systems |
| 2118.1 | Part 1: Standard |
| 2275 | Combustible gas detection instruments for use in explosive atmospheres |
| 2275.1 | Part 1: General requirements for explosion protection of electrical apparatus and systems |
| 2275.2 | Part 2: Performance requirements |
| 2430 | Classification of hazardous areas |
| 2430.1 | Part 1: Explosive gas atmospheres |
| 2430.2 | Part 2: Combustible dusts |
| 2430.3 | Part 3: Specific occupancies |
| 2444 | Portable fire extinguishers and fire blankets—Selection and location |
| 2812 | Welding, brazing and cutting of metals—Glossary of terms |
| 2865 | Safe working in a confined space |

AS

3190 Approval and test specification—Residual current devices (current-operated earth-leakage devices)

4332 The storage and handling of gases in cylinders

AS/NZS

1020 The control of undesirable static electricity

WTIA Welding Technology Institute of Australia

Technical Note 7: Health and safety in welding

Technical Note 20: Repair of steel pipelines

1.3 DEFINITIONS For the purpose of this Standard, the definitions given in AS 2812 and those below apply.

1.3.1 Approved or approval—approved by or approval of the authority concerned.

1.3.2 Hazardous area—an area in which flammable liquids, vapours or gases, combustible liquids, dusts or fibres, or other flammable or explosive substances may be present.

NOTES:

- 1 Hazardous areas may be found in the following locations (the list is not exhaustive) where such substances are manufactured, used, handled or stored:

Cellulose nitrate plastics manufacturing plants.

Clothing manufacturing plants.

Coal pulverizing plants.

Combustible fibre manufacturing plants.

Conveyor belts and associated structures, where coal, wheat or other combustible materials are handled.

Cotton and other textile mills.

Cotton gins and cotton seed mills.

Distilleries and plants producing alcohol.

Dry-cleaning and dry-dyeing plants.

Flammable gas plants.

Flour mills, grain elevators and starch plants.

Locations where explosives, including pyrotechnics, are manufactured, used, handled or stored.

Marine vessels.

Paint manufacturing plant.

Paper manufacturing and storage.

Petroleum, petrochemical and chemical plants.

Plants producing industrial alcohol.

Plastics manufacturing plant and warehouses.

Sawmills and woodworking plants.

Spray painting establishments.

Varnish manufacturing plants.

Warehouses for—

baled waste, cocoa fibre, cotton (including cotton linters and cotton waste), excelsior, hemp, istle, jute, kapok, oakum, sisal or henequen, spanish moss, tow and other similar materials.

- 2 AS 1940 and AS 1596 specify minimum distances from sources of flammable and combustible liquids and gases to ignition points.
- 3 Further information on hazardous areas is to be found in AS 2430.1, AS 2430.2 and AS 2430.3.
- 4 A normally safe area, into which a tank, container or equipment containing flammable or combustible liquids, gases or vapours has been brought, may become a hazardous area.

1.3.3 Hot work—grinding, welding, thermal or oxygen cutting or heating, and other related heat-producing or spark-producing operations.

1.3.4 Responsible officer—a person having a satisfactory knowledge of the fire, explosion and toxicity hazards associated with hot work in hazardous areas and who is adequately trained and experienced in the testing procedures and precautions necessary for the elimination of any risk involved.

1.3.5 Shall—indicates that a statement is mandatory.

1.3.6 Should—indicates a recommendation.

SECTION 2 GENERAL PRECAUTIONS

2.1 SUPERVISION Hot work shall be carried out under the control of a person who is responsible for the safe execution of all operations and has authority to enforce the requirements of this Standard with respect to other employees, outside contractors and other people in the area. Before hot work is commenced in any location, this person shall ensure that—

- (a) the hazards of the location are identified;
- (b) a means of managing the hazards is in place;
- (c) the equipment complies with the requirements of Section 4;
- (d) the equipment is located so that, in the event of malfunction of the equipment, a fire or explosion hazard is not created; and
- (e) there is no inherent hazard due to the nature of the item on which the hot work is to be performed.

NOTE: Where hot work is being carried out by a contractor, the person responsible for the hot work should be approved by both the principal and the contractor.

2.2 HAZARDOUS AREAS Hot work in hazardous areas shall be carried out in accordance with Sections 2 and 3.

2.3 CONFINED SPACES Hot work in confined spaces shall be performed in accordance with AS 2865 and this Standard.

2.4 INSPECTION OF SITE Before hot work commences, the site shall be thoroughly inspected and made safe, or alternative methods of carrying out the work shall be adopted.

On completion of hot work, a thorough inspection of the site shall be carried out to ensure that the site is safe.

2.5 LOCATION Where there exists a possibility of hot work causing an explosion or fire and no practical means of moving the work to a safe site exists, the provisions of Section 3 shall apply.

2.6 WELDING WORKSHOPS Workshops designed specifically for hot work shall be monitored to ensure that—

- (a) where hot work constitutes a fire or explosion hazard, the requirements of this Standard are observed;
- (b) any flammable and combustible liquids are stored in accordance with AS 1940; and
- (c) fire extinguishers are provided in accordance with Section 5.

2.7 OFF-CUTS AND ELECTRODE STUBS Before any hot work commences, arrangements shall be made to prevent any work off-cuts, hot metal, slag or electrode stubs from lodging in places where there is any possibility of starting a fire.

2.8 TIMBER Where any hot work is to be carried out adjacent to or above timber, the timber shall be protected, by wetting or other suitable means, from the direct heat of any flame or arc and from sparks, slag and hot metal particles.

2.9 ROPE During hot work, ropes shall be protected from the heat of any flame or arc and from sparks, slag and hot metal particles. Particular care shall be exercised with respect to ropes supporting loads, guy ropes and scaffolding ropes.

NOTE: Natural or synthetic fibre ropes should not be used for supporting scaffolding where hot work is being carried out.

2.10 OTHER MATERIALS Where hot work is to be carried out in the presence of other materials, care should be taken to protect the surfaces of those materials from damage or from starting a fire.

2.11 GRASS FIRES AND BUSHFIRES Before hot work commences near dry grass or bush, the immediate area shall be cleared or wetted sufficiently to prevent the hot work from starting a grass fire or a bushfire.

2.12 PROTECTIVE GUARDS Protective guards shall be stable, of ample size and arranged so as to prevent sparks, slag and hot metal particles from rolling beneath them or penetrating openings in them. Protective guards shall be of fire-resistant material.

2.13 CONTAMINANTS Contaminants produced from any hot-work operation (including cleaning in preparation for the hot work and after the hot work has been completed) shall be disposed of in a manner approved by the relevant environmental authority.

SECTION 3 HAZARDOUS AREAS

3.1 GENERAL Hot work shall not be undertaken in a hazardous area unless authorized by a responsible officer (see Clauses 1.3.4 and 3.2). The general precautions of Section 2 also apply.

NOTE: Guidelines for hot work in hazardous areas are given in Appendix A.

3.2 RESPONSIBLE OFFICER A responsible officer shall be appointed to be responsible for the safe execution of any hot work, and shall have authority to enforce the requirements of this Standard with respect to employees, contractors and other workers.

NOTE: Where hot work is being carried out by a contractor, the responsible officer who is appointed should be approved by the principal and the contractor.

3.3 BEFORE PERFORMING HOT WORK Prior to the commencement of hot work in any hazardous area, the following precautions shall be taken, to prevent any fire, explosion, injury or other danger developing during the performance of the hot work:

- (a) Identify and control any fire hazard (including the presence of flammable or combustible liquids, gases, vapours, dusts, fibres or substances) within 15 m from the hot work.
- (b) Consider relevant hazards that may exist outside the area referred to in Item (a) above.
- (c) Consider the possibility of changing circumstances during the progress of the hot work and whether they may render the area unsafe for the work to continue.
- (d) Properly ventilate the hot-work area.
- (e) Suitably locate the equipment, including emergency firefighting equipment.
- (f) Isolate the area where the hot work is to be performed.
- (g) Provide a safe entry to and exit from the hot-work area.
- (h) Test for the presence of any flammable gas or flammable vapour, in accordance with Clause 3.4, in the atmosphere within the area referred to in Item (a) above and in any pipe, drum, tank, vessel and piece of equipment adjacent to or involved in the hot work.
- (i) Ensure the concentration of any flammable gas and flammable vapour, as determined by the testing required by Item (h) above, is less than 5 percent of its lower explosion limit (LEL).
- (j) The responsible officer required by Clause 3.2 shall make a thorough inspection of the site.
- (k) When the responsible officer is satisfied that the hot work may safely proceed, that person shall issue a hot-work permit complying with Clause 3.5.
- (l) If specified by the hot-work permit, a firewatcher shall be stationed in the area near the hot work, for the purpose of safeguarding personnel and equipment, and shall follow the procedure specified in Clause 3.6.
- (m) Do not commence the hot work, until complying with all of the above requirements.

3.4 TESTS Tests for the presence of flammable gas and flammable vapour shall comply with the following:

- (a) The detectors used for the testing shall comply with AS 2275.1 and AS 2275.2.
- (b) Each detector used for the testing shall be used by a person who is skilled in its operation, limitations and maintenance.

- (c) Testing shall continue until every source and potential source of flammable gas and flammable vapour has been tested.
- (d) Testing shall take place as late as practical before the hot work is commenced, subject to it being not more than 2 h beforehand.

3.5 HOT-WORK PERMIT Each hot-work permit shall include the following appropriate information:

- (a) Permit identification number.
- (b) Identification of the site (e.g. building, floor, department).
- (c) Job identification.
- (d) Date of issue of the permit.
- (e) Period of currency of the permit, including starting time and finishing time for the permit, which shall have a duration period of not more than 8 h.
- (f) Equipment to be used.
- (g) Checks to be made.
- (h) Precautions taken.
- (i) The following details of the gas testing:
 - (i) Date and time of testing.
 - (ii) Results of test.
 - (iii) Name and signature of the testing officer.
- (j) Name and signature of the operators carrying out the hot work.
- (k) Name and signature of the responsible officer.
- (l) Name and signature of the firewatcher, where required.

NOTE: A typical form for a hot-work permit is included in Appendix B.

3.6 FIREWATCHING Assigned firewatchers shall follow the following procedure:

- (a) Be alert for any fire outbreak or hazard.
- (b) Inspect adjoining compartments, if heat transfer is possible.
- (c) Take immediate action to combat any outbreak of fire that may occur.
- (d) Not allow hot work to proceed outside the area specified on the hot-work permit.
- (e) Immediately stop the work and withdraw the hot-work permit, if a hazardous condition is observed.
- (f) Monitor changes in wind direction (e.g. by means of a windsock).
- (g) Be aware of the need to use eye protection, to protect eyes against flashes where hot work involves arc welding, cutting or arc gouging.
- (h) Obtain fire extinguishers or fire hose or both.
- (i) Not leave the job unless properly relieved by an authorized person.

NOTE: Firewatching does not consist of periodic checks, but is a continuous and thorough inspection and presence in the area and its vicinity by the assigned personnel, with special attention being given to any new developments that might affect the safe condition of operations.

3.7 CONDUCT OF WORK While carrying out hot work in or near any hazardous situation, the following requirements apply:

- (a) The work shall be authorized by a responsible officer in accordance with Clause 3.2.
- (b) The particular work shall be covered by a current hot-work permit complying with Clause 3.5.
- (c) Each person associated with hot work shall be conversant with the precautions to be taken as specified on the hot-work permit and with the safety requirements of the site.
- (d) Welders shall not work alone.
- (e) Welders shall be provided with any assistance that is considered necessary by the responsible officer.
- (f) Hot work shall be carried out only during the period stated on the hot-work permit.
- (g) A new hot-work permit is required, in the event of the hot work ceasing for a period of more than 2 h or of extending beyond the currency of the permit (see Item 3.5(e)).
- (h) Further testing, including continuous monitoring, shall be undertaken during the duration of hot work, as required by the responsible officer.
- (i) In the event of the concentration of flammable gas and flammable vapour in the test area exceeding 5 percent of the lower explosion limit (LEL), the hot work shall cease, the hot-work permit shall be cancelled and corrective action shall be taken to reduce the concentration of flammable gas and flammable vapour.

SECTION 4 HOT - WORK EQUIPMENT

4.1 ARC CUTTING AND WELDING EQUIPMENT Arc cutting and welding equipment shall be installed and used in accordance with AS 1674.2 and the recommendations of the manufacturer of the equipment.

When arc welding is suspended for a substantial period of time, such as during lunch periods or overnight, the power source to the equipment shall be de-energized, the electrodes shall be removed from the holders and the holders shall be placed so that accidental contact or arcing cannot occur.

4.2 GAS CUTTING, HEATING AND WELDING EQUIPMENT Gas cutting, heating and welding equipment shall be installed and used in accordance with the recommendations of the manufacturer of the equipment and at such pressures and in such a manner to prevent flashback.

NOTE: The use of flashback arresters is recommended.

Acetylene and LP Gas cylinders shall be secured in an upright position during use. Acetylene cylinders (full or empty) shall be stored in accordance with AS 4332. LP Gas cylinders (full or empty) shall be stored in accordance with AS 1596. Care shall be taken that gas cylinders, equipment and hoses are not damaged by inadvertent bumping, abrasion, contact with sharp metal edges or hot metal particles or exposure to flame or artificial heat.

When gas welding or cutting is suspended for a substantial period of time, such as during lunch periods or overnight, the blowpipe and cylinder valves shall be closed, the regulator adjusting screws released and the hoses withdrawn from confined spaces.

4.3 LIGHTING OF BLOWPIPES Suitable means (e.g. a flint gun) shall be provided for the lighting of gas welding, cutting or heating blowpipes. Rope wicks and other smouldering matter shall not be used.

4.4 GRINDING MACHINES Work that includes the use of grinding machines driven by either electric power or compressed air shall be regarded as hot work within the meaning of this Standard.

4.5 POWER-OPERATED EQUIPMENT Power-operated equipment, including that for welding, shall not be used in any hazardous area unless a hot-work permit has been issued for that purpose.

NOTE: Where a hot-work permit allows for the use of power-operated equipment, such equipment should be flameproof, intrinsically safe or pneumatically driven, particularly if it is readily available.

4.6 LIGHTING AND EXTENSION LEADS Non-flameproof lighting, switches, plugs and sockets may be authorized in hazardous areas by issue of a hot-work permit to cover their use. Extension leads shall be heavy duty sheathed flexible, not less than 1.5 mm² or 30/0.25 mm strands.

4.7 ELECTRICAL PROTECTION Electrical tools and electrical portable equipment that is operated at more than 32 V a.c. in an area covered by a hot-work permit shall be protected by an earth-leakage (core balance) device complying with AS 3190.

SECTION 5 FIRE PROTECTION

5.1 GENERAL PROVISIONS During hot work, adequate precautions shall be taken to prevent fire or explosion. In particular, compliance with the following shall be ensured:

- (a) Welders and any other person concerned with hot work shall—
- (i) watch for any fire that may occur;
 - (ii) know where the fire equipment is located and how to use it;
 - (iii) know how to raise the alarm; and
 - (iv) initiate immediate steps to extinguish any fire.

NOTE: Fires can be caused in locations remote from the actual working area by sparks or hot slag from hot-work operations or by transfer through metal walls or bulkheads.

- (b) Suitable equipment and extinguishing agents appropriate to the risk shall be provided and made available for immediate use.

NOTE: Even after a fire has been extinguished, there is often sufficient heat remaining to cause the temperature of ignitable material to rise above its ignition point and re-ignition to occur.

- (c) An extinguisher complying with the following shall be provided:
- (i) Be appropriate for the particular type of fire hazard.
 - (ii) Be selected in accordance with AS 2444.
 - (iii) Comply with the relevant Australian Standard.
 - (iv) Be located within 10 m of the work area.
 - (v) Be maintained in accordance with AS 1851.1.
 - (vi) Be used in accordance with the recommendations of the manufacturer or supplier of the equipment.

5.2 FIXED FIRE-PROTECTION INSTALLATIONS Hot work on sprinkler installations shall be carried out in accordance with AS 2118.1 and, where appropriate, AS 1851.3, in addition to the precautions required by this Standard.

Hot work on or adjacent to other fire-protection installations shall be carried out only after consideration has been given to the effect that the hot work may have on the system and any need for alternative protection.

NOTE: It should be noted that smoke and heat detectors may operate by detecting heat, smoke or flames from welding operations. Checks should be made as to whether fire protection systems should be isolated.

Where fire protection systems have been isolated, a final check shall be made after the hot work has been completed, to ensure that these systems have been put back on line.

5.3 FINAL INSPECTION After hot work has been completed, inspections shall be carried out to ensure that no smouldering materials remain.

SECTION 6 AFTER FIRE HAS OCCURRED

Where a fire of sufficient magnitude to require extinction by portable or permanent fire-extinguishing equipment has occurred, the following actions are required:

- (a) Immediately after the fire has been extinguished, the person or persons who have operated the fire-extinguishing equipment shall advise the person responsible for the safe execution of the work (see Section 2) of the following:
 - (i) The location of the fire.
 - (ii) The magnitude and extent of the fire.
 - (iii) The identification of the fire-extinguishing equipment used.
- (b) The person responsible for the safe execution of the work shall ensure that the following applies:
 - (i) A watch is maintained in the vicinity of the location of the fire until such time as it is considered that re-ignition is not possible.
 - (ii) The site is revisited some time after it is considered that re-ignition is not possible.
 - (iii) No further work is carried out until effective fire equipment is available for use.
 - (iv) Equipment that has been used is properly serviced (see Clause 5.1(c)(iv)).
 - (v) The circumstances contributing to the fire and the results from any subsequent investigation are recorded.
 - (vi) The procedures for managing hazards and the hot-work permits are promptly reviewed and if necessary amended.

NOTES:

- 1 If appropriate, the relevant firefighting authority should be notified of the occurrence of the fire.
- 2 Workers' compensation regulations or insurance policies may require records of the fire to be retained for a minimum specified period.

APPENDIX A
GUIDELINES FOR HOT WORK
(Informative)

A1 SCOPE This Appendix gives guidelines for the precautions and preparation that should be followed to ensure that work covered by a hot-work permit can be carried out safely without risk to people or plant.

A2 HOT-WORK AREA The area within a radius of 15 m from the point where the hot work is to be undertaken, including the space above and below that area, should be made safe by various techniques, preparation and testing, to ensure that any risk of fire or explosion resulting from the hot work is eliminated.

The following containments should be effected:

- (a) The hot-work area should be isolated using appropriate warning barriers.
- (b) Vapour-tight barriers may be necessary between equipment, piping, sewers, tanks and the like that may contain hazardous materials and the hot-work area. Screens should also be used to protect other workers from arc welding or cutting 'flash'.
- (c) Any pipe or tank in the hot-work area that may be a hazard should be positively isolated by blanking off, blinding, plugging or removing spool pieces and blanking off open ends.
- (d) Discharge from pressure relief, excess flow and overflow valves should be piped to discharge at a safe area. It may be necessary to find other means of venting the adjacent lines, to eliminate the hazard of the relief valve opening while hot work is in progress.
- (e) Valves, tappings and other equipment or facilities that may produce flammable or combustible liquids, gases or vapours in or around the safe area should be secured against inadvertent opening.

A3 SAFE ATMOSPHERES Appendix C gives recommended procedures to prepare for hot work on equipment that has held or may have held flammable or explosive substances.

Equipment, piping and tanks on which hot work is to be undertaken should be thoroughly drained, flushed with water, dried, steamed and air purged as necessary, to provide an atmosphere that can be tested and certified gas free, immediately before commencement of hot work.

Sludge and scale should be removed, as they may have entrapped volatile material that could be released and ignited by sparks or hot metal.

A4 PURGING Forced or induced draft ventilation should be used in enclosed tanks or lines where natural draft is inadequate.

A5 HOUSEKEEPING Combustible material that cannot be removed should be covered with a safely-secured non-flammable cover.

Oily surfaces and oil spills should be hosed down, then sanded over. Trash, oily rags and the like should be removed.

A6 SEWERS AND DRAINS For sewers and drains fitted with a p-trap or other type of seal, the operator should ensure that the bottom of the baffle is below water level. Sewers and drains should be covered by wet sandbags, to prevent escape of vapours from the sewer.

Where a hazard exists in the vicinity of vent pipes from a liquid seal, the vents should be plugged or otherwise blocked to prevent the escape of flammable vapours or gas.

A7 SOURCES OF LEAKS Pump, line and vessel bleeders, sample points and the like (which could be a source of leakage) should be plugged off. Valves cannot be regarded as leakproof and are subject to inadvertent opening. Special attention should also be given to valve glands, to ensure that they are not leaking flammable material.

A8 VENTING Tanks and lines adjacent to hot work should be properly vented to a safe area. This will eliminate the danger of expansion of oil or gas in this equipment, which could cause failure of gaskets, pressure gauges, packing glands, sight glasses or other vulnerable connections and thus cause a fire (e.g. pressure and vacuum vents on storage tanks can be extended by temporary piping).

A9 FIREFIGHTING EQUIPMENT On-site firefighting equipment and alarms should be serviceable and ready to operate, should an emergency develop during a period of hot work.

A10 FIREWATCHERS AND OTHER PERSONNEL During progress of hot work, the assigned firewatcher, area operating personnel, maintenance personnel and other persons responsible for the safe conduct of the hot work should ensure that no condition arises, or action is taken, that will lead to a hazardous situation in the hot-work area. Constant vigilance, checking of adjacent equipment and observance of safe practices is essential. Not every contingency can be anticipated. Personnel concerned with hot work should be looking for the unexpected or unusual circumstance.

A11 CONTAMINATED GROUND Ground that has been contaminated by spilled flammable or combustible liquids should be covered with at least 50 mm of clean sand, to prevent sparks or other hot metal from igniting vapour that may originate from such contamination.

A12 PUMPS AND VALVE GLANDS Extreme care should be taken with pumps and valve glands, as a leakage could occur after initial checking. Where any such leak develops, the job should be stopped and the necessary corrective action taken before continuing the hot work.

A13 WIND Wind may carry gases, vapour or dust into a hot-work area from adjacent areas. Regular gas testing of hot-work areas should be carried out to ensure that there is no ingress of flammable material (see Paragraph C5).

A14 MOVEMENT OF TRAFFIC Whenever possible, vehicular traffic should be kept out of hot-work areas while work is in progress.

A15 REFUELLING ENGINES During refuelling of internal combustion engines, hot work should be discontinued and engines should be switched off and left to cool before refuelling. Where two or more engines are stationed close together, the engines should be shut down and allowed to cool before being serviced. Engines should be refuelled directly from service tanks or, where this is not possible, by means of safety cans. A funnel of adequate size should be used in conjunction with a safety can.

A16 OPENING OF DRAINS Before drains or sewers are opened, hot-work permits should be withdrawn, work stopped and a careful check made for smouldering materials.

A17 FLAMMABLE LIQUIDS Do not take flammable liquids, including cleaning solvents, into an area covered by a hot-work permit.

A18 WELDING EQUIPMENT Welding machines and gas cylinders should be located in a known gas-free area at a safe distance from equipment being welded. Welding return leads should be connected as close as practicable to the weld (see AS 1674.2).

A19 SHIELDING Where shielding is required to confine a hot-work area, non-combustible welding drapes should be used in preference to wet tarpaulins. Dry canvas or rubberized tarpaulins should not be used.

A20 JOB COMPLETION The site or work area should be secured overnight and at the expiry of a hot-work permit period.

At the completion of a job, the equipment should be returned to its normally secure mode and the firefighting equipment that has been brought to the hot-work site should be returned to its normal storage.

A21 SPECIAL OPERATIONS In some cases, it is necessary to carry out hot work on lines or equipment that are in service or where it is not possible to make a positive isolation. This type of work includes hot tapping, welding brackets and the like onto operating equipment, and welding on lines after cold cutting and plugging. Special precautions are required for this type of work and should be defined in the hot-work permit. Further guidance on hot tapping is given in WTIA Technical Note 20.

APPENDIX B
TYPICAL FORM FOR A HOT-WORK PERMIT
(Informative)

1 Site location _____ Date _____ Permit No. _____

2 The hot work that is covered by this permit _____

3 The location of the hot work _____

4 The equipment to be used _____

5 The firefighting equipment to be laid out at the worksite _____

6 Whether the following checks been made: (Note: All questions are to be answered and initialled by the issuing responsible officer. 'N.a.' means 'not applicable').

6.1 Have drains, pits and depressions been checked, isolated and sealed?

6.2 Have combustible materials been removed from the work area or made safe?

6.3 Have tanks, valves, vents and pipelines been blanked off or effectively isolated?

6.4 Is ventilation adequate?

6.5 Are spark and flash screens in place?

6.6 Have leaks from valve and pump glands, flanges and the like been controlled?

6.7 Have pressure relief valves been vented to safe areas?

6.8 Has contaminated ground been covered?

6.9 Is the fire equipment checked and laid out ready for use?

6.10 Is the fire pump or fire brigade on standby?

6.11 Is a firewatch required?

6.12 If required, has a firewatch been organized?

6.13 Is the wind direction satisfactory for hot work to be done?

6.14 Has product movement been stopped in the area of hot work?

6.15 Has the site of the hot work been isolated and roped off?

6.16 GAS TESTING:
Equipment make and model _____

Serial No. _____

Date of last equipment check _____

Date of test _____

Time of test _____

Results of tests

Percentage L.E.L. _____

Is hot-work safe to proceed? _____

Initials of tester _____

7 The following conditions and precautions were observed:

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8 This permit is valid from _____ am/pm on ___/___/___ to _____ am/pm on ___/___/___

9 Name of contractor performing the work _____ Order or contract no. _____

10 Name and signature of firewatch (where required) _____

11 Permit received by:

(print name)

(signature)

12 Person in charge of location:

(print name)

(signature)

13 Responsible Officer:

(print name)

(signature)

Return permit:

This permit was returned/cancelled by:

(print name)

(signature)

to:

(print name)

(signature)

at am/pm ___/___/___

The worksite has been inspected by me at the expiry/cancellation of this hot-work permit and declared safe for normal operations to resume.

(print name)

R.O.

(signature)

THIS HOT-WORK PERMIT SHOULD BE PROMINENTLY DISPLAYED ON THE WORKSITE

APPENDIX C
PROCEDURES FOR HOT WORK ON EQUIPMENT THAT
HAS HELD FLAMMABLE OR EXPLOSIVE SUBSTANCES

(Informative)

C1 GENERAL Explosions, fire or health risks may result if hot work is carried out on equipment that may not be free of flammable or combustible solids, liquids, gases or dusts. The precautions given in this Appendix are therefore recommended to render such items safe for such work.

Cleaning of equipment that has held dangerous goods should be performed by personnel familiar with characteristics of the content and the proper method of cleaning.

Contaminants produced as a result of the cleaning operation should be disposed of in a manner that will not constitute a hazard to any person, equipment or environment.

C2 HAZARDOUS CONDITIONS Flammable or explosive substances may be present under the following circumstances:

- (a) The equipment has contained a petroleum product or other type of volatile liquid that releases flammable gases or vapours at atmospheric pressure.
- (b) Metal equipment has contained an acid or alkaline material and hydrogen has been generated.
- (c) The equipment has deposits of sludge or scale, or traces of resin, gum, varnish, bitumen or similar deposits, or has held a non-volatile oil or a solid that at ambient temperature does not release vapours, but may produce flammable or explosive gases or vapours if the equipment is exposed to heat.
- (d) The equipment has held a substance that is in a finely divided state and has formed an explosive mixture with air (e.g. coal dust, wheat dust).
- (e) Equipment has been coated internally and has filled with explosive vapours after being heated.

Sight or smell should not be relied upon to decide whether it is safe to carry out hot work on a closed container, because a very small amount of residual vapour or gas-forming substances can cause an explosion. Where there is doubt whether a substance is flammable or the method of removing the substance is appropriate, the method should be referred to the responsible officer and a work permit obtained before commencement of the hot work.

C3 PREPARATIONS Hot work should not be carried out without appropriate approval having been obtained and the equipment having been thoroughly cleaned.

Before cleaning is undertaken, the following sequential precautions should be carried out:

- (a) Sources of ignition (e.g. flames, electric lights, equipment that has not been approved as safe for hazardous conditions) should be rendered inoperative or removed from the vicinity of the equipment.
- (b) The substance previously held in the equipment should be identified, if necessary by appropriate chemical analysis to identify the contents and assess its hazardous nature.
- (c) An appropriate method of cleaning should be chosen (see Paragraph C4).
- (d) Where possible, the equipment should be moved outdoors or to a well-ventilated and drained area for cleaning.

C4 METHODS OF CLEANING EQUIPMENT

C4.1 General The equipment, including any internal piping and the like should be completely drained and any sludge removed.

Metal parts used in steaming or mechanical cleaning should be bonded to the equipment and earthed to prevent a build-up of static electricity (see AS/NZS 1020).

Equipment divided into two or more compartments should have each compartment treated in the same manner, regardless of the portion of the equipment that is to be subjected to hot work.

NOTE: Where entry to equipment is necessary for cleaning, the requirements of AS 2865 should apply.

C4.2 Water washing Where the substance is readily soluble in water, the equipment may be completely filled with water and drained several times with appropriate testing and disposal of the drained liquid.

C4.3 Steam cleaning Where the substance includes petrol, oil or other light petroleum by-products that are not readily soluble in water, steam may be admitted in a manner that will prevent a pressure build-up, with the equipment positioned so that steam and condensate will drain from the lowest point.

The steaming process should be applied for not less than 30 min after the whole of the equipment has become hot to touch.

Where low-flash high-vapour-pressure oils are present, steam cleaning should not be used, because of the possibility of evolution of flammable gases due to heat or of a static charge developing an incendiary spark.

C4.4 Hot chemical solution Where the substance includes petrol, oil or other light petroleum by-products, a hot chemical solution of trisodium phosphate (washing powder) or a caustic cleaning compound dissolved in hot water can be applied to the equipment. The residue should then be flushed out with water.

When cleaning by this method, the operator should be protected from vapours, gases and cleaning compounds.

C4.5 Mechanical cleaning Mechanical cleaning may be used when any scaly, dry or insoluble residues are left on the surface.

Mechanical cleaning methods include scraping, brushing, abrasive blasting, high pressure water washing and rotating the equipment while partially filled with sand.

C4.6 Chemical cleaning Chemical cleaning may be used if the equipment holds insoluble deposits. In this case, the chemical manufacturer should be consulted to determine a suitable solvent to be used and the appropriate cleaning procedure to be followed. Precautions should be made to protect the operator and to safely dispose of the chemical residue.

C4.7 Purging Purging may be used to supplement other cleaning methods described. The procedure is as follows:

- (a) Drain the equipment of any free liquid and remove the caps, drain plugs, hatches and the like.
- (b) Apply forced draft ventilation by extraction or induction for not less than 4 h, or for such longer period as may be necessary to ensure that subsequent gas testing indicates that the equipment is free of flammable vapours.

Alternatively, apply forced draft ventilation by extraction for not less than 1 h. During subsequent hot work, fill the equipment with nitrogen and apply a continuous flow of nitrogen. Care should be taken to ensure that no air is introduced into the equipment at any time during hot work.

C4.8 Other methods The methods described in Paragraphs C4.2 to C4.6 may be used in combination to facilitate cleaning, but care should be taken to ensure that hazardous reactions do not occur.

The methods of cleaning listed do not preclude the use of other methods that are peculiar to specific industries.