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Supplement

Explosive atmospheres — Classification of areas — Explosive gas atmospheres — Commentary (Supplement 1 to AS/NZS IEC 60079.10.1:2022)



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Preface

This Supplement was prepared by the Joint Standards Australia/Standards New Zealand Committee MS-011, Classification of Hazardous Areas.

The objective of this Supplement is to provide commentary and additional information to support the application of AS/NZS IEC 60079.10.1:2022.

AS/NZS IEC 60079.10.1:2022 is intended for use by those with demonstrated competence in the classification of explosive gas atmospheres. This Supplement aims to help those with some proficiency but varying levels of experience or competency in particular aspects or approaches to hazardous area classification. Examples for hazardous area classification are also provided.

In this Supplement, AS/NZS IEC 60079.10.1:2022 is referred to as "the Standard" while this document is referred to as "this Supplement".

The numbering and titles of clauses in this Supplement align with those in AS/NZS IEC 60079.10.1:2022 except that the numbers are prefixed by the letter "C". The figures, tables and equations in this Supplement are numbered according to the clause in which they are located; their numbering is also prefixed by the letter "C". Therefore, any references to clauses, tables, figures, equations and appendices that are not identified by the prefix "C" refer to those in the Standard unless indicated otherwise.

Documents referenced in this Supplement are listed in the Bibliography.

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Introduction

This Supplement contains commentary on AS/NZS IEC 60079.10.1:2022 (the Standard) and additional informative appendices. Annexes ZA, ZB, and ZC in the previous edition AS/NZS 60079.10.1:2009 included many examples for the classification of hazardous areas which were developed over a number of years. Some of these examples have come to be accepted as commonly accepted industry classifications in Australia and New Zealand and others were not intended to be treated as commonly accepted industry classifications and were provided only for illustration. Relevant examples from the 2009 edition have been incorporated into this Supplement as appendices.

The appendices of this Supplement provide the following additional information that supports the application of the Standard:

(a) *Appendices A to F* — Hazardous area classification examples.

(b) *Appendix G* — Examples for a generalized method of classification.

(c) *Appendix H* — Additional information on local ventilation design.

(d) *Appendix I* — Information on risk assessment for equipment protection levels (EPLs).

This Supplement also includes additional definitions applicable to this document. Other definitions and explanations of terms are given in the Standard together with the main principles and procedures relating to hazardous area classification.

For recommendations regarding the extent of the hazardous areas in specific industries or applications, reference may also be made to national or industry codes relating to those applications.

Attention is drawn to the fact that an area classified non-hazardous (NH), in accordance with the Standard, is not necessarily safe in all respects (for example, toxic and chemical hazards).

In the Standard the classification of hazardous areas is intended to be used for the selection of equipment but may also be used (with judgement) for other ignition sources. Such other ignition sources are often considered as higher hazard ignition sources (for example, flames and grinding and other high energy or exposed “naked” ignition sources). For the higher hazard sources, larger safety distances are often applied than might commonly be required for electrical and mechanical equipment; for example, AS 3846 specifies a larger distance for “naked” ignition sources than is typically required for the hazardous area classification. Larger distances for higher hazard sources also allow for the carriage of hot particles or flames over greater distances before they become cool (for example, transport of hot embers in the wind). As a result, many industries will specify a greater distance for higher hazard sources, which include no smoking zones, but a lesser distance may be accepted for the classification of hazardous areas.

NOTE AS/NZS 60079.14 provides for management of ignition sources by conditions of control for fixed or portable equipment. Application of suitable control measures might be an appropriate means of managing the possibility of ignition by portable equipment or mobile plant which is not otherwise rated for a hazardous area.

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Section 1 Scope and general

1.1 Scope

The objective of this Supplement is to —

(a) provide commentary on relevant clauses and annexes of the Standard;

(b) provide additional information and examples in appendices to support the application of the Standard; and

(c) provide additional information on artificial ventilation that was previously part of AS 1482.

1.2 Application

This Supplement is intended to be read in conjunction with AS/NZS IEC 60079.10.1:2022.

It is assumed that the predominant users of the Standard will be competent persons with an understanding of the fundamentals of gas or vapour releases and dispersion relevant to the application or equally qualified but less experienced persons working under their guidance. It is intended that the Standard and this Supplement be applied and interpreted primarily by such persons.

1.3 Normative references

There are no normative references in this document.

NOTE Documents referenced for informative purposes are listed in the Bibliography.

1.4 Terms and definitions

For the purposes of this document, the terms and definitions given in AS/NZS IEC 60079.0, AS/NZS IEC 60079.10.1 and the following apply.

1.4.1
approved package
container used to store or transport substances that —

(a) for Australia, complies with the requirements of the *Australian Code for the Transport of Dangerous Goods by Road and Rail* (ADG Code); or

(b) for New Zealand, the *UN Recommendations on the Transport of Dangerous Goods*

1.4.2
authority
authority having statutory (legal) control of the subject area

1.4.3
capacity
<tank or cylinder> total volume of the space enclosed within the tank or cylinder

[SOURCE: AS/NZS 1596:2014, 1.4.6, modified]

Note 1 to entry: This is also known as “water capacity”.

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1.4.4
compressed natural gas
CNG
gaseous fuel composed predominantly of methane (CH_4), commonly sourced from natural gas and used as a vehicular fuel, that is compressed to less than 1 % of its volume at standard atmospheric pressure

1.4.5
cylinder
vessel that is constructed in accordance with the AS 2030 series for Australia or with the requirements of the *Health and Safety at Work (Hazardous Substances) Regulations 2017* for New Zealand

1.4.6
dispensing cabinet
part of the cabinet forming a *fuel dispensing unit* (1.4.7), which encloses the hydraulic components other than the delivery hose, delivery pipe, breakaway coupling and delivery nozzle

1.4.7
fuel dispensing unit
assembly of equipment intended for the delivery of fuel from a supply point through a nozzle to a receiving vessel

Note 1 to entry: This includes equipment for dispensing petrol, liquefied petroleum gas, compressed natural gas, and hydrogen, or similar fuels.

1.4.8
gas capacity
<tank or cylinder> maximum volume of gas at metric standard conditions, for lighter-than-air gases, that a tank or cylinder can contain, expressed in cubic metres

Note 1 to entry: Metric standard conditions mean a temperature of 15 °C and a pressure of 101.325 kPa absolute.

1.4.9
liquefied natural gas
LNG
hydrocarbon fluid composed predominantly of methane (CH_4) refrigerated to the liquid phase

[SOURCE: AS 3961:2017, 1.3.21, modified]

1.4.10
liquefied petroleum gas
LPG
hydrocarbon fluid composed predominantly of any of the hydrocarbons propane (C_3H_8), propylene (C_3H_6), butane (C_4H_{10}) or butylene (C_4H_8) or mixtures of all or any of these

[SOURCE: AS/NZS 1596:2014, 1.4.36, modified]

Note 1 to entry: Unless specifically stated otherwise, any reference to “propane”, “butane”, etc. means the commercial grade of that product.

Note 2 to entry: The characteristics of the various LPGs, together with methods for their determination, are specified in AS 4670.

Note 3 to entry: Autogas sector fuel quality is regulated federally in Australia through the *Fuel Quality Standards (Autogas) Determination 2019*.

Note 4 to entry: In New Zealand, NZS 5435 sets out the composition and other requirements for the following types of LPG: commercial propane, commercial butane, general product and special product.

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1.4.11
natural gas
hydrocarbon gas composed predominantly of methane (CH_4)

Note 1 to entry: Natural gas may include other gases, such as hydrogen, but these would not be the dominant gas.

1.4.12
pressure relief device
device incorporated in equipment to protect equipment against excessive pressure by venting gas or liquid when a pre-determined pressure is exceeded

1.4.13
source of ignition
ignition source
source of energy sufficient to ignite an explosive atmosphere

Note 1 to entry: Examples of ignition sources include flames, incandescent material, electrical sparks, hot surfaces and mechanical impact sparks.

1.4.14
storage cabinet
<flammable liquid> purpose-built enclosure for the storage of flammable goods, which conforms to the requirements of AS 1940 in Australia or complies with the *Health and Safety at Work (Hazardous Substances) Regulations 2017* in New Zealand

1.4.15
vapour barrier
wall or other barrier to prevent the passage of vapour between adjacent areas

Note 1 to entry: A vapour barrier is called a physical barrier in the Standard.

1.4.16
warehouse
building or portion of a building where packages are stored, with no access to the general public

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Section 2 Commentary

C1 Scope

The Standard sets out the basic principles for hazardous area classification and also provides examples of calculations and assessment methodologies that may be used. When classifying hazardous areas, a methodology should be selected which is suitable for the application as well as the user's requirements or competency. For example, CFD analysis might give the most detailed results but is often expensive and requires a high level of competency, whereas the use of an example could provide an acceptable result, be within the competency of the user, and have a lower cost.

The Standard applies for typical atmospheric conditions. These conditions are different to those in AS/NZS IEC 60079.0 and AS/NZS 60079.14 as the parameters are intended for different aspects related to hazardous areas. In the Standard, the atmospheric parameters relate to conditions that can affect the dispersion and combustion parameters of a gas or vapour. In this context the difference between, for example, 40 °C and 60 °C, might not be significant. In the equipment and installation standards, the parameters relate to the performance of equipment to prevent a possible ignition source. In that context, a similar temperature variation could result in the equipment exceeding the ignition temperature of a particular gas.

C2 Normative references

(No Commentary)

C3 Terms and definitions

C3.6.1 Flammable substance

While the definition in the Standard refers to a substance which is itself flammable, or is capable of producing a flammable gas, vapour or mist, the term "flammable substance" is intended to refer to a material that can give rise to a hazardous area. These substances are commonly classified as hazardous chemicals or dangerous goods in accordance with the *Globally Harmonized System of Classification and Labelling of Chemicals* (GHS). Other codes, such as the ADG Code in Australia or the *Hazardous Substances and New Organisms Act* (HSNO) in New Zealand, might also apply.

The term "flammable substance" is a common term that includes flammable liquids (see Clause C3.6.2), flammable gases, and liquefied flammable gases (see Clause C3.6.3) and is not meant to include materials that might otherwise burn or decompose when exposed to heat or flame (such as timber or plastics, which are referred to as combustible materials in AS 1940).

C3.6.2 Flammable liquid

For the purpose of hazardous area classification in Australia and New Zealand, the definition of flammable liquids at atmospheric conditions is taken to mean liquids within GHS Category 1, 2 or 3 (flash point up to 60 °C). Refer to AS 1940:2017 Clause 1.4 for further information.

C3.6.3 Liquefied flammable gas

Liquefied flammable gases include liquefied petroleum gas (LPG) (refer to AS/NZS 1596), liquefied natural gas (LNG) (refer to AS 3961) and other gases.

C3.6.8 Flash point

Flash point should be determined by the closed cup method with reference to the GHS categories for classification of liquids as per Clause C3.6.2 and AS 1940.

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C3.6.11 Auto-ignition temperature

The minimum ignition temperature, or auto-ignition temperature, is based on defined specific conditions. In practice the actual ignition temperature might be higher than published values. Actual ignition temperature could vary based on a number of parameters, including mixture composition, surface area, duration of exposure to a heat source, humidity, gas or vapour temperature, surface geometry, materials, and turbulence.

C3.7.1 Normal operation

Note 2 to entry states that normal operation includes start-up and shut-down conditions. These conditions should only be considered for plant which regularly starts and stops as part of normal operation.

In some cases, routine maintenance can be managed by safe work procedures rather than by including the activity in the hazardous area classification.

C3.7.3 Rare malfunction

The Standard does not include consideration of rare malfunctions as these are considered unwarranted as a basis for the classification of hazardous areas. While this concept could have general application, it is not easily defined in practice.

A rare malfunction may be regarded as any situation where a release occurs that is not normally anticipated. Examples of such situations include —

(a) failure of a gasket due to operation well outside of the anticipated design operating envelope;

(b) complete rupture of a regulator diaphragm (minor holes are not considered rare malfunctions);

(c) failure or premature operation of a correctly applied pressure safety or relief device to prevent other release conditions;

(d) excess movement or stress leading to pipe, flange or containment failure;

NOTE 1 Pipe systems are typically designed for the service conditions including expected movement or stress, e.g. due to earthquake or ground settlement if applicable.

(e) flange failures that lead to misting in well rated piping systems where industry experience suggests that such failures do not occur; and

(f) failure of welded pipe joints.

NOTE 2 This list is not exhaustive and cases should be assessed based on the specific application conditions.

C4 General

C4.1 Safety principles

In the context of the general principles of Clause 4.1 of the Standard, new plant and equipment design and operating practices are continually being developed to reduce the probability and extent of any release. For example, one plant design could use spiral wound gaskets and other plant designs could use ring type joint (RTJ) gaskets with a lower potential for failure.

Therefore, it is necessary to consider individual details when determining the classification of a hazardous area in a plant and not all examples will be relevant.

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C4.2 Hazardous area classification objectives

The importance of reviewing the hazardous area classification during the life of the plant is restated. This does not imply that hazardous area classifications should be revised regularly to reflect current standards, but rather that they are checked to reflect current plant design and operations. Classifications to previously adopted codes or revisions of a standard may be accepted where the operational basis has not changed.

C4.3 Interior of equipment containing flammable materials

(No Commentary)

C4.4 Explosion risk assessment

The Standard notes the optional consideration of an explosion risk assessment to establish equipment protection levels (EPLs). Normal allowances and required processes for establishing EPLs are provided in AS/NZS 60079.14.

Notwithstanding possible variances in the explosion parameters of different gases and vapours, it should be noted that the hazardous area concept is not intended to be applied to very small volumes. A Zone NE would normally apply where the extent of a hazardous area is assessed as less than approximately 0.2 m in any direction from a source of release. This principle is also noted in Clause 5.1 of the Standard. Larger distances may be considered where these can be justified for the particular gas or vapour concerned.

C4.5 Catastrophic failures

(No Commentary)

C4.6 Competence of personnel

The Standard recommends that competent persons carry out the classification and requires the competency of such persons to be appropriate to the nature of the plant and the classification methodology used.

The required level of competence and instruction is also relevant to the role of the person concerned. For example, basic work may be carried out under the supervision of a senior person with a higher level of competence.

Competency for classification of hazardous areas, as described in the Standard, may be supported by assessment to relevant units from AS/NZS 4761.1, the IECEx Scheme for Certification of Personnel Competencies (CoPC), or a similar assessment framework.

Competency may also be obtained or demonstrated without formal training or assessment through “on the job training” and by completion of validated hazardous area classifications. Competencies gained in this manner are only likely to be valid for the product(s) and processes applicable to the “on the job training”.

C5 Hazardous area classification methodology

C5.1 General

Clause 5.1 in previous editions of the Standard suggested that the classification of hazardous areas could be revisited based on industry experience. Industry experience in this context means experience that can be validated across several organisations or plants (for example, by broad industry bodies or studies). It is not meant to imply that limited experience (for example, of a single plant) can be used to justify an alternative basis for classification.

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C5.2 Classification by sources of release method

The Standard provides several options for assessing hazardous areas, including various forms of calculation, modelling, and the use of examples. It is recognized that these methods can give different results and that variance between these results might range from close similarity to significant divergence. These variances need not suggest an approach is incorrect, particularly when considering classification by use of examples. The most important aspect to consider is that an assessment arrives at a credible answer, rather than an absolute answer, so that a valid practical outcome is achieved.

When selecting an approach to classification of hazardous areas, the type of plant, conditions, availability, cost, and possible benefit of more advanced analysis should be considered. For indoor situations, examples are generally not able to reflect actual ventilation and particular gas or vapour dispersion conditions, whereas the use of a computer model can enable true conditions to be refined. The use of advanced computer models might lead to outcomes that suggest either lesser or greater extents of hazardous areas when compared to other approaches, depending on actual conditions.

It is reasonable to anticipate that the more advanced assessment methodologies, such as CFD analysis, will arrive at assessments that have more variance from examples than other methodologies. Such variances may be accepted where the analysis is validated, subject to the details of the particular situation. Variances from an example do not imply that an example is inadequate where it is sufficiently conservative, nor do they imply the use of advanced modelling is not appropriate if it suggests a lesser hazardous area to an example.

More detailed assessments are inherently more time consuming and expensive to complete; therefore, a cost-benefit analysis should be considered when carrying out a classification. Where a library of case histories can be established from previous assessments, the analysis might be used to further support the classification in comparable applications.

Assessments should be validated as being credible or suitably conservative according to the project need. For example, this can be achieved by relative comparison to other conditions, measurement of vapour conditions to validate or calibrate the analysis methodology, other examples, or previous validated studies.

When considering the use of computer models, such as CFD programs, the following factors should be acknowledged and accounted for:

(a) The assessment might be sensitive to the initial conditions selected. Therefore, it is often appropriate to look at a range of initial conditions to test the sensitivity to different conditions.

(b) Results should be treated as only approximate. Despite any apparent suggestion of accuracy, which might be indicated by coloured contours or numerical values typically provided from a model, such precision should not be assigned to any final assessment.

(c) The limitations of the modelling tools should be understood. Some models inherently use approximate calculations or have other limitations such as applications for gases of particular density, etc. The use of simpler models or modelling tools can be beneficial, e.g. to save costs or to help understand the nature of the influencing factors or general behaviour of the dispersion, but in these cases any results might require further moderation to arrive at a final assessment.

(d) The persons carrying out modelling should be competent in their own right; however, they might also need support from a person who is competent in the classification of hazardous areas when establishing appropriate factors, context, criteria and objectives. While persons who are proficient in computer modelling are often specialists in the use of the software, which is appropriate, such persons might need guidance on other aspects of the analysis.

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C5.3 Use of industry codes and national standards

In general, classifications in accordance with codes such as the following might be acceptable where application to the particular situation can be clearly demonstrated:

(a) EI 15.

(b) API RP 505.

(c) API RP 500.

(d) BS 5908-1.

(e) IGEM codes for natural gas installations, such as IGEM/SR/25.

NOTE IGEM calculations for natural gas are a very close approximation to other examples in the Standard and this Supplement when natural gas is the gas under consideration. For further guidance on situations not covered in this Supplement, refer to the IGEM codes.

(f) NFPA 58.

(g) NFPA 59A.

(h) NFPA 497.

Users are advised that some codes, including some NFPA codes and aviation codes, assign hazardous areas or distances from ignition sources considering safety distances for naked lights and flames. These distances might not be intended for the selection of equipment as applicable to the ISO 80079 series and AS/NZS 60079 series of standards. As such, the classifications suggested by these codes might be overly conservative for the classification of hazardous areas in accordance with the Standard and should be used with caution (see Clause C1).

Other documents, which are listed in Annex K of the Standard, may be accepted for examples that are not covered in the preferred codes above or Appendix A of this Supplement. The guidance in Annex K of the Standard should be noted; that is, where a standard is selected as a preferred base for a site or application, examples from another standard should not be selected to achieve a less rigorous classification without due justification.

In all cases, classification may be made using the fundamental principles of the Standard. Further guidance on the use of examples is provided in Appendix A of this Supplement.

Users of the Standard are advised that there are regulations specific to some industries or jurisdictions, such as, but not limited to, the Australian and New Zealand civil aviation safety authorities for hazardous areas in the aviation industry.

The examples in Appendices A to F in this Supplement are not intended to provide additional guidance for the following applications:

(i) Enclosed gas turbines.

(ii) Congested or stagnant plant areas.

(iii) Engines and compressors in ventilated enclosures specific for the device (packaged equipment).

(iv) Analyser houses.

(v) Complex facilities such as offshore platforms and mobile installations.

(vi) Drilling and work over rigs.

(vii) Complex major plants such as refineries and petrochemical plants.

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For these applications, the hazardous areas should be assessed using other approaches from the Standard or reference should be made to specific standards and codes for the application.

The generalized approach outlined in Appendix G may be used for large complex plants and is favoured in some situations due to the large number of potential sources of release, variations in release conditions, and the potential for large releases with complex plant geometries.

C5.4 Simplified methods

Simplified methods might be suited to larger plants where there are numerous possible sources of release. While general simplification of the assessment might be valid for Zone 2 areas, it is most important that sources of release which could lead to Zone 0 or Zone 1 areas are identified and analysed as these sources will commonly require further detailing and assessment of suitable distances.

C5.5 Combination of methods

In addition to the situations described in the Standard, a combination of methods might also be suitable for different sections of a plant.

C6 Release of flammable substance

C6.1 General

(No Commentary)

C6.2 Sources of release

The Standard does not characterize sources of release based on a specific frequency or duration. The Standard uses words such as “normal”, “abnormal”, “frequently”, “long”, “occasionally”, “infrequent” and “short” as terms to describe the likelihood of a hazardous area being present and not necessarily to imply a particular duration. While standards such as EI 15 provide guidance using a defined duration per year to assess sources as either leading to a Zone 0, 1 or 2, such defined criteria are not applied in the Standard and should not be used as a general rule as they can lead to inappropriate conclusions. Defined criteria based on duration of release within a year can lead to a misleading classification where the source of release does not occur regularly but still occurs in normal operation, such as a sample point that is used infrequently.

Clause 5.1 of the Standard states that if the quantity of a flammable substance available for release is “small”, e.g. in laboratory use, it might not be appropriate to use this area classification procedure. For guidance on laboratories, see Clause F.1.

C6.3 Forms of release

(No Commentary)

C7 Ventilation (or air movement) and dilution

C7.1 General

(No Commentary)

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C7.2 Main types of ventilation

C7.2.1 General

Other codes and standards have specific requirements for ventilation details (e.g. AS 3814 for industrial and commercial gas-fired appliances, AS 1375 for industrial fuel-fired appliances and AS/NZS 5601.1 for gas installations).

C7.2.2 Natural ventilation

(No Commentary)

C7.2.3 Artificial ventilation

Artificial ventilation can be provided using either dilution ventilation or extraction ventilation or a combination of the two.

The examples in this Supplement assume that, when using extraction ventilation, the exhausted air flow will contain only limited quantities of flammable gas or vapour such that the discharge air stream could be diluted even before discharge from the vent outlet. Once an air and gas/vapour mixture is discharged, it will further dilute in the surrounding atmosphere.

Discharge points should be located well away from inlets to the ventilated space to avoid re-entry of flammable gas or vapour.

Ventilation of structures with an internal hazardous area should also consider start-up conditions where the vapour or gas concentration can be higher than when the ventilation is normally running. The examples provided also consider this condition. Where other conditions are applicable, reference should be made to assessment by other methods according to the Standard or other relevant industry standard practice.

C7.2.4 Degree of dilution

To specify that plant or equipment is located in “open air” or in some “sheltered area” does not clearly define the degree of dilution. The degrees of dilution for the examples given in this Supplement are based on the following assumptions:

(a) *Outdoors* — Normally medium dilution; that is, there is sufficient ventilation or space available for dispersion to limit the type of zone and the extent of the zone (see Figure C7.2.4).

(b) *Inside structures* — The degree of dilution needs to be considered relative to the release rate and the application. To specify a ventilation arrangement as being adequate or inadequate is not valid unless both the amount of ventilation and the potential release rate are considered. Notwithstanding the need to consider both aspects, the examples in this Supplement provide guidance on arrangements that should provide medium dilution and which might help with assessment of some situations. These examples generally provide conservative guidance and more detailed analysis might lead to lesser requirements in some situations.

Structures with an open floor plan which are large relative to the process equipment can usually be considered to provide a medium degree of dilution.

General guidance for ventilation provisions in a small to medium structure that provide a medium degree of dilution for a wide range of situations with heavier-than-air gases and vapours includes structures having —

(i) not more than three solid walls, where all walls have continuous or virtually continuous ventilation openings along their full length comprising approximately 0.4 m high effective opening at the bottom, 0.3 m high effective opening at the top

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of the walls and 0.3 m virtually continuous effective opening at the highest part of the roof; or

(ii) effective, unobstructed openings equal to approximately 10 % of wall surface in all walls at both top and bottom of all sides, and 0.3 m continuous or virtually continuous effective opening at all ridges of the roof.

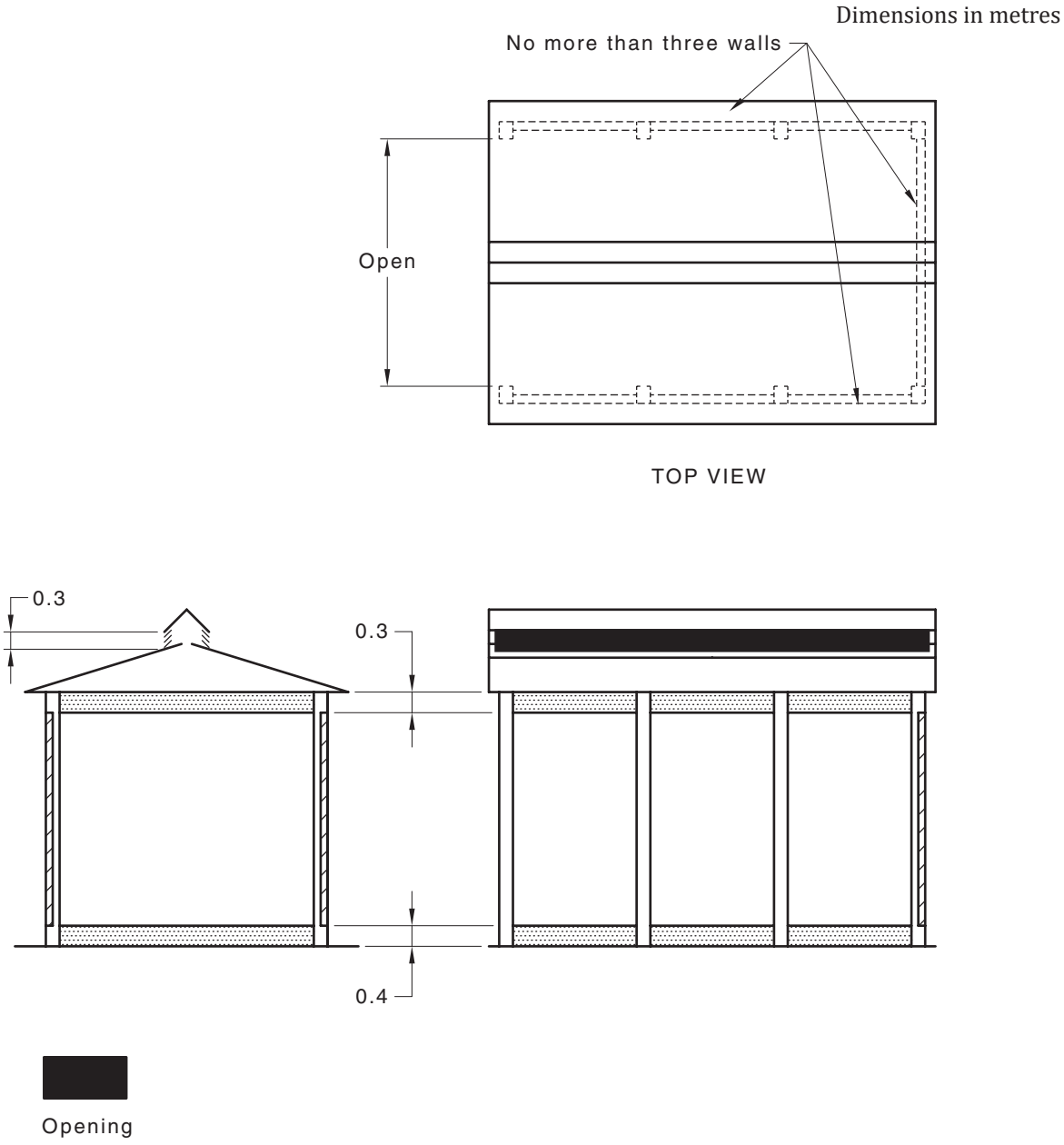


Figure C7.2.4 — Example of shelter providing medium dilution

C8 Type of zone

(No Commentary)

C9 Extent of zone

Vapour barriers can limit the extent of a hazardous area by providing an effective barrier to limit gas or vapour movement.

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The vapour barrier material should be impervious to and unaffected by the gas or vapour to which it could be exposed. It should also be sufficiently robust for a permanent installation and take into account any other operational risks; for example, a sheet metal barrier might not be appropriate where fork lift movements occur in the area due to the potential to damage a light metal sheet.

Vapour barriers in well ventilated areas, i.e. with good ventilation on both sides, can still be effective even with small gaps around service penetrations or a limited number of small holes provided that the greater part of the barrier effectively restricts gas or vapour movement. Such gaps or holes should not be subject to elevated pressure, e.g. from direct impingement of a gas release, or in locations where gas/vapour concentration could be many times the LFL. Once the vapour or gas begins to disperse away from the source of release there will usually not be any driving force to cause a diluted mixture to pass through small gaps. Additionally, any limited amount of gas or vapour that passes through the small gap in a well-ventilated area will normally be rapidly diluted on the other side of the gap.

NOTE Other codes or standards specify additional particular requirements for vapour barriers not referred to in this Supplement, e.g. fire rating.

Distances are normally considered in a horizontal plane around the end of any vapour barrier which acts as an intervention provided that the barrier is not lower than the height applied for the hazardous area without a vapour barrier.

The concepts associated with vapour barrier are illustrated in Figure C9.

Dimensions in metres

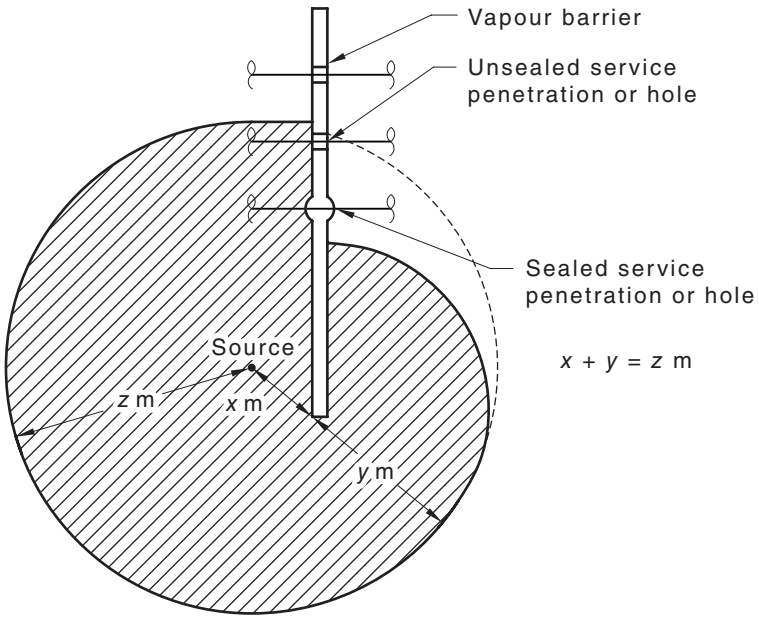


Figure C9 — Effect of a vapour barrier on the measurement of distances

C10 Documentation

C10.1 General

(No Commentary)

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C10.2 Drawings, data sheets and tables

When preparing classification drawings for a site, the following general principles should also be recognized:

(a) The classification of hazardous areas, by necessity, is not an exact science, and a reasonable allowance should be made for possible variances to arrive at a reasonable management approach. As such, the classifications should not be treated as precision solutions. When presenting classifications on a site, drawing them might be valid to show the extents with reference to other recognizable site features that aid in management of the hazards on site. For example, if a zone is nominally 3 m from a door and the roadway is 2.8 m from the door, then showing the zone to the roadway might be an acceptable management approach. Where this form of adjustment is made, it should not reduce the classification by more than 10 % of the nominal distance.

(b) When many sources of release are considered, it is inappropriate to suggest that non-hazardous areas can be included within small gaps between the zones from different sources of release or in the “nip” points of associated radii. Zones from multiple sources of release should be smoothed and rationalized considering practical boundaries as noted in point (a) above.

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Annex CA
(informative)

Suggested presentation of hazardous areas

Tables A.1 and A.2 of the Standard suggest possible formats for documentation of materials and assessment of individual sources of release. However, it is recognized that the documentation of hazardous areas strictly following these tables can be onerous. As such, other forms of documentation that capture the required information, assessment methodology and hazardous area assessment are also acceptable.

In all cases the relevant parameters considered for the classification of hazardous areas should be documented in accordance with the principles in Clause 10 of the Standard.

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Annex CB
(informative)

Estimation of sources of release

CB.1 Symbols

(No Commentary)

CB.2 Examples of grade of release

(No Commentary)

CB.3 Assessment of grades of release

(No Commentary)

CB.4 Summation of releases

(No Commentary)

CB.5 Hole size and source radius

Suggested hole sizes are not be applicable to all installation types and should be considered only where there is no other guidance in industry codes. Industry codes, and in particular gas codes, are generally prepared based on the specification of piping, equipment, and operations to prevent leaks.

Standards where Table B.1 should not be used include —

(a) AS 1375;

(b) AS 3814; and

(c) AS/NZS 5601.1.

The last column of Table B.1 provides values for severe failures such as blow out of gaskets. Such failures are considered as rare malfunctions in an appropriately designed and constructed plant and as such are beyond the scope of normal requirements for classification of hazardous areas [refer to Clause 1(c) of the Standard]. The values may be used to assess sensitivity of the classification to larger releases but are not required to be used.

The values in Table B.1 of the Standard for small bore connections up to 50 mm could be conservative when applied to screwed and compression fittings but are often used for consistency of assessments when numerous fitting types are considered in an installation.

Lower values from Table B.1 of the Standard are generally applicable for pressures well below the pressure rating for the piping system. Higher values should be considered for operating pressures closer to the maximum pressure rating of a system.

The values in Table B.1 of the Standard for conditions at which the release area can expand could also be applicable for installations with adverse conditions (e.g. vibration, corrosion, or maintenance regimes with a low inspection frequency).

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CB.6 Forms of release

(No Commentary)

CB.7 Release rate

CB.7.1 General

Clause B.7.1 notes parameters affecting release rate specific to flammable liquids. The following commentary is provided in relation to combustible liquids under certain conditions:

(a) *Heated combustible liquids* — Combustible liquids are defined in AS 1940 and include GHS Category 4 flammable liquids.

Combustible liquids that are stored, handled or processed at a temperature $T \geq FP - 6$ °C (where FP = flash point of the liquid) should be considered as possibly generating flammable vapour such that explosive atmospheres should be reviewed for such situations. Zonal distances for such conditions should be determined in accordance with the basic principles of the Standard unless a specific industry classification is applied. Consideration should be given to the likelihood of low release rates (which might not be represented by the calculations in Clause B.7.3 of the Standard) due to the nature of the liquid being heated. In well ventilated areas, the generally lower rate of release can then result in high dilution.

(b) *Diesel* — The examples provided in this Supplement are not intended for use with combustible liquids. Diesel fuels in Australia and New Zealand are typically formulated with flash points to provide a small safety margin above the 60 °C reference temperature for combustible liquids. Operating experience has shown this provides sufficient allowance so that diesel which is handled at ambient temperatures does not normally need to be considered in the classification of hazardous areas for Australian and New Zealand climatic conditions. This experience is also supported by calculations, modelling and historical measurements.

CB.7.2 Estimation of release rate

CB.7.2.1 General

Clause B.7.2.1 notes that the calculations are not intended to be applicable to all installations. The calculations in the Standard provide methodologies that may be suitable considering a range of possible factors and possible simplification of the numerical methods applied to arrive at a suitable approximation. Alternative calculations may be used where these are available in recognized codes or can be validated for the application. For example, IGEM codes have different calculations specific for natural gas, which are simpler but yield similar results to the more complex equations presented in the Standard.

CB.7.2.2 Release rate of liquids

(No Commentary)

CB.7.2.3 Release rate of gas or vapour

(No Commentary)

CB.7.3 Release rate from evaporative pools

The exact calculation of release rates from evaporative pools and spills on either land or water is extremely complex and depends on a wide range of factors. These factors include the temperature and heat input available from the surface or body onto which the liquid is spilled and the nature of that surface, including roughness.

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The equation presented in the Standard is empirical and does not account for these and other factors. It is therefore suggested for application to pools exceeding 1 cm deep. While this will not be representative of many spills, the calculation presented is still very simplified, even for deeper pools. The calculation presented is simplified for initial determination of an evaporation release and further analysis could be necessary.

CB.8 Release from openings in buildings

The Standard provides reasonable guidance for the consideration of openings. This guidance may also be used with the classification examples provided in this Supplement to further modify the examples provided.

Particular note should be taken of the following aspects of the guidance provided in Clause B.8 of the Standard:

(a) The examples of openings and criteria for openings need not be rigidly applied and may be varied according to a particular situation. Where variances are proposed, they should be justified in terms of the behaviour of the gas or vapour movement and operational conditions.

(b) Type B openings do not require sealing devices (e.g. gaskets) to be considered as effective, particularly for Zone 2 applications. When considering the basic definitions of the zone classifications and the principles of a vapour barrier as expressed in Clause C9, any substantial closure of an opening would not permit other than negligible quantities of gas or vapour beyond the opening. Such negligible quantities might not constitute a hazard.

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Annex CC
(informative)

Ventilation guidance

CC.1 Symbols

(No Commentary)

CC.2 General

Guidance on the provision of artificial ventilation for small rooms is provided in Appendix H of this Supplement.

While data on basic environmental factors such as wind velocity information is available from relevant bodies, this information should also be considered with respect to other local surface conditions and geographical features, which can affect actual wind conditions at a particular point or location.

NOTE Relevant bodies include the Bureau of Meteorology in Australia and the National Institute of Water and Atmospheric Research in New Zealand.

CC.3 Assessment of ventilation and dilution and its influence on hazardous area

(No Commentary)

CC.4 Examples of ventilation arrangements and assessments

CC.4.1 Introduction

(No Commentary)

CC.4.2 Jet release in a large building

(No Commentary)

CC.4.3 Jet release in a small naturally ventilated building

(No Commentary)

CC.4.4 Jet release in a small artificially ventilated building

(No Commentary)

CC.4.5 Release with low velocity

(No Commentary)

CC.4.6 Fugitive emissions

While the Standard provides some guidance regarding fugitive emissions in closed spaces, most gas and industry codes do not allow fittings in enclosures without some form of ventilation provision.

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CC.4.7 Local ventilation-extraction

Further guidance on the provision of local artificial ventilation is provided in Appendix H of this Supplement.

CC.5 Natural ventilation in buildings

While the Standard provides some basic guidance for assessing ventilation in buildings, it is recognized that this information is very basic and can oversimplify many details.

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Annex CD
(informative)

Estimation of hazardous areas

This Supplement includes a number of examples that are regarded as commonly accepted industry practice (see Appendices A to F of this Supplement). Where examples are provided as commonly accepted industry practice in Appendices A to F of this Supplement, the examples are preferred to classification by use of the charts in Annex D of the Standard.

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Annex CE
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Examples of hazardous area classification

The examples in Annex E of the Standard are intended to illustrate the calculation methodology using the equations and charts provided in the Standard and should not be taken to indicate examples of classification that might be applied in practice. The use of tables and other forms of presentation indicated are also not mandatory.

Industry accepted classifications for some applications are provided in Appendices A to F of this Supplement.

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Annex CF
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Schematic approach to classification of hazardous areas

(No Commentary)

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Annex CG
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Flammable mists

As noted in Clause G.5 of the Standard, the potential for a flammable mist condition in normal industrial applications should not be overstated. While research in the UK and references in the UK publication EI 15 (4th edition) suggest misting can occur at modest pressures, the risk of misting is not supported based on industry practice and experience for common applications. The hazard due to misting is normally considered as negligible for industries such as the petroleum distribution industry, hydraulics applications and other common applications where established industry standards apply for the operation and construction of piping and equipment. The research study is based on optimized laboratory conditions and is not representative of typical industry conditions or experience.

Misting hazards are known to occur in some specific applications, such as ship engines, heat transfer liquids operating at both very high temperatures and very high pressures, and high vibration applications. Caution should be used when applying the principles of area classification to flammable mist hazards.

NOTE No standards exist for the design of electrical equipment, or for the selection and installation of electrical equipment, in areas subject to flammable mist hazards. AS/NZS 60079.14 does not apply for flammable mist hazards.

Wherever it is proposed to classify an area for a mist hazard due to combustible liquids, the Standard does not apply. Different terms and definitions to those provided in the Standard should be used to differentiate the nature of the mist hazard from hazardous areas due to flammable gas or vapour. However, if the mist is due to a flammable liquid then the mist will be a source of vapour and the Standard should be applied accordingly.

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Annex CH
(informative)

Hydrogen

The diffusion rate of hydrogen can be illustrated through consideration of limited or low-rate releases of hydrogen in a room (e.g. battery charging). The hydrogen will rapidly disperse almost irrespective of any other ventilation measures. At a modest distance from the source of release, the bulk density of the hydrogen and air mixture will be diluted to well below the LFL and be similar to that of air. The low concentration mixture will then move with the general mass of the air. Under such conditions, relatively small openings in the room at high level, even openings such as gaps in roof sheeting, can provide sufficient removal of any low concentration gas.

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Annex CI
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Hybrid mixtures

(No Commentary)

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Annex CJ
(informative)

Useful equations in support of hazardous area classification

(No Commentary)

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Annex CK
(informative)

Industry codes and national standards

CK.1 General

This Supplement provides illustrative examples (see Appendices A to F) that are —

(a) commonly accepted industry classifications which could satisfy regulatory compliance or the requirements of other standards; or

(b) common applications that might be suitable for common situations; or

(c) illustrative examples that are not intended as specific or prescriptive guidance;

as outlined in the introductory text for each example.

In general, classifications in accordance with an example in this Supplement are acceptable where their application to the particular situation can be clearly demonstrated and subject to any limitations provided for each example.

It is not practicable to give an example for every conceivable variation of plant and process characteristics. Therefore, the examples chosen are those that are commonly found in industry.

In arriving at the distances shown in the diagrams, specific plant component conditions have been given. The leakage or source of release conditions have been considered in relation to the mechanical performance of the equipment and other representative design criteria. Factors such as the inventory of process material, shut-off time, dispersion time, pressure, temperature, and other criteria related both to plant components and process material all affect the area classification and will need to be applied to the particular problem being considered.

Thus, these examples represent guidance only and often need to be adapted so as to take into account particular circumstances. If it is intended that the examples given in any standard or code are used for area classification, account needs to be taken of the specific details of each individual case, e.g. process and location characteristics.

In each example, some but not all of the parameters that influence the type and extent of zones are given.

Many examples are based on historical industry acceptance and are not based on calculations. Therefore, they might be different to assessments made using calculation methodologies accepted in other parts of the Standard.

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Appendix A
(informative)

Classification examples — General

A.1 General

General principles in the use of examples are provided in Clause CK.1 of this Supplement as well as the Standard.

The examples in this Appendix are considered in three levels:

(a) *Case A: Commonly accepted industry classifications* — Classification examples in this case are considered as specific industry situations that are commonly accepted by industry to meet regulatory requirements. These examples should only be applied when the installation under consideration does not differ significantly from the direct example in terms of aspects such as layout, type of equipment, class of fluid, pertinent temperature, fluid pressure, or ventilation arrangement and operations.

The examples might not have been developed by calculation or modelling but have been shown to provide acceptable classifications.

(b) *Case B: Common application examples* — Classification examples in this case are considered as suitable for common situations. These examples do not represent every application and should only be applied when the installation under consideration does not differ significantly from the direct example in terms of aspects such as layout, type of equipment, class of fluid, pertinent temperature, fluid pressure, or ventilation arrangement and operations.

The examples might not have been developed by calculation or modelling but have been shown to provide acceptable classifications and may be modified by analysis in accordance with the Standard.

(c) *Case C: Illustrative examples* — The examples should be used with caution. Classification examples in this case are considered to provide conservative guidance and may be used on that basis. However, they might also be unsuitable for some situations.

The examples have not been developed using calculations or modelling and may be modified by analysis in accordance with the Standard.

A.2 Liquid flash point

Table A.2 provides the criteria for different categories of flammable liquids according to the *Globally Harmonized System of Classification and Labelling of Chemicals* (GHS). The requirements for the storage and handling of the different categories of flammable liquids are given in AS 1940 for Australia and in the *Health and Safety at Work (Hazardous Substances) Regulations 2017* for New Zealand.

Since the flash points and boiling points of liquids have a significant effect on the rate of vapour release for a liquid, the following guidance is applied to the examples provided in this Supplement unless otherwise noted. This guidance is also broadly consistent with the assessment of release rate and hazardous area distances following the options for calculation of hazardous areas as expressed in the Standard (e.g. by use of Annex D from the Standard):

(a) GHS Category 4 liquids are not required to be assessed for hazardous areas unless the bulk mass of the liquid is heated to greater than the flash point less 6 °C.

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NOTE Thermodynamic properties of liquids typically make it very difficult to approach the flash point of a liquid by solar radiation alone. Industry experience suggests that in typical situations solar radiation does not cause substantial heating of the bulk mass of a liquid.

(b) Where GHS Category 4 and higher flash point combustible liquids are heated above the flash point less 6 °C, hazardous areas should be assessed; however, the examples provided do not apply. In such cases, the assessments should be based on the individual factors including the temperature difference between the flash point and the maximum liquid temperature and the particular chemical composition of the fluid.

(c) Examples in this Supplement account for GHS Category 1 and 2 fluids unless noted otherwise.

(d) Unless the example already identifies it is intended for GHS Category 3 liquids, the distance may be reasonably reduced when considering GHS Category 3 liquids. Any such reduction should consider the actual flash point of the liquid(s) under consideration and guidance from the Standard.

(e) Where liquids of any category are deliberately heated, the hazard is increased, the examples do not apply, and reference should be made to the Standard.

(f) Where liquid temperatures are controlled to near or below the flash point, either as a result of the process or controlled environmental conditions such as temperature controlled rooms, then the classification may be reduced accordingly following guidance from the Standard.

Table A.2 — GHS categories for flammable liquids

Packaging Group	GHS Category	Criteria	Hazard statement	Examples
I	1	Flash point < 23 °C and initial boiling point ≤ 35 °C	Extremely flammable liquid and vapour	Propylene oxide, ether disulfide
II	2	Flash point < 23 °C and initial boiling point > 35 °C	Highly flammable liquid and vapour	Methanol, petrol, MIBK, etc.
III	3	Flash point ≥ 23 °C and ≤ 60 °C	Flammable liquid and vapour	Kerosene and jet fuels
–	4	Flash point > 60 °C and ≤ 93 °C	Combustible liquid	Diesel
NOTE Gas oils, diesel and light heating oils in the flash point range of 55 °C to 75 °C may be regarded as a special group for regulatory purposes in cold environments, e.g. New Zealand and Antarctica.				

A.3 Common situations

A.3.1 General

The examples given in Clauses A.3.2 to A.3.4 are common application examples [see Clause A.1(b)] that might be relevant to a variety of applications based on common principles.

A.3.2 Ventilation and dispersion — Mechanical ventilation exhaust and inlet ducts associated with an enclosed structure classified as hazardous (see Figure A.3.2)

Many applications use ventilation as a supplemental control measure to assist with the dispersion, dilution, or removal of flammable gas or vapour. The ventilation system might not remove the need to classify a hazardous area.

As a general principle, the classification of hazardous areas for ventilation systems and ventilation discharges should consider situations when the mechanical ventilation system is operating, when it has failed, and prior to start-up.

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A commonly accepted classification that may be suitable for many applications is as follows:

(a) The interior of both inlet and exhaust ducts is assigned the same zonal classification as the enclosed structure being served.

(b) Within 1 m radius of the exhaust duct outlet. **Zone 2**

NOTE AS/NZS 60079.13 provides requirements for controls where mechanical ventilation is used as a control measure related to hazardous areas.

Dimensions in metres

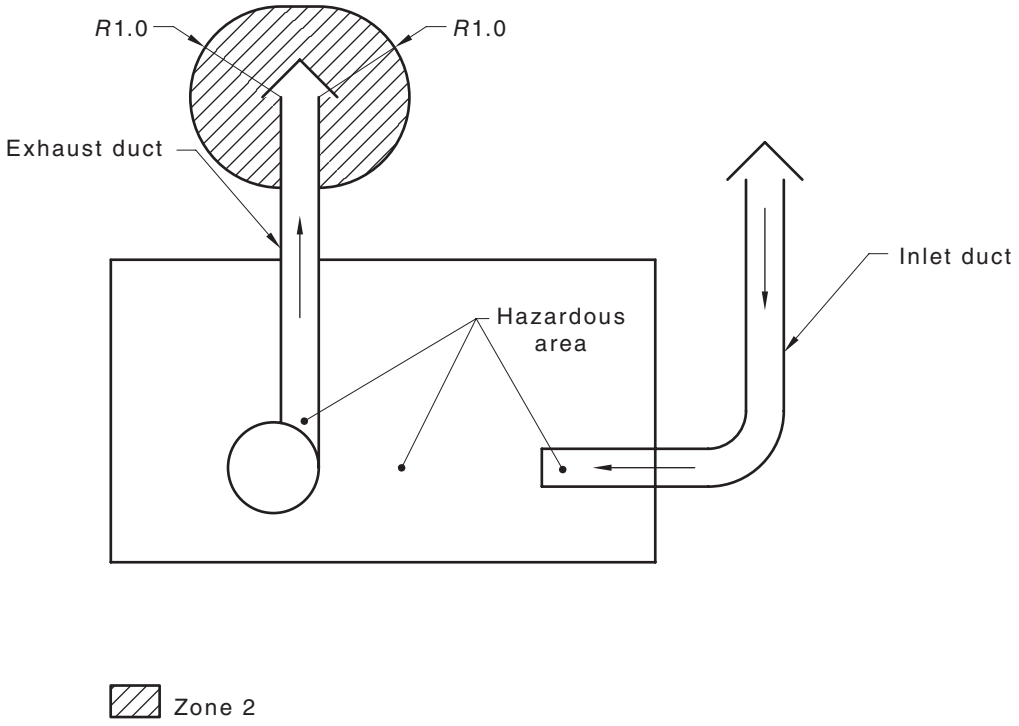


Figure A.3.2 — Ventilation exhaust and inlet ducts for enclosed structures classified as hazardous

A.3.3 Underground wiring enclosures

The examples provided are intended to cover ducts and wiring enclosures located below ground where there is a risk of ground contamination such that flammable liquid or flammable gas can enter the wiring enclosure. Such hazards might be relevant below the surface of hazardous areas associated with liquid transfer points, liquid dispensing units and liquid filling stations. The risk is particularly identified for retail service stations due to potential for soil contamination and for landfill gas applications where gas can be evolved through the soil. Example classifications are as follows:

(a) Wiring enclosures and ducts that —

(i) have mechanical strength at least equivalent to heavy duty conduit according to AS/NZS 2053; and

(ii) maintain an effective and secure barrier against the ingress of liquids likely to be encountered in service (see Note). **NH**

(b) All other wiring enclosures and ducts. **Zone 1**

NOTE In the application of Item (ii) the wiring enclosure should include all joints, fittings and cable entries into the enclosure system.

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A.3.4 Contaminated water and waste water facilities

A.3.4.1 General

This clause covers features and equipment that might be associated with contaminated water systems and that can be used for the collection and subsequent storage or treatment of contaminated water. This includes drains, sumps, plate separators and underground storage tanks for treating or holding waste water that can contain flammable liquids or entrained flammable gases.

The examples are based on situations where contamination of water other than by trace amounts is not expected to occur on a regular basis (i.e. it is infrequent). The examples are intended to be applied for small scale facilities with limited risk factors and not for major refineries and processing plants. For major facilities, reference should be made to recognized codes. For the applications considered, while contaminated water might be retained in holding tanks or treatment facilities for extended periods, the nature of the release conditions and industry experience has shown that such features do not warrant classification as Zone 0.

A.3.4.2 Pumps

Where the liquid being handled has a low concentration of flammable liquid, the degree of dilution should be high, irrespective of the area in which the pump is installed, e.g. indoors or outdoors. Based on these conditions, an example of classification is as follows:

The area within 0.5 m in all directions of a pump. **Zone 2**

A.3.4.3 Coalescing plate separator units in locations providing a medium degree of dilution (see Figure A.3.4.3)

Because a separator is intended to provide separation of flammable liquid from water, a higher release rate might be expected from some part of the system; thus, the rate of dispersion can influence the classification. In locations providing a medium degree of dilution, example classifications are as follows:

(a) The ullage space in the separator. **Zone 1**

(b) The area within 0.5 m above the unit and 0.5 m laterally extending down to ground level. **Zone 2**

NOTE Pollution control equipment such as coalescing plate separator units might treat waste water that contains flammable liquids during abnormal situations.

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Dimensions in metres

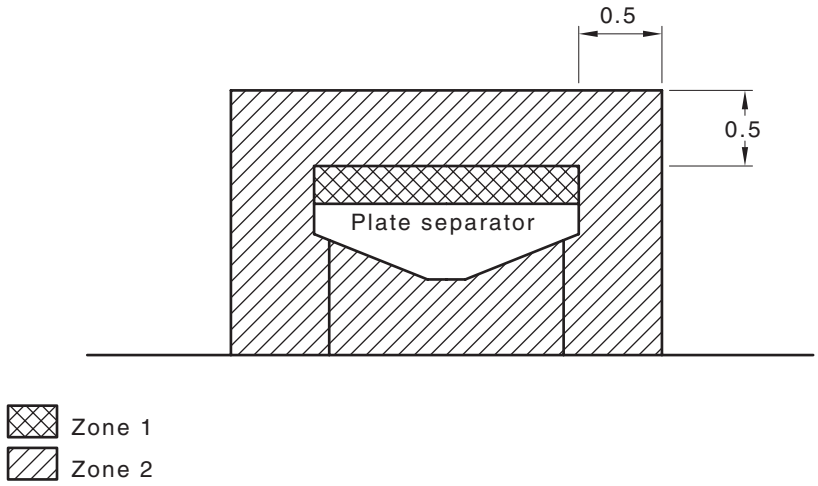


Figure A.3.4.3 — Coalescing plate separator units in locations providing a medium degree of dilution

A.3.4.4 Waste liquids collection and drainage facilities

In the following examples it is assumed that the waste liquids have a low concentration of flammables. The degree of dilution should therefore be high, irrespective of the area. Based on these conditions, example classifications are as follows:

(a) Open and covered drains, trenches, communicating piping and associated drain pits downstream from facilities that might handle contaminated water due to flammable liquids [see Figure A.3.4.4(A)]:

(i) Interior of pipe or drain to ground level. **Zone 1**

(ii) Above ground, 0.5 m laterally and 0.3 m vertically from drain. **Zone 2**

(b) Open-topped effluent pits or tanks for treatment or retention of contaminated water above and below ground level [see Figure A.3.4.4(B)]:

(i) Within the pit or tank from the liquid level to tank top or ground level. **Zone 1**

(ii) Open topped effluent pits or tanks below ground level, 3 m laterally and 0.5 m vertically above ground level. **Zone 2**

(iii) Open topped effluent tanks above ground level, 1 m laterally from the tank shell to 0.5 m above ground level and 0.5 m laterally from the tank shell to 0.5 m above the open tank top. **Zone 2**

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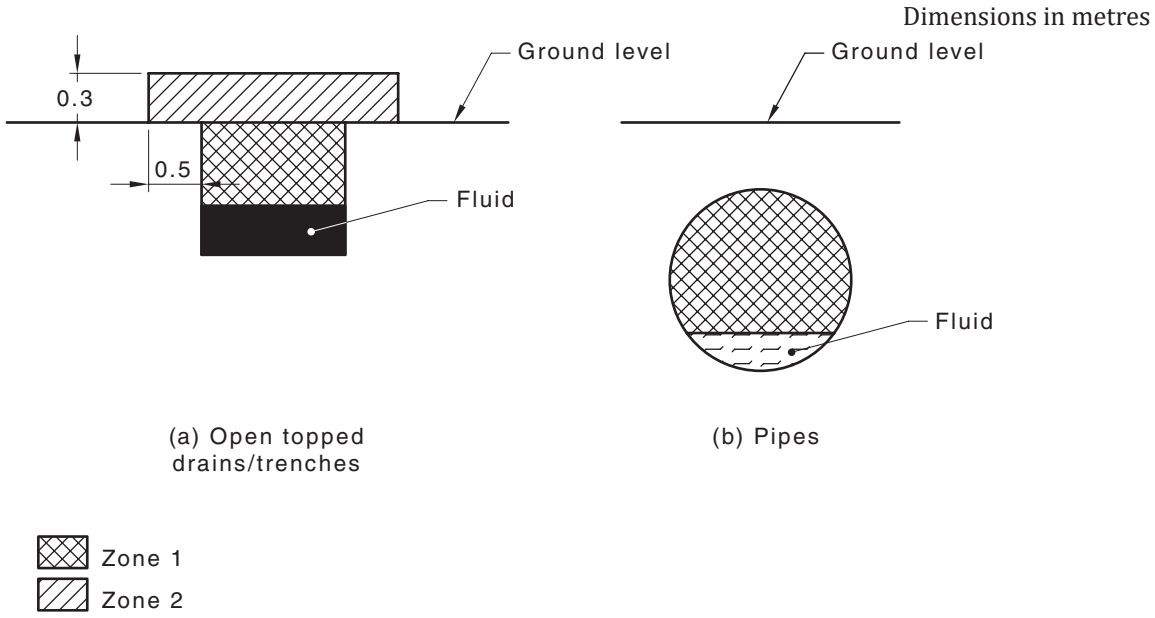


Figure A.3.4.4(A) — Waste liquid collection and drainage facilities, drains/trenches and pipes

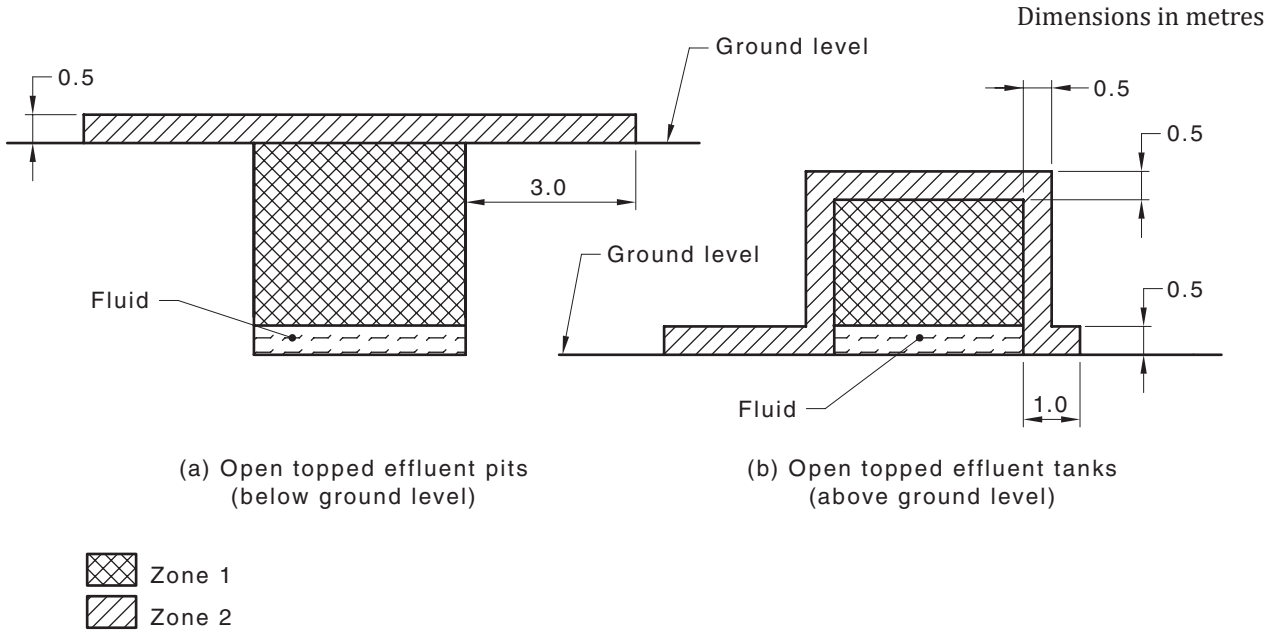


Figure A.3.4.4(B) — Waste liquid and drainage facilities, open topped pits and tanks

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Appendix B
(informative)

Classification examples — Vehicles, fuel dispensing, and aircraft

B.1 Vehicle workshops

The examples given in Clauses B.1 and B.2 are common application examples [see Clause A.1(b)]. In accordance with good workshop practice, it is expected that spills or releases of fuel would be limited, and the examples are provided on this basis. If significant quantities of fuel are spilled or released, then additional precautions (e.g. temporary controls for the management of the spill) are required.

Where service activities can only rarely give rise to escape of flammable liquids or vapours, it may be more appropriate to manage the potentially hazardous area by procedural or other engineering control rather than classify the pit as a hazardous area.

Example classifications are as follows:

(a) Floors at or above adjacent ground or street level. **NH**

(b) Unventilated depressions, pits or sumps, up to floor level. **Zone 1**

To be considered as non-hazardous (NH), service pits may also be provided with suitable mechanical ventilation as specified in the Standard and controls that meet the requirements of AS/NZS 60079.13.

NOTE 1 For the classification of workshops with pumps or similar devices for the dispensing of petrol or other flammable liquids and gases, see Clause C.6.

NOTE 2 For the classification of areas where tank-vehicles are garaged or areas where maintenance operations are carried out on such vehicles, see Clause C.8.

NOTE 3 For the classification of areas where spray painting or spraying operations occur, see Clause D.2.

B.2 Vehicle parking and standing areas

The examples are intended to cover vehicle parking and standing areas that are used exclusively for the parking or standing of vehicles and minor service or repair operations on such parked vehicles. These examples do not include refuelling in the parking area.

Classifications have been suggested on the assumption that hazardous vapours caused by spillage or escape of liquid or gaseous fuels will be cleared by any one of the following:

(a) Mechanical ventilation (for example, as required by the relevant building code for vehicle parking areas).

(b) Natural ventilation.

(c) Removal of a vehicle that is leaking fuel from the parking area and management of the condition under a safe work process.

Example classifications for general parking areas are as follows:

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(i) Vehicle parking or standing area. **NH**

(ii) Depression, pit, sump, or the like, provided for the collection of waste liquids. **Zone 2**

B.3 Petrol, ethanol, LPG and CNG dispensing

B.3.1 General

The classification examples given in Clauses B.3.2 to B.3.12 are commonly accepted industry classifications [see Clause A.1(a)]. The classifications are based on dispensers where all compartments of the dispensing unit are vented and the hydraulic compartment forms the lowest section of the dispensing unit.

The examples may not have been developed by calculation or modelling but have been shown to provide acceptable classifications. These examples apply only to dispensers designed in accordance with the AS/NZS 2229 series.

The examples are intended to cover petrol, ethanol, LPG and compressed natural gas (CNG) dispensing areas where petrol, ethanol, LPG or CNG are transferred by means of a dispensing pump, or similar dispensing device, to the fuel tanks (including auxiliary fuel tanks) of self-propelled vehicles or waterborne craft. The examples are not intended to cover hydrogen.

In the case of multi-product dispenser units, the classification zones applicable to the typical single product dispensers are overlaid on the units, with the severest composite classification becoming applicable.

NOTE 1 For equipment that may be associated with liquid fuel dispensers such as underground tanks and associated fill and vent pipes, see Appendix C.

NOTE 2 For equipment that may be associated with CNG dispensers such as CNG compressors and storage tanks, see Appendix E.

NOTE 3 The term “petrol” includes petrol/ethanol mixtures and any other flammable liquid fuels.

NOTE 4 It is appreciated that some motor vehicles fitted with electrical equipment unsuitable for hazardous areas may unavoidably remain in or pass through hazardous areas associated with fuel dispensing.

B.3.2 Interior of petrol and ethanol dispensing units outdoors (see Figure B.3.2)

Example classifications are as follows:

(a) For a dispensing unit without vapour barriers, entire cabinet. **Zone 1**

(b) For a dispensing unit with a single vapour barrier less than 1.2 m above the base of the dispenser:

(i) Below the vapour barrier. **Zone 1**

(ii) Above the vapour barrier. **Zone 2**

(c) For a dispensing unit with a single vapour barrier at least 1.2 m above the base of the dispenser:

(i) Below the vapour barrier. **Zone 1**

(ii) Above the vapour barrier. **NH**

(d) For a dispensing unit with two vapour barriers, where the upper vapour barrier is at least 1.2 m above the base of the dispenser:

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(i) Below the lower vapour barrier. **Zone 1**

(ii) Between the vapour barriers. **Zone 2**

(iii) Above the upper vapour barrier. **NH**

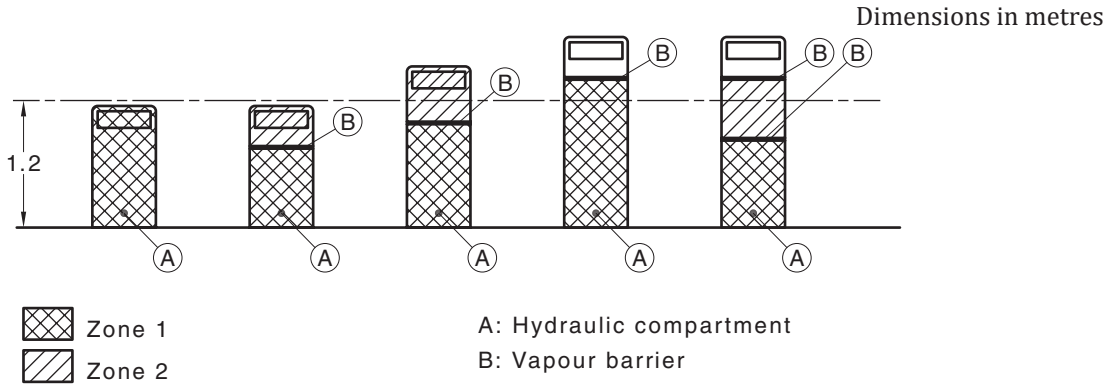


Figure B.3.2 — Interior of petrol and ethanol dispensing units outdoors

B.3.3 Exterior of petrol and ethanol dispensing units outdoors [see Figure B.3.3(A)]

Example classifications are as follows:

(a) Within 0.05 m above and 0.1 m below the dispenser nozzle spout housing and extending 0.1 m laterally from the dispenser housing [see Figure B.3.3(B)]. **Zone 1**

(b) For dispensers mounted at or near ground level, the area within the space 0.25 m above the base of the dispensing equipment and extending 1 m in all directions horizontally from the dispensing unit. **Zone 1**

(c) Within the space 0.5 m laterally of the dispensing equipment to a height of 1.2 m above the base of the dispenser. **Zone 2**

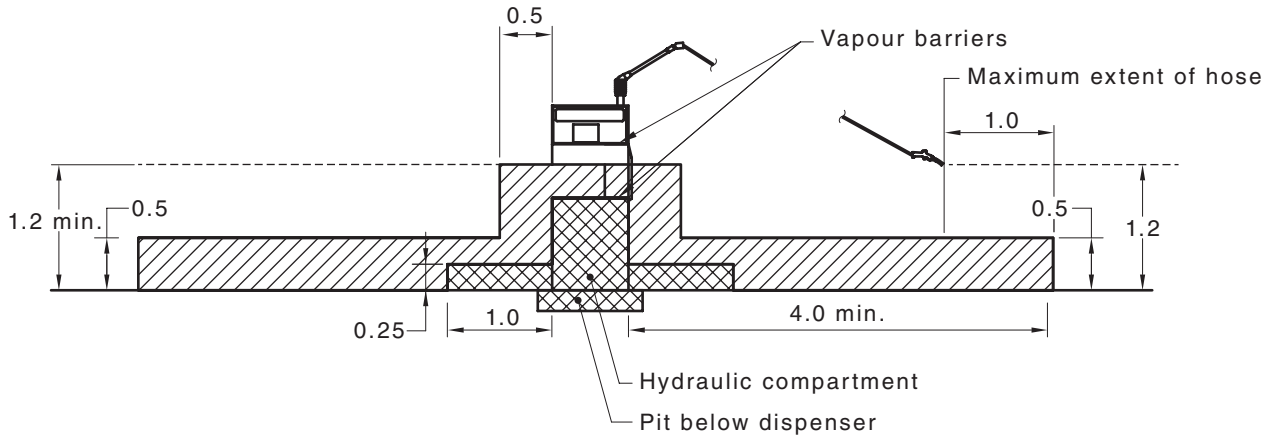
(d) Within the space 0.5 m above the driveway or ground level and extending 4 m in all directions horizontally from the dispensing unit or 1 m from the hose nozzle, whichever is the greater. **Zone 2**

NOTE The distance of 1 m specified in Item (d) is taken from the end of the hose nozzle held at a height of 1.2 m at its maximum lateral distance of travel from the dispenser unit in any direction.

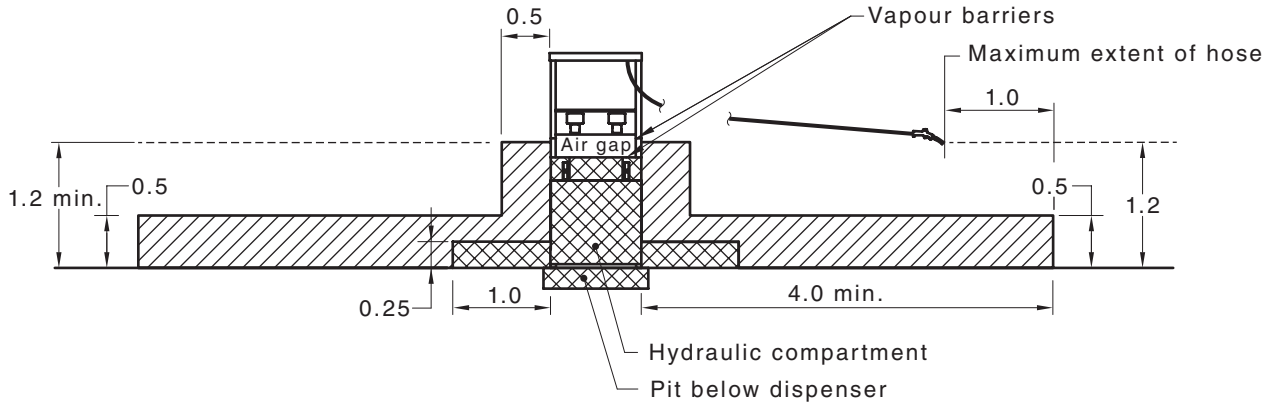
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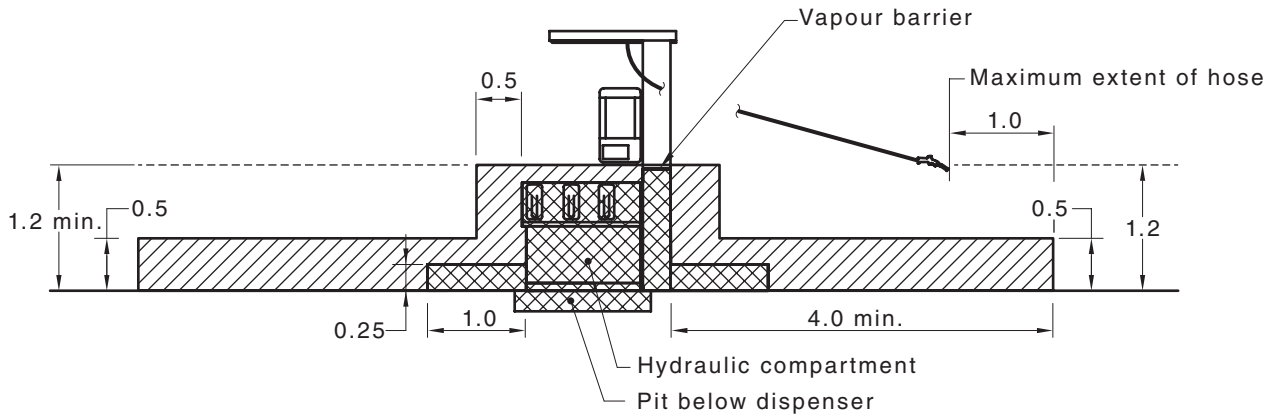
Dimensions in metres



(a) Dispenser Type 1



(b) Dispenser Type 2



(c) Dispenser Type 3



Figure B.3.3(A) — Exterior of petrol dispensing units outdoors

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Dimensions in metres

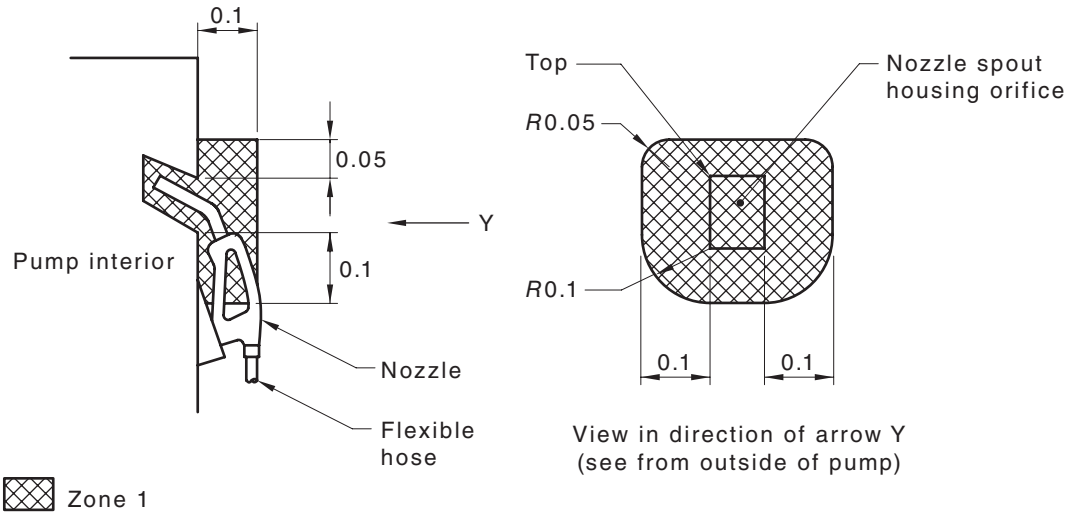


Figure B.3.3(B) — Dispenser nozzle spout housing

B.3.4 Exterior of petrol and ethanol dispensing units mounted on a wharf/jetty outdoors [see Figure B.3.4]

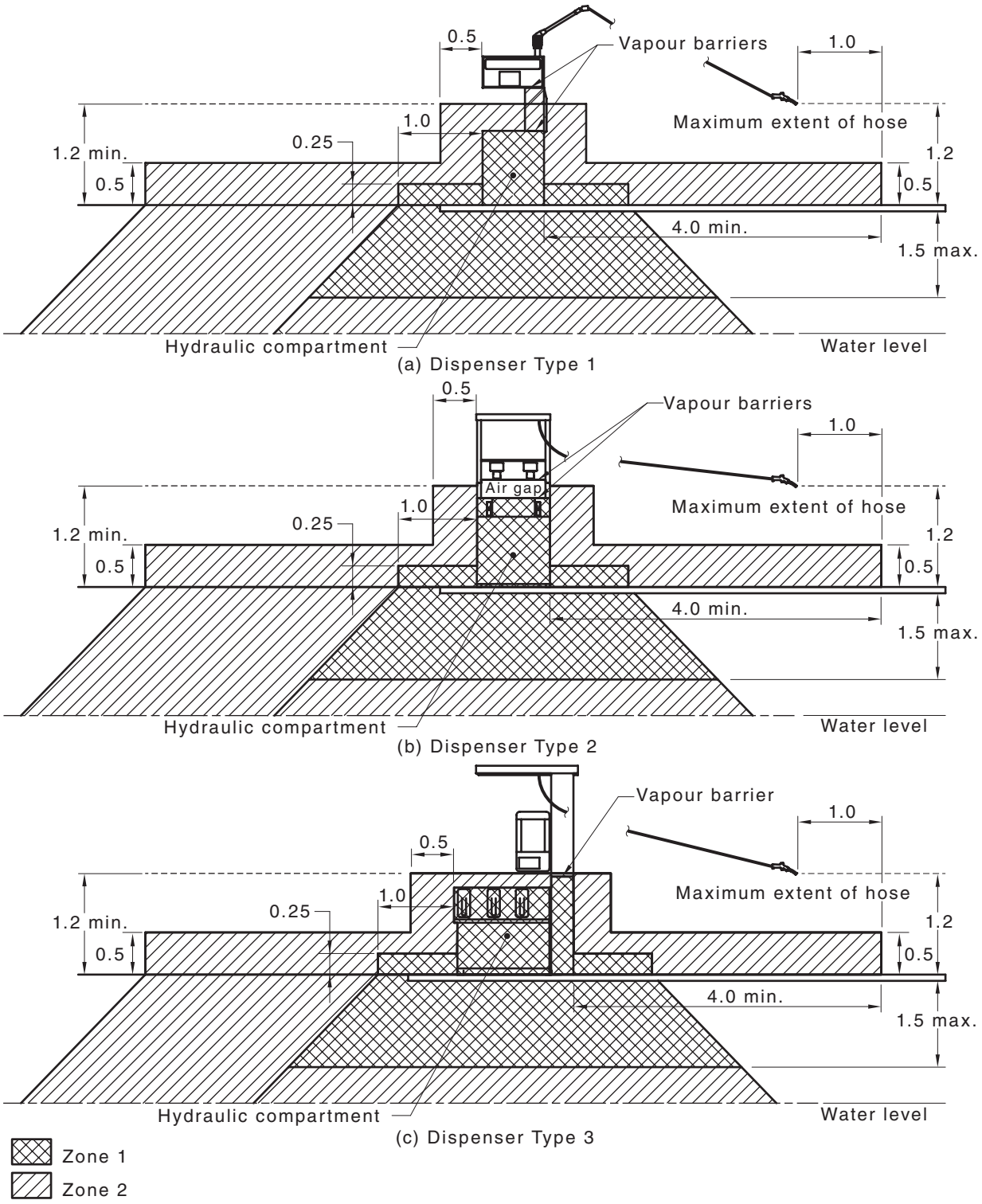
Example classifications are as follows:

(a)	Within 0.05 m above and 0.1 m below the dispenser nozzle spout housing and extending laterally from the dispenser housing 0.1 m [see Figure B.3.3(B)].	**Zone 1**
(b)	For dispensers mounted on a wharf/jetty, the area within the space 0.25 m above the base of the dispensing equipment and extending 1 m in all directions horizontally from the dispensing unit.	**Zone 1**
(c)	Within the space 0.5 m laterally of the dispensing unit to a height of 1.2 m above the base of the dispenser.	**Zone 2**
(d)	Within the space 0.5 m above the wharf/jetty and extending 4 m in all directions horizontally from the dispensing unit or 1 m from the hose nozzle, whichever is the greater. NOTE The distance of 1 m recommended in Item (d) is taken from the end of the hose nozzle held at a height of 1.2 m at its maximum lateral distance of travel from the dispenser unit in any direction.	**Zone 2**
(e)	Within the space adjoining that described in Item (b) splayed outwards 45° and extending down 1.5 m, or to the water level, whichever is lesser.	**Zone 1**
(f)	Within the space adjoining that described in Item (d) splayed outwards 45° extending to the water level.	**Zone 2**

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Dimensions in metres



NOTE Details as shown might be different depending on the wharf construction, which could act as a vapour barrier.

Figure B.3.4 — Exterior of petrol and ethanol dispensing units — Outdoor wharf/jetty locations

B.3.5 Petrol and ethanol dispensing units indoors (see Figure B.3.5)

Example classifications are as follows:

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