Committee Input No. 14-NFPA 497-2014 [Sections 5.9, 5.10]

Sections 5.9, 5.10

5.9 Classification Diagrams for Class I, Divisions.
Most diagrams in Section 5.9 and Section 5.10 include tables of “suggested applicability” and use check marks to show the ranges of process equipment size, pressure, and flow rates. (See Table 5.7.4.) Unless otherwise stated, these diagrams assume that the material being handled is a flammable liquid. Table 5.9 provides a summary of where each diagram is intended to apply. Class I, Division diagrams include Figure 5.9.1(a) through Figure 5.9.14.

### Table 5.9 Matrix of Diagrams Versus Material/Property/Application

<table>
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<tr>
<th>Figure Number</th>
<th>Special Condition</th>
<th>VD &gt; 1</th>
<th>VD ≤ 1</th>
<th>Cryogenic</th>
<th>Indoor, Poor Ventilation</th>
<th>Outdoor</th>
<th>Above Grade</th>
<th>At Grade</th>
<th>Refer to Table 5.7.4</th>
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<td>Outdoor</td>
<td>Above Grade</td>
<td>At Grade</td>
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5.9.1 Indoor and Outdoor Process-Flammable Liquids.
[See Figure 5.9.1(a) through Figure 5.9.1(n).]

**Figure 5.9.1(a) Leakage Located Outdoors, at Grade.** The material being handled is a flammable liquid.

![Figure 5.9.1(a) Leakage Located Outdoors, at Grade.](image)

<table>
<thead>
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<th>Material Flammable Liquid</th>
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**Figure 5.9.1(b) Leakage Located Outdoors, above Grade.** The material being handled is a flammable liquid.

![Figure 5.9.1(b) Leakage Located Outdoors, above Grade.](image)

**Figure 5.9.1(c) Leakage Located Indoors, at Floor Level.** Adequate ventilation is provided. The material being handled is a flammable liquid.

![Figure 5.9.1(c) Leakage Located Indoors, at Floor Level.](image)

**Figure 5.9.1(d) Leakage Located Indoors, above Floor Level.** Adequate ventilation is provided. The material being handled is a flammable liquid.

![Figure 5.9.1(d) Leakage Located Indoors, above Floor Level.](image)

**Figure 5.9.1(e) Leakage Located Indoors, at Floor Level, Adjacent to an Opening in an Exterior Wall.** Adequate ventilation is provided. The material being handled is a flammable liquid.

![Figure 5.9.1(e) Leakage Located Indoors, at Floor Level, Adjacent to an Opening in an Exterior Wall.](image)
Figure 5.9.1(f) Leakage Located Indoors, at Floor Level, Adjacent to an Opening in an Exterior Wall. Ventilation is not adequate. The material being handled is a flammable liquid.

Figure 5.9.1(g) Leakage Located Outdoors, at Grade. The material being handled is a flammable liquid.

Figure 5.9.1(h) Leakage Located Outdoors, above Grade. The material being handled is a flammable liquid.

Figure 5.9.1(i) Leakage Located Indoors, Adjacent to an Opening in an Exterior Wall. Ventilation is not adequate. The material being handled is a flammable liquid.
Figure 5.9.1(j) Leakage Located Indoors, Adjacent to an Opening in an Exterior Wall. Adequate ventilation is provided. The material being handled is a flammable liquid.

Figure 5.9.1(k) Leakage, Located Both at Grade and above Grade, in an Outdoor Process Area. The material being handled is a flammable liquid.

Figure 5.9.1(l) Multiple Sources of Leakage, Located Both at Grade and above Grade, in an Outdoor Process Area. The material being handled is a flammable liquid.

Figure 5.9.1(m) Multiple Sources of Leakage, Located Both at and above Grade, in an Outdoor Process Area. The material being handled is a flammable liquid.
Figure 5.9.1(n) Multiple Sources of Leakage, Located Both at and above Floor Level, in an Adequately Ventilated Building. The material being handled is a flammable liquid.

5.9.2 Outdoor Process — Flammable Liquid, Flammable Gas, Compressed Flammable Gas, or Cryogenic Liquid.  
[See Figure 5.9.2(a) and Figure 5.9.2(b).]  
Figure 5.9.2(a) Leakage Located Outdoors, at Grade. The material being handled could be a flammable liquid, a liquefied or compressed flammable gas, or a flammable cryogenic liquid.

Figure 5.9.2(b) Leakage Located Outdoors, above Grade. The material being handled could be a flammable liquid, a liquefied or compressed flammable gas, or a flammable cryogenic liquid.
5.9.3 Product Dryer and Plate and Frame Filter Press — Solids Wet with Flammable Liquids.

[See Figure 5.9.3(a) and Figure 5.9.3(b).]

Figure 5.9.3(a) Product Dryer Located in an Adequately Ventilated Building. The product dryer system is totally enclosed. The material being handled is a solid wet with a flammable liquid.

Figure 5.9.3(b) Plate and Frame Filter Press. Adequate ventilation is provided. The material being handled is a solid wet with a flammable liquid.
5.9.4 Storage Tanks and Tank Vehicles — Flammable Liquids.
[See Figure 5.9.4(a) through Figure 5.9.4(e).]

Figure 5.9.4(a) Product Storage Tank Located Outdoors, at Grade. The material that is being stored is a flammable liquid.

Figure 5.9.4(b) Tank Car Loading and Unloading via a Closed Transfer System. Material is transferred only through the dome. The material being transferred is a flammable liquid.

Figure 5.9.4(c) Tank Car Loading and Unloading via a Closed Transfer System. Material is transferred through the bottom fittings. The material being transferred is a flammable liquid.

Figure 5.9.4(d) Tank Truck Loading and Unloading via a Closed Transfer System. Material is transferred through the bottom fittings. The material being transferred is a flammable liquid.

Figure 5.9.4(e) Tank Car (or Tank Truck) Loading and Unloading via an Open Transfer System. Material is transferred either through the dome or the bottom fittings. The material being transferred is a flammable liquid.
5.9.5 Tank Vehicle — Flammable Liquefied Gas, Flammable Compressed Gas, or Flammable Cryogenic Liquid.  
(See Figure 5.9.5.)

Figure 5.9.5 Tank Car (or Tank Truck) Loading and Unloading via a Closed Transfer System. Material is transferred only through the dome. The material being transferred may be a liquefied or compressed flammable gas or a flammable cryogenic liquid.

5.9.6 Indoor or Outdoor Drum Filling Station — Flammable Liquids.  
(See Figure 5.9.6.)

Figure 5.9.6 Drum Filling Station Located Either Outdoors or Indoors in an Adequately Ventilated Building. The material being handled is a flammable liquid.
5.9.7 Emergency Impounding Basins, Emergency Drainage Ditches, or Oil–Water Separators — Flammable Liquids.

(See Figure 5.9.7.)

Figure 5.9.7 Emergency Impounding Basin or Oil–Water Separator and an Emergency or Temporary Drainage Ditch or Oil–Water Separator. The material being handled is a flammable liquid.

5.9.8 Storage of Liquid or Gaseous Hydrogen.

[See Figure 5.9.8(a) and Figure 5.9.8(b).]

Figure 5.9.8(a) Liquid Hydrogen Storage Located Outdoors or Indoors in an Adequately Ventilated Building. This diagram applies to liquid hydrogen only.

Figure 5.9.8(b) Gaseous Hydrogen Storage Located Outdoors or Indoors in an Adequately Ventilated Building. This diagram applies to gaseous hydrogen only.
5.9.9 Compressor Shelters — Lighter-than-Air Gas.

[See Figure 5.9.9(a) and Figure 5.9.9(b).]

Figure 5.9.9(a) Adequately Ventilated Compressor Shelter. The material being handled is a lighter-than-air gas.

Figure 5.9.9(b) Inadequately Ventilated Compressor Shelter. The material being handled is a lighter-than-air gas.
5.9.10 Storage Tanks for Cryogenic Liquids.
[See Figure 5.9.10(a), Figure 5.9.10(b), and Figure 5.9.10(c).]

Figure 5.9.10(a) Tank for the Storage of Cryogenic and Other Cold Liquefied Flammable Gases. Dike height less than distance from container to dike \( (H < x) \). [59A: Figure A.10.6.2(a).]

Figure 5.9.10(b) Tank for the Storage of Cryogenic and Other Cold Liquefied Flammable Gases. Dike height greater than distance from container to dike \( (H > x) \). [59A: Figure A.10.6.2(b)]

Figure 5.9.10(c) Tank for the Storage of Cryogenic and Other Cold Liquefied Flammable Gases. Container with liquid level below grade or top of dike. [59A: Figure A.10.6.2(c).]

5.9.11 Outdoor Handling — Liquefied Natural Gas or Other Cryogenic Flammable Gas.
(See Figure 5.9.11.)

Figure 5.9.11 Source of Leakage from Equipment Handling Liquefied Natural Gas or Other Cold Liquefied Flammable Gas and Located Outdoors, at or above Grade.
5.9.12 Indoor Handling — Liquefied Natural Gas or Other Cryogenic Flammable Gas.

(See Figure 5.9.12.)

Figure 5.9.12 Source of Leakage from Equipment Handling Liquefied Natural Gas or Other Cold Liquefied Flammable Gas and Located Indoors in an Adequately Ventilated Building.

5.9.13 Routinely Operating Bleeds — Liquefied Natural Gas or Other Cryogenic Flammable Gas.

(See Figure 5.9.13.)

Figure 5.9.13 Classified Zones around Liquefied Natural Gas Routinely Operating Bleeds, Drips, Vents, and Drains Both Outdoors, at or above Grade, and Indoors, in an Adequately Ventilated Building. This diagram also applies to other cold liquefied flammable gases. (Source: Table 10.6.2 of NFPA 59A.)
5.9.14 Marine Terminal — Flammable Liquids.

(See Figure 5.9.14.)

Figure 5.9.14 Classified Locations at a Marine Terminal Handling Flammable Liquids; Includes the Area Around the Stored Position of Loading Arms and Hoses.

5.10 Classification Diagrams for Class I, Zones.

Class I, Zone diagrams include Figure 5.10.1(a) through Figure 5.10.1(n). Table 5.9 provides a summary of where each diagram is intended to apply.
5.10.1 Indoor and Outdoor Process — Flammable Liquids.
Figure 5.10.1(a) Leakage Located Outdoors, at Grade. The material being handled is a flammable liquid.

Figure 5.10.1(b) Leakage Located Outdoors, above Grade. The material being handled is a flammable liquid.

Figure 5.10.1(c) Leakage Located Indoors, at Floor Level. Adequate ventilation is provided. The material being handled is a flammable liquid.

Figure 5.10.1(d) Leakage Located Indoors, above Floor Level. Adequate ventilation is provided. The material being handled is a flammable liquid.

Figure 5.10.1(e) Leakage Located Indoors, at Floor Level, Adjacent to an Opening in an Exterior Wall. Adequate ventilation is provided. The material being handled is a flammable liquid.
Figure 5.10.1(f) Leakage Located Indoors, at Floor Level, Adjacent to an Opening in an Exterior Wall. Ventilation is not adequate. The material being handled is a flammable liquid.

Figure 5.10.1(g) Leakage Located Outdoors, at Grade. The material being handled is a flammable liquid.

Figure 5.10.1(h) Leakage Located Outdoors, above Grade. The material being handled is a flammable liquid.

Figure 5.10.1(i) Leakage Located Indoors, Adjacent to an Opening in an Exterior Wall. Ventilation is not adequate. The material being handled is a flammable liquid.
Figure 5.10.1(j) Leakage Located Indoors, Adjacent to an Opening in an Exterior Wall. Adequate ventilation is provided. The material being handled is a flammable liquid.

Figure 5.10.1(k) Leakage, Located Both at Grade and above Grade, in an Outdoor Process Area. The material being handled is a flammable liquid.

Figure 5.10.1(l) Multiple Sources of Leakage, Located Both At Grade and Above Grade, in an Outdoor Process Area. The material being handled is a flammable liquid.

Figure 5.10.1(m) Multiple Sources of Leakage, Located Both at and above Grade, in an Outdoor Process Area. The material being handled is a flammable liquid.
Figure 5.10.1(n) Multiple Sources of Leakage, Located Both at and above Floor Level, in an Adequately Ventilated Building. The material being handled is a flammable liquid.

5.10.2 Outdoor Process — Flammable Liquid, Flammable Gas, Compressed Flammable Gas, or Cryogenic Liquid.

[See Figure 5.10.2(a) and Figure 5.10.2(b).]

Figure 5.10.2(a) Leakage Located Outdoors, at Grade. The material being handled could be a flammable liquid, a liquefied or compressed flammable gas, or a flammable cryogenic liquid.

Figure 5.10.2(b) Leakage Located Outdoors, above Grade. The material being handled could be a flammable liquid, a liquefied or compressed flammable gas, or a flammable cryogenic liquid.
5.10.3 Product Dryer and Plate and Frame Filter Press — Solids Wet with Flammable Liquids.

[See Figure 5.10.3(a) and Figure 5.10.3(b).]

Figure 5.10.3(a) Product Dryer Located in an Adequately Ventilated Building. The product dryer system is totally enclosed. The material being handled is a solid wet with a flammable liquid.

Figure 5.10.3(b) Plate and Frame Filter Press. Adequate ventilation is provided. The material being handled is a solid wet with a flammable liquid.
5.10.4 Storage Tanks and Tank Vehicles — Flammable Liquids.
[See Figure 5.10.4(a) through Figure 5.10.4(e).]

Figure 5.10.4(a) Product Storage Tank Located Outdoors, at Grade. The material being stored is a flammable liquid.

Figure 5.10.4(b) Tank Car Loading and Unloading via a Closed Transfer System. Material is transferred only through the dome. The material being transferred is a flammable liquid.

Figure 5.10.4(c) Tank Car Loading and Unloading via a Closed Transfer System. Material is transferred through the bottom fittings. The material being transferred is a flammable liquid.

Figure 5.10.4(d) Tank Truck Loading and Unloading via a Closed Transfer System. Material is transferred through the bottom fittings. The material being transferred is a flammable liquid.

Figure 5.10.4(e) Tank Car (or Tank Truck) Loading and Unloading via an Open Transfer System. Material is transferred either through the dome or the bottom fittings. The material being transferred is a flammable liquid.
5.10.5 Tank Vehicle — Flammable Liquefied Gas, Flammable Compressed Gas, or Flammable Cryogenic Liquid.

(See Figure 5.10.5.)

Figure 5.10.5 Tank Car (or Tank Truck) Loading and Unloading via a Closed Transfer System. Material is transferred only through the dome. The material being transferred may be a liquefied or compressed flammable gas or a flammable cryogenic liquid.

5.10.6 Indoor or Outdoor Drum Filling Station— Flammable Liquids.

(See Figure 5.10.6.)

Figure 5.10.6 Drum Filling Station Located either Outdoors or Indoors in an Adequately Ventilated Building. The material being handled is a flammable liquid.
5.10.7 Emergency Impounding Basins, Emergency Drainage Ditches, or Oil–Water Separators — Flammable Liquids.

(See Figure 5.10.7.)

Figure 5.10.7 Emergency Impounding Basin or Oil–Water Separator and an Emergency or Temporary Drainage Ditch or Oil–Water Separator. The material being handled is a flammable liquid.

5.10.8 Storage of Liquid or Gaseous Hydrogen.

[See Figure 5.10.8(a) and Figure 5.10.8(b).]

Figure 5.10.8(a) Liquid Hydrogen Storage Located Outdoors or Indoors in an Adequately Ventilated Building. This diagram applies to liquid hydrogen only.

Figure 5.10.8(b) Gaseous Hydrogen Storage Located Outdoors, or Indoors in an Adequately Ventilated Building. This diagram applies to gaseous hydrogen only.
5.10.9 Compressor Shelters — Lighter-than-Air Gas.

[See Figure 5.10.9(a) and Figure 5.10.9(b).]

Figure 5.10.9(a) Adequately Ventilated Compressor Shelter. The material being handled is a lighter-than-air gas.

Figure 5.10.9(b) Inadequately Ventilated Compressor Shelter. The material being handled is a lighter-than-air gas.
5.10.10 Storage Tanks for Cryogenic Liquids.

[See Figure 5.10.10(a), Figure 5.10.10(b), and Figure 5.10.10(c).]

Figure 5.10.10(a) Tank for the Storage of Cryogenic and Other Cold Liquefied Flammable Gases. Dike height less than distance from container to dike ($H < x$).

Figure 5.10.10(b) Tank for the Storage of Cryogenic and Other Cold Liquefied Flammable Gases. Dike height greater than distance from container to dike ($H > x$).

Figure 5.10.10(c) Tank for the Storage of Cryogenic and Other Cold Liquefied Flammable Gases. Container with liquid level below grade or top of dike.

5.10.11 Outdoor Handling — Liquefied Natural Gas or Other Cryogenic Flammable Gas.

(See Figure 5.10.11.)

Figure 5.10.11 Source of Leakage from Equipment Handling Liquefied Natural Gas or Other Cold Liquefied Flammable Gas, and Located Outdoors, at or above Grade.
5.10.12 Indoor Handling — Liquefied Natural Gas or Other Cryogenic Flammable Gas.
(See Figure 5.10.12.)
Figure 5.10.12 Source of Leakage from Equipment Handling Liquefied Natural Gas or Other Cold Liquefied Flammable Gas and Located Indoors in an Adequately Ventilated Building.

5.10.13 Routinely Operating Bleeds — Liquefied Natural Gas or Other Cryogenic Flammable Gas.
(See Figure 5.10.13.)
Figure 5.10.13 Classified Zones Around Liquefied Natural Gas Routinely Operating Bleeds, Drips, Vents, and Drains Both Outdoors, at or above Grade, and Indoors, in an Adequately Ventilated Building. This diagram also applies to other cold liquefied flammable gases.

5.10.14 Marine Terminal — Flammable Liquids.
(See Figure 5.10.14.)
Figure 5.10.14 Classified Locations at a Marine Terminal Handling Flammable Liquids; Includes the Area Around the Stored Position of Loading Arms and Hoses.

Submitter Information Verification
Committee Statement

Committee Statement: The committee has noticed that there are inconsistencies between the drawings in 5.9 that are intended to be essentially identical to the drawings in 5.10.

Response Message:
Committee Input No. 1-NFPA 497-2014 [ Section No. 5.9.8 ]

5.9.8 Storage of Liquid or Gaseous Hydrogen.
[See Figure 5.9.8(a) and Figure 5.9.8(b).]

Figure 5.9.8(a) Liquid Hydrogen Storage Located Outdoors or Indoors in an Adequately Ventilated Building. This diagram applies to liquid hydrogen only.

Figure 5.9.8(b) Gaseous Hydrogen Storage Located Outdoors or Indoors in an Adequately Ventilated Building. This diagram applies to gaseous hydrogen only.

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Committee Statement

Committee Statement: The committee would like to update figures to harmonize with NFPA 55, specifically including additional items for vents and add a new figure after 5.9.8(b) for high pressure hydrogen gas cylinders in the second draft.

Response Message: 

National Fire Protection Association Report
http://submittals.nfpa.org/TerraViewWeb/ContentFetcher?commentPara...
5.10.8 Storage of Liquid or Gaseous Hydrogen.

[See Figure 5.10.8(a) and Figure 5.10.8(b).]

Figure 5.10.8(a) Liquid Hydrogen Storage Located Outdoors or Indoors in an Adequately Ventilated Building. This diagram applies to liquid hydrogen only.

Figure 5.10.8(b) Gaseous Hydrogen Storage Located Outdoors, or Indoors in an Adequately Ventilated Building. This diagram applies to gaseous hydrogen only.

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