

# CLASSIFICATION OF HAZARDOUS LOCATIONS

The following discussion provides a basic understanding of approval issues and how they relate to heat tracing.

For complete information on the use of electrical equipment in hazardous locations, refer to the most recent issue of the National Electrical Code or the Canadian Electrical Code.

nVent heating systems are approved and certified for use in nonhazardous and hazardous locations by many agencies, including FM Approvals, CSA Group, UL, PTB, Baseefa, DNV, ABS and INMETRO.



## HOW ARE HAZARDOUS AREAS DEFINED?

According to the National Electrical Code, Article 500 and Section 18 of the Canadian Electrical Code, "Locations shall be classified depending on the properties of the flammable vapors, liquids, or gases, or combustible dusts or fibers that may be present and the likelihood that a flammable or combustible concentration or quantity is present."

Areas where fire or explosion hazards may exist due to flammable gases or vapors, flammable liquids, combustible dusts, or ignitable fibers or flyings are defined by the National Electrical Code (NEC) and the Canadian Electrical Code (CEC) as hazardous locations.

The class and division of an area are based on the type of hazard (Class) and the expected frequency of the hazard (Division).

### Class

The class of a location defines the type of explosive danger that exists or may exist in the location. Table 1 explains how the classes are defined.

**TABLE 1 HAZARDOUS LOCATION CLASSES**

Class	Explosive danger
Class I	Flammable gases or vapors
Class II	Combustible dusts
Class III	Combustible fibers or flyings

## Division

The division of a location defines the frequency that the hazard exists or may exist in a location.

### TABLE 2 HAZARDOUS LOCATION DIVISIONS

#### Division 1 Areas where one or more of these conditions exist:

1. Ignitable concentrations of flammable gases or vapors can exist under normal operating conditions.
2. Ignitable concentrations of such gases or vapors may exist frequently because of repair, maintenance operations, or leakage.
3. Breakdown or faulty operation of equipment or processes might release ignitable concentrations of flammable gases or vapors and might also cause simultaneous failure of the electrical equipment in such a way as to directly cause the electrical equipment to become a source of ignition.

#### Division 2 Areas where one or more of these conditions exist:

1. Volatile flammable liquids or flammable gases are handled, processed, or used, but in which the liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems, or in case of abnormal operation of equipment.
2. Ignitable concentrations of gases or vapors are normally prevented by positive mechanical ventilation, and which might become hazardous through failure or abnormal operations of the ventilating equipment.
3. Areas are adjacent to a Class I, Division 1 location, and to which ignitable concentrations of gases or vapors might be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards are provided against ventilation failure.

## NEC Group

The NEC Group of a hazard is based on specific characteristics of the explosive hazard present. Different sealing techniques are required depending on the molecular size of the hazardous materials and other criteria.

Flammable gases and vapors are placed into NEC Groups based on a determination of explosion pressures and maximum safe clearance between parts of a clamped joint under several conditions. See NEC Articles 500–505 for details. The various groups (A, B, C, and D for flammable gases and vapors, E, F, and G for combustible dusts) are described in Article 500 of the NEC.

The autoignition temperature and the NEC Group of a large number of explosive gases, vapors, and combustible dusts can be found in Article 500 of the NEC; also see Appendix: Hazardous Gases and Vapors.

The temperature identification number (often called T-rating) is based on the maximum operating temperature of the equipment.

### From NEC Article 500

\*Marking. Approved equipment shall be marked to show the class, group, and operating temperature or temperature range referenced to a 40°C ambient, or at the higher temperature if the equipment is rated and marked for an ambient temperature greater than 40°C. The temperature range, if provided, shall be indicated in identification numbers, as shown in Table 500.8(B).

Temperature identification numbers marked on equipment nameplates (often called T-rating) shall be in accordance with Table 500.8(B).

**TABLE 3 TABLE 500.8 (B). IDENTIFICATION NUMBERS**

Maximum temperature		
°C	°F	Identification number (T-rating)
450	842	T1
300	572	T2
280	536	T2A
260	500	T2B
230	446	T2C
215	419	T2D
200	392	T3
180	356	T3A
165	329	T3B
160	320	T3C
135	275	T4
120	248	T4A
100	212	T5
85	185	T6

For equipment to be used in a hazardous (classified) area, the equipment should be approved for both the class and division of the hazardous area and approved for the NEC Group of the hazard(s) present in the area. Also, the identification number of the equipment must be less than both the autoignition temperature of the hazard(s) present in the area and less than the maximum allowed in the area. (See NEC Article 500 reference Division 1 locations. Also, see NEC article 500.8(B), Exceptions 1–5, for exceptions to this rule.)

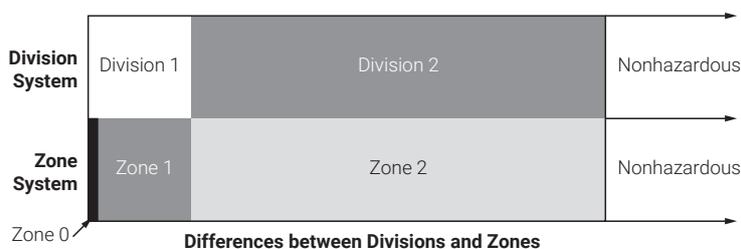
**Examples**

Acetaldehyde can be found in Table 2-1 of the NPFA 497. The data for acetaldehyde and numerous other fluids can also be found in Appendix: Hazardous Gases and Vapors. The NEC Group is Group C and the AIT (autoignition temperature) is 175°C. nVent RAYCHEM BTV-CR/CT, QTVR-CT, AND XTV-CT all have approvals for Class I, Division 2, NEC Group C. BTV-CR/CT (85°C) and QTVR-CT (135°C) have identification numbers (T-ratings) below 175°C (and below 80% of 175°C for CID1). Therefore, when used with the proper components, BTV-CR/CT or QTV-CT can be used in a Class I, Division 2 area where acetaldehyde may be present. The identification numbers for various XTV-CT products range from T3 to T2C, which is from 200°C to 230°C. Since these are all above the AIT of acetaldehyde (175°C), they should not be used in a hazardous area where acetaldehyde may be present in explosive quantities.

Benzene can be found in Table 2-1 of the NPFA 497 or Appendix: Hazardous Gases and Vapors. The NEC Group is Group D and the AIT is 498°C. Since BTV-CR/CT, QTVR-CT, and XTV-CT all have approvals for Class I, Division 2, NEC Group D and have temperature identification numbers well below 498°C, they can be used in a Division 2 area where benzene might be present. These standard products do not have approvals for Class I, Division 1 areas.

**Zones**

The IEC (International Electrotechnical Commission) uses the “zone” system for classifying locations where fire or explosion hazards may exist due to flammable gases, vapors, or liquids. The NEC adopted this approach in 1996 and expanded it in 1999 as an alternate to the Class and Division method previously discussed. It should be noted that the zone classification covers only flammable gases and vapors (Class I); it does not cover combustible dusts, fibers, or flyings (Classes II and III). Details on the use of the zone classification system as an alternative to the division classification system can be found in Article 505 of the NEC.



Zone 2 is equivalent to Division 2. Division 1 is split between Zone 1 and Zone 0. Note that heating cables can never be placed in Zone 0 areas.

The use of the zone system requires that:

- a. **Supervision of Work.** Classification of areas and selection of equipment and wiring methods shall be under the supervision of a qualified Registered Professional Engineer.
- b. **Dual Classification.** In instances of areas within the same facility classified separately, Class I, Zone 2, locations shall be permitted to abut, but not overlap, Class I, Division 2 locations. Class I, Zone 0 or Zone 1 locations shall not abut Class I, Division 1 or Division 2 locations.
- c. **Reclassification Permitted.** A Class I, Division 1 or Division 2 location shall be permitted to be reclassified as a Class I, Zone 0, Zone 1, or Zone 2 location provided all of the space that is classified because of a single flammable gas or vapor source is reclassified under the requirements of this article.

(Extracted from NEC Section 505.7 (C))

Therefore, the zone system approach will be most useful in new construction and significant upgrades.

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