

Oxygen measurement in hazardous applications

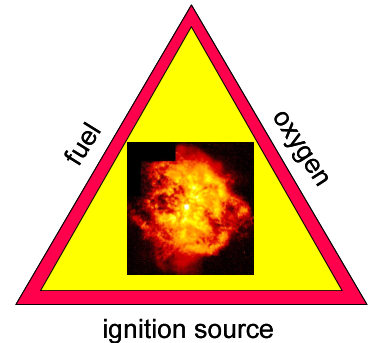


Figure 1. Ignition triangle.

can be prevented by elimination of at least one of these components. Electrical instruments used in hazardous areas should not act as ignition sources. For example, to implement the nonincendive protection concept, the possibility of arcs, sparks and hot surfaces is eliminated by proper instrument design.

Classification of hazardous areas

To determine the equipment usability in a hazardous area, the areas are classified based on the frequency of a likely hazard. Proper identification of potential hazards and correct classification are key issues to ensure safety.

The United States and Canada have two parallel systems in use for classifying hazardous locations. The older classifications based on Article 500 of the National Electric Code (NEC) and Section 18 of the Canadian Electrical Code (CEC) are still in use in parallel with the new NEC 505 and CEC Annex J classifications. Vaisala SPECTRACAP® Oxygen Transmitter OMT364 can only be used in areas with Class, Division, Group classification.

Hazardous area classifications in the USA and Canada

Hazardous area concepts and classifications are briefly presented to support the use of Vaisala SPECTRACAP® Oxygen Transmitter OMT364 in hazardous area applications.

Ignition triangle

Fuel, ignition source and oxygen are all required for an explosion to occur. This is often presented in the form of an ignition triangle (Figure 1). Explosions

Hazardous material in the atmosphere:

Class I	Flammable gases or vapors in quantities able to produce an explosion or fire
Class II	Combustible or conductive dust
Class III	Ignitable fibers or flyings, not likely present in the suspension in sufficient quantities to produce a fire (Group classifications not applied)

Table 1. Hazardous area classifications: Classes.

Presence of Hazardous Material:

Division 1	The substance is present during normal conditions
Division 2	The substance is present only in abnormal conditions (e.g. a system breakdown)

Table 2. Hazardous area classifications: Divisions.

The Article 500 of the National Electric Code (NEC) and Section 18 of the Canadian Electrical Code (CEC) divide hazardous areas to Classes and Divisions, see Tables 1-2.

The gases, vapors and liquids in Class I are further divided to Groups A, B, C and D according to their ignitability from sparks, the gases in Group A being the most ignitable.

Representative gases:

- A: Acetylene
- B: Hydrogen
- C: Ethylene
- D: Methane

Similarly, the combustible dusts in Class II are further divided to Groups E, F and G. Representative materials in the Groups E-F are:

Representative materials:

- E: Metal dust
- F: Carbon dust
- G: wheat dust

Temperature classes

In addition to Class, Division and Group classification, the gases are divided according to their ignition energy. The Temperature Class of a gas is determined according to the lowest temperature at which a hot surface is able to ignite the explosive atmosphere (see Table 3). The instrument temperature should not exceed the ignition temperature of the gas/air mixture. Equipment classified with higher temperature class, e.g. T5, can be used in applications having a lower temperature class, in this case T1-T4.

Temperature class	Max. surface temperature of the equipment (° C)	Max. surface temperature of the equipment (° F)
T1	450	842
T2	300	572
T2A	280	536
T2B	260	500
T2C	230	446
T2D	215	419
T3	200	392
T3A	180	356
T3B	165	329
T3C	160	320
T4	135	275
T4A	120	248
T5	100	212
T5A	85	185

Table 3. Temperature classes.

Local authorities should be involved in hazardous area classification and local regulations should be followed. The use of specialists is recommended if any uncertainty prevails. The decisive authority over instrument installations into hazardous areas rests with the local health and safety authorities.

Vaisala SPECTRACAP® Oxygen Transmitter OMT364

Instruments designed for hazardous area use have different protection types. An instrument that is well suited for one hazardous area application may not be appropriate for other applications.

Vaisala SPECTRACAP® Oxygen Transmitter OMT364 is designed and built for the North American market. The OMT364 has a probe design (see Figure 4), which enables direct installation into the process in many



Figure 4. The Vaisala SPECTRACAP® Oxygen Transmitter OMT364.

applications, making sampling and sample conditioning unnecessary. An optional sampling cell is available for applications where in-situ installation is not possible due to high temperature or pressure or challenging process design.

The permitted areas for using Vaisala SPECTRACAP® Oxygen Transmitter OMT364 are collected in Table 4. The OMT364 is approved for indoor and outdoor use with an enclosure rating IP66. The protection type in OMT364 is Non-Incendive, meaning that arcs, sparks and hot surfaces are excluded by instrument design.

OMT364 (FM Approvals):

Whole transmitter	Class 1, Division 2 Groups A, B, C, D Temperature class T4 Ta = -20 °C to 60 °C
Probe part	Class I, Division 1 and 2 Groups A, B, C, D Temperature class T4 Ta = -20 °C to 80 °C

Table 5. Permitted use of Vaisala SPECTRACAP® Oxygen Transmitter OMT364.

Further reading

NFPA 70 - 1999 National Electrical Code®, 1999 Edition, National Fire Protection Association.

National Electrical Code Handbook 2005, National Fire Protection Association.

Canadian Electrical Code Part 1 (18th edition), Safety Standard for Electrical Installations.

Crowl, D. A. and Louvar, J. F. Chemical Process Safety Fundamentals with Applications, 2nd Ed. Prentice Hall 2002.

Barton, J. [editor] Dust Explosion Prevention and Protection a Practical Guide, Gulf Professional Publishing, 2002.

BSI Standard PD CEN/TR 15281:2006: Guidance on Inerting for the Prevention of Explosions.

VAISALA

For more information, visit www.vaisala.com or contact us at sales@vaisala.com

Ref. B210846EN-A ©Vaisala 2009

This material is subject to copyright protection, with all copyrights retained by Vaisala and its individual partners. All rights reserved. Any logos and/or product names are trademarks of Vaisala or its individual partners. The reproduction, transfer, distribution or storage of information contained in this brochure in any form without the prior written consent of Vaisala is strictly prohibited. All specifications – technical included – are subject to change without notice.