VENTILATION IN CLASSIFIED AREAS

All the operators which daily work in plants know how much warm could interfere on the normal working development and how heavier is the right management of the whole activities.
When we talk about plants installed in classified areas, that are in places with potentially explosive atmosphere, the ventilation, which provides a continuous air renewal, is really important to avoid the development of clouds which could be triggered by a spark or by an equipment over-temperature.

The regulatory framework

At international level the IEC 60079-10-1 recommendations, now European standard EN 60079-10-01, are followed for areas classification and, consequently, for considerations about the necessary ventilation in a plant’s defined zone. This standard concerns classes of substances belonging to gas, vapors and fog. The standard EN 60079-10-2 concerns, instead, the hazardous areas classification for the presence of combustible dusts. EN 60079-10-1 standard is applied in all that places in which there are vapor or gas that in can develop explosive mixtures, in contact with air.
Ventilation is completely discussed in the Attachment B of this standard. As regards Italy, the CEI Guide 31-35:2012indicates the principles for the scientific evaluation of ventilation degree.
This Guide is a precious reference for all specialists who have the necessity to classify a dangerous area and need to be guaranteed about the precision of their evaluations.
In the rest of the world, in particular in the Anglo-Saxon one, EN 60079-10-1 standard is considered enough. The calculation systems introduced in the attachments, are only an example because the standard clearly admits different methods of evaluation.

Defining ventilation efficacy

Once the type of substance that can be present in normal conditions of plant is defined and the possible emission sources are established, due to evaluate the degree of danger there must be defined the reference values of ambient temperature and the ventilation’s features.
In the attachment B of the standard there are indication to evaluate the ventilation degree and to specify the extension of zones. Furthermore, these appendices provide the formulas which permit to calculate the range of emission and evaporation from puddles, the dangerous distance (dz) and the related ventilation data.
As regards Italy, in the appendix GC of CEI 31-35 Guide, there are a statistic data series related to the atmospheric pressure, the volume of mass, the seasonal medium temperature and the wind, for different Italian locations.
The supposed volume (Vz) represents the volume in which the medium concentration of gas or inflammable vapor is 0.25 or 0.5 over the LEL (Lower Explosive Limit). The ventilation efficacy is evaluated in degree VH, VM, VL, depending on the supposed volume of dilution V0, as the Figure 1 below shows.

### Figure 1 – Ventilation efficacy

**High ventilation (VH)**
- Vz negligible
- Explosive atmosphere

**Medium ventilation (VM)**
- Vz not negligible
- No-explosive atmosphere

**Low ventilation (VL)**
- Vz higher than the enviroment's

### Availability of ventilation

Beyond the ventilation degree, it must be considered also the parameter of “Availability of ventilation” that can be:
- Good – when the presence of ventilation is continuous
- Appropriate – when the presence of ventilation is during the normal operation
- Lacking – when the ventilation is neither good nor adequate.

A ventilation which does not respond to expected requisites, should not be considered as a contribute to the ventilation of that place.
Defining the type of zone

At the end of the process described above, we proceed defining the type of zone using the table B1 of EN 60079-10-1 Standard and calculating the distance that determines the size of dangerous zone.

<table>
<thead>
<tr>
<th>Emission degree</th>
<th>Ventilation Degree</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>High</td>
</tr>
<tr>
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<td>Medium</td>
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<tr>
<td></td>
<td>Low</td>
</tr>
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</table>

<table>
<thead>
<tr>
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<th>Good</th>
<th>Adequate</th>
<th>Scarce</th>
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<tbody>
<tr>
<td>Continuous</td>
<td>Zone 2</td>
<td>Zone 1</td>
<td>Zone 0</td>
</tr>
<tr>
<td>Not dangerous zone</td>
<td>Zone 0 + Zone 2</td>
<td>Zone 0 + Zone 1</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>First</th>
<th>Not dangerous zone</th>
<th>Zone 2</th>
<th>Zone 2</th>
<th>Zone 1</th>
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</thead>
<tbody>
<tr>
<td>Second</td>
<td>Not dangerous zone</td>
<td>Zone 2</td>
<td>Zone 2</td>
<td>Zone 2</td>
</tr>
</tbody>
</table>

(Table b1 of EN 60079-10)

Furthermore, the extension of dangerous zone depends on the emission modality, in particular on:
- State of emission (gas or vapor in single phase, liquid or liquefied gas, etc.)
- Speed of emission.
Gas and vapors tend to spread in the air and to occupy the whole space available. So, depending on weight and ventilation, gas disperse in the air.

Conclusion

At theoretic level, if we had always the possibility to ensure an adequate ventilation of spaces and plants, where it is possible the development of explosive atmosphere, it would not be the need to protect the equipment from the formation of sparks, arcs or surface temperature such to trigger an explosion.
But it is not always possible, rather it is very rare. For this reason, even in presence of an apparently adequate ventilation, designers must adopt all the necessary prudence to ensure the safety of plants and workers, installing appropriate equipment that respond to standard requisites of protection against explosions.