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| | | Rev: 01 |
| | | June 2011 |
| KLM Technology Group #03-12 Block Aronia, Jalan Sri Perkasa 2 Taman Tampoi Utama 81200 Johor Bahru Malaysia | ELECTRICAL AREA CLASSIFICATION (PROJECT STANDARDS AND SPECIFICATIONS) | |

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SCOPE

This Project Standards and Specifications shall be used for the electrical classification of areas in which flammable gases or vapors are, or may be, present, in the air in quantities sufficient to produce explosive or ignitable mixtures. Classification of new facilities or extensions/additions to existing facilities shall be performed using the Class I/Zone/Group method per API RP 505 and, for selected facilities as specified below, NFPA 70.

REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

1. American Petroleum Institute (API)

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| API RP 500 | Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1, and Division 2 |
| API RP 505 | Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2 |

2. National Fire Protection Association (NFPA)

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| NFPA 30 | Flammable and Combustible Liquids Code |
| NFPA 30A | Automotive and Marine Service Station Code |
| NFPA 59 | Storage and Handling of Liquefied Petroleum Gases at Utility Gas Plants |
| NFPA 70 | National Electrical Code (NEC) |
| NFPA 325 | Fire Hazard Properties of Flammable Liquids, Gases, and Volatile Solids |
| NFPA 496 | Purged and Pressurized Enclosures for Electrical Equipment |

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DEFINITIONS AND TERMINOLOGY

A combustible liquid - is a liquid that has a flash point greater than 54°C.

A flammable liquid - is a liquid that has a flash point equal to or less than 54°C.

A Classified Location:

- **A Class I, Zone 0** location is an area that meets one of the following:
 - o in which ignitable concentrations of flammable gases or vapors are present continuously
 - o in which ignitable concentrations of flammable gases or vapors are present for long periods of time
- **A Class I, Zone 1** location is an area that meets one of the following:
 - o in which ignitable concentrations of flammable gases or vapors are likely to exist under normal operating conditions
 - o in which ignitable concentrations of flammable gases or vapors may exist frequently because of repair or maintenance operations or because of leakage
 - o in which equipment is operated or processes are carried on, of such a nature that equipment breakdown or faulty operations could result in the release of ignitable concentrations of flammable gases or vapors and also cause simultaneous failure of electrical equipment in a mode to cause the electrical equipment to become a source of ignition
 - o that is adjacent to a Class I, Zone 0 location from which ignitable concentrations of vapors could be communicated, unless communication is prevented by adequate positive pressure ventilation from a source of clean air and effective safeguards against ventilation failure are provided.
- **A Class I, Zone 2** location is an area that meets one of the following:
 - o in which ignitable concentrations of flammable gases or vapors are not likely to occur in normal operation and if they do occur they will exist only for a short period
 - o in which volatile flammable liquids, flammable gases, or flammable vapors are handled, processed, or used, but in which the liquids, gases, or vapors normally are confined within closed containers or closed systems from which they can escape, only as a result of accidental rupture or breakdown of the container or system, or as the result of the abnormal operation of the equipment with which the liquids or gases are handled, processed, or used.
 - o in which ignitable concentrations of flammable gases or vapors normally are prevented by positive mechanical ventilation, but which may become hazardous as a result of failure or abnormal operation of the ventilation equipment

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- that is adjacent to a Class I, Zone 1 location, from which ignitable concentrations of flammable gases or vapors could be communicated, unless such communication is prevented by adequate positive pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

A nonclassified location - is one which is completely outside Class I, Zone 0, Zone 1 and Zone 2 classified locations. Also in the "nonclassified location" category are those enclosed spaces, not containing a release source, in Class I, Zone 0, Zone 1, Zone 2 locations, that are pressurized or purged by inert gas or by air taken from nonclassified locations by systems that comply with type "X" or type "Z" purging, respectively, per NFPA 496.

A volatile liquid - is defined as any of the following: a flammable liquid, a combustible liquid at a temperature within 8°C of its flashpoint or at a temperature equal to or above its flashpoint.

An adequately ventilated indoor location - is one that meets the conditions noted in API RP 505 Section 6.6 on Ventilation.

An adequately ventilated outdoor location - is any space which is open and free from obstruction to the natural passage of air through it, vertically or horizontally. Such locations may be roofed over and/or closed on one side.

Combustible gases and vapors - gases and vapors that can form flammable or explosive mixtures with air.

Heavier-than-air gas/vapor - is a gas/vapor with a density under release conditions that is equal to or greater than 75% of that of air at atmospheric pressure and 15°C.

Lighter-than-air gas/vapor - is a gas/vapor with a density under release conditions that is less than 75% of that of air at atmospheric pressure and 15°C.

GENERAL DESIGN

1. Area Classification Drawings shall be developed for all facilities where flammable liquids, gases, or vapors are produced, processed, stored or handled. This applies to new facilities, or extensions/additions to existing facilities. The classification shall be performed using the Class I/Zone/Group method per the guidelines within API RP 505 and this standard. Extensions/additions to existing facilities already classified by the "Division"

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method can be classified by the same method with approval of the Chief Fire Prevention Engineer.

2. Ventilation

Indoor locations shall be designated "adequately ventilated" if the conditions noted in Section 6.6, Ventilation, of API RP 505 are met.

3. Mixtures of Gases or Vapors of Different Ignition Temperatures

Where a mixture of gases or vapors is composed of gases/vapors of different ignition temperature, designation of the ignition temperature of the mixture shall be by any one of the following methods:

- The ignition temperature of that gas/vapor in the mixture having the lowest individual ignition temperature per NFPA 325.
- The ignition temperature of the mixture as determined by a test specified in NFPA 325.

4. Mixtures of Gases of Different Densities

For a gas or mixture of gases composed entirely of lighter-than-air gases, the extent of the classified location shall satisfy the requirements for lighter-than-air vapors.

Where a mixture is composed of lighter-than-air and heavier-than-air gases and the mixture density is less than 75% of the density of air at standard conditions, the extent of the classified area shall satisfy the requirements for lighter-than-air vapors.

Where the mixture has a density equal to or greater than 75% of air at standard conditions, it shall be considered as a heavier-than-air vapor for area classification purposes.

5. Mixtures of Gases of Different Groups

Where a mixture contains gases of different Groups per NFPA 70, the area classification shall satisfy the requirements for every Group for which the aggregate volume of gas constitutes 30% or more of the mixture composition.

6. Electrical Area Classification Drawings

The development of the electrical classification drawings shall follow the guidelines presented within API RP 505. These drawings shall be produced as part of any project proposal, final design, and as-built issue of drawings for any capital or maintenance project that creates or changes the extent of an electrically classified location. The drawings shall, as a minimum, show the following information:

- The demarcation of the Zone 0, 1, 2 and unclassified areas, both vertically and horizontally via plan, elevation, and section views.

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- The minimum ignition temperature of the mixture of gases/vapors creating each classified location.
 - The type of gas or vapor in each of the classified areas. This shall be presented as the name(s) of the gas/vapor and by the Group IIA, B, or C designations defined within NFPA 70 and API RP 505.
7. Typical relationship between Zone classification and the presence of flammable mixtures can be seen in the following rule-of thumb.

| Zone | Flammable Mixture Present |
|--------------|------------------------------------|
| 0 | 1000 or more hours/year (10%) |
| 1 | 10 < hours/year < 1000(.1% to 10%) |
| 2 | 1 < hours/year <10 (.01% to .1%) |
| unclassified | Less than 1 hour/year (.01%) |

Refer to API RP 505 section 6.5.8 for further details.

EXTENT OF CLASSIFICATION LOCATIONS

General Conditions

The distances specified in this section are the minimum distances necessary to delineate the electrically classified location created by a specific release point or piece of equipment.

General Release Sources

A release source is a point or location from which a flammable gas, vapor or liquid may be released into the atmosphere such that an ignitable gas atmosphere could be formed. Given below are designated release sources. For each source, rules are given for determining the extent of the classified location attributable to it.

For figures, refer directly to the API RP 505 and NFPA references cited. Where Figure 20, 21 or 22 is referenced in this Standard, the "additional Zone 2 area" is mandatory.

1. For relief valves venting to atmosphere, the classified area shall be determined by:
 - Figure 20, or Figure 21, when the source is adequately ventilated and the gas/vapor is heavier than air.
 - Figure 24, when the source is adequately ventilated and the gas/vapor is lighter than air.