Dodge Products: Hazardous Location Guidance

Industrial environments may include areas in which a combustible material is used or generated as part of a process. These areas are called “Hazardous (Classified) Locations” (HazLoc) in the Americas and “Potentially Explosive Areas” in other parts of the world. For the purposes of this paper, the term “Ex Area” will be used when referring to locations in which a combustible material is identified. Where an Ex Area is identified, there are restrictions on the types of equipment that can be used.

The process owner or facility owner is wholly responsible for determining the area classification.

When a combustible material is identified, the process or facility owner is required by law to classify those areas in which the combustible material may be present under certain conditions. The result is an “Area Classification Map” which summarizes the material properties and the extent of the Ex Area to be used for equipment planning and selection purposes.

Documentation of the Hazardous Area

An area classification starts with understanding the processes and the materials used in each step of the process. Combustible materials may be added to a process or be a by-product of the process and, in some instances, the process may change the properties of a material or generate a potential source of ignition. Therefore, the process owner is responsible for determining whether or not an area should be designated as an Ex Area and documenting the pertinent information on the Area Classification Drawing (see *NFPA 70, articles 500.4 and 505.4*).

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*This documentation shall be available to the authority having jurisdiction (**AHJ**) and those authorized to design, install, inspect, maintain, or operate electrical equipment at the location.*

The US Occupational Safety and Health Administration (OSHA) requires that employees are warned of potentially dangerous situations and that they are protected as much as possible from harm during work. The area classification is an essential document to help convey potential hazards to those who are or may be in the area. The area classification document also helps maintenance and facility personnel select, install, commission, and maintain the equipment in an appropriate manner. Many industries have published recommendations with prescribed area extents based on the process and potential release points. These are quite conservative estimates but do provide the AHJ with confidence in area classification maps which use such recommendations.

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The strict requirements for equipment operating in Ex Areas are described in *NFPA 70, articles 500 through 516*.

In the US, there are two (2) different systems used for area classification: Divisions and Zones. While the material properties are the basis for each classification system, the resulting area classification is not the same. Thus, the process owner must select either the Division system or the Zone system prior to completing the area classification and associated documentation.

This document is intended only to summarize the main definitions of Ex Areas so the reader may understand where the Dodge products may be installed and used.

Combustible materials and designation of risk

At a high level, the area classification provides an indication of the potential hazard (material(s) used or generated) along with the probability of a combustible mixture being present and the ease of igniting the combustible mixture. The parameters are independent from each other, so it is essential that each parameter be clearly identified, regardless of the classification system used.

Key parameters of a complete area classification:

- Type of fuel which may be present
- Probability of combustible mixture in air being present
- Material GROUP
- Ignition temperature
- Ambient temperature range

There are two (2) main types of combustible media recognized around the world: 1) Gases and vapors, and 2) Solid particulates which include dusts, fibers, and flyings.

This paper will explain each of the key parameters for both the Division system and Zone system of classification.

Area Classification of Gases and vapors

Under the US Division system, flammable gases vapors are given a CLASS I designation. Per *NFPA 70 article 500.5(B):*

> *Class I locations are those in which flammable gases, flammable liquid-produced vapors, or combustible liquid-produced vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.*

An area is also sometimes designated as a CLASS I area when the Zone system is used, but this is an optional designation as the Zone number identifies the type of combustible media.

Probability of combustible mixture

There are either two (2) designations used in the Division system or three (3) designations used in the Zone system. The designations are intended to provide a high-level understanding of the probability of a combustible mixture being present with a lower numbered designator indicating a higher probability.

A summary of the various general area classifications is summarized in TABLE 1 below. The contents may be found in *NFPA 70, articles 500.5 and 505.5*.

TABLE 1 shows the comparison between the two (2) Divisions and three (3) Zones. Note that while the Division or Zone general indicates the probability of a combustible mixture of a gas or vapor in air, there are significant differences between the two systems. In both cases, the lower the number of the designator, the more probable a combustible mixture.

TABLE 1 SUMMARY OF PROBABILITY DESIGNATIONS – GASES AND VAPORS	
DIVISION 1	DIVISION 2
Where ignitable concentrations can exist under: 1) normal operating conditions, or 2) liquids stored above flashpoints might exist frequently due to repair or maintenance or leakage, or 3) breakdown or faulty operation may result in the release of ignitable concentrations at the same time as equipment may become an ignition source	Where: 1) gases and vapors are confined within a closed system, or 2) positive mechanical ventilation is present, or 3) adjacent to a Class I Division 1 location where combustible concentrations may occasionally exist

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TABLE 1 SUMMARY OF PROBABILITY DESIGNATIONS – GASES AND VAPORS		
ZONE 0	ZONE 1	ZONE 2
Where ignitable concentrations of flammable gases or vapors are present: 1) continuously, or 2) for long periods of time	Where ignitable concentrations of flammable gases or vapors are: 1) likely to exist under normal operating conditions, or 2) likely to exist under frequently due to repair or maintenance operations or because of leakage, or 3) potentially released due to breakdown or faulty operation at the same time as equipment may become an ignition source, or 4) may be communicated into an area adjacent to a Zone 0 location	Where ignitable concentrations of flammable gases or vapors are: 1) not likely to exist under normal operating conditions, and if they do occur, only exist for a short period, or 2) prevented by positive mechanical ventilation, but which may become hazardous because of failure or abnormal operation of the ventilation equipment, or 3) may be communicated into an area adjacent to a Zone 1 location, or 4) where volatile flammable liquids, flammable gases, or vapors are handled, processed or used but in which the liquids, gases, or vapors are normally confined within closed containers of closed systems from which they can escape, only as a result of accidental rupture or breakdown of the containers or system, or as a result of the abnormal operation of the equipment with which the liquids or gases are handled, processed, or used

Note that while the definitions are similar, they are quite different. While it is generally understood that Division 2 and Zone 2 are equivalent, this cannot be stated for Division 1 and Zone 1. There are some small locations within a Division 1 location in which the combustible mixture is present continuously, which is the definition of a Zone 0 location. Most equipment identified for use in a Zone 1 location may not be installed in Division 1 location due to this difference. This will be discussed further in this document.

Material Groups

Each material is further divided into a GROUP which is intended to provide an indication as to the ease of igniting the material. The summary of the material GROUP designation is summarized in TABLE 2.

TABLE 2 SUMMARY OF MATERIAL GROUPS FOR GASES AND VAPORS				
DIVISION GROUP	DEFINITION	EXAMPLE(S)	DEFINITION	ZONE GROUP
A	Acetylene	Acetylene	Flammable gas, flammable liquid-produced vapor, or combustible liquid-produced vapor mixed with air that may burn or explode, having either: 1) **MESG** ≤ 0.50 mm, or 2) **MIC** ratio ≤ 0.45	IIC
B	Flammable gas, flammable liquid-produced vapor, or combustible liquid-produced vapor mixed with air that may burn or explode, having either: 1) **MESG** ≤ 0.45 mm, or 2) **MIC** ratio ≤ 0.40	Hydrogen, Butadiene, Ethylene oxide, Propylene oxide, Acrolein		
C	Flammable gas, flammable liquid-produced vapor, or combustible liquid-produced vapor mixed with air that may burn or explode, having either: 1) 0.45 mm < **MESG** ≤ 0.75 mm, or 2) 0.40 < **MIC** ratio ≤ 0.80	Ethylene, Carbon monoxide, Ether, Hydrogen sulfide, Cyclopropane, Ethyl, Isoprene, Acetaldehyde	Flammable gas, flammable liquid-produced vapor, or combustible liquid-produced vapor mixed with air that may burn or explode, having either: 1) 0.50 mm < **MESG** ≤ 0.90 mm, or 2) 0.45 < **MIC** ratio ≤ 0.80	IIB
D	Flammable gas, flammable liquid-produced vapor, or combustible liquid-produced vapor mixed with air that may burn or explode, having either: 1) **MESG** > 0.75 mm, or 2) **MIC** ratio > 0.80	Propane, Methane (natural gas), Acetone, Ammonia, Benzene, Butane, Ethanol, Hexane, Methanol, Vinyl chloride, Naphtha	Flammable gas, flammable liquid-produced vapor, or combustible liquid-produced vapor mixed with air that may burn or explode, having either: 1) **MESG** > 0.90 mm, or 2) **MIC** ratio > 0.80	IIA

In summary, a Group A gas (Acetylene) is much easier to ignite than a Group D gas (Propane). Thus, equipment marked for use in Group A is suitable for installation and use in areas of Groups B, C, and D.

Similarly, Group IIC gases are much easier to ignite than Group IIA gases, so equipment marked for IIC may be used in locations where the gas is IIB or IIA.

Ignition Temperature

Each combustible gas or vapor has an auto-ignition temperature (AIT) at which it spontaneously ignites. Since the AIT is highly dependent on the chemical structure of the material, it has been possible over the decades to develop a coding system instead of listing each AIT for each material in question. Each gas and vapor has been sorted into a group with a minimum AIT, starting with T6 corresponding to an AIT of +85˚C and ending with T1 corresponding to a minimum AIT of +450˚C. The full TEMPERATURE CODE (T-CODE) options are shown in TABLE 9 of this document.

When classifying an area where a volatile liquid is used or generated, the flashpoint is an important factor because any liquid stored or used above its flashpoint is guaranteed to generate a combustible concentration due to the evaporative process. The flashpoint is almost always lower than the AIT, but is not used to assign the T-code for an area.

Equipment is also assigned a T-code which represents the maximum service temperature with which the gas or vapor may come in contact. The location of the maximum service temperature may be inside the equipment if the equipment is not sealed (gas-tight).

Proper selection of equipment includes a comparison of the T-codes to ensure that the equipment will not exceed the T-code of the area while in use. Each T-code assignment includes a safety margin, so it is safe to use equipment marked as T3 in a T3 location. Equipment marked as T3 can also be used in an area designated as T2 or T1 since these indicate an AIT in excess of the maximum service temperature of the equipment.

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Area Classification of Dusts and Fibers/Flyings

Under the US Division system, flammable solid particulates are given a CLASS II or CLASS III designation. Per *NFPA 70 article 500.5(C):*

> *Class II locations are those that are hazardous because of the presence of combustible dust.*

CLASS III locations are those locations that are hazardous due to the presence of combustible particles which are too large to be considered dust per *NFPA 499.*

Probability of combustible mixture

There are either two (2) designations or three (3) designations used to indicate the probability of a combustible mixture of a gas or vapor in air, depending on whether the Division system or Zone system is used for the area classification. In both cases, the lower the number of the designator, the more probable a combustible mixture.

A summary of the various general area classifications is summarized below. The contents may be found in *NFPA 70, articles 500.5(C) and 506.5(C)*.

TABLE 3 SUMMARY OF GENERAL AREA CLASSIFICATION MEANING – SOLID PARTICULATES

	MATERIAL	DIVISION 1	DIVISION 2
CLASS II	Combustible dusts	Where dust is in the air under: 1) normal operating conditions, or 2) release due to mechanical failure or abnormal operation at the same time a potential ignition source is present, or 3) the material is a conductive material (metals are classified as GROUP E)	Where dust is in the air under: 1) abnormal operating conditions but not at combustible concentrations, or 2) accumulations are present but insufficient to interfere with normal operation, but may become airborne under fault conditions, or 3) accumulations could be sufficient to interfere with the safe dissipation of heat or could be ignitable by abnormal operation or failure of the equipment

TABLE 3 SUMMARY OF GENERAL AREA CLASSIFICATION MEANING – SOLID PARTICULATES			
CLASS III	Non-metallic combustible or ignitable fibers / flyings *metallic fibers and flyings are always CLASS II*	Where fibers and flyings are in the air under: 1) normal operating conditions, or 2) release due to mechanical failure or abnormal operation at the same time a potential ignition source is present, or 3) ignitable fibers and flyings are handled, manufactured, or used	Where fibers and flyings are in the air under: 1) abnormal operating conditions, or 2) accumulations are present but insufficient to interfere with normal operation, but may become airborne under fault conditions, or 3) ignitable fibers and flyings are stored or handled
ZONE 20		ZONE 21	ZONE 22
Where ignitable concentrations of combustible dust, combustible fibers/flyings, or ignitable fibers/flyings are present: 1) continuously or for long periods of time, or 2) GROUP IIIC combustible dusts are present in hazardous quantities continuously or for long periods of time		Where combustible dust, combustible fibers/flyings, or ignitable fibers/flyings are: 1) likely to exist under normal operating conditions, or 2 likely to exist frequently due to repair or maintenance operations or because of leakage, or 3) potentially released due to breakdown or faulty operation at the same time as equipment may become an ignition source, or 4) potentially communicated in an area adjacent to a Zone 20 location 5) GROUP IIIC combustible dusts are present in hazardous quantities occasionally, or frequently because of repair or maintenance operations or because of leakage	Where ignitable concentrations of combustible dust, combustible fibers/flyings, or ignitable fibers/flyings are: 1) not likely to exist under normal operating conditions, and if they do occur, only exist for a short period, or 2) handled, processed or used but in which the liquids, gases, or vapors are normally confined within closed containers of closed systems from which they can escape, only as a result of accidental rupture or breakdown of the containers or system, or as a result of the abnormal operation of the equipment with which the liquids or gases are handled, processed, or used, or 3) potentially communicated in an area adjacent to a Zone 21 location

Note that an area may be classified due to the ability of dust or fibers/flyings to be leaked, released or become airborne during handling.

Material Groups

Each material is further divided into a GROUP which is intended to provide an indication as to the ease of igniting the material. The summary of the material GROUP designation is summarized below:

TABLE 4 SUMMARY OF MATERIAL GROUPS FOR SOLID PARTICULATES

DIVISION GROUP	DEFINITION	EXAMPLE(S)	DEFINITION	ZONE GROUP
E	Metal dusts and other dusts with conductive properties	Aluminum, Magnesium, Titanium, Zinc, Commercial alloys	Metal dusts and other dusts with conductive properties	IIIC
F	Carbonaceous dusts that have more than 8% total entrapped volatiles	Coal, Carbon black, Charcoal, Coke dusts	All other combustible dusts	IIIB
G	Combustible dusts not included in Group E or F	Flour, Grain, Wood, Sugar, Starch, Organic dusts, Plastics, Chemicals		
FIBERS / FLYINGS	Materials too large to be classified as dusts Not further sub-divided	Wood shavings, Yarn fibers, Fabric fibers	Materials too large to be classified as dusts	IIIA

It is important to note that metal dust poses more of a risk than non-metallic dust or a fiber / flying which allows for equipment marked with Group E to be installed and used in Ex Areas where the media is designated as Group F or G and equipment marked for use in group IIIC may be used in Ex Areas where the media is IIIB or IIIA.

It should also be noted that where the combustible media is a solid particulate (dust or fiber / flying), the particle size and humidity play a tremendous role in the explosion properties and as such, each stage in a process may require property verification and testing periodically to ensure the area classification remains applicable.

Ignition Temperature

Where the fuel is a combustible dust or fiber/flying, the area classification will indicate the actual ignition temperature in degree-C. It is crucial to be aware that there are usually two (2) ignition temperatures associated with dusts and fibers/flyings: a cloud ignition temperature and a layer ignition temperature.

The cloud ignition temperature is nearly always lower than the layer ignition temperature due to the increased surface area exposed to the air (oxygen). The preference is to ensure dust clouds cannot be generated.

Even though the layer ignition temperature is higher than the cloud ignition temperature, equipment under a dust layer tends to be hotter than equipment not under a dust layer. A layer of dust may begin to smolder where it contacts the surface of equipment, out of sight of personnel or sensors. The risk is high that the smoldering layer will become an open flame on the surface. Once this happens, it only takes a small movement of air to loft dust into the air in the form of a dust cloud. With each dust cloud ignited, more dust is lofted into the air, resulting in secondary ignition(s) or explosion(s).

The devastation due to ignition of solid particulates can be catastrophic. Thus, the #1 best practice in all the NFPA dust standards over the years has been to prevent layers of dust from forming on equipment. Where dust clouds are possible, all industries recommend dust collection system, but they must be carefully designed and maintained to be effective.

Protecting against explosions

The best protection against an explosion is to eliminate the fuel or to reduce the quantity of fuel so as to minimize the potential. Most likely, the process owner has already reviewed these options and deemed them not feasible. Where the process cannot be changed to remove the Ex Area, strict requirements regarding the types of equipment to be used in the location are implemented. Such equipment must be "protected" by one or more of the protection techniques as described in *NFPA 70, articles 500.7 and 505.8*.

Protection Techniques

There are several methods available for ensuring equipment does not become an effective ignition source. These are known as Protection Techniques and can be useful in understanding how the equipment is prevented from causing ignitions. To understand the different protection techniques, it is helpful to review the fire triangle and to recall that the removal of any one aspect will prevent ignition.

Fire Triangle

In order for a fire to be started, a fuel, an oxidizer (air) and an ignition source must all occur at the same time.

If any one of the aspects of the fire triangle are removed, a fire and/or explosion is averted. The best method of prevention is to remove the source of fuel. Since fuel is usually part of or a result of a process, it is not possible to fully eliminate the potential for ignition.

Protection philosophies

Since the fuel source cannot be eliminated and equipment is the most likely source of ignition, there are three protection measures available, in order of preference: 1) eliminate the ignition source, 2) prevent the ignition source from coming into contact with the fuel, or 3) contain the ignition to a known location/area.

Energy Limitation

The idea of energy limitation is to reduce the available energy to levels below those needed to ignite combustible media. Intrinsic Safety (Ex i) is the best example of energy limitation, followed by increased (enhanced) safety (Ex e) then restricting the air transfer in and out of the equipment (Ex nR). In each of these strategies, there is not sufficient energy for the ignition source to ignite the surrounding material. There are restrictions on power sources, internal components and such, to ensure the energy is sufficiently limited.

Segregation

Where it is not possible to eliminate the ignition source or to reduce the energy low enough to prevent ignition, the next option is to segregate the fuel from the ignition source. This can be done by surrounding the ignition source with a gas (purge/pressurization) (Ex p), a liquid (oil-filled or oil-immersion) (Ex o)or a solid material (encapsulation/molding) (Ex m), or through making the equipment gas-tight (sealed) (Ex nC) or dust-tight (Ex ta, IP6x).

Containment

Lastly, if the ignition source cannot be segregated from the fuel, then containment is the next option and is usually achieved through a concept called flameproof (Ex d), quartz filling (Ex q). The idea here is that when the fuel is ignited inside the equipment, the flame/explosion wave cannot propagate outside the equipment. This is achieved through careful enclosure design, construction and maintenance activities.

Equipment Protection Level (EPL)

The Equipment Protection Level (EPL) provides an indication as to the overall level of protection required in a specific location. Equipment is also marked with an EPL to indicate in which zone(s) the equipment may be installed. The EPL consists of 2 alpha characters: G or D followed by a, b, or c. The first character indicates the possible fuel: G for gases and vapors, D for dusts and fibers/flyings. The second character indicates the level of protection needed for the area or the level of protection the equipment is considered to have.

TABLE 5 – SUMMARY OF EPL MARKINGS

First alpha character	Second alpha character		
	a	b	c
G	Very high protection level for use where the fuel is an ignitable gas or vapor	High protection level for use where the fuel is an ignitable gas or vapor	Enhanced protection level for use where the fuel is an ignitable gas or vapor
D	Very high protection level for use where the fuel is dust or fiber/flying	High protection level for use where the fuel is dust or fiber/flying	Enhanced protection level for use where the fuel is dust or fiber/flying

There are situations where the consequences of an explosion are significant enough to push for a higher-than-default EPL level. By contrast, a site may be so remote that the required EPL for an area can be downgraded. The EPL is the final determination with regards to where a piece of equipment may be installed and does not necessarily match the expected default EPL.

Equipment Markings

All equipment which has been assessed, identified, and listed for use in Ex Areas must also be marked (see *NFPA 70 article 500.8(C*)). The markings shall include the following:

TABLE 6 SUMMARY OF REQUIRED EQUIPMENT MARKING FOR DIVISION SYSTEM	
MARKING	POSSIBLE OPTIONS/EXPLANATION
CLASS (CL)	I, II or III Each material CLASS must be directly identified
DIVISION (DIV)	Div 2 = restriction to division 2 only Div 1 = both division 1 and division 2 If no Division is specified, then Div 1 is assumed
GROUP (S) (GRPS)	Material subgroups necessary for CLASS I and CLASS II No subgroup for CLASS III
TEMPERATURE (T-CODE) OR MAX SERVICE TEMPERATURE	CLASS I uses T-codes T1 through T6, including letter suffixes Classes II and III use maximum service temperature
AMBIENT TEMPERATURE RANGE	-25˚C to +40˚C assumed if not marked

All equipment which has been assessed, identified, and listed for use in Ex Areas must also be marked. Zone markings provide more detailed information as they include an alpha code showing the Protection Type and an Equipment Protection Level to aid the user in better determining where the equipment may be installed.

Per *NFPA 70 articles 505.9(C) and 506.9(C)*, the equipment listed for use in zones shall include the following:

TABLE 7 SUMMARY OF REQUIRED EQUIPMENT MARKINGS FOR ZONE SYSTEM	
MARKING	POSSIBLE OPTIONS
CLASS (CL)	CLASS I is optional marking for Zone 0, 1, and 2
ZONE (ZN)	Zone 0, 1, 2

TABLE 7 SUMMARY OF REQUIRED EQUIPMENT MARKINGS FOR ZONE SYSTEM	
MARKING	POSSIBLE OPTIONS
	Zone 20, 21, 22
SYMBOL	AEx
PROTECTION TECHNIQUE	**ia (Dodge performance sensor),** ib, ic, ea, eb, ec, nC, nR, db, dc, ma, mb, mc, pxb, pyb, pzc, qb, qc, ta, tb, tc, op is, op sh, op pr, *h (Dodge non-electrical equipment)*
GROUP (S)	**IIC,** IIB+H2, IIB, IIA **IIIC**, IIIB, IIIA
TEMPERATURE (T-CODE) OR MAX SURFACE TEMPERATURE	Zones 0, 1, and 2 use T-codes T1, T2, **T3**, T4, T5, T6 Zone 20, 21, and 22 use "**T155˚C**", where the temperature recorded is the maximum service temperature
EQUIPMENT PROTECTION LEVEL (EPL)	**Ga (Dodge performance sensor)**, *Gb (Dodge non-electrical equipment),* Gc **Da (Dodge performance sensor)**, *Db (Dodge non-electrical equipment),* Dc
AMBIENT TEMPERATURE RANGE	-20˚C to +40˚C assumed if not marked

Glossary

The following definitions may be helpful in understanding this document.

AUTHORITY HAVING JURISDICTION (AHJ) = an organization, office, or individual responsible for enforcing the requirements of a code or standard, or for approving requirement, materials, an installation, or a procedure

CLASS = general category of combustible material; there are 3 classes in the Division system

FLAMMABLE LIQUID = a liquid which may generate a vapor which is combustible in air under standard atmospheric pressure and temperature

VOLATILE FLAMMABLE LIQUID = a flammable liquid having a flash point below 38˚C (100˚F) or a flammable liquid whose temperature is able its flash point, or a Class II combustible liquid that has a vapor pressure not exceeding 276 kPa (40 psia) at 38˚C (100˚F) and whose temperature is above its flashpoint

COMBUSTIBLE DUST = solid particles that are 500 micrometers or smaller (i.e. material passing a US No 35 standard sieve) that can form an explosible mixture when suspended in air at standard atmospheric pressure and temperature

COMBUSTIBLE FIBERS / FLYINGS = Fibers / Flyings where any dimension is greater than 500 micrometers in nominal size, which can form an explosible mixture when suspended in air at standard atmospheric pressure and temperature

IGNITABLE FIBERS / FLYINGS = Fibers / Flyings where any dimension is greater than 500 micrometers in nominal size, which are not likely to be in suspension in quantities to produce an explosible mixture, but could produce an ignitable layer fire hazard

GROUP = designation intended to provide a general measure of ignitibility; there are seven (7) groups in the Division system and six (6) groups in the Zone system

MAXIMUM EXPERIMENTAL SAFE GAP (MESG) = maximum separation between two smooth surfaces (approximately 1 inch wide) through which the energy from an explosion of a specific material on one side will not transmit to the other side; a narrow gap is needed for highly combustible materials

MINIMUM IGNITION CURRENT (MIC) RATIO = ratio of minimum current needed to ignite a specific gas or vapor as compared to that needed to ignite coal dust; a lower ratio indicates a material which is much easier to ignite

IGNITION TEMPERATURE = temperature at which a fuel can ignite once exposed to an ignition source

AUTO IGNITION TEMPERATURE (AIT) = temperature at which a combustible material will self-ignite

LAYER IGNITION TEMPERATURE = minimum temperature at which a layer of combustible dust will self-ignite and usually noted as T_{layer}; usually determined through test and noted in area classification documents. The default layer thickness is 5.0 mm unless otherwise noted in the documentation.

CLOUD IGNITION TEMPERATURE = minimum temperature at which a combustible dust will self-ignite when suspended in air under standard atmospheric pressure and usually noted as T_{cloud}; usually determined through test and noted in area classification documents

TEMPERATURE CODE (T-CODE) = short cut notation (**T1, T2, T3, T4, T5, or T6**) to indicate the minimum **AIT** for a Class I material or to indicate the maximum service temperature of equipment with which the gas or vapor may come in contact

TABLE 9 –T-CODES FOR GASES AND VAPORS

CODES USED IN DIVISION AND ZONE SYSTEMS			CODES USED IN DIVISION SYSTEM ONLY		
CODE	AIT (˚F)	AIT(˚C)	CODE	AIT(˚F)	AIT (˚C)
T1	842	450			
T2	572	300	T2A	536	280
			T2B	500	260
			T2C	445	230
			T2D	419	215
T3	392	200	T3A	356	180
			T3B	329	165
			T3C	320	160
T4	275	135	T4A	248	120
T5	212	100			
T6	185	85			

SERVICE TEMPERATURE = maximum temperature of equipment when used within the worst-case operating conditions; service temperature takes into account the maximum ambient temperature specified by the equipment manufacturer. Service temperature may be on the surface of the equipment or inside the equipment

FLASHPOINT = Temperature at which evaporation of a flammable liquid is sufficient to guarantee a combustible mixture in air at normal atmospheric pressure

AMBIENT TEMPERATURE RANGE = temperature range specified by the manufacturer where equipment may be used