

HAZARDOUS APPLICATIONS

I. WHAT CONSTITUTES A HAZARDOUS CLASSIFIED AREA?

Any area inside or outdoor that has explosive gas, vapor, dust or flyings mixed with air in ignitable concentrations.

II. WHAT TYPES OF INDUSTRIES HAVE HAZARDOUS CLASSIFIED AREAS?

Just about any industry can have a classified (hazardous) area in their plant. However, the major industries are:

- Chemical
- Petro Chemical
- Pharmaceutical
- Bio-Tech
- Paint Batching/ Blending
- Dye Houses
- Munitions Plants
- Grain Elevators
- Flour Mills
- Film & Cassette Tape Manufacturers
- Perfume Manufacturers
- Propane Filling

Some that may not be as evident are:

- Soap Producers (alcohol in scent perfumes)
- Food Manufacturers (Explosive dust; i.e. flour or powered gelatin)
- Cleaning Operations

III. WHAT ARE WE TRYING TO PROTECT AGAINST?

The answer is obvious - PREVENT A FIRE OR EXPLOSION. What could be the cause, that starts it all off --- there are several.

The most obvious one is an electrical spark, hot enough to ignite the gas, vapor, or dust.

Another unsafe condition would be some device that overheats like a lighting fixture, or electric motor or a mechanical drive like a pulley/belt arrangement or bearing race on a conveyor.

Another potentially dangerous condition is the sparking caused from metal to metal contact, friction or static electricity discharge.

Any of the above conditions could be the cause of ignition and a potentially serious fire or explosion and needs to be considered when determining equipment suitability.

IV. WHAT ARE THE TYPES OF PROTECTION METHODS EMPLOYED TO GUARD AGAINST POTENTIAL UNSAFE CONDITIONS?

1. Locate the equipment in question outside the hazardous area. If that is not possible, place as much of the equipment as possible outside the hazardous area (i.e., load cells and Start-Stop station in the classified area, controls and indicator in the safe area).
2. Use intrinsic safe designed equipment that is suitable for the specific environment. PUMA/ HAP/ 8525/ 8141/ CMOS Truck Scales.
3. Use NEMA 7/9 explosion proof enclosures or Purge Systems suitable for the specific environment.
4. Eliminating or reducing the potential sparking from mechanical contact or friction (metal to metal or metal to some other type sparking material). Non-sparking metals such as aluminum, stainless steel or brass can be used to reduce or eliminate this risk.
5. Static electricity is another potential risk which can cause sparking. The use of ground straps, ground clamps, conductive wheels on portable scale applications and conductive belting on conveyor systems can greatly reduce this risk.

V. HAZARDOUS AREA APPLICATION INFORMATION YOU SHOULD BE AWARE OF

A) WHAT ARE THE CLASSIFICATIONS?

CLASS I - Flammable gases or vapors
Groups A-B-C-D

CLASS II - Combustible dusts
Groups E-F-G

CLASS III - Ignitable fibers and flyings

DIVISION I - Normally Present

DIVISION II - Not Normally Present

UNCLASSIFIED - Far enough away from a classified area
to be determined safe.

See Chart "AA" (3 pages) and the National Electric Code Book (N.E.C.), Article 500, for a more detailed explanation.

HAZARDOUS LOCATIONS CLASSIFICATIONS

Class I: Flammable Gases and Vapors

Includes: Groups A, B, C, and D

Group A: Atmospheres Containing Acetylene

Example Gases AIT

Acetylene 581°F

Group B: Gases, or Vapors Equivalent in Hazard to Hydrogen

Example Gases AIT

Hydrogen 752°F

Butadiene 788°F

Ethylene Oxide 804°F

Propylene Oxide 840°F

Acrolein 455°F

Group C: Gases, or Vapors Equivalent in Hazard to Examples Below

Example Gases AIT

Methyl Ether 662°F

Cyclopropane 938°F

Ethylene 842°F

Ethyl Benzene 810°F

Group D: Gases, or Vapors Equivalent in Hazard to Examples Below

Example Gases AIT

Acetone 869°F

Butane 550°F

Ethanol 685°F

Gasoline 536-800°F

Toluene 896°F

Benzene 928°F

Propane 842°F

Class II: Combustible Dusts

Includes: Groups E, F, and G

Group E: Atmospheres Containing Combustible...

- Metal Dusts (regardless of resistivity)
- Dusts of similarly hazardous characteristics with a resistivity less than 100 Ω -cm

Group F: Atmospheres Containing Combustible...

- Carbon Black, Charcoal, or Coke Dusts which have more than 8 percent total volatile material
- Dusts that represent an explosion hazard, and have a resistivity greater than 100 Ω -cm but equal to or less than 100,000 Ω -cm

<u>Example Dust</u>	<u>AIT</u>
Asphalt	950°F
Charcoal	356°F
Coal Tar	356°F
Petroleum	1166°F

Group G: Atmospheres Containing Combustibles...

- Dusts having resistivity of 100,000 Ω -cm or greater
- Electrically Non-Conductive Dust

<u>Example Dust</u>	<u>AIT</u>
Alfalfa Meal	392°F
Wheat Flour	680°F
Cellulose Acetate	644°F
Sulfur	428°F

Note: Group “E” and “F” Atmospheres:

If the resistivity of the dust is less than 100,000 Ω -cm, then the area must be classified as a Division 1 location (NEC Article 502-1). **NOT DIVISION 2.**

Class III: Ignitable Fibers for Flyings

Note: Items included in Class III are not grouped

Example Manufacturers

- Textile Mills
- Cotton Products manufacturing, processing.
- Clothing Plants

Fibers and Flyings Include:

- Rayon, Cotton
- Sisal, Hemp
- Jute, Spanish Moss

Note: For further examples of Class I, II, and III gases, dusts and fibers, refer to the National Electric Code (NEC) Handbook, Article 500.

B) DIVISION I & II LOCATIONS

Division 1 Locations:

- Division 1 locations are, in general, those locations in which hazardous gases, vapors, dusts, and fibers/ flyings are present, or are likely to be present as a result of normal operation.
- Division 1 locations are, more specifically, locations in which ignitable concentrations of flammable gases, vapors, dusts, and fibers can exist:
 - (1) Under normal operation conditions.
 - (2) Frequently, because of repair or maintenance operations.
 - (3) Frequently, due to leaks.
 - (4) Due to a breakdown of equipment or processes.

Division 2 Locations:

- Division 2 locations are, in general, those locations in which hazardous gases, vapors, dusts, and fibers are **NOT** present in normal operation, but could be if some type of fault occurs.
- Division 2 locations are, more specifically, locations in which volatile flammable compounds are handled, processed, or used, but under normal situations the ignitable gases, vapors, dusts, or fibers will normally be confined within closed containers or systems from which they can escape only by accidental rupture of containers, or due to abnormal operation of equipment. Or may be adjacent to a Division 1 area.

Note: For a more detailed explanation of the distinction between divisions consult the National Electric Code (NEC) Handbook, Article 500.

C) **WHAT IS AUTO IGNITION TEMPERATURE (A.I.T.)?**

A.I.T. is the temperature at which a classified gas, vapor, dust, or fiber/flying will ignite, explode or start to smolder or burn without the presence of a spark or flame. (Self Ignition)

HOW WOULD SELF IGNITION OCCUR?

Self ignition is caused by a situation where the gas, vapor, dust, or fiber/flying is heated too or above its ignition temperature. This could be caused by any number of things happening (i.e., sunlight heating an object, a bearing race overheating, a lighting fixture over heating, a load cell over heating, a hot spot on a printed circuit and many more).

D) **T-RATINGS:**

T-Rating is a marking that manufactures put on a piece of equipment as a warning to the installer. This marking indicates the worst case surface temperature or temperature rise, based on an ambient of 100 degrees F, that the equipment could attain.. If the customer/ installer has a gas, vapor, dust fiber or flying with an A.I.T.lower than the T-Rating it would constitute an **Unsafe Condition**. See Table Below

Table 500-3(d).

Identification Numbers

Maximum Temperature Degrees C	Degrees F	Identification Number
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

Note: Table taken from 1996 National Electric Code Handbook, Article 500

Commonly Asked, Questions and Answers

PUMA Indicator

- 1. Does fiber optic cable have to be run in rigid explosion proof conduit? No!**
The Fiber Optic cable Mettler Toledo is using carries a (UL) OFNP rating and does not need to be run in conduit.
Some customers may run the fiber optic cable in conduit for mechanical protection.
- 2. Is it recommended to use the AC power supply when driving a remote device? Yes,** the fiber optic transmitter/receiver mounted in the PUMA will draw additional current, reducing battery life by about 10 % for one (1) transmitter and 20 %, for two (2) transmitters.
- 3. Maximum L/C cable distance - 350'.**
- 4. Millivolt builds - with hazardous indicators ---PUMA--- applications.**

The PUMA is NTEP approved for 5000 divisions. Any of the Mettler Toledo scale bases with NTEP(5000e) approval can be calibrated. Other scale builds should follow this simple guideline. Calculate the microvolt build (uV/g) using the formula below.

$$\frac{3200 \times \% \text{ of load cell(s)}}{\text{Number of graduations}} = \text{uV/grad, Build}$$

The PUMA will go down to 0.05 uV/graduation under ideal conditions. I would not go lower than 0.1 to achieve a stable build. Remember in the real world, vibration, deflection, wind load, un-level mounting structure, connections, jacketed tanks and more can affect the overall accuracy and repeatability.

See the PUMA technical manual for a more detailed uV/grad definition.
Note; the NTEP minimum uV build is 0.19 uV/g for 5000e.

- 5. Can the PUMA with power supply be used in groups A & B?**
The PUMA can be located in Groups A-G. The PUMA AC Power Supply can only be used in groups C-D-E-F & G or safe area.
- 6. How far can the Fiber Optic cable be run.**
The new, Glass, FO Cable(0961-0189-xxx),can be run up to 1000 Feet (304 meters) Two cables are required for bi-directional communications.
Note; the glass fiber optic cable cannot be terminated in the field, it requires special tools.

7. Fiber Optic transmitter/receiver kits for the 8141, 8525 and PUMA Indicators.

The 8141 and PUMA kits utilize the same PCB but different mounting hardware and harnesses. The 8525 kit uses a different PCB and hardware.

8. Dual Channel (safe area) Fiber Optics Converter.

The dual channel receiver is the same for all three indicators. The unit has two (2) separate Bi-Directional channels(Thus the name Dual). It converts the light source fiber optic ASCII data to either RS232 or 20 mA current loop ASCII.

9. Communications Capabilities.

One or Two, Bi-Directional fiber optic kits can be added to the PUMA.

Host, bi-directional, Loop Through or Star configuration. The Loop through allows connection of 2-99 Pumas in a single fiber optic loop utilizing a single dual channel converter for connection to the host. Party line approach.

Star connection is where each PUMA is connected through a dedicated dual channel FO converter to the host. Basically one on one. This requires a communications channel on the computer per Puma indicator.

Mettler Toledo standard continuous and Short continuous.

Printer output string. Single line or Multiple line. (G-T-Net, ID, T/D, Scale Number).

8525 <ENQ>, Host mode.

SICS, Mettler Host, level "0".

Questions and Answers

NEMA 7/9 Boxes

1. Why do the NEMA 7 (gasses and vapors) Boxes have specific ratings?

Example - Good for Group C&D but not A&B. The NEMA 7/9 Box is designed to contain an explosion inside the box, should it occur, and not expel burning gas or sparks into the surrounding environment.

Example - Group "A" and "B", gas/vapors creates a higher explosive force than does Group "C" or "D". Therefore the box must be much stronger to contain the explosion. i.e. Group "A" must be stronger than Group "B" and "B" stronger than "C" and "C" stronger than "D".

2. NEMA 9 - Dust Hazard Boxes are designed to keep dust out. If dust does get in when the box is opened for service or installation, it must contain the burn or explosion just like the NEMA 7 design for gases and vapors.

Most explosion proof boxes carry both Class I (vapors/gases) NEMA 7, and Class II (dusts) NEMA 9 thus the rating of NEMA 7/9.

3. **Conduit:** Explosion proof, rigid threaded metal conduit with conduit seals, must be used on all wire runs in Hazardous Classified Areas.

Ridged explosion proof conduit like NEMA 7/9 Boxes are designed to contain an explosion, should it occur, inside the conduit and not pass burning material or sparks out into the surrounding environment.

Conduit Seals (Sealing pylets) are used to block the transfer of burning material from conduit to conduit or, in or out of NEMA 7/9 Boxes.

All entrances into and out of NEMA 7/9 Boxes must have conduit seals to stop the transfer of burning gasses or material. This includes conduit seals for Fiber Optic cables and Intrinsic Safe Wiring as well. All conduit seals must be filled with sealing compound and allowed to dry before the system can be powered up.

All conduit installation and wiring is to be done by a Trained and Qualified electrician familiar with the guidelines set forth in the National Electric Code (N.E.C.).

NOT METTLER PERSONEL

4. NEMA Rating: NEMA 7/9 type boxes are not rated NEMA 4, and are not watertight unless they have an O-Ring fitted to the lid. Not all boxes can be fitted with such a seal. Some that are, include the Toledo HAP Module, and NEMA 7/9 8623 Display. The 8140 and M5000 NEMA 7/9 do not have the O-Ring seal.

NOTE: Some of the larger NEMA 7/9 Enclosures can be fitted with a special O-Ring to meet NEMA 4 requirements. Contact METTLER TOLEDO for suitability.

WARNING: Gaskets, any type grease or filler cannot be used between the LID and box housing on NEMA 7/9 Enclosures. There must be metal to metal contact to maintain the explosion proof rating.

Questions and Answers

C-MOS - Intrinsic Safe Barrier

- 1. What scales can this be used on?** Only the truck scale C-Mos power cells. No other cells can be used.
- 2. Can be C-Mos Barrier be located in the hazardous area?** No! It must be in a safe area or mounted in suitable NEMA 7/9 box or x-purge cabinet.
- 3. What indicators can be used with this barrier?** Only the 8530, 8530VS and 8146 with auxiliary power supply can be used.
- 4. How many cells can a system have?** Up to a maximum of 24 C-Mos power cells can be connected using two (2) C-Mos barriers.
- 5. How long a home run cable can be run?** Maximum of 400'.
- 6. Is there any reduction in scale build, like when using the HAP module or 8141 or 8525 indicators?** No! The excitation voltage in the C-Mos system is the same as a standard power cell (N-Mos) system, with no loss in scale build.
- 7. Is the system Factory Mutual approved?** Yes! The cells can be located in Class I or II, Division I or II, Groups C-D-E-F or G area with a NEC temperature marking of T-4 (275° F).

Questions and Answers

X-Purge Systems

- 1. What type of air is required for X-Purge systems? And at what pressure?** Clean dry non-hazardous air or inert gas, at 10 to 60 psi. The purge system regulator will reduce the pressure down to the 2-3 psi required to feed the system.
How much air will it use? Approximately 100 SCFM (cubic feet per hour) for a standard book purge system.
- 2. What indicators does METTLER TOLEDO X-Purge?** Just about all of them - 8132, 8142, 8510, 8146, 8530 with CMOS Barrier, M5000, SM200, 9215, 9127, 9475, 9360.
- 3. What NEMA rating does METTLER TOLEDO X-Purge cabinet carry?** The cabinet carries either NEMA 12 or NEMA 4 for stainless steel. The Purge System is rated NEMA 7/9 and meets dust tight requirements but is not rated for washdown NEMA 4, see NEMA 7/9 Q&A for explanation.
- 4. What is the difference between rigid conduit and explosion proof conduit?** Rigid explosion proof conduit differs in several ways from standard threaded conduit. First explosion proof conduit used NPT (National Pipe Thread) taper connections with a minimum of 5 threads contact in all joints. The wall thickness is also heavier, and conduit seals are used to prevent (block), the passing of sparks or burning material to the next section of conduit or NEMA 7/9 Box. Only apply approved rigid explosion proof conduit.
- 5. Why does the Operating Range on purge systems only do down to 40°F (5°C)?** Moisture could be present in the purge air and could condense and freeze in the purge system, causing an unsafe condition to occur.

Mettler -Toledo Questions and Answers

HAP Module - Intrinsic Safe Module

- 1. What load cells can be used with the HAP Module?** The HAP Module can only be used with Analog Type Load Cells, that are on the METTLER TOLEDO Factory Mutual approval listing.

What if some other manufacturers cells are existing and are to be used? Ugh! This can be done. Fast Factory must review the application for compliance to the National Electric Code (N.E.C.), which includes evaluation of the specified load cells. If suitable, the system can be supplied, but the Factory Mutual stickers must be removed.

- 2. Is it recommended to put the HAP module closer to the scale or to the indicator? Why?** On older - LSI versions of the 8142, the 8132 and the 8146, the HAP module needs to be near the load cells for the remote sensing to work properly.

On the current Jaguar, Lynx and Panther Indicators, the HAP can be located any place between the cells and the indicator.

- 3. What does the HAP Module actually do?** Its purpose is to limit the voltage and current that can pass from the digital indicator out to the load cells, should a fault occur.
- 4. What if the indicator is in a safe area - and only the load cells are in the classified area?** You still need a HAP Module.
- 5. Does the HAP Module have a large excitation voltage drop like other barriers, i.e. (MTL, STAHL, TAYLOR)?** No. Most competitive barriers rely on a 50 to 70% voltage drop over the barrier to achieve a safe voltage/current ratio. The problem with this could be a very unstable scale build during temperature changes.

The METTLER TOLEDO design starts with a reduced, regulated and very stable excitation voltage, with only 10-30% drop over the barrier. Also the HAP Module is made from the same precision parts used in our indicators and load cells. This is a much more stable system.

- 6. Is the HAP Module waterproof?** Yes! The HAP Module has an O-Ring seal on the lid that meets NEMA 4 requirements.

7. **Can the HAP Module be located in the safe area?** ayes!. But if it is, protective conduit must be run on the Home Run Cable between the HAP Module and where it enters the Hazardous Area. **Why?** The output of the HAP Module is intrinsic safe and must be isolated from any and all other wiring.
8. **What is the maximum length Home Run Cable can be run?** 250/300'.

HOW THE PUMA is APPLIED

The PUMA indicator is an Intrinsic Safe design terminal for connection to Approved analog load cells, see Mettler Toledo 122502 for a complete listing. It is designed to be located in the Hazardous Classified area. Power is supplied by an internal 1.2 AH(amp hour) battery, external 7 AH battery or external AC power supply.

It can be used for portable or stationary straight weighing applications, set point filling/discharging using the MD3015, print

Weights & Measures The PUMA is NTEP(NIST) approved for 5000 graduations.

Factory Mutual approved for Class I&II, Division 1&2, Groups A,B,C,D,E,F & G, NEC Temperature Rating of T4A, when used with the internal 1.2 AH battery or external(long life) 7 AH battery.

The 115VAC and 230VAC power supplies are FM approved for Class I&II, Division 1&2, Groups C,D,E,F & G onlt NOT Groups A&B, NEC Temperature Rating of T4A. The AC Power Supply can power the PUMA in Groups A&B if the Power Supply is located in the safe area or Group C,D,E,F or G.

AC Power Supply, may be located in the hazardous or safe area. If located in the Hazardous area, the AC power connections must be run in approved threaded metal conduit with appropriate conduit seals and installed per local and national codes. This wiring and conduit connections must be installed by a qualified electrician, NOT METTLER PERSONEL.

Remote Devices. All peripheral devices, Host PC, PLC, Printers, Scoreboards, Displays, Analog/BCD modules, MD3015 Set Point controller are all connected Via Fiber Optics communications. The PUMA can have 1 or 2 optional, Bi-Directional, Fiber Optic kits.

Fiber Optics was chosen as the communications medium for several reasons.

- It provides a safe means to transfer data, ie; does not require the addition of intrinsic safe barriers typically required for voltage signals.

- Does not need to be run in expensive conduit.

- Provides electrical noise isolation for externally connected devices.

- The NEW glass FO cable(0901-0189-xxx) can connect to devices up 1000 feet from the PUMA indicator.