

Explosion Protection Safety Assessment for 3D printers.

The most important things you should know about industrial additive manufacturing.

With the expansion of additive manufacturing in the last years, allowing rapid prototyping but also ready to use parts for the industry, the use of 3D printers has increased exponentially. While the use of industrial manufacturing printers is still at a starting point, and the usage of different materials is also on an exploration phase, several different machinery manufacturers placed already their products in the market.

We give you an overview of the most important aspects for 3D printing.

HOW DOES 3D PRINTING WORK?

From desktop printers to big industrial additive manufacturing machines, most of them have or use the same general structure, starting with powder containers (small cartridges to big bags), mixing and qualification station, heating or pre-heating stations, the additive manufacturing process chamber (with one or several nozzles), and then the cooling and unpacking station. While adding material, a dust collector is also commonly used, which conveys the used powder (but not added) back in the process.

WHICH (EXPLOSION PROTECTION) NORMATIVE REQUIREMENTS ARE VALID FOR 3D PRINTERS?

Some of the materials used in additive manufacturing (usually as powder) are combustible and explosive as dusts (from plastics to metals). Also during the process itself dust from micro- to nano-particles of material surrounding the

area will be generated under high temperature and pressure. According to various valid directives, such as the ATEX directives and its harmonized standards, IEC 60079 series or the NFPA standards, there is a risk that an explosive atmosphere may occur.

Even if additive manufacturing poses an explosion hazard due to dust formation, 3D printers do not have to be certified according to the Explosion Protection Ordinance. Because according to the definition of the EU Machinery Directive 2006/42/EC, a 3D printer is a machine. In addition the ATEX Directive (2014/34/EU), in its general provisions (Article 1 – Scope) defines the application range to “equipment and protective systems, intended for the use in potentially explosive atmospheres”. So the machinery, as “equipment” does not have to comply with any explosion protection standards, as it is not going to be placed in an explosion area. Please have a look at the exception later.

Even if the equipment is not to be marked, there is a chance of having an explosive atmosphere inside some parts of the machine, depending on the material used. Coming back to the EU Machinery directive, the Annex I states the essential health and safety requirements relating to the design and construction of machinery, and specifically under the paragraph 1.5.7 describes that “Machinery must be designed and constructed in such a way as to avoid any risk of explosion posed by the machinery itself or by gases, liquids, dust, vapours or other substances produced or used by the machinery”.

WHAT HAVE TO BE CONSIDERED FOR PLACING 3D PRINTERS INTO A MARKET?

In order to successfully place 3D printers in a market, the machines must fulfil the existing regulations, which are always behind the state-of-the-art technology, and set the framework for the general and specific safety of machinery. When introducing products to the market, manufacturers must take country-specific market entry regulations into account. In EU countries, for example, products may be placed on the market without testing or certification by third parties. A prerequisite for this is the CE mark, where the declaration of conformity is made by the manufacturer. Nevertheless, a risk assessment for machinery is an essential part of all marking or certification processes. For additive manufacturing, depending on the process and the materials used, some existing hazards related to explosion protection, must be analysed and assessed.

QUICKCHECK

Have you clarified the following aspects to avoid the risk of explosion within the machine?

TO START WITH RISK ASSESSMENT, SEVERAL QUESTIONS FOR THE DIFFERENT STAGES ARISE:

Material:

- Is the powder material used eventually flammable or explosive?

Material supply:

- How is the powder supply done? Does the material come in closed cartridges directly inserted into the machine? Is there an on-site refilling process? Comes the material in small or big (open) bags?

Material pre-processing (mixing, pre-heating):

- The manufacturer must find out if there is a risk of explosion at this stage, by answering some of the following questions: Is the material processed before use? Is it still a powder? Is dust generated during the process? Is there Oxygen present? Is this pre-processing pressurized? Is there any ignition source within the process?

Additive process: while the same questions as for pre-processing arise, depending on the additive process used (i.e. as for ISO 17296-2:2015), the use of heat plates, nozzles, pistons, rollers and even lasers, introduce new variables to the equation.

Manufacturer of machinery should always ensure that a risk assessment is carried out for the machinery which he wishes to place on the market, design the machine to avoid or reduce to the minimum any existing risks, introducing the needed measures, and also prepare a technical construction file. Due to the complexity of the topic, it is highly recommended to perform an Explosion Protection Safety Assessment, to be included into the technical file.

HOW CAN WE SUPPORT YOU?

Our experts can perform the Explosion Protection Safety Assessment, starting with an open information exchange with the manufacturer's design and safety department. We help you to define, check and test the main topics related to explosion protection, as for dust characterization, determination of the conditions that allow potentially explosive atmospheres to be created, the avoidance of potentially hazardous leakages, definition of hazardous locations by handling the printing powder, ex area definition, etc. Our systematic approach through an extensive risk assessment, the definition of counter-measures to eliminate or reduce risks, and the documentation of the whole process, help the manufacturers to ensure that their products are compliant with the safety requirements in any final market worldwide.

We gladly review your individual situation in a personal appointment. Contact us now.

References

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