



HIKVISION Explosion-Proof Cameras

COMPLETE PROTECTION
WITH SUPERIOR DESIGN
INSIDE & OUT

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1. BACKGROUND

In some industries such as coal mining, oil exploitations, chemical plants, textile mills, etc., there will be explosive gas, steam, or dust during the production process. The production locations of the above industries are called as the hazardous place with explosion risks.

There are three necessary conditions for explosion in hazardous sites with explosion risks:

- ❖ Heat (electric spark or hot surface)
- ❖ Fuel (explosive gas or dust)
- ❖ Oxygen



Figure 1 Three Necessary Factors for Explosion

When the three factors coexist, and the mixture of oxygen and fuel reaches a high level, explosion is inevitable. Thus, to prevent the explosion, measures are taken to avoid the three explosion factors existing at the same time. And for the hazardous places video surveillance, the design and the use of the surveillance products must in accordance with the rules and the standards to make sure that they will not cause explosion.

We will introduce the Hikvision explosion products from the perspective of explosion-proof performance, installation convenience, and product manufacturing process. Since the designs of explosion-proof cameras are similar, explosion-proof PTZ camera's design is taken as the example in the following introduction.

2. KEY TECHNOLOGIES

2.1. DESIGN OF EXPLOSION-PROOF PERFORMANCE

The most popular type of explosion-proof camera is the flameproof type. The flameproof devices are equipped with a flameproof enclosure and marked with "d". The enclosure must be able to withstand inner explosion pressure and prevent the spread of the explosion to the around environment.

The explosive mixture enters the device enclosure due to respiration. When the device

produces electrical flame and heat, the explosive mixture inside the enclosure will explode and there will be a huge explosion force and shockwave. The enclosure must remain unbroken after an inner explosion; on the other hand, the enclosure's joints should be seamless enough to prevent the spread of the flame to fire the explosive mixture outside the enclosure. Thus, the enclosure should be **firm (withstand the inner explosion)** and **seamless (no flame spreading risk)**.

2.1.1. ENCLOSURE FIRMNESS'S DESIGN

The enclosure is made of 304/316L stainless steel and every part is welded together. The thickness of the applied stainless steel is greater than 3.5 mm. The enclosure design passes the force analysis of ANSYS to make sure the enclosure can stand the 1.5 times the maximum pressure of the inner mixture explosion and remain unbroken and with no permanent deformation after the explosion.

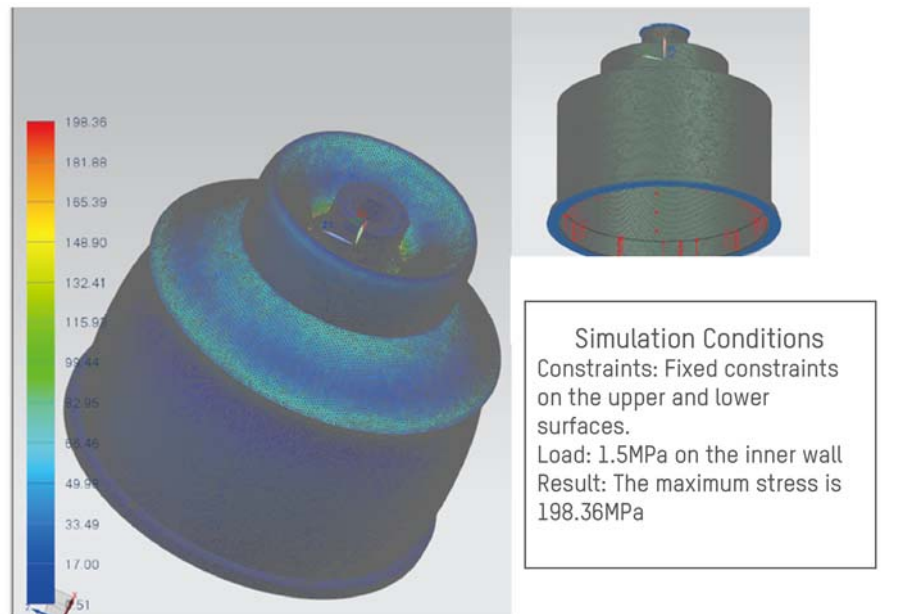


Figure 2 ANSYS Result

2.1.2. SEAMLESS ENCLOSURE'S DESIGN

Limited by manufacturing, installation, and maintenance, the enclosure cannot be made of one piece of stainless steel, but consists of several components and parts. However, the joints between the components could potentially be the route for the flame to spread to fire the explosive mixture outside the enclosure. The surfaces of the adjoining components are called adjoining planes, and the joints between adjoining planes are known as joint gaps.

The adjoining plane could be planes' structure could be plane, cylinder, screw thread, or cement joint. Current Hikvision explosion-proof products adopt cylinder adjoining planes

and cement joint to ensure the enclosure is seamless enough for flame-proof performance, as shown in the following figure.

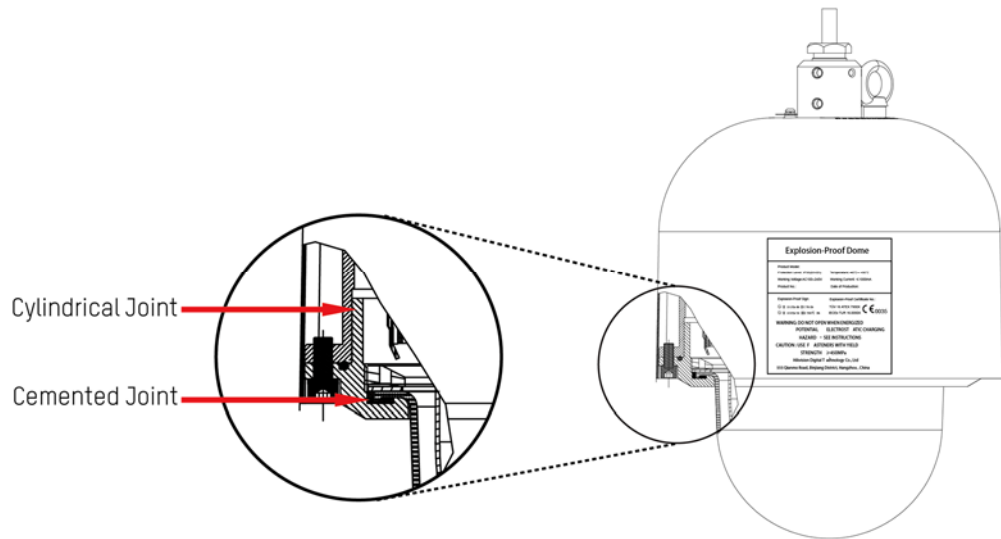


Figure 3 Design of Seamless Enclosure

The design strictly follows the below standards:

- ❖ IEC 60079-0: 2011 Explosive atmospheres –Part 0: Equipment – General requirements;
- ❖ IEC 60079-1: 2014 Explosive+atmospheres- Part 1: Equipment protection by flameproof enclosures "d";
- ❖ IEC 60079-31: 2013 Explosive atmospheres –Part 31: Equipment dust ignition protection by enclosure "t";
- ❖ EN 60079-0: 2012 Explosive atmospheres –Part 0: Equipment – General requirements;
- ❖ EN 60079-1: 2014 Explosive + atmospheres- Part 1: Equipment protection by flameproof enclosures "d";
- ❖ EN 60079-31: 2014 Explosive atmospheres –Part 31: Equipment dust ignition protection by enclosure "t".

2.2. CONSIDERATE INSTALLATION DESIGN

2.2.1. CONVENIENT CABLE CONNECTION

The one-piece wiring component adopts the casting technology. It satisfies the IEC 60079-0: 2011 EN 60079-0: 2012, IEC 60079-1: 2014 EN 60079-1: 2014, and IEC 60079-31: 2013 EN 60079-31: 2014 requirement. Compared to other manufactures, this wiring is more convenient since users do not have to fill explosion-proof plaster inside the pipe, but

directly wire the cables through the explosion-proof pipe and connect the cables to an electricity box or galvanized steel pipe, as shown in the following figure.

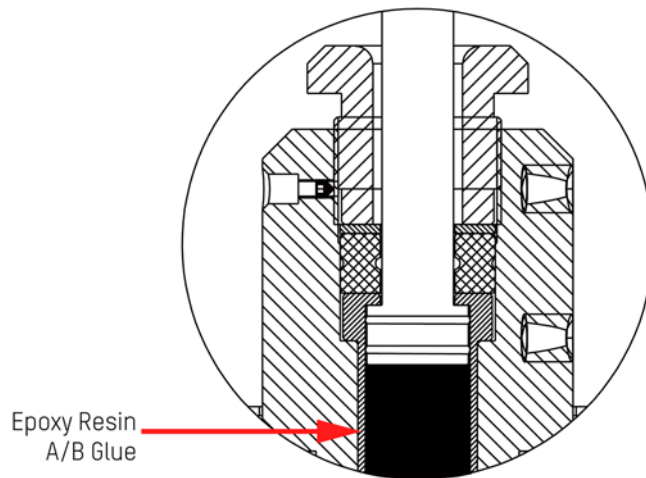


Figure 4 Explosion-Proof Pipe Cross-Section

2.2.2. PRE-INSTALLING BRACKET

The bracket is made of 304/316L stainless steel and every part is welded together to withstand five times the camera's weight. Users can install the bracket with the camera on the ground, and then hang them on the mounting base, which is mounted on the wall in advanced. The design makes the installation convenient and only one man is needed for the installation. See the below picture for the installation procedure. The installation can be completed in only three steps.

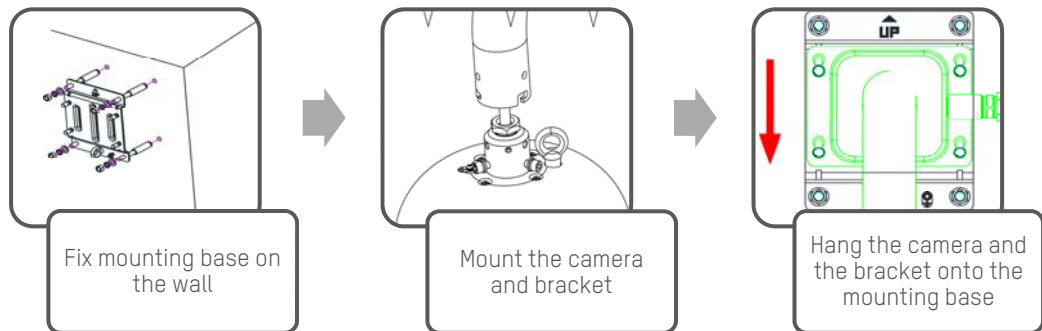


Figure 5 Installation Procedure

2.2.3. FIRM SAFETY ROPE

The safety rope that connects the bracket and the camera can prevent the camera from dropping in unforeseen circumstances.

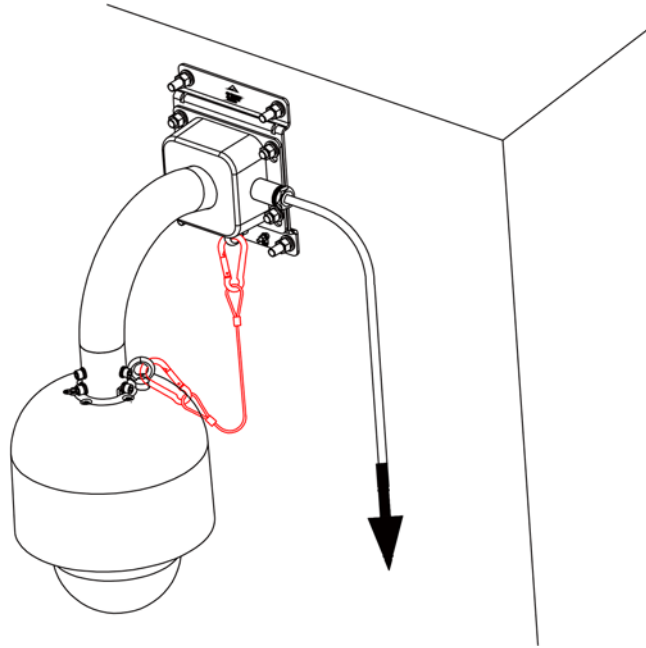


Figure 6 Safety Rope on the Camera

2.3. PRECISE MANUFACTURING PROCESS

From material selection to assembly, there are 10 major procedures during the production process.

1. Material Selection: Use only the steel that passes the quality test and meets the enclosure firmness standard.
2. Molding: Cutting and burnishing after sawing and rough turning.
3. Welding: Automation-based welding technology ensures good welding quality and high product consistency.

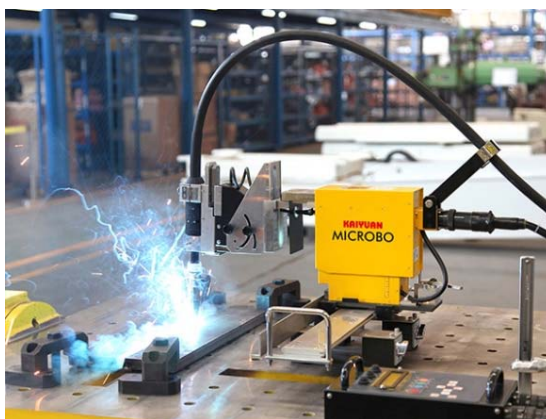


Figure 7 Automation Welding

4. Solution Treatment: Eliminate the welding stress by heat treatment and improve the product stability.

5. Semi-Finish Turning: Turn the components with CNC lathe.



Figure 8 Semi-Finish Turning

6. Semi-Finished Product Quality Inspection: Check the semi-finished products' quality to improve the product yield.
7. Finish Turning: Turn the products that pass the quality inspection for the second time and improve the flameproof planes' precision and flatness, and narrow the gap.
8. Finished Product Quality Inspection: Check the product for dimension, surface flatness, flameproof thread, and welding performance according to international standards.

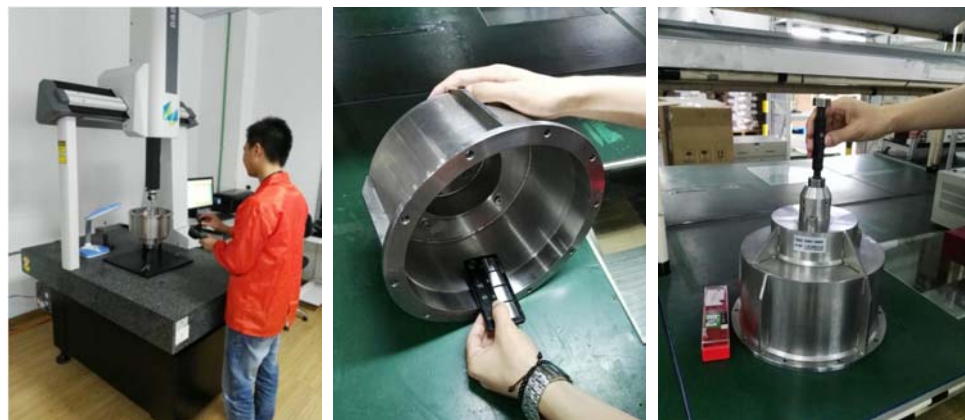


Figure 9 Inspections of Dimension (left), Surface Flatness (Middle), and Flameproof Thread (Left)

9. Ultrasonic Cleaning: Process ultrasonic cleaning on every component to remove the dirt in and outside of the product and guarantee the airtightness after assembling.



Figure 10 Ultrasonic Cleaning

10. Assembly: Professional workers and specific production lines guarantee explosion-proof performance

3. APPLICATIONS

Hikvision explosion-proof cameras adopt qualified 304 or 316L stainless steel and are designed fully considering the product firmness and airtightness. The camera has achieved several global accredited explosion-proof certifications such as ATEX and IECEx. The models use 316L stainless steel also support anti-corrosion certification (C5-M and NEMA 4X) and satisfy some special scene's application. During the product manufacturing process, every stage is under strict control to maximally guarantee the product quality. Hikvision explosion-proof cameras are widely applicable to petroleum refineries, chemical plants, dusty workshops, gasoline stations, gas stations, metal factories, etc., and supplies high-quality and stable video surveillance.

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