

Safety Interlock Device for Quick Opening Blind Plate

Instructions for Use, Service Environment, Calibration Cycle and Calibration

Method

The main types of the quick opening blind plates manufactured by us include: clamp type quick opening blind plate, pressure ring type quick opening blind plate, and buckle type quick opening blind plate. Different safety interlock devices are provided according to different types of blind plates.

I. Clamp type quick opening blind plate safety interlock device: The clamp type quick opening blind plate safety interlock device consists of safety bolt, safety plate, and safety pin. The safety pin is connected to the safety plate through a circlip for shaft, and the safety bolt is connected to the safety plate through the circlip for shaft, as shown in the figure below:

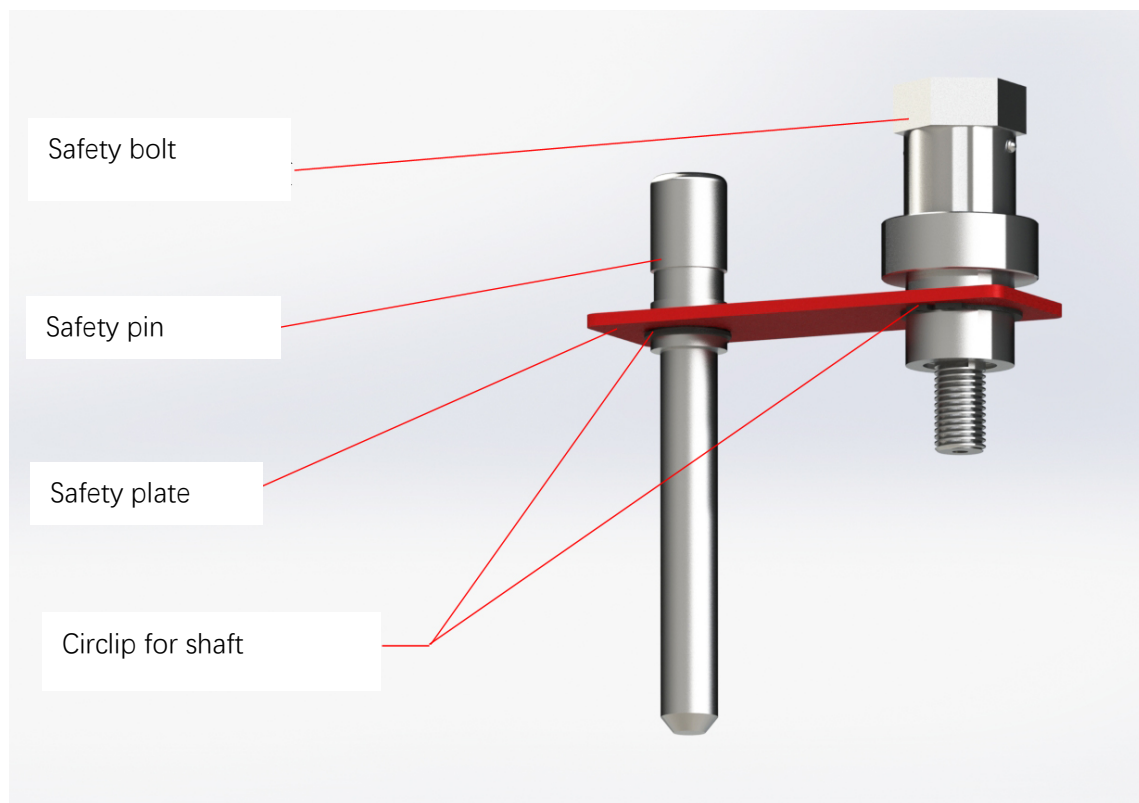


Figure 1: Clamp Type Quick Opening Blind Plate Safety Interlock Device

After the clamp type quick opening blind plate is closed in place, the sealing surface around the threaded hole on the head cover needs to be cleaned, and the safety bolt should be connected to the threaded hole on the blind plate head cover that is connected internally. At this point, the safety pin should be able to be inserted into the hole of the nut fixing plate welded to the clamp. If it cannot be inserted, it means that the clamp is not closed in place, and the opening and closing screw should be rotated continuously for closing. After closing in place, align the safety pin with the hole of the nut fixing plate, insert it, and rotate the safety bolt clockwise to connect with the head cover.

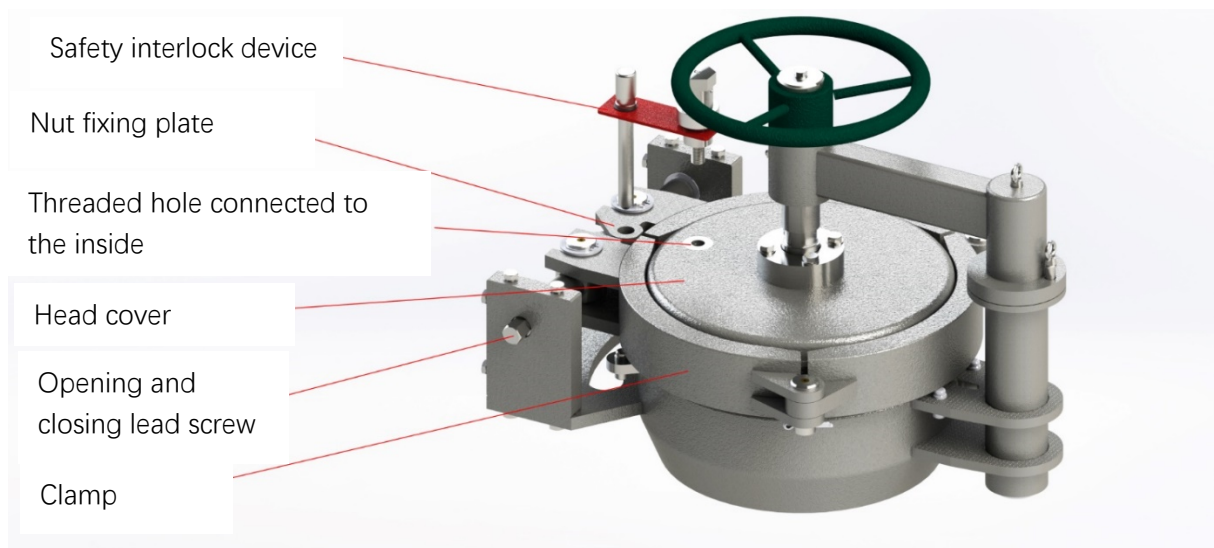


Figure 2: Installation Diagram of Clamp Type Quick Opening Blind Plate Safety Interlock



Figure 3: Installation Completion Diagram of Clamp Type Quick Opening Blind Plate Safety Interlock

Device

II. Pressure ring type quick opening blind plate safety interlock device: The pressure ring type quick opening blind plate safety interlock device consists of safety bolt, safety plate, and limit block.

The safety bolt is connected to the safety plate through the circlip for shaft, and the limit block is connected to the safety plate through welding, as shown in the figure below:

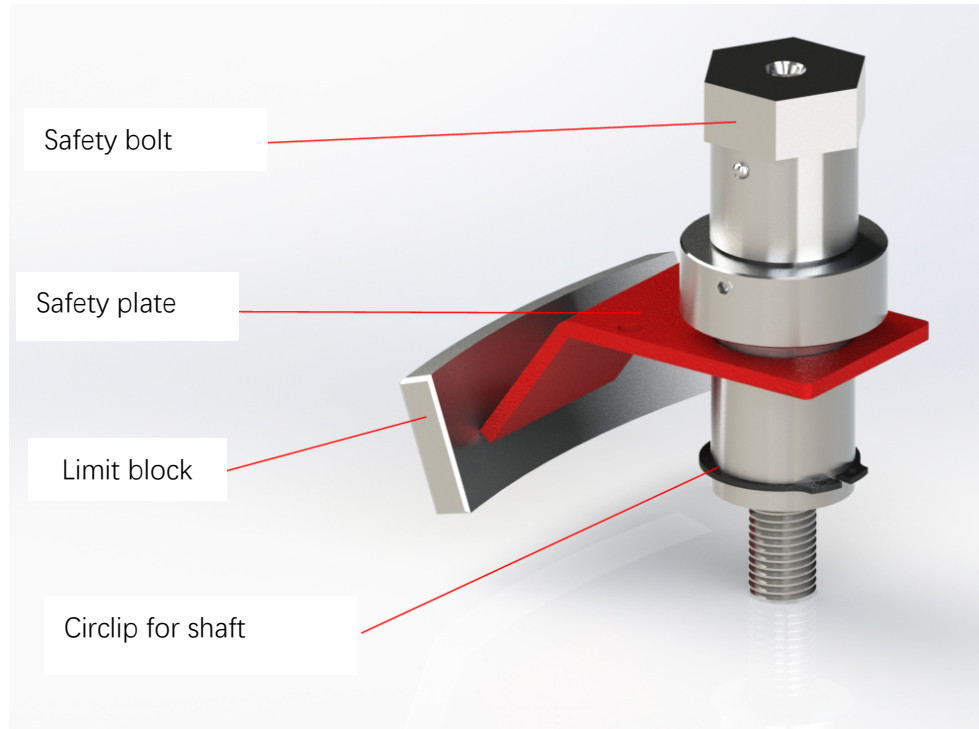


Figure 4: Pressure Ring Type Quick Opening Blind Plate Safety Interlock Device

When the pressure ring type quick opening blind plate is closed in place, the pressure ring is fully inserted into the gap between the cylinder flange and the head cover. The sealing surface around the threaded hole on the head cover needs to be cleaned. At this point, insert the limit block of the safety interlock device into the reserved space in the middle of both ends of the lock ring. The safety bolt should be aligned with the threaded hole on the blind plate head cover that is connected to the inside of the equipment. If the threaded hole is not aligned, it indicates that the lock ring is not closed in place. Check for any foreign objects between the sealing surfaces or between the sliding surfaces of

the lock ring, and repeat the closing action until the lock ring is closed in place. The limit block can be smoothly inserted into the reserved space at both ends of the lock ring, and the safety bolt can be rotated clockwise to connect it to the head cover.

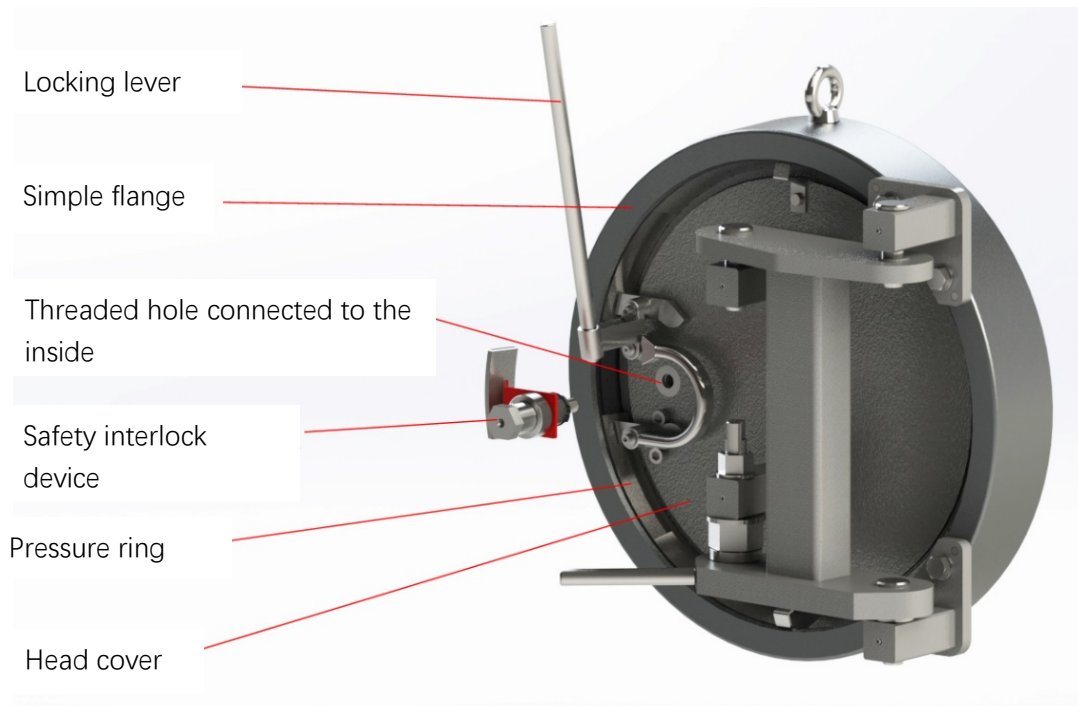


Figure 5: Installation Diagram of Pressure Ring Type Quick Opening Blind Plate Safety Interlock

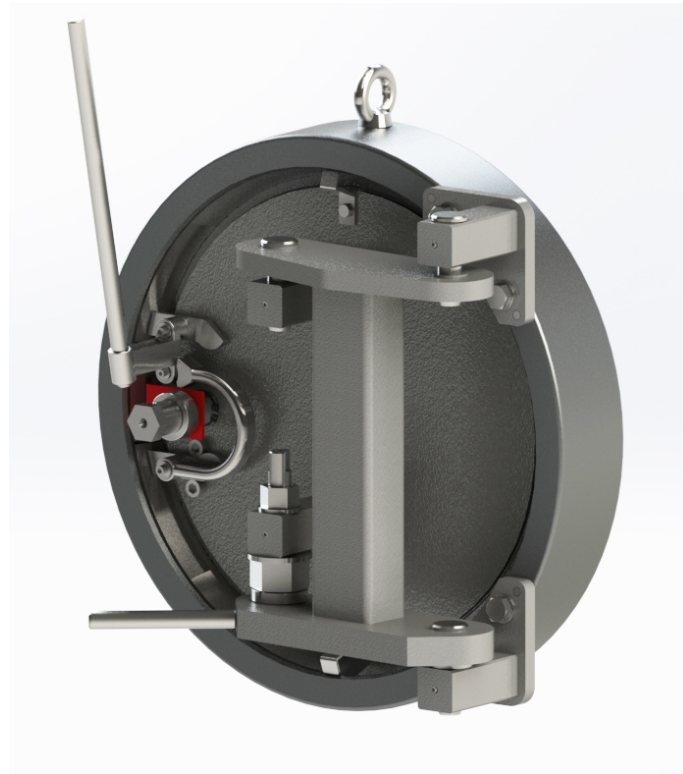


Figure 6: Installation Completion Diagram of Pressure Ring Type Quick Opening Blind Plate Safety

Interlock Device

III. Snap-type quick-opening blind plate safety interlock device: The snap-type quick-opening blind plate safety interlock device consists of a safety bolt and a safety plate. The safety bolt is connected to the safety plate through an elastic retaining ring for the shaft, as shown in the figure below:

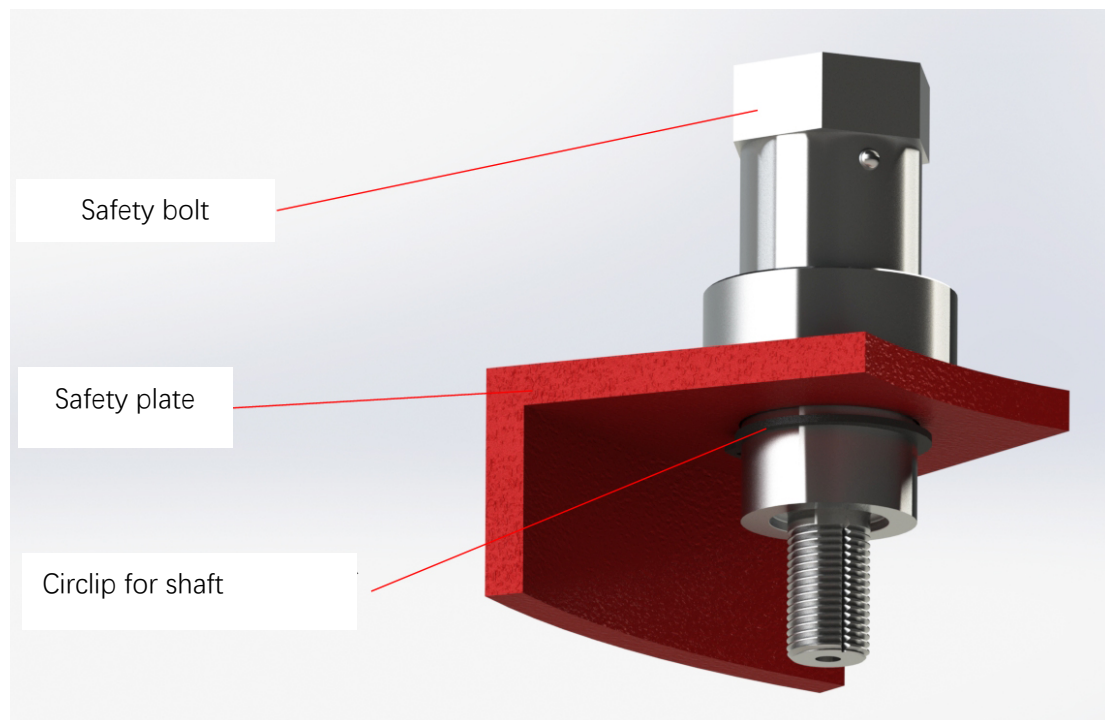


Figure 7: Buckle Type Quick Opening Blind Plate Safety Interlock Device

After the buckle type quick opening blind plate is closed in place, the sealing surface around the threaded hole on the head cover needs to be cleaned after the trapezoidal threads of the cylinder and the head cover are fully engaged. At this point, the safety plate of the safety interlock device should be inserted into the reserved space at the engagement position of the cylinder and the head cover. The safety bolt should be aligned with the threaded hole on the blind plate head cover that is connected to the inside of the equipment. If the safety plate cannot be inserted into the space, it indicates that the head cover is not currently closed in place. Check for any foreign objects between the sealing surfaces or between the sliding surfaces of the threads, and repeat the closing action until the head cover is closed in place. The safety plate can be smoothly inserted into the space where the head

cover and the cylinder engage, and the safety bolt is rotated clockwise to connect it with the head cover.

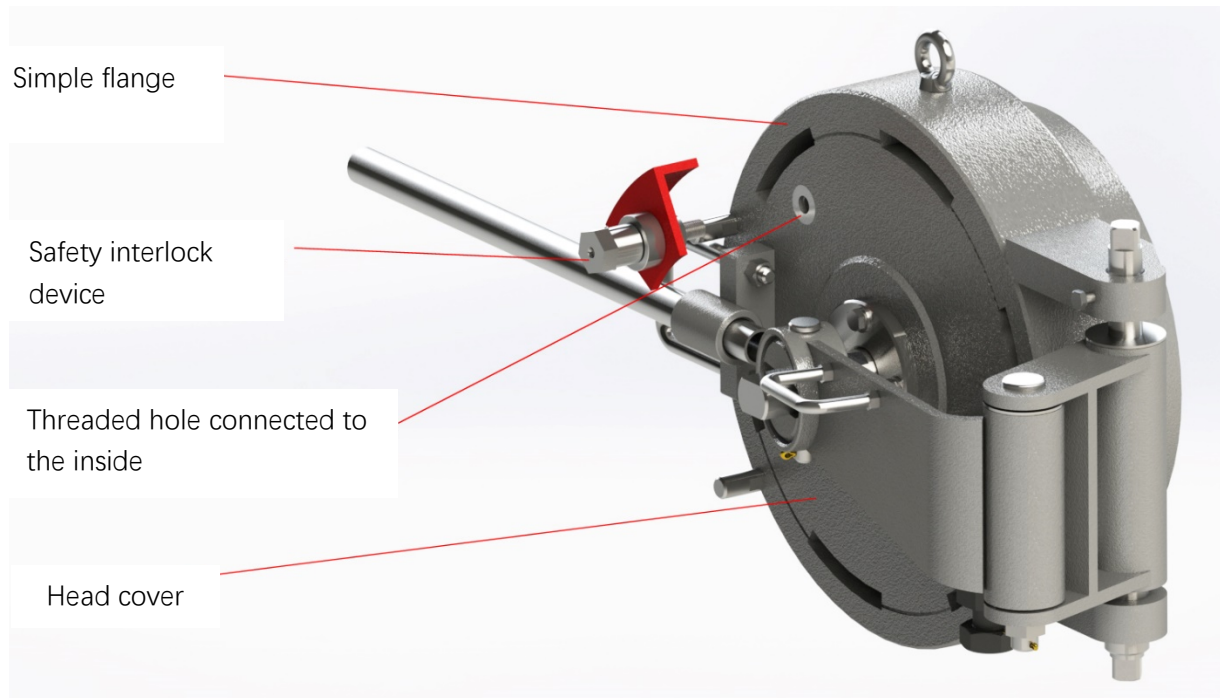


Figure 8: Installation Diagram of Buckle Type Quick Opening Blind Plate Safety Interlock

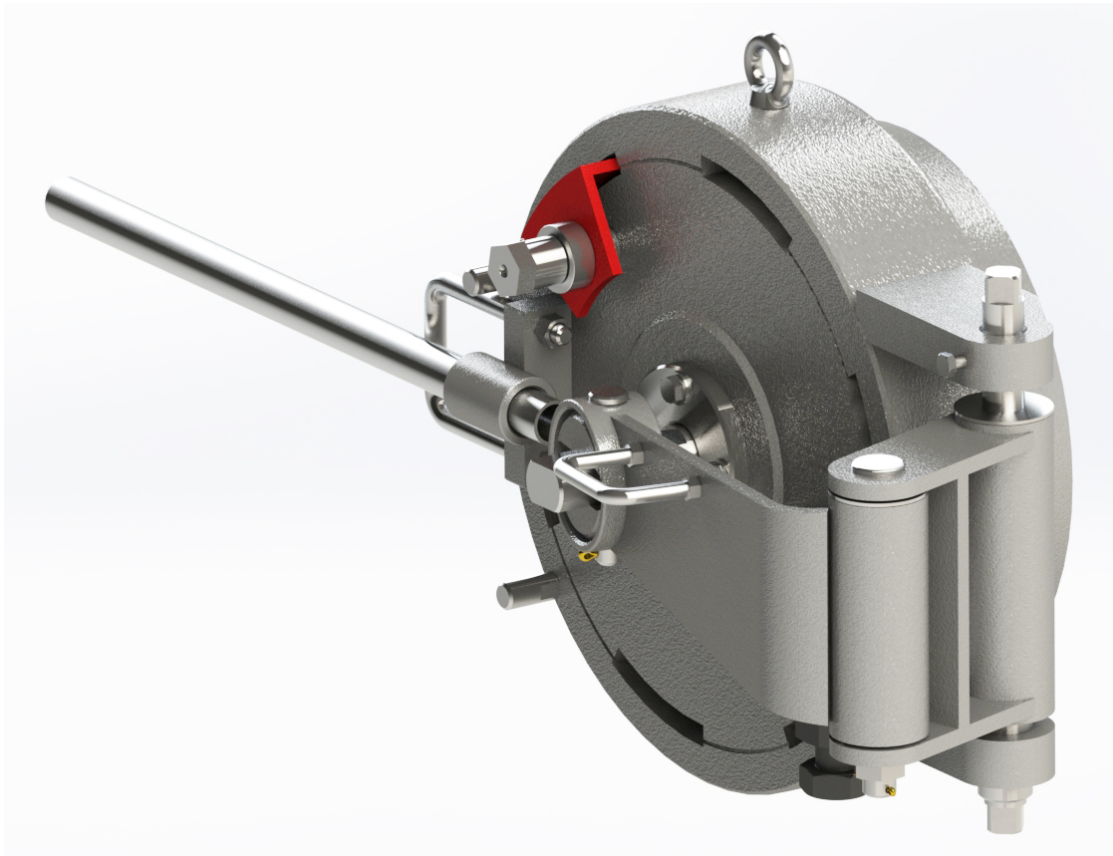


Figure 9: Installation Completion Diagram of Buckle Type Quick Opening Blind Plate Safety Interlock

Device

IV. Operating principle of the safety interlock device: The safety interlock device is divided into the above three types according to the type of blind plate, but its operating principle is basically the same. The purpose is to meet the requirements of SY/T 0556-2018 "Technical Specification for Quick Opening Blind Plate", i.e., "The safety interlock device should have the interlock function associated with internal pressure to ensure that the quick opening blind plate cannot be pressurized if it is not closed in place, and the quick opening blind plate cannot be opened if the internal pressure of the pressure vessel is not completely released."

The quick opening blind plate safety interlock devices manufactured by us are all based on our

patented product "A Safety Protection Bolt with Self-locking Mechanism" (patent number: ZL 2019 2 1939047.9,-- hereinafter referred to as the "safety bolt") to complete the above functions. Its structure is as shown in the figure below (to facilitate understanding of the meshing parts, the protective sleeve is as shown in a half-section state):

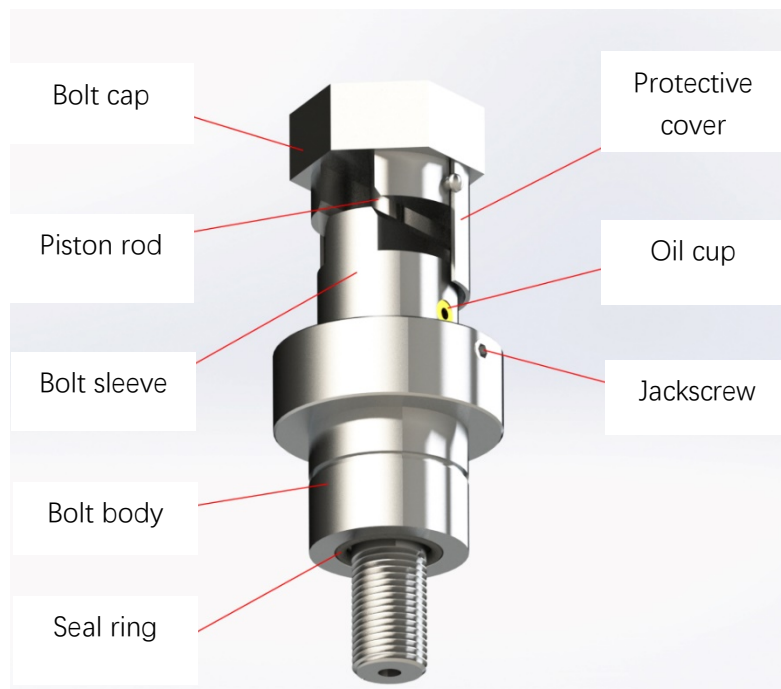


Figure 10: Safety Bolt In Working Condition

The starting pressure of the safety bolt is $\geq 0.1\text{MPa}$, and the safety bolt starts to return when the return pressure is $< 0.1\text{MPa}$. The safety interlock returns to the original position until the internal pressure is completely released. The fatigue life of the interlock is > 5000 cycles.

Operating principle of the safety bolt: The above three types of safety interlock structure indicate that, when the quick opening blind plate is not closed in place, the safety interlock device cannot be

installed in place, and the threaded hole connected to the inside on the blind plate head cover is not sealed, and the internal pressure of the equipment will leak through the threaded hole, thus completing the function that "the quick opening blind plate cannot be pressurized when it is not closed in place".

When the quick opening blind plate is closed in place and the safety interlock device is installed, the safety bolt and the equipment head cover are sealed by the bottom sealing ring. When the internal pressure of the equipment exceeds the starting pressure, the pressure will enter the internal cavity of the bolt body through the hole at the bottom of the bolt body. There is a piston structure in the cavity, and the piston rod drives the bolt cap to pop out. At this point, the engagement part between the bolt cap and the bolt sleeve is disengaged, and the bolt cap is in a free state. You cannot drive the bolt sleeve and the bolt body to rotate by rotating the bolt cap, so it cannot be separated from the equipment head cover. Therefore, the corresponding limit block, safety plate, or safety pin connected to the opening and closing part of the equipment cannot be separated, and the equipment cannot be opened, thus completing the safety interlock function that "the quick opening blind plate cannot be opened when the internal pressure of the pressure vessel is pressurized or the internal pressure is not completely released".

When the internal pressure is released to the return pressure, the piston will start to rebound. There is a chamfer at the engagement part of the bolt cap and the bolt sleeve. Although the bolt cap and the bolt sleeve are already in contact at this point, they are not truly engaged. When a rotational force is

applied, the two parts will still disengage along the chamfer direction. The bolt sleeve and the bolt rod can be driven to rotate by the rotation of the bolt cap and then be separated from the head cover only when the pressure is completely released, and the bolt cap and the bolt sleeve are fully engaged. At this point, the safety interlock device can be removed, and the quick opening blind plate can be opened.



Figure 11: Safety Bolt in a State of Complete Internal Pressure Release

V. Environmental requirements for the use of safety interlock device: When the equipment medium is purified natural gas or other purified gas, the service environment for the safety interlock device of outdoor quick opening pressure vessel should meet the following requirements: When the

temperature is $\leq 0^{\circ}\text{C}$, it must be used only under non-rainy and non-snowy weather conditions; when the temperature is $> 0^{\circ}\text{C}$, there are no special requirements for rainy or snowy weather; however, at any time, the wind scale should not exceed scale 4. When it is used in an indoor environment, good indoor ventilation should be maintained.

When the equipment medium is liquid, regardless of whether the equipment is indoors or outdoors, the service environment for the safety interlock device must simultaneously meet two conditions below: Firstly, the ambient temperature should be higher than the freezing point or condensation point of the liquid; secondly, the ambient temperature should ensure that the viscosity of the liquid is less than or equal to 1.56 centipoise (i.e., the liquid should have good fluidity).

The safety interlock device is mainly sealed by a nitrile rubber ring, so it should be noted that nitrile rubber is not weather-resistant, ozone aging-resistant, or phosphate ester hydraulic oil-resistant. The operating temperature range is $-20^{\circ}\text{C} \sim 100^{\circ}\text{C}$. In case of the service environment above, the manufacturer should be informed and seal rings made of other materials should be selected.

VI. Calibration cycle of the safety interlock device: For the outdoor environment that meets the service environmental conditions aforesaid, the calibration cycle of the safety interlock device is about one quarter. For indoor environment that meets requirements, the calibration cycle of the safety interlock device can be extended to six months.

VII. Calibration method of the safety interlock device: ① Close the equipment inlet valve, open the vent valve and drain valve (if the equipment is equipped with a vent valve and drain valve), and

completely release the internal pressure of the equipment. When the pressure gauge on the equipment shows zero, the safety interlock device can be released; ② When releasing the safety interlock device on the quick opening blind plate, observe whether there is pressure discharged from the safety bolt hole. If so, tighten the safety bolt again and continue to repeat step ① to empty the pressure inside the equipment. Before releasing the safety interlock device, confirm again that all residual pressure inside the equipment has been completely discharged. After emptying, rotate the safety bolt counterclockwise and then remove the safety interlock device, and then open the quick opening blind plate head cover; ③ Clean the rubber sealing ring on the safety interlock device and inspect visually for defects such as indentations or scratches. Determine whether to replace the sealing ring, then thoroughly clean away the surface dirt of each part of the safety interlock device, and wipe it clean with a soft cloth; ④ Check whether the connection between the safety bolt, safety plate, safety pin, or limit block (if any) is firm, and check whether the circlip for shaft is ineffective. In case any of the above components are ineffective, replace the corresponding parts in time; ⑤ By repeatedly pulling and rotating the hexagonal position of the safety bolt head, check whether the internal piston of the safety bolt is stuck or the spring is ineffective. In case of any clamping stagnation, lubricate through the oil injection hole of the safety bolt. If the spring is ineffective, replace it in time. If the problem cannot be solved after maintenance, please contact us for after-sales service as soon as possible; ⑥ Conduct a 0.1Mpa pressure test on the safety bolt to test whether the hexagon of the safety bolt pops out at 0.1Mpa. At this point, check whether rotating the hexagon can

drive the main body of the safety bolt to rotate or remove the safety bolt. After pressure relief, check whether the hexagon returns to its original position. After it returns to its original position, check whether rotating the hexagon can smoothly drive the main body of the safety bolt to rotate and remove the safety bolt. ⑦ After the inspection is completed, clean the corresponding sealing surface of the safety bolt and then reinstall it. ⑧ After all components are reset, pressurize the equipment to check whether the hexagon of the safety bolt pops out and whether there is leakage at the threaded connection. If there is leakage, repeat the above steps.

VIII. Inspection and maintenance of quick opening blind plate: During the inspection of the safety interlock device, the sealing surface and sealing rubber ring of the quick opening blind plate shall be cleaned and inspected. The maintenance and inspection methods for the sealing surface and sealing rubber ring of the quick opening blind plate should be with reference to the equipment manual.