

The use of electrical socket outlets in environments with explosive atmosphere

The engineering philosophy in general, and in particular the one for explosive environments, besides the normal design for the realization of the production processes, may consider the need for a proper management and maintenance of the plant as a whole: the management and maintenance of the production process and of all the "Utilities" that contribute to the functionality of the production process.

For these reasons, the designer, in addition to the civil, mechanical and process components, studies and analyzes that the equipment operate in continuity and as provided in the processual logic.

One of the many components of industrial plants or hazardous environments are the power sockets.

Normally, in order to ensure the ability to operate in full security and without interfering with operational areas with temporary electrical wires, the designer considers the orographic positioning of the sockets so that the operator can work with cables of lengths which not cause hindrance.

For this reason, more than one power outlet system type is required in the plant, such as:

1. *Lighting sockets circuits*, single-phase + PE, 16A or 20A, with variable voltage depending on the voltage levels provided at the installation site (e.g. in Italy, they will be 240VAC, while in the Arab countries they will be 208VAC and so on). The orographic allocation of these types of lighting sockets usually covers a radius of 25 ÷ 30 meters.
2. *Safety sockets circuits*, single phase + PE, 16A, with voltage from 12VAC up to 230VAC. The orographic allocation of these types of safety sockets is due to the functional criticality of the process equipment and it is therefore defined by the designer along with the process engineer and the security system.
3. *Power sockets circuits*, three-phase + PE or three-phase + N + PE, 32A or 63A, with variable voltage depending on the voltage levels provided at the installation site (e.g. in Italy they will be 400VAC, while in the Arab countries they will be 415VAC and so on). The orographic allocation of these types of sockets usually covers a radius of 50 ÷ 60 meters.

There are other socket outlets types for specific dedicated functions such as power sockets, three-phase + PE or three-phase + N + PE, 63A or 125A, with variable voltage depending on the voltage levels at the installation site (E.g. in Italy they will be FM of 400VAC, while in the Arab countries they will be 415VAC and so on), for the supply of filter presses for the oil recovery of power transformers, large welders, compressors and for all those portable devices that can be useful in servicing and/or revamping up the process plant.

The choice of Cortem Group has been to use the most standard market equipment and, for this reason, it has opted for the use of industrial magneto-thermic circuit breakers, in order to give the user the opportunity to find spare parts on the market and not having to rely on Cortem Group for the replacement of the circuit breaker.

It is well known that the circuit-breakers are suitable for operating under normal operating conditions, thus opening and closing the rated current (Thermal current "I_{th}") but also designed to be capable of interrupting the short-circuit current resulting from a fault between phases or to the ground "I_{cu}".

Industrial switches are manufactured in accordance with IEC/EN 60947-2, with an operating cycle "O-t-CO", where "O" is for Open, "t" is the interval between the intervention and the following closure and "CO" is for Open-Closed. In case of failure, first the switch opens automatically and then, after a "t" time varies depending on the takeover of the operation, the operator operates the function of "C" closing the circuit breaker and, if the cause of the fault persists, the switch will automatically open again "O".

In this case, the circuit breaker may still be able to open and close the nominal current, obviously after eliminating the cause of the failure, but will never be able to protect the downstream user in case of short circuit, making it in fact no longer protected.

This is basically the motivation that led Cortem Group to choose to install in its EPC1... /EPRC1... series and FSQC... series sockets, industrial switches and not 'Ex de m' encapsulated switches which could not be replaced in a timely and cost-effective way.

Cortem Group, for explosion-proof environments, Zone 1-2-21-22, according to IEC/EN 60079-14, produces three series of power sockets complying with IEC/EN 60079-0, IEC/EN 60079-1 and IEC/EN 60079-31, suitable for maximum surface temperature as per specific certificates, broken down as follows:

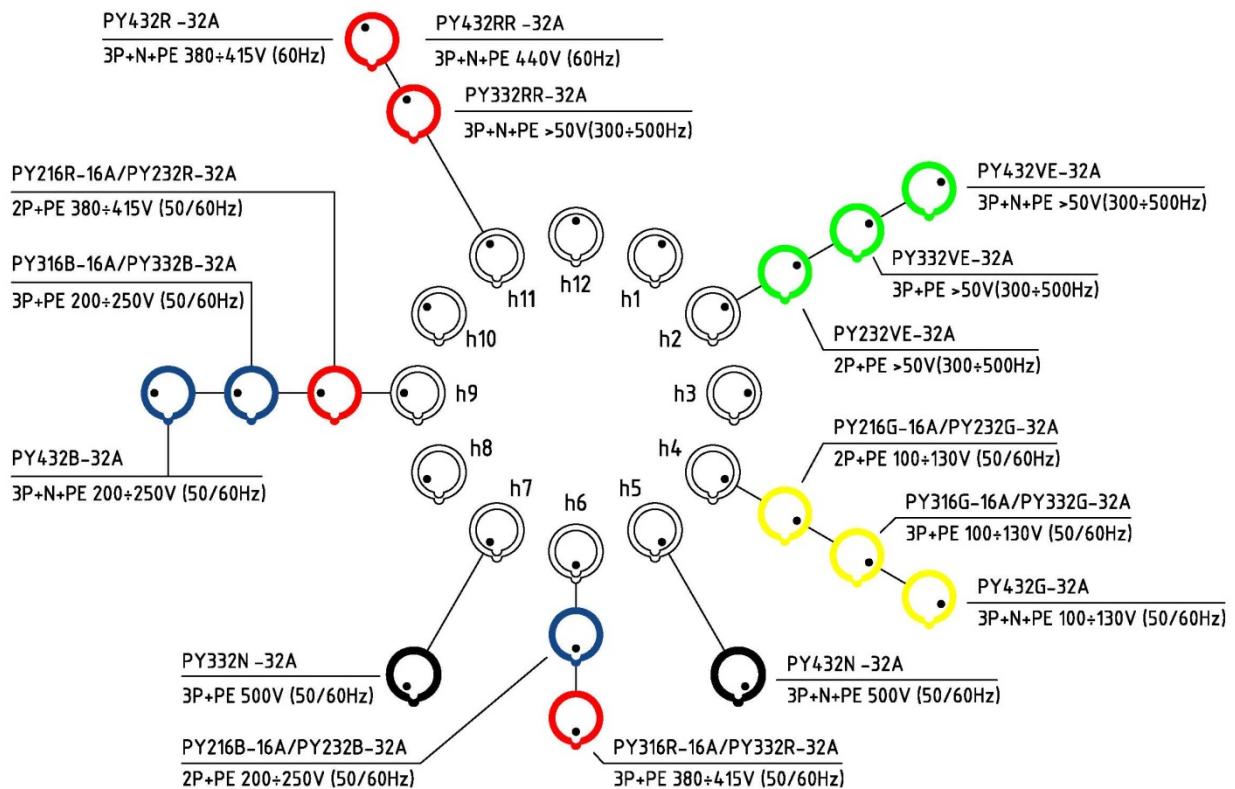
PY series socket outlets, marking 'II 2 GD Ex d IIC T6 Gb; Ex tb IIIC T76° C Db' IP66 Tamb. -20°C ÷ + 50°C, with body and lid in low copper aluminum alloy. They are provided with an interlocked disconnecter with the plug underneath it, in order to ensure, thanks to the rotation and closing/opening in a special explosion chamber which contains the possible explosion in the event of gas, the connection of the electric circuit, only after the plug has been properly inserted in its seat, and to ensure that it is removed only after the electrical circuit has been disconnected electrically.

The range includes socket outlets, bipolar + earth (PE); triple-pole + earth (PE) and triple-pole + neutral + earth (PE) with rated current from 16A up to 32A and 20VAC up to a maximum of 690VAC and a maximum frequency of 500Hz. These socket outlets are suitable in all environments with potentially explosive atmospheres and they are constructed not to allow the coupling with industrial plugs.



The peculiarity of these sockets is that they can be equipped with plugs SPY series ..., with the same characteristics but with the possibility of being used also on industrial outlet sockets. This is a peculiarity only of Cortem Group which has been designed to allow the user to have stocks in a limited extent compared to competitive outlets that do not have this feature. In fact, the positioning of the phase and earth pins and the colored ring, which comply with the color coding as per IEC / EN 60309-2 rule for industrial sockets and plugs, are characterized by their voltage and current consumption.

For a better understanding, we provide here below the earth pin (PE) positioning diagram and its colorings, in accordance with IEC/EN 60309-2, for operating voltages greater than 50.



TECHNICAL NEWS



To be sure to be safe.

EPC1.../ EPRC1 series socket outlets, marking 'II 2 GD Ex d IIC T6 Gb; Ex tb IIIC T85 ° C Db' IP66 Tamb. -20°C ÷ + 55°C, with body and lid in low copper aluminum alloy.

These sockets are particularly suitable for powering utilities with a power greater than 32A, such as filter presses for the oil recovery of power transformers, large welders, electro-pneumatic compressors, generators and a whole range of large utilities furniture necessary for the maintenance and/or revamping of parts of process parts.

Unlike the PY... series sockets, the EPC1... /EPCR1... series sockets are equipped, because they must be suitable for high power loads, with a magneto thermic circuit breaker with both thermal (overload) and magnetic (short circuit) protection with curves "C" typical for electrical loads and with threshold current intervention fixed and predefined during design phase.

The switch handle is external and it is mechanically interlocked with a safety system that prevents the electrical circuit from being closed if the plug is not properly plugged into its explosion-proof housing and prevents its removal if the circuit breaker has not been opened preventively.

The range includes socket outlets, triple-pole + earth (PE) and triple-pole + neutral + earth (PE) with rated current from 63A up to 125A and a maximum of 500VAC and a frequency of 50/60Hz.

These socket outlets are suitable in all environments with potentially explosive atmospheres and they are constructed not to allow the coupling with industrial plugs.



FSQC-... series socket outlets, marking 'II 2 GD Ex d IIC T6 Gb; Ex tb IIIC T85° C Db IP65' Tamb. -20°C ÷ + 40°C, with body and lid in low copper aluminum alloy.

These sockets differ from the PY series sockets for not having the fourth pole (3F + N) but having only two-phase + earth (PE) and three phase + earth (PE) types, so only suitable for single-phase or three-phase loads.

They are equipped with an automatic magneto thermic circuit breaker with both thermal (overload) and magnetic (short circuit) protection with curves "C" typical for electrical loads and with threshold current intervention fixed and predefined during design phase.

The circuit breaker is interlocked with the plug underneath it, in order to ensure, thanks to the rotation and closing/opening in a special explosion chamber which contains the possible explosion in the event of gas, the connection of the electric circuit, only after the plug has been properly inserted in its seat, and to ensure that it is removed only after the electrical circuit has been disconnected electrically.

The range includes socket outlets, bipolar + earth (PE); and triple-pole + earth (PE) with rated current from 10A up to 63A and a maximum of 690VAC and a frequency of 50/60Hz.

Even for these sockets, Cortem has chosen to adopt industrial circuit breakers, such as the EPC1.. /EPRC1... sockets, which can be fitted with 63A FP series plugs.

These socket outlets are usable in all environments with potentially explosive atmospheres and they are constructed not to allow the coupling with industrial plugs.



Finally, we remind that cable glands and/or accessories required for connecting the power supply cables to the socket outlet, as well as for the plug connection, must meet the requirements set out in the reference standard for the installation environment (IEC/EN 60079- 14) and meet the requirements of the socket outlets manufacturer.

Likewise, the cables must meet the requirements of the socket outlets manufacturer and be suitable for operation at a minimum temperature specified in the manufacturer's certificate.

The above applies also to any plugs that must be of the certified type and have threads conforming to the requirements of the power outlet manufacturer.