

SolConeX

- uncompromising safety for flexible power distribution
The new generation of explosion protected plugs and sockets

by R. Nägele



Figure 1: SolConeX – the new series of plug and sockets

With its new SolConeX Series, R. STAHL presents an innovative successor to the successful CES Series of explosion protected plugs and sockets up to rated current 16 A and 32 A (Figure 1). The new plugs and sockets provide optimised benefits to the customer by incorporating the experience of many users and represent what is currently the most up-to-date product series in this sector.

Compliance with Standards

Plugs and sockets are used to connect and operate mobile apparatus, such as pumps or portable hand lamps. It is important to note that not only the plugs and sockets, but also the devices connected to them must comply with the equipment categories permitted for the relevant zone in hazardous areas of Zones 1, 2, 21 and 22.

The new SolConeX Series complies with the requirements of Equipment category 2 G/D pursuant to Directive 94/9/EC and has been designed by R. STAHL in compliance

with the Standards listed in Table 1. The complete marking is thus Ex II 2G EEx ed IIC T6 and Ex II 2D IP66 T85°C. Special version with intrinsically safe auxiliary contacts Ex II 2G EEx ed [ia] IIC T6.

Compatibility

As is customary at R. STAHL, the new SolConeX Series is fully compatible with the existing CES Series. This means that the previous plugs fit the new sockets and that the new plugs fit the previous sockets (Figure 6).

This provides the user with the required scope for conversion from old to new and affords major advantages for retrofitting and spare parts procurement.

The dimensions of the socket sleeve base and the pin arrangement are standardised in accordance with IEC/EN 60309. Design measures ensure that there is no possibility of confusion of explosion protected plugs and sockets with non-explosion protected plugs and sockets. In addition, the explosion protected plug must fit both an explosion protected socket and a standard industrial socket. This is extremely important, since portable equipment designed for the hazardous area is also operated in the safe area.

Of course, the SolConeX sockets are designed so that standard industrial plugs cannot be operated in them.

Technology

With the aim of achieving a flexible range of application, SolConeX has been designed consistently modular. The result is a socket flange, which can be used both for flanged sockets and also in modular fashion for wall sockets or coupler sockets. This simplifies spare parts procurement.

This has been made possible by integrating the isolating switch in the socket flange on SolConeX (Figure 2). This means that the sockets have become more compact and lightweight, which is important particularly for mechanical engineering, where weight and size still play an important role.

In addition, direct conductive continuity has been achieved without intermediate wiring between switch and contact bushing, thus

meaning less temperature rise and a longer service life.

The modular design means that the terminal chamber of the wall socket is far larger and, thus, installation is far simpler, safer and faster.

Omission of the separate switch also affords advantages for multi socket-outlet distribution since it allows a larger number of flanged sockets than previously in the relevant enclosures (Figure 3). This relates equally to socket-outlet distribution with miniature circuit breakers, which can thus also be designed far more compact.

One premise in the new development was retaining the large operating handle and simple, foolproof actuation.

The large operating handle always pro-



Bild 3: Steckdosenverteilung mit Leitungsschutzschaltern

vides the user with a reliable switch position indication, and inserting-switching or switching-disconnecting can be done without complex rotary movements, causing material fatigue as is usual on industrial plugs and sockets.

One other new feature is the handy bayonet catch on plug and socket, which ensures the high degree of protection of IP 66. One particularly positive aspect is that the plug provides this degree of protection not only when connected, but in any other application position. This is an important safety aspect when using the equipment in rough ambient conditions, such as those on oil platforms.

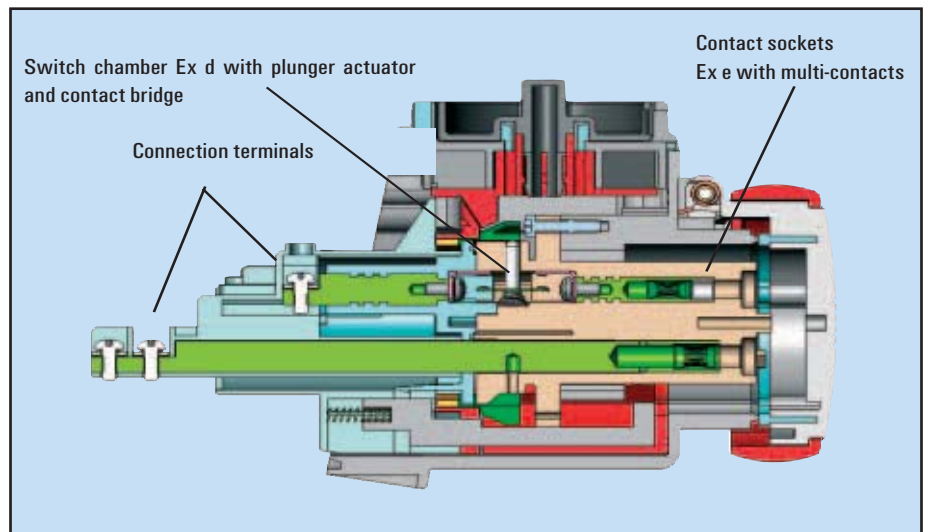


Figure 2: Longitudinal section through the socket flange, 4-pin, 16 A

Table 1: Standards in question

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IEC/EN 60079-0	Electrical apparatus for explosive gas atmospheres - General requirements
IEC/EN 60079-1	Electrical apparatus for explosive gas atmospheres - Flameproof enclosure "d"
IEC/EN 60079-7	Electrical apparatus for explosive gas atmospheres - Increased safety "e"
IEC/EN 60079-11	Electrical apparatus for explosive gas atmospheres - Intrinsic safety "i"
IEC/EN 60241-1	Electrical apparatus for use in the presence of combustible dust - Protection by enclosures "tD"
IEC/EN 60309	Plugs, socket outlets and couplers for industrial purpose (formerly CEE Publication No. 17)
IEC/EN 60947	Low-voltage switchgear and control gear
IEC/EN 60529	Degree of protection provided by Enclosures (IP Code)

SolConeX was developed for worldwide use under the most arduous climatic conditions and, consequently, is approved for a wide ambient temperature range of $-30\text{ }^{\circ}\text{C}$ to $+55\text{ }^{\circ}\text{C}$.

With the optionally available metal glands or adapters for conduit systems (conduit installation), SolConeX can be used for all internationally conventional installation systems.





Figure 4: Socket with inboard, hinge-down strain relief

→ Frequently, plugs and sockets are installed at a large distance from the sub-distribution board, thus necessitating laying long supply cables with a larger cross-section.

Attention has been given to this circumstance on socket Type 8570/1, 16 A, by increasing the maximum possible conductor size from 4 mm² to 6 mm².

In addition, all conductive connection terminals feature protection against accidental contact (including finger contact), degree IP20.

Through-wiring option, low connection and disconnection forces owing to floating contact pins and optimal contacting thanks to multi-contacts for reducing the contact resistances are positive features which users are already used to from the CES Series and which they do, of course, not need to do without with SolConeX.

The isolating switch integrated in the flange has full motor making and breaking capacity AC-3 up to 690 V, thus allowing use of the sockets as safety switches or motor switches.

For the US market, it was possible to achieve a making and breaking capacity of 20 A (HP rated to UL 508, type 2 protection) with the 16 A plug and socket.

The plugs have an interior strain relief,

which allows formation of a visible loop on wire connection. Unlike the exterior strain relief, the interior strain relief offers the certainty that the lead is not pulled taut unintentionally when closing the plug. This avoids faulty wiring.

The hinge-down strain relief (Figure 4) and the improved connection terminals simplify easy and fast wiring of the leads on the plug.

The procedure for closing the plug was simplified further by a locking facility provided by the plug locking screw. At the same time, this increases protection against accidental loosening. This means that SolConeX can also be used on strongly vibrating machines with no problems.

Installation safety

Plugs and sockets are the interfaces between permanently wired electrical installations and mobile equipment which are frequently brought into the installation and operated by outside companies. This means that the plugs and sockets play a particularly important role in installation safety.

For this reason, R. STAHL has designed SolConeX consistently for installation safety, in

the same way as the previous CES Series. The most important safety feature is the isolating switch with large switching capacity for clear switch position indication.

The integrated mechanical locking facility prevents both switch-on of the socket without the plug inserted and disconnection of the plug when live.

The SolConeX flange incorporates a safety pin in order to ensure this locking. This safety pin is pushed through the lug of the plug and this releases a locking cog-wheel.

Outwitting the plug and socket by detaching the plug lug is thus reliably prevented.

This protection is necessary since users of hazardous installations have realised that persons attempt to outwit the explosion protected sockets in the installations in order to connect non-explosion protected apparatus.

The sockets can be locked in ON and OFF positions by attaching a commercially available padlock. This avoids both unauthorised use and switching off the plug and socket, jeopardising safety.

Integration in automation systems

Low-voltage switchgear is included to an ever-increasing extent in automation systems during the course of modernisation of many installations in order to obtain a signal on the status of this switchgear in the control and instrumentation system.

In hazardous areas, these control and instrumentation systems generally communicate with the devices in the field via intrinsically safe Remote I/O Systems or intrinsically safe field bus systems.

If explosion protected plugs and sockets are to be integrated in these automation systems using intrinsically safe circuits, the auxiliary contacts must be designed for type of protection Intrinsic safety "i" in accordance with regulations.

For this reason, R. STAHL has equipped



Figure 5: SolConeX with Ex i-auxiliary contacts for integration in automation systems

SolConeX as the first plug and socket system on the market to date with 2 optional auxiliary contacts suitable for intrinsically safe circuits.

The marking of these versions is Ex II 2G EEx ed [ia] IIC T6 resp. Ex II 2D IP66 T85°C.

Of course, the auxiliary contacts are also available on versions for non-intrinsically safe standard circuits and for all versions of pin arrangements.

The special advantage for the user relates to the fact that they can be latched very easily onto the flange (Figure 5) and can thus be retrofitted at any time.

This means that the user is very flexible, since he can still opt for additional auxiliary contacts after installation of the socket in the system.

This means, amongst other things, simplified storage, more flexible installation and easy modifications during commissioning.

All auxiliary contacts are leading the main contacts when switching off and can be used for disconnection of loads.

The auxiliary contacts feature Ex-e cage clamp terminals. On this type of spring-loaded terminal, the contact quality is largely independent of the person connecting the

conductor. This is achieved by design-preset clamping force in line with the cross-section. Fast, vibration-proof and maintenance-free clamped connections thus offer major advantages in respect of reliability and freedom from malfunction throughout the entire service life.

With its new SolConeX plug and socket system, R. STAHL has developed an explosion protected device providing an extremely



Figure 7: SolConeX-plug and socket system 16A and 32 A

→ high level of safety, which is an excellent successor to the long proven CES Series with a rated current of 16 A and 32 A both as regards design and handling (Figure 7).

Coupler sockets for extension cables are to follow as an extension of the SolConeX Series.



Bild 6: 100% Compatibility of SolConeX and the existing CES-series

Table 2: Lists a selection of possible versions of the SolConeX plugs and sockets for 16A und 32A						
Rated current	Number of pins	Rated voltage	Frequency	Clock position of the socket for the PE pin	Colour coding	Type
16 A	2P + PE	110V-130V	50/60 Hz	4 h	yellow	8570/1-304
		220V-240V	50/60 Hz	6 h	blue	8570/1-306
		277V	60 Hz	5 h	light grey	8570/1-305
		> 50V-110V	DC	3 h	light grey	8570/1-303
	3P + PE	200V-250V	50/60 Hz	9 h	blue	8570/1-409
		380V-415V	50/60 Hz	6 h	red	8570/1-406
		480V-500V	50/60 Hz	7 h	black	8570/1-407
		600V-690V	50/60 Hz	5 h	black	8570/1-405
	3P + N + PE	120/208V-144/250V	50/60 Hz	9 h	blue	8570/1-509
		220V/346V-240/415V	50/60 Hz	6 h	red	8570/1-506
		277/480V-288/500V	50/60 Hz	7 h	black	8570/1-507
		347/600V-400/690V	50/60 Hz	5 h	black	8570/1-505
32 A	3P + PE	200V-250V	50/60 Hz	9 h	blue	8571/1-409
		380V-415V	50/60 Hz	6 h	red	8571/1-406
		480V-500V	50/60 Hz	7 h	black	8571/1-407
		600V-690V	50/60 Hz	5 h	black	8571/1-405
	3P + N + PE	120/208V-144/250V	50/60 Hz	9 h	blue	8571/1-509
		220V/346V-240/415V	50/60 Hz	6 h	red	8571/1-506
		277/480V-288/500V	50/60 Hz	7 h	black	8571/1-507
		347/600V-400/690V	50/60 Hz	5 h	black	8571/1-505