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Ex Special Interest Group Briefing Note: Bonding of Ex Electrical Equipment Assets

The Institute of Measurement and Control Explosive Atmospheres Special Interest Group (Ex-SIG) aims to promote good practice and support continuing professional development in the Ex discipline through a range of activities and publications. The group produces briefing notes to help inform members on key topics. This article is one such briefing note on bonding of Ex electrical equipment assets.

Ex-SIG Briefing Notes are first released to members of the SIG before being made publicly available.

Electrical bonding of equipment items prevents the development of significant potential, under fault conditions, between the equipment item and local metalwork or other equipment items.

If an electrical fault occurs that makes the equipment enclosure/housing 'live', the expectation is that the electrical protection will operate (e.g. fuse, protection relay) and disconnect the supply. The protection depends upon a significant fault current flowing through a combination of the 'circuit protective conductor' (typically the cable steel wire armour) and local earth connections or fortuitous return paths through plant infrastructure (steelwork etc.)

Until the supply is disconnected the equipment item may sit at a high potential relative to the local earth potential or the local metalwork. This may give a risk of electrocution to personnel through the 'touch potential' on the equipment or may give rise to an incendive spark if a bridging connection is made e.g. with a spanner or other tool.

Bonding prevents the development of a large potential difference between the faulty equipment item and the local metalwork; bonding connects the different conductive equipment items together, so they will be at substantially the same potential. The requirement then is to provide a connection between the equipment item and the local steelwork/pipework. If an equipotential bonding conductor system (typically copper strap) is provided as part of the infrastructure for the installation this is ideal.

Note that simply connecting an equipment item to an earth tag 'banjo washer' on a connecting cable gland does not provide any bonding. The cable gland is connected to a remote earth via the cable steel wire armour and this remote earth may be at a different potential to that in the local area under fault conditions. Any cable gland will typically be connected to the equipment by virtue of being screwed into the metal housing (or by securing with a locknut and star washer); the addition of a bonding connection between an equipment earth stud and the cable gland would typically be redundant (but may be useful if there is reason to doubt the gland/enclosure connection).

Similarly, connections between glands are not useful for bonding purposes on metal enclosures.

Bonding is often achieved through bolting of the equipment to the installation steelwork/piping, which may make a dedicated bond redundant, but this 'fortuitous' bonding may not always be satisfactory.

"Exposed conductive parts need not be separately connected to the equipotential bonding system if they are firmly secured to and are in conductive contact with structural parts or piping which are connected to the equipotential bonding system."

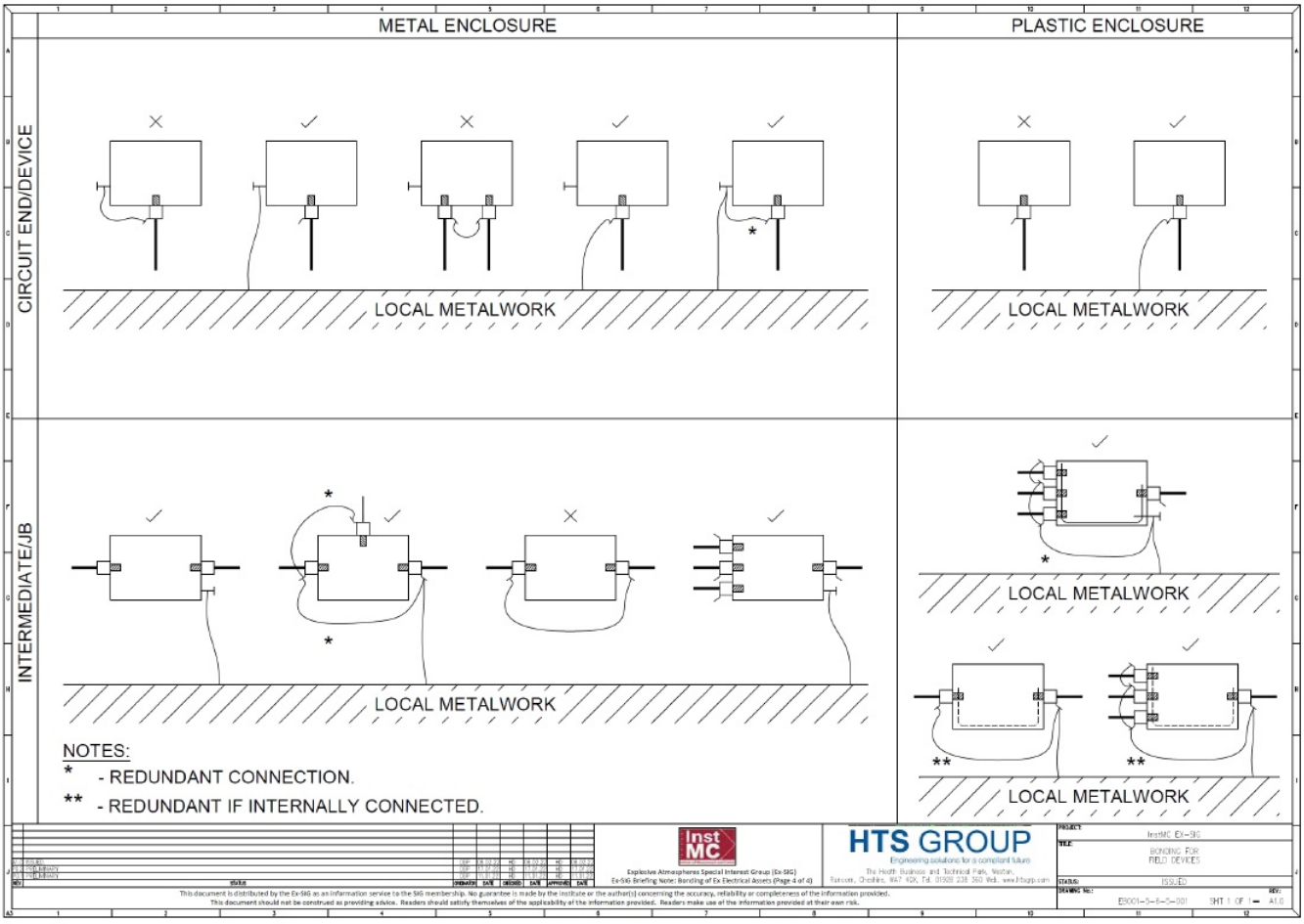
(BS EN 60079-14:2014)

Retrofitting dedicated bonds to all assets may be an unduly burdensome exercise and it may be appropriate to exempt certain categories of assets e.g., where fortuitous bonding is apparent, and the voltage is 24V dc or 55V ac (the categorisation should be appropriately tailored to the context of the installation).

It is recognised that particular circumstances may make retrofitting of a connection impractical.

Many equipment items offer an 'earth stud' which can be used for the bonding connection. In the absence of an earth stud, an earth tag 'banjo washer' on a gland which has a conducting connection to the enclosure is a good alternative.

(Note that sometimes earth tags are fitted regardless of the requirement of



the installation; there is no obligation to connect to the washer if it is not needed for bonding/earthing.)

If an enclosure is non-conductive (e.g. plastic) and has plastic glanding, then there is no requirement for bonding of the enclosure, but any metal gland (which effectively becomes a conducting part of the enclosure) should be bonded if this is practicable (e.g. if an external earth stud or banjo washer is available).

(There is less of a hazard from a plastic enclosure, but it is possible that an internal conducting continuity plate could be energised under fault conditions, making the gland itself live, and it is prudent to continue the bonding practice where practicable.)

If an enclosure/junction box is installed at an intermediate point in a circuit(s) (e.g., a marshalling junction box) the electrical continuity of the circuit protective conductor(s) must be maintained – if this is the steel wire armour, this may be via the metalwork of the enclosure itself. If the enclosure is plastic this continuity must be maintained through an internal conductor (preferred) or by a dedicated external conductor. If the enclosure is plastic and has plastic glanding then there is no requirement for bonding, but the continuity of the circuit protective conductor must be maintained.

The attached sketches (see top of this page) show acceptable, unacceptable, and preferred bonding approaches for metal and plastic enclosures with metal glands, either at the end of a circuit or at an intermediate point. Connections marked with an asterisk, whilst doing no harm, would be redundant.

There is no requirement for bonding of intrinsically safe equipment unless it is a particular requirement of the installation design.

Occasionally an equipment item may be situated remotely from any metalwork that would provide a convenient point to connect to, but in such a circumstance there is not the same prospect of a hazard arising from a possible bridging contact.

Any local regulations or standards should of course be considered. ■