Image: Shutterstock

Intrinsically safe circuit inspection requirements

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 intrinsically safe circuit inspection.

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

This briefing note considers the inspection requirements in relation to an intrinsically safe circuit as a whole, as distinct from the individual asset items.

In accordance with IEC 60079-17, there is a requirement at all inspection levels (visual/close/detailed) to check *'Circuit and/or equipment documentation is appropriate to the EPL/Zone'*.

There is a separate requirement at close/detailed level (but not visual) to check that the 'Equipment installed is that specified in the documentation'. In combination these checks confirm the installed equipment arrangement is appropriate to its zone of use (if visual inspection only, the documented specification would be confirmed as correct but not the field equipment itself).

In practice it will often be convenient to directly check the installed equipment itself for its appropriateness for the zone of use (in the same way as is usual with equipment using other protection types), and separately check that the installed equipment (model type) is that specified in the approved design documentation (sometimes referred to as a 'descriptive document') to confirm that the equipment item corresponds with the specified model.

(The designer is responsible for specifying equipment that is compatible with the duty and the zone of use. This will typically involve a check on the circuit electrical parameters. It is for this reason that the cross-check with the design documentation is important: it confirms that the installed equipment combination (barrier and field item) has been approved as compatible with the zone requirements.)

The descriptive document may be formatted in a variety of ways, and the required information may be distributed across more than one document. The key requirement for the field inspector is that the information is provided so that they may check the installed equipment items match those identified in the approved design. Separate loop drawings and equipment schedules may meet the requirement (in support of detailed inspections if required, the information should also identify any specific conditions of use and specific cabling or earth connection requirements).

The barriers should be similarly checked to confirm that they too correspond with the models specified in the design documentation.

The barrier should also be checked for its condition, is it securely mounted, connected, and the circuit identified (typically by tagging or cable idents). If a Zener barrier is used (as distinct from a galvanic barrier), is the earth connection secure? (Galvanic barriers do not rely on an earth connection. Depending on the scope of the inspection, a check on the Zener earth resistance may be appropriate.)

It will typically be found convenient to check barriers at a different time to the inspection of the field equipment items, since they will normally be housed together in a remote safe area location, and it will then be possible to check many circuits at the same time.

If the equipment (either barrier or field item) is found not to match the design documentation, the discrepancy should be flagged. (Any discrepancy discovered will not necessarily be hazardous, but it should be checked by a competent person, and the design documentation revised. It is possible the design documentation has not yet been revised to reflect a modified but satisfactory as-built arrangement.)

If there are intermediate junction boxes associated with the intrinsically safe circuit these should be checked as assets in their own right (they might be separately identified on an equipment register), although it will normally be sufficient to check that they are installed appropriately and that their condition is satisfactory (not being active components, they do not need to correspond with a specific model with identified electrical parameters).

If, unusually, there are other active equipment items in the circuit, (e.g. field indicators) these should also be checked for correspondence with the equipment items nominated in the design

documentation for the circuit in question. Again, these items may be identified as separate assets on the equipment register.

Sometimes an intrinsically safe sensor may be protected by a barrier installed in a local field transmitter housing, the sensor and local transmitter often being a matched pair as part of a single vendor proprietary offering (e.g., some Coriolis flow meters). In this case it will be sufficient to confirm the proprietary pairing of sensor and local transmitter.

The barrier circuit for such proprietary offerings will typically be integrated into the transmitter and there will be no separate discrete barrier to examine. The transmitter protection type labelling will typically be for Ex d [ia] or [ib], where the square brackets indicating the intrinsically safe aspect relates to the barrier provision (the sensor circuit 'associated apparatus' – just as it would if the marking were on a conventional discrete barrier). This barrier provision is not itself rated for a zoned area and depends upon being in the Ex 'd' enclosure.

If a separate discrete barrier is mounted in a field housing within a zoned area, this housing will need to be appropriately protected, typically this will be by Ex 'd' or Ex 'p' protection. If in an Ex 'd' enclosure, it may be appropriate to not routinely inspect the barrier to avoid disturbing the enclosure. The housing should be identified as a separate asset on the equipment register.

If performing a detailed inspection, it will be necessary to open enclosures to check the internal condition and confirm correct installation. ■

About the author

Harvey T. Dearden CEng is a consulting engineer with HTS Engineering Group Ltd. and registered with the InstMC as both a Registered Explosive Atmospheres Engineer (RExE) and a Registered Functional Safety Engineer (RFSE).