

Application Note

Intrinsically Safe Installations in Class I Division 1 Areas

OVERVIEW

A class I Division 1 area is defined as an area where combustible gas, vapor or mist will be present or expected to be present for long periods of time under normal operating conditions. This is typical for on top of oil tanks or at well heads. Any equipment installed in these locations must be properly rated for the hazardous area.

Intrinsically safe (IS) equipment and wiring is designed such that energy levels are low enough that they cannot generate an arc, spark, or temperature that could cause ignition in an explosive environment. This differs from an explosion-proof (XP) system in which an ignition is contained within an enclosure so that it cannot ignite the explosive environment. Properly rated IS and XP equipment can be used in a Class I Division 1 area, but the installation requirements differ.

Intrinsic Safety offer significant cost advantages (and installation ease) as they do not require heavy conduits with seals or heavy enclosures, such as is required for XP installations.

IS INSTALLATIONS

All Class I Division 1 SignalFire equipment is rated as an IS apparatus. The SignalFire IS devices can be connected to any other IS approved apparatus provided that the Entity Parameters are evaluated. All IS equipment has a control drawing which details the entity parameters and may include other installation requirements. All IS rated equipment has four rating parameters: Voltage, Current, Capacitance, and Inductance.

The Entity concept states that:

- $U_i/V_{max} \geq U_o/V_{oc}$ (Max input voltage \geq max output voltage)
- $I_i/I_{max} \geq I_o/I_{sc}$ (Max input current \geq max output current)
- $C_a \geq C_i + C_{cable}$ (Max capacitance \geq apparatus capacitance + cable capacitance)
- $L_o/L_a \geq L_i + L_{cable}$ (Max inductance \geq apparatus inductance + cable inductance)

EXAMPLE IS ENTITY PARAMETER EVALUATION

As an example the entity parameters for a Sentinel-HART are:

$U_o/V_{oc}=21$ VDC, $I_o/I_{sc} = 111$ mA, $C_a = 1.16$ uF, $L_o/L_a = 11.5$ mH

And the entity parameters for a VegaFlex 81 are:

$U_i = 30$ VDC, $I_i = 131$ mA, $C_i = 0$ uF, $L_i = 5$ uH

To evaluate the combination of these two pieces of equipment the entity parameters must be compared.

$U_i/V_{max} \geq U_o/V_{oc}$	30 Vdc ≥ 21 Vdc	TRUE
$I_i/I_{max} \geq I_o/I_{sc}$	131 mA ≥ 111 mA	TRUE
$C_a \geq C_i + C_{cable}$	1.16 uF ≥ 0 uF + cable	TRUE
$L_o/L_a \geq L_i + L_{cable}$	11.5 mH ≥ 5 uH + cable	TRUE

As the four entity parameters for these two IS apparatus are all true, they may be combined to be used as an intrinsically safe system.

IS WIRING

As stated, IS wiring does not require rigid conduit with poured seals as is common in XP installations. The ANSI/ISA-RP12.06.01 standard contains the recommended practice for wiring methods for IS equipment in classified locations. The following are excerpts from this standard:

504.20 Wiring Methods. Intrinsically safe apparatus and wiring shall be permitted to be installed using **any of the wiring methods suitable for unclassified locations**, including Chapter 7 and Chapter 8. Sealing shall be as provided in 504.70, and separation shall be as provided in 504.30.

This statement means that any standard wiring practice for unclassified locations shall be permissible in IS installations provided two exceptions. The first regarding sealing only applies when IS circuits are run into a non-IS area, if all equipment is IS this does not apply. The separation requirements state that IS wiring must be separated from non-IS wiring by at least 2". Again, this does not apply as all wiring (in this case) is IS. Also IS wiring from different IS circuits run together must have an insulation thickness of 0.01".

Additionally the table below provides detail on the wiring requirements for Class I Division 1 IS showing all standard wiring methods are acceptable (see highlighted column).

B.1 Wiring in hazardous locations

Table B.1 — Field wiring in Class I locations ^{a,b}

Wiring system	Zone 0	Zone 1 or Division 1		Zone 2 or Division 2	
	IS	IS	NIS	IS/NI	NIS
Threaded rigid metal conduit	A	A	A	A	A
Threaded steel intermediate metal conduit	A	A	A	A	A
Flexible metal explosion proof fitting	A	A	A ^c	A	A
Type MI cable	A	A	A ^d	A	A
Type ITC, MC, MV, PLTC, SNM, and TC cable	A	A	NA	A	A
Type MC-HL and ITC-HL	A	A	A	A	A
Flexible metal conduit	A	A	NA	A	A ^{c,e}
Liquid-tight, flexible metal conduit	A	A	NA	A	A ^{c,e}
Electrical metallic tubing (steel)	A	A	NA	A	NA
Flexible cord	A	A	Note 1 ^f	A	A ^{c,f} Notes 1,2
Any other wiring method suitable for unclassified locations	A	A	NA	A	NA

^a Abbreviations: A = Acceptable, IS = Intrinsically Safe, NA = Not Acceptable, NI = Nonincendive, NIS = Not Intrinsically Safe