

## Intrinsic Safety – impact of Gas Group on loop approval and cable lengths.

1 November 2017

Further to my previous articles:

### How to calculate an intrinsically safe loop approval

(<http://www.instrumentation.co.za/7571a>)

### Calculating intrinsically safe loop approvals – Part 2

(<http://www.instrumentation.co.za/7782a>), we consider the impact of Gas Group on cable lengths for IS loops.

In part 2, I discussed using Exic for zone 2 applications ‘Intrinsic Safety in normal operation’ i.e. with no safety factor required.

To repeat, firstly and importantly, there is a misconception that the Co values are defined by the design of barrier/isolator. The Co value is actually defined in IEC/SANS60079-11: 2012 Table A.2 page 96 (102 of 149).

So, any barrier/isolator with 28V safety description will have Co = 83nF (Zone 0/1; IIC). In practice Co will define the maximum allowable cable length in most cases.

However as explained in part 2, using Exic where applicable is one method to have longer cable lengths.

Gas Group classification impacts Co parameter as per Figure 1.

### Factors affecting max. cable lengths for IS loops (SANS60079-11:2012 Table A2 pg. 96)

Voltage V	Permitted capacitance $\mu\text{F}$							
	for Group IIC apparatus		for Group IIB apparatus		for Group IIA apparatus		for Group I apparatus	
	with a factor of safety of	with a factor of safety of	with a factor of safety of	with a factor of safety of	with a factor of safety of	with a factor of safety of	with a factor of safety of	
	x1	x1,5	x1	x1,5	x1	x1,5	x1	x1,5
28,0	0,272	0,083	1,65	0,650	6,60	2,15	9,35	3,78

- Zone 0, 1 (Ex ia or ib) requires 1.5 safety factor
- Zone 2 (Ex ic) does not require safety factor
- IIC Zone 0, 1 - 83nF      Zone 2 – 272nF
- IIB Zone 0, 1 – 650nF      Zone 2 – 1.65uF
- IIA Zone 0,1 - 2.15uF      Zone 2 – 6.6uF
- Remember L/R if  $L_o > L_i + L_c$  fails!



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Figure 1. Co values

## Exia - Verification of safety compatibility

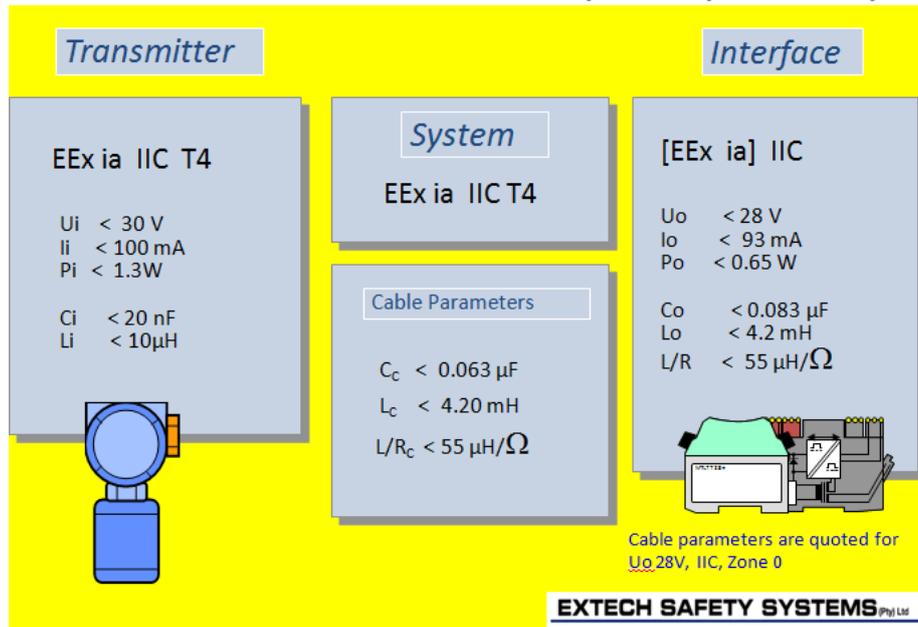


Figure 2. IIC IS loop for Zone 0/1 (Co 83nF)

Figure 2 shows an Exia loop with a  $C_o=83\text{ nF}$ . The max cable capacitance  $C_c=63\text{ nF}$ . With a typical cable capacitance of  $95\text{ nF/km}$ , this would equate to maximum cable of  $660\text{ m}$ .

If the loop was Exic, the  $C_o=272\text{ nF}$ , so  $C_c=252\text{ nF}$  would theoretically allow  $2.5\text{ kms}$  of cable. i.e. no longer a limiting factor. (The limiting factor in this system is likely to be operating voltage at the end of the cable being high enough for the transmitter to work).

If the Gas Group were IIB, the  $C_o=650\text{ nF}$  which eliminates capacitance as a limiting factor.

### Conclusions:

- 1) For installations requiring long cable runs, classifying the area as zone 2 offers significant benefit.
- 2) Alternatively, a IIB (or IIA) classification is another way of allowing longer cables lengths.

Comments or suggestions welcome.

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