IEC 61508 STANDARD

CERTIFICATE

Temperature probe certification

N° 170898/2019

The National Institute for Industrial Environment & Risks (INERIS Institut National de l'Environnement Industriel et des Risques, France), a public industrial and commercial organization, established by decree No. 90-1089 of 7 December 1990, listed in the Official Journal of the European Communities on 25 October 1995 with identification No. 0080, and accredited by COFRAC under number 5-0045 for certification of products and services (scope of accreditation available on the website www.cofrac.fr),

issues a certificate of compliance related to IEC 61508 and IEC 61511 standards for the following product:

Products	3 and 4 wires Résistance Temperature Detectors (RTD) and Thermocouples (TC) temperature probes
Designation:	111TE, 112TE, 113TE, 114TE AND 215TE
Manufacturer:	**Thermo Engineering Srl**
Certificate requested by:	**Thermo Engineering Srl** ***Malagnino - Italy***

Those safety equipments, after examination and tests included in the following report (DRA-19-170898-03245B), are declared to comply with requirements of IEC 61511 and IEC 61508.

The INERIS certifies that, for the configurations, proof test intervals, environmental conditions and mode of operation listed in the table 2, 3, 5 and 6 of the present certificate, and for the related indicated SIL capabilities:

- the IEC 61508 and IEC 61511 standards hardware requirements are met;
- The IEC 61508 and IEC 61511 standards probability of failure requirement are reached;
- The validation by tests has been properly done by Thermo Engineering;
- Required Safety integrity levels (SIL) are achieved for the SIF listed in appendix 1 of this certificate.

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The probes must be used in accordance with the configuration and usage assumptions listed in this certificate and in accordance with the supplier documents to ensure that the certified SIL remain valid.

Any modification to the above item implies to issue an amendment to this certificate.

The rules of certification are available on the website www.ineris.fr.

1. Functional Safety

The safety function complies with functional safety levels and is declared classified as follows:

Standard: **IEC 61508** (2010)
Level of compliance: **According to table below**

Standard: **IEC 61511** (2018)
Level of compliance: **According to table below**

The SIL depend on:

- the technology used;
- the stress of the environment;
- the wiring configuration and the architecture;
- the mode of operation;
- the proof test interval of time.

All the certified configurations are identified in the certification report DRA-19-170898-03245B.

2. Results - RTD

a. 3 wires

Output	Single RTD: 1oo1		Double RTD: 1oo2		Double RTD: 2oo2	
Stress level	Low	High	Low	High	Low	High
SFF	82,00%	81,11%	82,00%	81,11%	82,00%	81,11%
PFD_{6m}	7,88E-04	2,98E-03	1,61E-04	6,43E-04	3,15E-03	1,19E-02
PFD_{1y}	1,58E-03	5,96E-03	3,29E-04	1,38E-03	6,31E-03	2,38E-02
PFD_{5y}	7,88E-03	2,98E-02	1,91E-03	1,07E-02	3,15E-02	1,19E-01
PFH (h^{-1})	3,60E-07	1,36E-06	7,65E-08	3,37E-07	1,44E-06	5,44E-06
Type	A	A	A	A	A	A
HFT	0	0	1	1	0	0
DC	80,00%	78,75%	80,00%	78,75%	80,00%	78,75%

Table 1: FMECA results - RTD 3 wires

		SIL capability			
		IEC 61508 - IEC 61511 low demand			IEC 61508 high and continuous demand
		(T = 6 months)	(T = 1 year)	(T = 5 years)	
Low stress	1oo1	SIL 2	SIL 2	SIL 2	SIL 2
	1oo2	SIL 3	SIL 3	SIL 2	SIL 3
	2oo2	SIL 2	SIL 2	SIL 1	SIL 1
High stress	1oo1	SIL 2	SIL 2	SIL 1	SIL 1
	1oo2	SIL 3	SIL 2	SIL 1	SIL 2
	2oo2	SIL 1	SIL 1	SIL 0	SIL 1

Table 2: SIL capability for RTD - 3 wires according to IEC 61508 and according to IEC 61511 for low demand

		SIL capability
		IEC 61511 high and continuous demand
Low stress	1oo1	SIL 1
	1oo2	SIL 3
	2oo2	SIL 1
High stress	1oo1	SIL 1
	1oo2	SIL 2
	2oo2	SIL 1

Table 3: SIL capability for RTD - 3 wires according to IEC 61511 for high demand and continuous mode of operation

b. 4 wires

Output	Single RTD: 1oo1		Double RTD: 1oo2		Double RTD: 2oo2	
Stress level	Low	High	Low	High	Low	High
SFF	89,60%	89,60%	89,60%	89,60%	89,60%	89,60%
PFD_{6m}	4,56E-04	1,82E-03	9,22E-05	3,82E-04	1,82E-03	7,29E-03
PFD_{1y}	9,11E-04	3,64E-03	1,87E-04	8,00E-04	3,64E-03	1,46E-02
PFD_{5y}	4,56E-03	1,82E-02	1,02E-03	5,41E-03	1,82E-02	7,29E-02
PFH (h^{-1})	2,08E-07	8,32E-07	4,31E-08	1,91E-07	8,32E-07	3,33E-06
Type	A	A	A	A	A	A
HFT	0	0	1	1	0	0
DC	89,55%	89,55	89,55%	89,55	89,55%	89,55

Table 4: FMECA results - RTD 4 wires

		SIL capability			
		IEC 61508 - IEC 61511 low demand			IEC 61508 high and continuous demand
		(T = 6 months)	(T = 1 year)	(T = 5 years)	
Low stress	1oo1	SIL 2	SIL 2	SIL 2	SIL 2
	1oo2	SIL 3	SIL 3	SIL 2	SIL 3
	2oo2	SIL 2	SIL 2	SIL 1	SIL 2
High stress	1oo1	SIL 2	SIL 2	SIL 1	SIL 2
	1oo2	SIL 3	SIL 3	SIL 2	SIL 2
	2oo2	SIL 2	SIL 1	SIL 1	SIL 1

Table 5: SIL capability for RTD - 4 wires according to IEC 61508 and according to IEC 61511 for low demand

		SIL capability
		IEC 61511 high and continuous demand
Low stress	1oo1	SIL 1
	1oo2	SIL 3
	2oo2	SIL 1
High stress	1oo1	SIL 1
	1oo2	SIL 2
	2oo2	SIL 1

Table 6: SIL capability for RTD - 4 wires according to IEC 61511 for high demand and continuous mode of operation

3. Results - TC

Output	Single TC: 1oo1		Double TC: 1oo2		Double TC: 2oo2	
Stress level	Low	High	Low	High	Low	High
SFF	87.50%	87.50%	87.50%	87.50%	87.50%	87.50%
PFD_{6m}	1,37E-03	5,48E-03	2,84E-04	1,25E-03	5,48E-03	2,19E-02
PFD_{1y}	2,74E-03	1,10E-02	5,87E-04	2,83E-03	1,10E-02	4,38E-02
PFD_{5y}	1,37E-02	5,48E-02	3,74E-03	2,69E-02	5,48E-02	2,19E-01
PFH (h^{-1})	6,25E-07	2,50E-06	1,39E-07	7,19E-07	2,50E-06	1,00E-05
Type	A	A	A	A	A	A
HFT	0	0	1	1	0	0
DC	87.24%	87.24%	87.24%	87.24%	87.24%	87.24%

Table 7: FMECA results - TC

		SIL capability			
		IEC 61508 - IEC 61511 low demand			IEC 61508 high and continuous demand
		(T = 6 months)	(T = 1 year)	(T = 5 years)	
Low stress	1oo1	SIL 2	SIL 2	SIL 1	SIL 2
	1oo2	SIL 3	SIL 3	SIL 2	SIL 2
	2oo2	SIL 2	SIL 1	SIL 1	SIL 1
HIgh stress	1oo1	SIL 2	SIL 1	SIL 1	SIL 1
	1oo2	SIL 2	SIL 2	SIL 1	SIL 2
	2oo2	SIL 1	SIL 1	SIL 0	SIL 0

Table 8: SIL capability for TC according to IEC 61508 and according to IEC 61511 for low demand

		SIL capability
		IEC 61511 high and continuous demand
Low stress	1oo1	SIL 1
	1oo2	SIL 2
	2oo2	SIL 1
HIgh stress	1oo1	SIL 1
	1oo2	SIL 2
	2oo2	SIL 0

Table 9: SIL capability for TC according to IEC 61511 for high demand and continuous mode of operation

4. Validity

The present EC type examination certificate is valid up to 26/06/2024.

Verneuil-en-Halatte, 26/06/2019

The Chief Executive Officer of INERIS
By delegation
D. CHARPENTIER
Certification Division,
Manager

INERIS France

Liste des références / reference list

The list of references covered by the present EC type examination certificate is provided hereafter:

N°	Technology	Wiring configuration	Architecture
111TE	RTD	1 RTD 2 wires, 1 RTD 3 wires, 1 RTD 4 wires / 2 RTD 2 wires, 2 RTD 3 wires, 2 RTD 4 wires (all of them)	1oo1, 1oo2, 2oo2
	TC	Single TC, Double TC (all of them)	1oo1, 1oo2, 2oo2
112TE	RTD	1 RTD 2 wires, 1 RTD 3 wires, 1 RTD 4 wires / 2 RTD 2 wires, 2 RTD 3 wires, 2 RTD 4 wires (all of them)	1oo1, 1oo2, 2oo2
	TC	Single TC, Double TC (all of them)	1oo1, 1oo2, 2oo2
113TE	RTD	1 RTD 2 wires, 1 RTD 3 wires, 1 RTD 4 wires / 2 RTD 2 wires, 2 RTD 3 wires, 2 RTD 4 wires (all of them)	1oo1, 1oo2, 2oo2
	TC	Single TC, Double TC (all of them)	1oo1, 1oo2, 2oo2
114TE	RTD	1 RTD 2 wires, 1 RTD 3 wires, 1 RTD 4 wires / 2 RTD 2 wires, 2 RTD 3 wires, 2 RTD 4 wires (all of them)	1oo1, 1oo2, 2oo2
	TC	Single TC, Double TC (all of them)	1oo1, 1oo2, 2oo2
215TE	RTD	1 RTD 2 wires, 1 RTD 3 wires, 1 RTD 4 wires / 2 RTD 2 wires, 2 RTD 3 wires, 2 RTD 4 wires (all of them)	1oo1, 1oo2, 2oo2
	TC	Single TC, Double TC (all of them)	1oo1, 1oo2, 2oo2