Instructions:
Increased Safety Stator Winding RTDs
II 2 G Ex eb IIC Gb
IECEx Ex eb IIC Gb
CSA/US Class I, Zone 1, Ex/AEx eb IIC Gb

Intrinsic Safety Stator Winding RTDs
II 1 G Ex ia IIC Ga
IECEx Ex ia IIC Ga
CSA/US Class I, Zone 0, Ex/AEx ia IIC Ga
CSA/US Class I, Division 1, Groups A, B, C, D

SPI 00-0935 Rev D (Document 2188862 Rev D)

1. Description

The Resistance Temperature Detectors (RTDs) for Stator Windings, Type B217137, are intended to be built into the stator slots of rotating electrical machines.
Versions for 2-, 3- or 4-wire measurement circuits are available.

Operating temperature range: -50°C to +180°C.

2. Attestation of Conformity

This Attestation of Conformity is issued under the sole responsibility of the manufacturer.

Resistance Temperature Detectors (RTDs) for Stator Windings, Type B217137.

The product defined above is in conformity with the following relevant legislation:
ATEX Directive 2014/34/EU
EN 60079-0:2012+A11:2013 Explosive atmospheres - Part 0: Equipment - General requirements
EN 60079-7:2007* Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
EN 60079-11:2012 Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
EN 50495:2010 Safety devices required for the safe functioning of equipment with respect to explosion risks – SIL2 capable
EN 61508:2010 Functional safety of electrical/electronic/programmable electronic safety-related systems – Parts 1 to 6
IEC 60079-0:2011+ISH1:2013* Explosive atmospheres - Part 0: Equipment - General requirements
IEC 60079-7:2006* Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
IEC 60079-11:2011 Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
CAN/CSA C22.2 No. 60079-0:15 Explosive Atmospheres - Part 0: Equipment - General requirements
CAN/CSA C22.2 No. 60079-7:16 Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
CAN/CSA C22.2 No. 60079-11:14 Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
CAN/CSA C22.2 No. 61010-1-12 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements
UL 60079-0:2013 Explosive atmospheres - Part 0: Equipment - General requirements
UL 60079-7:2017 Explosive atmospheres - Part 7: Equipment protection by increased safety "e"
UL 60079-11:2014 Explosive atmospheres - Part 11: Equipment protection by intrinsic safety "i"
UL 61010-1:2012 Electrical Equipment For Measurement, Control, and Laboratory Use; Part 1: General Requirements

*NOTE: The standard IEC 60079-0:2017 has been compared to the standard used for certification purposes and no changes in the "state of the art" apply to the product. The standards EN 60079-7:2015 and IEC 60079-7:2015 have been compared to the standards used for certification purposes and no changes in the "state of the art" apply to the product.

Certificate DEKRA 15ATEX0027 U
Certificate IECEx DEK 15.0018U
Certificate CSA.18.70197724
Certificate CSA 12.2533905**
**Models certified only to this CSA certificate, with no US certification: S102040, S100050 to S100055, S200050 to S200055, S207977, MS_ _200_, MS_ _251_, MS_ _302_, MS_ _353_, MS_ _404_, and MS_ _455_.

DEKRA Certification B.V. (0344)
Meander 1051
6825 MJ Arnhem
The Netherlands

Rob Bohland 14 October 2019
Rob Bohland, Ex Authorized Person
Minco Products, Inc
7300 Commerce Lane
Minneapolis, MN 55432 USA

3. Mounting Instructions

Type of protection increased safety "e" for the RTDs is obtained by the construction of the measuring element and its fit in slots of the stator windings of rotating electrical machines with a rated insulation voltage of up to 11 kV in type of protection increased safety "e" per EN 60079-7, flameproof enclosure "d" per EN 60079-1 or pressurized apparatus "p" per EN 60079-2.
The RTD must be installed in such a way that it is protected against mechanical danger.
The apparatus must be installed in the stator slots, and must be impregnated or sealed within the windings (e.g. Vacuum Pressure Impregnation), of rotating electrical machines where non-metallic surfaces are not in contact with the atmosphere.
The leads of the RTD, for connection to the measuring circuit, must be connected to suitable Ex eb terminals in a suitable Ex eb enclosure.

4. Electrical Data – Increased Safety Ex eb

Measuring current:	≤10 mA
Power (under fault conditions):	≤1,5 W
Voltage:	≤20 V
Test voltage dielectric strength test:	5000 V rms, duration 1 minute (Standard)
	3200 V rms, duration 1-3 seconds (Optional - depending on customer requirements)
	3200 V rms, duration 1 minute (Optional - depending on customer requirements)

5. Electrical Data – Intrinsic Safety Ex ia

Maximum Input Voltage:	20 V		
Maximum Input Power:	0,17 W		
Cable for a length of 3 meters:	Ci = 84 pF	Li = 4 µH	Ri = 0,48 Ω

6. Special Conditions for Safe Use – Intrinsic Safety Ex ia

The equipment is intrinsically safe and can be used in potentially explosive atmospheres.
The apparatus must be only connected to certified associated intrinsically safe equipment and this combination must be compatible as regards to intrinsic safety rules.
The electrical parameters of the associated intrinsically safe equipment must not exceed any of the following values:
Ui = 20 V and Pi = 170 mW.
The connection of the cable must be effected in an enclosure with a minimum protection degree IP20 per clause 6.1 of EN 60079-11:2012.

For a temperature class T6, T5, T4 or T3 per EN 60079-0:2012+A11:2013, the maximum ambient temperature depends on the power dissipated in the RTD as listed in the following table:

Power dissipated in the sensor (W)	**Maximum Temperature Class T6**	**Maximum Temperature Class T5**	**Maximum Temperature Class T4**	**Maximum Temperature Class T3**
0,01	+78°C	93°C	128°C	180°C
0,05	+70°C	85°C	120°C	180°C
0,10	+60°C	75°C	110°C	175°C
0,17	+45°C	60°C	95°C	160°C

As a safety device in accordance with EN 50495, the RTD is used as a component of a full system, and the safety parameters are calculated for the RTD only. The entire safety chain (the complete security device with RTD included) must fulfill the requirements of the safety function, according to table 1 of EN 50495:
For use in category 2 (zone 1 with Ex eb) a SIL=2 with a HFT=0 (single RTD) is required.
For use in category 1 (zone 0 with Ex ia) a SIL=2 with a HFT=1 (dual RTD or two RTDs in same motor phase) is required.

The following table indicates results for a maintenance interval of 20 years:

Parameter	**Single Sensor RTD** with detection of open and short circuit	**Two Single Sensor RTDs installed in same motor phase** with detection of open and short circuit	**Dual Sensor RTD** with detection of open, short circuit, and drift
HFT	0	1	1
SFF	83%	83%	90%
PFD_{avg}	7.18×10^{-3}	$< 7.18 \times 10^{-3}$	9.45×10^{-4}
PFH [1/h]	82×10^{-9}	$< 82 \times 10^{-9}$	11×10^{-9}
SIL	2	2	3

Ordinary industrial RTDs typically drift less than 0.1°C/year. This drift may be positive or negative, but worse case would be a drift of ±2.0°C based on 0.1°C*20 year life used in MTBF.

7. Temperature Classes and Calculations – Intrinsic Safety Ex ia

Temperature class changes are function of the ambient temperature. Under no conditions may the surface temperature of the sensor exceed the temperature class. The surface temperature includes the temperature increase caused by the power dissipation plus the ambient temperature. There is also a security factor based on the ambient temperature that must be considered. The security factor is 5°C for ambient temperatures below or equal to +200°C (T6, T5, T4, T3 classes).

To determine the temperature class, you must calculate the maximum surface temperature of the sensor. See the following example.

Example:
The above table can be rewritten for temperature class calculations at higher temperatures. The right column gives you the surface temperature increase due to the power dissipation.

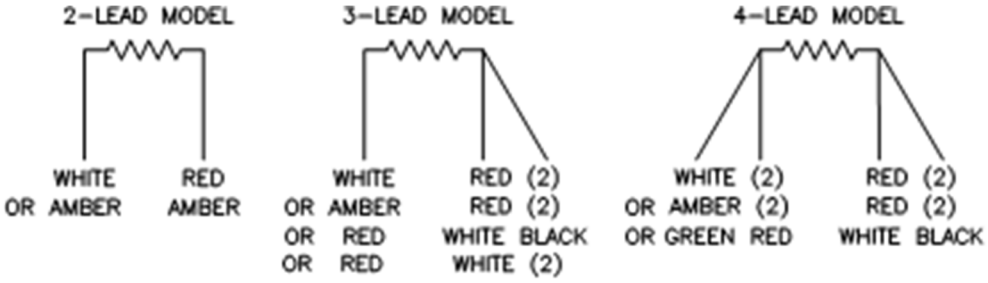
Power Dissipated in the Sensor (W)	Maximum Ambient Temperature for a Temperature Class T6	Temperature Increase Due to Power Dissipation
0,01	+78°C	2°C (80°C – 78°)
0,05	+70°C	10°C (80°C - 70°)
0,10	+60°C	20°C (80°C - 60°)
0,17	+45°C	35°C (80°C - 45°)

The maximum surface temperature is calculated as follows: $T_{surface} = T_{ambient} + T_{power\ dissipation}$

If the explosive atmosphere is 45°C and the power is 0,17W the surface temperature is:
$T_{surface} = 45 + 35 = 80°C$
The temperature class must be greater than the surface temperature plus the security factor:
$T_{surface} + T_{security\ factor} = 80 + 5 = 85°C$
The lowest temperature class that meets this requirement is T6 (85°C) per EN 60079-0.

8. Electrical Connections

RTD Connections

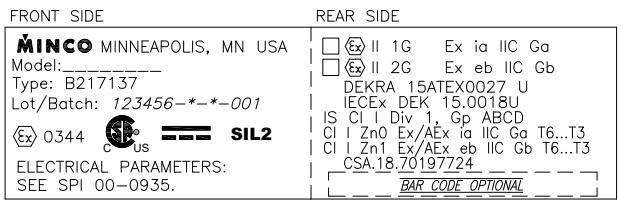


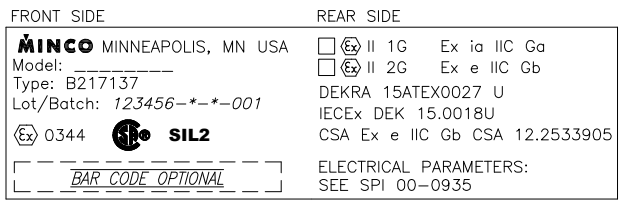
The above color code is Minco's standard colors, but alternatives can be used. Refer to the model specification drawing for the actual color code.

9. Marking Examples

The polyester label, adhered to sensor leads, shall always be inside the motor or terminal enclosure.

IMPORTANT: On the marking label, the user must check the box (☐) corresponding to the selected protection mode for ATEX/IECEx installations.





NOTE: Models listed below will include label shown on the right:
S102040, S100050 to S100055, S200050 to S200055, S207977, MS_ _200_, MS_ _251_, MS_ _302_, MS_ _353_, MS_ _404_, and MS_ _455_.