Fuel Level Sensors

Specification for Tube Level Senders

224-011-000-xxx

Contents

1. General

1.1 Scope

Tube Level Sensor with flange diameter 54 mm and 80 mm for fuel indicators.

1.2 Design:

Acc. to drawing; requirements on drawings deviating from this specification take precedence.

1.3 Applicable laws and regulations

EU: Directive 70/221

1.4 General Requirements

Flange diameter	**54 mm**	**80 mm**
Operating voltage	6-24V	6-24V
Operating temperature	-25°C to +65°C	-25°C to +70°C
Storage temperature	-30°C to +65°C	-30°C to +70°C

2. Function

2.1 Sensor Resistances

Acc. to drawing.

2.2 Contact pressure

0.25 N ± 0.1 N

3. General Test Conditions

A minimum of 6 devices are to be tested.

If tolerances are not specified for temperatures, a tolerance of ± 2°C shall apply.

Temperature measuring points acc. to DIN 50 011-11 and DIN 50 011-12.

Unless otherwise specified, all testing is performed at room temperature TRT and a relative air humidity of 25 to 75 %.

Test voltages shall be in accordance with Table – Test voltages. The test voltages shall be documented in the test report.

3.1 Test voltages

Test voltage [1])	**12V Systems**	**24V Systems**
Test voltage at running engine	14V ± 0.1V	28V ± 0.2V
Test voltage at battery operation	12V ± 0.1V	24V ± 0.2V
[1]) Test voltage applied to the DUT		

4. Leak Tightness with Respect to Gas

Test pressure	1, 5 bar (absolute)
Duration of testing	5 min
Test fluid	water
Test volume	< 50 l

5. Pressure Resistance

After testing, connector lugs and connecting tubes shall not show any leaks.

Test sequence (accelerated internal pressure acc. to DIN 53 758):

Test pressure	2, 5 bar (absolute)
Duration of testing	1 min
Duration of pressure increase	(3 to 5) min

Sealing of connections shall permit pressure testing.

6. Aging in Mechanically Circulated Air without Load (Conditioning)

Aim

This test serves for conditioning the DUT before starting the tests.
On principle, each DUT shall be conditioned once.

Test

Operating type	No lines are connected to the DUT
Test duration	48 h
Test temperature	54mm: 65°C / 80mm: 70°C

Requirement

One or more functions of the DUT do not perform as specified during exposure to the test parameters but return to normal operation after the end of exposure.

7. Temperature Cycle (with Specified Speed of Change)

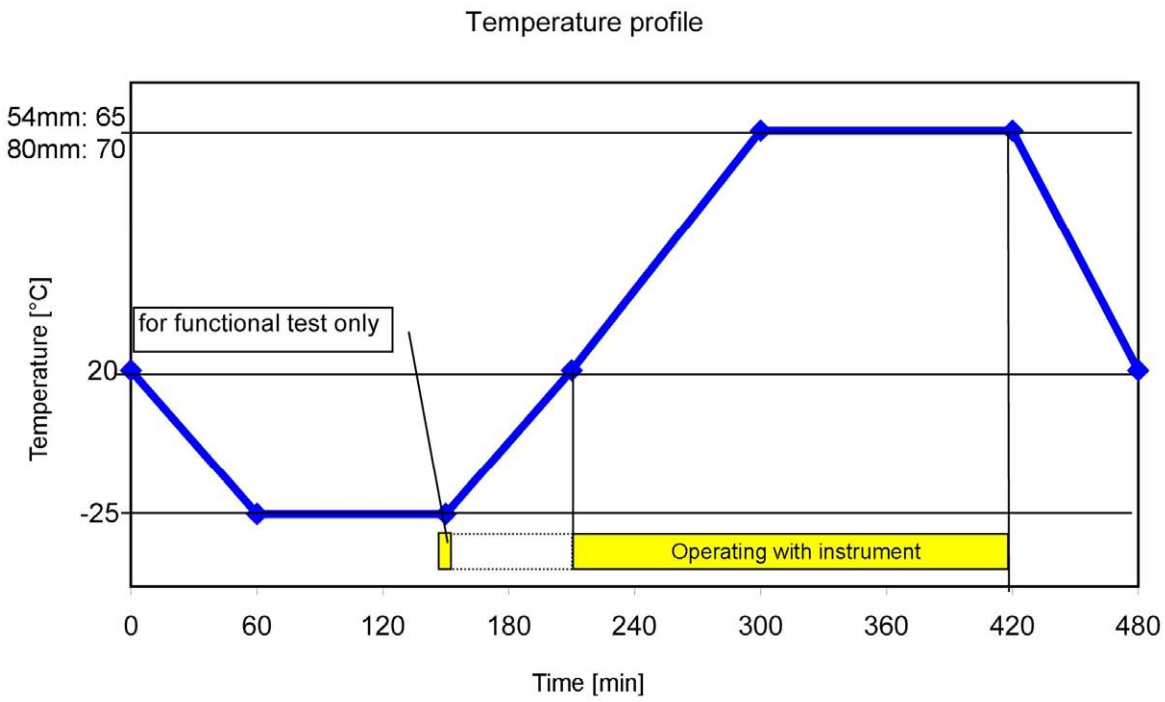
Aim

Operation of the DUT at temperature changes is simulated.
NOTE: This test is not a life test.

Test

Operating type:	according to figure,
Operating without instrument:	all lines are connected acc. to vehicle installation, but no voltage is applied.
Operating with instrument:	all lines are connected acc. to vehicle installation on Instrument N02 222 512 (12V) or N02 222 712 (24V) with N05 800 762 (12V) or N05 800 764 (24V) [or a technically comparable instrument].
Test temperature and course of the test	see table and figure
Number of cycles	30
Test procedure	according to test Nb stated in DIN EN 60068-2-14

NOTE: No additional air drying in the temperature chamber.



Temperature cycle with specified speed of change

Temperatures and durations of a temperature cycle

Time (min)	Temperatures (°C)
0	20
60	-25
150	-25
210	20
300	65 (80 mm: 70°C)
420	65 (80 mm: 70°C)
480	20

8. Plug Resilience and Pull-out Strength

Plug resilience according to Table Connector types and forces:
Forces shall not be carried by solder points.

Test rate 100 mm/min

Connector types and forces

Flat terminal on the device		
Width x thickness (mm)	**Possible mating connector**	**Plug resilience / pull out strength (N)**
9.5 x 1.2	Flat contact (maxi-power timer)	≥ 200
7.7 x 0.8	Flat contact	≥ 180
6.3 x 0.8	Flat contact	≥ 150
5.0 x 0.8	Flat contact	≥ 150
5.0 x 0.6	Flat contact	≥ 70
4.8 x 0.8	Flat contact (standard-power timer)	≥ 120
2.8 x 0.8	Flat contact	≥ 80
2.8 x 0.5	Flat contact (junior-power timer)	≥ 80
1.5 x 0.6	Flat contact (micro-timer)	≥ 55
1.6 x 0.8	Flat contact	≥ 55
0.63 x 0.63	Box connector 0.63 mm	≥ 50
Round connector on the device		
Ø (mm)	**Possible mating connector**	**Plug resilience / pull out strength (N)**
4.0	Round connector 4.0 mm	≥ 150
2.5	Round connector 2.5 mm	≥ 80
1.6	Round connector 1.6 mm	≥ 40
1.0	Round connector 1.0 mm	≥ 40
The forces are measured at room temperature		

9. Resistance to Environmental Factors

The DUT shall not be subjected to any further testing.

Aim

Resistance to environmental factors of the flange is tested.

Test position corresponds to as-installed position.

9.1 Sealing against Dust and Water Spray

Aim

The resistance of the DUT against penetration of dust and water spray is tested.

Test

Operating type All lines are connected acc. to vehicle installation, but no voltage is applied.
Test procedure acc. to DIN 40 050-9

Requirement

One or more functions of the DUT do not perform as specified during exposure to the test parameters but return to normal operation after the end of exposure.

Surface protection type

IP 20 (internal space)
IP 00 (connector)

9.2 Humid Heat, Cyclic

Aim

Operation of the DUT at high air humidity is simulated.
This test is performed using the DUT which have passed the dust and water spray sealing test.

Test

Test procedure according to test Db, type 1, stated in DIN EN 60068-2-30.

- Maximum temperature +55°C
- Number of cycles 6

Functional test

If the maximum temperature is reached: all lines are connected acc. to vehicle installation on instrument
N02 222 512 (12V) or
N02 222 712 (24V)
with
N05 800 762 (12V)
N05 800 764 (24V)
[or a technically comparable instrument].

Otherwise: all lines are connected acc. to vehicle installation, but no voltage is applied.

Requirement

Functional state with connected instrument:
All functions of the DUT perform as specified and after exposure to the test parameters.

9.3 Salt Spray Fog

Aim

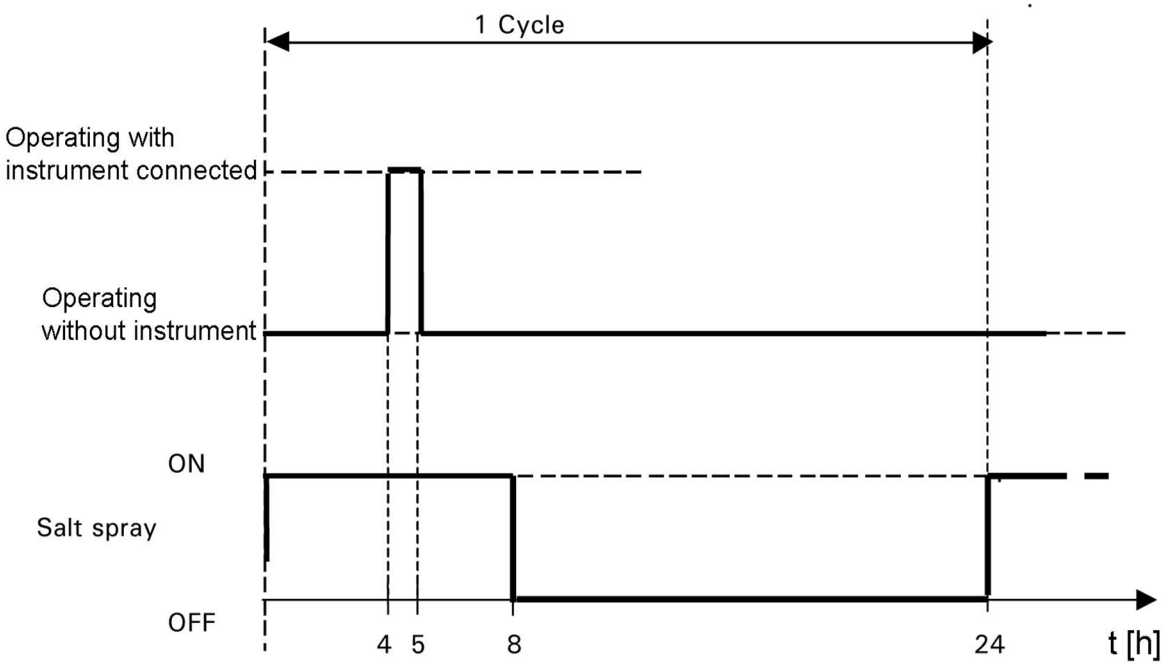
The resistance of the DUT against salt spray fog and salt water is tested.
Furthermore, the leak tightness of the DUT is tested by switching it on.

Test

Operating type: all lines are connected acc. to vehicle installation, but no voltage is applied.

Between the fourth and the fifth hour of the test cycle:
all lines are connected acc. to vehicle installation on instrument
N02 222 512 (12V) or
N02 222 712 (24V)
with
N05 800 762 (12V)
N05 800 764 (24V)
[or a technically comparable instrument].

Test procedure: according to test Ka stated in DIN EN 60068-2-11
Cycle duration: 24h
Number of cycles: 6
One cycle consists of 8h exposure to salt spray fog followed by 16h without salt spray fog (see Figure).



Test cycle for salt spray fog test and electrical operation

Requirements

Operating with connected instruments:

All functions of the DUT perform as specified and after exposure to the test parameters.

Operating without connected instruments:

One of more functions of the DUT do not perform as specified during exposure to the test parameters but return to normal operation after the end of exposure.

Penetration of salt water is not permissible.

10. Resistance to Chemical Agents

Aim

The resistance of a DUT to various chemical agents is tested.

Test

Operating type: all lines are connected acc to vehicle installation, but no voltage is applied.

Visual test: Execution of the test with the unaided emmetropic eye with normal color perception and from a normal distance at sufficient illumination.

Test conditions

Immersion air-dry for approx. 15s
Subsequent aging 48h (for temperature see table).
Each DUT shall be subjected to one chemical agent only.

Chemical agents

Chemical agent	Description	DUT to be aged at
a) Diesel fuel	Acc. to DIN EN 590	65°C(80 mm: 70°C)
b) FAM test fuel	ACC. to DIN 51 604 B	23°C ± 5°C
c)Sealant		65°C (80 mm: 70°C)
d) Central hydraulic system fluid		65°C (80 mm: 70°C)

Requirements

One or more functions of the DUT do not perform as specified during exposure to the test parameters but return to normal operation after the end of exposure.

No changes may occur which affect the performance of the DUT (e.g. sealing functions or legibility of lettering and labels).

11. Vibration

In the vibration test the correct functioning of the DUT under a load similar to practice is tested. Profile and duration of the vibration shall make fatigue obvious. The vibration test is not a wear test.

The DUT shall be mounted in installation position on the vibrator table/sliding table by means of suitable holders. Cables and hose connections as well as related add-on parts shall be properly mounted. Cables and hoses shall be supported in accordance with installation conditions without influencing the DUT.

The specified values refer to directly mounted devices. The acceleration measuring point is the interface between test table and DUT.

Orientation of DUT and test sequence shall be documented in the test report.

As vibration load may occur in the vehicle at low and high temperatures, the vibration load test is performed with a temperature profile acc. to "temperature cycle". Electrical operation as specified in section for the endurance test.

Requirements: all lines are connected acc. to vehicle installation on instrument
N02 222 512 (12V) or
N02 222 712 (24V)
with
N05 800 762 (12V)
N05 800 764 (24V)
[or a technically comparable instrument].

All functions of the DUT perform as specified and after exposure to the test parameters.

No disturbing noise may occur for any operating type.

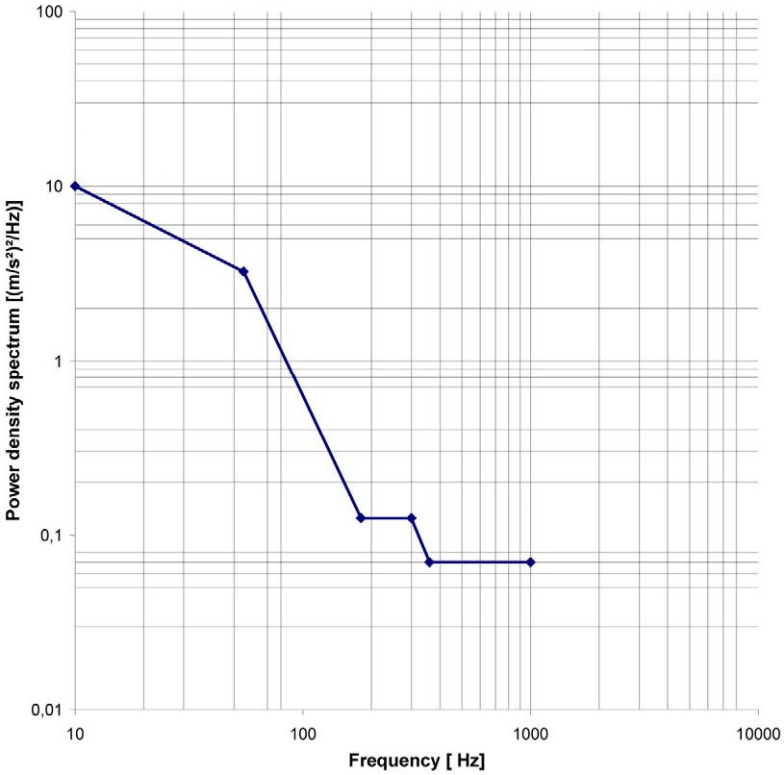
Testing

Aim

In the tank area is a wide band random vibration.

Test

Excitation with wide band random vibrations
Procedure according to DIN EN 60068-2-64.
Test duration for each spatial axis: 8h
Actual acceleration value: 19.7 m/s²



Wide band random vibration profile

Wide band random vibration profile values

Frequency (Hz)	Power density spectrum decreased by -3dB [(m/s²)²/Hz]
10	10
55	3.25
180	0.125
300	0.125
360	0.07
1000	0.07

12. Endurance Testing

Aim

The DUT is operated under vibration load, electrical load and temperature load at the same time and monitored.

Test

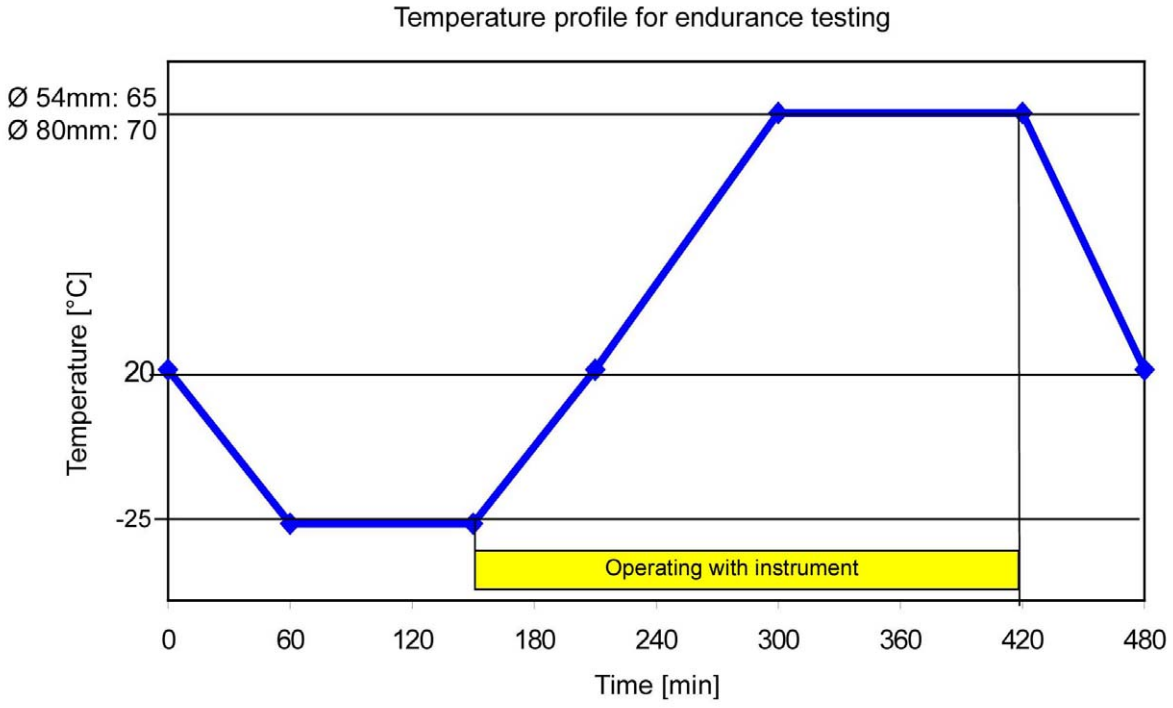
The vibration load must be applied at the beginning of the test.
Each DUT shall be tested in all 3 spatial axes.

Vibration load test procedure according vibration test.
Operating type for temperature profile: according to figure,
all lines are connected acc. to vehicle installation on Instrument
N02 222 512 (12V) or
N02 222712 (24V)
with

N05 800 762 (12V) or
N05 800 764 (24V)
[or a technically comparable instrument].

Requirements

Wide band random vibration with temperature profile acc. to figure	24 h
Operation at 65°C (80mm: 70°C)	656 h
Temperature profile acc. to figure	320 h



Temperature profile for endurance testing

Temperatures and durations of a temperature cycle

Time [min]	Temperatures [°C]
0	20
60	-25
150	-25
210	65 (80mm: 70)
420	65 (80mm: 70)
480	20

Load cycles	10 000
Number of load cycles per second	0.20 to 0.34 (full-empty-full)
Test fluid	premium unleaded fuel acc. to DIN EN 228 (ROZ ≥ 95.0; MOZ ≥ 85.0) (The sliding contact shall be moistened with the test fluid prior to testing and at least twice within 24h.)
Load	display unit

The swivel range of the test fixture shall pass over the entire resistance range of the sensor during one cycle.

Requirement

Operating with connected instrument:
All functions of the DUT perform as specified and after exposure to the test parameters.

13. Referenced Standards

DIN 40 050-9
DIN 50 011-11
DIN 50 011-12
DIN 51 604
DIN 53 758
DIN EN 228
DIN EN 590
DIN EN 60068-2-11
DIN EN 60068-2-14
DIN EN 60068-2-30
DIN EN 60068-2 64
EU Directive 70/221