May 21, 2021

PCN
Transfer of NTC sensor production from Zhuhai to Batam

In future, the production of EPCOS NTC sensors will be consolidated at the plant in Batam/ Indonesia. The Batam site specializes in NTC sensor production and is the main production location for these sensors. As the back-end production of all NTC elements is already on site and most sensor systems are produced in Batam, sensor system production will now also be transferred from Zhuhai/ China to Batam. The production, as well as specifications and quality of the products, remain unchanged.

Affected products

Ordering code	Ordering code	Ordering code
B58100A0303A000	B58100A0625A000	B58100A0853A000
B58100A0303A001	B58100A0635A000	B58100A0868A000
B58100A0323A000	B58100A0677A000	B58100A0869A000
B58100A0348A000	B58100A0678A000	B58100A0911A000
B58100A0362A000	B58100A0703A000	B58100A0916A000
B58100A0362A001	B58100A0709A000	B58100A0964A000
B58100A0379A000	B58100A0710A000	B58100A0966A000
B58100A0379A001	B58100A0712A000	B58100A0994A000
B58100A0379A002	B58100A0714A000	B58101A0037A000
B58100A0577A000	B58100A0724A000	B58101A0038A000
B58100A0586A000	B58100A0750A000	B58101A0039A000
B58100A0592A000	B58100A0751A000	B58101A0042A000
B58100A0603A000	B58100A0822A000	B58101A0043A000
B58100A0610A000	B58100A0824A000	B58101A0053A000
B58100A0610A001	B58100A0839A000	B58101A0056A000
B58100A0610A002	B58100A0840A000	B58101A0105A000
B58100A0619A000	B58100A0852A000	B58101A0811A000

Scheduled date of change:	September 2021	Ambient Air Sensors
	March 2022	Integral Metal Sensors
		Integral Angular Sensors
		Evaporator Sensors
Estimated date of first deliveries:	January 2022	Ambient Air Sensors
	July 2022	Integral Metal Sensors
		Integral Angular Sensors
		Evaporator Sensors

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May 21, 2021

Enclosure PCN (ID No. TPS T126-04)
Detailed information on the transfer
Validation summary

Contact Daniel Oelbermann, TPS PM, Berlin

Customers are asked to address inquiries directly to their sales contacts.

Product / Process Change Notification

1. ID No. PCN TPS T126-04		**2. Date of announcement** May 21, 2021	
3. Product / product group NTC sensor B58100A*, B58101A* from Zhuhai production	**Old ordering code** B58100A*, B58101A*	**New ordering code** No changes	**Customer part number**

4. Description of change

The production of sensors will be consolidated in TDK's production plant Batam, Indonesia.

Batam focuses on sensor production and is the main production site for sensors. As the backend production of all NTC Elements and most of the sensor systems is already located in Batam, the production of sensor systems will now also be transferred from Zhuhai, China to Batam, Indonesia. The plant is focused on sensor production and offers us the possibility of supporting your growing demands for sensors. For more details, please see attached presentation.

5. Effect on the product or for the customer (benefit, quality, specification, lead time)

The complete process, equipment and the materials will be transferred to Batam. Production will remain unchanged. There will be no difference in specification and quality.

6. Quality assurance measures / risk assessment

The Batam plant is certified according to ISO 9001, IATF 16949 and ISO 14001. In order to maintain the same quality level that our customers expect, we will apply appropriate quality assurance measures at this plant.

The internal production and product release procedure will be performed according IATF 16949 in conjunction with ISO 9001 requirements. The necessary buffer stock for the process transfers will be put in place. Deliveries between start of transfer and named SOP in Batam will be covered by a buffer stock in Zhuhai. All product families currently produced in Zhuhai will also be produced in and delivered from Batam. This transfer of production, therefore, is a consolidation of already approved production locations.

7. Scheduled date of change

September 2021: Ambient Air Sensors

March 2022: Integral Metal Sensors, Integral Angular Sensors and Evaporator Sensors

8. Estimated date of first delivery of changed product

January 2022: Ambient Air Sensors

July 2022: Integral Metal Sensors, Integral Angular Sensors and Evaporator Sensors

If TDK Electronics AG does not receive notification to the contrary within a period of 10 weeks, TDK Electronics AG assumes that the customer agrees to the change.

☒ For an interim period we cannot rule out that old as well as new products will be shipped.

☐ Future shipments can consist of old and new products as the new changed product is used as an alternative to the old product.

Quality Management	Signature
Name Dr. Philipp Schmidt-Weber	Signed Schmidt-Weber

Product Marketing

Name Daniel.Oelbermann

Tel. +49 30 890 4055 5124

E-mail Daniel.Oelbermann@tdk-electronics.tdk.com

Signature

Signed Oelbermann

Customer feedback	
Customer acknowledgement	Signature

Attracting Tomorrow

Process Change Notification

Transfer NTC sensor production from Zhuhai, China to TDK main NTC sensor plant on Batam Island, Indonesia

PT TDK ELECTRONICS INDONESIA
Temperature and Pressure Sensors Business Group • OM
Batam, Indonesia
May 2021

Description of change

The production of sensors will be consolidated in TDK's production plant Batam, Indonesia.
Batam focuses on sensor production and is the main sensors production site. As the back-end production place of all NTC elements and most of the sensor systems are already produced in Batam, we will move also the sensor systems production from Zhuhai, China to Batam, Indonesia.
The plant is focused on sensor production and offers us the possibility to support your growing sensor demands.
For a review of affected part numbers please see attachment.

Effect on the product or for the customer

The complete process, equipment and the materials will be transferred to Batam. All production equipment and processes will remain unchanged. There will be no difference in specification and quality.

- All product families currently produced in Zhuhai are as well produced and delivered from Batam
- Therefore this production transfer is a consolidation of already released production locations
- No changes in process, all machines and equipment in Zhuhai will be transferred and once again released
- No change of the NTC element production location (back-end production place of all NTC elements is already in Batam)
- No change in fit, form, function of the products
- No change of packaging

Advantages

- Consolidation of NTC sensor production in TDK's main NTC production facility
- Full end to end production: one production plant for front-end production (NTC elements) and back-end production (NTC systems)
- NTC elements and NTC systems production is established for decades in Batam
- Standardized production system and supply chain management
- Unified technical and quality standards
- Highly developed industrial area with best infrastructure as well as independent water and power supplies
- Additional space available to cover rising quality and capacity demands
- Avoid import restrictions in the US for products produced in China

Quality assurance measures / Risk assessment

The Batam plant is certified according to ISO 9001, IATF 16949 and ISO 14001. In order to maintain the same quality level that our customers expect, we will apply respective quality assurance measures at this plant.
The internal production and product release procedure will be performed according IATF 16949 in conjunction with ISO 9001 requirements. The necessary buffer stock for the internal process transfers will be put in place. Deliveries between start of transfer and named SOP in Batam will be covered by a buffer stock in Zhuhai. All product families currently produced in Zhuhai are as well produced and delivered from Batam. Therefore this production transfer is a consolidation of already released production locations.

Process release and documentation, internal and for the customer

PPAP* level 3 (PSW with product samples and complete supporting data, acc. PPAP requirements)

- Customer-specific documentation (e.g. ISIR) if contractually confirmed
- Part history sheet
- Dimensional result reports, minimum 5 pcs with minimum 1 pc per cavity for each of the transferred products
- Validation report for the selected reference product (please see details next page)
- FMEAs, not submitted to the customer but can be reviewed during a site visit
- Control plan, not submitted to the customer but can be reviewed during a site visit
- Others than per PPAP level 3

* Remark: The **Production Part Approval Process** (**PPAP**) is a standardized **process** in the industries that helps manufacturers and suppliers communicate and approve **production** designs and **processes** before, during, and after manufacture. **PPAP** is an output of **APQP. Advanced product quality planning** (**APQP**) is a framework of procedures and techniques used to develop and release products and processes in industry.

Validation plan for production transfer from Zhuhai to Batam

Automotive systems

- Integral metal sensor: B58100A 610A V 3
- Integral angular sensor: B58100A 751A V 3
- Ambient air sensor: B58100A 677A V 3
- Evaporator sensor: B58100A 868A V 3

Validation tests period: max 8 CW

Validation parameter:

- Geometry: acc. to drawing
- Electrical: $\Delta R_R / R_R$
- Functional/ Reliability: drop test, response time, thermal shock …

For a review of the test conditions please see attached “Validation Summary” overview.
Performed with serial sensors produced after the transfer.

Transfer and release schedule automotive aystems

Ambient Air Sensors

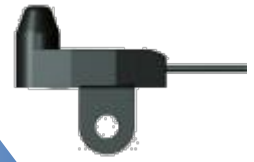
Transfer milestones

PCN to customer
May 2021

Create buffer stock
May-Aug 2021

End of production and production transfer
Sep/Oct 2021

SOP and 1st delivery ex Batam Jan 2022



Release milestones

Sample production ZH current status

Jul 2021

Release procedure BT acc. APQP and sample production

Oct/Nov 2021

Validation and PPAP Customer release

Nov/Dec 2021

Reference sample:
Ambient air sensor B58100A 677A V 3

Transfer and release schedule automotive systems

Integral Metal Sensor, Integral Angular Sensor and Evaporator Sensor

Transfer milestones

PCN to customer
May 2021

Create buffer stock
May-Mar 2022

End of production and production transfer
Mar/Apr 2022

SOP and 1st delivery ex Batam Jul 2022

Release milestones

Sample production ZH current status

Jan 2022

Release procedure BT acc. APQP and sample production

Apr/May 2022

Validation and PPAP Customer release

May/Jun 2022

Reference samples:

Integral metal sensor	B58100A 610A	V 3
Integral angular sensor	B58100A 751A	V 3
Evaporator sensor	B58100A 868A	V 3

Plant overview PT TDK ELECTRONICS INDONESIA

Product range

Temperature & Pressure Sensors BG

- NTC sensor elements & systems for
  - ¬ Automotive
  - ¬ Appliances
  - ¬ Industrial
- Plant area
  - ¬ Total land owned 45,000 m^2
  - ¬ Total buildup area 30,000 m^2
- Headcount 5000 (as of end of Mar' 21)
- Founded in 2007

Certifications

- IATF 16949
- ISO 14001
- ISO 9001
- ISO/IEC 17025
- CSR (Corporate Social Responsibility)
- Indonesian Health & Safety Standard (SMK3)

PT TDK ELECTRONICS INDONESIA
Jalan EPCOS Jaya,
Blok B 1-10
Panbil Industrial Estate
Muka Kuning
Batam 29433
Indonesia

DUNS 726585479

Process Change Notification: • Transfer NTC sensor production from Zhuhai, China into TDK main NTC sensor plant on Batam Island, Indonesia

Plant overview PT TDK ELECTRONICS INDONESIA

The Batam sensor plant is located close to **Singapore** and in one of Indonesia's highest developed industrial areas.

Plant overview PT TDK ELECTRONICS INDONESIA

Product portfolio temperature sensors elements

Minisensor

S861, S863

S867, S869

S864

Leaded disc NTC

S871

S875

S881

S891

S964

Glass NTC

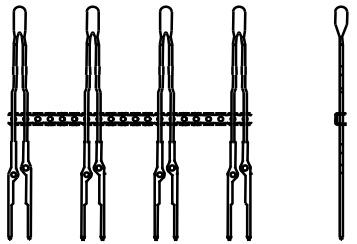
G540

G550

G560

G541, G551, G561

Leadframe



NTC chip S860

Plant overview PT TDK ELECTRONICS INDONESIA

Product portfolio temperature sensors systems

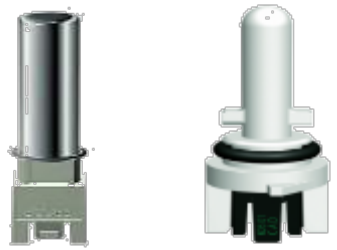
Automotive probes

Refrigerator and freezer probes

Heating, ventilation, and air-conditioning probes

Laundry probes

Dish washer probes

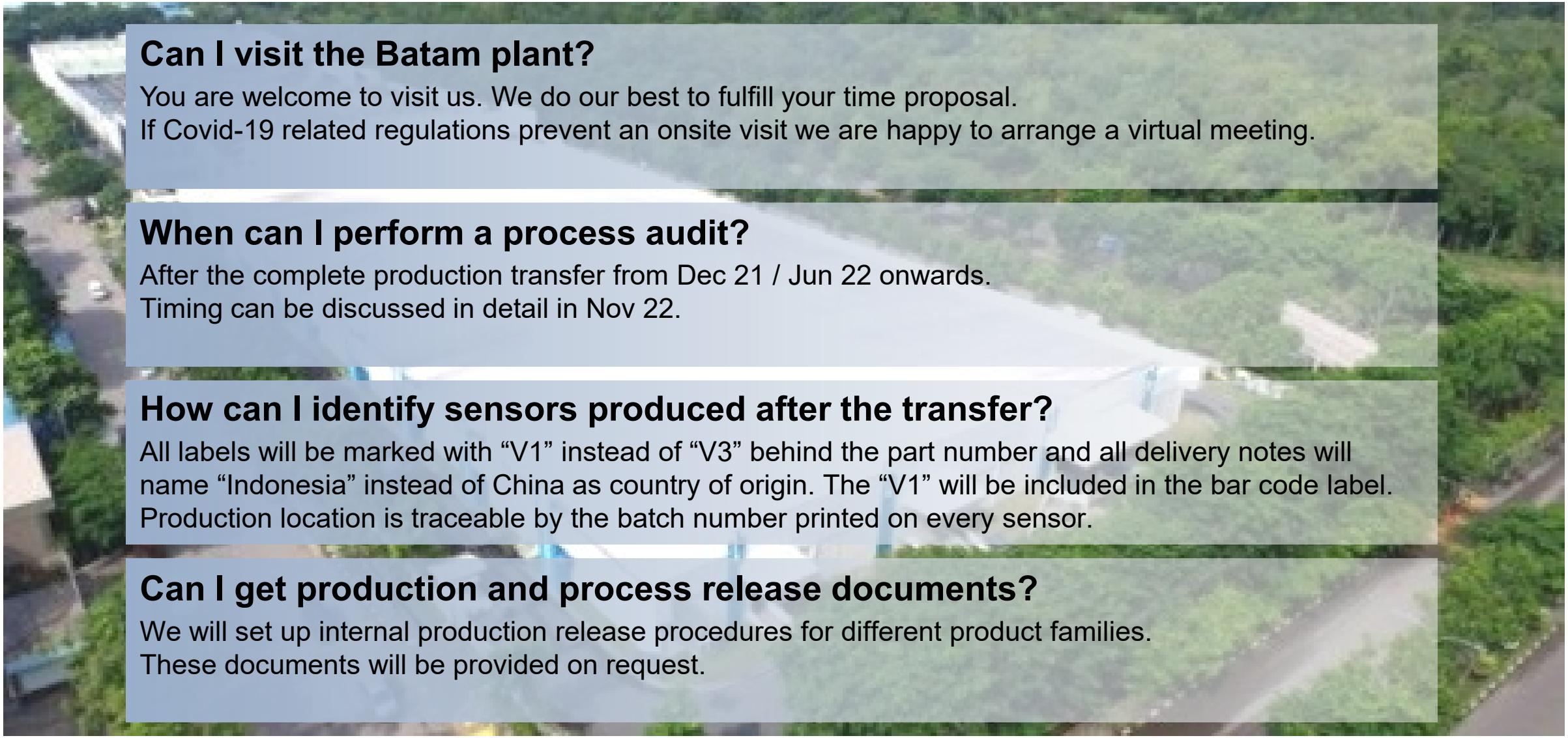


Industrial and small appliances

E.g., ovens, cookers, hotplates

Process Change Notification: • Transfer NTC sensor production from Zhuhai, China into TDK main NTC sensor plant on Batam Island, Indonesia

FAQ



Can I visit the Batam plant?

You are welcome to visit us. We do our best to fulfill your time proposal.
If Covid-19 related regulations prevent an onsite visit we are happy to arrange a virtual meeting.

When can I perform a process audit?

After the complete production transfer from Dec 21 / Jun 22 onwards.
Timing can be discussed in detail in Nov 22.

How can I identify sensors produced after the transfer?

All labels will be marked with “V1” instead of “V3” behind the part number and all delivery notes will name “Indonesia” instead of China as country of origin. The “V1” will be included in the bar code label.
Production location is traceable by the batch number printed on every sensor.

Can I get production and process release documents?

We will set up internal production release procedures for different product families.
These documents will be provided on request.

www.tdk-electronics.tdk.com

Validation Summary: Control Plan for the metal sheet air-duct sensor (family type B58100A610A)

Performed with serial sensors produced after transfer

PRODUCT PARAMETER

1	2	3	4	5
No	**PARAMETER**	**SC**	**TEST CONDITIONS / TOOLS / AMOUNT**	**CRITERIA**
GEOMETRY				
1	Complete sensor		Geometry according to drawing Visual inspection: • Quality of resin parts (e.g., cords, holes, inclusions, burr) • Quality of metal ledge (e.g., difference of glance, scratches, dents, material) • Quality of connector part (e.g., existence of the contact pins, differences of height of pins, tin-plating of pins) 90 pcs. min 2 per cav	Geometry within tolerances
ELECTRIC PARAMETER				
2	R_R B(25/100)		**T_R = 25 °C R_R(T=25 °C) = 10000 Ω ± 2.0%** **B(25/100) = 3988 K ± 0.5%** For all sensor operation: Pre-resistor: 10 k Ω Supply-voltage: 5 V 90 pcs.	**R_R = 10000 Ω ± 2.0%** **B(25/100) = 3988 K ± 0.5%**
3	DR (range)		T = –20 °C R -20 = 97070 Ω ± 3.2% T = 0 °C R 0 = 32650 Ω ± 2.7% **T = 25 °C R 25 = 10000 Ω ± 2.0%** T = 85 °C R 85 = 1072 Ω ± 3.2% T = 100 °C R 100 = 680.00 Ω ± 3.4% 90 pcs.	R –20 = 93926 - 100214 Ω R 0 = 31781 - 33519 Ω **R 25 = 9800 - 10200 Ω** R 85 = 1038 - 1106 Ω R 100 = 656.9 - 703.1 Ω
4	Response time in water		Change from 25 °C in air into 85 °C water The time where sensor reaches 63.2% of changed temp is measured (τ_{63}) DUT #1-20	τ_{63} < 6 s
RELIABILITY (SEQUENCE)				
4	Thermal shock in air		Acc. IEC60068-2-14 Na -40 °C / 90 °C; dwell time 5 min; transfer time ≤ 10 sec; not connected, not operated; 500 cycles Post measurement: Measure R @ -20; 0; 25; 85 and 100 °C DUT #1-50	$\Delta R_R / R_R \leq 2\%$
4a	Storage test in air		24 h @ –50 °C; 48 h @ 100 °C; 24 h @ –50 °C; 48 h @ 100 °C; 1 h bei 120 °C; not connected, not operated Post measurement: Measure R @ -20; 0; 25; 85 and 100 °C DUT #1-50	$\Delta R_R / R_R \leq 1\%$
5	Vibration test		10-1000 Hz; 10 Hz : 7 $(m/s^2)^2$/Hz, 50 Hz : 3.5 60 Hz : 1.75, 1000 Hz : 0.06; Effective accelleration:20.9 m/s^2; 8 h per axis Temperature profile: T = 20 °C at t = 0 min TU = –40 °C at t = 60 min TU = –40 °C at t = 150 min T = 20 °C at t = 210 min TO = 90 °C at t = 300 min TO = 90 °C at t = 420 min T = 20 °C at t = 480 min Test according to DIN 72300-3 (Draft), random vibration with pre-set spectral density of the acceleration after DIN 72300-3 5.1.2.4 (spring suspended masses / automobile body) The temperature sensor connected with an original mating connector and provided with leads about 150 mm long should be installed into a gauge which represents the tolerance range of the mounting hole. Half of the parts to be tested should be installed into the max-size gauge and the other half into the min-size gauge. It has to withstand a vibration test with this parameters; min 2 parts per cav: Post measurement: Measure R @ -20: 0: 25: 85 and 100 °C #DUT 1-20	$\Delta R_R / R_R \leq 2\%$
6	Shock test		Test according to DIN EN 60068-2-27 Number of samples: 10 Peak acceleration: 500 m/s^2 Shock duration: 11 ms Shock waveform: half sine pulse Number of shocks: 1x each direction per sample Direction: ±X, ±Y, ±Z Using tools with several nests at least two parts per nest should be tested. Post measurement: Measure R @ -20; 0; 25; 85 and 100 °C DUT #21-30	$\Delta R_R / R_R \leq 1\%$
7	Drop test		Test according to DIN EN 60068-2-32 (Method 1) Free fall from a height of 100 cm onto a ground made of concrete or stone. Number of samples: 6 pcs. with 4 test per sample, 2 samples per drop-axis. DUT #31-36	$R_N / \Delta R_N \leq 1\%$

8	Insulation resistance		Test of insulation resistance in accordance with DIN 72300-2 (draft). If the insulation resistance test is preceded by a test including humidity or immersion, then the samples should be aired for 30 minutes at room temperature. After this the insulation resistance is tested. The samples are brought into a container which is filled with 5% NaCl-solution at a constant temperature of T=25 °C. The contacts of the temperature sensor are connected with one contact of the test unit, the second contact of the test unit is immersed into the 5% NaCl-solution. The temperature sensor is immersed into the solution so far as only the connector is outside of the liquid. The insulation test can be started after the temperature sensor reached the temperature of the liquid. Test conditions: Test voltage: 500V DC Test duration: 60 s Liquid temperature: 70 °C Post measurement: Measure R @ -20; 0; 25; 85 and 100 °C DUT 1-#50	R_{ins} > 10M Ω $\Delta R_R / R_R \leq 1\%$ Visual inspection: The samples should not have any visible damaging
9	Response time		Change from 25 °C in air into 85 °C water The time where sensor reaches 63.2% of changed temp is measured (τ63) DUT #1 - 20	$\tau 63 < 6$ s
10	ESD		According to ISO TR 10605 The sensor is not connected when the discharge occurs to the contacts and connected when the discharge occurs to the metal plate. Discharges: contact: ±6 kV, air: ±8 kV; 5 discharges Post measurement: Measure R @ -20; 0; 25; 85 and 100 °C DUT #51-60	$\Delta R_R / R_R \leq 1\%$ Visual inspection: The samples should not have any visible damaging
12	Pin pull-out force		The test is performed according to DIN IEC 512-8 Each connector pin has to withstand an axial push-in and pull-out force of at least 60 N without any damage or deformation. This test has to be carried out with 10 samples. Using tools with several nests at least two parts per nest should be tested. DUT #71-80	$F_{push/pull}$ > 60 N Visual inspection: The pins should not be pushed in or pulled out of the connector housing.
13	Connector pull-off force		The test is performed according to DIN IEC 512-8 The connector pull-off force should be tested and documented in accordance with the specification of the connector manufacturer. This test has to be carried out with 10 samples. Using tools with several nests at least two parts per nest should be tested. DUT #81-90	F_{pull} > 20 N

Validation Summary: Control Plan for full plastic air duct sensors (family type B58100A751A)

Performed with serial sensors produced after transfer

PRODUCT PARAMETER

1	2	3	4	5
No	**PARAMETER**	**SC**	**TEST CONDITIONS / TOOLS / AMOUNT**	**CRITERIA**
GEOMETRY				
1	Complete sensor	*	Geometry acc. to drawing 10 pcs.	Geometry within tolerances
ELECTRIC PARAMETER				
2	ΔR_N (range)	*	T = -30°C TN = 0°C T = 25°C T = 85°C 50 pcs.	R-30 =170694–183306 Ω R0 = 31781 – 33519 Ω R25 = 9800 – 10200 Ω R85 = 1083 – 1106 Ω
3	B-value		B (25/100) 50 pcs. (from 2)	3988 K ± 0.5 %
FUNCTIONAL PARAMETER				
4	Response Time		The thermal response time (t63) is the time the sensor requires to indicate a change in temperature of 63 % between the start (TStart) and final (TEnd) value. At the beginning of the test, the sensor must be heated to the start temperature value. The temperature change is to be induced as follows: Air type sensors have to be placed in an airstream (vAir) so that the oncoming air flow is identical to the air flow direction in the HVAC unit. The time (t63) until the sensor indicates 63 % of the temperature difference must be recorded. (air to air): TStart = 40 °C, TEnd = 80 °C, vAir = 5 m/s 10 pcs. (from 1)	τ_{63} < 15 s
RELIABILITY (SEQUENCE)				
5	High/low temperature aging		Test according to LV124: K-01 • DuT's were stored at -40°C for 12h and at 100°C for 12h • DuT's are connected but not powered • Duration : 2 cycles 50 pcs. (from 3)	ΔR0/R0 < 1% ΔR85/R85 < 1%
6	Parameter Test		T = -30°C TN = 0°C T = 25°C T = 85°C 50 pcs. (from 5)	ΔR-30/R-30 ≤ 1% ΔR0/R0 ≤ 1% ΔR25/R25 ≤ 1% ΔR85/R85 ≤ 1%
7	Free Fall		Test according to VW LV124: M-01 DUT operating mode : Operating mode I.a Drop height : 1 m Impact surface: Concrete floor Test cycle : For each of the 3 DUTs one drop in both directions ofa spatial axis (1st DUT: ±X, 2nd DUT: ±Y, 3rd DUT: ±Z) 50 pcs. (from 6)	ΔR0/R0 < 1% ΔR85/R85 < 1%

8	Low temperature operation		Test according to LV124: K-03 The test is carried out acc. to DIN EN 60068-2-1, test Ab DUT operating mode: Intermitting 12 h operating mode II.a and 12 h operating mode II.c each Test duration: 48 h Test temperature: -40°C 50 pcs. (from 7)	ΔR0/R0 < 1% ΔR85/R85 < 1%
9	Temperature Shock test in air		Test according to LV124: K-05 The test is carried out acc. to DIN EN 60068-2-14 Na DUT operating mode: Operating mode I.b Temperature of the cold test bath: -40°C Temperature of the Warm test bath: 100°C Dwell time at upper/lower temperature : 15 min Transfer duration : ≤ 30s Number of cycles : 100 50 pcs. (from 8)	ΔR0/R0 < 3% ΔR85/R85 < 3%
10	Parameter Test		T = -30°C TN = 0°C T = 25°C T = 85°C 50 pcs. (from 9)	ΔR-30/R-30 ≤ 3% ΔR0/R0 ≤ 3% ΔR25/R25 ≤ 3% ΔR85/R85 ≤ 3%
11	Mechanical Shock Test		Test according to LV124: M-05 The test is carried out acc. to DIN EN 60068-2-27 DUT operating mode: Operating mode II.c Peak acceleration: 500 m/s2 Shock duration: 6 ms Shock form: Half-sine Number of shocks: per direction (±X, ±Y, ±Z) 10 50 pcs. (from 10)	ΔR0/R0 < 1% ΔR85/R85 < 1%
12	Vibration test - wide-band vibration excitation		Test according to LV124: M-04 The test is carried out acc. to DIN EN 60068-2-64 DUT operating mode : Repeating, acc. to Figure below Superimposed temperature Profile : Repeating, acc. to Figure below Lower Temperature : -40°C Upper Temperature : 100°C 3 axis / 8 h each 50 pcs. (from 11)	ΔR0/R0 < 1% ΔR85/R85 < 1%
13	Parameter Test		T = -30°C TN = 0°C T = 25°C T = 85°C 50 pcs. (from 12)	ΔR-30/R-30 ≤ 1% ΔR0/R0 ≤ 1% ΔR25/R25 ≤ 1% ΔR85/R85 ≤ 1%
14	Salt spray test		Test according to LV124: K-07 The test is carried out acc. to DIN EN 60068-2-11 Ka DUT operating mode : During spray phase: Intermitting 55 min operating mode II.a and 5 min operating mode II.c each During rest phase: operating mode II.a Test temperature : 35 °C Test cycle : Each test cycle consists of a spray phase of 8 h and a rest phase of 4 h acc. to Figure below Number of test cycles : 2 50 pcs. (from 13)	ΔR0/R0 < 3% ΔR85/R85 < 3%

15	Humid heat cyclic with frost		Test according to LV124: K-09 The test is carried out acc. to DIN EN 60068-2-38 DUT operating mode: Intermitting 40 min operating mode II.a and 10 min. operating mode II.c each Total test duration: 240 h Number of cycles: 10 Test cycle sequence: The first five cycles must include a cold phase and the remaining cycles must be carried out without a cold phase. 50 pcs. (from 14)	ΔR0/R0 < 2% ΔR85/R85 < 2%
16	Connector test – a (single test)		The tests have to be conducted according to DIN IEC 60512-8 Coupling forces of the connector (with pins in all terminals) The forces for plugging (Fin) and unplugging (Fout) the connector must be measured. 10 pcs. (from 4)	F in ≤ 20N F out ≥ 50N No damages
17	Connector test – b (single test)		The tests have to be conducted according to DIN IEC 60512-8 Coupling forces of the pins The retention force of the pins inside the connector terminals must be tested. A pull out and a push through force (F p) must be applied in axial direction on every single pin. 10 pcs. (from 16)	F p ≥ 60N No damages
18	ESD test		According to ISO TR 10605 Discharge 5 bursts on the connector pins and the NTC housing. Connector pins: ± 6 kV Housing: ± 8 kV 50 pcs. (from 15)	ΔR0/R0 < 1% ΔR85/R85 < 1%
19	Parameter Test - Final		T = -30°C TN = 0°C T = 25°C T = 85°C 50 pcs. (from 18)	ΔR-30/R-30 ≤ 5% ΔR0/R0 ≤ 5% ΔR25/R25 ≤ 5% ΔR85/R85 ≤ 5%

Operating mode I - DUT not electrically connected
Operating mode I.a
The DUT is not electrically connected, without plug and harness.
Operating mode I.b
The DUT is not electrically connected, but with connected plugs and harness.

Operating mode II - DUT electrically connected
Operating mode II.a each
The DUT must be operated without operating load.
=> Supply voltage: 5V; pull up resistor: 9kΩ
Operating mode II.b
The DUT must be operated with minimal operating load.
The DUT must be operated in a way that minimal self-heating occurs (e.g. by means of a reduction of a continuous output performance or unfrequent activation of external loads).
=> Supply voltage: 4.9V; pull up resistor: 9kΩ
Operating mode II.c
The DUT must be operated with maximum load (power user, but no misuse). The DUT must be operated in a way that maximum self-heating occurs (e.g. by means of a realistic maximization of a continuous output performance or frequent activation of external loads).
=> Supply voltage: 5.1V; pull up resistor: 9kΩ

Validation Summary: Control Plan for ambient air sensors (family type B58100A677A)

Performed with serial sensors produced after transfer

PRODUCT PARAMETER

1	2	3	4	5
No	**PARAMETER**	**SC**	**TEST CONDITIONS / TOOLS / AMOUNT**	**CRITERIA**
GEOMETRY				
1	Complete sensor	*	Geometry acc. to drawing 10 pcs.	Geometry within tolerances
ELECTRIC PARAMETER				
2	ΔR_N (range)	*	Tn = 0°C T = 25°C T = 85°C 50 pcs.	R-20 = 10960 –11288Ω R0 = 6252 – 6434Ω R25 = 2546 – 2597Ω R85 = 309 – 323Ω
3	B-value		B (25/100) 50 pcs. (from 2)	3774 K ± 0,5 %
FUNCTIONAL PARAMETER				
4	Electrical characterization with thermal gradient		Only the measurement point of the sensor is placed into an air duct. Ambiant temperature: 23°C Air flow in the duct: 5 m/s Temperature in the air duct: 50°C and -10°C The temperature is measured outside and inside the duct by reference sensors. 10 pcs. (from 1)	ΔR/R0 < 3% ΔR/R25 < 3%
5	Response Time		Transfer from 25°C (air, air flow = 5m/s) to 50°C (bath) The whole sensor is placed in an air stream. After stabilisation the whole sensor is put into a bath of 50°C immediately. The air stream is placed over the bath 10 pcs. (from 4)	τ_{63} < 60 s
RELIABILITY (SEQUENCE)				
6	Constant humid heat life test		T=85°C±2°C, rel. humidity= 85%¬±5% Test duration: 180h Cycles power off (8.5h) / power on (25min) Operation mode: Voltage: 5V dc, Series resistance: 6.8kOhm Voltage Measurement: - first check: after 60h - second check: after 120h 50 pcs. (from 3)	ΔR/R0 < 3% ΔR/R25 < 3%

7	Cold Storage		Samples are stored at -40°C for 24h Sensor not connected 50 pcs. (from 6)	ΔR/R0 < 3% ΔR/R25 < 3%
8	Thermal Shocks pre-ageing		Samples stay for 1 hour at -40°C (air) and 1h at 85°C (air), Transition time: <30s, duration: 20 cycles, Connected but no voltage applied 50 pcs. (from 7)	ΔR/R0 < 3% ΔR/R25 < 3%
9	Liquid Tightness		Test according DIN 40050-9: IP X6 50 pcs. (from 8)	ΔR/R0 < 1% ΔR/R25 < 1%
10	High Pressure Spray Test (Kärcher test)		Test according 40050-9: IP X9K pressure: 10.000 kPa, distance 10-15 cm, spray at 0°, 30°, 60°, 90° for 30s per position - T water = 15°C ±5°C, T ecu = 80°C ±5°C and - T water = 80°C ±5°C, T ecu = 15°C ±5°C 50 pcs. (from 9)	ΔR/R0 < 1% ΔR/R25 < 1%
11	Splash Water Test		100 water splashes: 10 cycles of: Stabilize the temperature of the Sample for at least 1 h in dry air at 85°C in a ventilated heat chamber. Transfer Sample from the thermal chamber to the water splash test chamber 10 cycles of: spray for t=60±5s, no spray for 30 s, T water < 5°C Test fluid: de-ionized water with 3% fine Arizona dust according ISO 12103-1 Number of rotations of the spray line: 10 (average speed: 60°/s) 50 pcs. (from 10)	ΔR/R0 < 3% ΔR/R25 < 3%
12	Thermal Shocks in water		Cycle: 30min in bath at 0°C, 30min bath at 80°C, Transition <15 s, 100 cycles Power on, check sensor resistance during temperature rising and degreasing 50 pcs. (from 11)	ΔR/R0 < 3% ΔR/R25 < 3%
13	Withstand Voltage		Apply a voltage of 500 V rms ac between terminals and an electrode wrapped around housing (e.g. metal foil), frequency: 50-60 Hz, duration: 60 s 50 pcs. (from 12)	ΔR/R0 < 3% ΔR/R25 < 3%

14	EMC (equipment not supplied)		Test according ISO 10605: Air discharge: ±15 kV Sensor not supplied 50 pcs. (from 13)	ΔR/R0 ≤ 1% ΔR/R25 ≤ 1%
15	EMC (equipment supplied)		Test according ISO 10605: Air discharge: ±15 kV Sensor supplied Voltage: 5V dc, Series resistance: 6.8kOhm 50 pcs. (from 14)	ΔR/R0 < 1% ΔR/R25 < 1%
16	ΔRn final (range)		T = -20°C Tn = 0°C T = 25°C T = 85°C 50 pcs. (from 15)	R-20 = 10960 –11288Ω R0 = 6252 – 6434Ω R25 = 2546 – 2597Ω R85 = 309 – 323Ω

Validation Summary: Control Plan for air evaporator sensors (family type B58100A868A)

Performed with serial sensors produced after transfer

PRODUCT PARAMETER

1	2	3	4	5
No	**PARAMETER**	**SC**	**TEST CONDITIONS / TOOLS / AMOUNT**	**CRITERIA**
GEOMETRY				
1	Complete sensor		Geometry acc. to drawing 10 pcs.	Geometry within tolerances
ELECTRIC PARAMETER				
2	$R_N/\Delta R_N$	*	T = -10°C TN = 0°C T = 25°C T = 85°C 50 pcs.	R-10 = 15252 Ω ± 1.6 % R0 = 9000 Ω ± 1.0 % R25 = 2757 Ω ± 2.3 % R85 = 295.6 Ω ± 4.5 %
3	ΔR_N (Range)		T = -10°C TN = 0°C T = 25°C T = 85°C 50 pcs. (from2)	R-10 =15007–15497 Ω R0 = 8810 – 9090 Ω R25 = 2694 – 2819 Ω R85 = 282.2 – 308.9 Ω
RELIABILITY (SEQUENCE)				
4	Thermal shock in air		Similar to IEC60068-2-14 Na; (–40±2)°C / (90±3)°C; each 15 min; transfer ≤ 30 sec; U = 5V, RV = 6.8 kΩ; Duration 200 cycles 50 pcs. (from 3)	ΔR/R0 < 2% ΔR/R25 < 2%
5	Salt spray test		Similar to DIN 50021-SS; U = 5V, RV = 6.8 kΩ; voltage 2 h on / 2 h off; Protect the connector from direct spraying; 1/day voltage measurement; 10 d; after the test cleaning according to IEC 68-2-52 50 pcs. (from 4)	ΔR/R0 < 2% ΔR/R25 < 2%
6	Insulation test		5% NaCl-solution; 500 V DC; 20 sec; after the test cleaning according to IEC 68-2-52 50 pcs. (from 5)	Rins > 1 MΩ
7	Vibration load		Similar to EN 60086-2-6 Fc; sinusoidal, 5±0,5 g; 5-200 Hz; 1 Oct/min; transition frequency 20±2 Hz; U = 5V, RV = 6,8 kΩ; duration: 8 h per axis; at 70°C and –20°C; fitted with counter-connector and 150 mm cable 50 pcs. (from 6)	ΔR/R0 < 2% ΔR/R25 < 2%
8	Plug-in and extraction forces		Test according to DIN IEC 512-8 50 pcs. (from 7)	Plug-in: ≤ 30 N Extraction: ≥ 40 N (after 5 cycles of Insertion / extraction)
9	ΔR_N final (range)		T = -10°C TN = 0°C T = 25°C T = 85°C 50 pcs. (from 8)	R-10 =15007–15497 Ω R0 = 8810 – 9090 Ω R25 = 2694 – 2819 Ω R85 = 282.2 – 308.9 Ω