

### 1 Scope

This company standard applies to Thomas Magnete GmbH.

### 2 Content

This company standard describes the handling of the topic "technical cleanliness" in relation to suppliers of the company Thomas Magnete GmbH.

This company standard is to be understood as a superordinate and supplementary document for suppliers on the subject of "technical cleanliness".

This company standard enters into force on the day of approval for components, means of production and processes in which specifications for technical cleanliness have been established with reference to this company standard.

#### 2.1 Concept / Philosophy

Due to constantly increasing requirements regarding product cleanliness e.g. from the automotive industry, especially regarding "technical cleanliness", it is necessary for suppliers of cleanliness-sensitive components to implement a wide-ranging cleanliness concept. To implement this concept, it is essential to think and act in an interdisciplinary manner.

Every single person, from the project purchaser to the production employee, must be aware of the importance of technical cleanliness as a functional feature of our products. It is advisable to communicate this know-how in the form of training courses.

#### 2.2 Product

This chapter defines the most important aspects of "technical cleanliness" related to purchased parts from Thomas. The goal of the CS is to develop and implement a uniform standard of "technical cleanliness" for all relevant purchased parts. In order to implement this goal, the regulations and recommendations of this company standard are based on VDA 19 / ISO 16232. These can be considered as a standard work on "Technical Cleanliness", especially in the automotive industry. An exception is the technical cleanliness of electronic assemblies as purchased parts, which is additionally described in chapter 2.2.4.

##### 2.2.1 Drawing specification

The technical cleanliness specifications must be defined on the drawing. A uniform procedure is chosen here. This applies to all relevant purchased parts of Thomas Magnete GmbH. The nomenclature is in accordance with VDA 19.1. The use of deviating internal standards and nomenclatures for new projects (except for parts to be adopted) is not permitted. Reference must be made to the present company standard.

The VDA 19.1 nomenclature provides a description of "technical cleanliness" in accordance with the so-called CCC (Component Cleanliness Code), which must be used in every case. The CCC data can refer to a single component (reference value "N", see Figure 1) or to several components (reference value "n", see Figure 2). If the reference value "n" is used, it must be indicated on the drawing as a sampling size  $n = X$  in order to determine the sampling size for the given limit values (see Figure 2).

The permissible number of particles in the respective size classes is given in whole numbers. For the reference value "N" (single component), the limit values in the CCC apply to a single component; for the reference value "n" (several components), the limit values in the CCC apply to the specified number of components (sampling size).

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The particle size classes are based on the size classes according to VDA 19 / ISO 16232, but can be also combined as desired (see Figure 3-4). Unless otherwise described on the drawing, the particle size classes apply to the length of the particles, the length of a particle is defined here as Feret diameter. If it is necessary to distinguish between reflecting and non-reflecting particles, this must also be specified on the drawing. Basically, if not differently indicated on the drawing, fibers are not considered.

$$CCC = N(B755840/C43720/D36791/E938/F502/G394/H48/I7/J5/K2/L1/M1/N0)$$

Figure 1 - Specification of the CCC with a reference N, as well as particle limit values in absolute numbers per component.

$$CCC = n(H1/I-N0) \quad n=20$$

Figure 2 - Indication of the CCC with reference value n, as well as indication of the sampling size (exemplary: n = 20 components)

Number of particles per size class												
B	C	D	E	F	G	H	I	J	K	L	M	N
5	15	25	50	100	150	200	400	600	1000	1500	2000	3000
≤ x < 15	≤ x < 25	≤ x < 50	≤ x < 100	≤ x < 150	≤ x < 200	≤ x < 400	≤ x < 600	≤ x < 1000	≤ x < 1500	≤ x < 2000	≤ x < 3000	<

Figure 3 - Specification of particle size classes according to VDA 19 / ISO 16232

Number of particles per size class							
B - D	E	F	G	H	I	J	K - N
5	50	100	150	200	400	600	1000
≤ x < 50	≤ x < 100	≤ x < 150	≤ x < 200	≤ x < 400	≤ x < 600	≤ x < 1000	<

Figure 4 - Exemplary summary of individual size classes for simplified notation

#### 2.2.2 Test methodology

In order to guarantee the technical cleanliness requirements of the purchased parts, regular inspections at the suppliers are necessary.

The cleanliness test at Thomas suppliers shall be carried out according to VDA 19.1. The equipment being used does not necessarily have to agree with the equipment of Thomas if a procedure according to VDA 19.1 is applied at the supplier and the equipment used has been qualified according to VDA 19.1. It is useful to

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coordinate the test parameters between the supplier and Thomas Magnete GmbH. The "**Form sheet Product Cleanliness FB0180**" is available for this purpose.

The use of an encapsulated rinsing cabinet in combination with a residual dirt microscope system is recommended, e.g.

- rinsing cabinet: company Gläser model ACM-16 or ACM-18
- residual dirt microscope system: company Jomesa

### 2.2.3 Tests during production

In general, the supplier is responsible for the quality of his components; this also applies to compliance with the cleanliness specifications recorded in the drawings. This must be proved regularly by the supplier. In addition, Thomas Magnete GmbH carries out regular incoming goods inspections of the relevant components, any conspicuous components are reported to the supplier.

### 2.2.4 Cleanliness of electronic assemblies as purchased parts

#### 2.2.4.1 Quoted standards and applicable documents

- IPC-A-610D
- VDA volume 19.2

#### 2.2.4.2 Area of application

For all electronic assemblies that are supplied as Thomas purchased parts.

#### 2.2.4.3 Purpose

Ensuring the required cleanliness of supplier assemblies and end products for the function.

#### 2.2.4.4 Classification

The allocation of the assembly is based on the IPC-A-610D ("Acceptance criteria for electronic assemblies") with regard to the cleanliness of printed circuit boards and assemblies (Chapter "10.4 Cleanliness") in

- Class 1 ("Common electronic products"),
- Class 2 ("Designated electronic products ")
- Class 3 ("high-performance electronics").

The classification of the electronic assembly into the IPC classification is to be taken from the specifications.

Unless otherwise agreed, at least the classification into Class 1 must be ensured (the classification can be found under 1.4.1 ("Classification") of IPC-A-610D).

2.2.4.5 Drawing entry in circuit diagrams

The reference for the cleanliness of electronic assemblies is located as a drawing entry in the circuit diagram.

	Date	Name	Project Name				
Drawn							
Inspected							
Approved			_A4 quer Schematic Thomas.SchDot				
Scale	Sheets Total		Sheet No.	Item No.			Index
1:1 (A4)			tbd.	tbd.			
PCB-board classification (unless otherwise agreed): IPC-A-610 / Class 3	 Thomas Magnete GmbH Innomotion Park 3 57562 Herdorf		Drawing No.				Version
			Variant		tbd.		
			Chg notification	Referred to	Name		
			Date	First use in project			

Figure 5 - The drawing entry for the cleanliness of electronic assemblies as a supplier part is made as a text entry in the circuit diagram in the title block (see example).

2.3 Logistics / Packaging

The entire logistics and packaging concept of a Thomas product must also be adapted to the requirements of "technical cleanliness". Contamination of clean components by inadequate packaging is not permitted and will be rejected by Thomas. Thomas Magnete GmbH provides suitable packaging as agreed, the correct handling is the responsibility of the supplier.

3 Other applicable documents

VDA 19 Part 1 and 2

ISO 16232

IPC-A-610D

4 Notes

For drawings that were released before 01/01/2014 and are based on the then valid company standard CS 0092, the following extract from the former company standard CS 0092 applies:

Thresholds:

Designation in the drawing <sup>2)</sup>		Biggest hard particle	Biggest soft particle	Based on 100 cm <sup>2</sup> area <sup>1)</sup>			Number of samples per analysis
				Number of particles >15 µm (all)	Number of particles >150µm (hard)	Gravimetry	
		[µm]	[µm]	[pieces]	[pieces]	[mg]	[pieces]
<b>cleanliness class 0</b>	Component in the system <b>without</b> cleanliness requirements	No machining residues/dirt visible on visual inspection (without tools), individual fibers are permissible					Max. 3
		<b>Not for new projects!</b>					
<b>cleanliness class 1</b>	Component in the system <b>low</b> cleanliness requirements	800	10.000	10.000	8	5	3-10 (small parts more)

	(Cleanliness Standard 1)						
<b>cleanliness class 2</b>	Component in the system <b>high</b> cleanliness requirements (Cleanliness Standard 2)	400	4.000	2.000	2	1	3-10 (small parts more)
<b>cleanliness class 9</b>	Component in the system with <b>special</b> requirements	Individual definition by Thomas required! Definition is specified in the comment bar					

- 1) „Surface" means the area that can contaminate the customer system or is relevant from a functional point of view.
- 2) The cleanliness level in the finished device may differ from the delivery cleanliness. In these cases, the final cleanliness level of the individual part is saved in a table in the final assembly drawing. In addition, the cleanliness condition of the complete device is stated.

For all magnets, valves, actuators, dosing pumps and other Thomas end products before direct delivery to the customers.

Only for old products and adaptation projects.

Ensuring the required cleanliness

**Thresholds:**

Designation in the drawing		Biggest hard particle	Biggest soft particle	Based on 100 cm <sup>2</sup> area <sup>1)</sup>			Number of samples per analysis
				Number of particles >15 µm (all)	Number of particles >150µm (hard)	Gravimetry	
		[µm]	[µm]	[pieces]	[pieces]	[mg]	[pieces]
<b>cleanliness class 1</b>	devices with <b>low</b> cleanliness requirements	800	10.000	10.000	8	5	3-5
<b>cleanliness class 2</b>	devices with <b>high</b> cleanliness requirements	400	4.000	2.000	2	1	3-5
<b>cleanliness class 9</b>	devices with <b>special</b> (customer) requirements	Individual definition by Thomas required!					3-5

- 1) Surface" means the area that can contaminate the customer system or is relevant from a functional point of view.