

JWN 890 115

INNIO Cleanliness Standard for Engine Components

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1 Scope

This Jenbacher Company Standard applies to all bought-in and self-made components, where the relevant requirements are stated in the specification, and replaces all other cleanliness requirements. In the event of a conflict between this Jenbacher Company Standard and any references cited, this Company Standard shall take precedence. This Company Standard does not apply to cast blanks or components being machined.

2 Purpose

This Jenbacher Company Standard (JWN) is intended to lay down the objectives of the cleanliness requirements for "installation-ready" components. Cleanliness of components is directly related to damage when running in engines and to long-term reliability. Contamination of components by residual and manufacturing particles substantially impairs product quality, can cause serious operational problems up to and including the total failure of the end product and must therefore be avoided at all costs.

3 Relevant documents

Please refer to the following documents:

- VDA 19** Inspection of technical cleanliness
- ISO 16232** Road vehicles – Cleanliness of components of fluid circuits
- WI_TPC** Item Creation Technology
- ISO 9001** Quality management systems – Requirements
- ISO 14644** Clean rooms and associated controlled environments

4 Terms, definitions and acronyms

The following definitions, terms and acronyms are used in this document:

| Definition/Term/Acronym | Explanation/Description |
|--------------------------------|--|
| Degree of cleanliness | A specified, measurable maximum permissible degree of contamination in a specified zone, measured in terms of particle size, quantity and mass by extraction. |
| Contamination | Unwanted particles on a component. |
| Component | General term for parts, subassemblies or parts of assemblies. |
| Particle size | Geometric feature of a particle, as laid down in the cleanliness specification. If not specified, the particle size is the same as its longest dimension (Feret _{max}) |
| Particle mass | Measured by gravimetric analysis: Measurement of the contamination mass extracted from a fluid or component. |

| Definition/Term/Acronym | Explanation/Description |
|---------------------------|--|
| Extraction | Procedure in which particulate residues are detached from the test piece using an extraction fluid. |
| Critical surface | Any surface of a component necessary for observing a specified degree of cleanliness. Depending on the component, this can be either the entire surface or only individual areas of the component surface. |
| Installation-ready | A component that if fitted in an Jenbacher engine meets the cleanliness standard without any further work. |

5 Component definition

The cleanliness class is defined in the component specification.

Depending on the class, the following limit values must be observed:

INNIO Jenbacher GmbH & Co OG Definition of the cleanliness class:

Table 1: Cleanliness degree for mass – relevant for all dirt contamination

| Jenbacher cleanliness class | Total particle mass (mg / 1,000 cm ²) |
|-----------------------------|---|
| | All sizes inclusive of the residual dirt mass |
| 1 | n/a |
| 2 | 5 |
| 3 | 20 |
| 4*) | 50 |
| 5*) | 200 |
| 6*) | 500 |

Table 2: Cleanliness degree for particle quantity and size – only relevant for metallic contamination

| Class as per VDA 19 | Particle size (number of particles / 1,000 cm ²) | | | | | | | | | |
|-------------------------|--|----------------------|----------------|----------------|----------------|-----------------|-------------------|-------------------|-----------|---|
| | E | F | G | H | I | J | K | L | M | |
| | 50 ≤ x < 100 | 100 ≤ x < 150 | 150 ≤ x < 200 | 200 ≤ x < 400 | 400 ≤ x < 600 | 600 ≤ x < 1,000 | 1,000 ≤ x < 1,500 | 1,500 ≤ x < 2,000 | x ≥ 2,000 | |
| Innio Cleanliness Class | 1 | Class 1: see Table 3 | | | | | | | | |
| | 2 | no limit value | no limit value | 100 | 20 | 3 | 0 | 0 | 0 | 0 |
| | 3 | no limit value | no limit value | no limit value | 100 | 20 | 5 | 0 | 0 | 0 |
| | 4*) | no limit value | no limit value | no limit value | no limit value | 150 | 30 | 2 | 0 | 0 |
| | 5*) | no limit value | no limit value | no limit value | no limit value | no limit value | 150 | 30 | 10 | 0 |
| | 6*) | no limit value | no limit value | no limit value | no limit value | no limit value | 250 | 50 | 25 | 0 |

*) For information only, not relevant for Jenbacher parts.

Table 3: Cleanliness class 1 – cleanliness by component type – only relevant for metallic contamination

| Component | Reference | Permissible particle value for different size classes [μm] | | | | | | |
|-------------------------------------|-----------|---|------------------|-------------------|--------------------|--------------------|-----------|--------------|
| | | $0 \leq x < 25$ | $25 \leq x < 50$ | $50 \leq x < 100$ | $100 \leq x < 200$ | $200 \leq x < 400$ | $x < 400$ | non-metallic |
| High-pressure injector | 3.1 | no limit value | record only | 85 | 12 | 0 | 0 | record only |
| High-pressure safety valve | 3.2 | no limit value | record only | 200 | 25 | 0 | 0 | record only |
| High-pressure fuel pump | 3.3 | no limit value | record only | 200 | 20 | 5 | 0 | record only |
| High-pressure fuel line | 3.4 | no limit value | record only | 50 | 6 | 0 | 0 | record only |
| High-pressure inlet measuring valve | 3.5 | no limit value | record only | 150 | 40 | 5 | 0 | record only |
| High-pressure terminal box | 3.6 | no limit value | record only | 180 | 30 | 7 | 0 | record only |

Special class: "visual cleanliness"

Components must be visibly free from loose particles to the human eye. If the critical area is not visible, use suitable equipment (e.g. a borescope) to evaluate it.

Components must be free from rust, swarf, abrasion or loose particles.

Forgings and castings must not show any residual rust, erosion, steel grit, nicks or burrs. More precise details are set out in the relevant specification.

In order to achieve this, the following measures must be taken:

Parts should be cleaned using a suitable cleaning tool and/or a suitable method. This is set out in the MPP or the internal process documentation.

The parts should be packed after cleaning to protect them from recontamination.

The parts should be protected from corrosion as described on the relevant specification.

Cross bores must be deburred and secondary burrs removed completely.

6 Inspection of technical cleanliness as specified in JWN 890 115 - Classes 1-6

If requirements for technical cleanliness as specified in JWN 890 115 are shown on the drawing, any actual contamination must not exceed the limits stated in JWN 890 115. The inspection of this feature must be shown to have been completed.

General guidelines and instructions for testing technical cleanliness are set out in VDA 19 "Inspection of technical cleanliness".

Inspection facilities:

The inspection facility must be suitable for the inspection to be conducted (see VDA 19). Evidence of the suitability must be documented in the form of a blank value (as described in VDA 19). The inspection of technical cleanliness is usually conducted in a monitored environment similar to a clean room (minimum: ISO 14644, Class 8). It must be secured on site (clean room) or mechanically (closed rinsing cabinet).

Extraction:

The extraction method selected is spraying (as described in VDA 19). The extraction parameters must be determined by decay measurement (as described in VDA 19). This qualification measurement must be prepared as evidence of the suitability of the inspection method and documented in the form of an inspection specification. Geometrically similar components can be grouped into component families and inspected on the basis of an inspection specification.

If process parameters change during the preceding production, cleaning or packing process, the suitability of the inspection parameters must be shown to have been documented by means of a two step verification (as described in VDA 19).

The filter mesh size to be used is shown in the table below:

| Cleanliness Class as per JWN 890 115 | Mesh size |
|---|-----------|
| 1 | 5 µm |
| 2 | 20 µm |
| 3 | 20 µm |
| 4 | 50 µm |
| 5 | 50 µm |
| 6 | 50 µm |

Analysis:

Weighing scales with a 0.1 mg resolution must be used for the gravimetric analysis. The progress of the procedure is described in VDA 19.

The numerical analysis of the filters requires at least one computerised, photo-optical system capable of distinguishing metallic from non-metallic shiny particles (see VDA 19).

Documentation:

The results are documented in an inspection report containing at least the following information:

Header data:

- Inspection date
- Jenbacher part number
- Component designation
- Cleanliness class in accordance with JWN 890 115
- Inspection facility used
- Component surface inspected [cm²]
- Associated blank value, if any

Extraction parameters:

- Method used
- Batch size
- Description of rinsing medium
- Filter type used

- Quantity of testing medium (extraction and rinsing off [ml])
- Volumetric flow [ml/min]

Analysis parameters:

- Microscope scale/resolution [μm /pixels]
- Evaluation diameter [mm]
- Largest metallic shiny particle ($\text{Feret}_{\text{max}}$) [μm]
- Measured values in accordance with JWN 890 115
- Test result

Miscellaneous

The procedure for monitoring technical cleanliness must be checked and approved by a INNIO Jenbacher GmbH & Co OG SQE in collaboration with the INNIO Jenbacher GmbH & Co OG GSCM quality department.

7 Escalation when limits are exceeded

As a rule, cleanliness limits represent control limits and not tolerance limits. A limit which has been exceeded does not result directly in a fault, but increases the risk of one. If a component is identified in the course of a technical cleanliness inspection as exceeding the limits referred to above, three further components from the same production batch must be inspected. A non conformance report is only to be issued if the average value of this triple inspection exceeds the limit. If the average value for these three measured parts is within the specified limits, no fault exists and no fault report is to be issued.

In case of a fault, the control procedure for faulty products according to the management system should be started.

8 Revision code

Revision history

| Index | Date | Description/revision summary | Expert Auditor |
|-------|------------|--|---|
| 4 | 28.02.2023 | Relevantes Dokument WI_JGSCM091 WI TecSa Inspection entfernt / Relevant document WI_JGSCM091 WI TecSa Inspection removed | Baumgartner M. <i>Wolf S.</i> |
| 3 | 23.01.2020 | GE durch INNIO ersetzt / GE replaced by INNIO | Kecht S. <i>Pichler R.</i> |
| 2 | 29.02.2016 | Ergänzung Beachtung technischer Sauberkeit / Addition of observation instructions Ergänzung Tabelle 3; Werte für Klasse 1 / Addition of table 3; values for cleanliness class 1 Freigabe für Klasse 3 / Release of class 3 Ergänzung Kapitel – Prüfung der Technischen Sauberkeit gemäß JWN 890 115 – Klassen 1-6 / Addition of chapter – Inspection of technical cleanliness as specified in JWN 890 115 – Classes 1-6 | Carrol B./ Spichalski A. <i>Wolf S.</i> |
| 1 | 03.12.2014 | Erstausgabe / First issue | Mauro P. <i>Whittaker R.</i> |

