

The English translation is believed to be accurate. In case of discrepancies the German version shall govern.

Norm vor Anwendung auf Aktualität prüfen / Check standard for current issue prior to usage.

QUELLE: NOLIS

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|--|---|--|---|--|--------------------------------|--|----------------------|-------------|---------------|---|
| <p>VOLKSWAGEN AG</p> | <p align="center">Case-Hardened Transmission Components Drawing Notes on Material and Component Properties</p> | <p align="center">VW 500 19</p> | | | | | | | | |
| <p>Konzernnorm</p> | | | | | | | | | | |
| <p>Descriptors: case-hardened, transmission component, transmission, gearbox, internal stress, CHD, case-hardening depth, case depth, case hardening, surface hardness, dedendum core hardness, drawing note</p> | | | | | | | | | | |
| <p>Changes The following changes have been made as compared to Volkswagen standard VW 500 19, 2003-10:</p> <ul style="list-style-type: none"> - Determination and testing of the case depth changed | | | | | | | | | | |
| <p>Previous issues 1999-06; 2003-02; 2003-10</p> | | | | | | | | | | |
| <p>1 Scope</p> <p>This standard applies to case-hardened transmission components. It specifies how requirements on material and component properties shall be represented in technical drawings and defines the measuring points for internal stresses, case-hardening depth, surface hardness and dedendum core hardness.</p> | | | | | | | | | | |
| <p>2 Description</p> <p>Description example for an indexing wheel of the material according to Technical Supply Specification TL 4521:</p> <p>Carbonitratet and tempered to ≥ 680 HV 30; CHD according to VW 500 19, class 0.5; Gear tooth system shot peened according to VW 500 19, class 3; Dedendum core hardness: (400 + 100) HV30</p> | | | | | | | | | | |
| <p>3 Requirements</p> <p>Deviations from the specifications below shall be documented in the drawing.</p> | | | | | | | | | | |
| <p>3.1 Material quality, heat treatment and shot peening</p> <p>The requirements according to DIN 3990-5, quality of MQ case hardening steel, apply. Deviations from this are specified by this standard and/or drawing note.</p> <p>Shot peening on parts without hardening treatment shall be performed directly after case hardening and tempering.</p> <p>For hardening-treated parts, shot peening occurs after hardening treatment. Functional surfaces that shall not be shot peened shall be identified in the drawing.</p> | | | | | | | | | | |
| <p align="right">Page 1 of 4</p> <table border="1" style="width: 100%;"> <tr> <td colspan="2"> Fachverantwortung/Responsibility </td> <td colspan="2"> Normung/Standards (EZTD, 1733) </td> </tr> <tr> <td> K-QS-32/1 Klingemann </td> <td> Tel: -28499 </td> <td> Dr. Eisenberg </td> <td> Frau Hager-Süß Tel: +49-5361-9-49035 Sobanski </td> </tr> </table> | | | Fachverantwortung/Responsibility | | Normung/Standards (EZTD, 1733) | | K-QS-32/1 Klingemann | Tel: -28499 | Dr. Eisenberg | Frau Hager-Süß Tel: +49-5361-9-49035 Sobanski |
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Form FE 41 - 01.03

3.2 Transmission steels

3.2.1 Normal load

According to TL 4227 (differentiated according to hardenability).

Replacement for TL 4123, TL 4124, TL 4125, TL 4128, TL 4129, TL 4130, TL 4131, TL 4221 and TL 4220. These Technical Supply Specifications must no longer be used for new designs.

3.2.2 Maximum load

According to TL 4521 (differentiated according to hardenability).

NOTE: The use of other materials is not excluded for normal and maximum load; if required, it shall be agreed upon with the responsible material test laboratory.

3.3 Dedendum core hardness

For measuring point see Section 3.6,

- for steel according to TL 4227 = (340 + 140) HV 30,
- for steel according to TL 4521 = (400 + 100) HV 30,
- for steel components according to TL 4521 that are subject to a straightening operation after heat treatment or are very voluminous (e.g. crown wheels) = (350 + 130) HV 30.

3.4 Case depth and surface hardness

CHD according to DIN EN ISO 2639. See Table 1. Measuring point see Section 3.6.

Basis: three classes, usage depends on module, only one limit hardness of 550 HV 1.

If the selected class is not sufficient due to increased loads, the next higher class shall be selected.

Class 0.6 shall only be used for components which are to be straightened (e.g. shafts).

Table 1

| Property Class | Limit hardness (HV 1) | CHD (mm) | Module m_n | CHD [mm] of ground surfaces | CHD [mm] of finished tooth flanks | Surface hardness after heat treatment | Surface hardness after hardening treatment |
|-------------------|-----------------------|-----------|--------------|-----------------------------|-----------------------------------|---------------------------------------|--|
| 0.3 ¹⁾ | 550 | 0.3 + 0.2 | 1.0 to 1.99 | ≥ 0.20 | ²⁾ | ≥ 680 HV 10 | ≥ 680 HV 5 |
| 0.5 | 550 | 0.5 + 0.3 | 2.0 to 2.99 | ≥ 0.35 | ≥ 0.4 | ≥ 680 HV 30 | ≥ 680 HV 10 |
| 0.6 | 550 | 0.6 + 0.3 | 2.5 to 3.99 | ≥ 0.45 | ≥ 0.5 | ≥ 680 HV 30 | ≥ 680 HV 30 |
| 0.8 | 550 | 0.8 + 0.4 | 3.0 to 6.0 | ≥ 0.65 | ≥ 0.7 | ≥ 680 HV 30 | ≥ 680 HV 30 |

1) Recommended for synchronizer hubs and operating sleeves
2) Finished gear systems not permissible. The next class shall be selected.

3.5 Internal stress values and surface oxidation depth

See Table 2. Measurements according to Test Specification PV 1005.

Table 2

| Class | Material | Compressive internal stresses (Mpa) | | | | Surface oxidation ²⁾ scraped surface | Remarks |
|-------|--------------------------------------|-------------------------------------|------------------------|--------------------------|-----------------------|--|---------|
| | | Measuring point: | Surface | 20 μm | 50 μm | | |
| | | Tolerance: | (1 to 5) μm | (10 to 30) μm | $\geq 50 \mu\text{m}$ | | |
| 2 | TL 4521 | ≥ 600 | ≥ 800 | ≥ 600 | $\leq 7 \mu\text{m}$ | Normal load | |
| | TL 4227 | | | | $\leq 15 \mu\text{m}$ | | |
| 3 | TL 4521 | ≥ 800 | $\geq 1,000$ | ≥ 800 | $\leq 7 \mu\text{m}$ | Maximum load | |
| | TL 4227 | | | | $\leq 15 \mu\text{m}$ | | |
| 4 | TL 4521 | ≥ 900 | $\geq 1,100$ | $\geq 1,100$ | $\leq 7 \mu\text{m}$ | Increase as compared to class 3 ¹⁾ | |
| | TL 4227 hardening-treated surface | | | | | | |

1) Two directed compressed air blasting processes with consideration of the required roughness according to part drawing
2) No surface oxidation exists in hardening-treated areas

3.6 Measuring points for measuring of internal stresses and material testing

See Figures 1 to 3.

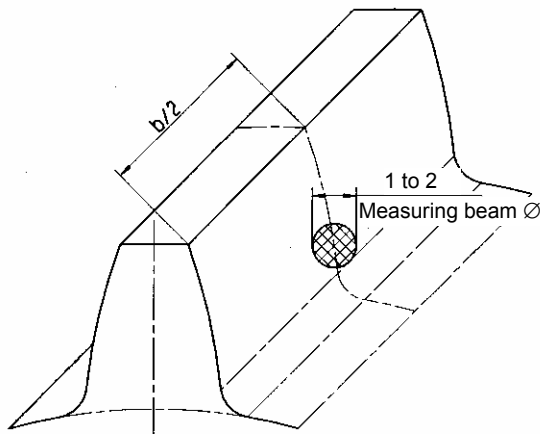


Figure 1 – Spur wheel
Measuring point for internal stress:
Measuring beam tangential to the minimum \varnothing
of the flank test area

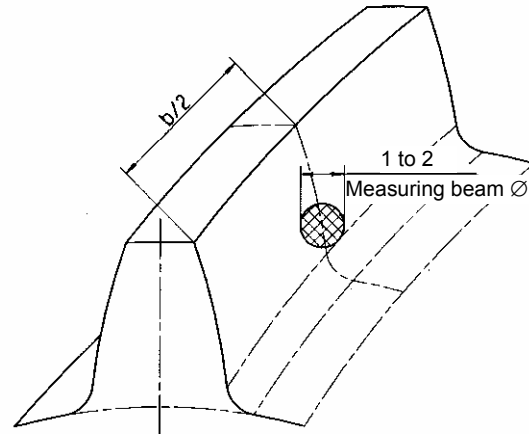
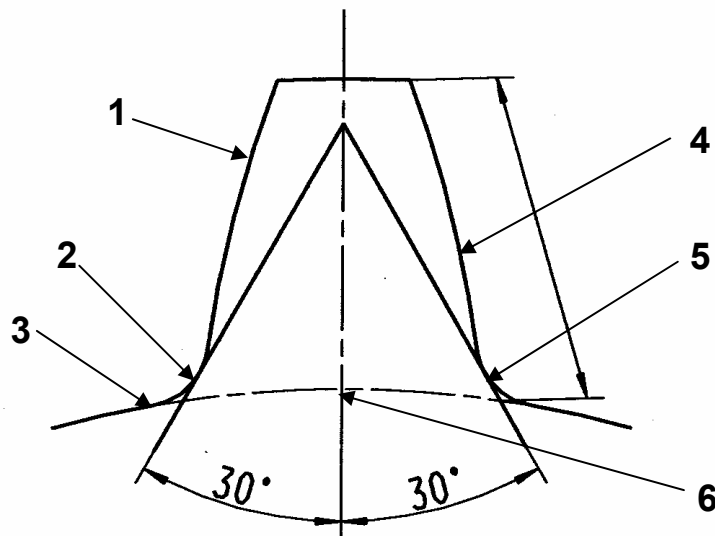


Figure 2 – Bevel wheel
Measuring point for internal stress on traction
flank (concave pinion, convex crown wheel):
measuring beam tangential
to end of dedendum radius



Legend

- 1 Tooth flank
- 2 Dedendum radius
- 3 Tooth base
- 4 Tooth flank, center (1/2 tooth height)
optional measuring point for CHD and surface hardness
- 5 Drawing requirement = acceptance criterion
30° tangent (crossing point tangent/dedendum radius)
CHD with HV 1,
hardness within surface distance of 0.05 mm \geq 680 HV 0.5
= surface hardness (additional value)
- 6 Measuring point for dedendum hardness (HV 30),
tooth center between dedendum radii

**Figure 3 – Microsection
 (normal section at b/2)**

4 Referenced standards^{*)}

| | |
|-----------------|---|
| PV 1005 | Internal Stress Measurement; Determination of Depth Characteristics of Internal Stresses on Ferritic Iron Materials |
| TL 4227 | Einsatzstahl, legiert; Werkstoffanforderungen (currently only available in German) |
| TL 4521 | Einsatzstahl, Ni-legiert; Werkstoffanforderungen (currently only available in German) |
| DIN 3990-5 | Calculation of Load Capacity of Cylindrical Gears; Endurance Limits and Material Qualities |
| DIN EN ISO 2639 | Steels – Determination and Verification of the Depth of Carburized and Hardened Cases |

^{*)} In this section, terminological inconsistencies may occur as the original titles are used.