High-strength steel for chassis applications - learn about its mechanical properties and behaviour

Presenter:
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Tested steel grades

- Docol HR 420LA, 2-4mm (3.0mm), Ferritic, VDA
- Docol HR 420HE, 2-4mm (3.0mm), Ferritic, EN 10149

- Docol HR 500LA, 2-4mm (3.8mm), Ferritic, VDA
- Docol HR 500HE, (600FB) 2-4mm (3.8mm), Ferritic-bainitic, VDA

- Docol HR 700LA, 2-4mm (3.0mm), Ferritic, VDA
- Docol HR 800CP, 2-4mm (3.8mm), Bainitic, VDA
- Docol HR 1000CP, 2-4mm (3.0mm), Bainitic, Development material
- Docol HR 1200M, 2-4mm (3.0mm), Martensitic, VDA

- Naked and pickled
Tensile test

Tested values, no guarantees

~1200 MPa
~750-1000 MPa
~600 MPa
~500 MPa
Mechanical properties comparison

Yield strength [MPa]

Tensile strength [MPa]

Elongation A80 [%]
Strength increase in a lower control arm

Tensile test

Collapse load

DOCOL®
THE AUTOMOTIVE STEEL
Low cycle fatigue – strain controlled

Tested values, no guarantees

![Diagram showing strain reversals and total strain values for different materials, including Total Strain DX500MCD, Total Strain DX700MCD, and Total Strain DX800CP.]

**Graph highlights:**
- **Strain vs. Reversals** plot with ideal, hard, and soft lines.
- **Graph axes:**
  - Y-axis: Strain
  - X-axis: Reversals

**Key points:**
- Tested values indicate no guarantees for fatigue life.
- Materials performance varies with reversals and strain levels.
High cycle fatigue
Stress controlled

Tested values R=0, no guarantees
FLD

Tested values, no guarantees
Edge ductility
HER

\[ \text{HER} = \lambda = \frac{D_f - D_0}{D_0} \times 100 \]

HOLE EXPANSION
ISO 16630
HER

Varying cutting clearance  (Standard 12%)

Tested values, no guarantees
Punched vs Pre-piercing

Punched

Pre-pierced

Trimming cut $z$ [mm]

Cutting clearance

Blank holder

Test piece

Initial cut

$z$
HE Punched and pre-pierced

Varying cutting clearance in the second cut
Punched vs Pre-piercing

Punched

Pre-Pierced
Pre-piercing – Laser vs Punched

Second cut

4mm

Laser cut - Punched
Avg
Punched - Punched
Avg

Sample

HER [%]
Pre-piercing results is an effect of

1. smoother surface

2. less hardness along the outer edge

• Can be even more improved by laser cutting
Trimming cut size dependent
Burr dependent
Delayed HE
Delayed HE with pre-piercing
HCF-testing of punched edges

- 700LA
- 800CP
- 800CP PP

Cycles

Sample
Summary