Docol highlights – High-end steel grades for improved performance

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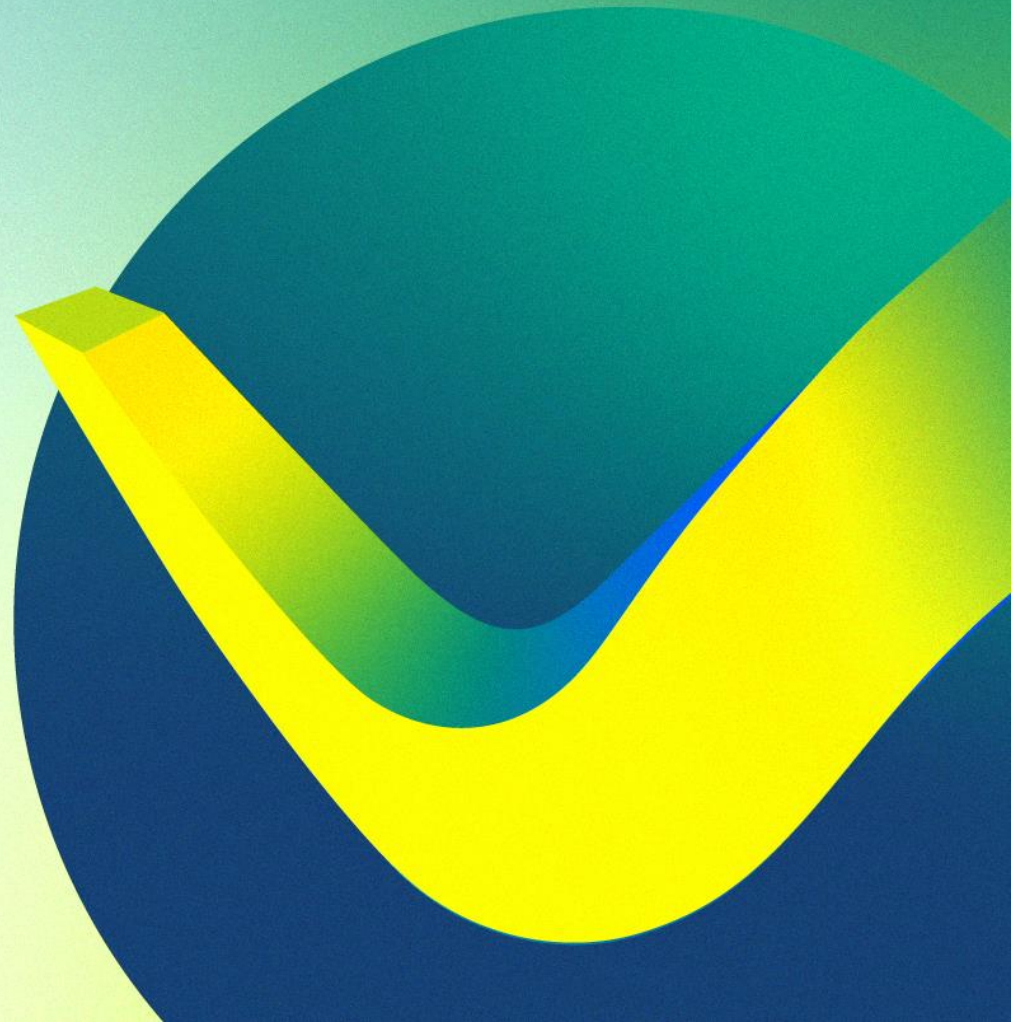

Martensitic steels

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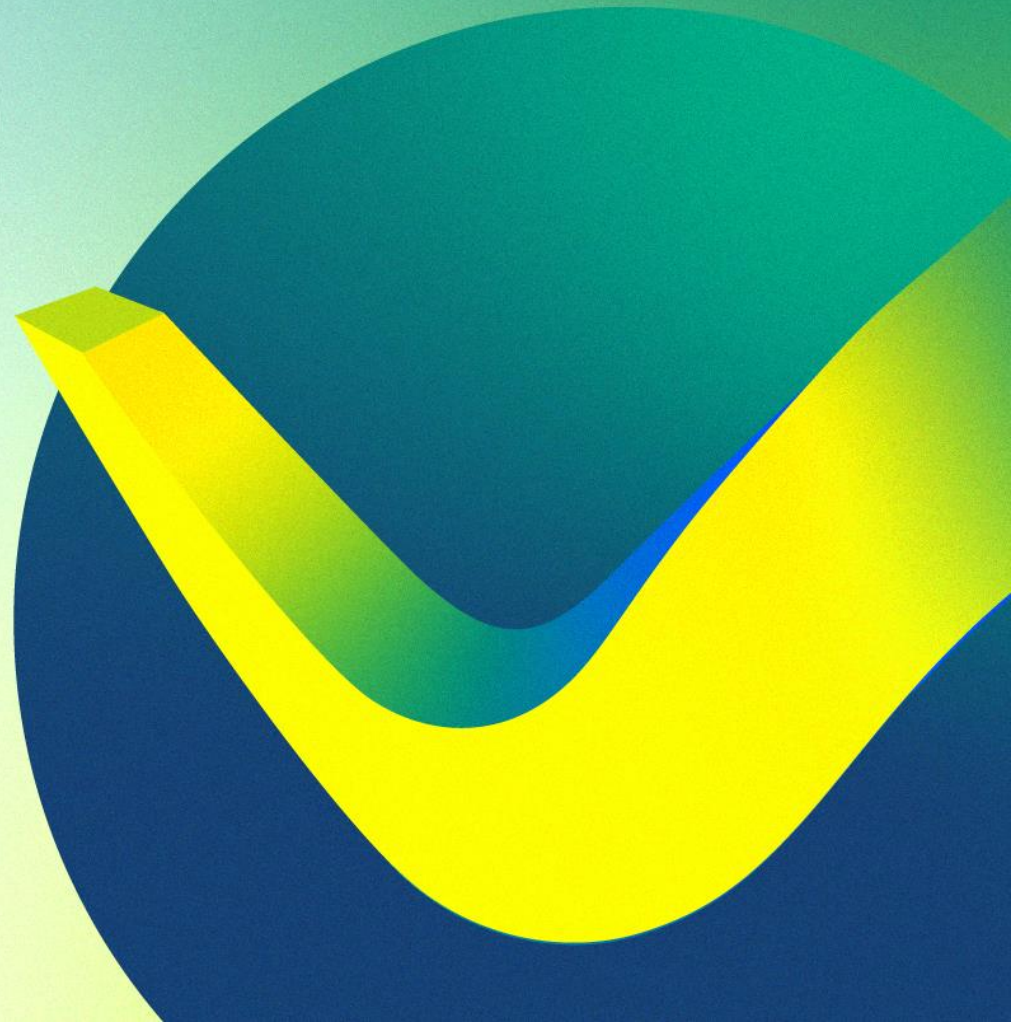


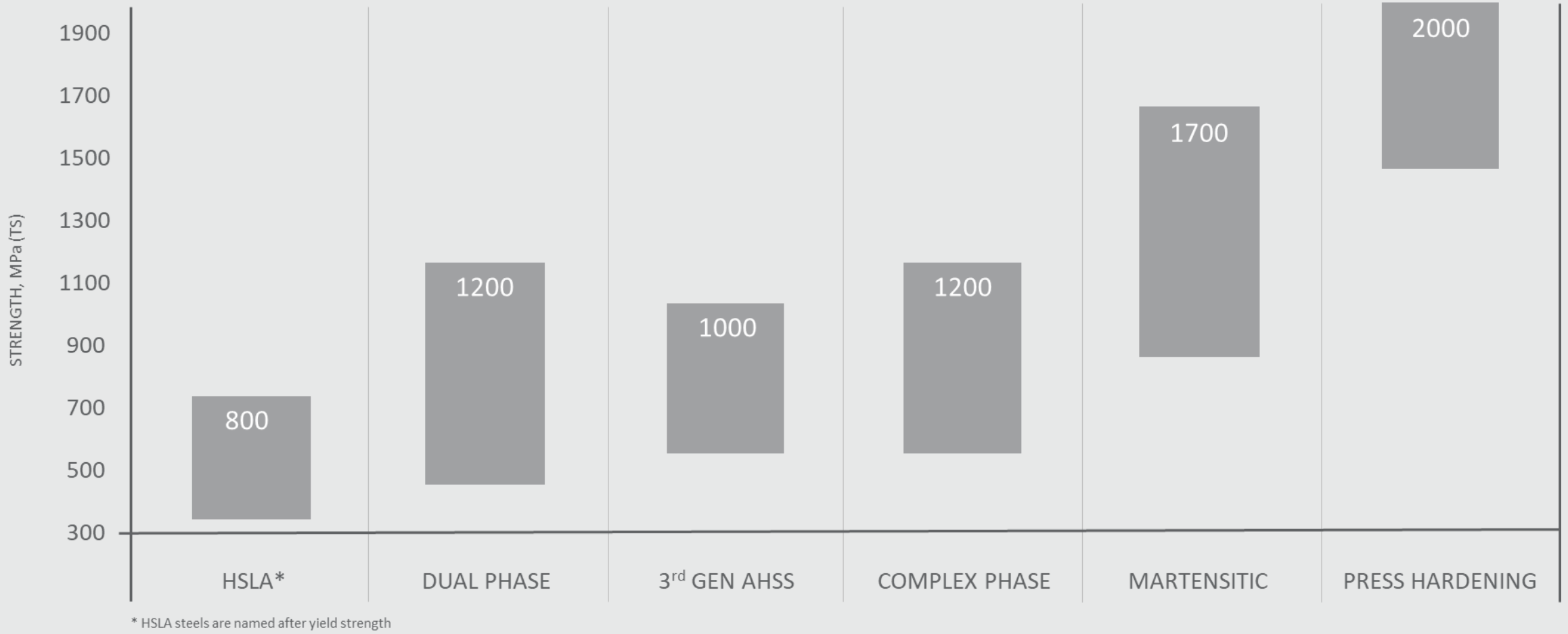
Agenda

SWEDISH
STEEL PRIZE

- Overview
- Forming technology
- Welding technology
  - Resistance spot welding
- H-embrittlement
  - SEP1970
- Applications
- Outlook

DOCOL product family

SWEDISH STEEL PRIZE



* HSLA steels are named after yield strength

CR1220Y1500T-MS

SWEDISH STEEL PRIZE

Standard	Coating	Test direction	Yield strength $R_{p0.2}$ [MPa]	Tensile strength R_m [MPa]	Elongation A_{80} [%]	Bake hardening BH_2 [MPa]	Min. inner bending radius for 90°
VDA 239-100: 2016	UC, EG	L	1220 – 1520	1500 – 1750	3	30	4.0 x t

Cold rolled, uncoated:

thickness: 0.5 mm … 2.1 mm

width: up to 1500 mm

Cold rolled, electrogalvanized:

thickness: 0.8 mm … 2.0 mm

width: up to 1300 mm

Application example: bumper

CR1350Y1700T-MS

SWEDISH STEEL PRIZE

Standard	Coating	Test direction	Yield strength $R_{p0.2}$ [MPa]	Tensile strength R_m [MPa]	Elongation A_{80} [%]	Bake hardening BH_2 [MPa]	Min. inner bending radius for 90°
VDA 239-100: 2016	UC	L	1350 – 1700	1700 – 2000	3	30	4.0 x t

Cold rolled, uncoated:

thickness: 1.0 mm … 2.1 mm

width: up to 1250 mm

Cold rolled, electrogalvanized:

available on request

Application example: roof rail

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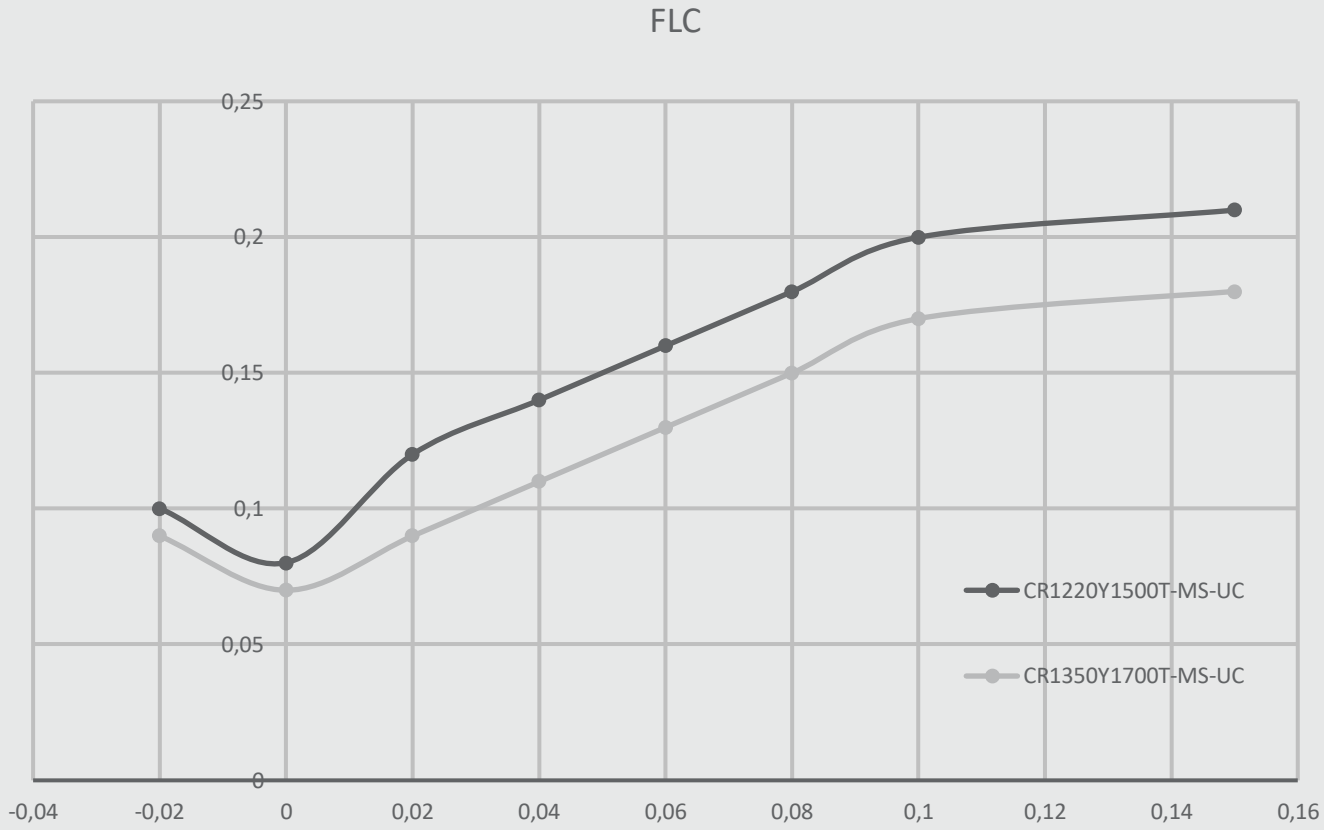
SWEDISH
STEEL PRIZE

CR1220Y1500T-MS-EG - forming technology

SWEDISH STEEL PRIZE

Improving cold forming capability:

- deep drawing ratio: 2.0
- hole expansion ratio: typically 40% (tested as a guarantied value for HR-chassis-grades)
- bending guaranteed: 4.0*t
- roll forming guaranteed: 3.5*t
- material cards available GISSMO, CrachFEM, …

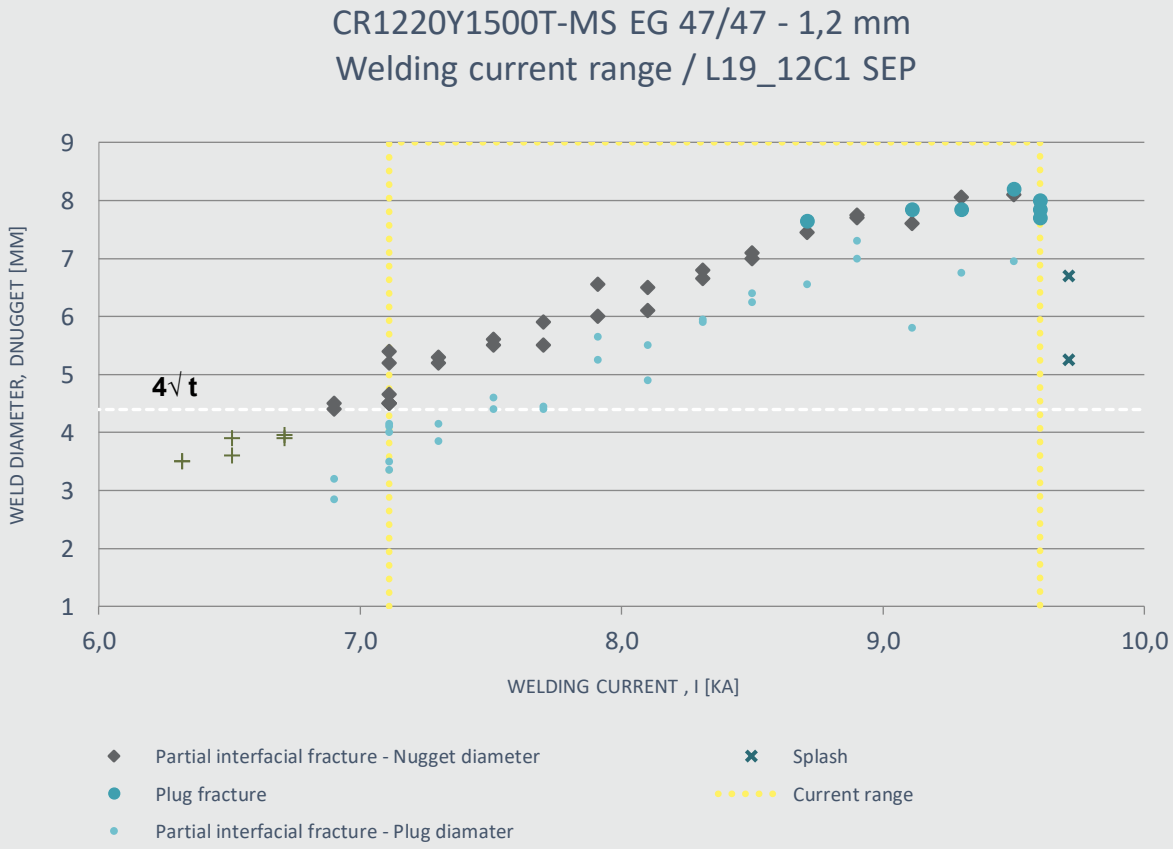


CR1220Y1500T-MS-EG - resistance spot welding

SWEDISH STEEL PRIZE

Spot welding according SEP1220-2:

- Imin: 7.1 kA
- Imax: 9.6 kA
- Welding range: 2.5 kA
- Partial interfacial fracture (>70% plug)
- Lap shear strength: 13.0 kN (Imin)
- Cross tension strength: 4.3 kN (Imin)



Welding current range according to SEP1220-2

CR1220Y1500T-MS-EG - resistance spot welding

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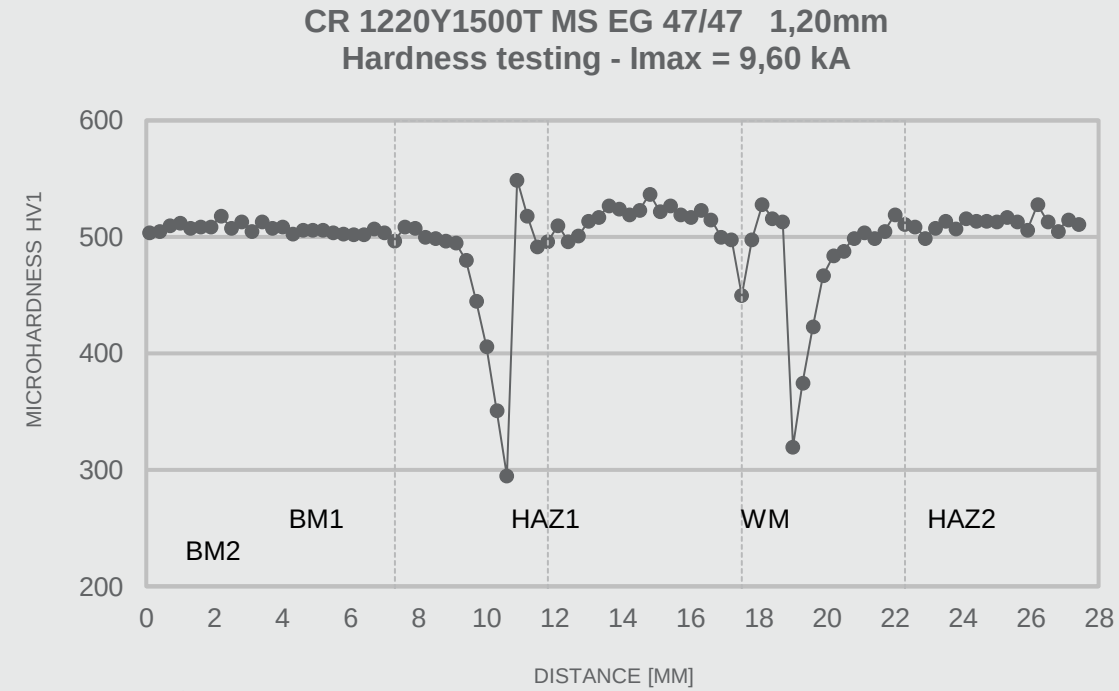
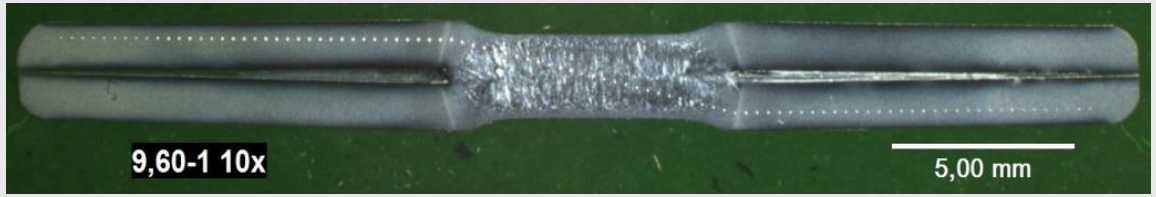
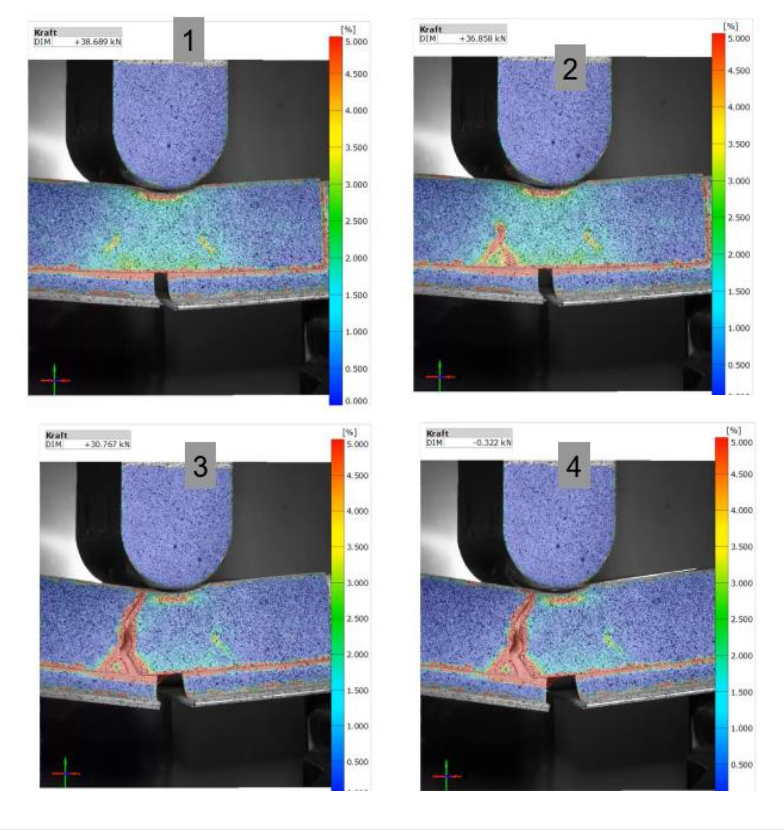


Hardness profile, Imax

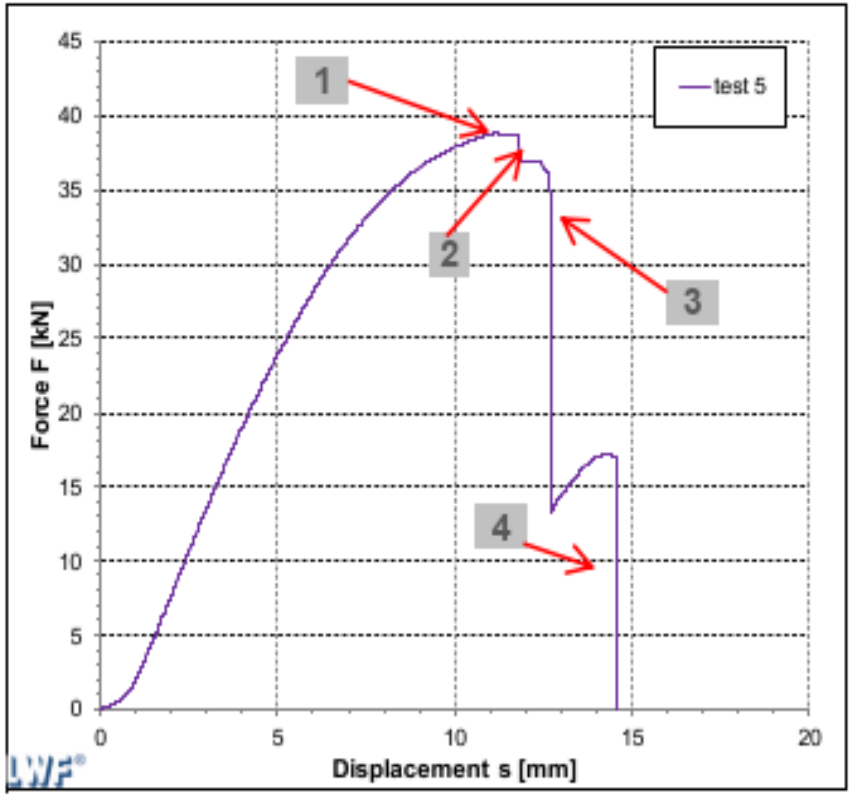


CR1220Y1500T-MS-EG - resistance spot welding

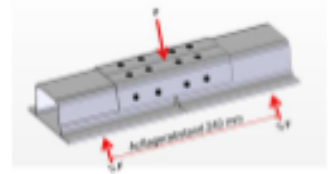
SWEDISH STEEL PRIZE



Evaluating the weakening of the heat affected zone



Testing method
Free 3-point-bending
Test speed
10 mm/min
Material
Docol1700M+ZE; t= 1.4 mm
Joining technology
Resistance Spot Welding
Deformation measurement
Cross head displacement
Test temperature
Room temperarure
Specimen geometry
Double hat profile



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STEEL PRIZE

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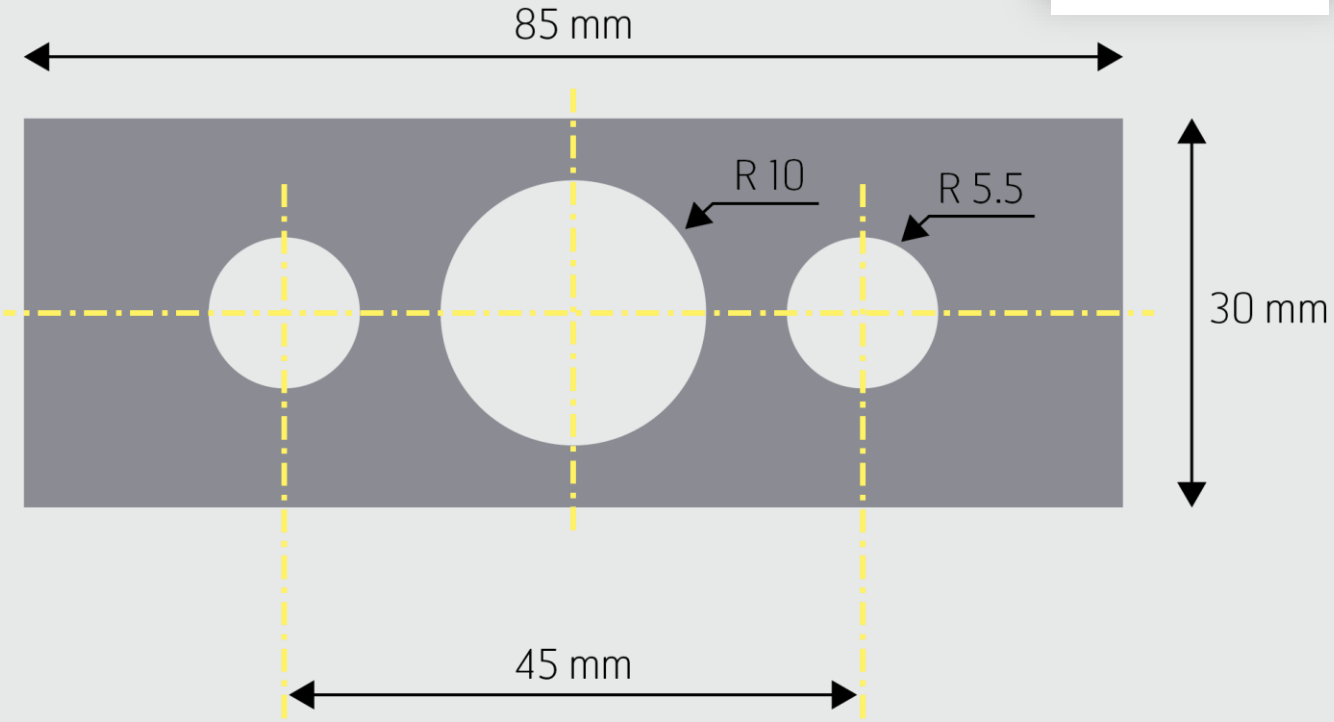
CR1220Y1500T-MS - H-embrittlement

SWEDISH STEEL PRIZE

SEP1970:

- loaded with Rp0.2
- testing 96 h, in air
- no H-sensitivity for CR1500M and CR1700M (EG, UC)



Specimen SEP1970

CR1220Y1500T-MS - H-embrittlement

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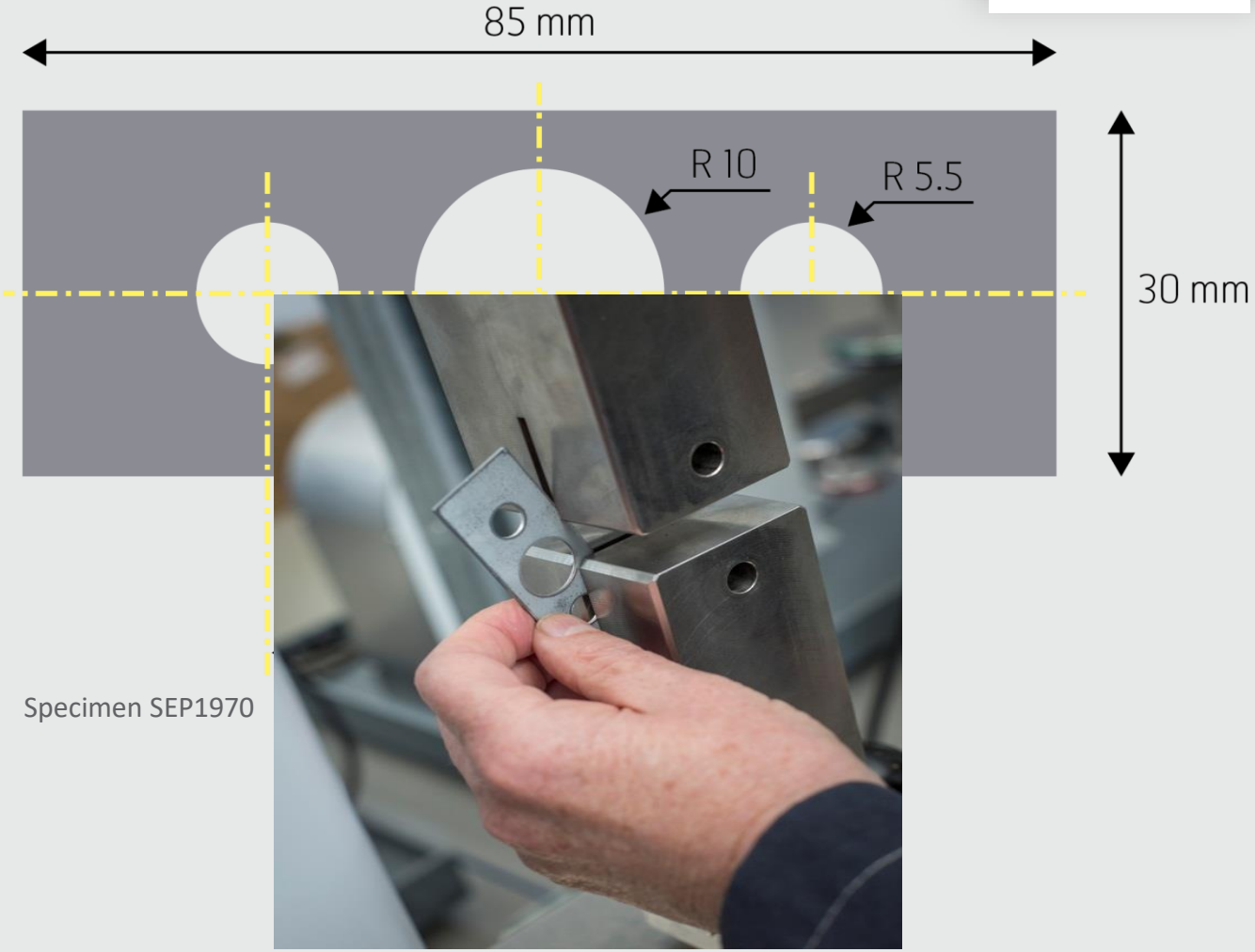


Specimen SEP1970

CR1350Y1700T-MS - H-embrittlement

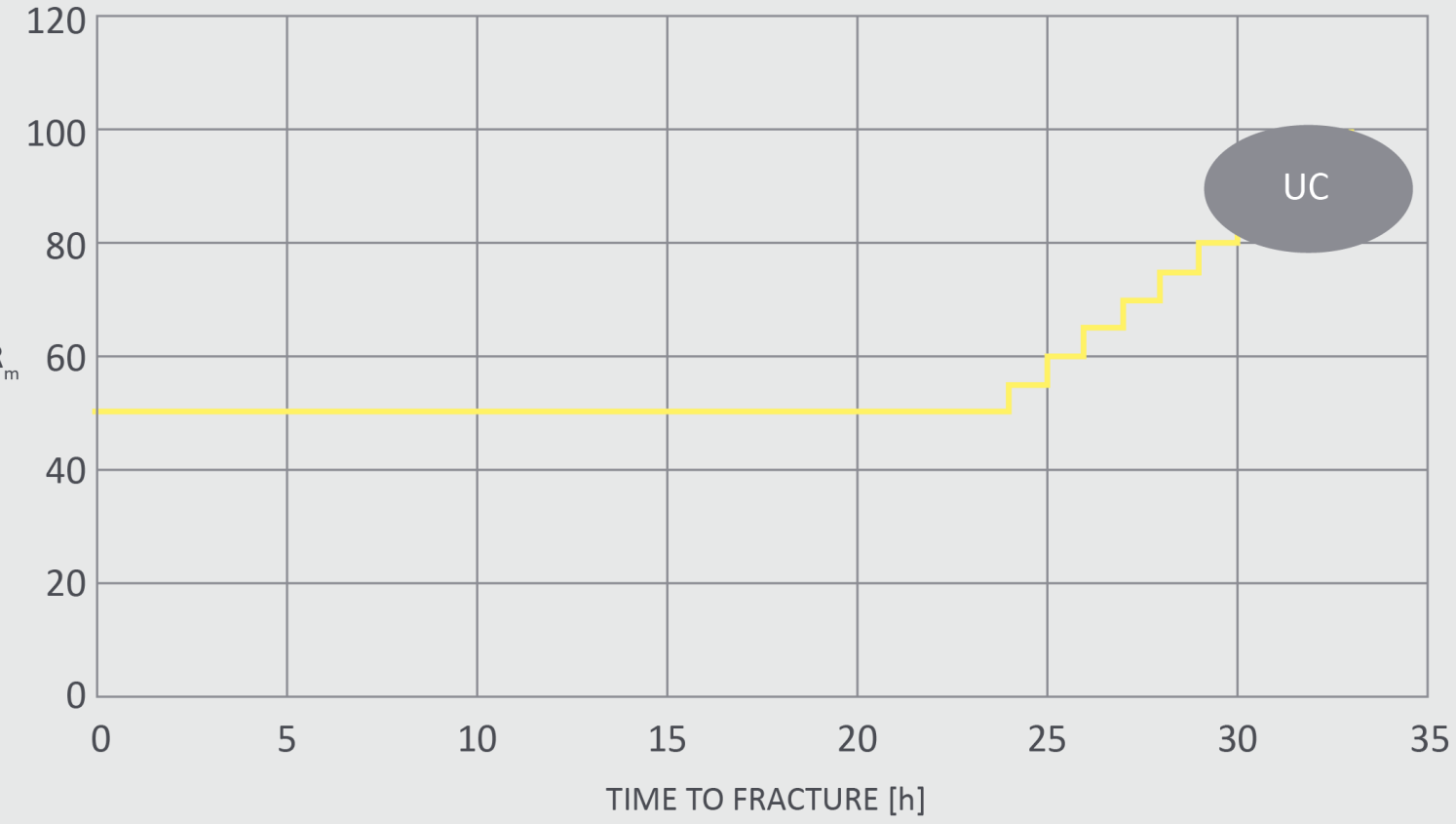
SWEDISH STEEL PRIZE

SEP1970:

- loaded with Rp0.2
- testing 96 h, in air
- no H-sensitivity for CR1500M and CR1700M (EG, UC)

VDA238-201:

- 80…100% FmK for UC



CR1350Y1700T-MS - H-embrittlement

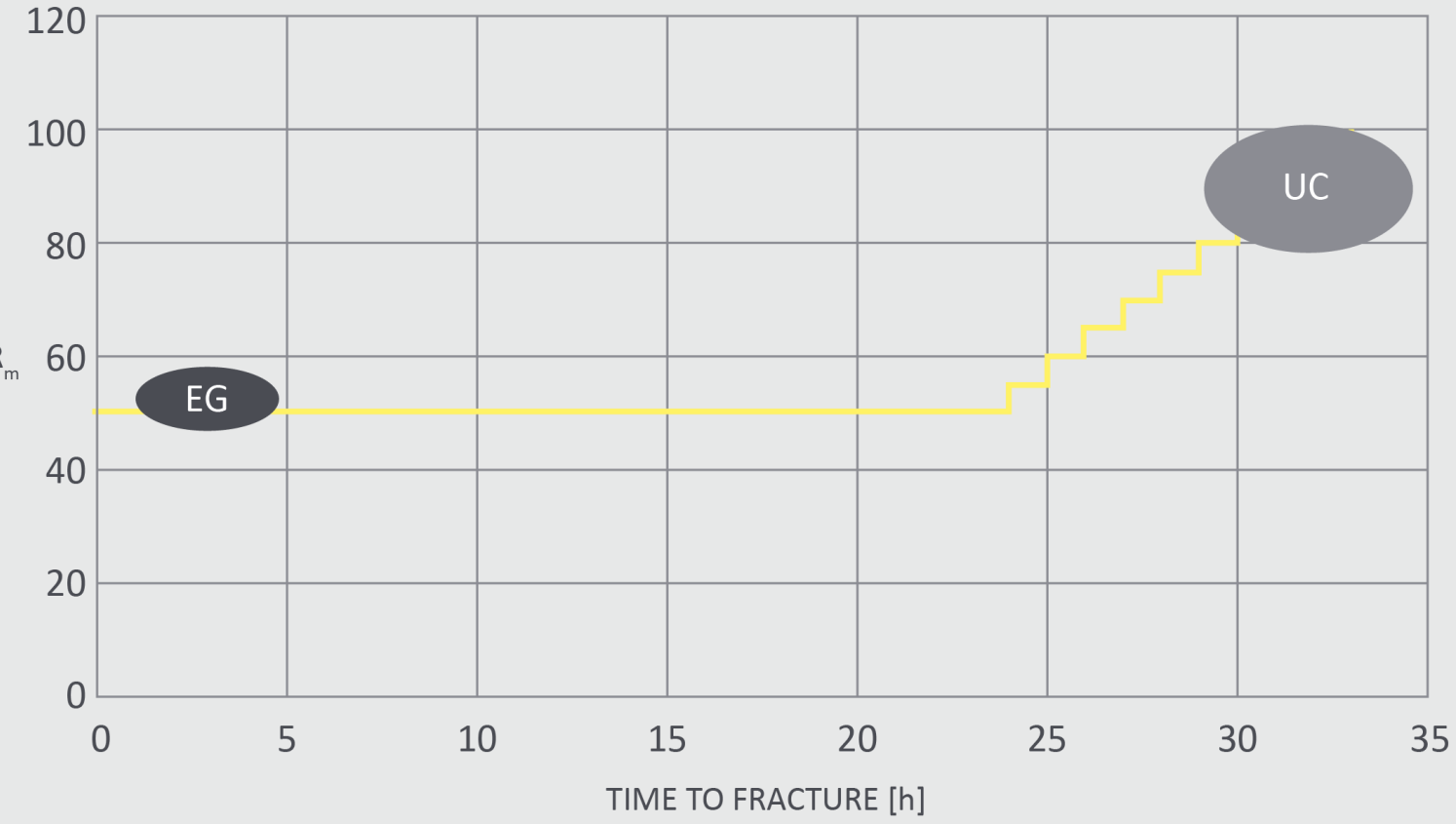
SWEDISH STEEL PRIZE

SEP1970:

- loaded with Rp0.2
- testing 96 h, in air
- no H-sensitivity for CR1500M and CR1700M (EG, UC)

VDA238-201:

- 80…100% FmK for UC
- 50% FmK <5h for EG



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SWEDISH
STEEL PRIZE

Body components - rocker panel

SWEDISH STEEL PRIZE

CR1150Y1400T-MS-EG

- introduced over a decade ago (e.g. Ford Focus)
- widely used within the automotive industry
- roll formed
- in line cutting and forming
- low weight
- cost- and energy efficiency

Let’s discuss together if a CR1350Y1700T-MS-EG can be used in that environment

Body components – side impact beam

SWEDISH STEEL PRIZE

CR1150Y1400T-MS-EG

- tested in a serial tool designed for CR950Y1200T-MS-EG
- cold formed instead of hot stamped or aluminum
- conventional stamping process = no need for press hardening investment
- also feasible with CR1220Y1500T-MS-EG

Body components – side impact beam

KIRCHHOFF AUTOMOTIVE

SWEDISH STEEL PRIZE

CR1220Y1500T-MS-EG and **CR1350Y1700T-MS-EG**

- cold formed prototypes

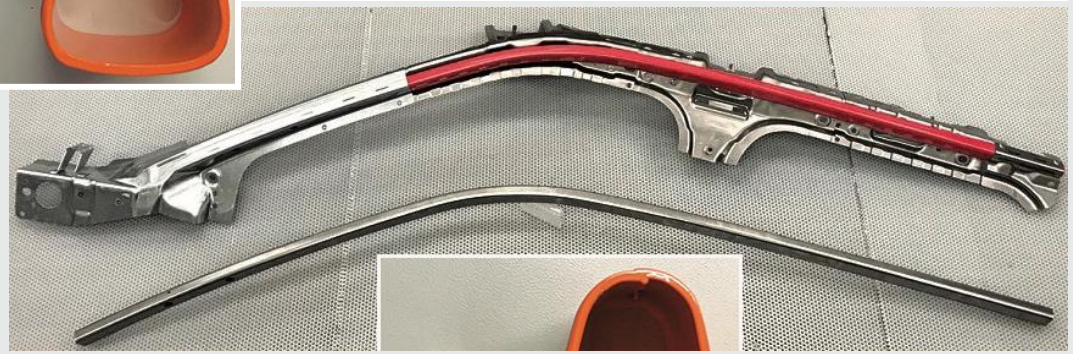
CR1220Y1500T-MS-EG

CR1350Y1700T-MS-EG

Body components – roof rail

CR1350Y1700T-MS-UC

- low weight combined with cost- and energy efficiency cold forming process
- improved visibility for the driver
- roll-forming and 3D-bending process
- in automotive serial production
  - Ford Explorer
  - Escape
  - …



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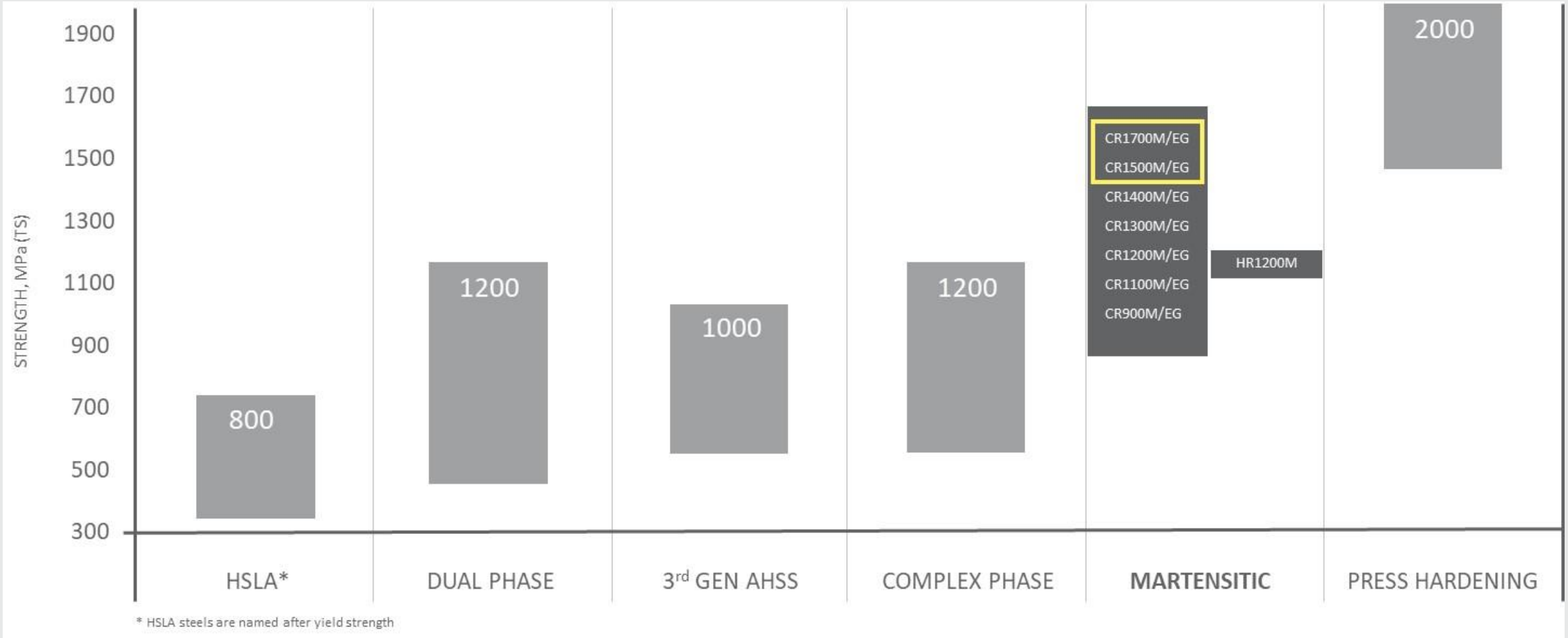
SWEDISH
STEEL PRIZE

DOCOL product family is further expanding

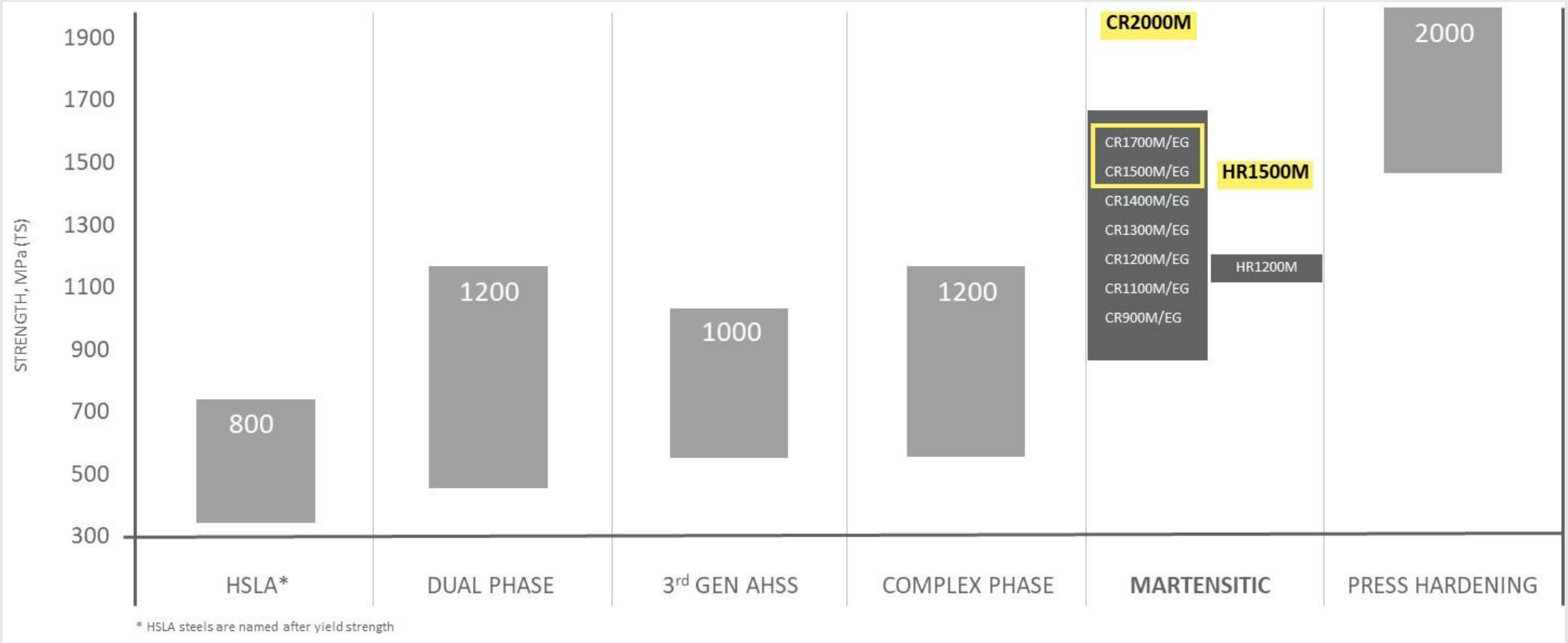
SWEDISH STEEL PRIZE



* HSLA steels are named after yield strength

DOCOL product family is further expanding

SWEDISH STEEL PRIZE



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High edge ductility and complex phase steels for chassis applications

Kenneth Olsson

Senior Business Development Specialist

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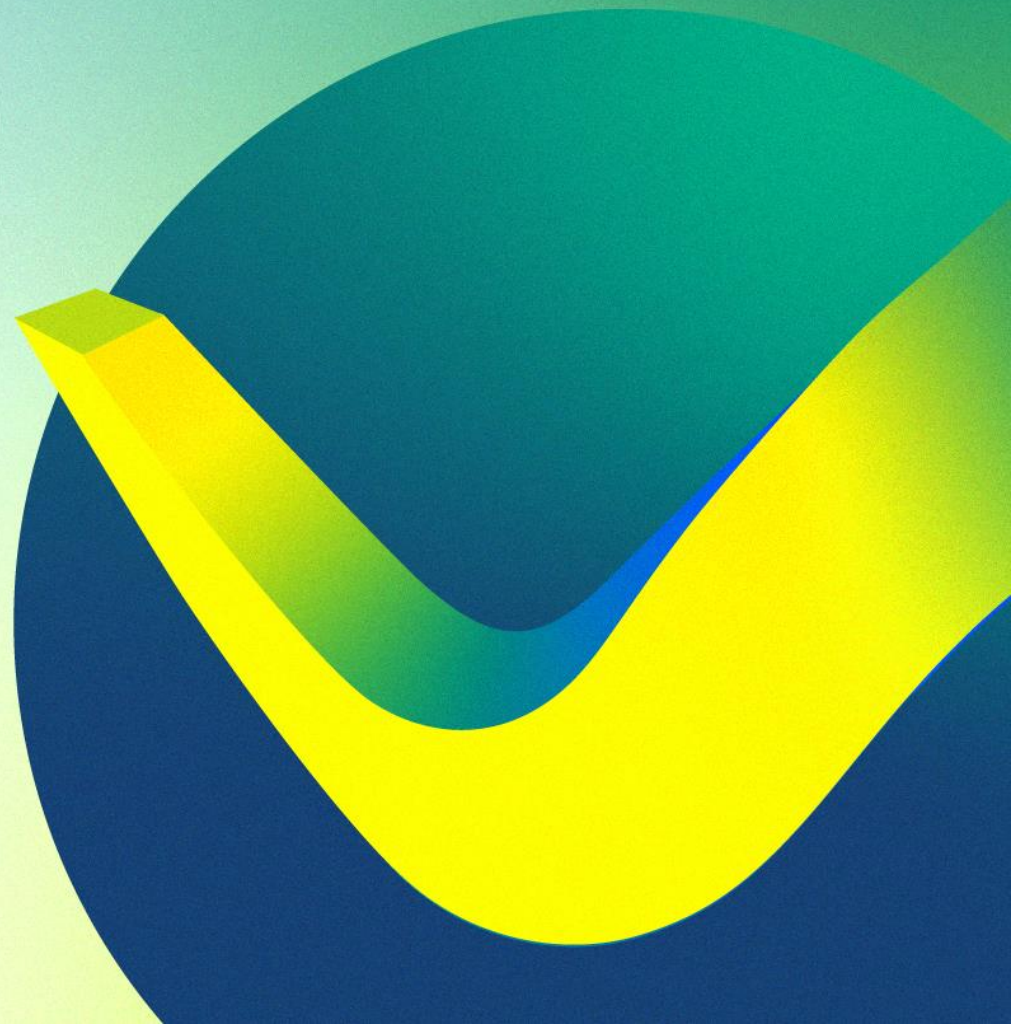

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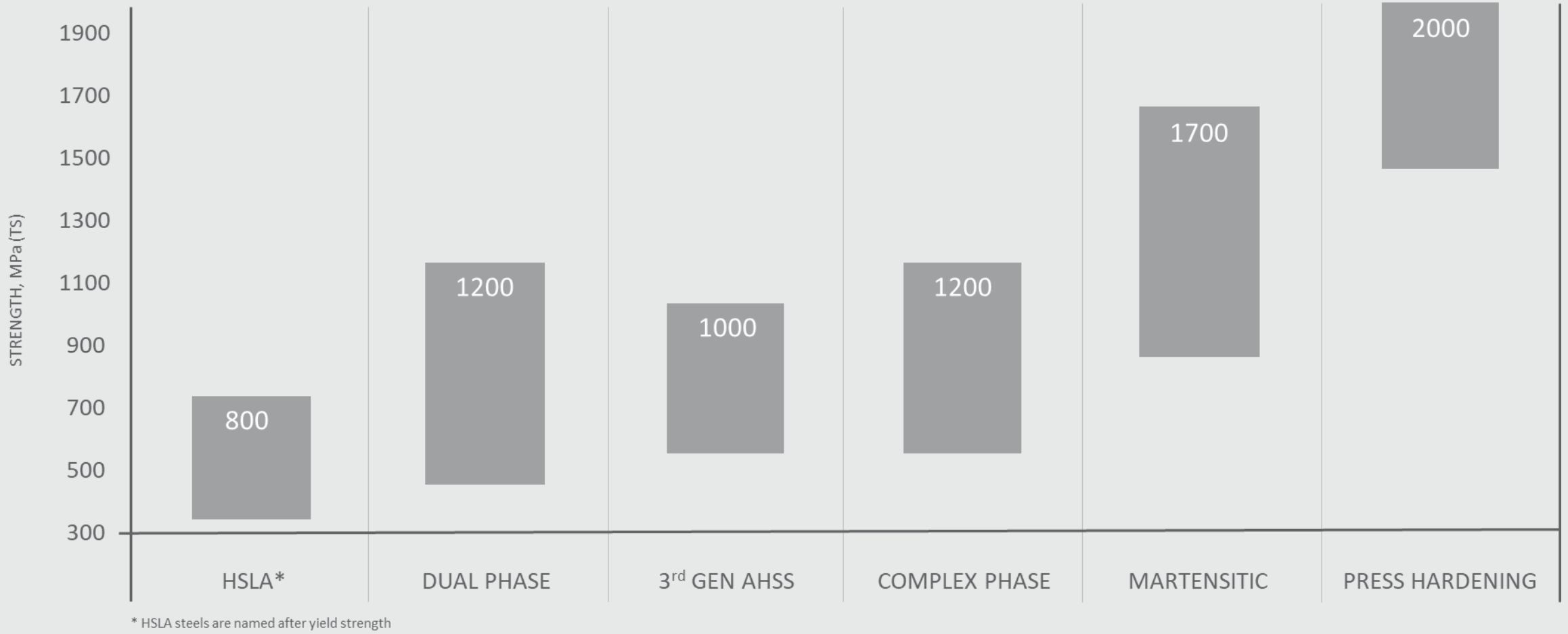
SWEDISH
STEEL PRIZE

DOCOL product family

SWEDISH STEEL PRIZE



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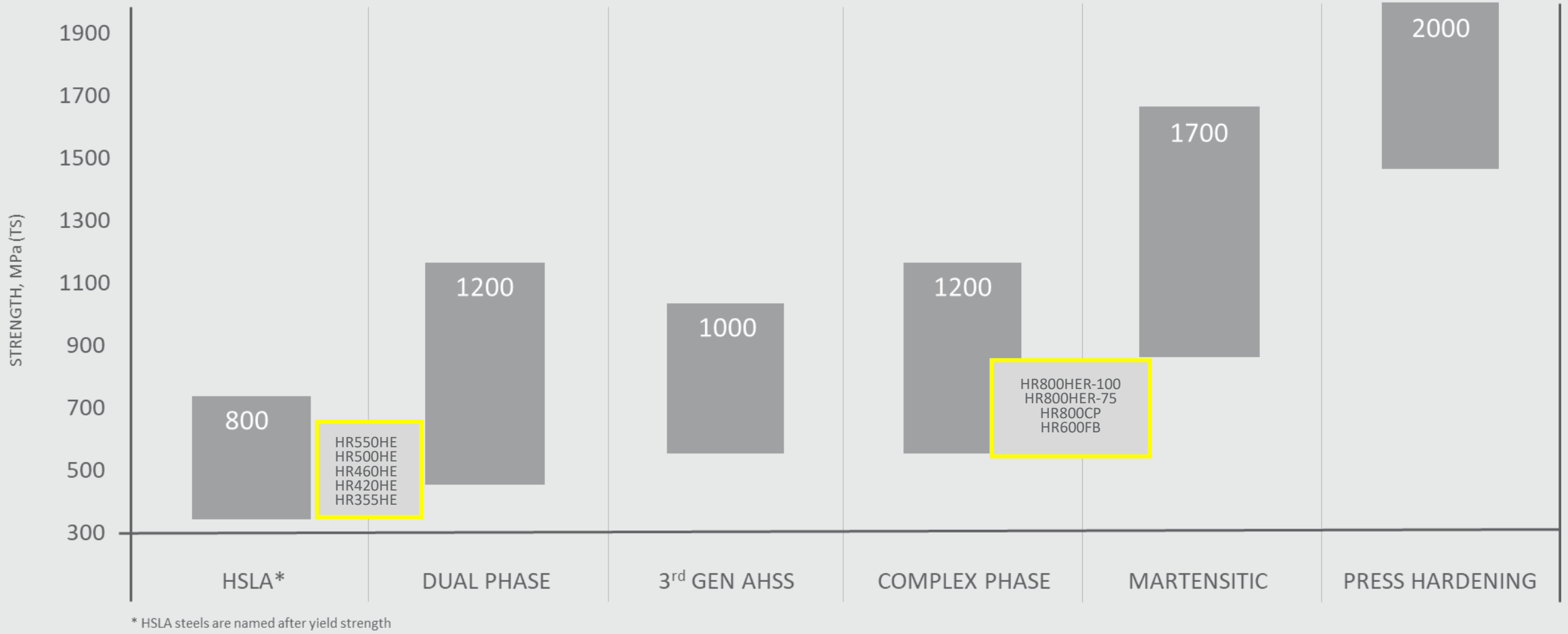
DOCOL product family

SWEDISH STEEL PRIZE



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SWEDISH
STEEL PRIZE

Docol HR HE vs standard HSLA

SWEDISH
STEEL PRIZE

IMPROVED CUT EDGE QUALITY

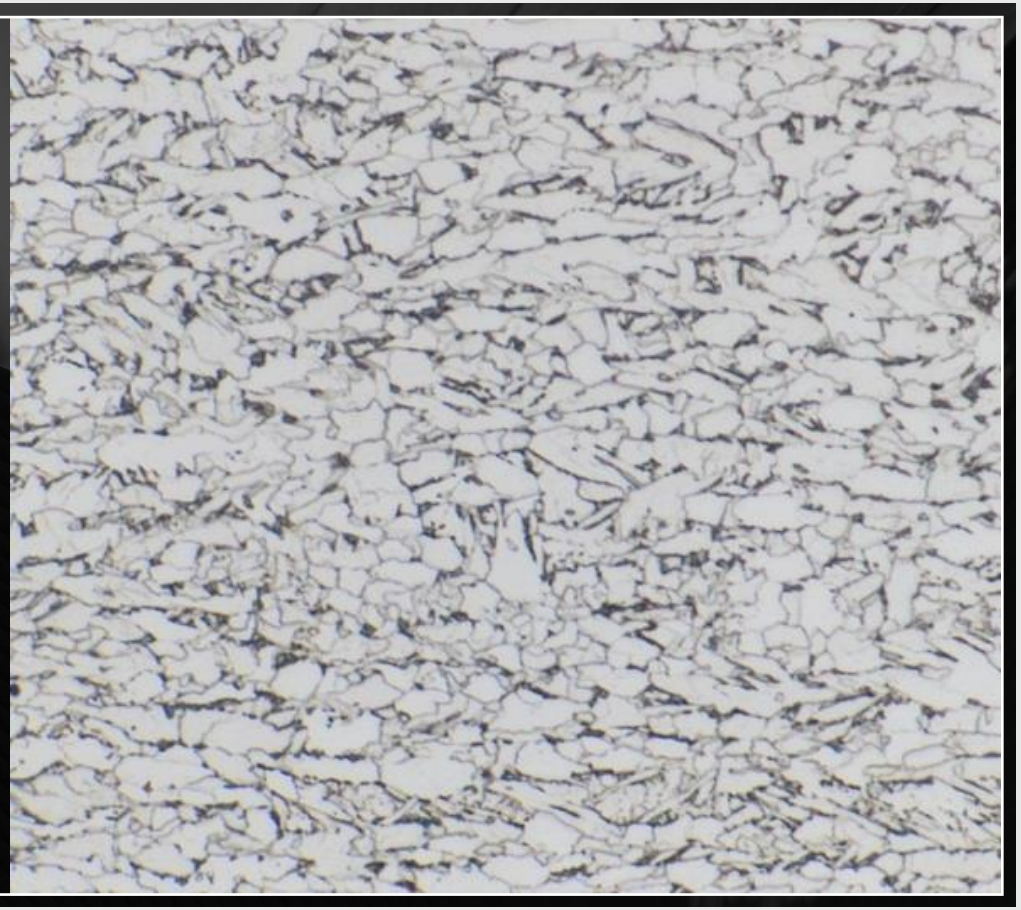
IMPROVED EDGE DUCTILITY

IMPROVED HOLE EXPANSION

IMPROVED BENDABILITY

IMPROVED LOCAL FORMABILITY

LESS SENSITIVE TOOL SETTINGS AND TOOL WEAR



Docol HR HE -Takes your production one step ahead

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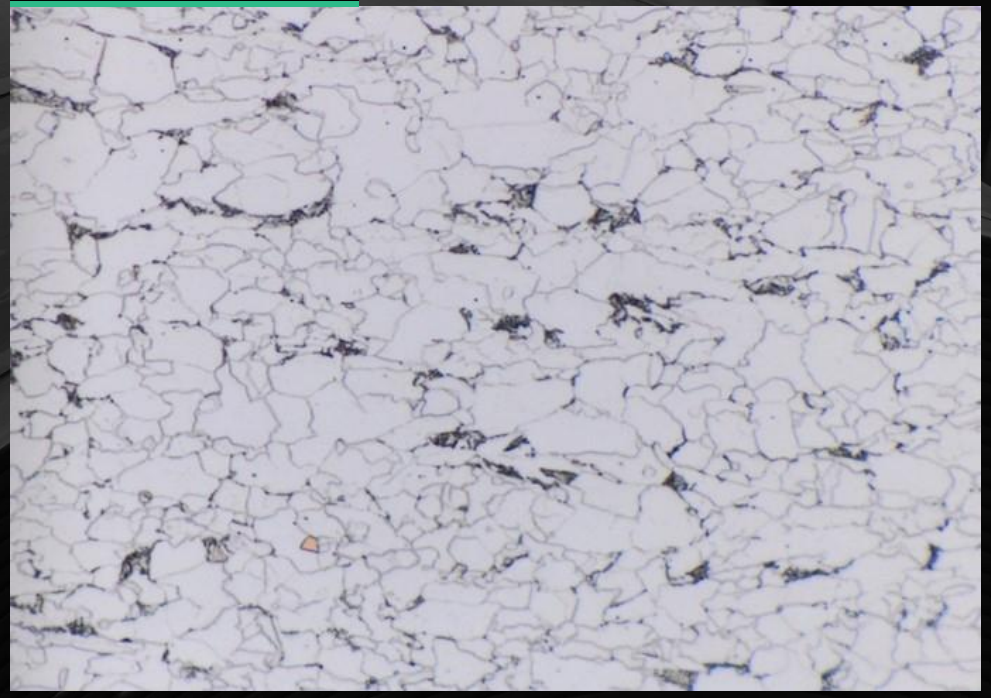
STEEL PRIZE

TODAY



Standard MC or LA grades
Current EN or VDA standard

TOMORROW

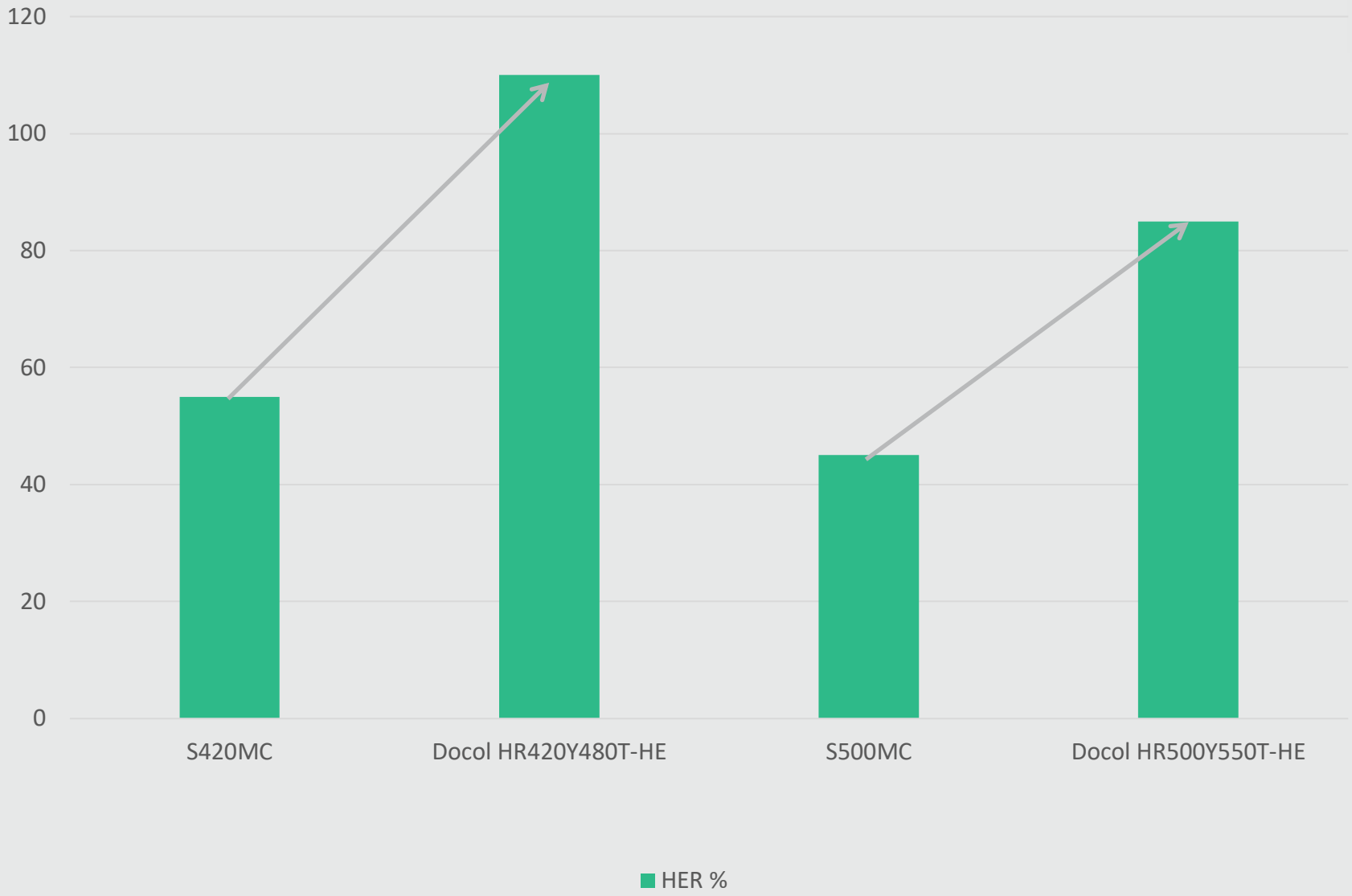
BETTER CONSISTENCY

BETTER FORMABILITY

BETTER DUCTILITY

Docol HR HE grades
IMPROVED EN or VDA standard with double certification

Improved HER %



SWEDISH
STEEL PRIZE

New Docol® 800 MPa grades with improved HER properties

SWEDISH STEEL PRIZE

- Docol HR product portfolio is expanded with new and improved grades on the 800 MPa strength level
- Docol HR800HER-75 is an improved complex phase grade with the option to add a guarantee of minimum hole expansion ratio
- Docol HR800HER-100 is an addition to the family of high edge ductility grades available with a very high minimum hole expansion

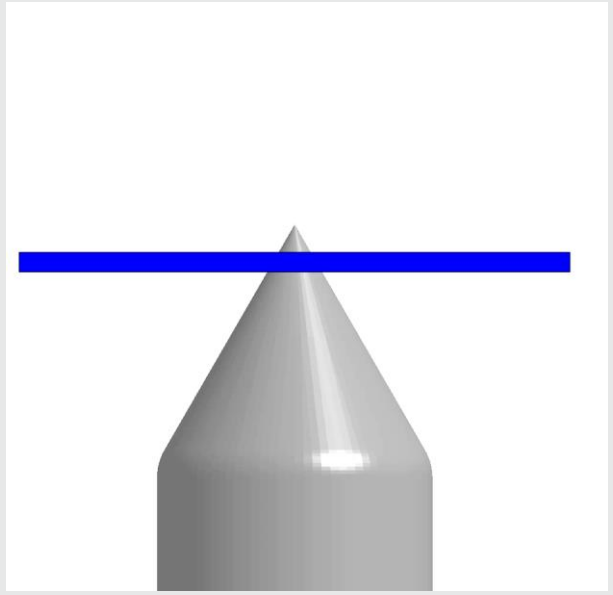
Docol HR800CP

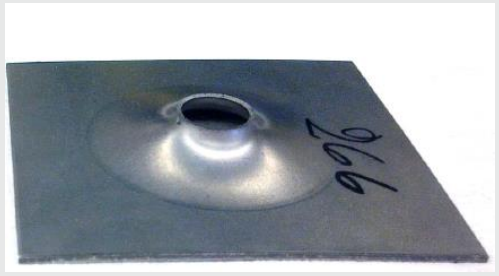
Docol HR800HER-75

Docol HR800HER-100

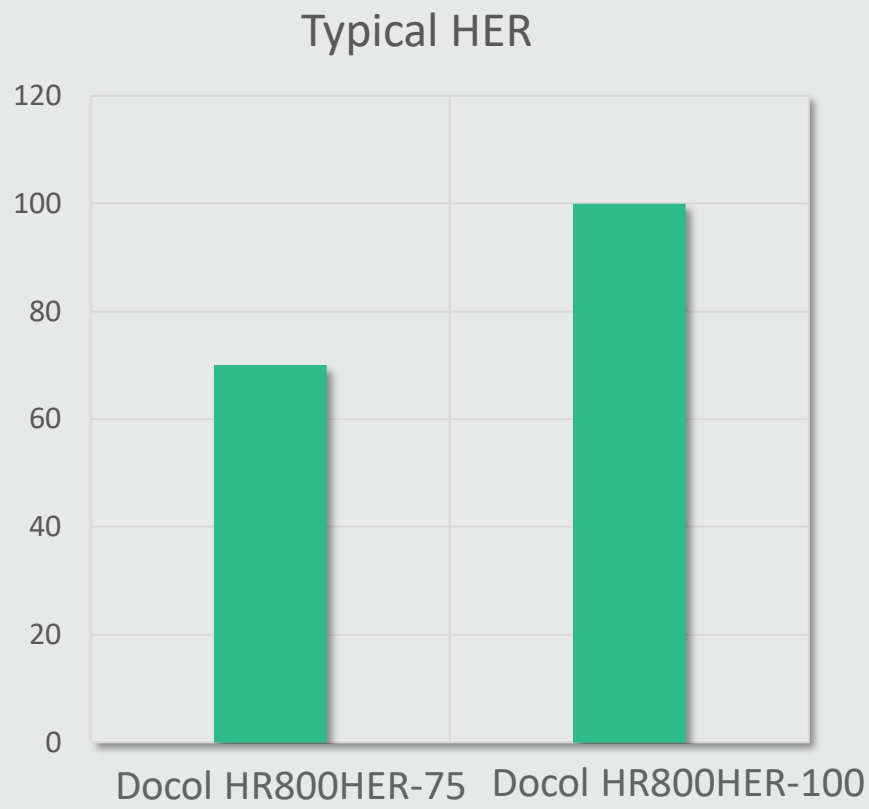
ISO 16630 Hole expansion test

- Docol HR800HER-75
- Docol HR800HER-100





2,0 mm ≤ t
Cutting clearance 12 % +/- 1 %



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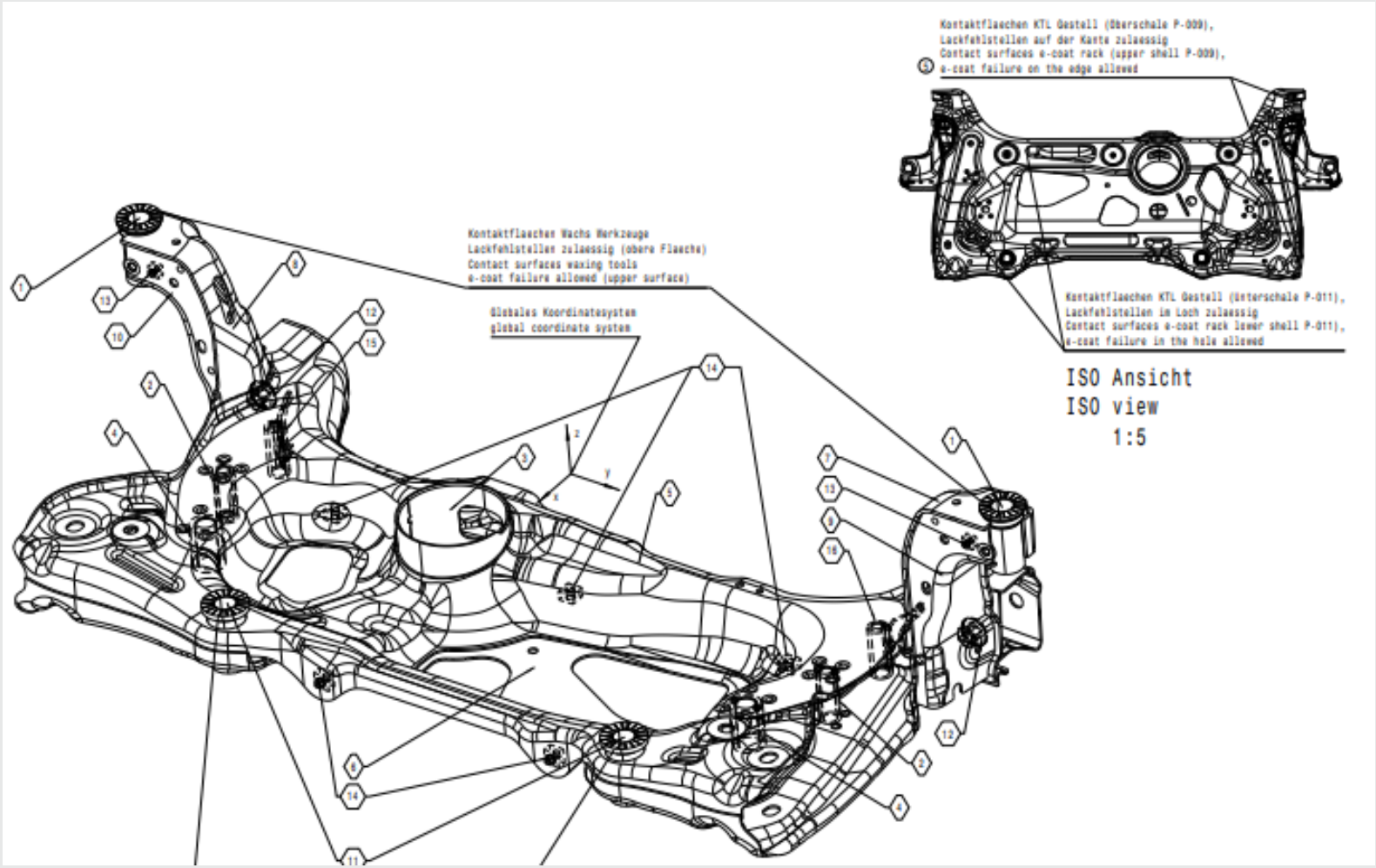
SWEDISH
STEEL PRIZE

Sub frame – Docol HR440Y580T-FB

SWEDISH
STEEL PRIZE



Complex geometry

Problem solving with Docol HR500Y550T HE

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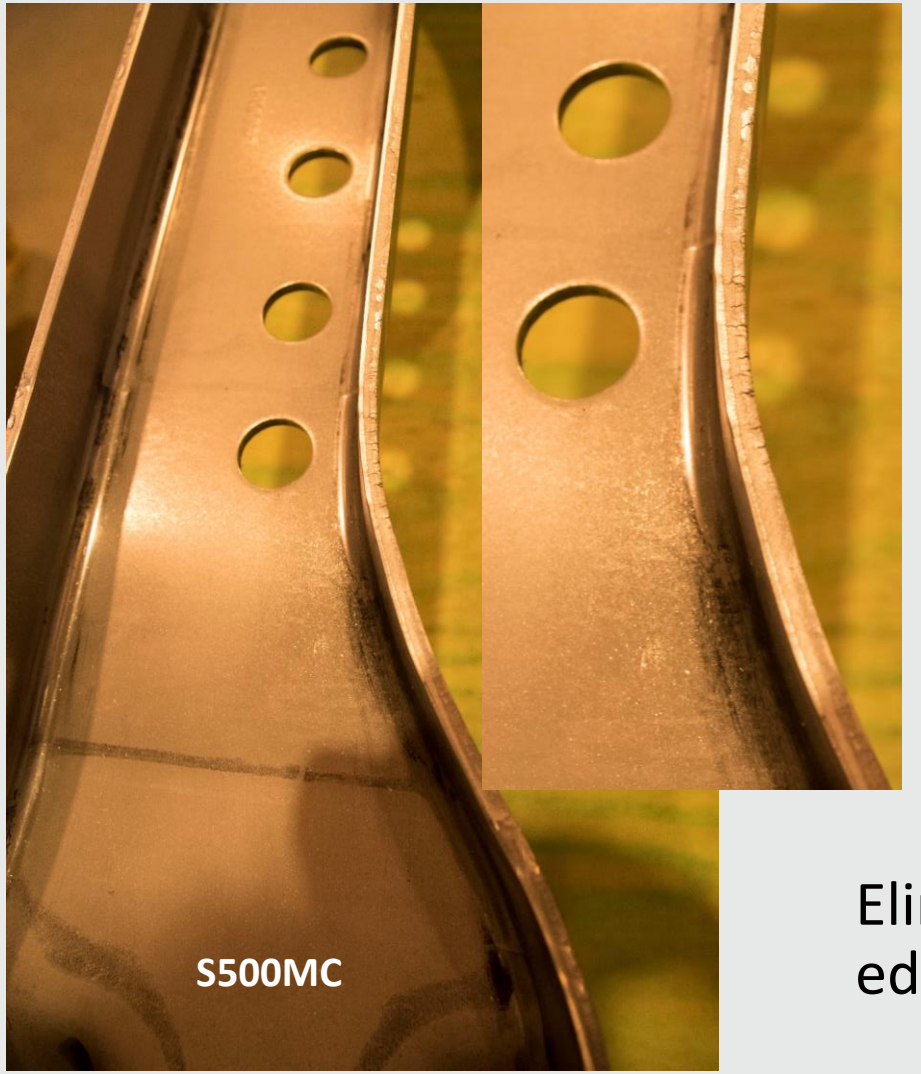
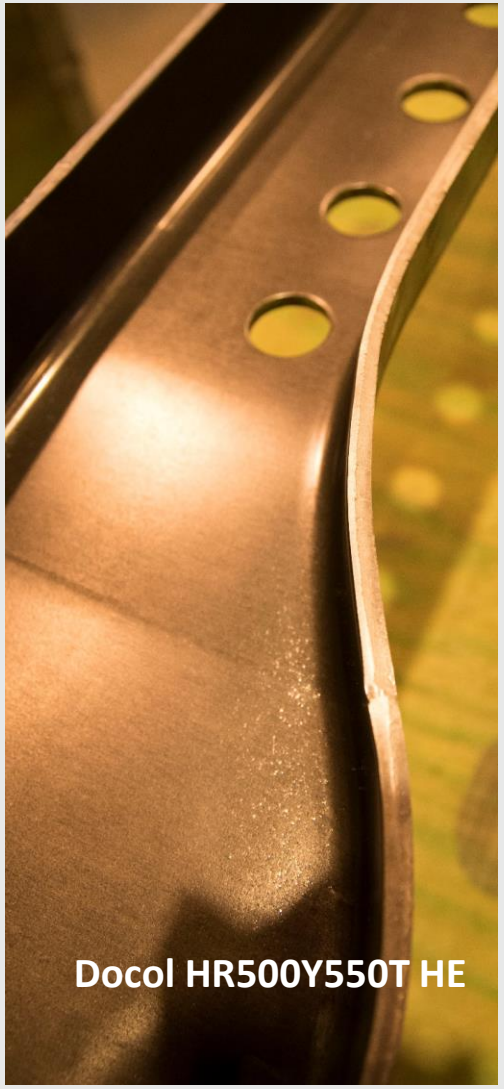
STEEL PRIZE



Elimination of edge cracks



Frame rails – Docol HR800HER-75

SWEDISH
STEEL PRIZE

Reduced weight with increased strength

Front lower control arm – Docol HR800Y950T-CP

SWEDISH
STEEL PRIZE

Docol HR800Y950T-CP:

- In serial application
- Available thicknesses on request:
  2,0 mm … 3,2 mm
- Also available as EG coated

Front Lower control arm 2,9 mm

Swedish Steel Price finalist 2023

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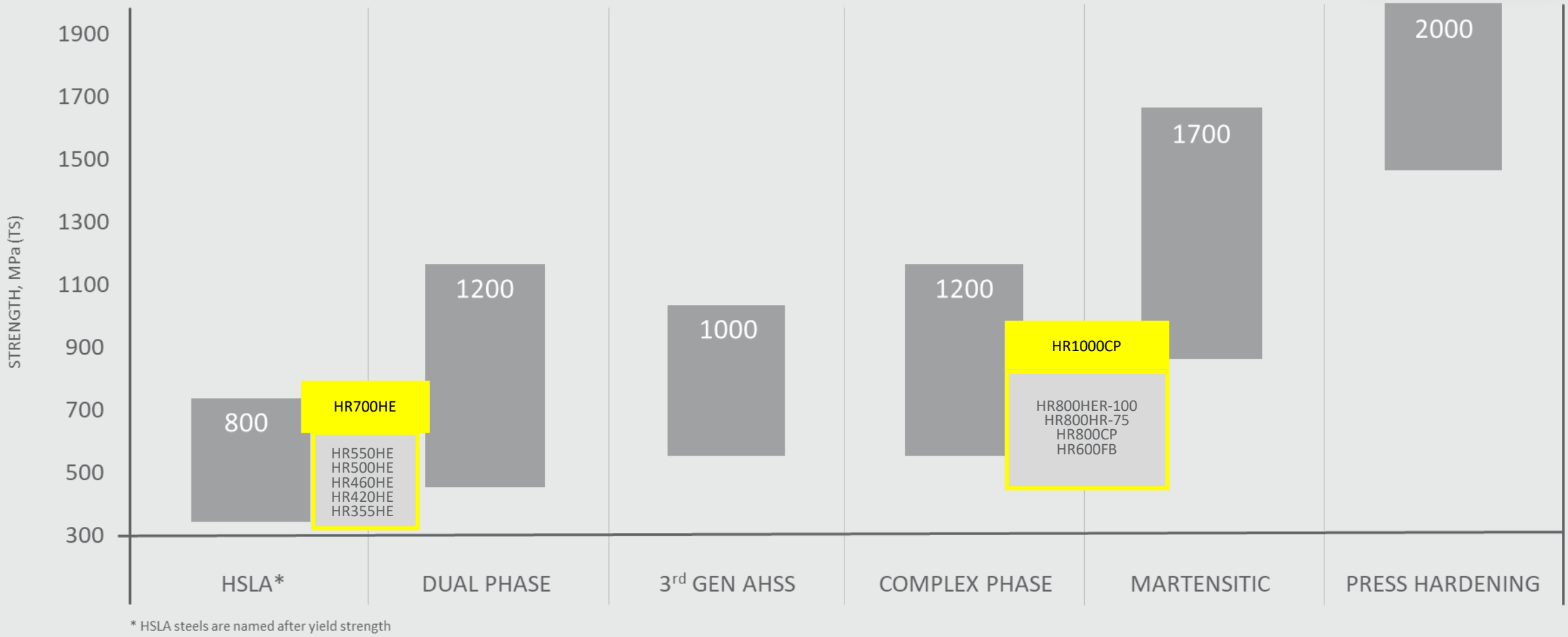

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Q&A

THANK YOU!

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