



Bainidur 1300

The special steel for distortion-free
and cost-efficient forgings

Conventional steels in the automotive industry

The distortion of steel components is a well-known phenomenon in the drop forging industry and is mainly caused by non-uniform distribution of residual stresses in the material.

Forged automotive components, such as e.g. steering knuckle, pistons and common rail systems, are often affected by distortion.

Over-dimensioning is a proven remedy to meet the standards of the automotive industry and to compensate the distortion. After a final heat treatment the excess material will be removed.

As a consequence the production time will extend and production costs increase.



Alternatively, precipitation hardened ferritic-pearlitic (AFP) steels are used to overcome distortion since they exhibit considerably less distortion after forging. A major drawback is the lower toughness and strength as well as the low nitridability.

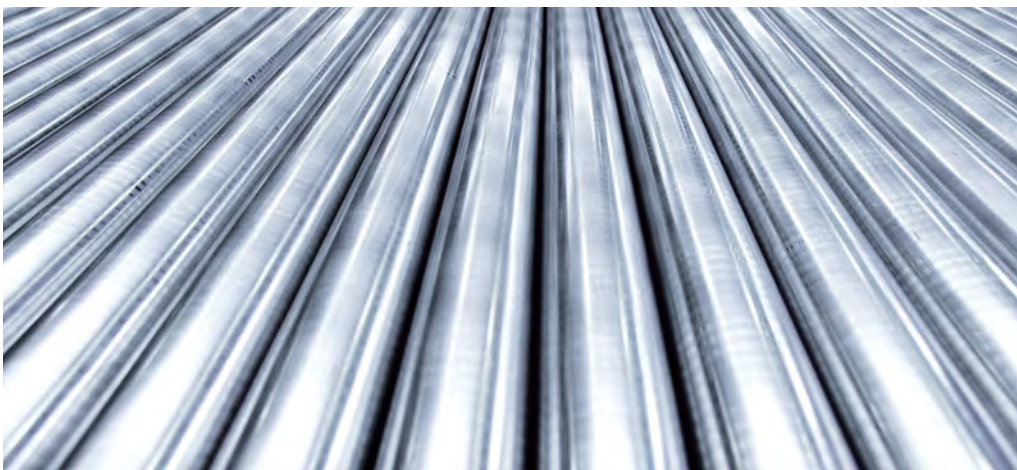
As a result, AFP steels are only limited usable for the production of high-performance light-weight components in the automotive industry. A low toughness also negatively affects the use at sub-zero temperatures. The lower the temperature, the brittle the material becomes – at worst causing component failures.

To shorten the process chain and reduce costs, high-strength bainitic steels become an increasingly popular solution for massive forming.

Bainitic steels achieve an extremely high strength, without additional heat treatment. However, adjusting the correct bainitic microstructure requires a high level of technological sensitivity, especially in case of large-format and complex components.

The limits for the cooling rate to adjust a homogeneous microstructure are very tight – especially after drop forging. Exceeding the tight limits will form a mixed microstructure with degraded properties and unevenly distributed residual stresses. This directly leads to a distortion at the component. Accordingly, avoiding expensive post-treatments and ensuring process stability, reproducibility and consistent quality is very challenging for the drop forging industry if processing bainitic steels. In addition, conventional bainitic steels are only nitridable with a loss of strength and restrictions for the use of machining.

Deutsche Edelstahlwerke has coped with this challenges by developing a new bainitic steel – Bainidur 1300.



Bainidur 1300 for distortion-free and cost-efficient forgings

Bainidur 1300 allows distortion-free and cost-efficient forgings.

By adding selected alloys, such as molybdenum, the new special steel Bainidur 1300 has an expanded Bainit range compared to conventional bainitic steels. As a result, the limits for the cooling rate to adjust a homogeneous microstructure during drop forging becomes significantly larger. After forging the workpiece can be cooled like conventional forgings in an unregulated way without the risk of distortion.

On top of this, Bainidur 1300 breaks the rule that applies to all conventional bainitic steels: the larger the forging, the more difficult the controlled cooling process and the adjustment of the bainitic microstructure is.

Bainidur 1300 allows a process-reliable adjustment of the bainitic microstructure even for large components (> 60 mm rd.) with consistently high quality.

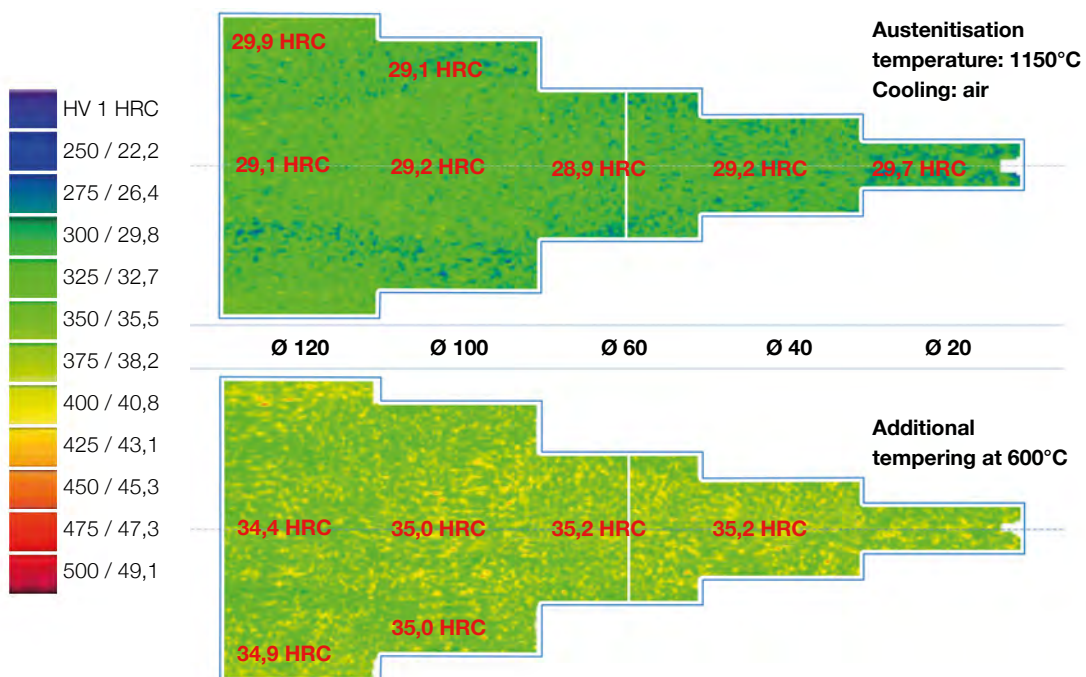
This is a unique selling proposition and a requirement for a cost-effective and efficient production process and the distortion-free production of innovative high-strength as well as ductile lightweight components.

Bainidur 1300 additionally offers impressive mechanical properties. The new steel has an average strength of 1200 MPa, which can be increased to customer specific requirements. Additional tempering after forging is not required. Higher alloying costs compared to conventional quenched and tempered steels can be compensated by a reduction of the production steps resulting in higher process reliability as well as optimized material properties of Bainidur 1300, such as machinability and nitridability. Last but not least, the Bainidur 1300 is characterized by a high notched impact strength.

**Property profile of Bainidur 1300
in comparison to standard used material groups**

Steel group	Tensile strength > 1000 MPa	Toughness	Simple / Short process chain				Nitridability
			Heat treatment	Distorsion	Machinability	Reproducibility	
AFP steel grades	-	-	+	+	+	+	-
Quenched and tempered steels	+	+	-	-	0	+	+
Bainitic steels	+	+	+	0	0	0	-
Bainidur 1300	+	+	+	+	+	+	+

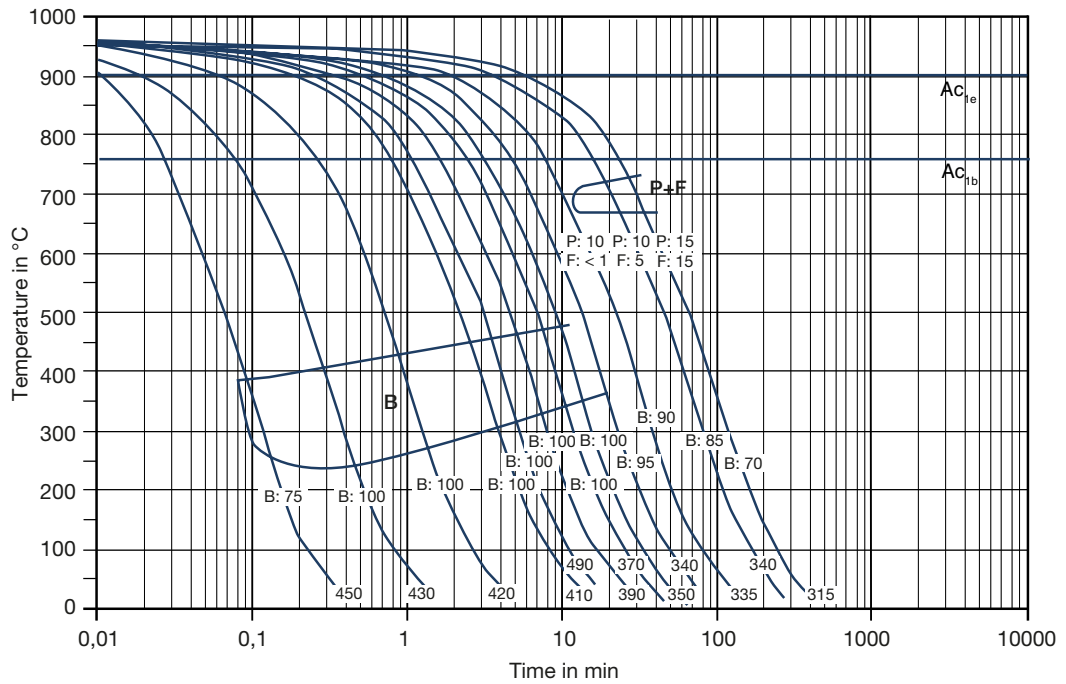
**Hardness profile across cross section (incremental turning test sample)
made from Bainidur 1300, $\psi \approx 0$**



Chemical composition in weight-% (standard analysis)

C	Si	Mn	Cr	Mo	V	B
0.17	0.70	1.50	1.00	0.70	0.10	+

Continuous time-temperature-transformation diagram



General note (liability)

Printing errors, omissions and changes accepted. Product-specific data sheets have priority over the information providing in this brochure. The desired performance characteristics are binding only if the are exclusively agreed upon at the conclusion in a contract.





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