



Premium hot work steels for demanding forging operations.

FORGING DIES

FORGING DIES UNDER INCREASING DEMANDS

Forging operations place intense thermal and mechanical loads on tooling systems.



Die Forging is one of the most important processes in the production of serial parts in all areas of our lives. Basic requirements of forgings in all application areas are high dimensional precision and excellent material properties to allow for a long service life, often in safety-critical components .

Wear, cracking and plastic deformation reduce tool life, interrupt production and increase cost per part. Reliable die performance is therefore critical for productivity, process stability and component quality.

- Modern forging applications continue to increase these demands through:
- more complex component geometries,
 - advanced workpiece materials,
 - longer production series,
 - and tighter dimensional tolerances.

Kind & Co. develops premium hot work steels engineered for reliable performance under demanding forging conditions.

Performance Characteristics That Determine Die Life

High Temperature Strength
Supports dimensional stability under extreme thermal loads.

Hot Wear Resistance
Reduces impression wear and extends maintenance intervals.

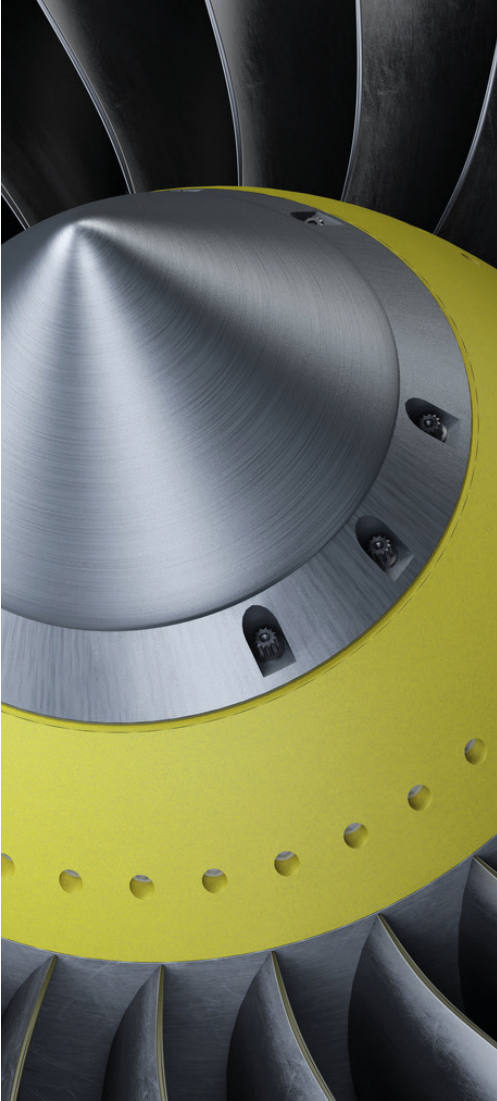
Toughness
Improves resistance to cracking under dynamic loading conditions.

- The right balance of these properties contributes to:
- longer tool life,
 - reduced downtime,
 - stable production,
 - lower tooling costs,
 - and decreased total tooling costs.

Material-Specific Requirements for Forging Dies

The dominant failure mechanism in forging dies depends strongly on the workpiece material and process conditions.

- Different applications therefore require different balances of:
- hot wear resistance,
 - tempering resistance,
 - and toughness.



ENGINEERED IN BIELSTEIN SINCE 1888.

Since 1888 we have been producing high-quality tool steel exclusively at our site in Bielstein. Kind & Co is still a family owned company today.

We stand for sophisticated material solutions, highest quality, reliable service and competent advice – tailored to the respective application.

We have particularly strong application expertise in the areas of die casting, extrusion and die forging.



SELECTING THE RIGHT TOOL STEEL FOR EACH FORGING CONDITION

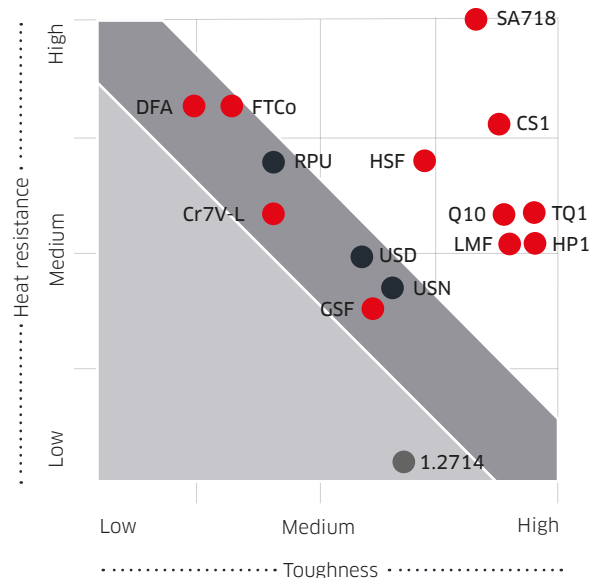
Different forging applications create different thermal and mechanical loading conditions.

- The selection of the appropriate tool steel depends on:
- workpiece material,
 - forging process,
 - process step,
 - and dominant failure mechanism.

The following overview illustrates typical application conditions and corresponding Kind & Co. grade recommendations.

See next page.





PREMIUM HOT WORK STEEL

with property combinations tailored to meet the necessary intended use

LMF A tool steel for advanced mechanical loads in finisher dies. For forging of aluminium alloys.

Cr7V-L The premium tool steel to manage die wear. For long product series and for high demanding tolerances, for pre-rolling tools

Q10 Superior economics for press forging dies facing thermal fatigue

HSF Outstanding resistance to plastic deformation in warm forging and hot forging

DFA Economics for medium round tools facing high temperature strain

HP1 Excellent toughness. For dies with the tendency facing radial cracks. ESR remelted. For forging aluminium alloys

TQ1 A well balanced excellent ESR remelted steel to manage advanced challenges hot forging

CS1 A top performance ESR remelted tool steel to manage even highest impacts in forging, e.g. high temperature resistant alloys

FTCo A ESR remelted matrix steel of singular high temperature strength and high tempering resistance. For high demanding forging mandrels and die forging stems, subjected to high compression, also for forging of Cu and brass alloys

GSF High toughness at improved level of tensile, hardened ex-mill. For impressions subjected to cracks, especially for dies in hammer forging; also perfect for rams of hammers

SA718 Outstanding high temperature resistance and ductility. A Ni-base alloy for special applications in drop stamping like isothermal presses and forming devices of Ti- alloys

● Premium ● Good Standard ● Standard

From Premium Steel to Ready-to-Use Tooling Solutions

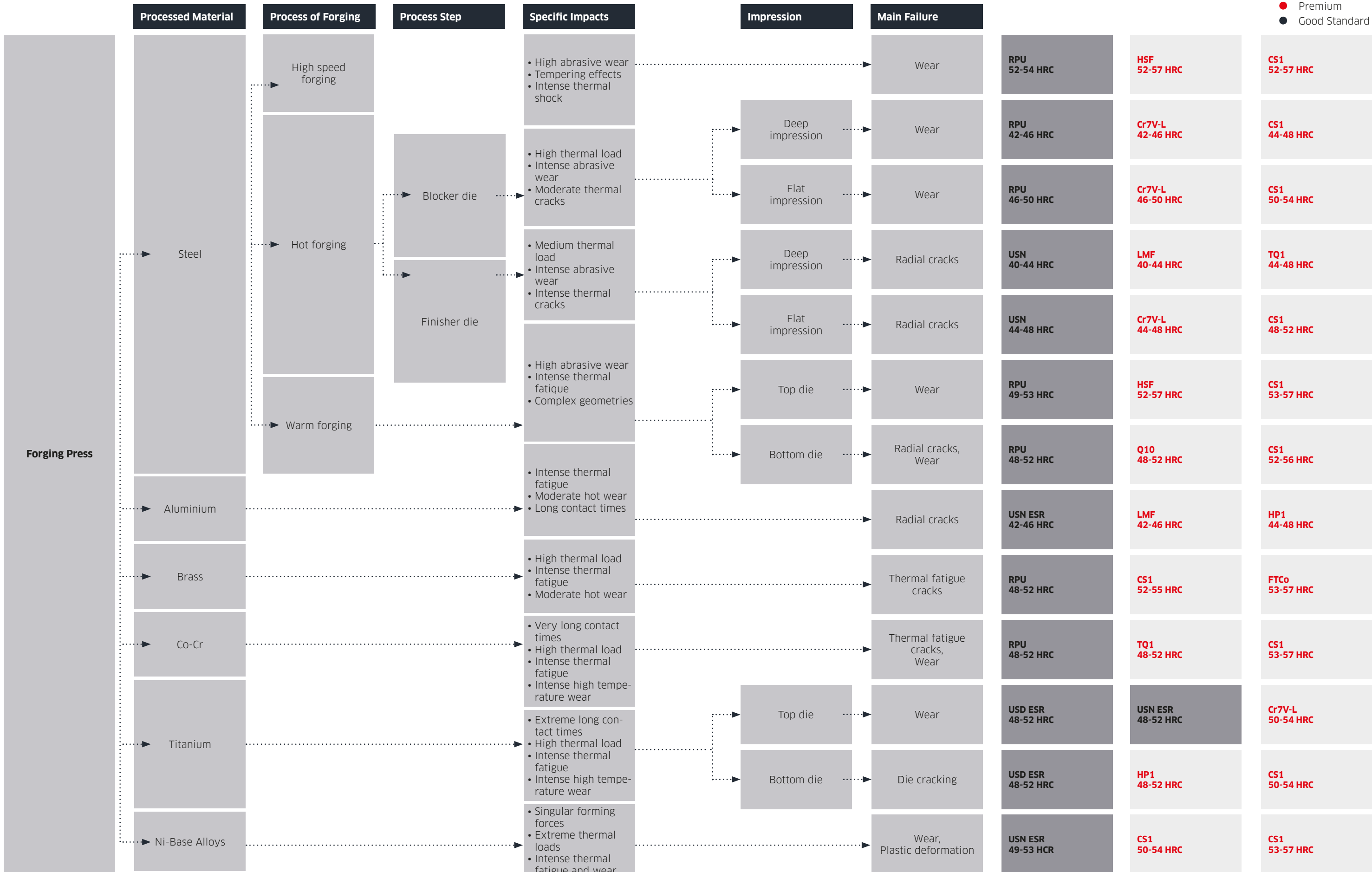
Kind & Co. supplies premium tool steel as well as machined tooling solutions tailored to customer requirements.

Tooling Application	Bar	Block / Ring	Pre-machined	At Working Hardness	Manufactured to Drawing	3D Data Processing
Round dies	✓	✓	✓	✓	✓	
Flat dies	✓	✓	✓	✓	✓	
Tapered rolls		✓	✓	✓	✓	✓
Main rolls		✓	✓	✓	✓	✓
Expanding mandrels		✓	✓	✓	✓	✓
Mandrel sleeves		✓	✓	✓	✓	✓
Stems		✓	✓	✓	✓	✓
Forging rolls		✓	✓	✓	✓	
Cross wedge rolls		✓	✓	✓	✓	



TOOL STEEL SELECTION

We provide premium tool steel as well as machined tooling – ready for impression





PREMIUM TOOLING SOLUTIONS

for Rolling and Preforming Operations



PREMIUM TOOLING SOLUTIONS

for Hammer Forging Tools and Masses of Hammer

Kind & Co. supplies premium tool steels and machined tooling solutions for:

- reducer rolling,
- cross wedge rolling,
- forging rolls,
- and preforming applications.

Rolling and preforming processes support:

- stable material distribution,
- process consistency,
- and dimensional accuracy in downstream forging operations.

Our grades are designed to provide:

- high wear resistance,
- dimensional stability,
- and long service life.

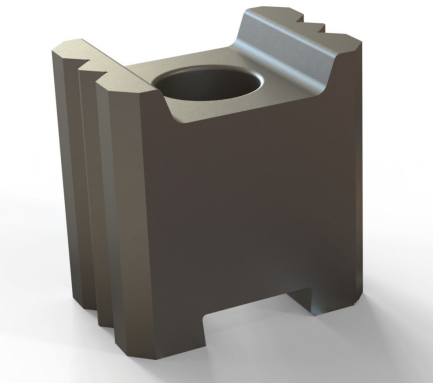
GSF for Hammer Forging Applications

Hammer forging applications expose tooling and machine components to high dynamic impact loads.

Under these conditions, toughness and crack resistance become critical.

GSF has been developed for:

- hammer forging dies,
- rams,
- and heavily loaded components.



Mechanical properties at RT	High Toughness	→	High Strength
Tensile strength Rm [N/mm²]	900 - 1000	1000 - 1250	1250 - 1400
0,2 % yield strength Rp0,2 [N/mm²]	min. 720	min. 800	1000
Elongation A5 [%]	min. 15	min. 13	min. 10
Notch impact energy [J]	min. 55	min. 40	min. 27

Reference case | GSF

3 D forged blocks treated to 1000-1200 MPa, Customer results: Increasing of the global tool life with from 600.000 to 1 million strokes before repairing. Advantages: Decreasing of the crack problems and the maintenance cost, Excellent weldability.

PROVEN PERFORMANCE

Product	Machine Type	Grade in Comparison	Reason for Failure	Kind Premium Tool Steel	Improved Lifetime Forged Against Standard Used before
Crankshaft for passenger car (4 cylinder)	Hydraulic press 4000 tons Hot forging	AISI H13 43-46 HRC	Wear	Cr7V-L 43-46 HRC in blocker and finisher die	~60%
Dies for forging of connecting rods for passenger cars	Hydraulic Press 2000 tons Hot forging	AISI H13 47-50 HRC	Wear	Cr7V-L 43-46 HRC in blocker and finisher die	~53%
Steering and suspension parts for passenger cars like steering arms, control arms, cross members	Hydraulic Press 3200 tons Hot Forging	AISI H11 45-47 HRC	Wear	Cr7V-L 47 HRC in blocker and finisher die	up to 65%
Round dies for truck spider parts approx. ø 275mm finish size	Hydraulic Press Hot Forging	AISI H11 45-47 HRC	Wear/Cracks in the transition area to the base of impression	-	Completely switched over to Cr7V-L
Truck parts die sizes 400 x 240 x 600mm	Hydraulic Press Hot Forging	1.2343	Wear	Cr7V-L 50 HRC in blocker and finisher die	~50%
Heavy duty shackles and chain slings	Hydraulic Press 1600 tons Hot Forging	AISI H13 steel 45-50 HRC	Wear/Cracks after ~2000 forgings	Cr7V-L 52-54 HRC	Cr7V-L raised die life more than 2 times
Crankshafts 2,7, 3,0 and 3,5 L V6 motors	Hot forging on 6300 tons press Hot Forging	Die Steel 1.2714mod with ~5000 pushes	Cracking/Wear	Blocker dies made of Cr7V-L (42-45 HRC) Finisher dies made of LMF (42-45 HRC)	1. run + 34% blocker / finisher 2. run + 72% blocker / finisher 3.+4. run plus 20% >40%
Forging cup, wheel cup for passenger car on Transfer press	Connected forging line Hot Forging	1.2343, 47-49 HRC	Thermal fatigue/Wear	Q10 with 50 HRC in blocker and finisher die	>200%
Cardan parts for truck and agriculture market	Mechanical press Hot Forging	1.2714:38-42 HRC Total lifetime 12.116 strokes	Strong wear attack, intense re-machining required	Q10: 42-46 HRC performs with 6 total lifetime 35.036 strokes	3x
Forged Pistons	Hydraulic press 1600 tons Hot Forging	1.2367	Inferior die life, cracking/wear	HSF with 51-53 HRC	>28%
Forged motorcycle crankshaft	Hydraulic press 2000 tons Hot Forging	AISI H13 (52 HRC) 3000 pieces; 1.2367 (53 HRC) 6000 pieces	Wear with H13/ cracking and wear with 1.2367	HSF with 56-57 HRC	>60%, more than 10000 pc
Sleeves, bottom die	Hydraulic press 2000 tons Hot Forging	SKD 61 (1.2344) 52-53 HRC + nitriding 5000-8000 pc RPU (1.2367) 53 HRC 10000 pushes	Wear	HSF with 56-58 HRC	15000- 20000 pushes stable/HSF increased die life by up to 100 %
Drive shaft special-shaped, upper punch	Hydraulic press 1000 tons Warm Forging	RPU (1.2367) 53-55 HRC + nitriding 1500 pcs	Wear, plastic deformation and local wear	HSF with 56-58 HRC + nitriding 2000 pieces	>33%
Hot Forging of stainless 316 Elbow pipe/ T-pipe	Hydraulic press	SKD 61 (1.2344) 52-53 HRC + nitriding	-	HSF with 56-58 HRC no nitriding	>40%
Bearing	High Speed Forging AMP 50	RPU (1.2367): 50 HRC	-	HSF with 54-57 HRC	>52%
Stainless steel fittings, hot forged	Hydraulic press	RPU (1.2367): 50 HRC	-	CS1 with 54-56 HRC	>65%
Precision gears, warm forged	Hydraulic press	1.2367, 50-52 HRC	Wear/tear Maximum service life 1000-1500 parts	FTCo with 53-56 HRC	>80-100%, Gears show much higher precision
Pliers, wrenches and manual spanner tooling in CRV steel	31,5 MN Drop Hammer	1.2714 +laser hardening = 5.000 Forging strokes	-	GSF 38-42 HRC	>8000 Forgings
Spanners in CRV steel	Drop Hammer	L6 / 1. 2714, T2 (38-42 HRC)	-	GSF 38-42 HRC	>55%
Wrenches in CRV steel	Drop Hammer	L6 / 1. 2714, T2 (38-42 HRC)	-	GSF 38-42 HRC	GSF performs very satisfactory in these applications and has become standard

In Industrial Forging Applications

Measurable improvements in die life and process reliability across demanding forging operations. Kind & Co. grades are used worldwide in forging applications exposed to severe thermal and mechanical loading conditions. The following examples illustrate selected customer results achieved through application-specific grade selection and optimised tooling performance.

Product	Machine Type	Grade in Comparison	Reason for Failure	Kind Premium Tool Steel	Improved Lifetime Forged Against Standard Used before
Complex design of metal braket	Forging hammer	1.2714 – 38-40 HRC	deep cracks in the bottom radius	GSF – 40-42 HRC	2 times less cracks less remachining
Ring gear made of engineering steel	Hydraulic press 1600 tons	1.2367 – 45 HRC	failure due to die breakage	Q10 – 48-52 HRC	~ 3 times
Suspension parts	Hydraulic press 2500 tons Blocker and finisher	AISI H 11 (1.2343)	Wear	Cr7V-L – 50-54 HRC	+ 50%
Larger connecting rods	Hydraulik press 3000 tons Finish forging die	Medium alloyed die steel, improved for toughness	Die crack	Q 10 – 44-46 HRC	+ 75%
Truck parts	Hydraulic press 6500 tons	1.2714	Crack	GSF – 38-42 HRC	+ 38%
Automotive suspension part	Hydraulic press 2500 tons Blocker and finisher	1.2343	Micro surface cracks and wear	Cr7V-L – 50-54 HRC	+ 42%
Connecting rods	Hydraulic press 2500 tons	(1.2367)	Wear	Cr7V-L – 50-52 HRC	+ 27%
Crankshafts	Hydraulic press 4000 tons Blocker die	AISI H 13 (1.2344)	Wear	Cr7V-L – 40-42 HRC	+ 38%
Crankshafts	Hydraulic press 4000 tons Finisher die	AISI H 13 (1.2344)	Micro cracks	Cr7V-L – 40-42 HRC	+ 26%
Crankshafts	Hydraulic press 12000 tons Blocker die	AISI H 13 (1.2344)	Wear	Cr7V-L – 38-41 HRC	+ 43%
Connecting rods	Hydraulic press 2500 tons Blocker die	AISI H 13 (1.2344)	Wear	Cr7V-L – 48-50 HRC	+ 25%
Sector shafts	Mechanical press 2000 tons Hot forging 1st forging stage Bottom die	AISI H 13 (1.2344)	Wear	Cr7V-L – 50-52 HRC	+ 35%
Sector shafts	Mechanical press 2000 tons Hot forging 2nd forging stage Bottom die	AISI H 13 (1.2344)	Cracking	Q10 – 48-50 HRC	+ 52%
Aluminium forging Chassis suspension parts components	Concatenated Forging line	many test series with different tool steel materials	Intensive radial cracks	HP1 – 45 HRC	Best performance of all tested standard and special grades
Orthopedic implant Ti and Co Cr alloys	Precision forging line Near net shape forging	1.2367 50-52 HRC	Radial cracks	CS1 – 53-55 HRC	+ 62%
Turbine blades made of Ti composite	Screw press 4000 tons and 8000 tons	(H 11) 1.2343 46-48 HRC	Cracks in the bottom die	USN ESR 3 d forged	+ 142%
Brass components	650 tons press	1.2367	Wear	FTCo – 52 HRC	~ 5 times
Stem tool for high speed forging	Hatebur P 50	1.2365 50-52 HRC	Wear and intense deformation	FTCo – 54-56 HRC	~ 3 times
Spindels	Warm forging press 1st forging stage Bottom die	Warm forging press 1st forging stage Bottom die	Wear	Cr7V-L – 52-54 HRC	+ 57%



Kind & Co. Edelstahlwerk GmbH
Bielsteiner Str. 124-130
51674 Wiehl - Bielstein | Germany
www.gmh-gruppe.de

 **Edelstahlwerk Kind & Co.**
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