



MOBILITY

## voestalpine RACING SOLUTIONS CAMSHAFTS

### WHEN PERFORMANCE MATTERS

A racing camshaft determines the performance of the engine. Lobe positioning and profile are designed and manufactured to the highest precision for optimum performance. Catastrophic failure is rare in camshafts. However, the high valve-spring forces, aggressive lobe profiles and lower viscosity oils which improve performance are a challenge for the surface-hardening and tool steel grades commonly used in camshafts. These adverse conditions can lead to two types of surface damage:

1. Adhesive/abrasive wear or deformation, particularly on the lobe noses
2. Pitting and spalling, caused by fatigue just below the lobe surfaces

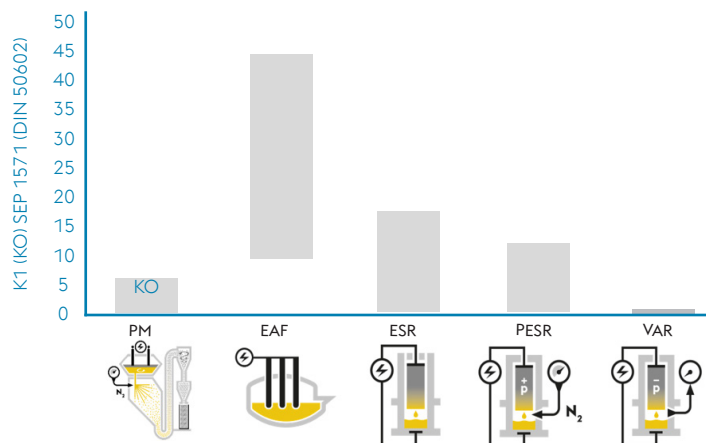
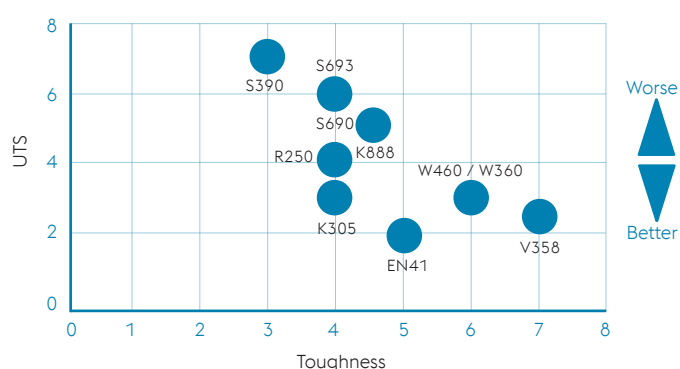
Even small amounts of wear can drastically reduce performance. Uneven wear or spalling leads to excess vibration, misfiring and eventually, valvetrain failure. Fortunately, high-strength, high-cleanliness, through-hardened steel grades have been designed to resist wear and subsurface fatigue cracking. These steels have been proven as high-reliability camshafts, conducting victories at the highest levels of racing.

### MATERIAL FAILURE & OUR SOLUTION

Material Related Failure	voestalpine Solution	Material Grades
Adhesive/abrasive wear; deformation	High hardness, high core strength, good polishability	BÖHLER K888, S693 & S390
Pitting & spalling from subsurface fatigue stress	High purity, hardness and fatigue strength	BÖHLER K888, S693, W360, A2, S690, S390, M50, V358

## COMPARISON OF PROPERTIES

## CLEANLINESS VS. MELTING PROCESS



## COMPARISON OF CAMSHAFT STEELS

Property	BÖHLER S693 / S690	BÖHLER S390	BÖHLER K888	BÖHLER W460 / W360	BÖHLER R250	BÖHLER K305	BÖHLER V361 / V358	EN41
Steel Type	HS 6-5-4	HS 10-2-5-8	HS 2-4-1	High C / CMV	HS 0-4-1	X153Cr MoV12	3% CrMoV	1%Cr +0.25 Mo + Al
Melting Route	Powder Metallurgy	Powder Metallurgy	Powder Metallurgy	Air Melt PESR (W360) AM + VAR X 2 (W460)	Air Melt / VAR	Air Melt	VIM + VAR (V361) AM + VAR (V358)	Air Melt
UTS	★★★★★	★★★★★	★★★★	★★★	★★★★	★★★	★★★	★★
Toughness	★★★★	★★★	★★★★	★★★★★	★★★★	★★★★	★★★★★	★★★★
Cleanliness	★★★★	★★★★	★★★★	★★★★★*	★★★★★	★★★	★★★★	★★★
Hardness	★★★★	★★★★	★★★★	★★★	★★★	★★	★★	★★
Specs	M4 (S693) ~M4 (S690)	Bespoke	Bespoke	Bespoke	M50	AISI A2 BS 4659	AMS6481 (V361) EN 40C EN 29 S132	–
Surface Hardening	PVD	PVD	PVD	Nitriding PVD Carb possible	Nitriding PVD	Nitriding possible	Nitriding PVD Carb possible	Nitriding

\* 5 star cleanliness based on the VAR version.

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ONE STEP AHEAD.