

# Gears and Shafts

## Through Hardened



When gears and shafts are mainly designed to meet high toughness demands combined with increased fatigue properties then normally tough tempered medium carbon steels are used. Typical mechanical properties would be: Hardness – 300 HB, Yield Strength – 800 MPa, Tensile Strength – 1000 MPa and Impact 30 J at  $-20^{\circ}$  C.

The objective is to use a material that will heat treat in a cost effective way to give good toughness combined with good strength.

The oldest and most well known UK specification is En 19A now called 709M40 and other alternatives include En 24 called 817M40.

Where 'clean steel' is a pre-requisite then the most commonly used material is S132. Other grades are available where companies have developed specifications to overcome specific problems associated with either mechanical properties or processing. OvaX 200 is our super clean material to meet this need.

## OvaX 200

Today at Ovako we have designed a modern alloy steel alternative specifically developed for through hardening. OvaX 200 is a perfect steel for conventional furnace hardening and quenching followed by a tempering process.

The material has been designed to give:

- High Cleanliness
- Slow Air Cooling

- Very Low Distortion
- Reduced Grinding and Finishing
- Temper Resistance
- High Operating Temperature

## Chemical composition

Element	C	Si	Mn	P	S	Cr	Ni	Mo	V	O	Ti
Min.	0.14		1.20			2.10	0.45	0.45	0.15		
Max.	0.17	0.15	1.40	0.020	0.003	2.30	0.55	0.55	0.25	9 ppm	30 ppm

## Delivery Condition & Machining

We do not normally recommend that the material to be delivered with a conventional hardness of between 190-220 HB. While the material will be very suitable for cold or warm forging the structure will be too tough for normal machining since it will have an impact strength of about 240 J at an ambient temperature.

The material is naturally produced with a hardness of approximately 350 HB. The material is in an

air quenched & self-tempered condition with a martensitic structure and is capable of being machined directly with standard or coated carbide cutting tools.

As you can see from the table below the mechanical properties can be adjusted by tempering to offer greater impact strengths.

	Temp- ering	Yield strength R <sub>p0.2</sub> (MPa)	Ultimate tensile str. R <sub>m</sub> (MPa)	Elongation A <sub>5</sub> (%)	Contraction Z (%)	Hardness (HB)	Impact toughness K <sub>v</sub> -20° C (J)	Impact toughness K <sub>v</sub> +20° C (J)
Hot rolled	No	850	1200	15	60	350	22	33
Hot rolled	650	740	920	20	70	280	35	85
Hot rolled	700	580	680	25	75	215	170	200

OvaX 200 can be conventionally quenched and tempered to give an even higher hardness, 380-400 HB, but some of the low distortion characteristics will be lost, since distortion is primarily a function of quenching speed. However, the resultant mechani-

cal properties will be excellent – yield strengths of 900 MPa, tensile strengths of 1300 MPa. The figure for elongation will be 11 and impact will be about 10-15 J at -20° C.

### Disclaimer

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