Bar products from Ovako
The Ovako Group has grown out of mergers of steel companies with long traditions. With a combination of vast experience and know-how gathered over generations through continuous research and the latest technology, we are a qualified business partner with strong resources.

Ovako is one of the leading European producers of engineering steel bars in many executions, for a large number of applications. Our customers are primarily in the rolling bearing, heavy vehicle, automotive and engineering industries.

An integrated production chain, a skilled workforce and modern production technology are some of the key factors that enable us to meet very challenging requirements. With several sales companies in Europe and the USA, we are always close to our customers.
Bar products that keep their promises

Ovako is well known in the marketplace as a quality bar steel manufacturer. Over the years we have gained a good reputation for our products where fatigue strength, toughness and wear resistance are of great importance. As well as meeting the specified requirements our bar products usually offer good formability, machinability or weldability, making them a cost saving solution for our customers.

Our technical support, application know-how and logistic solutions are further important factors that help our customers to improve their competitiveness.

We have three steel mills with different specialities, but working together with our customers. This means that our know-how in all application areas is very comprehensive, enabling us, for example, to produce a wide range of non- and low-alloyed engineering steels with excellent performance.

At Ovako, in addition to round, flat and square bars we produce special profiles to meet your needs. Our hot rolled bars can be further processed by heat treatment, machining and chrome plating.

A major part of our round bars are supplied peeled, ground or drawn.

Although our bar products are used over a very wide spectrum of applications, they all have one thing in common: You can always rely on products that fulfil your specification. This is achieved by continuously improving and modernizing our process and production technology, backed by product development.
Our steel bars cover a wide field of applications

Modern fuel injection pumps for diesel engines are subject to very high pressures. Here Ovako's super-clean bearing steels are ideal.

Today's rolling bearings have a service life bordering on the infinite. So rolling bearings are manufactured from very clean steel. Such as ours.

Rock drilling equipment requires steels with high toughness that can withstand extreme stress.

In forklift trucks the use of Ovako's steel include hydraulic cylinders and forks.

For agricultural machines, such as ploughs, Ovako supplies different grades of boron steels.

In tools like this axe, hardness, toughness and edge sharpness are important material properties.

Bolts for massive marine diesel engines require steel with high strength and toughness. Our steels have these properties.

Mooring chains for offshore platforms are subject to a very tough environment that places severe demands on the steel used.

In the power train for heavy vehicles such as trucks, Ovako supplies bars for different applications.

For road grader blades Ovako supplies customized special profiles made of boron steels with outstanding wear resistance.

For the automotive industry Ovako supplies different steels for the power train as well as for steering and suspension.

Ovako's bars, bright bars and hard chrome-plated bars are used for the manufacture of piston rods, pistons and eyes for hydraulic cylinders.
Ovako’s three steelmaking plants and five rolling mills are founded on tradition and have a long history of know-how. Some parts of the company were around in the industry’s pioneering days. Today, they work together forming an integrated whole. With modern process and production technology, well-developed logistics, and extensive research and development we are able to look well beyond tomorrow.

**Imatra**

Ovako Imatra is an integrated steel works with an electric arc furnace, secondary metallurgy and continuous bloom casting. The annual capacity is 250,000 tonnes of a wide range of high quality low-alloyed engineering steels.

There are two rolling mills in Imatra; the Heavy Bar mill and the Medium Bar mill. The size range covers dimensions from Ø 25 mm to 200 mm and square bars up to 150 mm.

Imatra also has a number of further processing operations, such as heat treatment, peeling, drawing, threading, etc.

**Smedjebacken**

The Smedjebacken works produces steel in an electric arc furnace, with secondary metallurgy and continuous casting of billets. The annual capacity is about 450,000 tonnes per year of non- and low-alloyed engineering steels.

Smedjebacken works specializes in hot rolled flat bars, but also produces round bars.

The size range for flat bars is widths from 100 to 250 mm and thicknesses from 5-60 mm and for round bars Ø 43-100 mm.
**Hofors**
Ovako Hofors is an integrated steel works operating with an electric arc furnace in a bottom tap furnace, secondary metallurgy and ingot casting. The annual capacity is 500,000 tonnes in a wide range of high quality low-alloyed engineering steels.

The Hofors heavy bar rolling mills’ size range is Ø 80-190 mm. Besides bars, tubes, rings and cut rings are also produced.

**Hällefors**
At the Hällefors rolling mill the hot rolled bars are produced in the size range Ø 24-75 mm in one medium rolling mill. The annual production capacity is about 250,000 tonnes.

The mill also has a broad range of further processing facilities with heat treatment and bright bar production.

**Boxholm**
The facilities at Boxholm consists of one rolling mill for medium bars and a fine rolling mill for the smaller size range in Ovako’s bar program. A speciality of the Boxholm mill is the manufacture of special profiles tailor-made for individual customer applications. The annual production capacity is about 100,000 tonnes.

The size range for round bars is Ø 14-42 mm and for special profiles widths from 15 to 300 mm and thicknesses from 4-45 mm.
Expertise in engineering steels

Over the years, we have developed strong competence in many engineering steels. If you need steel that withstands extreme wear, or if you need high toughness and strength, as a customer of Ovako, you can set your expectations high. Below are some characteristic examples of Ovako’s metallurgical development.

**General structural steels**
The high strength structural steels are called HSLA steels (High Strength Low Alloy Steels) or micro-alloyed steels. These steels are alloyed with vanadium, niobium or titanium. The carbon content is relatively low. Due to their composition and controlled rolling, the HSLA steels have high yield strength, good impact strength and excellent weldability.

The HSLA steels are delivered rolled or normalizing rolled. Thanks to their good cleanliness and fine grain size micro-alloyed steels are easy to cold form, for instance to bend. This makes them particularly suitable for use in the vehicle, hydraulic and general engineering industries.

**Alloyed engineering steels**
A major proportion of the steel produced by Ovako is low-alloyed engineering steels. This group includes case hardening, quenched and tempered, spring, boron, through-hardening and nitriding steels.

**Spring steels**
Spring steels are mainly used for the manufacture of different kinds of springs for the automotive industry. These steels are usually alloyed with chromium or silicon with additions of vanadium and molybdenum, where bigger sizes are required. After quenching and tempering, a relatively high yield strength can be achieved. The favorable relationship between yield strength and tensile strength, combined with a very low level of non-metallic inclusions, guarantees steels with the right features for high performing springs. Development in recent years has focused on improving fatigue resistance and strength in this group of steels.

**Boron steels**
Boron steels are used in wear resistance parts for agricultural, forestry and off-road vehicles, and also in fasteners. Boron alloying even in small quantities significantly increases the hardenability of steel, allowing lower contents of carbon and other alloying elements. The benefits are low hardness in the rolled condition, good weldability and formability. After hardening and tempering, a good combination of high tensile strength and toughness will be achieved. Often more highly alloyed grades can be replaced with boron steel.

**Through-hardening bearing steels**
There is an ever growing demand for reliable rolling bearing elements that are expected to last longer and to endure more and more stress. To meet these requirements, the steel used for manufacturing rolling bearing elements must be subject to constant development. Working side by side with the leading manufacturers of rolling bearings, we are continuously gaining new knowledge that helps us to develop better and better products in this application area.

Our ambition is to consistently improve production processes at our different works in order to produce steel with better purity, properties and performance. This is done by applying precise process and purity control, thus minimizing non-metallic inclusions, and by using key technologies, such as inductive stirring, vacuum degassing and protected casting. By optimizing all the possibilities within each production process, we can produce rolling bearing steel products that are suited to any need.

Ovako’s bearing steels are also used in a number of other applications, where strength and wear resistance
are important factors. Today, Ovako is one of the world leaders in producing through-hardened steel for rolling bearings.

**Nitriding steels**

Ovako’s nitriding steels are designed as a multipurpose steel grade with many favorable properties which can be utilized in a variety of applications, e.g. in transmissions or hydraulic components, tools and other mechanical parts with severe demands on wear and corrosion resistance or mechanical properties.

In recent years there has also been a dramatic improvement in the execution and control of nitriding processes in order to attain specific properties. As a result these improvements, Ovako has developed some nitriding steels where aluminium is replaced by chromium and molybdenum, both of which are also nitride formers. The relatively low carbon content in these steels also helps to accelerate the formation of the nitrided layer. Components made of these steels offer better surface hardness and wear resistance, high temperature stability and retention of hardness at high temperatures, high fatigue strength, improved corrosion resistance, good dimensional stability in treatment and better machinability.

This increased knowledge of how steel’s chemical composition and the nitriding process influence the properties of a nitrided component has made nitriding steels an attractive alternative in many applications.

**Steels for improved machinability**

In manufacturing various details, cutting processes are often a considerable cost factor. M-steel lowers these costs by allowing high cutting speeds and a non-interrupted production environment. With a cutting speed of up to 30% over conventional steels, Ovako’s M-steel meets market demands for lower processing costs.

The M in M-steel stands for Machinability. M-steels are based on treated non-alloyed or low-alloyed special steel. M-treatment means that all production processes are thoroughly controlled to achieve optimal cutting ability – this without affecting any of the other steel properties such as hardenability, fatigue resistance and toughness. M-steels meet the requirements of the EN standards.

The advantages of M-steel in highly automated serial production are obvious. Since the steel always has the same properties, there are virtually no variations in the cutting conditions. Thus, there is much less need to change tools or cutting data. M-steels were introduced some 20 years ago. Since then, they have been used more and more frequently in a large number of applications, mainly in the automotive and general engineering industries.
Our most common steel grades

In the following tables you will find the standard production programme at Ovako. These are only the basic steel designations and grades. Working together with you as a customer, we can also offer products tailored to meet your specifications.

### Standard Grades Nominal chemical composition

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<th>Designation according to EN 10027-1</th>
<th>Ovako Designation</th>
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<th>Mn %</th>
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Most case hardening, quenching and tempering, nitriding, and structural steels can be M-treated for improved machinability. All bearing steels and most case hardening, quenching and tempering and nitriding steels can be supplied with higher cleanliness quality (BQ, PBQ and IQ).
## COMPARABLE STANDARD DESIGNATIONS

<table>
<thead>
<tr>
<th>Designation according to EN 10027-1</th>
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<th>Designation Imatra Works</th>
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Our hot rolled bars are available in a large range of sizes. They all have close tolerances, excellent straightness and roundness, good surfaces and low decarburization. This makes them much appreciated, particularly in the forging industry.

**Size range**
Standard hot rolled bars are delivered in diameters from 14 mm to 200 mm, and in a large number of different sizes. Up to Ø 75 mm they can be delivered at 1 mm intervals. Larger dimensions are available at 5 mm intervals.

**Tolerances on dimensions and shape**
The tolerances on dimensions and shape are according to European standards, for round bars EN 10060. Our rolling mills have excellent capability to produce tighter tolerances, for instance, half the standard tolerance. Please contact our sales organization when enquiring and ordering hot rolled bars if tighter tolerances are needed.

**Lengths**
The most common bar length is 6 metres, but it can be varied between 3.5 and 18 metres depending on the producing rolling mill. Heat treatments may restrict the maximum length.

**Manufacturing lengths**
If not otherwise specified, the manufacturing length is 6,000 mm (+200 mm). Bar diameter, heat treatment and yield optimization may result in a deviation from this common length. 10% of the bars may be below the minimum of the ordered range, but not less than 3 metres.

**Exact lengths**
When agreed at the time of enquiry and order, the bars can be delivered sawn to exact lengths.

**Roundness**
Out of roundness is measured as the difference between the maximum and minimum diameters. Out of roundness is at most 2/3 of the diameter tolerance.

**Straightness**
Straightness is measured as the maximum height of arch, i.e. the largest deviation from the straight line. Normally the test length is 1.0 metre. Standard deviation of straightness is 2 mm/metre maximum.

**Surface quality**
Standard surface crack depth is max. 1% of diameter. When agreed at the time of enquiry and order, the bars can be inspected for instance by magnetic dispersion or the magnetic particle method. Normally, surface quality class D can be achieved for diameters up to Ø 80 mm and C for diameters up to Ø 120 mm complying with EN 10221.

**End executions**
Smaller sizes, up to Ø 75-90 mm depending on the rolling mill, are normally cold sheared. Larger sizes are hot sawn or abrasive cut. Deburred ends and other end executions are available according to requirements.

**Minimum quantities**
In sizes Ø 75-90 mm, 5 to 6 tonnes depending on the rolling mill. These quantities are only valid for deliveries from mill.
Flat bars

Our structural and boron steel flat bars have been developed for uses where high strength, good bendability and weldability are required characteristics. Besides these properties they offer good impact toughness and high yield strength. The steel in our spring steel flat bars has a very low level of non-metallic inclusions and optimal hardenability, which contributes to a favorable relationship between yield strength and tensile strength when quenched and tempered – a combination of properties that give the final springs the right features.

Size range
Hot rolled flat bars are delivered in widths from 15 mm to 250 mm and in thicknesses from 5 mm to 55 mm.

Lengths
The standard bar length is 6 metres. But the length can vary from 2.8 metres to 18 metres. Bars up to 12 metres can be straightened. Longer bars will be delivered in rolled straightness.

Tolerances on dimensions and shapes
The tolerances on dimensions and shapes comply with the European standards, for general-purpose flat bars EN 10058 and for spring steel flat bars with rounded edges EN 10092-1 profiles A and C.

Minimum quantities
8 tonnes.

Flat bars with sharp edges
EN 10058.

Spring steel flat bars with round edges
Flat bar with half-rounded ends. Radius approx. 1/2 thickness of EN 10092-1 profile A.

Flat bar with straight ends and rounded edges. Corner radius up to 40 mm is 8 mm and over 40 mm, 12 mm. EN 10092-1 profile C.
Square bars

Square bars (billets) are mainly used for drop forgings of components for the automotive industry. Ovako's square bars have a uniform inner structure and a very good surface finish, which is an absolute requirement when producing drop forged parts. Steel grades are mostly tailored to customer’s specifications, but we also produce square bars in our standard steel grades. In many cases both types of steel can be M-treated.

Square bars for forging are delivered in rolled and shot blasted condition. The bars have rounded edges; the radius is approx. 15% of the side length.

Size range and tolerances
30-150 mm side length. Tolerances according to EN 10059.

Surface quality and testing
If required, square bars for forging can be delivered inspected by magnetic powder in a range of 75-150 mm. The maximum depth of defects does not exceed 0.5 mm.

End executions
When agreed at the time of enquiry and order, the bar ends can be plane milled or deburred.

Length
The standard bar length is max. 10 metres.

Minimum quantities
For standard steel grades, 10 tonnes.
For special steel grades, two charges.
Since we can produce hot rolled special profile bar tailored to your needs, some manufacturing steps may be eliminated, lowering your costs considerably. Our special profiles can be produced in both symmetrical and asymmetrical shapes.

Cost-effectiveness and high productivity are among the primary goals for the manufacturing industry. Being able to produce hot rolled special profile bars that are tailored to suit your needs, we can often find a solution that allows more efficient manufacturing and lower production costs.

Even apparently simple profiles, such as flats with welding chamfers and rounded corners, often afford high cost savings by comparison with machining or gas cutting.

Special profiles are used in a large number of industrial applications. For lifting applications with end products such as cranes, booms and hooks, in off-road vehicles to produce grader blades and linings, or in other applications including the transport, shipping and rail sectors as well as in the vehicle and agricultural industries.

**Size range**
Our special profiles are produced in both symmetrical and asymmetrical shapes. They are rolled in widths from 15 mm to 300 mm and thicknesses from 4 mm to 45 mm.

**Minimum quantity**
25 tonnes per type of special profile.

**Examples of the special profiles we manufacture:**

<table>
<thead>
<tr>
<th>Eco-track</th>
<th>Fish plates</th>
<th>Bevel sections</th>
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<td><img src="image" alt="Fish plates" /></td>
<td><img src="image" alt="Bevel sections" /></td>
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</tbody>
</table>

**Eco-track**
Eco-track is used for caterpillar track in forestry machines.

**Fish plates**
Fish plates are used as joints for rails and points. This profile is available in various versions depending on the shape and dimension of the rail.

**Bevel sections**
Bevel sections are used for wear parts in off-road vehicles. These sections are manufactured single sided or double sided.
Further bar processing operations

Being a fully integrated steel producer, Ovako controls the whole production chain, from melting the steel, through rolling and further processing.

Our cold worked bars – peeled, ground, drawn or hard-chrome plated – are produced to the exact diameter required by our customer and they also meet stringent quality demands with regard to roundness, straightness and freedom from surface defects.

**Peeled bars**
Our peeled bars are produced with very high precision and control. This contributes to problem free production and makes our peeled bars a cost-efficient choice.

**Ground bars**
Ovako’s ground bars are characterized by good straightness and roundness and a fine surface. The ground bars are available in three executions: rough ground, fine ground standard and fine ground special.

**Drawn bars**
Drawn bar products from Ovako are made from hot rolled wire rod, pre-peeled wire rod or from hot rolled bars. Most of our drawn bar products are made according to customer specifications. A standard drawn bar product is M-treated Imatra 550.

**Hard-chrome plated bars**
Cromax is the brand name for our hard-chrome plated bar products. These are mainly used as piston rods for hydraulic cylinders, but also for other applications where the requirement is a hard, smooth surface with low friction and good corrosion resistance.

**Grinding media**
Ovako further processes bars into grinding balls. Quenched and tempered execution combined with low chromium content, constitutes a cost-effective alternative for the mining and cement industry, and ensures consistent performance in our customer’s high volume production. Ovako can also offer a suitable program of grinding rods.

More detailed information about our bright bar products is available on our home page at www.ovako.com
Pre-machined components

The trend in the market is towards buying pre-machined components for just-in-time delivery. The ensuing demand has resulted in increasing manufacture of components within Ovako, and is an important factor in the development towards higher value-added products and specialization. Ovako has comprehensive resources for manufacturing pre-components from bar in various stages of machining, from cut blanks to finished parts that are controlled and ready for assembly. Our production systems are designed to meet the customers’ requirements on product optimization and short lead times. The equipment can be adapted to both long and short production runs.

Cutting
Hot rolled bars can be cut to fixed lengths.

Chamfering
Ends and edges can also be chamfered at a 45° angle.

Drilling
Using CNC equipment, we perform drilling operations with very high precision. Center holes on round bars can be drilled according to ISO 866, ISO 2540, and ISO 2541. Other drilling operations can be performed, including threading on round, flat and square bars.

Milling
Welding grooves can be prepared on flat bars by rolling or machining.

Tumbling
Short pieces of bars can be tumbled in order to remove grades and chips from cutting.

Planing
We offer planing to provide planed ends with high surface quality.

Turning
Turning treatments of all kinds are available according to your requirements.

Threading
We can deliver threaded bars for studbolts according to ASTM A193 A grades B7 and B16 and ASTM A 320 grade 7. The dimension range is from UNC “1 to 4”. The standard length is 50-3,709 mm.

More detailed information about our pre-machined components is available on our home page at www.ovako.com
Heat treatment

Ovako’s heat treatment resources consist of car-bottom type furnaces for batch hardening and semi continuous plants for quenching and tempering, isothermal annealing and normalizing. We also have an advanced continuous line for inductive surface hardening.

Our bars can be supplied in the following heat-treated conditions or combinations thereof:
- Normalized
- Soft annealed
- Spheroidized
- Stress relief annealed
- Isothermal annealed
- Quenched and tempered
- Induction hardened
- Controlled cooling for case hardening steels

Quality, Environment and Certifications

All customers using our bar products must be able to rely on obtaining properties, delivery time and service that meet high expectations. For this reason, Total Quality is a central concept within Ovako. All operations are geared towards producing and supplying products and services that meet our customers’ requirements and expectations. Comprehensive quality systems help us achieve the highest standards. Our quality systems conform to ISO 9001:2000, ISO 9000:1998 and ISO/TS 16949:2002.

A good environment is an important part of our Total Quality concept. For this reason Ovako actively works to continuously improve both the external and the internal environment. The target is to operate all our plants with a minimum of pollution and a maximum of energy saving. All our units are certified according to the international ISO 14000 standard.

Logistics and IT based solutions

At Ovako, logistics has always been a strategic issue and an integral part of our operations. With our long experience of supplying steel products to customers all over the world, we have continuously refined our logistic solutions by offering even shorter lead times, more rational and cost effective transport systems, and more purpose-driven warehousing routines. One example of the IT based solutions available to our customers is our FunSi service system. This system can under certain conditions be used to give you detailed process information relating to your business activities. The system also makes it possible to present data from different Ovako units in a uniform way. Our objective has always been to enable our customers to simplify their material handling, reduce their capital costs and enjoy better service.
Research and development

Making steel requires an in-depth understanding of steel. We need to know what to expect from the steel in various situations. Through continuous research and development we are able to improve and meet increasing demands from the market, and thus to fulfil our customers’ needs and expectations – even to be one step ahead sometimes.

Today, our research and development activities concentrate on gaining a better understanding of steel, how it performs from a metallurgical point of view and how this affects the material properties. We take an active role in developing and improving our products: For example, by improving the steel’s cleanliness to obtain steels with higher strength and better fatigue properties, making more innovative forging steels, and improving the steel’s machinability and heat treatment properties.

Our ultimate goal is to optimize the steel performance for every application, and to come up with entirely new, cost-efficient material solutions. To reach this goal, we cooperate with a number of research institutes and universities in order to widen our own competence and knowledge base.

Customer support

Making steel is only a part of the job. Just as important is technical cooperation with every individual customer. Using our comprehensive knowledge and experience of different applications and production methods, we can give qualified customer support not only regarding the properties of our steel, but also on how to heat-treat and machine it. We can also be a partner when discussing new ideas on how to get the most out of our products in production, to achieve high quality end products as well as the best production economy.

Technical support
Also at your service is our homepage, www.ovako.com, where you can find up-dated information about all our standard steel grades, products, and the services we offer. You will also find contact details for our sales and technical support.
Ovako is a leading producer of special long steel products for the heavy vehicle, automotive and engineering industries. Production covers low-alloy steels and carbon steels in the form of bars, wire rod, tubes, rings and pre-components. The company has 16 production sites and several sales companies in Europe and the USA. Net sales in 2007 were EUR 1.5 billion and the company employs 4,300 people. Total steel production is at 2 million tonnes.

SALES UNITS:

Finland:
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