



UNITED CAST BAR LIMITED
Spital Lane, Chesterfield, Derbyshire S41 OEX
United Kingdom

Tel: 00 44 (0)1246 201194 Fax:00 44 (0)1246 540435
e-mail:sales@unitedcastbar.com
Website: www.unitedcastbar.com



UNITED CAST BAR LIMITED
Spital Lane, Chesterfield, Derbyshire S41 OEX
United Kingdom

Tel: 00 44 (0)1246 201194 Fax:00 44 (0)1246 540435
e-mail:sales@unitedcastbar.com
Website: www.unitedcastbar.com

UNIBAR Machinist Guide

Dear Sirs,

United Cast Bar have felt for some time that there were many misconceptions and a general lack of information available for machining continuous cast iron. Therefore, we thought it would be helpful to you, the machinist, if we put together a guide which we would address commonly asked questions and provide a basis for improved machining.

In compiling this information, we knew not all processes of machining and their many variations could be covered. Therefore we have concentrated on the basic operations and equipment most commonly found.

We hope you will find the **UNIBAR** Machinist Guide conducive to reducing your machining costs.

Yours faithfully
United Cast Bar Limited



Table of Contents

CONTINUOUS CAST IRON PROCESS	5
UNIBAR vs SAND CASTINGS	6
REASONS TO USE UNIBAR	7
Lower Cost Material	7
Improved Machinability	7
Improved Performance	7
UNIBAR GRADES AND STRUCTURES	8
Unibar Flake Grey Cast Iron	8
Unibar SG (Nodular) Cast Iron	8
Advantages of Unibar	9
Complete Absence of Defects	9
Machinability	9
Elimination of Costly Patterns	9
Less Machining Allowance	10
High Wear Resistance	10
Excellent Thermal Conductivity	10
Homogeneous and Close Grained Structure	10
Excellent Damping Capacity	10
Exceptional Dimensional Stability	10
High Fatigue Strength	11
Availability	11
Superb Corrosion Resistance	11
Low Density	11
Heat Treat Response	12
Excellent Surface Finish	12
Low Residual Stresses	12
Strength and Ductility	12

UNIBAR GRADES AND STRUCTURES	13
UNIBAR 200	13
UNIBAR 250	14
UNIBAR 300	14
UNIBAR GF	15
UNIBAR 350	15
UNIBAR 500-7	16
UNIBAR 400-15	16
UNIBAR 600-3	17
UNIBAR 700-2	17
UNIBAR-ADI	18
UNIBAR NI-RESIST	19
UNIBAR MACHINING	19
UNIBAR APPLICATIONS	21
Hydraulic & Pneumatic	22
Automobile Industry	23
Fluid Power: Pumps and Compressors Industry	23
Glass Manufacturing Industry	24
Oil and Gas	24
Steel Machinery	24
Miscellaneous	25



UNIBAR vs SAND CASTINGS

What is the difference between **Unibar** Continuous Cast Iron and the iron I have machined for years?

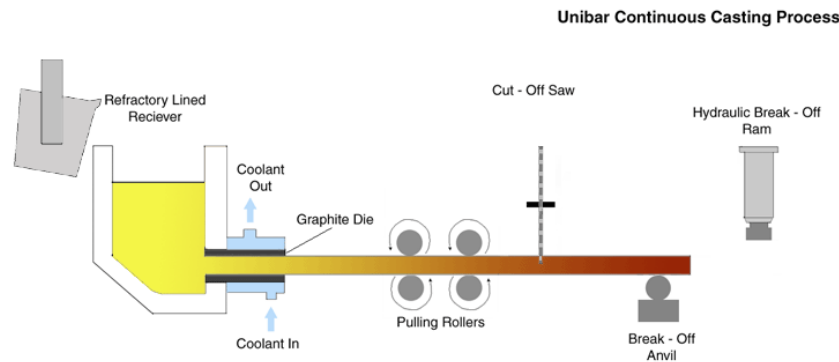
We need to understand that iron castings and sand cast iron bars are not the same products as **Unibar** continuous cast iron bars. While sand cast iron has been around for a long time, concast technology was developed in the 1960's.

The difference being – **Unibar** is metallurgically superior to conventional sand castings.

The **Unibar** continuous casting process virtually eliminates rejections due to porosity and centre line shrinkage. These internal flaws usually show themselves after the last bit of expensive machining has been completed. For sand castings internal flaws are usually found at the end of the machining cycle; productivity levels reduced and additional expense is increased.

Therefore **Unibar** can significantly reduce the risk of machining unusable material.

CONTINUOUS CAST IRON PROCESS



REASONS TO USE UNIBAR

Unibar saves you money:-

Lower Cost Material

Unibar is a lower cost but highly effective alternative when compared directly to many grades of alloy and carbon steel.

Improved Machinability

Unibar's fine grained microstructure offers a consistent soundness and uniformity previously unknown to the machinist who might already be working with sand cast iron.

Improved Performance

The high graphite flake content of concast **Unibar** offers two very important advantages.

First, these microscopic flakes or spheres of graphite feature tiny recesses that promote the retention of oil; this helps maintain lubricity.

Secondly this well dispersed graphite acts as self lubricant in the event of oil loss. A part made of **Unibar** will have better chance of survival. A sliding or wear part will last longer in the absence of lubrication.

The naturally occurring non-abrasive quality gives the **Unibar** bars and tubes extremely high wearability. We believe that **Unibar** concast iron is the most favourable hydraulic metal.

Unibar can be supplied with very high physical properties. As cast our ductile iron is available from 60,000 to 80,000 psi tensile strength. As cast our Nodular (ductile) iron has an UTS of 400 to 700 MPa or 60 to 100 Kps.

These **Unibar** products offer excellent compression strength and high vibration dampening capability. Good dampening capacity reduces machinery noise and thus helps to diminish fatigue caused by vibration.

UNIBAR GRADES AND STRUCTURES

Unibar Flake Grey Cast Iron

The typical structure of the **Unibar** flake iron material consists of a fine outer rim of under cooled graphite (predominantly ferrite matrix and random 'A' type graphite), and a predominantly pearlite matrix in the core of the bar. By introducing suitable inoculants and pearlite stabilizing elements, it is possible to produce an iron with a predominantly pearlitic rim and fully pearlitic core. Components produced from **Unibar** have consistent tensile strengths and the designer can have confidence in the tensile test result, since this test has been taken from actual product and not a separately cast test bar (which is the case with static castings).

Unibar SG (Nodular) Cast Iron

The microstructure of SG iron can be pearlitic, ferritic or a combination of both, containing small nodules of graphite. United Cast Bar manufacture 4 grades of SG Unibar, 400-15, 500-7, 600-3 and 700-2 as standard. These grades correspond to international standard EN 1563: 1997.



American Standard 65-45-12 and 80-55-06 are also manufactured as standard throughout United Cast Bar foundries.

Advantages of Unibar

Many of the advantages of **Unibar** over other materials can be attributed to the two phases present in the structure: an iron metallic one, similar to steel, and a graphitic phase with graphite in flake or spheroidal form.

Therefore the advantages of **Unibar**, as compared with other materials, are as follows:

Complete Absence of Defects

This means a reduction in total manufacturing cost, due to the elimination of rejected parts and abortive machining. In addition, the machining tools last longer and there is less machine maintenance required.

Machinability

The machinability of **Unibar** is high, fundamentally due to the presence of microscopic particles of graphite in the structure, which act as a lubricant. In addition to this, the homogeneity of its structure and the absence of the abrasive inclusions of sand which are typical in sand casting, improve machinability and therefore prolong the life of tools, drastically cutting your costs.

Elimination of Costly Patterns

Resulting in lower overall costs and quicker delivery, when compared with alternative casting processes.



Less Machining Allowance

This is due to the homogeneous fine grain structure of **Unibar** which allows us to produce sections with dimensions very close to the final measurements of the part. This obviously results in a considerable saving in costs, both in terms of material, and in terms of machining. Little or no deburring is required after drilling.

High Wear Resistance

Unibar possesses good wear resistance due to a self-lubricating network of graphite flakes in a matrix of pearlite in the contact surface. This results in a low wear factor, and minimal friction between contact surfaces.

Excellent Thermal Conductivity

Generally **Unibar** is highly recommended for applications in which heat dissipation is the priority, since graphite is an excellent heat conductor.

Homogeneous and Close Grained Structure

Giving excellent machinability, good wear resistance and ability to withstand hydraulic or pneumatic pressures.

Excellent Damping Capacity

Unibar has excellent damping properties, both in its laminar and its spheroidal form since graphite absorbs vibration.

Exceptional Dimensional Stability

Unibar has high dimensional stability due to the patented **Unibar** die design producing uniform hydrostatic pressure during casting.



High Fatigue Strength

Unibar is an ideal material for those applications in which high fatigue strength is being sought due to the absence of inclusions and porosity, as well as better cohesion of its structure compared with traditional sand casting.

Availability

Availability of a very comprehensive range of bar material stock, thus facilitating improved stock management and control for our customers.

Superb Corrosion Resistance

Unibar Ni-Resist grades offer high resistance to corrosion, much better than that of steel and, in the case of water and oil, almost as good as that of non-ferrous metals.

Unibar products are suited to COMPACT STORAGE, saving valuable space, in comparison to alternative products such as sand castings.

Low Density

Today, the weight of the machinery and therefore of its components, is a decisive factor, not only due to the energy saving this represents, but due to the reduction in transport and logistic, as well as the in actual cost of the material. The specific weight of **Unibar**, which is 10% less than that of steel, satisfies these aspects without risking its physical and mechanical characteristics.

Heat Treat Response

Within its range of products **Unibar** offers qualities which can undergo heat treatment, thus producing ferritic structures. This results in certain physical properties such as better thermal conductivity or dimensional stability, in addition to better machining.

Excellent Surface Finish

In the case of applications on-view the most suitable **Unibar** qualities are those with small graphite flakes.

Low Residual Stresses

Since the core of **Unibar** remains liquid, while the periphery is solid at the moment the bar exits the die and cooling system. This means that the bar undergoes a heat treatment, intrinsic to the process, from the inside to the outside of the bar, allowing for uniform stress distribution.

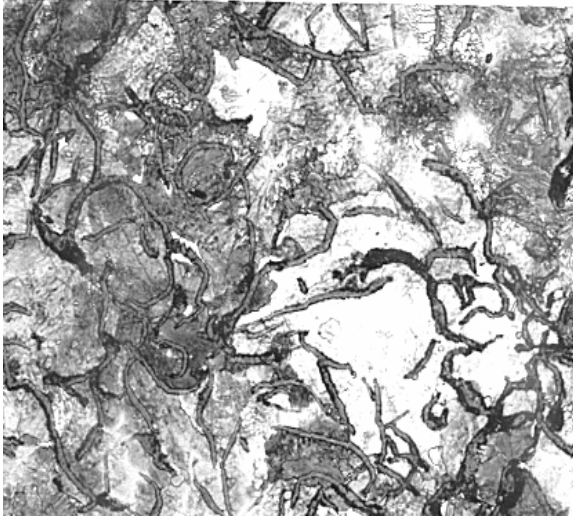
Strength and Ductility

Comparable to that of mild and low alloy steels (**Unibar Spheroidal**).

Excellent bearing properties, SELF-LUBRICATING and OIL RETAINING PROPERTIES.



UNIBAR GRADES AND STRUCTURES



UNIBAR 200

FERRITIC FLAKE CAST IRON (ANNEALED) (GJL-200 EN-1561)

GENERAL DESCRIPTION

This is the least hard quality, (120-180 HB) and is therefore recommended if your requirements are for good machinability with low requirements of tensile strength and resistance to wear. In addition, because of its ferritic structure, it is recommended for applications requiring good thermal conductivity. The surface finish of **UNIBAR-200** is, however, inferior to that of the other qualities, which are harder and therefore have better structural cohesion.

AVAILABILITY

Available subject to consultation. **UNIBAR-200** quality is obtained by means of thermal/ annealing treatment of **UNIBAR-250**.

UNIBAR 250

FERRITIC-PEARLITIC FLAKE CAST IRON (GJL-250 EN-1561)
GENERAL DESCRIPTION

This is a quality of average hardness (180-220 HB) and is therefore recommended for uses where a balance is required between mechanical characteristics and machinability. It can be annealed in order to obtain the previous **UNIBAR-200** quality.

AVAILABILITY

Available from stock.

However, any other size not included in the list can be produced according to minimum tonnage and after consultation.

UNIBAR 300

PEARLITIC FLAKE CAST IRON (GJL-300 EN-1561)

GENERAL DESCRIPTION

This is one of the hardest qualities, (200-250 HB,) and is therefore used when high tensile strength and/or resistance to wear is required, because of its pearlitic structure. Its surface finish is better than that of other softer qualities because of its better structural cohesion, which allows surface hardening.

AVAILABILITY

Available subject to consultation, taking the **UNIBAR-250** sizes as a basis. Subject to minimum order.

UNIBAR GF

INTERDENDRITIC FERRITIC CAST IRON (SPECIAL) GENERAL DESCRIPTION

This quality is recommended for glass moulds because of its ferritic structure with fine graphite (ID/IE). The thin film of graphite improves the surface finish, while the ferritic matrix encourages the expulsion of heat from the mould due to its greater heat conductivity in comparison with pearlitic casting. This quality can be offered in the annealed condition UNIBAR-GF (100% ferritic-140/180 HB) or as- cast UNIBAR-GP (20/30 % ferrite-160/200 HB).

AVAILABILITY

Available subject to consultation. Subject to minimum order.

UNIBAR 350

HIGH CONTENT PEARLITIC CAST IRON (SPECIAL) GENERAL DESCRIPTION

This is the hardest quality with the highest resistance (220-280 HB, depending on dimension). Its most important quality is the fact that the structure is also pearlitic on the outside rim (90% pearlite), and is therefore suitable for those applications in which high resistance to wear is required in the parts close to the outside of the bar. In addition, this quality allows surface hardening. In particular, this quality with high phosphorus content (0.3/0.6%) is recommended when a higher resistance to wear is required than that provided by a fully pearlitic structure, as is the case with valve guides, etc. In addition, the very hard **UNIBAR-350** quality (HB-250/310), obtained using fine graphite (ID/IE) in the center of the bar as well, constitutes one of the highest values in terms of cohesion and resistance.

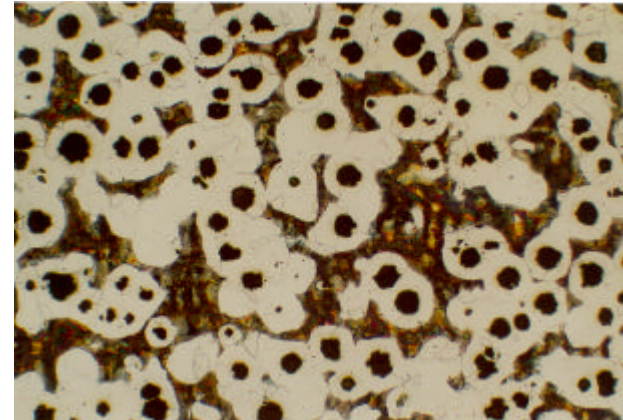
AVAILABILITY

Available subject to consultation. Subject to minimum order.



UNIBAR 500-7

UNIBAR 400-15



SPHEROIDAL PEARLITIC-FERRITIC CAST IRON. (GJS-500-7 EN-1563)

GENERAL DESCRIPTION

UNIBAR 500-7 (180-230 HB) has a better resistance to wear than **UNIBAR 400-15** because of its pearlitic-ferritic structure, and is therefore recommended for applications in which good machinability and surface finish are required, as well as minimal friction with other parts and/or materials.

The values of hardness vary according to the dimensions of the bar, producing a maximum of 220-210-200-190 HB (for pearlitic structures of 15/20%). This means that **UNIBAR 500-7** also complies with the mechanical characteristics required and the values of hardness, from qualities of **UNIBAR 400-15**(GJS-400-15) and **UNIBAR 500-7**(GJS-500-7).



Subject to special order specifications certain dimensions can be supplied with maximum hardness of 190 HB, it being necessary to anneal smaller dimensions (**UNIBAR 400-15**) in order to reach this hardness; and given that, due to its partially pearlitic structure (20%), the maximum hardness can reach 220/230 HB.

AVAILABILITY - Available from stock.

UNIBAR-500-7 Core 20% Pearlite. HB>200

UNIBAR-500-7 Core 10% Pearlite. HB<200

UNIBAR 600-3

SPHEROIDAL PERLITIC CAST IRON (GJS-600-3 EN-1563)

GENERAL DESCRIPTION

UNIBAR 600-3 has a structure that is predominantly pearlitic (>50%) in the core, which makes it specially recommended for applications requiring high resistance to wear and maximum strength. The average hardness values fall within the range HB-200-260.

AVAILABILITY

Available subject to consultation. Subject to minimum order.

UNIBAR 700-2

SPHEROIDAL PEARLITIC CAST IRON (GJS-700-2 EN-1563)

GENERAL DESCRIPTION

UNIBAR 700-2 possesses a pearlitic structure, including the periphery, with percentages of 20-30% of ferrite in the core. Resistance to wear, tensile stress and elastic limit have maximum values corresponding to hardness 230-290 HB.

AVAILABILITY

Available subject to consultation. Subject to minimum order.

UNIBAR-ADI

(AUSTEMPERING DUCTILE IRON)

GENERAL DESCRIPTION

UNIBAR-ADI is an austempered material (isothermic transformation of the austenite), a process that produces a bainitic structure. Therefore **UNIBAR-600-3** is alloyed with elements such as Molybdenum, Nickel and Copper. This type of structure increases the strength and particularly the elastic limit, producing a higher resistance to deformation. These values can equal or even exceed those of some steel alloys.

UNIBAR-ADI is manufactured subject to consultation, since it is not a standard item.

Among the advantages of **UNIBAR-ADI**, are the following:

The ability to utilise dimensions very close to the finished size prior to the austempering treatment, thus allowing better dimensional stability in comparison with steels. Through hardening is required to produce similar properties in steels with the attendant risk of distortion.

Ease of machining, similar to **UNIBAR-600-3**, in comparison with various steels, due to the lubricating effect of the graphite. The hardness values prior to the austempering treatment vary between 220-280 HB;

UNIBAR-600-3 can also be pre-annealed in order to get a better machinability prior to the austempering process.

Vibration damping higher than that of steel;

Good ratio of ductility to strength with high values of elastic limit:

AVAILABILITY

Available subject to consultation, Subject to minimum order.



UNIBAR NI-RESIST

UNIBAR-NR-F (FLAKE GRAPHITE) AND UNIBAR-NR-S (SPHEROIDAL GRAPHITE)

GENERAL DESCRIPTION

UNIBAR Ni-Resist is characterised by having an austenitic structured matrix produced by means of alloying with Ni, in the presence of carbides. **UNIBAR Ni-Resist** offers excellent resistance to heat, corrosion and wear, and its non-magnetic properties make it ideal for electrical or navigational components. In addition, it has high values of resistance to wear without this affecting machinability. It is non-magnetic at any temperature, making it especially suitable for electrical applications and navigational components.

UNIBAR Ni-Resist guarantees dimensional stability since austenite is a stable phase even at high temperatures.

UNIBAR MACHINING

So that our customers can maximize the use of their precision machining centres (which are costly to run) to produce their more complex parts, we provide all **Unibar** Production Centres with machining facilities. Less complicated operations, or the prior work of proof machining, can be carried out, thus lowering the overall cost of production. In addition to the clear reduction in pre-machining costs due to using less costly machinery in this operation, machined **Unibar** products allow our customers to increase their production capacity by subcontracting part of their machining process to **Unibar**, thus allowing them to meet peaks in demand which they would not otherwise be able to satisfy.

This also means that our customers can concentrate their investments on more complex and up-to-date machinery, which will allow them to maintain and improve their competitive position in an environment subject to continual change.

Unibar can be supplied machined direct from foundries or stockists, as turned, peeled, milled or sawn bar.

Non Standard size round bar can be supplied with a commercial turned finish of approximately 3 to 4 mm (0.125 – 0.160 inch) so saving the buyer time and money by allowing the component to be machined to final tolerance in one operation.

For round bar

In addition to this, **Unibar** has more than 150 different unmachined sizes permanently in stock, allowing us to adapt to any standard hydraulic block dimension in existence on the market.

The range of dimensions that **Unibar** offers is increasing daily, and new sizes are continually being incorporated into the **Unibar** production schedule.

The following are the most common applications of **Unibar** milled;

= Hydraulic blocks

= Guides

= Bases

NOTE: Tighter tolerances are also available depending on the length of the pieces.



UNIBAR APPLICATIONS

In addition to offering the advantages listed above, Unibar is extremely suitable for those applications whose geometry is close to the standard sections: round, square.

However, Unibar can be produced in a multitude of forms to meet the customers' requirements. You can see some of the existing applications below, with these being split into the following sectors:

- **HYDRAULIC & PNEUMATIC**
- **MACHINERY & MACHINE TOOLS**
- **AUTOMOBILE INDUSTRY**
- **FLUID POWER: PUMPS AND COMPRESSORS**
- **GLASS MANUFACTURING INDUSTRY**
- **OIL AND GAS EQUIPMENT**
- **STEEL MACHINERY**
- **MISCELLANEOUS**



Hydraulic & Pneumatic

Cylinder blocks
End Caps
Glands
Hydraulic Manifolds HIGH Pressure
Hydraulic Manifolds LOW Pressure
Hydraulic Pistons
Piston ring inserts
Pump bodies
Rotors
Spool valves
Spools
Valve bodies
Valve guides
Valves
Bearings
Brake Pistons
Bushings
Carriers
Chain Rollers
Cross-slides
Die blocks
Face plates
Flywheels
Gear racks
Gears
Gears for Printing Machinery
Jibs
Guide rail
Jib strips
Jigs & fixtures
Metal fed tubes
Paper press rolls
Piston for electric impact drill
Press rams
Pulleys
Rams
Rotary tables
Shoe moulds for plastic
Side frames
Sleeve casting
Slides
Spindle Housings
Spindles
Taper lock bushes



Automobile Industry

Brake Pistons
Camshafts
Cylinder liners
Damper Pistons in Shock Absorbers
Fluid pumps - tanker types lorries for pumping fluids
Gears
Motorcycle Disc Brake
Pulleys
Rail Spacers
Shafts
Tappet Guides
Turbocharger Bushings
Valve guides
Valve seat inserts



Fluid Power: Pumps and Compressors Industry

Crankshafts
End covers
Gears
Housings
Liners
Mechanical Seals
Piston ring inserts
Pistons
Pump rings
Rollers
Rotary Screws
Rotors
Rotors in fluid pumps
Rotors in vacuum pumps
Screw Rotors for pumps
Seals
Shaft coupling for cooler compressor
Spacer rings
Vane - type rotors



Glass Manufacturing Industry

Baffles
Blank molds
Bottom plates
Discs
Full molds
Funnels
Guide and neck rings
Plungers
Sleeves



Oil and Gas

Hammer Head for Drilling Machine
Piston for Drilling Machine



Steel Machinery

Guide rolls
Pinch rolls
Runout table rolls
Steel Mill Rolls
Table rolls



Miscellaneous

Aluminium mold plates

Bearings

Bushings

Cams

Core boxes

Dies

Drum for winches

End Plates

Fuel rod moulds

Gears

Jacks

Metal fed tubes

Pattern plates

Plunger Pin

Pulleys

Pump Body

Sleeve casting

Spacer Rings

Thermocouple sheaths in large industrial furnaces

Wheels