

# Specialist in Castings & Forgings



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**Elcee**  
Future Engineering



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• Since 1923 •

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Holland B.V. Deutschland GmbH Belux China

# Leading supplier in engineered parts

One stop service concept

## Our company

Elcee Holland is one of the seven companies within the Elcee Group. Over 90 years of experience, we offer a solid base for the future. The companies in the group excel as industrial suppliers in technical knowledge, applied engineering and sophisticated logistics. LKL Staal, LKL Wuxi and LKL Ningbo have been added to the Group in 2015. With the acquisition of LKL Wuxi, Elcee has a production unit in Asia to its disposal with machining and welding operations.

## Solid business partner

In practice, we have proven to be a solid business partner. We only work with brands and products that have conclusively proven their value in use. We annually receive the D & B 1 rating, which stands for minimum risk of bankruptcy. Obviously Elcee is certified according to ISO 9001-2008.



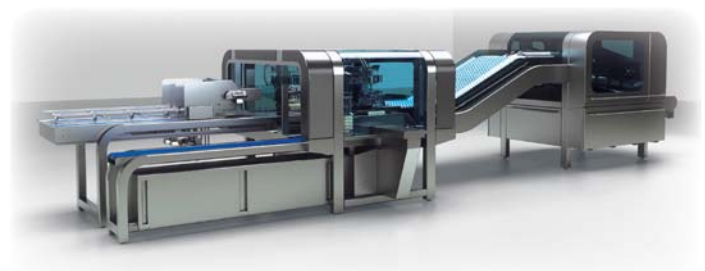
## Specialist in Castings & Forgings

*One stop shopping solution for ferrous and non-ferrous components, produced according to virtually every manufacturing method.*

Castings & Forgings is one of the six specialistic business units of Elcee Holland. We invest in specific expertise and tools, in order to make the best suitable product. All our castings are tailor-made and we have no limits in the manufacturing processes.

A large number of industrial companies uses the expertise of Elcee. Elcee acts as a co-maker. The collaboration with our clients is much more than a normal client-supplier relationship. We support our customers with the engineering and are able to create a 3D tangible model by rapid prototyping.

We are active in the automotive & pump industry, food & beverage industry, industrial & agricultural machinery, general engineering, façade engineering, railway, heavy duty, marine and in nuclear power stations.



## Reduction TCO

We have been constantly developing and improving our expertise, professionalism and service level. The factors below play a major role in reducing your Total Cost of Ownership (TCO).

### Outsourcing in China

To offer our customers additional benefits on quality and prices we began to outsource our production in Asia (1986). This early fostering helped us develop relationships with trustworthy, high quality business partners.

The cooperation with our Chinese partners has resulted in a rapid growth. That's why Elcee decided to start a 100% Dutch owned subsidiary office; Elcee China in 2006. Elcee China supports Elcee Holland in a technical and commercial way.

### Clever design

In the development phase of a casting or a forging we critically look at the design. We carefully choose the right material and production method for each product. During the production,

constant monitoring takes place.

Due to these checks, we achieve total production control. Our most common techniques are described in this folder. Other methods are also possible!

### Smart Logistics

Due to our smart production process, product lines are shortened, in combination with a 12.000 m<sup>2</sup> warehouse, we can offer you the best and most flexible logistic solutions possible.

### Quality guaranteed!

Our own quality department forms an important link in the assurance of quality. All our castings are checked both in China and the Netherlands for quality and preconditions. Both companies are equipped with 'high tech' measuring instruments, which are annually calibrated. On the next page you will find more information about our quality department.

## Investment casting (Silica sol process)

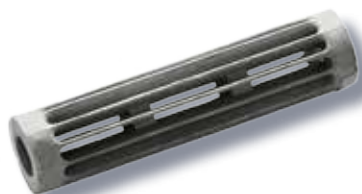
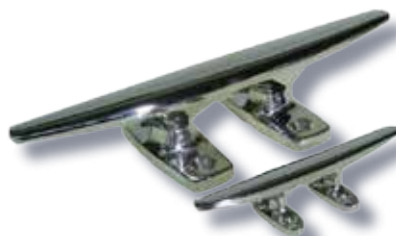
### Description

This technique is also called lost wax casting technique and is one of the oldest casting techniques, which offers unlimited freedom in design and material choices. Products ranging from a few grams to more than one hundred kilogram are possible. Typical applications can be found in the automotive, pump and food industry, architecture and general industrial engineering.

By producing wax models with water-soluble or ceramic cores, it is possible to produce complex, internal structures in castings. Due to the high precision of this technique, it is highly suited to convert conventional produced products into castings, with minimising the additional operations and by reducing the weight of the final product.

Investment casting components can be easily grinded, which makes it possible to produce excellent decorative structural components. The low investment in tooling and start-up costs makes it irrelevant whether a few pieces or hundreds of thousands of pieces are produced.

Due to the possibilities by 3D printing of wax models we can save the investment in tooling and directly start-up the casting process. This advantage is used in case of pilot series or at development stages producing prototypes.



#### Benefits

- Precise tolerances
- Thin walls are possible
- Fine surface structure
- Complex shapes can be achieved without draft angles
- Small marks can be casted very clearly, such as letters or company logos
- Suitable for a wide variety of materials

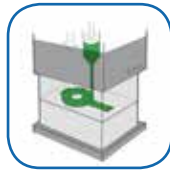
#### Possible alloys

- Stainless steel and duplex grades (such as 304 (L) or 316 (L))
- Carbon steel, tool steel, austenitic manganese steel and heat-resistant steel
- Various kinds of non-ferrous steel alloys (such as aluminium or copper)

## Process



1. Tooling production



2. Wax injection



3. Tree assembly



4. Slurry dipping



5. Ceramic strewing



6. Dewaxing



7. Shell baking



8. Melting & pouring



9. Shell breaking



10. Gates removing



11. Grinding



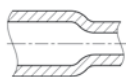
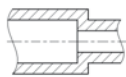
12. Measurement check

## Technical specifications

- The commonly used casting tolerance table for linear dimensions is CT6 according to ISO 8062 (wall thicknesses CT7)
- Weight: 0.005 - 120 kg
- Casting surface roughness: Ra 3.2  $\mu\text{m}$
- Maximum dimensions: 1000 x 620 x 380 mm
- Casting wall thickness:  $\geq 3$  mm, locally 0.5 mm can be reached
- Angle tolerances:  $\pm 1^\circ$
- Geometric tolerances that are required for the function, should be specified in the drawing

Dimensions (mm)		CT6	CT7
-	$\leq 10$	$\pm 0,26$	$\pm 0,37$
> 10	$\leq 16$	$\pm 0,27$	$\pm 0,39$
> 16	$\leq 25$	$\pm 0,29$	$\pm 0,41$
> 25	$\leq 40$	$\pm 0,32$	$\pm 0,45$
> 40	$\leq 63$	$\pm 0,35$	$\pm 0,5$
> 63	$\leq 100$	$\pm 0,39$	$\pm 0,55$
> 100	In consultation		

## Design, avoid abrupt transitions and use radii



## Finishing options

- Pickling and passivation
- Electrolytic polishing
- Vibra-polishing
- Blasting
- Electrolytic zinc plating
- Hot-dip galvanising
- Chrome plating
- Mirror polishing
- Dull polishing

## Investment casting (Water glass process)

### Description

Water glass casting (sodium silicate casting) is a technology of Russian origin. This technology is mostly used for steel and stainless steel components. By using this technique more complex designs can be made compared to the sand casting technique. Pricewise it is for big size products more interesting, compared to silica sol castings, however less precise in dimensions.

Water glass (sodium silicate) is used to cure the ceramic layers. This substance is added to the slurry (see the next page). The wax tree is then immersed (*in the slurry*). The slurry continues to adhere to the wax, after which it is strewn with ceramics. It is then placed in a bath with a water chloride solution. The water glass (adhering to the wax with the slurry) reacts to this solution in the bath, thereby curing the layer. This layering process is repeated a number of times until the layer is sufficiently thick enough for pouring. If necessary, a smoother casting surface can be achieved by using the first ceramic layers as it is used in the silica sol technique. Only it will take longer to make the shell.

Water glass cast components are mainly used where heavier/stronger and yet more complex shapes are required. Applications of this technique are widely presented in production of trailers, agricultural machineries and in offshore industry.



### Benefits

- Reduction of the cost price, since expensive processing and welding operations are eliminated
- Cheap moulding process
- Complex design without draft angles
- Flexible in production numbers
- Higher accuracy in comparison to sand casting

### Possible alloys

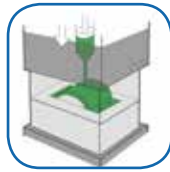
- Carbon steel
- Heat-resistant steel
- Stainless steel
- Non-ferrous steel alloy



## Process



1. Tooling production



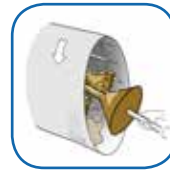
2. Wax injection



3. Tree assembly



4. Slurry dipping



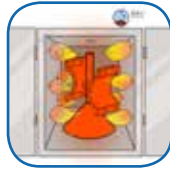
5a. Ceramic strewing



6. Curing in a chloride solution bath



7. Smelting wax



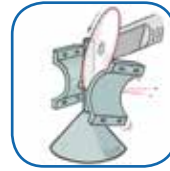
8. Shell baking



9. Melting & pouring



10. Shell breaking



11. Gates removing



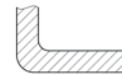
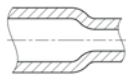
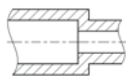
12. Measurement check

## Technical specifications

- The commonly used casting tolerance table for linear dimensions is CT8 according to ISO 8062 (wall thicknesses CT9)
- Weight: 0.2 - 150 kg
- Casting surface roughness:  $\geq Ra\ 6.3\ \mu m$
- Maximum dimensions: 1000 mm
- Casting wall thickness:  $\geq 4\ mm$
- Geometric tolerances that are required for the function, should be specified on the drawing

Dimensions (mm)		CT8	CT9
-	$\leq 10$	$\pm 0,5$	$\pm 0,75$
> 10	$\leq 16$	$\pm 0,55$	$\pm 0,8$
> 16	$\leq 25$	$\pm 0,6$	$\pm 0,85$
> 25	$\leq 40$	$\pm 0,65$	$\pm 0,9$
> 40	$\leq 63$	$\pm 0,7$	$\pm 1$
> 63	$\leq 100$	$\pm 0,8$	$\pm 1,1$
> 100	$\leq 160$	$\pm 0,9$	$\pm 1,25$
> 160	$\leq 250$	$\pm 1$	$\pm 1,4$
> 250	$\leq 400$	$\pm 1,1$	$\pm 1,6$
> 400	$\leq 630$	$\pm 1,3$	$\pm 1,8$
> 630	$\leq 1000$	$\pm 1,4$	$\pm 2$
> 1000	$\leq 1600$	$\pm 1,6$	$\pm 2,3$

## Design, avoid abrupt transitions and use radii



## Finishing options

- Electrolytic zinc plating
- Hot-dip galvanising
- Blasting
- Primer, wet painting and powder coating
- KTL (Cataphoresis)

### Description

Sand casting is one of the widely used techniques, which is used both manually as mechanically (such as a semi-auto molding line and a auto molding line), depending on the quantities required. It is mostly used for grey iron, as well as ductile iron, but also for aluminium, steel and stainless steel varieties.

Tooling is mostly made of metal or composite materials, which guarantees a long life. However, tooling can also be made out of wood, in order to reduce the cost price. These are often selected in case of small and/or one-of series. The disadvantage of this is that the surface roughness is less smooth than with an aluminium tooling.

The production process is quite simple, although cores can be used to achieve complex shapes. However, consideration must be taken to the draft angles and the manner in which tooling divisions are built up. This technique is suitable for small as well as large series, ranging from around 200 grams to several tons.



#### Benefits

- High production adaptability
- Small quantities are possible
- Large components can be made

#### Possible materials

- Ductile cast iron (also ADI - Austempered ductile iron)
- Grey cast iron
- (Stainless) steel
- Non-ferrous metal

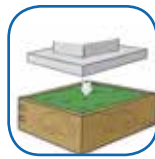
## Process



1. Tooling plates



2. Sand filling



3. Compressing



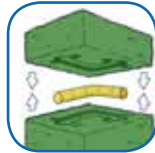
4. Turning tool plate



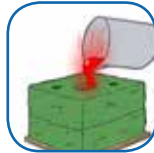
5. Removing shuttering



6. Removing



7. Box assembly (with core)



8. Pouring



9. Sand removing



10. Gates removing



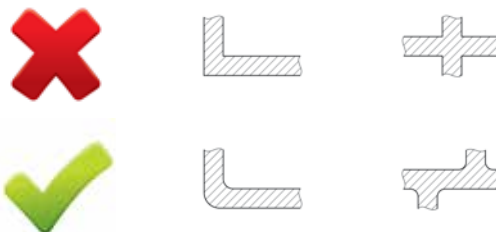
11. Measurement check

## Technical specifications

- Commonly used casting tolerance table for linear dimensions is CT10 according to ISO 8062 (wall thicknesses CT11)
- Weight: from 0.2 kg
- Maximum dimensions: 2.000 mm
- Casting wall thickness:  $\geq 6-8$  mm. Smaller is possible, but depending on the structure
- Draft angle: min.:  $\pm 1.5^\circ$
- Geometric tolerances that are required for the function, should be specified on the drawing
- As far as possible, use uniform wall thicknesses to achieve a uniform solidification of material. In case of different wall thicknesses, inclusions and cracks, and even porosity may result

Dimensions (mm)		CT10	CT11
-	$\leq 10$	$\pm 1$	$\pm 1,4$
$> 10$	$\leq 16$	$\pm 1,1$	$\pm 1,5$
$> 16$	$\leq 25$	$\pm 1,2$	$\pm 1,6$
$> 25$	$\leq 40$	$\pm 1,3$	$\pm 1,8$
$> 40$	$\leq 63$	$\pm 1,4$	$\pm 2$
$> 63$	$\leq 100$	$\pm 1,6$	$\pm 2,2$
$> 100$	$\leq 160$	$\pm 1,8$	$\pm 2,5$
$> 160$	$\leq 250$	$\pm 2$	$\pm 2,8$
$> 250$	$\leq 400$	$\pm 2,2$	$\pm 3,1$
$> 400$	$\leq 630$	$\pm 2,5$	$\pm 3,5$
$> 630$	$\leq 1000$	$\pm 3$	$\pm 4$
$> 1000$	$\leq 1600$	$\pm 3,5$	$\pm 4,5$
$> 1600$	$\leq 2500$	$\pm 4$	$\pm 5$
$> 2500$	$\leq 4000$	$\pm 4,5$	$\pm 6$
$> 4000$	$\leq 6300$	$\pm 5$	$\pm 7$
$> 6300$	$\leq 10000$	$\pm 5,5$	$\pm 8$

## Design, avoid abrupt transitions and use radii



## Finishing options

- Electrolytic zinc plating
- Blasting
- KTL (Cataphoresis)
- Primer, wet painting and powder coating
- Hot-dip galvanising



## High pressure die casting

### Description

This technology can be used to manufacture aluminium or zinc alloy products at very attractive product prices.

This metal casting process is characterized by forcing molten metal under high pressure into a mold cavity. The mold cavity is created using two hardened tool steel dies which have been machined into shape and work similarly to an injection mold during the process. Depending on the type of metal being cast, a hot- or cold-chamber machine is used.

The minimum production quantities depend on the size of the product, and start from 1000 pieces.



#### Benefits

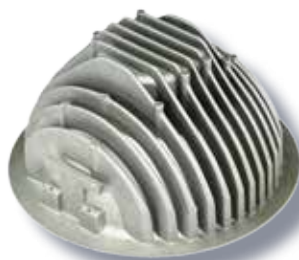
- The dimensional accuracy is excellent
- Suitable for small and complex thin-walled parts
- The quality of the products is consistent
- Low unit price in comparison to gravity die casting or sand casting
- High production speeds

#### Possible alloys

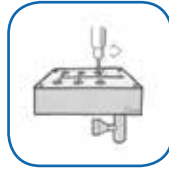
- Aluminium alloys
- Zinc alloys (such as Zamak)
- Magnesium alloys

#### Finishing options

- Technical anodising, but not decorative (it becomes spotty matt black)
- Grinding and polishing
- Blasting
- Vibra-polishing
- Primer, wet painting and powder coating



## Process



1. Tooling production



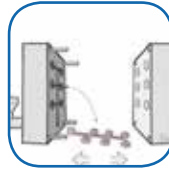
2. Anti-adhesion paste



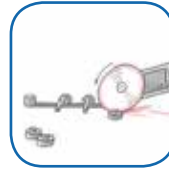
3. Aluminium injection



4. Cooling under pressure



5. Product extraction



6. Gates removing



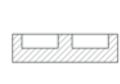
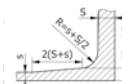
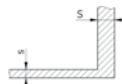
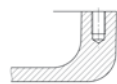
7. Measurement check

## Technical specifications

- Commonly used aluminium casting tolerance table for linear dimensions is CT6 according to ISO 8062 (wall thicknesses CT7)
- The weight depends on the alloy: 30 grams to around 10 kg (depending on the shape)
- Casting surface roughness:  $\pm Ra\ 6.3\ \mu m$
- Maximum dimensions: 650 mm
- Minimum casting wall thickness for aluminium: 2.5 mm, maximum of 8-10 mm. The wall thickness should be kept as uniform as possible - there should be no material accumulations. The strength can be obtained with reinforcement ribs
- Geometric tolerances that are required for the function, should be specified on the drawing
- Minimum draft angle depends on the height of the wall or rib. The higher it is, the less draft angle is necessary. Minimum draft from  $0.5^\circ$

Dimensions (mm)		CT6	CT7
-	$\leq 10$	$\pm 0,26$	$\pm 0,37$
> 10	$\leq 16$	$\pm 0,27$	$\pm 0,39$
> 16	$\leq 25$	$\pm 0,29$	$\pm 0,41$
> 25	$\leq 40$	$\pm 0,32$	$\pm 0,45$
> 40	$\leq 63$	$\pm 0,35$	$\pm 0,5$
> 63	$\leq 100$	$\pm 0,39$	$\pm 0,55$
> 100	$\leq 160$	$\pm 0,44$	$\pm 0,6$
> 160	$\leq 250$	$\pm 0,5$	$\pm 0,7$
> 250	$\leq 400$	$\pm 0,55$	$\pm 0,8$
> 400	$\leq 630$	$\pm 0,6$	$\pm 0,9$
> 630	$\leq 1000$	$\pm 0,7$	$\pm 1$

## Design, avoid abrupt transitions and use radii



## Gravity die casting & Low pressure die casting

### Description

Gravity die casting, together with low pressure die casting, can be called permanent mould casting. The tooling used for these techniques is mainly made from steel.

To achieve proper filling, the factory may choose to cast at low pressure, or using a rotary die which rotates during the casting process, in such a manner that the material thoroughly fills the entire mould. By means of using sand cores or retractable metal pins, complex internal cavities can be realised.

The casting has to solidify before it can be ejected from the mould.



#### Benefits

- It offers more possibilities compared to sand casting
- Consistent dimensional accuracy
- Possibility to insert metal parts in the casting (such as bolts, pipes etc.)
- Highly suitable for finishing operations

#### Possible alloys

- Aluminium alloys
- Magnesium alloys
- Copper alloys

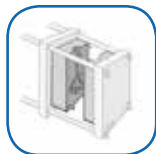
#### Finishing options

- Technically anodising, but not decorative (it becomes spotty matt black)
- Blasting
- Vibra-polishing
- Primer, wet painting and powder coating

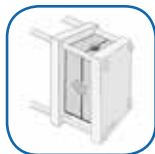
## Process



1. Tooling production



2. Tooling mounting



3. Tooling closing



4. Melting & pouring



5. Ejecting the solidified casting



6. Gates removing



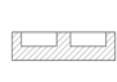
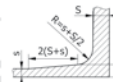
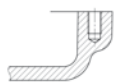
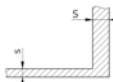
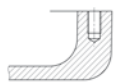
7. Measurement check

## Technical specifications

- The commonly used casting tolerance table for linear dimensions is CT8 according to ISO 8062 (wall thicknesses CT9)
- Weight: 30 grams to 80 kg
- Casting surface roughness:  $\pm Ra\ 6.3\ \mu m$
- Maximum dimensions: 1000 mm
- Casting wall thickness:  $\geq 3\ mm$ . Wall thickness should be distributed as evenly as possible
- Geometric tolerances that are required for the function, should be specified in the drawing
- Minimum draft angle depends on the height of the wall or rib. The higher it is, the less the minimum draft angle is required. Minimum draft angle from  $1^\circ$ , starting from  $2^\circ - 3^\circ$
- The position of the ejection pins has to be discussed with the customer

Dimensions (mm)		CT8	CT9
-	$\leq 10$	$\pm 0,5$	$\pm 0,75$
> 10	$\leq 16$	$\pm 0,55$	$\pm 0,8$
> 16	$\leq 25$	$\pm 0,6$	$\pm 0,85$
> 25	$\leq 40$	$\pm 0,65$	$\pm 0,9$
> 40	$\leq 63$	$\pm 0,7$	$\pm 1$
> 63	$\leq 100$	$\pm 0,8$	$\pm 1,1$
> 100	$\leq 160$	$\pm 0,9$	$\pm 1,25$
> 160	$\leq 250$	$\pm 1$	$\pm 1,4$
> 250	$\leq 400$	$\pm 1,1$	$\pm 1,6$
> 400	$\leq 630$	$\pm 1,3$	$\pm 1,8$
> 630	$\leq 1000$	$\pm 1,4$	$\pm 2$
> 1000	$\leq 1600$	$\pm 1,6$	$\pm 2,3$

## Design, avoid abrupt transitions and use radii



## Closed die forging

### Description

This technology can produce homogeneous products, with excellent mechanical characteristics.

Die forging is suitable for medium to large series. Forging weights range from a few grams to dozens of kilograms.

The minimum production quantity depends on the size of the product, normally starts at 1.000 pieces.



#### Possible alloys

- Steel, alloy steel, tool steel and stainless steel
- Aluminium, bronze and copper alloys

#### Benefits

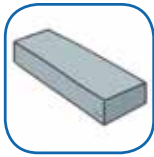
- Good repeatability
- Highly homogeneous material with mechanical properties
- High production speed
- Economical process compared to welding assemblies

#### Finishing options

- Electrolytic zinc plating
- Hot-dip galvanising
- Vibra-polishing
- Blasting
- Primer, wet painting and powder coating



## Process



1. Bar cutting



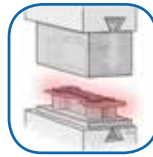
2. Pre-heating



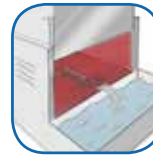
3. Forging



4. Ejection



5. Trimming



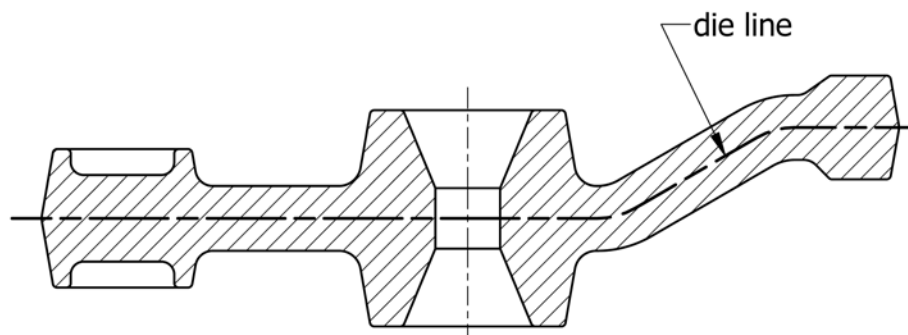
6. Heat treatment



7. Measurement check

## Technical specifications

- The tolerances of steel forgings are, as per EN 10243-1, and the following criteria are decisive:
  - ✓ Forge weight
  - ✓ Shape of the tool division
  - ✓ Category of the steel (high or low alloy)
  - ✓ Form complexity factor, which depends on the factor between the weight of the component and the envelope weight
- Weight: 200 grams - 120 kg, while shaft products can weigh up to 200 kg
- Maximum dimensions: length 1200 mm
- Forging wall thickness:  $\geq 4$  mm
- Geometric tolerances that are required for the function, should be specified on the drawing
- The most important tolerances apply to:
  - ✓ Length, width, height and thickness dimensions
  - ✓ Finishing of the forging edge
- Adequate draft angle should be provided; a good guideline is at least  $3^\circ$  for aluminium and  $5^\circ$  to  $7^\circ$  for steel
- Use big radii to avoid quick tooling wear or cracks in forgings
- Ribs should be low and wide
- The various cross-sections must be balanced to prevent extreme variations in the flow of the metal
- The tooling division must be passing the centre of the forging and not along one side. From this division the forging needs to be detachable



### Description

This technology can be used to press pieces of steel alloy into a form without having to make special moulds. One can produce various forms, using a combination of various free-form forging processes, wherever required.

Examples of open die forgings are: shafts, rings and flanges.

Before the material is forged in its (pre)form, it is first brought to the requisite temperature, after which the forging process is commenced. During the forging process, maximum effort is taken to achieve the end shapes/sizes as accurately as possible. Normally, the pieces are fully machined afterwards, to achieve the desired result.

Open die forging is the best choice when large components of the material, with high exacting internal conditions (homogeneity), are required.



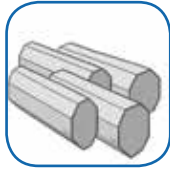
#### Benefits

- Small quantities
- Large parts
- No/low investment costs
- Long/big items can be forged
- Homogeneous material
- High strength

#### Possible alloys

- Alloy steel
- Steel
- Tool steel
- Stainless steel and duplex grades (such as 304 (L) or 316 (L))
- Aluminium alloys
- Bronze alloys
- Copper alloys

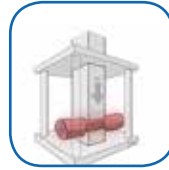
## Process



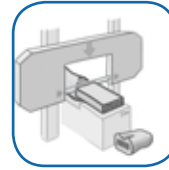
1. Ingots



2. Pre-heating



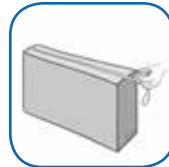
3. Forging



4. Sawing



5. Heat treatment



6. Measurement check

## Technical specifications

- Weight: from 2 kg to hundreds of kilograms
- Wide tolerances
- Maximum dimensions: several meters

## Finishing options

- Electrolytic zinc plating
- Hot-dip galvanising
- Blasting
- Primer, wet painting and powder coating



### Description

Sintering offers the possibility of manufacturing products with highly precise tolerances and a smooth surface finish. Various steel, stainless steel and bronze alloys can be used in this technology.

Metal powder and binder materials are mixed together until the exact composition of the powder is obtained. This powder is placed into a mould (negative), after which the powder is compressed under great pressure. The product is then heated in an oven, whereby the binder is melted out and the metal powder is further fused together (the actual sintering process).

After this step, one may, if so desired, use pressure to calibrate; impregnate the product with oil (for lubricating characteristics for example) or deburr the product through vibra-polishing. The part is finally checked for dimensions and other specifications.

The minimum product quantities depend on the size of the product, and start at 2.000 pieces.



#### Benefits

- Favourable costs in case of high volumes
- Good reproducibility, even in the long-term
- Little loss of material during production
- A nice, smooth surface finish
- The parts have a controlled porosity, due to which they can be made self-lubricating or be used as a filter
- High precision process
- Complex shapes are possible, if the part is pressed in the axial direction

#### Possible alloys

- Carbon steel
- Copper alloys
- Stainless steel

#### Finishing options

- Zinc coating
- Nickel coating
- Blackening (black oxide)

## Process



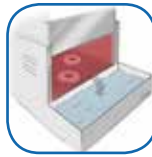
1. Metal powder mixing



2. Powder compacting



3. Sintering



4. Heat treatment



5. Vibration polishing



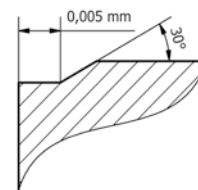
6. Impregnation with oil (optional)



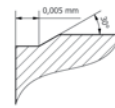
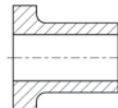
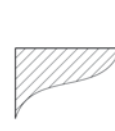
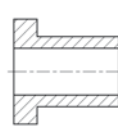
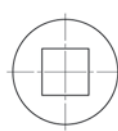
7. Measurement check

## Technical specifications

- The largest possible dimension is about  $\varnothing 180$  mm, but this depends on a number of factors. The most important factors are:
  - ✓ The shape of the component
  - ✓ The pressure capacity of the press
  - ✓ The material with the desired density
- The tolerance depends on the tool divisions, the pressing direction, and the material: they are normally between  $\pm 0.05$  mm and  $\pm 0.75$  mm
- The component is formed by the mould, the dies and optional core rods:
  - ✓ The outer contour is formed by the mould
  - ✓ The top and bottom sides of the component are formed by the core rods.
- The component must be shaped, so that the powder can be compressed; the tool with the dies must also be robust
- Cavities perpendicular to the pressing direction are not possible, unless by secondary processes
- Steps, conical surfaces, markings etc. can be made in the pressing direction by shaping them with the dies
- Holes in the pressing direction can be made in various shapes, using core rods of at least  $\varnothing 1.6$  mm, depending on the length of the desired hole
- The draft angle for the outer contour is not necessary, only on the surfaces, which are formed by the punches ( $\pm 7^\circ$ )
- Minimum wall thicknesses are 2 mm, depending on the design. Preferably, to keep the compressed powder robust
- Weight: from a few grams to 1.5 kg
- Strength depends on a number of factors, such as: the density and the shape
- Sharp edges are prevented by tapering the most outer corners on the surface, formed by the tool divisions. Preferably,  $30^\circ$  in the pressing direction (see the figure below)



## Design, avoid abrupt transitions and use radii





# Quality department

Total process control, from design to final product

## Spectro-analysis equipment

For the analysis of the chemical composition of metal, we use two devices: a spectro-analysis device which very accurately determines the chemical composition based on resulted gases after the sparking of the tested material.

Furthermore we have access to a so-called XRF-analysis machine which, by means of X-ray, can quickly analyse the chemical composition of, for example: stainless steel, but also of the most non-ferrous materials, such as aluminium and copper alloys.



## 3D measuring machine (CMM)

Our portable measurement arm can execute accurate measurements up to 0.005 mm and has a maximum measuring volume of 1.2 meters. The software guides our employees through the checks involved, so that no measurement can be forgotten. The test results are being defined in a clear report.

## Roughness tester

Through this device the roughness of processed and unprocessed surfaces can be measured. The roughness profile can be set according to the roughness profile R or primary profile P. It is also possible to make analyses according to DIN 4476, MOTIF-R and MOTIF-W. For the calculations most common standards are used, including ISO.



## Hardness testers

With our 2 hardness testers we can measure how hard a certain metal is. With the hardness measurement according to Brinell, a ball is being pressed into the tested material. The diameter of the indentation is a measurement for the hardness of the material. The Rockwell test determines the 'hardness' as 'resistance to local penetration'.

# Design & 3D modelling

Your idea converted into a conceptual design

## Research & Design

The early design is very important for final product optimization. Elcee is constantly developing innovative methods for the improvement of new and existing products. For example, more and more welding assemblies are converted into castings. This ensures a greater freedom in design. Also problems with welded seams are being prevented.

### 3D printing (solid modelling)

All our castings are custom made. The tooling is based on a 3D drawing. To offer our customers an extra service, we have the possibility to produce a tangible model with our HP colour design jet 3D. This way you can judge your casting in plastic, before it is taken into production.

The 3D printer can produce a solid model by rapid prototype within a few hours. The machine produces ABS plastic wires, which are printed layer by layer and are 'glued' together to a solid form.



# Elcee - four business units

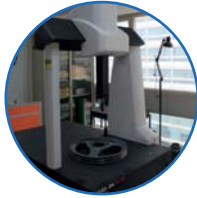
Functional & durable product solutions!



## Production facility in China

In Wuxi (China) Elcee has access to 3000 m2 production (CNC factory). A wide range of machining operations are possible. From conventional operations to complex CNC machining (wholly or partially). We are also able to produce welding assemblies and combined products in our own facility.

Critical products are processed in-house, in order to maintain control during production.



## Castings & forgings

This business unit is specialised in advising, designing and delivering products made according to drawing, in casted, forged or assembled executions. The products can also be designed in 3D by means of inhouse rapid prototyping.

## Stainless steel fasteners

Reliable stainless steel fasteners for durable, safe constructions, specials, hose clamps and thread inserts. Large stock, quick deliveries, competitive prices and excellent service level.

## Plain bearings

We are the specialist in engineering, manufacturing and calculating plain bearings for your application. The largest in the field of TriboTop® composite materials and bearings of high alloy steel and bronze. Agent for the Netherlands for igus® plastics, linear guidings and spherical bearings.

## Lifting

Agent of the Netherlands of Gunnebo® and GrabIQ® chain and components, Gunnebo® lashing equipment, Gunnebo® Johnson snatch blocks and Gunnebo® Anja shackles and rigging screws.

## VISION

Elcee wants to be a major player (globally active) and a leading supplier of engineered parts, assembled products and standard products for the industrial and construction market.

Supported with innovative concepts, high technical quality norms, educated personnel, reliable supply chains, competitive pricing, with an ultimate service-orientation and a professional attitude.



'Multi competence centre' &  
'Total concept supplier'

## MISSION

- Knowledge Organization
- Highly trained personnel
- Multi-technology competence center
- One stop service
- Development, design, delivery
- 3D design & prototyping
- Quality guaranteed
- Reduction 'TCO' (Total Cost of Ownership)
- Sophisticated logistics
- Solid financial basis

## STRATEGY

- Internationalisation & export development
- Elcee China acts as a sales company for Asia, U.S.A. & Australia
- Continuous search for sales agents or strategic distribution alliances
- Focus on add-on acquisitions and interesting take over possibilities
- Continuous improvement of existing business and current processes
- Expansion of existing product lines

Globally active!





# Elcee Group

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For more information about other  
companies in the Elcee Group:

- Elcee Germany GmbH
  - Elcee Belgium bvba
  - Elcee China
  - LKL Staal B.V.
- [www.elceegroup.com](http://www.elceegroup.com)

