

The background of the page is a grayscale image of industrial machinery. It features a large, complex metal part with a central circular opening and a smaller cylindrical protrusion. Below this, there is a gear-like component with several teeth. A bright green curved line runs across the image, starting from the top right and curving towards the bottom left, passing behind the machinery.

Ideas Shaped, Quality Delivered



Quality we provide with :

- ✦ Track record of providing Best Quality castings to customers.
- ✦ Chemical analysis done on Bruker Tasman Q4 (German make) spectrometer.
- ✦ In house laboratory for wet analysis for confirmation of Spectro results.
- ✦ Tensile, Elongation and Yield Testing machine to check mechanical properties on testbars.
- ✦ Rockwell Hardness testing.
- ✦ Certified vendors for Radiography, MPT etc.

Facilities we have :

In house for..

- ✦ **Heat treatment** : State of the art heat treatment furnace with nitrogen purging facility to achieve desired mechanical properties with facility to graph the heat treatment process cycle if required by the customer.
- ✦ **Machine Shop** : 3 different machine shops having conventional; CNC and VMC, machines with Honing, Grinding, Lapping and Polishing machines for mass production and accuracy.
- ✦ **Surface treatment** : Polishing machine with latest electro polishing plant to achieve desired brightness of the casting.

Material we work with :

- ✦ **Standards** : IS, BS, ASTM, DIN, GOST, ISO & MIL
- ✦ **Metals** : Carbon Steel, SG Iron, Stainless Steel (Austenitic, Martensite, Heat Resisting), Duplex Steel, Super Duplex Steel, Duralloys, Carpenter, Chromel, Cupronickel, Hastelloy, Inconel, Monel, Nickel Chrome, Stellite, HSS, Pb1, Pb2, Gunmetal, Brass, Aluminum.

Our Achievements :

- ✦ Casting of weight 5.4 grams with accuracy of ± 0.1 gram in weight.
- ✦ Smallest casting of 3.0 gram with 12 critical dimension.
- ✦ Biggest casting of 35 kg.
- ✦ Import substitute, complete machined castings for orthotic & prosthetic applications for rehabilitation.



Process in brief

Investment casting is taken to mean casting into singlepiece ceramic shell moulds, eliminating the mould (pattern) parting line and the imprecision and flash associated with it. The characteristic feature of Investment casting is that the pattern is melted away and thus lost. The process is described by the following detail production steps.

- ✦ For every casting, a wax pattern has to be produced. Pattern are manufactured using an injection moulding machine in metal moulds made of soft metal alloy, aluminium or using wax.
- ✦ The Pattern are glued either individually (in the case of large workpieces) or in groups forming 'clusters' to a gating system (sprue, gates, feeder) which is also manufactured using wax.
- ✦ Repeated immersion of the patterns in a ceramic slurry followed by packing in sand, after drying and where necessary chemical hardening, the patterns are surrounded by a refractory ceramic cell between 6 and 10 mm thick.
- ✦ After drying and curing of the mould material, the wax patterns are melted and the moulds fired at temperatures up to 1100° C.
- ✦ Casting is carried out by pouring into the moulds while hot. As even the finest details of the mould are completely filled, a compact casting result is achieved.
- ✦ After cooling and knocking out of the filled moulds, the casting are separated, machined and subjected to a final inspection.

Investment castings is a precision casting method which is growing steadily in international significance for reason of economy. The method is being used to produce larger and larger castings. Investment castings is also employed on an increasing scale for so-called super alloys which require ever more complex melting processes. Due to the economic benefits it offers, increasing weight is being attached to investment casting in comparative value analyses. Its scope for optimum shaping is unmatched by any other casting method. Investment castings-oriented design frequently offers an answer to technical problems which would be either impossible or far more expensive to implement using any other method.

Surface quality

The castings are produced without any trace of flash, and with an excellent surface finish. In many cases-expect for producing the required seat dimensions – there is no need for a follow-on machining process.

Piece weights

Generally speaking, the investment casting technique is used for piece weights of between 3 gm and 30 kg.

Summary

The investment casting technique is characterized by

- ✦ Almost unlimited scope for the shaping of castings.
- ✦ Hardly any restrictions in terms of materials.
- ✦ A high degree of dimensional accuracy due to elimination of the mould parting line usually responsible for casting imprecision.
- ✦ Low material allowance on surfaces to be machined.
- ✦ A high standard of surface quality.



INDUSTRIES SURVED



Valve Industries



Pump Industries



Fire Fighting Industries



Automobile Industry



Aircraft



Aerospace



Agricultural Industries



Automotive Bearings



Defense Armament & Fire



Diesel & Gas Turbine Engines



Food & Dairy Equipment



Material Handling Equipment



Flow Measuring & Monitoring Equipments



Mining Machinery



Power Tools



Earth Movers



Panel Locks



Refrigeration



Switchgears



Packing & Printing Machineries



Pharmaceutical Machinery



Machine Tool Industry



Nuclear Fuel Industry



Food Products Machinery



Pneumatic Tools Industry



Plumbing Fixtures



Surgical industries



Hardware & Architectural items

We specialize in making investment castings for Furnaces in Austenitic Steels

We have experience resulting in obtaining expertise in manufacturing complex castings in Austenitic Steel for Heat Treatment Furnaces. The synergy of technical know how and metallurgy is used to the advantage of the customers resulting in more variety of castings. Our capability is being enhanced further with more complex castings. We are exporting these castings to Europe since many years.

Material : Austenitic Stainless Steels, Ferritic Austenitic Steels, Non Magnetic Steels etc.



General Engineering

Number of customers from India and Europe source their precision and machined parts from us. We manufacture Stator and Rotor for turbo pumps; Brackets for the oil and gas pipe lines used in extreme weather conditions; Critical hangers for the conveyor systems; Coupler, Spindle used in food industry; Bearings for submersible pumps and lot many components for many applications and usage.



Defense

Our niche is in quality product for the defense sector. We are registered vendor for the Ordnance Factories, Ministry of Defense, Govt. of India and also supply investment castings to other DOFA Registered companies. Interest is shown by companies from Israel, Sweden and Russia for their requirements

Standards : IS, BS, GOST , MIL etc.



Industrial Sewing and Textile

We have noticeable presence in this segment of the industry. We manufacture small and critical castings having weight range from 2 gms to few hundred grams and many of these are import substitutes helping the user segment to save on foreign exchange and help them to save on costs for procurement.

Material : 8620, WCB , BS3146 Pt.1 and 2, Pb1, Pb2, Gunmetal, Aluminum LM6 etc.



Electricals and Electronics

Since many years we supply castings and fully finished castings (ready to fit) to many of the MNCs for their switchgears. We also are involved with them in their new product development and this itself speaks a lot about the quality we offer, the faith our customers have in us and the commitment we have to excel.

Material : EN Series, Stainless Steel, Carbon Steel etc.



Automotive

We manufacture few but critical castings for the automotive sector and we export fully finished castings (ready to fit) to Europe.

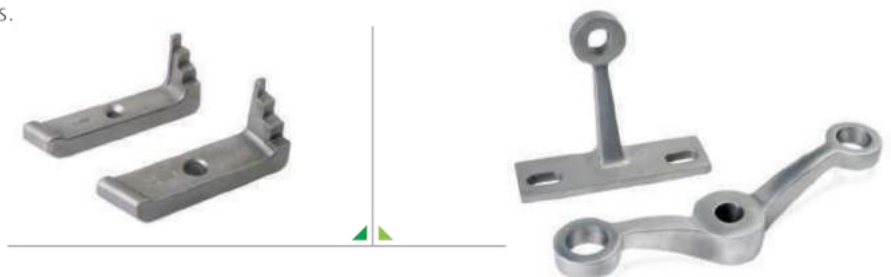
Material : CK40, EN Series, SG Iron



Hardware

From fasteners to Architectural fittings (Glass Brackets/Spiders), demanding aesthetics, we have customers who sources castings from us.

Material : Stainless Steel



Saddlery

Leisure Sports is the segment we have ventured into and most of the castings are exported to Europe. These castings demand high quality standards, especially the mechanical properties and esthetics. We are able to meet these demands

Material : Stainless Steel, Carbon Steel etc.



Orthotics and Prosthetic

Trushape do not end with making Investment Castings for engineering field applications, it is today also known for manufacturing & supplying Castings for Rehabilitation Aids – Lower Limb Orthotic (Calipers) and Lower Limb Prosthetics (Artificial legs). Intending further to develop the product range for Upper limb prosthetics (Artificial hands)

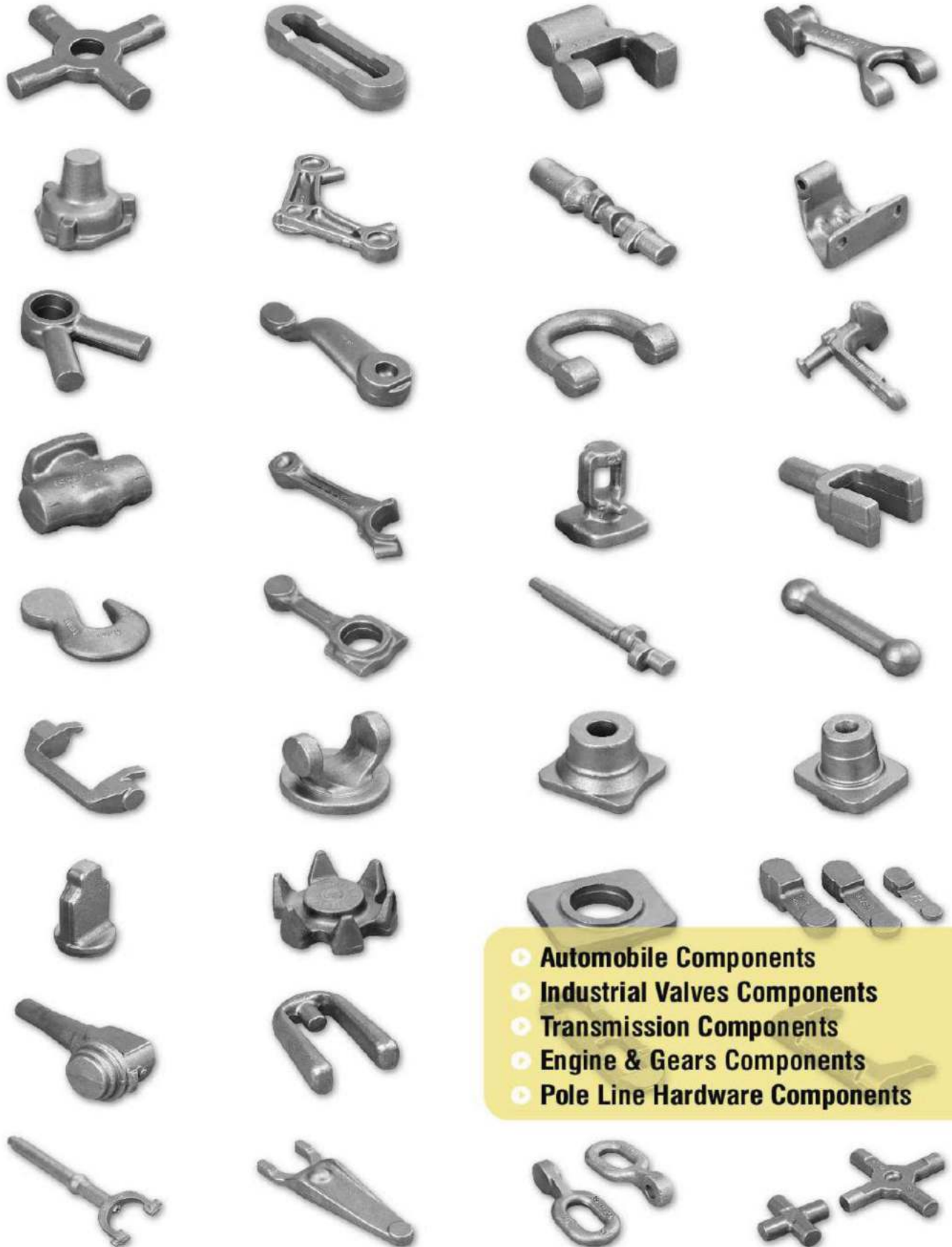


Pump Components



- ◉ Pump Components
- ◉ Valves Components
- ◉ Mechanical Seals
- ◉ Instrumentation Components
- ◉ General Engineering Components

Automobile Components



- Automobile Components
- Industrial Valves Components
- Transmission Components
- Engine & Gears Components
- Pole Line Hardware Components



- ▶ Automobiles Components
- ▶ Crane Components
- ▶ Earth Moving Components
- ▶ Machine Tool Components
- ▶ Switch Gear Components



- ◉ Automobile Components
- ◉ Transmission Components
- ◉ Engine Components
- ◉ Insulator Components



Table 1: Tolerances for linearity, flatness, parallelism and line area shape*

Accuracy level	Length of tolerated element		
	up to 25 mm	25 to 50 mm	over 50 mm
	Permissible dimensional variation		
D ₁	0.15 mm	0.25 mm	0.6%
D ₂	0.10 mm	0.20 mm	0.4%
D ₃	0.10 mm	0.15 mm	0.3%

*Without/with reference dimensions tolerated in accordance with immersion casting principles

Table 2: Machining allowances depending on the type of machining (all values in mm)

Greatest nominal dimension		Allowance per surface	
over	up to	coarse	fine
–	50	0.5	0.3
50	80	0.8	
80	120	1.0	
120	220	1.5	0.5
220	500	2.0	1.0
500	–	> 2.0	> 1.5

Table 3: Surface qualities to DIN ISO 1302

		CLA [μinch]	R _a ¹⁾ [μm]	R _z ¹⁾ [μm]	R _t ¹⁾ [μm]
Machining	N 1	1	0.025	0.22–0.30	0.24–0.40
	N 2	2	0.050	0.15–0.60	0.49–0.90
	N 3	4	0.1	0.8–1.1	0.85–1.45
	N 4	8	0.2	1.0–1.8	1.10–2.40
	N 5	16	0.4	1.6–2.8	1.75–3.60
	N 6	32	0.8	3.0–4.8	3.2–6.0
Investment casting	N 7	63	1.6	5.9–8.0	6.3–10.0
	N 8	125	3.2	12–16	13.0–19.5
	N 9	250	6.3	23–32	25–38
Sand casting	N 10	500	12.5	46–57	48–68
	N 11	1000	25	90–110	95–130
	N 12	2000	50	180–220	190–250

¹⁾R_a, R_z and R_t are approximated values

Formation of relationship between R_a, R_z and R_t is not permissible.

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Table 1: Linear tolerances (dimensions in mm)

Range of nominal size	D ₁		D ₂		D ₃		A ₁		A ₂		A ₃	
	Zone	GTA	Zone	GTA	Zone	GTA	Zone	GTA	Zone	GTA	Zone	GTA
up to 6	0.3	14	0.24	13.5	0.2	13	0.3	14	0.24	13.5	0.2	13
6 up to 10	0.36		0.28		0.22		0.36		0.28			
10 up to 18	0.44		0.34		0.28		0.44		0.34			
18 up to 30	0.52		0.4		0.34		0.52		0.40			
30 up to 50	0.8	14.5	0.62	14	0.5	13.5	0.8	14.5	0.62	14	0.5	13.5
50 up to 80	0.9		0.74		0.6		0.9		0.74			
80 up to 120	1.1		0.88		0.7		1.1		0.88			
120 up to 180	1.6	15	1.3	14.5	1.0	14	1.6	15	1.3	14.5	1.0	14
180 up to 250	2.4	15.5	1.9	15	1.5	14.5	1.9	15.5	1.5	14.5	1.2	14.5
250 up to 315	2.6		2.2		1.6		2.6		2.2			
315 up to 400	3.6	16	2.8	15.5			2.8	16	2.4	15.5	1.7	14.5
400 up to 500	4.0		3.2				3.2		4.0		2.6	
500 up to 630	5.4		4.4				4.4		5.4		3.4	
630 up to 800	6.2	16.5	5.0				6.2	16.5	4.0	15.5	1.9	
800 up to 1000	7.2						5.6		7.2		4.6	
1000 up to 1250							6.6		8.0			

The general casting tolerance series GTA correspond to DIN 1680 Part 2
For wall thickness tolerances, see table 2.

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Validity of the accuracy level

In each of the material grouping D and A, there are three accuracy levels specified.

Accuracy level 1 applies for all untoleranced dimensions.

Accuracy level 2 applies for all toleranced dimensions.

Accuracy level 3 can only be adhered to for individual dimensions and must be agreed with supplier, as for other additional production steps elaborate tool corrections are also necessary.

Dimensional tolerance for wall thicknesses

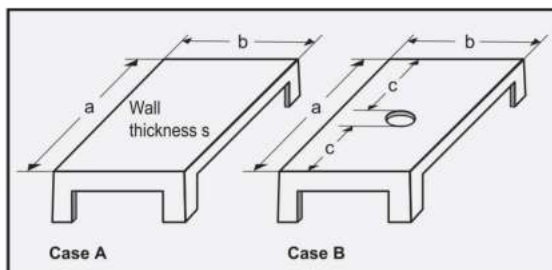
The wall thickness tolerance depend on

- the size of the (ceramic) walls of the mould
- their uninterrupted surface area
- their possible thermal distortion
- the metalostatic pressure of the molten metal.

The wall thickness tolerance are, for this reason, not dependent on the level of accuracy. They are restricted (or reduced) by thicker edge sections, break-throughs (openings, holes), webs to be included in the casting, ribs and similar, which serve to 'relieve' the wall thickness. The tolerance range in question in each case is indicated in Table 2.

Table 2: Wall thickness tolerances

Smallest lateral length of a surface mm	Material group D Fe, Ni, Co, Cu based on alloys mm	Material group A Al and Mg based on alloys mm
< 50	± 0.25	± 0.25
50 up to 100	± 0.30	± 0.30
100 up to 180	± 0.40	± 0.40
180 up to 315	± 0.50	± 0.50
> 315	± 0.60	± 0.60



Case A

The surface formed by the dimension a and b is not interrupted. Dimension b determines the wall thickness tolerance.

Case B

The surface formed by the dimensions a and b is interrupted by a borehole in the centre. The non-interrupted surface in this case is therefore formed by the dimensions b and c. The dimension c is smaller than b, and therefore c determines the wall thickness tolerance.

Table 3: Angular tolerances

Accuracy level	Range of nominal sizes ¹							
	up to 30 mm		30 up to 100 mm		100 up to 200 mm		over 200 mm	
	Permissible misalignment							
	Angular minutes	mm per 100 mm	Angular minutes	mm per 100 mm	Angular minutes	mm per 100 mm	Angular minutes	mm per 100 mm
1	30 ²	0.87	30 ²	0.87	30 ²	0.87	20 ²	0.58
2	30 ²	0.87	20 ²	0.58	15 ²	0.44	15 ²	0.44
3	20 ²	0.58	15 ²	0.44	10 ²	0.29	10 ²	0.29

¹For the range of nominal sizes, the length of the short arm is authoritative.

²The angle may deviate in both directions.

Table 4: Surface roughness factors

Surface roughness standards	Material group D		Material group A	
	CLA (µinch)	Ra (µm)	CLA (µinch)	Ra (µm)
N 7	63	1.6		
N 8	125	3.2	125	3.2
N 9	250	6.3	250	6.3

Table 5: Dimensions for holes, blind holes and channels

dia. /□ or similar d (mm)	Greatest length or depth	
	Through hole l	Blind hole t
G 2 up to 4	R1 x d	R0.6 x d
> 4 up to 6	R2 x d	R1.0 x d
> 6 up to 10	R3 x d	R1.6 x d
> 10	R4 x d	R1.6 x d

Table 6: Dimensions for slots and grooves

Width b (mm)	Greatest depth, bottom	
	Open l	Closed t
G2 up to 4	R1 x b	R1.0 x b
> 4 up to 6	R2 x b	
> 6 up to 10	R3 x b	R1.6 x b
> 10	R4 x b	R2.0 x b

Degree of accuracy

Material group D
Iron, nickel, cobalt and copper-based alloys

D1 to D3

Material group A
Aluminium and magnesium-based alloys

A1 to A3

• Above details are for information only. For actual requirement, refer to respective standard.

Note : The information, specifications, claims and photographs etc. in this catalogue are only indicative and for tentative reference; and are not a legal offering and are subject to change at the sole discretion of the management of Trushape Precision Castings Pvt. Ltd. without any prior notice.

