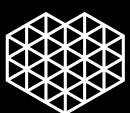
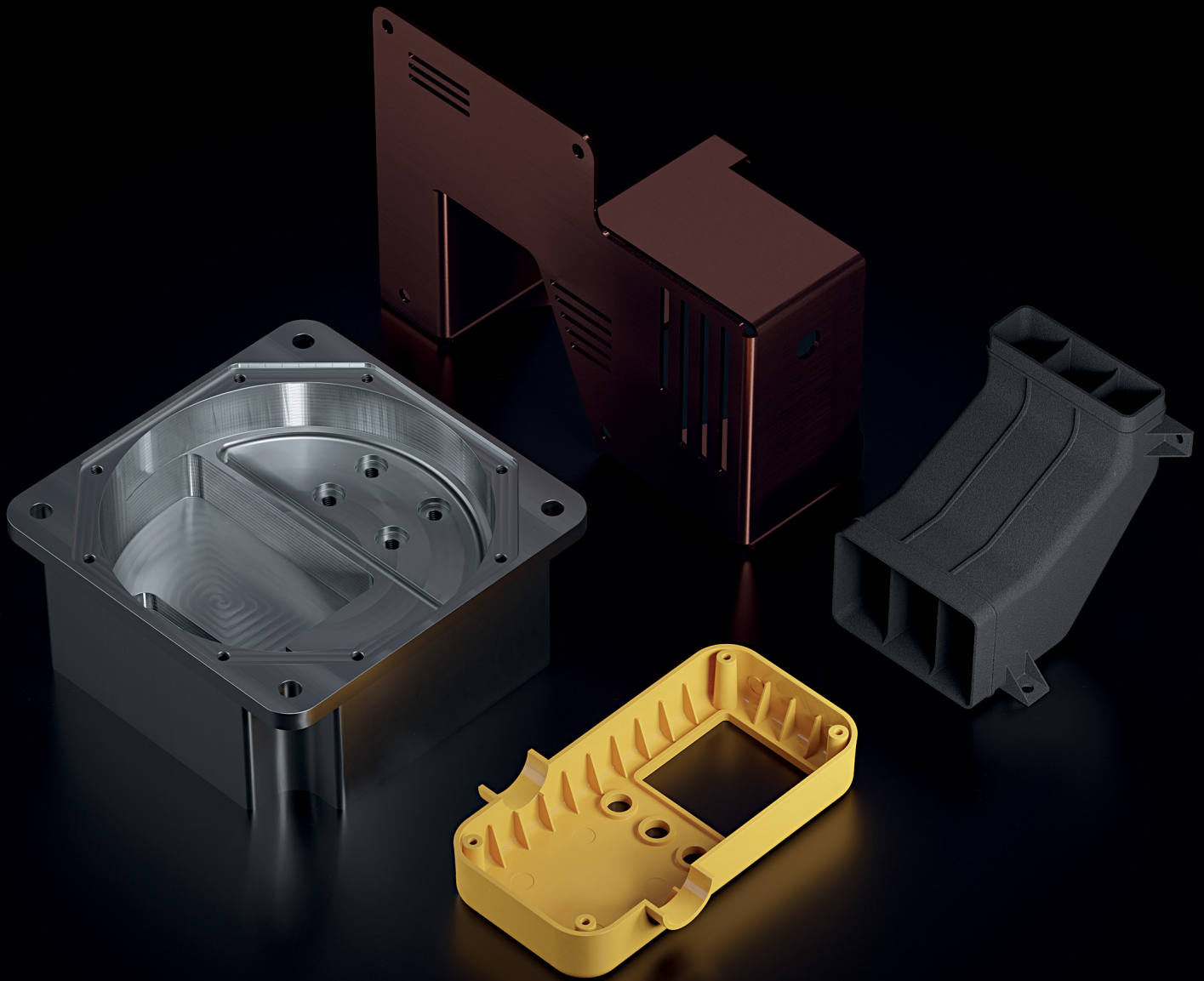


# Manufacturing services



3D HUBS

[sales@3dhubs.com](mailto:sales@3dhubs.com)  
[www.3dhubs.com](http://www.3dhubs.com)

EU +44 20 3966 9208  
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2020  
V. 3.06



INVENTAS. Injection molding, Black Nylon 30%GF

## Capabilities available online

Get an instant quote & order parts online in less than 5 minutes for the following technologies.

3D Printing	FDM, SLA, SLS, MJF, DMLS
CNC Machining	CNC Milling (3-, 4-, 5-axis), CNC Turning (lathe), Mill-turning
Injection Molding	Thermoplastic & silicones, Overmolding*, Rapid Tooling
Sheet Metal Fabrication	Laser cutting, Bending

\* Available upon request. Contact [sales@3dhubs.com](mailto:sales@3dhubs.com)

## Capabilities available through your account manager

Request a quote through your account manager or [sales@3dhubs.com](mailto:sales@3dhubs.com) for the following technologies.

EDM	Die-sink, hole drilling & wire-cutting
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## Additional services

Certifications	ISO 9001, material certificates
Expedited production	As fast as 5-day lead time for CNC Machining
Sample Verification Program	Premium first article inspection for productions of 100+ units

## Financial services

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Credit terms for  
certified businesses

NET30 or 50% down payment

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Blank/open  
Purchase Orders

Set up pre-approved credit for your engineers to use for time  
sensitive projects.

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The Phased Array Company  
CNC Machining, aluminium 6061, anodized color



# 3D Printing capabilities

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**Sample parts**

Left to right, top to bottom:  
 3D Printing, ABS (FFF),  
 graphite reinforced nylon  
 (SLS), carbon-reinforced  
 nylon (CFF), HP nylon (MJF),  
 rigid opaque resin (material  
 jetting), transparent resin  
 (SLA), ultra clear resin  
 (material jetting), castable  
 resin (DLP)

## Processes & materials

Process	Application	Materials
Prototyping FDM	Fast and affordable form-fit prototyping, jigs & fixtures	PLA, ABS, ASA, PETG, TPU
Industrial FDM	Functional prototypes & low-run production parts	ULTEM 9085, ULTEM 1010, ABS M30, ABSPlus, PA 6 Stratasys, PC Stratasys, Markforged Onyx
Prototyping SLA	High-detail visual prototypes	Formlabs Grey Pro Resin, Formlabs Clear Resin, Formlabs Durable Resin, Formlabs High Temp Resin, Formlabs Tough Resin, Formlabs Rigid Resin, Formlabs Standard Resin
Industrial SLA	High-detail functional prototypes and master patterns for casting	Accura 25, Accura 60, Accura Xtreme White 200
SLS	Functional prototypes & low-run production parts	PA 12, Glass-filled PA 12
MJF	Functional prototypes & low-run production parts	HP PA 12, Glass-filled HP PA 12
DMLS	Functional prototypes & metal parts	Stainless steel 316, Aluminum AlSiMg10

## Design guidelines and layer height options

Process	Min. wall thickness	Layer height	Max. build size	Tolerances
FDM	0.8 mm	100 - 300 $\mu$ m	500 × 500 × 500 mm	$\pm$ 0.5% with a lower limit of $\pm$ 0.5 mm ( $\pm$ 0.020")
SLA	0.5 mm	50 - 100 $\mu$ m	250 × 250 × 250 mm	$\pm$ 0.5% with a lower limit of $\pm$ 0.15 mm ( $\pm$ 0.006")
SLS	0.7 mm	100 $\mu$ m	420 × 500 × 420 mm	$\pm$ 0.3% with a lower limit of $\pm$ 0.3 mm ( $\pm$ 0.012")
MJF	0.7 mm	80 $\mu$ m	380 × 285 × 380 mm	$\pm$ 0.3% with a lower limit of $\pm$ 0.3 mm ( $\pm$ 0.012")
DMLS	0.4 mm	50 $\mu$ m	250 × 325 × 250 mm	$\pm$ 0.2% with a lower limit of $\pm$ 0.2 mm ( $\pm$ 0.008")



SLS parts being  
tumble/vibro polished

# CNC machining capabilities

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Sample parts - Brass, aluminium 6061 and stainless steel 304

## Materials

Aluminium	2014, 2017, 2024, 5052, 5080, 5083, 6061-T6, 6063, 6082, 7050, 7075-T6, A380, MIC6
Stainless steel	301, 303, 304L, 316L, 416, 420, 430, 440C, 15-5, 17-4, 2205 (Duplex)
Mild, alloy & tool Steels	1018, 1020, 1045, 1215, A36, 4130, 4140, 4340, A2, A3, D2, H13, O1, S7, P20
Brass/Copper	Brass C360, Copper C110, Copper C101
Other metals	Magnesium AZ31B, Titanium grade 1, Titanium grade 2, Inconel 718, Invar
Plastics	POM, PC, ABS, Nylon 6, Nylon+GF (30%), G-10, PVC, PMMA (Acrylic), PP, PP+GF(30%), HDPE, UHMWPE, PEEK, PTFE (Teflon), PET, FR-4

## Finishes and part marking

Bead blasting	Bead blasting
Anodizing	Anodizing Type III (hardcoat), Smoothed + Anodizing Type II (glossy), Bead blasted + Anodizing Type II (Matte)
Plating	Nickel*, zinc*, tin*, Brass*, copper*, Silver*, gold*, Teflon impregnated*, Electroless nickel*, copper*
Powder coating	Powder coating, Metallic spray painting*, Plastic spray painting*, Rubber oil painting*, UV oil painting*
Other finishes	Chromate coating/conversion (Alodine), Black oxide coating, UV protection coating*, Teflon coating*, Physical vapor deposition*, Gilding (gold film)*, Sand blasting*, Brushing Polishing*, Vapor polishing*, Brushing + Electropolishing
Part marking	Laser etching/laser engraving*, Silk screening*

\* Available upon request. Contact sales@3dhubs.com.



## Design guidelines

Dimension	Tolerances	Angularity
< 12" (300 mm)	±0.005" (0.125 mm)	±0.5°
< 24" (600 mm)	±0.010" (0.250 mm)	±1.0°
< 36" (900 mm)	±1/64" (0.400 mm)	±1.0°

Tightest tolerance: ±0.0004" (0.010 mm)

Tighter tolerances are examined on a case by case basis

## Surface roughness

As machined (standard)	RA 3.2 µm (126 µin)
------------------------	---------------------

Smooth machining	RA 1.6 µm (63 µin)
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Smoothest surface roughness: 0.25 µm (10 µin)

Smoothen surface roughness requirements are examined on a case by case basis

## Size limitations

Maximal part size	1000 mm (40 in) — Larger parts are reviewed on request
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Minimal part size	0.5 mm (0.02 in)
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Minimal diameter	0.3 mm (0.01 in)
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## Certifications

ISO 9001	Available upon request*
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Material certificates	Available upon request*
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\* Contact [sales@3dhubs.com](mailto:sales@3dhubs.com)



# Injection molding capabilities

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## Materials

ABS	PMMA (Acrylic)	POM (Delrin)	TPU*
PVC	Polypropylene (PP)	Glass-fibre reinforced PP*	PBT*
Polyethylene (PE)	Polystyrene (PS)	Carbon-fibre reinforced PP*	PPI*
Nylon	HDPE	High Impact PolyStyrene HIPS*	PPS*
Polyurethane (PU)	Polycarbonate (PC)	Low Density PolyEthylene LDPE*	Silicon*
PC/ABS	PEEK	TPE*	LSR*

\* Available upon request. Contact [sales@3dhubs.com](mailto:sales@3dhubs.com).

## Surface finishes

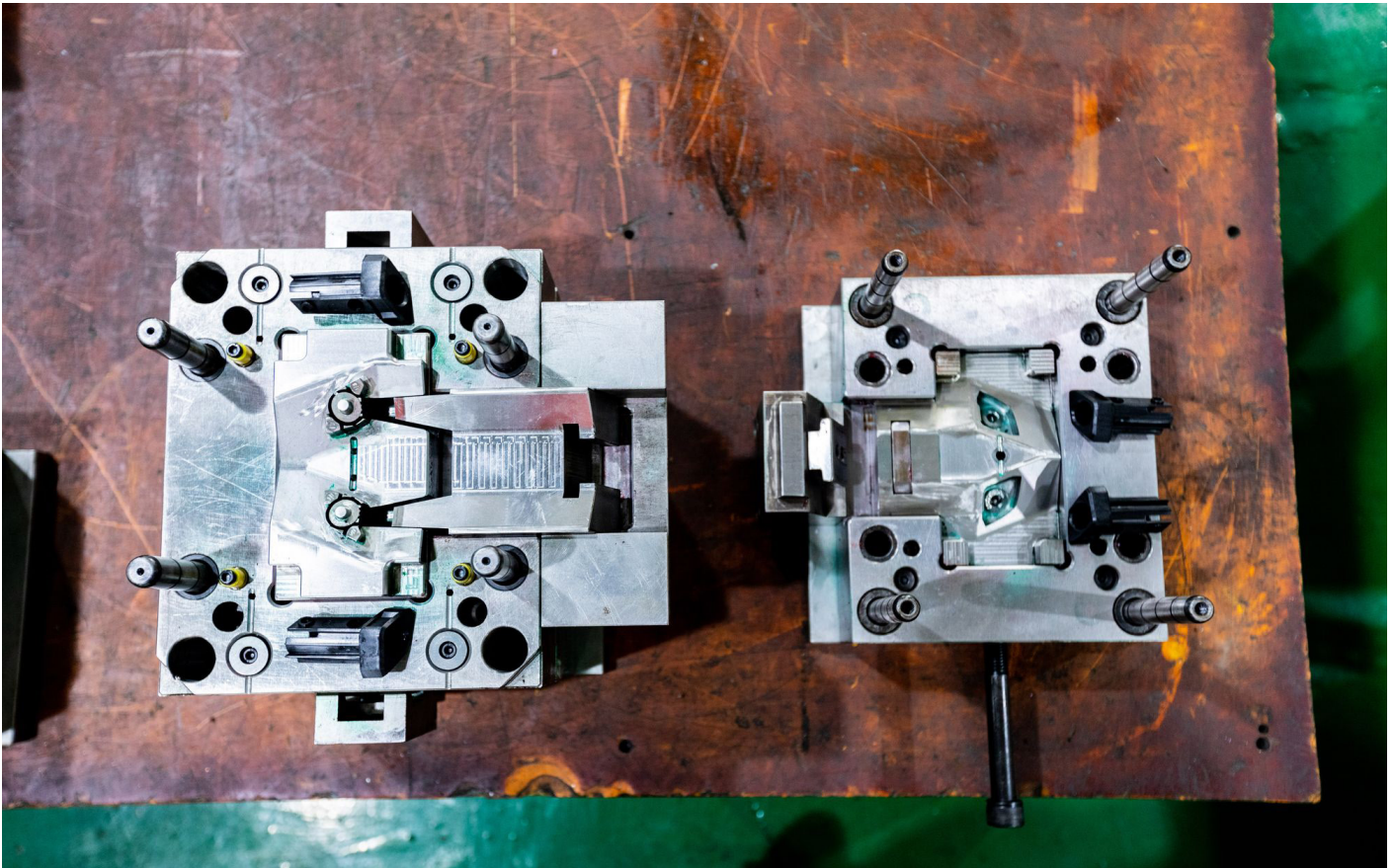
(A1) Super high glossy finish	(B1) Fine semi-glossy finish	(C1) Fine matte finish	(D1) Satin textured finish
(A2) High glossy finish	(B2) Medium semi-glossy finish	(C2) Medium matte finish	(D2) Dull textured finish
(A3) Normal glossy finish	(B3) Normal semi-glossy finish	(C3) Normal matte finish	(D3) Rough textured finish

## Additives

UV absorbers	Colorants
Flame retardants	Carbon fibers
Plasticizers	Glass fiber

## Capabilities

Single cavity molds	Insert molding
Molds with side-action cores	Family Molds
Overmolding	Multi-cavity molds



A production mold

## Mold services

Minimum order quantity	500 (Production), 100 (Rapid)
Mold material	Tool Steel P20, Carbon Steel S50C, Aluminium
Mold life time	20,000 - 100,000 shots
Mold storage	Min 2 years
Mold lead time	4-5 weeks (Production), 2-3 weeks (Rapid)
Quality assurance	Inspection reports included, full dimensional report and material certifications available upon request.
Sample Verification Program	Similar to First Article Inspection. You will receive 2 sets of parts upon the machining of the mold to test for fit before continuing to full production.
Reorders	Unit price is based on the quantity required. Reorders have an additional set up fee of €100.

# Sheet metal fabrication capabilities

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## Materials

Aluminium	5052, 5754
Stainless steel	304, 316L
Mild steel	1018
Copper	C110

## Size limitations

Process	Allowable sheet thickness	Maximum size
Laser cutting	0.0197 - 0.394" (0.5 - 6 mm)	39.37 × 59.05 × 0.394" (1000 × 1500 × 10 mm)
Bending	0.0197 - 0.236" (0.5 - 6 mm)	39.37 × 59.05 × 0.394" (1000 × 1500 × 10 mm)

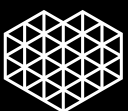
## Tolerances

Feature	Tolerance
Cutting feature	±0.00787" (0.2 mm)
Bend angle	±1.0°
Bend to edge	±0.010" (0.254 mm)



# Our surface finishing capabilities

For CNC machining and injection molding



3D HUBS

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# Our standard surface finishes for CNC machining

Use 3D Hubs as your one-stop solution for both manufacturing and surface finishing of your custom CNC machined parts, reducing the risk of production. Choose the right finish for your material. Different surface finishes can be applied to different materials. Find below a quick cheat sheet of surface finish and material compatibility.

Name	Material compatibility	Rough price increase*
Smooth machining	All plastics and metals	+10%
Bead blasting	All metals	+5%
Powder coating	All metals	+15%
Smoothing + Anodizing (type II) (Glossy)	Aluminum and Titanium alloys	+15%
Bead blasting + Anodizing (type II) (Matte)	Aluminum and Titanium alloys	+20%
Anodizing hardcoat (type III)	Aluminum and Titanium alloys	+30%
Brushing + Electropolishing	All metals	+15%
Black oxide	Stainless steel and copper alloys	+10%
Chromate conversion coating	Aluminum and Copper alloys	+10%
Brushing	All metals	+5%

\*Price increase estimates are based on one-off parts. Bulk pricing also applies to surface finishes.

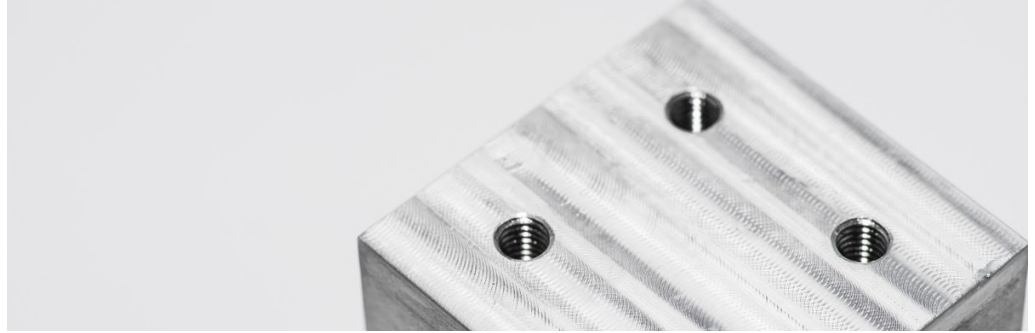
For custom surface finishes such as electroplating or polishing, please contact [sales@3dhubs.com](mailto:sales@3dhubs.com).



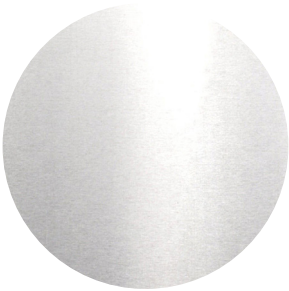


## As machined

Our standard finish is “as machined” finish. It has a surface roughness of  $3.2\ \mu\text{m}$  ( $126\ \mu\text{in}$ ). All sharp edges are removed and parts are deburred. Tool marks are visible.

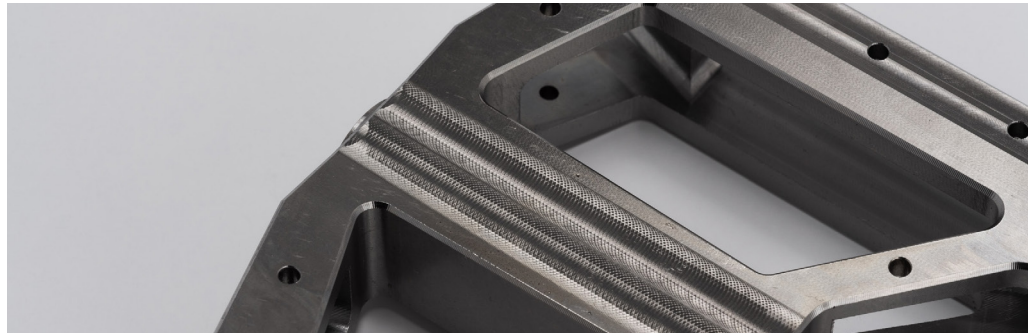


Example of as machined on aluminum



## Smooth machining

A finishing CNC machining operation can be applied to the part to reduce its surface roughness. The standard smoothing surface roughness ( $R_a$ ) is  $1.6\ \mu\text{m}$  ( $63\ \mu\text{in}$ ). This can be decreased down to  $0.4\ \mu\text{m}$  ( $15.7\ \mu\text{in}$ ) upon request and on a case-by-case basis. Machine marks are less evident but still visible.



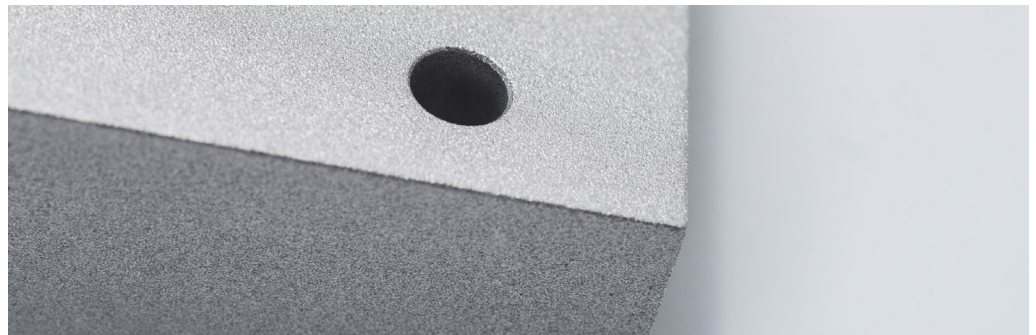
Example of smoothing on stainless steel



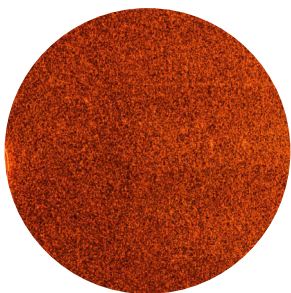
## Bead blasting

Bead blasting adds a uniform matte or satin surface finish on a machined part, removing the tool marks. This is used mainly for visual purposes and comes in several different grits which indicate the size of the bombarding pellets.

Requirement	Specifications
Grit	#120
Color	Uniform matte of raw material color
Part masking	Indicate masking requirements in technical drawing



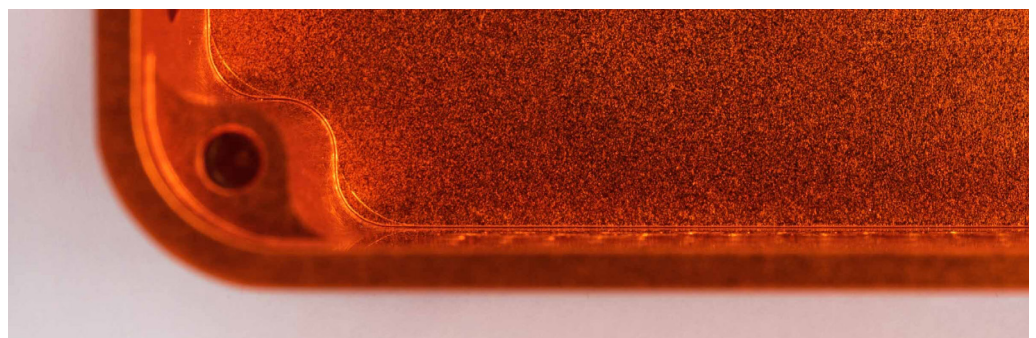
Example of bead blasting on aluminum



## Bead blasting + anodizing (type II) (Matte)

Type II anodizing is mainly used to produce parts with a uniform, aesthetically pleasing surface and provides good corrosion and limited wear resistance.

Requirement	Specifications
Thickness	8 - 12 $\mu\text{m}$ (color), 4 - 8 $\mu\text{m}$ (clear)
Color	Black, clear or any RAL code or Pantone number
Part masking	Indicate masking requirements in technical drawing



Example of anodizing on aluminum



## Smoothing + anodizing (type II) (Glossy)

Type II anodizing is mainly used to produce parts with a uniform, aesthetically pleasing surface and provides good corrosion and limited wear resistance.

Requirement	Specifications
Thickness	8 - 12 $\mu\text{m}$ (color), 4 - 8 $\mu\text{m}$ (clear)
Color	Black, clear or any RAL code or Pantone number
Part masking	Indicate masking requirements in technical drawing



Example of anodizing on aluminum



## Anodizing hardcoat (type III)

Type III anodizing provides excellent corrosion and wear resistance, suitable for functional applications.

Requirement	Specifications
Thickness	50 - 125 $\mu\text{m}$
Color	Black or clear
Part masking	Indicate masking requirements in technical drawing



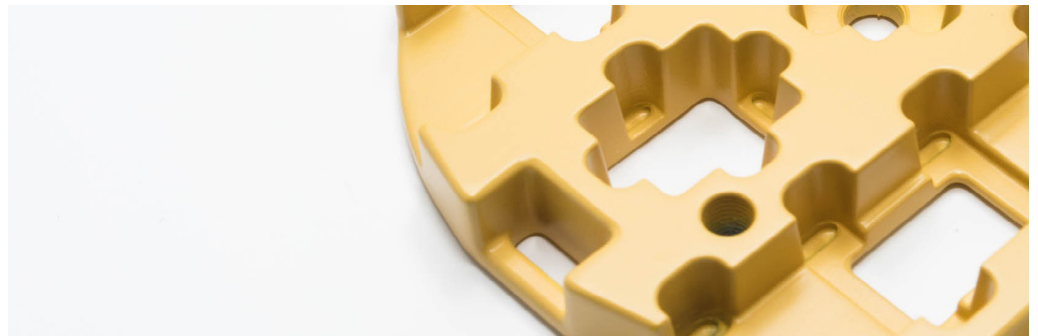
Example of anodizing on aluminum



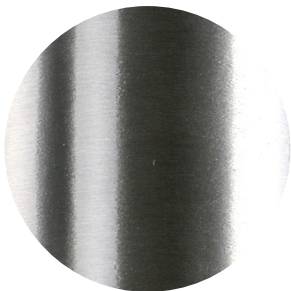
## Powder coating

Powder coating is a strong, wear-resistant finish that is compatible with all metal materials and can be combined with a bead blasting to create parts with smooth and uniform surfaces and excellent corrosion resistance.

Requirement	Specifications
Thickness	50 - 125 $\mu\text{m}$
Color	Black or clear
Part masking	Indicate masking requirements in technical drawing



Example of powder coating on aluminum



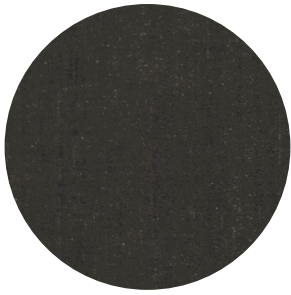
## Brushing + electropolishing

Electropolishing is an electrochemical process used to polish, passivate and deburr metal parts. It is useful to reduce surface roughness.

Requirement	Specifications
Color	Natural metal color
Part masking	Indicate masking requirements in technical drawing



Example of electropolishing on stainless steel



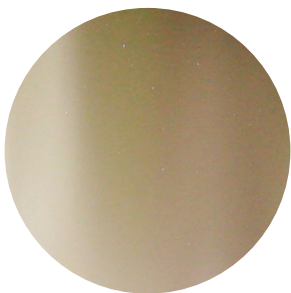
## Black oxide

Black oxide is a conversion coating used to improve corrosion resistance and minimize light reflection.

Requirement	Specifications
Color	Black
Part masking	Indicate masking requirements in technical drawing



Example of black oxide on stainless steel



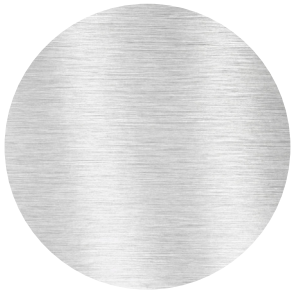
## Chromate conversion coating (Alodine/Chemfilm)

Chromate conversion coating is used to increase the corrosion resistance of metal alloys while maintaining their conductive properties.

Requirement	Specifications
Color	Clear or yellow
Part masking	Indicate masking requirements in technical drawing



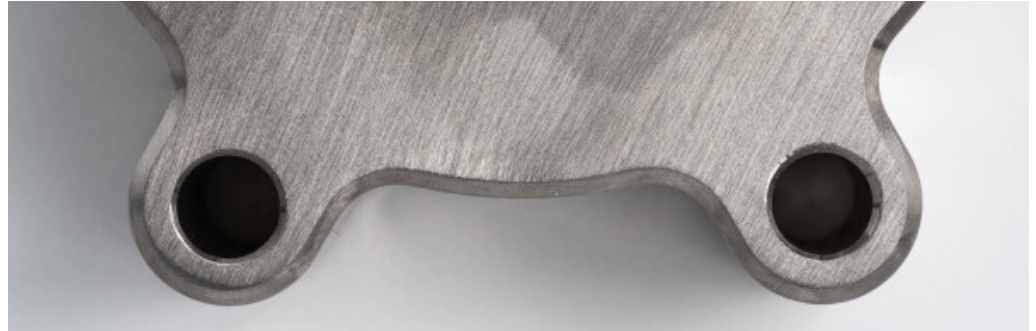
Example of chromate conversion coating on aluminum



## Brushing

Brushing is produced by polishing the metal with grit resulting in a unidirectional satin finish. Not advisable for applications where corrosion resistance is required.

Requirement	Specifications
Surface roughness	0.8 - 1.5 $\mu\text{m}$
Grit	#80-120
Part masking	Indicate masking requirements in technical drawing



Example of brushing on aluminum

# Our standard surface finishes for injection molding

Surface finishes can be used to give an injection molded part a certain look or feel. Besides cosmetic purposes surface finishes can also serve technical needs. For example, the average surface roughness (Ra) can dramatically influence the lifetime of sliding parts such as plain bearings.

Glossy finish	Semi-gloss finish	Matte finish	Textured finish
A-1	B-1	C-1	D-1
A-2	B-2	C-2	D-2
A-3	B-3	C-3	D-3

When selecting a glossy surface finish, remember these useful tips:

- A high glossy mold finish is not equivalent to a high glossy finished product. It is significantly subject to other factors such as plastic resin used, molding condition and mold design. For example, ABS will produce parts with a higher glossy surface finish than PP. To find the recommended material and surface finish combination visit the appendix.
- Finer surface finishes require a higher grade material for the mold. To achieve a very fine polish, tool steels with the highest hardness are required. This has an impact on the overall cost (material cost, machining time and post-processing time).



A-1



A-2



A-3

## Glossy finish (A-1, A-2, A-3)

Suitable for parts that require the smoothest surface finish for cosmetic or functional purposes (Ra less than 0.10 µm). The A-1 finish is suitable for parts with mirror-like finish and lenses.

Finish	SPI* standard	Finishing Method	Typical surface roughness
Super High Glossy finish	A-1	Grade #3, 6000 Grit Diamond Buff	0.012 to 0.025 µm
High Glossy finish	A-2	Grade #6, 3000 Grit Diamond Buff	0.025 to 0.05 µm
Normal Glossy finish	A-3	Grade #15, 1200 Grit Diamond Buff	0.05 to 0.10 µm

\* SPI (Society of Plastic Industry) standards



B-1



B-2



B-3

## Semi-gloss finish (B-1, B-2, B-3)

Suitable for parts that require a good visual appearance, but not a high glossy look.

Finish	SPI* standard	Finishing Method	Typical surface roughness
Fine Semi-glossy finish	B-1	600 Grit Paper	0.05 to 0.10 µm
Medium Semi-glossy finish	B-2	400 Grit Paper	0.10 to 0.15 µm
Normal Semi-glossy finish	B-3	320 Grit Paper	0.28 to 0.32 µm

\* SPI (Society of Plastic Industry) standards





## Matte finish (C-1, C-2, C-3)

Suitable for parts with low visual appearance requirements, but machining marks are not acceptable.

Finish	SPI* standard	Finishing Method	Typical surface roughness
Fine Matte finish	C-1	600 Grit Stone	0.35 to 0.40 µm
Medium Matte finish	C-2	400 Grit Stone	0.45 to 0.55 µm
Normal Matte finish	C-3	320 Grit Stone	0.63 to 0.70 µm

\* SPI (Society of Plastic Industry) standards



## Textured finish (D-1, D-2, D-3)

Suitable for parts that require a satin or dull textured surface finish.

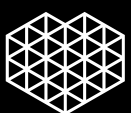
Finish	SPI* standard	Finishing Method	Typical surface roughness
Satin Textured finish	D-1	Dry Blast Glass Bead #11	0.80 to 1.00 µm
Dull Textured finish	D-2	Dry Blast #240 Oxide	1.00 to 2.80 µm
Rough Textured finish	D-3	Dry Blast #24 Oxide	3.20 to 18.0 µm

\* SPI (Society of Plastic Industry) standards



Daqri - CNC Machining, black anodised aluminium 6061

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