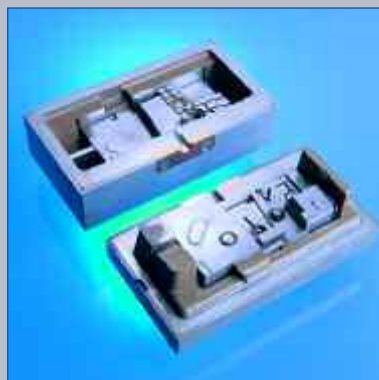


MCP TOOLING TECHNOLOGIES

RAPID TOOLING
RAPID REALISATION
RAPID MANUFACTURING
RAPID PROTOTYPING



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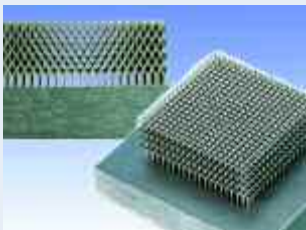
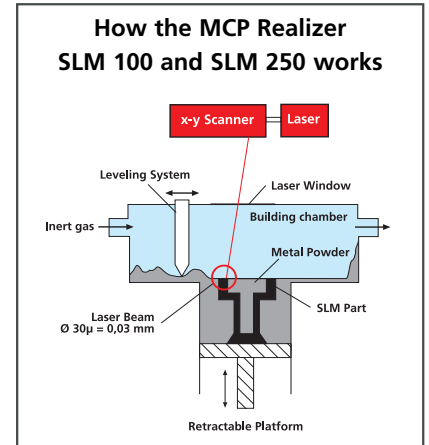


A new world-class generative process developed for direct product realisation with **Selective Laser Melting.**

Applications include sheet metal press tools, pressure die casting tools, injection moulds and finite metal parts. Even high quality metal parts such as components for medical implants can be produced to exact details.

The advantages of the MCP SLM Realizer Technology:

- Builds high quality parts and tooling inserts from almost any type of metal: Stainless steel (tool steel), titanium, cobalt-chrome, various nonferrous-metals and, if required specially designed HQ-Powders.
- Homogeneous build up of components and tool cavities up to 100% density depending on requirements.
- Fast and low cost because no post processing such as heat treatment or infiltration.
- Same day process: produce the component (insert, press or mould part) literally within hours. Fully automatic building process – parts overnight.
- Produces tools and inserts with internal undercuts and channels for conformal cooling.
- High resolution process, dimensional accurate, low heat generation, no distortion.
- Quick building process – 7.000 mm³ dense steel per hour on average.



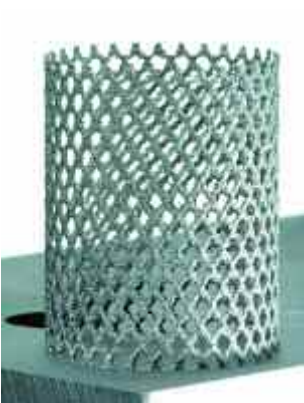


SLM Examples

Tooling made from stainless steel (316 L) or Tool Steel (H13) for heavy gauge sheet metal formings. 3000 parts with 3 mm thickness without visible wear.



Individually generated medical implants, dental bridges and crowns. Material: Cobalt chrome CoCr (right) with material properties better and more durable than castings. Acetabular cup (left). Material: Titanium (Ti6Al7Nb).



Light weight and lattice constructions. Material: Titanium (TiAl6V4). These applications and prospects are seen in the areas of medical implants, aircraft and the automotive industry.



Injection mould insert in dense tool H13 (right). The built-in conformal cooling channels reduce cycle times.



SLM (Selective Laser Melting) is a registered Trademark of F & S GmbH.

Worldwide, the most widely used system for prototype part manufacture – The MCP Vacuum Casting System

A full package turnkey system, first introduced in 1987 for producing exact and complicated prototype components in vacuum plastics, nylon and wax materials. A package system generally includes a combination of vacuum casting machines and ovens of the size required. Also included are tooling materials – usually silicone rubber – and a range of over 30 MCP Vacuum Plastics (comparable in performance to thermoplastics), and, important accessories. A full course of training, at the customer's premises, worldwide is always included in all MCP Package System.

With this process, multi segment moulds can be made overnight to be cut open the next day ready for casting the first prototypes on the vacuum casting equipment. Using the MCP Vacuum Casting Technique 30 to 50 color matched functional prototypes can be produced within two to three days from any type of model. MCP Vacuum casting has now become the state-of-the-art technology for achieving Multiples of technical prototypes for exhibition and functional testing and mould design checks. On average, users can expect to save 97% in time and cost compared to conventional steel tooling.

Widest range of materials and equipment, unrivalled customer training
MCP is the largest supplier with the most comprehensive and best performing range of vacuum casting and silicone rubber tooling materials worldwide.

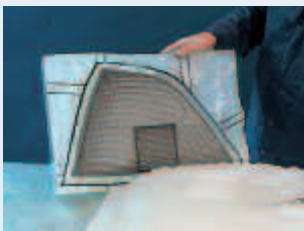
Completely Different Applications for MCP Vacuum Casting Machines

VarioPressure Casting
Parts from highly viscous materials such as Silicone Rubber.

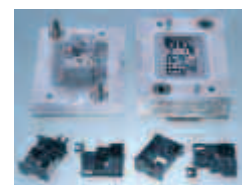
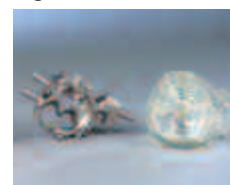
Wax castings
for metal investment casting.

Fusible Core Technology: internally undercut plastic castings.

EP Tooling Resin for injection moulds, processed on MCP Vacuum Machines.



Multi colour prototypes. Produced with the MCP Vacuum Casting System.



MCP Nylon Vacuum Casting



A completely new Rapid Prototyping, Rapid Manufacturing Process for prototype and production parts in Nylon PA-6. This new technology has all the advantages of the MCP standard Vacuum Casting Process.

- Quick, accurate, multi-segment silicone mould making within 12 hours
- Use any type of model for mould making
- Demould in only 6 minutes after casting Nylon
- Extremely thick and thin walled parts
- MCP PA 2000, PA 1000 and PA 700 have all the properties of injection moulded nylon polymers (see comparative data below)
- MCP Nylon Castings are air, gas and water tight
- Suitable for crash testing
- Can be welded and glued
- Chemically resistant
- Can replace metal components due to high strength and rigidity

Further applications include: one part automotive inlet manifolds, engine compartment parts and lamp housings.

MCP Vacuum Cast Parts in Nylon PA 6 can be used for clips, living hinges, containers, 2 part inlet manifold shells, air filter housings, radiator water tanks and gears.

- 1 3 MCP NYLON PA 2000
- 2 4 MCP NYLON PA 1000
- 5 MCP NYLON PA 700



The MCP 5/04 Nylon Module Version Machine. Easy to use controls to guarantee best casting results.



Load the silicone mould. Standard silicone mould technology is used for this process.



Close the doors and let the PLC controller take over.



Clips with permanent living-hinges. Typical Nylon PA 6 Vacuum Castings.

		MCP®		MCP®		MCP®		MCP®		Test	
	Unit	NYLON PA 3000	PA 12	NYLON PA 2000	PP	NYLON PA 1000	ZYTEL®	NYLON PA 700	PE HD	PE LD	ISO / DIN
Flexural Modulus	Mpa	2400	1500 - 2500	1950	950	862	750	600	550 - 750	500 - 600	178
Tensile Modulus	Mpa	2400	1000 - 2000	1800	1300	850	900	650	700 - 1400	200 - 500	R 527
Tensile Strength	Mpa	70	52 - 60	60	15 - 37	42	41	32	18 - 35	18 - 35	R 527
Heat Deflection Temp. (HDT) 1,8 Mpa	°C	125	42 - 80	105	45	51	71	49	50	50 - 35	75 (A)
Heat Deflection Temp. (HDT) 0,45 Mpa	°C	225	--	195	120	131	140+	76	50	50 - 35	75 (B)

Comparative data: Injection moulded DuPont™ Zytel® ST801 Polyamide 66, conditioned.

Data after conditioning

In 48 hours to perfect Metal Castings – The MCP Metal Part Casting Process The finest in Investment Casting Technology



Pressure Die Casting Quality Guaranteed!

No voids, excellent surfaces no finishing. The MCP Metal Part Casting Process has been designed specifically to meet the increasing demand for quick, economical metal castings for prototypes, low and medium runs of several hundred parts.

MCP Metal Part Casting is a new and complete package process for producing quick metal prototypes and mould inserts in as little as one day in materials such as zinc, aluminium, bronze, brass and copper when using "burn out" models in wax, polystyrene (SLS) or Quick Cast. Or, three days when using other types of model from which moulds for vacuum casting of waxes need to be made.

To apply the new process, wax castings or meltable „burn out“ models are required, which are encapsulated in ceramic and heated and melted out to leave a cavity which is filled with metal either under vacuum, pressure or gravity using the MCP Metal Part Casting Equipment.

Further important advantages of the process:

Use Any Rapid Prototyping Model
Start the process with any type of master model such as SLA, QuickCast, Objet, ThermoJet, Viper, LOM, SLS, FDM etc. and in any complexity.

Combined MCP Technologies to save time and cost

Low Cost Tooling

Utilise the **MCP Silicone Tooling Method** to produce quick, low cost, multi segment moulds for wax part production, impossible with standard, traditional tooling methods.

Produce Precision Wax Models

Use the well established method of master model duplication, the **MCP Vacuum Casting Process**, to produce thin walled, undercut wax models using silicone tooling.

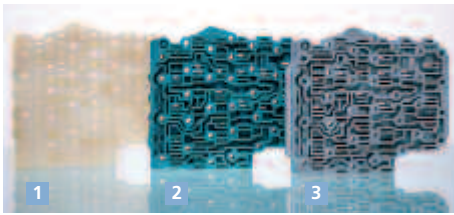
User Friendly, Clean

The automated Metal Part Casting Equipment, is suitable for a clean laboratory type environment not usually associated with a foundry applications.

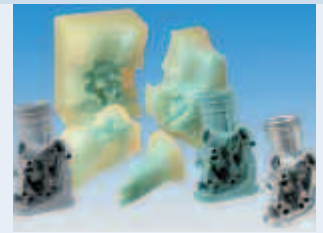
**No heat radiation - No dirt -
No fumes**

- 1 Set up the wax models adding the gate & some risers.
- 2 Place the casting flask over the wax models.
- 3 Mix and cast ceramic under vacuum to encapsulate the wax models in the flask. Place in the oven.
- 4 Remove the flask from the oven and place into the casting unit and close.
- 5 The PLC touch screen controller will operate all important parameters of the casting process. Melting takes between 15 and 20 minutes depending on the type and amount of metals. The casting operation is performed automatically in just a few seconds giving perfect results. No heat radiation, no dirt, no fumes.
- 6 The metal part can be removed from the ceramic mould within 30 to 60 minutes after casting. No voids, excellent surface detail, dimensionally accurate.

Examples of MCP Metal Part Casting



- 1 The Rapid Prototyping Model (RP).
- 2 The wax model produced with the MCP Vacuum Casting Technology.
- 3 The resulting complex aluminium component, an automotive gearbox duct plate with more than 80 measuring points, made with the MCP Metal Part Casting Process. More than 750 parts produced for prototypes and pre-series requirements. No voids, excellent surface detail, dimensionally accurate, no finishing.



3 days to complex metal parts
 -left, the model and the multi-segment silicone mould
 -the highly accurate wax casting through MCP Vacuum Casting
 -right, the resulting casting through MCP Metal Part Casting in die casting quality



MPA 1500R Custom build System



MPA 300 Complete Installation



One day from the model to the metal casting.
 SLS Polystyrene "burn out" model and the resulting Metal Part Casting in aluminium.



One day from the model to the metal casting. 3D QuickCast "burn out" model and the resulting Metal Part Casting in aluminium.

Machine type	Casting volume of metal	Flask size
MPA 300	3,0 dm ³ (8 kg Aluminium)	Ø 350 x 500 mm
MPA 1000	10,0 dm ³ (28 kg Aluminium)	Ø 550 x 700 mm
MPA 1500R	15,0 dm ³ / 3,0 dm ³ (42 kg / 8 kg Aluminium)	L 950 / W 650 / H 700 mm

Some data (extract) on Metal Part Casting Units



Product design and low series production – MCP Injection Moulding and Blow Moulding Machines for prototypes and short run plastic parts

The quick and economic way of making thermoplastic components „in house“

MCP semi-automatic moulding machines are capable of long or short production runs and are particularly suitable for insert moulding. The machines have a power lock and a dwell timer, enabling a preset ram pressure to develop a single, timed injection stroke at the push of a button. Alternatively, MCP machines provide the option of manual operation, a particularly useful feature for setting up moulds.

Specification:
MCP 50/E Blow Moulding Machine

Platen size	350 mm V x 250 mm H
Platen stroke	150 mm total (max daylight 300mm)
Clamp force	1 t
Parison control	By pressure programme
Machine size	2000 x 1050 x 700 mm H x W x D
Machine weight	500 kg
Power	@ 220V/110V 1 phase 2,5 kW (max)
Air	Approx 8 bar (max) x 5 LT/cycle (max)

Specification:
MCP 100 KSA Injection Moulder

Locking pressure	20 t
Standard diameter*	35 mm
Injection pressure	410 bar
Shot weight	100 g
Heating capacity	1.8 kW @ 220V/110V
Plasticising capacity	7 kg/h
Electric supply	2 kW @ 220V/110V 50 or 60 cycles
Air supply	Approx 8 bar
Maximum tool size**	150 x 150 x 250 mm H x W x D
Machine size	1280 x 760 x 400 mm H x W x D
Machine weight	260 kg

* Optional injection units are available

** By removing the end stop, moulds longer than 250 mm can be used

Fields of Application

- Production machine for prototype and small batch production from 10 to 1000 and more parts
- Production machine for insert moulding
- Laboratory machine for testing plastics and moulds
- Machine for schools and training establishments
- Injection moulding machines for wax models for investment casting

Advantages of the MCP Machines

- Low cost
- Robust design
- Simple Installation
- No servicing
- Low space requirement
- Simple low cost moulds
- Easy mould access
- Quick and easy mould and material change
- Relative to injection capacity MCP Machines are the most compact and easy to use on the market

Further Advantages of MCP- Injection Moulding and Blow Moulding Machines

- Moulds most thermoplastic materials
- Quick material changes
- Use low cost „bridge tooling“ systems such as metal spray moulds, aluminium or EP Tooling Resins
- Quick installation – easy to use
- Moulds set-up within minutes
- Permanent access to mould – manual demoulding saves costly ejector systems
- High shot capacity – low investment

Quality injection tools in just a few days – MCP EP Tooling Resins

The path to product success with MCP Tooling Technology

Shortened product cycles require new and better methods for realising production tooling. Injection moulding is internationally the most used plastics processing method but conventional tooling for this process is expensive and time consuming to produce. New methods of Rapid Tooling such as MCP EP tooling resins show that it can be achieved quicker and at a lower cost. Decisive is a tooling material which is easy to use and which will produce tooling to fulfil all the requirements of injection moulding. Further, the material needs to have similar stability to aluminium with a high surface quality. With MCP EP tooling resins, MCP-HEK has developed a material which fulfils all the requirements completely. Moulds produced in EP tooling show an extremely high glass transition temperature and compressive strength. Shrinkage is negligible at approximately + 0.02 percent. Despite the high aluminium filler content of 80 percent, EP tooling resin demonstrate excellent casting properties with high surface finish reproduction from any type of model.

The Chemical resistivity of MCP EP tooling resin is above average and the high quality dense surface can be polished to a mirror like finish if required. For mould changes and alterations, EP tooling resin moulds can be reworked easily without losing mould stability and strength. MCP EP tooling resin makes possible the manufacture of quick, economically acceptable injection moulds and quality parts.

Well tried applications for MCP EP tooling resins include:

- Large and small injections moulds
- Blow moulds
- Wax injections moulds
- Press moulds
- Shoe sole injections moulds

Type	EP 310 Resin/B Standard hardener	EP 310 Resin/BLP Long pot life hardener
Colour	grey	grey
Viscosity (cps)	30.000	40.000
Density (kg/dm)	2.0	2.0
Pot Life (min.) at 25° C	60 min	90 min
Hardness (Rockwell)/(Shore D)	112 R / 91 D	112 R / 91 D
Flexural Strength Mpa	130	125
Flexural Modulus Mpa	13.800	15.500
Tensile Strength Mpa	75	75
Tensile Modulus Mpa	14.000	14.500
Compr. Strength Mpa	265	255
Compr. Modulus Mpa	6.800	9.000
Izod Impact Strength (J/cm)	0,7	0,7
Shrinkage (%)	- 0,01	± 0
Thermal Conductivity (W/mK)	1,65	2,08
Linear Expansion (10° x mm/mm/K)	30	31
Deflection Temperature (°C)	250	250

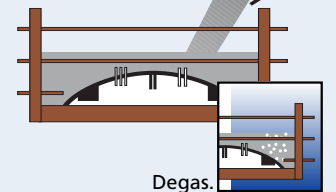
Processing EP Tooling Resin

Day One

Use models in any materials: wood, plaster, leather, silicone, resin or any type of rapid prototyping model. Fit metal inserts if required.



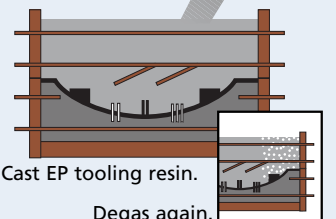
Fix casting frame and cooling pipes. Cast EP tooling resin.



Degas.

Day Two

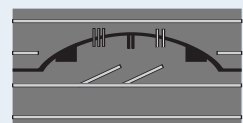
Fix upper casting frame.



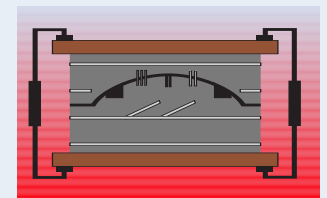
Cast EP tooling resin.

Degas again.

Day Three



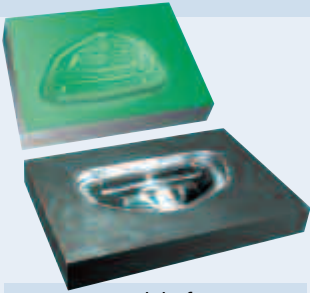
Remove the casting frame.



Heat cure the mould in the oven.



Completed injection tool.



Prepare a model of any material i.e.: wood, tooling board, styrofoam or SLA (Stereolithography)



To produce the punch, fill the casting pattern with MCP Alloy using a pre-prepared sheet metal retainer frame.



Punch and blankholder finished.



Assembled punch and blankholder.



Coat with wax sheet in the thickness of the sheet metal to be used and cast the MCP Alloy to produce the bottom die.



The finished component, manufactured in a MCP Sheet Metal Forming Die.

Prototype sheet metal forming tooling using MCP Low Melting Point Alloys

Sheet metal tooling in as little as 2 - 5 days

Sheet metal forming tooling produced with MCP 137 Low melting point alloy is used by many European automotive manufacturers, such as BMW and Daimler Chrysler. These automakers use this process for prototype runs of 20 – 200 pressings. This technology offers a multitude of tool making options for the user:

Easy to use, clean process with many user options

The most straight forward procedure is to use an existing sheet metal component (with the required modifications), suspend this in a casting frame and cast the alloy to produce the top and bottom tool simultaneously. Generally, the standard method of tool manufacture is to produce a model of either one or other side of the component required. The Low melt alloy is cast against this model to produce the first half of the tool. Demould the model after cooling and lay up the alloy casting with pattern maker's sheet wax in the required thickness of sheet metal required, for example 0.8 mm and cast low melt alloy against the wax sheet. Within a matter of hours after casting, the tool can be on the press to produce sheet metal prototypes and small runs in materials up to 3 – 4 mm. The process offers options of integrating steel inserts and die plates for extending tool life up to 2 – 3000 parts and casting tools with blank holders for deep drawing applications.

System Specification and requirements:

MCP 137 Low melting point alloy and melting equipment are the basic requirements to produce tooling. Melting tanks are supplied in sizes ranging from 150 kg (approx 330 lbs) melting capacity and up to 60 metric tons alloy capacity for producing automotive floor pan press tools.

The main advantages of the MCP 137 Alloy Tooling Process are:

- Large automotive press – tools in only 2 days
- Dimensionally extremely accurate
- No distortion
- No finishing required
- Low processing temperature
- Non toxic
- Completely re-usable



Multi-Purpose and Reusable MCP Low Melting Point Alloys

Melt between 47°C to 300°C. Formulated to expand, contract or remain dimensionally stable. Solve your problems of: anchoring, bending, bonding, metal forming, locating, mould making, radiation shielding, safety devices, soldering, fusible core technology, supporting.

Some interesting applications with MCP Alloys.

Make the Impossible: a five cylinder inlet manifold from Daimler Chrysler in 35% glass filled nylon.

- 1 **Left:** The metal core in MCP Low Melt Alloy. **Centre:** The metal core, over-moulded in plastic. **Right:** The finished component, after core melt out, internally undercut, impossible to produce with conventional tooling methods. The alloy used for this production application is MCP 137.
- 2 A transparent, internally undercut, one piece MCP Vacuum Casting in SG 95 Produced with fusible core technology. The Casting represents a cylinder head water jacket used to visualize water flow testing.
- 3 **Workholding of optical lenses (lens blocking).** Worldwide the standard technology for holding optical lenses in glass or plastic during grinding operations using alloys from 47°C - 70°C melting temperature.
- 4 **Tube and profile bending.** Allows wrinkle free bending of the thinnest of wall thickness. Also used for producing "T" pieces and complicated window profiles using alloys from 70°C – 124°C melting temperature.
- 5 **Workholding of turbines blades.** Worldwide the standard technology for holding aircraft and steam turbine blades using alloys from 70°C – 137°C melting temperature.



Melting tanks for casting and re-melting MCP alloys. Melting tanks are available in many sizes.





Service and training manuals, technical Videos and CD-ROMs.



Individual training.



Practical interactive training.



User Group Meeting



Rapid Tooling and Rapid Manufacturing Seminars.

About the MCP Group

From MCP's earliest days as a Bismuth Metal specialist a global approach to distribution and marketing has been called for. An international presence is important too for raw material purchasing and trade in surplus materials and residues. Our local companies have become a key factor in our determination to provide unequalled customer service.

An important task for MCP is to develop further our markets in Eastern Europe, Asia, South America, USA and Australasia.

Demonstration Centres are important too as a method of ensuring effective communication with customers. Trained application engineers, operating in purpose-built centres, are best able to deal with client queries and advise on the latest tooling techniques and materials.

Customer liaison and co-operative ventures are vital but we also have extensive dialogue with Universities and Institutes so that our concepts are always "one step ahead". Increasingly efficient use of scarce resources will always require a radical approach.

The Group's Central Laboratories have recently been expanded and reequipped. They are now housed in state-of-art facilities in Lübeck, Germany and Wellingborough, UK and provide an unrivalled service to all MCP companies. Quality Control must surely be at the heart of every successful business: MCP's laboratories for optimum control are fine examples of this philosophy.

The MCP Group Internet site is a popular point of reference for those interested in Minor Metals, Low Melting Point Alloys, Bismuth Chemicals, Rapid Prototyping or other MCP products and services. All are welcome to seek technical or commercial information and can do so quickly and economically round the clock using the e-mail links provided. MCP Internet and e-mail addresses are listed in full at the end of the brochure.

MCP's Worldwide Success

Comprehensive, individual customer training has been a major contributor to the tremendous worldwide success of MCP Vacuum Casting processes and Tooling technologies generally.

A further important factor is the total package supply concept which includes machines and equipment, tooling materials, casting materials, accessories and last not least training and service – all from MCP. One supplier means: complete responsibility for customer satisfaction!

Complete equipment • materials • customer training • customer satisfaction based on DIN ISO 9001 – worldwide

MCP RAPID TOOLING PROCESS TECHNOLOGY FROM A-Z



Over a period of 50 years the MCP Group of companies has grown to become a leading innovator with a worldwide reputation for supplying, installing and training in advanced mould technologies.

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MCP equipment and materials are exclusively distributed throughout Eastern Europe, Middle East, India, Pakistan, Far East, Australasia, S. America and S. Africa.

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MCP 
G R O U P