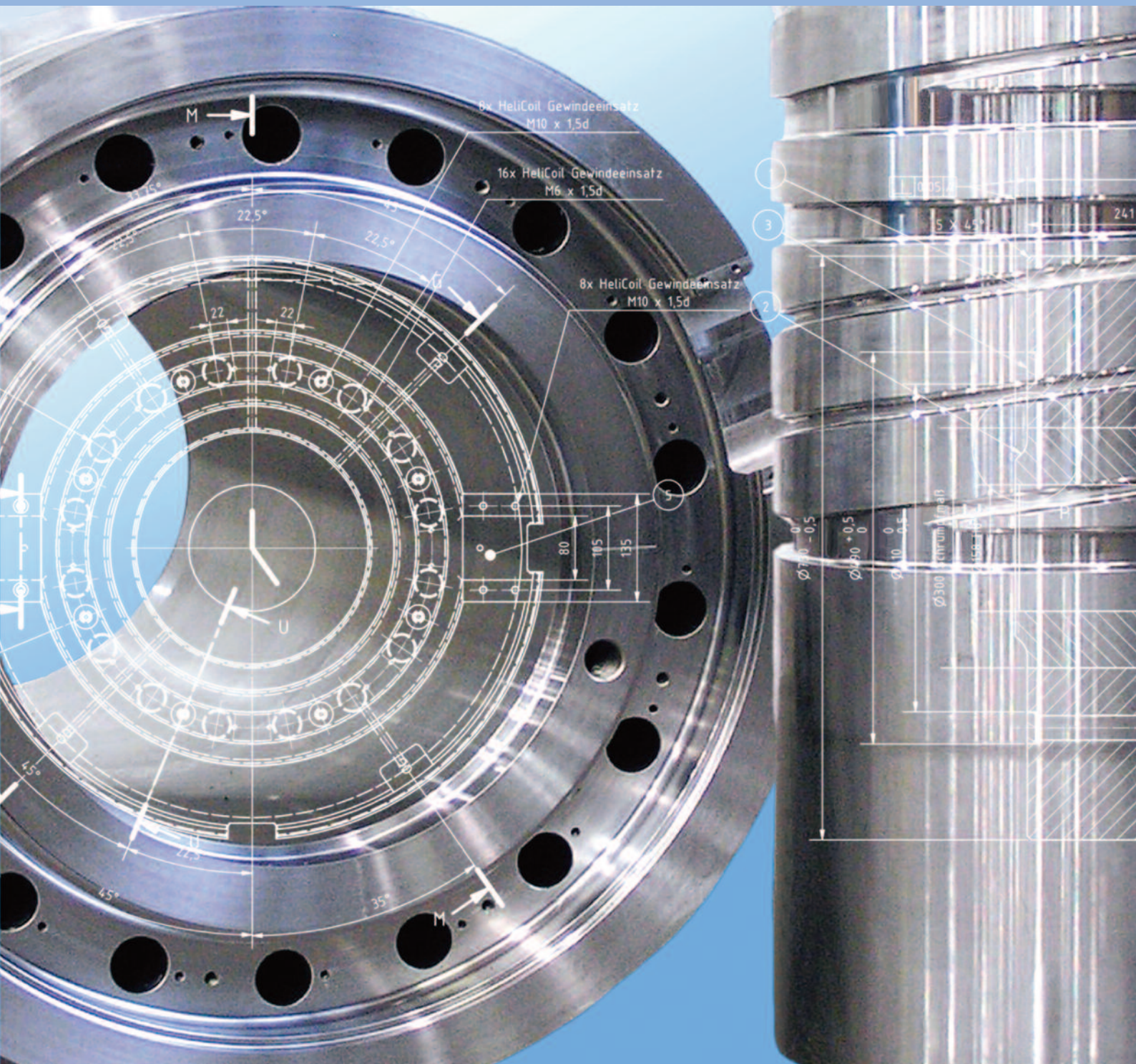


# Solutions for the extrusion industry



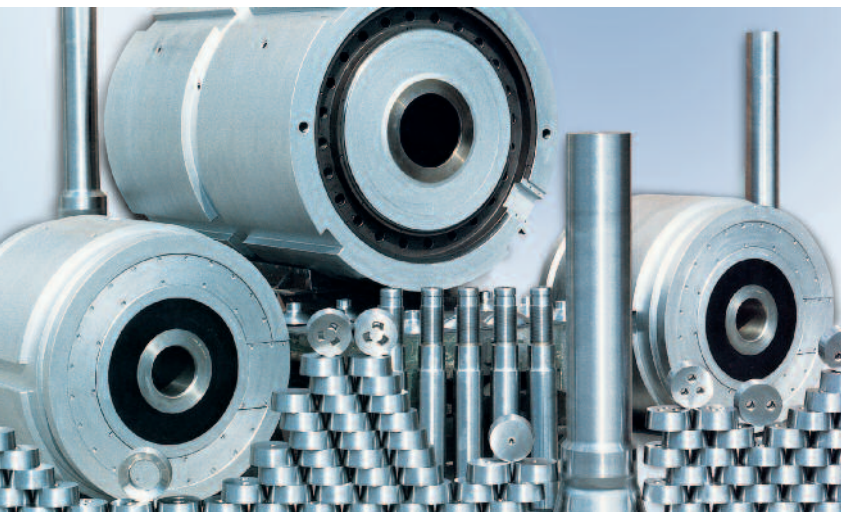
# Extrusion industry

## S+C Extrusion Tooling Solutions (ETS): Leading partner for the extrusion industry

The efficiency of extrusion depends to a large extent on the performance of the tooling, in particular on its service life. The durability of the extrusion tooling is influenced mainly by the following four factors:

- tool design
- material selection and heat treatment
- tool manufacture
- working conditions

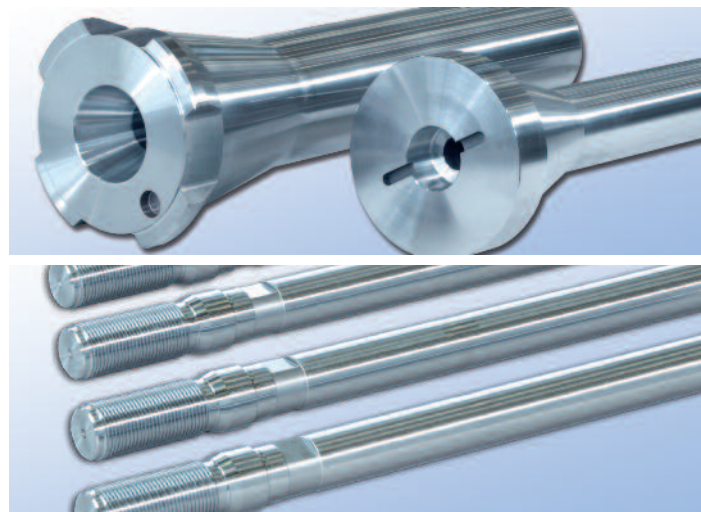
These are clear criteria for the competence and selection of a partner. The alloy steel specialist Schmidt + Clemens is recognised worldwide as a leading supplier to the extrusion industry. S+C has acquired extensive expertise over a number of years through innovation and reliable products that go far beyond the



## Material selection for extrusion tooling

The material selection depends primarily on the following factors:

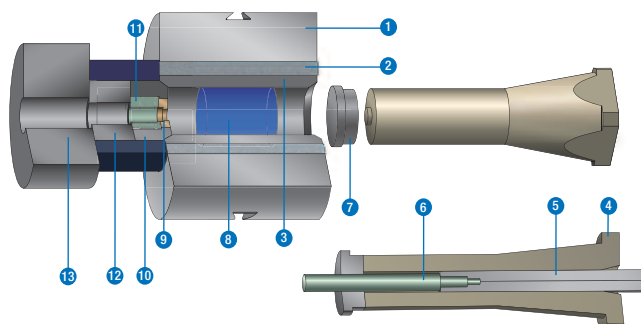
- material being extruded (aluminium, copper and copper alloys, steel)
- press temperature (up to 1000°C, partly long contact times)
- extrusion program/press sequence
- billet dimensions
- type of press
- extrusion speed
- press power
- extruded profile



criteria in this branch of industry. Based on many years of cooperation with the extrusion industry, S+C is regarded as a problem solver and partner that can be relied upon for sound advice.

S+C specialist engineers are internationally involved in the development and design of new tools and processes.

## Tooling of a metal tube and rod extrusion press



## Pre-machined or ready to use tools

Whether pre-machined or ready to use tools – S+C is the right partner, because the S+C Group has extensive expertise that sets international standards.

The most important tools are shown based on the example of a horizontal tube and rod extrusion press. Not all of the tools shown here are in direct contact with the hot extrusion material or are involved in the forming process. The loads/stresses and temperatures to which these tools are exposed therefore differ considerably. The complex interaction of all these components must meet the following requirements: All tools must enable the production of extruded profiles of the highest precision and quality at low tooling costs.

- |                          |                  |
|--------------------------|------------------|
| 1. mantle                | 8. billet        |
| 2. liner holder          | 9. extrusion die |
| 3. liner                 | 10. die holder   |
| 4. hollow extrusion stem | 11. die backer   |
| 5. mandrel holder        | 12. bolster      |
| 6. mandrel               | 13. tool holder  |
| 7. pressure pad          |                  |

# Containers

## Containers

Containers are the most expensive tools in extrusion. The design, material and manufacture of the containers are therefore of special importance. The high stresses occurring in the containers are mainly deformation loads, thermal stresses and wear.

S+C takes all of these factors fully into account. We meet the high demands on “critical tools” with our special expertise.

In addition to material selection, the container design is of special importance. This is where the specialised knowledge of S+C comes into its own, because design is part of our daily business.

This applies similarly to complex temperature control as required for modern zone-heated and cooled containers. S+C technology is state of the art in terms of product and system expertise.

The following table shows the materials used for individual container components. This includes the materials for processing aluminium, copper and copper alloys.

## Extrusion stem

The extrusion stem must withstand the total deformation resistance of the material being extruded. The occurring extrusion loads result in very high compressive and partly bending stresses in the stem.

Although the pressure pads prevent the stem from having direct contact with the hot billet, the stem head can be exposed to excessive temperature by the heat radiated from the liner and transferred via the pressure pad. In addition to high stresses, these conditions define the demands on special steels.

Steels for such use are shown in the table below.

### Materials for containers and extrusion stems

Mantle	Light metal		Copper and copper alloys	
	Designation	Material No.	Designation	Material No.
Normal load	WAGT/PHM	1.2311 / 1.2323	PHM	1.2323
	SRSE	1.2714	DCM	1.2343
High load	DCM	1.2343	DCM	1.2343
			WM30	1.2367
Liner holder	Light metal		Copper and copper alloys	
	Designation	Material No.	Designation	Material No.
Normal load	PHM	1.2323	DCM	1.2343
	DCM	1.2343	WM30	1.2367
High load (with cooling)	DCM	1.2343	WM30	1.2367
	WM30	1.2367		
Liner	Light metal		Copper and copper alloys	
	Designation	Material No.	Designation	Material No.
Normal load	DCM	1.2343	WM28	1.2365
	DCV	1.2344		
High load	WM30	1.2367	W512	~ 1.2779
			D690	1.2779
			SL6	(Inc. 718)
Extrusion stem specific load	Light metal		Copper and copper alloys	
	Designation	Material No.	Designation	Material No.
$P_{\text{spec}} \leq 700 \text{ N/mm}^2$	DCM / DCV	1.2343 / 1.2344	DCM / DCV	1.2343 / 1.2344
			WM30	1.2367
$P_{\text{spec}} > 700 \text{ N/mm}^2$	DCM / WM30	1.2343 / 1.2367	WM30	1.2367

# Extrusion dies and die inserts

## Extrusion dies and die inserts

The extrusion dies for forming are without doubt exposed to the highest loads due to temperature, friction, compression and wear. It goes without saying that every extrusion press operator prefers to use materials that ensure a long service life, but these are usually very expensive to manufacture.

However, the service life is not only determined by these loads. In addition criteria such as tool profile design, tolerances and surface quality of the extruded material and have to be considered amongst others.

Due to the multifarious requirements, there are no materials that can be used universally for solid dies or die inserts. Selection of the die material therefore always depends on the individual case. The following table contains an extensive selection of materials.

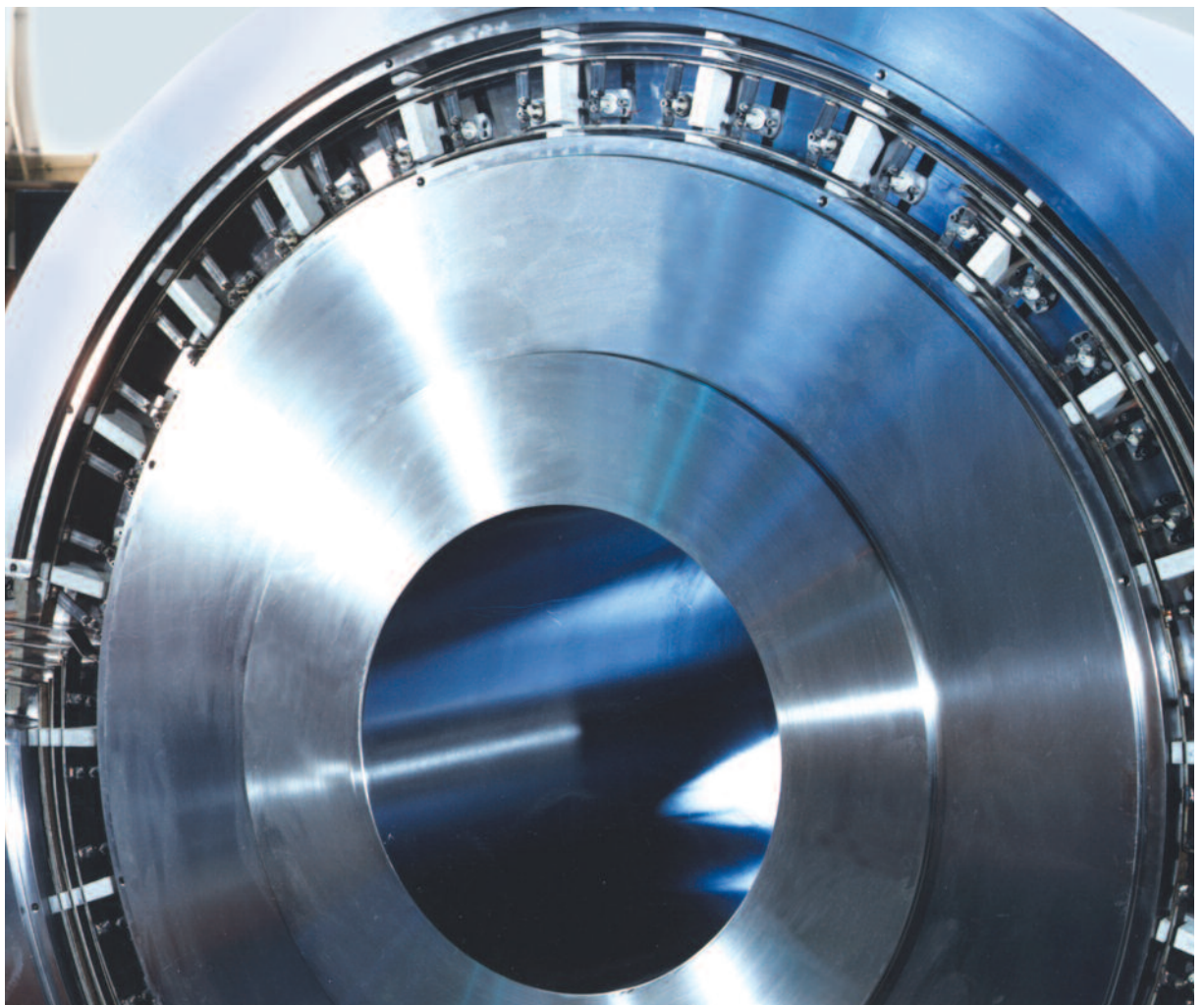
S+C specialist engineers will be happy to provide advice on material selection.

## Pressure pads

The pressure pads transfer the force applied by the extrusion stem to the billet. For this reason, they are always in contact with the billet throughout the extrusion process. They are subject to high temperatures and reach high local temperatures in the process.

The pressure pads must be cooled to normal temperature following extrusion. These tool components are subject to very high loads due to the high temperature fluctuations. High thermal stresses also occur on the edges when extruding with a shell.

Similar to the extrusion dies, distinction must be made between the extrusion of aluminium and heavy metals for the pressure pads.

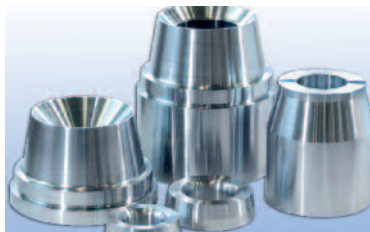
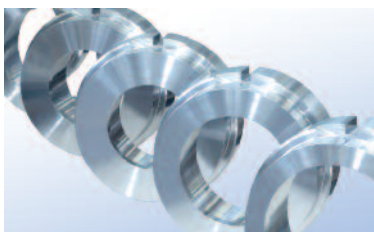


## Materials for extrusion dies

Aluminium		Designation	Material No.
Extrusion dies	Profiles with normal loading	DCM / DCV	1.2343 / 1.2344
Porthole dies	Profiles with high loading	WM30	1.2367
Copper and copper alloys		Designation	Material No.
Solid dies	Bar material and profiles with normal loading	WM28 / PWC PWC2 / REM W512	1.2365 / 1.2678 1.2888 / 1.2731 -1.2779
Die inserts	Profiles, wires and tubes with high loading	REM / REM Spez. SL6 / SL15 P63 / P42W / P42H Ceramic	1.2731 / 1.2758 2.4668 / 2.4973 2.4979 / Stellite 3/4 Ceramic

## Materials for pressure pads

Light metal		Designation	Material No.
Pressure pads	Normal loading	DCM / DCV	1.2343 / 1.2344
	High loading	WM30	1.2344 / 1.2367
Fixed pressure pads	Normal loading	DCM / DCV	1.2343 / 1.2344
	High loading	WM30	1.2367
Copper and copper alloys		Designation	Material No.
Pressure pads	Normal loading	WM28 / PWC WMC	1.2365 / 1.2678 1.2885
	High loading	PWC2 / W512 SL6	1.2888 / ~1.2779 2.4668

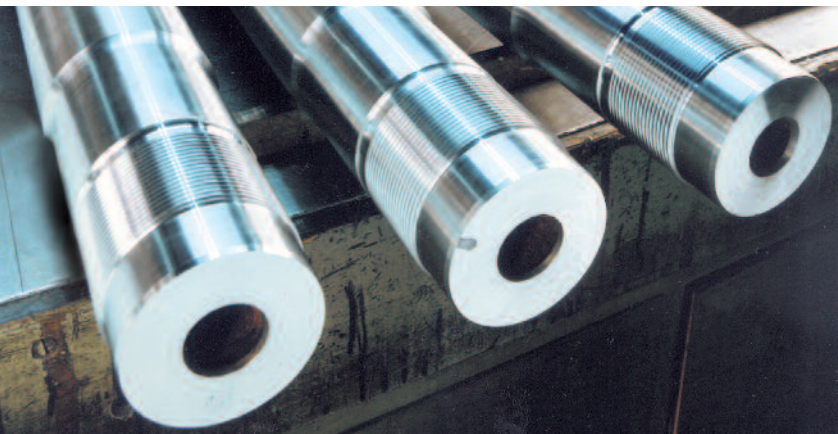


# Extrusion mandrels

## Extrusion mandrels

Extrusion mandrels are surrounded by the hot billet throughout the entire extrusion cycle. The thermal stress is correspondingly high. Piercing is also frequently carried out with the same mandrel. This results in high bending forces and compressive loads.

During the extrusion process, the material flows along the surface of the mandrel, which results in high friction and tensile loads. Extrusion mandrels are mainly used in the processing of heavy metals. The materials for mandrels for use with aluminium are also shown in the table. The quality of the mandrel determines the performance. S+C has extensive expertise in the manufacture of finished mandrels.



## Other extrusion tools

Only the sealing plate in indirect extrusion comes into direct contact with the material being extruded. With the cleaning discs, contact is limited only to the residual shell and discards. The thermal loads therefore only play a less important role.

Further extrusion tools are shown in the table below.



## Materials for extrusion mandrels

Aluminium		
Extrusion mandrels with dimensions	Designation	Material No.
up to 40mm Ø (without cooling)	DCV / WM30	1.2344 / 1.2367
> 40mm Ø (with cooling)	DCV / WM30	1.2344 / 1.2367
> 120mm Ø (without cooling)	DCM / DCV	1.2343 / 1.2344

Copper and copper alloys		
Extrusion mandrels with dimensions	Designation	Material No.
up to 40mm Ø (without cooling)	PWC / WM28	1.2678 / 1.2365
> 40mm Ø (with cooling)	WM28 / WM30	1.2365 / 1.2367
> 120mm Ø (without cooling)	WM30 / DCV	1.2367 / 1.2344
Mandrel tips	WM30 / SL15	1.2367 / 2.4973

## Materials for extrusion tools

Aluminium		
	Designation	Material No.
Mandrel holder	SRSE / DCM	1.2714 / 1.2343
Bolsters/pressure plates	SRSE / DCM	1.2714 / 1.2343
Die holders	SRSE / DCM	1.2714 / 1.2343
Sealing plates	DCM	1.2343

Copper and copper alloys		
	Designation	Material No.
Cleaning discs	DCV	1.2344
Mandrel holder	SRSE / DCM	1.2714 / 1.2343
Bolsters/pressure plates	SRSE / DCM	1.2714 / 1.2343
Die holders	WM28 / PWC W512	1.2365 / 1.2678 ~1.2779
Sealing plates	WM28 / PWC W512 / SL6	1.2365 / 1.2678 ~1.2779 / 2.4668

## Extrusion Service Centre (ESC)

In addition to an extensive range of hot work tool steels in the form of bars and forgings, S+C enjoys a worldwide reputation as a supplier of finished machined tools and components.

S+C offers customers in the extrusion industry a complete range of tools and components including planning, design and after-sales service.

S+C plans together with customers, designs and manufactures complete containers including heating and cooling control concepts. The Extrusion Service Centre "looks after" these containers throughout their life span.



## Advantages for S+C customers

- Everything under one roof – from planning to the finished tool
- Reliable and short delivery times
- High level of expertise
- Extensive technical support
- Cost savings due to the use of special production facilities and techniques
- Standard-setting research and development in cooperation with internationally leading institutes and universities

## Relining in the Extrusion Service Centre

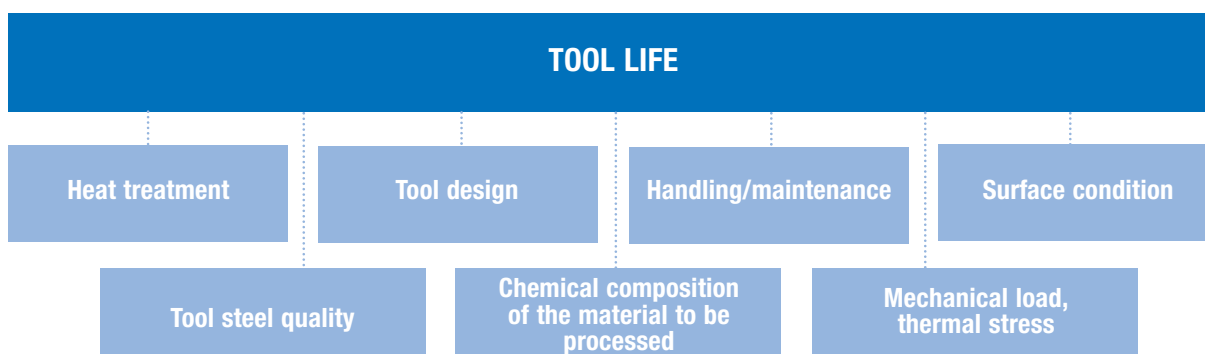
The container is the heart of the extrusion press. Its performance and that of the liner depend to a large extent on careful maintenance and correct replacement of the liner.

In the Extrusion Service Centre (ESC), all diagnostic results, work performed and dimensions of the container are documented.

In this way, every container is provided with its own specific documentation – the S+C Pass – which documents the entire "life cycle" relating to quality, diagnostics, performance features, maintenance, liner replacement and repairs. This ensures maximum precision with long life spans, which contributes to greater efficiency. S+C stands for maximum performance and efficiency.

## Complete S+C service for the relining

- Manufacture of a replacement liner made of Märker® hot work tool steel. This is best carried out before the relining process. Premanufactured liners can be stored at S+C ready for the arrival of the container. This significantly reduces the time for the relining process.
- Careful examination of the container for cracks or damage. Repair welding can be carried out if necessary.
- Measurement of the hardness of individual container components.
- Shrinking out of the old liner and, if necessary, the liner holder.
- Assessment and, if required, rough machining of the mantle/liner holder bore.
- Finished machining of the new liner to the interference fit dimensions.
- Shrink fitting.
- Documentation of the interference fit dimensions.
- Honing of the liner bore.
- Inspection and possible repair of the heating by arrangement.
- Order of a new replacement liner for carrying in stock.



## PETROCHEMICAL INDUSTRY

### Branches

- Petrochemical industry
- Iron-ore direct reduction

### Services for petrochemicals

- Metallurgy and material engineering
- Material analysis and examinations
- Metallurgical defect analysis
- Process and material consulting
- Design of tubes and tube systems
- Material welding services
- Convection zones

### Production sites

Germany, Spain, Malaysia, Brazil, Czech Republic, Saudi Arabia

### Contact

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## SPECIAL PRODUCTS

### Branches

- Separation technology
- Power technology
- Industrial furnace construction
- Marine-/Offshore
- Chemical and petrochemical

### Services

- Material and design consulting
- Mechanical machining
- Laboratory services
- Welding

### Production sites

Germany

### Contact

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### Branches

- Extrusion industry

### ETS services

- Relining
- Subcontract machining
- Videoscopic examinations
- Process consulting

### Production sites

Germany

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- Pump manufacturing
- Marine technology
- Power technology
- Chemicals industry
- Plant and machine construction

### Production sites

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## S+C BOWERS & JONES

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- Rolls and tube manufacturers

### Production sites

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