

## Manufacturing processes in the metalworking industry

Manufacturing processes are processes in which solid geometrical bodies are produced from *feedstock*<sup>1</sup>. These bodies may be produced either manually or by machine.

During the manufacturing process, the shape of the workpiece can be created, changed or *retained*<sup>2</sup>.

All manufacturing processes can be organised into six main categories which may be further *subdivided*<sup>3</sup>. The manufacturing processes contained in each group all share the same basic characteristics. Group 1, "Primary Shaping", consists of all the manufacturing processes which create particle *cohesion*<sup>4</sup>. Group 2, "Forming", contains the processes in which cohesion of particles is retained. Group 3 is entitled "Machining and Cutting". Manufacturing processes in this group cause a reduction in particle cohesion. Group 4, "Joining and Fastening", and group 5, "Coating", both consist of manufacturing processes which increase particle cohesion. Lastly, the manufacturing processes in group 6, "Material Property Changes", are all characterised by a simultaneous *retention*<sup>5</sup>, reduction and increase in particle cohesion.

*In the box below, you can see examples of various manufacturing processes. Look up any new words in a dictionary or in your Metal Trades Handbook and add the German equivalents to the wordlist on the right-hand side of the page. Then match each of the manufacturing processes to one of the six main groups, using the chart provided on the following page. You may add more examples.*

casting	nitriding	rolling	filing	annealing
	deep-drawing			turning
soldering		varnishing		
milling	welding	bending	hot-dip galvanising	
	sintering	hardening	reaming	

<sup>1</sup> feedstock – Ausgangsmaterial

<sup>2</sup> retained – beibehalten (verb: to retain)

<sup>3</sup> be subdivided – unterteilt werden (verb: to subdivide)

<sup>4</sup> cohesion – der Zusammenhalt

<sup>5</sup> retention – die Beibehaltung

annealing – **Glühen**  
 bending – **Biegen**  
 casting – **Gießen**  
 deep-drawing – **tiefziehen**  
 filing – **feilen**  
 hardening – **härten**  
 hot-dip galvanizing – **feuerverzinken**  
 milling – **fräsen**  
 nitriding – **nitrieren**  
 reaming – **reiben**  
 rolling – **walzen**  
 sintering – **sintern**  
 soldering – **löten**  
 turning – **drehen**  
 varnishing – **lackieren**  
 welding – **schweißen**

# Manufacturing processes

Group	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Name of the group	<b>Primary shaping</b>	<b>Forming</b>	<b>Machining and Cutting</b>	<b>Joining and Fastening</b>	<b>Coating</b>	<b>Material Property Changes</b>
Common basic characteristics of the group	<b>particle cohesion is created</b>	<b>cohesion of particles is retained</b>	<b>cohesion of particles is reduced</b>	<b>cohesion of particles is increased</b>	<b>cohesion of particles is increased</b>	<b>cohesion of particles is retained, reduced and increased</b>
Examples of manufacturing processes	<ul style="list-style-type: none"> <li>• casting</li> <li>• sintering</li> </ul>	<ul style="list-style-type: none"> <li>• rolling</li> <li>• deep-drawing</li> <li>• bending</li> </ul>	<ul style="list-style-type: none"> <li>• turning</li> <li>• milling</li> <li>• reaming</li> <li>• filing</li> </ul>	<ul style="list-style-type: none"> <li>• welding</li> <li>• soldering</li> </ul>	<ul style="list-style-type: none"> <li>• hot-dip galvanising</li> <li>• varnishing</li> </ul>	<ul style="list-style-type: none"> <li>• annealing</li> <li>• nitriding</li> <li>• hardening</li> </ul>
Explanatory facts	<ul style="list-style-type: none"> <li>• workpiece is created from shapeless liquid, granulated, powdery or molten material</li> </ul>	<ul style="list-style-type: none"> <li>• an existing simple workpiece is transformed into a more complex one</li> <li>• mass &amp; material composition are not changed</li> <li>• applied force results in plastic deformation</li> </ul>	<ul style="list-style-type: none"> <li>• shape of a workpiece is changed as material is removed</li> <li>• volume and number of particles of the workpiece decrease</li> </ul>	<ul style="list-style-type: none"> <li>• individual workpieces are joined to form a new workpiece with a new shape</li> </ul>	<ul style="list-style-type: none"> <li>• adhesive covering is applied to the surface of an object to improve the surface properties of the substrate</li> <li>• the shape of the workpiece is not changed</li> </ul>	<ul style="list-style-type: none"> <li>• purposeful changing of the material properties of a workpiece to achieve desirable characteristics of a material</li> <li>• the shape of the workpiece is not changed</li> </ul>



# Fertigungsverfahren

Gruppe Nr.	Gruppe 1	Gruppe 2	Gruppe 3	Gruppe 4	Gruppe 5	Gruppe 6
Name der Gruppe	<b>URFORMEN</b> (primary shaping)	<b>UMFORMEN</b> (Forming)	<b>TRENNEN</b> (Machining & Cutting)	<b>FÜGEN</b> (Joining & Fastening)	<b>BESCHICHTEN</b> (Coating)	<b>STOFFEIGENSCHAFTEN ÄNDERN</b> (Changing material properties)
Gemeinsames Merkmal aller Verfahren in der Hauptgruppe	Zusammenhalt des Werkstoffes wird geschaffen	Zusammenhalt des Werkstoffes wird beibehalten	Zusammenhalt des Werkstoffes wird vermindert	Zusammenhalt des Werkstoffes wird erhöht	Zusammenhalt des Werkstoffes wird erhöht	Zusammenhalt des Werkstoffes wird beibehalten, erhöht und vermindert
Beispiele für Verfahren in der Hauptgruppe	<ul style="list-style-type: none"> <li>• Gießen</li> <li>• Sintern</li> </ul>	<ul style="list-style-type: none"> <li>• Walzen</li> <li>• Tiefziehen</li> <li>• Biegen</li> </ul>	<ul style="list-style-type: none"> <li>• Drehen</li> <li>• Fräsen</li> <li>• Reiben</li> <li>• Feilen</li> </ul>	<ul style="list-style-type: none"> <li>• Schweißen</li> <li>• Löten</li> </ul>	<ul style="list-style-type: none"> <li>• Feuerverzinken</li> <li>• Lackieren</li> </ul>	<ul style="list-style-type: none"> <li>• Härten</li> <li>• Glühen</li> <li>• Nitrieren</li> </ul>
Fakten, Erklärungen	<ul style="list-style-type: none"> <li>• Werkstück wird aus formlosem flüssigen, pulverigen, granulierten oder geschmolzenen Material hergestellt</li> </ul>	<ul style="list-style-type: none"> <li>• einfaches Werkstück wird in eines mit komplizierterer Form umgeformt</li> <li>• Masse &amp; Materialzusammensetzung werden nicht verändert</li> <li>• Kraft → plastische Verformung</li> </ul>	<ul style="list-style-type: none"> <li>• Material wird entfernt → Form des Werkstücks ändert sich</li> <li>• Volumen &amp; Anzahl der Partikel im Werkstück verringern sich</li> </ul>	<ul style="list-style-type: none"> <li>• individuelle Werkstücke werden miteinander verbunden u. bilden ein neues Werkstück mit einer neuen Form</li> </ul>	<ul style="list-style-type: none"> <li>• haftende Beschichtung wird auf Oberfläche eines Werkstücks aufgebracht um die Oberflächeneigenschaften zu verbessern</li> <li>• Form des Werkstücks wird nicht verändert</li> </ul>	<ul style="list-style-type: none"> <li>• Ändern der Materialeigenschaften eines Werkstücks um gewünschte Eigenschaften eines Materials zu erzielen</li> <li>• Form des Werkstücks wird nicht verändert</li> </ul>

