

Leseprobe

The education professional for technology

Christiani

Technical Institute for
Vocational Training

Metal Trades Handbook



Dr.-Ing. Paul Christiani GmbH & Co. KG
www.christiani.de

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Symbols

Basic principles

Metal technology symbols						
Directional valves			5/3-way valve with blocking centre position		Roller	
	Designation: Here 3/2-way valve 3 connections (1-3) 2 switching positions (a, b)		Directional throttle valve with 2 outer limit positions		Spring	
	2/2-way valve, normal position open		Directional throttle valve with neutral centre position		Pressurisation, hydraulic	
	2/2-way valve, normal position closed	Operating states of valves			Pressurisation, pneumatic	
	3/2-way valve, normal position closed		Normal position closed		Pressurisation, indirect Hydraulic	
	3/2-way valve, normal position open		Normal position open		Pressurisation, indirect Pneumatic	
		Actuation methods			Indirect actuation via pressure release	
	4/3-way valve, normal position open		Muscle power, general		Electromagnet and pilot directional valve	
	4/2-way valve		Pushbutton		Electromagnet	
	4/3-way valve with closed centre position		Lever		Electric motor	
	4/3-way valve with floating centre position		Pedal	Other devices		
	5/2-way valve		Plunger, pushbutton		Timing element, adjustable	
	Roller, operates only in one direction		Light			
Directional valves, short designation and connector labels			Cylinder			
Short designation		Connector label				Single-acting cylinder, return stroke through force
Example designation		Connection	Old standard	for 2/2-way valve, manually operated	for 3/2-way valve, pneum. operated	for 5/2-way valve pneum. operated
		Pressure supply.	P	1	1	1
		Working line	A	1	2	2
		Working line	B	-	-	4
		Venting	R	-	3	3
		Venting	S	-	-	5
		Control connection	Y	-	12	12
		Control connection	Z	-	-	14
						Single-acting cylinder, return stroke through spring
						Double-acting cylinder with single piston rod
						Double-acting cylinder with two-sided piston rod
						Cylinder with adjustable damping on the piston side
						Cylinder with double, adjustable damping

Dimensioning: grooves, recesses, special dimensions

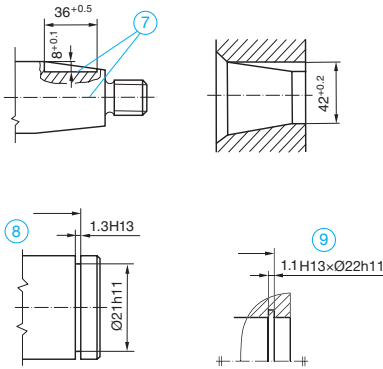
Documentation

Technical Documentation

Standardisation

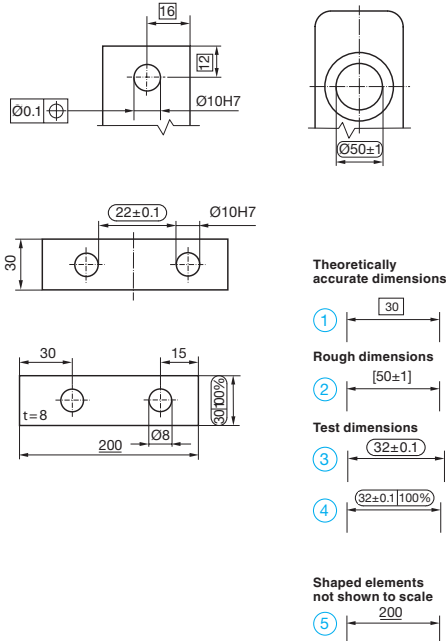
Technical drawing

Dimensioning of grooves and recesses



- ⑧ With peripheral grooves or recesses, the groove width and base diameter are dimensioned.
- ⑨ Grooves or recesses for retaining rings, locking rings etc. are dimensioned in simplified form by specifying width (fit) x groove base diameter (fit).

Special dimensions



- ① *Theoretically accurate dimensions* are also indicated in tables and lists by a rectangular frame and without tolerances.
- ② If a drawing of the unmachined part is not prepared, the *rough dimensions* are shown in the production drawing in square brackets. The meaning of these brackets must be explained in the drawing title block.

Test dimensions are shown in frames with two semicircles. An explanation of the meaning and the test scope must be provided near the title block, for example

- ③ Dimensions are specially checked by the orderer (recipient) during the acceptance test or
- ④ Dimensions are 100% checked by the orderer (recipient) during the acceptance test. They are not checked randomly!
- ⑤ Shaped elements that are not shown to scale are indicated by *underlining* their dimensions.

Note:
 Use of this marking is not permitted in CAD drawings.

Thread run-outs, thread undercuts, screws

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Machine elements

Thread run-outs and thread undercuts

DIN 76-1

Male thread						Female thread					
<i>d</i>	<i>P</i>	<i>x_{1 max}</i>	<i>d_g h13</i>	<i>g</i>	<i>r</i>	<i>d</i>	<i>P</i>	<i>e_{1 min}</i>	<i>d_g H13</i>	<i>g</i>	<i>r</i>
M1	0.25	0.6	0.6	0.9	0.12	M1	0.25	1.5	1.1	1.4	0.12
M2	0.4	1	1.3	1.4	0.2	M2	0.4	2.3	2.2	2.2	0.2
M3	0.5	1.25	2.2	1.75	0.2	M3	0.5	2.8	3.3	2.7	0.2
M4	0.7	1.75	2.9	2.45	0.4	M4	0.7	3.8	4.3	3.8	0.4
M5	0.8	2	3.7	2.8	0.4	M5	0.8	4.2	5.3	4.2	0.4
M6	1	2.5	4.4	3.5	0.6	M6	1	5.1	6.5	5.2	0.6
M8	1.25	3.2	6	4.4	0.6	M8	1.25	6.2	8.5	6.7	0.6
M10	1.5	3.8	7.7	5.2	0.8	M10	1.5	7.3	10.5	7.8	0.8
M12	1.75	4.3	9.4	6.1	1	M12	1.75	8.3	12.5	9.1	1
M16	2	5	13	7	1	M16	2	9.3	16.5	10.3	1
M20	2.5	6.3	16.4	8.7	1.2	M20	2.5	11.2	20.5	13	1.2
M24	3	7.5	19.6	10.5	1.6	M24	3	13.1	24.5	15.2	1.6
M30	3.5	9	25	12	1.6	M30	3.5	15.2	30.5	17.7	1.6
M36	4	10	30.3	14	2	M36	4	16.8	36.5	20	2
M42	4.5	11	35.6	16	2	M42	4.5	18.4	42.5	23	2
M48	5	12.5	41	17.5	2.5	M48	5	20.8	48.5	26	2.5
M56	5.5	14	48.3	19	3.2	M56	5.5	22.4	56.5	28	3.2
M64	6	15	55.7	21	3.2	M64	6	24	64.5	30	3.2

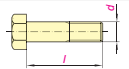
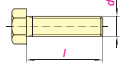
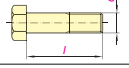
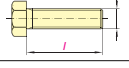
Identification of threads (examples)

M30	Metric ISO thread, standard thread, nominal diameter 30 mm
M 30x1	Metric ISO thread, fine thread, nominal diameter 30 mm, pitch 1 mm
M 30 - LH	Metric ISO thread, standard thread, nominal diameter 30 mm, left-hand thread
Tr 40x14 P7	Metric ISO trapezoidal thread, multiple starts, 40 mm nominal diameter, 14 mm pitch, 7 mm spacing, number of starts = pitch/spacing = 14/7 = 2 (two-start thread)

Screws

Screw types – overview

Hexagon head screws

DIN EN ISO 4014		Stem and regular thread	M1.6 – M64	Mechanical engineering, Tool building, Automobile construction
DIN EN ISO 4017		Regular thread up to head	M1.6 – M64	
DIN EN ISO 8765		Stem and fine thread	M8x1 to M64x4	
DIN EN ISO 8676		Fine thread up to head	M8x1 to M64x4	

Screw locking element → 254, Screw connection → 230

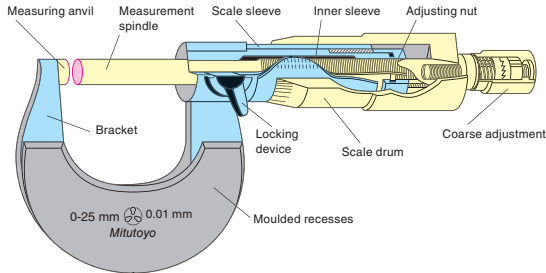
Machine elements

Measurement and testing technology

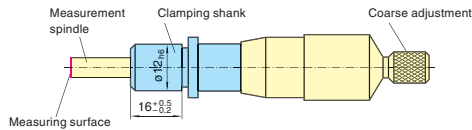
Basic principles of dimensional metrology and measuring instruments

**Micrometers
DIN 863**

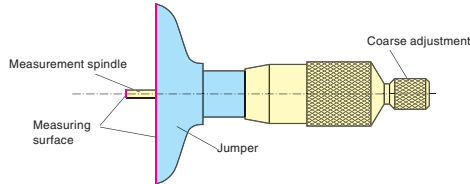
Micrometer gauge



Integrated micrometer

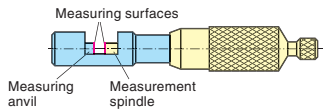


Depth micrometer



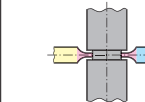
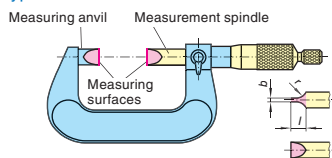
**Special
designs of
micrometers**

**Micrometer with small clamp
Type D2**



Measuring of wire thicknesses and ball diameters

**External screw type micrometer with narrow measuring surfaces
Type D4**



Measurements at narrow recesses
(e. g. for retaining rings)

Measurement
and test. tech

Steels, short names

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Materials engineering

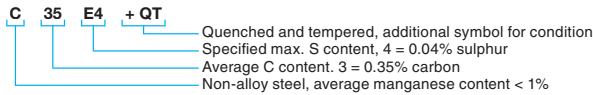
Short names of steels

DIN EN 10027-1

Structure of the short name based on chemical composition

A few minor changes have been made to the structure of the short name based on chemical composition in DIN EN 10027 in comparison with the old designation systems.

Designation example:



Steel groups	Principal symbols Code letter	C content Identification number	Chemical composition	Additional symbols ²⁾ DIN EN 10027-1										
			Alloy content Chemical symbols, identification numbers											
Non-alloy steels (with the exception of freecutting steels), average manganese content < 1%	C GC ¹⁾	Average % C content x 100	-	E, R D, C, S, U, W										
Non-alloy steels average manganese content >1%			<i>Chemical symbols</i> sorted by decreasing element content <i>Identification numbers</i> $\hat{=}$ % proportion of alloying elements x factor											
Non-alloy freecutting steels, low-alloy steels (with the exception of high-speed steels)	G ¹⁾		<table border="1"> <thead> <tr> <th>Factor</th> <th>Alloying element</th> </tr> </thead> <tbody> <tr> <td>1000</td> <td>B</td> </tr> <tr> <td>100</td> <td>P, S, N, Ce, C</td> </tr> <tr> <td>10</td> <td>Al, Cu, Mo, Ta, Ti, V, Be, Pb, Nb, Zr</td> </tr> <tr> <td>4</td> <td>Si, Co, Cr, W, Ni, Mn</td> </tr> </tbody> </table>	Factor	Alloying element	1000	B	100	P, S, N, Ce, C	10	Al, Cu, Mo, Ta, Ti, V, Be, Pb, Nb, Zr	4	Si, Co, Cr, W, Ni, Mn	-
Factor	Alloying element													
1000	B													
100	P, S, N, Ce, C													
10	Al, Cu, Mo, Ta, Ti, V, Be, Pb, Nb, Zr													
4	Si, Co, Cr, W, Ni, Mn													
High-alloy steels (with the exception of high-speed steels), content of one alloying element \geq 5%	X GX ¹⁾		<i>Chemical symbols</i> sorted by decreasing element content. <i>Identification numbers</i> $\hat{=}$ % proportion of alloying elements without C content = $\frac{\text{Identification number}}{100}$ %	-										

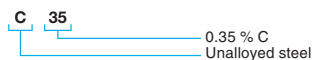
¹⁾ For cast steels, the short name must begin with the letter G.
²⁾ The additional symbols can be added to the principal symbol as a suffix if necessary.

Designation examples:

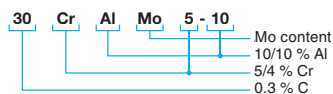
Structure based on purpose and mechanical properties



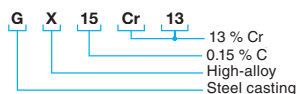
Structure based on chemical composition, non-alloy steel



Structure based on chemical composition, low-alloy steel



Structure based on chemical composition, high-alloy steel



Materials

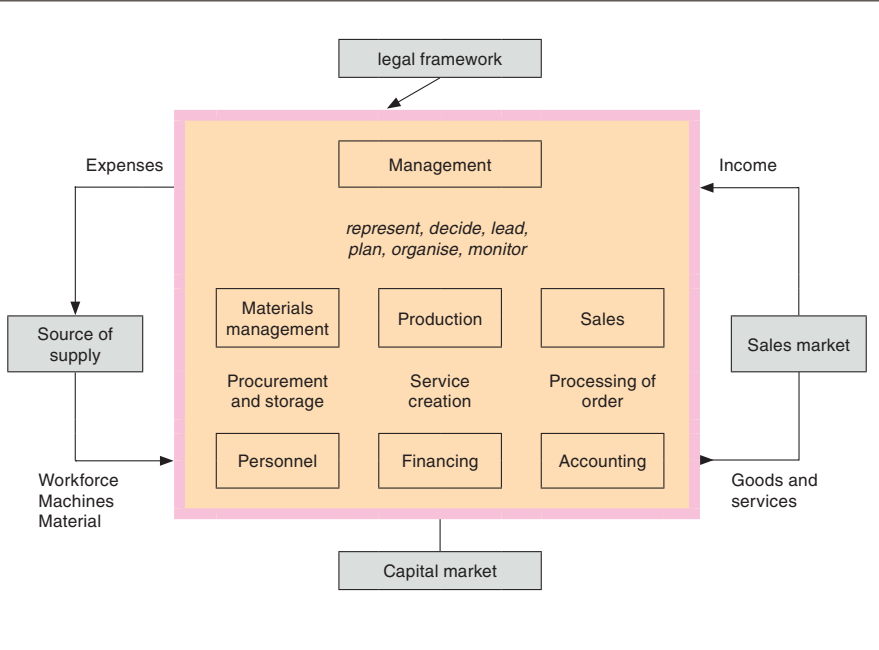
712

Enterprise and company, environment and enterprise

Interdisciplinary skills

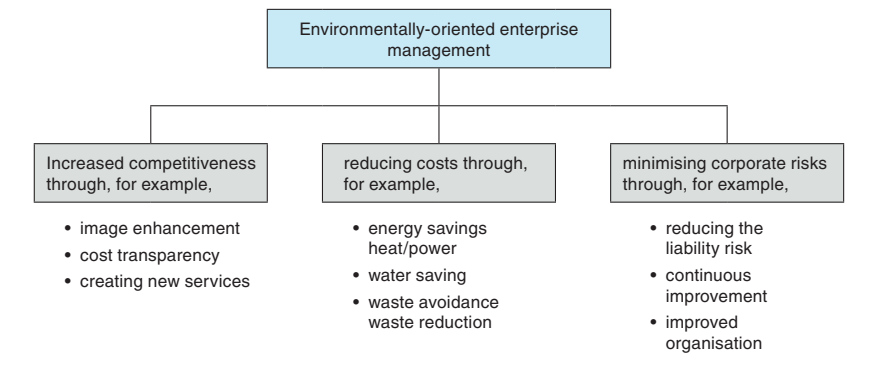
Enterprise and company

Model: Industrial enterprise



Environment and enterprise

Every company must be interested in operating in an environmentally-aware manner for purely *economic reasons*. On the one hand, this provides *competitive advantages* and on the other, it *reduces costs*. Companies that do not do this are taking considerable risks.



Skills

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