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für metalltechnische Berufe

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Lösungsbuch

TECHNISCHES ENGLISCH zur FACHKUNDE METALL

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Vorwort

Das **Lösungsbuch Technisches Englisch für die Fachkunde Metall** dient zur Erarbeitung und Überprüfung der **Exercices** (Übungen) im Lehrbuch **Technisches Englisch für die Fachkunde Metall.**

Es enthält die **Fragen bzw. Aufgaben der Exercises** aus dem Lehrbuch und die dazu gehörenden **Antworten bzw. Lösungen.**

Die Antworten/Lösungen sind in Blau gedruckt und heben sich dadurch deutlich von den in Schwarz gedruckten Fragen/Aufgaben ab.

Die Exercises sind in derselben Reihenfolge und Kapitelnummerierung wie im Lehrbuch **Technisches Englisch für die Fachkunde Metall** angeordnet. Eine zusätzliche Seitenangabe lässt die jeweiligen Exercises im Lehrbuch rasch auffinden.

Nach jedem Kapitel bietet das **Lösungsbuch** eine Seite mit einer **Übungseinheit** (Test unit) zur Leistungsüberprüfung an.

Die **Übungseinheit** kann vom Lernenden als selbstgestellte Überprüfung seines Wissensstandes genutzt werden oder kann vom Lehrer durch Kopieren als Klassensatz zur Leistungsüberprüfung der Klasse verwendet werden.

Nach dem Bearbeiten der Übungseinheit (Test unit) können die erarbeiteten Lösungen mit einem Lösungsvorschlag verglichen und korrigiert werden.

Sollten Sie Verbesserungsvorschläge zum **Lösungsbuch** haben, so freuen wir uns auf Ihre Zuschrift. Bitte senden Sie Ihre Hinweise und Vorschläge per E-Mail an: lektorat@europa-lehrmittel.de

Sommer 2024 — Die Autoren, der Verlag

Empfehlungen zum Lernen mit dem Lösungsbuch

Zur Erzielung eines optimalen Lernerfolgs mit dem Lösungsbuch hat sich die folgende Vorgehensweise bewährt.

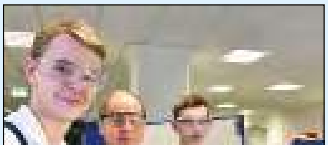
1. Sie wählen das entsprechende Sachthema aus und schlagen die Seite im Lösungsbuch auf, z. B. Seite 6. Sie decken die Antwort der Aufgabe 1 a) mit einem Blatt Papier ab.

A new colleague from England

Exercises page 7, Textbook

1. **Übersetzen Sie unter Beachtung der Reihenfolge S V O im Satz.**

a) Der Ausbilder zeigt John einen Bohrer.



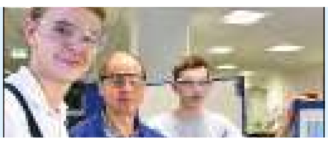
2. Sie überlegen sich die Lösung und notieren sie stichwortartig auf dem Blatt Papier.

The instructor shows John a drill.

3. Sie schieben das Blatt Papier zur Seite und vergleichen Ihre Lösung mit der korrekten Lösung im Lösungsbuch.

1. **Übersetzen Sie unter Beachtung der Reihenfolge S V O im Satz.**

a) Der Ausbilder zeigt John einen Bohrer.
The instructor shows John a drill.



4. Sie prägen sich die vollständige und richtige Lösung ein.
5. Dann gehen Sie zur nächsten Frage und bearbeiten sie auf gleiche Weise.

Table of Contents

Inhaltsverzeichnis

Answers to the questions in the Textbook **TECHNISCHES ENGLISCH zur FACHKUNDE METALL**

A new colleague from England in vocational training

Exercises page 7, Textbook

1. Übersetzen Sie unter Beachtung der Reihenfolge S V O im Satz.

a) Der Ausbilder zeigt John einen Bohrer.
The instructor shows John a drill.

b) Mit dem Haarlineal misst man die Ebenheit von Werkstücken.
With the straight edge you measure the flatness of workpieces.

c) John feilt ein Werkstück und bohrt Löcher.
John files a workpiece and drills bores.

d) Man trifft häufig freundliche Leute im Biergarten.
You often meet friendly people in the Biergarten.

2. Bilden Sie die Fragesätze in Englisch.

a) In welchem Land produziert die Firma von Max?
In which country does the company of Max produce?

b) Wer ist der Chef von Max und John?
Who is the boss of Max and John?

c) Wann kommt Max jeden Tag in die Werkstatt?
When does Max come to the workshop every day?

d) Mit welchem Werkzeug wird die Ebenheit von Werkstückoberflächen geprüft?
Which tool is used to check the flatness of workpiece surfaces?

3. Form the suitable tenses in the following sentences (Simple Present and Past Progressive).

a) Max (to wash) ____________ his hands after work.
Max washes his hands after work.

b) Look! John (to drill) ____________ bores into the flat bar.
Look! John is drilling bores into the flat bar.

c) The instructor (to sit) ____________ in his room now and (to examine) ______________ the workpieces.
The instructor is sitting in his room now and is examining the workpieces.

d) Please be quiet, John, I (to write down) __________________ the measured value of the diameter.
Please be quiet John, I am writing down the measured values of the diameter.

1 Measuring technique

1.1 Physical quantities and units

Exercises page 8, Textbook

1. Working with words. Which words from the text are described here?

a) Every material has certain ______________, for example it has a special density.

Every material has certain physical properties, for example it has a special density.

b) In order to find out the correct diameter of a workpiece, you need to ______________ it with an instrument.

In order to find out the correct diameter of a workpiece, you need to measure it with an instrument.

c) The speed of a car is also called __________.

The speed of a car is also called velocity.

2. Define physical quantities in German by using the information from the text above.

Die an einem Objekt (z. B. bei einem bestimmten Werkstoff) messbaren Eigenschaften, Vorgänge oder Zustände werden physikalische Größen genannt.

3. Answer the following questions in English.

a) Which two elements does a physical quantity have? Find an example to explain it.
A physical quantity consists of a numerical value and a unit.
For example: A workpiece has a *length* l of 330 mm:
330 represents the numerical value and **mm** the unit.

b) Which 7 base quantities does the International System of Units SI define?
The 7 base quantities defined by the International System of Units SI are
- length,
- mass,
- time,
- electric current,
- temperature,
- amount of substance,
- luminous intensity.

c) What is the difference between base quantities and derived quantities?
The base quantities cannot be transferred into another quantity. The derived quantities can always be transferred back into the base quantities.

Examples:
The time t is a base quantity. The force F is a derived quantity. It can be derived by its formula $F = m \cdot a = m \cdot \frac{2\,l}{t^2}$ to base quantities: m, l, t.

Exercises page 9, Textbook

1. Write down the formula and explain the correct derived units. (Use your Metal Trades Handbook)

a) pressure p
$p = F : a$; Pressure p is defined as the effect of a force F applied to a surface a. The SI unit of pressure is Pascal (Pa), defined as a force of one Newton per square meter.

b) velocity v
$v = s : t$; Velocity v is defined as the distance s divided by time t. The SI unit for velocity is meter per second (m/s), defined as a distance measured in meter which is covered in the duration of one second.

c) density ϱ
$\varrho = m : V$; Density ϱ is defined as mass m per volume V. The SI unit for density is kilogram per cubic meter (kg/m^3), defined as a mass m measured in kilograms per volume V in cubic meters.

d) tension σ
$\sigma = F : S$; Tension σ is defined as a force F acting on a defined cross section S of a specimen in order to elongate him. The unit for tension in engineering is Newton per Millimeter N/mm^2.

e) electrical energy W
$W = P \cdot t$; Electrical energy W is defined as the electrical power P multiplied by the time t. The SI unit for electrical energy is Watt (W), defined as the power which gives rise to energy of one Joule in one second.

f) frequency f
$f = 1 : T$; Frequency f represents the number of occurrences of a repeating event per peroid time T. The SI unit for frequency is Hertz (Hz), defined as the rate of repetition per duration of one second.

2. Convert the measurements from imperial units into metric units. (Use your Handbook)

a) 120 miles in km

$120 \cdot 1.609\ \text{km} = 193.08\ \text{km}$

b) 3.300 ft in metres

$3.300 \cdot 0.3048\ \text{m} = 1.00584\ \text{m}$

c) 1 ½ pints in litres

$1.5 \cdot 0.5683\ \text{l} = 0.8525\ \text{l}$

d) 4.5 ounces in kilogram

$4.5 \cdot 0.02835\ \text{kg} = 0.1276\ \text{kg}$

e) 1/8 inch in mm

$0.125 \cdot 25.4\ \text{mm} = 3.175\ \text{mm}$

f) 22.5 pounds in kg

$22.5 \cdot 0.4536\ \text{kg} = 10.2060\ \text{kg}$

3. Calculate the physical quantities by using SI-Units.

a) A compact disc (CD) has a diameter of 120 mm. Calculate the area in mm^2.

$A = \pi \cdot r^2$;

$A_{CD} = \pi \cdot (60\ \text{mm})^2 = 11309.724\ \text{mm}^2$

b) The volume of a steel rod is 0.50 dm^3 and has a density of 7.85 kg/dm^3. Calculate the mass in kg.

$m = \varrho \cdot V$;

$m_{rod} = 7.85\ \text{kg/dm}^3 \cdot 0.50\ \text{dm}^3 = 3.925\ \text{kg}$

c) A turning tool moves 9.3 cm in a time of 3 seconds. Calculate the feed velocity in mm/s.

$v = m : t$; $v_{ftool} = 93\ \text{mm} : 3\ \text{s} = 31\ \text{mm/s}$

1.2 Fundamentals of measuring technique

Exercises page 10, Textbook

1. Translate the following inspection aids and name the main group of these devices.

a) plug limit gauge

Grenzlehrdorn – Lehren (gauges)

b) prism block

Prisma – Hilfsmittel (auxiliary aids)

c) folding rule

Gliedermaßstab – Messtechnik (measuring devices)

d) micrometer

Bügelmessschraube – Messtechnik (measuring devices)

e) snap gauge

Rachenlehre – Lehren (gauges)

f) vernier calliper

Messschieber – Messtechnik (measuring devices)

2. Name the correct inspection aid to find out these measurements.

a) the diameter of a shaft of 22 mm

vernier calliper

b) the length of a rail of 1.80 m

folding rule

c) the angle of 120°

protractor

d) the bore of ∅ 20 mm

vernier calliper

e) the depth of 10 mm of a groove

vernier calliper

f) the radius R5

radius gauge

3. Answer the questions in English.

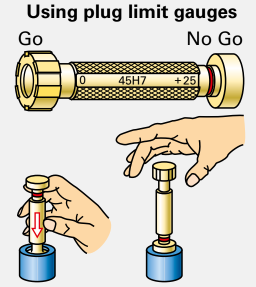
a) What are dimensional representatives?

Dimensional representatives are measuring devices allowing certain dimensions to be compared with a measuring scale.

b) Which result do you get when you use a gauge? Give an example.

A gauge is used to check whether a dimension corresponds to the given standard.
For example a plug limit gauge can be used to check whether the diameter of a hole is within specified limits and therefore accurate.

Using plug limit gauges



c) Which result do you get when you use an indicative measuring device? Give an example.

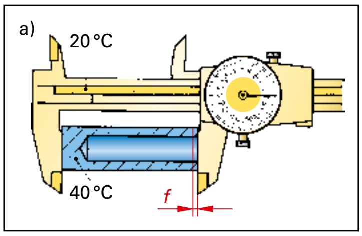
With an indicative measuring device, a numerical result is achieved. For example, when a shaft is measured with a vernier calliper.

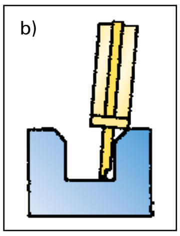
d) When do you need an auxiliary aid? Give an example.

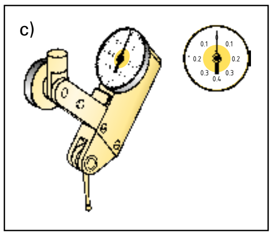
Auxiliary aids are used to fix objects in order to be able to measure them using measuring tools. For example to fix a shaft in a prism block and finally check it with a dial indicator.

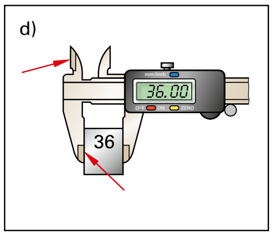
Exercises page 11, Textbook

1. Match the pictures a)–d) to the type of measuring error (1)–(4).
Specify if it is a systematic or a random error.









Type of measuring error: **(1) parallax error** **(2) wear of measuring surfaces** **(3) bad positioning of device** **(4) temperature too high**

a) – 4 = systematic error
b) – 3 = random error
c) – 1 = random error
d) – 2 = systematic error

2. Make a list of six common measuring devices (e. g. steel rule, vernier calliper, gauge block, dial gauge protractor, etc.) and find out their type of inspection aid/measuring/range/accuracy. (Use a webpage of a company for measuring devices e. g. www.mitutoyo.com; www.mahr.de; www.hoffmann.de).

Measuring device	Type of inspection aid	Measuring range	Accuracy
steel rule	dimensional representative	150 – 1000 mm	0.5 / 1 mm

Measuring device	Type of inspection aid	Measuring range	Accuracy
steel rule	dimensional representative	150 – 1000 mm	0.5 / 1 mm
vernier calliper	indicative measuring device	150 mm	0.01 / 0.2 mm
protractor	indicative measuring device	180°	0.1° / 0.5°
micrometer	indicative measuring device	0–300 mm	0.005 / 0.01 mm
plug limit gauge	gauge	0.5–500 mm	0.01 mm / 0.02 mm
dial indicator	indicative measuring device	50 µm – 100 µm	0.001 mm
folding meter	dimensional representative	2000 mm	0.5 / 1 mm

1.3 Length Measuring Instruments

Exercises page 12, Textbook

1. Match the correct expression of the following measuring devices to the pictures at the right.

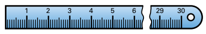
a) absolute scale

b) flexible steel rule

c) tape rule

d) folding rule

e) impulse scale

1	
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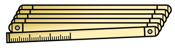
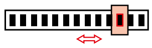
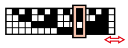
3	
4	
5	

a) – 5
b) – 1
c) – 2
d) – 3
e) – 4

2. Answer the following questions in English.

a) What is the difference between measuring instruments and gauges?
Measuring instruments provide a numerical value for the quantity, size, weight, distance or capacity of an object, whereas gauges are geometrical representations of certain dimensions or forms.

b) Why do straight edges and engineer's squares have lapped test blades?
Lapped test blades guarantee a high grade of flatness. Thus they enable the naked eye to realize different tiny light gaps between the blade and the tested object. These light gaps reveal inaccuracies concerning straightness and flatness of the workpiece.

c) What can you check with straight edges?
Straight edges are used to check the straightness and flatness of an object`s surfaces.

d) What is the light gap method?
The test blades are laid upon the surface of the object to be tested. If any tiny light gaps between the blade and the tested object are visible, they reveal inaccuracies in the surface.

e) Mention 3 different types of gauges and choose a certain measurement of a workpiece which can be checked by them.
Plug gauge – internal diameter of bores
Snap gauge – external diameter of cylindrical objects
Gauge block – external dimension of any three-dimensional object.

Exercises page 13, Textbook

1. Find the correct answer of the questions and mark it in the table below with a tick.

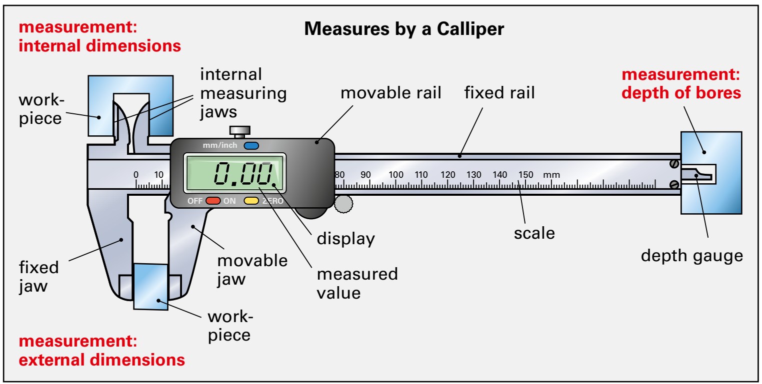
a) A tolerance is a …	clearance between a shaft/mating bore	measurement error	range of the dimensions
b) Which of the following statement of plug gauges is true (only 1)?	The Go side is smaller than the No Go side of the plug gauge.	Only slight pressure is needed to slide the Go member into the bore.	The No Go member is designated with the minimum limit size.
c) Which of the following statements of snap gauges is true (only 1)?	The Go member should fail to slide into the bore.	The Go member is marked in red.	The Go member doesn't represent the minimum limit size.

a) A tolerance is a …	clearance between a shaft/mating bore	measurement error	range of the dimensions ✓
b) Which of the following statement of plug gauges is true (only 1)?	The Go side is smaller than the No Go side of the plug gauge. ✓	Only slight pressure is needed to slide the Go member into the bore.	The No Go member is designated with the minimum limit size.
c) Which of the following statements of snap gauges is true (only 1)?	The Go member should fail to slide into the bore.	The Go member is marked in red.	The Go member doesn't represent the minimum limit size. ✓

2. Create a stack of gauge blocks and write down the combination of blocks.

a) 42.123 mm	1.003	b) 74.357 mm	1.000	c) 81.685 mm	1.005
	1.020		1.007		1.080
	1.100		1.050		1.600
	9.000		1.300		8.000
	30.000		70.000		70.000

1.4 Digital calliper



Exercises page 15 above, Textbook

1. Translate the third paragraph of the text in the Textbook page 14 into German.

Der Messschieber kann sowohl zur Messung von Außenmaßen und Innenmaßen von Bauteilen als auch zur Messung der Tiefe von Bohrungen oder Nuten genutzt werden.

2. Some of the following six statements are wrong. Find these statements and correct them.

a) The digital calliper is the least used measuring device in the workshop.
⇒ Wrong
The digital calliper is the **most** frequently used measuring device in the workshop.

b) A calliper can measure diameters of bores and shafts, the width and thickness of a part.
⇒ Correct

c) With a digital calliper, measurements of 0.03 inch and 0.05 mm are possible.
⇒ Correct

d) A digital calliper can be used to measure dimensional deviations with direct display.
⇒ Correct

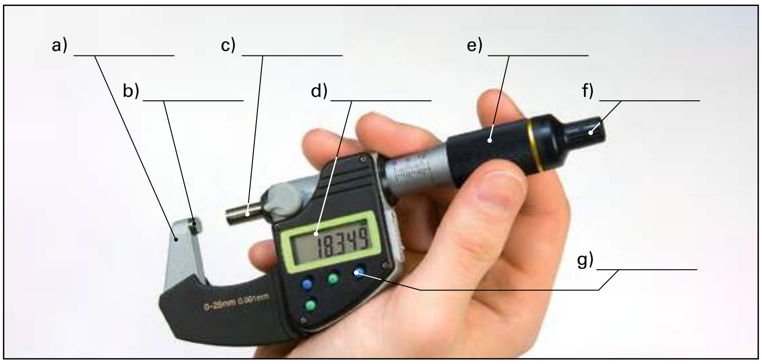
3. Name the measure value from page 14 in your Textbook, figure 2, rounded to one decimal place.

36.9 mm

1.5 Micrometer

Exercises page 15 below, Textbook

1. Label the parts in the figure of the micrometer.



a) bracket

b) anvil

c) measuring spindle

d) display

e) turnable knurl

f) clutch ratchet

g) switch

1.6 Surface testing

Exercises page 16, Textbook

1. Complete the missing information about form deviations in the table.

Degrees of form deviation	Examples	Possible cause
1st degree: form deviation	…	…
…	waves	…
3rd degree: roughness	…	…
…	…	Sequence of chip formation, surface deformation during fabrication of the part

Solution

Degrees of form deviation	Examples	Possible cause
1st degree: form deviation	straightness or roundness, other than the required form	Clamping marks, wear in the guides of the machine tool
2nd degree: waviness	waves	Vibrations of machine tool
3rd degree: roughness	grooves	Geometry of the cutting tool, feed or depth of cut of the tool during fabrication of the part
4th degree: roughness	scoring, scales, bumps	Sequence of chip formation, surface deformation during fabrication of the part

2. Answer the questions in English.

a) Which surface testing instrument is very quick and easy to use? Why?

Surface roughness comparators, because they can be used during the manufacturing process, without having to place the workpiece in a measuring apparatus.

b) Explain why you can compare the surface roughness visually and by touching.

Because both methods make roughness comprehensible through senses.

c) Describe how a stylus instrument works.

Stylus instruments are surface roughness testers, which record the peaks and valleys by a diamond stylus. It is drawn at a constant speed across the workpiece. The amount to which the stylus is raised or lowered is printed in a diagram. It shows the increased surface profile.

Exercises page 17, Textbook

1. Answer the questions in English.

a) Which surface texture parameters are often used in USA and which in Germany?

The surface parameter *Rz* is widely used in Europe, *Ra* is the most specified U.S. parameter.

b) Explain the difference between the surface parameter *Rmax* and *Rz*.

Rz considers the five highest peaks and the five deepest valleys. The complete evaluation length is divided into five cut-offs. In each of these the highest distance between peak and valley is a value (Rz_{1-5}). *Rmax* represents the maximum height of the five values in the sampling length.

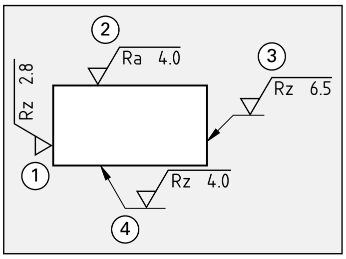
c) Why is the surface texture parameter *Rmax* not a very reliable value?

Because it represents only an extreme and not the average surface texture. This means one scratch could give a false impression about the surface quality.

d) Explain the surface texture parameter *Ra*.

Ra (arithmetic average roughness) considers all peaks and valleys of the roughness profile. Thus, extremes are neutralised and have no significant influence on the final result.

2. Name the type of surface parameters and its value of the positions (1) to (4) shown in the figure.



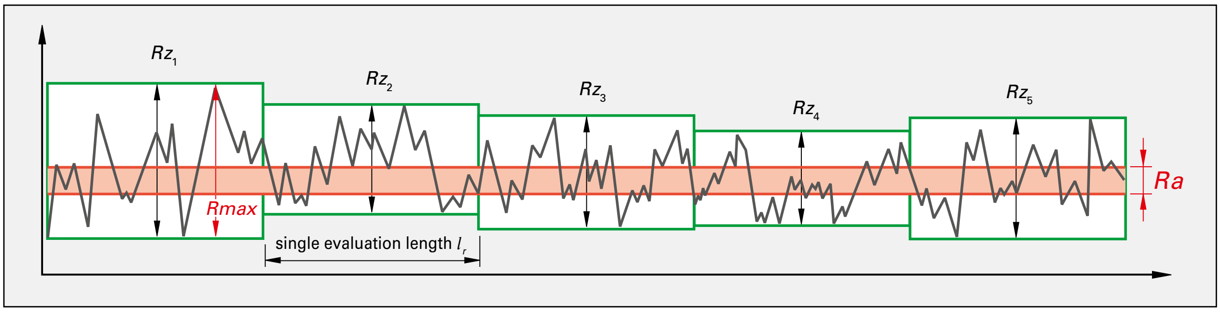
(1) *Rz* = 2.8 µm (average peak to valley height)

(2) *Ra* = 4.0 µm (arithmetic average roughness)

(3) *Rz* = 6.5 µm (average peak to valley height)

(4) *Rz* = 4.0 µm (average peak to valley height)

3. Copy a roughness profile from your own test or from a book and draw in the three parameters:
– *Rmax* **– Rz_1–z_5** **– *Ra***



1.7 Fits

Exercises page 18, Textbook

1. Answer the following questions in English.

a) What is a fit?
A fit is the dimensional relationship of two mating construction components.

b) Which two criteria are given to select the type of fit?
The choice of the different fit is determined either by the use or by the production of the parts.

c) What are the dimensions of the hole and shaft, when a clearance fit is given?
The lower limit size of the hole is greater or at least equal to the upper limit size of the shaft.

d) Which three types of fits are possible? Explain!
Clearance fit always enables some space between the hole and shaft. The lower limit size of the hole is greater or at least equal to the upper limit size of the shaft.
Interference fit always has some excess material between the hole and shaft. The upper limit size of the hole is smaller or at least equal to the lower limit size of the shaft.
Transition fit is a fit where both types of fit may occur. The tolerance zones of the hole and shaft partly or completely interfere. There can be a clearance fit or an interference fit.

2. Find the correct expressions and match them to the abbreviation.

a) F_{Imin}/F_{Imax}
minimum interference/maximum interference

b) G_{IH}/G_{UH}
hole minimum dimension/hole maximum dimension

c) T_H/T_S
hole tolerance/shaft tolerance

d) G_{IS}/G_{US}
shaft minimum dimension/shaft maximum dimension

e) F_{Cmin}/F_{Cmax}
minimum clearance/maximum clearance

1.8 Fit Systems

Exercises page 19, Textbook

1. Answer the questions in German.

a) Which difference do the basic hole system and the basic shaft system have?
Beim **System Einheitsbohrung** wird die maximale Abweichung vom Nennmaß der Bohrung festgelegt. Die gewünschte Passung wird durch Auswahl einer Welle mit entsprechender Toleranz erreicht.
Beim **System Einheitswelle** wird die maximale Abweichung vom Nennmaß der Welle festgelegt. Die gewünschte Passung wird durch Auswahl einer Bohrung mit entsprechender Toleranz erreicht.

b) Where is the basic hole system used?
Das System Einheitsbohrung wird hauptsächlich im Maschinenbau und in dem Fahrzeugbau verwendet.

c) Which letters are used in the basic hole system for interference fits?
H/n or p…z

2. Determine the type of fit of the following fits:

a) 8H9/d9
clearance fit

b) 24H7/s6
interference fit

c) 9K7/h6
transition fit

d) 153 H11/c11
clearance fit

3.

a) Read the required values for the fit of Nr. 2 a) to d) from a Metal Trades Handbook.

a)
8H9: 8.000 mm + IT9 = 8.000 mm + 0.036 mm = 8.036 mm
8d9: 8.000 mm – 0.040 mm = 7.960 mm (upper specification limit)
7.960 mm – 0.036 mm (IT9) = 7.924 mm (lower specification limit)

b)
24H7: 24.000 mm + IT7 = 24.000 mm
+ 0.021 mm = 24.021 mm
24s6: 24.000 mm + 0.048 mm = 24.048 (upper specification limit)
24.048 mm – 0.013 mm = 24.035 mm (lower specification limit)

c)
9K7: 9.000 mm + K-value (table)
= 9.000 mm + 0.005 mm = 9.005 mm (lower specification limit)
9.005 mm + IT7 = 9.005 mm – 0.015 mm
= 8.990 mm (lower specification limit)
9h6: 9.000 mm (upper specification limit)
9.000 mm + IT6 = 9.000 mm – 0.009 mm
= 8.991 mm (upper specification limit)

d)
153H11: 153.000 mm (lower specification limit)
153.000 mm + IT11 = 153.000 mm
+ 0.250 mm = 153.250 mm
(upper specification limit)
153c11: 153.000 mm – 0.210 mm
= 152.790 mm (upper specification limit)
152.790 mm – IT11 = 152.790 mm
– 0.250 mm = 152.540 mm
(lower specification limit)

b) Calculate the maximum and minimum clearance or interference, by using your Metal Trade Handbook.

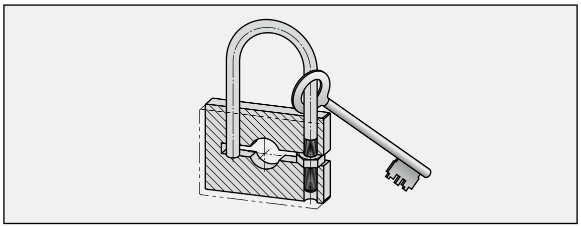
a)
hole limits:
max. = 8.036 mm; min. = 8.000 mm
shaft limits:
max. = 8.000 mm – d9
= 8.000 mm – 0.040 mm = 7.960 mm
min. = 7.960 mm – 0.036 mm = 7.924 mm
Maximum clearance
= max. hole – min. shaft
= 8.036 mm – 7.924 mm = 0.112 mm
Minimum clearance
= min. hole – max. shaft
= 8.000 mm – 7.960 mm = 0.040 mm

b)
hole limits:
max. = 24.021 mm; min. = 24.000 mm
shaft limits:
max. = 24.048 mm; min. = 24.035 mm
Maximum clearance
= max. hole – min. shaft
= 24.021 mm – 24.035 mm = –0.014 mm
Minimum clearance
= min. hole – max. shaft
= 24.000 mm – 24.048 mm = –0.048 mm

c)
hole limits:
max. = 9.005 mm; min. = 8.990 mm
shaft limits:
max. = 9.000 mm; min. = 8.991 mm
Maximum clearance
= max. hole + min. shaft
= 9.005 mm – 8.991 mm = 0.014 mm
Minimum clearance
= min. hole + max. shaft
= 8.990 mm – 9.000 mm = –0.010 mm

d)
hole limits:
max. = 153.250 mm; min. = 153.000 mm
shaft limits:
max. = 152.790 mm; min. = 152.540 mm
Maximum clearance
= max. hole – min. shaft
= 153.250 mm – 152.540 mm = 0.710 mm
Minimum clearance
= min. hole – max. shaft
= 153.000 mm – 152.790 mm = 0.210 mm

1. You are an **exchange student** in Manchester, Great Britain, and work at a metal processing company for three weeks. Your **instructor** has given you a demonstration copy of a **key fob** and forwarded you the order to produce one of it.



Describe the work required to do this.

2. In order to **check all relevant dimensions** and to **test if all parts can be assembled** you have to **make an inspection plan** of the steel block (part 1) and the bracket (part 2). See below.

The tolerances are according to **General tolerances**, class m, DIN ISO 2768-1. (Use the **Metal Trades Handbook** for looking up the tolerances)

Inspection plan **Key Fob part 1: steel block**
Identification number: **18012** Drawing number: **24107**
Designation: **steel block** Inspection plan no.: **81**

Serial No.	Inspection characteristic	Tolerance GT/m	Measuring instrument
1	length l_1 *= 65 mm*	*± 0.3*	*Calliper*
2	width w_1		
3	height h_1		
4	groove, lenght l_2		
5	groove, height h_1		
etc			

Inspection plan **Key Fob part 2: bracket**
Identification number: **18012** Drawing number: **24108**
Designation: **bracket** Inspection plan no.: **82**

Serial No.	Inspection characteristic	Tolerance GT/m	Measuring instrument
1	length l_1 *= 50 mm*	*± 0.3*	*Calliper*
2	diameter bracket d_1		
3	external diameter d_{ex}		
4	length l_2		
5	metric thread		
6	depth of metric thread d_{mt}		

3. Your are back in your training workshop and **present your manufactured key fob.** Your instructor would like to **display this key fob** on the special event of the open house.

Therefore he asked you to **translate the inspection plan** of the **steel block** and the **bracket** into German. Here is the beginning. Translate it completely.

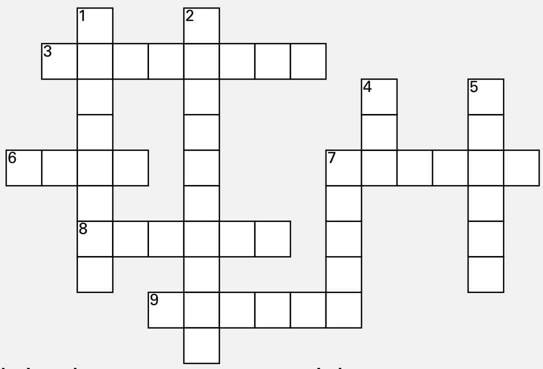
Prüfplan des **Schlüsselanhängers Teil 1: Stahlblock**
Identifikationsnummer: 18012 *Zeichnungs Nr: 24107*
Bezeichnung: Stahlblock *Prüfplan Nr: 81*

Ldf. Nr.	*Prüfmerkmal*	*Toleranz*	*Prüfmittel*
1	*Länge l_1 = 65 mm*	*± 0,3*	*Messschieber*
2			
3			
etc			

Prüfplan des **Schlüsselanhängers Teil 2: Bügel**
Identifikationsnummer: 18012 *Zeichnungs Nr: 24108*
Bezeichnung: Bügel *Prüfplan Nr: 82*

Ldf. Nr.	*Prüfmerkmal*	*Toleranz*	*Prüfmittel*
1	*Länge l_1 = 50 mm*	*± 0,3*	*Messschieber*
2			
3			
etc			

4. Now **check your knowledge** about **measuring techniques and equipments** with the crossword puzzle below.



horizontal

3 The most common measuring device in the workshop

6 The prefix for units for a multiple of thousand

7 With this instrument you can record the roughness of a surface

8 The used unit for electric current

9 The unit for a force

vertical

1 The measuring error caused by an incorrect reading of the scale

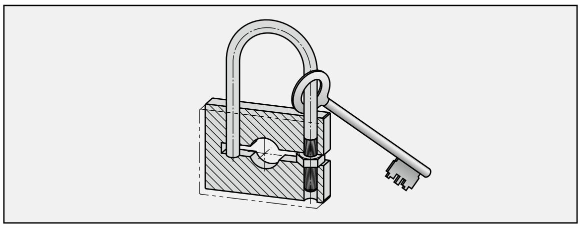
2 The measuring instrument for very accurate measurements

4 A relationship between a bore and a matching shaft is called:

5 The measuring devices represent certain dimensions or geometric forms e.g. radii

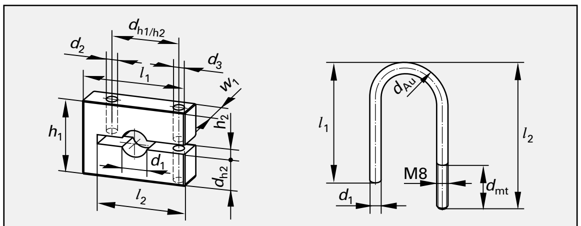
7 Number of SI-base quantities in technology

1. You are an **exchange student** in Manchester, Great Britain, and work at a metal processing company for three weeks. Your **instructor** has given you a demonstration copy of a **key fob** and forwarded you the order to produce one of it.



Describe the work required to do this.

First you need to disassemble the key fob. Then you need to lay down the dimension of the parts to be measured in a technical drawing.



part 1: Steel block
part 2: Bracket

You enter the dimensions in an inspection plan.

With the measurements, the steel block of the key fob can be milled and drilled.

The bracket is made by bending a round steel.

2. In order to **check all relevant dimensions** and to **test if all parts can be assembled** you have to **make an inspection plan** of the steel block (part 1) and the bracket (part 2).

The tolerances are according to **General tolerances, class m**, DIN ISO 2768-1. (Use the **Metal Trades Handbook** for looking up the tolerances)

Inspection plan **Key Fob part 1: steel block**
Identification number: **18012** Drawing number: **24107**
Designation: **steel block** Inspection plan no.: **81**

Serial No.	Inspection characteristic	Tolerance GT/m	Measuring instrument
1	length l_1 = *65 mm*	*± 0.3*	*Calliper*
2	width w_1 = *12 mm*	*± 0.2*	*Calliper*
3	height h_1 = *40 mm*	*± 0.3*	*Calliper*
4	groove, length l_2 = *50 mm*	*± 0.3*	*Calliper*
5	groove, height h_1 = *8 mm*	*± 0.2*	*Calliper*
6	internal diameter groove d_1 = *16 mm*	*± 0.2*	*Calliper*
7	diameter hole d_2 = *8.1 mm*	*± 0.2*	*Calliper*
8	depth of hole d_{h2} = *12 mm*	*± 0.2*	*Calliper*
9	distance from center of holes $d_{h1}/_{h2}$ = *40 mm*	*± 0.3*	*Calliper*
10	diameter hole d_3 = *8.1 mm*	*± 0.2*	*Calliper*

Inspection plan **Key Fob part 2: bracket**
Identification number: **18012** Drawing number: **24108**
Designation: **bracket** Inspection plan no.: **82**

Serial No.	Inspection characteristic	Tolerance GT/m	Measuring instrument
1	length l_1 = *50 mm*	*± 0.3*	*Calliper*
2	diameter bracket d_1 = *8 mm*	*± 0.2*	*Calliper*
3	external diameter d_{ex} = *48 mm*	*± 0.3*	*Calliper*
4	length l_2 = *65 mm*	*± 0.3*	*Calliper*
5	metric thread *M8*	*± 0.2*	*thread gauge*
6	depth of metric thread d_{mt} = *20 mm*	*± 0.2*	*Calliper*

3. Your are back in your training workshop and **present your manufactured key fob.** Your instructor would like to **display this key fob** on the special event of the open house.

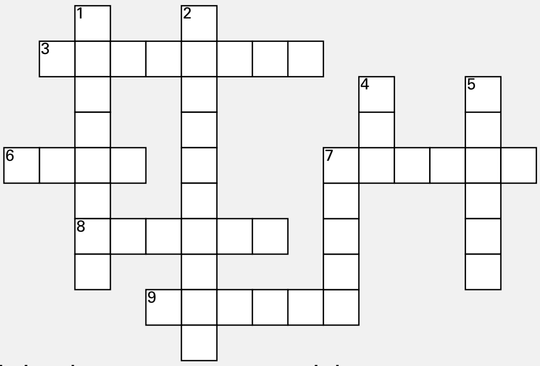
Therefore he asked you to **translate the inspection plan** of the **steel block** and the **bracket** into German. Here is the beginning. Translate it completely.

Prüfplan des **Schlüsselanhängers Teil 1: Stahlblock**
Identifikationsnummer: 18012 *Zeichnungs Nr: 24107*
Bezeichnung: Stahlblock *Prüfplan Nr: 81*

Ldf. Nr.	*Prüfmerkmal*	*Toleranz*	*Prüfmittel*
1	*Länge l_1 = 50 mm*	*± 0,3*	*Messschieber*
2	*Breite w_1 = 12 mm*	*± 0,2*	*Messschieber*
3	*Höhe h_1 = 40 mm*	*± 0,3*	*Messschieber*
4	*Nut/Länge l_2 = 50 mm*	*± 0,3*	*Messschieber*
5	*Nut/Höhe h_2 = 8 mm*	*± 0,2*	*Messschieber*
6	*Innendurchmesser der Nut d_1 = 16 mm*	*± 0,2*	*Messschieber*
7	*Durchmesser Bohrung 2 d_2 = 8,1 mm*	*± 0,2*	*Messschieber*
8	*Tiefe Bohrung 2 d_{h2} = 12 mm*	*± 0,2*	*Messschieber*
9	*Bohrungsabstand $d_{h1/h2}$ = 40 mm*	*± 0,3*	*Messschieber*
10	*Durchmesser Bohrung 3 d_3 = 8,1 mm*	*± 0,3*	*Messschieber*

Prüfplan des **Schlüsselanhängers Teil 2: Bügel** *Identifikationsnummer: 18012* *Bezeichnung: Bügel*		*Zeichnungs Nr: 24108* *Prüfplan Nr: 82*	
Ldf. Nr.	*Prüfmerkmal*	*Toleranz ISO 2768-m*	*Prüfmittel*
1	*Länge l_1 = 50 mm*	*± 0,3*	*Messschieber*
2	*Breite d_1 = 8 mm*	*± 0,2*	*Messschieber*
3	*Außendurchmesser d_{Au} = 48 mm*	*± 0,3*	*Messschieber*
4	*Länge l_2 = 65 mm*	*± 0,3*	*Messschieber*
5	*M8*	*± 0,2*	*Gewindelehre*
6	*Gewindetiefe d_{mt} = 20 mm*	*± 0,2*	*Messschieber*

4. Now **check your knowledge** about **measuring techniques and equipment** with the following crossword puzzle below.



horizontal

3 The most common measuring device in the workshop

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7 With this instrument you can record the roughness of a surface

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vertical

1 The measuring error caused by an incorrect reading of the scale

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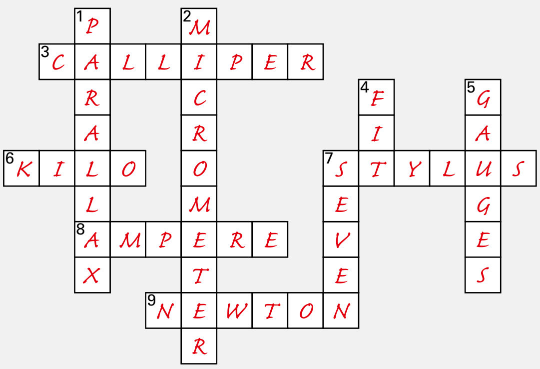
5 The measuring devices represent certain dimensions or geometric forms e.g. radii

7 Number of SI-base quantities in technology



2 Quality management

2.1 Basics of quality management

Exercises page 20, Textbook

1. Working with words. Which words from the text are described here?

a) If the product looks really good, the design is very ______________.

If the product looks really good, the design is very appealing.

b) If the device runs without a problem for a long time, it is very ______________.

If the device runs without a problem for a long time, it is very reliable.

c) If the product can be used in many different ways, the ______________ is very high.

If the product can be used in many different ways, the performance is very high.

2. Translate the definition of quantitative and qualitative characteristics from your Textbook in German.

Quantitative Merkmale sind messbar oder können gezählt werden, beispielsweise die Länge eines Werkstücks oder der Durchmesser einer Welle.
Qualitative Merkmale beschreiben eine Beschaffenheit, wie beispielsweise die Qualität der Lackierung eines Fahrzeugs.

3. Answer the following questions in English.

a) Which 3 quality characteristics (= requirements of the customer) should your next smart phone have?
It should have an appealing design, good performance, diverse functions and be very reliable.

b) Which system supports the quality process in companies?
A quality management system according to ISO 9000 standards, supports the quality process.

c) What does the 1-10-100 rule describe?
The 1-10-100 rule states that when a product moves through a production sequence, the cost of correcting an error multiplies by 10 from stage to stage.

d) Which different stages appear in a product circle?
Construction, development – Production planning – Quality planning – Inspection e.g. supplied parts – Quality control – Quality improvement – Production – Assembly – Product – Final testing – Delivery

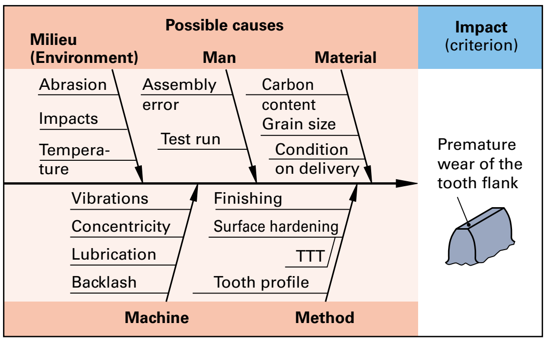
2.2 Quality tools

Exercises page 21, Textbook

1. Answer the questions:

a) Which two type of graphs are used in a Pareto chart?
Bars and a line. The bars indicate the type and the frequency of the defects. The line displays the cumulative total of the errors.

b) Why is the Ishikawa diagram also called fishbone diagram?
The Ishikawa diagram is a cause-and-effect diagram. You plot the possible causes on a problem in a special graph. It has the shape of a fish skeleton.



c) What is meant by the 6 Ms?
Manpower, Machine, Method, Material, Milieu (environment), Money.

d) Which function has a tally sheet?
A tally sheet is used to summarize data in order to draw a histogram.

e) What is shown in a histogram?
A histogram shows the distribution of measured results. It indicates the frequency of data within a range of values, called a class.

f) What does the height of a bar in a histogram show?
The height of a bar in a histogram indicates the frequency of the data that falls in each class.

2. Draw a histogram on an extra sheet of paper by using the data below.

Length of the shaft in mm										
Measured class values	14.990	14.995	15.000	15.005	15.010	15.015	15.020	15.025	15.030	15.035
Frequency n_j	2	5	10	13	15	16	13	9	6	3

2.3 Normal distribution

Exercises page 22, Textbook

1. Give three examples of nature or technology in which data can be normally distributed.

- Intelligence of humans
- Body height of people
- Deviations from the diameter of turned shafts.

2. Explain the experimental principle of a Galton board in German. Use the following structure:

a) Construction of the board

Das Galton-Brett besteht aus einer vertikalen Fläche, auf der Stiftreihen in gestaffelter Reihenfolge so angeordnet sind, dass herunterfallende Kugeln nach links oder rechts daran abprallen können. Die Vorderseite des Geräts besteht aus Glas, damit der Weg der Kugeln beobachtet werden kann. Unterhalb der Hindernisse werden die Kugeln in Fächern aufgefangen.

b) Experimental procedure

Eine Anzahl Kugeln wird auf die Hindernisreihen fallen gelassen und anschließend ihre Verteilung auf die Fächer im unteren Teil des Apparats überprüft.

c) Experimental result

Die unterschiedlichen Höhen der Säulen bilden in allen Fällen eine Kurve in der Form einer Glocke. Diese wird Glockenkurve, Gaußsche Verteilungskurve oder Normalverteilungskurve genannt.

3. Translate the sentences according the normal distribution into English:

a) Die Normalverteilung entsteht, wenn viele zufallsbedingte Einflüsse wirksam sind.

A normal distribution occurs when many random influences are effective.

b) Sie zeigt eine typische Glockenkurve der Häufigkeit über dem Merkmal $\bar{x}$.

It shows a typical bell-shaped curve of frequency around the mean $\bar{x}$.

c) Der Mittelwert $\bar{x}$ liegt beim Kurvenmaximum und zeigt die Lage der Verteilung.

The mean $\bar{x}$ is located at the peak of the curve and shows the position of the distribution.