FLAME

FURNITURE AND LANGUAGE
INNOVATIVE INTEGRATED LEARNING
FOR SECTOR ATTRACTIVENESS
AND MOBILITY ENHANCEMENT

Module 1

Standards, technical drawings and technical regulations

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Module 1

Standards, technical drawings and technical regulations

AIM OF THE MODULE

The subject of this unit is to provide general information about the main rules concerning standards and regulations. Standards and regulations involve international, national and industrial rules. Some companies set their own production rules. These rules help improve entrepreneurship through quality assurance and clear documentation.

LEARNING OUTCOMES

Knowledge

acceptance standards
technical regulations
technical drawings
measuring methods and tools

Skills

assist in the implementation of quality assurance methods
read technical drawings
read, understand and fill in documentation
take measurements

LEARNING PLAN

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Unit 1.4 \ The main technical drawing standards – pg. 25

Unit 1.5 \ Manual tools and software in the technical drawing field – pg. 31

ESCO PROFILES

8172 Wood processing plant operators
1321s Industrial production manager
1324s Supply Chain manager (Supply, distribution and related managers)

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Unit 1.1

EU standards and national standards

PEDAGOGICAL APPROACH


Course book


Additional readings


External links


Exercises & games

ASSESSMENT


Quiz (at the end of the module)

DURATION

2

HOURS

ECVET

0.08

Credits / 0.24 total of the module

CONTENT

Standards 5
Office field 6

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Unit 1.1 EU standards and national standards

There are standards in the furniture industry that regulate the characteristics of products: specific **National (1)**, **European (2)** and **International standards (3)** define the technical, health and safety standards of different materials that make up domestic furniture (for example, the glues used for the manufacturing of a product cannot exceed a certain level of formaldehyde emissions).

Exclusive national standards are a rarity in EU countries at present. The majority of the technical standards in this geographical area are developed by **CEN (4)** at the European level and are subsequently adopted, in the exact same way, by the appropriate national standardisation bodies.

Therefore, standards are documents that define the characteristics (dimensional, environmental, organisational, performance and security-wise,) of a product, a process or a service. Standards are in accordance with the state of the art and are the result of work by tens of thousands of experts in the country of competence and in EU and international institutions, with the final result of establishing a standard based on the consensus of the interested parties and recognised as a reference point and a description of the state of the art in a specific field.

The specific and main characteristic of the technical standards are:

- Consensus: it must be approved through the consensus of those who have taken part in the work;
- Democracy: all interested economic/social parties can take part in the work, particularly those who are able to provide observations in the procedures that precede the final approval;
- Transparency: the **standardisation (5)** body points out the fundamental phases of a standard's draft approval procedures, keeping the draft itself available to those interested;
- Voluntary action: the standards are a reference point that the interested parties dictate for themselves of their own accord.

The furniture industry as such is comprised of 5 essential groups of categories: the furniture group, the furnishing accessories group, the upholstered furniture group, the kitchens group and the sleeping systems group.

The industry's reference standard is characterised by voluntary standards (**technical standards (6)** and mandatory standards **(technical rules (7)**).

Reference European voluntary technical standards on furniture define the requirements to be satisfied to ensure that the products are safe from a mechanical standpoint and that they perform adequately. They deal with the different categories of furniture: **fold-out beds (8)** for children, **seating (9)** of every kind, **storage units (10)**, **camping tables (11)**, **beam seating (12)**, tables of every kind, **mattresses (13)** and **beds (14)**, **links for non-domestic seating (15)** connected in a line, **fencing for domestic use (16) and cribs for domestic use (17).**

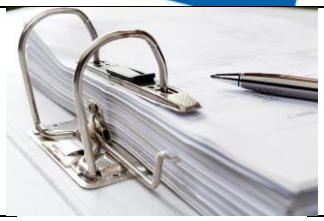
In addition to mechanical safety requirements, the characteristics of furniture surfaces, those of surface resistance to **dry heat (18)**, **moist heat (19)**, **cold liquids (20)** and those related to work desk tops necessary to ensure optimal work conditions at computer terminals, such as determining the **specular reflection (21)** and **reflectance (22),** are also subject to technical standards.

Office field

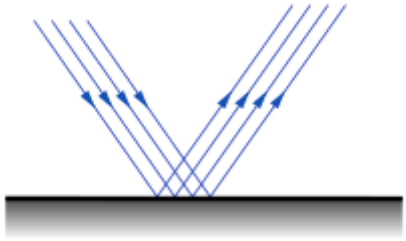
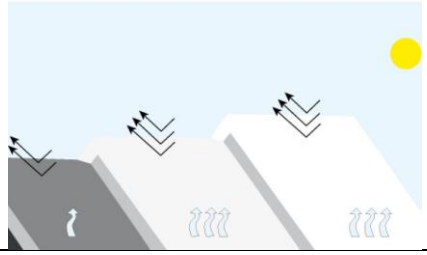
The production of office furniture, with respect to domestic furniture, is much more standardised and subject to **standardisation (5)** both because of the reduced number of product categories and because the production is subject to tender specifications, sustainability protocols and **technical specifications (23)** as well.

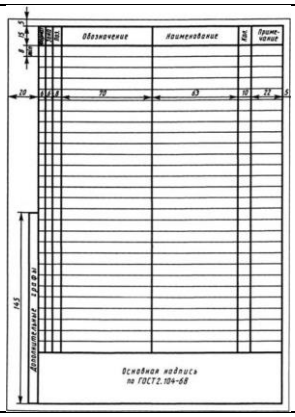
The main reference standards, in this case, deal with **worktables (24)**, **work desks (25)**, **desks (26)**, **storage units (10)**, **seating (9)**, **partition screens (27), sliding doors (28) and roll-up doors (29)**. They mainly define the **mechanical safety requirements (30)** that furniture must comply with in order to be considered suitable for creating a workstation in an office, in accordance with what has been established by the reference legislation and **regulations (31)**.

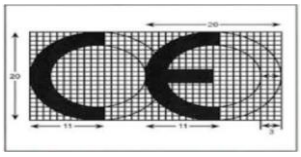
EU STANDARDS AND NATIONAL STANDARDS		
Keyword	*Description*	*Image*
(1) National standard	Standard adopted by a national standardisation body.	
(2) European standard	Standard adopted by a European standardisation body.	
(3) International standard	Standard adopted by an international standardisation body	
(4) EN	The acronym EN identifies the standards developed by CEN (European Committee for Standardization). EN standards must be adopted by CEN member countries.	
(5) Standardisation	Action that leads to establishing and implementing rules defined with the consensus of the interested parties and approved by an officially recognised body to give order and rationalise a specific field of activity, to reach an optimal economic situation and in compliance with functional and safety necessities.	

(6) Technical standard	A technical specification, adopted by a recognised standardisation body for repeated or continuous implementation and with which compliance is not mandatory.	
(7) Technical rule	Document that establishes technical specifications with compulsory implementation.	
(8) Fold-out bed	Foldout beds, also called foldout camp beds, are composed of a half-foldable frame, to allow the bed to occupy one tenth of the space it occupies when open.	
(9) Seating	Part of a piece of furniture upon which one may sit, this term indicates all of the pieces of furniture (domestic or urban) designed for people to sit on (benches, chairs, armchairs, etc.). Seating is, for all intents and purposes, a synonym of seat.	
(10) Storage unit	A type of furniture with doors, drawers and open compartments.	

(11) Camp table	A type of foldout furniture, a table composed of legs that can be folded up against the horizontal plane in order to make the storage space more convenient and the table portable.	
(12) Beam seating	Suitable for conference and meeting rooms. Fixed seating, with or without armrests, arranged in a line on the same rigid support (generally shaped like a bridge or a beam). Different accessories can be applied (for example a table top, a board, a writing desk).	
(13) Mattress	A mattress is essentially a big “cushion” normally laid on a frame fastened to a bed, upon which one can sleep or rest.	
(14) Sofa bed	Type of sofa also made to be used as a bed, at times with convenient compartments underneath the horizontal plane and in the headboard to store bed sheets, blankets and pillows.	
(15) Links for non-domestic seating	Links used for non-domestic seating connected in a line.	
(16) Fence for domestic use	Playpen composed of a barrier and a built-in base to provide children with a delimited play space.	

(17) Crib for domestic use	Bed for newborn babies used in domestic settings.	
(18) Dry heat	Hot air that acts by oxidising cellular components.	
(19) Moist heat	A technique that takes advantage of the action of flowing (Koch's steam steriliser) or saturated steam (autoclave).	
(20) Cold liquids	Cold liquids commonly available in work environments include: alcohol, acetone, ammonia, coffee, water and others. Some are particularly aggressive (ammonia, acetone), others are bothersome and pervasive (coffee, red wine).	
(21) Specular reflection	The quantity of incident light reflected by the surface under certain angles. It is exclusively influenced by the surface structure.	
(22) Reflectance	Reflectance or reflectivity or albedo: the ability of a material to reflect solar radiation. It is expressed in %.	

(23) Technical specification	A document that prescribes the technical requirements that a specific product, process, service or system must satisfy.	
(24) Worktable	Worktables are employed in many work environments and are made with a metal zinc-plated or varnished supporting structure and a tabletop of scratch-resistant wood. Worktables can be accessorised in many ways including by inserting wheels, lower desktops or drawers.	
(25) Work desk	Work desks are used in many work environments and are made with a metal zinc-plated or varnished supporting structure and a tabletop of scratch-resistant wood. Work desks can be accessorised in many ways including by inserting wheels, lower desktops or drawers.	
(26) Desks	A piece of furniture of varying shapes and sizes, it is composed of a horizontal plane and is a specific table that is used as a support to write or work.	

(27) Partition Screens	A structure used in the construction and furniture industry to divide indoor and outdoor spaces.	
(28) Sliding doors	Pocket doors that open and close thanks to sliding systems. Sliding mechanisms, which are retractable, are used in order for the door to slide in.	
(29) Roll-up doors	Roll-up doors are a type of closing device. Their functioning is based on the rolling of a cloth, generally in high-resistance PVC, directly on a rolling tube.	
(30) Mechanical safety requirements	They define the characteristics that a product must have to reduce to a minimum a possible risk of injury for the user.	
(31) Regulation	Process defining written standards (specifications) that put into writing the entirety of the verbal agreement, traditions and customs that regulate a company's existence.	

Unit 1.2

How to develop European technical standards

PEDAGOGICAL APPROACH


Course book


Additional readings


External links


Exercises & games

ASSESSMENT


Quiz (at the end of the module)

DURATION

1

HOUR

ECVET

0.04

Credits / 0.24 total of the module

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Who develops European Standards? 14
Developing a European Standard 14

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Unit 1.2 How to develop European technical standards

What is a Standard?

A standard (French: Norme, German: Norm) is a technical document designed to be used as a rule, **guideline (32)** or definition. It is a repeatable way of doing something built upon consensus.

Standards are created by bringing together all interested parties such as manufacturers, consumers and **regulators (33)** of a particular material, product, process or service. All parties benefit from standardisation through increased product safety and quality as well as lower transaction costs and prices.

A European Standard (EN) automatically becomes a national standard and therefore is included in the standards catalogue of CEN's Members, the **National Standardization Organizations - NSO (34)** in 34 countries.

Information leaflet: CEN Compass - The World of European Standards.

Who develops European Standards?

CEN's 34 National Members work together to develop European Standards and other deliverables in a large number of sectors to help build the European internal market in goods and services, removing **barriers to trade (35)** and strengthening Europe's position in the global economy.

More than 50,000 technical experts from industry, associations, public administrations, academia and societal organisations are involved in the CEN network that reaches over 600 million people.

We work in a decentralised way. Our members – the National Standardisation Bodies (NSBs) of the EU and **EFTA countries (36)** – operate the technical groups that draw up the standards. The CEN-CENELEC Management Centre (CCMC) in Brussels manages and coordinates this system.

Developing a European Standard

The development of a European Standard (EN) is governed by the principles of **consensus (37)**, openness, **transparency (38)**, national commitment and technical coherence and follows several steps:

Proposal to develop an EN
Any interested party can introduce a proposal for new work. Most standardisation work is proposed through the **CEN Members (39).**

Acceptance of the proposal
Once a project to develop an EN is accepted by the relevant Technical Body, or by the **Technical Board (40)**, the member countries shall put all national activity within the scope of the project on hold. This means that they neither initiate new projects nor revise existing standards at the national level. This obligation is called the **'standstill agreement' (41)** and it allows efforts to be focused on the development of the EN.

Drafting
The EN is developed by experts within a Technical Body.

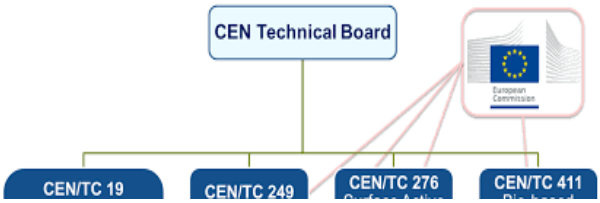
Enquiry – Public comment at the national level & weighted voting
Once the draft of an EN is prepared, it is released for public comment and vote, a process known as 'Enquiry'. During this stage, everyone who has an interest (e.g. manufacturers, public authorities, consumers, etc.) may comment on the draft. These views are gathered by the members, who then submit a national position by means of a **weighted vote (42)**, which is subsequently analysed by the CEN **Technical Body (43)**. If the results of the Enquiry show approval for the EN, the Technical Body can decide to publish the Standard.

Adoption by weighted Formal Vote
If the results of the Enquiry show that the draft of an EN requires technical reworking, the Technical Body can decide to update the draft and resubmit it for another weighted vote, called the Formal Vote.

Publication of the EN
Following the approval of the EN, either from the **Enquiry (44)** or the **Formal Vote (45)**, the EN is published. A published European Standard must be given the status of national standard in all member countries, which are also obliged to withdraw any national standards that conflict with it. This guarantees that a manufacturer has easier access to the market of all the member countries when applying European Standards and this also applies whether the manufacturer is based in a member country's territory or not.

Review of the EN
To ensure that a European Standard is still current, it is reviewed within five years of its publication (**review of an EN standard (46)**). This review results in the confirmation, modification, revision or withdrawal of the EN.

HOW TO DEVELOP EUROPEAN TECHNICAL STANDARDS		
Keyword	*Description*	*Image*
(32) Guideline	Information intended to advise people on how something should be done or what something should be.	
(33) Regulators	A person or organisation whose job is to define mandatory rules and confirm that they are respected.	
(34) NSO - National Standardization Organizations	Technical standardisation body at a national level.	
(35) Barrier to trade	Something, such as official rules or tariffs, that makes buying and selling between countries difficult.	
(36) EFTA Countries	Countries that have joined the European Free Trade Association: Iceland, Liechtenstein, Norway and Switzerland.	
(37) Consensus	A generally accepted opinion or decision among a group of people.	
(38) Transparency	A situation in which business and financial activities are done openly and without secrets, so people can trust others to be fair and honest.	
(39) CEN Members	The national technical standardisation bodies that comply with CEN and are obliged to adopt EN standards when they are made available, simultaneously withdrawing any national standard that could potentially conflict with them.	

(40) Technical Board	Body which controls the full standards programme and promotes its speedy execution by the Technical Committees (TC), the CEN-CENELEC Management Centre (CCMC) and other bodies.	
(41) Standstill agreement	Obligation for the members of CEN to halt standardisation work at the national level on topics that are officially included in CEN's work programme.	
(42) Weighted vote	Vote counting procedure to which a different weight is assigned according to the representativeness and the size of the population of the country that has expressed them.	
(43) Technical Body	Working group of technical experts on the subject who meet periodically to discuss the regulatory text that will be published later.	
(44) CEN Enquiry	Formal investigation procedure on the CEN standard's drafts that aims to collect comments from stakeholders at the European level.	
(45) CEN Formal Vote	Voting procedure on the final drafts of CEN standard drafts. The final phase of the EN standards approval procedure.	
(46) Review (of an EN standard)	Examination of an existing EN standard, to be done within five years from its publication through a formal consultation between CEN members, to deliberate whether the standard can be confirmed for five more years or if it must be updated or withdrawn.	

Unit 1.3

Technical drawings

PEDAGOGICAL APPROACH


Course book


Additional readings


External links


Exercises & games

ASSESSMENT


Quiz (at the end of the module)

DURATION

1

HOUR

ECVET

0.04

Credits / 0.24 total of the module

CONTENT

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What does technical drawing depict? 19

What functions does technical drawing carry out? 19

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Unit 1.3 Technical drawings

Creation of the technical design

Graphic representation, a communication tool based on the human ability of visual perception that dates back to the beginnings of humanity, proceeds along two parallel tracks. One is based on realistic images or images that aim to represent reality as it looks to our eyes. The other, operating through conventions and symbols, aims to impart directions, targeted to several specific purposes.

A typical example of this second path is technical drawing, a language apparently comprehensible to most, but that is actually comprehensible only to those who know the representation code formalised in methods and rules developed across centuries.

For centuries, in fact, the drawing of technical objects, constructions, machines and tools has not moved away from figurative representation, usually suitable to communicate a general ideal of the object, yet remains devoid of the necessary precision to provide constructive directions, which is the main aim of technical drawing.

In the 18th century there was a change and depictions appeared, which are suitable to provide more precise information in terms of construction, drawings and illustrations: the first concept of technical drawing traces back to the name of G. Monge (Paris 1793) and was developed by **Descriptive Geometry (47)** scholars of the time. It was immediately recognised as such an important tool that it was initially protected as a military secret.

What does technical drawing depict?

- A depiction of technical objects;
- A graphic representation of geometric elements in space, the fundamental rules of which are dictated by descriptive geometry;
- A document that allows **designers (48)/**draughtsmen to translate their ideas graphically and to provide useful directions for the creation of a project/product;
- A document made according to the principles established by national and international **standardisation (49)** and **unification (50)** bodies.

What functions does technical drawing carry out?

- It allows the mental reconstruction of the model of the object;
- It ensures the possibility of spreading useful information about the object and the project that is the subject of work and analysis;
- It documents the state of company knowledge and the history of the product (company knowledge);
- It supports the distribution of necessary information for the whole of the **product's life cycle (51);**
- It allows defining processes and verification, validation, measuring and test activities that are specific for the product **(ISO 9000 (52));**
- It enables distributed design activities (outsourcing in the design and with suppliers).

The function of information dissemination conveyed by technical drawing has made the definition of a single conventional and international "language" necessary:

- Necessity of easy understanding for all of the parties and the stakeholders operating in the field;
- Provide the field with a lexicon and vocabulary which are complete and shared at international level;
- Transferability of concepts and process stages within the field and the different parties and stakeholders;
- Continuous possibility to integrate, in the light of new discoveries and updates in the field, all of the elements and processes of the system;
- Unified language used within the field by the different parties and stakeholders.

Starting from the necessity of establishing a code of universal information for the field of technical drawing, in order to contribute to the creation and the rise of a shared field, we have come to the creation of a series of standards defined at the international level by a group of standardisation bodies:

ISO (53) – International Organization for Standardization
CEN (54) – European Committee for Standardization
UNI – Ente Nazionale Italiano di Unificazione (National Italian Unification Body)
DIN – Deutsches Institut fur Normung (German Institute for Standardization)
BSI – British Standard Institution
ANSI – American National Standards Institute

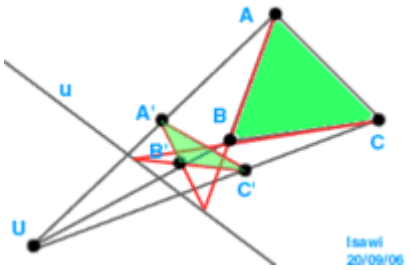
Drawings can be classified based on two parameters:

A) The depicted object's structuring level;
B) The placement in the development cycle.

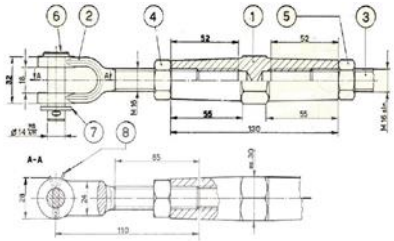
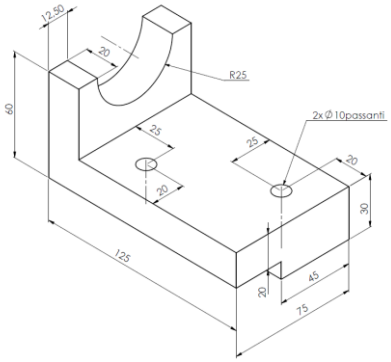
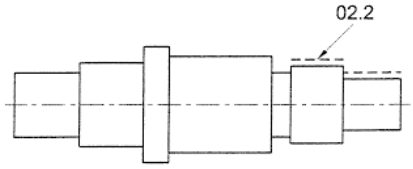
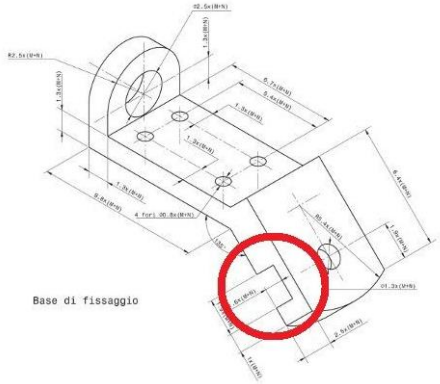
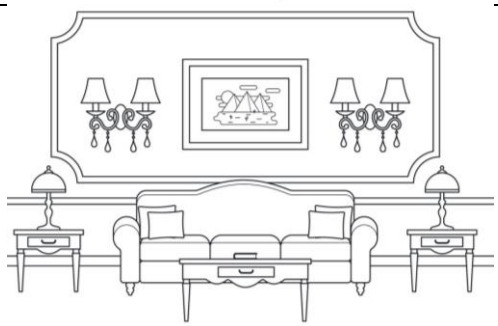
A) Classification based on the structuring level

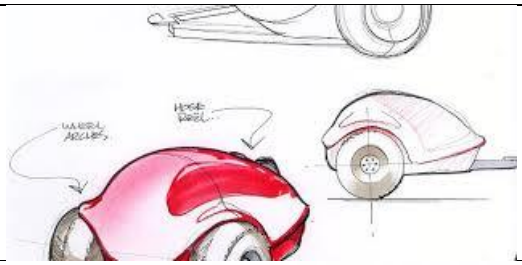
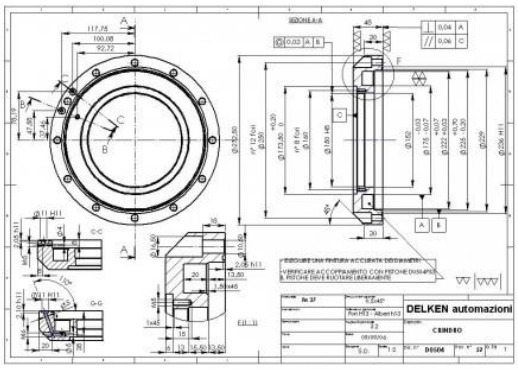
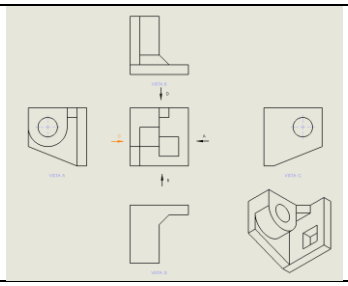
1) **Assembly drawing (55)**: it defines a machine or a complete object, composed of distinct groups, in order to specify its overall dimensions and function;
2) **Group drawing (56):** it depicts a collection of details with their own autonomous function;
3) **Subgroup drawing (57)**: it depicts a collection of details that do not have their own specific function;
4) **Drawing of a specific component/detail (58)**: it depicts a piece that cannot be further broken up into parts.

B) Classification based on the placement in the product's development cycle
1) **Conception or preliminary draft drawing (59)**: made in the **conceptual design (60)** phase (sketches…);
2) **Constructive drawing (61)**: it depicts all of the functional directions in a complete way (dimensions, tolerance, surface finishing, materials);
3) **Manufacturing drawing (62)**: it depicts all of the directions for the manufacturing, control and assembly work of the assembly drawing;
4) **Drawing of the assembled piece (63)**: it depicts the characteristics of the object or the finished.

TECHNICAL DRAWINGS		
Keyword	*Description*	*Image*
(47) Descriptive geometry	The science that allows the unequivocal depiction of two and three-dimensional objects on one or more planes through specific geometric constructions.	
(48) Designer	The person who designs a project, often an architectural or technical project, through a design process or activity.	
(49) Standardisation	An action that leads to establishing and implementing rules defined by the consensus of the stakeholders.	
(50) Unification	Type of standardisation that collects dimensional, procedural or other requirements in order to obtain equivalent and interchangeable products in a relatively reduced number of types and variations.	
(51) Product life cycle	Marketing model traditionally employed to describe and analyse the stages (introduction, growth, maturity and decline) that a product goes through throughout its service life, that is from the moment it hits the market to its elimination. The duration of the whole product's life cycle	

	and its stages is determined by sales performance.	
(52) ISO 9000	The acronym ISO 9000 identifies a series of standards and guidelines developed by the International Organization for Standardization (ISO) that define the requirements for the creation of a quality management system within an organisation in order to carry out business processes, improve effectiveness and efficiency, to create the product and for the service delivery, to obtain and boost customer satisfaction.	
(53) ISO	The International Organization for Standardization is the most important organisation at the global level for the definition of technical standards.	
(54) CEN	The European Committee for Standardization is a standardisation body that aims to harmonise and write technical standards (EN) in Europe in collaboration with national and supranational standardisation bodies like the ISO.	

(55) Assembly drawing	A drawing that defines a machine, a complete object, composed of separate groups, in order to specify its overall dimensions and functions.	
(56) Group drawing	Drawing that depicts a specific functional group in a complete way. It can depict functional dimensions that are subject to control.	
(57) Subgroup drawing	Similar to the group drawing, but at a lower hierarchical level (a higher level of detail).	
(58) Drawing of a detail	Drawing that depicts a single component. It contains all of the necessary directions for manufacturing and controlling the single component (for example: dimensions, tolerance, roughness, etc.)	
(59) Concept drawing (or preliminary draft drawing)	Drawing composed mainly of sketches and more or less complete drawings in which geometry is not defined in each detail. It is usually not made according to standards.	

(60) Conceptual design	First stage of the design process in which the main functional and shape lines of something are articulated.	
(61) Constructive drawing (or definition drawing)	Drawing that depicts the geometry and functional requirements of the component in a complete way. It can be made according to standards.	
(62) Manufacturing drawing (or production drawing)	Drawing that depicts all of the instruction necessary for manufacturing and controlling each piece (for example: dimensions, tolerances, roughness, etc.) Must be made according to standards.	
(63) Drawing of the assembled piece	Drawing that depicts the characteristics of an object or a finished piece.	

Unit 1.4

Main standards for technical drawing

PEDAGOGICAL APPROACH


Course book


Additional readings


External links


Exercises & games

ASSESSMENT


Quiz (at the end of the module)

DURATION

1

HOUR

ECVET

0.04

Credits / 0.24 total of the module

CONTENT

Standards for Technical Drawing 26

Co-funded by the Erasmus+ Programme of the European Union

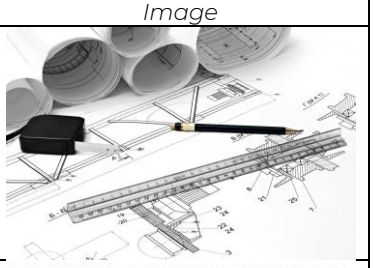
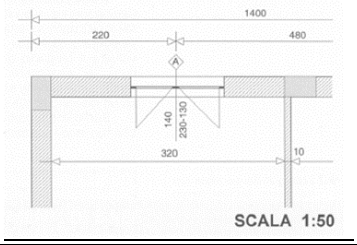
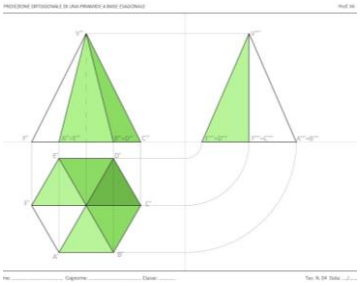
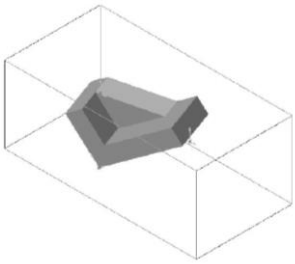
Unit 1.4 Main standards for technical drawing

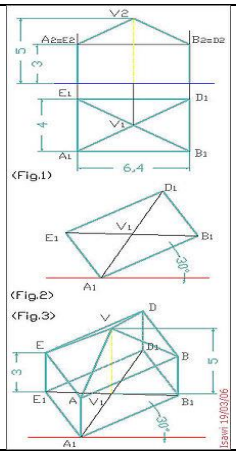
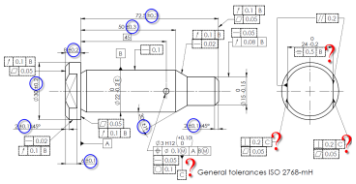
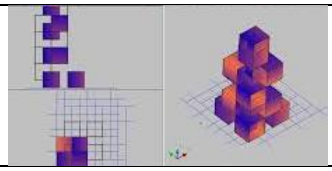
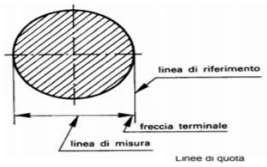
Technical drawing is also standardised with shared technical standards dedicated to **technical drawings (64)**.

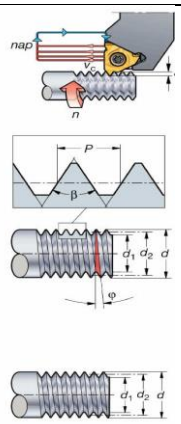
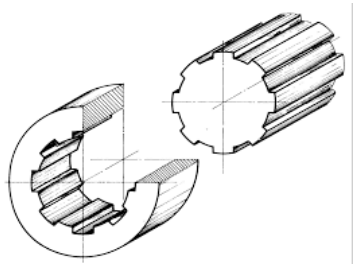
The main ones deal with **metric scales (65)**, requirements for **microfilming (66)**, methods of **orthogonal projection (67a)**, including **orthographic representations (67b)**, **axonometric views (68)** and perspective representations, graphic signs for the indication of **geometric tolerances (69)**, the representation of dimensions, lines and **modular grids (70)**, the representation of **dimensions (71)** and tolerances, **formats (72)** and the arrangement of graphic elements on the drawing sheet.

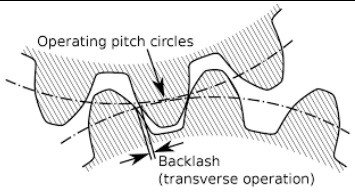
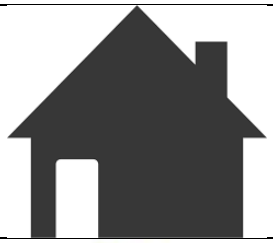
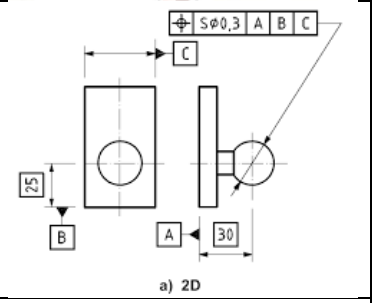
Other standards define in detail the methods of representations and the conventions used for drawing various mechanical components such as **glassware (73)**, **rolling bearings (74)**, **threads (75)**, **threaded inserts (76)**, **splined (77)** and **toothed couplings (78)**, etc.

Other standards deal with **general (79)** and **specific (80) simplified representation** in the field of **Geometric Product Specifications (GPS) (81)** or **Technical Product Documentation (TPD) (82)**.

MAIN STANDARDS FOR TECHNICAL DRAWING		
Keyword	*Description*	*Image*
(64) Technical drawing	Drawing made for technical purposes in relation both to the drawing method and the information conveyed.	
(65) Metric scale	Metric scale means the ratio between the dimension of the depicted object and its actual value.	
(66) Microfilming	The procedure though which it is possible to transform any physical document into a digital document.	
(67a) Orthogonal projection / Orthogonal representation	Representation technique that allows an object to be visualised even in three dimensions on a two-dimensional plane (the drawing sheet). It consists in projecting the same object from three points of view, orthogonally (perpendicularly) to three different planes, thus obtaining three different views, one from the top, called aerial projection, one from the front called perspective drawing, and one from the side called the profile.	
(67b) Orthographic representation	Method of orthogonal projections (or orthographic projections). The object to be depicted is projected on more than one plane, which are usually orthogonal among themselves. On each plane of projection, a figure called a “view” is obtained. A “view” is therefore a parallel and orthogonal projection associated with a specific direction. The representation in orthogonal projections of an object consists in the drawing of a necessary and sufficient number of views to ensure the object is interpreted correctly.	

(68) Axonometric view	The term axonometry comes from the Greek word *axon* (axis) and *metria* (measurement): it is a system of graphic geometric representation based on the three-dimensional representation of an object, making sure to measure its dimensions on three axes arranged orthogonally among them.	
(69) Geometric tolerances	Geometric tolerances account for errors of form that actual surfaces have in respect to the ideal ones depicted in drawing. A geometric tolerance establishes the space (area or volume) within which the element subject to the tolerance must be. Geometric tolerances can be divided into four categories: - Tolerance of shape; - Tolerance of orientation; - Tolerance of oscillation; - Tolerance of position.	
(70) Modular grids	Grids composed of content blocks.	
(71) Dimension / Dimensioning	Procedure through which linear and angular dimensions, considered important for the purpose of the drawing, such as the length, width or height of an object to build, are written in the drawing. The numerical values written in the drawing are called quotas (not to be confused with quota, meaning elevation).	
(72) Format	Standardised mode of dividing a technical drawing sheet according to conventional dimensions: the dimensions of the drawing sheet are unified: the basic format is A0, with a 1-m^2 surface, while the following formats are all in geometric progression sequence equal to $\sqrt{2}$.	Dimensioni dei fogli Designazione | Dimensioni x × y (mm)² | Designazione A0 841 × 1189 A6 A1 594 × 841 A7 A2 420 × 594 A8 A3 297 × 420 A9 A4 210 × 297 A10 A5 148 × 210

(73) Glassware	A series of objects and equipment, traditionally made of glass, used for experiments and other scientific work, especially in chemistry and biology laboratories.	
(74) Rolling bearings	A rolling bearing (or roller bearing) is an element positioned between a shaft (rolling part) and a support (fixed part). The rotation of the fixed part (ring or slewing ring in contact with the support) and the mobile part (ring or slewing ring in contact with the shaft) is ensured by the presence of rolling elements (spheres, cylindrical rollers or conical rollers), thus creating a mechanism based on rolling friction.	
(75) Threads	The term “threads” is applied to two acceptations connected between each other: it means the type of mechanical construction which aims to create a helicoidal coupling between two elements, as well as the operation that leads to the creation of this type of coupling. Generally, the structure created is called “thread”.	
(76) Threaded inserts	What unites two different parts reliably and efficiently.	
(77) Splined couplings	This type of coupling is used when one wants to make the conductor element (usually a shaft) and the conducted element integral in the rotation, while still allowing a certain liberty in the axial movement. The shaft is therefore coupled with a hub, upon which protuberances and cavities in axial directions are derived.	

(78) Toothed couplings	Links between the shaft and the hub, that is to say links between machine elements called shafts and other rotating parts such as toothed wheels, designed to receive and impart motion.	
(79) General simplified representation	Used when the exact shape of the details making up the product are not relevant.	
(80) Specific simplified representation	This applies when it is important to highlight the configuration of some functional product details.	
(81) Geometric Product Specification (GPS)	Normative framework for the specification and the verification of the geometric characteristics of products.	 a) 2D
(82) Technical Product Documentation (TPD)	Technical documentation of a product, including technical drawings, geometric specifications and their verification through measuring. The documentation includes the execution, interpretation, filing, management, reproduction, traceability and exchange of technical information. The geometric specification includes the indication of dimensional and geometric tolerances and surface properties. Verification includes principles, requirements and calibration of the measuring equipment, the margin of error of dimensional measuring and the decision-making rules to verify the conformity.	

Unit 1.5

Manual tools and software in the field of technical drawing

PEDAGOGICAL APPROACH


Course book


Additional readings


External links


Exercises & games

ASSESSMENT


Quiz (at the end of the module)

DURATION

1

HOUR

ECVET

0.04

Credits / 0.24 total of the module

CONTENT

Manual tools and software in the field of technical drawing 32

Co-funded by the Erasmus+ Programme of the European Union

Unit 1.5 Manual tools and software in the field of technical drawing

Technical drawings can be made on **paper (83)**, **matt (84)** or **translucent (85)** paper (so-called **tracing paper (86)**). The classical tool for technical drawings is the pencil. **Pencil (87)** drawings are usually finished with **pens (88) or Indian ink (89)**, with **calibrated pens (90)** for the sizes of the lines to be drawn. For erasing mistakes, rubber pencil or pen **erasers (91)** or tiny razor blades and scratches are used for more resistant ink. Other technical instruments for technical drawing are: the **ruler (92)**, the **set square (93)**, the **stencil (94)** (for letters, numbers and symbols), the **drafting machine (95),** a couple of **rulers (92)** mounted on a **goniometer (96)** that allows their rotation and the **drawing board (97)**.

Nowadays, drawings are mainly done on computers through software called CAD (Computer Aided Design). **CAD (98)** software enables creating product models in two or three dimensions. CAD software-generated models can be exported to:

- A **CAM (99)** (Computer Aided Manufacturing) to generate instructions for the machine tool that makes the designed model. Alternatively, it is possible to employ a CAD/CAM system which integrates the functions of CAD with those of CAE.

- A **CAE (100)** software *(*Computer Aided Engineering) to perform the technical calculations necessary to validate and optimise the project. Alternatively, it is possible to employ a CAD/CAE system, which integrates the functions of CAD with those of CAE.

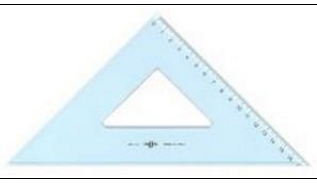
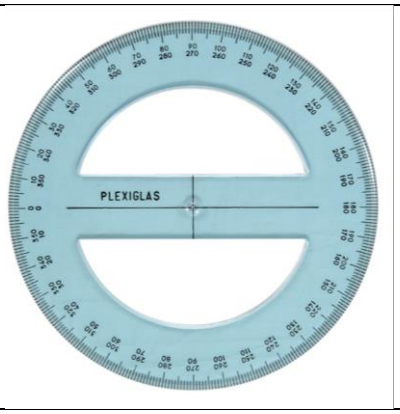
In the 1990s, the simplification of computer use due to the availability of graphical interfaces and the decreased cost of hardware made CAD systems available to all professionals and companies, even small ones.

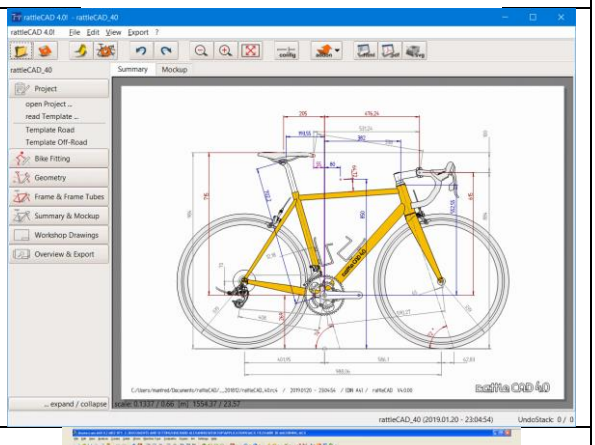
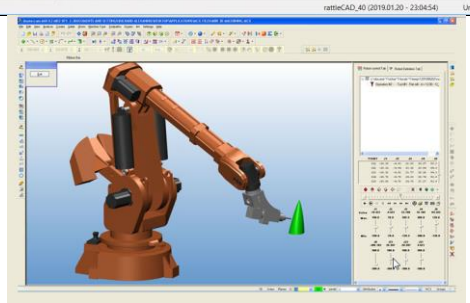
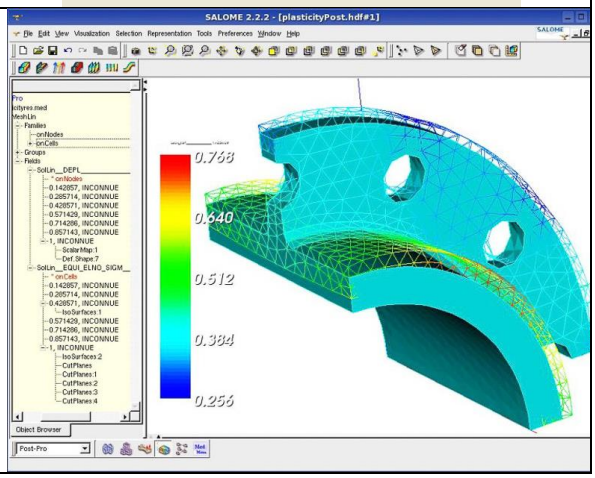
There are free or open source CAD software like Archimedes, BRL-CAD, IntelliCAD and QCad, as well as commercial CAD software, among which the main ones are: ArchiCAD – (Graphisoft.com), AutoCAD, CATIA (Dassault Systemes), Pro/ENGINEER, Rhinoceros (Robert McNeel & Associates), Solid Edge, Solidworks and NX.

MANUAL TOOLS AND SOFTWARE IN THE FIELD OF TECHNICAL DRAWING

Keyword	*Description*	*Image*
(83) Paper	Paper drawing sheet.	
(84) Matt paper	Sketch paper mainly used in the preliminary phase of a project where one draws in pencil or in colour.	
(85) Translucent paper	Polyester tracing paper employed in the final graphic representation of a project where the drawing is usually made with Indian ink, rulers and set squares.	
(86) Tracing paper	Semi-transparent paper, ideal for copying a drawing.	

(87) Pencil	Tool to draw, colour and write.	
(88) Pen	Tool used to apply ink to a surface, usually paper, to write or draw.	
(89) Indian ink	Indian ink is a black ink used for writing, drawing and painting. Indian ink is composed of a charcoal black pigment and a water-based binding agent and come in the form of sticks to rub on a stone in water.	
(90) Calibrated pens	Small-sized pens calibrated in order to improve the accuracy and precision of a line.	
(91) Rubber eraser	A piece of stationary, in natural or synthetic rubber, designed to mechanically remove ink or traces of graphite from writing or drawing **.	
(92) Ruler	A simple tool for measuring length. It is composed of a bar on which there is a graduated scale.	

(93) Set square	A tool to draw, trace a line or design.	
(94) Stencil	A specific type of tool for technical drawing used for the writing of uniform characters. It is composed of a plate made out of plastic or some other material on which letters of the alphabet or other useful shapes are carved.	
(95) Drafting machine	A tool that assists in technical drawing composed of a set square (or two rulers bound orthogonally) mounted on a goniometer that enables its angular rotation. The set (set square/two rulers – goniometer) is able to move freely on workspace surfaces through direct or indirect sliding on two rails attached to the drawing table or desk. There, rails that function as a track bind the movement of a set horizontally or vertically with respect to the workspace surface and may be blocked independently one from the other.	
(96) Goniometer	This tool measures angles.	

(97) Drawing board	This table, usually adjustable in height and inclination, allows designers to maintain a correct operating position.	
(98) CAD	Computer Aided Design	
(99) CAM	(Computer Aided Manufacturing) Generates instructions for the machine tool that creates the designed model.	
(100) CAE	(Computer Aided Engineering) Performs the technical calculations necessary to validate and optimise the project.	

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International Organization for Standardization: https://www.iso.org/home.html

European Committee for Standardization: https://www.cen.eu/Pages/default.aspx

Ente Italiano di Normazione: https://www.uni.com/