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Selected Learning Materials

Industrial design

AIM OF THE MODULE

- To acquire knowledge about technical creation, fundamentals of the creation of new products, course of construction, and production of assays.
- To develop skills on how to apply the principles of technical creation, and knowledge in technological processes, while creating new wooden products.

ASSESMENT FORM

- During the acquisition of the module, students get acquainted with the concept, development and importance of innovation and industrial design.
- During the acquisition of the module, the students perform case analyses on various design samples
- During the acquisition of the module, the students get acquainted with the problems and approaches of digitization and design.

TARGET GROUP

Wide range of learners of various profiles and scales of woodworking and furniture manufacturing companies, as well as different levels of responsibility and competence - from employees directly involved in production technological processes to a medium-sized woodworking plant manager.

WORK-BASED-LEARNING

The implementation of the project is based on the allocation of fields of responsibility based on the area in which their company works, or personal interest. Work based learning is following all the models from the beginning to the end of the studies.
All the topics have been chosen to be relevant to the working environment in a wood processing or furniture company, and all the discussions and case studies have been related to a real work environment, including practical, drafting, layout, planning work. This is also reflected in the Methods and ideas for learning process and Assessment of acquired learning outcomes (optimal level)).

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3. GOOD FURNITURE, FANCY FURNITURE, OR PERHAPS... SAFE FURNITURE (*Vilnis Jakovļevs*)

4. FINAL TEST ASSIGNMENT

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Topic:

"PROJECT DEVELOPMENT FROM A TO Z"

Author
Agris Zalcmanis, Kristaps Dambinieks

Project number: 601123-EPP-1-2018-1-DE-EPPKA2-SSA

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ERASMUS+; INDUSTRIAL DESIGN; PROJECT DEVELOPMENT FROM A TO Z

Agris Zalcmanis[1], Kristaps Dambinieks[1],
[1] AS Latvijas Finieris, Iekārtu Rūpnīca, Latvia;
15.04.2021

Latvijas
Finieris

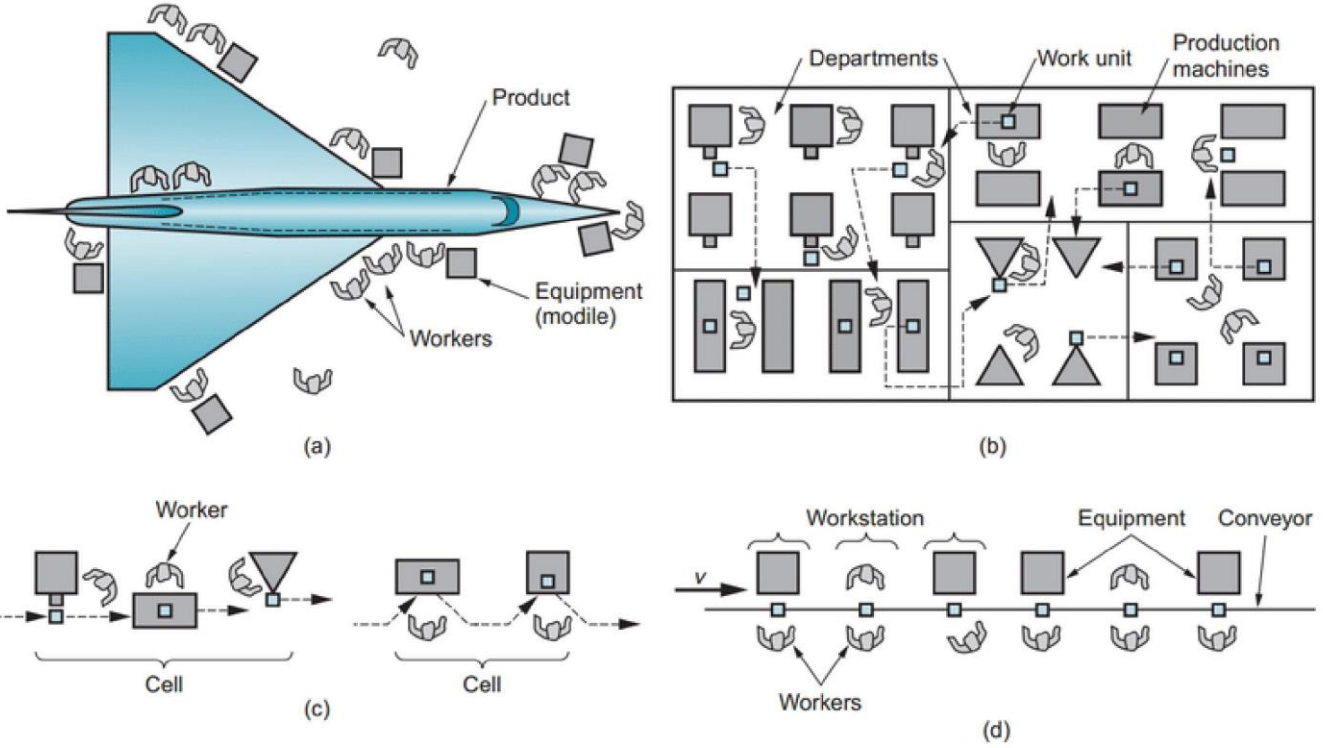
Main topics

- Production plant layout and material flow; machine tools;
- Production planning and quality management;
- Design;
- Production software.

Production plant layout

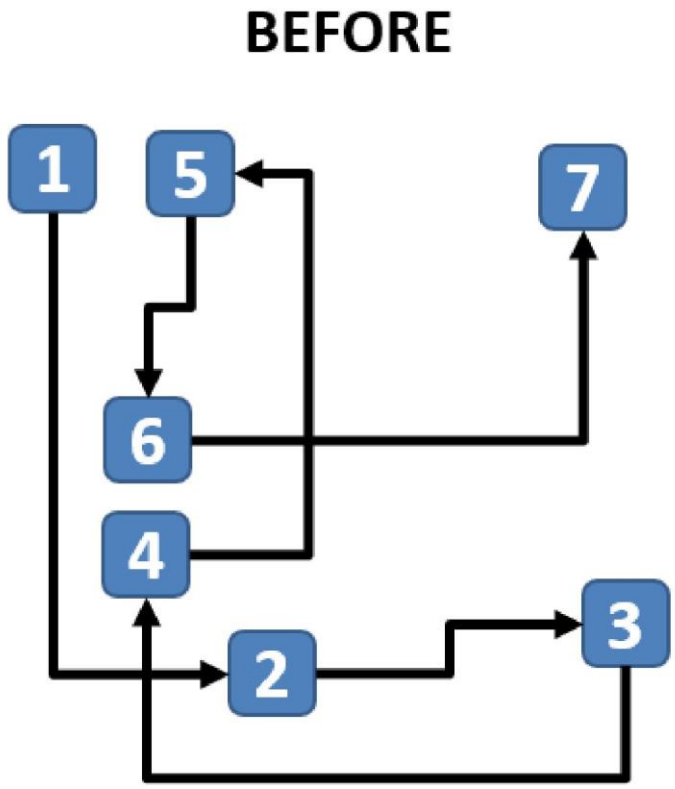
- Fixed position arrangement — One project; (a)
- Functional arrangement — One project, one batch, recurring batches; (b)
- Cell arrangement — One batch, recurring batches, continuous process; (c)
- Product-orientated arrangement — Continuous process, mass production. (d)
- Reality creates restrictions:
- Floor area of the production plant;
- Room layout;
- Special circumstances of the production plant.

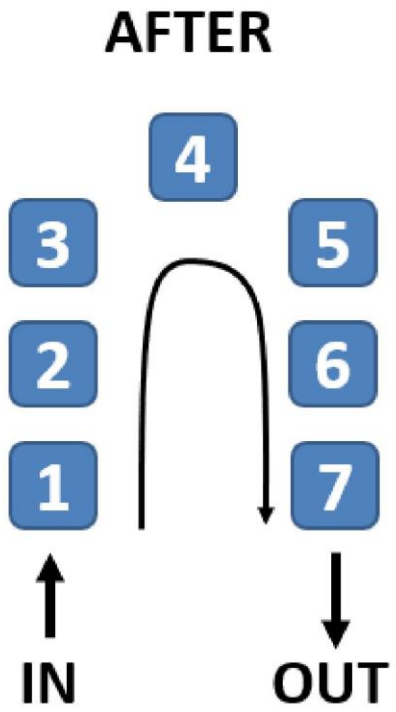
Production plant layout



https://www.researchgate.net/figure/a-fixed-position-layout-b-process-layout-c-process-layout-and-d-product_fig4_325178996

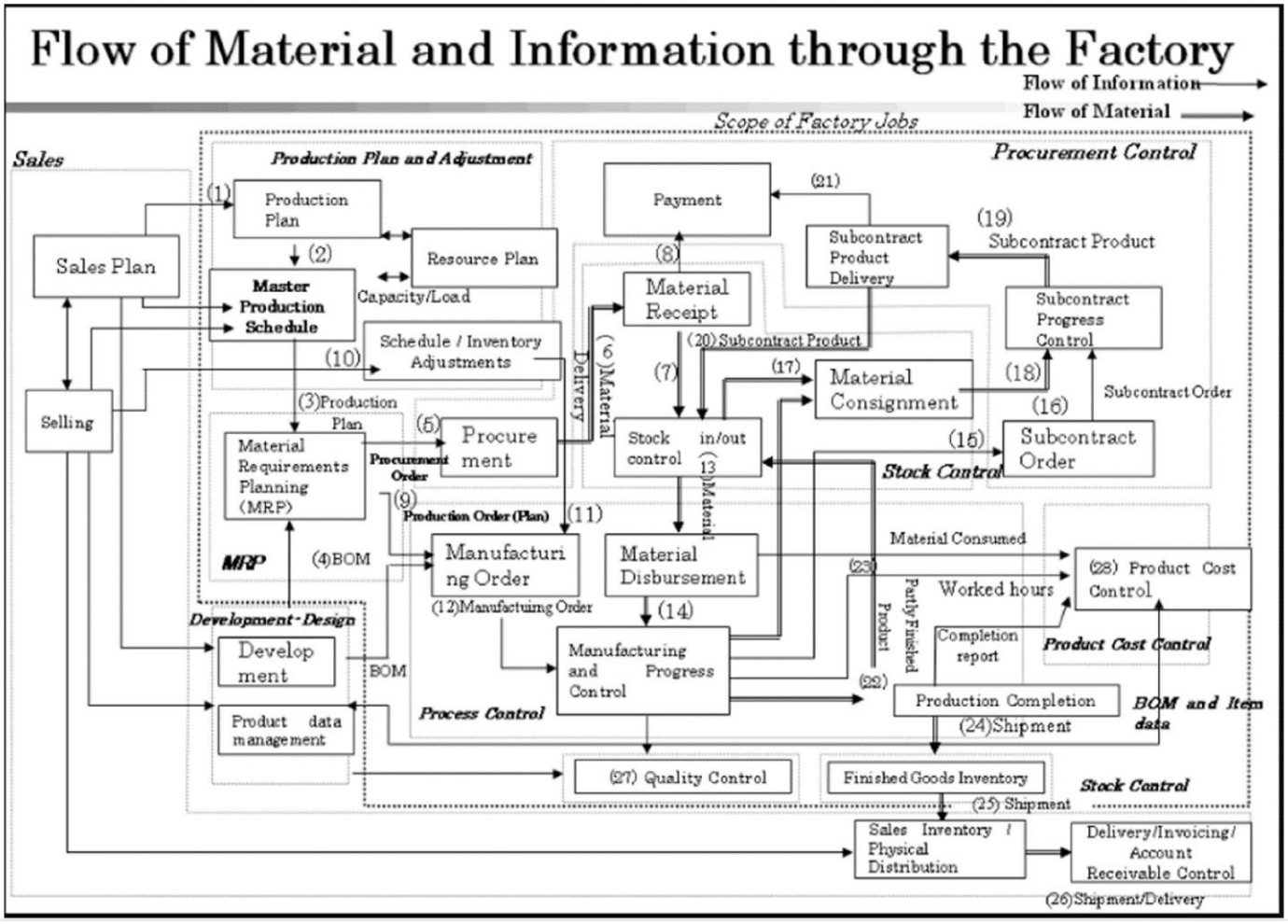
Theory vs reality





https://www.leansixsigmadefinition.com/ glossary/cellular-manufacturing/

Material and information flow



http://www.lean-manufacturing-japan.com/factory/flow_of_material_and_informati.html

Simplified production process steps

1. Procurement/warehousing of materials, procurement of workpieces;
2. Processing of workpieces: cutting, sand/shot blasting, guillotine, plasma;
3. Do the workpieces need machining? Yes/No;
4. Mounting (metalworkers) and welding (welders) of subassemblies;
5. Does the subassembly need machining? Yes/No;
6. Priming and painting of subassemblies;
7. Product assembly;
8. Product testing/adjustment;
9. Product preparation for transport/packaging;
10. Transport;
11. Installation;
12. Start-up/adjustment;
13. Hand-over to the client;
14. Additions/improvements (both covered and not covered by warranty (increasing the output, installing additional equipment)).

Machine tools

1. Universal, specific, specialised;
2. Part manufacture quality;
3. Technical condition of machine tools;
4. Auxiliary equipment (exhaust hoods, filters, curtains, chip conveyors).

Universal machine tools

- Universal lathe, mill

https://www.knuth-machinetools.com/com_en/uwf-1-1-universal-milling-machine-362693

https://www.knuth-machinetools.com/com_en/servomill- uwf-15-servo-conventional-milling-machine-conf-301258

https://www.knuth-machinetools.com/com_en/vector- 1000-m-si-c-frame-vertical-machining-centers-conf- 181270

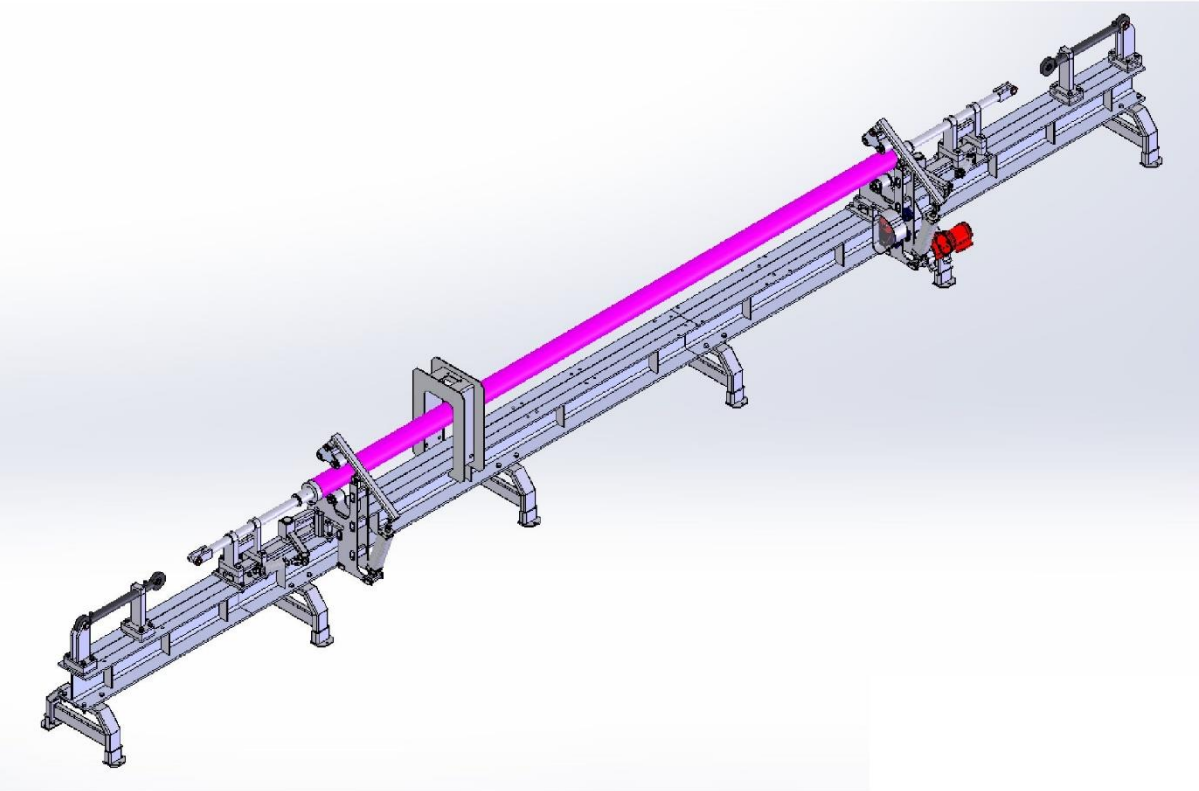
Specific machine tools

- Similarly to universal machine tools, these usually differ in the size of pieces they can process, or in the precision of machining;
- Iekārtu Rūpnīca example:
- Lathe with a machining length of up to 5000 mm and a diameter of 300 mm;
- Lathe with a machining length of up to 1000 mm and a diameter of 1000 mm;
- Machining centre that mills, drills and lathes with very large machining dimensions: length 5000 mm, width 2000 mm, height 1400 mm.

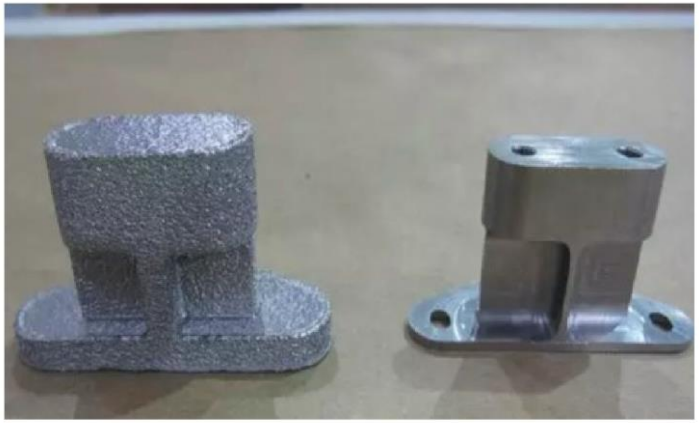
http://www.iekarturupnica.lv/en/services/metal-processing-and-machining

Specialised machine tools

- Intended to perform a particular operation.
- Iekārtu Rūpnīca example:
- Machine for making long rollers.



Part manufacture quality

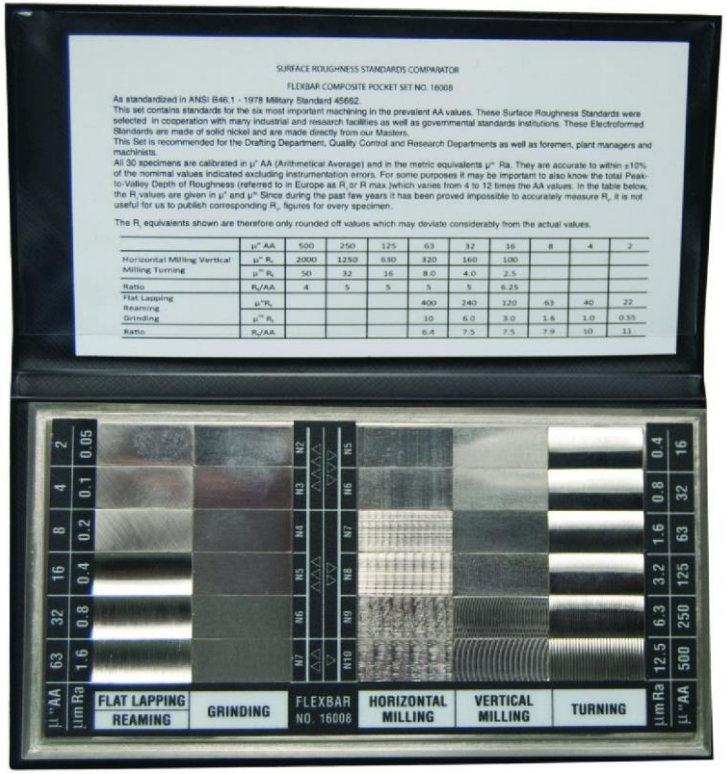


https://www.valvemagazine.com/web-only/categories/technical-topics/9430-understanding-surface-finish-in-metal-3d-printing-of-valves.html

- The quality in which parts are manufactured differs for different machine tools and production technologies;
- One must carefully inspect the properties of the product to select the optimum machine tool or production technology;
- Manually-guided machine tools are used when dealing with smaller quantities and relatively simple operations;
- The quality delivered by manually-guided machine tools depends on the worker's skill level, fatigue, well-being, occupational environment and mood;
- Computer-controlled machine tools are used to make complex or very precise parts, or if large quantities of parts are involved;
- If the manufacturing takes place in-house, then you must look at the product as a whole, not at individual operations.

Technical condition of machine tools

- Wear parts: bearings, guides, cutting parts (milling heads, sawing blades, cutter bits);
- Effect on the product:
- Precision;
- Quality;
- Key requirements for correct operation:
- Regular inspections, logged;
- Preventive maintenance;
- Compliance with the operating modes determined by the manufacturer.



https://www.flexbar.com/products/ surface-roughness-standards-sets

Auxiliary equipment (exhaust hoods, filters, curtains, chip conveyors).

- Human is the most important resource in production, except for when it is fully automated;
- Well-being and safety of people at the workplace;
- Minimisation of environmental impact;
- Effect of dust and chips on the quality.

https://www.flextraction.co.uk/id/hood-positioning-device-articulated-2

Questions

Production planning

a) Plan preparation;

b) Execution sequence;

c) Plan coordination;

d) Plan supervision;

e) Plan execution;

f) Involvement of other managers in the execution of the plan.

Cost control

a) Resource flow preparation;

b) Worktime planning;

c) Long-term relations with suppliers and subcontractors;

d) Combining deliveries.

Quality management

- Main standards;
- Principles;
- Items 1–9 in the material flow apply;
- Influence on project costs.

Why does one need a quality management system?

To enable continuous long-term improvements in quality; to improve services provided to clients; to improve production; to efficiently use resources; to track products and raw materials as part of the production process; to promote the competitiveness of products; to ensure that the activities do not cause environmental or occupational harm, and that they bring benefits to society as a whole.

LF board chairman Jānis Ciems

Key standards for quality management

- Quality management systems are certified using the international standard ISO 9001;
- The environmental management system is certified in accordance with ISO 14001;
- Occupational health and safety is certified using ISO 45001;
- Welding of metal structures is certified based on ISO 3834;
- A quality management system certificate confirms that the organisation has a certain process for fulfilling its clients' requirements, covering everything from accepting orders to finalising them with specific procedures, instructions, and the use of standards and directives.

Principles for quality management at IR

- Various descriptions (of work duties, production processes), logs, forms and external documents (standards, directives, technical specifications) are used;
- The workers conduct the basic control of orders in accordance with the requirements set for the order, or appropriate technical documentation. The results of this control are recorded in a log, or on a drawing;
- The head of the production unit or its production engineer monitors the quality of the work and the control measurements specified in the work duties; they also randomly perform control measurements;
- A representative for projects, production technology and quality group conducts random independent control measurements. The measurement results are recorded in a log.

Quality control in material flow

1. Procurement/warehousing of materials, procurement of workpieces;
2. Processing of workpieces: cutting, sand/shot blasting, guillotine, plasma;
3. Do the workpieces need machining? Yes/no; Mounting (metalworkers) and welding (welders) of subassemblies;
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13. Hand-over to the client;
14. Additions/improvements (both covered and not covered by warranty (increasing the output, installing additional equipment)).

Strict quality control is necessary

Impact of quality on project costs

- Internal deficiencies;
- If you go upstream in the material flow, the cost of corrective action decreases;
- External complaints;
- Fines, correcting mistakes at own cost, including transport, supplier stoppage, cost of making and replacing defective assemblies;
- Additional costs are created not only by the lack of quality or quality control, but also by excessively high quality requirements set during the design stage.

Questions

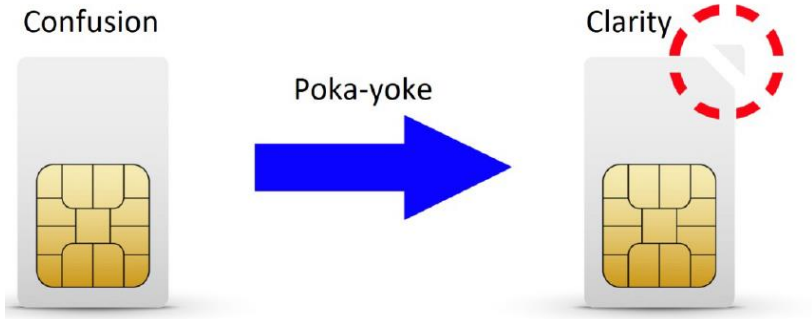
Design

- Principles of quality control;
- Course of design;
- Key mechanical engineering directives;
- Safety requirements;
- Modernisation or new object;
- Mechanical and/or electric part;
- Main components of the product;
- Items 1–14 in the material flow apply;
- Effect of the solution on overall costs (machining time, selection of specific workpieces).

Principles of design quality control at IR

- Designers conduct the basic control of the completion of order, signing the drawings to acknowledge the accuracy of the documentation;
- The lead designer inspects the project to minimise errors;
- Typical design errors:
- Poorly selected technical solution;
- Carelessness mistakes.

Choosing the technical solution



- How do you get a nail in the wall?
- Solutions (advantages and disadvantages);
- Physical principles;
- Preventing mistakes in performing assembly, various actions (Poka-Yoke);
- Poka-Yoke in everyday life (https://tulip.co/blog/poka-yoke-examples-everyday-life/):
- SIM card;
- Microwave not working if the door is open;
- Spellchecking;
- USB ports etc.

https://fractory.com/poka-yoke-in-manufacturing/

Design stages

- Development of the technical solution;
- Review of the technical solution;
- Calculation of costs, approval of the costs by the client;
- Development of details for the project;
- Preparation of drawings;
- Preparation of operating documentation.

Key mechanical engineering directives

- In Latvia, the safety of machinery is governed by the following regulations:
- Cabinet Regulation No. 195 ‘Regulations Regarding the Safety of Machinery’ (https://likumi.lv/ta/id/173016-masinu-drosibas-noteikumi);
- Directive 2006/42/EC of the European Parliament and of the Council (https://eur- lex.europa.eu/eli/dir/2006/42/oj/?locale=LV);
- Providing machinery with CE marking is mandatory in the EU;
- The CE marking should be fully recognised as being the only marking which guarantees that machinery conforms to the requirements of this Directive. All other markings which are likely to mislead third parties as to the meaning or the form of the CE marking, or both, should be prohibited. (2006/42/EC (21));
- EC compliance statement or certification, depending on the risk group of the product.

9. Essential Safety and Harmlessness Requirements for Machinery 9.1 General Requirements

- 78. The essential safety and harmlessness requirements for machinery specified in this Section are mandatory. However, if the existing level of technology in the manufacture of the machinery in question does not enable the achievement of all the aims set out by these requirements, the manufacturer or the authorised representative thereof shall design and manufacture machinery so that the previously set out aims are achieved as closely as possible.
- 80. In selecting the most appropriate methods, the manufacturer or the authorised representative thereof shall apply the following principles:
- 80.1. eliminate or reduce risks as far as possible, developing safe machinery construction;
- 80.2. take protective measures in relation to risks that cannot be eliminated; and
- 80.3. inform users of the residual risks, for the need of any particular training and about personal protective equipment.

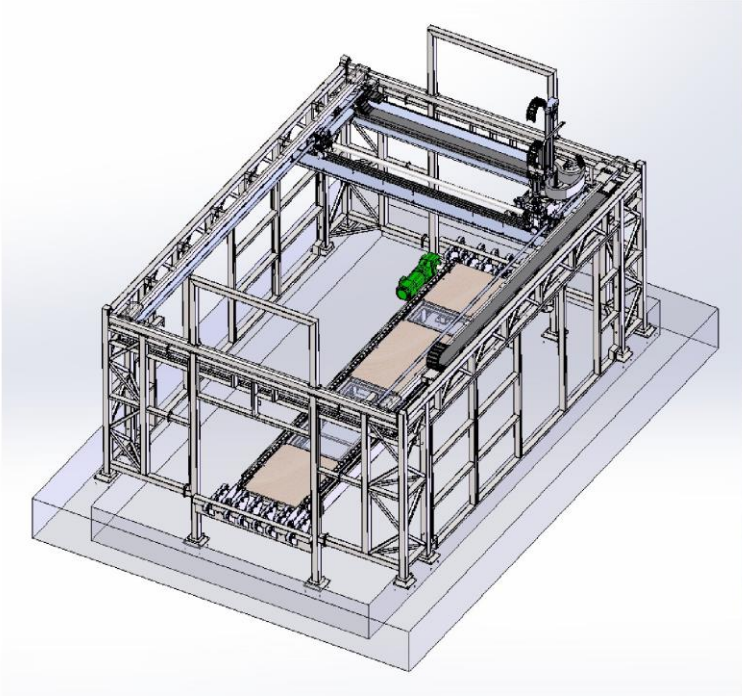
Design

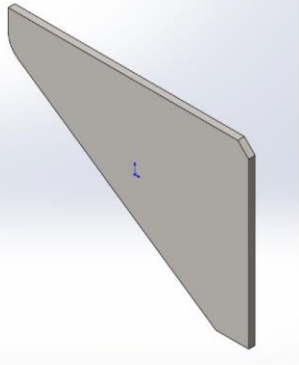
- Modernisation or new object;
- Mechanical and/or electric part;
- Main components of a product:
- Parts;
- Subassemblies (2... parts, welded and assembled);
- Assemblies (2... parts and/or subassemblies);
- Assembled units.

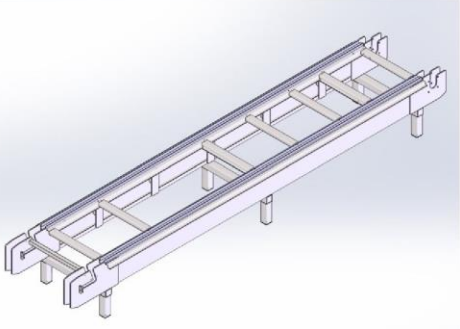
Edge coating machine

- New object;
- Mechanical and electric part;
- Main components of a product:
- Parts (683);
- Assemblies and subassemblies (149, welded and assembled);
- Drawings (468);
- Assembly units (6).

Edge coating machine







Edge coating machine in the flow of material

1. Procurement/warehousing of materials, procurement of workpieces;
2. Processing of workpieces: cutting, sand/shot blasting, guillotine, plasma;
3. Do the workpieces need machining? Yes/No;
4. Mounting (metalworkers) and welding (welders) of subassemblies;
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13. Hand-over to the client;
14. Additions/improvements (both covered and not covered by warranty (increasing the output, installing additional equipment)).

All items must be included in the

Effect of the solution on overall costs

- Number of parts;
- Optimum workpiece and (appropriate) production technology;
- Objective quality/precision requirements;
- Optimum machining time.

Project development from A to Z

Material flow is like a backbone that encompasses quality processes, layout of the production plant, production planning and design. All these stages matter in ‘Project development from A to Z’.

Further development of the product

- Additions/improvements (both covered and not covered by warranty (increasing the output, installing additional equipment)).
- Upgrading of actuators (replacing asynchronous motors with servomotors; hydraulics, with a threaded rod and servomotor combination);
- Optimisation of control algorithms;
- Process digitisation;
- Industry 4.0 (‘smart factory’).

Questions

Production software

- CAD - SolidWorks+Simulation: modelling, stress calculations, preparation of drawings (https://www.youtube.com/watch?v=e7fUXy0H7Ig;
- Free online engineering tools (CAE) (https://www.tribology-abc.com/ ; https://www.engineeringtoolbox.com/ https://www.unitconverters.net/);
- Manufacturer-specific engineering tools (https://www.festo.com/cat/lv_lv/products#);
- Specialised tools for increasing capacity (https://www.youtube.com/watch?v=hMkBQqkDUZI);
- CAM processing software for NC machine tools (https://www.youtube.com/watch?v=rm3xVxUfJnE).

Production planning software

- Axapta 2012: the procurement service uses this software to order materials and components. One can check if everything necessary for the implementation of the project has been order, as well as the delivery times;
- MS Excel: the most versatile software one can use to put together critical information pertaining to the planning and management of production:
- Plan preparation;
- Execution sequence;
- Plan supervision;
- Plan execution.
- Gantt: allows planning in the same way as Excel;
- Moneo etc.

Questions

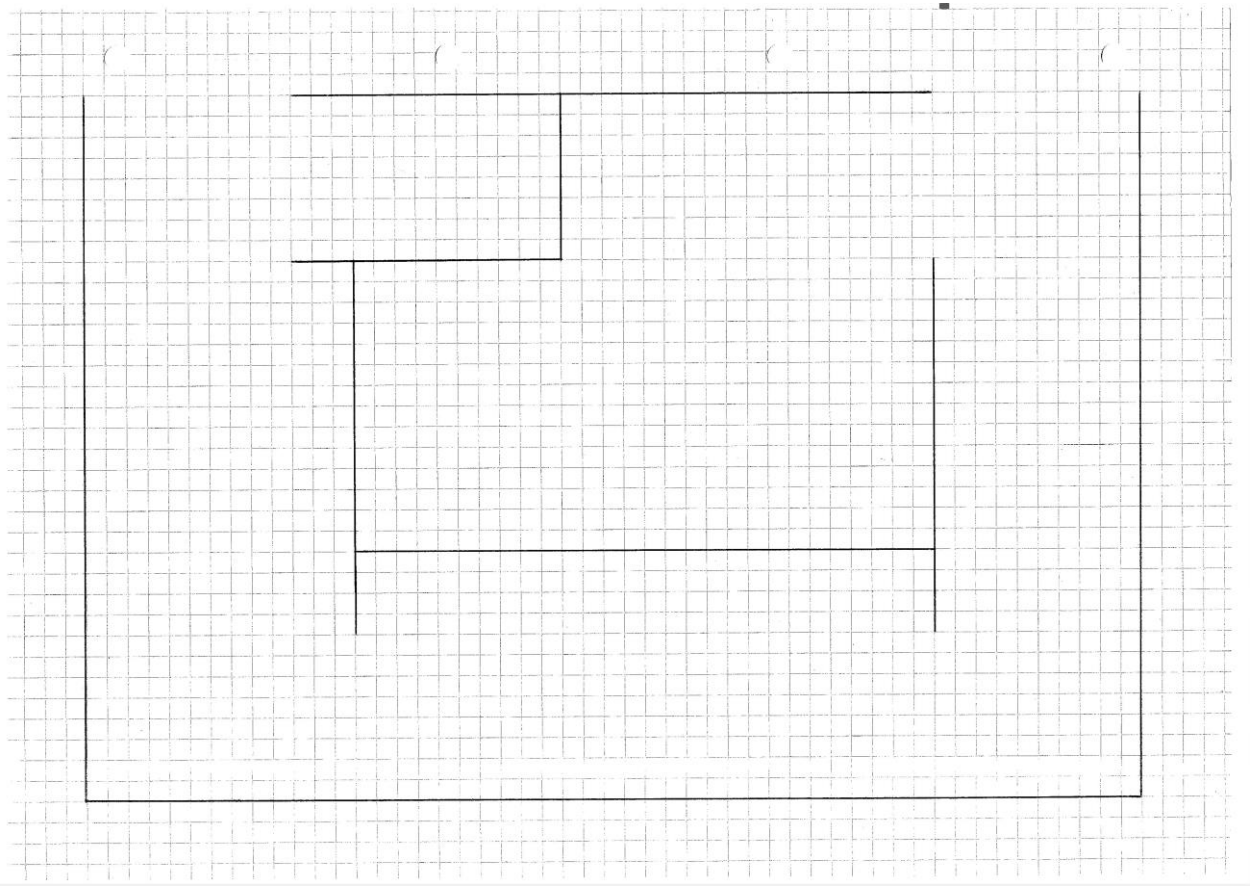
Practical assignment. Production plant optimisation

- Use the previous example with a lathed part with a collar and a precision-machined surface for installing a bearing;
- The initial arrangement of the factory is sent to the students;
- The goal is to shorten the overall route;
- Changing the sequence and number of processes is not allowed;
- Lines a 0/90°, along the square edges only;
- Rebuilding walls is not allowed;
- Changing the dimensions of workstations and material flow directions is not allowed. Rotating the entire workstation is allowed.

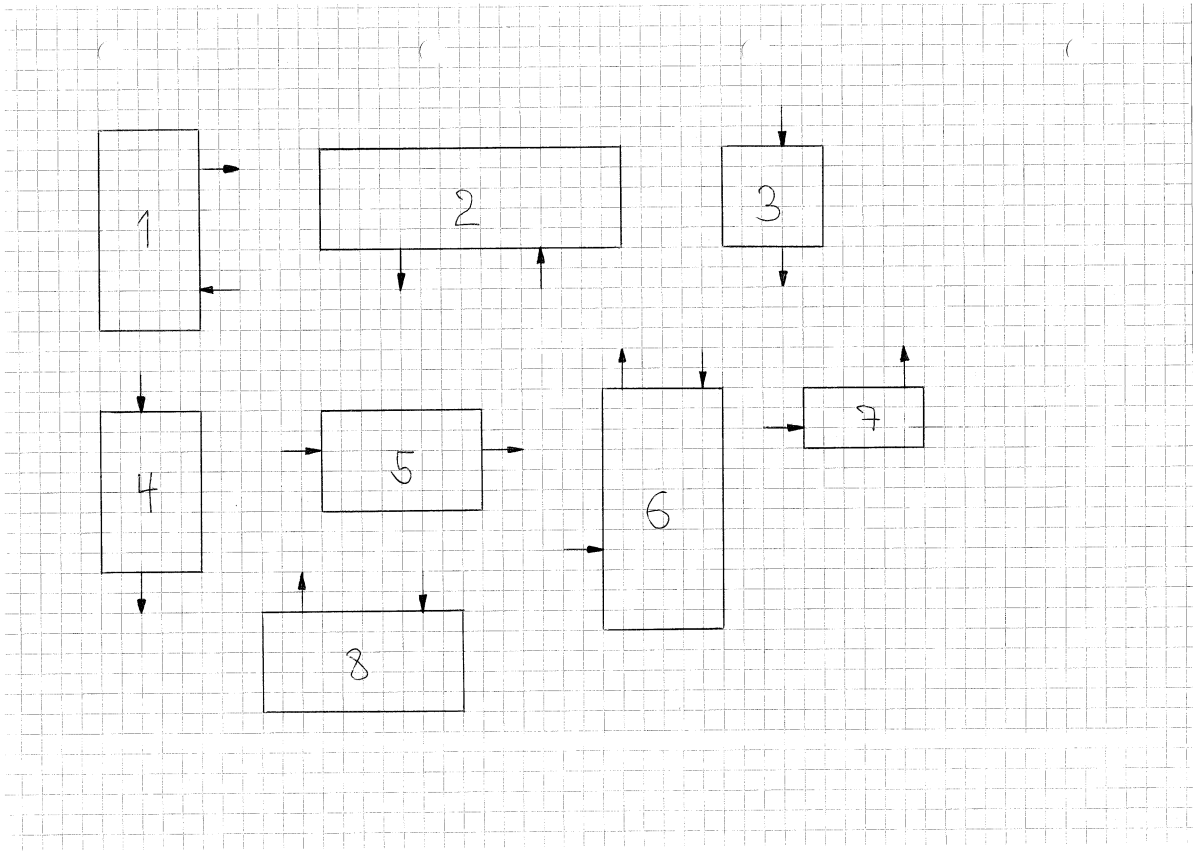
Processes:

1. Storage of raw materials;
2. Storage of workpieces;
3. Cutting of workpieces;
4. Rough lathing;
5. Smooth lathing;
6. Installation of bearings;
7. Packaging;
8. Storage of finished products.

Practical assignment. Factory layout



Practical assignment. Machine tools and equipment

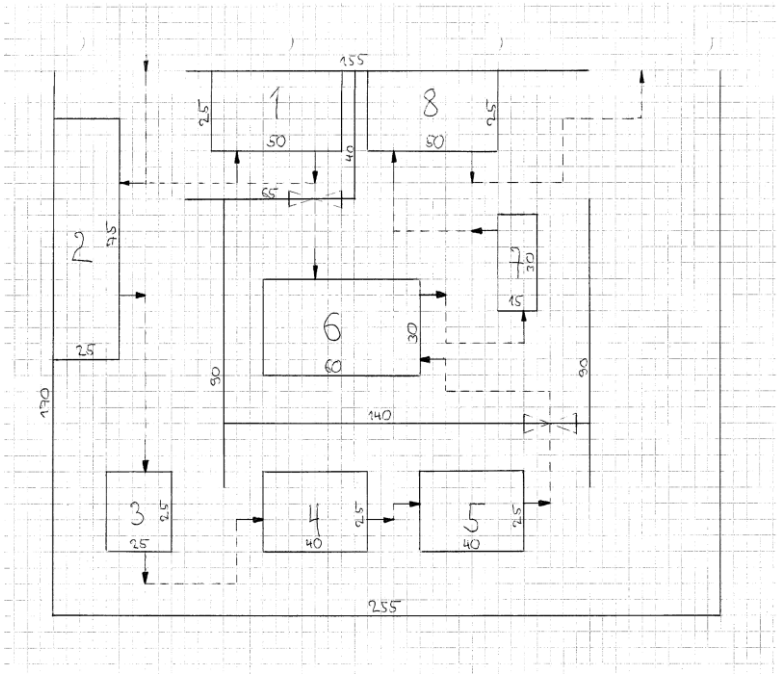


Analysis of results and discussion

- Best result;
- How to improve the result?
- Conclusions.

Conclusions

- There is no better or worse solution. The task does not have a single correction solution, and this is currently the best one;
- The production environment is dynamic. You must adapt to the current conditions and requirements in production;
- Other optimal solutions will arise as the conditions change.



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Thanks for your attention!

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Topic:

"SKETCHING"

Author
Mārīte Zīmele

Project number: 601123-EPP-1-2018-1-DE-EPPKA2-SSA

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Sketching

Mārīte Zīmele 18.03.2021

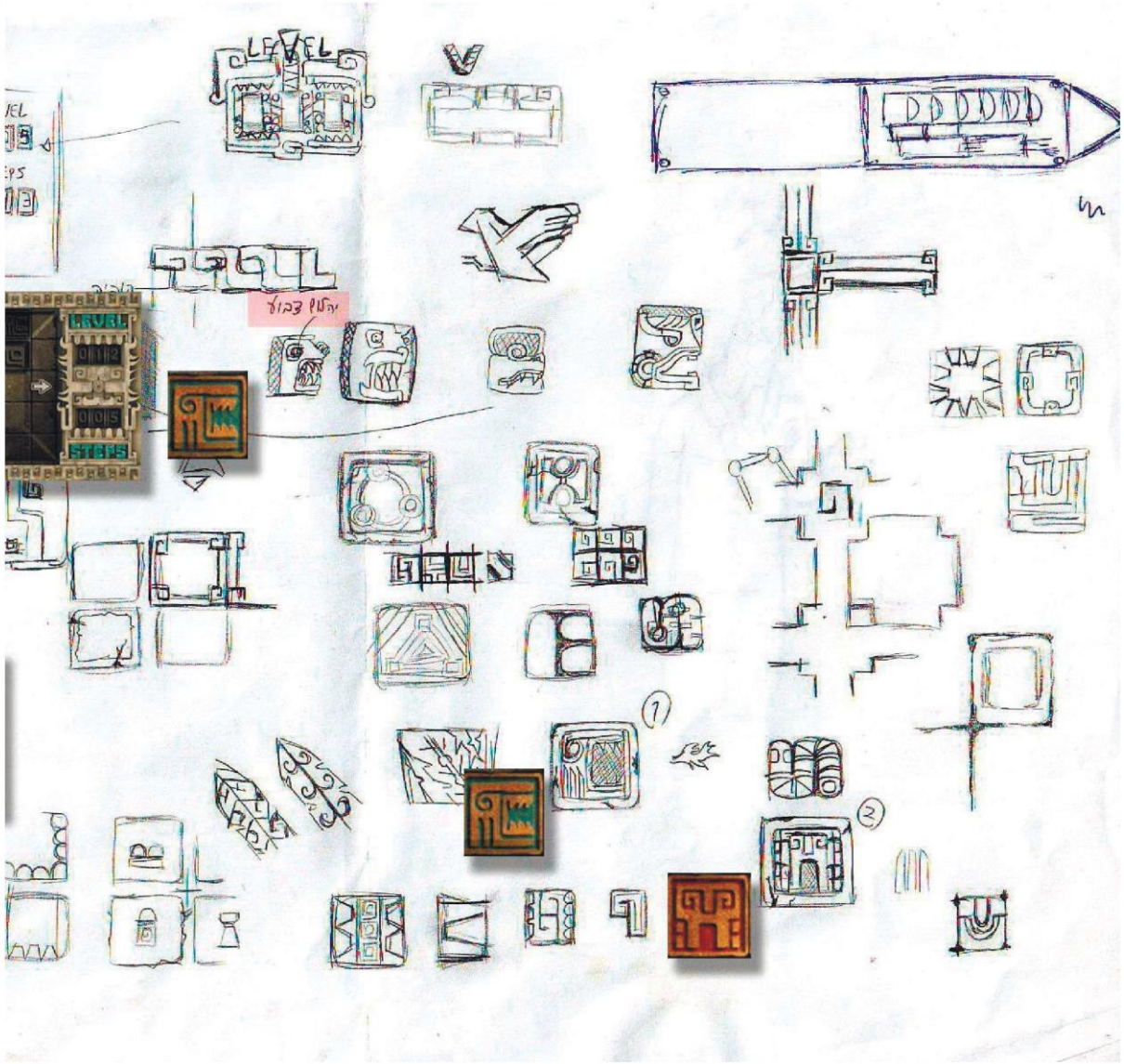
Contents

A. What is a sketch and what is its purpose?
B. Recommendations for developing sketching skills
C. Types of sketching
D. Principles of sketching

F. Practical assignments

What is a sketch?

Sketching is the most direct and effective way of converting thoughts into specific results, and communicating with others.



Good sketch?

Bad sketch?

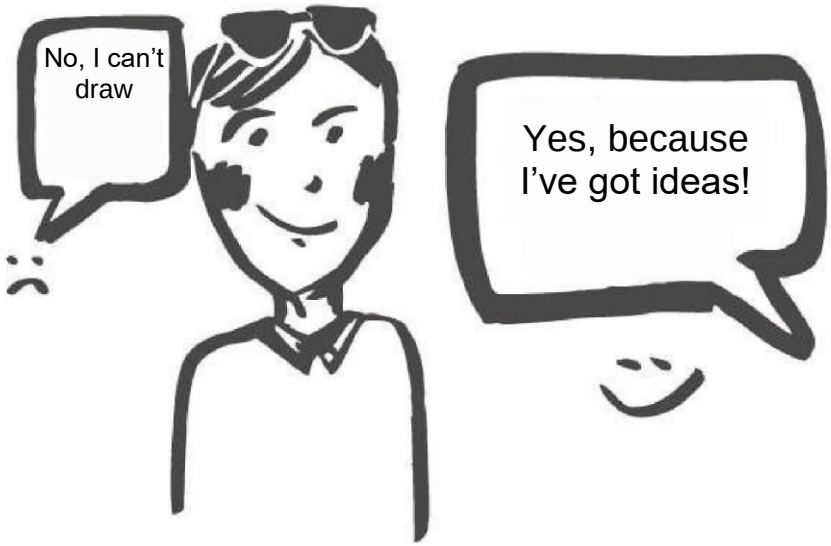
Effective sketch!

IT'S IMPORTANT TO UNDERSTAND THAT THERE'S NO SUCH THING AS A 'GOOD' OR 'BAD' SKETCH

A SKETCH IS MORE THAN A PAPER DRAWING, IT REPRESENTS THINKING/VISUALISATION PROCESSES.

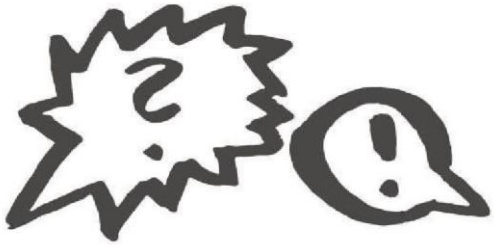
A SKETCH IS NOT A GOAL, IT IS A PROCESS.

CAN I MAKE SKETCHES?



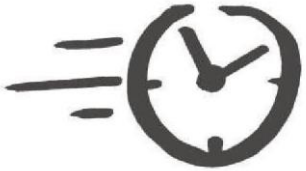
HOW CAN A SKETCH HELP ACHIEVE BETTER RESULTS?

Think about your own ideas in a broader and more creative way



Discuss, criticise and **share** your ideas with others

Create ideas rich in content **without worrying** about their quality



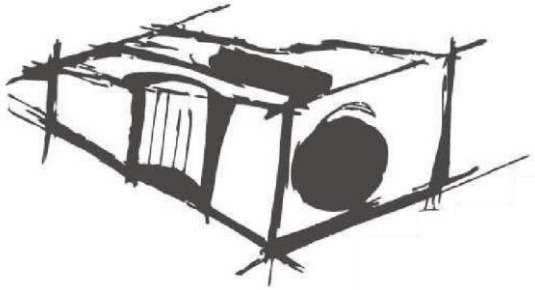
Invent and **explore** concepts, by quickly noting down ideas

Select the ideas worthy of more attention

Archive your ideas for later review

BE CREATIVE

TIPS
FOR DEVELOPING YOUR SKETCHING SKILLS

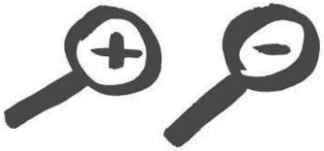


A SKETCH SHOULD BE:

Quick: you should be able to make it quickly;
On time: you can make *a sketch* when one is needed;
Without additional costs: it's cheap, and the costs do not slow down the development of the concept;
Replaceable: the value of a sketch is in its concept, not in its cost;
Clear: details can distract the viewer from what's important, and must be kept to a minimum;
Expandable: sketches are made open-ended and can be expanded at any time.
Sketches are not as precise and strictly regulated as technical drawings;
Recommends and learns more than asserts: sketches do not tell a story, they suggest one.
The value is not in the sketch itself, but in how it promotes discussions, conversations, actions;
Ambiguous: a significant part of the value of a sketch is specifically in the different ways it can be interpreted.

1 SKETCH QUICKLY AND MORE THAN ONCE

Sketching describes and directs thinking. Your idea must be visualised quickly, so that you can record it. If you spend more time drawing a sketch than necessary, and it contains too many details, you will have to slow down and focus on it. Sketch quickly, elaborating your idea as you go, to see what needs improving.
Decide how many sketches are necessary (e.g. seven), and once they are done, choose the best one! The exact number should be high enough, but no more than your ability to focus: i.e. the difference between when your interest in the project is at its peak, and the moment when you start losing energy.



2 SKETCH IN LARGE AND SMALL FORMATS

Make large sketches when you need to grasp the real scale of the product and to add various details. Make small sketches when you need to focus on the overall shape and avoid including too many details. Make sure that your product is sketched at different scales, so that you can make out its various aspects.

3 SKETCH CONSTANTLY

The reason why you should develop your sketching speed is the ability to sketch constantly. As you generate an idea, you record every thought that springs to your mind. Keep a sketchbook with you to make drawings and write your ideas down.
If you don’t have one, use a voice recorder, or make a sketch on a piece of material you have available: make sure you keep it, and record the date.
This method will free your mind of any unnecessary thoughts, because you convert these ideas into a different format enabling you to look back at them later, and perhaps also use them.

4 THINK ABOUT THE PURPOSE OF YOUR SKETCHING

When choosing the size and the materials for a sketch, think about what it’s for. What goal must the sketch achieve and what specifically must it demonstrate? These questions might seem self-evident, but asking them is very important.

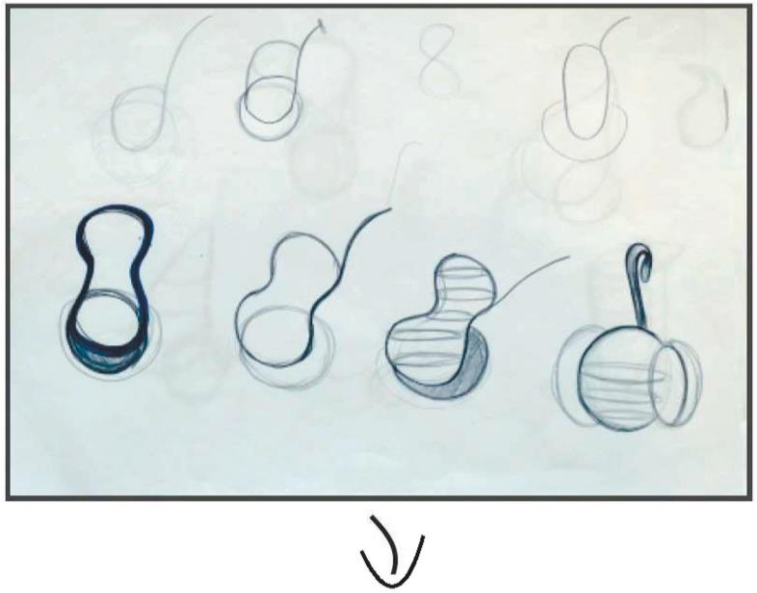
TYPES OF SKETCHING

PEOPLE USE SKETCHING AT DIFFERENT STAGES OF DEVELOPING A DESIGN: GENERATING IDEAS, RESEARCHING AND DEVELOPING IDEAS, CREATING A FINAL CONCEPT.

EVERY TYPE OF SKETCH HAS ITS USE AND PURPOSE

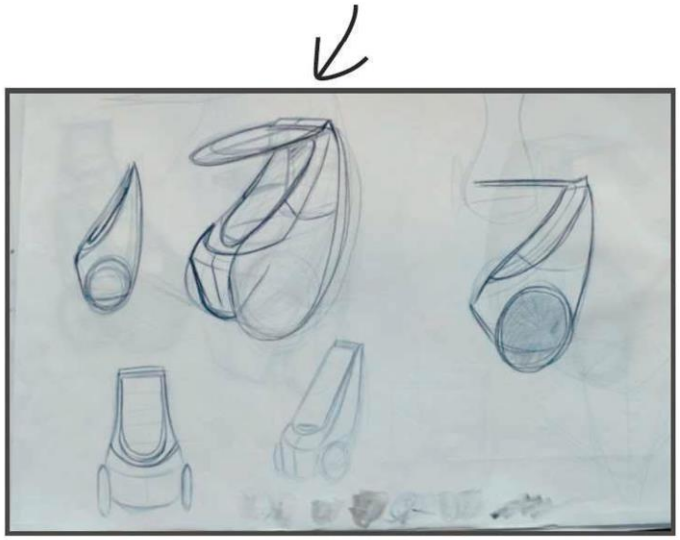
1 Generating ideas

A sketch is a direct representation of your thoughts through simple lines. The purpose of these sketches is to look for a solution to the proposed problem. As you work on your initial idea and your first sketch, it can lead you to another one, and a new sketch. When you're generating ideas, the sketches tend to be rather small at first, because fine details do not belong in initial ideas. However, these sketches can contain potentially good ideas that can grow into real offers or concepts. Sketches for generating ideas also include diagrams and notes to explain them. At this stage of developing a design, the primary purpose of a sketch is not to communicate with others, but to put your ideas on paper, developing them in this manner.



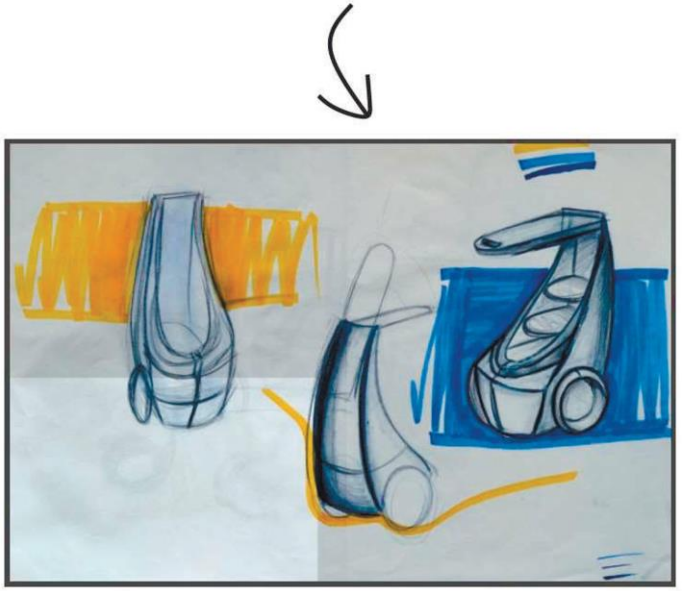
2 Researching and developing ideas

During the development of a design, the most successful potential solutions that came from the idea generation stage are selected, researched and developed further. The sketches at this stage are proportionally bigger and more detailed than the initial idea sketches. The lines are complemented by colour elements that highlight the prominent details of the object. These sketches show the function and form of the object, and the interactions between its different parts, and explain the technical solutions. Design concept solutions are sketched from different points of view, creating a three-dimensional appearance. The main function of these sketches is to explain the idea, and not to sell it. At this stage, the ideas can already be shown to the client for conducting discussions, or used as material for communicating with other people involved in the design process.



3 Presenting the design concept

The final design concept stage involves making a sketch that is as realistic as possible, with the goal of impressing the audience and making it possible for the project to successfully develop further. These sketches show interactions between different parts of the product and explain its technical solutions, also demonstrating the product in its environment, in contact with its user and various objects. Sketches and drawings may be used for presentations during the development of the design. The client is not usually a designer: a client can be a sponsor, a project manager or a user of the design, and not be interested in its fine technical points. The client wants a clear and inspiring presentation of the product.



PRINCIPLES OF SKETCHING

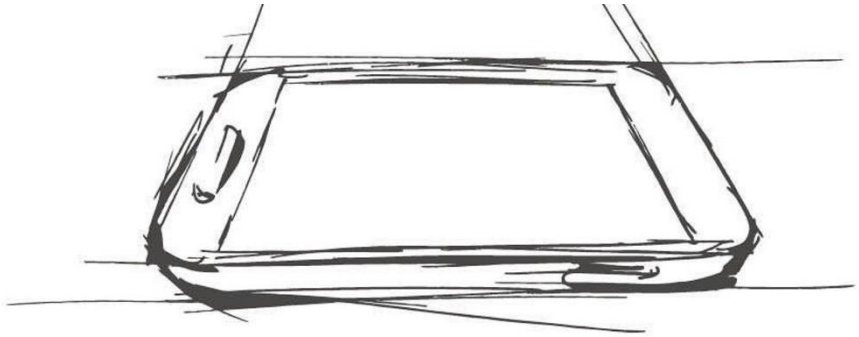
1 LINES

A sketch consists of outlines, structural lines and auxiliary lines. When you begin sketching, it’s important to train your hand, practising drawing even and convincing lines without a ruler. The motion of the hand must come from the shoulder, without straining your wrist, quickly making even and flowing lines.
The slower the motion of your hand, the less even the line will be.

2 PRINCIPLES OF PERSPECTIVE

Perspective studies are at the foundation of creating product design sketches. As you start drawing, first determine the location of the object or group of object relative to eye level (the horizon line). All perspective lines that are at an angle to the horizon line in the drawing lead to its vanishing point.
Principle of linear perspective: lines that are parallel in real life all lead to the same vanishing point at the horizon.
The illusion of space can be created by using one, two or three-point perspective.

The horizon line is always at the level of the eye, meaning that:
- We see the bottom of the objects that are above the horizon;
- We see the top of the objects that are below the horizon;
- We see the front of the objects that are at the horizon level.

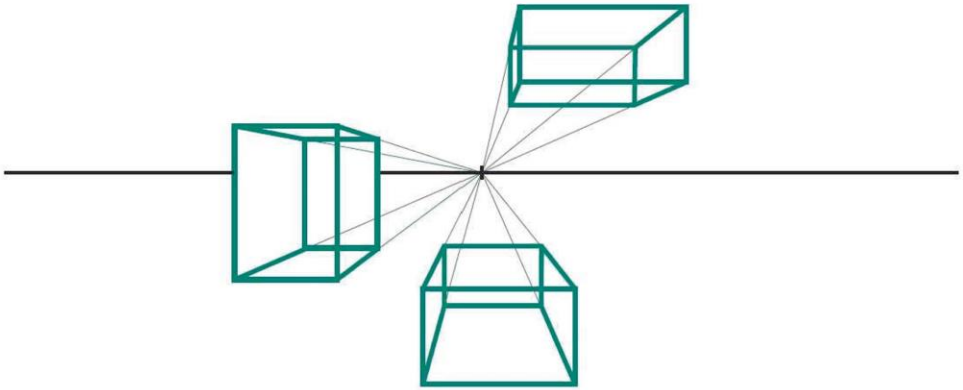


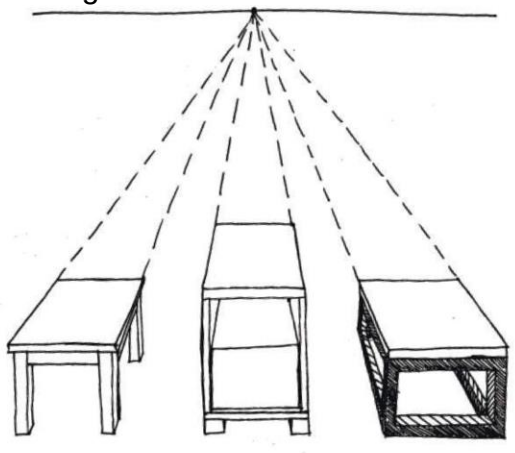
Tips for sketching in perspective:
- Use long lines and a fine technical pen, because a pencil can create a desire to delete lines, preventing you from practising and gaining confidence in the lines and the object you intend to draw;
- Sketch using the transparent technique, i.e. showing the structural lines. These lines will help you in subsequent work, as you adjust the perspective and create volume;
- Choose a viewing angle that best presents the object;
- Begin the sketch with the main shapes, leaving the details for last;
- Choose the right size for your sketch depending on the complexity of the object. Typically, a sketch should be limited to the size of a hand.

PRINCIPLES OF SKETCHING

ONE-POINT PERSPECTIVE

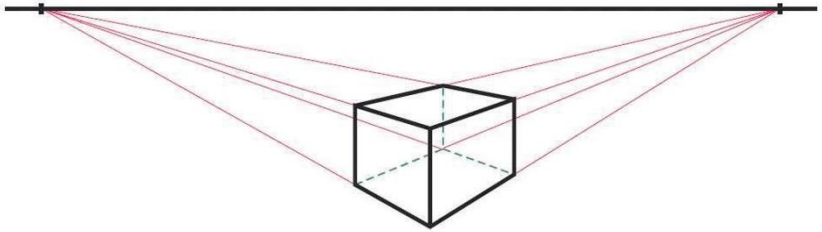
One-point perspective is also referred to as central perspective. The object shown is directly in front of the viewer. This is one of the easiest approaches to perspective, because all lines lead to the same point.
Its main principle is that all vertical and horizontal structural lines are parallel to each other. First draw the frontal view of the object, and then lead the lines towards the vanishing point.
This approach is easy to read and is typically used for sketches in interior design

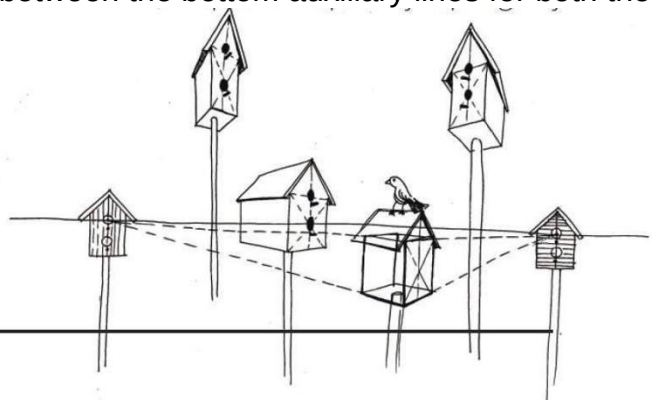




TWO-POINT PERSPECTIVE

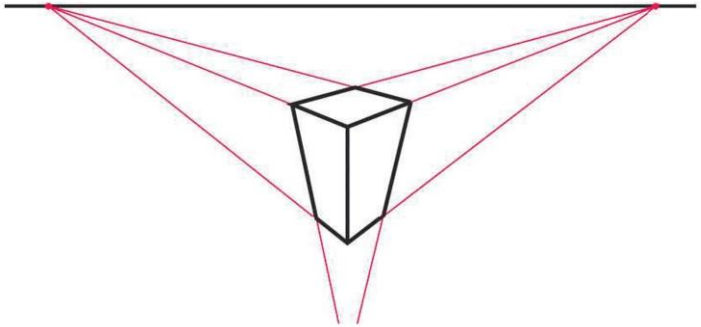
Two-point perspective is the type most commonly used when sketching objects. It involves using two vanishing points located on the horizon. It is created by showing vertical structural lines parallel to each other and leading auxiliary lines from a single central edge to both the vanishing points. It is recommended not to bring the vanishing points too close to each other, in order to avoid distortions in the perspective. To make sure that the perspective is correct, check if the angle between the bottom auxiliary lines for both the vanishing points is 90 degrees.

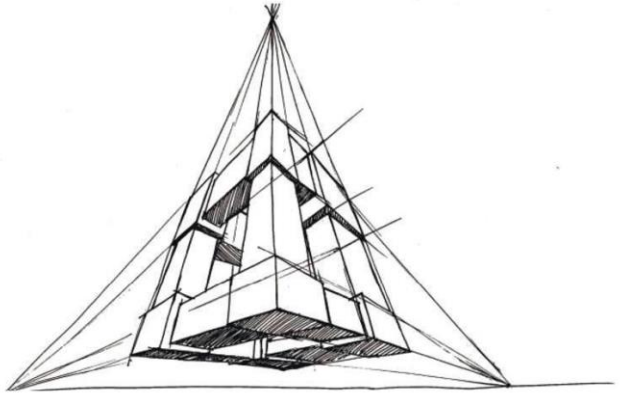




THREE-POINT PERSPECTIVE

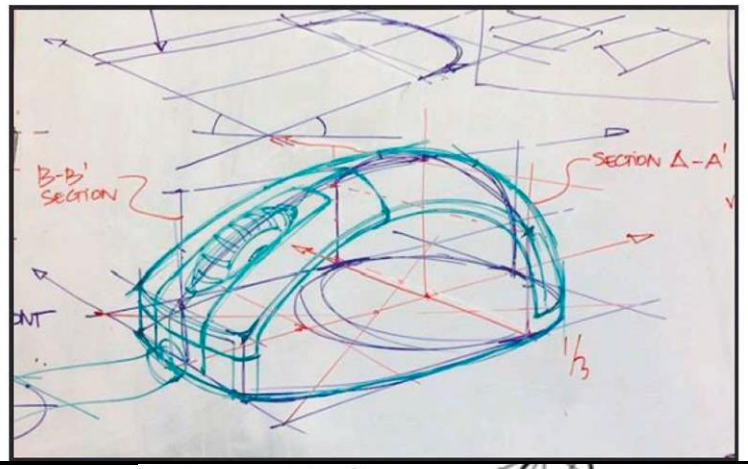
This approach to perspective is based on the existence of a third vanishing point that is located below or above the horizon line. This means that the object is viewed either from the top, or from the bottom. Unlike two-point perspective, vertical structural lines lead to the third vanishing point. If you use this type of perspective, the object appears to be more monumental, more massive if you look at it from below.





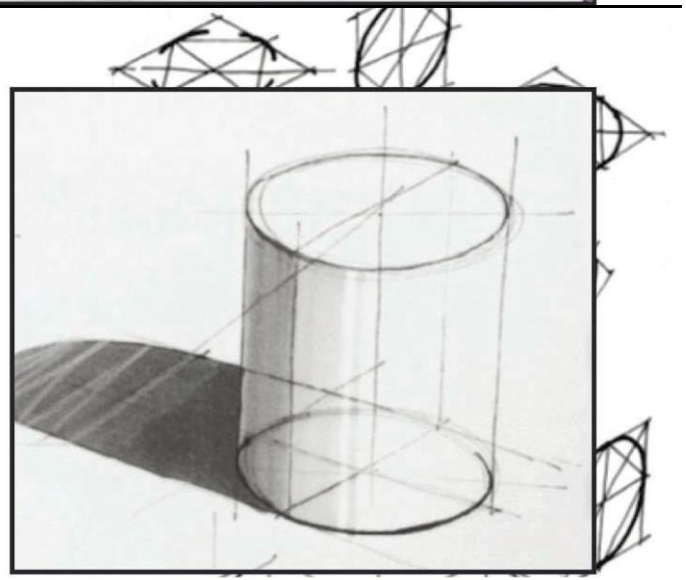
3 PERSPECTIVE FOR COMPLEX SHAPES

When sketching complex three-dimensional shapes, one must first use perspective structures as the basis. They are followed by drawing the outlines of the object relative to the horizontal and vertical centre line.
In order to produce an external line, set up a reflexive symmetry relative to the central vertical axis. Connect the outer lines you get, using the ellipse structure as the basis. Using this method, you can create base structures for three-dimensional shapes.



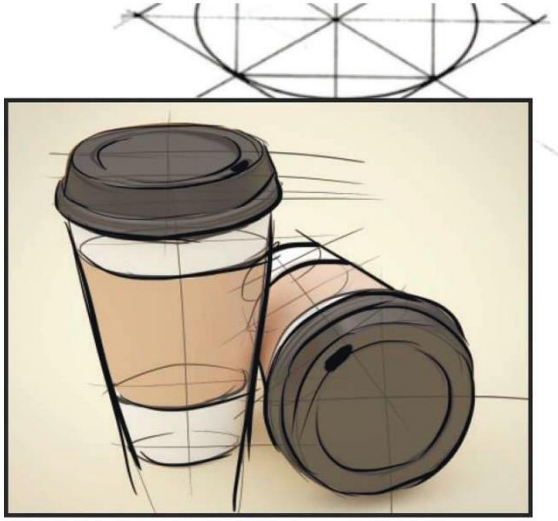
4 DRAWING ELLIPSES

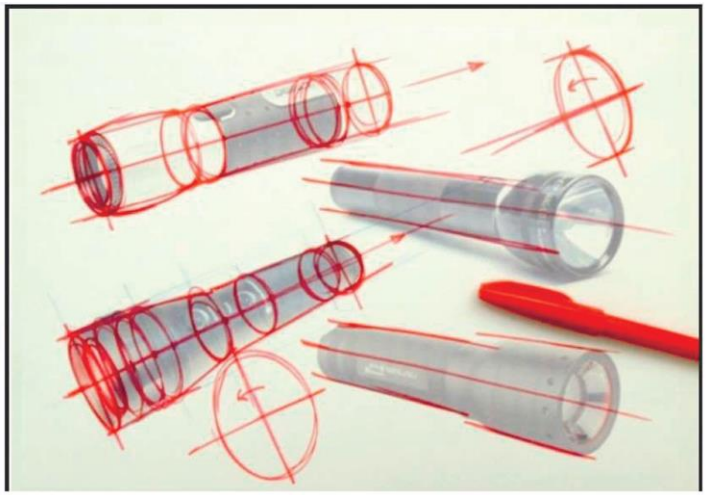
Drawing ellipses is one of the main structural elements of a sketch that uses the principles of perspective. This is done relative to a central axis and middle line. Regardless of the angle, at which the object is positioned, the location of the ellipse is horizontal. If the ellipse is an element on a different plane, then use the perspective of the respective plane for drawing it. The height of the ellipse depends on the point of view: the further the ellipse is from the eye level, the wider it becomes.

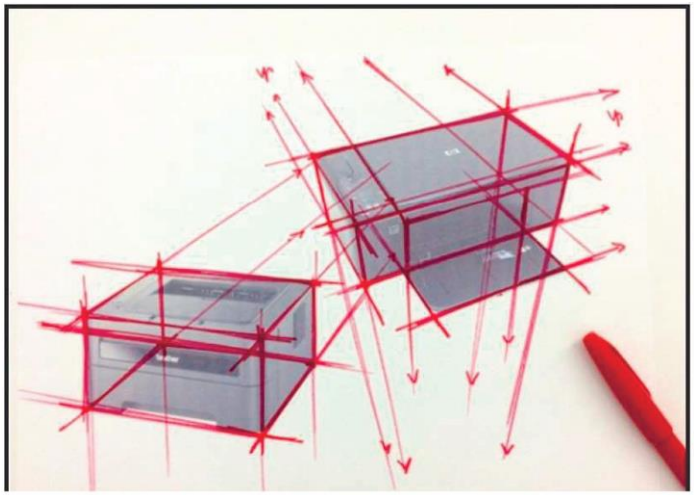


5 DRAWING SURROUNDING OBJECTS

Using your knowledge of the principles for how to produce sketches, such as perspective and drawing of ellipses, you can sketch surrounding objects, looking into their structure. Every factory-made object around use is a result of design development, which includes making a three-dimensional model, i.e. using basic shapes to put together a structure. Objects can be cylindrical, spherical, linear, or have non-standard shapes. When inspecting an object, identify the principles for how its shape is formed, and the elements of the shape.
For example, a disposable cup consists of ellipses of different widths.
Perspective and ellipse studies develop the understanding of how objects are built and help present your own ideas in a three-dimensional way. If you create the base structure for objects, they are easier to perceive.





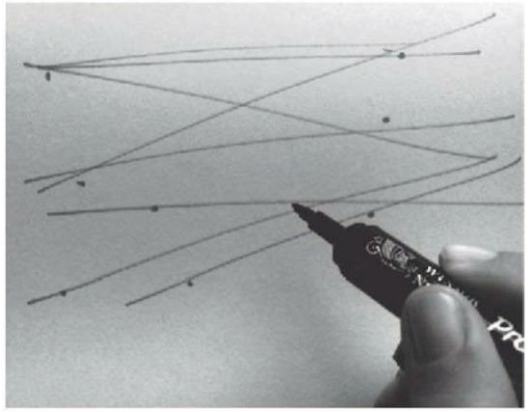


MANUAL DEXTERITY

IT ALL STARTS WITH A LINE!

The motion of the hand must come from the shoulder, without straining your wrist, quickly making even and flowing lines. The slower the motion of your hand, the less even the line will be.
Use sketching paper, a pen, a technical pen or a marker.

Task 1: On a sheet of paper, draw to points at a distance of 10 to 15 cm from each other. Connect them by drawing a line in a quick single motion!



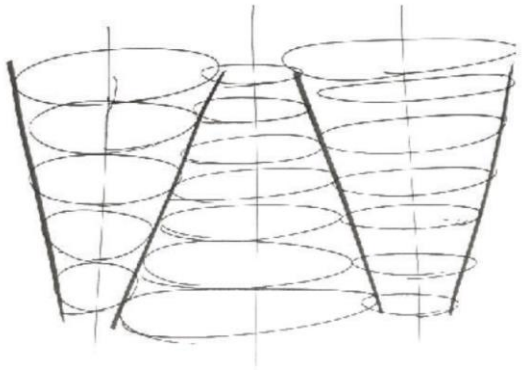
Task 2: Draw parallel lines on a sheet of paper: horizontal ones at first; then practise drawing vertical lines as well.

MANUAL DEXTERITY

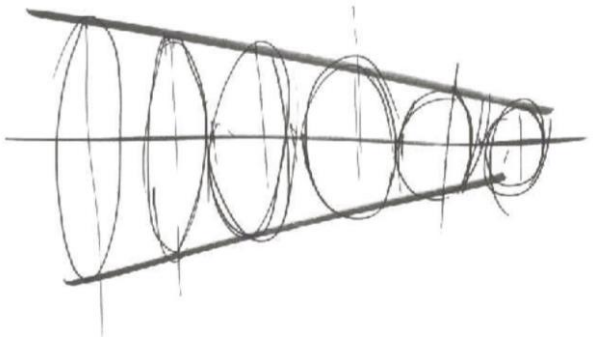
PRACTISE DRAWING ELLIPSES!

Use sketching paper, a pen, a technical pen or a marker.

Task 1: Draw two cone-like lines on a sheet of paper, then draw a central axis between them, and as quickly as possible, draw ellipses of different widths;
The width of the ellipses depends on the distance between the outer lines.



Task 2: Sketching ellipses of different heights, depending on the point of view.
Using outer lines and a central axis, practise quickly drawing taller and shorter ellipses.

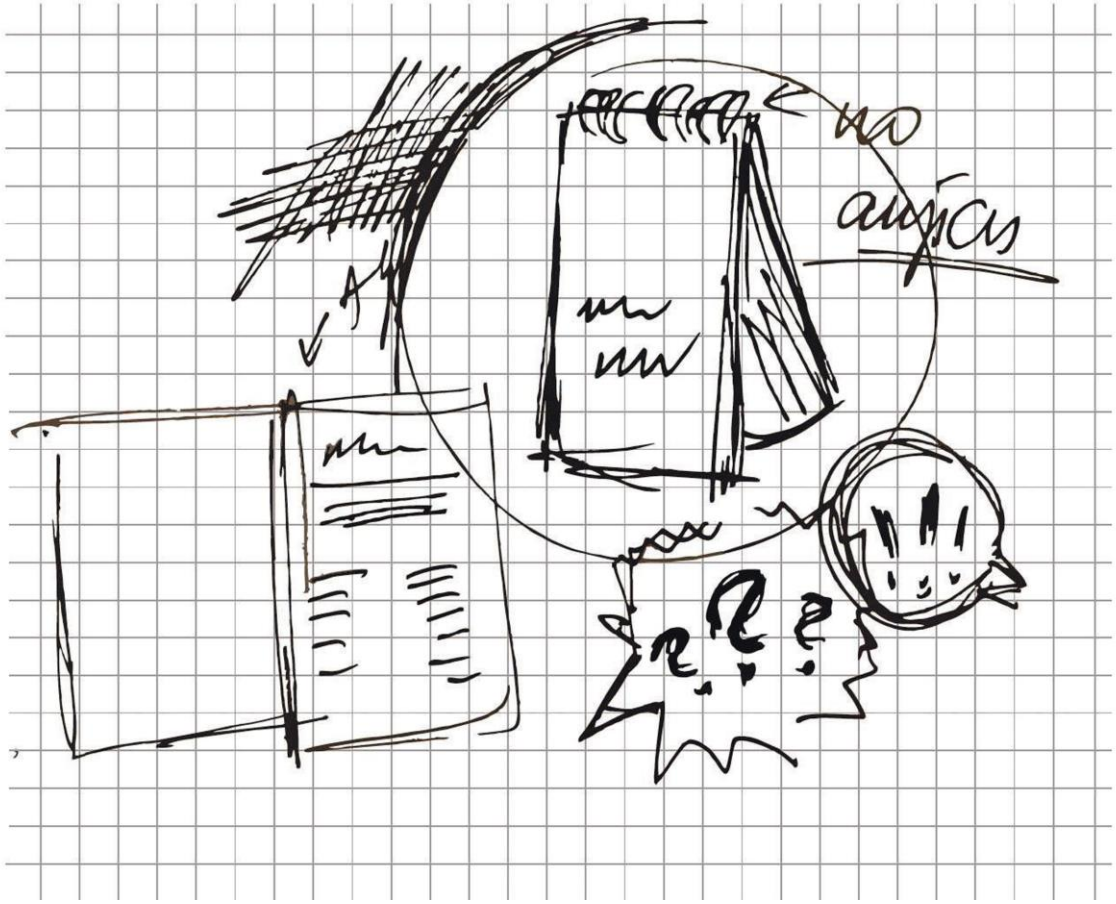


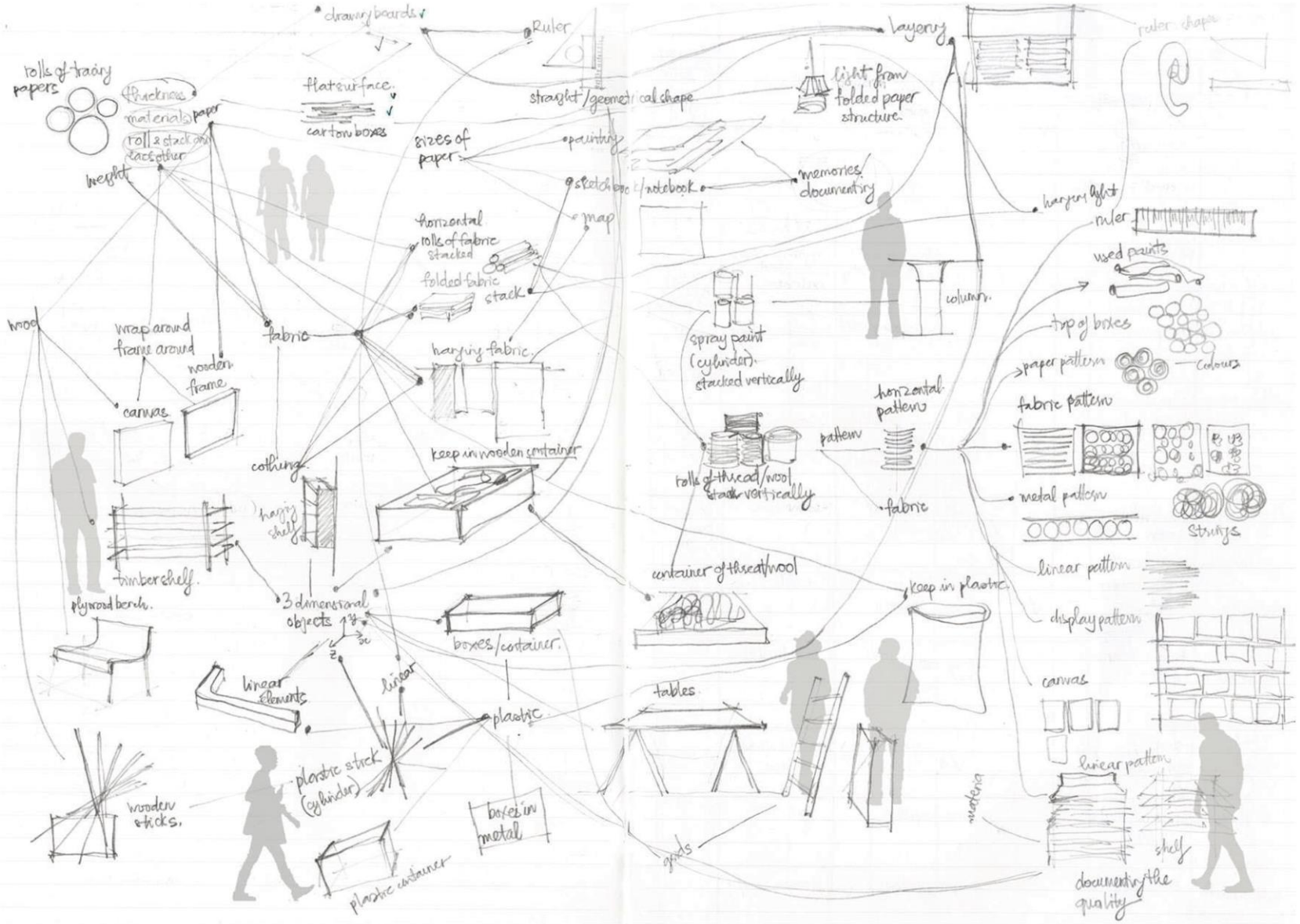
GENERATING IDEAS

GET YOUR IDEAS OUT INTO THE WORLD!

Looking for a solution to a problem? A really cool idea has sprung to your mind?
Have you noticed something significant in the things around you?

Record it!





Khanh Luu's sketch

SKETCHING THINGS AROUND YOU

PUT THEORY INTO PRACTICE!

Use a pen, technical pen, coloured marker, sketching paper, tracing paper.

Task 1: sketch the basic elements: the centre line, the structural perspective line, the ellipses.
Highlight the outline of the object using a coloured marker!
Task 2: Sketch the objects you have on your desk: pen, daily planner, mobile phone, computer, water bottle etc.
Sketch quickly! Ideally, you should spend 10 minutes on sketching three objects.

SKILLED UP

Latvia
University of Life
Sciences and
Technologies

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

Thank you!

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

Topic:

"GOOD FURNITURE, FANCY FURNITURE, OR PERHAPS... SAFE FURNITURE"

Author
Vilnis Jakovļevs

Project number: 601123-EPP-1-2018-1-DE-EPPKA2-SSA

SKILLED UP

Latvia
University of Life Sciences
and Technologies

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

Good furniture
Fancy furniture, or perhaps...
Safe furniture

Forest and Wood Products Research and Development Institute
(MeKA) Testing Laboratory engineer ***Vilnis Jakovļevs***

MEKA
Mežs Koks Attīstība

- *Mechanical testing sector.*
- *Bioenergy sector.*
- *Fire reaction testing sector.*
- *Furniture testing sector — This one's mine☺*

What direction will the wind blow from?

- Let’s talk about:
- Me.
- Standards and types of furniture; selecting and using it.
- Groups of furniture.
- General testing principles, visualisation.
- Terms.

Standards are like dogs!

Standards and democracy!

EN

European Standard

Let’s make sense of our thoughts!

Types of standards

- Requirement standard;
- Testing standard;
- Requirement and testing standard.

Types of furniture

- Furniture for storage;
- Furniture for sitting;
- Tables;
- Beds;
- etc.

Testing principles

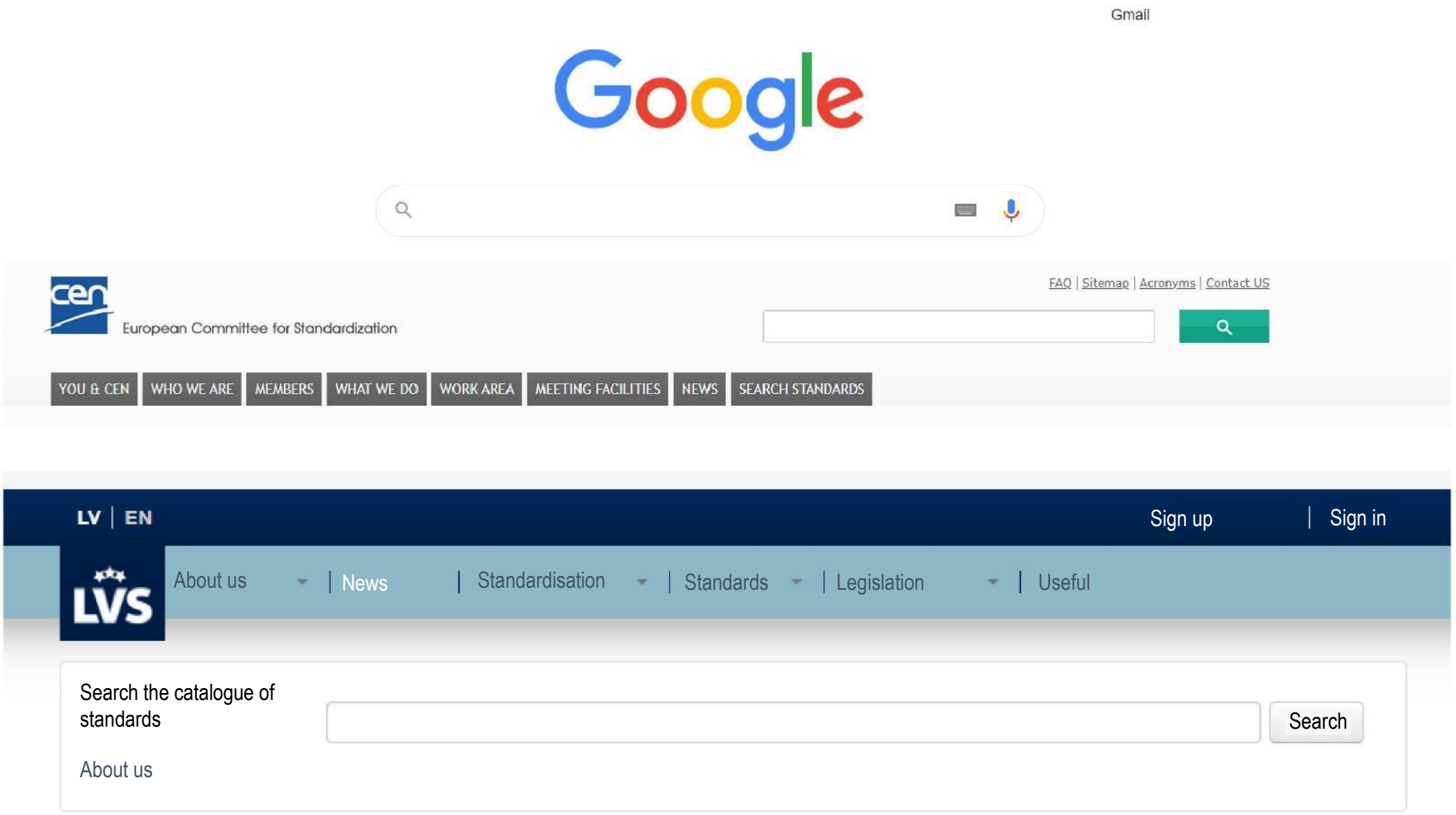
- Sizes;
- Statics;
- Impact loads;
- Durability;
- Stability.

Accreditation

- For testing standards only

Using standards in furniture!

Where do you find all the standards?



European Committee for Standardization

Committee : CEN/TC 207 Furniture

Standards : 70

Committee	Reference, Title	Status	Sales Points
CEN/TC 207	EN 1021-1:2014 (WI=00207226) Furniture - Assessment of the ignitability of upholstered furniture - Part 1: Ignition source smouldering cigarette	Published	
CEN/TC 207	EN 1021-2:2014 (WI=00207236) Furniture - Assessment of the ignitability of upholstered furniture - Part 2: Ignition source match flame equivalent	Published	
CEN/TC 207	EN 1022:2018 (WI=00207231) Furniture - Seating - Determination of stability	Published	
CEN/TC 207	EN 1023-1:1996 (WI=00207045) Office furniture - Screens - Part 1: Dimensions	Published	
CEN/TC 207	EN 1023-2:2000 (WI=00207046) Office furniture - Screens - Part 2: Mechanical safety requirements	Published	
CEN/TC 207	EN 1023-3:2000 (WI=00207047) Office furniture - Screens - Part 3: Test methods	Published	
CEN/TC 207	EN 1116:2018 (WI=00207250) Furniture - Kitchen furniture - Coordinating sizes for kitchen furniture and kitchen appliances	Published	
CEN/TC 207	EN 1129-1:1995 (WI=00207008) Furniture - Foldaway beds - Safety requirements and testing - Part 1: Safety requirements	Published	

General | Structure | Work programme | Published Standards

EN FR DE

Project

Reference	EN 1022:2018
Title	Furniture - Seating - Determination of stability
Work Item Number	00207231
Abstract/Scope	This document specifies test methods and requirements for the determination of the stability of all types of seating for adults weighing up to 110 kg, without regard to use, materials, design/construction or manufacturing process. The test methods described can be used for seating for children and heavier adults by modifying test loads and loading points. This document does not apply to children's highchairs, table mounted chairs and bath seats which are covered by other European Standards.
Status	Published
Reference Document	
date of Availability (DAV)	2018-11-14
ICS	97.140 - Furniture
A-Deviation(s)	
Special National Condition(s)	

Legal

Directive(s)	
Mandate(s)	
Citation in OJEU	

Implementation Dates

date of Ratification (DOR) (1)	2018-07-01
date of Availability (DAV) (2)	2018-11-14
date of Announcement (DOA) (3)	2019-02-28
date of Publication (DOP) (4)	2019-05-31
date of Withdrawal (DOW) (5)	2019-05-31

Relations

Supersedes	EN 1022:2005
Normative reference (6)	
Sales Points	

(1) Date of ratification (dor) date when the Technical Board notes the approval of an EN (and HD for CENELEC), from which time the standard may be said to be approved

(2) Date of availability (dav) date when the definitive text in the official language versions of an approved CEN/CENELEC publication is distributed by the Central Secretariat

(3) Date of announcement (doa) latest date by which the existence of an EN (and HD for CENELEC), a TS or a CWA has to be announced at national level

(4) Date of publication (dop) latest date by which an EN has to be implemented at national level by publication of an identical national standard or by endorsement

Standard number!

LATVIJAS STANDARTS

LVS EN 14988+A1

7 May 2020

ICS 97.190* 97.140

Replaces: LVS EN 14988:2017

Bērnu barošanas krēsli. Prasības un testēšanas metodes

Children's high chairs - Requirements and test methods

National foreword

The Latvian standard **LVS EN 14988+A1:2020** 'Bērnu barošanas krēsli. Prasības un testēšanas metodes' is identical to the European standard **EN 114988:2017+A1:2020** 'Children's high chairs - Requirements and test methods'.

The European standard was adopted as a national standard without any changes.

BS EN 14988:2017+A1:2020

BSI Standards Publication

Children's high chairs — Requirements and test methods

immediate download *Released: 2020-10*

DIN EN 14988

Children's high chairs - Requirements and test methods (includes Amendment :2020)

Kinderhochstühle - Anforderungen und Prüfverfahren (enthält Änderung :2020)

CURRENCY EUR

LANGUAGE

English	☐	Printed version 197.09 EUR	☐	PDF 179.17 EUR	Add to cart
German	☐	Printed version 157.55 EUR	☐	PDF 143.22 EUR	

Status:	**Standard**
Released:	**2020-10**
Standard number:	**DIN EN 14988**
Pages:	**60**

LVS
LATVIJAS STANDARTS

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Children's high chairs — Requirements and test methods

Find differences and similarities!

immediate download *Released: 2020-10*

DIN EN 14988

Children's high chairs - Requirements and test methods (includes Amendment :2020)

Kinderhochstühle - Anforderungen und Prüfverfahren (enthält Änderung :2020)

CURRENCY EUR

LANGUAGE English Printed version 197.09 EUR PDF 179.17 EUR

German Printed version 157.55 EUR PDF 143.22 EUR

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Status:	Standard
Released:	2020-10
Standard number:	DIN EN 14988
Pages:	60

BS 8509:2008+A1:2011

BSI Standards Publication

Children's beds for domestic use – Safety requirements and test methods

ICS 97.140

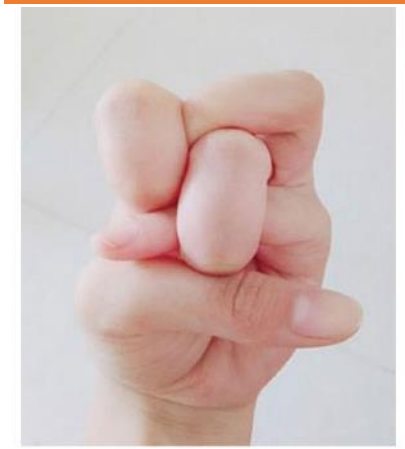
BS 8509:2008+A1:2011

BSI Standards Publication

Children's beds for domestic use – Safety requirements and test methods

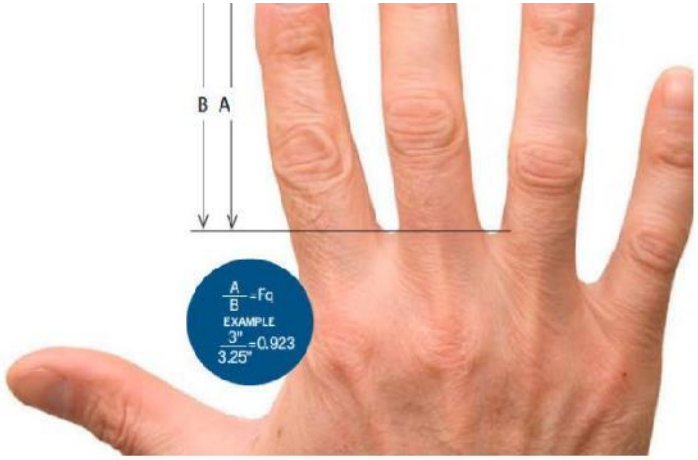
ICS 97.140

Requirement standard/testing standard!




1. Spread your fingers.
2. Put your hand on a flat, even horizontal surface.
3. Measure the length of the protrusions.
4. Anything shorter than 40 mm is not considered a finger.
5. Count the fingers.
6. Write down the number of fingers in the log.
7. Based on the log, prepare a Test Report.
8. Include at least the following information in the Test Report:

1. .....
2. .....
3. .....



Requirement standard/testing standard!

LATVIJAS STANDARTS

LVS EN 716-1+AC

16 May 2019

ICS 97.140* 97.190

Replaces: LVS EN 716-1:2017

Mēbeles. Mājas apstākļiem paredzētās parastās un saliekamās bērnu gultiņas, 1.daļa: Drošuma prasības

Furniture - Children's cots and folding cots for domestic use - Part 1: Safety requirements

LATVIJAS STANDARTS

LVS EN 716-2

7 September 2017

ICS 97.190* 97.140

Replaces: LVS EN 716-2+AI:2013

Mēbeles. Mājas apstākļiem paredzētās parastās un saliekamās bērnu gultiņas. 2. daļa: Testing methods

Furniture - Children's cots and folding cots for domestic use - Part 2: Test methods

Requirement standard/testing standard!

LATVIJAS STANDARTS

LVS EN 1729-1/AC

17 November 2016

ISC 97.140

Mēbeles. Krēsli un galdi mācību iestādēm. 1. daļa: Funkcionālie izmēri

Furniture - Chairs and tables for educational institutions - Part 1: Functional dimensions

LATVIJAS STANDARTS

LVS EN 1729-2+A1

28 April 2016

ISC 97.140

Replaces: LVS EN 1729-2:2012

Mebeles. Krēsli un galdi mācību iestādēm. 2. daļa: Drošuma prasības un testēšanas metodes

Furniture - Chairs and tables for educational institutions - Part 2: Safety requirements and test methods

LATVIJAS STANDARTS

LVS EN 1022

28 February 2019

ISC 97.140

Replaces: LVS EN 1729-2:2012

Mājas mēbeles. Sēdekļi. Stabilitātes noteikšana

Furniture - Seating - Determination of stability

ISC 97.140

LATVIJAS STANDARTS

Mēbeles. Galdi. Testēšanas metodes stabilitātes, stiprības un izturīguma noteikšanai

LVS EN 1730

31 January 2013

Replaces: LVS EN 1729-2:2012

Furniture - Tables - Test methods for the determination of stability, strength and durability

EUROPEAN STANDARD EN 1730:2012

ADOPTED AS A LATVIAN STANDARD

ISC 97.140

LATVIJAS STANDARTS

Mēbeles. Sēdmēbeles. Testēšanas metodes stiprības un ilgizturības noteikšanai

LVS EN 1730

31 October 2012

Furniture - Seating - Test methods for the determination of strength and durability

EUROPEAN STANDARD EN 1730:2012

ADOPTED AS A LATVIAN STANDARD

Nice case!

ICS 97.190

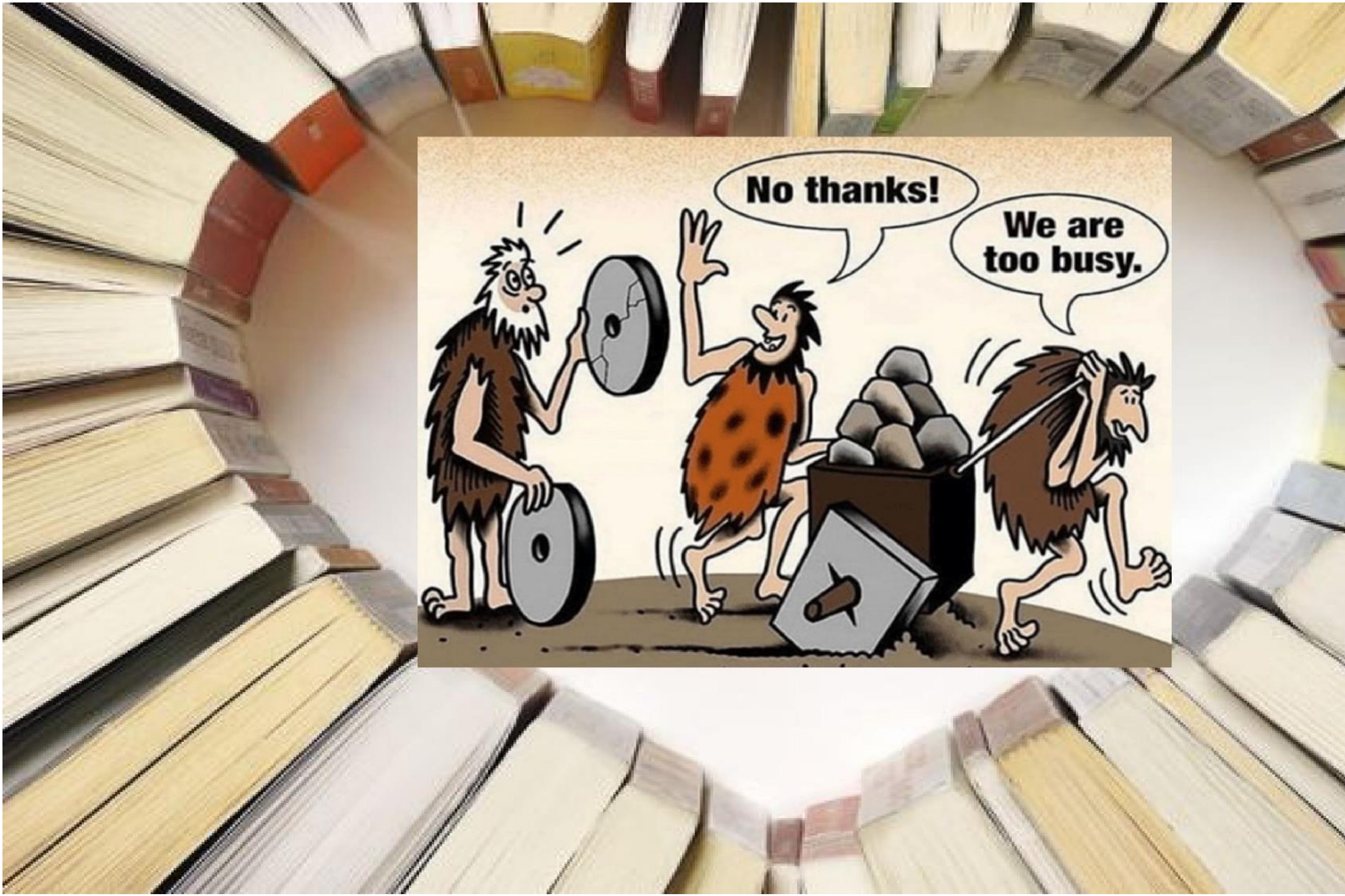
LATVIJAS STANDARTS	**Bērnu aprūpes priekšmeti. Aizsargbarjeras. Drošuma prasības un testa metodes**	**LVS EN 1930** 12 April 2012

Replaces LVS EN 1930:2001. LVS EN 1930:2001/A1:2006

Child use and care articles - Safety barriers — Safety requirements and test methods

EUROPEAN STANDARD EN 1930:2011

ADOPTED AS A LATVIAN STANDARD


No thanks!
We are too busy.

Let’s summarise what we’ve heard about standards

- Requirement standard;
- Testing standard;
- Requirement and testing standard.

Children’s furniture!

EN 716-1&2

EN 14988-1&2

EN 747-1&2

EN 12221-1&2

EN 12521

EN 1729-1&2&3

EN 12520

Home furniture!

EN 14749

EN 12520

EN 12521

EN 1725

EN 14749

EN 14749

Home furniture!

Office furniture!

EN 16139

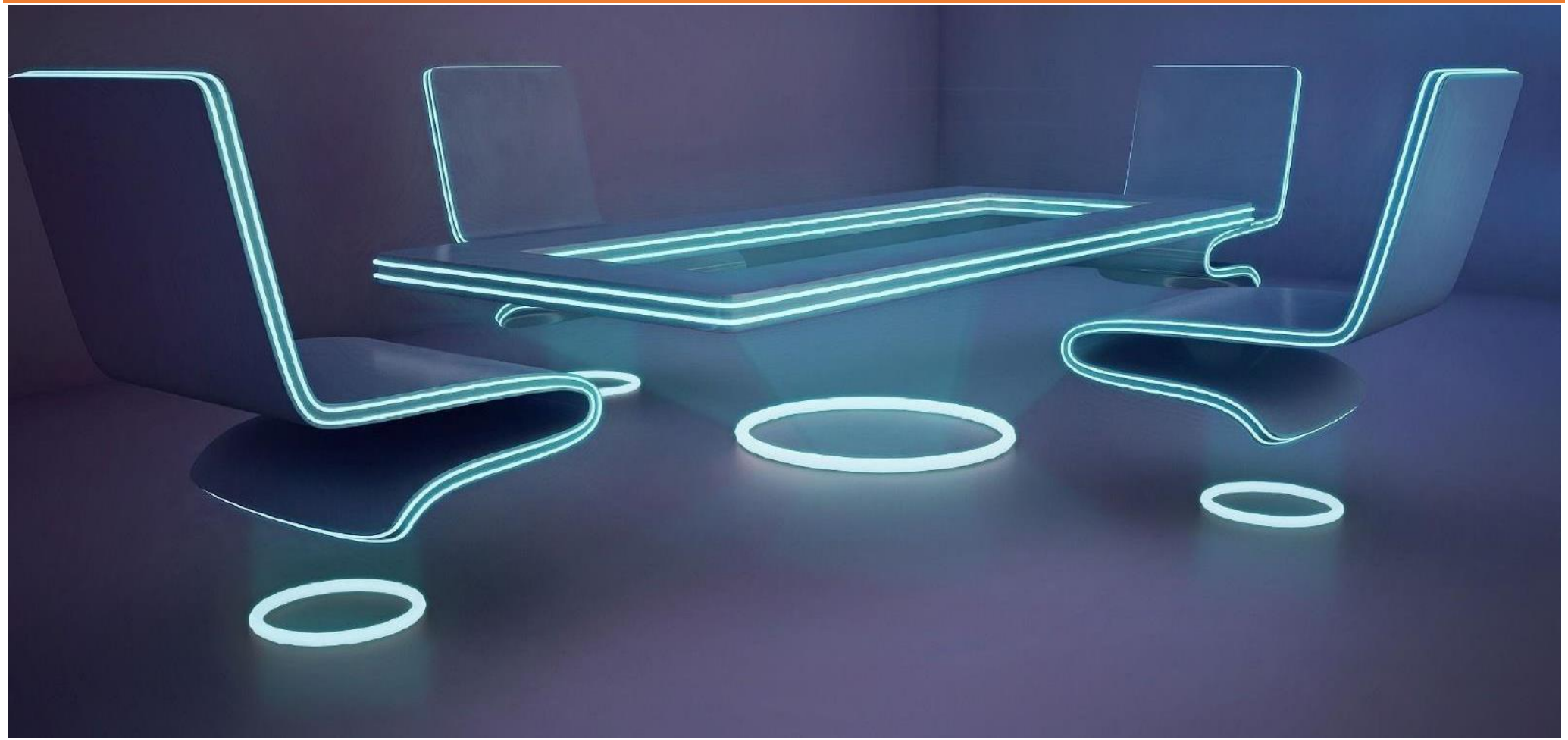
EN 527-1&2&3

EN 14073-1&2&3

EN 1335-1&2&3

Office furniture!

Office furniture!



School furniture!

Outdoor furniture!

Laboratory furniture!

Various scenarios!

Storage furniture EN standarts

- Domestic EN 14749; EN 16122
- Non-domestic EN 16121
- Office CEN/TR 14073-1; EN 14073-2; EN 14073-3; EN 14074
- Laboratory EN 14727
- Screens EN 1023-1; EN 1023-2; EN 1023-3

Domestic use case!

LATVIJAS STANDARTS

LVS EN 14749

26 May 2016

ICS 97.040.10* 97.140

Replaces: LVS EN 14749:2005

Furniture. Domestic and kitchen storage units and kitchen-worktops. Safety requirements and test methods.

Domestic use case!

— the height of the centre of gravity of the unit, or any part, is > 650 mm above the floor and the total mass is > 10 kg,

or

— when the potential energy (3.9) of the unit, or any part, is > 65 Nm and the height of the centre of gravity of the unit, or any part, is < 650 mm.

Domestic use case

Part	Unit	Load
Horizontal surfaces, tops, shelves, door baskets, etc.	kg/dm^2	1,5
Extension elements, trays and baskets	kg/dm^3	0,2
Suspended pocket files	kg/dm [a]	4
Clothes rails	kg/dm	4
[a] Measured perpendicular to the plane of the pocket files.		

Domestic use case!

Table 3 — Stability tests

Test No	Test	Reference	Loading	Force
5.6.1	Doors, extension elements and flaps closed, all storage units unloaded - Units that are, or can be, adjusted to a height of 1000 mm or less	EN 16122:2012, 11.2.1	Vertical force, N	750
5.6.2	Doors, extension elements and flaps closed, all storage units unloaded - Units that are, or can be, adjusted to a height of more than 1 000 mm	EN 16122:2012, 11.2.2	Vertical force, N Outward force, N	350 50
5.6.3	All storage areas unloaded and all doors, extension elements and flaps open	EN 16122:2012, 11.4.1	-	-
5.6.4	All storage areas unloaded with overturning load	EN 16122:2012, 11.4.2	Vertical force, N	100
5.6.5	All storage areas loaded with overturning load	EN 16122:2012, 11.4.3	Vertical force, N	20 % of total mass (3.5) of the unit but not greater than 300 N
5.6.6	Doors, extension elements and flaps closed and locked	EN 16122:2012, 11.5	Outward force, N	100
5.6.7	Dynamic stability test for units with castors [a]	EN 16122:2012, 11.6	-	-

[a] The test shall be carried out in accordance with EN 16122:2012, 11.6, except that the stops shall be 12 mm high with square edges

Domestic use case!

Test No	Test	Reference	Loading	Requirement
5.7.1.1	Static load test for tops and bottoms	EN 16122:2012, 6.2.2	Force, N Cycles	750 10
5.7.1.2	Shelf retention test – horizontal outward	EN 16122:2012, 6.1.2	Force, N	50 % of unloaded shelf weight
5.7.1.3	Shelf retention test – vertical downward	EN 16122:2012, 6.1.3	Force, N	100
5.7.1.4	Strength of shelf supports	EN 16122:2012, 6.1.5	Cycles Mass per unit area, kg/dm^2 steel impact plate, EN 16122:2012, Table 1	10 0,65 1
5.7.1.5	Vertical load on pivoted doors	EN 16122:2012, 7.1.2	Mass, kg 10 cycles	30
5.7.1.6	Horizontal load on pivoted doors [a]	EN 16122:2012, 7.1.3	Force, N 10 cycles	60
5.7.1.7	Strength of bottom-hinged flaps	EN 16122:2012, 7.3.1	Force, N Cycles	200 10
5.7.1.8	Strength of extension elements [b]	EN 16122:2012, 7.5.2	Force, N Cycles	200 10
5.7.1.9	Slam shut and open of extension elements [c]	EN 16122:2012, 7.5.4	Velocity, m/s, at calibration points Slam open 5 kg	1,30 1,00

35

Let’s summarise what we’ve heard about types of furniture

- The name of the furniture is not important; its function is;
- Different standards should be used depending on the expected use;
- Different standards use different test loads, but the testing methods themselves are very similar.

Testing principle summary

- Dimensions, operating manual, markings;
- Statics;
- Durability;
- Impact loads;
- Stability.

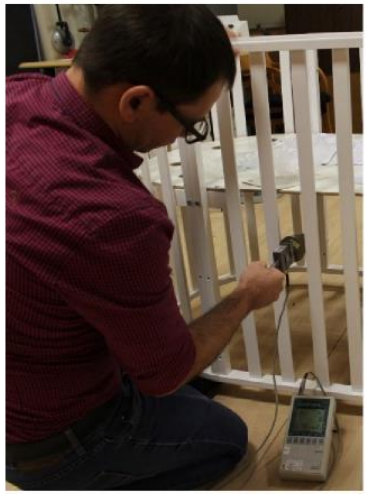
Dimensions and safety requirements

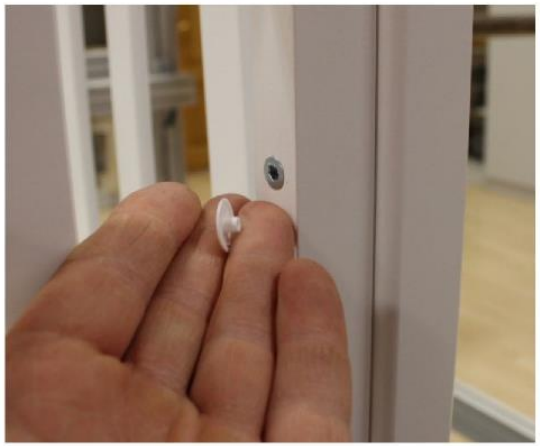
ITEM#GH188 BABY COT

ASSEMBLE INSTRUCTION

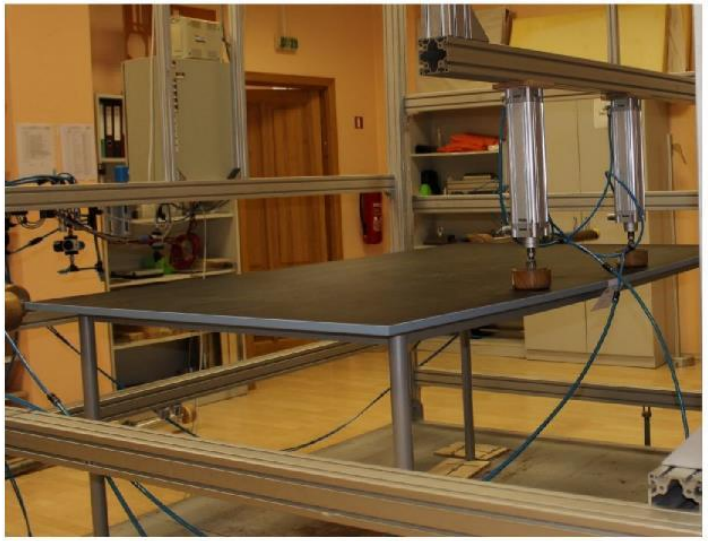
Adult assembly required.
Small parts may present choking hazard prior to assembly.
Enclosed please find simple step-by-step instructions to help you quickly assemble your products. Before you begin we recommend that you following the steps below:
1. Please read the instructions thoroughly
2. Identify all parts and hardwares
3. You will need the following tools:
Philips head screw driver
Hammer
Do Not Use Power Drills or Drivers

To protect your parts during assembly please place them on a soft surface.
To clean surface use only water on a damp cloth. Do not use window cleaners or cleaning abrasives as it will scratch the surface and could damage the protective coating.

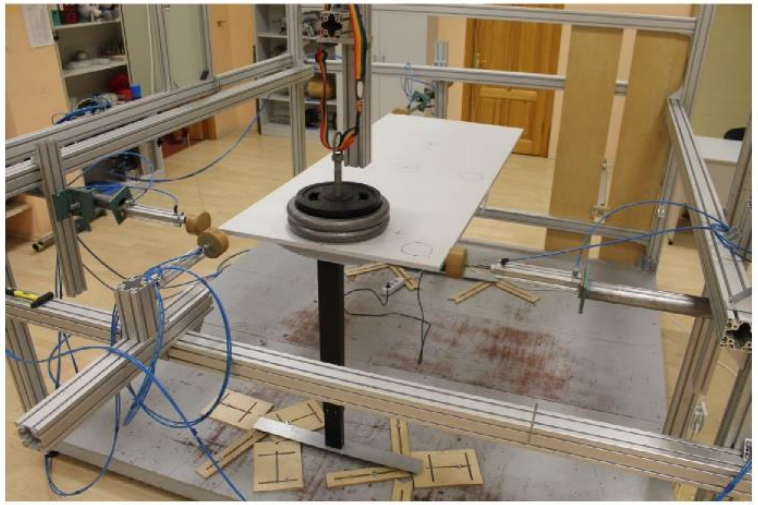




Static load



Durability



Impact loads

Stability test

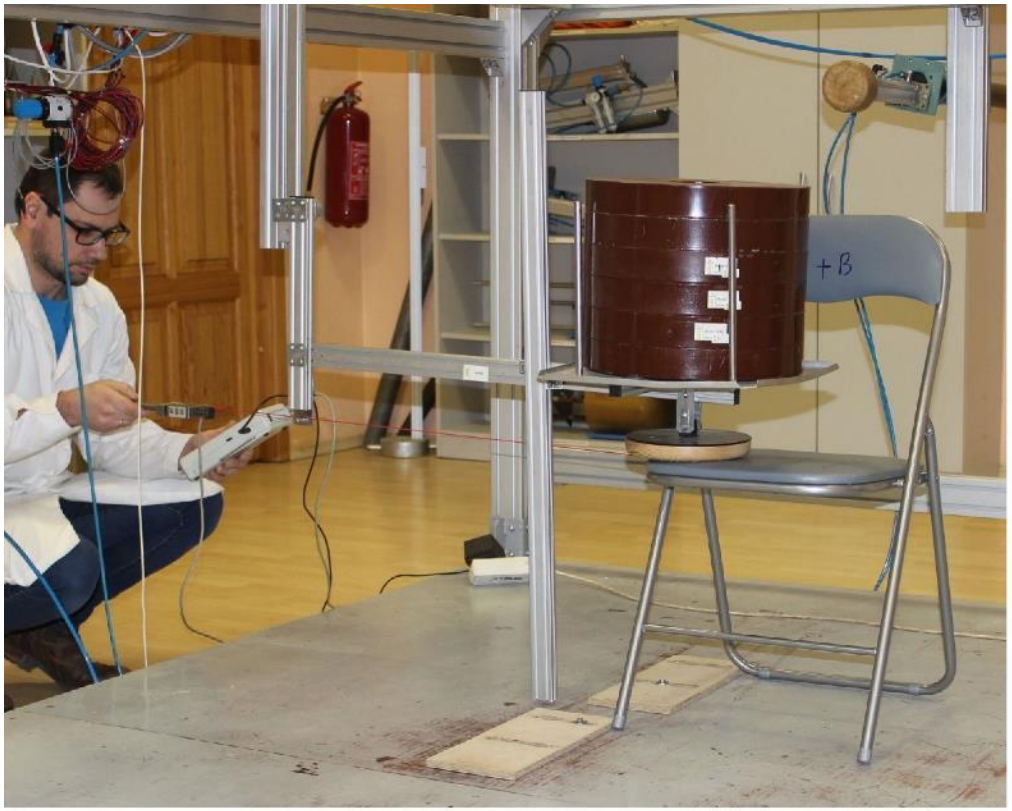
Chair example

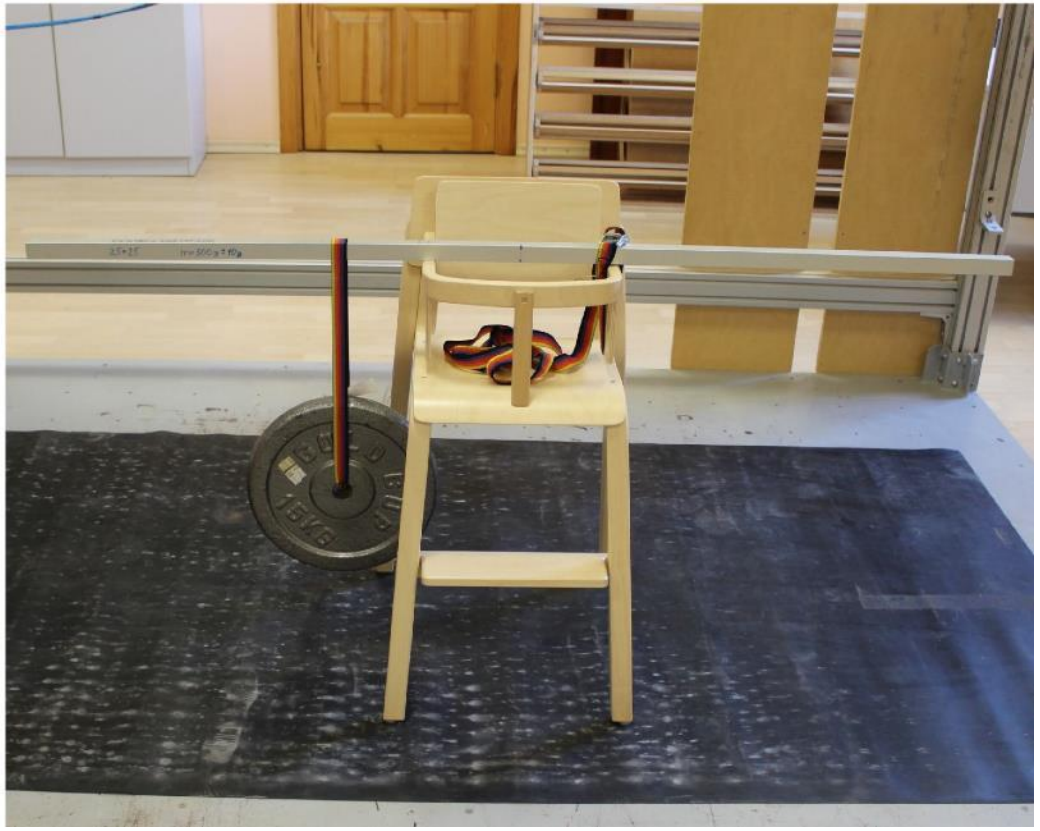
Domestic use

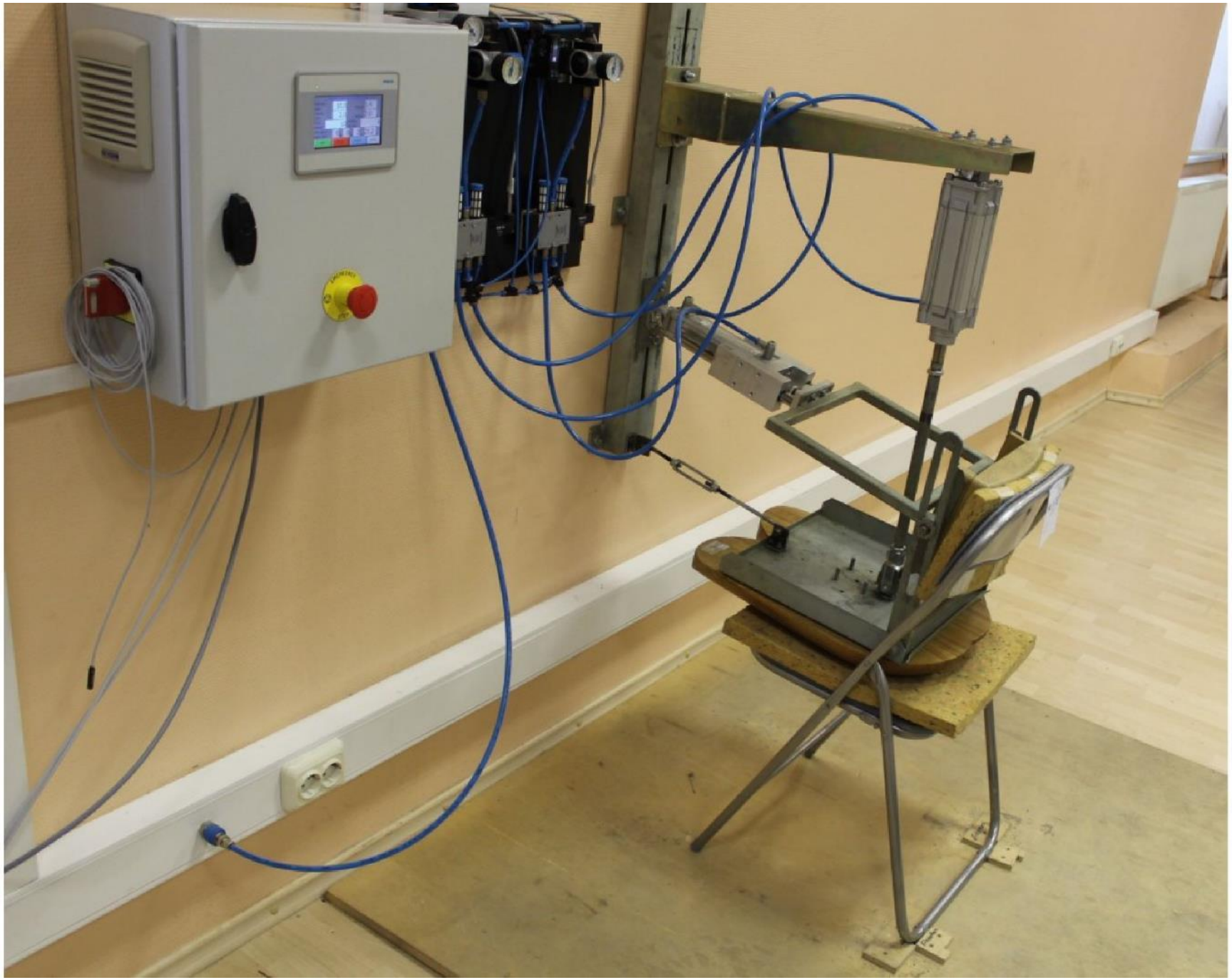
Non-domestic use
- L1
- L2

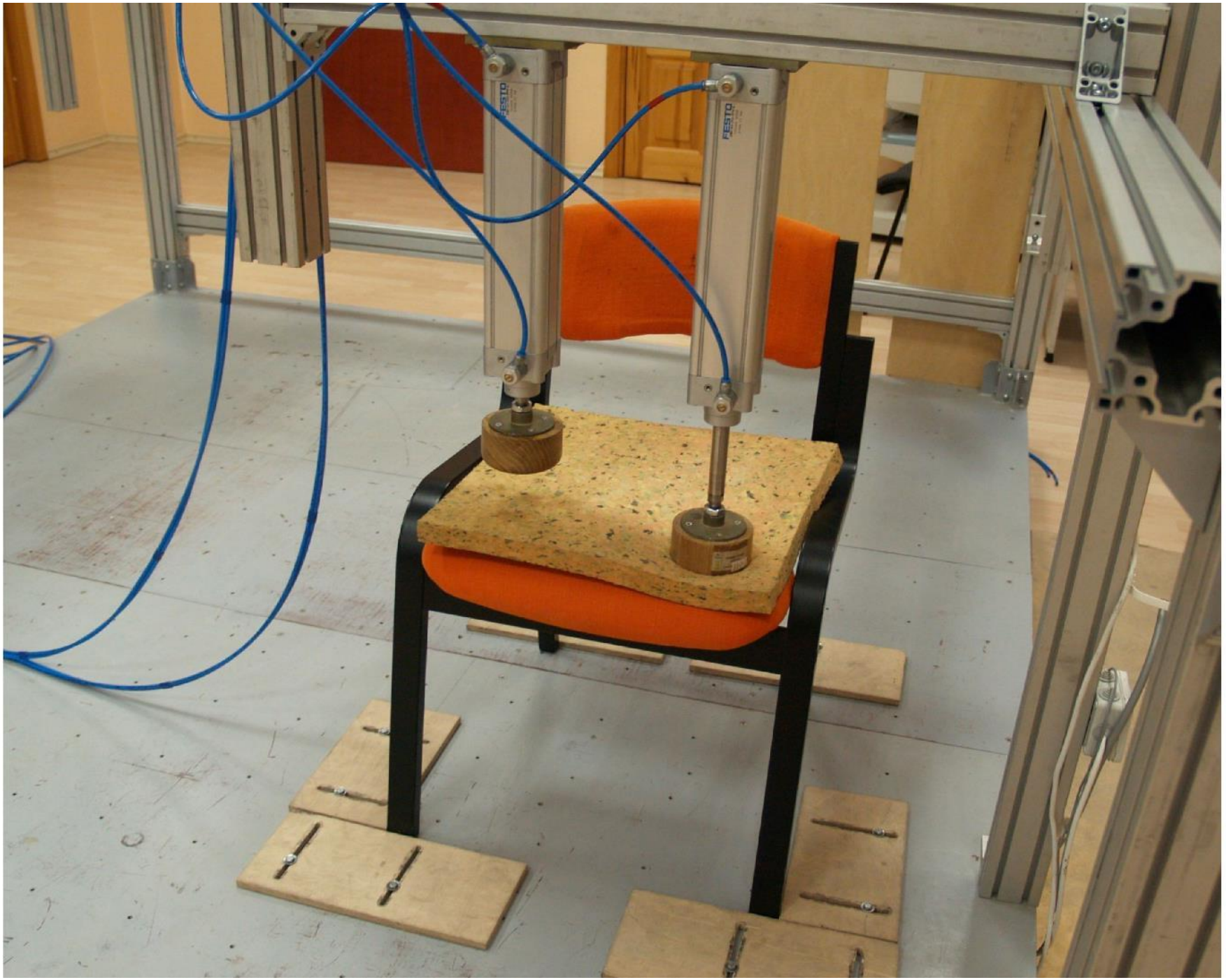
School chair

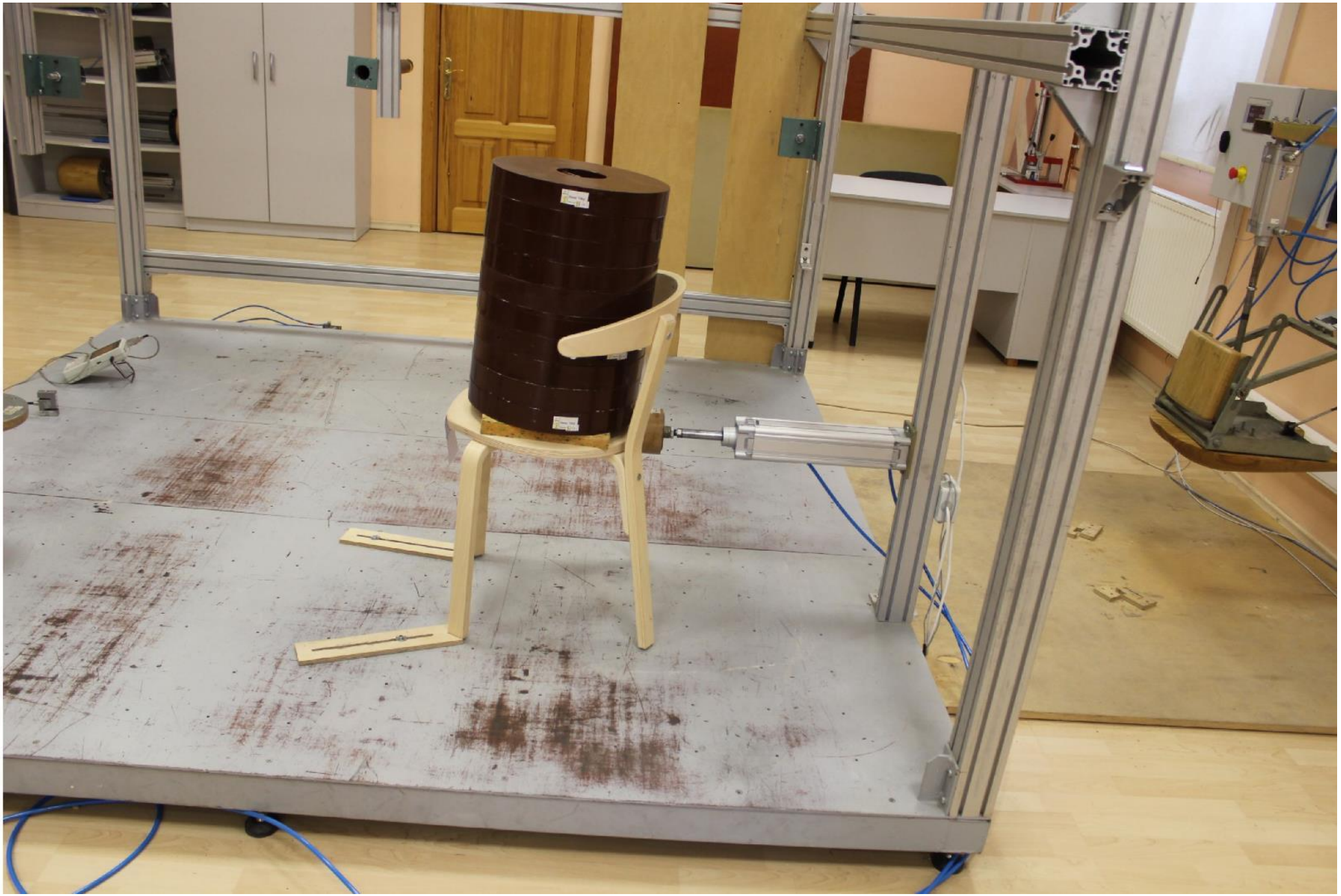

B
A

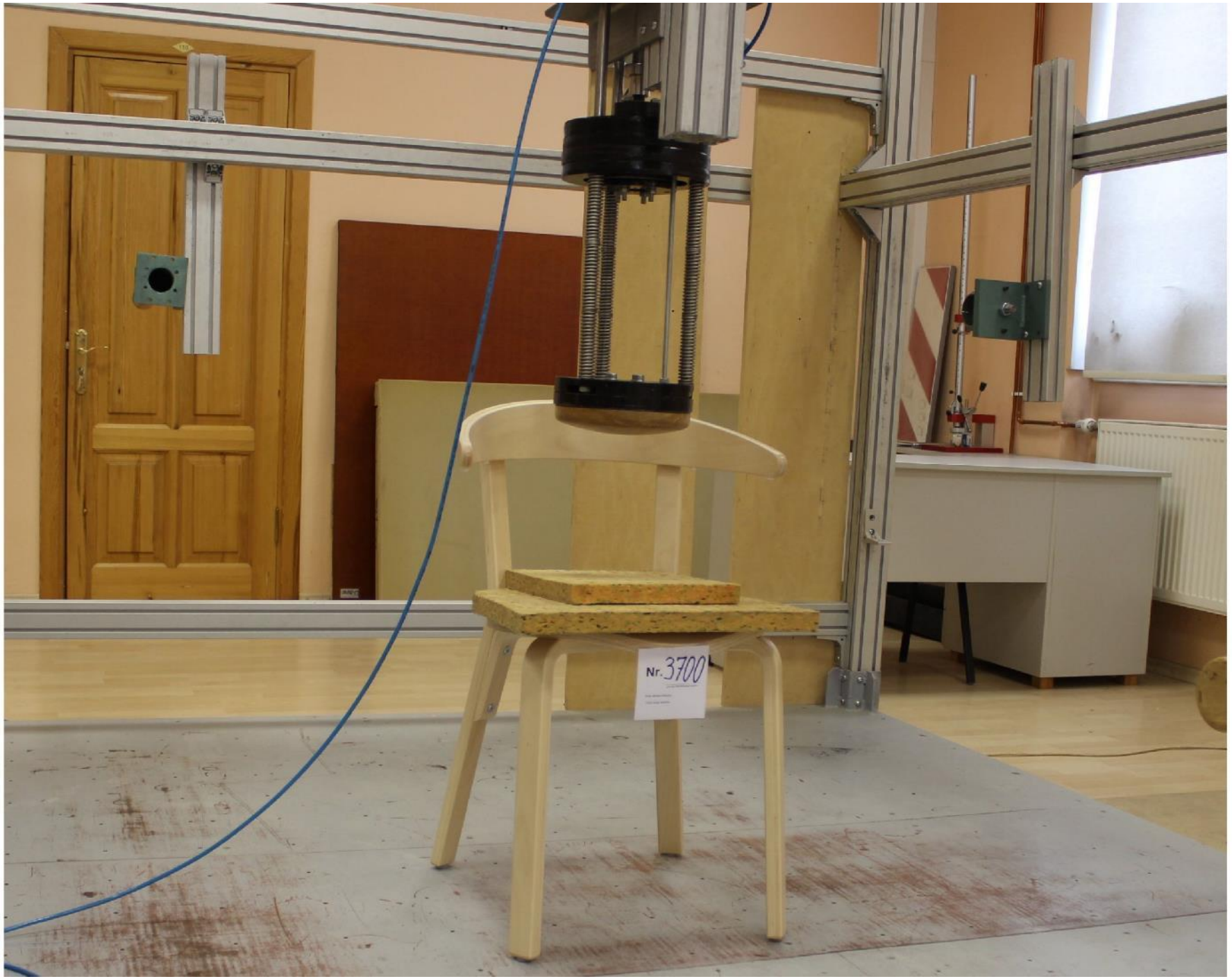

+B

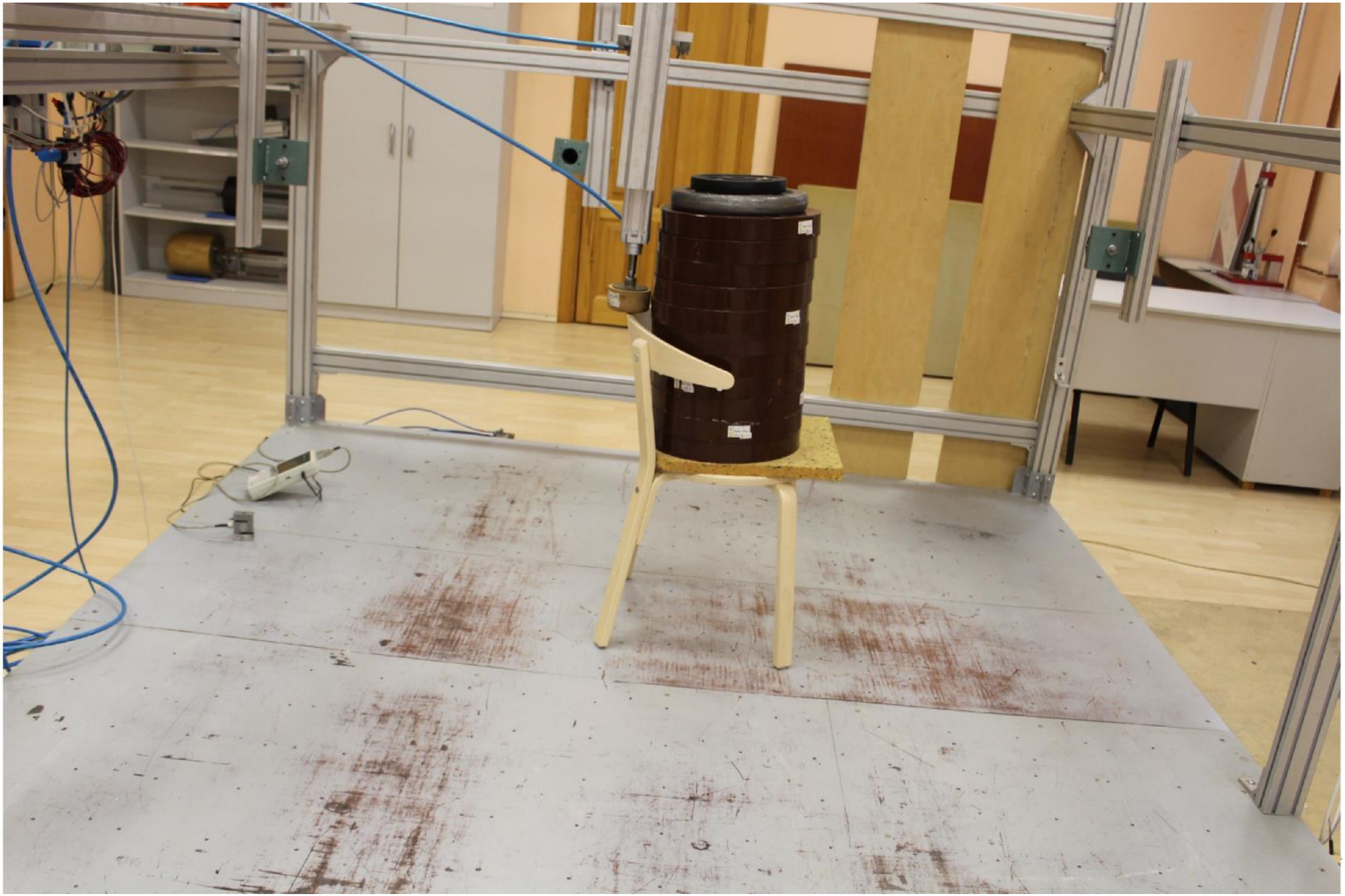


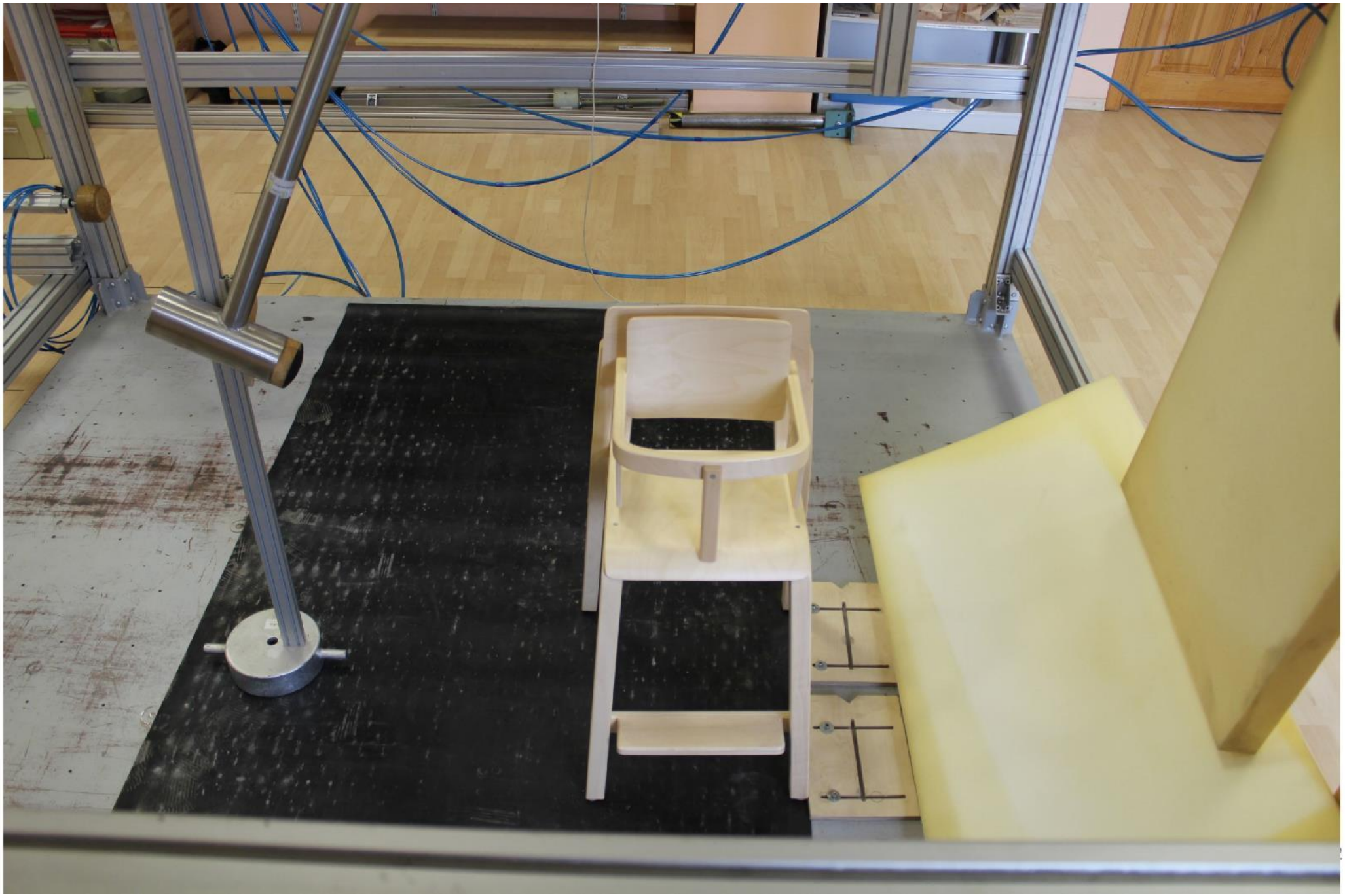


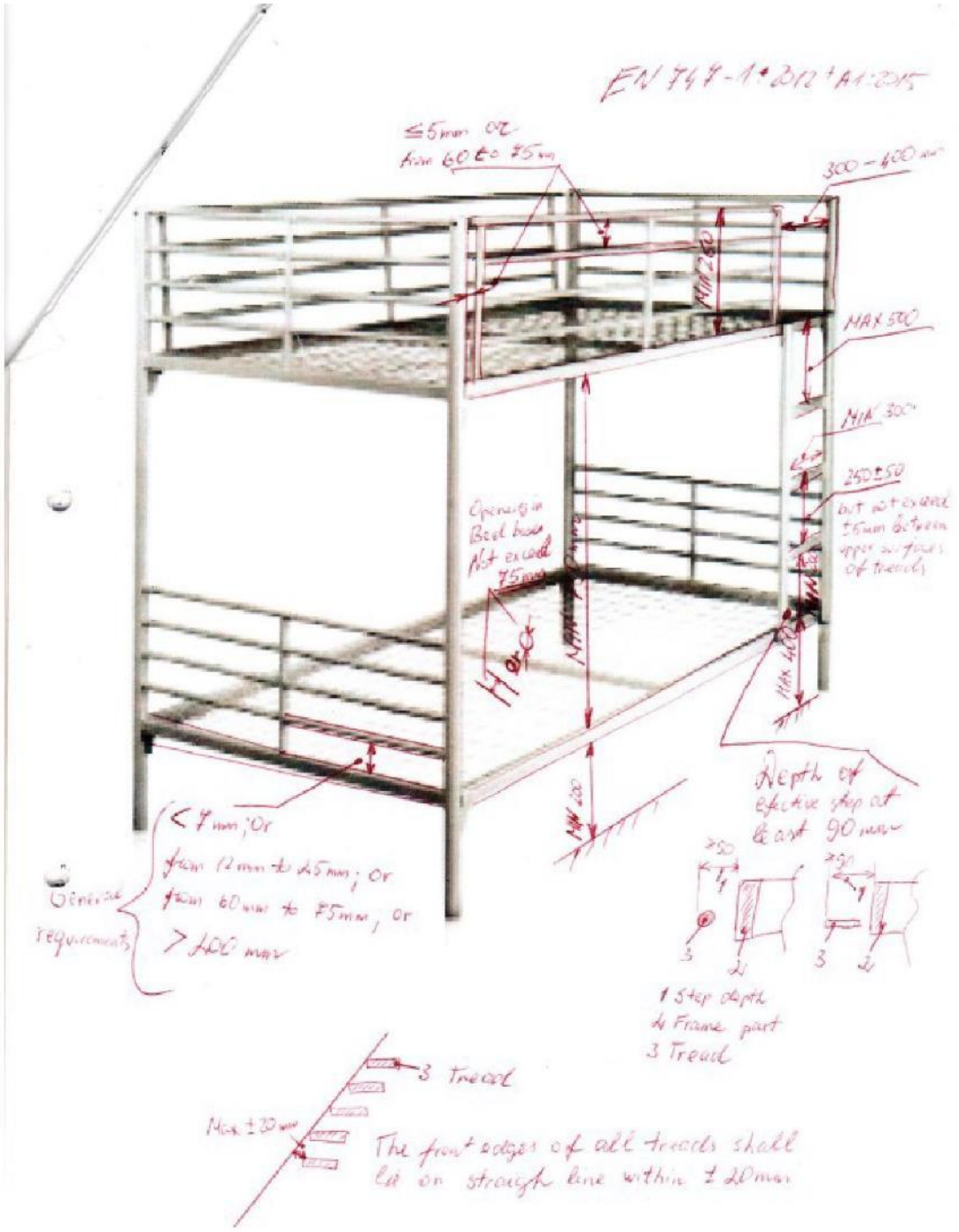

FESTO
FESTO




Nr. 3700






EN 747-1:2012+A1:2015
≤5mm or
from 60 to 75mm
300 – 400 mm
MIN 230
MAX 500
MIN 300
250±50
but not exceed 35mm between upper surfaces of treads
Openings in Bed base Not exceed 75mm
MIN 400
MAX 400
MIN 230
Depth of effective step at least 90 mm
< 7 mm; Or
from 12 mm to 45 mm; Or
from 60 mm to 75 mm; Or
> 400 mm
General requirements
≥30
≥30
3
2
3
2
1 Step depth
2 Frame part
3 Tread
3 Tread
Max ±20 mm
The front edges of all treads shall lie on straight line within ±20mm

YES/NO

An old lady once said!..

- Latvian standard, European standard, other national standard.
- Certificate.
- Self-declaration.
- Testing report.
- Expert report.
- Service life.

Certificates can also be fuzzy

ISO IEC 17000
17025
17065

5.2
attestation
issue of a statement, based on a decision following **review** (5.1), that fulfilment of **specified requirements** (3.1) has been demonstrated

NOTE 1 The resulting statement, referred to in this International Standard as a "statement of conformity", conveys the assurance that the specified requirements have been fulfilled. Such an assurance does not, of itself, afford contractual or other legal guarantees.

NOTE 2 First-party and third-party attestation activities are distinguished by the terms 5.4 to 5.6. For second-party attestation, no special term is available.

5.4
declaration
first-party **attestation** (5.2)

5.5
certification
third-party **attestation** (5.2) related to products, processes, systems or persons

5.6
accreditation
third-party **attestation** (5.2) related to a **conformity assessment body** (2.5) conveying formal demonstration of its competence to carry out specific conformity assessment tasks

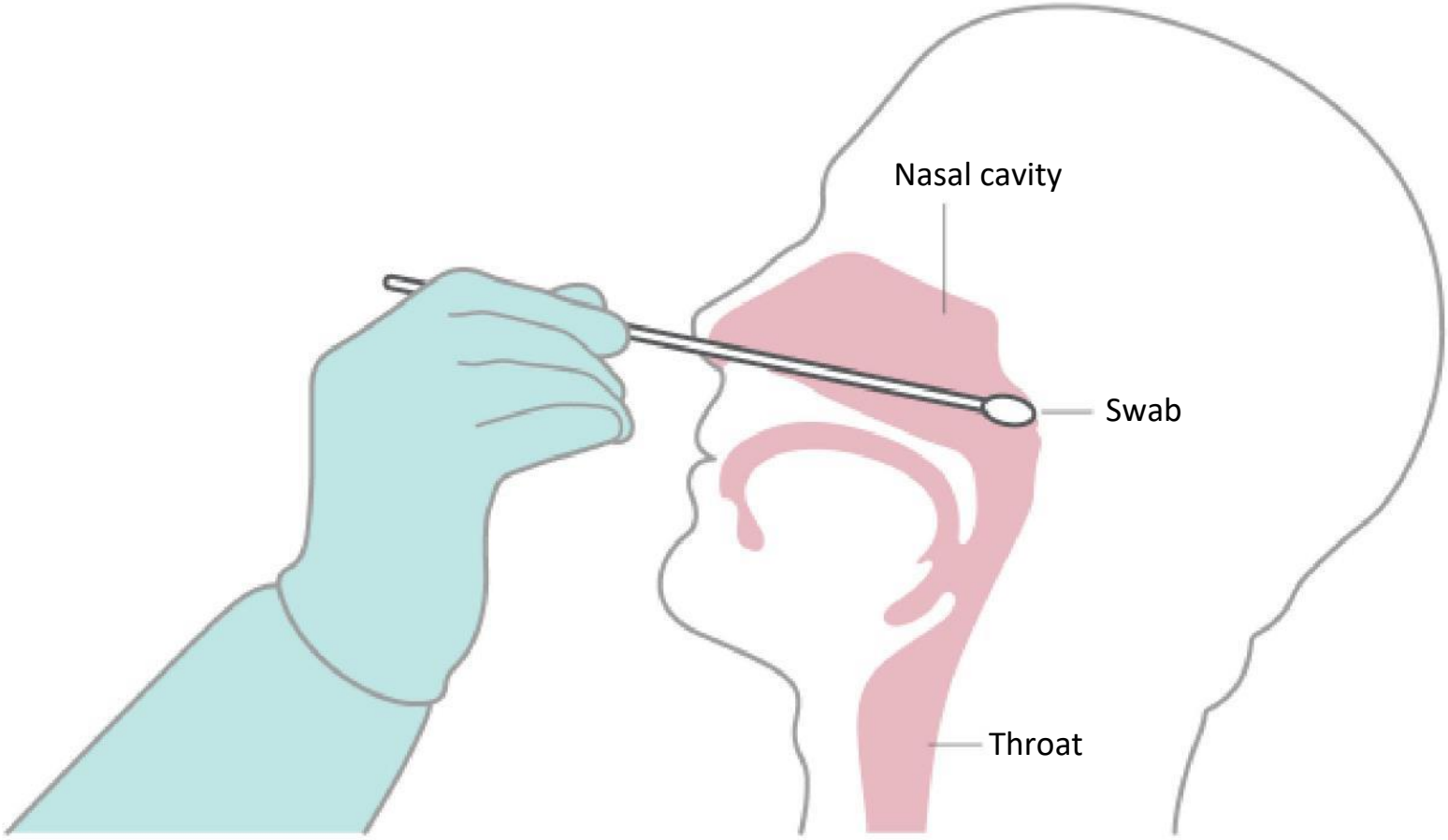
Preferred procedure.

1. Investigating the regulatory environment and choosing the right standards.
2. Reviewing the standard and making a potential piece of furniture in accordance with it.
3. Finding a testing institution and then testing the product made.
4. Receiving a positive test report.
5. Releasing a safe furniture product on the global market.

Conclusions

- European standards are not the most complete documents in the world, but they are some of the most objective documents out there, and they are useful for manufacturers, entities that supervise them, as well as end consumers.
- Lab-tested products are more likely to be safe. However, one must understand that if made by a responsible manufacturer, a product can meet mechanical strength requirements even if not lab-tested for mechanical loads.
- The best central document to prove mechanical strength is the ‘Testing report’ defined by the standards themselves; all of the rest are ‘certificates’, and for the testing methods mentioned in the presentation, they are most commonly paid derivatives.
- The standards aren’t too many or too few, and before you start buying/making furniture, it’s worth looking into them, or contacting specialists—though I must say that there aren’t a lot of those.
- When testing furniture in accordance with furniture standards, you check the dimensions, static strength, impact strength, durability and various other things that demonstrate the product’s long-term and short-term properties. A stability testy is absolutely required. All the results obtained are shown in the ‘Testing report’.

To test or not to test?



Forest Tree Development

MeKA and society

MeKA is a socially responsible company that maintains an active dialogue with the public, providing it with information, and engages in business activities that are geared towards satisfying the needs of the company's owners, clients, employees, experts and various institutions (interactions between the company and its stakeholders).

- Overview video about the laboratory: https://www.youtube.com/watch?v=COC3rdK7kaY
- And specifically about furniture testing: https://www.youtube.com/watch?v=cjNbxnQ3YeQ


2016 NISSAN VERSA

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

Topic:

“Final Test Assignment”

Project number: 601123-EPP-1-2018-1-DE-EPPKA2-SSA

SKILLED UP Latvijas Lauksaimniecības universitāte Co-funded by the Erasmus+ Programme of the European Union

Industrial design

FINAL TEST ASSIGNMENT

ASSIGNMENT

Working as a team, develop a project for a mobile office building. Everyone works on the same project, assigning fields of responsibility based on the area in which their company works, or personal tastes/interest.

LIMITATIONS

1. The office building must be mobile.
2. The external dimensions of the building must never exceed the external dimensions of a 40’ shipping container, as specified in ISO 668.
3. The project must include at least the following positions:
    - 3.1. Load-bearing structure: bonded structure material panels with a thickness of at least 90 mm for walls (not including insulation), and at least 120 mm for the roof and the floor.
    - 3.2. Layer of insulation: an eco-friendly material, with a thickness of at least 120 mm.
    - 3.3. Exterior finish: panel material with hidden joints.
    - 3.4. Interior finish.
    - 3.5. Furniture and interiors: two workplaces, cabinets for storing and printing documents, and other minor office tasks, recreation zone (with upholstered furniture).
    - 3.6 Doors and windows: floor-to-ceiling windows at the ends of the building, shorter windows with shutters that can be used for providing shade are optional. One lockable door with stairs.
    - 3.7. Module foundation solution, in general form.

OPERATING CONCEPT

(see Deliverables) Some of the assignment is carried out by everyone individually, and the rest of it, as a team, allocating the areas of responsibility.

The meetings of the team take place at the end of the day with classes.

Deliverables

BY EVERY STUDENT:

- Hand-drawn sketches showing the process of completing the assignment and details of the project (in digital format).
- Sketches and specifications for the products made at the student's company.
- Presentation about the student's contribution.

By the group:

- Fully-developed 3D model of the building (including all the elements listed in 'Restrictions' + additional things, in clear format).
- Full material specifications.
- Market analysis and potential strategy.
- General presentation covering the project.

Deadline

29 April 2021: final presentation.