



Polskie Stowarzyszenie Gipsu



**Instytut Technologii Eksploatacji
– Państwowy Instytut Badawczy**

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Installation of wall lining systems 712[06].S1.03

Student's Handbook



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1. INTRODUCTION

You will find this handbook useful while acquiring knowledge about the rules of installing the wall lining systems in Technology of Interior Drywall Systems.

The Handbook includes:

1. Prerequisite skills, i.e. a list of indispensable skills and knowledge which you should possess before training within this modular unit.
2. Learning objectives of the modular unit.
3. Reference material (Chapter 4) which will enable you self-preparation for performing the tasks and successful test completion. In order to broaden your knowledge use the literature indicated and other sources of information. It covers also:
 - revision questions checking the knowledge indispensable for task completion,
 - tasks including instructions, the way of task completion and workplace resources,
 - progress checks checking the level of knowledge following a task completion.

While doing a progress check you should use “yes” or “no” to answer a question, which indicates that you have acquired the reference material or not. Successful task completion is a proof that you have acquired the skills specified in a given modular unit. If you find the subject or tasks difficult to understand, ask the teacher or instructor to explain or, alternatively, check if you perform a given activity properly.

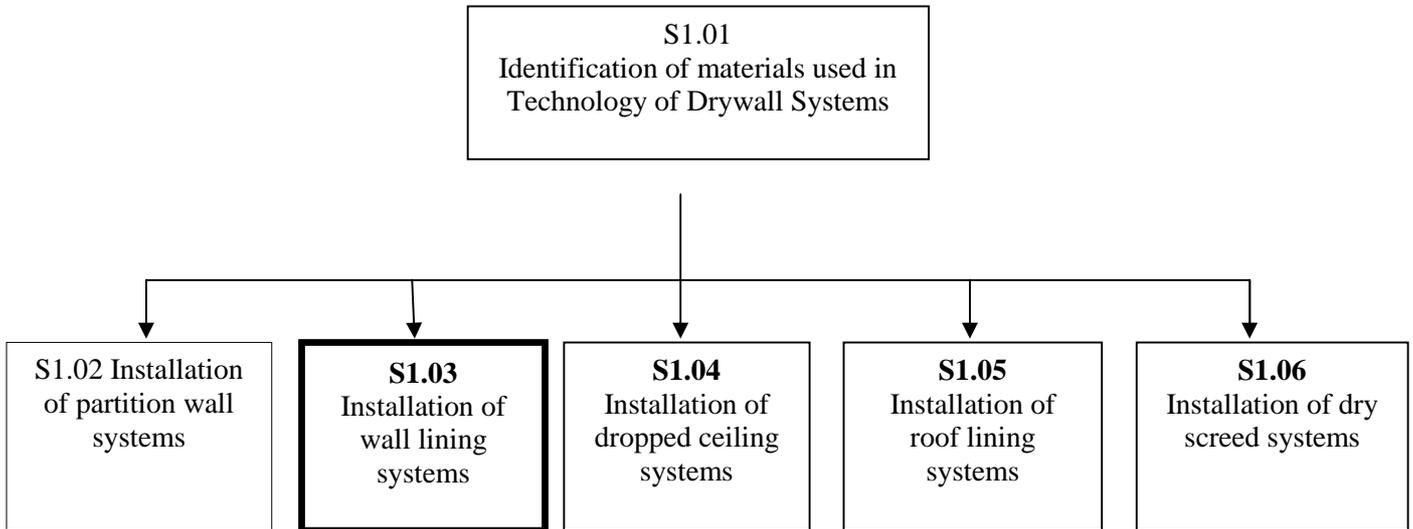
4. A set of revision questions checking your acquisition of the knowledge and skills covered by the entire unit. After getting familiar with the reference material try to take a test covering the whole unit.

The modular unit “Installation of wall lining systems”, the contents of which you will get familiar with now is a part of a module “Technology of Interior Drywall Systems”.

Safety and hygiene at work

During your stay in the workshop you must observe rules, regulations, safety and fire procedures related to the type of work performed. You will get familiar with these regulations in the course of your training.

Diagram of modular units



2. PREREQUISITE SKILLS

Before starting the modular unit program “Installation of wall lining systems”, you should be able to:

- use technical building terminology,
- read and construe technical building drawings,
- use technical building documentation,
- identify construction elements of a building,
- organize the workplace in line with rules of ergonomics and safety,
- ensure the proper transportation of building materials,
- use different sources of information,
- identify materials used in Technology of Interior Drywall systems,
- prepare gypsum mortar,
- select appropriate tools and equipment for installation works,
- take basic measurements in construction works,
- prepare scaffolding for construction works.

3. LEARNING OBJECTIVES

Upon completion of the modular unit programme, you should be able to:

- prepare the workplace for the installation of wall lining systems,
- prepare a place where materials for the installation of wall lining systems can be stored,
- prepare the background for wall linings,
- select appropriate boards,
- prepare and cut to size the boards for the wall lining system,
- attach wall linings directly to masonry background,
- mark guidelines on the floor and the ceiling to establish the new wall plane,
- mark vertical guidelines on the background to establish the bonding positions,
- select and assemble steel profiles appropriate for the installation of wall linings,
- fit insulation material,
- attach the boards to the profiles,
- install wall linings with cavities in which service lines can be concealed,
- complete finish works such as filling, finishing external angles, board cleaning,
- apply the occupational health and safety rules, fire regulations, as well environmental law requirements.

4. REFERENCE MATERIAL

4.1. Wall lining systems

4.1.1 Reference material

The drywall system consists of a set of products prepared and recommended by a plasterboard manufacturer to be installed according to the guidelines provided by the system supplier. The set of products includes: appropriate steel profiles, plasterboards, sealing tapes, filling compounds, fixing components and accessories. The drywall system allows the user to install plasterboards directly onto the masonry background and other vertical elements in a building's structure by means of gypsum adhesive as well as steel profiles.

Appropriate and failure-free performance of construction components executed in the drywall system – e.g. wall linings – depends, to a large extent, on the correct specification of requirements. They are described in the technical documentation. The most crucial parameters for wall linings are their rigidity and strength which in the case of wall linings usually must represent the highest values permitted.

An important argument in favour of the use of wall linings in modern building industry is a significant reduction of the time needed for finishing works and avoidance of labour-consuming plastering. Another parameter which is essential in the installation of wall linings - in the case of installation with the use of steel profiles – is acoustic insulation, which determines the comfort of the interior. Protection against noise is included in building standards and specifies requirements which any wall must meet, depending on the type of a room. On the other hand, fire-resistance is a parameter which specifies the time during which a wall lining (with the exclusion of plasterboards) in the situation of a fire can be a barrier for the fire. The requirements regarding fire resistance of buildings and structural objects depending on their purpose are specified by technical parameters which the buildings as well as their location must meet. Fulfilment of the said requirements is enforced in the course of technical acceptance of construction works.

We can distinguish three basic types of wall linings, classified by the way in which plasterboards are installed. There are also differences related to labelling and some applied solutions resulting from a variety of commercial offers by domestic manufacturers of drywall systems which have been omitted here.

Basically, we can distinguish three major systems of wall linings:

- drywall (plasterboard put on the wall by means of adhesive bonding),
- wall lining – plasterboard fixed to CD60 steel profiles,
- pre-wall (lining of a shaft)

The choice of an appropriate wall lining system, e.g. selection of adhesive or the right type of steel profiles to be used, plasterboard type, and the material filling a pre-wall interior or a wall lining (type of mineral wool filling the pre-wall interior, its volumetric density, thickness) have a crucial impact on attaining the pre-determined technical parameters by the wall. It refers to thermal insulation, fire resistance and rigidity.

In other words, selection of the right wall lining system is a crucial element of an interior arrangement, not only from the aesthetic point of view. Wall linings and pre-walls executed in

the drywall systems are characterized by low mass of 1 m² of the structure and a quick installation procedure.

Plasterboards are an inflammable material allowing to build pre-walls and linings which do not spread fire.

Using impregnated plasterboards of enhanced resistance to moisture (type H), we do not encounter any constraints concerning the use of drywall systems to build interiors, in which temporarily (up to 10 hours), increased humidity occurs, however, not exceeding 85%.

The use of wall lining systems offers possibilities which other solutions do not, namely: fast and easy assembly of wall linings. It happens so owing to a comprehensive approach, adjustable elements of the system and elimination of labour-consuming wet processes. What is more, installation of all necessary wiring and piping under a wall lining is easy as we do not have to bore the wall or use wall slats which do not look very attractive. Another favourable characteristic of wall lining systems is a possibility of their faster completion and earlier occupancy of the rooms without necessity of waiting for attaining by them appropriate strength and humidity.

Dry plaster

Plasterboards used as a masonry wall lining create the so-called “dry plaster”. Such a solution is used mainly for interior redecoration. The system helps to conceal parts of walls which do not look nice, hide service lines and improve thermal insulation. Replacing traditional plaster with plasterboards significantly reduces the time of redecoration. The simplest solution for such application of plasterboards is bonding them with gypsum adhesive to vertical backgrounds made of ceramics, concrete, aerated concrete, and cement and lime.

The background to which plasterboard will be fixed cannot be wet, or greasy and must be deprived of any lime- or oil paint coating. It must be prepared in such a way as to possess required adhesion to gypsum adhesive. Absorptive backgrounds and backgrounds of reduced adhesion must be first coated with appropriate primer in line with the system supplier’s recommendations. Accuracy of a masonry wall execution often diverges significantly from standard requirements. The use of plasterboards enables correction of possible shortcomings in this area.

Wall lining installed on CD60

Another method of fixing plasterboards is installation of a wall lining on CD60 steel profiles on the wall. To this end we use CD60 steel profiles fixed to the wall by means of ES adjusting brackets positioned vertically at 60 cm intervals.

A wall lining is installed on CD60 profiles when:

- the wall height exceeds 300 cm,
- preparing a wall for the use of adhesive is not economically justified,
- improved acoustic insulation and fire-resistance of a wall are expected.

CD60 profile ends are inserted into UD30 profiles which are fixed horizontally to the wall and the ceiling by means of appropriate mechanical connectors. The latter are placed at intervals of less than 100 cm from each other. Linings can consist of one or two layers. When a single layer is used we apply plasterboards of minimum 12.5 mm in thickness.

As a rule, wall linings can have an aesthetic role or enhance acoustic insulation of the wall or in the case of fire-proof plasterboard layers (types: F, DF, FH2, DFH2) they can also qualify as fire-proof materials. Acoustic insulation of a traditional wall becomes significantly improved in

instances where a space between the background and the plasterboard layer is filled with mineral wool.

Pre-wall

A pre-wall is a self-supporting structure. It is installed at existing walls in order to improve sound and fire resistance. This type of structure is used also as linings in lift and service line shafts or in the case when a wall surface is uneven or of small-load capacity. A pre-wall assembly on CW (C) profiles resembles erecting an independent wall with a plasterboard on one side only. A pre-wall sound-resistance depends on the materials used and assembly technology applied. In practice, depending on our expectations, different types of wall linings are used.

A choice of an appropriate profile size depends on the height of the room.

Table 1. Wall heights and profile thicknesses

Pre-wall height	Structure type
3 m	CW (C) 50
	UW (U) 50
4 m	CW (C) 75
	UW (U) 75
5 m	CW (C) 100
	UW (U) 100

Because of the fact that maximum lengths of commercially available profiles are 4 m, in some cases it is necessary to join profiles on their length, e.g. by overlap joining. The length of an overlap for the CW (C) 100 profile is 1.0 m, for CW (C) 75 profile – 0.75 m, and for CW (C) 50 profile – 0.50 m. In the walls higher than 300 cm you must not use profiles which are joined on their length

4.1.2. Revision questions

Answering these questions you can check if you are prepared for the tasks and their completion.

1. What materials are wall linings made of?
2. What are the plasterboard characteristics?
3. What types of wall linings do you know?
4. How are plasterboards fixed to the background walls in the drywall system?
5. What are the rules of installing wall linings bonded with gypsum adhesive?
6. What is a pre-wall?
7. What types of profiles are used for the installation of wall linings?
8. What types of plasterboards are used for particular types of wall linings?
9. What is the difference between a pre-wall and wall linings fixed on CD60 profiles?
10. What types of profiles are used for the installation of a pre-wall depending on its height?

4.1.3. Tasks

Task 1

Identify types of wall lining systems presented by the teacher in the form of drawings or models.

Tips for task performance:

To do this task you should:

- 1) get familiar with the types of wall lining systems (reference material from Chapter 4.1.1),
- 2) get familiar with the materials provided by the teacher,
- 3) identify particular types of wall linings,
- 4) present the completed task,
- 5) assess correctness of the task completed.

Workplace resources:

- reference material from Chapter 4.1 of Student's Handbook,
- drawing instruments,
- drawings or models of the wall lining system structure.

Task 2

On the basis of the documentation provided by the teacher and indicated places of the wall lining installation, suggest a proper type of wall lining.

Tips for task performance:

To do this task you should:

- 1) get familiar with rules of using particular types of wall linings (reference material from Chapter 4.1.1),
- 2) get familiar with the documentation presented by the teacher,
- 3) get familiar with the substrate (background) to which the wall lining is to be applied,
- 4) organize the workplace for task performance,
- 5) select an appropriate type of wall lining,
- 6) present the completed task,
- 7) assess correctness and aesthetics of the task completed.

Workplace resources:

- technical documentation,
- drawing instruments,
- reference material from Chapter 4.1 of Student's Handbook.

Task 3

The teacher provides you with cards on which the names of different materials are. Group them by their application in the wall lining systems.

Tips for task performance

To do this task you should:

- 1) get familiar with types of wall lining systems (reference material from Chapter 4.1.1),
- 2) get familiar with the installation of wall lining systems (reference material from Chapter 4.1.1),
- 3) organize the workplace for task performance,

- 4) group the cards with names of the materials written on them and match them to the types of wall linings,
- 5) present the completed task,
- 6) assess correctness and aesthetics of the task completed.

Workplace resources:

- cards with the names of the materials used in wall lining systems,
- reference material from Chapter 4.1 of Student’s Handbook.

4.1.4. Progress check

	Yes	No
Are you able to:		
1) identify different types of wall linings?
2) identify basic structural elements of a wall lining installed on CD60 profiles?
3) identify types of steel profiles for assembling a pre-wall structure?
4) identify advantages of wall linings?
5) identify insulation materials used in pre-walls and wall linings?

4.2. Steps in the installation of wall lining systems

4.2.1. Reference material

General requirements for installation works

Starting works with the use of plasterboards is possible only when all “wet” works (including base floors) have been finished and all window and door frames have been installed. At the same time it is required that the temperature in the rooms cannot fall below 10° C. If works are carried out in winter, heating should already be working in the building. The requirement of keeping a minimum temperature refers also to the hours when workers are not on the construction site. Temporary warming up of the rooms (e.g. for 8 hours) by means of building site heaters is unacceptable; neither is a temperature drop at night hours. This requirement results from the necessity to maintain relative air humidity below 70%. What is more, it must be borne in mind that plasterboards must be stored in closed rooms or under a roof.

Establishing the position of wall linings

Plasterboard wall linings are accomplished by adhesive bonding of paper-based plasterboards directly to a wall, or panelling a frame – made of steel profiles – with paper-based plasterboards, which are assembled as a self-supporting structure, or directly to the wall by means of ES brackets.

In the former case there is no need to mark guidelines determining the position of a wall lining. In the case of pre-walls and a wall lining installed on CD60 profiles it is necessary to determine the wall lining position. On the floor one must draw a line indicating positioning of the planned wall as it is shown in the technical documentation. Basically it is enough to mark it using one line, yet, it should be the line next to which a UW (U) profile will be fixed. It requires a simple calculation from the drywall system assembler. Usually, the technical documentation provides either dimensions to the wall axis or to its edge, whereas the line drawn on the floor is to determine the position of a UW (U) profile’s edge. Initially, the assembler should draw the lines on both sides of the profile. Only when he gets some experience it will be enough to use a pre-determined sign marked next to the line indicating on which side of the line the profile is going to be situated.

After the position of a pre-wall has been marked on the floor, its position should also be marked on the ceiling. This activity can be performed more quickly and easily if a bricklayer’s laser is used. Using this instrument one can transfer not only the levels and determine right angles on a horizontal plane but, first and foremost, determine the position of vertical planes.

Plasterboard installation

The first activity when plasterboards are fixed to adhesive “dabs” is determining the plane of a wall lining position. To determine this plane one must have a spirit level. This can be done also with the use of two plumb-lines and a level or a piece of string which is placed horizontally. To facilitate later attachment of plasterboards, the plane should be determined by means of gypsum dabs (“dabbing out method”). Plasterboards should be bonded with gypsum adhesive applied pointwise within the plasterboard area or along all four edges in order to avoid the so-called “piano-key-effect”. Gypsum adhesive “dabs” should be applied in two vertical columns at regular intervals of 35 cm from one another (measuring axiswise) in the middle of the board. Distances between dabs measured vertically cannot exceed 35 cm. In order to fix plasterboards one should use the system-included gypsum adhesive intended for plasterboard bonding. Horizontal joining is out of the question. Before the gypsum adhesive is applied, one

should have the boards prepared - cut to appropriate length (room height minus 1.5 cm). Attention! The maximum permitted height of rooms in which the drywall system is to be used is 300 cm. Attaching plasterboards can be started from the corner or the middle of the wall. If the length is less than 6 m, you can start from the corner. If the length is more than 6 m, you can start from the centre of the wall's width.

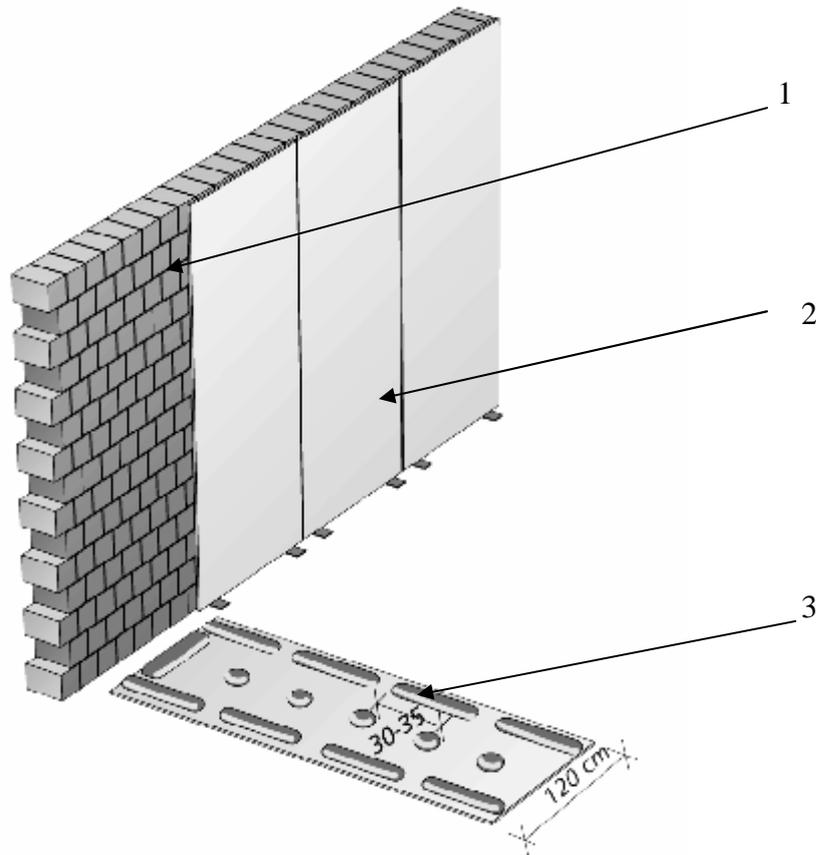


Fig. 1. Basics of drywall installation: 1. wall, 2. fixed plasterboard, 3. plasterboard with gypsum adhesive dabs applied.

Correct fixing of the first plasterboard decides about the quality of the whole wall lining installation, therefore it must be done with utmost care. The very first board is “the base” determining the plane of the remaining plasterboards. It is recommended that the positioning of subsequent plasterboards should be monitored systematically.

It is important for the bottom edge of the plasterboard to be slightly (ca. 10-15 mm) lifted above the floor plane. While fixing the second and then each subsequent plasterboard, one must position them in relation to the previous one. Their coplanarity is checked by means of a long, 200 cm in length, rigid spirit level (preferably made of aluminium with a box-like cross section). Checking is accomplished by applying the spirit level horizontally in 3 places of the wall height.

Structure assembly

In the case of a drywall fixed to the wall by means of the system-included gypsum adhesive, no structure assembly occurs.

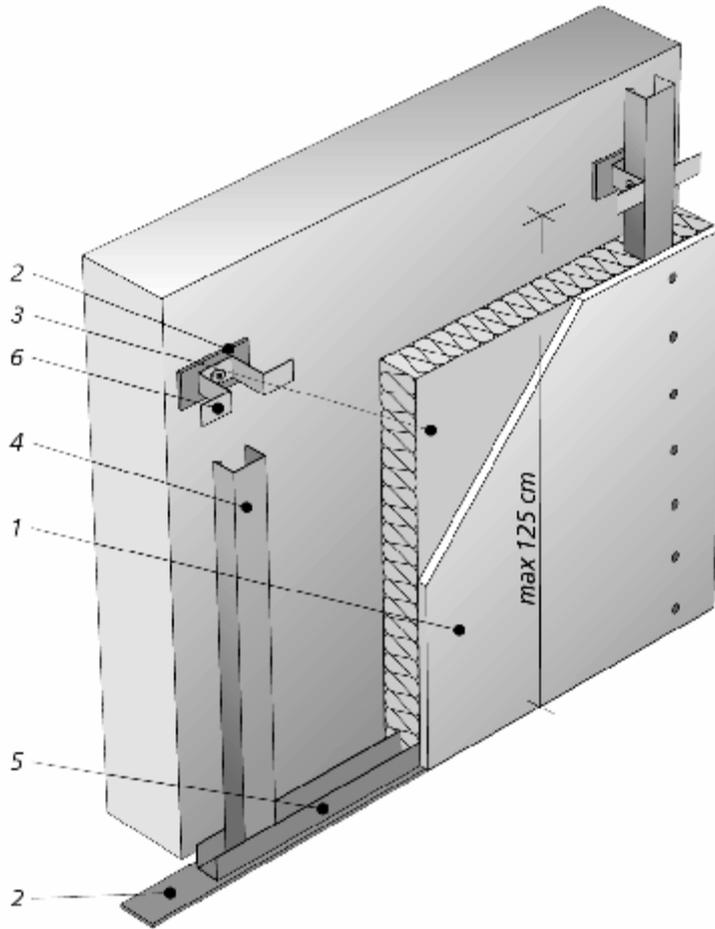


Fig. 2. Wall lining on CD 60 profiles:

1. Plasterboard, 2. sealing tape, 3. mineral wool, 4. CD 60 profile, 5. UD 30 profile, 6. ES bracket for CD 60 profiles.

Wall lining installation starts with determining the structure plane. On the floor and the ceiling, with the help of a rope with coloured powder, the guidelines indicating the vertical plane are marked. Along the lines drawn, with the use of quick assembly expansion bolts, the UD 30 profiles are fixed.

Next, on the wall, the places for fixing ES brackets are determined. They are positioned every 60 cm horizontally and maximum every 125 cm vertically. A CD profile is cut to the length smaller by ca. 10 mm than the room height and then inserted into already fixed UD 30 profiles and the ES bracket.

Attention! Profiles CD 60 should not be connected permanently to UD30. Profiles are connected to ES brackets by means of screws. Two screws should be on each side of a profile. Before using the screws fixing a plasterboard, using a long spirit level one must check if the installation plane is even.

In the case of a pre-wall, UW profiles are fixed following their earlier taping with a sealing tape. CW (C) profiles are produced in lengths approaching the most commonly encountered room heights, however, usually they have to be shortened. It is accomplished by means of a pair of shears intended for steel sheets. It is a rule that the CW(C) profile should be by ca. 10 mm

shorter than the room height. Attention! CW and UW profiles should not be connected permanently with each other.

Because of the fact that maximum lengths of commercially available profiles are 4 m, in some cases it is necessary to join profiles on their length, e.g. by overlap joining. The length of an overlap for the CW (C) 100 profile is 1.0 m, for CW (C) 75 profile – 0.75 m, and for CW (C) 50 profile – 0.50 m. In the walls higher than 300 cm you must not use profiles which are joined on their length

Insulation fitting

In drywall systems in which plasterboards are installed on adhesive dabs, we do not use insulation with the exception of an integrated plasterboard (i.e. a plasterboard connected with insulation). In the two remaining systems, i.e. a pre-wall system and wall lining system, if there is a need to enhance thermal insulation, fire or sound resistance, we put a layer of mineral wool between profiles. Its thickness cannot exceed the distance between the profile front and the wall. If the wall lining is installed on an external wall, it is necessary to use a vapour-insulation put between the mineral wool and a plasterboard. In the case of a wall lining installed on CD 60 profiles, mineral wool is fitted by means of wool mat tapping after the ES brackets have been installed.

In the case of a pre-wall we put mineral wool between profiles. The wool should tightly fill the space between profiles. Careless placing of mineral wool results in reducing insulation effectiveness. The use of partition walls being light structures made of paper-based plasterboards and filled with mineral (glass or rock) wool panels or mats ensures all parameters of sound insulation.

Panelling

While installing plasterboards as wall linings, we put them most often with their length in vertical position so that they can stretch from the floor to the ceiling. In the case of a plasterboard the maximum height cannot exceed 3 m (this is the length of commercially available plasterboards). There are no such constraints in the case of the plasterboard assembly on steel profiles fixed to the wall by means of ES brackets. Plasterboards should be fixed by screws to CD 60 profiles only. They must not be fixed by screws to horizontal profiles (UD 30). Plasterboards must not be placed directly on the substrate (background). A gap of ca.10 mm should be left.

4.2.2. Revision questions

Answering these questions you can check if you are prepared for the tasks and their completion.

1. What determines the installation of drywall lining systems?
2. What are the rules governing determination of the wall lining position?
3. What types of steel profiles are used for a pre-wall assembly?
4. What is the ES bracket used for?
5. What is the maximum distance between adhesive dabs when you are installing a plasterboard?
6. What is the maximum height of a wall lining installed on gypsum adhesive?
7. In which of the wall lining systems is thermal insulation used?
8. What are gypsum dabs?

4.2.3. Tasks

Task 1

Determine a plasterboard position on the basis of the technical documentation of an interior indicated by the teacher.

Tips for task performance:

To do this task you should:

- 1) get familiar with a plasterboard structure (reference material from Chapter 4.2),
- 2) get familiar with the documentation of the place where the plasterboard is to be applied,
- 3) organize the workplace for task performance,
- 4) prepare materials and equipment for establishing the position of the plasterboard installation,
- 5) determine the position of the plasterboard,
- 6) present the completed task,
- 7) assess correctness and aesthetics of the task completed.

Workplace resources:

- technical documentation of the interior,
- materials for plasterboard installation,
- measuring instruments,
- equipment and tools for plasterboard installation,
- drawing instruments,
- reference material from Chapter 4 of Student's Handbook.

Task 2

On a plasterboard, determine places of gypsum adhesive application in line with the rules of plasterboard adhesive bonding.

Tips for task performance:

To do this task you should:

- 1) get familiar with a plasterboard structure (reference material from Chapter 4.1.1),,
- 2) get familiar with the rules of application of gypsum dabs and gypsum adhesive to plasterboards,
- 3) organize the workplace for task performance,
- 4) mark (e.g. with a piece of chalk) the places where gypsum adhesive is to be applied,
- 5) present the completed task,
- 6) assess correctness and aesthetics of the task completed.

Workplace resources:

- a plasterboard,
- drawing instruments,
- reference material from Chapter 4.1 of Student's Handbook.

Task 3

Using adhesive, fix two plasterboards to the wall indicated by the teacher.

Tips for task performance:

To do this task you should:

- 1) get familiar with a plasterboard structure (reference material from Chapter 4.2),
- 2) get familiar with the place where plasterboards are to be fixed,
- 3) organize the workplace for task performance,
- 4) prepare plasterboards,
- 5) select materials,
- 6) apply gypsum adhesive to plasterboards,
- 7) fix the plasterboards to the wall,
- 8) present the completed task,
- 9) assess correctness and aesthetics of the task completed.

Workplace resources:

- plasterboards,
- tools and equipment needed for plasterboard fixing,
- gypsum adhesive,
- reference material from Chapter 4 of Student's Handbook.

Task 4

Determine the wall lining's position on CD60 channels and positions of ES brackets needed for their fixing.

Tips for task performance:

To do this task you should:

- 1) get familiar with the structure of a wall lining fixed on CD60 profiles (reference material from Chapter 4.2),
- 2) get familiar with the place where the wall lining is to be installed,
- 3) organize the workplace for task performance,
- 4) prepare the tools and equipment needed for establishing the wall lining positioning,
- 5) establish the wall lining's position,
- 6) determine the positioning of ES brackets,
- 7) install some brackets in pre-determined positions,
- 8) present the completed task,
- 9) assess correctness and aesthetics of the task completed.

Workplace resources:

- technical documentation concerning to wall linings,
- ES brackets,
- tools and equipment for determination of the wall lining positioning,
- reference material from Chapter 4 of Student's Handbook.

Task 5

Install a fragment of a wall lining prepared for the water and sewerage piping installation (e.g. lining of a shaft).

Tips for task performance:

To do this task you should:

- 1) get familiar with the structure of a wall lining fixed on CD60 profiles (reference material from Chapter 4.2),
- 2) get familiar with the place where the wall lining is to be installed,
- 3) organize the workplace for task performance,

- 4) prepare the tools and equipment needed for the determination of the position of a wall lining,
- 5) determine the wall lining's position in the place intended for water and sewerage piping,
- 6) install profiles and brackets,
- 7) install plasterboards,
- 8) present the completed task,
- 9) assess correctness and aesthetics of the task completed.

Workplace resources:

- plasterboards,
- steel profiles,
- tools and equipment needed for the assembly,
- reference material from Chapter 4 of Student's Handbook.

4.2.4. Progress check:

	Yes	No
Are you able to:		
1) identify basic steps in plasterboard installation?
2) identify types of profiles used for the wall lining installation?
3) identify intervals between screws fixing plasterboards in one-layer linings?
4) identify intervals between screws fixing plasterboards to each layer in two-layer linings?
5) identify plasterboard types used in rooms of higher humidity?
6) identify the rules of plasterboard installation?

4.3. Joint filling and finishing works

4.3.1. Reference material

After the plasterboards have been fixed on walls, all plasterboard edges and heads of the screws used for fixing them are clearly visible. To get a uniform surface the joints and screw heads must be masked and all possible defects should be concealed as well as other damage in plasterboard edges. To this purpose a system-included joint compound is used.

The purpose of joint-filling is not only to conceal plasterboard joints but first of all to make all plasterboard sheets into one continuous whole. A characteristic quality of a significant majority of the joint compounds used is the fact that their resistance to compression is several times higher than their tensile strength. To allow the joint to transfer even the slightest tensile forces, it must be provided with a tape made of a fibrous material.

Joint filling is one of the most important stages in the wall lining installation. Appropriate selection of filling materials and appropriate execution ensure a faultless performance of interior drywall systems.

The surface for joint filling must be cleaned of gypsum dust. Depending on the type of the joint compound or gypsum mud used we distinguish joint filling with and without a joint tape. In both cases, when we apply the first coat of a joint compound, we spread it laterally to the plasterboard junction line, pressing it as deeply as possible and tightly filling the whole joint. Next, applying a uniform movement, preferably a single stroke, we spread and smooth out a joint compound along the whole joint.

For joint filling on tapered edges in commercially available plasterboards, we use a tape. We distinguish three types of tapes:

- paper tapes,
- self-adhering mesh tapes of glass fibre,
- glass fibre (felt) tapes.

For tapered-edge plasterboards (NS, PRO, KS and KPOS), all types of joint tapes can be applied to their vertical junctions. A self-adhering (mesh) tape should be applied to the edges of joined plasterboards directly onto their cardboard in the case of cardboards of the NS and PRO type edges and to an earlier applied structural joint compound ("on wet gypsum") in the case of edges of the NS, PRO, KS and KPOS types. "Felt" or paper tapes should be applied to the "wet gypsum" joints.

Vertical joints (on edges tapered in the factory) between plasterboards of half-round tapered edges (KPOS), can be "mudded" without the use of a tape in a situation when a special joint compound is prepared specially to this purpose.

Mudding horizontal joints between plasterboards, i.e. of the so-called "cut" edges should be accomplished with the use of tapes of the "felt" or paper type applied on "wet gypsum".

Mudding of vertical and horizontal joints between plasterboards with the use of a tape applied to an earlier applied joint compound (to "wet gypsum") requires the second coat of mudding with a joint compound, the aim of which is to "cover" the tape. The aesthetic standard of finishing works in interiors in which drywall systems were applied is determined by the smoothness of their wall surfaces. Joints (convex, concave) cannot be visible following painting or wall papering.

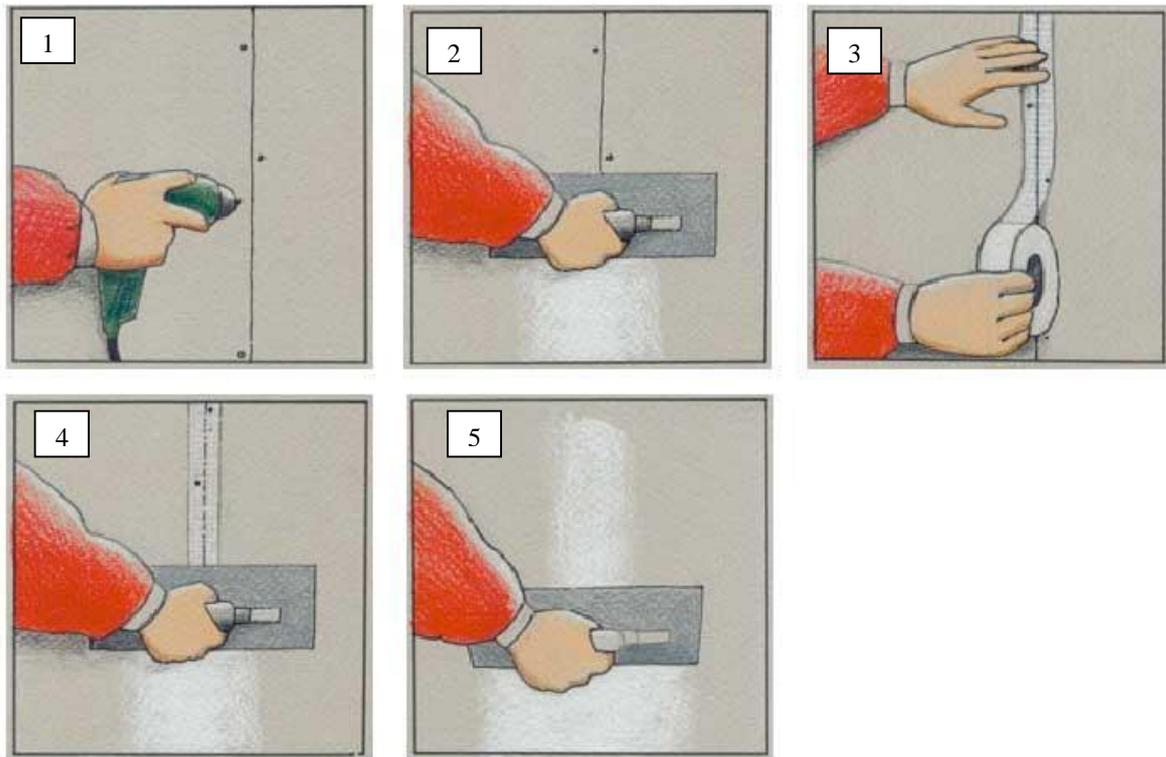


Fig. 3. Steps in plasterboard joint filling

1. Appropriate intervals between screws during an assembly, appropriate spacing between screws and plasterboard's "cut" or beveled edges must be assured. We use screws of the lengths recommended by the manufacturer. 2. We fill the joint with the system-included gypsum for joint filling. 3. Mudding of a taped edge will conceal joints between plasterboards. 4. Paper or felt tape is applied to a plasterboard surface and masked with the use of gypsum. 5. The second coat of "mud".

Four quality levels of gypsum board finish are used to describe and classify the quality of drywall finishing in Technology of Drywall Systems. The Polish standards in this field are conformable with the European classification of Quality Levels. They are described with the use of four different levels of gypsum board finish.

Levels of gypsum board finish (Quality Level 1 (Q1))

Quality Level 1 for gypsum board finish refers to wall surfaces made of plasterboards towards which no aesthetic requirements are formulated (e.g. a substrate for ceramic tiles). It is enough to apply basic mudding which consists of filling the plasterboard joints and covering the visible fixing and finishing elements with a joint compound.

At this level of gypsum board finish it is assumed that a joint tape of glass fibre (self-adhering mesh) has been applied to the edges of the NS and PRO type plasterboard and – depending on the system supplier's recommendations – covered with one or two coats of a joint compound.

Joint filling in the case of plasterboards having the KS type of edges should look a bit different. In this case, when a paper or felt tape or a fibre glass mesh tape is applied, the first step should be applying the system-included joint compound to an edge joint and then the tape should be applied. It must be borne in mind that after the first coat of a joint compound with a tape applied to it has dried up, the joint should be mudded again with the use of one coat of the system-included joint compound.

If the joint compound has been applied to KPOS edges – like in the case of KS edges – when we use a paper tape, or a felt tape, or a mesh tape of glass fibre, the first thing which must be checked is the use of the system-included joint compound onto which the tape is applied. After the first coat of the joint compound with a tape applied to it has dried up, the joint should be mudded again with one more coat of the system-included joint compound.

It is worth remembering that the application of a joint compound without the use of any tapes is also possible, e.g. in the case of KPOS edge plasterboards. A special, system-included joint compound is employed for joint filling without the use of a joint tape. Subject to a system supplier's recommendations, two or three coats of a joint compound should be applied to such plasterboard joints.

When walls are lined with many layers of plasterboards, a joint compound is applied to all subsequent layers, and the joints in the external surface must be additionally taped for joint filling. On the other hand, applying a joint compound to screw heads in internal layers is not needed.

At this level of the joint compound application, the occurrence of occasional ridges resulting from the joint compound shrinkage or tool marks are permitted. Additional application of a finishing joint compound is not practised. The drywall system finished in line with the Quality Level 1 recommendations is suitable as a substrate for wall linings (ceramic tiles, panels, etc.) and in temporary or technical rooms.

Levels of gypsum board finish (Quality Level 2 (Q2))

At this level the aim of finishing works performed by an assembler of drywall systems is to even up and smooth out the junction so that it will make one uniform surface with a plasterboard. This applies also to fixing elements, internal and external angles and other joints. Mudding at the Quality Level 2 includes basic Q1 mudding and repeat mudding with the system-included “mud”: structural – when it is required, and finishing mud until a joint and a plasterboard surface make a smooth, seamless whole. No ridges or tool marks are permitted. If it is necessary, the mudded surfaces should be sanded. The surface which has been treated in such a way is well-prepared for, e.g. wallpaper, structural paints and decorative plaster. After Q2 mudding we cannot exclude that an ultimately finished surface (e.g. painted one) will reveal a visible transition between the surface of drywall cardboard and a surface coated with a mud layer (e.g. on a joint).

Levels of gypsum board finish (Quality Level 3 (Q3))

Gypsum board finish at Q3 Level includes Q2 level mudding as well as mudding the entire surface of the drywall element (joints and cardboard) with the system-included “mud” compounds and skim coats the aim of which is to smooth out the surface and close the micropores, making the texture and absorbability of these surfaces uniform. In this case the thickness of the coat applied is negligible and usually it does not exceed 1 mm. Attaining such an effect is possible only on condition we use steel trowels whose working surfaces are polished and edges - perfectly straight. Possible irregularities of surface, after the coat applied has set, should be sanded delicately with the use of a sanding mesh or sandpaper (grain 200).

Levels of gypsum board finish (Quality Level 4 (Q4))

To meet the highest aesthetic standards of mudded drywall system surfaces, it is necessary to apply a thin coat of gypsum plaster (type: alabaster stuccowork gypsum) to the whole surface. Q4 Level mudding includes manual or mechanical application of a thin plaster

layer or a special skim coat to the whole surface of the drywall system element (layer thickness: up to 3 mm). Besides, it is frequently needed to polish the whole layer applied.

Gypsum board finish of Quality Level 4 is always a result of the class of the interior and the method of its ultimate finish. A wall surface which has been treated like this can be painted with matt paints or wallpapered with thick wallpaper.

Treatment of cut edges

In the case of plasterboards whose edges have been cut, joint filling is more difficult. The “sharply cut” edges, not covered with cardboard, must be joint filled in several stages. To joint fill such edges, the following activities should be performed:

- the plasterboard edge must be bevelled at an angle of 22.5°, to the depth of 50-75% of the board thickness; to this end we must use an assembler’s knife, a rasp or a special chamfer plane,
- the visible gypsum core should be wetted with water,
- a triangle which has been formed between the bevelled edges should be filled with the system-included mud; at the same time a paper tape should be applied in such a way as to prevent its excessive jutting out over the surfaces of joined plasterboards,
- when the first coat has set, another coat of the system-included mud intended for finish mudding should be applied. The width of this coat spreading is ca. 60 cm (30 cm on each side of the joint axis),
- after the previous coat has set or dried up, in order to achieve maximum surface smoothness, sandpaper can be used for additional smoothing of the joint.

Angle finishing

A paper tape is used for taping a joint in internal angles. It is embossed lengthwise, which enables its easy bending. The mudding process is similar to that used for cut edges.

External angle mudding is accomplished with the use of perforated aluminium angles, or special paper ones with a steel insert (Alux type). The angle should be fixed with the use of mud and not fastened with e.g. staples.

Steps in the protective angle assembly:

- clean the plasterboard’s cut edges of dust (priming is not needed),
- apply “mud” to the angle,
- press and position (level) the angle in the wall angle (stick it),
- wipe off the mud excess and add as much mud as it is needed to cover the whole angle, on both sides,
- after the mud has dried up, fill in the places where it shrank and apply the mud at the length of 30 cm in order to obtain a uniform plane,
- in the case of the Alux type angles, press them with metal face to the wall.

Mudding the places of fixing

Before you start mudding, check whether screws do not stick out of plasterboards. A correctly installed screw should be ca. 0.5 mm – 1 mm below the plasterboard surface. The cardboard next to its head must not be broken. Screws are covered with mud in two cycles: at the first mudding of joints and then at final mudding with a finishing mixture. Screw mudding is performed together with joint mudding.

Assessment of the final effect of works in drywall systems

Like in the case of majority of construction works, the final effect of using drywall systems depends on each and every stage of their installation. When we talk about the final effect we mean completion of all works connected with drywall system installation, from the moment of the wall positioning until final mudding preceding painting, wallpapering or any other method of finishing the surface.

A number of activities undertaken by the drywall system assembler belong to the so-called “disappearing works”. Therefore, at the moment of the works acceptance some difficulties can occur when it comes to assessing their quality. For this reason the drywall system assembler should realize that whereas careless positioning of a wall or a ceiling will be clearly visible and easy to prove at the moment of the works acceptance, a careless execution of a steel profile structure or fitting the mineral wool insulation will become visible later after the building has been used for some time.

The following “disappearing works” are usually specified when we speak about the installation of drywall system elements:

- making a steel profile structure,
- mineral wool fitting,
- installation of plasterboards and the use of a tape,
- joint filling and mudding.

The final effect of the works performed is equally important. A drywall assembler – while performing works - should be aware that during the acceptance procedure of the works he did among the aspects assessed there will be dimensional tolerances for the positioning of planes and edges. Particular attention will be given to:

- deviations of surfaces from the plane, in other words – is the wall surface “corrugated”,
- deviation of the plane edges from the straight line, in other words – are there any deviations vertically and horizontally in the places where two planes intersect, e.g. in internal angles, and external wall angles,
- deviations of surfaces and edges from the vertical direction,
- deviations of surfaces and edges from the horizontal direction,
- deviations of intersecting planes from the angle specified in the documentation.



Fig. 4 Checking the surface and edge deviation from the vertical direction



Fig 5. Checking deviation of intersecting planes from the angle specified in the documentation.

You can find a detailed description of possible deviations in a book entitled "Warunki techniczne odbioru i wykonania systemów suchej zabudowy z płyt gipsowo-kartonowych"

(Technical acceptance of drywall system installations and their execution (group work, Polskie Stowarzyszenie Gipsu, Warszawa 2010)

Finishing works

To the finished wall surface, a coat of primer is applied. Primer helps to eliminate the differences between absorbability of a plasterboard and mud compound. Before further treatment is started, the primer must be dry. Before tiles are applied, places which are directly exposed to water (e.g. in the bathroom) must be insulated with the so-called “liquid foil”, which is a special preparation reducing water absorption of gypsum contained in the plasterboard core.

Commonly available dispersion paints are used for painting. The paints which contain lime and water glass (liquid glass) should not be used. All commonly available wallpaper types and wallpaper adhesives can be used for plasterboard wallpapering. Impregnated plasterboards of the H2 type are recommended for kitchens and bathrooms. Before tiles are applied, plasterboards must be covered with a coat of primer. Plasterboards prepared for tiles are not mudded with the finishing mud.

4.3.2. Revision questions

Answering these questions you can check if you are prepared for the classes and task completion.

1. What activities are described as “disappearing works”?
2. What basic steps are distinguished in plasterboard joint filling?
3. What are the characteristics of the basic standard mudding?
4. What are the most common errors made during the partition wall installation?
5. What finishing works can be performed on drywall system walls?

4.3.3. Tasks

Task 1

Perform joint filling on a fragment of a plasterboard wall lining indicated to you by the teacher.

Tips for task performance:

To do this task you should:

- 1) get familiar with a structure of the plasterboard on which joint filling is to be performed,
- 2) select the quality level of joint filling,
- 3) organize the workplace for task performance,
- 4) select materials and tools for aligning the board so that it is plumb,
- 5) perform joint filling on the indicated part of a wall lining,
- 6) present the completed task,
- 7) assess correctness and aesthetics of the task completed.

Workplace resources:

- a fragment of a plasterboard wall lining,
- materials for joint filling,
- tools for joint filling,

- reference material from Chapter 4 of Student’s Handbook.

Task 2

Finish a fragment of an internal angle between the ceiling and the wall with a wall lining attached to it.

Tips for task performance:

To do this task you should:

- 1) get familiar with the place in which the internal angle is to be finished,
- 2) specify the way in which the angle should be finished,
- 3) select the quality level of joint filling,
- 4) organize the workplace for task performance,
- 5) select materials and equipment for aligning the board so that it is plumb,
- 6) select materials for making the internal angle,
- 7) apply selected finishing technique to the angle indicated to you,
- 8) present the completed task,
- 9) assess correctness and aesthetics of the task completed.

Workplace resources:

- fragments of a ceiling and wall lining made of a plasterboard,
- materials for joint filling,
- tools for joint filling,
- materials for angle finishing,
- reference material from Chapter 4 of Student’s Handbook.

Task 3

Finish a fragment of an external angle made by the walls with plasterboard wall lining attached to them.

Tips for task performance:

To do this task you should:

- 1) get familiar with the place, where the external angle is to be finished,
- 2) specify the way in which the angle should be finished,
- 3) select the quality level of joint filling,
- 4) organize the workplace for task performance,
- 5) select materials for external angle finishing,
- 6) select materials and equipment for aligning the board so that it is plumb,
- 7) apply selected finishing technique to the angle indicated,
- 8) present the completed task,
- 9) assess correctness and aesthetics of the task completed.

Workplace resources:

- fragments of walls with a plasterboard wall lining attached,
- materials for joint filling,
- materials for making the external angle,
- tools for joint filling,
- materials for finishing the angle,
- reference material from Chapter 4 of Student’s Handbook.

4.3.4. Progress check

	Yes	No
Are you able to:		
1) identify the characteristics of the basic Q1 mudding?
2) identify gypsum board finish quality levels ?
3) identify the steps in the angle assembly?
4) identify joint tape types?

5. TEST OF ACHIEVEMENTS

INSTRUCTIONS FOR STUDENTS

1. Read the instructions carefully.
2. Sign the answer sheet with your name and surname.
3. Get acquainted with test tasks.
4. The test consists of 20 tasks of two difficulty levels. It includes tasks of the following types: open, gap-fill, multiple-choice and True/False.
5. Give your answers on the enclosed answer sheet only. Put a cross (X) in the appropriate column or write the correct answer. If you make a mistake, put a circle around the incorrect answer and then put a cross (X) next to the correct answer.
6. The test consists of 2 parts containing tasks of different difficulty levels: tasks 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 19 – represent the basic level, whereas tasks: 15, 16, 17, 18, 20 – represent the above-basic level.
7. Work on your own because only then you will get satisfaction of completing the task.
8. When you find answering a question difficult, leave it for a later time and return to it when you have time.
9. You have 90 minutes to complete the test.

Good luck !

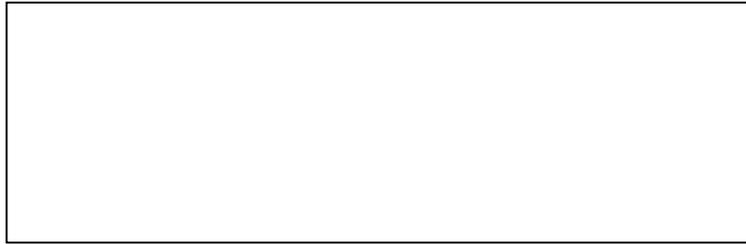
A SET of TEST TASKS

1. Identify the basic elements of the wall lining systems :
 - a)
 - b)
 - c)
 - d)
2. Identify the main wall lining systems.
 - a)
 - b)
 - c)
3. Plasterboards in drywall systems are fixed by means of:
 - a) adhesive bonding and mechanical fixing,
 - b) only mechanical fixing,
 - c) adhesive bonding
 - d) depending on the type of their structure.
4. What is the role of gypsum dabs in drywall systems?
 - a) they smooth out the wall to which plasterboards are attached.

- b) mark the plane of the plasterboard positioning.
 - c) allow to use additional wall filling,
 - d) reduce adhesive consumption.
5. How long should adhesive bonded plasterboards in drywall systems be?
- a) shorter by ca. 3 cm than the room height,
 - b) of the length which allows them to be well adjusted to the room height,
 - c) lower by 1.5 cm than the room height,
 - d) equal the room height.
6. The maximum permitted height of rooms in which plasterboard installation is performed is:
- a) 2 m.
 - b) 3 m.
 - c) between 3 and 4 m.
 - d) 2.5 m.
7. Adhesive bonding of plasterboards starts from:
- a)- when the wall is less than 6 m in length,
 - b) - when the wall is more than 6 m in length.
8. CD60 profiles are placed vertically and are fixed to:
- a) the floor and the ceiling by means of appropriate brackets.
 - b) the structural wall by means of appropriate brackets.
 - c) UD 30 wall profiles fixed to the floor and the ceiling.
 - d) UD30 wall profiles placed all over the wall.
9. The interval between the ES brackets for fixing CD60 profiles should be:
- a) maximum 125 cm vertically.
 - b) at least 125 cm vertically,
 - c) maximum 60 cm horizontally,
 - d) at least 60 cm horizontally.
10. Pre-walls are mounted on the following profiles:
- a) CD.
 - b) UW(U).
 - c) CW(C).
 - d) UA.
11. Which wall lining systems require marking a line indicating the wall lining positioning?
- a) plasterboards.

- b) wall linings on CD60 profiles.
- c) pre-walls.

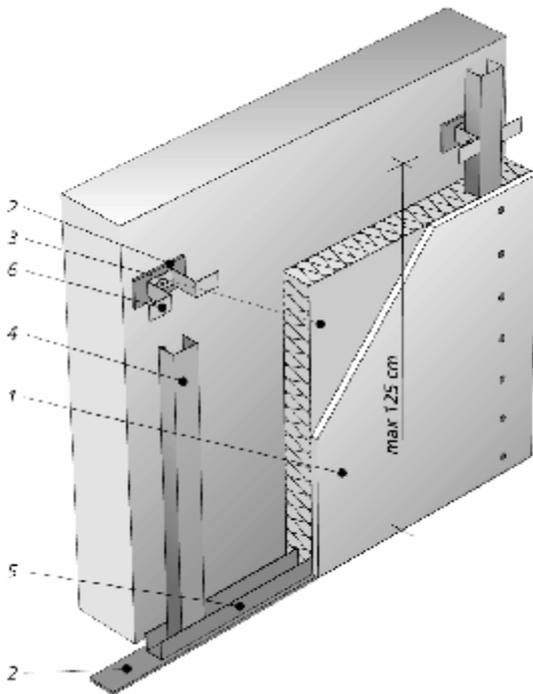
12. On this plasterboard projection, mark the places of applying gypsum adhesive which is to bond the board to the wall.



13. The line marking the wall lining positioning on the floor should be the one:

- a) marking the position of the wall lining surface.
- b) to which the centre of UW profiles is applied.
- c) to which the external edge of UW profiles is applied.
- d) to which the internal edge of UW profiles is applied.

14. Identify the elements of the wall lining structure on CD60 profiles:



- a) 2 -
- b) 4 -
- c) 5 -
- d) 6 -

15. When installing a wall lining on the outside wall, apart from mineral wool, you must use:

16. When you join profiles, the length of an overlap depends on their length and it is:
- a) for CW (C) 50 profiles -
 - b) for CW (C) 75 profiles -
 - c) for CW (C) 100 profiles -
17. The height of a pre-wall that can be accomplished with the use of the profiles indicated below is:
- a) for CW (C) 50, UW (U) 50 profiles -
 - b) for CW (C) 75, UW (U) 75 profiles -
 - c) for CW (C) 100, UW (U) 100 profiles -
18. The length of CW (C) profiles in a pre-wall structure should:
- a) equal the room height,
 - b) be less by ca. 1 cm than the room height,
 - c) be less by the CU profile thickness,
 - d) be less by ca. 2 cm than the room height.
19. Plasterboards are fixed to profiles which are:
- a) only vertical,
 - b) only horizontal,
 - c) vertical and horizontal,
 - d) vertical, but at bigger heights – also horizontal.
20. Identify the basic dimensional tolerances in the positioning of completed planes and edges, which will be assessed during the acceptance procedure of construction works:
- a)
 - b)
 - c)
 - d)
 - e)

ANSWER SHEET

Name and surname

Installation of wall lining systems

Mark the correct answer, write in a missing phrase or an answer.

Question number	Answers				Points scored
1	a	b	c	d	
2	a		b	c	
3	a	b	c	d	
4					
5	a	b	c	d	
6	a	b	c	d	
7	a		b		
8	a	b	c	d	
9	a	b	c	d	
10	a	b	c	d	
11	a	b	c		
12					
13	a	b	c	d	

14	a	b	c	d	
15					
16	a	b	c		
17	a	b	c		
18	a	b	c	d	
19	a	b	c	d	
20	a	b	c	d	e
Total					

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Bibliography should be updated as new publications appear on the market.