



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

Module 3

Construction, mounting and assembly techniques

FLAME

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FOR SECTOR ATTRACTIVENESS
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Module 3

Construction, mounting and assembly techniques

AIM OF THE MODULE

This module concerns knowledge about constructional design of furniture. This furniture design has to be correlated with furniture form together with production capabilities of each enterprise. The subject of description of the furniture structure is connected to mounting and assembly techniques, as well as furniture accessories.

LEARNING OUTCOMES

Knowledge

furniture construction
joining techniques
mounting and assembly techniques
upholstery making

Skills

producing furniture parts
selecting and mounting fittings
combining parts of furniture to a complete furniture
combining different furniture to a system
sewing covers
cutting materials to size

LEARNING PLAN

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Unit 3.2 \ Part production technology – pg. 10

Unit 3.3 \ Joining materials – pg. 15

Unit 3.4 \ Furniture accessory elements – pg. 20

Unit 3.5 \ Mounting and assembly techniques – pg. 25

ESCO PROFILES

7522 Cabinet-makers and related workers

7534 Upholsterers and related workers

8172 Wood processing plant operators

1321s Industrial production manager

8219s Furniture assembler

9329 Factory hands - Manufacturing labourers not elsewhere classified

8153 Sewing machine operators



Unit 3.1

Types of furniture constructions and parts

EDUCATIONAL APPROACH			CONTENT	
 Course book	 Additional readings	 External links	 Exercises and games	Types of furniture constructions 5
				Furniture parts 6
ASSESSMENT	DURATION	ECVET		
 Quiz (at the end of the module)	1 HOUR	0.04 Credits/ 0.2 total of the module		



Unit 3.1 Types of furniture constructions and their parts

Furniture is defined as utensils or useful items to store, perform functions, sit or rest. There are different classifications of furniture.

By function:

- Receptacle furniture: to store products. Cabinets, wardrobes, sideboards.
- Small furniture: service trolleys and bedside tables.
- Furniture for rest: beds and lift up bases.
- Furniture for sitting: benches, stools, armchairs, sofas and chairs.

For its construction:

- Body furniture: dressers, cabinets, desks, tables.
- Shelves: furniture with frontal opening.
- Tables: furniture formed by a horizontal board resting on a frame.

Types of furniture constructions

According to the arrangement of the different parts and the joining mode, a distinction is made between:

- **Planking construction (1).**
The parts of the furniture are made using glued or non-glued boards, exposing the grain of the wood's face and trying to achieve the same colour and texture for greater aesthetics. The most appropriate joints are made with teeth, grooves and tongues, dovetails and tenons.
- **Frame construction (2).**
Frames and panels are used for the flat parts of the furniture. Frames in general are made with sole or central boards to withstand well. The panels can be made of solid wood, plywood or chipboard and must never be glued. The pieces of the frame must receive the shelf and keep it flat, so a groove or rabbet is made in them. They are joined with grooves, dowels or by chiselling.
- **Feet construction (3).**
The feet are based on the use of legs as a support to bear the weight of both the furniture and the sides. The bottoms, the sides and the doors can be worked as frames or be made of boards. The legs are joined to the sides by dowels and tongues while the bottoms are joined to the sides and the legs by dowels or glue. The corners of the bottoms are fitted to match the size and shape of the legs.
- **Board construction (4).**
As the name implies, parts made with plywood or veneered chipboard boards are used. The union of the sides and the bottoms can be by mitre joint (dowels or laminated tongues), by butt joint, or with removable hardware. Furniture constructed with boards can be provided with a plinth or leg frame. The sides can be extended to the ground to act as bearing elements.



Furniture parts

The body

The body is the part of the furniture that provides functionality. The body is formed by:

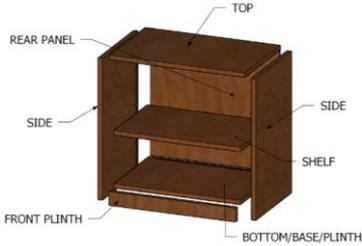
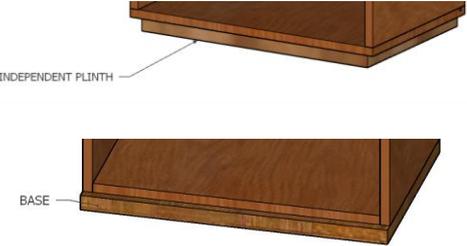
- The **sides (5)**. Panels that act as a wall and complete the furniture on the sides.
- The cover or **top (6)** and the floor or **bottom (7)**. The upper and lower walls of the furniture respectively. According to the interior division of the furniture we can find central panels and intermediate floors such as racks or **shelves (8)** (fixed or movable). Furniture can have the **top between the sides (9)** or **over the sides (10)**.
- The back or **rear panel (11)**. Panel that completes the furniture from behind, prevents dust from entering and helps to maintain a square shape. It is manufactured with plywood, chipboard or wood fibreboards.
- The **front (12)**. The front part of the furniture which is placed in view and which users interact with. It can be open or closed to protect the contents against the entry of dust or light as well as against theft. Drawers and doors can go **overlapped (13)** (outside the top and plinth) or **by light (14)** (levelled to the top and plinth). There are different types of fronts:
 - **Swinging doors (15)**. Those that require turning space. They can be tucked in if they are placed between the sides, with a flap if they are attached to the side by the flap or cantilevered if they rest on the sides.
 - Sliding doors. They move horizontally in the body of the furniture and do not require turning space. They are made of composite woods or glass. They can be **supported (16)** or **hanging (17)**.
 - Furniture shutters. These are formed by narrow wooden slats or special profiles of plastic or metal and the lock. The first slat joins the lock. There are **vertical (18)** and **horizontal (19)** opening shutters.
 - **Drawers (20)**. They are storage pieces to place objects that can be hidden behind a door or exposed to enhance the front of the furniture. Like furniture, they are divided into different parts:
 - **Front (21)**. It can be solid wood, plywood or chipboard. There are four positions with respect to the frame of the furniture: levelled, tucked into the frame, standing out when there is light overlap, and superimposed when there is notable overlap.
 - **Sides (22)**. They are usually guided and made of solid wood, but also of hollow plastic profiles, plastic-coated plywood, veneer or pressed boards.
 - **Rear panel (23)**. This is the piece that closes or finishes from behind.
 - **Bottom (24)**. This piece supports the weight of the objects and keeps the drawer squared. It is usually made of lined plywood, hardwood fibre or laminated fibre with plastic.

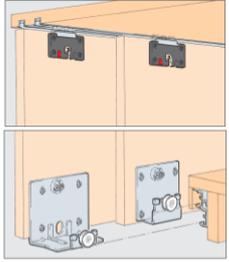
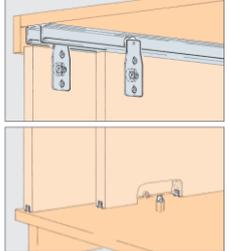
The base

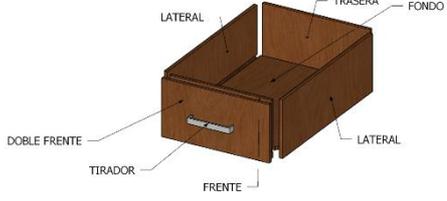
The base is the part that supports the furniture. It can be made up of:

- **Legs (25)** and **crossbars (26)**: the legs act as a point of support with the floor surface while the crossbars are responsible for connecting the legs to each other to better distribute the weight of the furniture and increase the stability.
- **Plinths (27)**: they are walls with three or four sides that connect the sides and sometimes the bottom of the furniture to the floor.



TYPES OF FURNITURE CONSTRUCTIONS		
Keyword	Description	Image
(1) Planking construction	Style where the parts of the furniture are made using glued or non-glued boards, exposing the grain of the wooden face.	
(2) Frame construction	Style where frames and panels are used for the flat parts of the furniture. The frame acts as a skeleton and keeps the panel flat, which acts as a wall.	
(3) Feet construction	Style that is based on the use of legs as support to bear the weight of both the furniture and the sides.	
(4) Board construction	Construction style that differs from that of planking because parts made with plywood boards or veneered chipboards. The legs do not support the sides.	
FURNITURE PARTS		
Keyword	Description	Image
(5) Sides	Panels that act as walls to delimit the sides of the furniture.	 
(6) Top	Upper furniture wall.	
(7) Bottom	Inferior furniture wall.	
(11) Rear panel	Rear furniture wall.	
(12) Front	Front wall of the furniture with which the interaction is made.	
(27) Plinths	Wall or walls that connect the sides and sometimes the bottom to the floor. Same function as the legs.	
(8) Shelves	Central panels or intermediate floors that divide the interior of the furniture body into different spaces to separate the objects to be stored and act as support. Its thickness depends on the load to support and the gap between them.	

<p>(25, 26) Legs and crossbars</p>	<p>A support point transmits the weight to the floor, distributes the force and increases the stability.</p>	
<p>(9) Top between the sides</p>	<p>Construction model where the top is placed between the sides. A cover can be used to hide the lateral edges.</p>	
<p>(10) Top over the sides</p>	<p>Construction model where the top is placed over the edges of the sides.</p>	
<p>(15) Swinging door</p>	<p>Door that requires turning space, which swing due to the hinges. The image shows a swinging door to the left.</p>	
<p>(16) Supported sliding door</p>	<p>The width must be greater than the height to avoid tilting when moving. It is guided by the lower edge with sliding hardware.</p>	
<p>(17) Hanging sliding door</p>	<p>Suspended by the upper edge with sliding or rolling hardware that circulates on guide rails fixed to the ceiling.</p>	

<p>(18) Vertical opening shutter</p>	<p>It can open up or down. The surface of the shutter is moved along the front of the furniture using a guide profile. The lower part of the blind has a slat that makes contact with the bottom and can contain a lock.</p>	
<p>(19) Horizontal opening shutter</p>	<p>It is pushed laterally for opening. The surface of the shutter covers from the sides to the rear wall.</p>	
<p>(20, 21, 22, 23, 24) Drawers</p>	<p>These are small storage containers located inside the furniture. They can be covered with a front door or constitute the front of the furniture themselves. They are divided into different parts just like the furniture: front, side, back and bottom.</p>	
<p>(13, 14) Overlapped and encased</p>	<p>1st Image. Overlapped: outside top and plinth. 2nd Image. Encased: levelled at the top and the plinth.</p>	

Unit 3.2

Part production technology

EDUCATIONAL APPROACH			CONTENT		
				Parts production technology	11
Course book	Additional readings	External links	Exercises and games	Types of boards to produce the parts	12
ASSESSMENT	DURATION	ECVET			
	1	0.04			
Quiz (at the end of the module)	HOUR	Credits / 0.2 total of the module			



Unit 3.2 Part production technology

Part production technology

Furniture is a composite system consisting of different components or parts. All the parts are produced through a chain process of consecutive optimizations consisting of different phases:

1. **Wood treatment (28).** Necessary to meet the minimum durability requirements against biotic and abiotic agents which the wood will be exposed to. Protectors: insecticides, fungicides, flame-retardants and light protectors. They can be organic, salts or creosotes. There are two classes: preventive and curative protectors. Surface treatments include brushing, spraying or immersion. In-depth treatments include hot and cold immersion and autoclaving.
2. **Wood drying (29).** Essential to eliminate the water that occupies the gaps between the wood fibres and hinders transformation processes such as gluing or varnishing. This process also helps to avoid the deformation of wood over time. It can be dried outdoors or artificially by heat, dehumidification or vacuum.
3. **Curving (30).** This is an optional phase that consists of applying a heat treatment to the wood such as vaporization or radiofrequency, subjecting it to compression efforts without exceeding the breaking limit and cooling it to obtain a curved deformation.
4. **Cutting (31).** The initial wooden panels are divided into different sections by cutting at different depths and angles according to the target functional and aesthetic characteristics for the pieces to be produced. This process eliminates the knots, the areas where branches have grown that weaken the board.
5. **Veneering and edgbanding (32).** This consists of covering the panels with thin sheets of wood. It is used to prevent the interruption of the exterior grain of large surface panels composed of different pieces glued between them, or to hide the pieces of furniture made with ordinary wood with noble wood. Veneering is done on the faces and the edgbanding on the edges. Currently there is no need for gluing in edgbanding due to lasers.
6. **Drilling (33).** Drilling the parts in the target places is carried out to facilitate the insertion of assembly hardware or complementary accessories.
7. **Joining and gluing (34).** Assembly and gluing the different pieces is carried out to form the different parts of the removable furniture, or the complete piece of furniture. The assembly process varies according to the type of furniture:
 - Tables. The legs are assembled with the rear, side and front crossbars. In the tables without legs where the sides act as support, they are assembled directly with the rear side. Finally, the upper panel is placed on top. If it has drawers, the drawer frame will be mounted first and then the drawers will be inserted.
 - Chairs. First, the front legs are joined with the front apron and the rear legs with the rear apron. They are assembled together with the side aprons and the bottom is added. The backrest can be joined directly to the rear legs or to the aprons.
 - Sofas. First, the base is assembled with the legs together with the sides and the backrest, constituting the frame.
 - Cabinets. This process starts at the base, followed by the bottom, the sides and the back, the top cover, the drawers and finally the doors.
 - Drawers. The sides and the front are assembled, the bottom is introduced and closed with the rear panel. A double front can be assembled.
8. **Sanding (35).** The surface is prepared to make it easier to complete the finishing by friction-based removal of all imperfections produced by machining. This process also allows the pores of varnishes or paints to be opened when these are to be applied and an additional layer is desired.

9. **Finishing (36)**. This process is intended to highlight the aesthetic qualities of wood, incorporating a suitable tone, touch and brightness permanently without losing them due to the effect of light, variations in humidity, temperature and erosion over time.
10. **Upholstery (37)**. This process consists in covering the furniture using different types of fabric once they are assembled and finished. There is furniture that can be upholstered without prior varnishing. The upholstery varies according to the type of furniture and is generally used in:
 - Sofas. This begins with the **webbing (38)**, the process of stapling elastic rubber strips to cover the surface of the backrest and the seats. Subsequently, the support fabric is placed at the rear of the backrest and finally the entire frame is covered by gluing it with laminated foam fabric. The final upholstery fabric is stapled on top of the rubber. Foam cushions are lined in parallel. The hole under the base is also covered with fabric. Once the upholstery is finished, the sofa is packed with protective plastic.
 - Chairs. The foam pillow is placed at the bottom of the chair, wrapped with the fabric and fixed with staples to the aprons. It is possible to choose to cover the backrest with laminated foam fabric and then staple the final upholstery.

Types of boards to produce the parts

The different parts of the furniture can be manufactured by boards made of different types of wood, which provide different structural and functional properties, such as flexibility and strength.

Solid wood boards

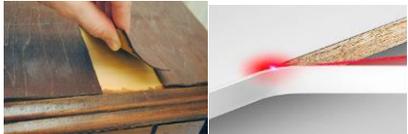
Boards, sheets or slats obtained directly from the tree trunk. These are of higher quality and greater aesthetic value. They can be from **hardwoods (39)** from deciduous trees such as oaks or chestnuts, or from **softwoods (40)** from evergreen trees such as pines or firs.

Composite wood boards

Formed by different types of wood. Different classes:

- Layered woods. These are formed by different sheets of glued veneer to form boards and moulded parts. They are classified into **plywood (41)**, triplay wood and synthetic resin wood.
- **Composite boards (42)**. These consist of a central layer and a coating layer on both sides. The central layer can be made of solid sheets or slats, layered wood, chipboard sheets, fibreboards, expanded resins or even hollow or hexagonal cardboard honeycombs, among others.
- **Particleboards (43)**. These are manufactured with chips from recycled wood and synthetic resin glues by applying heat and pressure. There are flat and extruded agglomerated boards, and moulded parts.
- **Fibreboards (44)**. As the name implies, they are created with different wood fibres and are joined together by different pressing forces and temperatures, the addition of materials such as adhesives and the binding power of the fibres. They are divided into porous and hard plates.



PART PRODUCTION TECHNOLOGY		
<i>Keyword</i>	<i>Description</i>	<i>Image</i>
(28) Treatment	Work done to meet the minimum durability requirements against biotic and abiotic agents to which the wood will be exposed.	
(29) Drying	Elimination of the water that occupies the gaps between the wood fibres and hinders the transformation processes such as gluing or varnishing, and also threatens to cause deformations.	
(30) Curving	Optional phase that consists of applying a heat treatment to the wood such as vaporization or radiofrequency, subjecting it to compression efforts without exceeding the breaking limit and cooling it to obtain a curved deformation.	
(31) Cutting	Division of the initial wooden panels into different sections by cutting at different depths and angles according to the target functional and aesthetic characteristics for the pieces to be produced.	
(32) Veneering and edgebanding	Coating of the panels with thin sheets of wood to avoid the interruption of the exterior grain of large surface boards composed of different glued pieces, or to hide the pieces of furniture made of ordinary wood with noble wood. Veneering is made on the faces and edgebanding on the edges.	
(33) Drilling	Drilling of the parts in the target places to facilitate the insertion of assembly hardware or complementary accessories.	
(34) Joining and gluing	Assembly and adhesion of the different pieces with glues to form the different parts of the removable furniture, or the complete piece of furniture.	
(35) Sanding	Friction-based removal of all imperfections produced by machining to make it easier to complete the finishing. It also allows the opening of the pores of wood previously treated with varnishes and paint.	

(36) Finishing	This is intended to highlight the aesthetic qualities of wood, incorporating a suitable tone, touch and brightness permanently.	
(37) Upholstery	This consists of lining, using fabrics of different types of furniture once assembled and finished. There are pieces of furniture that can be upholstered without prior varnishing.	
(38) Webbing	Stapling process of elastic rubber strips to cover the surface of the backrest and the seats in the upholstery. It is used in both chairs and sofas.	

TYPES OF BOARDS TO PRODUCE THE PARTS

<i>Keyword</i>	<i>Description</i>	<i>Image</i>
(39) Hardwood	These woods come from deciduous trees such as oaks or chestnuts. They grow slowly, have thick trunks, little resin, are very resistant and are difficult to work. Hardwoods come in a wide variety of colours.	
(40) Softwood	These woods come from evergreens such as pines or fir trees. They grow quickly, usually have light colours, more marked rings, and a lot of resin. They are usually lighter and easier to work than hardwoods.	
(41) Plywood	Composite wood board formed by different sheets of unrolled wood veneer glued with the fibres transversely one above the other through strong pressure and heat.	
(42) Composite board	Composite board consists of a central layer and a coating layer on both sides. The central layer can be of solid sheets or solid slats, among others, while the lateral ones can be of plywood.	
(43) Particleboard	Composite wood board made of chips from recycled pieces combined with synthetic resin glues and the application of heat and pressure.	
(44) Fibreboard	Composite wood board manufactured from the decomposition of wood into fibres and the combination of these fibres with additional glues and waxes under different temperature and pressure conditions.	

Unit 3.3

Joinery materials

EDUCATIONAL APPROACH			CONTENT	
 Course book	 Additional readings	 External links		 Exercises and games
ASSESSMENT	DURATION	ECVET		
 Quiz (at the end of the module)	1 HOUR	0.04 Credits / 0.2 total of the module		
			Detachable joinery materials 17	



Unit 3.3 Joinery materials

These are components that serve as a link to join, close or turn the different structural elements of the furniture. They can be both glues and hardware.

Fixed joinery materials - without the possibility to disassemble -

The most commonly used joinery materials in this type of joint are adhesives. They are generally applied in relatively small furniture that does not require disassembly for transportation reasons. The advantage is that all assembly is performed at the factory and the disadvantage is the requirement for large cargo volumes that explains why this system is not used for export. The most usual types of adhesives are:

Artificial glues:

- Water-based vinyl glues
- Hot-melt glues (thermoplastic) for high-speed adhesions
 - Polyolefin (PO)
 - Polyurethane and reactive polyurethane glues (PUR)
 - Ethylene-vinyl acetate (EVA)
 - Amorphous poly-alpha-olefins (APAO)
- Urea-formaldehyde glues
- Epoxy resin adhesives

Natural glues:

- Gelatine glues
- Casein glues

Adhesives are classified according to their climate conditions and durability:

- C1: Interiors, wood humidity content < 15%.
- C2: Interiors, short and occasional expositions to liquid water, condensations or high relative air humidity. Wood humidity content <18%.
- C3: Interiors, short and frequent exposure to water. No exposure of external parts to atmospheric conditions.
- C4: Interiors, large and frequent exposures to liquid water or condensations. Exposure of external parts.

The adhesives are generally employed with the following basic woodworking joints:

- Box joint or dovetail joint (solid wood)
- Rabbet joint (solid wood) and groove joint (slot, groove)
- Tongue and groove joint (solid wood)
- Mortise and tenon joint (loose or biscuit)
- Straight or angled joint with dowels (on solid wood and panels). The dowel must be glued over all its grooved cylindrical surface.
- Mitre joint with dowels or biscuit (generally 45° angle, solid wood and panels)
- Foldable mitre joint (folding)
- Joints with **non-detachable spreading connectors (45)** (can also be glued)



Detachable joinery materials

There is a wide variety of traditional and modern hardware, the application of which depends mainly on the availability in the market, the costs and the quality (function and safety) of the furniture. They are mainly used in large pieces of furniture that are assembled in the destination place. They are classified into:

Fixation hardware

Its only function is to maintain a stable union between the different parts of the furniture. It is usually metallic or plastic. Among the most **traditional hardware (46)** we can find nails, pins and different types of screws:

- **Nails (47)**: long and thin iron pieces with a head and a tip (end) used in the fastening of parts.
- **Pins (48)**: small nails used for fine work.
- **Screws (49)**: set of nails with a varied head, provided with a helix thread and a cylindrical section between both parts. There are four types: flat head, round head, tallow drop head and double ended screws.

In recent years, more complex, stable and resistant hardware has been developed. These include:

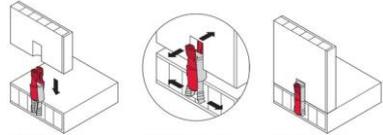
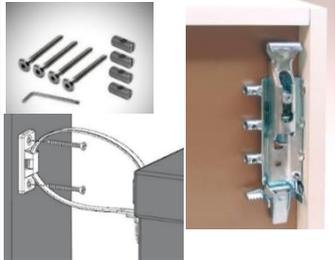
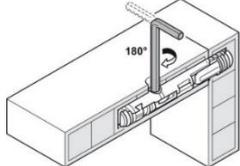
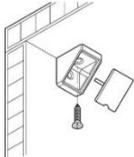
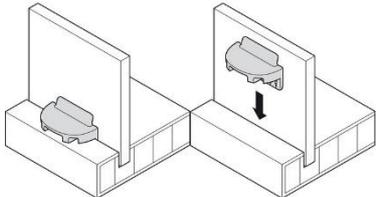
- **Detachable special hardware for mitre joints (50)**.
- Special hardware such as **eccentric cam lock bolts (51)** in different variants.
- Combined joint of dowels and **metal bolt with transverse nut (52)**.
- **Detachable spreading connectors (53)**.
- **Angular union hardware (54)**.
- Hardware for rear panels:
 - **Connectors for guided lateral groove insertion (55)** of rear panels (small furniture).
 - **Connectors for guided frontal groove insertion (56)** of rear panels by drilling.
- Specific hardware for shelves and wardrobes:
 - **Clip connectors (57)** with dowels or screws.
 - **Dovetail groove joint hardware (58)** for invisible assembly.
 - **Plastic boss insert with support (59)** for stable unions.
 - **Supports for glass shelves (60)**.

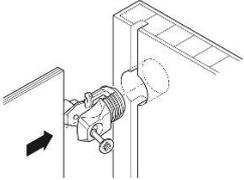
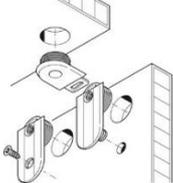
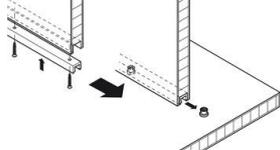
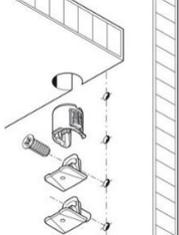
Articulation hardware

Apart from providing fixation, this hardware is also responsible for the movement of the pieces they join. Hinges are articulated hardware made up of different pieces with a common axis that serves to join two surfaces allowing the rotation of both pieces or one piece with respect to the other.

In general, hinges are classified and differentiated according to their degree of opening, their level of visibility and their placement system. We can distinguish among other types between:

- **Flat/butt hinges (61)**: composed of two articulated wings by means of an axis or pin. They are usually used on doors and windows.
- **Pivot hinges (62)**: composed of a blade with a tenon that is supported or inserted into another so that one of them can easily rotate with respect to the other.
- **Concealed hinges (63)**: the most commonly used hinge in all types of furniture. Invisible from the outside, they close themselves from a certain angle, are removable and also adjustable. Also included in this class are **mitre hinges (64)**.

FIXED JOINERY MATERIALS – WITHOUT THE POSSIBILITY TO DISASSEMBLE -		
Keyword	Description	Image
(45) Non-detachable spreading connector	For concealed joints. Non-removable cabinet connectors in small furniture items and drawers. Application: MDF board and chipboard. It can be combined with wooden dowels or glue.	
DETACHABLE JOINERY MATERIALS		
Keyword	Description	Image
(46, 47, 48, 49) Traditional hardware (nails, pins and screws)	Used in simple joints or in fixing more complex support hardware. Made up of nails, tips and screws of different types.	
(50) Detachable special hardware for mitre joints	Reinforces the joint while enabling disassembly if transportation is needed. The biscuit-shaped tongues provide one example.	
(51) Eccentric cam lock bolt	Strong fastening mechanism employed in particleboard furniture that does not require specialised tools, only a screwdriver and an Allen key.	
(52) Metal bolt with transverse nut	Super strength fixing hardware. More secure than conventional screws.	
(53) Detachable spreading screw for cabinets and large furniture. It is inserted by drilling, the pieces are assembled and tightened to expand with a hex key.	Expandable and removable spreading screw for cabinets and large furniture. It is inserted by drilling, the pieces are assembled and tightened to expand with a hex key.	
(54) Angular union hardware	Detachable connector for small bodies. It is placed between the corner of the two panels and fixed with screws.	
(55) Connectors for guided lateral groove insertion	For invisible applications, the assembly is carried out from the back of the furniture. It is inserted into the slot from the side. Simple assembly, no tools or drilling needed in small furniture.	

<p>(56) Connectors for guided frontal groove insertion</p>	<p>They are pre-installed in the hole of the groove and allow the positioning and final assembly of the rear panel to be guided. When screwing the piece in, the rear panel is pushed forward and the piece is adjusted accordingly.</p>	
<p>(57) Clip connectors</p>	<p>Allow joints to be established with high angular stability, required for large and tall bodies such as wardrobes or shelves. Practical and tight assembly.</p>	
<p>(58) Dovetail groove joint hardware</p>	<p>Concealed joint that provides solid reinforcement for each shelf. Stabilizes high and protruding components.</p>	
<p>(59) Plastic boss insert with support</p>	<p>The support is inserted into the side wall and the pieces of furniture are squeezed by hand. The boss insert expands on the shelf and is fixed with the support. Secures the shelf against turning over. No tools are required, but the support can be screwed for a more stable connection.</p>	
<p>(60) Supports for glass shelves</p>	<p>Supports for 3 mm and 5 mm drills with two wedge tabs and inlay pin that ensures that the glass does not slip or 8.</p>	
<p>(61) Flat/butt hinges</p>	<p>The wings are introduced into the chiselled holes of the edges of the furniture and the door. For concealed mounting and doors without rabbet. The axis of rotation is fixed to the two wings.</p>	
<p>(62) Pivot hinges</p>	<p>They allow for the rotation of glass doors or other fragile materials and materials that are difficult to pierce with conventional hinges. They are usually more aesthetically pleasing.</p>	
<p>(63) Concealed hinge</p>	<p>This consists of a cup and a mounting arm. The cup is fixed, embedded in the inner face of the door. Some models can be reinforced with screws.</p>	
<p>(64) Mitre hinge</p>	<p>Subclass of the concealed hinge created specifically for the articulation of mitre doors.</p>	

Unit 3.4

Furniture accessory elements

EDUCATIONAL APPROACH			CONTENT
 Course book	 Additional readings	 External links	
<p>General accessories for furniture doors 21</p> <p>Sliding systems for drawers and shelves 21</p> <p>Equipment for wardrobes and closets 22</p>	<p>ASSESSMENT</p>  Quiz (at the end of the module)	<p>DURATION</p> <p>1 HOUR</p>	<p>ECVET</p> <p>0.04 Credits / 0.2 total of the module</p>



Unit 3.4 Furniture accessory elements

Accessory elements are dispensable components that provide additional functionality to the furniture but are not part of its basic structure because the furniture itself is already functional without them.

General accessories for furniture doors

Regardless of the type of furniture in question, all furniture that has a front covered with a door may be complemented with:

- **Handles (65).** They are grips that are pulled to open furniture doors or drawers. They have a horizontally elongated shape and are often fixed to the doors with two screws, although they can also be embedded.
- **Knobs (66).** The knobs are grips with the same function as the handles, but with the difference that they usually have a more circular shape and are fixed to the door with a single hole.
- **Pressure latches (67).** Assisted opening mechanisms without the need for handles or knobs that are activated under pressure. When tightened, the spring mechanism is activated and the door is opened.
- **Damping system.** They are accessories that are inserted near the door groove to decrease both the physical and acoustic impact of the door during closing. There are two types of shock absorbers:
 - **Air dampers (68).** They consist of an air chamber with a spring mechanism that absorbs the impact of the door and an adapter plate that fixes the chamber near the groove. When the door opens the chamber is filled with air and the spring expands. When the door hits during closing, the spring contracts by gradually expelling the air that had entered the chamber.
 - **Elastic dampers (69).** They are much simpler than air absorbers. They are simply introduced along the groove of the door by drilling, nailing or gluing. When the door hits during closing, the bumpers compress and absorb the impact.
- **Opening limiters (70).** These are accessories that prevent the door from exceeding a certain opening angle. They are useful in hinged doors that have no defined opening limit.
- **Locks and closing systems (71).** Metal mechanisms that are fixed on doors to protect the contents of the furniture and prevent them from being opened without the owner's authorization.

Sliding systems for drawers and shelves

The sliding systems are complementary fittings that facilitate opening drawers, provide mobility to shelves, absorb their weight and their content and increase the value of the furniture. They can allow the drawer to be extracted partially or completely and, depending on the model, some systems have an integrated self-closing mechanism.

- **Drawer slides:**
 - **Ball bearing runners (72).** Formed by steel or plastic ball bearings and a retainer that firmly holds them so that it allows relative movement between the two parts of the guide.
 - **Guide rails (73).** They are usually plastic surfaces composed of two parts, one fixed to the sides of the drawer and the other to the furniture, which are interconnected by grooves that act as rails without balls or rollers.

- **Roller runners (74).** Movement rails where the responsible elements are rollers. The type of rollers varies from friction bearing mounted polyamide rollers to ball bearing mounted polyamide rollers, ball bearing mounted polyamide-coated steel rollers and silent moving rollers.
- **Concealed undermount runners (75).** Invisible to the naked eye. They increase the aesthetic appeal of the furniture. They are placed superimposed on the drawer, the guide below the bottom and on the sides of the drawer. It binds the sides of the furniture.
- Shelf slides:
 - **Shelf ball bearing runners (76).** They are ball bearing guides with special fastening mechanisms to join under the top of the furniture so the rails are suspended. The shelves are placed on top of special supports that keep them subject and stable.
 - **Shelf roller runners (77).** These are placed on the sides. The mechanism is roller-based.

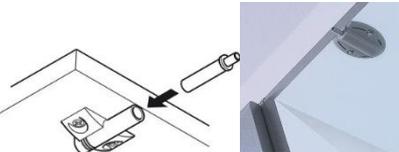
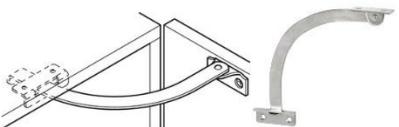
Equipment for wardrobes and closets

Both the wardrobes and the cabinets have additional accessories to restructure the internal space of the furniture and increase the level of use. Within the different accessories we can find:

Hangers

They are all the accessories that allow clothes to be hanged to keep them wrinkle-free or to avoid them touching the floor of the closet. Hangers can have a fixed assembly or be removable. There are different types of hangers:

- **Fixed bars (78).** This is the simplest type of hanger. It consists of a bar that is generally made of hollow profiles of plastic or light metals such as aluminium and that is fixed to the side walls of the cabinet by means of special adapters. In turn, these adapters are fixed by screws.
- **Articulated bars (79).** More complex than fixed bars. They consist of two lateral arms attached to joints that are anchored in the side panels of the closet by means of screws and a central bar responsible for supporting the weight of the hanging clothes. A traction rod is what allows the bar to move in an articulate form.
- **Removable bars (80).** They are bars with the capacity to move through lateral guides that are anchored to the closet. They have a more limited movement than the articulated bars since they only move along a single plane. However, they can be folded to occupy less space.
- **Racks (81).** Racks are hangers similar to the bars that are screwed under the shelves or the top of the piece of furniture. A rack consists of a guide rail that controls the horizontal movement of the hanger in case it obstructs the path when other garments are searched.
- **Tie racks (82).** These are a special type of rack to hang ties. They consist of a horizontal support from which different teeth protrude and are screwed to the side of the cabinet.
- **Belt racks (83).** Hangers similar to tie racks but intended for belt buckles. They operate according to the same principle of horizontal support but with fewer teeth and greater separation between them.

GENERAL ACCESSORIES FOR FURNITURE DOORS		
Keyword	Description	Image
(65) Handle	Grip with horizontally elongated shape. It is often fixed to the doors with two screws. They can be embedded.	
(66) Knob	Grip with a more circular shape than the handles. It is fixed with a single screw.	
(67) Pressure latch	For assisted opening without handles or knobs. It is activated by pressure. It can have a magnetic or rubber tip.	
(68) Air damper	Mechanism that has a chamber with air that dampens the recoil produced by the impact of the door during closing.	
(69) Elastic dampers	Solid dampers that are introduced by drilling, nailing or gluing in the grooves of the door.	
(70) Opening limiters	These are accessories that prevent the door from exceeding a certain opening angle.	
(71) Locks and closing systems	Metal mechanisms that are fixed on doors to protect the contents of the furniture and prevent opening without the owner's authorisation..	
SLIDING RAILS FOR DRAWERS AND SHELVES		
Keyword	Description	Image
(72) Ball bearing runners	Rails formed by steel or plastic ball bearings and a retainer that holds and guides them in a way that allows relative movement between the two members of the guide.	
(73) Guide rails	Plastic surfaces composed of two parts, one fixed to the sides of the drawer and the other to the furniture, which are interconnected by grooves that act as rails without balls or rollers.	

(74) Roller runners	Sliding rails where the elements responsible for the movement are the rollers.	
(75) Concealed undermount runners	They are invisible to the naked eye. Increase the aesthetic appeal of the furniture. They are placed superimposed on the drawer, the guide below the bottom and on the sides of the drawer.	
(76) Shelf ball bearing runners	Rails with special fastening mechanisms to join by suspension under the ceiling of the furniture.	
(77) Shelf roller runners	The same mechanism as above but they are placed on the sides and use rollers to move the rails.	

EQUIPMENT FOR WARDROBES AND CLOSETS

<i>Keyword</i>	<i>Description</i>	<i>Image</i>
(78) Fixed bar	The simplest type of hanger. It is fixed to the side panels by special supports.	
(79) Articulated bar	Composed of two lateral arms and the central bar. A traction rod allows for the position of the bar to move. It is screwed on the side boards.	
(80) Removable bar	A bar moves along guides anchored to the side walls of the closet. Movement along one plane.	
(81) Rack	The rack is screwed under the shelves or furniture top. It presents a guide that controls the movement along the rail.	
(82) Tie rack	Special rack for hanging ties consisting of a support from which different teeth protrude. It can be fixed or removable.	
(83) Belt rack	Same structure as the tie rack, but with a greater separation between the teeth. It can be fixed or removable.	



Unit 3.5

Mounting and assembly techniques

EDUCATIONAL APPROACH			CONTENT	
 Course book	 Additional readings	 External links	 Exercises and games	Flat joints 26
ASSESSMENT  Quiz (at the end of the module)			DURATION 1 HOUR	ECVET 0.04 Credits / 0.2 total of the module
				Corner joints 27 Frame corner joints 27 Lengthwise joints 27 Stretcher joints 27



Unit 3.5 Mounting and assembly techniques

A joint is the combination of the geometry of the parts to be assembled and the means employed (glue and/or hardware). They can be fixed or detachable, depending on the joint material. The woodwork, dilatation and contraction, must be considered in all joints.

Flat joints

Flat joints without glue

Flat joints are typically used in flat wide surfaces of solid wood exposed to high humidity variations. Their function is to bind separated worked boards in an unnoticeable manner and to avoid deformations by not cutting very wide.

- **Half wood joint (84).** Each board has alternated rabbets of equal dimension and half board thickness with depth according to preferences. Uses: simple coatings and roof and floor covering.
- **Tongue and groove joint (85).** Union of the edge from one board that has a tongue with the edge of the other one that has a groove. More solid than the half wood joint. Uses: walls and roofs coating, covering of floorboards, among others. In wood used for flooring, the groove is off centred to provide greater thickness to the erosion face.
- **False tongue and groove joint (86).** A groove is made in the edges of the boards and they are joined with a tongue that consists of a piece of plywood or fibreboard. Uses: the same as the tongue and groove joint.
- **Overlapped joint (87).** Union of the distinct boards grooved by both edges, so that the upper wing of the groove perfectly binds to the groove of the other and with the lower wing of the same. Uses: covering of housing and garage boards.

Flat joints with glue

These are based on flat surfaces prepared so that the joints are not noticeable after gluing, always paying attention to the direction of the contraction and the woodwork.

- **Edge to edge butt joint (88).** This joint consists of joining the edge of a board with the edge of the other. Generally, the boards are coupled and glued without smoothing down to latter flatten out in surface and equalize in thickness. Uses: wall sections of furniture and doors, other fillers and solid wood bodies.
- **Crown joint (89).** It is a joint between the edges of boards, where the surface to be glued is increased through zigzag milling. Uses: prepared boards, slaughterhouses and bakeries.
- **Dowel joint (90).** Union with wooden dowels to achieve an elevate fixation. The dowels are from 2 mm to 3 mm shorter than the drilled depth to absorb the excess glue.
- False glued tongue and groove joint.

Fastening of glued solid wood boards

- Dado joint with dovetail
- End strips



Corner joints

These joints are used to make furniture bodies. Wide solid wood boards, plywood boards or fibreboards are bound by the ends.

- **Nailed joint (91)**. If a rabbet is made in the joint, it is considered a nailed tongue and groove joint.
- **Tongue and groove joint (92)**. Appropriate joint for external edges in solid wood products and prepared boards, not fibreboard.
- **Rabbet joint and groove joint (93)**. Used in solid wood boards bound in T shape. The tongue is always milled in the part that goes through and the groove/rabbet is opened in the piece with which it abuts.
- **Dowel joint (94)**. There are two different types: butt dowels and mitre dowels (straight or angular).
- **Finger joint (95)**. This consists of multiple teeth or tenons fitted together with others. Allows for the contraction and swelling of bound pieces, but it does not prevent them from warping. There are different types of fingers: simple, semi-hidden, mitre dovetail, machined, straight tongue and groove, and **mortise and tenon (96)**.
- Joints with detachable hardware.

Frame corner joints

Frames are generally the elements of support or reinforcement of constructions. Joints must avoid deformations from appearing. There are different types of assemblies:

- **Half wood joints (97)**
- **Mortise and tenon (98)**
- Chiselled joints
- Tongue, false tongue or dowels

Lengthwise joints

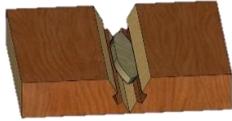
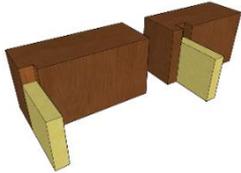
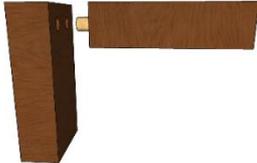
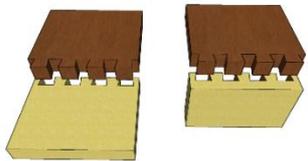
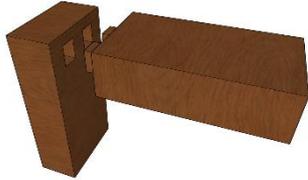
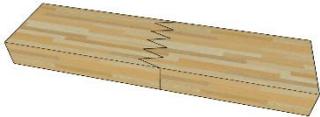
Lengthwise joints (99) allow the wood to be position in the direction of the grain. It can be done with half wood, tongue and groove, with false tongue, with layered gluing or with dovetails.

Stretcher joints

These joints serve to join feet or supports with fences or crosspieces. The joints of chiselled crosspieces and crosspieces with dowels are appropriate for this type.



FLAT JOINTS		
Keyword	Description	Image
(84) Half wood joint	The simplest joint. It consists of connecting rabbeted tables in an alternative form. Profiling can be made to emphasize the joint.	
(85) Tongue and groove joint	Solid joint, between a board with a tongue and another with a groove. Tongue thickness and groove width: $\frac{1}{3}$ board thickness. Groove Depth: $\frac{1}{2}$ board thickness or $1\frac{1}{2}$ tongue thickness.	
(86) False tongue and groove joint	This avoids the loss of material in the board width as the two edges of each board are rabbeted and the tongue is made apart. Tongue width: between 1 and $\frac{1}{4}$ the width of the board. Thickness: $\frac{1}{3}$ board width.	
(87) Overlapped joint	Joint type where the union is alternate by rabbets.	
(88) Edge to edge butt joint	The edge from one board is glued to the edge of the other. The angles must be squared for a proper joint. The assembly is executed with a plane by hand or with a machine.	
(89) Crown joint	Employed in joints that require high resistance. The large gluing surface helps to secure cohesion.	
(90) Dowel joint	Higher fixation. Drilling must be done correctly. Length: double of wood thickness. Diameter: $\frac{2}{5}$ to $\frac{3}{5}$ of the thickness.	
CORNER JOINTS		
Keyword	Description	Image
(91) Nailed joint	Simple assembly. The nails do not hold as good in the end side and corner strips must be provided to reinforce the joint or the protruding nail tip must be pounded again.	

(92) Tongue and groove joint	Similar to the dowel joint, this joint increases the assembly resistance.	
(93) Rabbet joint and groove joint	Rabbet: recess cut into the edge of a piece of material, usually wood. Groove: slot or trench cut into a part that runs parallel to the grain, as opposed to the rabbet, the groove is not present in the edges of the piece. Dado: when the groove runs perpendicular to the wood grain.	
(94) Dowel joint	Joinery technique to reinforce an assembly and increase its resistance.	
(95) Finger joint	Joinery technique where a series of 'pins' cut to extend from the end of one board interlock with a series of 'tails' cut into the end of another board.	
(96) Finger joint (mortise and tenon)	Joinery technique between two different components where the tenon, formed on the end of a part generally referred to as a rail, fits into the mortise, a square or rectangular hole cut into the other, corresponding part.	
FRAME CORNER JOINTS		
<i>Keyword</i>	<i>Description</i>	<i>Image</i>
(97) Half wood joints	The simplest joint for frame corners and the one that lasts the least. It must be glued or reinforced with nails.	
(98) Mortise and tenon	The most suitable joint for manufacturing furniture and windows. It may be with squared tenon (image), one-side mitre or two-side mitre.	
LENGTHWISE JOINTS		
<i>Keyword</i>	<i>Description</i>	<i>Image</i>
(99) Lengthwise joints	Dowel joint combined with the fingers of the gluing areas.	

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