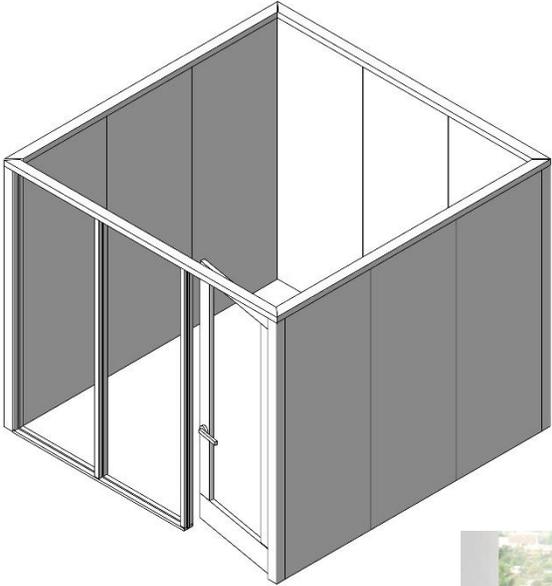
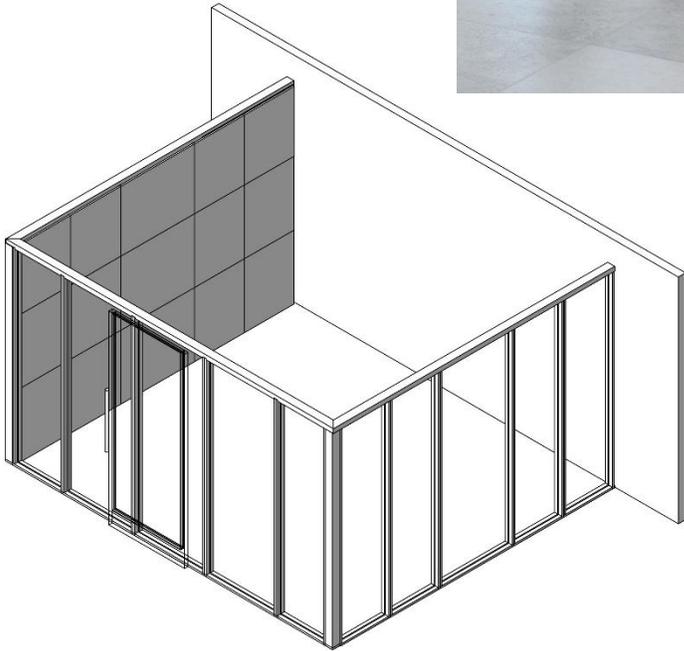


1208



Floor to Ceiling Wall System Construction



Carpenters Training Committee for Northern California (CTCNC)

OFFICE MODULAR SYSTEMS INSTALLER

APPRENTICESHIP PROGRAM

Course of Instruction

Year	Class#	Class Title (All classes 36 hours - Four (4) Days - 7:00am - 4:30pm)
1	1201	Orientation to Health and Safety
	1202	Introduction to Office Modular Systems Installation
	1203	Tool and Equipment Applications
	1204	Print Reading – Measurement and Layout
2	1205	Modular System Construction and Quality Control I
	1206	Modular System Construction and Quality Control II
	1207	Drapery & Window Coverings, Fine Furnishings
	1208	Floor to Ceiling Wall System Construction

CARPENTERS TRAINING COMMITTEE

FOR NORTHERN CALIFORNIA

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Sexual harassment in any form or degree by an employee or apprentice against another individual, regardless of their relationship or respective status, is strictly against the policy of the Carpenters Training Committee for Northern California and will not be tolerated. Any such action or activity shall be reported immediately to the person in charge of the training facility. The matter will be promptly investigated and appropriate action will be taken. Copies of all complaints and actions are to be forwarded to the Assistant Director of Field Operations.

Apprentices shall not use lewd and vulgar language while they are on the premises of the Carpenter's Training Center. Any such action shall be reported immediately to the person in charge of the training facility. The matter will be promptly investigated and appropriate action will be taken.

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COURSE OBJECTIVES

At the completion of this course, the apprentice will be skilled in the techniques and procedures needed to layout and build a three-sided wall system and a freestanding four-sided wall system. In addition, the apprentice will become familiar with the many accessory items that fall in the modular category. The student will also be able to correctly assemble and place a benching system. Finally, the learner will demonstrate the ability to scribe and field cut worktops and apply edging.

SPECIFIC OBJECTIVES

Upon the completion of this unit, the student will be able to:

1. Safely cut metal using the miter saw and a non-ferrous blade.
2. Accurately layout and build a 3-sided DIRT wall system.
3. Correctly install a door in a DIRT wall system.
4. Disassemble a DIRT brand system mock-up.
5. Identify the basic components of a typical benching system.
6. Given a plan and the parts, assemble a benching system.
7. Use the plans to build a 4-sided wall system by Haworth.
8. Stabilize the freestanding wall system.
9. Correctly install a door in the Haworth wall system.
10. Disassemble a Haworth brand system mock-up.
11. Safely lift and transport glass using suction cups.
12. Assemble a height adjustable table.
13. Identify the following accessories: task lighting, keyboard trays monitor arms, headwalls, nurse station and ancillary furniture.
14. Explain the numbers in a thread designation for tapping and drilling.
15. Crosscut a sheet of 1" Melamine and apply edging to one at least one side.
16. Explain how a conference table is joined together.
17. Scribe a top around a column.
18. Successfully drill and tap holes in a piece of 1/4" metal

MODULAR APPRENTICE TOOL LIST

Minimum tools required for a Modular Installer should include:

1. Hard Hat
2. Safety Glasses
3. Work Boots
4. Safety Vest
5. 25' Tape Measure
6. Carpenter Bags or Cloth Apron
7. Tool box or Bag
8. Dead Blow/Rubber Mallet
9. Wonder Bar
10. Socket Set- Up to 3/4" Sockets
11. Adjustable Wrench
12. Set of Straight and Phillips Screwdrivers
13. Set of Wrenches
14. Bits---P1, P2 ,P3 Straight Slot and Phillips Head Bits
15. Robertson Square Bit
16. Magnetic Bit Holder
17. Hex Drive Magnetic Bits—1/4", 5/16", 3/8" and 1/2"
18. Utility Knife
19. Electric Meter Tester
20. Hack Saw
21. 9" Torpedo Level (Magnetic Preferred)
22. Chalk box and chalk

1208 FLOOR TO CEILING WALL SYSTEM CONSTRUCTION

PRE-TEST

Instructions: In the following true/false questions circle the correct answers.

1. T F When cutting worksurfaces, cut from the underside of the top.
2. T F Height adjustable tables do not work with benching.
3. T F An installer who can do a wood furniture repair is a valuable asset to the employer.
4. T F Lounge chairs, sofas, side chairs and end tables are types of ancillary furniture.
5. T F A cutting fluid that is used with a tap, sharpens the tool.
6. T F When working with burn-in material, heat the knife so that the liquid resin bubbles.
7. T F When installing a CPU holder, make sure that there is room to swivel.
8. T F The Enclose wall system is manufactured by Haworth.
9. T F Hospital nurse stations must be securely attached to the floor.
10. T F An open office plan provides more privacy than a cubicle plan.
11. T F Task lighting is for doing things such as reading and keyboarding.
12. T F On the plans, an elevation view looks directly down on an object.
13. T F Many times it is necessary to scribe a worksurface around a column.
14. T F When tapping metal, the tapped hole should be 60% of full thread.
15. T F When using the burn-in knife clean off excess material.
16. T F Standing work stations are commonly set at 44" above the floor.
17. T F A permanent marker that contains a stain/polish mixture is a touch-up marker.
18. T F All burn-in knives run on lighter fluid.
19. T F When drilling into metal, a low drill speed works best.
20. T F Each tap size has a corresponding drill bit.

MODULAR INSTALLER GRADING AND EVALUATION

Grading

A uniform weighing system will be used as follows:

1. Class Participation and Attitude 10%
2. All Tests Except Final Exam 10%
3. Hands On Lessons..... 60%
4. Final Exam 20%

Assignment Of Grades Will Be As Follows:

A 92 – 100%

D 67 – 69%

B 80 – 91%

F Less than 67%

C. 70 -79%

Criteria for Evaluation

1. Completion of assignments
2. Accuracy
3. Participation
4. Following instructions

1208

FLOOR TO CEILING
CONSTRUCTION

Carpenters Training
Committee for Northern
California

Chapter 1 Introduction to Floor to Ceiling Construction

In unit 1206 we built two examples of floor to ceiling wall systems. In this unit we will build an additional two wall systems; a DIRTT wall system comprised of three walls, and an Enclose wall system, by Haworth, which will include four walls. We will review some of the basics of wall systems construction.

Advantages of floor to ceiling over systems furniture:

- ❖ Privacy
 1. Acoustical privacy
 2. Physical privacy—many times they can be locked
 3. Visual privacy—they can have solid walls that block others from viewing, although many have glass panels
- ❖ Large variety of finishes including textures and colors
- ❖ Can incorporate many technological elements such as built-power and communications ports. Many wall systems will work with various audio-visual components such as monitors, tv screens and sound systems
- ❖ Wall system can create a visual impact by blending of styles, colors, shapes and textures
- ❖ Wall systems offer a lot of flexibility in design and configuration—the walls can be changed or reconfigured to meet the needs of the company

Wall installation varies from cubicle and benching installation in many ways. These include:

- ❖ Layout is precise, the walls have to go where specified
- ❖ The walls are structural and need to be attached to the structure of the building
- ❖ The wall materials are generally heavier than cubicle components
- ❖ The height of the walls means that they will be installed off of ladders or scaffolding
- ❖ Wall systems use more glass than cubicles
- ❖ Wall installation frequently includes the setting of doors

Chapter 1

Keeping these points in mind, the next two following sections cover each of the two wall products in detail and there is a sheet of questions for each. After this is complete, we will begin building each mockup.

Chapter 2 Accessories

Besides installing cubicles and wall systems, the installer will also be responsible for accessory items such as keyboard trays, monitor arms and CPU holders. These items are all related to ergonomics, which is making the workstation compatible with the worker. With the advent of the computer in the workplace, millions of workers have suffered from injuries sustained by having a workstation that is not suited to their needs. As we learned in an earlier class, a good task chair with proper ergonomic options is a major component of worker comfort. These other accessories are also used to make the workstation fit the worker.

CPU Holders

The Central Processing Unit is the brains of the computer. To keep the unit from taking space on the worksurface, the unit is often stored under the worksurface. There are many different types of holders, but they all basically work the same. They are generally on a track that allows the unit to be accessible for cords, and also allows for maintenance. The key to the installation is to make the unit as unobtrusive as possible, workers do not want to be banging their knees on the unit. Shown here is a typical holder.

Notice that the unit swivels to allow for the unit to be worked on by the IT people. This means that the holder needs to be positioned so there is room for it to swivel. Generally, install the unit as far back under the worksurface as possible to keep it out of the way of the worker.

The holder needs to be located close enough to the keyboard to assure that any connections will be able to reach the keyboard and the mouse.



Keyboard Trays

Keyboard trays are mounted under the worksurface to allow for the worker to have the keyboard at a comfortable height. Keyboard trays are used to prevent carpal tunnel by having the wrists at an angle that is neutral, not bent high or low and not twisted out to the side. Having a keyboard on top of the worksurface may cause the worker to have to reach, thereby putting stress on the wrists, the arms and the shoulders. There are numerous styles and types of keyboard trays available, but all mount the same way.

When preparing to install a tray, you will have the track, the mechanism, the tray and the mouse platform. Here is a typical tray install.

Hardware included:
Check the contents of the box to make sure you have every part needed to assemble the Uplift Keyboard Tray.

Tools needed:
- Phillips Head Screwdriver
- 3/8" wrench

Step One - Mount track to the desktop
This is most easily done with your desktop upside down. Choose the longest of the two tracks (either 11" or 21") that will fit under your worksurface, and place it in position. Leave about 1/2" from the front edge of the desk. If there are pre-drilled holes in your desktop, line the track up with the holes, or you can pre-drill your own 1/8" pilot holes.
- Attach track to the desktop using eight 5/8" screws.
- Install the rear bumper using one 5/8" screw.

Step Two - Install mechanism onto the track
With the desk right side up, line up the mechanism with the grooves on the track and slide it in.
Please note: the mechanism will not adjust up or down until the tray has been attached and the shipping pin is removed (see steps three and four)

Step Three - Mount tray to the mechanism
Attach the tray to the mechanism by lining up the integrated screws on the bottom of the tray with the holes on the mechanism, and secure by screwing the 4 acorn nuts in to the underside of the tray.

Step Four - Remove the shipping pin
Lift up on the front of the tray & lower the back to relieve pressure on the shipping pin and remove it.

Step Five - Attach front bumper
Finally, lower the tray, slide it back on the track and install the front bumper.

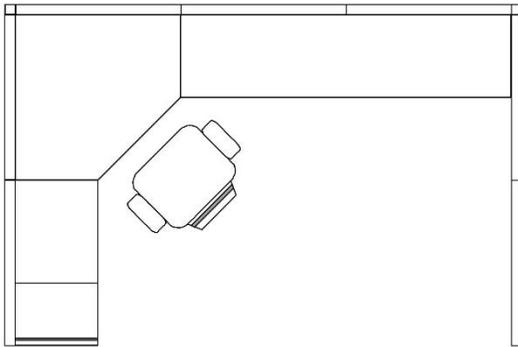
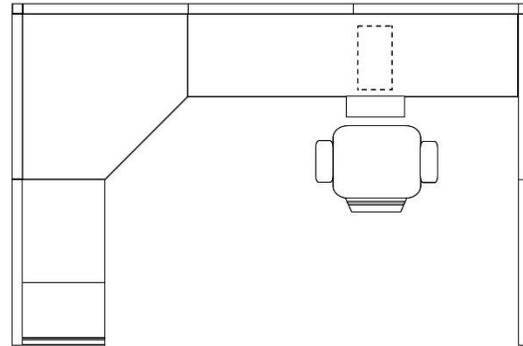
Step Six - Add accessories
- Slide the foam palm support onto the front of the tray.
- Slide the mouse platform to desired side & place the mousepad and cord catcher to the platform.
- Optional, non-slip pads can be placed in any position on the board

To adjust the tilt of the tray, turn the knob at the center of the tray.

To adjust the height of the tray up and down, push down on the back of the tray while lifting the front.

If it is possible, mounting the track on the worksurface prior to installing the worksurface will be easier than having to work from underneath once it is installed. Generally, the tray will be installed in the middle of the worksurface. The component plan will usually show where the keyboard tray will go, however, that is not always the case.

Here is a component plan that shows where the keyboard tray will go.

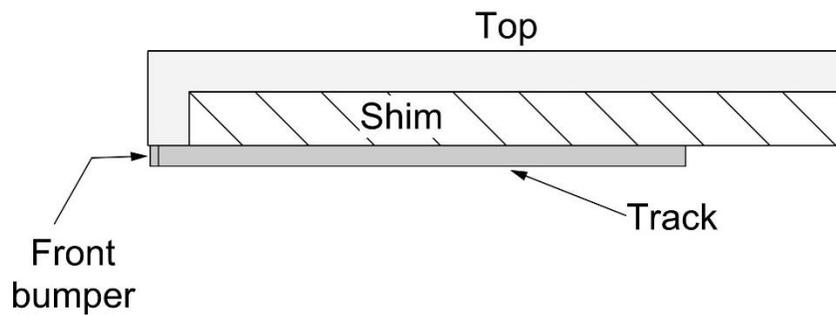


In this example, the tray is not shown on the component plan. However, the designer shows the chair where the worker will be working, so that tells the installer to put the keyboard tray there.

There are two stops or bumpers. The back stop keeps the keyboard from falling off the track. The front bumper is usually a finish piece that stops the tray from falling on the floor. The front bumper screws up into the worksurface.

There is a mousepad that mounts onto the tray, it can be set for left-handers or right-handers. However, since the end user is not usually there at the time of installation, the installer usually puts it on the right side and the end user can change it if necessary.

Sometimes the worksurface of the desk top will have a front edge that is deeper than the rest of the top. When installing a keyboard tray on this type of top, it will be necessary to shim under the top keep the track level with the bottom edge of the lip.



The shim should be wider than the track so that there is room to attach the shim to the underside of the top and also be able to attach the track to the shim. Care must be taken when attaching the shim to the top so that the screws do not project through the top.

Once the track is installed, slide the mechanism into the track, set your bumpers and then attach the tray with the screws provided. The tray can be adjusted up and down, side to side and tilted, but the installer usually does not adjust the tray because that is a matter of personal preference for the user.

A variation of the keyboard tray is the corner sleeve. This is used when there is a 90° corner between two worksurfaces. The corner sleeve is installed in the corner, but the tray is set at a diagonal. As shown here, the sleeve slips over the worksurface and is screwed to the underside of the top. Then the tray is set as it would be if it was a straight installation.



Many people like the keyboard trays, however, others find them cumbersome. Tall people, for instance, may bang their knees on them and some women complain that trays ruin their stockings or their clothes.

Pencil drawer

Many cubicles are short on storage space, so sometimes a pencil drawer is installed. A pencil drawer is simply a shallow drawer around two inches deep that is used for small items that would not be practical in an overhead storage or a pedestal. The pencil drawer installs very similarly to the keyboard tray, it has a track that attaches to the underside of the worksurface. Pencil drawers are usually shown on the component plan. There may be a conflict where there is not enough room for a pencil drawer and a keyboard tray on the same run. In that case, the client or the project manager would get together to decide which would prevail.

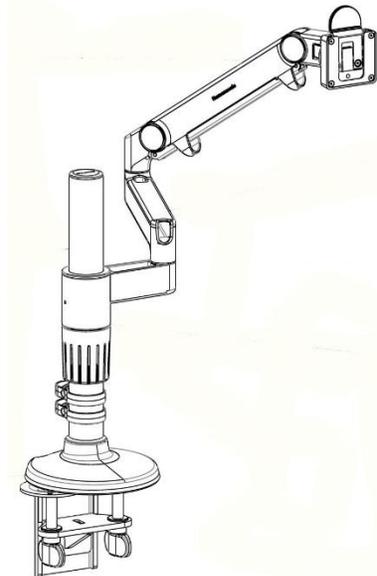


Monitor arms

Another element of the workstation set up is the monitor arm. This is an additional part of making the workstation ergonomically friendly. The monitor arm allows for the monitor to be placed in the right spot for the users comfort. The monitor should be directly in front of the user, no more than 35° off in either direction. In addition, the monitor should set slightly below eye level with the screen tilted slightly upward. An advantage of a monitor arm is that it frees up desk space and helps with cord management.

There are many brands of monitor arms, but they all mount similarly. There are several methods for installing a monitor arm, one of which is a clamp mount, which is the most common installation. This mount simply clamps onto the edge of the worktop, then it is tightened and screws are inserted. This means that the top must be held away from the panels to allow for the bracket and the cord. Another type of mount is to fasten the base directly to the top. This is not as stable as other mountings and is not used much.

Another frequently used installation is to drill a grommet hole in the worksurface and then insert the arm in the opening. The location of the hole is important, there is no room for a mistake. The plans may show the exact location of the arm, but if it doesn't, the project manager or the end user should decide where it goes. Use a hole saw drill that is sharp. Drilling into worktops will dull a hole saw quickly. When drilling the grommet, a roll of two inch tape can be placed around the hole saw to keep the sawdust and debris from scattering and making a mess. The mounting bracket is placed in the hole, and a bottom plate is added. Next, the pole is inserted and the assembly is screwed in place.

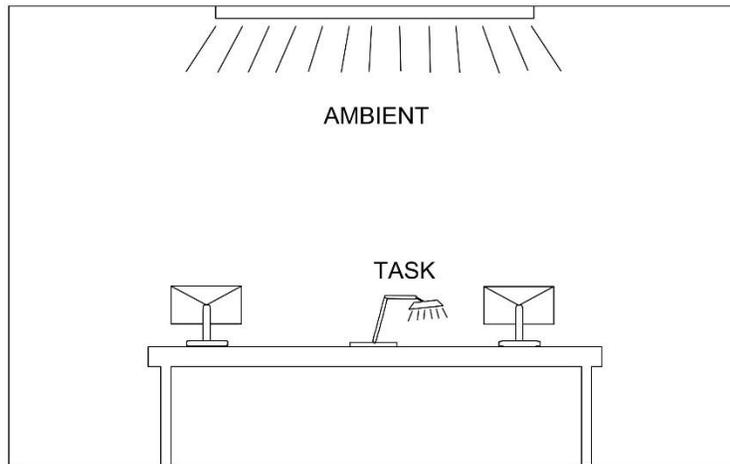


Some of the monitor arms are wall mounted. If the workstation is against a solid wall, then it needs to be fastened to studs, or with toggles that are strong enough to support the load. Many times the arm is located in a cubicle wall, and in this case it usually fastens to a slat wall as shown here.



Task Lighting

People need good light to work effectively. One kind of lighting is natural light, which enhances psychological well-being. However it is not practical for most large spaces to be lit by natural light. Besides natural lighting, there is ambient lighting, also known as general lighting, which radiates a comfortable level of brightness without glare and allows you to see and walk about safely. Task lighting is for more concentrated tasks such as reading and keyboarding.



There are a various task lights that are used with modular systems. The most common is a simple light that mount underneath a shelf or an overhead storage bin.



These lights are usually screwed up into the shelf or bin and have a cord that plugs into an outlet. When there are a series of lights, the lights are daisy chained together, meaning that one connects to the other and so forth, so that they all operate from the same switch.

Another type of task lighting is personal or desk lighting. Some of these are just lamps that are left on the worksurface for the user to place where they choose, others are mounted to the worksurface or to the wall. Each modular manufacturer has a line of task lighting that is part of their modular line of products. Shown here is are several task lights from Steelcase.



Many of the task lights can be mounted in several different ways; to the worksurface, clamped to the edge of the worksurface, mounted to a slat wall, or as mentioned before, freestanding. Another model shown is a type of unobtrusive light that works on a desk or benching.



Task lighting is a part of most installations, so the installer must have a basic knowledge of the lights and their mounting.

Other Modular Related Products

As the modern office changes, there are new products that being introduced to the workplace. One of these products is the phone pod or phone booth. The phone booth is a privacy room that can be used by one or more persons to make a phone call or video conference in privacy.

Chapter 2

This is a direct result of the move to benching as the common workstation; the open plan does not provide much privacy. In a study, about 50 percent of employees in open offices say the lack of sound privacy is the most frustrating aspect of their work environment.



Some of these phone booths are assembled piece by piece on the job, others come in sections that are then assembled in place and others come as a completed unit. Some types of these booths are put together with panels, similar to modular installation. Whatever the system, the installer can use their knowledge and skill to figure out how the product gets installed.

Another area that the modular installer may encounter is a hospital headwall. A headwall is essentially a wall that is behind the patient's bed. The wall will contain many types of outlets such as power, water and gas. The headwall may be panels that cover the entire wall or it may be a horizontal unit installed above the bed. Shown below are types of headwalls.



The headwall is a more efficient way to build a wall that contains a variety of connections for electrical, plumbing and gas. The headwalls come preplumbed and prewired and in a large range of finishes, materials and looks. Installation of the headwalls is a finished product, so the installer should take steps to protect the product.

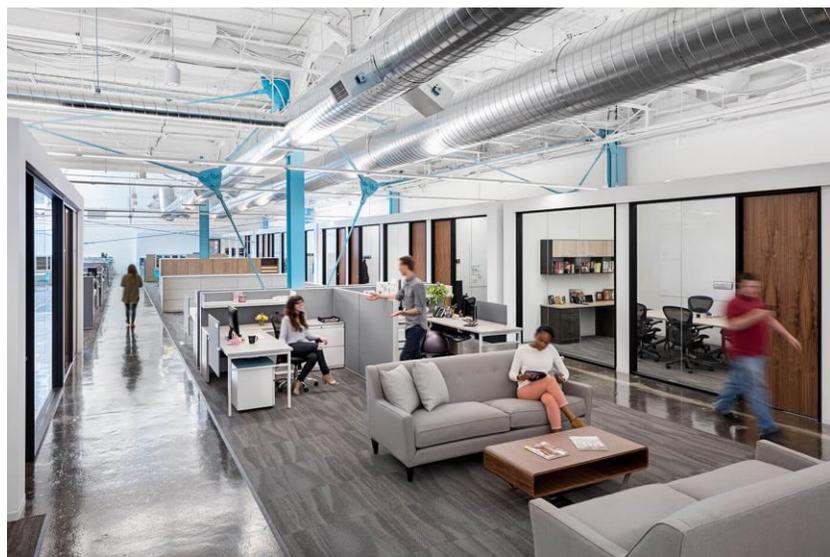
An additional hospital product to be installed is the nurse station. Many of the modular companies like Herman Miller and others, have a line of nurse stations. The station will often come with the capability to include many different types of electronic devices and they can be designed to fit all kinds of configurations. The



installation of these station requires that, unlike cubicle walls, these need to be securely fastened to the floor. Otherwise, the installation is similar to other modular systems.

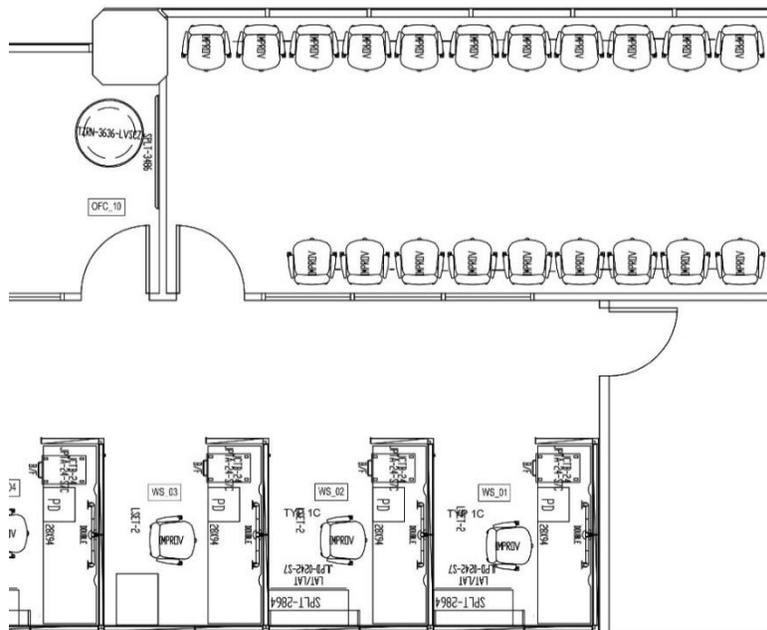
Ancillary furniture is one more area of work encountered by the installer. Ancillary furniture is a range of products that furnish an organization's less-formal settings and support a range of postures. This is furniture for office lounges, in-between spaces, enclaves, conference rooms, patios, work cafés and other collaborative spaces—areas that don't represent workers' primary work settings but that are becoming increasingly vital in contemporary work life. Examples of ancillary office furniture include lounge chairs, stools, benches, sofas, side chairs, end tables, coffee tables and bistro tables.

There may be some assembly needed for much of the ancillary, such as desks and tables. Since they are finished products, the installer must be very careful to avoid marring or damaging the furniture.





Shown above is a type of gang seating that is common in office waiting rooms and in airports. Again, some of these types of gang seating will need to be assembled. These should be placed according to the floor plan, as seen below. Make sure the seating is stable.



There are other types of seating that you may be asked to install, such as jury box seating and auditorium seating.



Conference tables are found in conference rooms (duh) and occasionally huddle rooms, which is essentially a smaller conference room. Conference tables run from the simple to the complex. The tables usually come with the base and top separate and they need to be joined. Larger tables may have more than one base that are connected together with the use of stretcher bars, which also add support to the top between the bases.

Depending on size of the table, the top may be in more than one piece. Tables over 8' are sometimes in two pieces and tables over 12' may come in three or more pieces. The size of the conference tables means that they usually won't fit in the elevator; they need to be hand carried up the stairs, a challenging task because the tops are often heavy and awkward. If the top is in pieces, it is necessary to tie them together. This could be through the use of a flat strap like the mending bracket, or tie plate used in cubicles. More often, the pieces are joined through the use of draw bolts. Draw bolts are a type of bolt that pull the two pieces together. The underside of the top is routed out to receive the bolt. Shown here are several types of draw bolts.

Many times the table must be accurately placed over an electrical floor core. There may be cutouts needed in the top for power boxes that house not only the power, but also data ports and audio visual ports. Other inserts include microphones in the top. Half of the time the top will have the cutouts completed, however, many times the installer will need to do the cut out themselves. Conference tables can run in the thousands, so any cutouts must be done with precision and care, particularly making sure the layout is in the correct place. Sometimes the layout will show on the plans, other times the location is decided by the people doing the tech work. Once the table is complete, its condition should be confirmed by a representative of the contractor or the owner. In some cases, it might be necessary to cover the table with blankets or paper to protect the product from damage from the other trades.



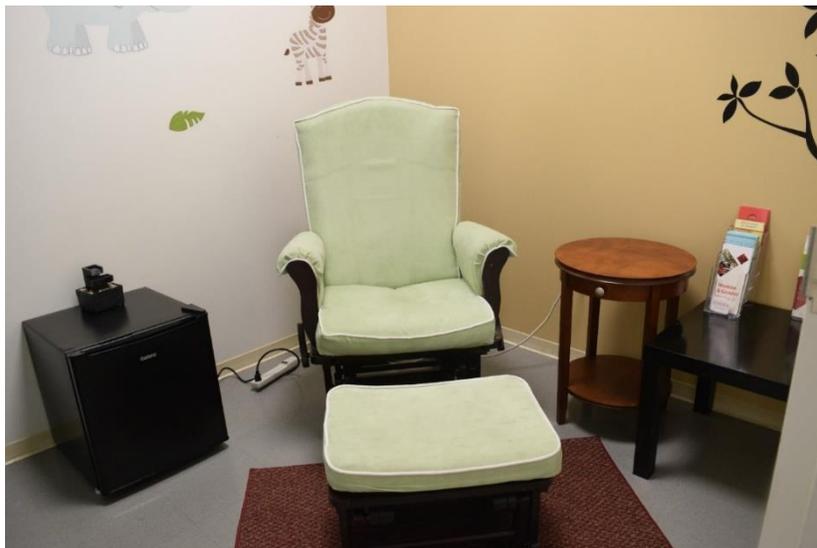


This is important because other trades may be tempted to use the table as a workstation, or perhaps even stand on it.

Again, these conference tables are heavy and expensive, so the handling and assembly of the table should be done carefully, without damage to the product.

Mothers are the fastest-growing segment of the U.S. labor force. Approximately 70% of employed mothers with children younger than 3 years old, work full time. Because of this, the Fair Labor Standards Act requires employers with 50 employees or more to provide a private space for nursing mothers. Lactation rooms provide that private space.

Lactation rooms provide breastfeeding mothers with a private space to pump or nurse. In general, the room will include a table, cleaning supplies, a sink, a refrigerator and a comfortable chair. The room pictured here is a typical arrangement, it does not require a lot of set up.



Recently, living walls have become popular in some workspaces. A living wall is a vertical wall of plants that is used indoors or outdoors. The use of such walls indoors helps the indoor air quality, actually removing VOCs from the air. There are many variations of these walls, most involve running horizontal slats that carry boxes that house the plants. DIRTT has a living wall called Breathe that is shown here.



This system is designed to take 6" x 6", 3" x 6" or 3" x 3" pots. On larger installations, there will be a portable irrigation system, with smaller installations, use a hose or watering can to water the plants. The fill point for the water is at the top of the wall. The water travels in the trough and the plants wick the water up using capillary action. Each plant is a separate unit that can be maintained and removed for servicing or replacement. There is a valve to drain any excess water at the bottom of the wall.

As can be seen in this chapter, there are many products that the installer encounters besides cubicles and wall systems. In addition, there are multiple styles, types and manufacturers of each of these products, so you are not going to know how to do each one. Take what you have learned about other systems and apply that knowledge to the new one; this may require some trial and error before perfecting the installation.

NOTES:

Chapter 3 Benching Systems



The term benching refers to the new style of systems furniture in the workplace. It is based on the old idea of each worker having their own desk in the middle of an open office area. Many companies are turning to this style of furniture. It provides a more open collaboration setting, making the worker more visible to co-workers and to management. The theory is that the worker will be more prone to work with their colleagues in this open environment. There are many different styles of benching: the simplest, for instance, could be a work surface, legs and a screen. Other styles might be loaded with height adjustable work surfaces, screens, power, data, lower and upper storage, keyboard tray platforms and articulating monitor arm holders. Typical benching may have workers next to and directly across from each other with a power source that is housed in a beam (trough) that runs down the center of the workstations. Most all of the major manufacturers have their versions of benching systems. The simplicity of the benching means that the cost of the system is less than that of the standard panel system.

The benching systems are usually ergonomically configured to fit the needs of the end user. Modern task chairs come with a variety of ergonomic adjusts, including pan (seat) adjustments, arm adjustments, back tilt adjustments and height adjustments. A popular ergonomic feature nowadays, is the height adjustable table.

Most work surfaces are a standard 27" to 30" which is a good sitting height for people 5'-8" to 5'-10". If you are taller or shorter you may need to have desk at a different height. This can be achieved by raising or lower your work surface supports. The height of the worksurface is fixed, however, when the support is a fixed pedestal, an end panel or a fixed support leg. Height adjustable tables go up and down according to the need of the user. These tables are manually adjusted by set screws, spring-loaded pins, or by a crank handle that is connected to gears and chains that raise or lower the legs of the worksurface base. Other height adjustable tables are raised or lowered by pneumatics or electricity. These may include control buttons with digital readouts of the different height settings. Shown below is an adjustable base with a motor attached.



Another popular item is the standing work station, this brings the work surface to a comfortable standing height, which relieves a lot of the problems associated with prolonged sitting. These are commonly set at 44". This could be accomplished in several ways; having the entire work surface at that height, or you can use adjustable monitor brackets that will raise the monitor and keyboard to standing height.

Benching has its advantages and disadvantages. On the plus side, with no walls between workers and between departments, there can be an increased flow of conversation and information between employees. It also could create a new level of cooperation among the workers. Another advantage of the benching system is that it maximizes space since there are no panels or connecting hardware between workspaces. Benching stations are usually simpler, with less storage and less room for personal belongings. Traditional cubicles have a lot of negative connotations associated with them, benching has a sleeker, more streamlined look that can change the look of an office. Benching opens up views which counteracts the closed-in feeling that cubicles can create.

There are some distinct disadvantages to benching systems, most centering around the lack of privacy. The lack of any walls means that conversation, phone calls and other personal habits can become distracting to the others in the work area and, oftentimes, it may be difficult to concentrate with the din of everyone talking. Additionally, the ability to have personal emails or phone calls in a benching environment is severely limited, everyone can see and hear what you are doing. While management may see this as a plus, it could have a negative effect on the workforce. Further, the clutter of people's work space is in full view, and it can create a feeling of messiness and disorganization.

Systems furniture frequently cycles through different trends, and the trend now is towards benching systems. The fact that benching systems are usually less complex than cubicles or walls systems does not mean that the installer can take the installation for granted. The assembly must be done correctly and with an attention to detail.

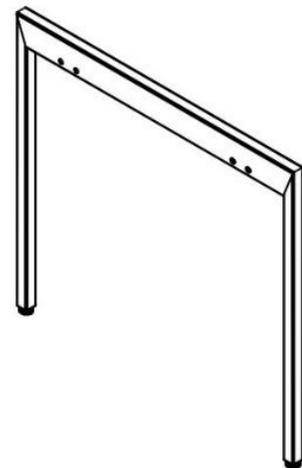
Lesson 3 Antenna Benching

The system of benching that we will be constructing is called Antenna, manufactured by Knoll. Like most benching, the assembly is not complicated. However, assembly must be done in a careful and logical manner. Some large businesses such as tech companies are using hundreds of benching stations, so the installer must become efficient at installing them.

Begin by consulting the plans and laying out where the installation will go. Next, lay the components out on the floor to do an inventory to make sure you have all the parts.

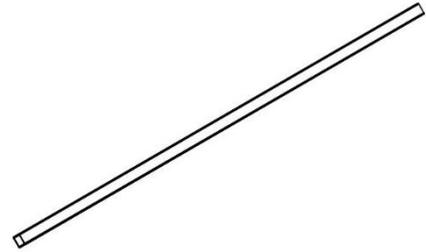


The Antenna system uses legs that look like this. In this case there will be two inside legs and two outside legs. The installation will start at one end and then progress from there. Our run will be six workspaces, however, it could be eight or more.



Lesson 3

The legs are connected with the use of joists known as rails. These are square shaped and mounted in a diagonal configuration.



Horizontal Rail (x2)

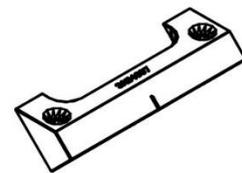
As seen here, there are four rows of rails, two on each side of the center beam. In the Antenna system, the rails in the first section are 3" shorter than the other rails, this allows for everything to align correctly.



The rails are held in place by the cradles which are screwed to the legs. Once the rails are positioned correctly, the clamp bracket is tightened down.

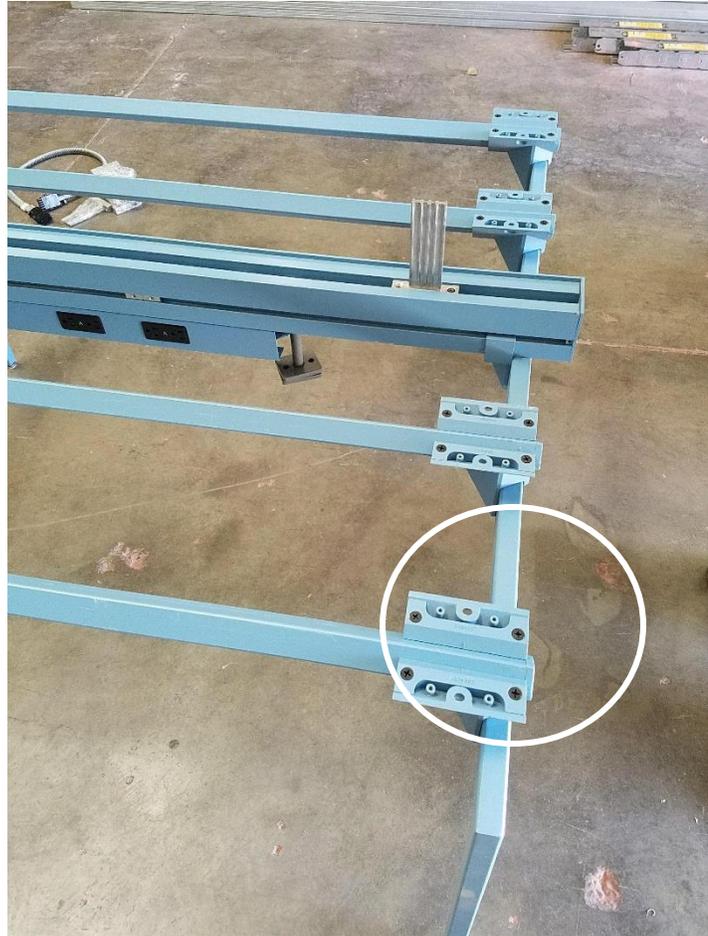


Horizontal Rail Cradle (x4)



Cradle Clamp Bracket (x8)

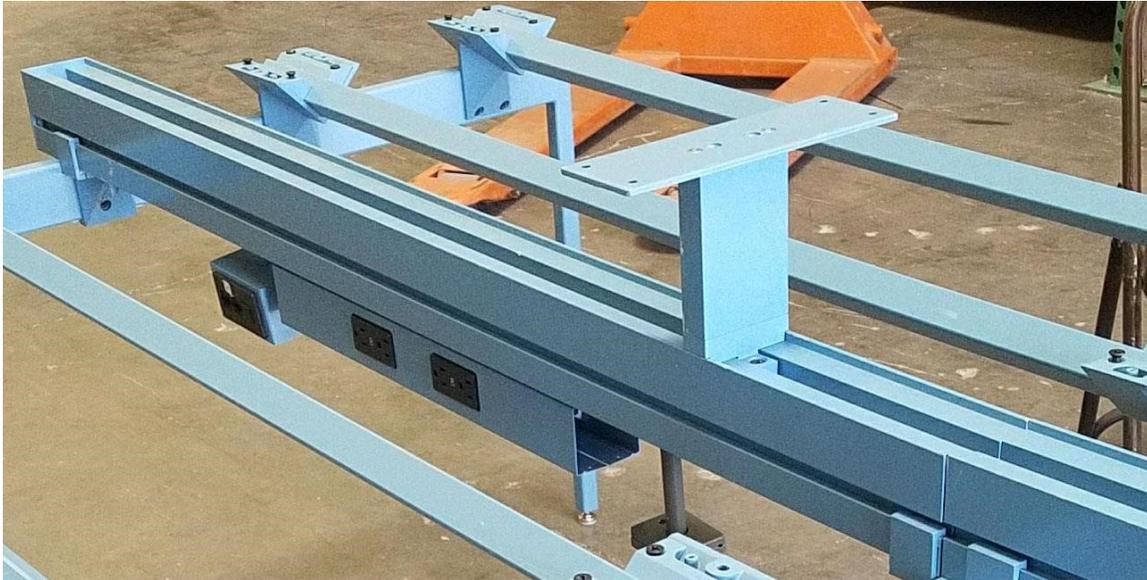
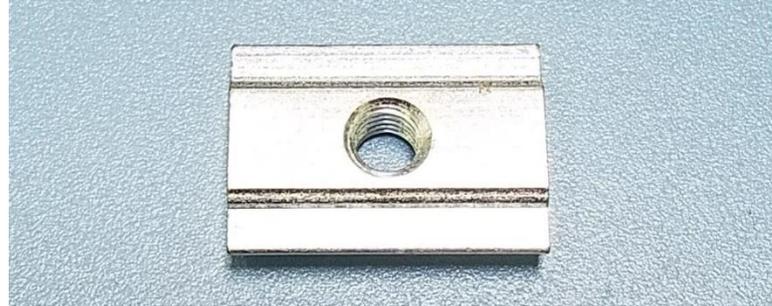
The clamp brackets have holes in them that allow for fastening the frame to the worksurface.



As stated above, begin the assembly at one end and work from there. The clamp brackets mount to the inside of the first end bracket and each subsequent cradle face toward the starter end. There is a beam that runs down the center of the assembly that carries all of the electrical and data needs. The beam should extend 1 1/2" past the outside starter.

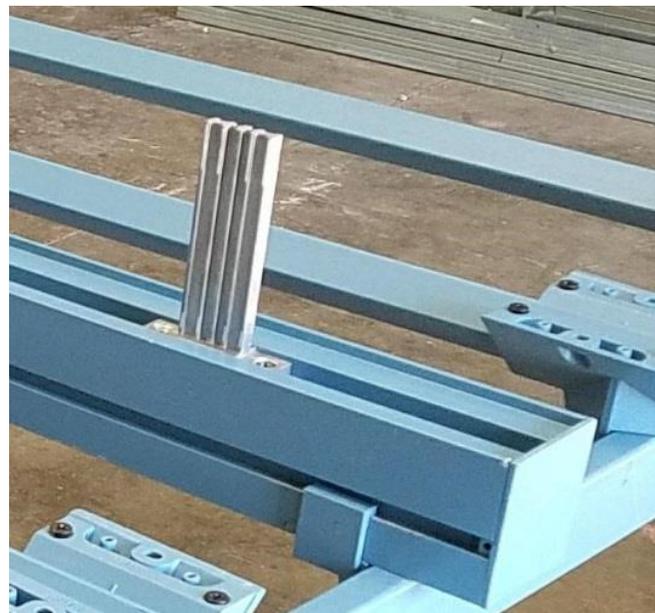
Lesson 3

The top of the beam has a recessed slot running down its middle. There are caddy screw inserts that slide in the slot and can be positioned wherever a bracket or shelf needs to be.



The bracket shown above is the support for a shelf.

This other bracket is for installing screens for the work station. There are two of these brackets for each screen. The screen itself has morticed out notches in the center of the bottom of the screen, and those recesses fit right over the brackets and that is what supports the screen.





When the assembly is at this point when everything is accessible, make sure that all the screws are tightened and that all the electrical is installed. Next install the tops and secure them in place with the screws provided. Note: many of the screws are similar—the coarse screws are used for the fastening to the support legs, and the fine screws are used to screw the inserts to the caddy screws.

NOTES:

Chapter 4 Drill & Tap

THIS CHAPTER IS PLANNED TO PROVIDE ANSWERS TO THE FOLLOWING QUESTIONS:

- **What is a tap?**
- **What are some of the taps used by carpenters?**
- **What size drill bit is needed for a tap?**
- **What is the purpose of cutting fluids?**

INTRODUCTION

When called upon to secure hardware to steel doors, steel door jams and other metal surfaces, the carpenter will use a threaded machine screw or machine bolt to complete the installation. With the exception of butts and lock sets, doors and jams do not arrive on the job site prepared for the hardware installation. The carpenter will layout the location of the screw holes, drill the pilot holes and prepare the hole to receive a threaded fastener. The carpenter cuts internal threads in the pilot hole with a tool called a tap.

The carpenter must learn to recognize various machine screw threads and the tap size required for a given size screw. Once the tap size is known the correct drill bit can be selected. This process becomes easy with experience.

TAPS

The internal threads are cut with a tool called a tap. The tap has a thread pattern and diameter that is identical to that of the machine screw. The tap machines a thread on the inside surface of the pilot hole.

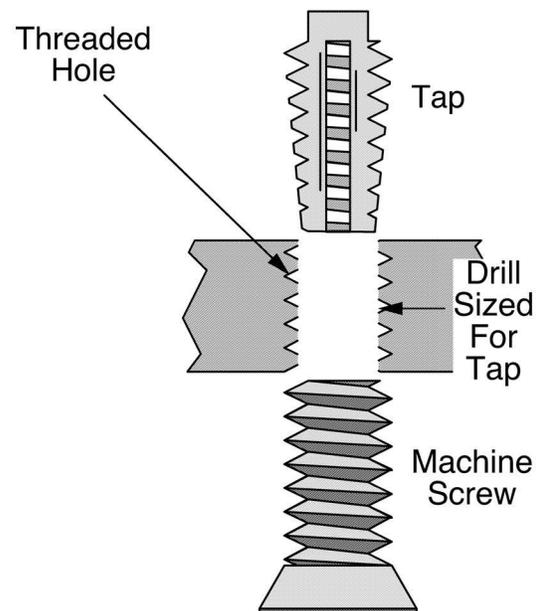


Fig. 4-1 Threaded Hole

A tap is a shank with square flats on one end for the handle and a threaded body that does the cutting. The threaded body is made up of cutters and channels to let the chips out and

allow cutting fluid to reach the cutters. The threaded body is tapered to permit the tap to enter the pilot hole and to spread the heavy cutting operation over several cutters.

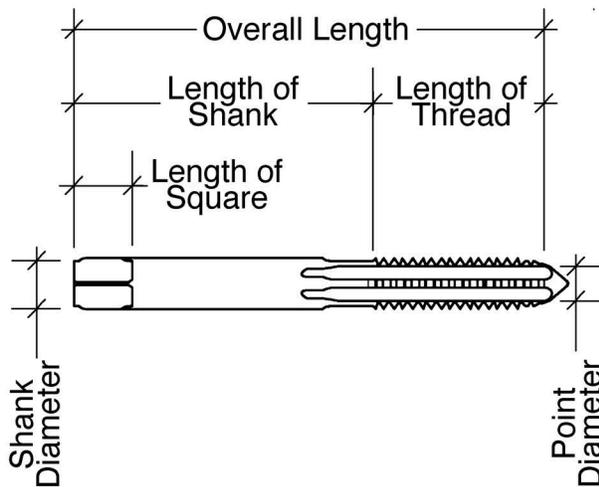


Fig. 4-2 Tap Dimensions

The thread designation is represented by several numbers and letters engraved or stamped on the tap. The first number is the nominal thread diameter given either as a gauge or as a measurement in inches. The second number is the number of threads per inch of screw. The first two letters “UN” represents the Unified National Threads Series, which is a set of specifications used by the manufactures of machine screws. The next letter indicates whether the thread is course, fine or extra fine. The first two items, nominal diameter and number of threads per inch, are important to the carpenter selecting a tap.

1/4 - 20 - UN C

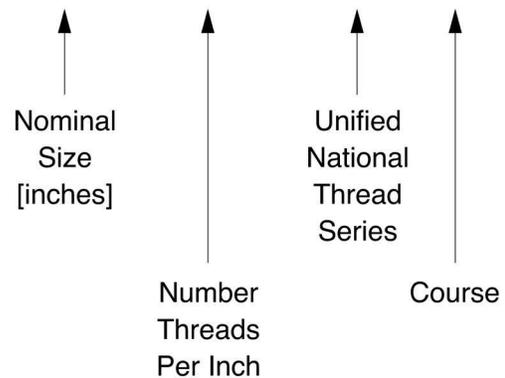


Fig. 4-4 Thread Designation - Nominal Size by Inches

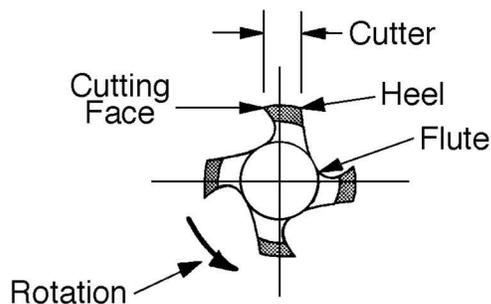


Fig. 4-3 Tap Cross Section

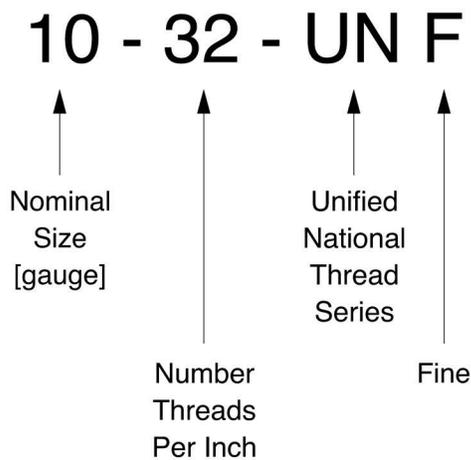


Fig. 4-5 Thread Designation - Nominal Size by Gauge

TAP DRILL SIZES

The first operation in internal threading is to drill the proper diameter hole. The usual method of selecting the drill size is to consult a “tap-drill size chart”. Please note that the chart is based on approximately 75% full thread. This means that the drill diameter is larger than the minor diameter of the thread to be tapped. The drill size noted in the table will produce a hole enough oversize so that 25% of the crest of the internal thread will be missing. This oversize tap hole is made to provide clearance between the tap hole and the minor diameter of the tap. If this is not done there will be no clearance and the tap will turn hard, tear the threads and there is a high risk of breakage. The 25% that is missing from the crest of the internal thread does not appreciably reduce its strength.

Tap and Drill Size for Commercial Hardware

The chart in Fig. 4-6 has more information than a carpenter needs to install hardware. Below is a chart with the taps and corresponding drill bits for the machine screws commonly used in hardware installation. Keep a copy in your tool box along with your set of taps.

FRACTION OR DRILL SIZE	DECIMAL EQUIVALENT	TAP SIZE	FRACTION OR DRILL SIZE	DECIMAL EQUIVALENT	TAP SIZE									
$\frac{1}{64}$	80 .0135	0 - 80	15	.2344	$\frac{5}{16}$ -18									
	79 .0145		64	.2380										
	78 .0156		LETTER SIZE DRILLS	2420										
	77 .0160		B	2460										
	76 .0200		C	2500										
	75 .0210		D	2570										
	74 .0225		E	2610										
	73 .0240		F	2656										
	72 .0250		G	2660										
	71 .0260		H	2720										
	70 .0280		I	2770										
	69 .0292		J	2810										
	68 .0310		K	2812										
	67 .0312		L	2900										
	$\frac{1}{32}$		66 .0320	1 - 64, 72		19	.2950	$\frac{3}{8}$ -16						
65 .0330		64	.2969											
64 .0350		M	.3020											
63 .0360		N	.3125											
62 .0380		O	.3160											
61 .0390		P	.3230											
60 .0400		Q	.3281											
59 .0410		R	.3320											
58 .0420		S	.3390											
57 .0430		T	.3438											
56 .0465		U	.3480											
$\frac{3}{64}$		55 .0520	2 - 56, 64		23	.3580	$\frac{7}{16}$ -14							
		54 .0550			64	.3594								
		53 .0595			V	.3680								
		52 .0625			W	.3750								
	51 .0635	X		.3770										
	50 .0670	Y		.3860										
	49 .0700	Z		.3906										
	48 .0730			.3970										
	47 .0760			.4040										
	46 .0781			.4062										
	45 .0820			.4130										
	44 .0860			.4219										
	43 .0890			.4375										
	42 .0935			.4531										
	$\frac{5}{64}$	41 .0960		3 - 48	27	.4688		$\frac{1}{2}$ -20						
40 .0980		64	.4844											
39 .0995		7	.5000											
38 .1015		16	.5156											
37 .1040		15	.5312											
36 .1065		32	.5469											
$\frac{7}{64}$		35 .1100	3 - 56		64	.5625	$\frac{9}{16}$ -12							
		34 .1110			7	.5781								
		33 .1130			16	.5938								
		32 .1160			15	.6094								
		31 .1200			32	.6250								
		$\frac{1}{8}$			30 .1250	4 - 40			39	.6406	$\frac{1}{2}$ -20			
					29 .1285				64	.6562				
					28 .1360				21	.6719				
					$\frac{9}{64}$				27 .1406	4 - 48		43	.6875	$\frac{3}{8}$ -9
	26 .1440			32				.7031						
	25 .1470			11				.7188						
	24 .1495			16				.7344						
	23 .1520			23				.7500						
	$\frac{5}{32}$			22 .1540				5 - 40	47			.7656	$\frac{7}{8}$ -9	
				21 .1562					32			.7812		
20 .1570			45	.7969										
19 .1590			11	.8125										
18 .1610			16	.8281										
$\frac{11}{64}$			17 .1660	6 - 40			55		.8438			$\frac{1}{2}$ -14		
			16 .1695				32		.8594					
		15 .1719	27			.8750								
		14 .1730	7			.8906								
		13 .1770	8			.9062								
		$\frac{3}{16}$	12 .1800		8 - 32, 36	57	.9219		$\frac{7}{8}$ -14					
			11 .1820			29	.9375							
			10 .1850			32	.9531							
			9 .1875			15	.9688							
			8 .1890			16	.9844							
	$\frac{7}{32}$		7 .2010			10 - 24	64	1.0000		1 - 8				
			6 .2031				1	1.0469						
			5 .2040				$\frac{13}{64}$	1.094						
			4 .2055				$\frac{17}{64}$	1.1250						
			3 .2090				$\frac{1}{8}$	1.1719						
$\frac{1}{4}$			2 .2130	10 - 32			$\frac{11}{64}$	1.2188			$\frac{1}{4}$ -12			
			LETTER SIZE DRILLS				$\frac{17}{32}$	1.2500						
			A .2188				$\frac{1}{4}$	1.2969						
			1 .2210				$\frac{1}{4}$	1.3438						
			1 .2280				$\frac{11}{32}$	1.3750						
		1 .2340	$\frac{3}{8}$		1.4219									
			$\frac{1}{2}$		1.5000									

Tap/Screw Thread	Drill Bit
1/4 - 20	#7
12 - 24	#16
10 - 32	#21
10 - 24	#25
8 - 32	#29
6 - 32	#36
4 - 40	#43

DRILL BIT SHARPNESS

Once an appropriate diameter drill bit is chosen, the tip of the bit must be checked for sharpness. Check that the correct angle has been ground and that the sides of the tip are symmetrical. The cutting edges of the tip must have a "relief" behind them for clearance. However, if too much material is removed, the edge will chip more easily.

Fig. 4-6 Tap/Drill Size Chart

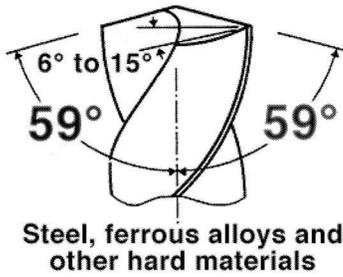


Fig. 4-7 Drill Bit - Metal

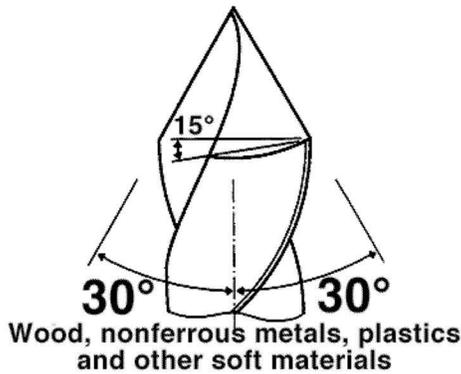


Fig. 4-8 Drill Bit - Wood

CUTTING FLUID

Drilling through construction materials at the recommended cutting speeds and feeds causes considerable heat to be generated at the drill point. This heat must be dissipated as quickly as possible; otherwise, it will cause a drill bit to dull rapidly. Cutting fluids have been developed for this purpose. The selection of cutting fluid also varies with the machine-ability of the material and the severity of the operation being performed.

The purpose of a cutting fluid is to provide both cooling and lubrication. For a liquid to be most

effective in dissipating heat, it must be able to absorb heat readily, have a good resistance to evaporation and have a high thermal conductivity. Unfortunately, oil has poor cooling qualities. Water is the best coolant; however, it is rarely used by itself because it promotes rust and has no lubrication value. Basically, a good cutting fluid should; cool the work piece and tool, reduce friction, improve the cutting action, protect the work against rusting, provide anti-weld properties, and wash away the cut chips. Below is a chart of recommended fluids for drilling.

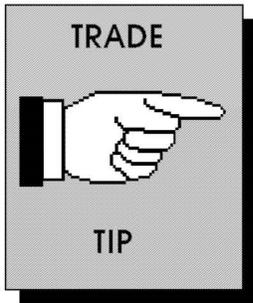
CUTTING FLUID	Hardened Steel	Soft Steel	Malleable Iron	Bronze or Brass	Aluminium	Cast Iron	Stainless Steel
EMULSIFIABLE OILS ("soluble oil", mixable with water)	X	X	X	X	X		X
MINERAL OILS (can contain: Fatty oils or Acids Sulfur, Chlorine or Phosphorous other chemicals)	X	X	X		X		X
TURPENTINE KEROSENE	X						
DRY or COMPRESSED AIR				X		X	

Fig. 4-9 Fluid Chart

SUMMARY

The carpenter installing hardware on metal doors and jambs will prepare the door and jamb by drilling and tapping holes for screws used to attach the hardware. Each tap has a corresponding drill bit. It is important to use the correct size drill bit. A small hole will cause the tap to turn hard, and may cause the threads to tear out. This will increase the possibility of

breaking the tap. Too large a hole will reduce the amount of contact between the screw and the hole thus reducing the holding strength of the screw. Cutting fluid dissipates heat and prolongs the life of drill bits. Drilling and tapping is a basic skill for carpenters engaged in installing commercial hardware.



For pilot holes, use only the recommended drill size.

A tapped hole with 75% of full thread is considered normal.

If this percentage falls below 65%, it is considered inadequate for hardware installation.

For 10-24 Thread		
Drill Size	Drill Diameter	Percentage of Full Thread
#21	0.1590 "	57%
#22	0.1570 "	61%
#23	0.1540 "	66%
#24	0.1520 "	70%
#25	0.1495 "	75%
#26	0.1470 "	79%
#27	0.1440 "	85%

← Inadequate for Hardware
← Recommended
← Possible Broken Taps

NOTES:

Lesson 4 Drilling & Tapping

INTRODUCTION

In this lesson you will drill and tap holes in a piece of steel for machine screws.

LESSON

At the end of the lesson the student will be able to drill and tap holes for the screws used in commercial hardware installation.

OBJECTIVES

On completion of this lesson the student will be able to:

1. Given a set of dimensions, layout, drill and tap holes for machine screws.
2. Given a machine screw, select the correct tap and corresponding high speed drill.
3. Given a hand held drill motor, safely drill a pilot hole in steel.
4. Given a tap and a piece of steel, hand tap holes using the correct step by step procedure.

APPLICATION IN THE FIELD

Traditionally carpenters work with wood. Attaching hardware to wood with a wood screw merely requires a starter hole punched with an awl or perhaps a drilled pilot hole for larger screws in hardwood. However the installation of hardware on metal doors calls for the use of threaded machine screws. The carpenter must be able to select the proper drill bit for the pilot hole and then correctly use a tap to thread the holes for the screws.

The holding power of threaded screws and bolts cannot be achieved unless the correct drilling and tapping tools are selected and used in the recommended manner.

EVALUATION

Each student will be evaluated on their participation in the construction, the quality of their work, and the score on the post test. A post test will be administered after the lesson is completed.

REFERENCES

1. Student Lesson Book

EQUIPMENT

To be supplied by the training facility (per student)

1. Drill motor
2. Extension cord
3. C clamp
4. $\frac{1}{4}$ - 20 tap w/ handle
5. #7 H.S. drill bit
6. 10-24 tap
7. #25 H.S. drill bit
8. Cutting Fluid

STUDENT TOOLS

1. OSHA approved eye protection
2. Smooth face hammer
3. Nail bags or overalls
4. Measuring tape
5. Pencil
6. Combination square or speed square
7. Center punch

INTRODUCTION:

Ease of tapping and the strength of the resulting threads are dependent on using proper sized drill holes.

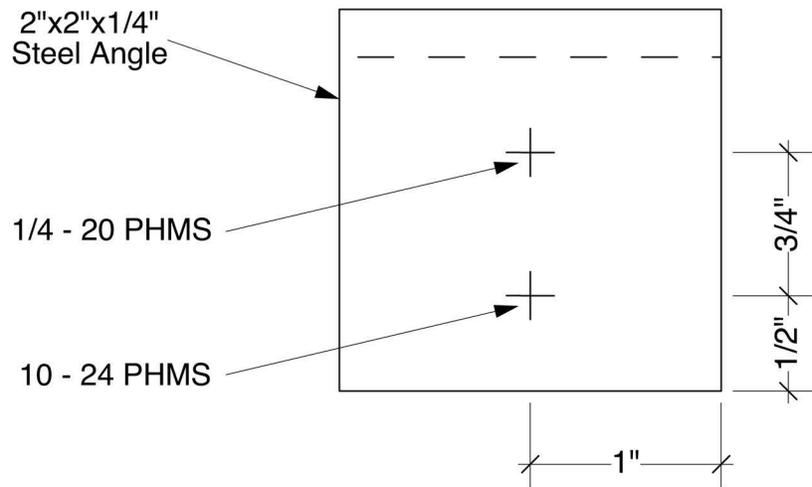
Drill holes to specifications:

- To cut $\frac{1}{4}$ - 20 threads, a #7 diameter hole will be needed.
- To cut 10 - 24 threads, a #25 diameter hole will be needed

Tap/Screw Thread	Drill Bit
$\frac{1}{4}$ - 20	#7
12 - 24	#16
10 - 32	#21
10 - 24	#25
8 - 32	#29
6 - 32	#36
4 - 40	#43

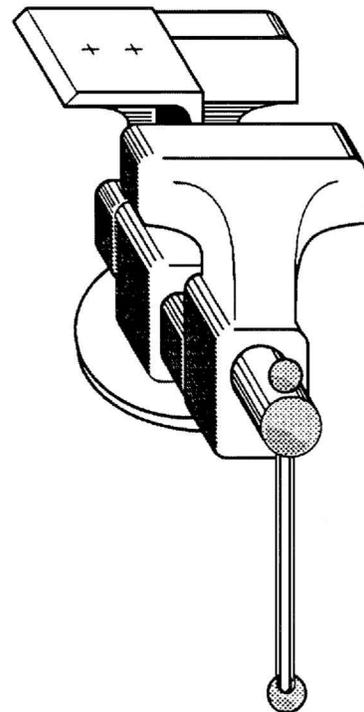
PROCEDURES

Drill and tap two holes in a piece of steel as shown in the drawing.



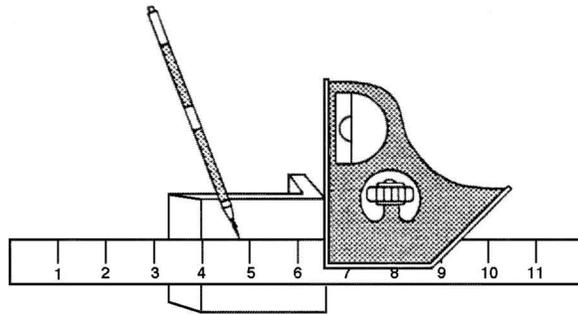
Mount work in a vise

In this lesson you will use a previously cut 2" x 2" x 1/4" angle iron.

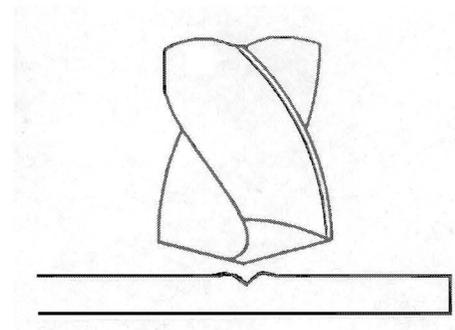


Drill the Pilot Hole

- With the piece clamped in the vice, locate the center of two holes shown in the drawing.



- Center punch a “dimple” at each point.
- Install the appropriate high speed drill bit into the chuck of a drill motor and tighten the chuck key.
- The #7 drill bit will be used as the pilot drill for the $\frac{1}{4}$ - 20 screw.



- The #25 drill bit will be used as the pilot drill for the 10 - 24 screw.
- Drop a few drops of cutting fluid on the dimple mark.
- Holding the drill at a 90 degree angle to the work, start the drill and push it into the work.
- Maintain the pressure until the drill passes all the way through the material.
- Do not allow the drill to lean or cock to one side during the operation as the drill bit may break.

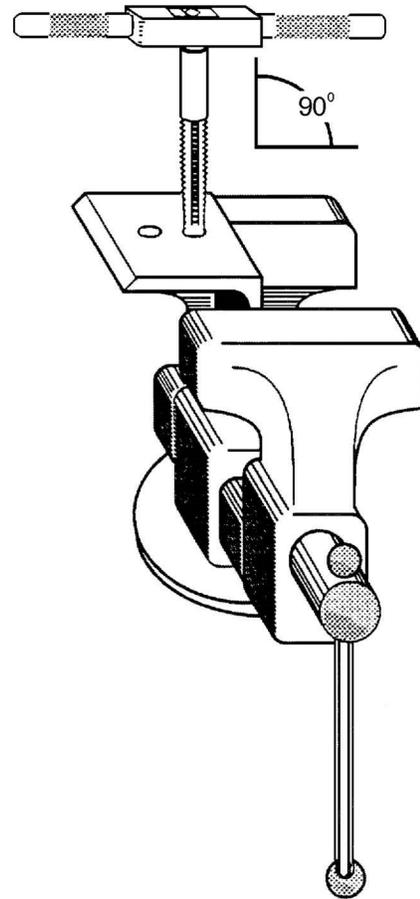
Tap the Hole

- Lock appropriate tap into tap handle. Grasp tap handle in the center directly over the tap. Start tap into hole with an even downward force while turning clockwise. Turn tap two or three times. When tap is started, remove tap handle.
- Check tap for squareness in the hole, by placing a square alongside the tap. If tap is not square with the work, take it out and restart.
- Except on cast iron, always use cutting fluid when cutting threads. Cutting fluids serve three main functions:

Lubrication: Metal to metal contact is reduced and thus friction is reduced. Less power is required to turn the tool and tool wear is reduced.

Cooling: Because heat always flows from a hotter substance to a cooler one, it will be carried away from the process by a cool flow of cutting fluid.

Anti-Weld Function: Compounds of sulfur, chlorine and other substances are added to the fluid to prevent the welding of the surfaces that meet with heat and pressure.



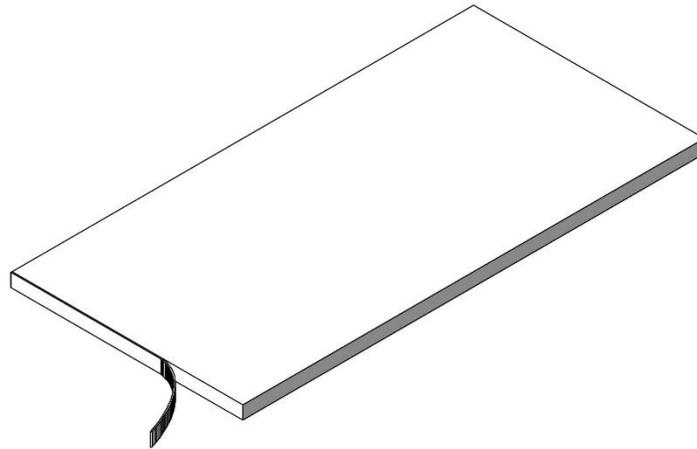
- Continue tapping hole, turn tap $\frac{3}{4}$ to $1\frac{1}{2}$ turn, then reverse the tap to break the chips. This aids in chip removal and prevents damage to the threads and tap.
- When the tap has run through the bottom of the hole, remove it from the hole. Clean chips out of the hole.
- Using your fingers run the full length of the appropriate machine screw into the threaded hole. It should thread smoothly with a minimum amount of play.

NOTES:

Chapter 5 Work Surface Field Cuts

Cutting work surfaces in the field is a common occurrence. Many times in offices, the designer likes to design work surfaces that span from wall to wall. To make that happen, the designer will order a longer work surface and have the installer cut it to fit in the space. The walls in these offices are often not straight or square, so the installer needs to know how to scribe cut a work surface. The scribe cut makes a nice clean look, without gaps. Another common situation is for a designer to designate work stations to be built around columns, so again, the work surface will have to be scribe cut around the column. Sometimes the installer will have to be creative and add some kind of support near the column.

Straight cuts are also very common, in reconfigurations, the designer will often use existing products along with new products to reconfigure the work stations or offices. When making a straight cut that is visible (not against a wall or column), the cut edge will have to have an edge band. The edge band is a thin strip of veneer that covers the exposed end or edge of a work surface. The installer needs to know how to take off the existing edge band and replace it after the cut has been done. The installer should pick the side of the work surface that is the least visible and then carefully peel off the existing edge band.



Next, thoroughly clean all the dry glue and material from the edge band. To attach the edge band to the new cut edge, apply glue (3M spray adhesive 90 works well), let the adhesive set up a little, and then reapply the edge band. Clean off any excess glue and wrap tape around the whole edge banding to act as a clamp. Once the glue has dried, remove the tape carefully so as not to pull off the newly glued edge banding. Finally, clean any excess glue residue.

When cutting work surfaces with a skilsaw, always cut from the underside of the work surface. The skilsaw blade rotates so that it cuts from the underside of the material up through the top. By cutting from the underside, the blade pulls the finished laminate into the body of the material, and by doing so, it avoids chipping. In addition, it is a good practice to add blue painter's tape where the cut will be on the finished side, this will also help to reduce chipping.

Cutting access holes in end panels and back panels is also a common modification that the installer needs to be able to do. In private offices sometimes the end or back panel will block the power or data ports. Begin by placing and leveling the furniture, then measure for the cut. The best way to make this cut is to, if possible, do a plunge cut with a skilsaw. This will give you a straighter cut than a jigsaw. After the cut has been made, depending on how visible the cut is, you might have to paint, or re-stain the cut edges for a more appealing look.

Care must be taken with all field cuts because this work is finish work that is exposed and, therefore, it must look good.

Lesson 5 Field Cut

Step 1

Each student will make a straight cut of a work surface. Use a straightedge and cut the 4' wide piece at 16". Be sure to cut from the back side to avoid any chipping.

1.



Step 2

The next step is to add edging to one length and one width of the worksurface.

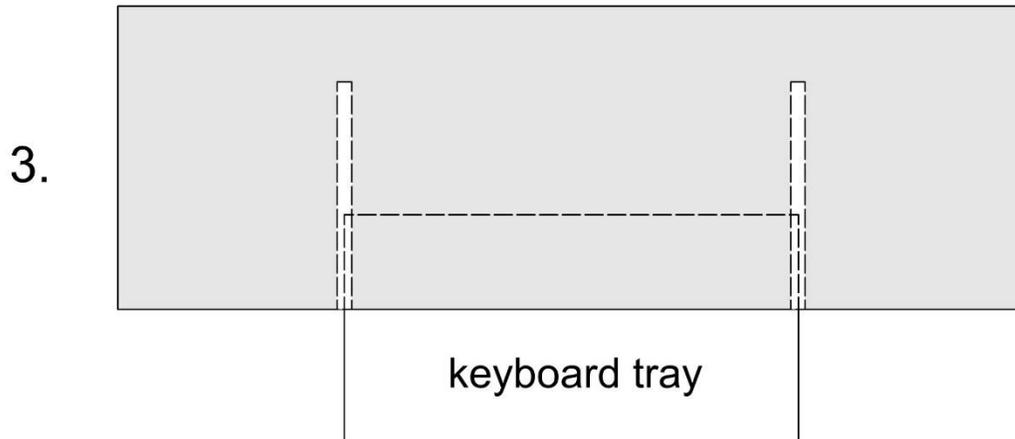
2.



Lesson 5

Step 3

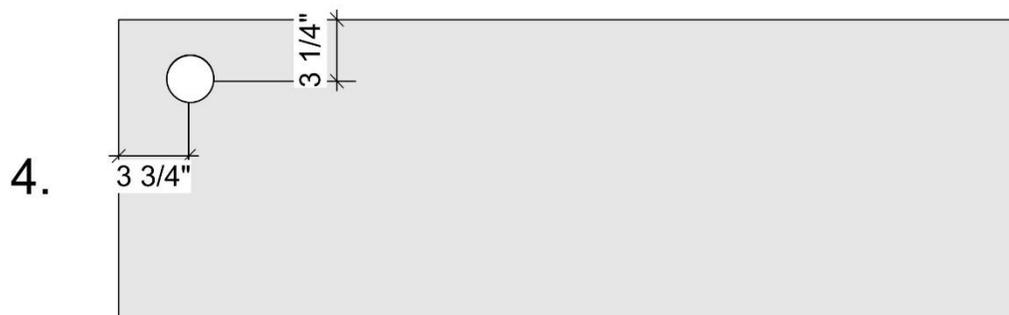
The next step is to mount a keyboard tray to the underside of the worksurface.



When it is completed, have your instructor check your installation, and then remove the tray.

Step 4

Lay out the 2" grommet hole. Place a roll of tape over the hole to contain the waste from the cut.

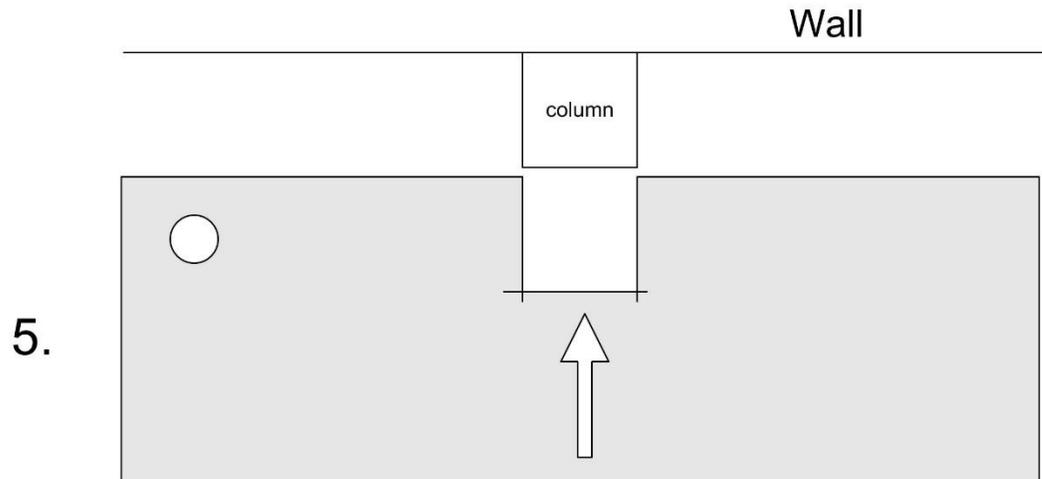


After drilling the grommet hole, install the monitor arm, making sure that it is secure.

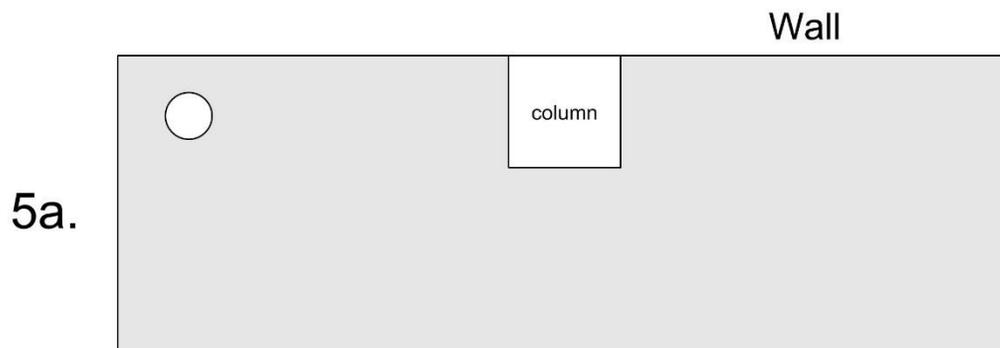
Step 5

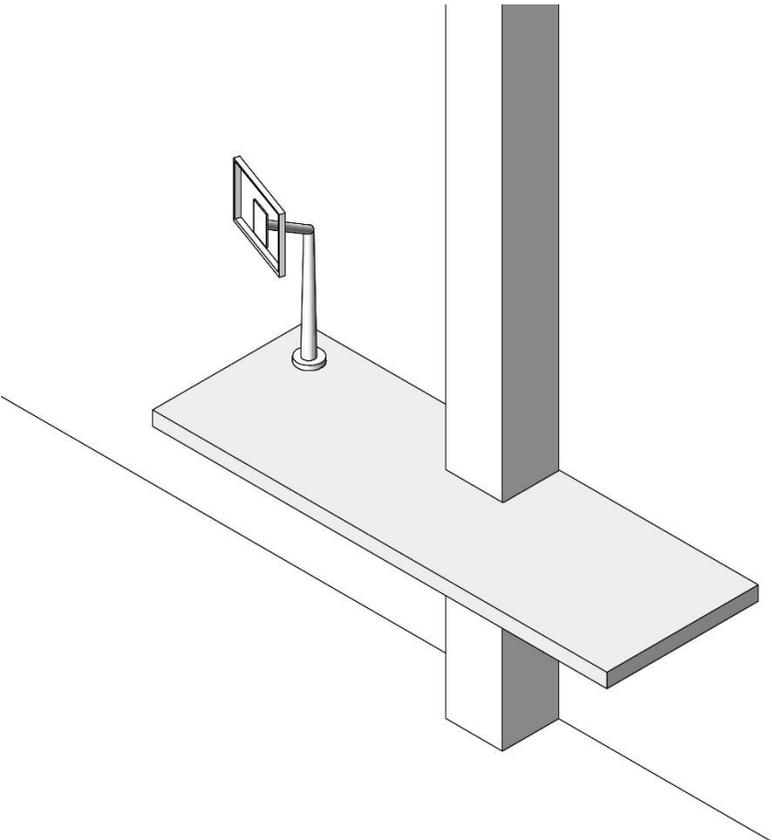
After your instructor evaluates your monitor arm installation, remove the monitor arm.

Support the worksurface and center it on the column. Scribe the worksurface around the column and the wall. Cut from the bottom and do not overcut any of your cuts.

Step 5a

Put the scribed worksurface in place and make any minor adjustments that are needed.





Chapter 6 Furniture Touch-Up

When dealing with fine wood furnishings, like wood desks, conference tables, private office furniture and reception desks, sometimes damage occurs. This damage could be from receiving and handling the furniture, or during installation. When the damage occurs, it is necessary, if possible, to touch-up the damage. Touching up wood furniture requires a good eye and a steady hand. A bad touch-up can be worse than no repair.

The damage can run from scratches, dings and gouges to actual broken furniture. Some damaged items need to be replaced, however, many can be successfully repaired. An installer that can do a wood furniture repair is a valuable addition to a crew and to their company. A conference table could cost thousands of dollars and a nick or scratch is unacceptable. It should be noted that many times the damage is done by workers of other trades putting tools and other things on the worksurface or standing on the furniture. Touch-up is the process of repairing the damage to an acceptable level. We will cover some of the most common repairs to wood furniture.

There are many products on the market that help the installer with the repair. One of these products is a touch-up marker. This is similar to a permanent marker except it contains a stain/polish mixture that colors the defect to match or blend in with the surrounding finish.



The color does not have to match exactly, these are usually used on smaller defects and blended in using your finger or a rag. This is effective on shallow scratches, it does not fill the scratch, but it does hide the scratch. When it dries, then you can polish it.

If the defect is bigger than a scratch, other products can be used to fill the dent. One option is to use a fill stick, which is essentially a colored stick of wax that is pressed into the dent and leveled off.



Rub the wax stick across the defect, filling the defect until it is slightly higher than the top, pressing it firmly into the dent. One advantage of the fill stick is that since it is not heated, it does not shrink.

Once the defect is filled, take a credit card and scrape it across the fill. Continue scrapping until the fill is flush with the top. When complete, you can polish the area and spray it with a top coat. The top coat should match the sheen of the existing top, for instance, a flat finish or perhaps a glossy finish.

Another type of repair is what is known as burn-in. This is when materials are heated and poured into the defect. The procedure is used to fill larger dings, anything up to the size of a dime. The first step is to remove with a knife any loose or ragged wood fibers from the defect.

The next step is to get the burn-in knife ready. There are several types of burn-in knives; some run on lighter fluid, some run on batteries and some are electric. This is an electric model.



The knife heats up enough to melt the fill material from a solid to a liquid, so it is hot enough to burn the user. There is a stand that comes with the knife and it should be used to prevent burns and accidents.

Seen here, the filler material, which is basically shellac with color added, comes in sticks of many different colors.



The knife should be clean so have a rag to wipe off the knife. If there is residue on the knife, it will make ridges in the fill. If the knife causes the stick material to bubble up, it is too hot. You can cool the knife a little by rubbing it on the rag or you can cool it a lot by spraying water on the knife.

Touch the hot knife to the fill material and let the resulting liquid drip into the void. It is possible to use more than one color, just melt each and blend together. Work the material into the sides and edges of the gouge and keep adding the liquid until it is slightly overfilled. Allow the mixture to cool, and then scrape off the excess with a credit card or a small rasp made for that purpose. Once the fill is level with the top, apply a balm or lubrication to the area; the balm is a jellylike material that you spread on the repair with your hands. Use the burn-in knife to wipe off the balm, across the grain. After each pass, wipe the knife off on the rag. When doing this, apply only light pressure to the repaired area. Once all the lubricant is removed, spray the area with an appropriate top coat.

The last step is to add in any grain that is missing. This is done with a graining marker, which is used to add a grain look to the patched area. This will require some degree of skill to mimic the surrounding grain. The ink will dry quickly and you can then put top coat over this area to lock in the repair.

Many companies have a repair kit that includes a large variety of products and various colors to handle any small repair, however, many of these kits are not inventoried regularly and products are often missing.

We covered here some basic wood repair instructions, however, repairs to other modular products such as panels, skins or chairs may be necessary. These repairs may call on you to be creative in your repair work, however, experience will help you to know what to do.

NOTES: