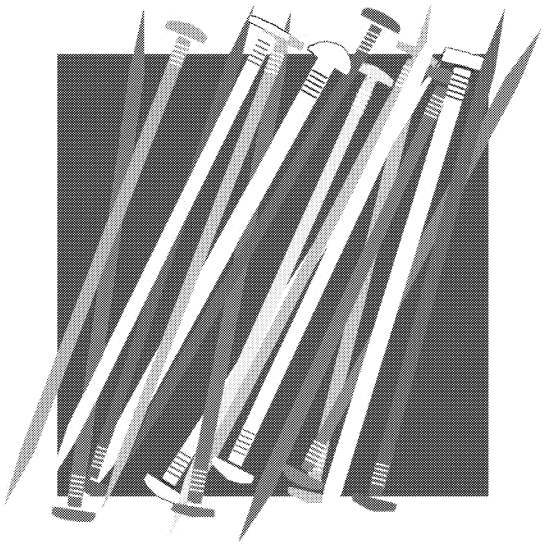
PRE-APPRENTICESHIP

BOOK 2



Carpenters Training Committee for Northern California

CARPENTERS TRAINING COMMITTEE FOR NORTHERN CALIFORNIA

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COURSE OBJECTIVES

This week the students will receive training in the proper use of the following power tools: router, plane, air compressor and pneumatic nail gun. They will also receive instruction on electrical safety and temporary power. Work on their toolboxes will be completed and they will be required to build a set of sawhorses.

SPECIFIC OBJECTIVES

Upon completion of this unit the student will:

1. Complete the lesson objectives for temporary power and electrical safety.

2. Complete the lesson objectives for compressors and pneumatic nail guns.

3. Build a set of saw-horses following the specifications set forth in the manipulative lesson provided.

4. Begin layout and build 8 x 12 foundation for student project.

CARPENTERS TRAINING COMMITTEE

FOR NORTHERN CALIFORNIA

SEXUAL HARASSMENT & APPRENTICE CONDUCT

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 Director of Field Services.

Apprentices shall not use lewd and vulgar language while they are on the premises of the Carpenters 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.

Any person violating the above policies shall be subject to disciplinary action, which may include suspension or expulsion from the training center and/or cancellation from the program.

Form 154A JB:llr
Opeiu-3-afl-cio-211 3/11/99
Revised 1-31-07

Date Instructor Name

PRE-APPRENTICESHIP - BOOK 2

PRE-TEST

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

1.	T	F	Concrete is a mixture of cement, sand, stone and water that when set, attains hardness like stone.
2.	T	F	A plot plan is a drawing indicating location, boundaries and dimensions of a parcel of property. May include the location of gas, electric and water lines under ground, as as all the buildings and their locations and shapes.
3.	T	F	A right triangle is any triangle whose altitude and base form a 45 degree angle.
4.	T	F	Some of the harmful effects of electricity can be, burns, shock/ electrocution, fire and explosions.
5.	T	F	Some materials such as wood, plastic, rubber and metal do a good job of resisting the flow of electricity.
6.	T	F	Pneumatic tools are driven by air.
7.	T	F	It is impossible to sustain a burn using an air compressor.
8.	T	F	When using a pneumatic nail gun, holding back the nose guard and randomly firing is sometimes necessary.
9.	T	F	When operating a nail gun on a roof slope of 8 & 12 or greater, the operator must wear a safety belt.
10.	T	F	It is an OSHA requirement that all temporary power boxes supplied to construction sites be equipped with a (GFCI) or Ground Fault Circuit Interrupter.
11.	T	F	Specifications are the detailed written descriptions that accompany the working drawings of a construction project.
12.	T	F	Excessive air pressure in a compressor can cause the pneumatic nail gun to explode or fly apart.

13.	T	F	It is important to drain the tank on compressors to avoid corrosion and rust forming inside the tank.
14.	T	F	There are two types of electrical circuits, direct current (DC) and alternating current (AC).
15.	T	F	A worker can be discharged for refusing to follow proper safety procedures on the jobsite.
16.	T	F	If a power tool is missing the ground on the plug it is still ok to use it because the power cord will be grounded.
17.	T	F	It is always a good idea to turn in and report all power tools or electric cords that are not working properly to your supervisor.
18.	T	F	Safety on the jobsite is the responsibility of the safety officer.
19.	T	F	Since style is always important, it is ok to wear baggy or loose clothing on the jobsite.
20.	T	F	Property lines on a blueprint indicate dimensions and shapes of a parcel of a property.
21.	T	F	R.O. is another term for rough opening.
22.	T	F	In wall framing there are the same number of top plates as there are bottom plates.
23.	T	F	The purpose of any plan or working drawing is to visually display the project in complete terms.
24.	T	F	Another name for a form nail is "sinker".

VOCABULARY TERMS

Instructions: Review the terms.

Anchor bolt *(AB)*	Fastener projecting from the top of foundation walls to secure the mud sill, *treated lumber*, to the foundation wall for wood framing.
Batter board	Boards nailed horizontally to stakes, temporarily used to mark the corners of a building and the height of the foundation early in construction, minimum 2 feet from the excavation.
Bench mark *(BM)*	A line or mark on some stable object from which other measurements and elevations are taken.
Building lines	1. Lines on a drawing that represent the outside of the foundation wall and indicate the shape of the building. 2. A line established by law beyond which a structure may not extend.
Cement	1. A substance made by burning a mixture of clay and limestone, and used as an ingredient of mortar and concrete. 2. A substance which, by hardening between two surfaces to which it adheres, binds them together.
Chalk line	Tool used to snap a temporary line from one point to another. Chalk is placed in a case that contains a string on a reel which is retracted after each use. Care should be taken not to get the line damp or wet.
Cleat or form tie	A 1x or 2x nailed to the top of the footing or wall properly spaced to hold the wall at an accurate dimension or thickness. Cleats can also be used to hold anchor bolts in place while concrete is setting up.
Concrete	A mixture of cement, sand, stone and water that when set, attains hardness like stone.
Diagonal	A line extending from one point to another on an angle.
Drain tile	Pipe of clay, concrete or synthetic plastic *(PVC)* set in gravel next to the footing around the perimeter of a building, inside and/or outside for water removal.
Dry line	A thick string attached to batter boards, that is used to find the location of the building lines by dropping a plumb bob at the intersecting points.
Expansion joint	1. A break in construction to allow for thermal expansion and contraction of the materials used in the structure. 2. Tar based material between two slabs that allows for the expansion and contraction of concrete.
Finish grade	Elevation of soil, walks, drives, and other improved surfaces after final grading operations.
Footing	Bottom portion of a foundation which spreads and transmits load directly to the soil. Formulas: Footing width = 2 x wall thickness. Footing height = wall thickness.

Form nail — Double headed fastener, used for temporary nailing. One head of the nail remains sticking out of the material making it easier to pull out. Most commonly used sizes for concrete forming are 8d, 10d, 12d and 16d.

Foundation — Supporting portion of structure below the first floor construction or below grade which includes footings.

Foundation wall — Portion of the foundation that sits on the footing. The wall is tied into the footing by the keyway.

Framing square — A right angle tool, used to layout angles and calculate lengths when laying out and erecting framing members. One leg is 24″ long and the other is 16″ long.

Grade beam — Thickened and reinforced section of a slab foundation designed to rest on supporting pilings, footings or caissons.

Grade nail — Tack (usually 6d nail) used at a designated positions along the inside of forms to indicate the height of footing or wall and where concrete finishers should level off.

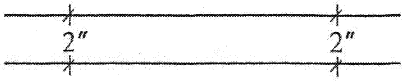
Hair pin — Steel wedge used at both ends of the snap tie.

Hypotenuse — The longest side of a right triangle.

Keyway — A groove in one lift of concrete, such as the top of the footing, which is filled with the concrete of the next lift giving shear strength to the joint.

Level — 1. A horizontal line or plane at right angles to the plumb line. 2. Any instrument that can be used to indicate a horizontal line or plane.

Lines in parallel — Two lines at equal distance from each other that never meet. Example:



Plat plan — Map showing division of a given area of ground into lots, streets, and townships.

Plot plan — A drawing indicating location, boundaries and dimensions of a parcel of property. May include the location of gas, electric and water lines under the ground, as well as all the buildings and their locations and shapes.

Plumb — Exactly vertical, or perpendicular, at right angles to the horizon.

Plumb bob — Pointed metal weight that can be tied to the instrument to center over a point. When suspended from a string, used to establish a vertical line.

Property lines — Lines on a drawing that indicate dimensions and shape of a parcel of property.

Pythagorean Theorem — Relationship of numbers to the hypotenuse, base and altitude of a right triangle.

Right triangle — Any triangle whose altitude and base form a 90° corner.

Snap tie — Combination spreader and form tie. Ties both wall forms together in addition to spreading the wall forms apart to a specified dimension.

Square (shape) — An object or area with equal dimensions on all sides and 90° corners.

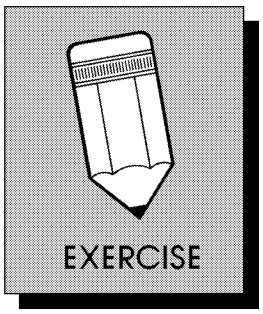
Square root — The square root of any number is another number that when multiplied by itself equals the original number. Example: $\sqrt{25} = 5$, because $5 \times 5 = 25$.
Example: $\sqrt{16} = 4$, because $4 \times 4 = 16$.

Squared (#²) — To multiply a number by itself. Example: $3^2 = 3 \times 3 = 9$.
Example: $7^2 = 7 \times 7 = 49$.

Stake — Wood or metal member pointed on one end, placed in the ground for grading or securing of concrete forms. Also be used as layout markers.

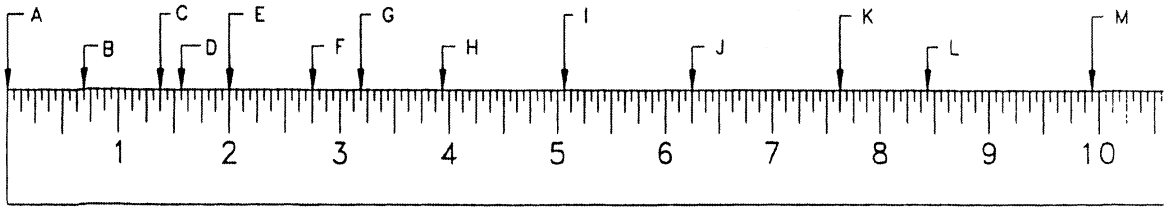
Water level — Plastic tube filled with water for finding elevations or transferring level marks. Water will find its own elevation point and level off.

NOTES:



MEASUREMENT EXERCISE 3

Fill in the correct inches and fractional parts of an inch that apply between the sets of letters below.



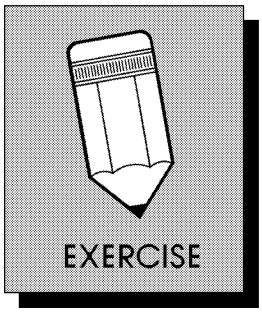
A-B_____ A-C _____ A-D_____ A-E _____ A-F _____

A-G_____ A-H _____ A-I _____ A-J _____ A-K _____

A-L_____ A-M_____ B-C_____ B-E _____ B-J _____

C-D_____ C-E _____ C-G_____ D-M_____ D-J _____

D-L_____ I-J _____ F-H _____ M-C _____ G-M_____



MEASUREMENT EXERCISE 4

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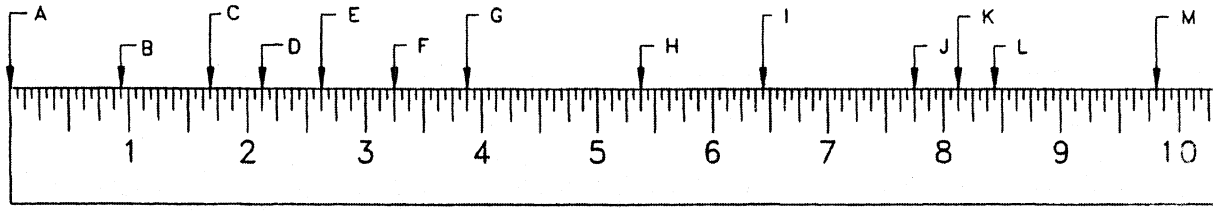


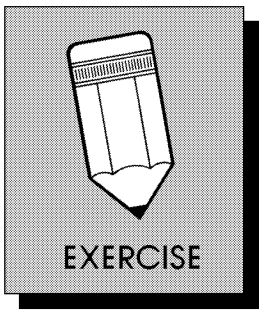
A-B_____ A-C _____ A-D_____ A-E _____ A-F _____

A-G_____ A-H _____ A-I _____ A-J _____ A-K _____

A-L_____ A-M_____ B-C_____ B-E _____ B-J _____

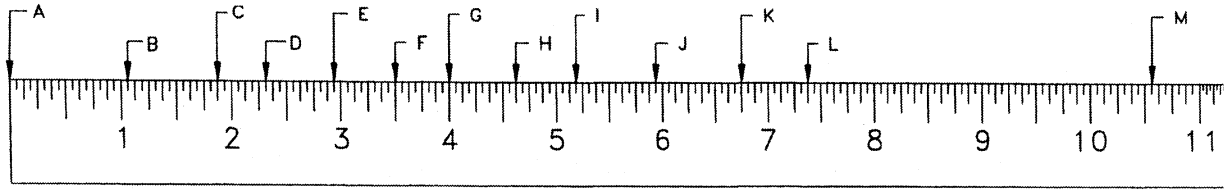
C-D_____ C-E _____ C-G_____ D-M_____ D-J _____

D-L_____ I-J _____ F-H _____ M-C _____ G-M_____



MEASUREMENT EXERCISE 5

Fill in the correct inches and fractional parts of an inch that apply between the sets of letters below.



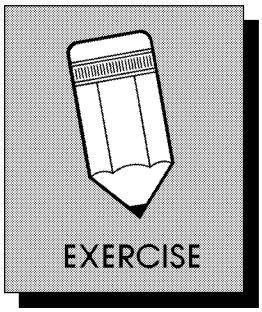
A-B_____ A-C _____ A-D_____ A-E _____ A-F _____

A-G_____ A-H _____ A-I _____ A-J _____ A-K _____

A-L_____ A-M_____ B-C_____ B-E _____ B-J _____

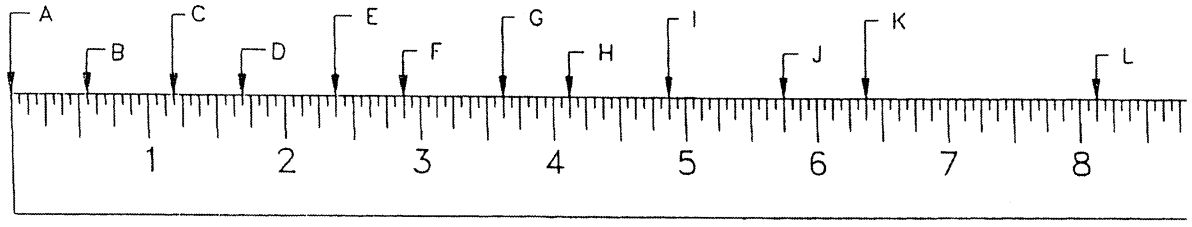
C-D_____ C-E _____ C-G_____ D-M_____ D-J _____

D-L_____ I-J _____ F-H _____ M-C _____ G-M_____



MEASUREMENT EXERCISE 6

Fill in the correct inches and fractional parts of an inch that apply between the sets of letters below.



A-B_____ A-C _____ A-D_____ A-E _____ A-F _____

A-G_____ A-H _____ A-I _____ A-J _____ A-K _____

A-L_____ B-C _____ B-E_____ B-J _____ C-D _____

C-E_____ C-G _____ D-J _____ D-L _____ I-J _____

F-H _____ _____ _____ _____ _____

THE CONSTRUCTION INDUSTRY AND MANAGEMENT

- **What Is the Labor-Management Alliance?**
- **What Is an Industry Management or Employer Association?**
- **What Is the function of Employer Associations and what are their major goals and objectives?**
- **Who are the major Employer Associations Involved In the Construction Industry?**
- **How and why did Employer Associations evolve?**

THE LABOR AND MANAGEMENT ALLIANCE

The Construction Industry is the largest single enterprise in this country as well as the world. It employs the greatest number of people - with the most diverse talents - of, virtually, all other fields combined. The Construction Field is made up of two major partners known as Labor and Management. Both are in the business of providing essential services to the industry.

The first partner, the Union or - "Organized" Labor - is in the business of providing the construction industry with trained, reliable, motivated workers who are highly skilled in specific work processes. Management, the second party, is in the business of organizing the actual building process by overseeing and coordinating the work and all the other endless details involved in this enormous undertaking.

Both parties have always been (and will always be) "risk-takers" involved in constantly changing, competitive, and even dangerous situations.

Although often depicted as being at odds with each other, Labor and Management are actually working in concert to insure that the industry remains a vital force in our economy. To put it in perspective, the historical characterization of "Labor and Management locked in a death struggle" has been rewritten by modern labor relations. Today, such phrases as; alliance, partnership, enlightened relationship, and "we need them as much as they need us" can be heard across the country and the world.

Even though the goals of Labor and Management are focused there still remains diverse opinions on how to achieve them. Both parties present their individual ideas and solutions at joint labor or management gatherings called collective bargaining sessions. Collective Bargaining is the process that will produce a written testament or "Contract" between these often diverse aspirations and will represent the compromises and sacrifices each party must endure to respect the other's opinion.

When totally "hammered out", these opinions will produce a document called a Collective Bargaining Agreement which defines, in exact terms, the wages, benefits, and working conditions union members will perform under.

EMPLOYER ASSOCIATIONS

When Organized Labor and Signatory Management engage in collective bargaining

sessions, each party sends it's respective elected or appointed delegates to represent them. Both delegations will champion the separate issues of their organization at negotiations.

The delegation from the Carpenters Union champions the issues of organized labor and the interests of local union members like you. This body is known as The Carpenters 46 Northern California Counties Conference Board.

The Conference Board delegates are elected by you from among your local union membership, both rank and file members and elected officers.

Sitting across the negotiating table from labor will be representatives from employer associations. The primary employer association which enters into collective bargaining with the Carpenters 46 Northern California Counties Conference Board is the Construction Employers Association (CEA). Member construction companies employ the majority of union carpenters in the 46 Northern California Counties. Other employer associations representing contractors in collective bargaining with the Conference Board include the Bay Counties General Contractors Association (BCGCA), Millwright Employers Association (MEA), Concrete Contractor's Association (CCA), Associated General Contractors (AGC), Building Industry Association (BIA), and Northern California Contractors Association (NCCA),

Construction Employers' Association of California

The Construction Employers' Association (CEA) has had a significant impact on the construction industry in California. Created in July of 1985, this organization has fostered greatly the development of better union management relations. The CEA has actively promoted and supported the apprenticeship program, and the CEA's secretary currently serves as a trustee of the Carpenters' Apprenticeship and Training trust Fund for Northern California.

While other associations in the past represented both union and nonunion contractors, the CEA chose to operate in a simpler fashion: It concentrates on collective bargaining for union contractors only. This effort has brought management and the union together in ways that are both ingenious and practical. CEA's progress was immediate; as early as its first year, the CEA negotiated the master labor agreement with the northern California carpenters. A first of its kind, this agreement was important because it provided for the establishment of the Carpenters' Work Preservation Committee, which became a decisive tool in effectively penetrating the nonunion marketplace. Contractors all over Northern California began to seek relief in wages, fringe benefits, and working conditions through this committee. Through diligent cooperation between the union and management, contractors were awarded relief, and a substantial amount of work that otherwise would have gone to the nonunion market was generated for union employees.

In 1988, the master labor agreement was again negotiated by the CEA on behalf of union contractors. The new agreement contained several innovative concepts to keep union contractors competitive, including the development of a marketing program to enhance the image of union contractors. A multimedia campaign was initiated to put the union contractor in direct contact with commercial and industrial consumers and to increase further the market share for union contractors.

This is an important time for the construction industry, CEA has earned a place in the history of the industry by improving in various ways the necessary, delicate relations between management and the union in northern California. Its spirit and teamwork are being felt statewide.

Independent Signatory Contractors

Employers who do not wish to affiliate with a employer association participating in the collective bargaining process but desire to be signatory to the Carpenters Master Agreement for the purpose of accessing a skilled union labor pool, may do so by being signatory to a Memorandum of Agreement. These employers are legally bound by all terms and conditions of the agreement but do not participate in negotiations.

THE CONSTRUCTION INDUSTRY AND MANAGEMENT
STUDY GUIDE

Instructions: In the space(s) provided, please fill in the correct answer(s).

1. The Construction Industry is the largest single _____ in this country.

2. The Construction Industry is made up of two major partners known as _____ and _____ .

3. _____ _____ is in the business of providing the construction industry with trained, reliable and motivated workers.

4. _____ is in the business of organizing the building process by _____ and _____ the work.

5. Labor and Management have always been and will always be _____ _____ .

6. _____ _____ is the process that through compromise will produce a contract.

7. A Collective Bargaining Agreement defines in exact terms _____ , _____ and _____ _____ union members will perform under.

8. The delegation representing the interests of Northern California carpenter local unions in collective bargaining is the _____ 46 Northern California Counties _____ _____ .

9. The primary employer association entering into collective bargaining with Northern California Carpenters is the _____ _____ _____ .

10. The Construction Employers' Association (CEA) was created in July of 1985 for the purpose of fostering better _____ _____ .

11. While other management associations represent both union and non-union contractors, the CEA admits to membership only contractors signatory to appropriate _____ _____ agreements.

12. As early as 1985 and again in 1988, the CEA negotiated the _____ _____ _____ with the carpenters on behalf of union contractors.

13. Two innovative concepts that have developed through CEA and union cooperation include the Carpenters _____ Preservation _____ and an aggressive _____ _____ to enhance the image of union contractors.

14. Contractors not affiliated with an employer association participating in collective bargaining but who desire to be signatory to the Carpenters Master Agreement may do so by signing a _____ of _____ .

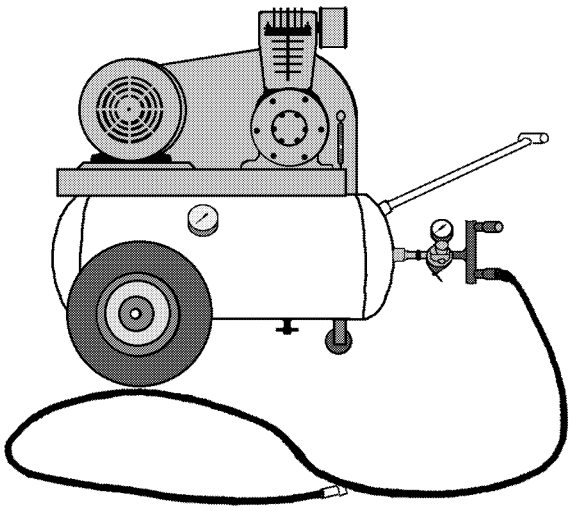
NOTES:

COMPRESSOR SYSTEMS

- **What is an air compressor system?**
- **What are the compressor hazards?**
- **How does the carpenter use a compressor and compressed air safely?**

INTRODUCTION

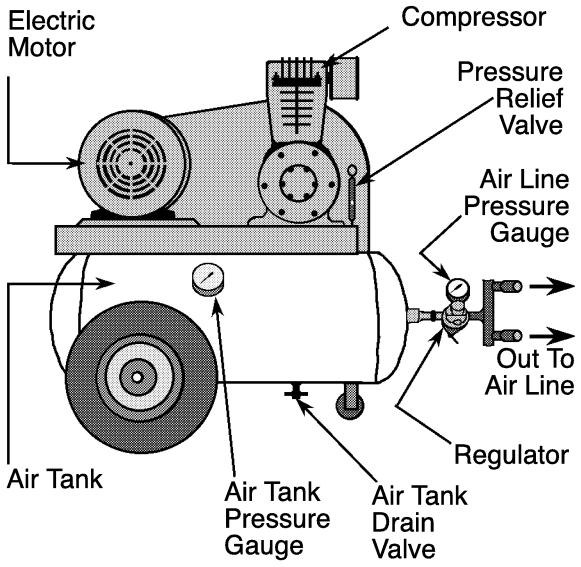
Another important way to power tools on a construction site is with compressed air. "Pneumatic" tools are driven by compressed air. The air comes from a compressor system, which is made up of a portable air compressor, pressure gauge, pressure regulator, and airlines. As with electrical tools, pneumatic tools, air lines, and air compressors have safety issues.



Air Systems

AIR COMPRESSOR

The air is compressed by a pump driven by an electric motor or gasoline engine. The compressed air is stored in a tank. The tank has a gauge that indicates the tank pressure. For safety, the tank has a relief valve that "blows off" before excessive pressure ruptures the tank. The pressure to the air lines is controlled by a regulator. There is also a gauge that indicates the air line pressure.



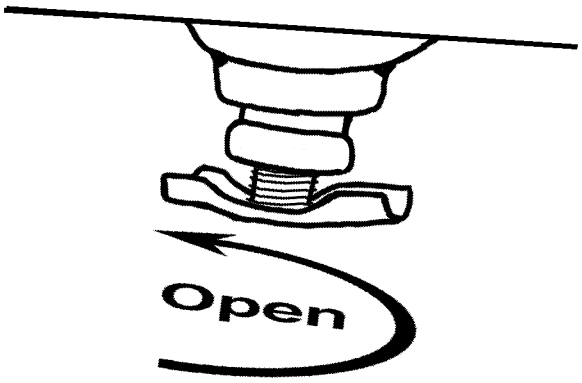
Air Compressor

Air Compressor Pump

The pump compresses the air with a piston that moves up and down in a cylinder. The compressed air is stored in an air tank.

Air Tank

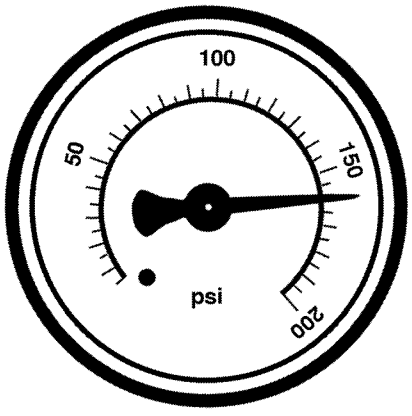
The air tank is a reservoir that provides an uniform flow of air to the pneumatic tool. The tank pressure is controlled by a switch that turns the compressor on and off. The tank also has a drain valve at the bottom. This valve is used to remove moisture from the tank. Open the valve when the compressor is turned off and the tank pressure is less than ten (10) psi. To open the valve turn the knob counter clockwise.



Tank Drain Valve

Air Tank Pressure Gauge

The tank pressure gauge indicates the pressure in the tank.

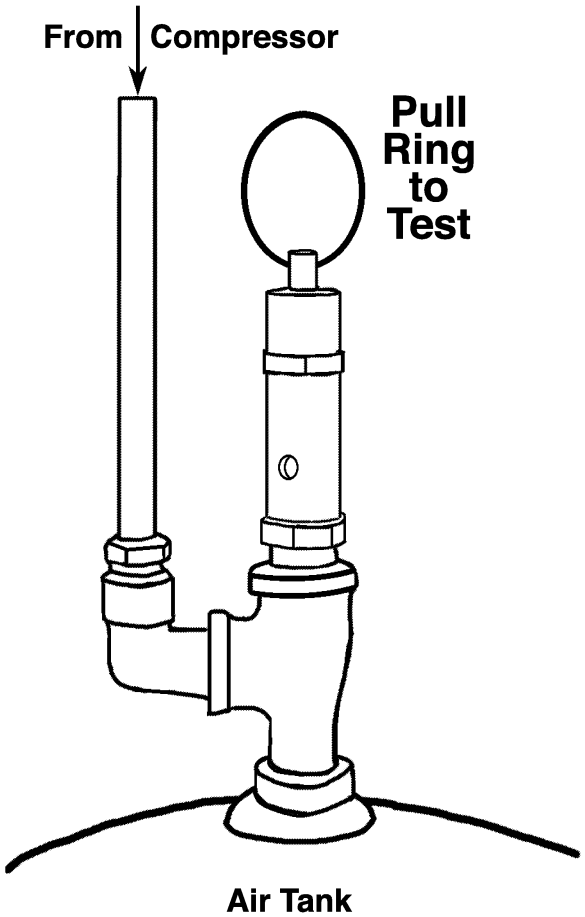


Pressure Gauge

Safety Relief Valve

This valve prevents tank rupture by relieving pressure when the compressed air reaches a certain predetermined level. The valve is preset by the manufacturer and must not be damaged or changed in any way.

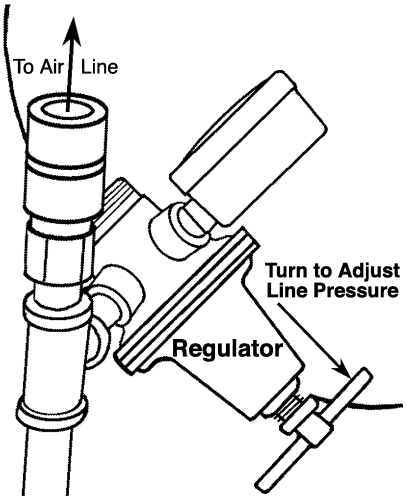
Check proper valve operation by pulling on the test ring. The valve will release air. If it does not; it is not working. Replace it immediately. The valve will reset automatically at a lower pressure when the ring is released.



Relief Valve

Air Line Pressure Regulator

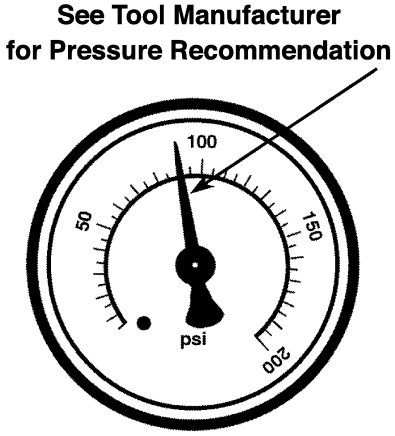
The regulator handle controls the air pressure from the tank into the air line. Turn the handle clockwise to increase the line pressure. Turn the handle counter clockwise to decrease the line pressure.



Regulator

Regulator Pressure Gauge

This gauge indicates the discharge pressure [controlled by the regulator] into the air line. The pressure will be equal to or less than the tank pressure. However, this pressure may not be the air pressure at the tool due to the length of the airline and any air leaks.



Regulator Gauge

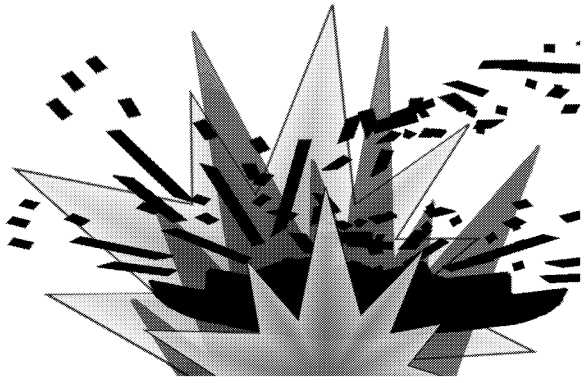
COMPRESSOR HAZARDS

As with any other tool, the compressor system has its own hazards. The hazards are bursting, fire or explosion, electric shock, flying objects, breathing hazards, moving parts, and burns.

Bursting

The following conditions can weaken the air tank, resulting in a violent explosion. Water from the compressed air can rust and thin the tank walls. Modifications or crude repairs can weaken the tank. It is dangerous to make unauthorized changes to the pressure switch, relief valve or other parts that control the tank pressure.

Drain the tank daily or after use. If the tank develops a leak, replace the tank or the compressor at once. Never drill into or weld the tank. The tank is designed to withstand certain operation pressures. Never make adjustments or substitute parts to alter the factory set operational pressures.



Explosion

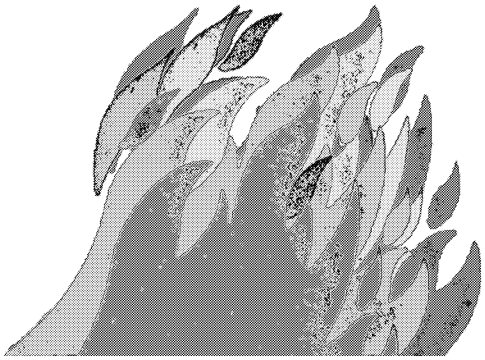
Fire or Explosion

It is normal for the electrical contacts in the motor and pressure switch to spark. If electrical sparks from the compressor come in contact with flammable vapors, they may ignite causing a fire or explosion. Also, restricting

any of the compressor ventilation openings will cause serious overheating and could cause fire.

Operate the compressor in a well ventilated area free of combustible materials, gasoline, or solvent vapors. If spraying flammable materials, located the compressor at least 20 feet from the spray area. Store flammable materials away from the compressor.

Never place objects against or on top of the compressor. Operate the compressor at least 12 inches away from any wall or obstruction that would decrease the flow of fresh air to the compressor ventilation openings.

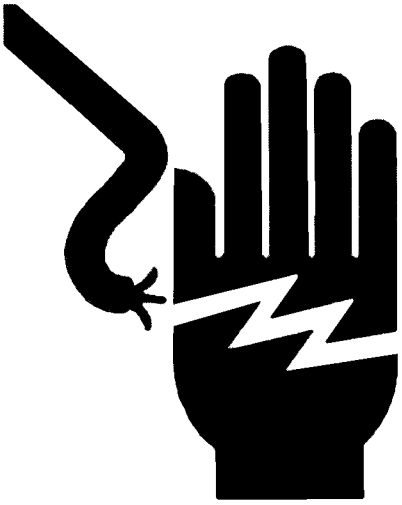


Fire

Electric Shock

The air compressor is powered by electricity. If it is not used properly, it could cause an electrical shock. Inadequate compressor electrical grounding could result in death or injury. Repairs by unqualified personnel can result in death or serious injury.

Never operate a compressor in the rain or other wet conditions. Do not operate a compressor with missing guards or shields. Repairs to electrical parts must be made by only trained and authorized personnel. Make sure the electric circuit to which the compressor is connected provides proper electrical grounding, correct voltage, and enough circuit protection.

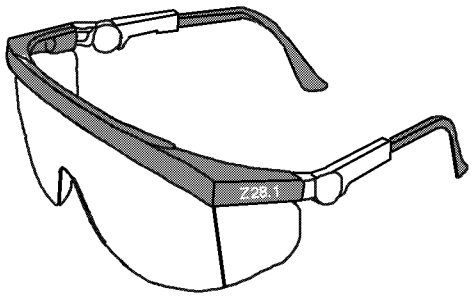


Electrocution

Flying Objects

The compressed air stream can cause soft tissue damage to exposed skin. The air stream can propel dirt, chips, loose particles and small objects at high speed, resulting in serious injury.

Never direct an air stream at people or animals. Always wear ANSI Z28.1 approved safety glasses with side shields when using compressed air.

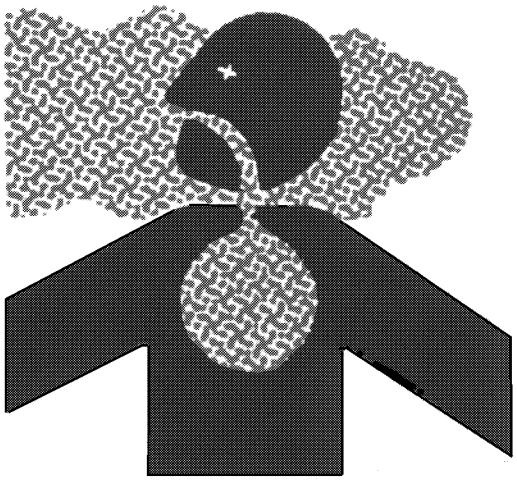


Flying Objects

Breathing Hazards

The compressed air from our compressor is not safe for breathing. The air stream may contain carbon monoxide, toxic vapors, or solid particles. Sprayed materials such as paint and paint solvents contain harmful vapors and poisons.

Never inhale air from the compressor either directly from or through a breathing device connected to the compressor. Operate the air compressor in a well ventilated area. When spraying materials use a NIOSH approved respirator designed for the specific chemical.

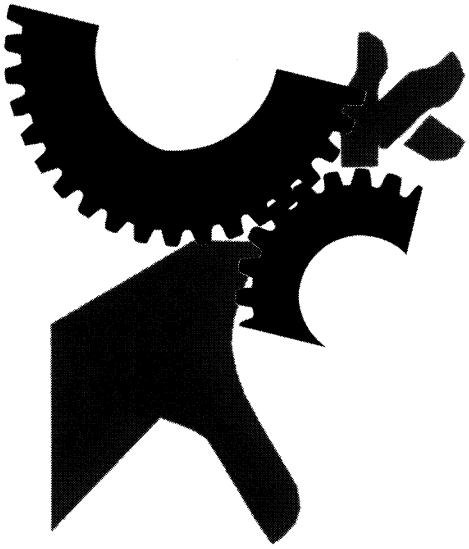


Breathing

Moving Parts

The compressor cycles automatically when the switch is on. Moving parts can cause serious injury or damage if they come in contact with you or your clothing.

Always shut off the compressor, disconnect the electricity, bleed the pressure from the tank, and air hose before doing any maintenance. Do not remove protective guards from the compressor. Never operate a compressor with missing or damaged guards or protective covers.



Moving Parts

Burns

Touching exposed metal such as the compressor head or outlet tube can result in serious burns.

Do not touch metal parts during or immediately after operation. Compressors will remain hot for several minutes after operation.

Burns

AIR LINES

The compressed air is delivered to the pneumatic tool with air lines. The initial air pressure in the air line is controlled by the regulator at the compressor. However, the pressure at the tool may be less than the pressure at the regulator. If the pressure is too low the tool may not work properly. Use the proper size air hose and fittings to keep the air pressure at a maximum throughout the airline. Most manufacturers recommend 70 to 90 psi at the tool.

Connect the air lines together with a locking device. If an air lines comes loose under high pressure, it can whip around and injure someone.

To ensure the best connection, clean any dirt off the nipple before connecting the air hose to the tool. When the tool is connected, check the hose and all connections for leaks.

AIR LINE SAFETY

Before making or breaking any air connection, always turn off the air supply. Use the valve to turn off the air supply. Do not kink the hose. Kinking the hose may damage or rupture the air line.

Protect the air hose from damage. Move it out of the way so vehicles do not run over it. Do not drag hoses around sharp corners.

Make sure the hose connections are secure to avoid the hose coming loose during use. High air pressure can cause serious injury.

SUMMARY

Pneumatic tools are driven by compressed air. On the construction site, the compressed air system is made up of a portable air compressor and one or more air lines.

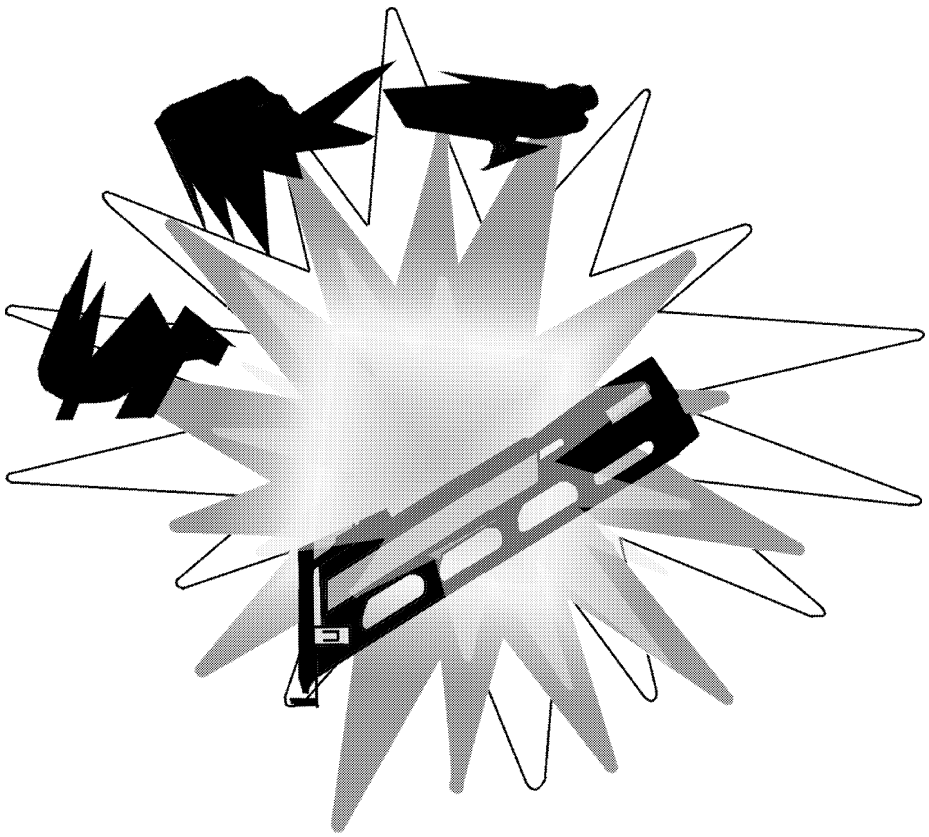
Compressor hazards are tank burst, fire or explosion, electric shock, flying objects, breathing risks, moving parts, and burns. Air line hazards are line burst due to damage from kinking or other misuse and loose hoses.

Completing some very simple tasks such as checking the relief valve, draining the tank, and protecting the air hoses will make compressor use safe.

REFERENCES:

Carpentry, Koel, Leonard, current edition, Unit 18

Do not exceed the pressure rating of the tool. Excessive pressure can cause the tool to explode or fly apart. This can cause serious injury



NOTES:

USING A PNEUMATIC NAILER

INTRODUCTION

In this lesson you will use a pneumatic nailer and a portable air compressor to nail sheathing.

LESSON OBJECTIVES

At the end of this lesson the student will be able to set up a portable air compressor and safely use a pneumatic nailer to fasten sheathing to 2x backing.

SPECIFIC OBJECTIVES

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

1. Given a pneumatic nailer and portable air compressor, identify the hazards and safety features of each.
2. Given a pneumatic nailer, portable air compressor and materials, safely face nail sheathing to a specified nail spacing.

APPLICATION IN THE FIELD

Driving a nail into a piece of lumber with a nail hammer is one of a carpenter's most basic skills. Doing it with two or three whacks and not bending it over requires good hand - eye coordination. It also requires some practice. However, efficient nailing of large areas of sheathing is done with air power rather than arm power. Repetitious production nailing of roof, floor, and wall sheathing is completed using pneumatic nailers. Often this task falls to apprentice carpenters.

Pneumatic nailers are powerful. They can drive a $3\ ^{1}/_{2}''$ nail into hard wood in an instant. Air pushes a long slender projectile out at high speed, much like a bullet. These projectiles will tumble end over end causing a lot of tissue damage if they strike you or a coworker. As productive as a pneumatic nailer is, it can be dangerous when improperly used.

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
2. Carpentry, Koel, Leonard, current edition, Unit 18

EQUIPMENT

To be supplied by the training facility (per 20 students):

1. One (1) Portable air compressor
2. Two (2) Pneumatic nailers
3. Two (2) Air lines
4. Ten (10) Skilsaws
5. Eleven (11) Extension cords
6. Ten (10) Saw horses

STUDENT TOOLS

1. Pencil
2. Measuring tape 1″ x 25′
3. Hammer 16 - 20 oz.
4. Set nail bags or overalls
5. Combination square or speed square
6. Utility knife

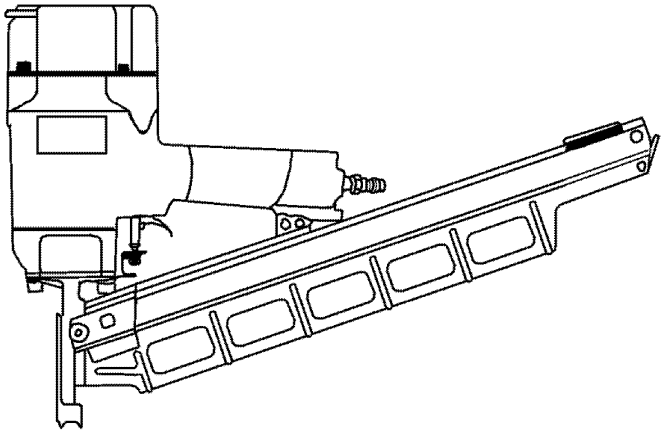
INTRODUCTION

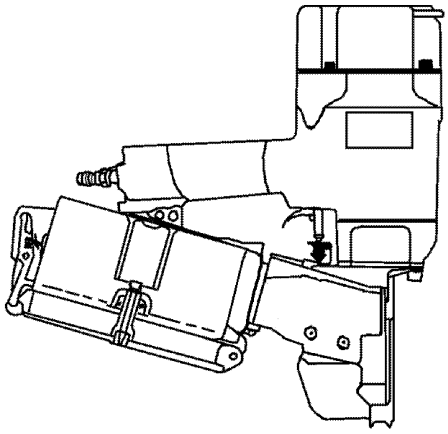
Pneumatic Nailer Types

Pneumatic nailers are made by a variety of manufacturers for many purposes. Some are for general use and others for highly specialized applications. The mechanism of a nailer is not complicated. A piston is charged with air. When the trigger and the safety device are engaged, the piston pushes a rod, driving the fastener.

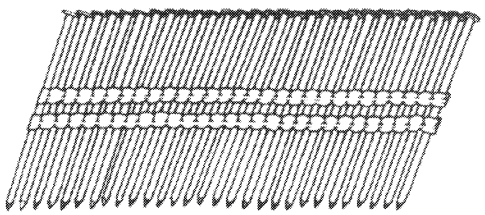
FRAMING NAILER

Framing nailers are used for general construction such as wall, floor and roof framing and sheathing. They drive nails 2 inches to 3 $^{1}/_{2}$ inches long. They have either a coil magazine or a strip magazine.

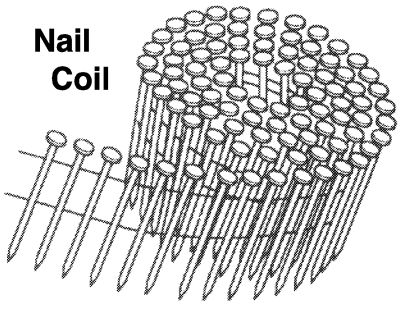




Nail Strip

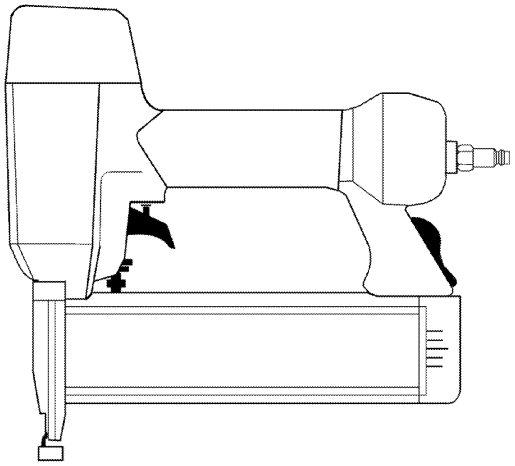


Nail Coil



FINISH NAILER

The finish nailer is used for light trim installation such as door and window casing and cabinet construction. They drive brads and small wire gauge finish nails. They have a strip magazine.



STAPLER

The stapler is used for both general construction and finish work when this type of fastener is allowed by the building codes. It is also used for mobile home and other kinds of manufacturing. The pneumatic stapler looks similar to the finish nailer, except it drives a staple rather than a nail.

Pneumatic Nailer Parts

All pneumatic nailers have essentially the same parts. However, each manufacturer arranges them differently. You must look at the manufacturer's instruction to determine the location of the components.

- Trigger

  Depress to discharge the fastener.

  There are two types of triggers, "sequential trip" (restrictive or single shot) and "contact trip" (continuous operation). More about that below.

- Magazine

  The fasteners are stored in the magazine.

  There are two types of magazines, strip and coil.

- Firing Head

  Nailer muzzle.

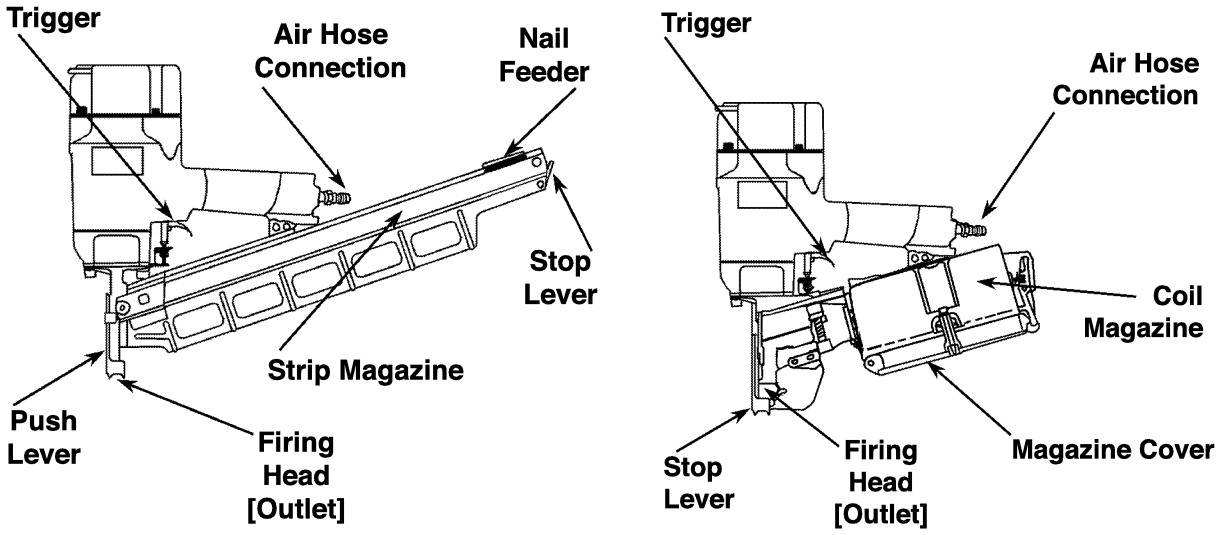
  The fastener discharges here. Point at work surface only.

- Push Lever (also called a stop lever or nosepiece)

  A safety feature. It must be depressed against the work surface for the nailer to discharge the fastener.

- Air Hose Connection

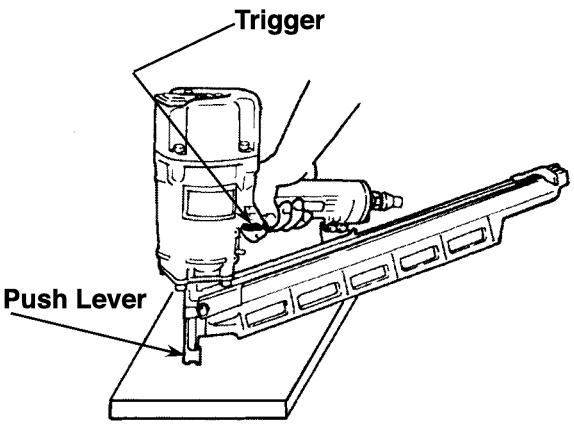
  Attach the air line here. It must be some kind of locking connector.



Trigger Types

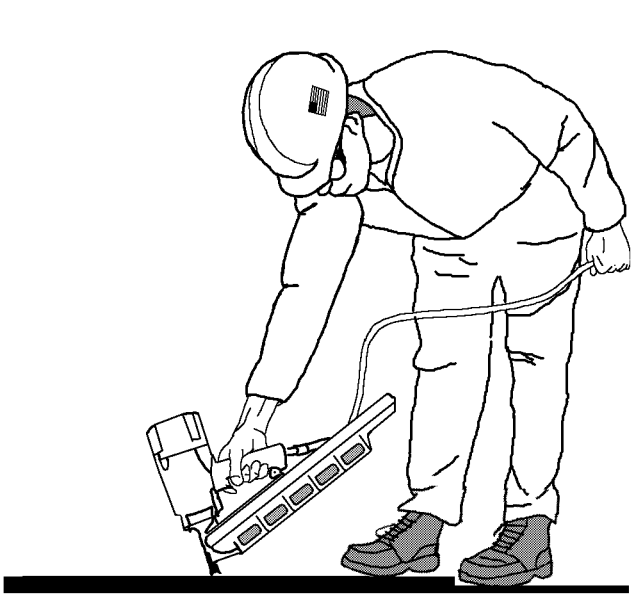
To drive a nail with a pneumatic nailer two things have to happen. The push lever must be pressed against the material and the trigger must be fingered.

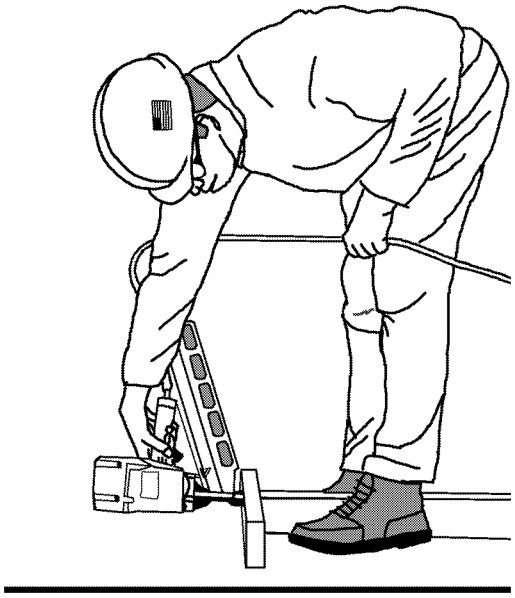
With the sequential trip trigger, the trigger must be squeezed and release every time a nail is driven. The other type of nail gun trigger is called a contact-trip or bounce fire. The finger keeps the trigger down and the nailer to continues to fire each time the push lever is depressed against the material.



The nailer will recoil each time it is fired. The recoil will lift the push lever off the work surface. This recoil action can cause a contact nailer to double fire. The back of the nailer can bounce off something or the pressure of your arm pushes the nailer down again and with the trigger still depressed, the nailer discharges. The second nail may fasten your foot to the sheathing or take off and strike a fellow worker.

When the nailer is held perpendicular to the work surface, such as when nailing sheathing, the recoil is easier to control and a nailer with a bounce trigger is selected; because it provides greater productivity. When the nailer is held parallel to the work surface, such as framing, an wayward nail is more likely to become airborne with a misfire due to recoil. For this type of operation a nailer with a sequential trip trigger is a safer choice.





Pneumatic Nailer Maintenance

Pneumatic nailers need a minimum amount of maintenance.

- Wipe clean daily and inspect for wear.
- Tighten any loose screws.
- Lubricate only according to manufacturer's instructions.

Some tools do not need lubrication, Others need to be lubricated daily or weekly.

Over lubrication can “gum up” the moving parts, slowing the operation.

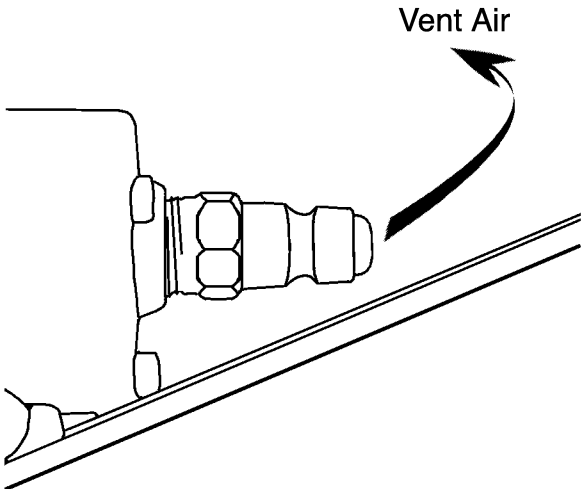
Pneumatic Nailer Hazards

Although the pneumatic nailer is useful for production nailing, the nailer itself and the work environment create hazards. Among them are injury due to accidental discharge, harm to the body from repetitive type work, and death or injury from falls from heights.

ACCIDENTAL DISCHARGE

Many worksite accidents occur when the nailer is carried around with the trigger depressed. Never carry the nailer around when connected to an air supply with your finger on the trigger. Remember, the trigger is one part of a two part safety system. With the trigger depressed, all you need to do is push the push lever against something to discharge a nail. Always treat the nailer like a loaded pistol or rifle, and do not point it at anyone.

Always disconnect the air supply when doing maintenance, clearing a jam, or fixing any malfunction. The fastener is waiting to be discharge as soon as the problem fixed. It will strike any body part in its path. Be sure the nailer is equipped with a fitting that releases air pressure when the tool is disconnected from the air hose. Storing air in a nailer is dangerous.



REPETITIVE WORK

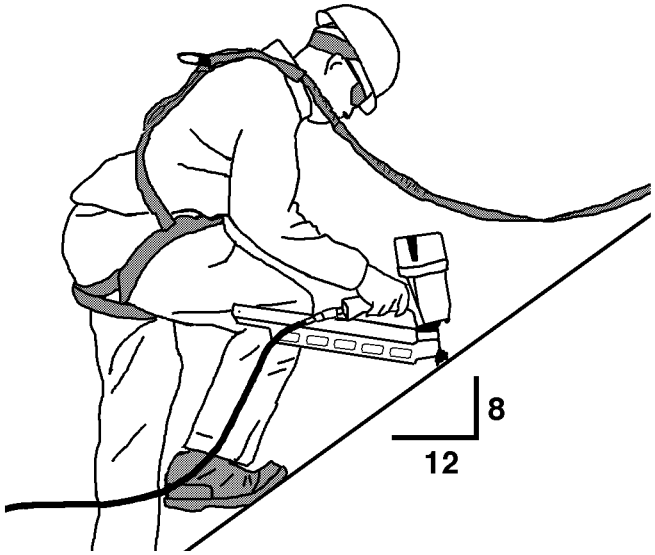
Nailing a deck is repetitive work. Doing the same motions over and over again puts stress on muscles, tendons and joints. Every time a muscle contracts and relaxes the tendons are stretched. Repeated stretching and pulling can lead to inflammation of the tendon, especially if the tendon and muscles do not get enough time for rest and recovery.

Nerves and blood vessels can also be damaged by repetitive work if they a squeezed against a hard tool handle or against muscle and bone. As repetitive work becomes tiring, you exert more muscle effort to make up for the fact your muscles are becoming less efficient with time. As you exert more muscle effort, you increase risk of damage to your nerves and blood vessels.

STEEP ROOF SLOPE

It is harder to keep your balance when moving down, rather than up, on a pitch roof. Also, the abnormal stretching puts excess strain your back and leg muscles. Always nail uphill on any pitched roof.

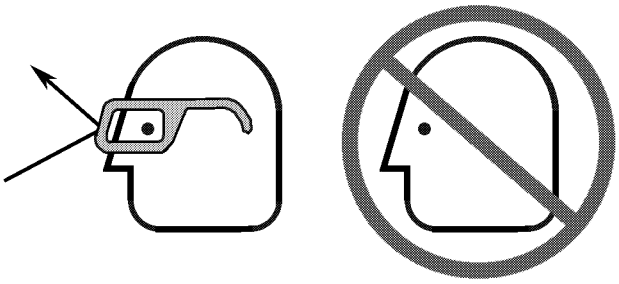
In addition to the loss of balance, the chance of slips, trips and falls increase as the roof slope increases. On steep roofs with a slope of 8 & 12 or more, the California Construction Safety Orders requires fall protection.



Pneumatic Nailer Safety

Read the manufacturer's manual first.

Most pneumatic nailers are designed to do the same type of job and operate in much the same manner. However, each brand and model is a little different from the others. Using the wrong fastener, air pressure, or lubricant may cause injury, reduced production, or increased tool wear.



Always wear OSHA approved safety glasses.

The operator must wear safety glasses with side shields when operating the nailer.

Safety glasses should be worn by everybody on a site where nail guns are used.

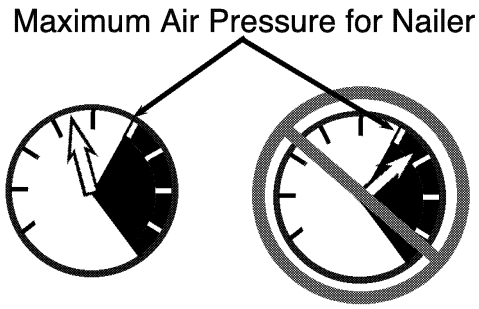
Also a hard hat and ear plugs will give you further protection from injury.

Keep your finger off the trigger when the nailer is not in use.

To operate the nailer you have to do two things. Depress the plunger at the end of the tool and squeeze the trigger. If you walk around the job with your finger on the trigger, you can bump any surface and discharge the nail. Any surface will do; hand, arm, knee. foot, head, elbow, stomach, chest or shoulder. All of these body parts have been punctured by a nail or staple.

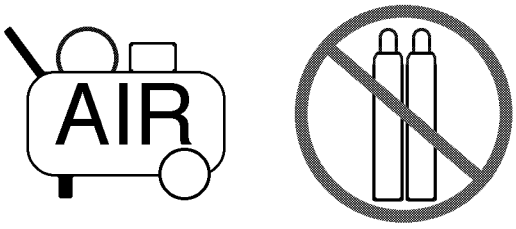
Never exceed the recommended air pressure at the tool.

The air line must have a regulator to control the air pressure to the nailer.



Use regulated compressed air only.

Never use bottled gases such as air, oxygen, acetylene, or carbon dioxide as a power source.



Operate the tool on the work surface only.

Do not squeeze the trigger unless the tool is pressed firmly against the material you are nailing.

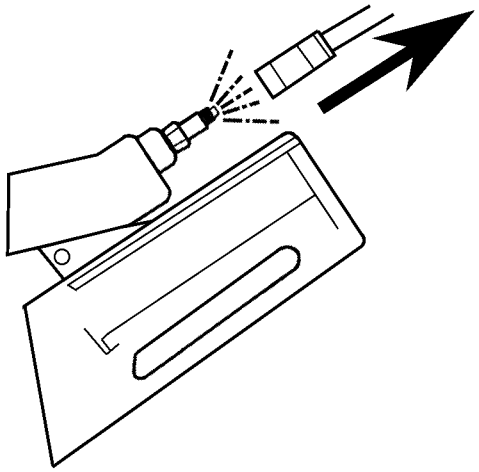
Do not nail close the edge of the material. The wood can chip out and the nail can be deflected into the air.

Always point the tool away from other people and yourself.

Nearly all pneumatic tool accidents happen because the business end of the tool was pointed away from the work surface.

Keep hands and feet away from the area being fastened.

Watch for crew members working near you. Never point the tool at another person.



Disconnect the air supply before servicing the tool.

Always disconnect the air supply before removing a jam or another malfunction. The fastener will discharge as soon as the problem is fixed. It will nail anything in its path, including body parts.

Never modify the tool.

You have a grand idea to improve a tool. Don't do it. The manufacturer spent millions of dollars on tool design and testing. They did this to make certain the tool is safe. Your "improvement" could turn the nailer into a lethal device.

Check the tool for proper operation before using.

Visually check for fastener jams.

Check the plunger and the trigger for operation.

Verify the fastener is driven flush with the material. Protruding nails have less holding power and present a trip hazard. Countersunk nails break the wood fibers and have less holding power.

PROCEDURES:

Safety Check

Visually examine the compressor and air lines for missing guards, parts, breaks, and other damage.

Start the compressor and allow air tank to fill. (compressor should shut off or idle).

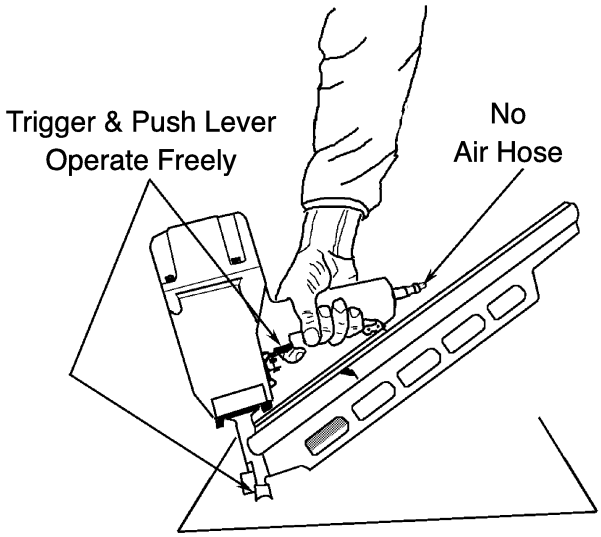
Pull and release ring on the pressure relief valve to confirm it works.

Connect the air lines and check for leaks.

Adjust the regulator to supply the recommended pressure.

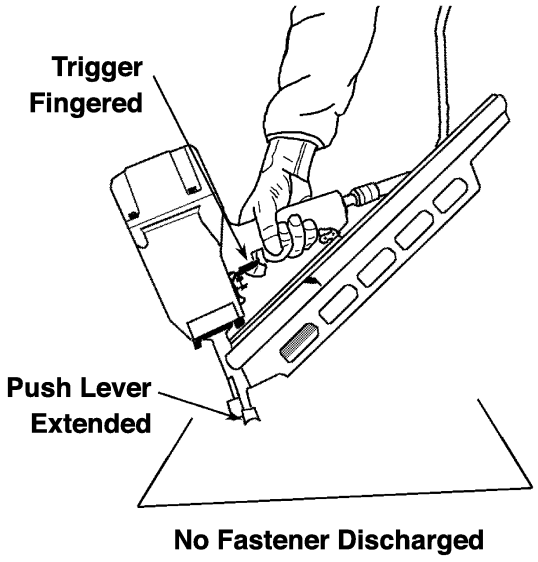
Nailer Safety Check

- Begin the nailer safety check with the air hose disconnected
- Push the nailer against the work surface to depress push lever and squeeze trigger. Both must move freely.
- Visually check for nail jams.

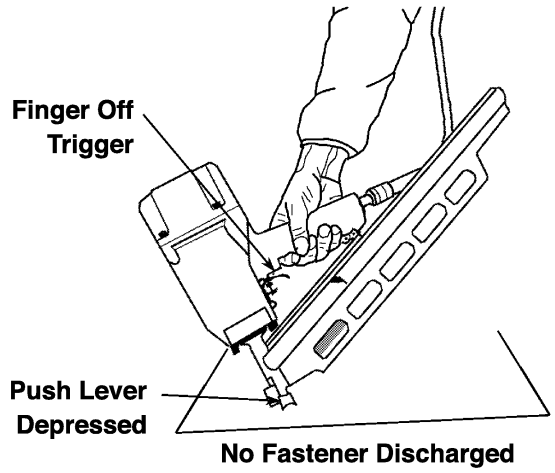


Connect the air line to the nailer.

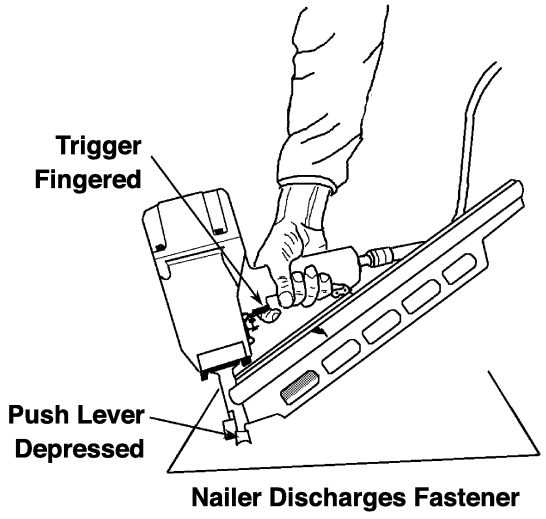
- Hold nailer away from work surface and squeeze the trigger.
- Nailer does not discharge.



- With finger off of the trigger depress the push lever against the work surface.
- Nailer does not discharge.



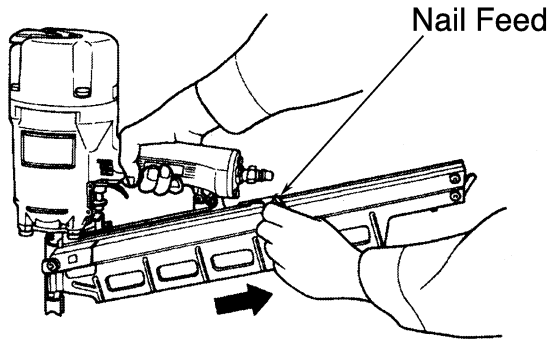
- Depress nailer against work surface and squeeze the trigger.
- Nailer discharges.



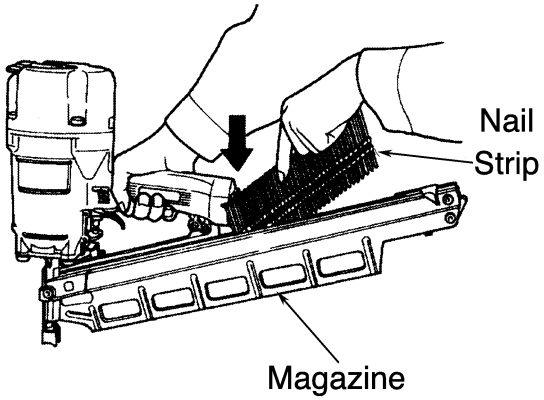
Load Nailer

Load nailer as shown.

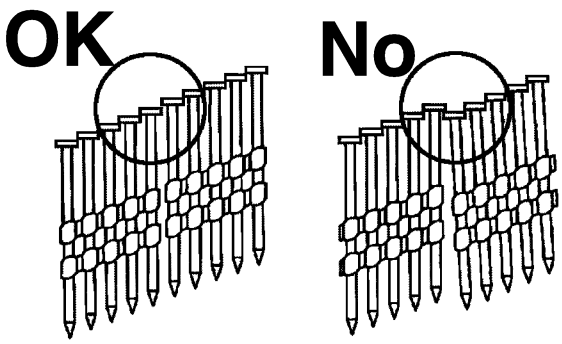
- Pull back the nail feed.



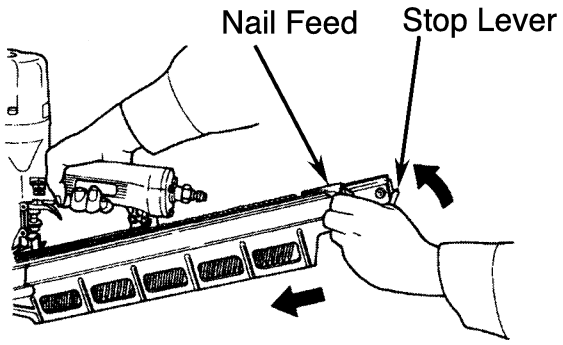
- Insert first nail strip

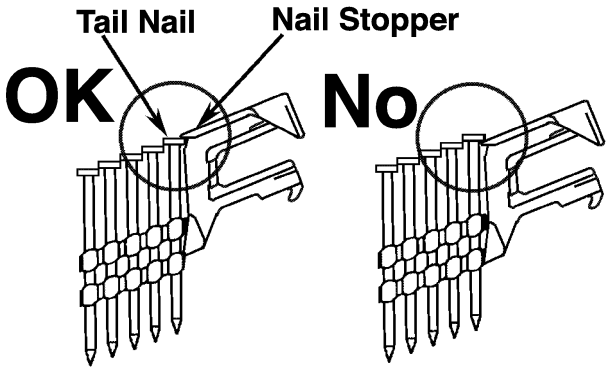


- Insert second nail strip. Be sure it overlaps the first strip as shown.



- Release the nail feed and slide it down to nail strip. Be sure it overlaps the nail strip as shown.





The nailer is ready for use. Remember, only squeeze the trigger when the nailer is depressed against the work surface.

NAILER PRACTICE

Use the drawing on page 42, equipment and materials provided, and the following directions to assemble a building element.

Using a skilsaw, cut the 2x4s to length.

Nail frame together by hand with 2 - 16d nails top and bottom each piece.

Use a skilsaw to cut the plywood to the size shown.

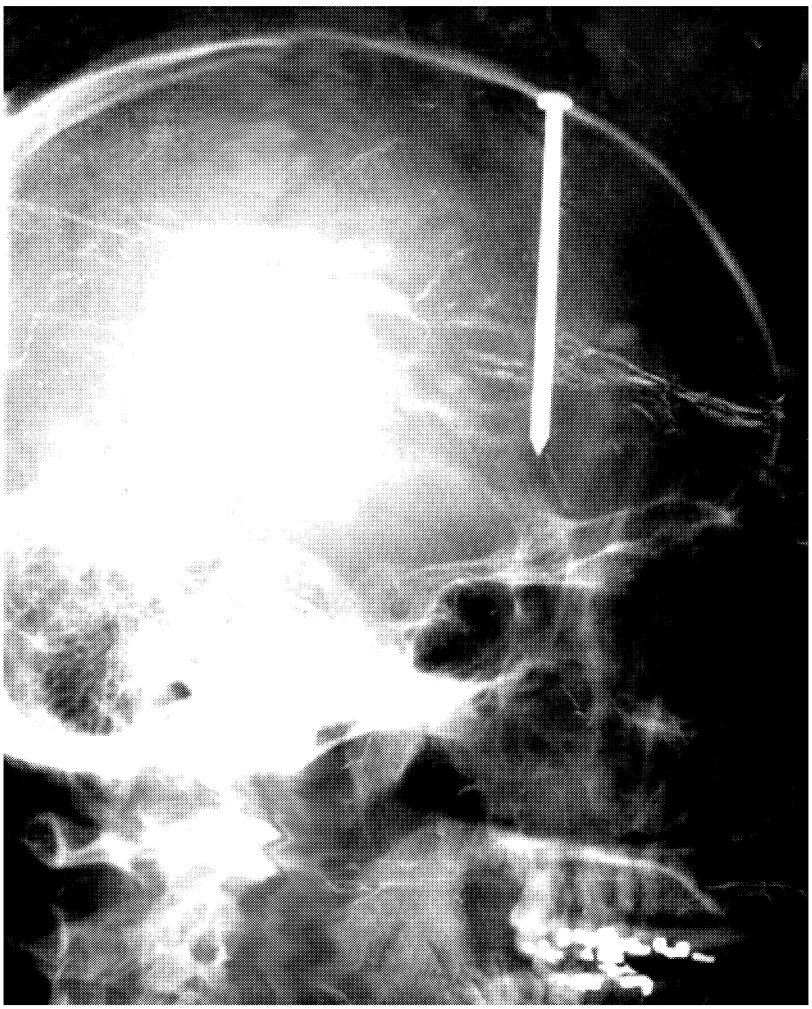
Set up and safety check the pneumatic nailer and compressor.

Use the pneumatic nailer to fasten the plywood to the frame. Use the nailing spacing shown on the drawing.

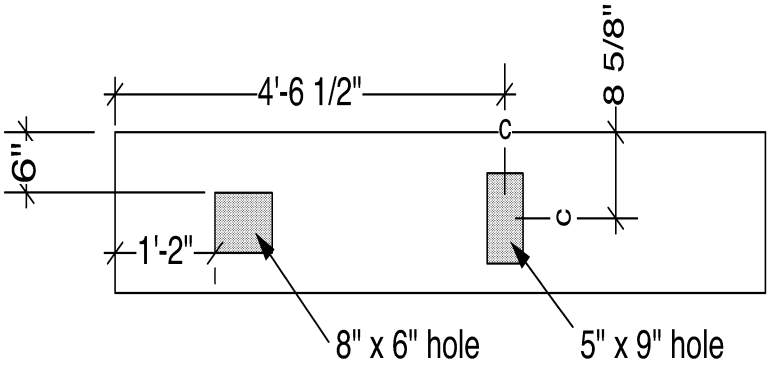
Use the skilsaw to plunge cut the two openings shown.

Watch for crew members working near you.

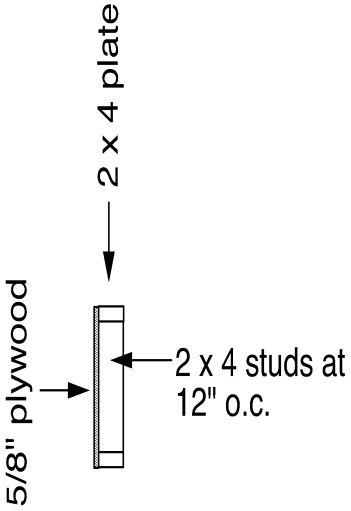
Keep your finger off the trigger.



Plan View

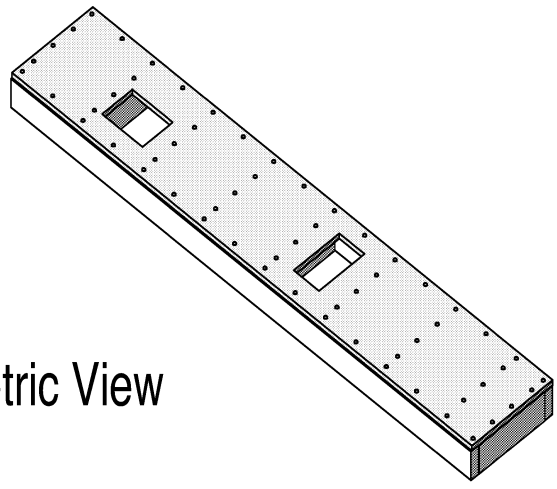


5/8" plywood with plunge cut holes



End View

Fasten plywood to 2 x 4s
with 8d nails at 6" o.c.



Isometric View

USING A PNEUMATIC NAILER

INSTRUCTIONS:

Use this check list to verify you have completed each step of the pneumatic nailer lesson.

Your instructor will use the check list to verify that you have correctly completed each step.

Use the material, tools, the student lesson book and the check list to build and assemble the project.

Checklist - Using a Pneumatic Nailer

		Student	Instructor
1.	Student can identify compressor and nailer parts by name	_____	_____
2.	The frame is assembled as shown	_____	_____
3.	Frame dimensions are +/- $^1/_8$″	_____	_____
4.	Student completed compressor safety check	_____	_____
5.	Student completed nailer safety check	_____	_____
6.	Student safely nailed plywood to frame	_____	_____
7.	Nails do not stick up above the plywood	_____	_____
8.	Nails do not break top plywood layer	_____	_____
9.	Openings are as shown +/- $^1/_8$″	_____	_____

NOTES:

DIAGONALS

- **What is a right angle?**
- **How are diagonals calculated?**
- **Why are diagonals used in the layout of a building?**
- **How is a 3-4-5 triangle used?**

INTRODUCTION

The majority of rooms or buildings built today are box shaped. To outline such a building the carpenter would form a square or rectangle on the area it is to be built. In order to build them correctly a carpenter must be able to accurately layout walls that are at right angles to each other. Any two straight lines or walls that intersect each other form an angle. If that angle is exactly 90° it is called a right angle and the walls or lines are said to be square with each other. A right angle stub wall can be laid out by tracing a line on the edge of a properly aligned framing or speed square. However, once a wall extends much beyond 2′ the accuracy of this procedure is reduced and an alternate method should be used. A better procedure is to calculate the distance between the ends of those lines, called the diagonal, and use this number to correctly lay them out, see Fig. 1 below.

DETERMINING THE DIAGONAL

Looking at fig.1 A we can see that if we draw in the actual diagonal measure of lines **a** and **b** it creates the right triangle of fig.1 B. The diagonal measure (line c) will always be on the opposite side of the right angle and therefore can be calculated from the lengths of the lines **a** and **b**. The formula for figuring out the length of line **c** can be written either as:

$$a \times a + b \times b = c \times c$$

or:

a multiplied by itself	added to **b** multiplied by itself	is equal to **c** multiplied by itself

or:

$$a^2 + b^2 = c^2$$

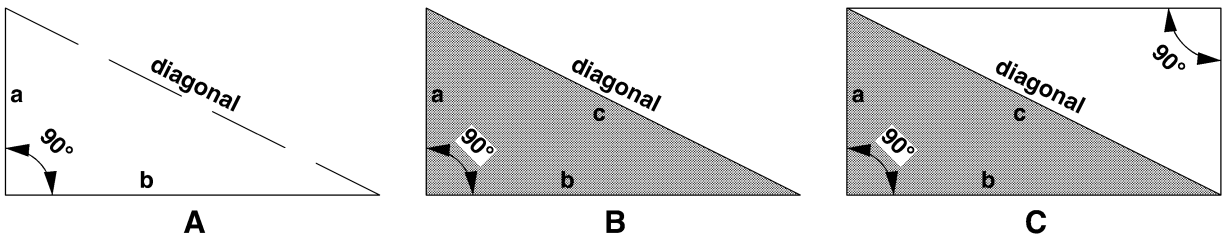


Fig. 1

It's important to remember that this formula gives you the answer to the diagonal line **c** multiplied by itself (c^2). So the result must be reduced by using the square root ($\sqrt{}$) button on your calculator

Example 1:

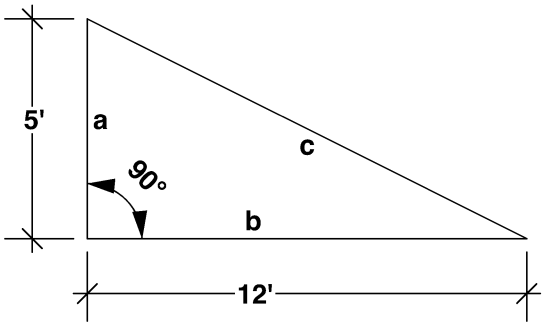


Fig. 2

In order to accurately lay out walls **a** and **b** of see Fig. 2 , start by calculating the length of the diagonal line **c**.

First multiply the length of line a by itself:

a = 5′

a x a = a^2

5′ x 5′ = 25 sq. ft.

a^2 = 25 sq. ft.

Next multiply the length of line **b** by itself:

b = 12′

b x b = b^2

12′ x 12′ = 144 sq. ft.

b^2 = 144 sq. ft.

then add the results together:

$c^2 = a^2 + b^2$

c^2 = 25 sq. ft. + 144 sq. ft.

c^2 = 169 sq. ft.

Finally reduce the result by using the square root button:

c^2 = 169 sq. ft.

$\sqrt{c^2} = \sqrt{169}$ sq. ft.

c = 13′

Therefore our diagonal is 13′

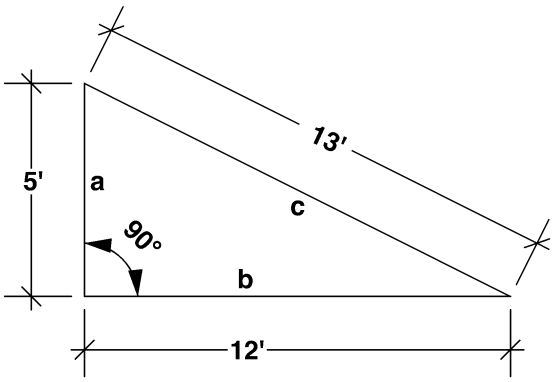


Fig. 3

USING THE DIAGONAL TO LAY OUT RIGHT ANGLE WALLS:

Now that we have completed the math, we can use our numbers to accurately lay out the walls. First measure and mark off 12′ for line **b**, see Fig. 4

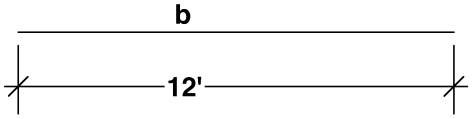


Fig. 4

Next, from the end that line **a** will extend out of, measure out 5′ and swing an arc in the approximate area where the wall should end, see Fig. 5 .

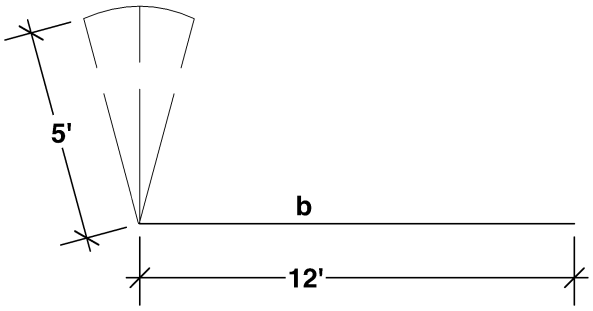


Fig. 5

Then, from the other end of line **b**, swing an arc at 13′ across the arc at 5′, see Fig. 6 .

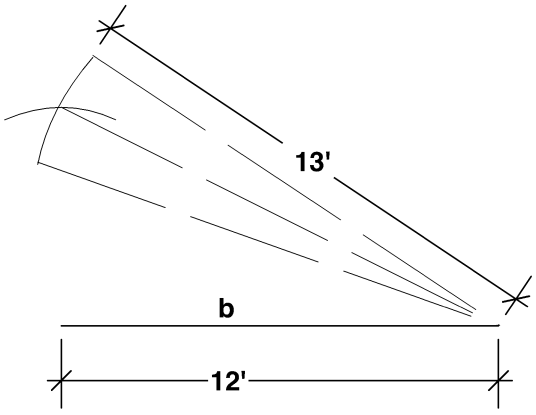


Fig. 6

Finally snap **a** chalk line from the starting point of line **b** through the point where the two arcs cross, see Fig. 7 .

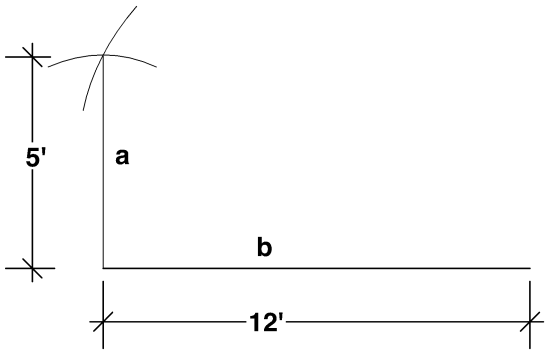


Fig. 7

USING THE DIAGONAL TO LAY OUT A RECTANGULAR BUILDING.

If we look back to fig. 6-1 and compare figures B and C, we can see that in laying out walls **a** and **b** we have completed half of a rectangle. In order to complete the rest of the rectangle, we can first repeat the steps taken to lay out line **a** on the other end of line **b**. So again measure out 5′ and swing an arc in the approximate area where the wall should end, see Fig. 8 .

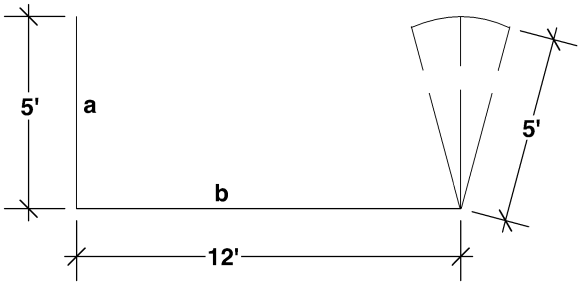


Fig. 8

Next, from the end where line **b** intersects with line **a**, swing an arc at 13′ across the arc at 5′, see Fig. 9 .

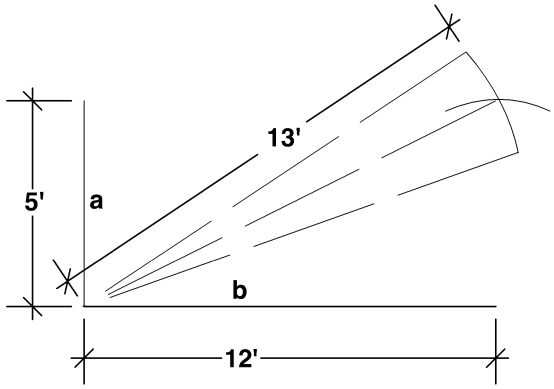


Fig. 9

Then snap a chalk line from the starting point of line **b** through the point where the two arcs cross, see Fig. 10 .

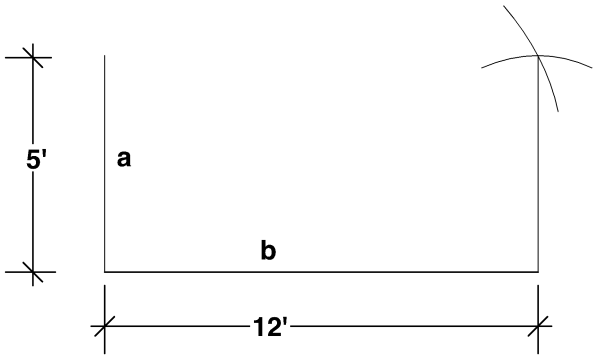


Fig. 10

Finally complete the rectangle by snapping a line to connect the open ends of the 5′ lines, see Fig. 11 .

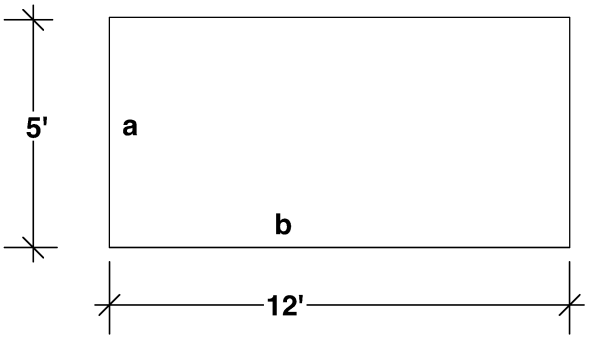


Fig. 11

This example also illustrates how to check if a rectangular or square building is laid out correctly. If it is, both diagonals must be identical, in this case both were equal to 13′, see Fig. 12 .

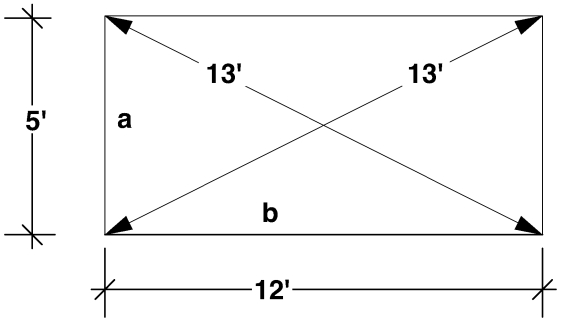


Fig. 12

THE DIAGONAL OF A SQUARE

A square is just a rectangle in which all four walls are the same length. We can use a procedure similar to example 1 to figure out what the length of its diagonal should be.

Example 2:

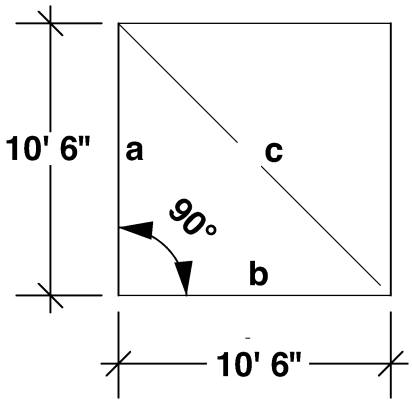


Fig. 13

First change the inch portion of the line **a** length measurement to feet and combine it with the foot portion:

6″ ÷ 12″/′ = .5′

10′ + .5′ = 10.5′

a = 10.5′

Then multiply the length of line **a** by itself:

a x a = 10.5′ x 10.5′

a^2 = 110.25 sq. ft.

Since, for a square, side **a** is equal to side **b** we can just add side $\mathbf{a}^2$ to itself for the next step:

$$\mathbf{a = b}$$

$$\mathbf{c^2 = a^2 + b^2 = a^2 + a^2}$$

$$\mathbf{c^2 = 110.25 sq.ft. + 110.25 sq.ft.}$$

$$\mathbf{c^2 = 220.5\ sq.\ ft.}$$

Then reduce the result by using the square root button:

$$\mathbf{c^2 = 220.5\ sq.\ ft.}$$

$$\mathbf{\sqrt{c^2} = \sqrt{220.5}\ sq.\ ft.}$$

$$\mathbf{c = 14.8492'}$$

In order to lay out this square, we need to read this number on our tape. So the final step is to convert the decimal foot fraction of this measurement to the nearest $^1/_{16}$ th. of an inch:

$$\mathbf{.8492' \times 12''/' = 10.1909''}$$

$$\mathbf{.1909'' \times 16 = 3.05'' \approx 3''}$$

$$\mathbf{.8492' = 10\frac{3''}{16}}$$

$$\mathbf{c = 14'10\frac{3''}{16}}$$

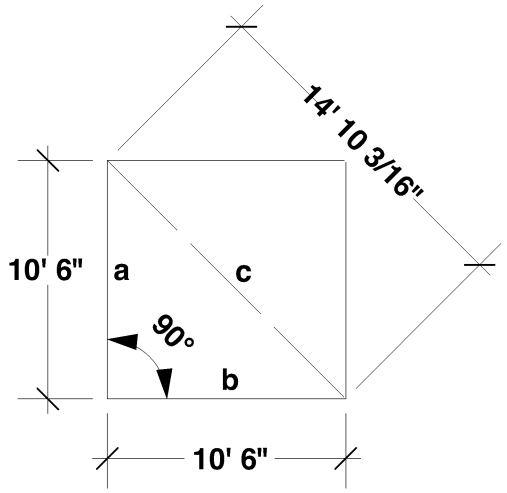


Fig. 14

THE 3-4-5 TRIANGLE

As the previous example shows, most calculations of diagonals will not come out in nice whole numbers, like the one for the triangle used in the first example. The most commonly used right triangle in which all three side lengths measure in whole units is one that has a ratio of 3-4-5, see Fig. 16 A.

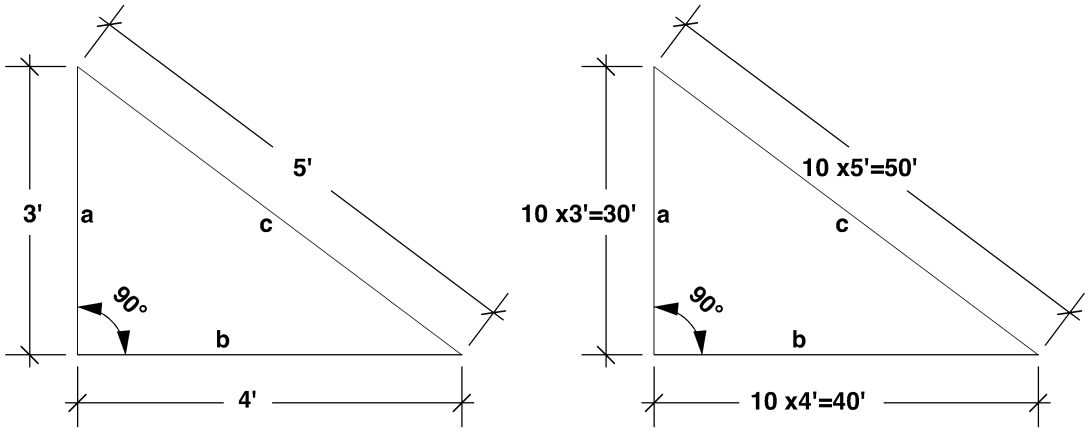


Fig. 15

For this triangle:

a x a + b x b = c x c

3′ x 3′ + 4′ x 4′ = 5′ x 5′

$9_{sq.ft.}$ + $16_{sq.ft.}$ = $25_{sq.ft.}$

In figure 15-B each side of the triangle from figure 15-A is multiplied by 10 and so for this triangle:

a x a + b x b = c x c

30′x30′+ 40′x40′ = 50′x50′

$900_{sq.ft.}$+ $1600_{sq.ft.}$ = $2500_{sq.ft.}$

This shows that as long as we multiply each of the three sides by the same number its shape remains the same. That is why rather than calculate a complicated number, often a carpenter will use the largest multiple of a 3-4-5 triangle that will fit inside the room or small building to check for square.

Example 3:

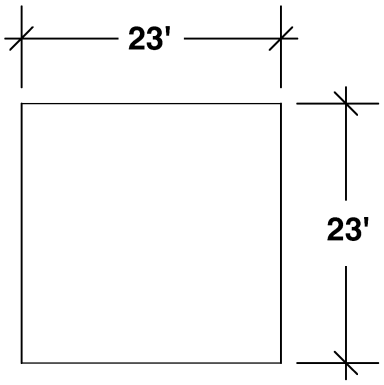


Fig. 16

To find the largest 3-4-5 triangle that fits inside the square building of fig. 6-16, divide the length of one side by 4′ and round the answer down:

23′ ÷ 4′ = 5.75 > 5

Next, multiply each side of the triangle by this number, in this case 5:

5 x 3′ = 15′

5 x 4′ = 20′

5 x 5′ = 25′

So, to check for square, we can measure out from a corner 15′ along one wall and 20′ along the other wall. Then check that the distance between these points measures 25′, see Fig. 17 .

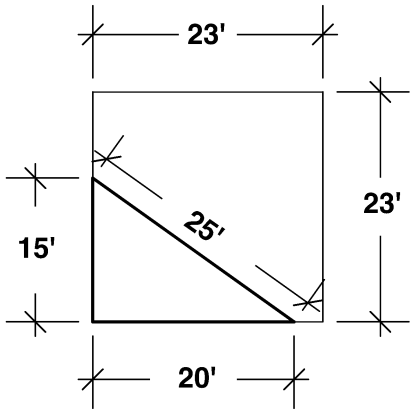


Fig. 17

Example 4:

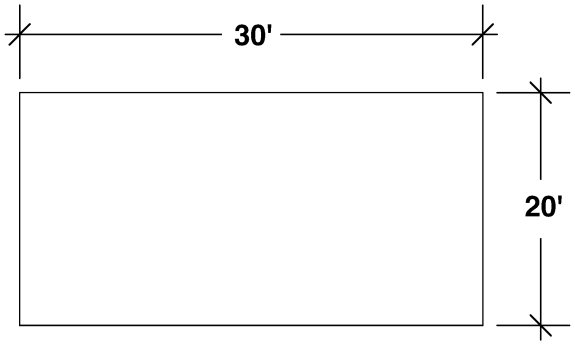


Fig. 18

To determine the largest 3-4-5 triangle that fits inside the rectangular room of fig. 6-18, first divide the length of the shortest wall by 3′ and round down:

20′ ÷ 3′ = 6.67 > 6

Next, divide the length of the longest wall by 4′ and round down:

30′ ÷ 4′ = 7.5 > 7

Then, multiply each side of the triangle by the smaller of the two numbers, in this case 6.

6 x 3′ = 18′

6 x 4′ = 24′

6 x 5′ = 30′

Finally, measure out from a corner 18′ along the short wall and 24′ along the long wall. Then check that the distance between these points measures 30′, see Fig. 19 .

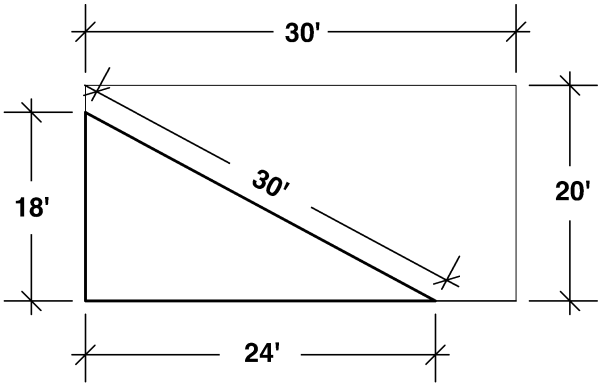


Fig. 19

If there is room on the slab to extend lines beyond the outline of fig. 6-18, it would be better to use a multiple of 8 (7.5 rounded up) on the 3-4-5 triangle to lay out the room. This procedure eliminates the need to extend the initial wall lines beyond the triangle, reducing the possibility of error, see Fig. 20 .

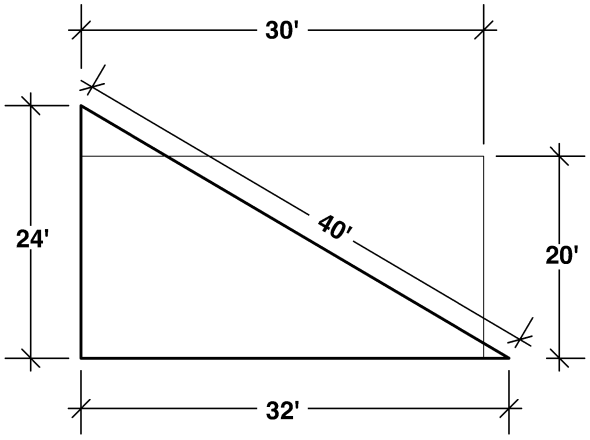


Fig. 20

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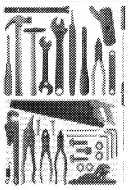
NOTES:

Realities of the Jobsite

The Work Environment

Tools



- Hand tools are your responsibility
  - If you need a tool for a job, go buy it that night
  - Buy quality tools, they last longer

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Realities of the Jobsite

Remember:

- Time is Money--give the employer a full day's work
- You are not expected to know everything, ask if you are not sure
- You will usually be working with someone

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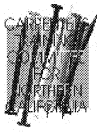
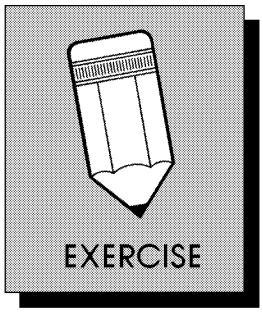
Realities of the Jobsite



THE END

By:

Carpenters Training Committee For Northern California (CTCNC)

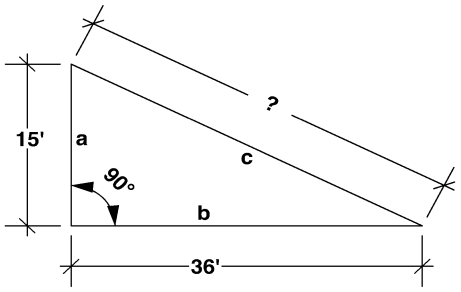


DIAGONALS

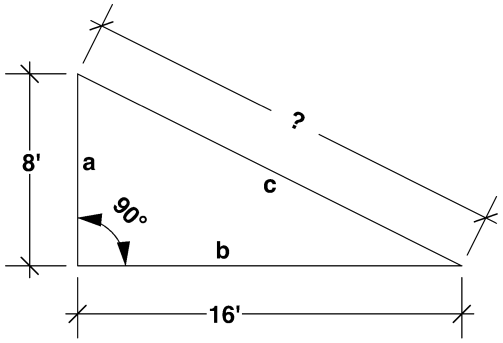
INSTRUCTIONS FOR EXERCISE

Determine the diagonal for each figure. Give the answer to the nearest 16th of an inch.

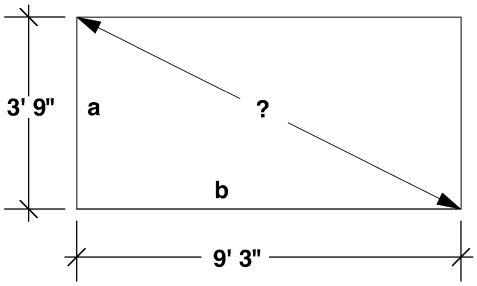
1. _____



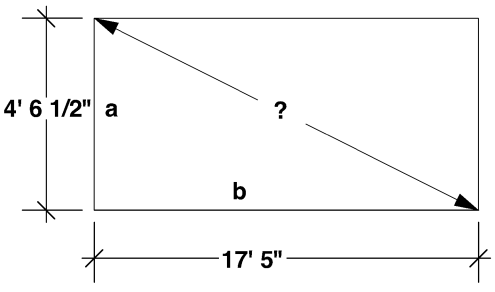
2. _____



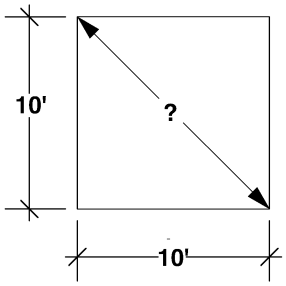
3. _____



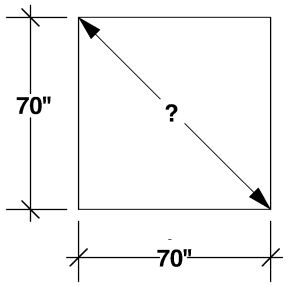
4. _____



5. _____

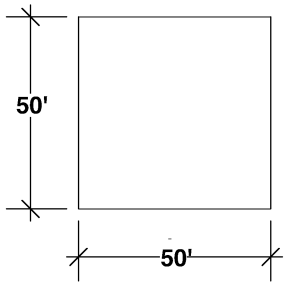


6. _____



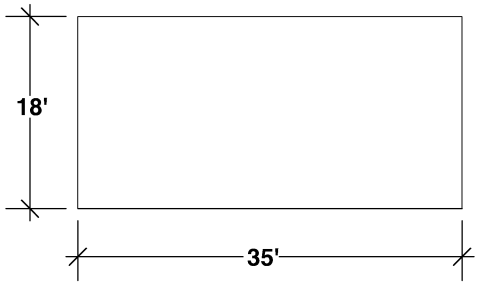
7. Find the largest 3-4-5 triangle that fits inside the building.

_____



8. Find the largest 3-4-5 triangle that fits inside the building.

_____



USING A DIAGONAL TO LAYOUT

INTRODUCTION

In this lesson you will use a measuring tape and chalk line to layout a square building.

LESSON OBJECTIVES

At the end of this lesson the student will be able to accurately layout a square building.

SPECIFIC OBJECTIVES

On completion of this lesson the student will:

1. Given a calculator and side measurement of a square, calculate the diagonal of the square.
2. Given the diagonal, measuring tape and chalk line, layout a square building to $^{1}/_{8}$″.

APPLICATION IN THE FIELD

In order to accurately build square or rectangular shaped buildings, a carpenter must be able to construct walls that intersect at right angles.

EVALUATION

Each student will be evaluated on their participation, work quality, and post test score.

REFERENCES

1. Student Lesson Book

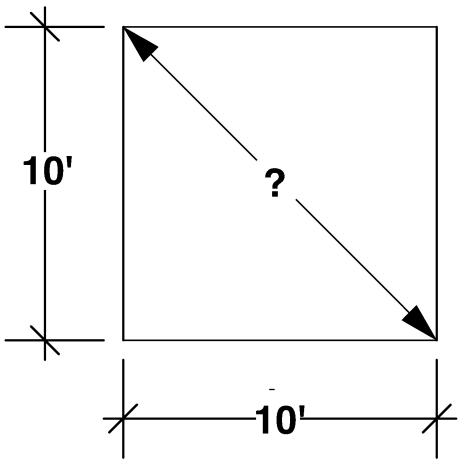
EQUIPMENT

To be supplied by the training facility

STUDENT TOOLS

1. One (1) Calculator
2. One (1) Measuring tape 1″ x 25′
3. One (1) Chalk Line
4. One (1) Pencil

PROCEDURES



1. Determine the diagonal length of the square above. _____
2. Snap out a chalk line and mark off 10′.
3. From one end, of the chalk line, measure out 10′ and swing an arc in the approximate area where the wall should end.
4. From the other end of the chalk line, swing an arc the length of the diagonal (from step 1) across the arc at 10′.
5. Snap a chalk line from the starting point of the first chalk line through the point where the two arcs cross.
6. Repeat steps 2 - 5 on the other end of the first chalk line.
7. Snap a line to connect the open ends of the lines at 10′ to complete the square.

USING A 3-4-5 TRIANGLE TO LAYOUT

INTRODUCTION

In this lesson you will use a measuring tape and chalk line to layout a rectangular building

LESSON OBJECTIVES

At the end of this lesson the student will be able to accurately layout a rectangular building.

SPECIFIC OBJECTIVES

On completion of this lesson the student will:

1. Given the dimensions of a rectangle, determine the largest 3-4-5 triangle that fits within it.
2. Given the 3-4-5 triangle, measuring tape and chalk line, layout a rectangular building to $^{1}/_{8}$″.

APPLICATION IN THE FIELD

In order to accurately build square or rectangular shaped buildings, a carpenter must be able to construct walls that intersect at right angles.

EVALUATION

Each student will be evaluated on their participation, work quality, and post test score. A post test will be administered after the series of chapter 6 lessons are completed.

REFERENCES

1. Student Lesson Book

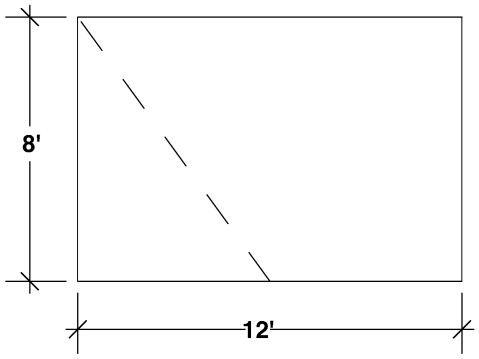
EQUIPMENT

To be supplied by the training facility

STUDENT TOOLS

1. One (1) Calculator
2. One (1) Measuring tape 1″ x 25′
3. One (1) Chalk Line
4. One (1) Pencil

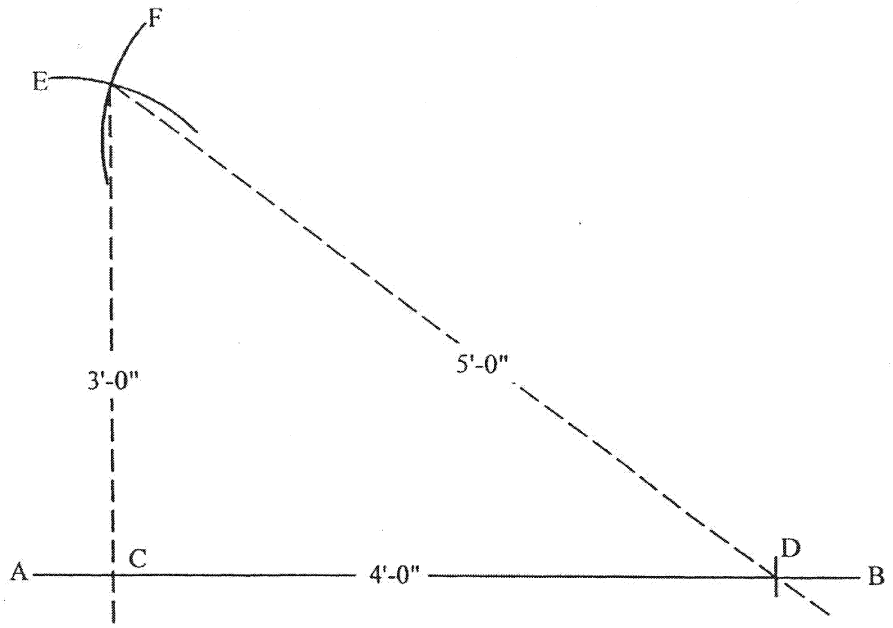
PROCEDURES

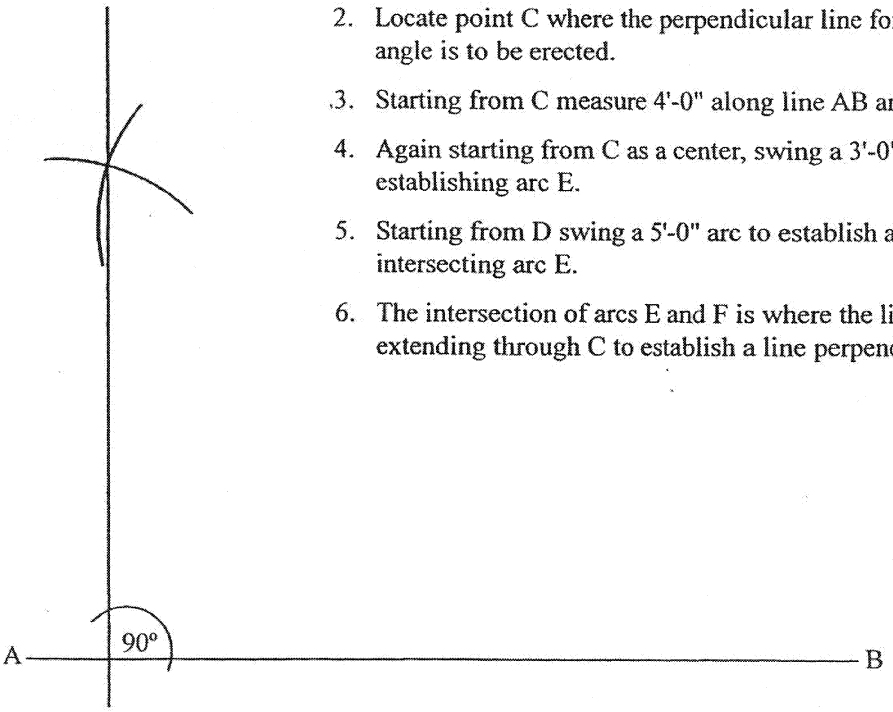


1. Determine the largest 3-4-5 triangle that fits inside the rectangle above._____
2. Snap out a chalk line and mark off 6′ and 12′.
3. From one end, of the chalk line, measure out 8 and swing an arc in the approximate area where the wall should end.
4. From the 6′ center mark of the chalk line, swing an arc the length of the diagonal (from step 1) across the arc at 8′.
5. Snap a chalk line from the starting point of the first chalk line through the point where the two arcs cross.
6. Repeat steps 2 - 5 on the other end of the first chalk line.
7. Snap a line to connect the open ends of the lines at 8′ to complete the rectangle.

ERECTING A PERPENDICULAR

Instructions: Use the 3, 4, 5 Method





1. Strike the line AB
2. Locate point C where the perpendicular line forming the right angle is to be erected.
3. Starting from C measure 4'-0" along line AB and mark point D.
4. Again starting from C as a center, swing a 3'-0" arc as shown establishing arc E.
5. Starting from D swing a 5'-0" arc to establish arc F as shown intersecting arc E.
6. The intersection of arcs E and F is where the line will be snapped extending through C to establish a line perpendicular to AB.

NOTES:

REALITIES OF THE JOBSITE

REALITIES OF THE JOBSITE

EVERYTHING YOU NEED TO KNOW TO
BE A SUCCESSFUL APPRENTICE
(BUT DIDN'T KNOW TO ASK)

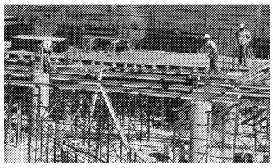
By:

Carpenters Training Committee For Northern California (CTCNC)

Realities of the Jobsite

Realities of the Jobsite

WHAT' S IT LIKE?

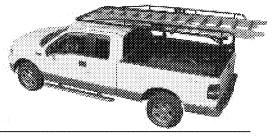


The Carpenters Training Committee For Northern California (CTCNC)

Realities of the Jobsite

GETTING THERE

- Being on time is essential
- Reliable transportation is a must
- Many workers often commute long distances



The Carpenters Training Committee For Northern California (CTCNC)

Realities of the Jobsite

GETTING THERE

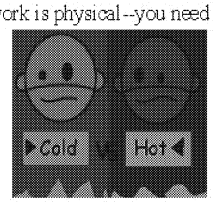
- Options:
  - Ride sharing
  - Mass transit (if practical)
- Keep your vehicle gassed up and maintained

The Carpenters Training Committee For Northern California (CTC/NC)

Realities of the Jobsite

The Work Environment

- Most work is done outdoors so you must deal with hot and cold conditions
- The work is physical--you need to be in shape



The Carpenters Training Committee For Northern California (CTC/NC)

Realities of the Jobsite

The Work Environment

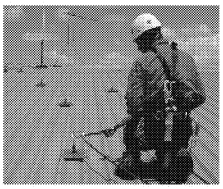
- Find out what your company's policy is, but generally, when it is raining, still show up for work on time, it might not be raining at the job

The Carpenters Training Committee For Northern California (CTC/NC)

Realities of the Jobsite

The Work Environment

- Working at heights is often required
- Mechanical ability is needed--not everyone has this



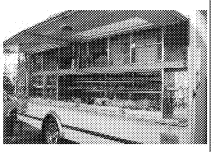
The Carpenters Training Committee For Northern California (CTCNC)

Realities of the Jobsite

The Work Environment

EATING AND DRINKING

- Bring your lunch--eating off the catering truck can cost $50 a week
- Carry your own water--it saves time



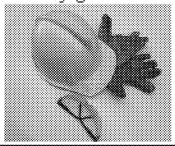
The Carpenters Training Committee For Northern California (CTCNC)

Realities of the Jobsite

The Work Environment

Personal Protective Equipment (PPE)

- The employer is supposed to supply PPE, however, you should show up with your own hard hat and safety glasses on the first day



The Carpenters Training Committee For Northern California (CTCNC)

PERIMETERS

- **What is a perimeter?**
- **How are perimeters calculated?**
- **What are the components of a circle?**
- **How are the radius, diameter and circumference related?**

INTRODUCTION

The perimeter is the distance around the edge of any flat (2 dimensional) object. If that object is a circle that distance is called the circumference. In order to calculate the amount of form material required to cast a cement slab a carpenter would first have to determine its perimeter. Knowing the perimeter of the slab would also enable a carpenter to determine the amount of framing material necessary to enclose it with the walls of a building.

Calculating the perimeter

To calculate the perimeter of any object add up the lengths of all the sides.

Example 1:

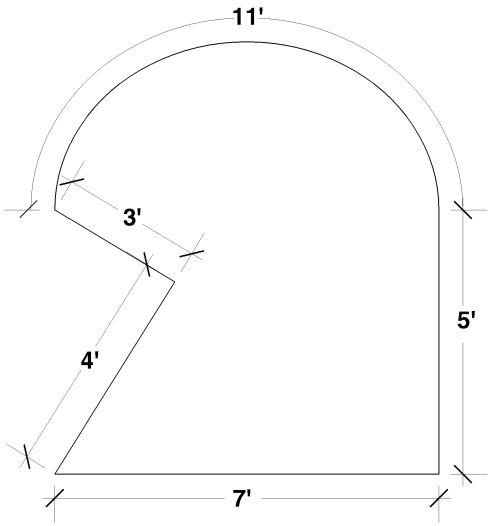


Fig. 1

For figure 7-1 the perimeter would equal:

$$P = 11' + 3' + 4' + 7' + 5'$$

$$P = 30'$$

This method works for any object where the lengths of all the sides are known. For some of the more common shapes alternate formulas can also be used.

Example 2:

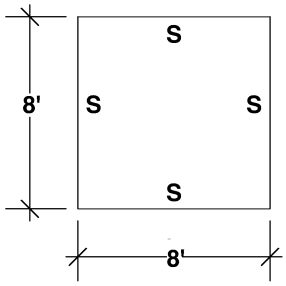


Fig. 2

Since a square has four equal sides, to find its perimeter we can either add up the four sides:

P = S + S + S + S

P = 8′ + 8′ + 8′ + 8′

P = 32′

or multiply one side by 4, as shown by the formula:

P = 4S

P = 4 x S

P = 4 x 8′

P = 32′

Example 3:

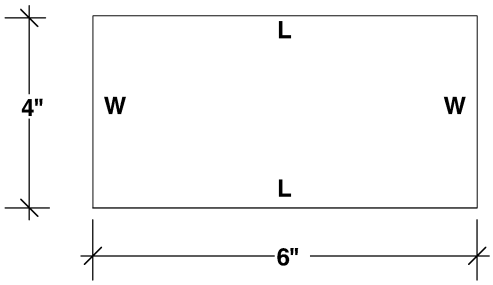


Fig. 3

A rectangle has 2 equal long sides, called the length (L) and 2 equal short sides, called the width (W). To find the perimeter of this rectangle we can either add up the four sides:

P = L + L + W + W

P = 6″ + 6″ + 4″ + 4″

P = 20″

or multiply the length by 2 and the width by 2 and add them together, as shown by the formula:

P = 2L + 2W

P = 2 x L + 2 x W

P = 2 x 6″ + 2 x 4″

P = 12″ + 8″ = 20″

Circumference

The size of a circle can be defined by any one of 3 related numbers, see figure 7-4.

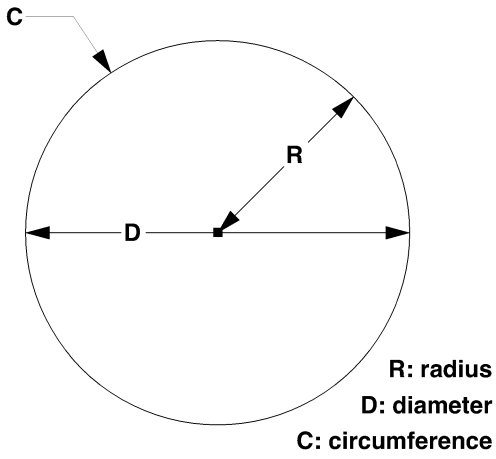


Fig. 4

The radius is the distance from the center of the circle to the edge.

The diameter is the edge to edge distance of the circle measured through its center.

The circumference is the length of the outer edge of the circle.

The diameter is always twice as long as the radius, therefore:

$$D = 2 \times R = 2R$$

and

$$R = D \div 2 = \frac{D}{2}$$

The circumference is related to the diameter by the ratio called pi (π) which we will round to 3.14. So, if we know the length of the diameter we can calculate the circumference by multiplying the diameter by 3.14:

$$C = \pi \times D = \pi D = 3.14D$$

Also, since D = 2R, if we know the radius length we can double it and multiply it by π to get the circumference:

$$C = 2\pi R = 2 \times \pi \times R$$

$$C = 2 \times 3.14 \times R$$

On blueprints the size of a circular object is usually given by the diameter or the radius. Often, to indicate that the number is a diameter, it is written with either the symbol Ø, θ or φ behind it.

Example 4:

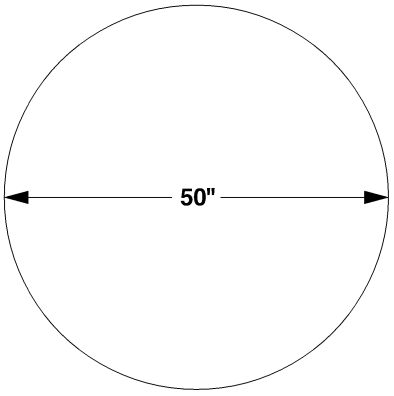


Fig. 5

To find the circumference of this circle multiply the diameter by pi:

$$C = \pi D = 3.14 \times 50'' = 157''$$

Example 5:

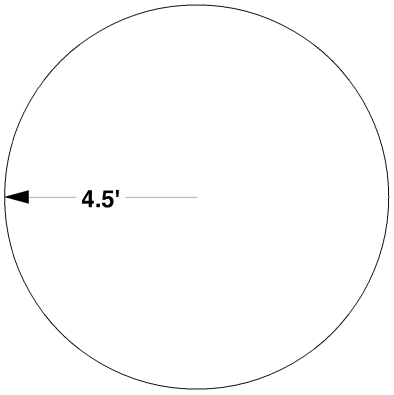


Fig. 6

To find the circumference of this circle multiply the radius by 2 and pi:

$$C = 2\pi R = 2 \times 3.14 \times 4.5'$$

$$C = 28.26'$$

ANGULAR MEASURE

Another way to measure a circle is in degrees (°). This measure is based on the opening between two lines that extend from the center of the circle forming an angle, see Fig. 7 below. The size of the angle depends on the opening between the lines, not their lengths.

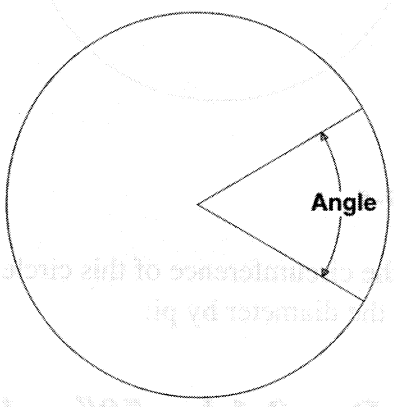


Fig. 7

Since a right angle is defined by two lines that are 90° apart, Fig. 8 below illustrates why there are 360° in a circle. Each 90° section of this circle is called a quadrant, since it forms $^1/_4$ of the circle.

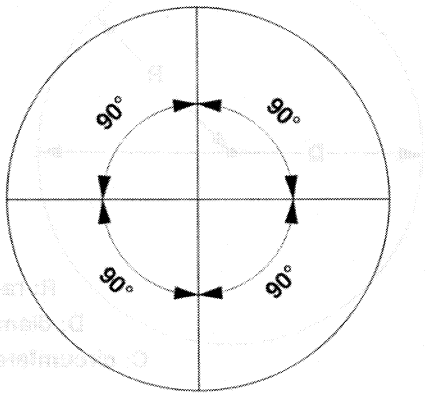


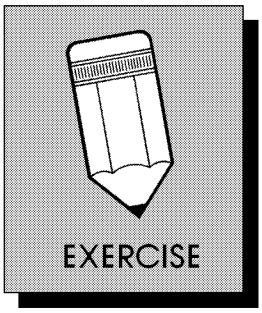
Fig. 8

If we need a more precise measurement each degree is divided into 60 parts called minutes(‘), and, just like with time measurements, each minute is divided into 60 seconds(“). An angular measurement of 15 degrees 30 minutes and 45 seconds would be written as:

$$15° 30' 45''$$

An angular measurement that has only minutes and seconds should be written with a 0° in front, to distinguish it from foot and inch measurement. For example, an angular measurement of 25′ 10″ should be written down as:

$$0° 25' 10''$$

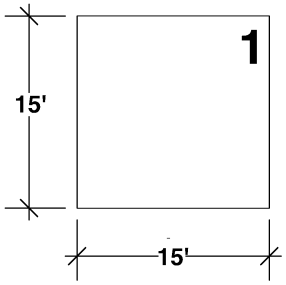


PERIMETERS

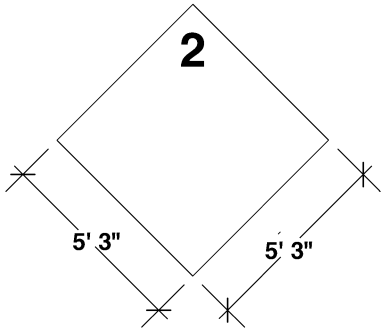
INSTRUCTIONS FOR EXERCISE

Determine the perimeter for shapes 1 - 6.

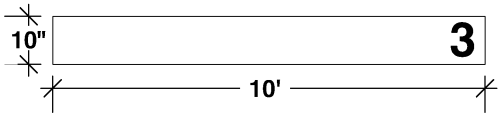
1. _____



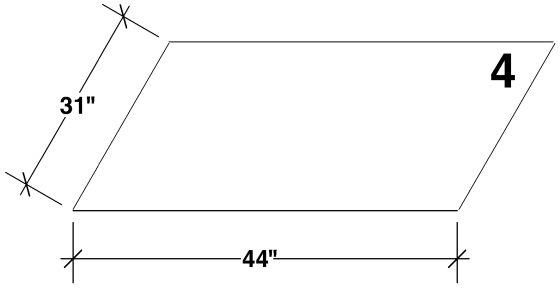
2. _____



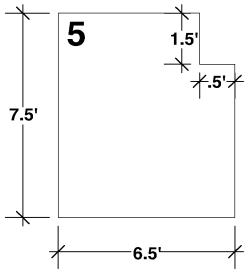
3. _____



4. _____



5. _____



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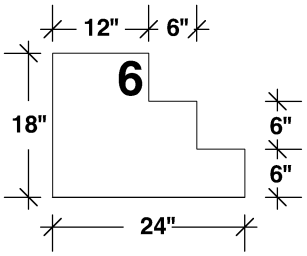
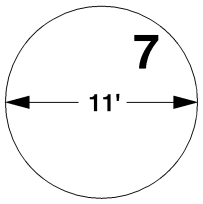
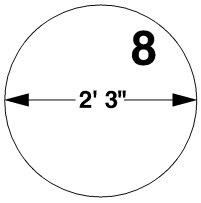


Instructions: Determine the circumference for the following circles. Give the answer rounded to two decimal spaces.

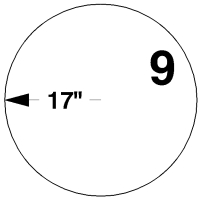
7. _____



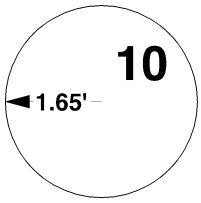
8. _____



9. _____



10._____



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