
1. Fasteners

Overview

Purpose

To enable the gas technician/fitter to choose the correct fastener for the job.

Objectives

At the end of this Chapter, you will be able to:

- identify the methods for selecting and securing correct fasteners; and
- identify types of fasteners.

Terminology

Term	Abbreviation (symbol)	Definition
Fastener		A device that attaches something firmly to something else.

Requirements for using fasteners

You must consider the following factors when fastening piping or equipment:

- type of material to which you must fasten the piping or equipment;
- type of equipment that you are fastening;
- weight and shape of the equipment;
- whether the equipment has support from above or below;
- whether expansion or vibration is a factor; and
- the number of fasteners or supports required.

In the gas industry, the three main types of material that you must fasten to or from are:

- wood;
- concrete; and
- steel.

Safety and security

It is important that you make sure you carry out the fastening of piping or equipment safely and securely. It is essential that anything you fasten remains in its original position. You should select a fastening device or design of a support or bracket with care.



CSA Group Gas Trade Training Materials – Red Seal Alignment

Red Seal		CSA Gas Trade Unit	1	2	3	4	4A	5	6	7	8	9
2014 Red Seal Block	2014 Red Seal Task	Title	Safety	Fasteners, Tools and Testing Instruments	Properties, Characteristics, and Safe Handling of Fuel Gases	Utilization Codes, Acts and Regulations	Utilization Codes, Acts, and Regulations – Ontario Supplement	Introduction to Electricity	Technical Manuals, Specifications, Drawings and Graphs	Customer Relations	Introduction to Piping and Tubing Systems	Introduction to Gas Appliances
A - Common Occupational Skills	Task 1	Performs safety-related functions.	✓									
	Task 2	Maintains and uses tools and equipment.	✓	✓	✓							
	Task 3	Plans and prepares for installation, service and maintenance.	✓			✓	✓	✓	✓			
B - Gas Piping Preparation and Assembly	Task 4	Fits tube and tubing for gas piping systems.									✓	
	Task 5	Fits plastic pipe for gas piping systems.									✓	
	Task 6	Fits steel pipe for gas piping systems.									✓	
C - Venting and Air Supply Systems	Task 7	Installs venting.									✓	✓
	Task 8	Installs air supply system.										
	Task 9	Installs draft control systems.										
D - Controls and Electrical Systems	Task 10	Selects and installs electronic components.						✓				
	Task 11	Selects and installs electrical components.										
	Task 12	Installs automation and instrumentation control systems.										
E - Installation of Systems and Equipment	Task 13	Installs gas-fired system piping and equipment.									✓	✓
	Task 14	Installs gas-fired system components.										
	Task 15	Installs propane storage and handling systems.										
F - Testing & Commissioning of Gas-fired Systems	Task 16	Tests gas-fired systems.										
	Task 17	Commissions gas-fired systems.	✓	✓	✓	✓	✓	✓			✓	✓
G - Servicing Gas-fired Systems	Task 18	Maintains gas-fired systems.										✓
	Task 19	Repairs gas-fired systems.										✓
	Task 20	Decommissions gas-fired systems.	✓	✓	✓	✓	✓	✓			✓	✓

© 2019 Canadian Standards Association. All Rights Reserved.

To ensure a secure installation, you should do the following:

- Select screws or bolts of the correct size and grade.
- Select the correct inserts, plugs, and shields that you must drill or place in concrete, and set them properly.
- Consider expansion, contraction, and vibration, and take appropriate measures to ensure the piping or equipment remains in place.
- Use the proper number of fasteners and supports for the weight or size of the piping and equipment.

Types of fasteners

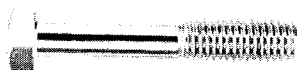
General fasteners

A huge variety of fasteners is available to the gas technician/fitter. Their designs are job-specific, so you must take care in selecting them. Small details can have a great effect on their function. Be sure to store all fasteners in a clean and dry environment so that they are in good condition for use.

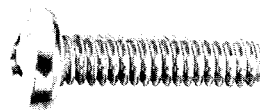
Screws

There are many different types of screws, such as wood screws, metal screws, machine screws, and set screws. Gas technicians/fitters extensively use all types, which come in varying sizes, lengths, and head type, but have one purpose—to fasten one object to another. Figures 1-1, 1-2, and 1-3 show some common types of screws.

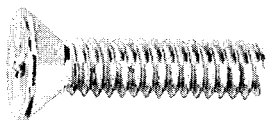
Figure 1-1
Various types of screws
Image courtesy of DeWalt



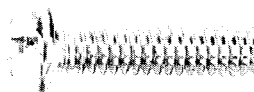
Cap screw



**Fillister head
machine screw**



**Flat head
machine screw**



**Round head
machine screw**

Figure 1-2
Self-tapping metal screws

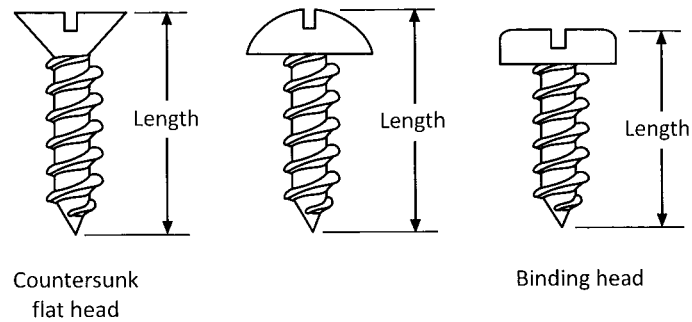
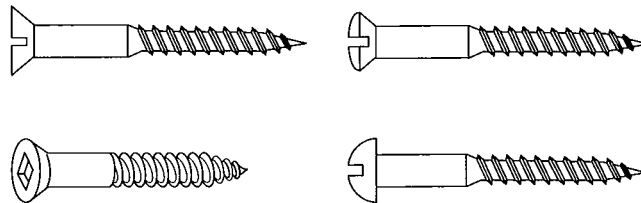


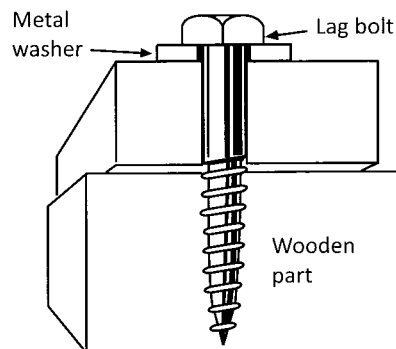
Figure 1-3
Wood screws



Lag bolts

Lag bolts are not actually bolts; they are heavy screws that help fasten brackets to wooden members (Figure 1-4). They are a practical alternative to a nut and bolt arrangement, although larger sizes of lag bolts may require a pilot hole.

Figure 1-4
Lag bolt

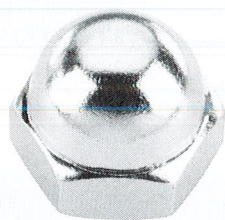


Bolts

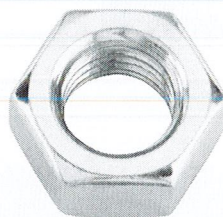
Bolts are available in various lengths, sizes, and configurations. They fasten objects into a set position by the leverage of the thread.

The thread on the bolt can be either National Fine (NF) or the more commonly used National Coarse (NC). Figure 1-5 shows some common bolts and nuts.

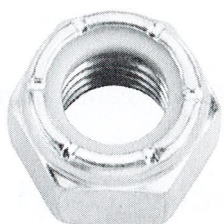
Figure 1-5
Various bolts and nuts
Image courtesy of DeWalt



Acorn nut



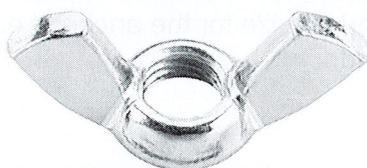
Hex nut



Nylon-insert lock nut



Rod coupler



Wing nut

Gas technicians/fitters measure the length of bolts from underneath the head to the end in most cases and from end to end in bolts with countersunk heads.

Often, the use of a manufactured bolt is not realistic because the correct length is not available, and adjustments are limited. In such cases, you can use a threaded rod and cut it to the required length. Figure 1-6 shows the types of threaded rod (also called ready rod).

Figure 1-6
Types of threaded rod



Steel rod with threaded ends



All-threaded rod

Anchoring fasteners

Various devices help fasten hangers and supports to concrete walls and ceilings. They may be iron, lead, or plastic.

Insert anchors and lead and plastic shields (rawl plugs)

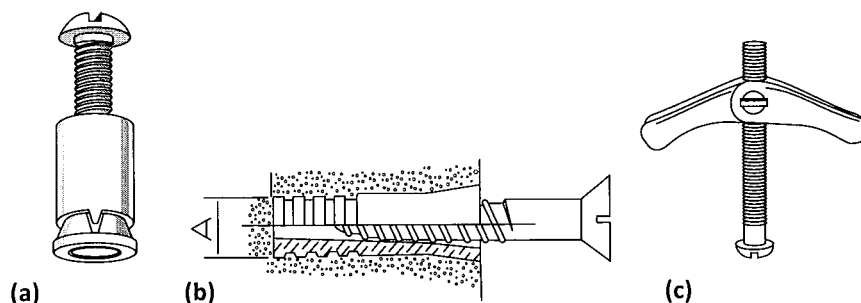
Gas technicians/fitters use insert anchors (Figure 1-7a) and lead and plastic shields (also known as rawl plugs, Figure 1-7b) with machine bolts or lag screws. They insert the anchor or shield into the hole and tighten the fastener into the shield. These anchors and shields require the drilling of a correctly sized hole into the surface. Drop-in anchors require a special tool or pin to set the anchor. The tool must be the appropriate size for the anchor, i.e., a 3/8 tool for a 3/8 anchor, and should not have a “mushroomed” end.

Toggle bolts

Toggle bolts (Figure 1-7c) help fix hangers to surfaces with hollow spaces behind them. The action of correctly tightening the toggle bolt causes a bracing mechanism to act against the back wall surface. The following are the three types:

- spring wing (butterfly);
- tumble; and
- riveted tumble.

Figure 1-7
Types of anchoring fasteners



Hose clamps

Gas technicians/fitters use a hose clamp to attach a hose to a pipe, pump, or other device. Hose clamps can be of the self-tightening type (spring loaded) (Figure 1-9) or of the type requiring manual tightening (Figure 1-8).

Generally speaking, hose clamps are not approved for use with a hose that carries either natural gas or propane.

Figure 1-8
Gear type hose clamp (manual tightening)

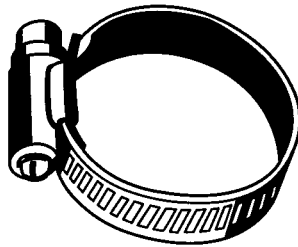
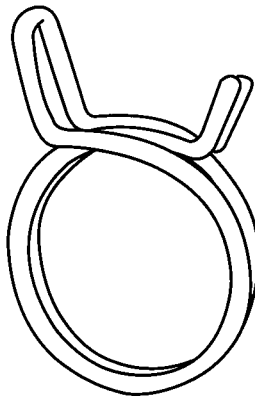


Figure 1-9
Hose clamp (self-tightening)



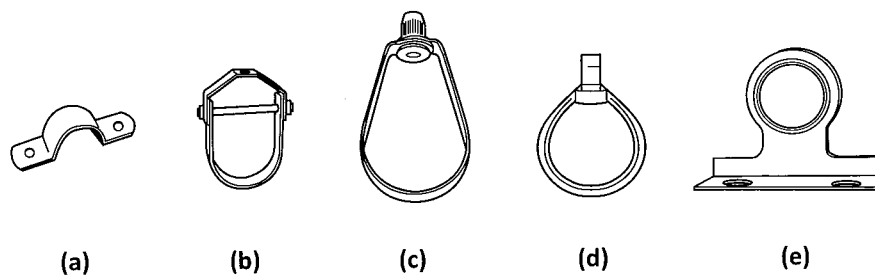
Pipe fasteners

The installation of piping systems is an integral part of the gas trade. Before installation, it is important to consider how, where, and how often you must support (or fasten) a piping system is to be supported from (or to) the structure. The pipe supports available, and the methods of fastening them are numerous. This Chapter describes some of the more common ones.

Straps and hangers

Figure 1-10 Picture	Type	Description
(a)	Pipe straps	Galvanized steel, copper, cast malleable iron, and plastic. At times, gas technicians/fitters use them on vertical and horizontal installations. They are available in <i>Nominal Pipe Sizes</i> NPS 1/2 to NPS 4.
(b)	Clevis hangers	Usually black steel. For proper performance, you must tighten the hanger load nut above the clevis securely.
(c)	Adjustable steel ring hangers	Zinc-plated. Sizes range from NPS 3/4 to NPS 8.
(d)	Adjustable swivel-ring hangers	Have a solid ring. Sizes range from NPS 3/4 to NPS 8.
(e)	Pipe stays/valley hanger	Provides support from the floor or wall.

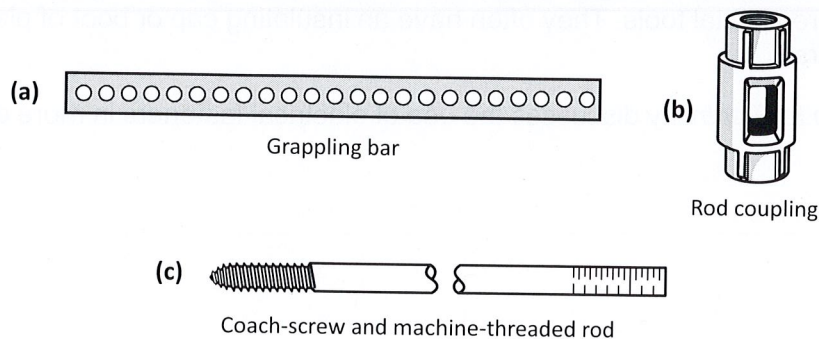
Figure 1-10
Pipe strap, clevis hanger, adjustable steel ring hanger, adjustable swivel ring hanger, and pipe stays



Hanger rod and attachments

Figure 1-11 Picture	Type	Description
(a)	Grappling bar	Also called an extension bar, hanger iron, strap iron, grapple iron, or perforated band iron. It is available in various thicknesses as straight lengths or coils of black and galvanized steel, and copper. You can form this into a ring-type hanger by bending it around pipe.
(b) and (c)	Threaded rod and rod coupling	Can help extend lengths where required.
(c)	Coach-screw (lag bolt) and machine-threaded rod	Used where one end of the coach-screw can be screwed into a wood member of a building, with the hanger attached to the other end. It is available in many dimensions and lengths. The thread type is usually National Coarse (NC).

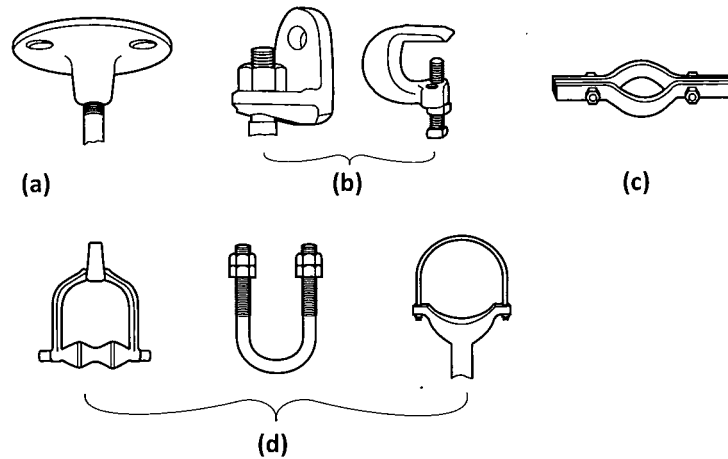
Figure 1-11
Grappling bar, rod coupling, and coach-screw and machine-threaded rod



Beam clamps and brackets

Figure 1-12 Picture	Type	Description
(a)	Floor and ceiling flanges	Popular for attaching pipe hangers to a ceiling or high building member.
(b)	Beam clamps	Used with hanger rods.
(c)	Riser clamps	Vertical pipe hangers. The clamp grips the pipe, forming a solid support. You may tack-weld it to steel pipe.
(d)	Other styles	Various other styles of pipe supports.

Figure 1-12
Beam clamps and brackets



Electrical fasteners

Much of today's gas equipment has electrically operated controls and components. Figure 1-13 identifies some common electrical fasteners.

These types of fasteners enable good mechanical and electrical connection without the need for solder. They are available in a range of sizes and shapes. Some are connected with common tools; others require special tools. They often have an insulating cap or boot of plastic or rubber over the conductors.

Unit 5 *Introduction to Electricity* discusses the use of electrical fasteners in more detail.

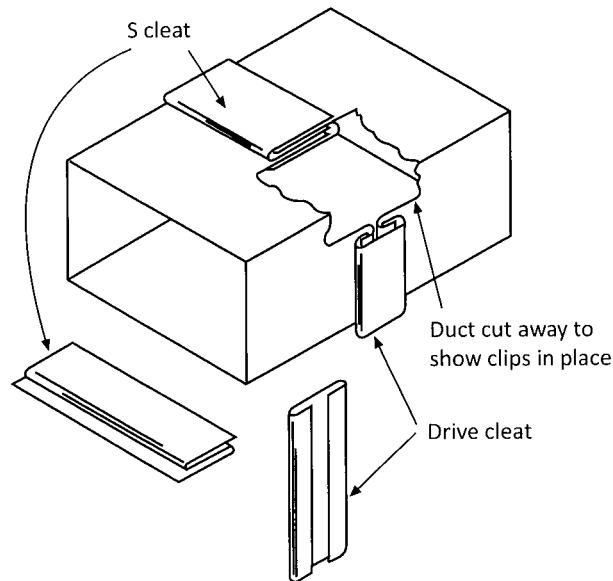
Figure 1-13
Solderless electrical connectors
 Image courtesy of Terry Bell



Sheet metal fasteners

The most common sheet metal fasteners you will encounter as a gas technician/fitter are a variety of self-tapping and -locking screw systems. For connecting sections of ductwork formed, metal S and drive cleats (Figure 1-14) are used.

Figure 1-14
“S” and drive cleats



Aluminum tape

Gas technicians/fitters use aluminum tape during thermal insulation of ductwork to fasten the insulation to the duct. The tape is available in different widths and manufacturers sometimes reinforce this with fibre threads.

Assignment Questions – Chapter 1

- 1) In the gas industry, what are the three main types of material that are fastened to or from piping and equipment?
 - a) Wood, concrete, steel
 - b) Brick, concrete, steel
 - c) Wood, plastic, concrete
 - d) Concrete, wood, brick
- 2) Why must expansion or vibration be taken into consideration when fastening or supporting equipment?
 - a) To reduce the possibility of leaks
 - b) To allow for service access
 - c) To ensure the equipment remains in place
 - d) To reduce noise