For The Way You Work!

Industrial Training Manual Index

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TRAINING MANUAL

"**Use 2" Red Binder**" with Sioux decal on front and spine
5 section divider - Avery or Equiv.

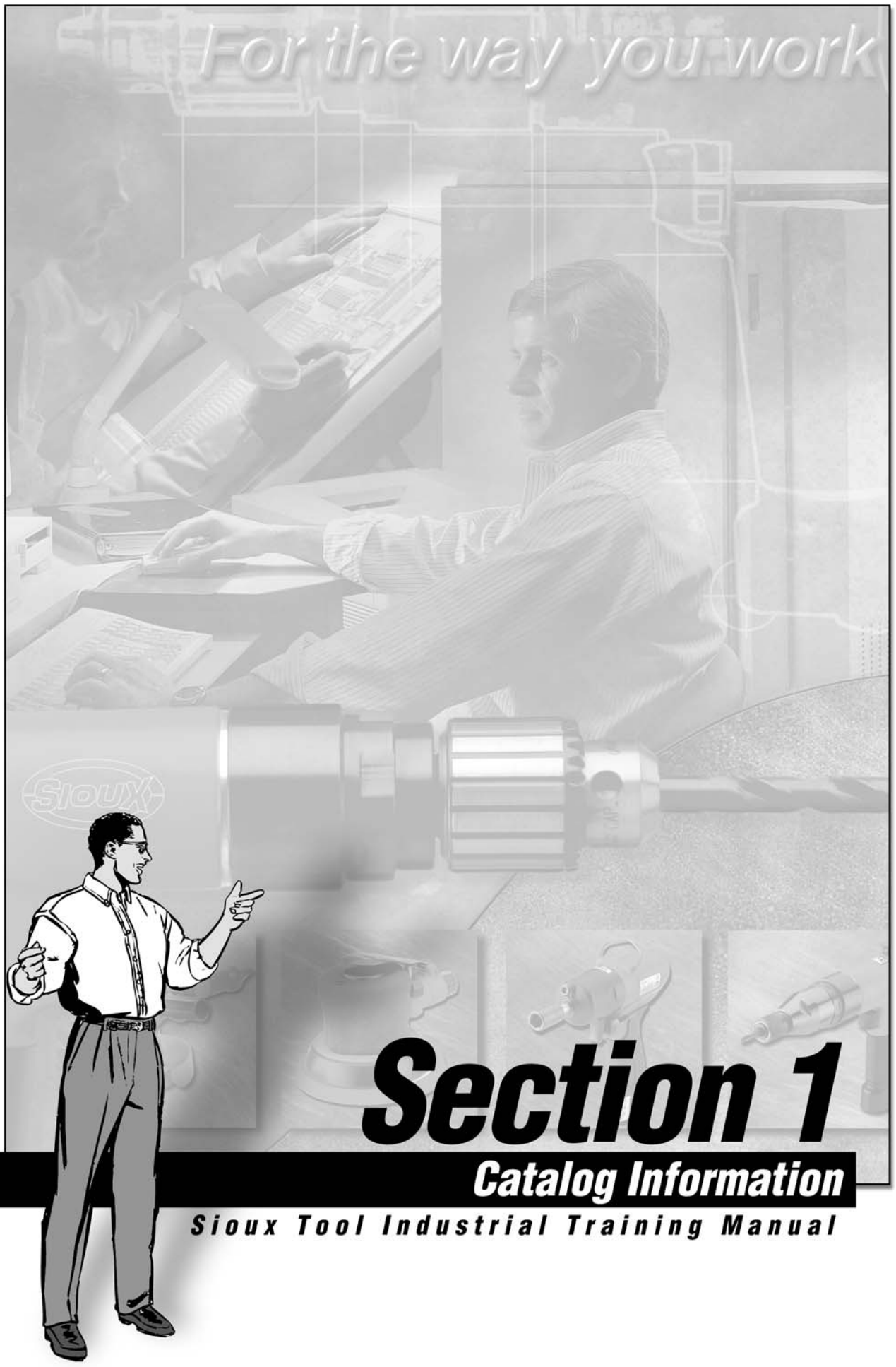
"**Use 2" Red Binder**" with Sioux decal on front and spine
5 section divider - Avery or Equiv.

For The Way You Work!

Industrial Training Tabs

w w w . s i o u x t o o l s . c o m

TRAINING MANUAL



Section 1

Catalog Information

Sioux Tool Industrial Training Manual

Section 1.1

Product Catalogs

Sioux Tool Industrial Training Manual

Section 1.2

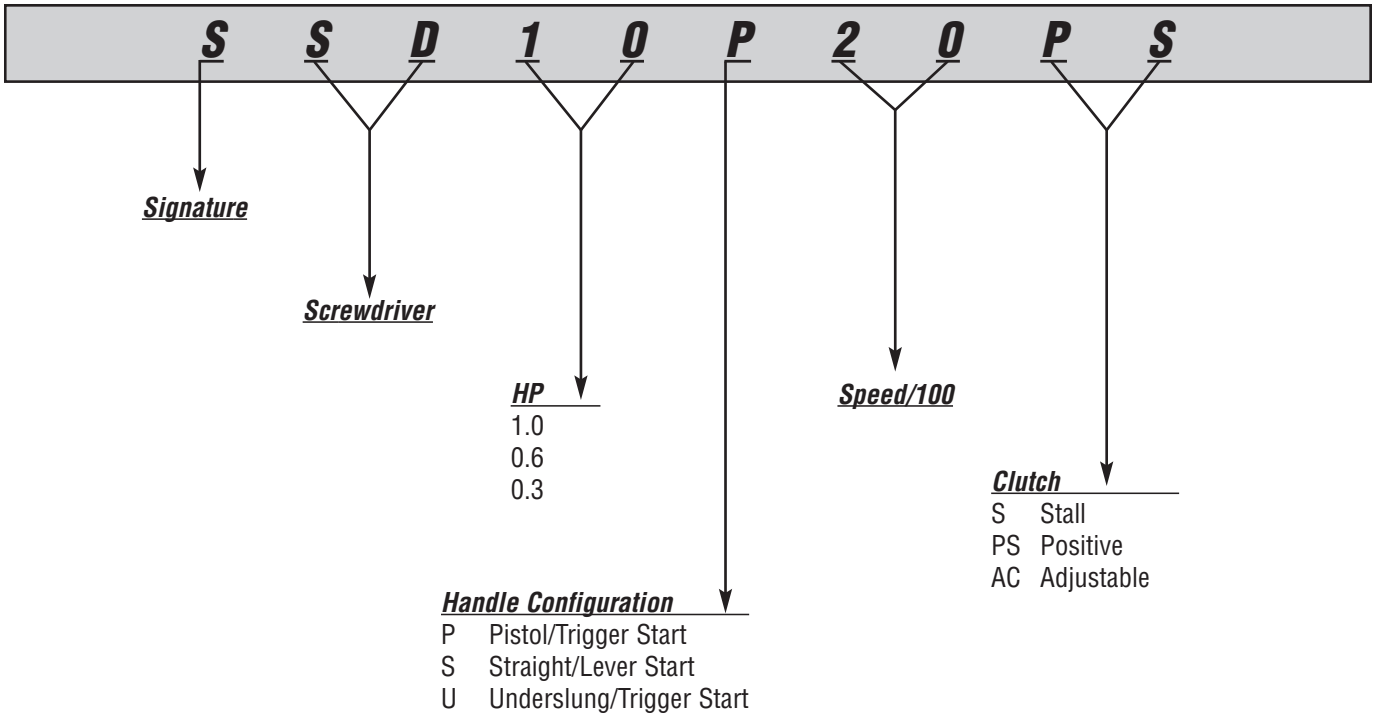
Price Lists

Sioux Tool Industrial Training Manual

Section 1.3

Numbering Charts

Sioux Tool Industrial Training Manual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Screwdriver
HP
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0.6
0.3
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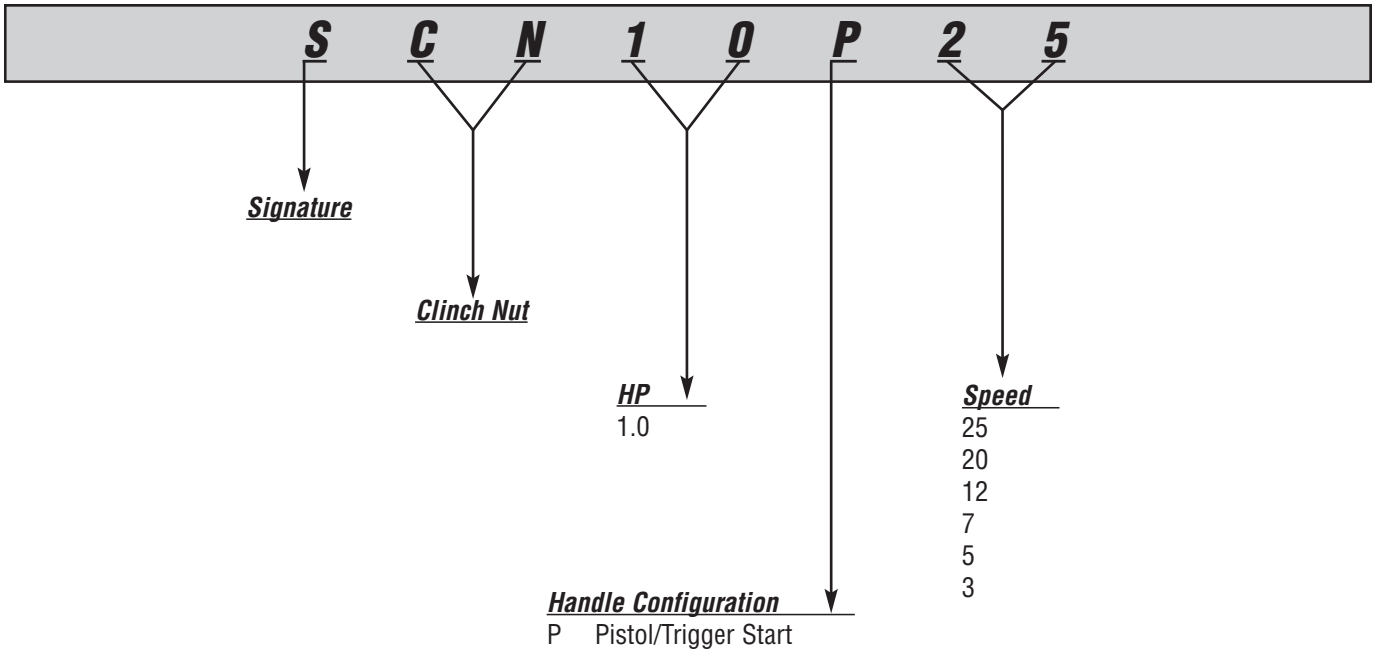
S Straight/Lever Start
U Underslung/Trigger Start
Speed/100
Clutch
S Stall
PS Positive
AC Adjustable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HP
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Handle Configuration
P Pistol/Trigger Start
Speed
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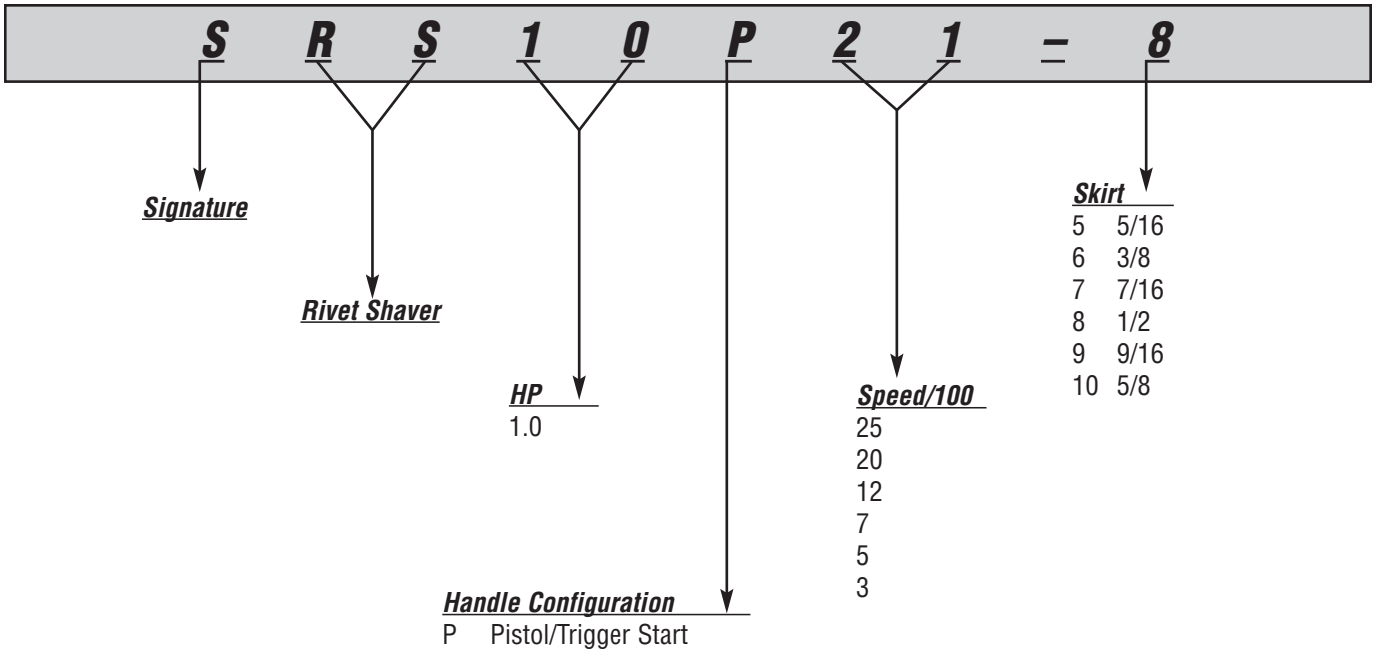
20
12
7
5
3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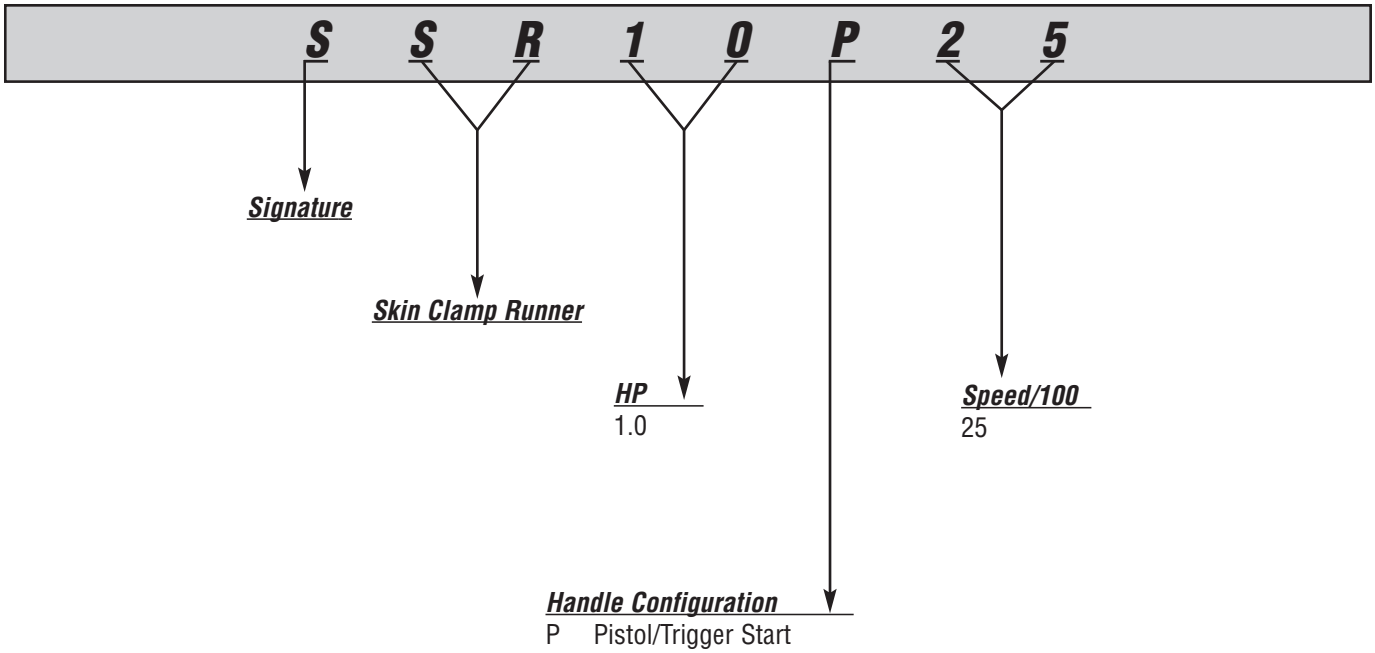
5 5/16
6 3/8
7 7/16
8 1/2
9 9/16
10 5/8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Speed/100
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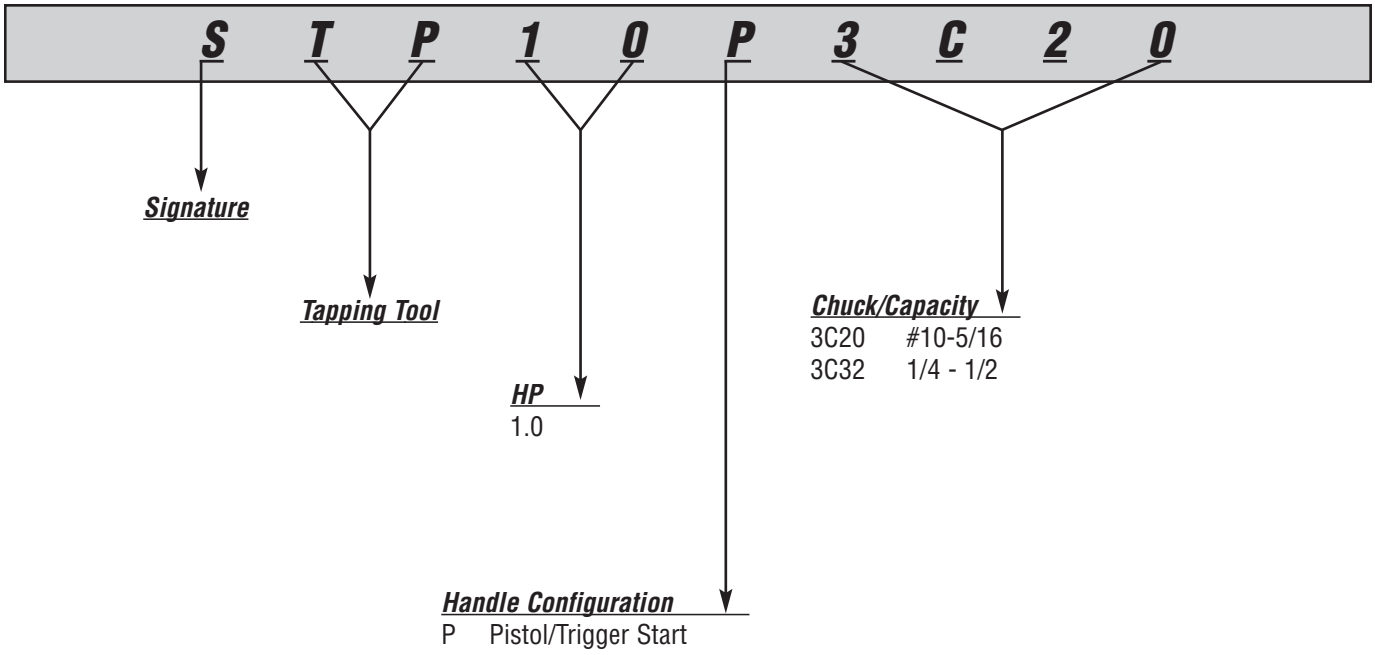
Handle Configuration
P Pistol/Trigger Start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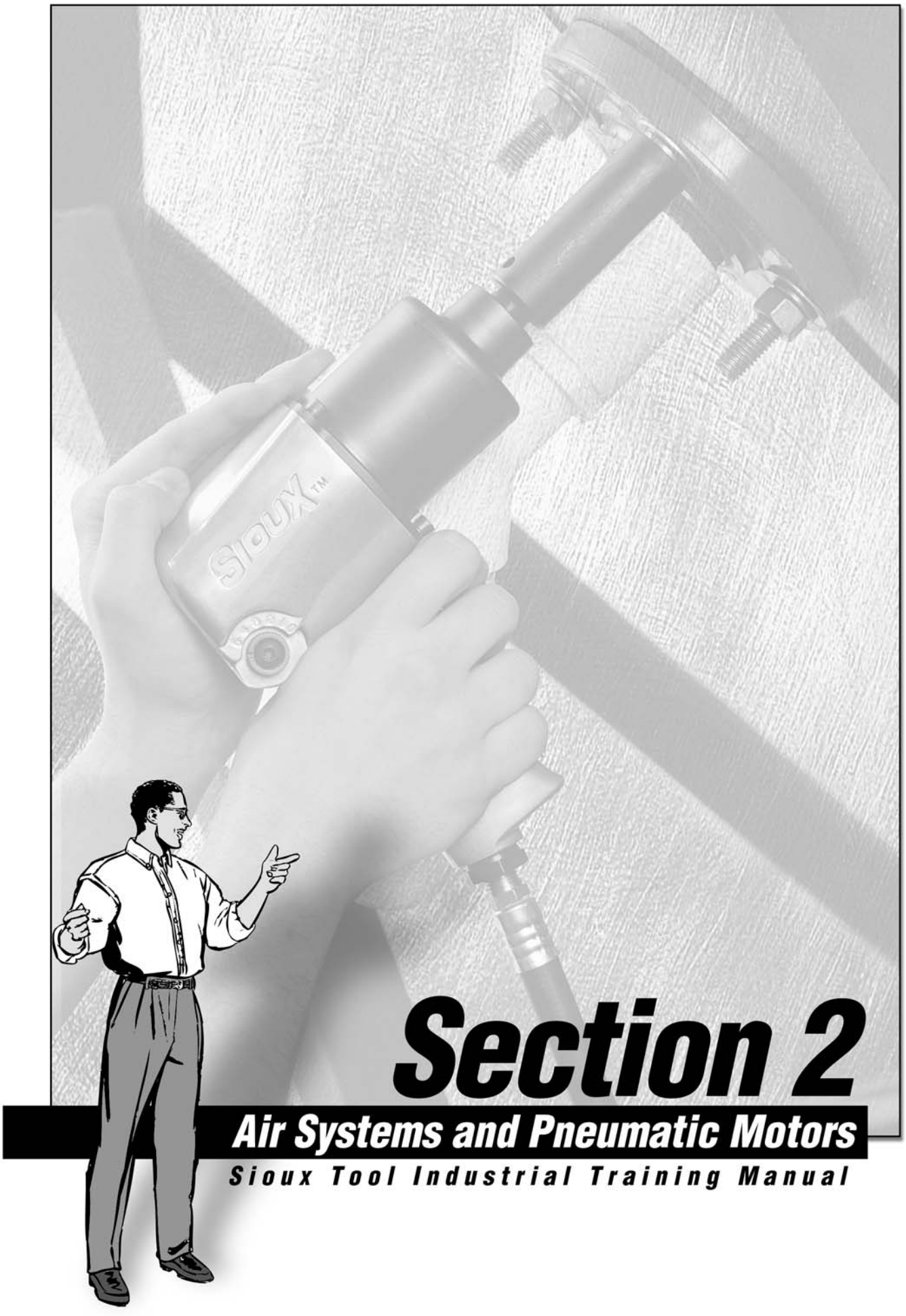
3C32 1/4 - 1/2



Section 2

Air Systems and Pneumatic Motors

Sioux Tool Industrial Training Manual

Section 2.1

Air Systems

Sioux Tool Industrial Training Manual

Air Systems

It is important to know how an air system functions so you can communicate effectively with your customer, recommend the proper air tools, and be able to solve problems that arise. Let's review a few terms before we discuss how an air system operates.

Air Regulators

Clean, dry, lubricated air at the proper pressure is the most important requirement for proper operation of air tools. Sioux tools are designed to operate at 90 psi (pounds per square inch) 0r 6.2 bars (metric) at the handle of the tool while the tool is operating, unless otherwise specified.

Sioux No. 1662

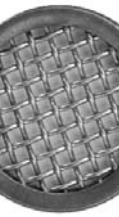
Moisture Separators

On installations where the piping system does not provide clean, dry air, the use of filters at hose connection points is recommended. A good filter, kept properly drained, will remove nearly all entrapped water whereas a poor one is practically useless. Most filters do not have adequate water storage capacity and, unless provided with an auxiliary storage receiver or automatic trap, soon cease to function.

Sioux No. 1663

Strainers

Many tools are provided with air strainers. To eliminate air restriction these strainers must be kept clean and free of obstructions. Strainers or filters should be used at each hose outlet, particularly where pipelines are old or are used intermittently.



Strainer

Lubrication

Most pneumatic tools, because of weight and space limitations, do not contain built-in lubricators. With such tools air line lubricators must always be used and their use is recommended with all air tools

Sioux No. 1661

Moisture Elimimation

The amount of moisture carried by compressed air varies with the temperature. As the temperature drops after compression, water is precipitated. In order to eliminate as much water as possible, compressors should be equipped with intercoolers, after coolers, and full size receivers. These should be kept drained and in good working condition.

Compressor Intake

Locate the intake to obtain the coolest, driest and cleanest air available. Intakes should be of ample size and as direct as possible. Avoid steam pipes, escaping steam and dusty or wet locations (as near roofs, floors, ground, etc.). When practical, take air from out-of-doors on the north side of the building. Provide proper screening and protection. Intake filters of suitable size should be used.

Piping System

Air mains and lines should be large enough to avoid excessive pressure loss under conditions of maximum flow.

In air lines, as in after coolers, water is continually precipitated as the air cools. For this reason pipelines should be provided with a means of draining or trapping this water before it reaches the hose outlets.

It is advisable to pitch (angle) the air line mains in the direction of airflow so that both gravity and airflow will carry the water to traps or water legs located at frequent intervals. These should be drained regularly and never allowed to become full and inoperative. Use of automatic traps will eliminate manual draining and the possibility of traps becoming full. However traps that drain to sewers can waste a considerable amount of air unless regularly inspected and kept in good working order. Provisions for quick and positive inspection of operation and for leakage should be made when traps are installed. Valves or petcocks in the drain lines are usually provided for this purpose.

To aid in preventing condensed moisture from reaching the tools, down pipes or hose connections should never be taken directly from the bottom of air pipes or mains. Connection should be made at the top of the main and a long radius return bend used.

Leaders, valves and hose connections should be large enough to pass the maximum amount of air required by the tool or tools on the line. This is particularly important if manifolds from which several hose lines run are used.

How Does Water And Moisture Enter The Air System?

Refer to ***Figure 1*** (page 5). This drawing represents a two-stage compressor. Atmospheric air is taken into the compressor by the first piston and compressed to around 150 psi (pounds per square inch) (10.3 bar). This is the 1st stage. (Do not confuse a twin cylinder compressor with a two stage compressor.) The compressed air is then taken in by the second piston and compressed to around 175 psi (12.1 bar).

The compressed air then goes through an after cooler and into the receiver tank. The tank has a drain at the bottom of the tank to drain any water that may accumulate in the tank. Where does this water come from?

If we look at a cube of atmospheric air, as shown in ***Figure 1*** (page 5), it will contain some moisture. The amount of moisture will be related to the humidity at that given moment. It will take about 7 of these cubes to compress the air to 150 psi. Therefore the moisture in 7 cubes of air is now in one cube of compressed air at 150 psi. There is no problem because the air is hot from being compressed. However when the compressed air enters the receiving tank and cools down, the humidity of the air becomes 100%. As the air in the tank becomes cooler, water drops out of the air, since the humidity will not exceed 100%.

We can think of the atmosphere around us when it is foggy. When the air gets warmer the humidity decreases and the fog dissipates or goes away. So the temperature and humidity are related. As the temperature of air rises the air can hold more moisture so the humidity decreases. As the temperature decreases the air can't hold as much moisture so the humidity increases. When the humidity reaches 100% the air is saturated and can't hold any more air. Then water drops out of the air.

To decrease the humidity in the compressed air in the receiving tank, a refrigerated unit can be added to the air system to cool the air to a lower temperature to remove water from the air. Then, when the air reaches the receiving tank and increases in temperature, the humidity will decrease.

This can also be accomplished by adding a chemical dryer that removes moisture from the air to lower the humidity.

Lowering the humidity of the compressed air is important because moisture in air lines and air tools causes problems. Water causes rust and corrosion in pipes and on air motor parts. Many air systems do have equipment to lower the humidity and improve the quality of the compressed air.

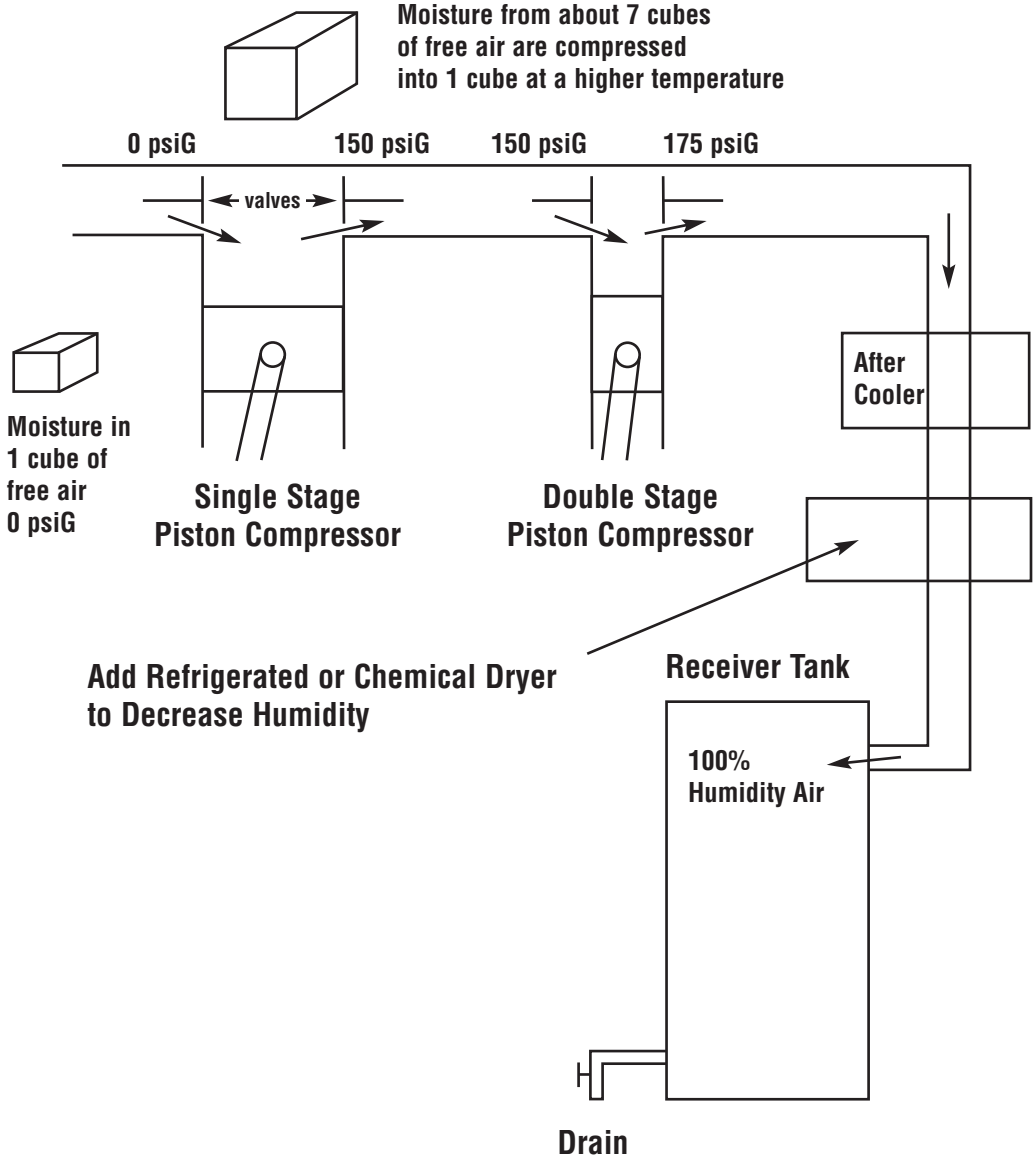
If we look at ***Figure 2*** (page 6), we see a suggested layout for piping to the tools or other air-actuated equipment. The main supply line is installed at an angle so that, as the air flows through and decreases in temperature, any water that drops out of the air can flow to the end of the pipe or to a point where it can be drained.

The feeder line should be started from the top of the main supply line so that any water in the main supply line will not flow down the feeder line. The feeder line should extend beyond the connection point for the air tools or air-actuated equipment so that any water in the feeder line can drop to the bottom of the feeder line and be drained.

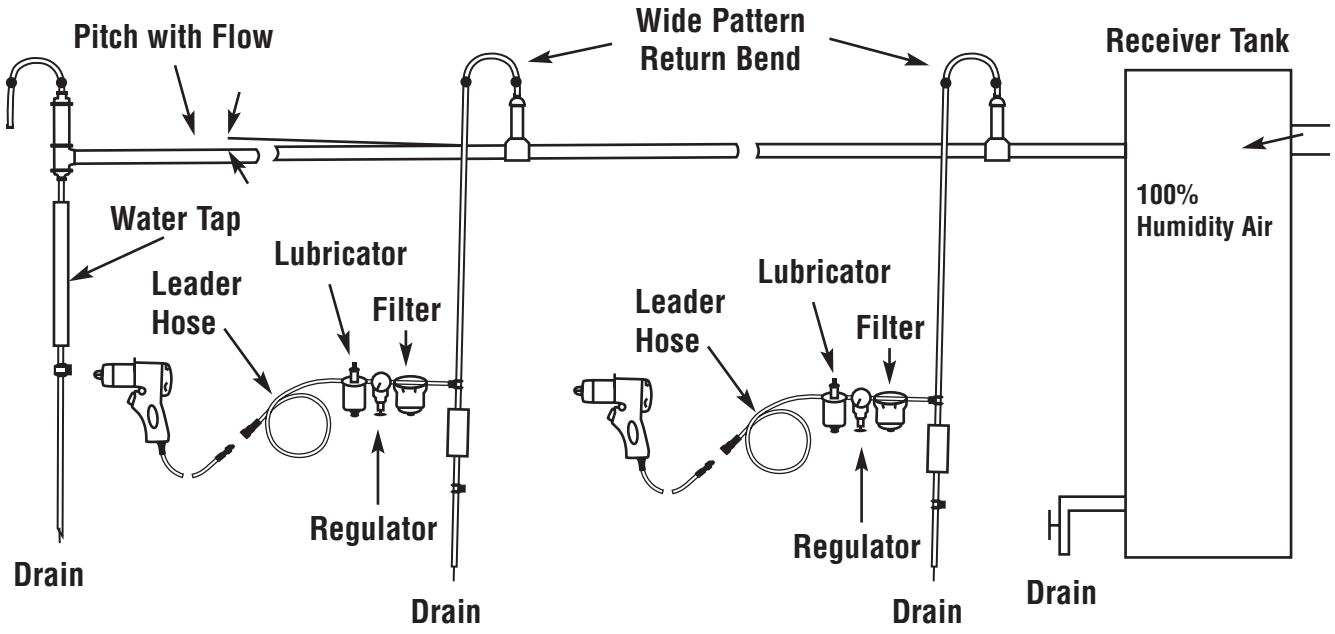
It is recommended that a Filter-Regulator-Lubricator (FRL) unit be installed as close to the air tool as possible. The importance of a FRL unit is explained starting on page 7 in this manual.

Sioux No. 1660

How Does Moisture And Water Get Into The Air System?



Piping System



Filter - Regulator - Lubricator (FRL Unit)

There are, basically, three essential considerations to make the most efficient and effective use of the compressed air power.

Sioux No. 1660

Filter - Use Clean Dry Compressed Air

Clean dry compressed air provides a highly efficient, flexible source of power for all types of Industrial requirements in order to utilize this power to the highest degree some basic precautions must be taken. The proper selection and use of the most suitable filter for a given job will guard against the following conditions common to compressed air lines; Pipe scale, pipe dope, condensed moisture, emulsified and deteriorated compressor oil are inherently present in all compressed air systems. These contaminants should be removed from the compressed air before the air is permitted to enter air tools, cylinders, valves, and other air-actuated equipment.

The air drawn into a compressor frequently contains solids which may or may not be effectively removed at the compressor intake. The ever-present moisture in a compressed air system accelerates corrosion of the conveying pipe lines, and accumulations of rust and pipe scale result. When these corrosion products break loose from the pipe, they are carried by the compressed air to all equipment connected to the compressed air system. Pipe scale, consisting largely of iron oxide, is extremely abrasive, and will severely score the cylinder walls and the vanes in air motors, in fact, all surfaces with which it comes in contact. Therefore, the removal of all solid material from your compressed air is essential.

Water or condensed moisture is forced from the air by the compression and expansion cycle to which the air is subjected. The quantity of condensed moisture existing within any compressed air system is dependent upon the relative humidity of the incoming air, and the amount of compressed air that is being used. Water permitted to enter or accumulate within air-actuated equipment accelerates corrosion of the vital working parts, thus increasing maintenance costs and decreases the life of the equipment.

Frequently, oil from the compressor will be carried into the piping system. This deteriorated oil will deposit on most surfaces that it contacts. This deposit is commonly referred to as "varnish". It is this inherent contamination of compressed air that makes efficient filtering essential. To get the best performance from air-actuated equipment, to keep maintenance expense at a minimum, and extend the life of the equipment connected to the compressed air system, the air must be filtered.

Pressure Regulator - Use The Correct Operating Pressure

Air-actuated equipment, such as tools, cylinders, and valves operate most efficiently at the manufacturer's specified operating pressure. To operate at higher than recommended air pressure increases 'the rate of wear and reduces the life of the equipment. The increased work output of the equipment is not proportionate to the increased air consumption when used above rated operating pressure. The efficiency of the equipment usually is lower when operating at above normal air pressure; therefore, compressed air is wasted. Proper control of the air operating pressure reduces maintenance cost, prolongs the life of air-actuated equipment, and conserves compressed air.

Lubricator - Keep Equipment Properly Lubricated

The Importance of proper lubrication can never be over-emphasized. Lubricate air-actuated tools and equipment is the most logical, efficient, and economical method when lubricant is injected into the compressed air that powers this equipment.

Air-borne lubrication (Micro-Fog or Oil-Fog) is a simple technique by which carefully metered amounts of lubricant are introduced into the air stream, and atomized into a finely divided fog that is carried to the equipment, coating the essential operating parts with a thin, protective oil film. The quantity of lubricant applied can be accurately controlled, and the equipment is continuously lubricated during its entire operating cycle,

Air-Borne lubrication is automatic, anytime the equipment is operating. It is being lubricated, thus saving valuable time otherwise devoted to periodic manual lubrication. Air-born lubrication assures optimum, continuous lubrication of the equipment, thus assuring maximum efficiency and life.

High-quality air motor oil, such as Sioux No. 288 Air Motor Oil, should be used in most air tools. This oil has a tackiness that will coat all parts and will stay on the parts to lubricate for a longer period of time. It also has an emulsifier additive that will allow the water and oil to mix, and it also contains a rust inhibitor, which will help keep the parts from rusting.

Trouble Shooting Chart

Before condemning the air tool for a problem, such as lack of power or speed, refer to the Trouble Shooting Chart in ***Figure 3*** (page 10). The most common problems are listed on the left of the chart. The possible causes are listed at the top of the chart. Looking at the possible causes, starting from the left, we see that the first 11 causes pertain to the air system and not the tool. There are more marked boxes to the left of the arrow, at the bottom of the chart, then the boxes to the right of the arrow. So please check the air system before condemning the tool.

This chart can be used as a third party influence when discussing a problem with a customer. Also maintenance personnel who repair air tools can utilize this chart.

The air pressure and the volume of air are equally important to the efficiency and power output in an air tool. Most air tools requires 90 psi (6.3 bar) measured at the handle of the tool while the tool is running. The tool may be many feet away from the compressor or supply main. It is important to ensure that a hose of sufficient diameter is used. This will reduce the pressure drop to the tool.

A simple analogy would be that of the typical garden hose. If an extremely long, small diameter garden hose is used to water the lawn or wash the car you may build up quite a bit of pressure. However when the nozzle is opened this pressure quickly drops off. Not much water (volume) comes out. It is the same for air. In the static mode you can have more than enough pressure. Once the tool is activated, and the pressure drops off rapidly. The tool does not come up to speed, and/or has very little performance. Another area to play close attention to is the size of the air fitting. Many times Sioux Tools will receive tools in for repair. The symptom is lack of power. The problem many times is a reducer in the inlet of the tool with a cheap fitting, of insufficient size.

So, as with water, the same is with air. The pipes and hoses must be large enough to allow the volume of air to reach the tool and provide the air pressure necessary for the tool to perform efficiently. Since there isn't a easy way to check to see if there is enough volume of air flowing to the tool, an air gage at the tool (with the tool activated) can easily check the pressure to indicate if there is enough volume.

Refer to ***Figure 4*** (page 13).

Sioux Tools Inc. - Trouble Shooting Chart - Air Tools

	Too Small Air Supply	Hose Too Small	Fittings Too Small	Dirty Air	Water In Air	Air Pressure Too High	Too Low An Air Pressure	Filter Screen Clogged	Insufficient Lubricant	Incorrect Lubricant	Exhaust Plugged	Incorrect Rotor Assembly	Gaskets Incorrectly Installed	Incorrect Gov. Spring Setting	Gov. Wt. Assembly Loose	Incorrect Bearings	Incorrect Gov. Parts	Worn Governor Parts	Worn Vanes	Worn Bearings	Worn Valve Seat	Worn Cap On Throttle Stem	Valve Rod Stuck	Operation At High Speed	Excessively Out Of Balance Wheels	Opening In Upper Plate Clogged	Air Leakage	Worn End Plate	Worn Rotor	Incorrect Assembly Of Vanes
Lack Of Power	●	●	●				●	●			●	●	●	●	●		●	●	●			●				●		●	●	●
Speed Too Low	●	●	●				●	●			●		●	●	●		●		●			●								
Speed Too High						●								●			●	●												
Throttle Won't Shut Off																							●							
Sparks From Exhaust																				●										
No Air When Throttle Is Open															●							●								
Tool Continues To Run, Throttle Off																					●		●							
Excessive Blade Wear				●					●	●														●						
Excessive Bearing Wear				●					●	●						●														
Motor "Blows" - Does Not Run				●	●				●	●									●	●						●				●
Exhaust Freezes					●																									
Rusting Of Parts					●				●	●																				
Vane Chipping				●					●																					
Delamination Of Blades				●	●					●																				
Not Possible To Adjust Speed							●	●									●	●												
Vane Breakage				●	●				●	●								●												
Rough I.D. Of Cylinder				●					●																					
Breakage Of Cylinder & Int. Parts Of Rotor				●	●														●											
Spindle Breakage																									●					
"Hunting" Or Variable Speed				●					●	●																				
High Air Consumption																			●								●	●	●	

Problem: Air Supply ↑ Problem: Tool / Mechanical

Figure 4 shows the loss of air pressure due to friction in the hose. The loss is based on 100 psi air pressure at the beginning of the hose. The left side of the chart shows the airflow in standard cubic feet per minute. Let's take an example of 18 to 20 scfm. For 10 feet of 1/4 inch hose, the second column it shows that we have a loss of 19.6 psi in 10 feet of 1/4 inch hose. Or approximately 20 psi. In 10 feet of 1/4 inch hose there is a 20 psi pressure drop. In 20 feet there would be a 40 psi pressure drop. In 30 feet there would be a 60 psi pressure drop. In 40 feet there would be a 80 psi pressure drop. Does that mean in 50 feet I would not have any air pressure? There would be some air coming out, but the pressure drop would be tremendous!

Taking the same example of the tool requirement of 18 to 20 scfm and use 10 feet of 3/8 inch hose, we see in the third column the pressure drop would only be 1 psi. So in 50 feet the pressure drop would be 5 psi. This illustrates a significant pressure drop differential between a 1/4 inch hose and a 3/8 inch hose.

Use this chart as a third party influence in communicating with people who are using too small of a supply hose or a hose that is too long. Sometimes you can tell a person what is the cause of a problem, but they will only realize it when you show them a chart or a typed explanation. So use this chart to solve problems.

Several examples. A manufacturing plant was using a Sioux 3/8 inch air drill to drill a hole through a piece of tubing. The tool would stall when breaking through the tubing and would not completely drill all the way through. A larger tool was suggested and sent to our salesman to take it into their plant to see if it would do the job. When he arrived at the plant they showed him the problem. He asked why they were using 100 feet of hose when the drilling operation was only about 10 feet from the supply line. They said that the hose was what maintenance gave them. Our salesman recommended replacing the hose with the minimum length of 3/8 hose. When the hose was changed the 3/8 inch drill did an excellent job. The tool was the right tool when the proper air pressure and volume of air was supplied to the tool.

Another example was in St. Louis, Missouri. A two story plant was built and our salesman in that area had the opportunity to supply all the air tools for the plant. He received a call informing him that a Sioux 1287L sander was not performing correctly and did not have the necessary power. When he observed the operation he told them that the tool was not getting enough air. They told him, that since this was a new plant with large supply lines and proper air system equipment, the air pressure and volume was not the problem. He then got out his air gage and installed it at the tool. The static pressure was 90 psi.

When the tool was turned on the air pressure dropped down to 60 psi.

In other words, "you don't have to believe me, but this is what the air pressure gage says". Upon investigating they found that the worker that installed the supply line did not have a large enough concrete dill bit to go through the concrete floor to the second floor, so he reduced the pipe size down to fit through the floor and then enlarged the the pipe to the supply line size. The problem was not in the tool but in the air system. The salesman's air gage was a helpful device and saved a lot of time in solving this problem.

Loss Of Air Pressure Due To Friction In Hose

Air Flow Cubic Feet per Minute	10' of 1/4" Hose	8' of 5/16" Hose	10' of 3/8" Hose	12 1/2' of 1/2" Hose	25' of 1/2" Hose	50' of 1/2" Hose	12 1/2' of 3/4" Hose	25' of 3/4" Hose	50' of 3/4" Hose	50' of 1/2" Hose+ 10' of 1/4" Hose	50' of 1/2" Hose+ 10' of 3/8" Hose	50' of 1/2" Hose+ 10' of 5/16" Hose	50' of 1/2" Hose+ 10' of 1/2" Hose	50' of 1/2" Hose+ 25' of 1/2" Hose	50' of 1/2" Hose+ 10' of 3/4" Hose
	Pressure Drop - Pounds per Sq. In. - Based on 100 pounds per Sq. ft. line pressure														
10 to 11	5.0	0.9								5.3	0.7	1.4			
11 to 12	5.9	1.0								6.2	0.8	1.6			
12 to 13	6.8	1.2	0.4							7.2	0.9	1.9			
13 to 14	8.0	1.4	0.5							8.4	1.1	2.2			
14 to 15	9.3	1.6	0.6							9.8	1.3	2.5			
15 to 16	11.0	1.9	0.7							11.6	1.5	2.9			
16 to 18	14.0	2.4	0.8							15.0	1.9	3.5	1.7		
18 to 20	19.6	3.0	1.0							21.4	2.4	4.5	2.0		
20 to 25		4.3	1.4	0.7	1.0	1.3					3.5	6.4	2.6	1.3	
25 to 30		6.6	2.1	1.0	1.5	2.3					5.2	9.8	3.8	2.6	
30 to 35		9.5	3.1	1.3	2.1	3.6					7.3	13.7	5.3	2.6	
35 to 40		12.8	4.2	1.7	2.8	5.2					9.6	18.4	7.1	3.5	
40 to 50		19.3	6.3	2.4	4.1	8.0					14.0		10.4	5.2	1.8
50 to 60			9.6	3.7	6.3	12.2					21.8		16.0	7.8	2.3
60 to 70			13.5	5.3	9.0	17.4	0.9	1.4	1.9				22.8	11.1	3.0
70 to 80			18.7	7.1	12.4		1.1	1.7	2.5					15.0	3.7
80 to 90			25.0	9.0	16.1		1.4	2.2	3.2					19.8	4.6
90 to 100				11.1			1.7	2.7	4.0						5.8
100 to 120							2.3	3.5	5.6						7.9
120 to 140							3.2	4.8	8.0						11.2
140 to 160							4.3	6.6	11.0						15.5
160 to 180							5.6	8.7	15.2						20.4
180 to 200							7.2	11.0							
200 to 220							9.0								

Typical Air System Layout

A simple typical air system layout would be a compressor and receiver tank and a main supply line going down the center of the plant to feed each department as shown in ***Figure 5*** (page 15). The department that requires the most air is the grinding and sanding department. It seems that this department is the furthest one from the compressor. Many times this department does not get the volume of air necessary to run the tools efficiently. One simple solution would be to install a receiver tank at the end of the supply line close to the grinding and sanding department.

A rule to remember when laying out a system or trying to see if your customer has a sufficient air supply or volume of air for the tools and air-actuated equipment is that generally an electric-powered compressor will produce 4 scfm per horsepower. A gasoline-powered compressor will produce 2 scfm per horsepower. This information is helpful to determine the available volume of air.

A better piping layout is shown in ***Figure 6*** (page 16). The loop system give a better chance of supplying the required volume of air to the tools. All the feeder line pipes should be connected to the main supply line so all the pipes are interconnected. The main supply line and feeder lines should be as large as possible. They also act as storage tanks to supply the volume of air when needed.

Volume Measurements - U.S. System

There seems to be some confusion between the terms cfm and scfm. Most air consumption requirements for air tools are expressed in scfm. In U.S. units the volume of air delivered by a compressor is given is either cubic feet of (free) air per minute (cfm free air) or standard cubic of air per minute (scfm).

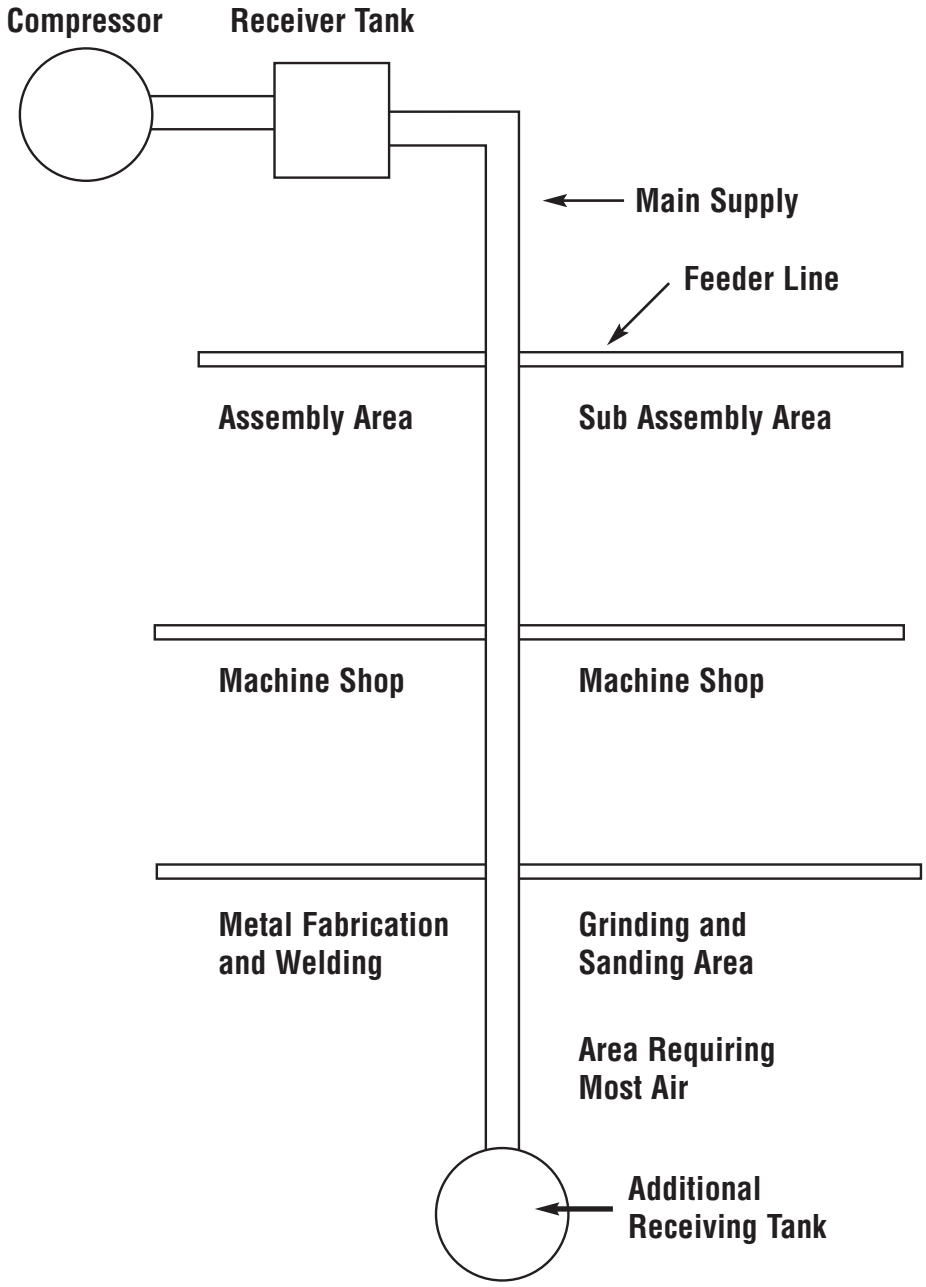
Free Air (cfm) is air at atmospheric pressure and ambient temperature. Free air volume is obtained by using Gas Laws to convert volume to actual pressure and temperature volume at atmospheric pressure and ambient temperature.

Standard Air (scfm) is air at standard atmospheric pressure (14.7 psia)(pounds per square absolute), standard temperature (68 degrees Fahrenheit), and 36 percent humidity.

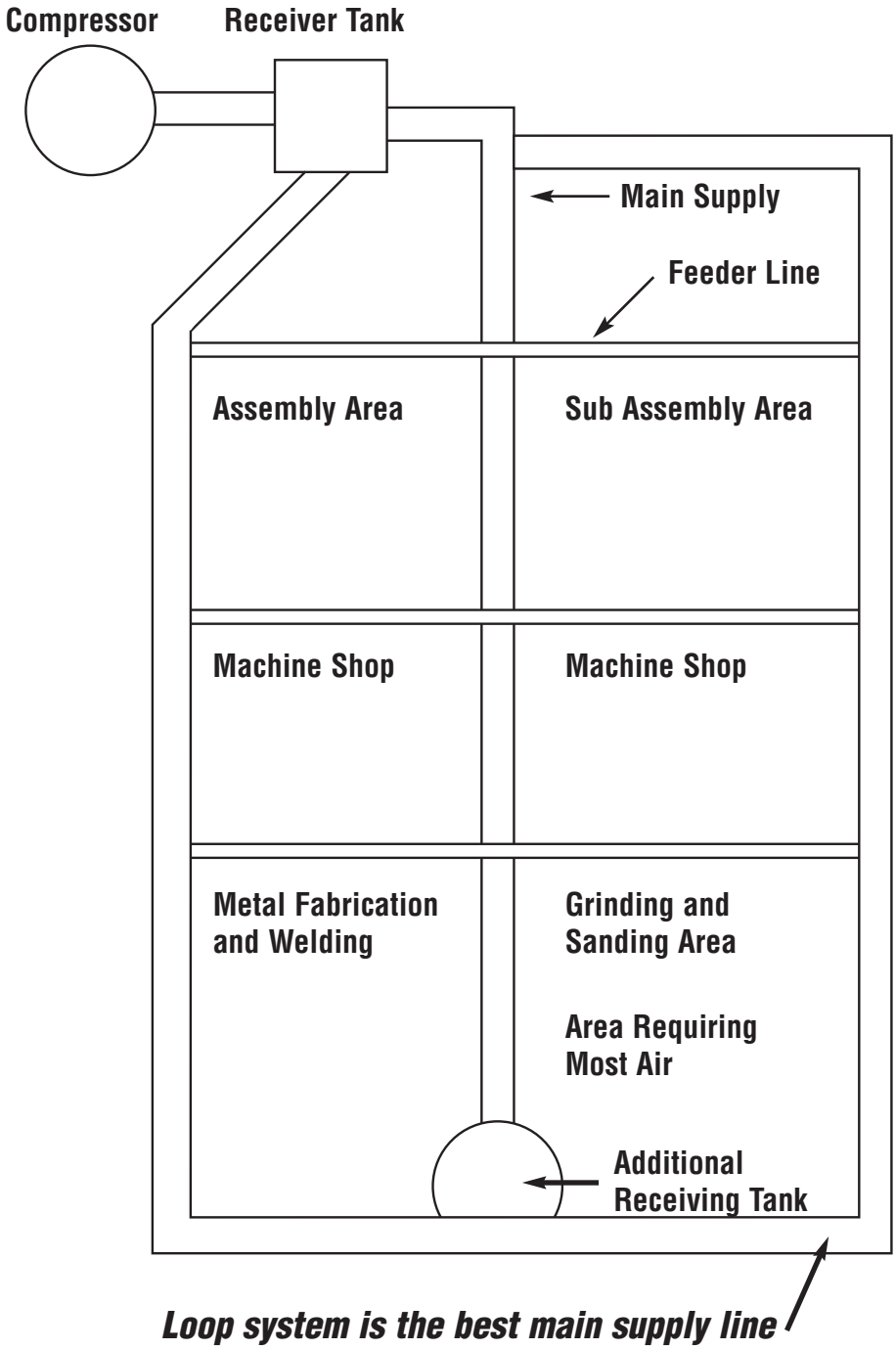
Generally, for tools, cfm is at 90 psi and you can multiply cfm times 7 to get the approximate scfm. Some older listing of air consumption for air tools specified cfm, but is actually scfm. The information in ***Figure 7*** (page 17) is helpful if you have to convert data from U.S. units to metric units.

Typical Air System

Generally an electric-powered compressor will produce 4 scfm per horsepower. A gasoline-powered compressor will produce 2 scfm per horsepower. This information is helpful to determine the available volume of air.



Best main supply line is a loop system tying all lines together to provide the volume of air needed by each department.



Conversion Information – USA to Metric

1/4 inch square = 6.350 mm square
3/8 inch square = 9.525 mm square
1/2 inch square = 12.700 mm square
3/4 inch square = 19.000 mm square
1 inch square = 25.400 mm square

1/4 inch hex = 6 .350 mm

Inch Pounds x 0.113 = Nm (New
Ft. Lbs. x 1.356 = Nm
Nm x 0.737 = Ft. Lbs.

1 Nm = 0.102 kgfm
1 Nm = 10.2 kgfcm

90 psig (pounds per square inch gage) = 6.2 bars = 620 kPa
psig many times is expressed as psi
1 bar = 14.5 psig =100 kPa
1 kPa= 0.145 psig = 0.01 bar

1 psig = 27.68 in. of H2O at 39.2(F or 4(C

I CFM (cubic feet per minute) = 28.371 L/m (liters/minute) = 0.0284 m3/min
1 L/m (liter/minute) = 0.0353 CFM
1 m3/min = 1000 L/m = 35.3 CFM
1 Nm3/min = 0.9 m3/min = 31.77 CFM

1 SCFM	=	7 CFM
1 inch	=	25.4 mm
1 foot	=	12 inches
	=	304.8 mm
1 oz (ounce)	=	28.35 grams
1 pound	=	16 oz
	=	0.4536 kg
1 mile	=	1.61 km
1 km	=	0.62 miles

(C = 5/9((F-32)
(F = 9/5((C)+32

1 HP	=	0.746 kW
1 kW	=	1.34 HP
1 kW	=	746 Watts

1 HP Electric Compressor will produce 4 CFM of air at 90 PSIG
1 HP Gasoline Compressor will produce 2 CFM of air at 90 PSIG
1 kW Electric Compressor will produce 151.74 L/m

Section 2.2

Pneumatic Motors

Sioux Tool Industrial Training Manual

A. Pneumatic Vane Motor

1. The pneumatic vane motor is a simple device. The pneumatic motor works on the same principle as a wind wheel, or water wheel.

(Refer to ***figure 1 & 1A*** for a. through d.)

a. A simple wind wheel has a ***jet of air (A)*** flowing against a vane ***(B)***. If there is no or little opposition, the AIR PRESSURE from the ***jet of air*** will cause the wheel ***(C)*** to turn.

b. When the wheel turns, the next vane ***(D)*** will pass under the ***jet of air***, which will apply additional force causing the wheel to turn faster.

c. The wind wheel will continue to increase its speed of rotation (turning) to some limit. The limit of rotational speed will be determined by:

1) The drag of the vanes ***(E)*** moving against the outside air.
2) The speed of the air flowing from the ***jet of air*** and the amount of air ***(F)*** that actually flows against the vanes (CFM or Liters/minute).

d. An improvement in the wind wheel's performance will be realized by providing a cylinder ***(G)*** so the air jet is concentrated against the vanes.

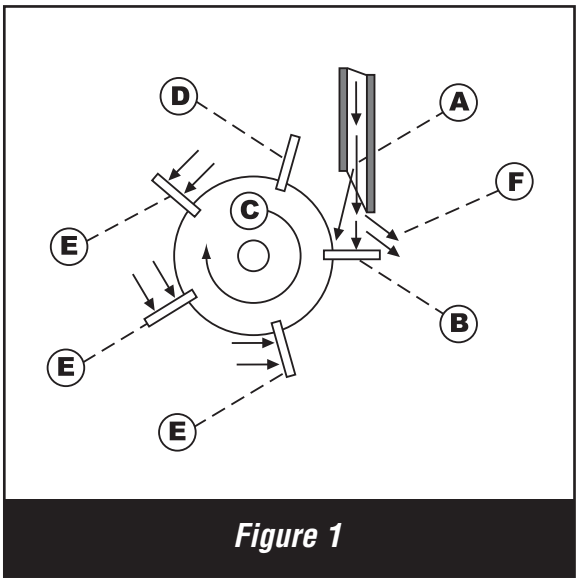


Figure 1

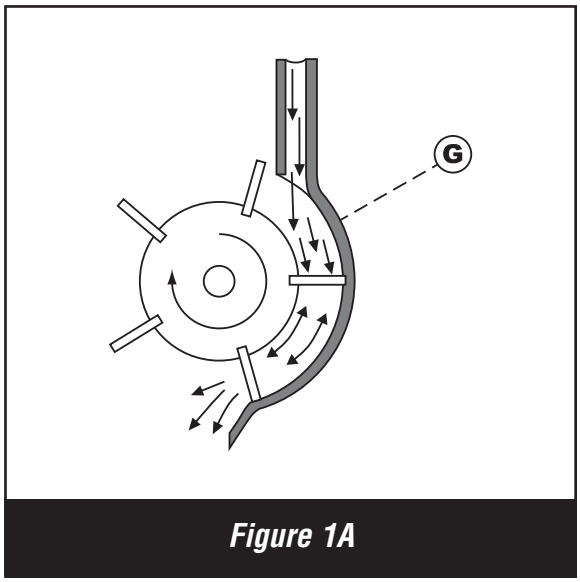


Figure 1A

(Refer to ***figure 2*** for e. through f.)

e. The sliding vane ***(A)*** is a further improvement in the wind wheel. The sliding vane ***(A)*** is fitted into a slot ***(B)*** in the rotor ***(C)***.

f. By placing the rotor ***(D)*** off-center inside the cylinder ***(E)***, an additional improvement in "wind wheel" performance will be realized because:
   1) Air ***(F)*** entering the cylinder pushes against a partially extended vane ***(G)***.
   2) The trailing vane ***(H)*** is almost completely retracted. The difference in the amount of vane surface extended provides additional torque on the rotor.
   3) As the rotor turns, the vanes ***(I)*** continue to extend. As long as the air between the vanes ***(I)*** and ***(G)*** is under pressure, it will push harder against the more extended vane ***(I)***
   4) When the vane ***(L)*** starts to retract, it passes an opening in the cylinder(exhaust), allowing air to escape to the outside (ambient) atmosphere.

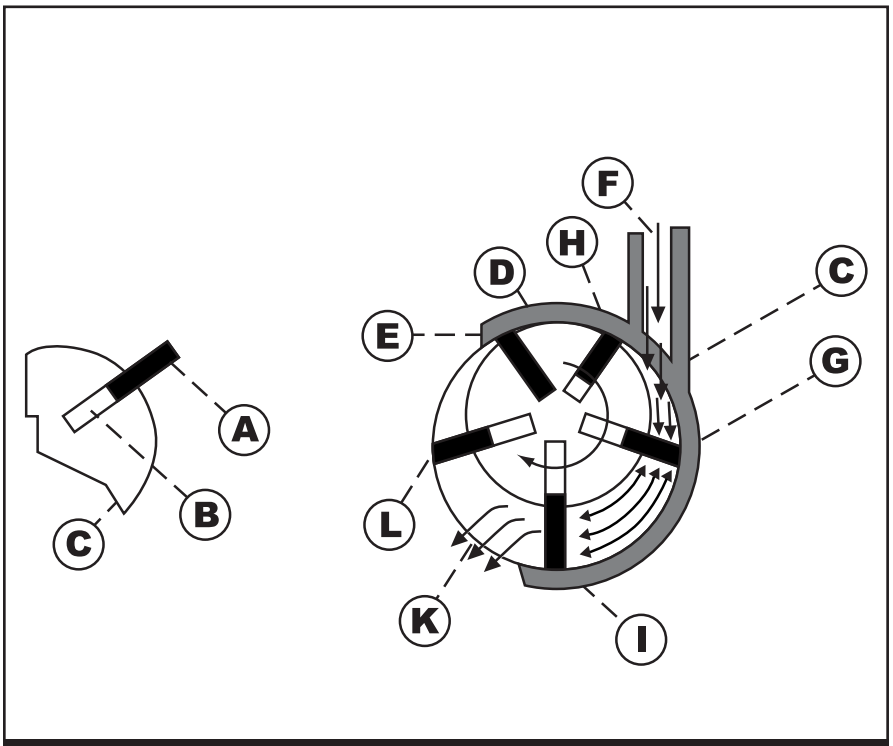


Figure 2

Figure 3 shows a typical, balanced reversible pneumatic motor configuration used by Sioux Tools and many other pneumatic tool manufacturers.

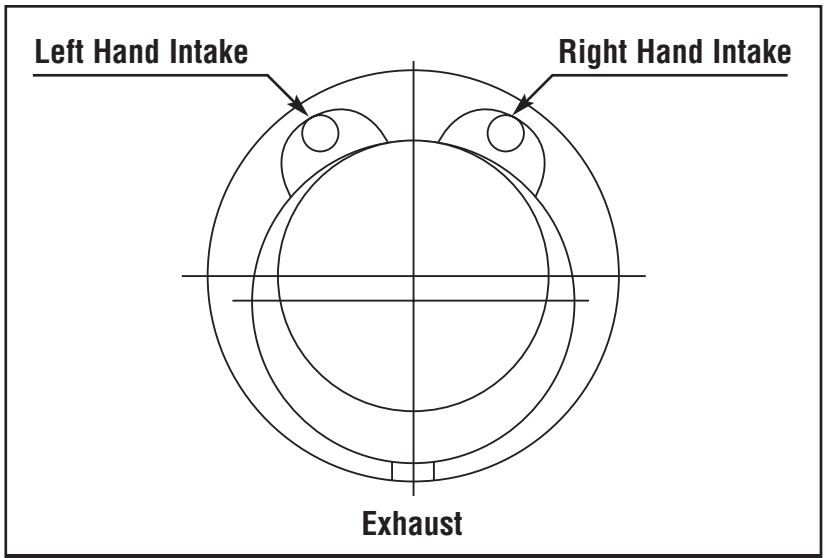


Figure 3

Figure 4 shows a typical Reverse biased motor configuration used by Sioux Tools and many other pneumatic tool manufacturers.

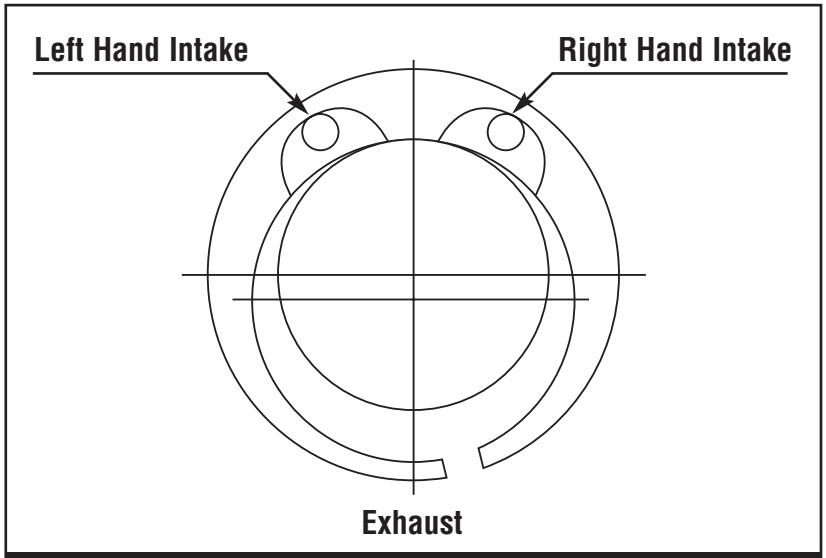


Figure 4

Figure 5 shows an exploded view of a Sioux reversible pneumatic motor.

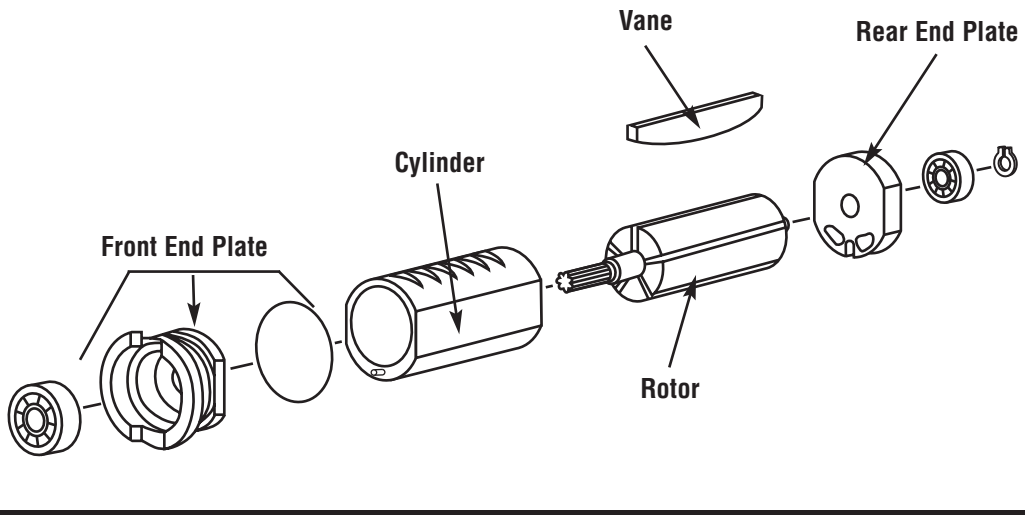


Figure 5

Most air tools are designed to operate with 90 psi (pounds per square inch gage pressure) or 6.2 bars (metric measurement) at the handle of the tool while the tool is running.

Assuming that there is no loss of air pressure in the tool handle, 90 psi of air goes into the right hand intake in ***Figure 4*** (page 3) This fills the chamber in from the top of the cylinder to the first vane (some people call them blades). As you can see in ***Figure 6*** there is a force on the area of the vane causing the rotor to turn in the right hand rotation.

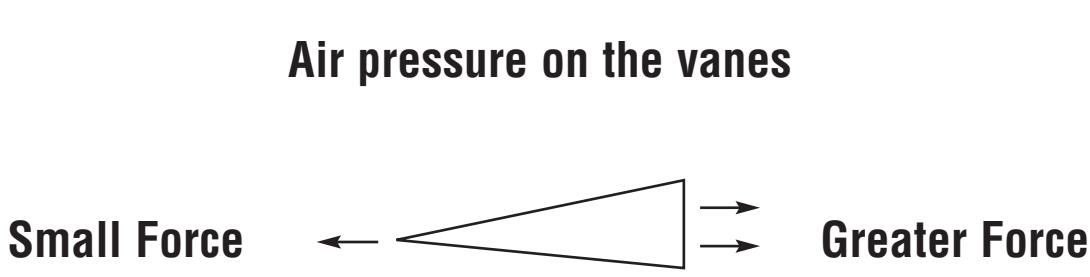


Figure 6

As the motor rotates the vane area becomes larger and the forces become greater to turn the rotor and creating more power as shown in Figure 7.

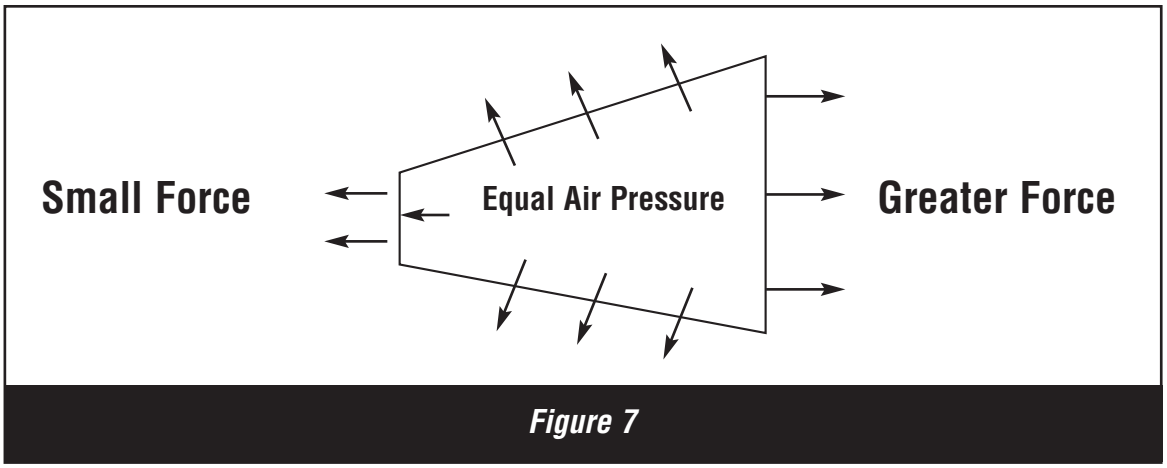


Figure 7

Many people, if you would ask them, would say that it is the air blowing on the vanes that causes the rotor to turn. This would be an impeller. It is the Expansion of Air Principle that causes the rotor to turn and the motor to have power.

In ***Figure 3*** (Page 3), the air enters the right hand intake and goes out the main exhaust at the bottom of the cylinder. As the vane continues past the main exhaust it would be compressing the air, decreasing the power of the motor, so the left hand intake is also made an exhaust, thereby eliminating any compression of air.

To reverse the motor a valve is moved which allows air to enter the left hand intake and the right hand intake is turned into an exhaust forcing the rotor to rotate in a left hand rotation or counterclockwise. Normally the same power and speed are obtained in either direction.

Some of you may have had a tool that will not run when turned on and only blows air out the exhaust. This happens when a vane in ***Figure 3*** (page 3), is stuck towards the center of the rotor and allows air to go directly out the main exhaust. Some motors have springs to force the vanes out, but most motors have provisions for the air pressure to go under the vanes by slots in the end plates, as shown in the parts breakdown, or at the end of the vanes which have an angle on them to allow air pressure to force the vanes out to the cylinder wall. This is especially important in an impact wrench where the motor actually stops and backs up on each solid blow. The vanes must be against the cylinder wall for the tool to impact each time and to obtain maximum efficiency.

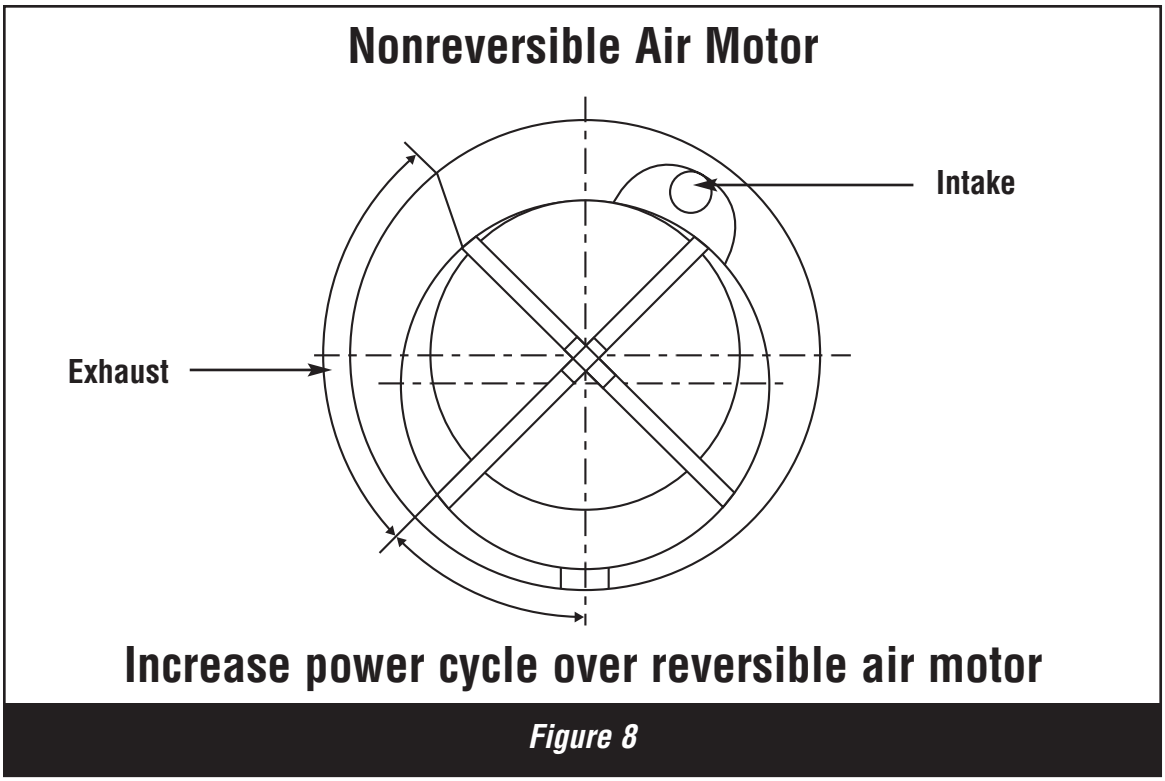


Figure 8

Nonreversible Air Motor

The nonreversible air motor, as shown in ***Figure 8***, does not have to be symmetrical in design like the reversible air motor in ***Figure 4*** (page 3).The left hand intake is not needed. If we move the main exhaust, let's say 45° for a 4-vane motor, we can increase the power cycle, which will increase the speed and power of the nonreversible air motor over the reversible air motor. The exhaust port can be a series of slots or holes.

This is important to know when working with assembly tools. The nonreversible tools have higher speeds and deliver more torque then the reversible tools. This could make a difference in the selection of the right tool for the job to be performed. It is also nice to know if someone asks the question, why does the nonreversible tool go faster and have more torque then the reversible tool?

There is another nonreversible air motor shown in ***Figure 10*** (page 8). By offsetting the vane slots we can increase the inside diameter of the cylinder, the depth of the vane slots, and the height of the vanes to increase the speed and power of the motor. This design is usually found in grinders, sanders, and routers where the higher horsepower is needed, but the tool should be as small and as light in weight as possible.

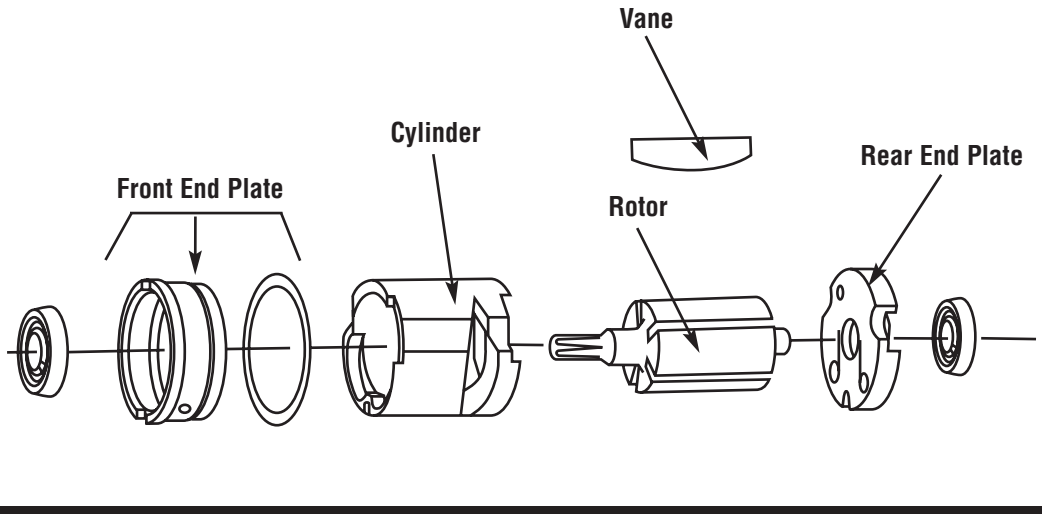


Figure 9

The illustrations show a 4 vane motor design in the cross sections, and either 4 or 5 vanes in the parts drawings. The size of the motor and the number of vanes are determined by the design engineer to accomplish the desired results of the specific tool. Normally the fewer number of vanes produces a higher speed and the higher number of vanes produces a higher torque output of the motor.

You will also find different materials used in the end plates and cylinder. The design engineer determines the selection of the material to meet the requirements of the specific tool being designed. Just because one tool has a certain material does not mean it is the best material for another type of tool.

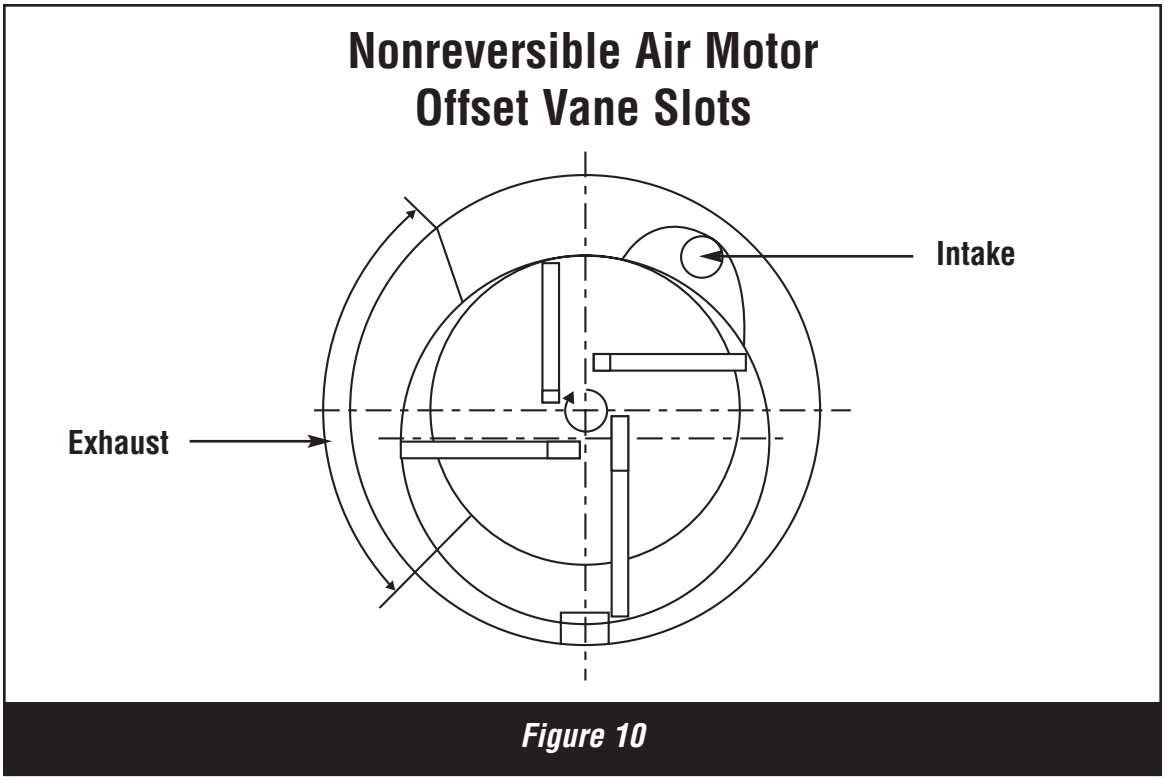


Figure 10

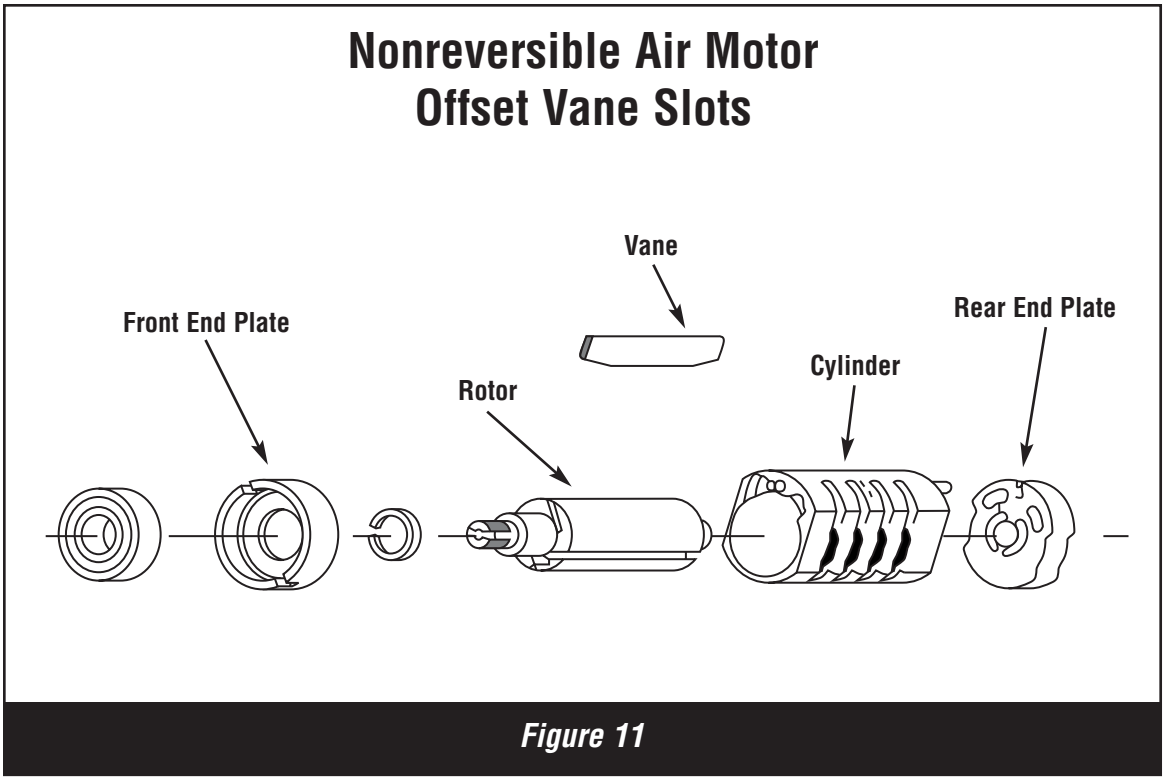
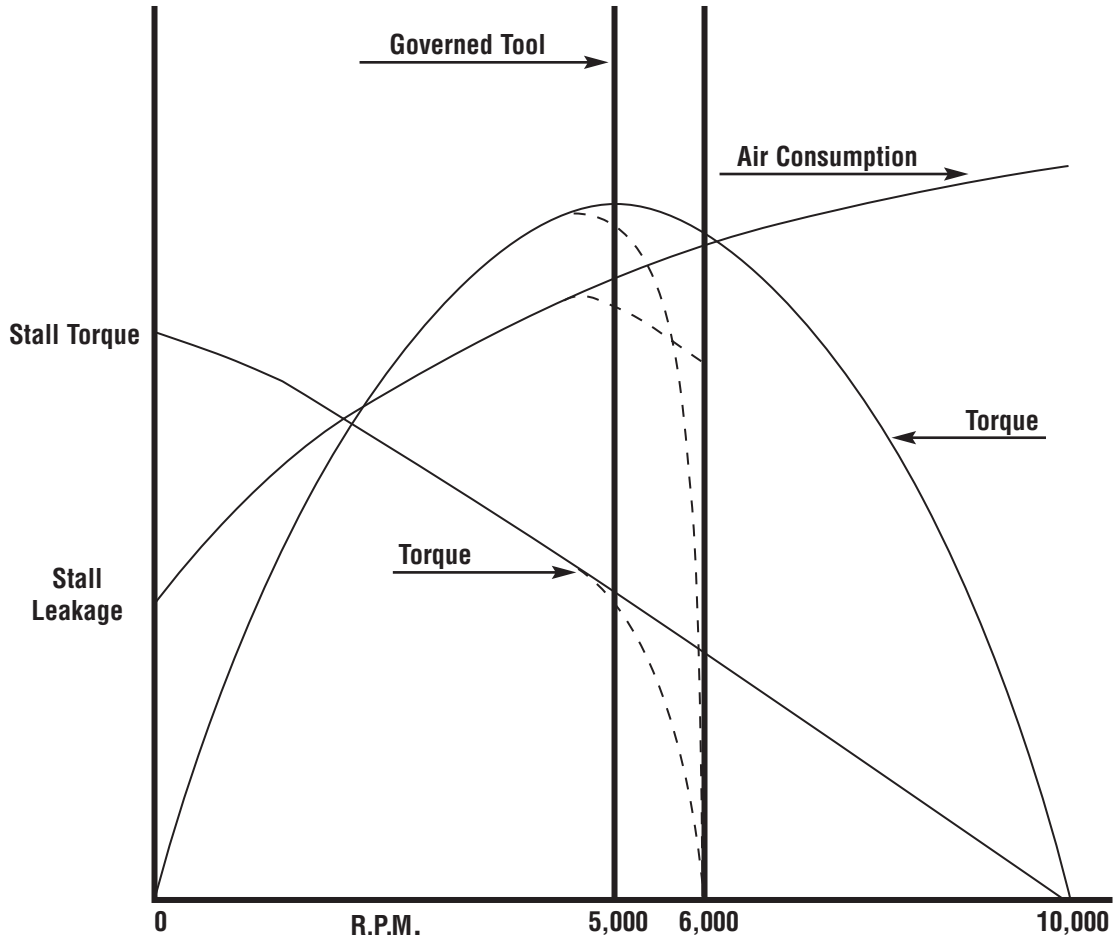


Figure 11

Performance of Air Motors



Typical Air Motor Performance Curves

Figure 12

Consider an air motor that has a no-load speed of 10,000 RPM.

Listed below are some common terms:

RPM Speed in revolutions per minute
CFM Air consumption in cubic feet per minute (Liters per minute - metric)
HP Power in horsepower (Watts, or kilowatts - metric)
Torque Turning or twisting force (called Torsion) in foot-pounds (ft lbs) or inch-pounds (in-lbs) or (newton-meters - metric)

When the motor is put to work or the motor is loaded, such as when drilling or tightening a screw or bolt, we slow the motor down. With a measuring device we can measure the amount of torque it takes to slow the motor down to a specific speed. If we plot the readings of the torque and speed, we get a chart as in ***Figure 12*** (page 9). The horsepower of the air motor can then calculated. The horsepower at no load speed and at stall is zero, because there is no work being performed. We see that the maximum horsepower is at half the no load speed. If enough torque is applied to the tool, the motor can be stalled. The torque required to stall the motor is called stall torque. This value is used to determine the selection of an assembly tool for fastening a bolt, nut, or screw.

The maximum air consumption is at no load speed. The air consumption at stall is called stall leakage. Sioux air motors are designed to provide the maximum amount of efficiency. This is obtained by designing for 0.001 of an inch clearance between the rotor and each end plate and between the rotor and the top of the cylinder. This means that the surfaces of the parts must be square and parallel. We could decrease the cost of production by increasing the clearance to 0.002 of an inch or more. The result would be decreased stall torque and increased stall leakage, which would mean lower efficiency for the user, your customer.

The dashed lines on the chart in ***Figure 12*** (page 9) relate to a governed tool.

Consider the function of a 7-inch sanding disc. The outside inch of the disc is all that is used in sanding. The grit or materials on the disc are actually all little cutters. You are most likely familiar with a turning lathe or drill press. The feed and speed of the cutter is very important in properly removing the material. By maintaining a high speed on the 7-inch disc the result will be greater efficiency for removing material.

However the maximum safe speed of the sanding disc or grinding wheel is extremely important. Therefore we show the free speed to be 6000 RPM.

The motor can be geared down to 6000 RPM, which gives us a higher stall torque, however stalling a sander doesn't remove any material. The working torque on most sanders and grinders is at the maximum horsepower. Therefore the maximum horsepower on the geared tool would be at 3000 RPM.

The tool can be governed to have a maximum no load safe speed of 6000 RPM. A simple analogy of a governor would be the cruise control on a car. When we set the cruise control to a certain speed, the engine will try to maintain that speed whether going uphill or downhill. The same is true with the governor on an air motor. It will try to maintain the higher speed. When we put the tool to work, the governor will allow more air to enter the motor, thus maintaining as high of speed as possible. As you see in ***Figure 12*** (page 9) the torque increases very rapidly as the air consumption increases. The maximum horsepower, which is the working point of the tool, is around 5000 RPM, at which point the governor is wide open providing the maximum amount of air.

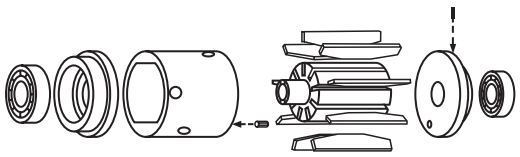
Therefore the purpose of a governor in a tool is to provide the maximum working speed at the maximum horsepower for the maximum efficiency in removing material in grinding, sanding, or routing.

Dual Chamber Motor

Sioux Pulse tools incorporate another type of air motor, the dual chamber air motor.
A cross sectional view in ***Figure 13*** shows the difference between the conventional single chamber motor discussed previously, and the dual chamber motor. The dual chamber cylinder has two offset bores or diameters with intake and exhaust in each chamber. The result is shown in the efficiency curve in ***Figure 13***. The free speed is slower in the dual chamber motor, but the important difference is the higher torque and higher speed than a conventional air motor. The dual chamber motors have a higher number of vanes. This illustration shows 6 vanes in the single chamber motor and 9 in the dual chamber motor.

Adding to the efficiency of the dual chamber air motor is the fact that the air consumption will be less than that of a conventional motor.

The dual chamber motors used in Sioux Pulse tools are designed to operate "oil-free". This eliminates the need for daily oiling or the installation of an in-line oiler.



Dual Chamber Motor

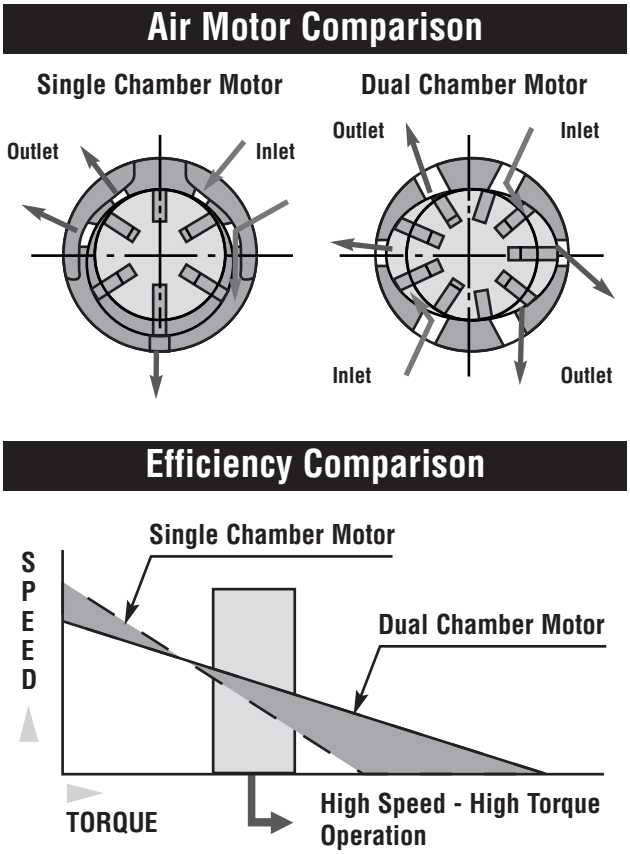
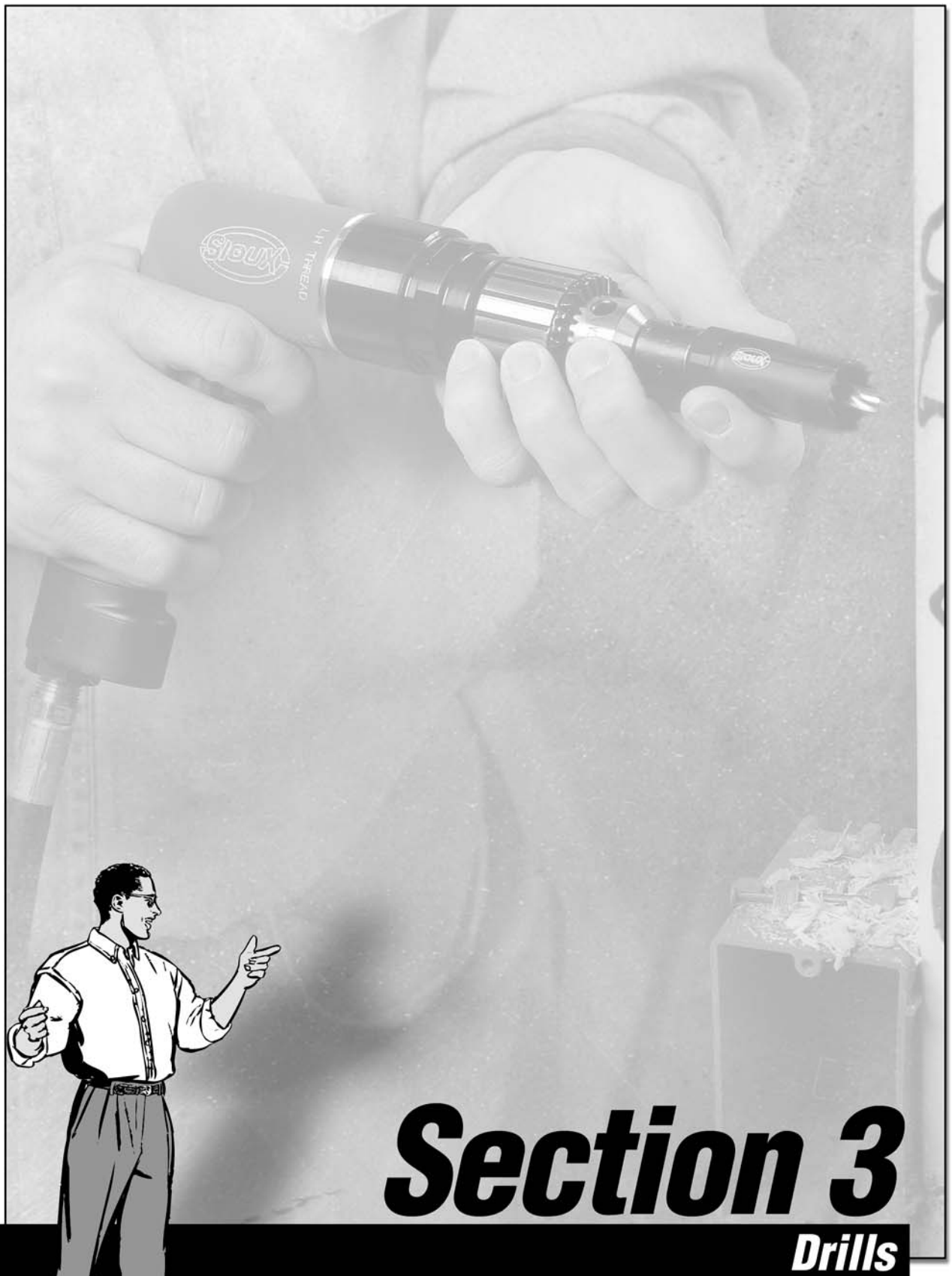


Figure 13



Section 3

Drills

Sioux Tool Industrial Training Manual

Section 3.1

Drill Product Literature

Sioux Tool Industrial Training Manual

Section 3.2

Drills

Sioux Tool Industrial Training Manual

Chips can cause eye injury.

Drilling creates chips. Proper eye protection must be worn at all times by tool user and bystanders.

Broken drill bits can cause eye injury.

Proper eye protection must be worn at all times by tool user and bystanders.

Sudden and unexpected tool movement can cause injury.

Be sure your body position allows you to have control of the tool at all times. Make sure your footing is secure.

Tools starting unexpectedly can cause injury.

Always remove tool from air supply and activate trigger to bleed air line before making any adjustments, changing accessories, or doing any maintenance or service on the tool.

Drill Principles of Operation

An air motor and reduction gearing are used to drive a spindle / drill chuck, which holds accessories for drilling, reaming, tapping, and hole sawing.

Motor size (horsepower), gear ratio, handle style and drive spindle determine the type of tool needed to handle an application.

Drill Uses

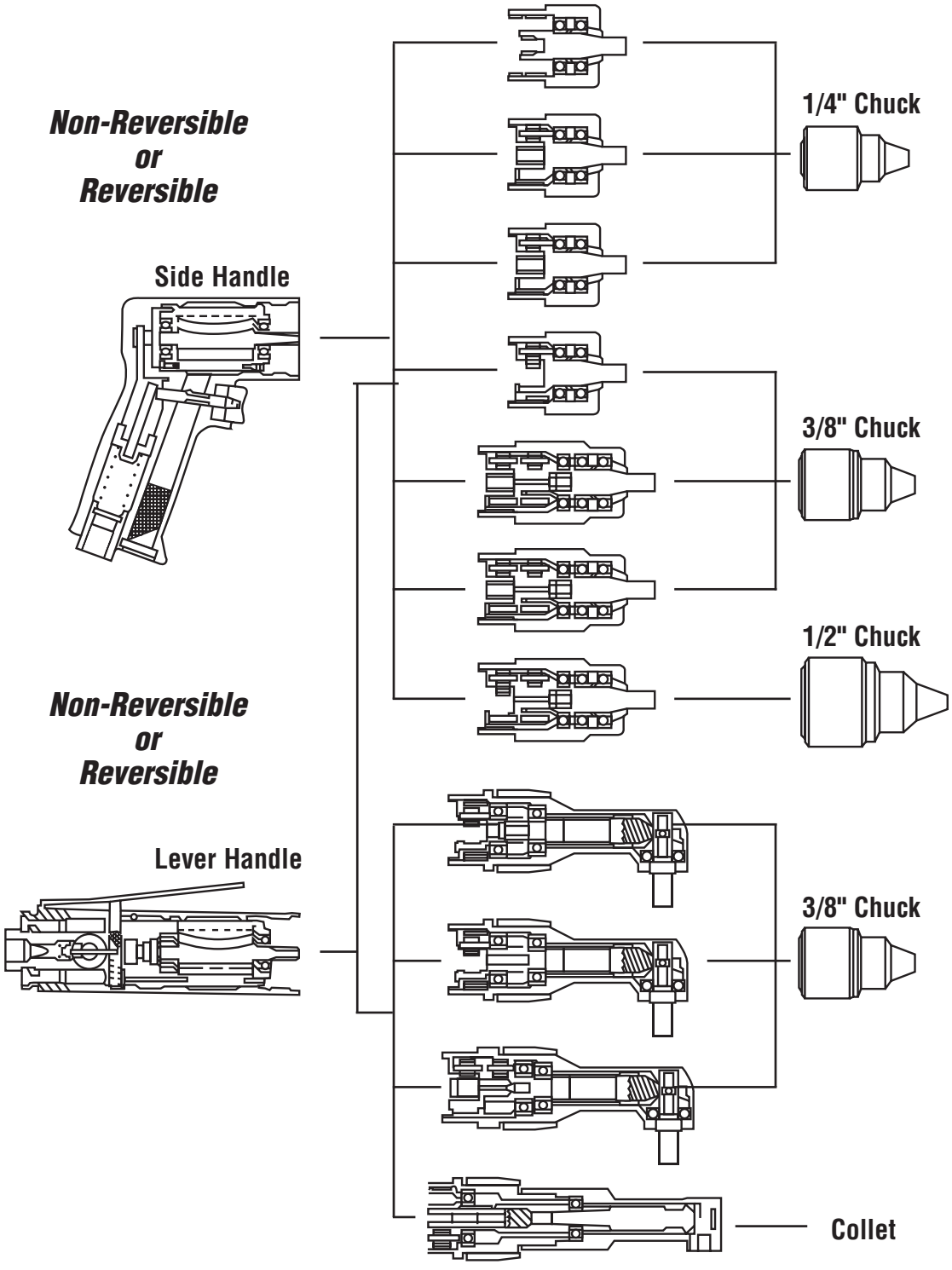
Pneumatic drills may first be thought of for drilling holes in wood, metal, or plastic. Drills are used in a wide variety of applications. Each of these applications require the proper tool with the proper horsepower and speed to get the best results.

Drilling – cutting a hole in material using a fluted bit.
Reaming – opening up or sizing a previously drilled hole or aligning offset holes.
Tapping – cutting threads in a drilled hole to accept threaded fasteners.

Where Used

Continuous-duty production drilling
For initial tap operations and thread closing
Wire brushing and deburring
Screwdriving
Hole sawing
General Maintenance

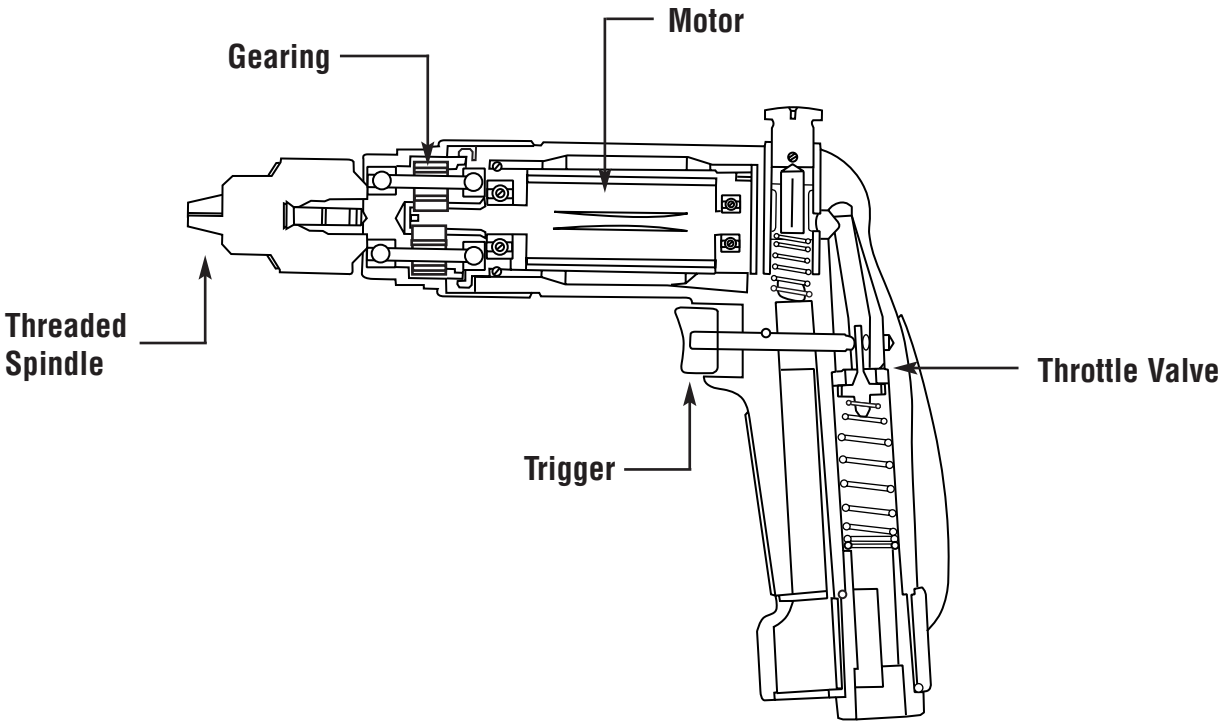
Typical Pneumatic Drill Components



Drill Maintenance

1. Tipper valve and valve seat is easily accessible for service
2. Slip fit of front end plate bearing allows easy service of the air motor without disturbing the rotor spacing
3. Drop in motor. No alilgnment necessary (applies to non-reversing drills only)
4. Rotor pinion is case hardened to resist wear
5. Grease zerk makes it easy to grease the gears without disassembly
6. Planetary reduction can be serviced without removing the chuck
7. Planet gear pins are slip fit for ease of assembly and disassembly
8. Ring gear is machined into the motor retainer for ease of assembly and disassembly
9. Interchangeable rotor, cylinder, bearings and endplates. This reduces the number of spare parts tool cribs need to stock

Typical Pneumatic Drill Components



Trigger and Valve

Allows the operator to adjust the amount of air needed to run the tool at its designated speed.

Motor Components Include

Rotor, rotor blades, liner and end plates.

Gearing

Gears are used to give desired speed and increase torque.

Threaded Spindle

Transfer rotating power from air motor and gearing to the accessory attached to the drill.

Considerations for Selecting Drills

What type of material is being drilled?
What size of hole will need to be drilled?
What are your horsepower requirements?
What speed requirements do you have?

What type of handle will be needed for the application(s)?

Pistol Grip
Straight
Angle

What class of service will the tool be utilized for?

High production
Low production
Maintenance or repair work

Section 3.3

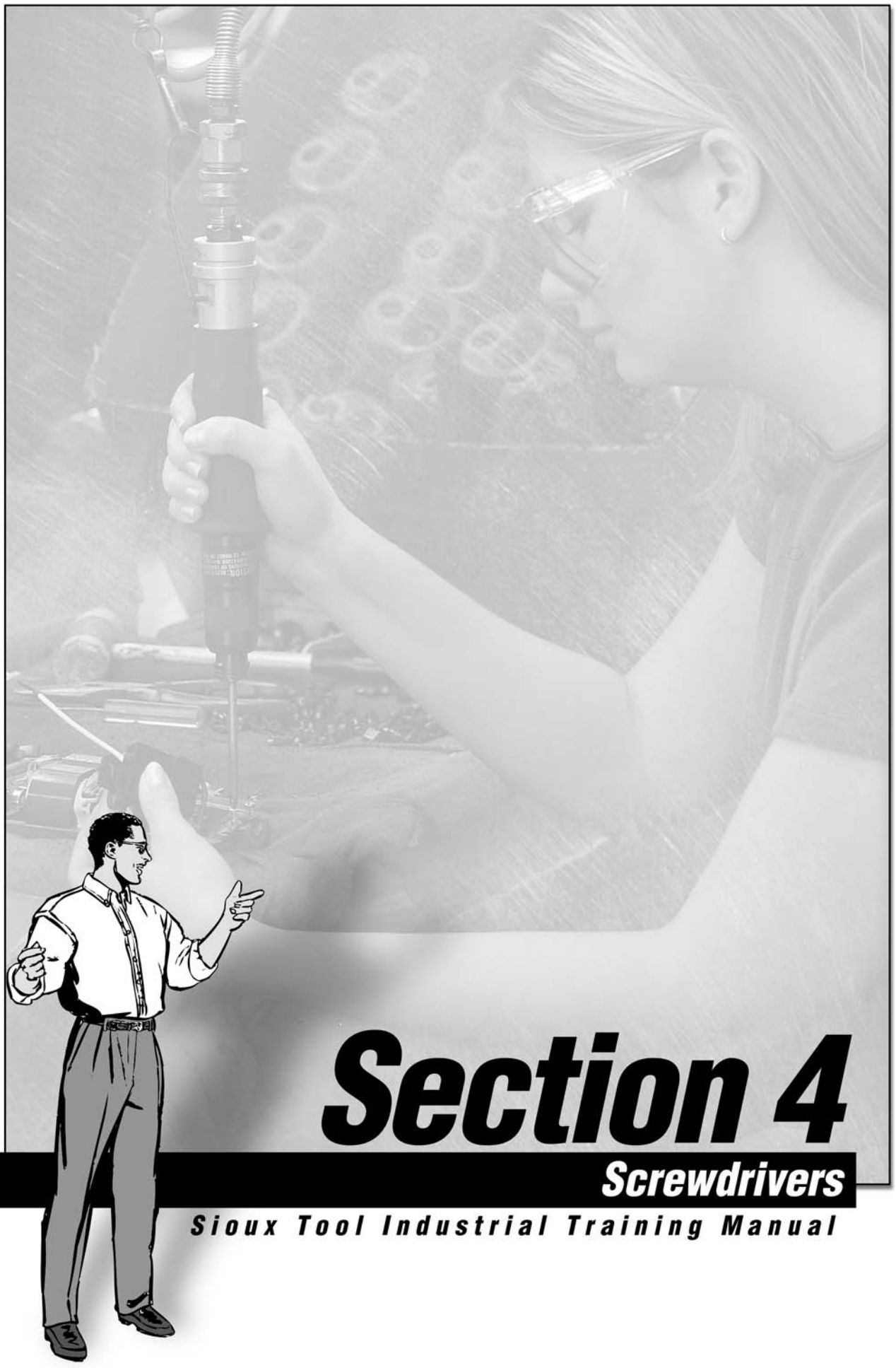
Drill Speed Guide

Sioux Tool Industrial Training Manual

Material	Surface Ft./Min.	1/16 (1.5)	Size of Hole to be Drilled (mm) 1/8 (3.0)	3/16 (5.0)	1/4 (6.0)	5/16 (8.0)	3/8 (9.5)	7/16 (11.0)	1/2 (13.0)
			Recommended Cutting Speed Range (rpm)						
Steel Alloy 300-400 Brinnel	20-30	1250 1800	600 900	400 600	300 450	250 350	200 300	175 250	150 225
Stainless Steel Cast Iron, Hard	30-40	1800 2500	900 1200	600 800	450 600	350 500	300 400	250 350	225 300
Steel Forgings	40-50	2500 3100	1200 1500	800 1000	600 750	500 600	400 500	350 425	300 400
Steel, Tool Annealed, .90-1.20 Carbon	50-60	3100 3700	1500 1800	100 1200	750 900	600 700	500 600	425 525	400 450
Steel .40-.50 Carbon	70-80	4300 5000	2100 2500	1400 1600	1000 1200	850 1000	700 800	600 700	500 600
Cast Iron, Med Hard	70-100	4300 6000	2100 3000	1400 2000	1000 1500	850 1200	700 1000	600 900	500 800
Bronze, High Tensile Strength	70-150	4300 9000	2100 4500	1400 3000	1000 2300	850 1200	700 1530	600 1300	500 1200
Malleable Iron	80-90	5000 5500	2500 2800	1600 1800	1200 1400	950 1100	800 900	700 800	600 700
Steel, Mild .20-.30 Carbon	80-110	5000 6700	2500 3400	1600 2300	1200 1700	950 1350	800 1150	700 1000	600 850
Cast Iron, Soft/Plastic	100-150	6000 9000	3000 4500	2000 3000	1500 2300	1200 1800	1000 1530	900 1300	800 1200
Aluminum/Brass/Bronze	200-300	12000 18000	6000 9000	4000 6000	3000 4500	2400 3700	2000 3000	1700 2600	1500 2300
Magnesium	250-400	15500 25000	7500 12000	5000 8200	3800 6100	3000 4900	2500 4000	2200 3500	1900 3000
Fiberglass/Wood	300-400	18000 25000	9000 12000	6000 8200	4600 6100	3700 4900	3000 4000	2600 3500	2300 3000

Actual drilling or cutting RPM will be approximately 80% of rated spindle speed of tool.

Surface Feet Per Minute = .26 x RPM x Drill Diameter in Inches.



Section 4

Screwdrivers

Sioux Tool Industrial Training Manual

Section 4.1

Screwdrivers

Sioux Tool Industrial Training Manual

Broken Sockets, Bits and Adaptors can cause injury.

Proper eye protection must be worn at all times by tool user and bystanders. Use only sockets, bits and adapters made for power tools and that are in good condition. Use only bits and adapters that are in good condition. Keep hands away from sockets, bits and adapters.

Sudden and unexpected tool movement can cause injury.

Be sure your body position allows you to have control of the tool at all times. Make sure your footing is secure. Consult manufacturer for proper reaction bar if movement is excessive.

Tools starting unexpectedly can cause injury.

Always remove the tool from air supply and activate trigger to bleed air line before making any adjustments, changing accessories, or doing any maintenance or service on the tool.

Falling tools can cause injury.

If the tool is used with a balancer or other suspension device, be sure the tool is firmly attached to the device.

Assembly Principles of Operation

An air motor and planetary reduction gearing are used to drive a clutch spindle, producing torque in a fastener.

The action of the torque creates clamp-load in the assembly

Motor size (horsepower), gear ratio, and type of clutch determine performance, and are key factors in selecting the appropriate tool for a given application

Generally equipped with a 1/4" female hexagon spindle that allows inserting a screwdriver bit.

Typical Components of Screwdrivers

Throttle & Valve

Allows the operator to adjust the amount of air needed to run the tool at its desired speed.

Motor

Components include – rotor, rotor blades, liner, and end plates.

Gearing

Ratios for all the speeds necessary for the application.

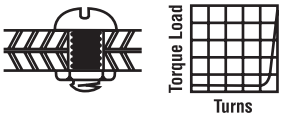
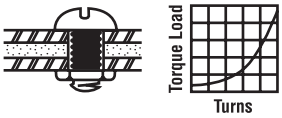
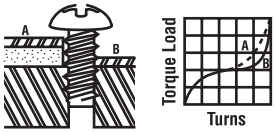
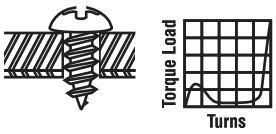
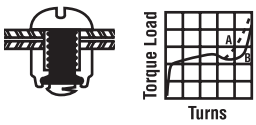
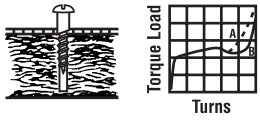
Clutch

Measures torque being applied to fastener. Choice of: shut-off, adjustable, positive, and direct drive.

Spindle

Square drive or Quick Release for positive bit retention.

Clutch Selection Guide

Type of Job	Clutch Performance			
	Torque Control	Adjustable	Direct/Stall Drive	Positive Clutch
1. FREE-RUNNING–SUDDEN STOP  Turns easily until screw head or nut seats against a solid stop. Resistance then builds up suddenly.	Excellent for all size screws.	Good for all size screws close torque control is not required.	Good for large or medium nuts or cap screws only.	Fair for all size screws where close torque accuracy is not required.
2. SOFT PULL-UP  Turns easily until screw head or nut seats, then resistance builds up gradually through one or more turns as resilient material compressed.	Excellent for all size screws.	Good for most screws close torque control is not required. Slow on large screws with long pull-up.	Good for large and medium-size screws. Must be adjusted to run rather slowly for small screws.	Good for small-to medium-size screws. Requires considerable operator pressure on large screws.
3. SELF-TAPPING IN THICK MATERIAL  Increasing heavy resistance through entire travel until screw head seats. Then either (A) gradual, or (B) sudden final build-up resistance.	Excellent for all size screws. Not suitable if tapping torque exceeds stripping torque.	Good for most screws. With proper operator technique, can be used where tapping torque exceeds stripping torque. Slow on large screws	Not recommended unless stripping torque is considerably higher than tapping torque.	Good for most size screws where stripping torque is considerably higher than tapping torque. Excellent in non uniform or misaligned material.
4. SHEET METAL SCREWS  Resistance increases rapidly at first, then eases slightly. At he end, it usually builds up suddenly when screw head seats.	Good for all size screws. Not suitable if tapping torque exceeds stripping torque.	Good for most screws. With proper operator technique, can be used where tapping torque exceeds stripping torque.	Not recommended unless stripping torque is considerably higher than tapping torque.	Good for all size screws where stripping torque is considerably higher than tapping torque. Excellent when sheets are frequently misaligned.
5. LOCK NUTS  Starts with heavy resistance that last through entire travel until screw or nut seats. Then either (A) gradual, or (B) sudden further build-up resistance.	Excellent for all size screws.	Good for most screws close torque control is not required.	Good for large and medium screws. Must be adjusted to run Must be adjusted to run rather slowly for small screws.	Fair for all size screws.
6. WOOD SCREWS  Starts with small resistance that steadily increases through entire travel with additional resistance as screw head seats.	Fair for all size screws.	Good for all size screws	Excellent for large and medium screws. Must be adjusted to run rather slowly for small screws.	Excellent for all size screws.

Considerations for Selecting Screwdrivers

This should be done in a systematic way to ensure no details are overlooked that could have an adverse affect on job function or results. The following are variables that must be considered to ensure proper tool selection.

What is being assembled?
What material is involved?
What type of screw or nut is being driven? What head type?
What screw size (standard or metric)?
What U.S. grade or metric class?
What torque (inch pounds or Newton meters)?
What torque tolerance (accuracy)?
What is the run-down torque vs. seating torque.
What type of joint pull-up (hard, medium, soft)?
What pull-up conditions (free run-down, sheet metal, wood, or plastic)?
What is the production rate?
Are there clearance problems?
What handle style is required (straight or pistol)?
Is the tool to be hand held or fixtured?
What type of clutch?
Speed required?
Is there a need for a reversible tool?
What type of drive (square, 1/4" hex, quick change)?
How is the application being done now?
Special consideration?

1. What is the size and type of screw or fastener on which the tool will be used?
   No. 1 Series Tools – 2 to 50 in-lb of torque. (Fasteners up to 1/4")
   No. 2 Series Tools – 5 to 360 in-lbs of torque. (Fasteners up to 3/8")
   No. 3 Series Tools – 5 to 60 ft-lbs of torque. (Fasteners up to 1/2")

2. What kind of application and material will the fastener be used on.
   The type of material helps to determine which type of clutch is needed.

	APPLICATION			
Screw Size	Clutch	Free Run Down	Soft Pull Up	Prevailing Torque
No. 8 and Smaller	Adjustable	Excellent	Excellent	Excellent
	Stall	Excellent	Good	Excellent
	Direct	Good	Good	Good
	Positive	Fair	Fair	Good
No. 10 and Larger	Adjustable	Good	Fair	Fair
	Stall	Good	Excellent	Excellent
	Direct	Good	Excellent	Excellent
	Positive	Excellent	Good	Good
	Positive "A"	Good	Excellent	Excellent
	Positive "ASQ"	Good	Excellent	Excellent

3. What are the torque requirements?
   Most air tools share the quality: as the speed increases, the torque decreases. This applies to tools within the same horsepower rating.
   A. Stall or direct clutch gives the most torque.
   B. Positive clutch tools are operator influenced.
   C. Adjustable torque clutches are available on most Sioux fastening tools.
   D. Torque control is available on No.1

4. At what angle or position will the tool be used?
   This will determine the style of tool best suited from an ergonomics point of view.
   A. If the fastener is in a vertical position, a straight or lever style tool will be best.
   B. If the fastener is in a horizontal position a pistol style tool will be best.
   C. If the fastener is in a tight or constricted area the "2S" series works well in this application.

5. Is reversing necessary?
   Most fastening applications are going to require a reversible tool. Keep in mind that in most cases a non-reversing tool will have more torque than a reversible tool.

6. Is the application operator influenced or restricted?
   A. Is the operator male or female? This can be a factor in determining the size of the power tool.(weight for example)
   B. Does the application lend itself to an auto start tool, as in the No. 1 series?

An example of applying these questions to an application would be:
Driving a 2" long wood screw into hardwood with a pilot hole. The fastener is in a horizontal position during assembly. A test with a hand torque wrench indicates a prevailing torque of 80 in-lbs, and a failing torque of 120 in – lbs.

1. 2" long wood screw

2. Hard Wood use positive clutch.

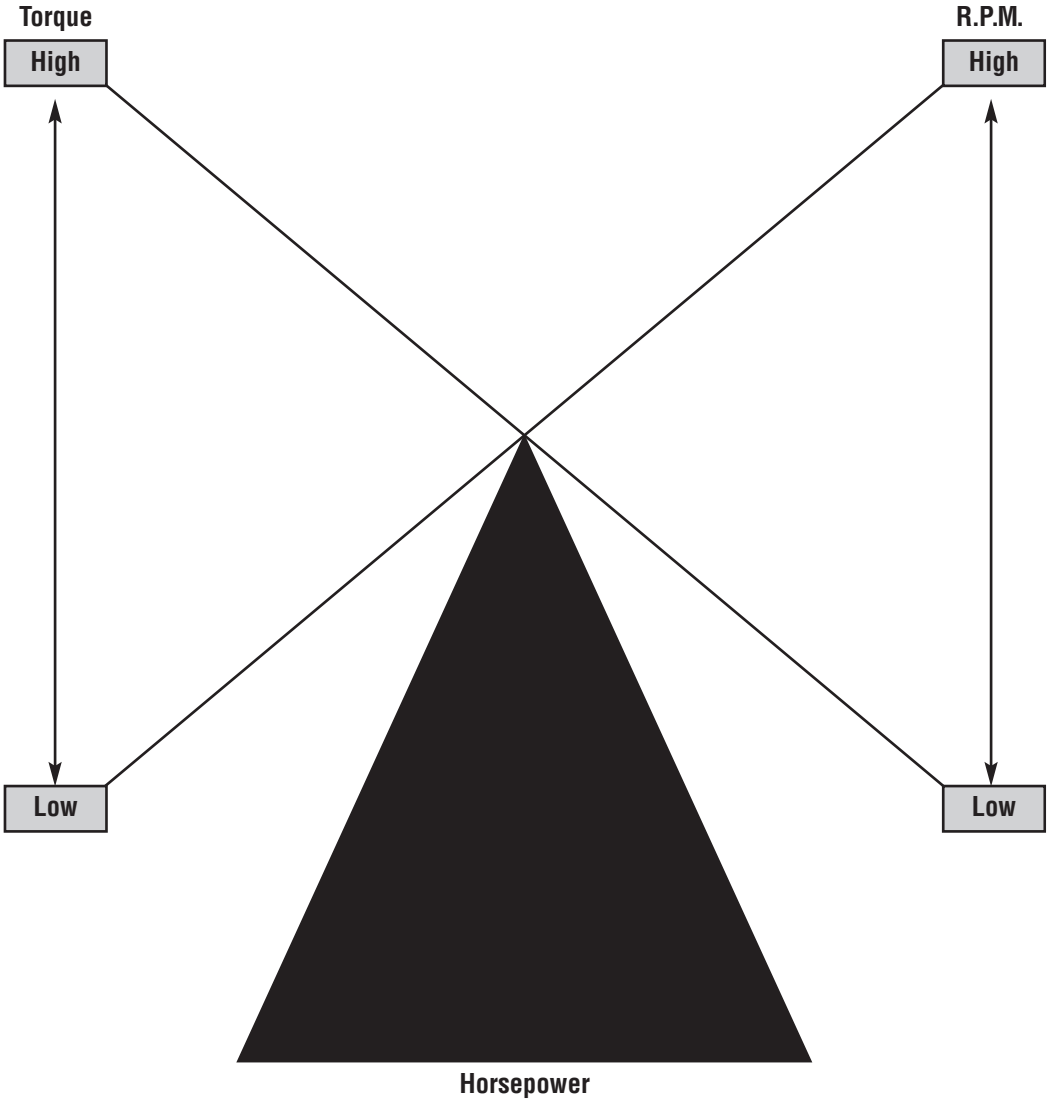
3. SSD10P20PS – 100 in-lb

4. Pistol will work best

5. Need reversing

6. Mostly male workers

Horespower = Torque x R.P.M.
63025



This illustrates how torque output will change (increase or decrease) per a given horsepower.

Horsepower vs. Torque Relationship

Standard nosepieces available for all fasteners shown below.

Wood Screws


flat head


round head


oval head

Machine Screws


round head


flat head


fillister head


oval head


truss head


binding head


washer head*


pan head

*Standard or Special, depending on the washer diameter.


flat side binding head


fillister pan head


flat fillister head


undercut flat head


knob screw head


lentil head


Jackson head


undercut oval head

Tapping or Sheet Metal Screws


round head


flat head

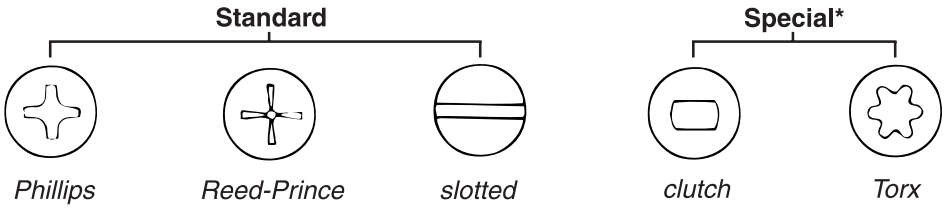

oval head


pan head


truss head

Drive Systems

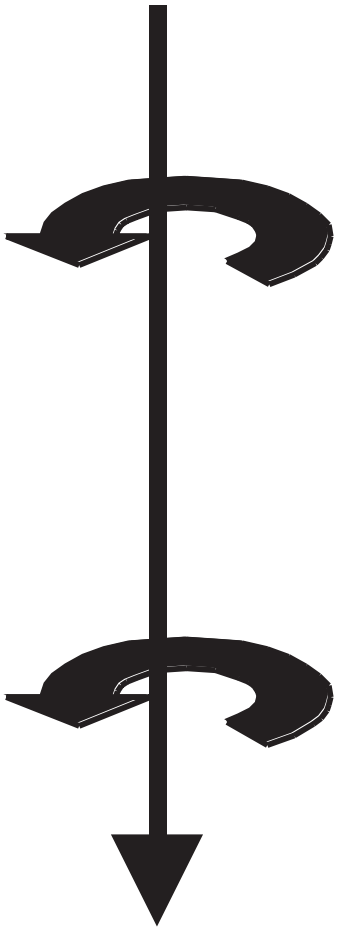
Special bits required for Clutch and Torx internal and external.
Call factory.



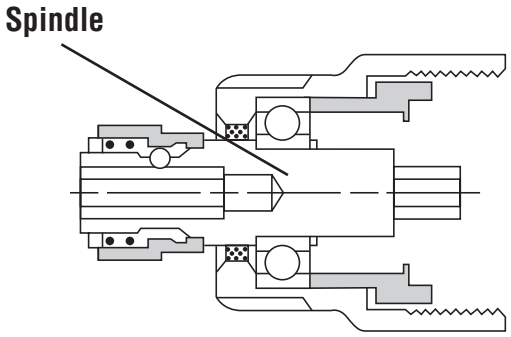
Section 4.2

Assembly Tool Clutch Types

Sioux Tool Industrial Training Manual


MOTOR
SPINDLE

Direct Drive Clutch



Torque Output

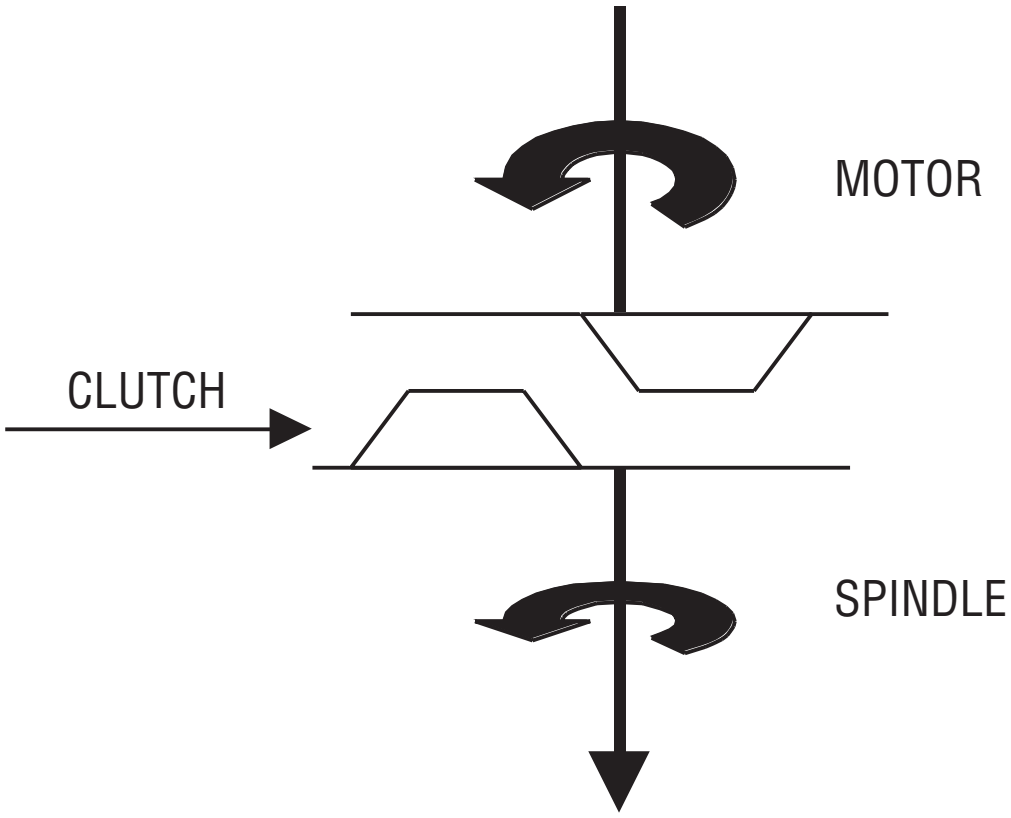
Torque output is determined by the stall torque of the motor/gearing at a given air pressure. When trigger is actuated, motor drives through the gearing to the spindle which stops when fastener torque reaches stall torque of the motor.

Major Characteristics

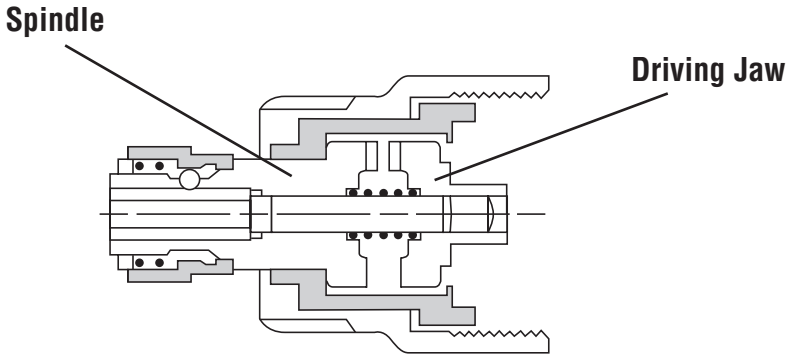
Final torque equals stall torque of motor/gearing.
Simple, low-maintenance design.

Where Used

Provides excellent fastening in soft-draw applications where the fastener can be run to the tool's stall torque.
Driving large-to-medium screws.


MOTOR
CLUTCH
SPINDLE

Positive Clutch



Torque Output

Torque output to the fastener is determined by the amount of force the operator exerts on the tool to keep the jaws engaged. When motor torque is reached, the clutch jaws cam out of engagement and start to slip.

Torque can be built up on fastener if the operator allows the slipping action to continue.

Major Characteristics

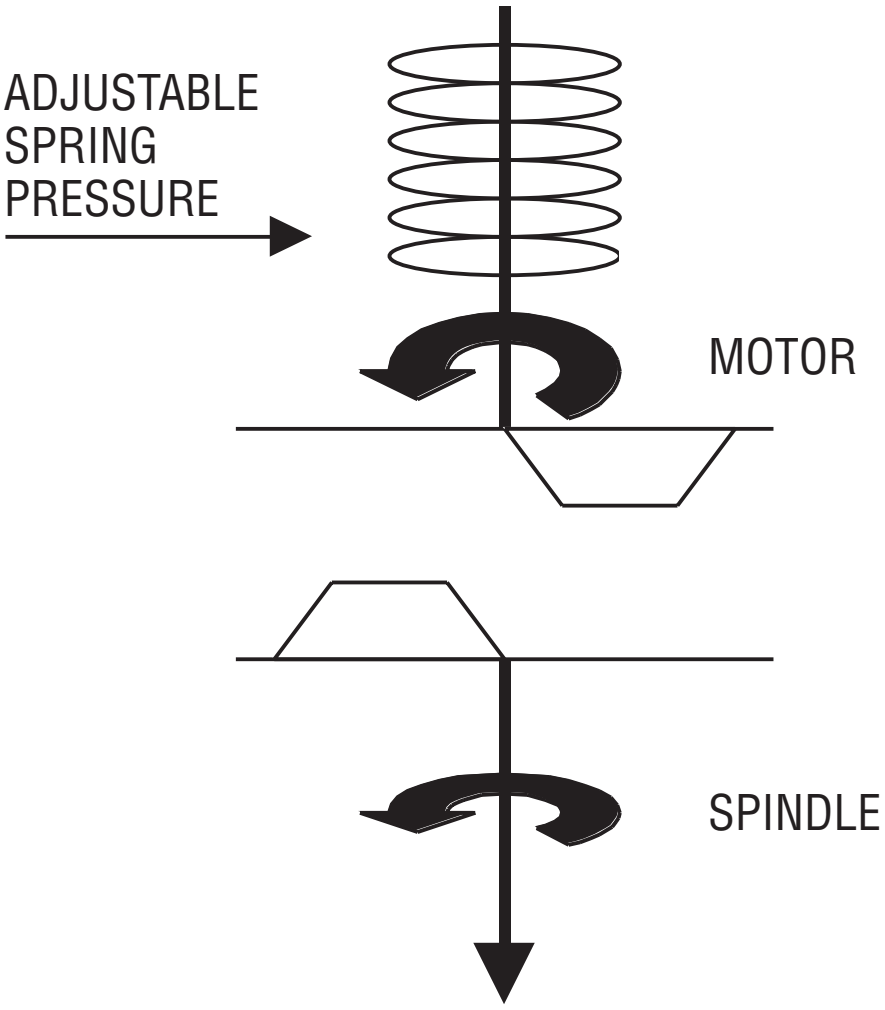
Simplest screwdriver clutch.

Torque builds up in fastener if the operator allows clutch to continue to impact,

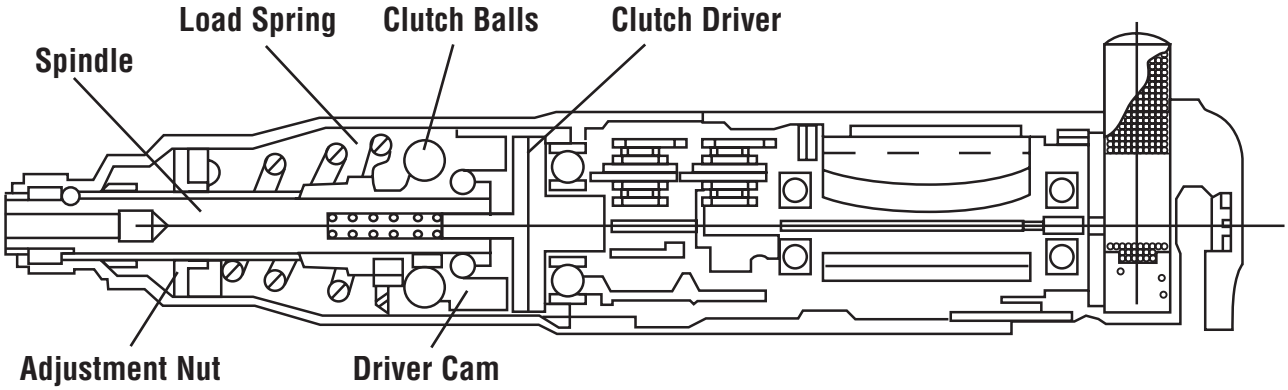
No adjustment of clutch is required.

Where Used

Driving fasteners where torque requirements varies due to inconsistent materials, and torque accuracy is not critical.


ADJUSTABLE
SPRING
PRESSURE
MOTOR
SPINDLE

Adjustable Clutch



Pre-set Torque Level

When the tools' pre-set torque level is reached, the clutch cams over the driver cam lobes. This causes the clutch to "slip", signaling the operator to release the trigger.

Torque can be adjusted by changing the amount of spring load on the clutch cams. This is accomplished by turning the tools adjusting nut, accessible through an opening in the clutch housing.

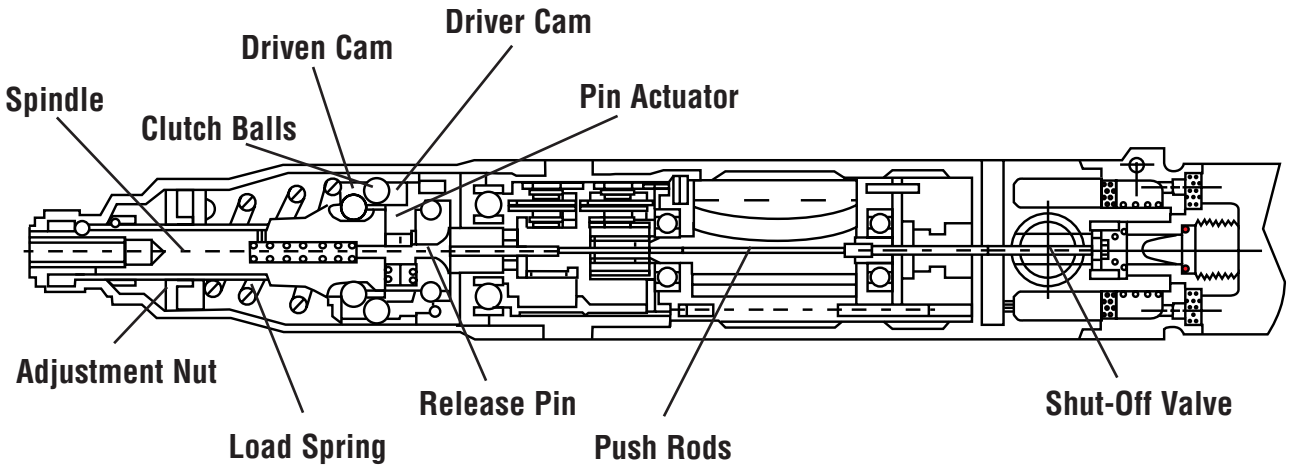
Major Characteristics

Tool ratchets on fastener, causing additional torque build-up.
Dependable general purpose clutch.

Where Used

On all types of screws and applications where torque accuracy is not critical.

Torque Control



Pre-set Torque Level

The two cams and the spindle in the torque controlled tool rotate together during rundown. When pre-set torque is reached, the driven cam and the spindle come to a stop. The driver cam then rotates around the stationary spindle, depressing the pin actuator. This frees the release pin which moves forward along with the push rods and shut-off valve, stopping the air supply to the motor. The mechanism resets itself when the tool is removed from the workpiece.

Torque level can be adjusted by increasing or decreasing the amount of spring load on the clutch cams, which determine when the driven cam will stop during rundown. Adjustment is made by turning a nut, accessible through an opening in the clutch housing.

Major Characteristics

High torque accuracy.
Conserves air due to automatic shut-off.
Quick fastener run-down.

Where Used

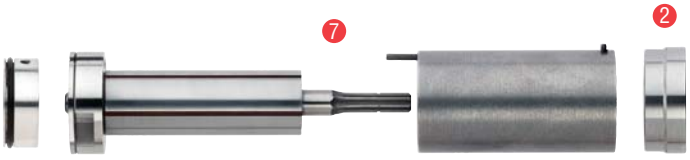
High volume assemblies where precise torque accuracy is critical.

Screwdriver Maintenance

Adjustable Clutch Screwdrivers

Positive Clutch Screwdrivers

Stall Drive Screwdrivers



1. Tipper valve and valve seat is easily accessible for service
2. Slip fit of front end plate bearing allows easy service of the air motor without disturbing the rotor spacing
3. Rotor pinion is case hardened to resist wear
4. Grease zerk makes it easy to grease the gears without disassembly
5. Ring gear is machined into the motor retainer for ease of assembly and disassembly
6. Planet gear pins are slip fit for ease of assembly and disassembly
7. Interchangeable rotor, cylinder, bearings and endplates. This reduces the number of spare parts tool cribs need to stock

Markets and Applications

Aircraft
Appliance
Motor vehicle
Electronics
Metal Furniture
Heating
Air-conditioning
Wood Furniture
Motors
Pumps
Toys
Recreational vehicles
Manufactured Homes

Section 5

Torque

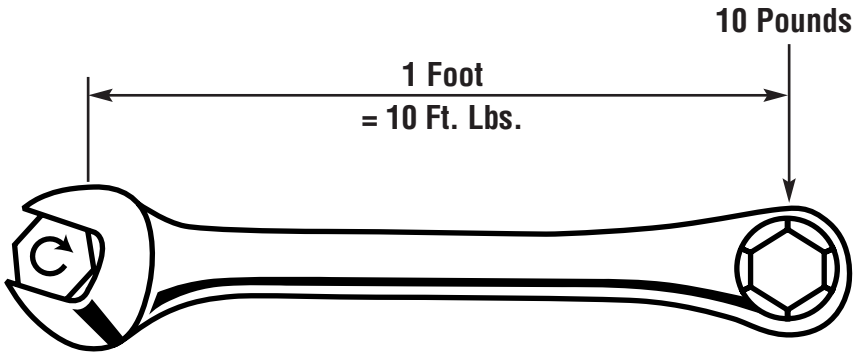
Sioux Tool Industrial Training Manual

Section 5.1

Torque Theory

Sioux Tool Industrial Training Manual

Torque Theory



What is Torque?

The word torque comes from the Latin word torquere, which means "to twist." It's a good choice of words, because it's the twisting or turning force applied to the nut or bolt that we call torque.

Torque is defined as the force you apply times the distance between the point of application and the axis around which you turning Torque = force x distance.

Torque is commonly measured in foot pounds or inch pounds. In the metric system it's measured in Newton meters, the Newton being the standard force in the metric system.

It's useful to distinguish between two types of torque: Dynamic Torque, which is the torque being exerted by a tool, moment by moment, as it tightens a fastener; and Static Torque, which is the torque required to restart a previously tightened fastener.

Measuring Torque

The device most commonly used to measure torque is the torque wrench. It's calibrated to translate the force at a fixed distance (the center of the hand hold) into the equivalent torque. The memory type can hold the maximum reading. That way the greatest torque you apply can be inspected after removing the torque wrench from the bolt.

What you apply and what torque gets to the fastener

As we seen, the whole point in tightening a threaded fastener is to bring the tension in the fastener to a specific value, assuring the proper clamping force. This force is called the CLAMP LOAD on the parts being joined. It's critical for this force to be carefully controlled. If the joint is too loose, the assembly will fall apart. If it's too tight, the mating parts may be damaged or the fastener can fail.

Now the difficulty is that this tension is seldom measured directly – it's just hard to do. Usually what we measure is the torque required to tighten the fastener. That may be convenient, but it is limited, because torque is only indirectly related to the tension in the fastener. Most of the applied force goes into overcoming friction under the bolt head and along the fastener threads. Typically as little as 10% goes into creating that clamping tension in the bolt

Fastening isn't simple. Lubrication, thread size, and condition, grade of fastener, and the mating and/or compression of parts all have an effect on the torque required to produce a quality assembly.

A Primer on setting Threaded Fasteners

Torque is turning force. Torque is expressed in inch pounds, foot pounds, or Newton-meters. A wrench one foot long pulled with a force of 20 pounds will put 20 foot pounds of torque on a threaded fastener. Equally, a wrench one meter long pulled with a force of 27 Newtons will put 27 Newton-meters of torque on a threaded fastener. When torque is applied to a fastener in an assembly, it squeezes components together, or compresses them. This compression is the CLAMP LOAD.

Clamp Load

This is expressed in pound or Newtons. A screw is a force multiplier. A few foot pounds of torque creates many pounds of clamping force. Not all torque is converted to clamp load. Some portion is used to overcome friction.

Friction

Friction exists between the fastener threads on a nut and bolt, and between the surfaces of the bolt head or nut and the pieces being clamped together. Friction is necessary to keep the assembly from unscrewing. If an assembly is subjected to high shock loads or to vibration, clamp load may be relieved momentarily, relieving friction also, and allowing the fastener to unscrew. To prevent this, nuts and bolts are sometimes locked together with wires or pins after they are set. Another way to preserve friction is to design interference into mating threaded parts, by making nut or bolt threads out of round, or displaced in pitch, or by adding soft frictional material, such as nylon or anaerobic compounds, to bear between threaded surfaces. All of these add torque during rundown and final tightening (except for anaerobics, which are liquid at first and then harden in the absence of air in their assembled position.) This added torque during rundown and in the final torque is called PREVAILING TORQUE.

Prevailing Torque

Self-tapping and thread-forming fasteners require extra torque during rundown, but don't maintain friction after the threads are cut or formed.

If friction varies from job to job, we can't tell how much clamp load we have for a given amount of torque. To control clamp load, we must control torque and friction. When pieces are clamped together by a threaded fastener, the pieces are in compression and the fastener is in TENSION.

Tension

Tension is also measured in pounds or Newtons, and in a given assembly is equal to the clamp load. When we talk of torque-tension relationships, we are talking about the relation of turning force to clamp force. A given size fastener has a given cross-sectional area, expressed in square inches or square meters. When the fastener is in tension, it is stressed to a given number of pounds per square inch (PSI), or Newtons per square meter (N/M2). When a fastener is put in tension, it stretches. When released from tension, it springs back to its original length. In an assembly, the stretch of a fastener is called its PRELOAD.

Preload

When an assembly is subjected to high shock loads or to vibration, a pre loaded (stretched) fastener can follow the momentary change in dimension of the clamped pieces, and maintain frictional forces on faces and threads, preventing the fastener from unscrewing. Preload may not be effective on very short fasteners, since short fasteners cannot stretch as much as longer ones. When a fastener is stretched past its elastic limit, it is in YIELD.

Yield

When a fastener is stretched into yield and then released from tension, it is longer than its original length. If a fastener is stretched into yield, and then stretched some more, it will break in two. Each type of material, steel, hardened steel, brass, etc., has its elastic limit, expressed in PSI or N/m2. A fastener breaks at its tensile strength, also expressed in PSI or N/m2.

Dynamic Torque

DYNAMIC TORQUE Is the torque measured while the fastener is turning. Applied torque is another term for this. While torque is applied to a rotating fastener, the fastener tension increases, the clamp load increases, threads slide against threads, and the fastener face under the head of the bolt or nut slides against the work. The maximum dynamic or applied torque on a fastener is its PEAK DYNAMIC TORQUE OR APPLIED TORQUE.

Static Torque

Is the torque necessary to restart a set fastener in a tightening direction. To do this, static friction between threads and faces must be overcome, and since static friction is greater than sliding friction, static torque measurements are greater than peak dynamic torque measurements. Moreover, research has shown that torque-tension relationships are far more reliable using dynamic torque measurements than in using static torque measurements; sliding friction is more uniform job-to-job than static friction.

Torque Rate

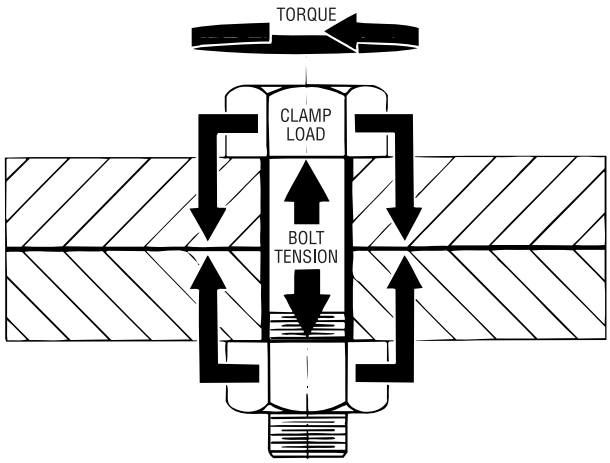
Is the number of foot pounds (or Newton-meters) that torque increases per revolution. A free running bolt has no torque rate. When the head of the bolt meets the work, torque may increase 30 foot pounds, for example, in 90° of turn, or in 1/4 of a revolution. The torque rate of the job would then be 120 foot pounds per revolution.

Joint Compression

In Order to assemble two or more components, the first thing you need is turning torque. It's measured in inch pounds, foot pounds, and Newton meters. When turning torque is applied, it squeezes the components together, which is clamp load. While you are applying turning torque you are causing friction. Friction is what holds all moving pieces together. Friction can be broken by constant shock, which in turn, will loosen the fastener. Ways to prevent the fastener from loosening are: anaerobic compounds, damaging the threads, etc. As you apply more turning torque you will put tension on the fastener which is the point when the fastener starts to stretch. Too much turning torque at this point will put the fastener into yield, which will eventually break the fastener. This is why we must get as much information from the end-user in order to get the right tool for the application.

There are two types of torque, dynamic and static torque. Dynamic torque is measured while the fastener is turning. While turning torque is applied to the fastener the tension increases, clamp load increases, threads slide against thread and the fastener faces slide against the work piece. This is when the fastener reaches its peak dynamic torque. Static torque is the turning torque necessary to restart a set fastener. To do this friction must be broken between the threads and faces. Since static friction is greater than sliding friction, torque measurements are higher. This is why dynamic torque measurements are more reliable.

Torque rate is the measure of torque that increases per revolution. A free running fastener has no torque rate. Hard jobs are when you reach dynamic torque in 1/16 of a revolution or less. Soft jobs are when dynamic torque is reached in one or more revolutions.



Look at the diagram above. It shows a bolt and nut that have been used to fasten two steel plates together. The head of the bolt and the nut act as a clamp to hold the two plates firmly in contact.

Two simple ideas are basic to understanding how fasteners work: (1) A tightened bolt exerts a clamping force, called "clamp load," on the pieces it joins and , (2) those clamped pieces push back on the bolt, creating tension within the bolt. It's just an example of actions equals reaction – something Isaac Newton discovered more than three centuries ago.

Now, what's the force on the bolt? As you can see, its two ends are being pulled away from each other; this pull on the bolts puts it in tension. At first, tightening the nut has the effect of drawing the pieces together in full contact. Then as you tighten further, the threads of the nut and bolt pull on the bolt, increasing the tension.

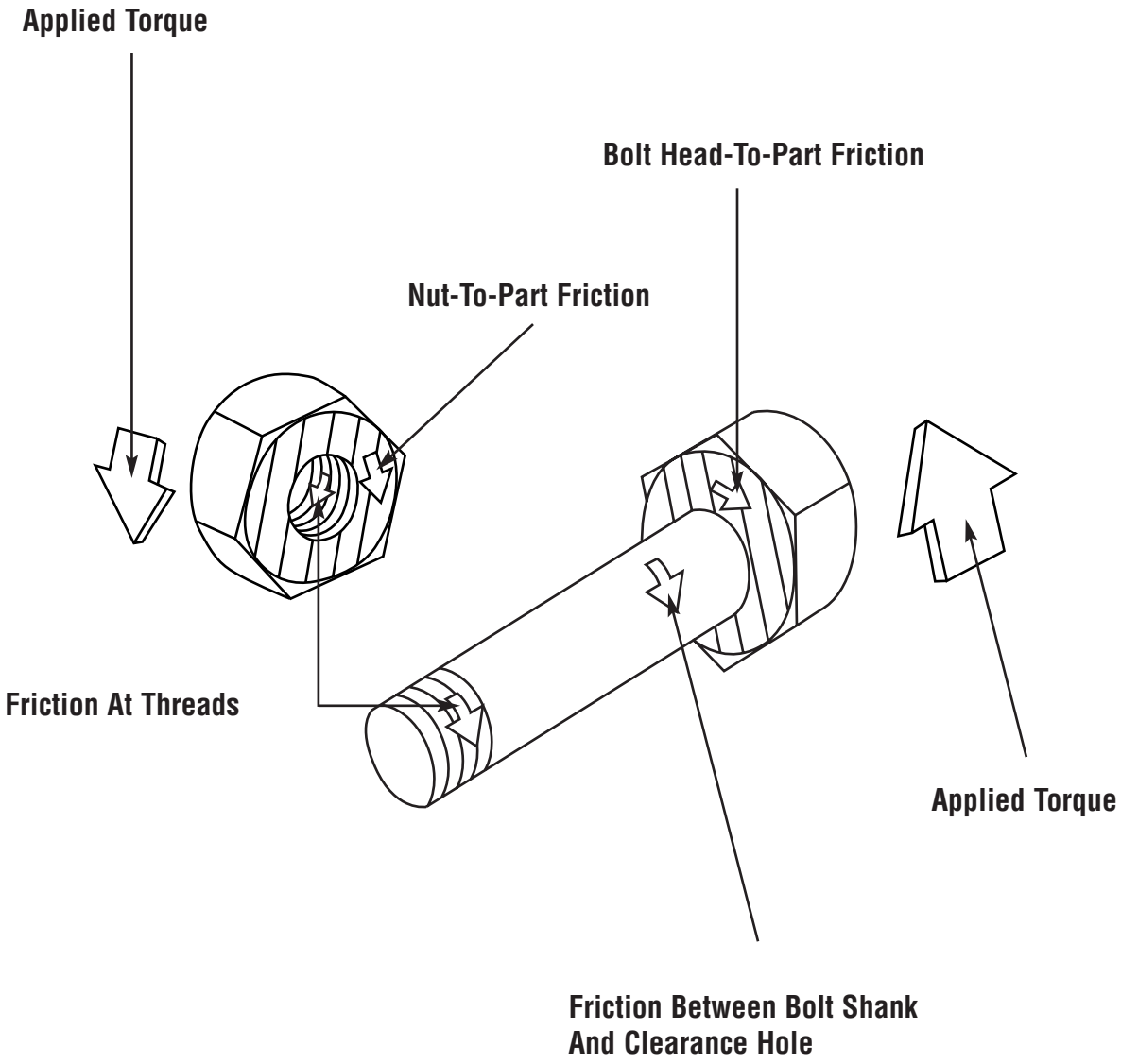
For every fastening job there's a correct tension that needs to be achieved in the fastener. Getting the tension right ensures:

1. The proper clamp load on the pieces being held together.

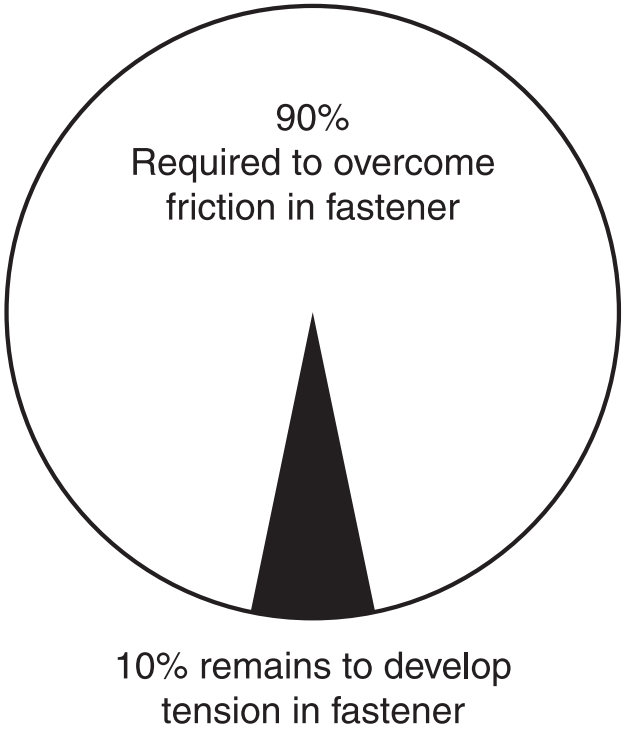
2. That excessive distortion of the mating parts is prevented.

3. The bolt thread has not been damaged or stripped weakening the assembly.

Variables that affect Joint Conditions



Total Torque Applied To Fastener

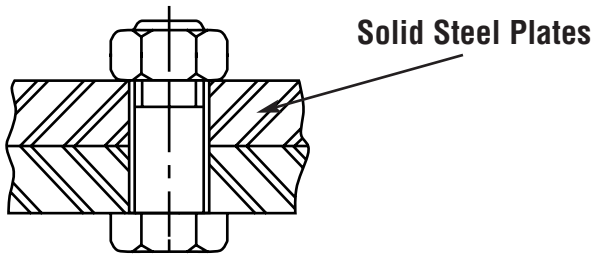


Assume 100 inch-pounds torque applied
90 inch-pounds to overcome friction
10 inch-pounds to develop friction

Note: A slight variation in friction will cause a great variation in fastener tension.

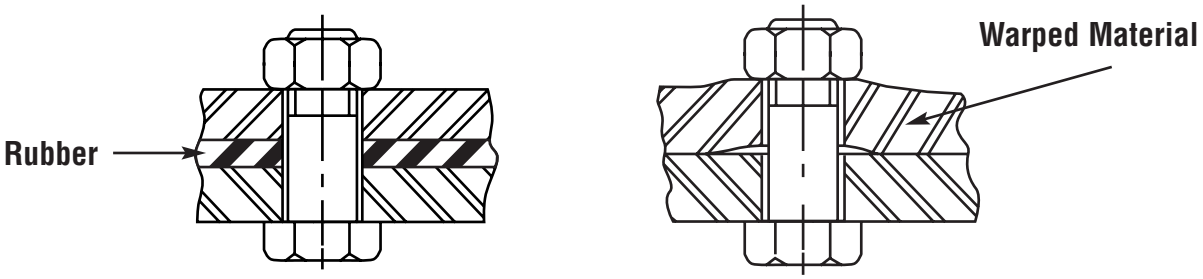
Types Of Pull-Up

Hard Pull-Up



The fastener reaches its final torque approximately 1/4 turn after initial joint resistance is met.

Soft Pull-Up



The fastener reaches its final torque approximately 2 turns or more after initial joint resistance is met.

Pull-up conditions are also affected by tight threads, dirt, rust, oil, lack of oil, and damaged threads.

Definitions:

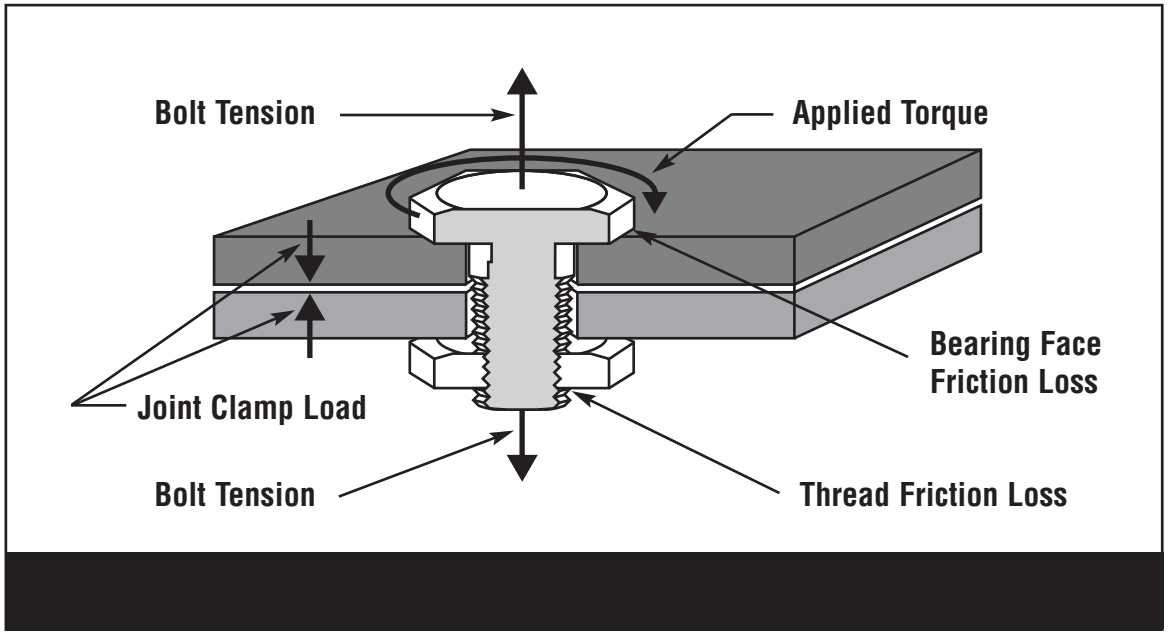
Torque Turning force expressed in inch - pounds, foot - pounds, newton – meters.

Clamp load The force compressing a fastened joint, expressed in pounds, or newtons.

Friction Friction exists between fastener threads on the nut and bolt, between the head of the bolt and nut, and the parts being clamped together.

Prevailing Torque A high initial torque, or resistance prior to setting the fastener. This initial torque or resistance is influenced by characteristics of the fastener, or joint. Fasteners with prevailing torque include self-tapping screws, fasteners with nylon locking slugs or anti-vibration material applied. *For example, sheet metal screws will have prevailing torque until the screw has expanded the pilot hole. Self-tapping screws will also have prevailing torque until the fastener has tapped the pilot hole.*

Tension Expressed and measured in pounds or newtons. In a given assembly, tension is equal to the clamp load. When a fastener is in tension it is stressed to a value expressed in pounds per square inch (psi), or newtons per square meter, (N/m2).



Preload The stretch of a fastener is called preload. Preloading a fastener allows an assembly to stay intact when subjected to shock loads and/or vibration. The preloaded fastener can follow the momentary changes in the assembly, preventing the fastener from loosening or unthreading. Preloading is more effective on long fasteners, since short fasteners cannot stretch as much as longer ones.

Yield When a fastener is stretched past its elastic limit, it is said to be in yield. When a fastener is stretched into yield and the tension is released, the fastener is longer than its original length. Additional stretching of a fastener already in yield will eventually lead to failure. A fastener will break at its tensile strength, which is expressed, in psi, or N/m2.

Dynamic Torque Torque measured while the fastener is turning. Often referred to as applied torque.

Static Torque The torque necessary to restart a fastener turning in the tightening direction. Static torque measurements will read higher than the peak dynamic torque, or maximum applied torque.

Torque Rate The increase in the number of foot-pounds, or newton meters of torque per additional revolution of the fastener.

Hard Joint An assembly that goes from loose to tight in 60˚ or less after contact of initial joint resistance.

Soft joint An assembly that goes from loose to tight in one revolution (360˚x) or more after contact of initial joint resistance.

Torque Transducer A device used to measure torque. The most common torque transducer utilizes a strain gage device.

Rotary Torque Transducer This device has strain gages bonded to a rotating shaft with slip rings and brushes to transmit signals to a display.

Reaction Torque Transducer This device has a strain gage bonded to a stationary housing which carries a reaction torque proportional to the torque on the rotating shaft, which is applying the torque to the fastener.

Angle encoder A device used to measure the angle of turn while a fastener is being set.

Scatter In a fairly uniform job scatter may be as little as 10% of the average or mean torque of the tool. *For example, if the mean torque were 50 ft-lbs, or 67.8 Nm, a scatter of 10% would be represented by torque values ranging between 47.5 ft-lbs and 52.5 ft- lbs., or 64.41 Nm, and 71.19 Nm.*

Mean Torque Average torque. Scatter follows the normal distribution around the mean torque

Six Sigma Scatter This is a mathematically derived prediction of a tolerance within which 99.74% of all further torque measurements should fall.

Mean Shift Measurements of torque with the same tool on hard and soft joints will typically show a mean torque that is higher on the hard joint than the soft joint. This difference in mean torque from hard joint to soft joint is called the mean shift. *For example, if the mean torque for a given screwdriver is 50 in-lbs on a hard joint, and 38 in-lbs., on a soft joint the mean shift is equal to 12 in-lbs.*

Tightening Techniques

The objective of a tightening operation is twofold:

1) Develop a minimum clamping force in the fastener.
2) Hold the assembly (joint) together under working loads.

High performance, critical joints typically have high clamp load requirements.
Typically joints are tightened to a specified torque range. Generally this torque range generates an average of 70% of the bolt's proof strength.

The highest clamp load is achieved by tightening to the fastener's torque tension yield point. This strategy is implemented by measuring the torque and rotation of the fastener with transducers, and electronically detecting the yield point during tightening.

Section 5.2

Pulse Theory

Sioux Tool Industrial Training Manual

Pulse Theory

Today's modern pulse tool resembles an impact tool in outward appearance. They normally come in pistol grip, straight, and right angle configurations. In contrast to an impact tool that uses a "hammer/anvil" method to impart rotational power into a fastener, resulting in torque, the pulse tool uses a hydraulic chamber to create the rotational power - again resulting in torque.

Both tools use rotary blade-type air motors - with the latest pulse tools employing the low weight-high power 9-blade, non-lubricated, dual chamber design. At this point, the tools differ in design:

Impact Tools

Utilize a series of hammer blows on an anvil, which turns the fastener and creates clamp load or torque. Pluses are: fast, usually light weight, and capable of achieving high final torque. Minuses are: noisy - metal hammer hitting a metal anvil, vibration feedback to the operator, impossible to control final torque - totally dependant on when the operator "lets go" of the throttle.

Pulse Tool

Transfers the air motor rotational power through a hydraulic cylinder into the drive spindle creating clamp load or torque. The air motor drives the cylinder case which, through the hydraulic fluid, turns the spindle/blades and rotates the fastener. As the torque builds in the fastener, power required to turn the spindle/blades increases until eventually, set torque is reached and the internal design allows the oil to by-pass internally. At the point of set torque being reached, the pulse tool can either "shut-off'' or continue to pulse by passing the oil without the fastener turning or becoming "tighter". The two designs are generally referred to as shut-off and non shut-off tools. Both have applications where one design is better than the other. Pluses of pulse tools: Torque control - usually operate within a plus/minus 5% of set torque range. Adjustable torque settings within the range of the tool. Quiet - no metal to metal contact. Low vibration feedback to the operator. Minuses Limited in output - today's designs are available up to about 350 ft/lbs. Usually more costly to purchase and maintain.

Torque

Impact wrenches produce **torque** through mechanical means. In a pneumatic impact wrench, an air motor drives a hammer mechanism against an anvil. The repeated blows of the hammer against the anvil results in a great amount of torque produced from a relatively compact package. However, the torque output of an impact wrench is quite difficult to control. Their high-speed air motors coupled with the impact mechanism often develop maximum torque in 5 – 10 seconds. Also, through this "hammering" process much vibration is produced.

Pulse Tool Profile

The **pulse tool** looks a lot like an impact tool. Instead of producing torque through a mechanical mechanism, a pulse tool incorporates a **hydraulic pulse unit** to develop the torque output. The air motor of the pulse tool rotates the hydraulic chamber, or pulse unit. The pulse unit rotates through a series of impulsing and non-impulsing cycles. In 360º of rotation torque is produced in the last 270˚ – 360˚ of the pulse cycle. The hydraulic fluid in the chamber "pulses" against the **pulse unit blades** transmitting torque to the output spindle/fastener. In a pulse tool, **torque can be controlled** by adjustment of a bypass valve. (Typical of the Sioux SPW-series and Fuji FPW-series) The bypass valve is adjusted to vary the pressure being applied against the blades of the pulse unit. Hydraulic fluid pressure is relieved through the bypass valve. The high-pressure hydraulic fluid is routed past the blades and torque output is minimized, and controlled.

The Sioux SPT-series and Fuji FPT-series pulse tools incorporates an air motor shut-off mechanism to increase torque accuracy and repeatability. An adjustable bypass valve is linked to a push rod, running through the center of the air motor rotor. Movement of the push rod causes an air pressure inbalance in the shut-off valve, causing it to close. This results in the tool stopping, or shutting off the air supply to the tool.

Dual Chamber Air Motor

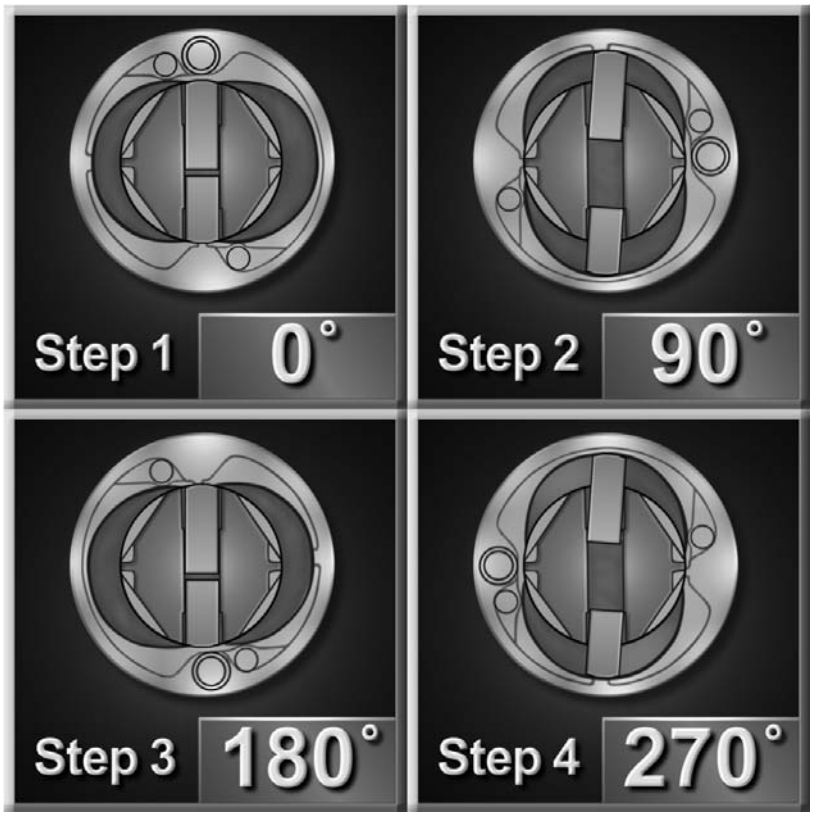
A state of the art dual chamber air motor powers the hydraulic pulse unit in a Sioux Pulse tool. (Air motors are discussed in section 1 of this manual.) The use of a dual chamber motor provides for a higher RPM through the working torque of the pulse tool. The dual chamber motor also uses less volume of air then a conventional air motor. A dual chamber motor will have a lower free speed than a conventional air motor, but higher torque. Sioux dual chamber pulse tool air motors are designed to operate without the use of air motor oil. This provides for an environmentally friendly power tool.

The following diagram shows the different stages of the pulse unit cycle.
This diagram is typical for the SPW, SPT, and SET series pulse tools.

The Pulse Advantage

The advantages of a pulse tool over an impact wrench are:

- Greater torque control and repeatability.
- Improved ergonomics
- Low Vibration
- Lower sound levels
- Oil-free air motor



The Pulse Theory

Section 5.3

TM Series Torque Multipliers

Sioux Tool Industrial Training Manual

Torque Multipliers

Features:

- Lightweight Titanium Gear Case - Offers 30% weight savings than standard steel gear casing
- Two Speed Gear Shift - More versitility and higher torque range
- High Quality Gears - For longer operating life expectancy between repairs
- Ergo Over Molded Grip - more comfort on the hand
- Integrated swivel joint between drive and gear case - Insures reaction-free operation over the entire bolting cycle
- Fine Pressure Control for torque pre-selection - Ultimate control
- No lateral or impact forces transmitted from tool to user - No sparks from the bolts and less vibration on the user than impact wrenches

TN50AP-4515K

Torque Mulitpliers

Model Number	Drive Size		Torque				Speed		Weight		Noise Level
			Gear 1		Gear 2		Gear 1	Gear 2			
	in.	mm	ft lb	Nm	ft lb	Nm	rpm	rpm	lb	kg	dB(A)
TM50AP-0775	3/4	19	45-188	61-255	125-580	169-786	69	12	10.7	4.9	84
TM50AP-0775K[1]	3/4	19	45-188	61-255	125-580	169-786	69	12	10.7	4.9	84
TM50AP-1075	1	25	59-295	80-400	220-900	298-1220	30	8	13	5.9	84
TM50AP-1075K[1]	1	25	59-295	80-400	220-900	298-1220	30	8	13	5.9	84
TM50AP-15100	1	25	40-370	54-502	150-1300	203-1763	25	7	15.6	7.1	84
TM50AP-1510K[1]	1	25	40-370	54-502	150-1300	203-1763	25	7	15.6	7.1	84
TM50AP-25100	1	25	110-600	149-813	340-2100	461-2847	9.4	2.6	22.4	10.1	84
TM50AP-2510K[1]	1	25	110-600	149-813	340-2100	461-2847	9.4	2.6	22.4	10.1	84
TM50AP-45150	1-1/2	38	160-1100	217-1491	500-3500	678-4745	6	1.7	23.1	10.5	84
TM50AP-4515K[1]	1-1/2	38	160-1100	217-1491	500-3500	678-4745	6	1.7	23.1	10.5	84
TM50AP-60150	1-1/2	38	220-1600	298-2169	650-5000	881-6779	5.3	1.5	36.3	16.5	84
TM50AP-6015K[1]	1-1/2	38	220-1600	298-2169	650-5000	881-6779	5.3	1.5	36.3	16.5	84

General:
Air Inlet Size: 1/4" NPT (Please use high flow fittings only)
Recommended Hose Size: 3/8" (10 mm)
Performance rated @ various air pressures as specified in operations manual
Standard Equipment:
Parts list, Safety and Instruction manual
Reaction arm
Metal carrying case

[1] Includes FRL Kit. If you do not own a filter regulator lubricator to operate your TM Series tools, we highly recommend that you purchase your tool with the FRL Kit included.

Torque Multipliers

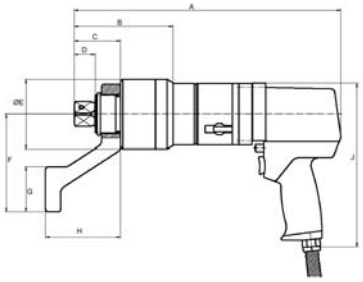
Right Angle Tools

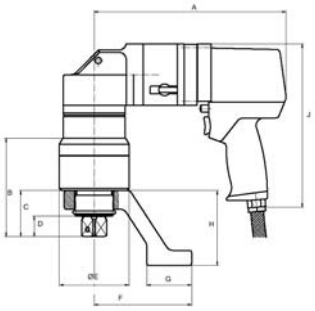
Model Number	Drive Size		Torque				Speed		Weight		Noise Level
			Gear 1		Gear 2		Gear 1	Gear 2			
	in.	mm	ft lb	Nm	ft lb	Nm	rpm	rpm	lb	kg	dB(A)
RATM50-07	3/4	19	45-220	61-298	150-590	203-800	46	15	72.2	7.8	84
RATM50-07K[1]	3/4	19	45-220	61-298	150-590	203-800	46	15	72.2	7.8	84
RATM50-10	1	25	60-295	81-400	220-900	298-1220	24	6.4	17.4	7.9	84
RATM50-10K[1]	1	25	60-295	81-400	220-900	298-1220	24	6.4	17.4	7.9	84
RATM50-15	1	25	80-370	108-502	220-1300	298-1763	20	5.6	20	9	84
RATM50-15K[1]	1	25	80-370	108-502	220-1300	298-1763	20	5.6	20	9	84
RATM50-25	1	25	110-600	149-813	340-2100	461-2847	7.5	2.1	26.8	12	84
RATM50-25K[1]	1	25	110-600	149-813	340-2100	461-2847	7.5	2.1	26.8	12	84
RATM50-45	1-1/2	38	160-1110	217-1491	500-3500	678-4745	4.8	1.4	27.5	12.5	84
RATM50-45K[1]	1-1/2	38	160-1110	217-1491	500-3500	678-4745	4.8	1.4	27.5	12.5	84
RATM50-60	1-1/2	38	220-1600	298-2169	650-5000	881-6779	4.2	1.2	40.7	18.5	84
RATM50-60K[1]	1-1/2	38	220-1600	298-2169	650-5000	881-6779	4.2	1.2	40.7	18.5	84

General:
Air Inlet Size: 1/4" NPT (Please use high flow fittings only)
Recommended Hose Size: 3/8" (10 mm)
Performance rated @ various air pressures as specified in operations manual
Standard Equipment:
Parts list, Safety and Instruction manual
Reaction arm
Metal carrying case

[1] Includes FRL Kit. If you do not own a filter regulator lubricator to operate your TM Series tools, we highly recommend that you purchase your tool with the FRL Kit included.

Measurements





Measurements

Model Number	A		B		C		D		E		F		G		H		J	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
TM50AP-0775	13.46	341	4.98	126	2.26	57	0.87	22	3.23	82	4.33	110	1.97	50	3.15	80	8.66	220
TM50AP-1075	13.5	342	5.12	130	2.44	62	1.06	105	3.23	82	5.12	130	2.36	60	3.94	100	8.66	220
TM50AP-15100	13.98	355	5.18	132	2.42	61	1.06	105	3.66	93	5.12	130	2.36	60	3.94	100	8.66	220
TM50AP-25100	15.55	395	5.91	150	2.87	73	1.06	105	3.86	98	6.69	170	2.36	60	3.94	100	8.66	220
TM50AP-45150	16.54	420	7.4	188	6.38	162	1.57	40	3.90	99	6.69	170	2.36	60	5.24	133	8.66	220
TM50AP-60150	17.9	455	10.37	263	3.86	98	1.57	40	4.72	120	7.48	190	3.15	80	5.91	150	8.66	220
RATM50-07	10.05	255	4.98	126	2.26	57	0.87	22	3.23	82	4.33	110	1.97	50	3.15	80	8.66	220
RATM50-10	10.05	255	5.12	130	2.44	62	1.06	105	3.23	82	5.12	130	2.36	60	3.94	100	8.66	220
RATM50-15	10.05	255	5.18	132	2.42	61	1.06	105	3.66	93	5.12	130	2.36	60	3.94	100	8.66	220
RATM50-25	10.05	255	5.91	150	2.87	73	1.06	105	3.86	98	6.69	170	2.36	60	3.94	100	8.66	220
RATM50-45	10.05	255	6.38	162	6.38	162	1.57	40	3.90	99	6.69	170	2.36	60	5.24	133	8.66	220
RATM50-60	10.05	255	10.38	264	3.86	98	1.57	40	4.72	120	7.48	190	3.15	80	5.91	150	8.66	220

Applications

Petroleum Processing
- Heat Exchanger
- Expander
- Preventer
- Converter

Blast Furnace Plants, Steel Works, Hot Rolling
- Pipe Construction, Flanges
- Pipe Welding Machine
- Blast Furnace Tongues

Non-Ferrous Metal Works
- Pipe Construction, Flanges
- Feed Pumps

Steeldrawing Plants and Cold Rolling Mills
- Rolling Mills
- Pipe Welding Tracks

Steel and Lightweight Metal Construction
- Bridge Construction
- Hall Construction
- Steel Girders
- Temporary Bridges
- Tower Crane
- Ship Deck Crane

Steelwork, Rolling Mill Equipment, Mining and Large Equipment
- Coking Plant
- Shovel Dozer
- Heading and Cutting Machine for Tunnels
- Crawler Mounted Excavator
- Hydraulic Excavator
- Crawler Type Undercarriages
- Crawler Mounted Crane
- Conveyor Systems
- Drawn up Cranes
- Crushers

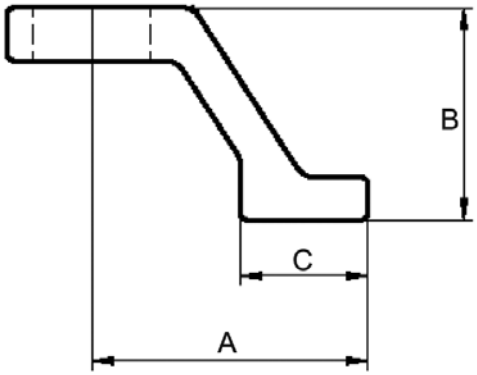
TM Series Torque Multiplier Accessories

Reaction Arms:

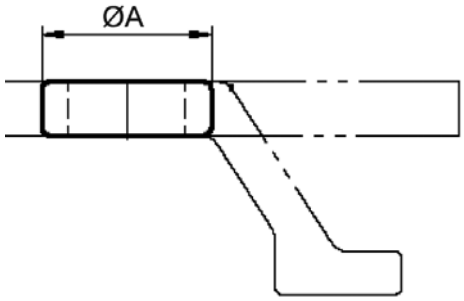
Standard reaction arms are included with each tool.
Long or deep reaction arms are used when standard arms fall short in length. Welding rings are used to make custom reaction arms by welding the extensions to the spline ring.

STANDARD REACTION ARM

WELDING RING



REACTION ARM



WELDING RING

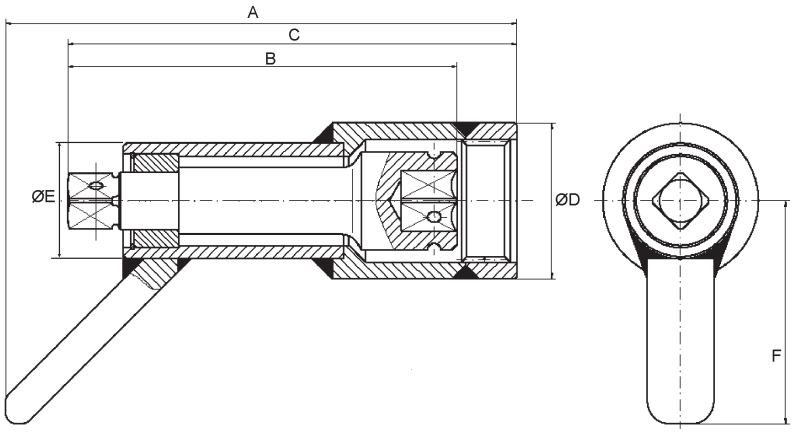
Standard Reaction Arms

Model Number	Tools Used On	A		B		C	
		in.	mm	in.	mm	in.	mm
RARM-1	TM50AP-0775, RATM50-07	4.33	110	3.15	80	1.97	50
RARM-2	TM50AP-1075, RATM50-10, TM50AP-15100, RATM50-15	5.12	130	3.94	100	2.36	60
RARM-3	TM50AP-25100, RATM50-25	6.69	170	5.11	129	2.36	60
RARM-4	TM50AP-45150, RATM50-45	6.69	170	5.24	150	2.36	60
RARM-5	TM50AP-60150, RATM50-60	7.48	190	5.91	150	3.15	80
Welding Rings							
WRARM-1	TM50AP-0775, RATM50-07, TM50AP-1075, RATM50-10, TM50AP-15100, RATM50-15	3.07	78	0.98	25	-	-
WRARM-2	TM50AP-25100, RATM50-25	3.86	98	1.3	33	-	-
WRARM-3	TM50AP-45150, RATM50-45 TM50AP-60150, RATM50-60	4.33	110	1.97	50	-	-
Long or Deep Reaction Arms							
LRARM-1	TM50AP-0775, RATM50-07	4.33	110	4.72	120	1.97	50
LRARM-2	TM50AP-1075, RATM50-10, TM50AP-15100, RATM50-15	5.12	130	5.52	140	2.36	60
LRARM-3	TM50AP-25100, RATM50-25	6.69	170	5.91	150	2.36	60
LRARM-4	TM50AP-45150, RATM50-45	6.69	170	7.1	180	2.36	60
LRARM-5	TM50AP-60150, RATM50-60	7.48	190	7.88	200	3.15	80

TM Series Wheel Extensions

Wheel Extensions

Model Number	Drive Size		A		B		C		D		E		F	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
TMEXT-07	3/4	19	9.38	238	6.89	175	8.27	210	2.76	70	1.89	48	3.94	100
TMEXT-07-8	3/4	19	10.36	263	7.87	200	9.26	235	2.76	70	1.89	48	3.94	100
TMEXT-07-10	3/4	19	12.33	313	9.84	250	11.23	285	2.76	70	1.89	48	3.94	100
TMEXT-07-13	3/4	19	15.48	393	13	330	14.83	365	2.76	70	1.89	48	3.94	100
TMEXT-10	1	25	9.5	241	6.89	175	8.35	212	3.07	78	2.05	52	4.33	110
TMEXT-10-8	1	25	10.48	266	7.87	200	13.28	237	3.07	78	2.05	52	4.33	110
TMEXT-10-10	1	25	12.45	316	9.84	250	11.31	87	3.07	78	2.05	52	4.33	110
TMEXT-10-13	1	25	15.6	396	13	330	14.46	367	3.07	78	2.05	52	4.33	110
TMEXT-25	1	25	10.05	255	6.9	175	8.51	216	3.55	90	2.36	60	5.32	135
TMEXT-25-8	1	25	11.03	280	7.88	200	9.5	241	3.55	90	2.36	60	5.32	135
TMEXT-25-10	1	25	13	330	9.85	250	11.47	291	3.55	90	2.36	60	5.32	135
TMEXT-25-13	1	25	16.15	410	13	330	14.62	371	3.55	90	2.36	60	5.32	135



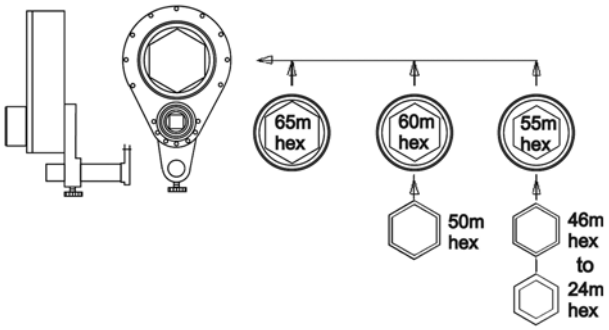
Filter-Regulator-Lubricator Kit

Model: FRLK1660
Weight: 17 lb
Includes 10 ft. 3/8" Hose, Stand, Filter, Regulator, Lubricator, Nuts and Bolts for mounting, and Pressure Gauge.

The FRLK1660 is used to regulte the air pressure and properly lubricate the air motor for ultimate life between service. The chart is an example of what's included in each tool's operation's manual. Air pressure regulates and controls torque output. All TM Series tools must be used with an FRL and it's strongly advised not to exceed the maximum amount of air pressure.

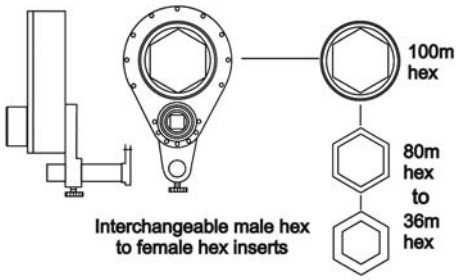
Off-set Gears

STX22-02-TL



Model Number	Description
Off-set Gear	**Hex Size**
STX22-02-TL	65
STX22-02-60	60
STX22-02-55	55
Inserts	**Hex Size**
STX22-H55M	55
STX22-H60M	60
STX22-H65M	65
Standard Inserts	**Inserts / Standard Inserts**
STX22-H55-24	55 / 24
STX22-H55-30	55 / 30
STX22-H55-32	55 / 32
STX22-H55-36	55 / 36
STX22-H55-41	55 / 41
STX22-H55-46	55 / 46
STX22-H60-50	60 / 50

STX36-02-TL



Model Number	Description
Off-set Gear	**Hex Size**
STX36-02-TL	100
Inserts	**Hex Size**
STX36-H100M	100
Standard Inserts	**Inserts / Standard Inserts**
STX36-100-80	100 / 80
STX36-100-75	100 / 75
STX36-100-70	100 / 70
STX36-100-65	100 / 65
STX36-100-60	100 / 60
STX36-100-55	100 / 55
STX36-100-50	100 / 50
STX36-100-46	100 / 46
STX36-100-36	100 / 36

Off-set Gears

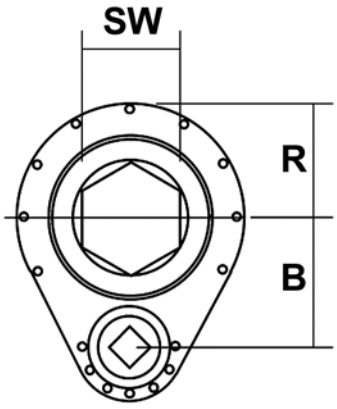
OFF-SET GEARS

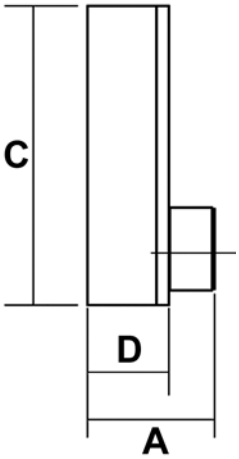
Off-Set Gear Measurements

Model Number	Max Torque		SW		A		B		C		D		R	
	ft lb	Nm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
STX22-02-TL	1623	2200	2.56	65	4.1	104	3.2	81	7.49	190	2.6	66	2.52	64
STX36-02-TL	2655	3600	3.94	100	4.18	106	4.39	112	10.02	255	2.68	67	3.82	97

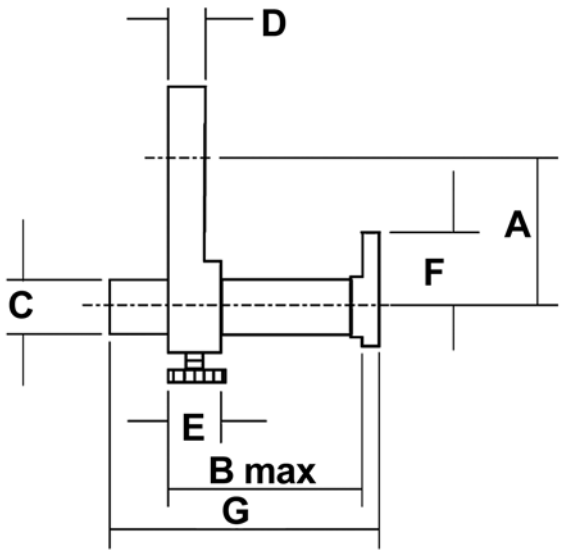
Reaction Member Measurements

Model Number	A		B		C		D		E		F		G		Weight	
	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	in.	mm	lb	kg
STX22-R	3.27	83	5.52	140	0.79	20	0.79	20	1.18	30	1.97	50	5.91	150	2.6	5.7
STX36-R	3.27	83	5.52	140	1.18	30	0.79	20	1.18	30	1.97	50	5.91	150	3.0	6.6





OFF-SET GEAR



REACTION MEMBER

Section 5.4

Pulse Tools Features & Benefits

Sioux Tool Industrial Training Manual

Pulse Tools Features And Benefits

FEATURE:

- TWO MODEL SERIES TO CHOOSE FROM
  - "SPW" Series Standard Pulsing Assembly Tool
  - "SPT" Series Shut-Off Pulse Assembly Tool

BENEFIT:

- Matches the correct Tool to the Application
- Keeps Costs Down on Less Critical Joints

FEATURE:

- DUAL CHAMBER AIR MOTOR
  - Faster Run Down and Tightening Speed
  - Higher Speed Through Rated Torque

BENEFIT:

- Reduce Fastening Cycle, Increases Productivity
- Lower Air Consumption

FEATURE:

- DUAL CHAMBER PULSE UNIT
  - Twin Blade Pulse Unit
  - Twin Chamber Pulse Cylinder

BENEFIT:

- Smoother Operation, Less Vibration
- Provides Higher Torque to Weight Ratio
- Improved Repeatability

FEATURE:

- Ergonomic Grip
- Isolates Hand from Cold
- Dampens Vibration

BENEFIT:

- Increase Worker Productivity
- Allows Longer Usage with Less Fatigue

FEATURE:

- Ergonomic Suspension Bail
- Allows for Suspending Tool with Balancer
- Removable

BENEFIT:

- Reduce Operator Fatigue
- Protects Tool from being Dropped/Damaged

Section 6

Impact Product Literature

Sioux Tool Industrial Training Manual

Section 6.1

Impact Wrenches

Sioux Tool Industrial Training Manual

Broken Sockets, Bits and Adaptors can cause injury.

Proper eye protection must be worn at all times by tool user and bystanders. Use only sockets, bits and adapters made for power tools and that are in good condition. Use only bits and adapters that are in good condition. Keep hands away from sockets, bits and adapters.

Sudden and unexpected tool movement can cause injury.

Be sure your body position allows you to have control of the tool at all times. Make sure your footing is secure. Consult manufacturer for proper reaction bar if movement is excessive.

Tools starting unexpectedly can cause injury.

Always remove the tool from air supply and activate trigger to bleed air line before making any adjustments, changing accessories, or doing any maintenance or service on the tool.

Falling tools can cause injury.

If the tool is used with a balancer or other suspension device, be sure the tool is firmly attached to the device.

Impact Wrench Principles of Operation

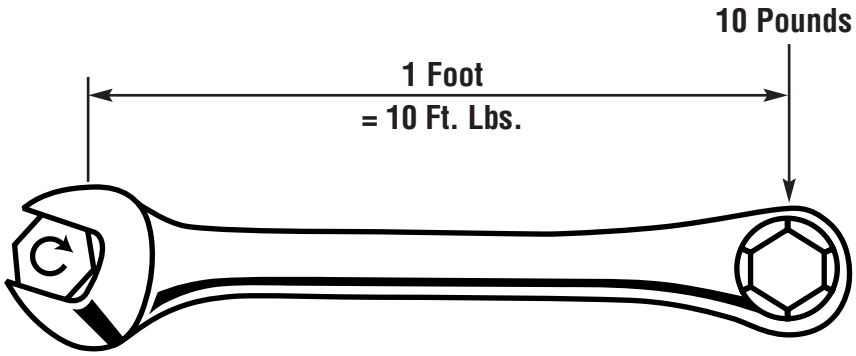
An impact wrench delivers a series of rotary blows to a fastener, producing torque.

The action of the torque creates clamp force in an assembly.

Interaction of the motor, clutch and drive-end determine the type of application an impact wrench can handle.

The advantages of impact wrenches are a high power-to-weight ratio, fast rundown, and no torque reaction to operator.

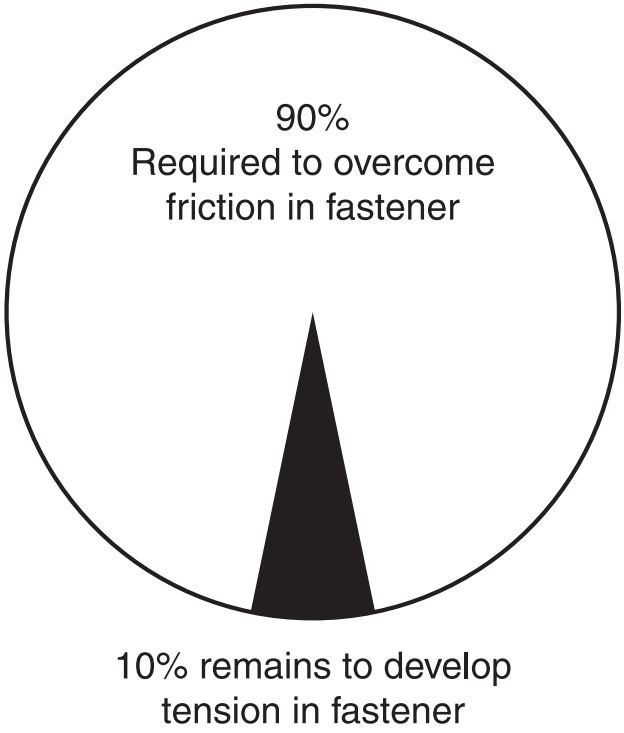
Impact Wrench Torque



Torque – Measured in:

Foot Pounds – Ft. Lbs.
Inch Pounds – In. Lbs.
Newton Meters – NM
Kilogram Meters – Kgm

Total Torque Applied To Fastener

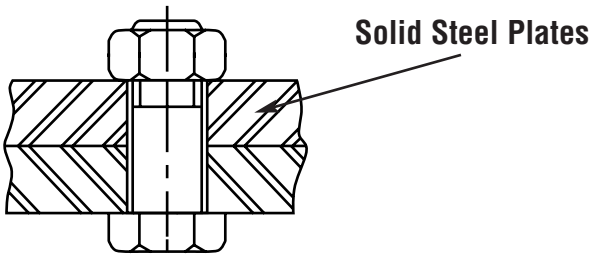


Assume 100 foot-pounds torque applied
90 foot-pounds to overcome friction
10 foot-pounds to develop friction

Note: A slight variation in friction will cause a great variation in fastener tension.

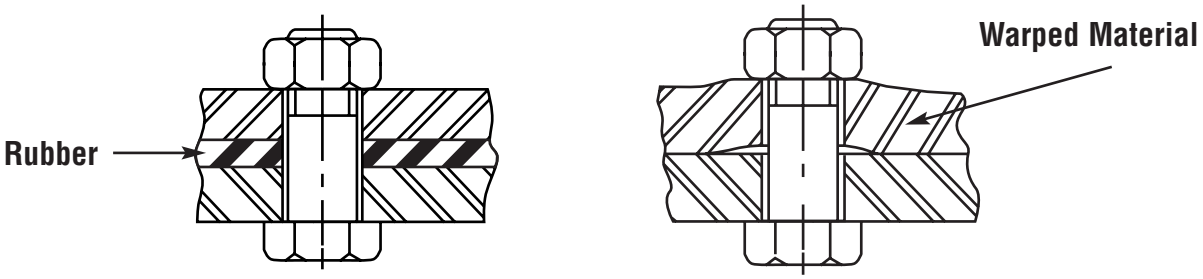
Types Of Pull-Up

Hard Pull-Up



The fastener reaches its final torque approximately 1/4 turn after initial joint resistance is met.

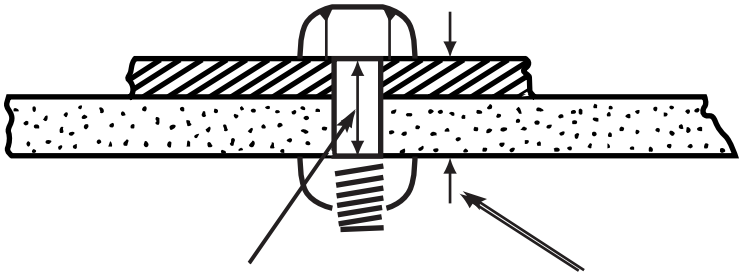
Soft Pull-Up



The fastener reaches its final torque approximately 2 turns or more after initial joint resistance is met.

Pull-up conditions are also affected by tight threads, dirt, rust, oil, lack of oil, and damaged threads.

Impact Wrench Clamp Force



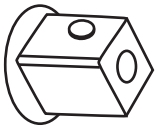
Factors Affecting Reliability

Operator skill
Thread quality and amount of engagement.
Finish of matching parts
Grip length of fastener
Fastener finish - plain or plated
Bolt size and grade
Pull-up conditions (ft. lbs./revolution)
Type of washer used
Condition of accessories used

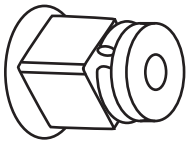
Impact Wrench Tool Nomenclature

Square Drive - 3/8", 1/2", 3/4", 1"

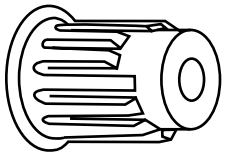
Pin Retainer



Ring Retainer

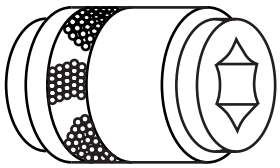


Spline Drive #5

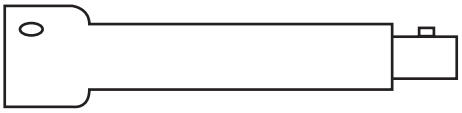


Quick Change Chuck (Slip Chuck)

Hex



Extension Bar (Hex or Square Drive)



How to choose the right Impact Wrench

In order to select the correct tool for an application, it is necessary to know what the job is…
Screw, bolt, or nut size
Grade designation
Torque specifications
Accuracy requirements

Class of Service

High production - automobile assembly plants, farm and construction equipment, etc.
Low production - large machinery assembly
Maintenance or repair work

Job Conditions

Hard pull-up - rigid joint
Soft pull-up - spring joint
Run-down - free running, or prevailing torque (lock nut, self threading screw.)

Material

Metal-to-metal
Metal/gasket
Rubber or plastic

Assembly Method

General tightening – operator judgement
Turn-of-the-nut - permanent assemblies (steel erection and construction equipment)

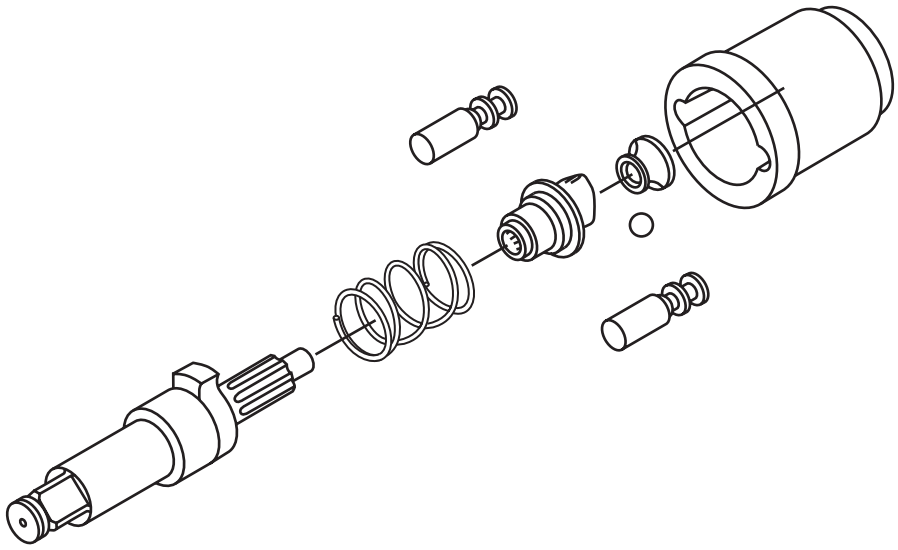
Note: If it takes five seconds or longer to reach final tightness, a larger wrench should be used.

Section 6.2

Impact Wrench Mechanisms

Sioux Tool Industrial Training Manual

Pin Clutch

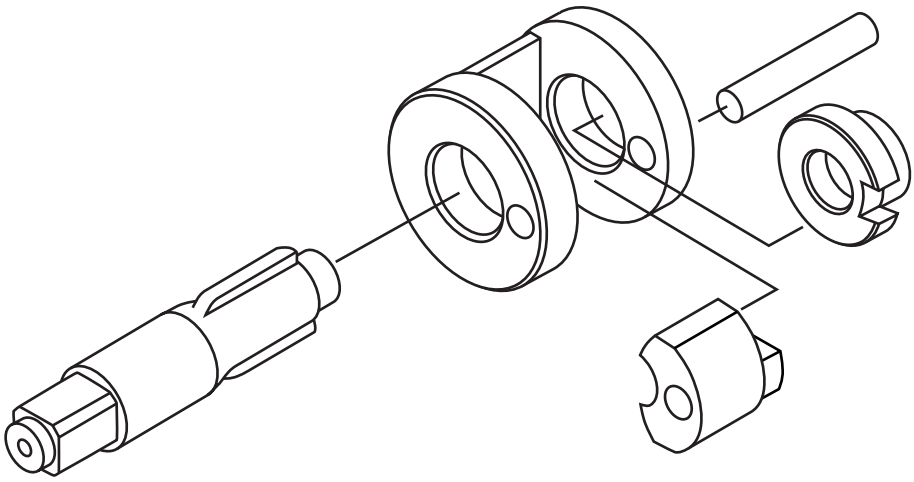


Principal of Operation

A ball lifts cam, causing pins to strike a blow on anvil. After blow, spring returns pins to starting position. Process repeats.

Higher torque than rocking-dog
Good for hard pull-up joints
Generally the least expensive

Rocking Dog

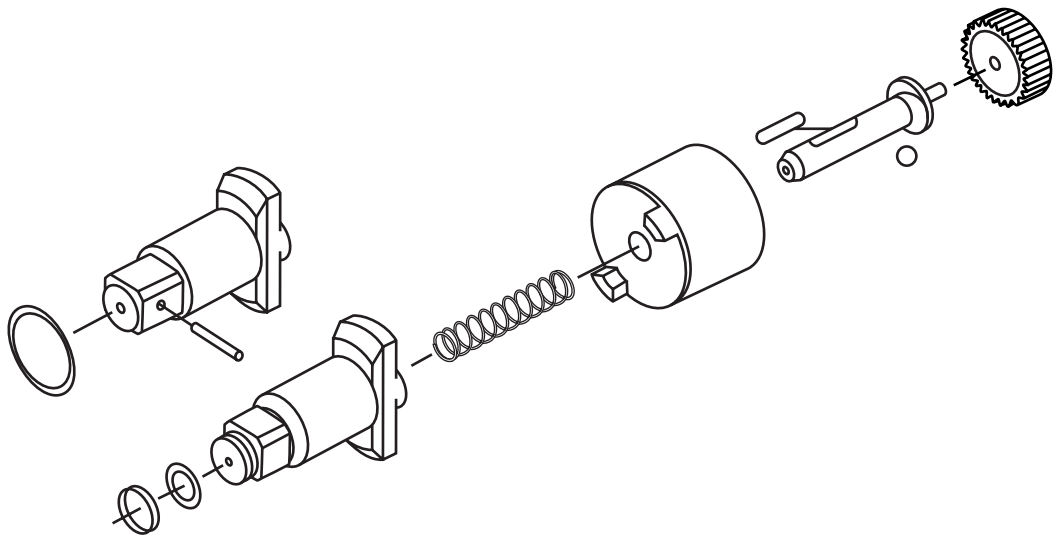


Principal of Operation

The "dog" strikes a blow on the anvil; the cam kicks the dog out of engagement, allowing the dog to rotate around for another blow.

Relatively low torque output
Excellent durability
Excellent clutch for soft pull-up

Two-Jaw

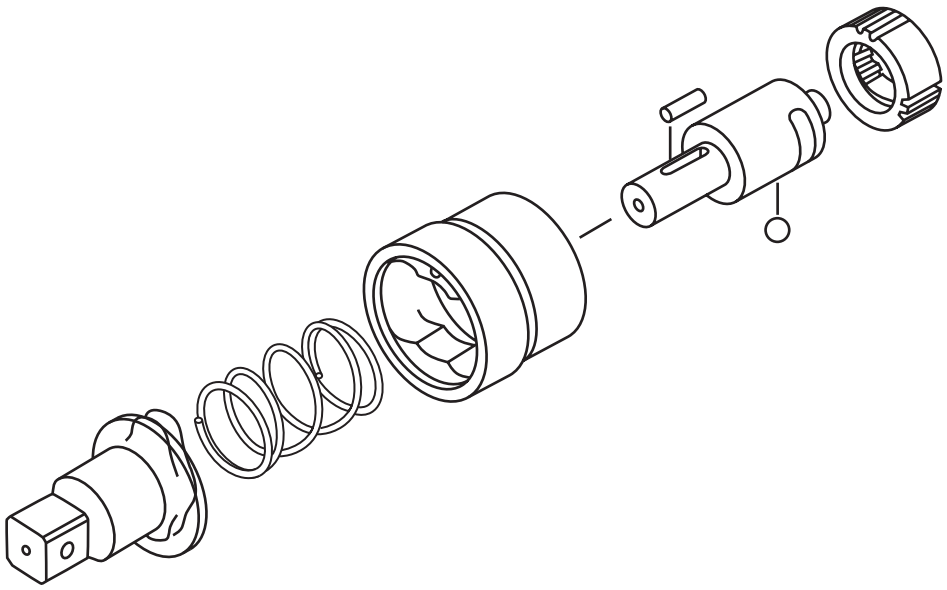


Principal of Operation

A ball lifts cam, causing dog to strike a blow on anvil. After blow, spring returns dog to starting position. Process repeats.

Greater torque in a smaller package
Good for maintenance and repair operation (MRO)

Twin-Lobe

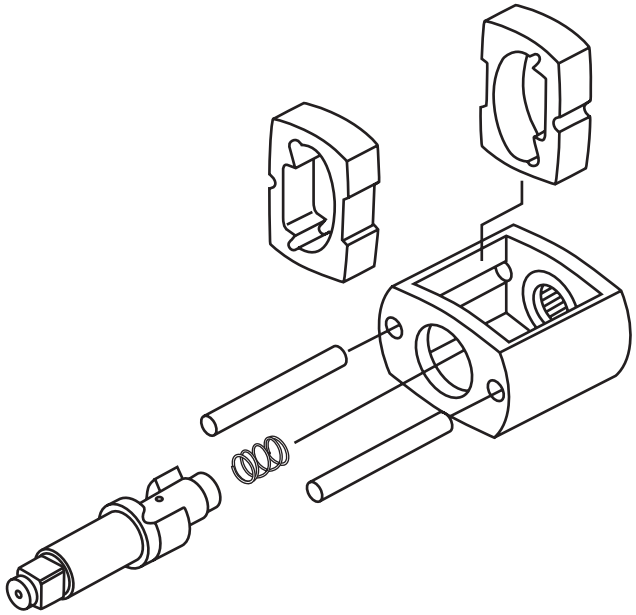


Principal of Operation

A ball lifts cam, causing dog to strike a blow on anvil. After blow, spring returns dog to starting position. Process repeats.

Very durable clutch
Excellent for maintenance and repair operation (MRO)

Twin Hammer

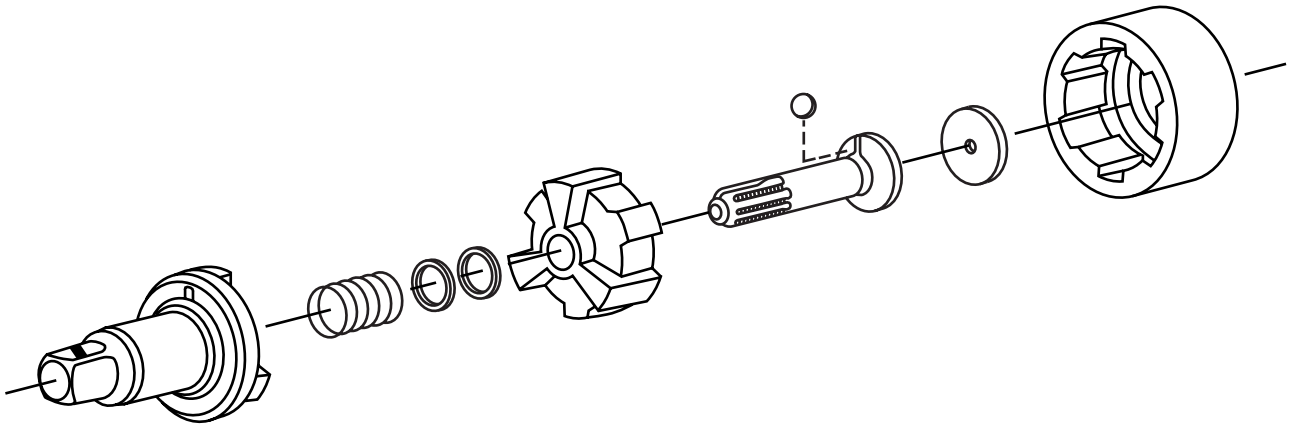


Principal of Operation

Cage rotates twin opposing hammers which strike a blow to the anvil. The twin hammers disengage allowing the cage to rotate for another blow. Process repeats.

Higher power than "Rocking Dog" clutch
Good for hard pull-up joints
Gradual build-up to "Peak Torque"

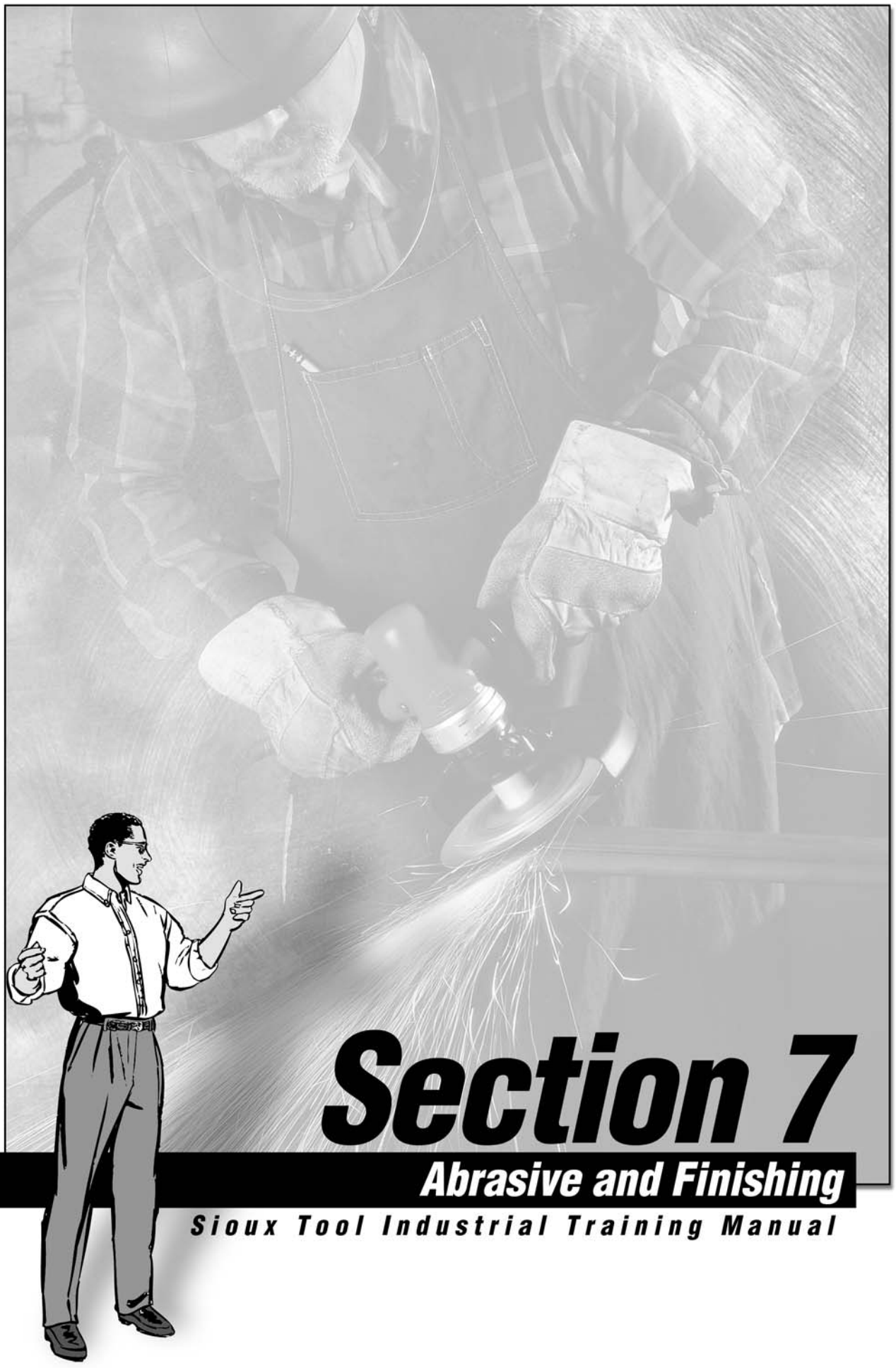
Triple-Lobe



Principal of Operation

A ball lifts cam, causing the triple-lobed dog to strike a blow on anvil. After blow, spring returns triple-lobed dog to starting position. Process repeats.

Smooth, gradual build-up to "Peak" torque for more control-low vibration
Higher power than "Rocking Dog" clutch
External grease lubrication - prevents oil leaks



Section 7

Abrasive and Finishing

Sioux Tool Industrial Training Manual

Section 7.1

Abrasive / Finishing Literature

Sioux Tool Industrial Training Manual

Section 7.2

Abrasive Tools

Sioux Tool Industrial Training Manual

Grinders can cause flying particles

Proper eye protection must be worn at all times by tools user and bystanders.

Under improper use and wear, Air Grinders can cause serious injury and death

The following instructions are important and should be followed explicitly but cannot cover all contingencies. Good judgment is always required.

Using a Grinder without a guard can cause Injrury

The grinder is to be operated with an appropriate guard at all times when a grinding wheel is used. Replace a damaged guard. The guard is to be the proper one for the wheel being used.

Damaged Grinding Wheels can explode

Check the wheel for damage before mounting, such as chips and cracks. Handle wheels carefully to avoid dropping or bumping. Protect wheels from extremes of temperature and humidity. Check wheels immediately after any unusual occurrence that may damage wheels

Over Speeding Wheels can explode

Check the speed rating of the accessory or the speed printed on the wheel. This speed must be greater than the name plate speed of the grinder/ sander and the actual speed of the grinder / sander as measured with a tachometer.

Unsecured work can move violently when grinding

Secure work; use clamps or vise to hold work.

Grinders may coast for a short time after the trigger is released

Be sure tool has come to a complete stop before setting it aside.

Grinding wheels that malfunction or spin off can cause injury

Be certain that all wheel, flanges, nuts and related equipment are in good shape, the proper ones for the type and size of wheel being used, and are securely fastened.

Exploding wheels can cause injury or death

If the normal sound of the grinder changes, or if it vibrates excessively, shut it off immediately, remove the wheel, and check speed with tachometer.

Unexpected starts can cause injury

Be sure actuator is off before hooking up air.

Breathing grinding dust can cause injury

Do not breathe grinding dust. Use approved mask.

Explosions and fire can cause injury

Only grind metals if the area is free of combustible or explosive materials or vapors.

Contact with rotating grinding wheels can cause injury

Keep hands and other body parts away from grinding wheels and sanding pads and disks to prevent cutting or pinching. Wear protective clothing and gloves to protect hands.

Tools starting unexpectedly can cause injury

Always remove tool from air supply and activate trigger to bleed air line before making any adjustments, changing accessories, or doing any maintenance or service on tool.

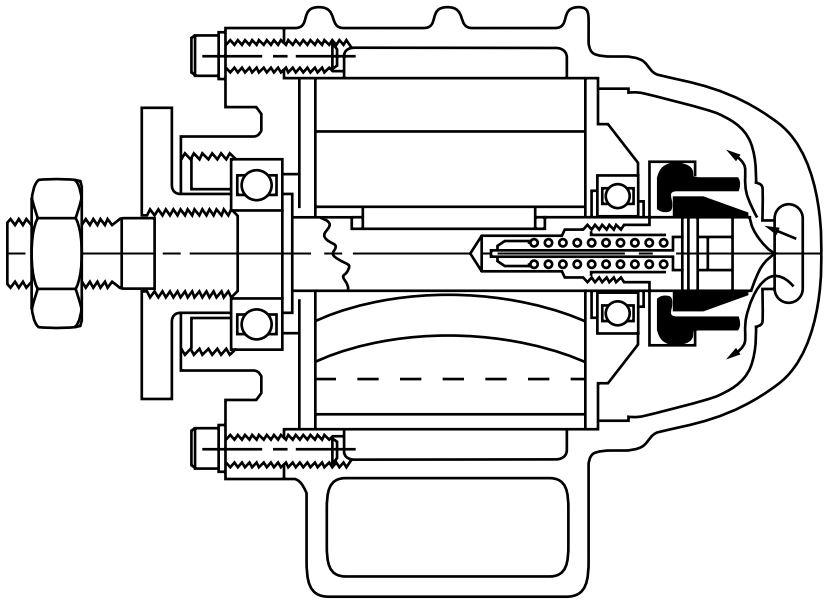
Flying grinding wheels or accessories can cause injury

Tighten collet securely. Match wheel or accessory shaft diameter to chuck or collet.

Exploding or flying parts can cause injury

Do not use cut off wheels or router bits with die grinders.

Governed Motor



Why a Governed Motor?

Governed motors maintain maximum working RPM.

Governed motor provides more power at higher RPM.

Governed motor requires less air.

Governed motor controls speed on wheel. Prevents overspeed.

What does the user gain?

Improved productivity while enhancing operator safety.

Increases abrasive efficiency.

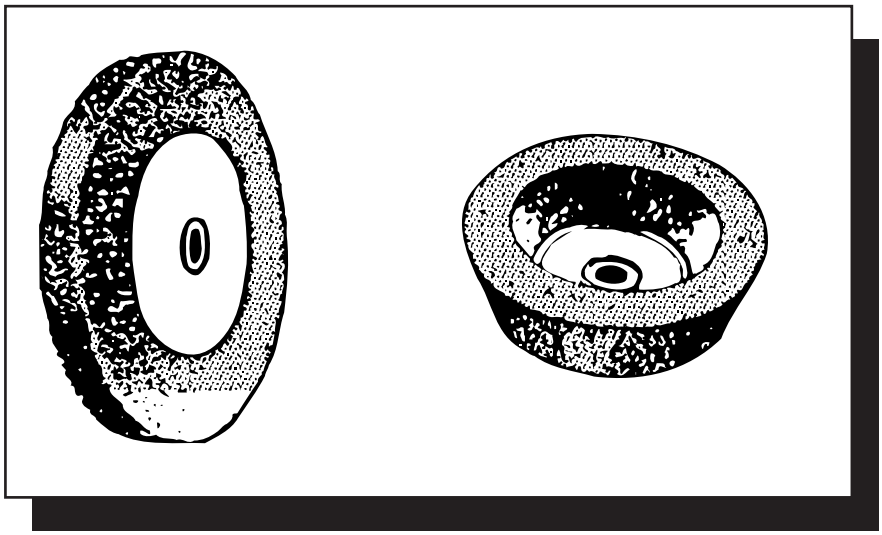
Improves service life of consumables.

Reduces cost.

Abrasive Grinders Principles Of Operation

When wheels, pads or other accessories are attached to the spindle, the tool can be used to remove metal or composites in a variety of ways.

Material Removal - understanding the basics

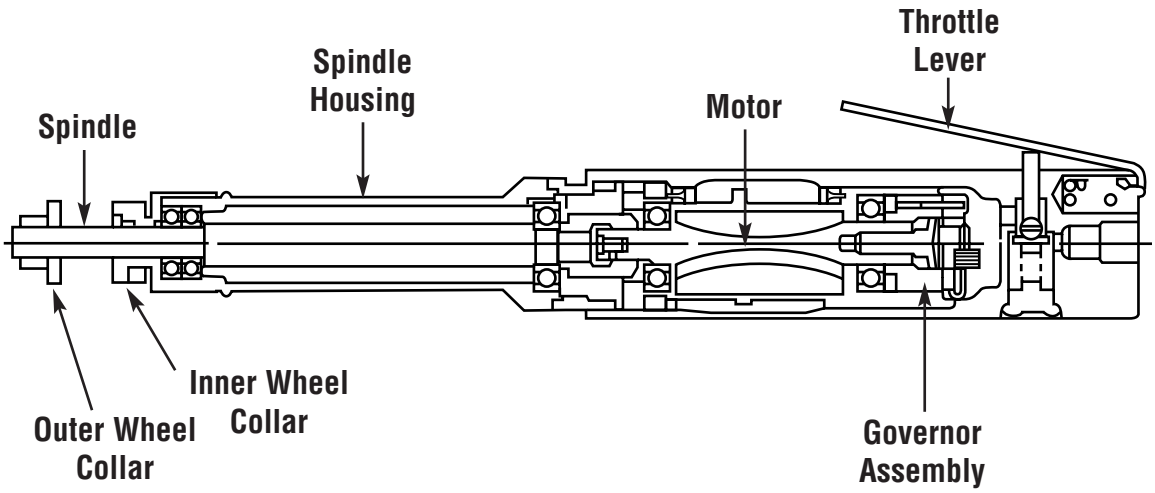


An abrasive wheel is made up of two basic ingredients: abrasive grain and a bonding compound. These two materials are separated by void space. A typical cross section at the edge of the wheel would appear something like as in the figure above.

The cutting action of a grinding wheel can be easily visualized by thinking of an ordinary wood saw. The sharp abrasive grains on the outer surfaces of the wheel are teeth; the bonding material is the saw body. As each abrasive grain comes in contact with the metal, it removes a small amount of material just as the teeth on a saw removes wood.

The metal removed from the work piece flies in the form of sparks. Caution: sparks emitted from a grinding wheel are hot molten metal.

Typical Components Of Abrasive Tools



Throttle & Valve

Allows the operator to adjust the amount of air needed to run the tool at its desired speed.

Governed Assembly

Controls and maintains the speed of the tool. Holds tool to safe operating speed and conserves air consumption.

Motor

Components include – rotor, rotor blades, liner, and end plates.

Spindle

Transfers rotating power from the air motor to grinder accessories such as stones, disks, and wire wheels.

Collar

Used to clamp and hold grinder accessories to spindle.

Wheel Guard

A wheel guard plays an important part in safe operation. ANSI Safety Code specifies that straight wheels, cupped wheels and depressed center wheels must be used with protective guards.

Considerations for Selecting Grinders

Amount of metal to be removed.
Geometry of the work piece.
Working space available
Frequency of use
Job difficulty
User preference
Horsepower
Speed (RPM)
Price

Die Grinder

Definition: A small straight or angle grinder offering the fastest speeds.
Available when compared to all other grinders.

Major Characteristics

Collet Size 1/8", 1/4", 3/8".
Horsepower Range: .33 HP to 1.5 HP.
Speeds (RPM): 12,000 to 25,000.
Steel, Aluminum, or Composite motor housings.
Short and Extended spindle housings.

Accessories

Carbide Burrs
Mounted Points

Where Used

Die Shops/Forge Shops - to contour and blend die cavities; die repairs
Foundry Cleaning Room - to smooth and clean castings in inaccessible areas.
Aircraft Industry - to smooth and polish jet engine blades; to remove burrs from compressor wheels.
Shipyards - to clean high-quality welds.
Stamping plants - for die repair; and burr removal.
Fabricators - for blending, smoothing and burr removal.
General Manufacturing - for bending, smoothing and burr removal.
Construction - for deburring, blending, and smoothing.

Angle Grinder

Definition: A type of grinder in which the motor and gearing are at a right angle to the drive spindle.

Major Characteristics

Most models equipped with a three, four, four 1/2, and seven inch guard.
Horsepower range: .80 HP to 1.0 HP
Speeds (RPM): 6,000 to 18,000
Steel, Aluminum, and Composite motor housings.
Governed and non-governed
Spindle thread 3/8" - 24 or 5/8" - 11

Accessories

Type 27 depressed center wheels.

Where Used

Foundry Cleaning Room - for tight corner cleaning work.
Fabrication Shops / Shipyards - for many blending, deburring, and smoothing applications.
Power Plants - for blending radiuses on structural steel and for smoothing flame-cut edges.

Vertical Grinders

Definition: A type of grinder in which the motor is in a vertical position to the drive spindle.

Major Characteristics

All models equipped with a 6", 7", or 9" wheel guard
Horsepower range: 1.0 HP to 3.0 HP
Speeds (RPM): 4,500 to 6,000
Aluminum alloy motor housing
All models have a 5/8" - 11 spindle.
Governed and Non-governed
"V" Series has over-speed Shutoff Protection

Accessories

Type 27 depressed center wheels
Cup wheels
Wire brush wheels

Where Used

Foundry Cleaning Room - to smooth risers and parting lines on large castings
Fabrication Shops / Shipyards - for heavy weld smoothing, grinding weld bevels, and removal of rust and scale.
Construction - for heavy-duty cleaning, smoothing and wire brushing applications.

Die Grinders

Model Number	Free Speed	Weight		Length		Air Consumption		Sound Level	Collet Size	Exhaust
	rpm	lb	kg	In.	mm	scfm	l/s	dB(A)		
Straight Die Grinders (1HP)										
SDG10S25F	25,000	1.65	0.75	7.50	190	30	14.2	77.7	1/4"	Front
SDG10S25M6F	25,000	1.65	0.75	7.50	190	30	14.2	77.7	6mm	Front
SDG10S25R	25,000	1.65	0.75	7.50	190	30	14.2	77.7	1/4"	Rear
SDG10S25M6R	25,000	1.65	0.75	7.50	190	30	14.2	77.7	6mm	Rear
SDG10S18F	18,000	1.65	0.75	7.50	190	30	14.2	77.7	1/4"	Front
SDG10S18M6F	18,000	1.65	0.75	7.50	190	30	14.2	77.7	6mm	Front
SDG10S18R	18,000	1.65	0.75	7.50	190	30	14.2	77.7	1/4"	Rear
SDG10S18M6R	18,000	1.65	0.75	7.50	190	30	14.2	77.7	6mm	Rear
SDG10S12F	12,000	1.65	0.75	7.50	190	30	14.2	77.7	1/4"	Front
SDG10S12M6F	12,000	1.65	0.75	7.50	190	30	14.2	77.7	6mm	Front
SDG10S12R	12,000	1.65	0.75	7.50	190	30	14.2	77.7	1/4"	Rear
SDG10S12M6R	12,000	1.65	0.75	7.50	190	30	14.2	77.7	6mm	Rear
SDG Directional Exhaust Conversion Kit Available. Part Number SDG-EXH										
Extended Die Grinders (1HP)										
SXG10S23R	23,000	2.20	1.00	12.10	308	30	14.2	77.7	1/4"	Rear
SXG10S23M6R	23,000	2.20	1.00	12.10	308	30	14.2	77.7	6mm	Rear
SXG10S18R	18,000	2.20	1.00	12.10	308	30	14.2	77.7	1/4"	Rear
SXG10S18M6R	18,000	2.20	1.00	12.10	308	30	14.2	77.7	6mm	Rear
SXG10S12R	12,000	2.20	1.00	12.10	308	30	14.2	77.7	1/4"	Rear
SXG10S12M6R	12,000	2.20	1.00	12.10	308	30	14.2	77.7	6mm	Rear

Collet Sizes Available as Accessory

1/8" Collet .....Part Number: 74072
3/16" Collet .....Part Number: 74073
1/4" Collet .....Part Number: 74074
3/8" Collet .....Part Number: 68030
3mm Collet .....Part Number: 74075
6mm Collet.....Part Number: 74076
8mm Collet .....Part Number: 68056

Vertical Type 27 Wheel Grinders

HG30AL-80P3

VG20AL-60D7

HG30AL-60S6

CE

Model Number	Free Speed	Wheel Capacity		Weight		Height		Sound Level	Air Consumption Under Load		Air Consumption Free Speed		Spindle Thread
	rpm	in.	mm	lb	kg	in.	mm	dB(A)	cfm	l/s	cfm	l/s	
2.0 hp (1.5 kw) - Class Vertical Grinders													
VG20AL-60D7	6000	7	175	7.4	3.3	5.5	145	85	75	35	26	12	5/8"-11
VG20AL-45D9	4500	9	230	7.4	3.3	5.5	145	85	75	35	26	12	5/8"-11
VG20AL-60D9	6000	9	230	7.4	3.3	5.5	145	85	75	35	26	12	5/8"-11
VG20AL-60C6	6000	6	150	7.4	3.3	5.5	145	85	75	35	26	12	5/8"-11
2.0 hp (1.5 kw) - Class Horizontal Grinders													
HG20AL-60S6	6000	6	150	10.5	4.8	20.8	530	85	75	35	26	12	5/8"-11
HG20AL-45S8	4500	8	200	10.5	4.8	20.8	530	85	75	35	26	12	5/8"-11
HG20AL-80P3	8000	3	75	10.5	4.8	20.8	530	85	75	35	26	12	5/8"-11
3.0 hp (2.2 kw) - Class Vertical Grinders													
VG30AL-60D7	6000	7	175	9.5	4.3	6.4	165	84	90	42	39	18	5/8"-11
VG30AL-45D7	4500	7	175	9.5	4.3	6.4	165	84	90	42	39	18	5/8"-11
VG30AL-45D9	4500	9	230	9.5	4.3	6.4	165	84	90	42	39	18	5/8"-11
VG30AL-60D9	6000	9	230	9.5	4.3	6.4	165	84	90	42	39	18	5/8"-11
VG30AL-60C6	6000	6	150	9.5	4.3	6.4	165	84	90	42	39	18	5/8"-11
3.0 hp (2.2 kw) - Class Horizontal Grinders													
HG30AL-60S6	6000	6	150	12.5	5.6	21.8	550	84	90	42	39	18	5/8"-11
HG30AL-45S8	4500	8	200	12.5	5.6	21.8	550	84	90	42	39	18	5/8"-11
HG30AL-80P3	8000	3	75	12.5	5.6	21.8	550	84	90	42	39	18	5/8"-11

General:
Air Inlet Size: 1/2" NPT
Recommended Hose Size: 1/2" (13 mm)
Performance rated @ 90 psig (6.2 bar) air pressure
Tools available with BSPT air inlet upon request

Standard Equipment:
Parts list, Safety and Instruction manual
Spindle Wrenches
Wheel Guard
Mounting Flange & Nut

Section 7.3

Finishing Tools

Sioux Tool Industrial Training Manual

Flying particles can cause eye injury

Proper eye protection must be worn at all times by tools user and bystanders.

A grinding wheel that bursts can cause injury or death

Never mount a grinding wheel or a cutoff wheel on a sander or polisher.

Breathing grinding dust can cause injury

Do not breathe grinding dust. Use approved mask.

Sanders and polishers that do not come to a complete stop before setting aside can cause injury

Be sure the tool has come to a complete stop before setting it aside.

Explosions and fires can cause injury

Only sand metal if the area is free of combustible or explosive materials or vapors.

Contact with sanding disks can cause injury

Wear protective clothing and gloves to protect hands. Keep hands and other body parts away from sanding pads and disks to prevent cutting or pinching.

Sanding or polishing pads, disks or accessories that burst can cause injury

Make sure disks or accessories have a higher speed rating than the tool. Do not exceed rated air pressure.

Prolonged exposure to vibration or an excessive exposed portion of the edge of a disk can cause injury

When using self adhesive sanding disks, make sure to mount them concentrically on the pad.

Tools starting unexpectedly can cause injury

Always remove tool from air supply and activate trigger to bleed air line before making any adjustments, changing accessories, or doing any maintenance or service on tool.

Tools that perform unpredictably can cause injury

Use only sanding and polishing pads, disks and accessories provided or specified by Sioux Tools.

COMING SOON: TRIANGULAR AND SQUARE SANDING PADS

DRILLS | ASSEMBLY | ABRASIVE | FINISHING | PERCUSSIVE | SPECIALTY | ACCESSORIES

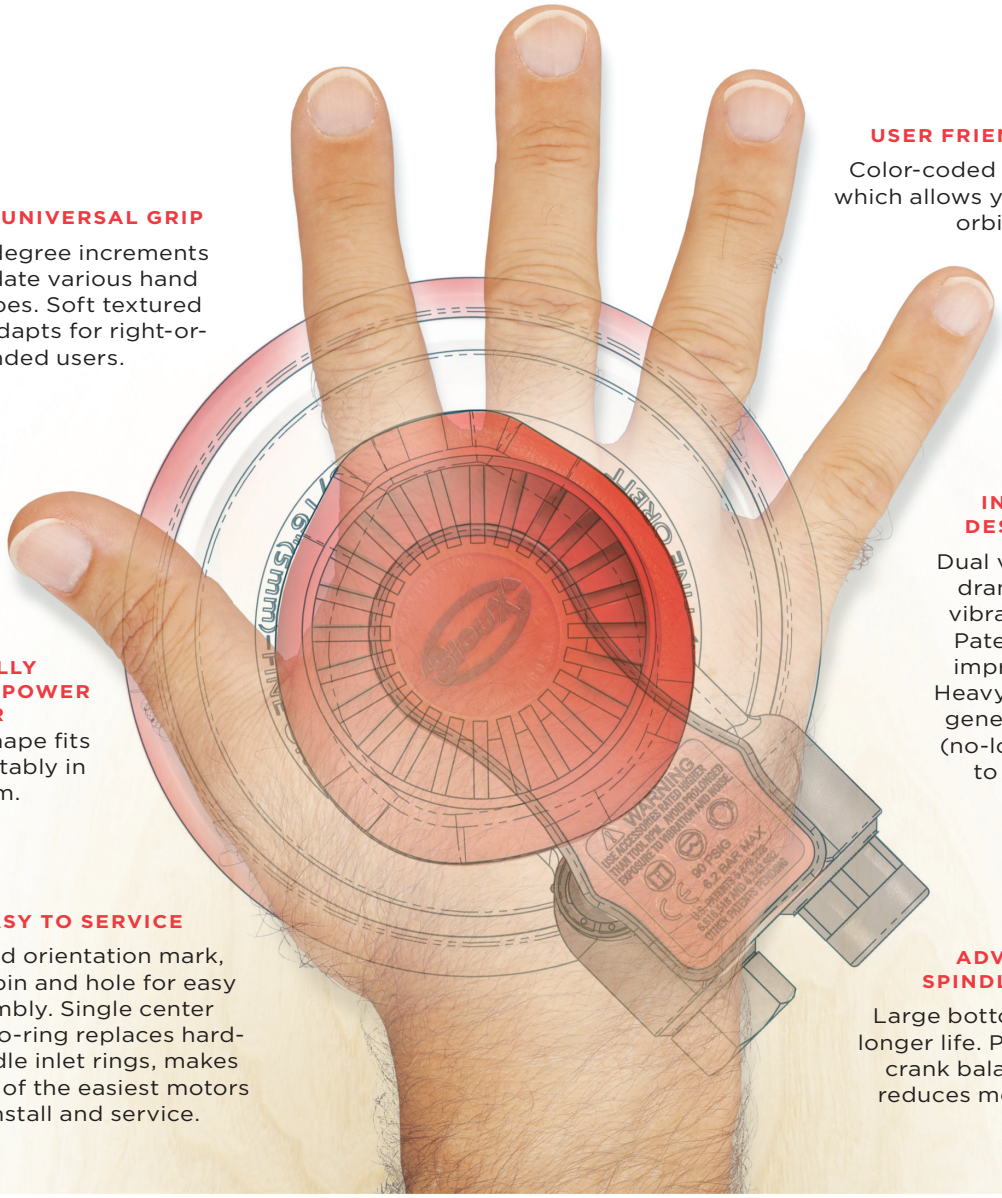
SWITCH TO THE SIOUX SANDER!

24-POSITION UNIVERSAL GRIP

Rotates in 15-degree increments to accommodate various hand sizes and shapes. Soft textured natural feel. Adapts for right-or-left handed users.

USER FRIENDLY LOCK RINGS

Color-coded and dual-embossed which allows you to quickly identify orbit diameter.



NATURALLY CONTOURED POWER LEVER

Sculpted S-shape fits more comfortably in the palm.

INTELLIGENTLY DESIGNED MOTOR

Dual vibration dampers dramatically reduce vibration and fatigue. Patented dust shield improves overall life. Heavy-duty ¼ hp motor generates 12,000 rpm (no-load) with pads up to 6″ in diameter.

EASY TO SERVICE

Molded orientation mark, aligns pin and hole for easy assembly. Single center sealing o-ring replaces hard-to-handle inlet rings, makes this one of the easiest motors to install and service.

ADVANCED SPINDLE DESIGN

Large bottom bearing for longer life. Precision spindle crank balancing further reduces motor vibration.

EVERYONE ELSE IS— ESPECIALLY AFTER THEY'VE TRIED IT.

If your job involves sanding wood, you will immediately feel the difference. This is the worlds' most comfortable pneumatic sander on the market today. There is virtually no vibration. Let us prove our point. Ask your Sioux representative for a demonstration. We'll demonstrate why everyone is switching to the Sioux sander - even if you do currently like the other guys.

SIOUX™

www.siouxtools.com

Sioux Tools | 250 Snap-On Drive | P.O. Box 1596 | Murphy, NC 28906 | 800-722-7290 | 828-835-9765 | FAX 828-835-7325

Random Orbital

Definition: A random orbital sander that operates at 12,000 rpm and uses a 3", 3.5", 5" or 6" pad.

Major Characteristics

Most models equipped with:
Horsepower range: .25 HP
Speed (RPM): 12,000

Orbits

3/32 Fine
3/16 Standard
3/8 Coarse

Vac Options

Non-Vacuum
Remote Vacuum
Venturi Vacuum

Sanders

Definition: An angle grinder that operates at lower speeds and uses a back-up pad and disc designed for sanding applications

Major Characteristics

Most models equipped with:
Horsepower range: .33 HP to 3.0HP
Speeds (RPM): 5,000 to 20,000
Aluminum alloy motor housing
Spindles have 1/4" collett, 1/4"-28, 3/8"-24 or 5/8"-11

1/3 HP Right Angle Sanders

Speed (RPM):12,000 to 20,000
Front, Rear, and vacuum exhaust
1/4" collett, 1/4"-20 External spindle thread, or 1/4"-28 Internal spindle thread.

Right Angle Sanders

Power: .80 to 1.0 HP
Speed (RPM): 6,000 to 12,000
Governed and Non-governed motors
3/8"-24 , 5/8"-11 spindles
Spindle lock (1280 Series)

Vertical Sanders

Power: 1.0 to 3.0 HP
Speed (RPM): 5,000 to 7,000
Governed and Non-governed motors
Overspeed Shutoff Protection (V Series)

Straight Sanders

Power: .60 HP
Speed (RPM): 540 to 5,800
1/2"-13 , 3/8"-24 Spindle

Considerations for Selecting Sanders

Amount of metal to be removed.
Geometry of the work piece.
Working space available
Frequency of use
Job difficulty
User preference
Horsepower
Speed (RPM)
Price

Where Used

Have wide application in the following industries:
Foundries
Construction
Shipyards
Motor Vehicle
Furniture and Appliance
General manufacturing

Polishers

Definition: A sander running at a slower speed with a wool polishing pad.

Right Angle Polishers

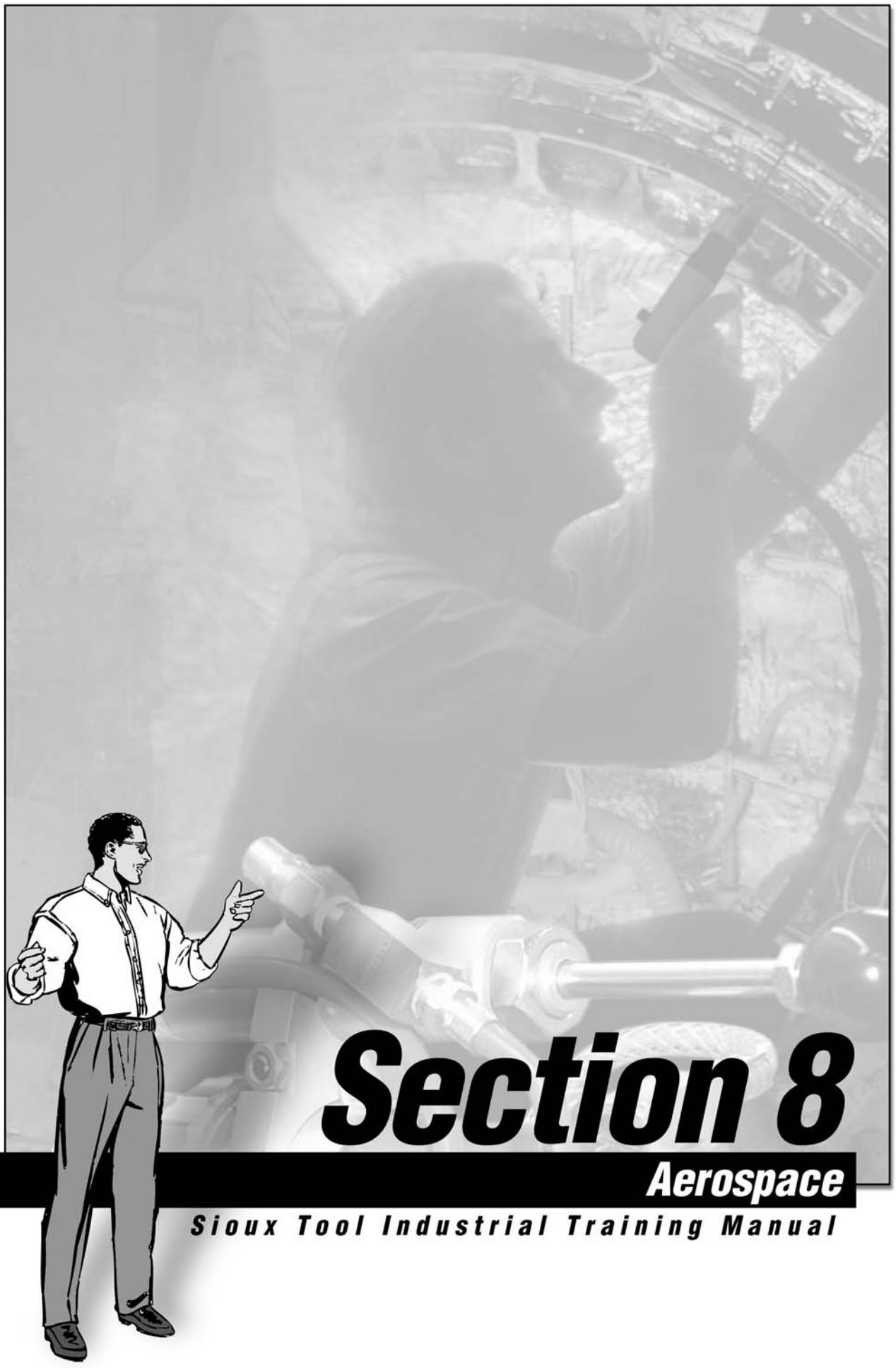
Power: 1.0 HP
Speed (RPM): 3,000
Governed Motor
5/8"-11 Spindle
Spindle Lock

Vertical Polishers

Power: 1.0 HP
Speed (RPM): 2,000 to 3,000
5/8"-11 Spindle

Where Used

Motor Vehicle
Furniture and Appliances
General Metal Manufacturing



Section 8

Aerospace

Sioux Tool Industrial Training Manual

Section 8.1

Aerospace Literature

Sioux Tool Industrial Training Manual

Section 8.2

Rivet Squeezers

Sioux Tool Industrial Training Manual

Rivet Squeezers Principles Of Operation

Air powered compression riveters deliver a squeezing action which drives the rivet by "flowing" the rivet metal with compression forces. Squeezing action is obtained by coupling an air cylinder and piston to a wedge or cam, thus multiplying the original force to extreme ratios. High compressive forces are obtained from a relatively compact unit having small diameter cylinders and using very little compressed air, comparatively speaking.

The advantage of relatively quiet operation of squeeze riveting: simple sounds of air exhaust and forward piston movement do not hint at the tremendous pressures being exerted at the work point.

Optimum control may be obtained in compression riveting; the rivet head is formed by a steady, uniform squeeze action; the set plunger and dolly are an integral part of the squeezer itself.

Length of the return stroke may be adjusted, so that the plunger itself does not have to travel its full length.

Consistently applied pressure makes for a better appearance of the finished product as well as giving the ultimate in structural efficiency.

Classification Of Squeezers

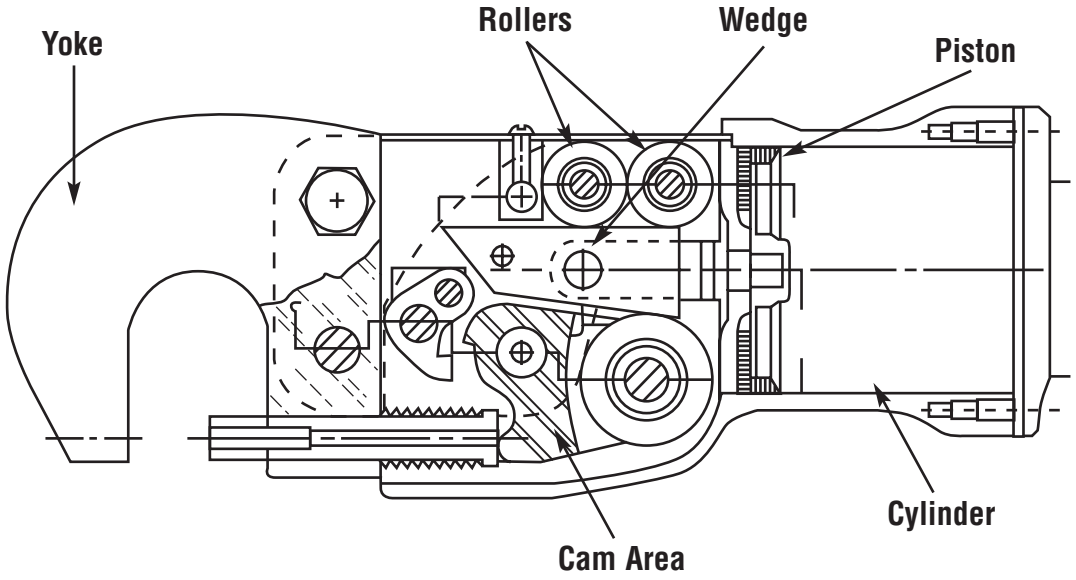
Alligator: The squeezing action of the jaws are similar to the movement of an Alligators jaws.

'C' Type: The rivet is squeezed between the two ends of the 'C'.

Type of Rivet:

- Rivet material.
- Rivet body diameter.
- Rivet length before and after compression.
- Force required to compress rivet.

What material is the rivet made from?
What size is the rivet?
What is the form of the head?
What components are being assembled?
Are there any clearance problems?
Is Alligator or 'C' type yoke required?
How is the application being done now?
Are there any special considerations?



To start the cycle of operation the throttle valve is opened by depressing the trigger, admitting air through a series of ports which lead directly into the rear of the cylinder chamber. As the piston travels forward in the cylinder, it moves quite freely until the rivet set contacts the rivet to be driven. At this point the pressure builds up quickly within the cylinder. The tool will remain at this point, a return spring causes the piston to move to the rear of the cylinder chamber when the trigger is released. The tool is now ready for the next cycle.

Squeezing Rivets vs. Hammering Rivets

Low noise = less operator fatigue
Optimum control = higher rivet quality
One person operation = No bucking person needed
No over-driving of rivets = Increased efficiency & quality

Terminology

Rivet Set: One die that fits or forms head of rivet
Two are required.
CR1 = 3/16" shank dia.
CR2 = 1/4" shank dia.

Reach: Distance to rivet axis from edge of workpiece.

Gap: Distance needed to allow for overall rivet length.

Closed height: Clearance left for rivet and sets after tool cycle is complete.

C - Yoke Rivet Squeezer

Range: 3000 to 6000 lbs. Force
Jaw reach: up to 1-1/2"

Application: Aircraft Automotive components
Truck
Bus
Boats
Metal Furniture
Electronic chassis
Appliance Industry

Alligator Yoke Rivet Squeezer

Range: 1800 to 6000 lbs. Force

Jaw reach: up to 3"

Applications: Aircraft
Automotive components
Truck
Bus
Melal Furniture
Electronic chassis
Appliance Industry

Yoke Terminology

Rivet Set: Term generally used to describe any one rivet die.

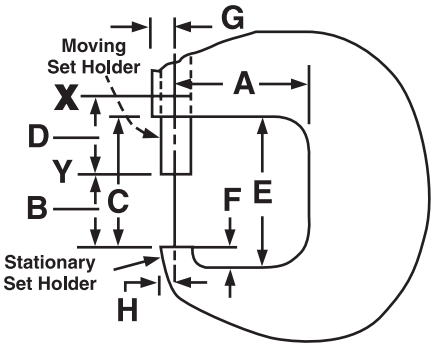
Dolly: Term frequently used to describe the rivet set which is mounted in the stationary set holder.

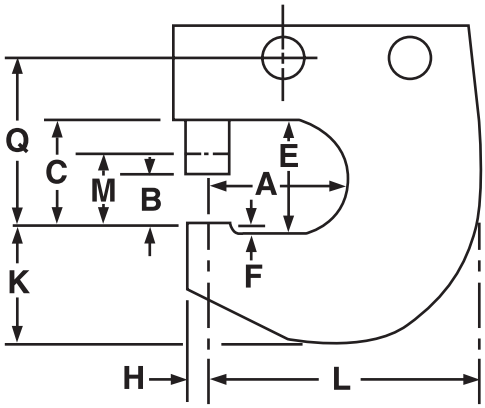
IMPORTANT

Rivet sets are not in place in the illustration below.

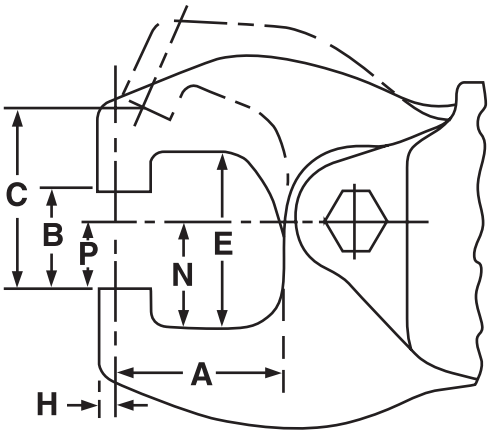
X - Extreme open position
Y - Extreme closed position

A - Reach
B - Closed height
C - Throat gap
D - Travel
E - Total yoke gap
F - Anvil work clearance
G - Upper offset
H - Lower offset





"C" YOKE



ALLIGATOR YOKE

Rivet Set Selection Data

To develop maximum power, the riveter must drive the rivet near the end of its stroke. The use of rivet sets having the required body length "A", shown in flgure 1, is the governing factor in applying the fixed closed height of the riveter to various lengths of rivet. Note that "A" is the external body length and, as shown in the sectioned view in figure 1, it is not affected by the rivet set cupping.

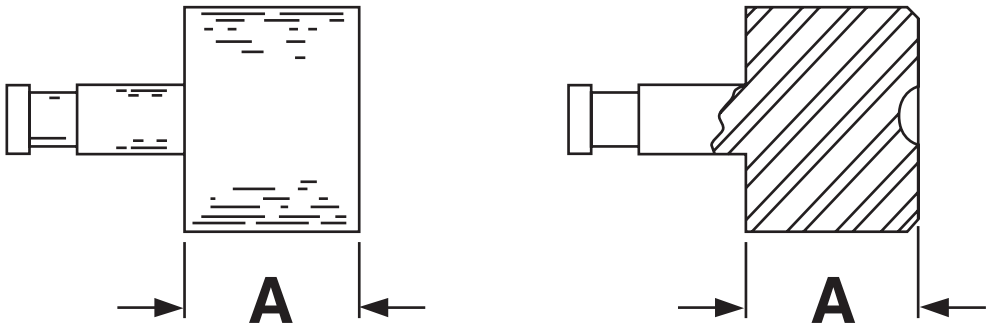
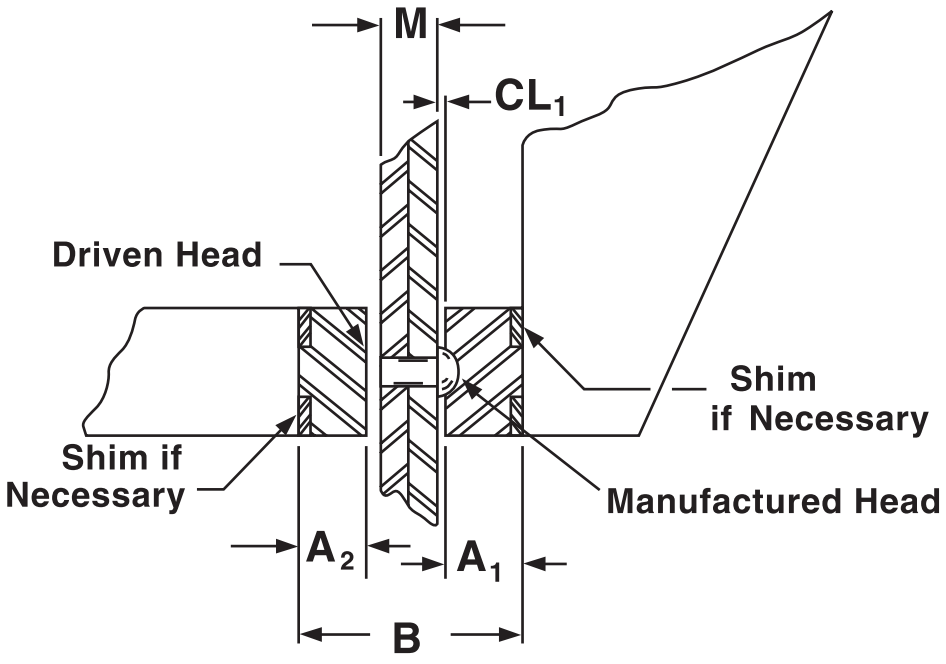


FIG.1

Rivet sets of proper body length, A1 or A2, shown in figure 2, are selected according to rivet diameter and cupping to match the manufactured head of the rivet: button, round,flat head or countersunk.



A1 & A2 - Set Body Length.

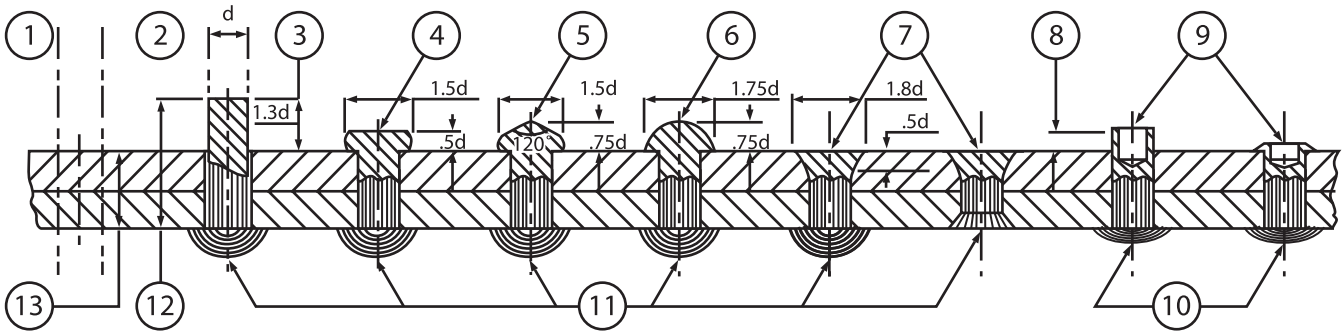
B - Closed Height Of Tool.

CL1 - Clearance Between Rivet Set And Material.

M - Total Material Thickness.

FOR RIVETS 1/6 DIA. THRU 3/8 DIA.

DRIVEN HEADS

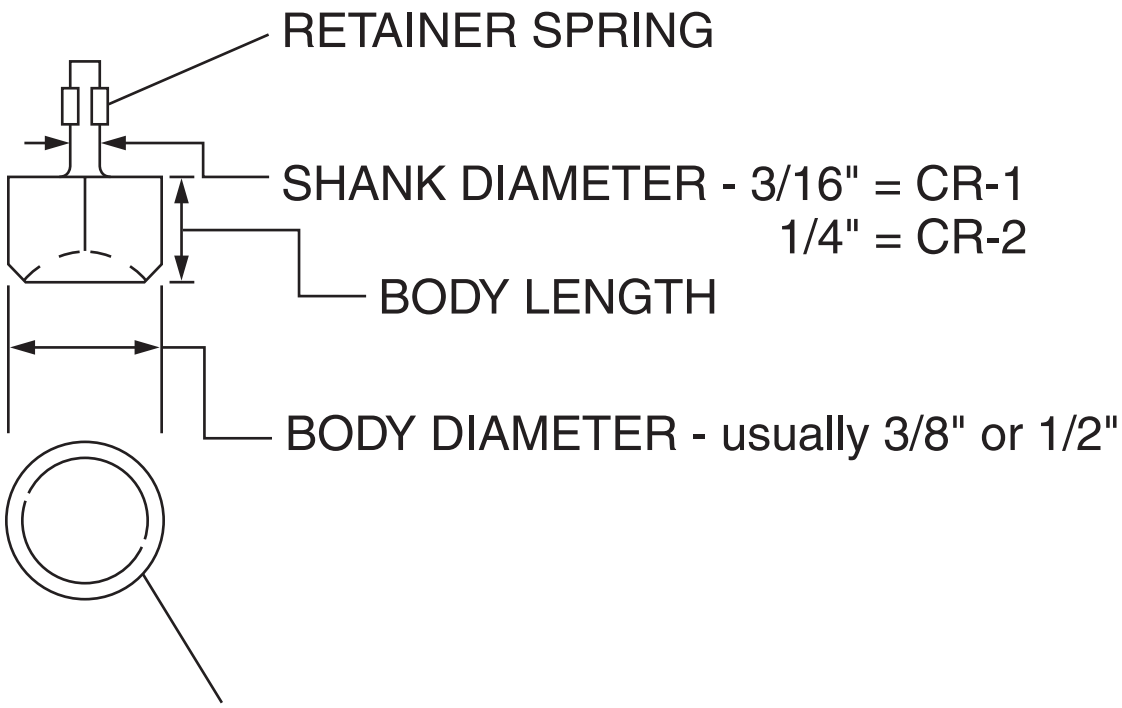


MANUFACTURED HEADS

RIVET TERMS

1. ASSEMBLY HOLE DIA.
2. BODY DIA. OR "d"
3. HEAD ALLOWANCE
4. FLAT HEAD
5. MODIFIED CONE HEAD
6. BUTTON HEAD
7. COUNTERSUNK HEAD
8. CLINCH ALLOWANCE
9. SEMI-TUBULAR RIVET
10. OVAL OR TRUSS HEAD
11. SOLID RIVETS
12. RIVET LENGTH
13. GRIP OR TOTAL MAT'L

Rivet Sets Head Or Die Configuration



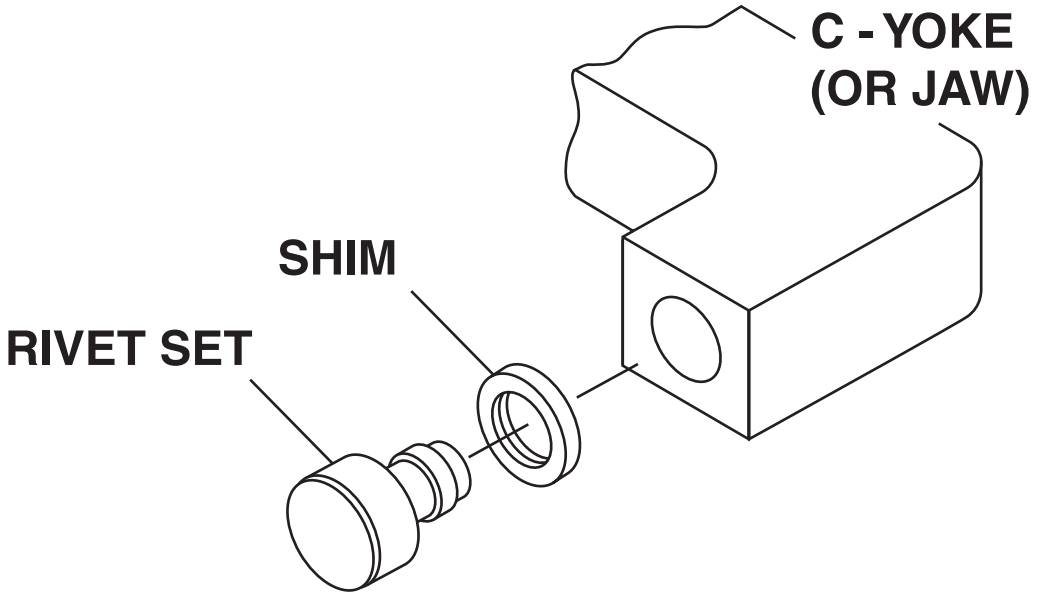
HEAD OR DIE CONFIGURATION

Cupped or Flush; available in:

Button, Round, Brazier, Modified Brazier

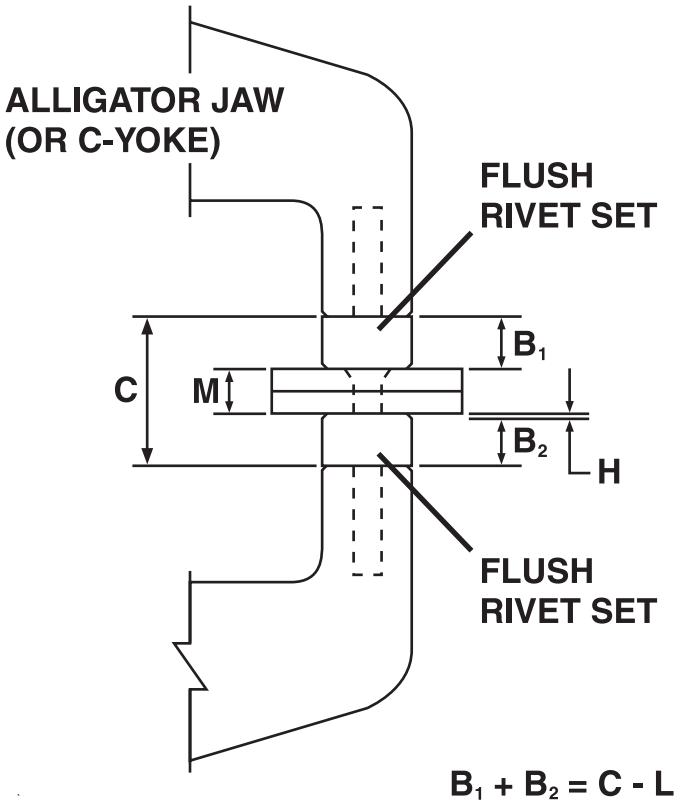
Universal or Flat Head configurations.

If necessary, select rivet sets a little short and shim to proper length with hardened shims. (1/64", 1/32", 1/16", or 1/8"" thick)



WHEN TWO FLUSH SETS ARE USED

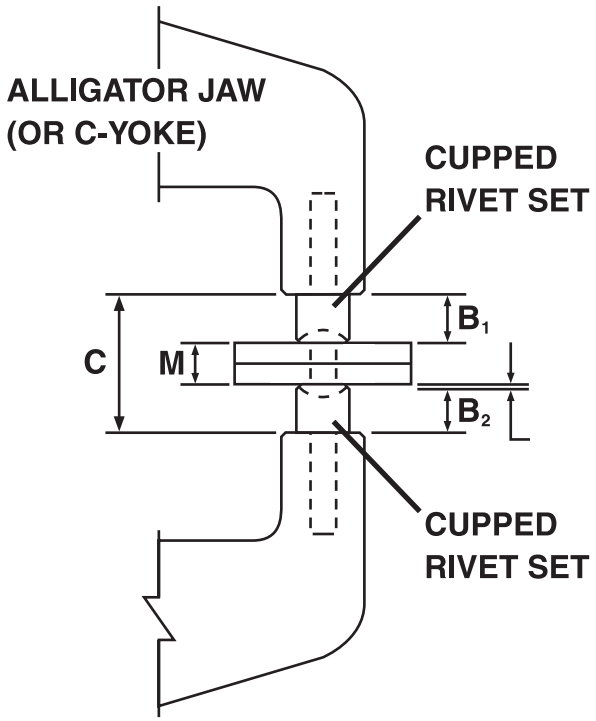
The length of the body dimensions of the two rivet sets (B_1,B_2) should equal the closed height dimension of the yoke (C) minus the overall length of the rivet after it is driven (L)



$B_1 + B_2 = C - L$

WHEN TWO CUPPED RIVET SETS ARE USED

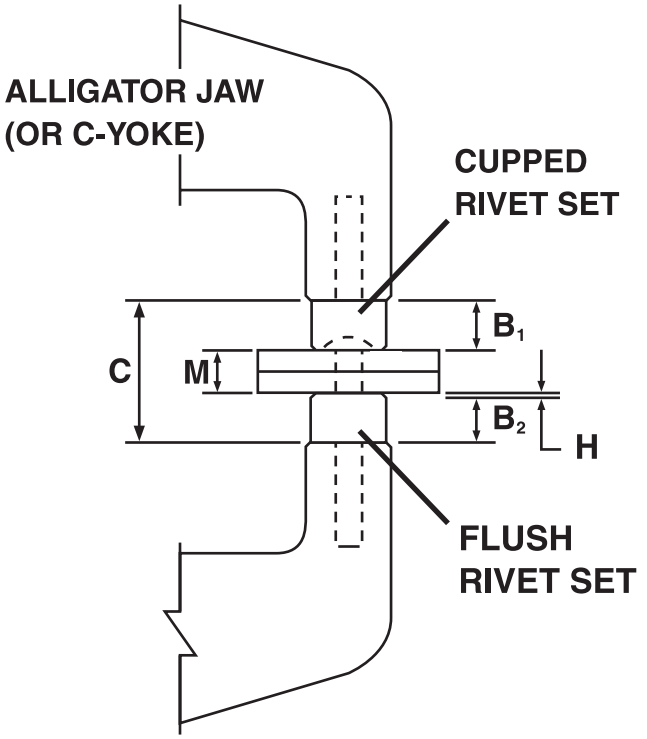
- The length of the body dimensions of the two rivet sets (B_1,B_2) should equal the closed height dimension of the yoke (C) minus the total thickness of the material being riveted (M).



$B_1 + B_2 = C - M$

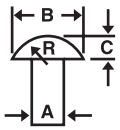
WHEN ONE CUPPED AND ONE FLUSH SETS ARE USED

The length of the body dimensions of the two rivet sets (B_1,B_2) should equal the closed height dimension of the yoke (C) minus the total thickness of the material being riveted (M) and the height of the finished rivet head driven by the flush set (H).



$B_1 + B_2 = C - M - H$

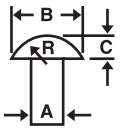
AN-435 A.S.A BUTTON



AN-435 Button

A		B		C		R	
in.	mm	in.	mm	in.	mm	in.	mm
3/32	2.4	0.166	4.22	0.070	1.78	0.084	2.13
1/8	3.2	0.219	5.56	0.094	2.39	0.111	2.82
5/32	4.0	0.273	6.93	0.117	4.32	0.138	3.51
3/16	4.8	0.328	8.33	0.141	3.58	0.166	4.22
1/4	6.4	0.437	11.10	0.188	4.78	0.221	5.61
5/16	7.9	0.546	13.87	0.234	5.94	0.276	7.01

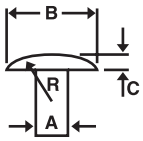
AN-430 ROUND



AN-430 Round

A		B		C		R	
in.	mm	in.	mm	in.	mm	in.	mm
3/32	2.4	0.187	4.75	0.070	1.78	0.098	2.49
1/8	3.2	0.250	6.45	0.094	2.39	0.130	3.30
5/32	4.0	0.312	7.92	0.117	2.97	0.162	4.11
3/16	4.8	0.375	9.53	0.141	3.58	0.195	4.95
1/4	6.4	0.500	12.70	0.188	4.78	0.260	6.60
5/16	7.9	0.648	16.46	0.234	5.94	0.325	8.26

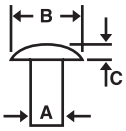
AN-455 BRAZIER



AN-455 Brazier

A		B		C		R	
in.	mm	in.	mm	in.	mm	in.	mm
3/32	2.4	0.234	5.94	0.047	1.19	0.170	4.32
1/8	3.2	0.312	7.92	0.063	1.60	0.226	5.74
5/32	4.0	0.390	9.90	0.078	1.98	0.283	7.19
3/16	4.8	0.468	11.89	0.094	2.39	0.340	8.64
1/4	6.4	0.625	15.83	0.125	3.18	0.453	11.51
5/16	7.9	0.781	19.84	0.156	3.96	0.565	14.35

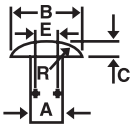
AN-456 MODIFIED BRAZIER



AN-456 Modified Brazier

A		B		C	
in.	mm	in.	mm	in.	mm
3/32	2.4	0.156	3.96	0.031	7.90
1/8	3.2	0.235	5.97	0.047	1.19
5/32	4.0	0.312	7.92	0.063	1.60
3/16	4.8	0.390	9.91	0.078	1.98
1/4	6.4	0.468	11.89	0.094	2.39
5/16	7.9	0.625	15.88	0.125	3.18

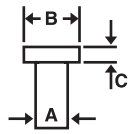
AN-470 UNIVERSAL



AN-470 Universal

A		B		C		R		E	
in.	mm	in.	mm	in.	mm	in.	mm	in.	mm
3/32	2.4	0.187	4.75	0.041	1.04	0.082	2.08	0.047	1.19
1/8	3.2	0.250	6.45	0.054	1.37	0.108	2.74	0.063	1.60
5/32	4.0	0.312	7.92	0.067	1.70	0.135	3.43	0.078	1.98
3/16	4.8	0.375	9.53	0.082	2.08	0.164	4.17	0.094	2.39
1/4	6.4	0.500	12.70	0.107	2.72	0.217	5.51	0.125	3.18
5/16	7.9	0.648	16.46	0.136	3.45	0.272	6.91	0.156	3.96

AN-422 FLAT



AN-442 Flat

A		B		C	
in.	mm	in.	mm	in.	mm
3/32	2.4	0.187	4.75	0.037	0.94
1/8	3.2	0.250	6.45	0.050	1.27
5/32	4.0	0.312	7.92	0.062	1.57
3/16	4.8	0.375	9.53	0.075	1.91
1/4	6.4	0.500	12.70	0.100	2.54
5/16	7.9	0.648	16.46	0.125	3.18

Section 8.3

Routers

Sioux Tool Industrial Training Manual

Pneumatic Routers Principles Of Operation

Routers are pneumatic motors geared or governed to speed determined by the application, materials, cutter and operation desired.

Thumb throttle or lever control operates the motor thus turning the motor spindle at the chosen rpm. Collets are available in standard and metric sizes measured to accommodate the shank of the cutting tool to be utilized. The cutting tool extends through a nosepiece and router guide to the work piece.
The router guide is attached to the nosepiece to guide and align the motor spindle, collet and cutter to the application in order to combat any deflection.

Classification Of Routers

Hand held: Cylindrical design held by hand.

Base mounted: Cylindrical design mounted into a base.

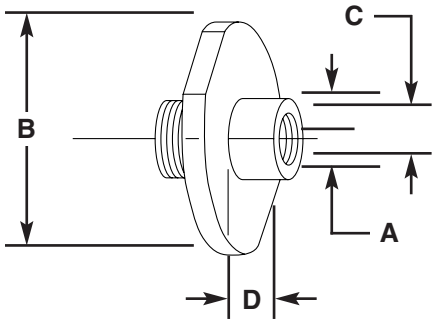
Mountable motor unit: Cylindrical design motor to be mounted in an already existing base.

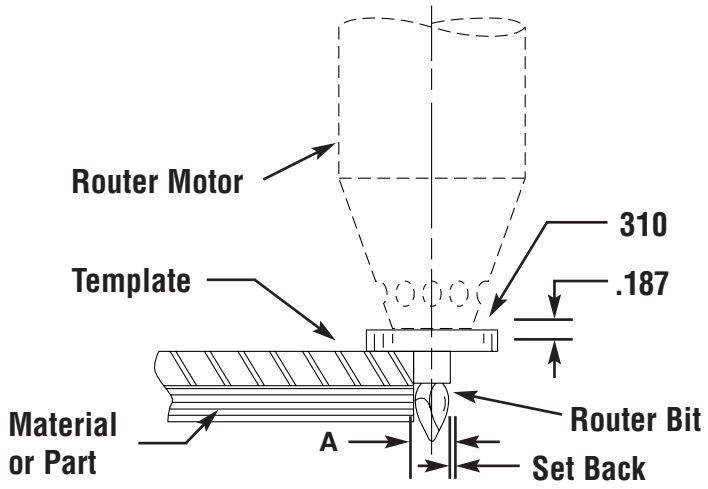
Router Selection Guide

Type of Material?
Cutter?
What is the material thickness?
What size is the cutter shank?
Are there any access concerns?
How is the application being done now?
Are there any special concerns?

Collar Guide Nomeclature

A. Pilot Diameter
B. Flange Diameter
C. Clearance Hole
D. Pilot Length





"A" Pilot Diameter Required
Bit diameter + (Set Back x 2) = "A"

Set Back Formula

$$\frac{A - \text{Bit Diameter}}{2}$$

Section 8.4

Saws & Trim Shears

Sioux Tool Industrial Training Manual

Pneumatic Saws Principles Of Operation

Air powered saws SZES100 and SZES101 utilize a geared motor with a mounting spindle extending from the front of the motor.

Depressing lever throttle on handle allows for the operation of the motor to turn the blade surrounded by a protective guard

The SZES600 and SZES600G utilize geared motors and governed motors.

Saw Selection Guide

What type of Material?
What is the material thickness?
What type of saw blades?
Are there any blade restrictions? (e.g. maximum rpm rating)
Are there any special considerations?

Trim Shears Principles Of Operation

Trim shears are pneumatic motors geared down for speed control, determined by the application material and thickness.

Lever or trigger control operates the motor thus turning the motor speed at the chosen rpm. The worm drive shaft extends from the motor, driving a two-wheel assembly mounted to the front of the tool.

One wheel is serrated to grip the material, while the other wheel cuts the material.

Trim Shear Selection Guide

What type of material?
What is the material thickness?
Are there any clearance problems?
Are there any special considerations?

Section 8.5

Rivet Shavers

Sioux Tool Industrial Training Manual

Rivet Shavers a.k.a 'Micro' Miller

SR510P

Rivet Shavers Principles of Operation

Rivet shavers are utilized with or without the stabilizer (shipped as standard equipment), a skirt and cutter. The tool has incremental .001 microstop adjustment by pulling forward on the sleeve and turning to the desired depth. This adjustment controls the depth of the cut with the intent of shaving the rivet flush with the material. The skirt is an added guide surrounding the rivet head to ensure a horizontal cut.

Rivet Shaver Selection Guide

Straight or Pistol Grip style tool?
Rivet head size?
Cutter and Skirt diameter?
Rivet material?
Kit requirement?
Are there any access concerns?

Major Characteristics

Power: 1.0 HP (0.75 kw)
Speed: 21,000 rpm
Rivet Shaver Skirts:

- 5/16" (8 mm)
- 3/8" (9.5 mm)
- 7/16" (11 mm)
- 1/2" (13 mm)
- 9/16" (14 mm)
- 5/8" (16 mm)

Section 8.6

Skin Clamp Runners

Sioux Tool Industrial Training Manual

Skin Clamp Runners

Skin Clamp Runners a.k.a 'Celco' Runner or 'Speed' Runner

Skin Clamps a.k.a Temporary Fasteners or 'Celco's'

Need to Shoot

SSR10P-25

2S2300SR

Skin Clamp Runners Principles of Operation

Temporary fasteners are utilized with a drilling template sheet or when two pieces of metal are overlapping require joining. The temporary fastener's (either hex driven or the newer cylindrical design) two or three piece stem is placed through the template and sheet metal, run down with the tool to approximately 10-40 in/lbs thus drawing back part of the stem and clamping the two sheets together. It is not uncommon to see mulitple temporary fasteners on a given application. Due to the low torque, after the job is complete, the temporary fasteners are removed by lightly tapping on the stem.

Skin Clamp Runners Selection Guide

What style of power unit? Pistol Grip or Z Handle?

What style of temporary fastener? Hex driven or Cylindrical?

What speed? 2200 rpm or 2500 rpm?

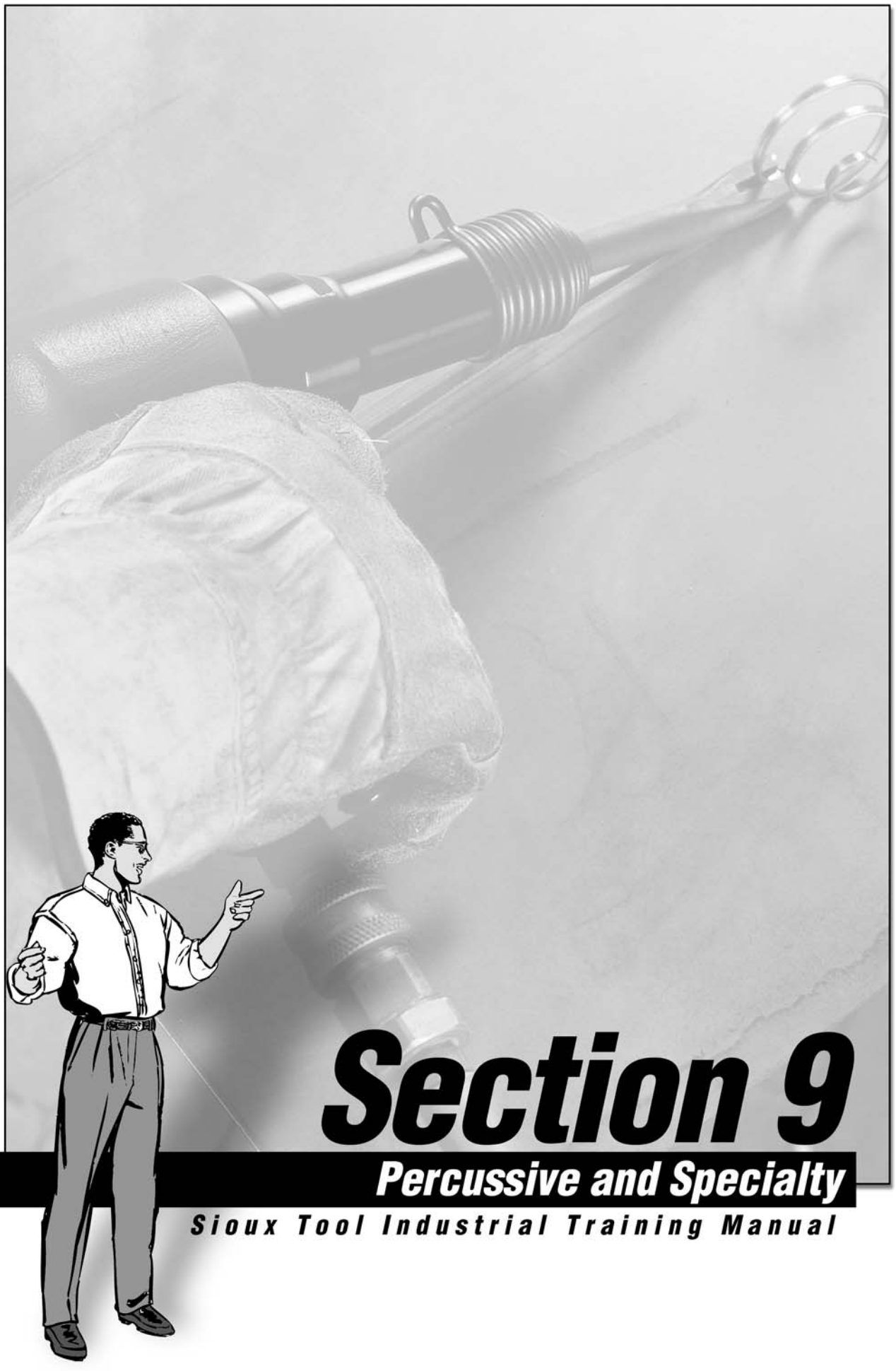
Thickness of material stack?

Length of fastener?

Are there any access concerns?

Major Characteristics

Speed: 2200 - 2500 rpm



Section 9

Percussive and Specialty

Sioux Tool Industrial Training Manual

Section 9.1

Percussive / Specialty Literature

Sioux Tool Industrial Training Manual

Section 9.2

Percussive Tools

Sioux Tool Industrial Training Manual

Percussive Tool Safety

Never operate a hammer without proper retainer in place. Always disconnect air line before changing chisels. Face and eye protection must be worn while operating tools. All chisels, rivet sets and other accessories shold be checked for cracks, excessive wear, or other physical damage before each use. Accessories that show damage should be replaced immediately.

Percussive Tool Principles Of Operation

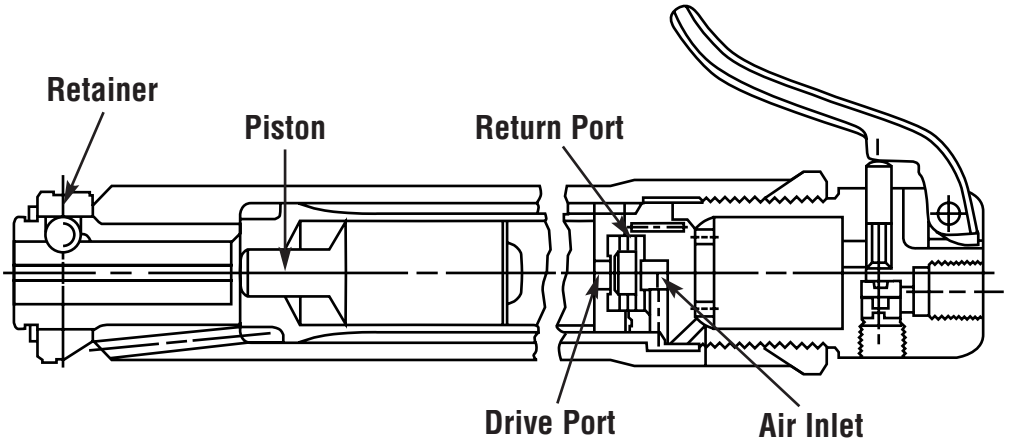
An air hammer is designed to deliver a series of straightforward blows, through the pounding action of a piston.

Depending on the speed and power of these blows, and the working end of the tool, hammers can perform a broad range of jobs.

Valve Classes

Pressure drop valve
Pressure Shift valve
Valveless

Pressure Drop Valve



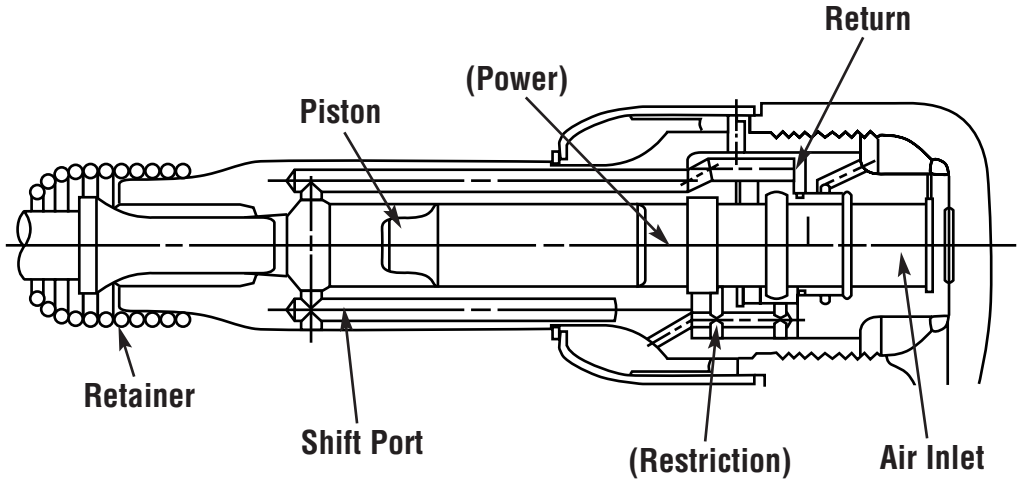
Principles of Operation

The combination of a pressure drop established by an open exhaust port and the compression effect of the piston creating an air cushion establishes a pressure differential across the valve disc causing the valve to shift.

Benefits

Good Controllability
Simple Design
Easy to Repair
Tolerant of dirt

Pressure Shift Valve



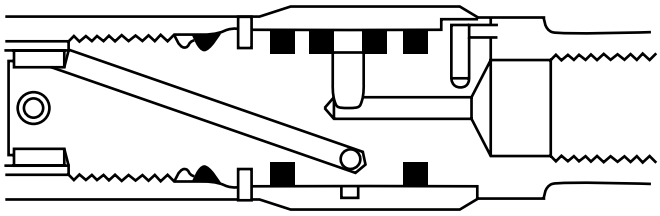
Principles of Operation

Piston blocks signal port; live air flowing through restriction pressurizes shift port and shifts valve into return. Compression effect of piston forming cushion acts on rear face of valve to initiate power stroke.

Benefits

Excellent Controllability
Slow, Heavy blows with light pistons
Ideal for Aluminum Riveting
Long service life

Valveless



Principles of Operation

Incoming air forces piston forward, blocking air inlet. Further travel opens exhaust and admits air to opposite end of piston. Process repeats.

Benefits

Simplicity – one moving part
High cycling speeds possible

Scalers

Definition: Light to medium duty hammers designed for chipping, cleaning, and cutting of all types of surfaces.

Major Characteristics

Models equipped with an integral retainer.
Blows per Minute (BPM) - 4,300 and 4,600
Retainer size and type - 1/2" Octagon and Square Shank

Where Used

Applications include chipping paint, rust and scale removal, and other metal removal in:
Foundries
Shipyards
Steel fabrication shops
Construction sites
Refineries
Steel mills

Needle Scalers

Definition: Hammers that transmit a blow through a group of floating needles for cleaning all types of surfaces.

Major Characteristics

All models equipped with a needle set
Blows per Minute (BPM) 4,300 and 4,600
Steel / beryllium / stainless needle sets
Round needle scaler attachment

Where Used

Well suited for removing weld flux, rust, scale, paint, and other residues in:
Foundries
Shipyards
Construction sites
Fabrication shops
Plant maintenance

Engraving Pen

Definition: The smallest percussive type tool available; designed for marking or engraving surfaces.

Major Characteristics

Equipped with engraving point and hose.
Cycles per Minute (CPM) - 13,000
Replaceable engraving points.

Where Used

General manufacturing - for identifying parts and equipment
Fabrication shops / weld shops - for identifying parts and equipment
Power plants - for identifying parts and equipment
Construction - for identifying parts and equipment

Hammers

Definition: A medium duty tool used mainly for riveting and cutting applications.

Major Characteristics

All models have beehive retainers. All models accepts .401 Parker Taper Rivet Sets and Chisels
Blows per Minute (BPM) - 1,700 to 2,500
Can drive cold steel rivets up to 1/4"

Where Used

Commonly used for aircraft type riveting and other riveting and fastening applications in:
Aircraft industry
General manufacturing
Shipyards
Fabrication shops
Weld shops

Utility

Definition: A general purpose tool used for light chipping and riveting applications.

Major Characteristics

All models equipped with spring retainer
Blow per Minute (BPM) 2,200 to 4,800
Shank size : .401"

Where Used

Commonly used for muffler and pipe removals, scraping rust, trimming, cutting, and riveting in:
Body and repair shops
Service stations
General manufacturing
Aircraft industry
Construction sites
Plant maintenance

Section 10

Specialty Tools

Sioux Tool Industrial Training Manual

ROUTERS

TAPPERS

NIBBLERS

SHEARS

CLINCH NUT TOOLS

RECIPROCATING SAWS

CUT OFF SAW

PANEL SAW

SRT10S Series Routers

Power: 1.0 HP

Speed: 18,000 to 25,000 RPM

Collets: 1/4", 6mm

Bases: 3"

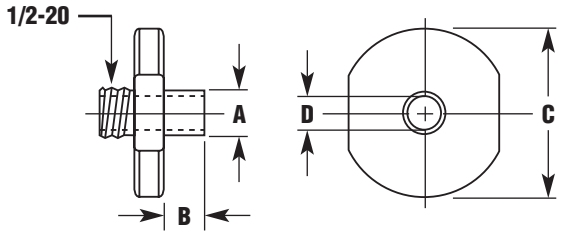
Laminate Trimmer Base

Template Follower Base

SRT10S25N | SRT10S25B | SRT10S25BB | SRT10S25LT

***Template Guide Chart**

Part Number	Dimensions In Inches			
	A Pilot O.D.	B Pilot Length	C Flange O.D.	D Pilot I.D.
68613-12	3/8	1/4	3/4	9/32
68613-14	3/8	3/8	3/4	9/32
68613-16	3/8	1/2	3/4	9/32
68613-22	3/8	1/8	1-1/2	9/32
68613-24	3/8	1/4	1-1/2	9/32
68613-26	3/8	3/8	1-1/2	9/32
68613-40	7/16	1/4	3/4	21/64
68613-42	7/16	3/8	3/4	21/64
68613-44	7/16	1/2	1-1/2	21/64
68613-48	7/16	1/4	1-1/2	21/64
68613-50	7/16	3/8	1-1/2	21/64
68613-52	7/16	1/2	1-1/2	21/64
68613-62	1/2	1/4	1-1/2	11/32
68613-64	1/2	3/8	1-1/2	11/32
68613-66	1/2	1/2	1-1/2	11/32
68613-72	1/2	1/2	2-1/2	11/32



Tappers

Power: 1.0 HP

Speeds: 400 to 1200 RPM

Torque: 115 in./lbs. to 310 in./lbs.

Inline and Pistol Grip

Rapid Reverse

Need to Shoot

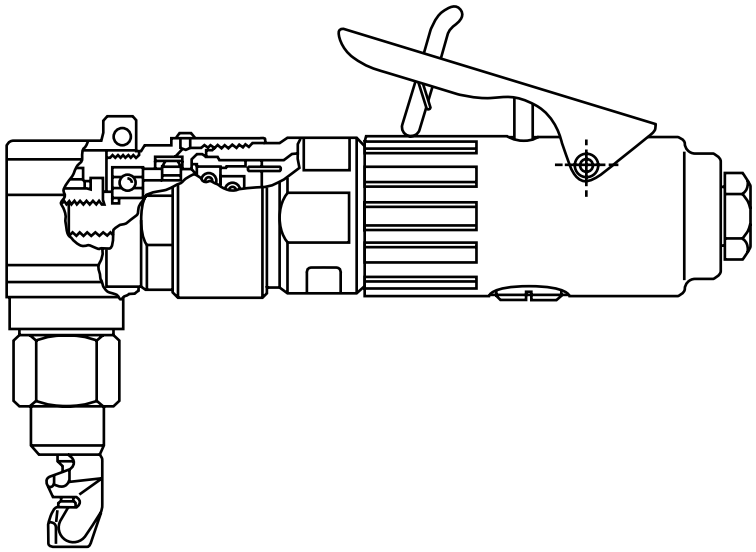
STP10P3C20

2L2550

Nibblers

Power: .75 HP

Capacity: 18 Ga.

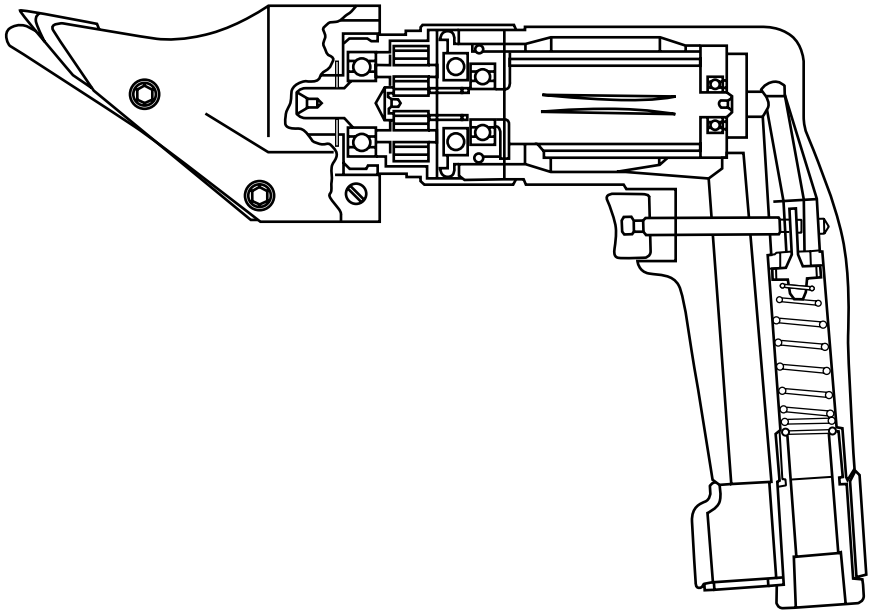


Shears

Power: .75 to .9 HP

Capacity: 18 Ga.

Inline and Pistol Grip



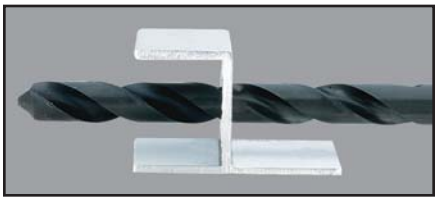
Clinch Nut Tools

Torque - 36 in./lbs to 300 in./lbs
Speed - 400 - 2500 rpm
All Reversible
Pistol Grip and Inline

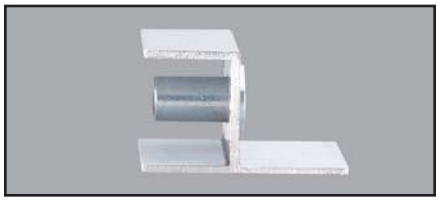
Clinch nuts, also known as captive nuts, or rivet nuts, provide a reliable means of securing assembly componenets in thin wall applications. These unique fasteners are inserted into pre-drilled holes in thin materials such as sheet metal, and with the aid of a Sioux clinch nut tool, compress and expand to clamp the material. This process creates a strong, secure base with either a female or male thread for assembling additional componenets.

Clinch Nut Installation Procedure

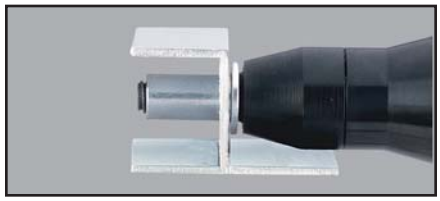
Step 1
Pre-drill hole for fastener.



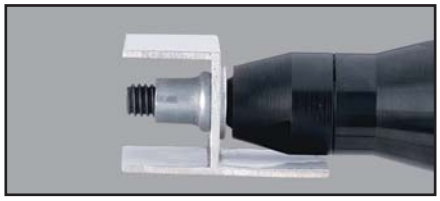
Step 2
Insert fastener.



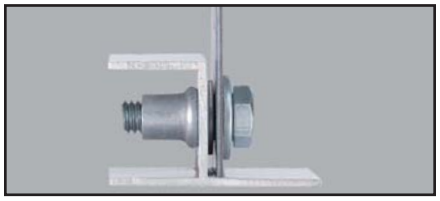
Step 3
Thread tool into fastener.



Step 4
Run tool to collapse fastener
Reverse tool to release.



Step 5
Assemble.



SCN10P Series Clinch Nut Tool Features

- A wrenchless head assembly making it easy to change the size or style without the use of tools.
- A grease fitting has been added to the nose, allowing lubrication to the thrust bearing for reduced wear and longer life.
- The size of the thrust bearing has been increased for improved bearing life.
- The smaller nose diameter allows easy access into tight spaces.
- Available with either a smooth or serrated nose and can be ordered for either clinch nut or clinch stud applications.

Reciprocating Saws

Power : 1.0 HP (0.7 kw)
Strokes per Minute: 1800
Stroke Length: 0.6" (15 mm)
Lockoff Trigger Start
Variable Speed
Swivel Air Inlet

1300

SC010S Series Cut Off Saw

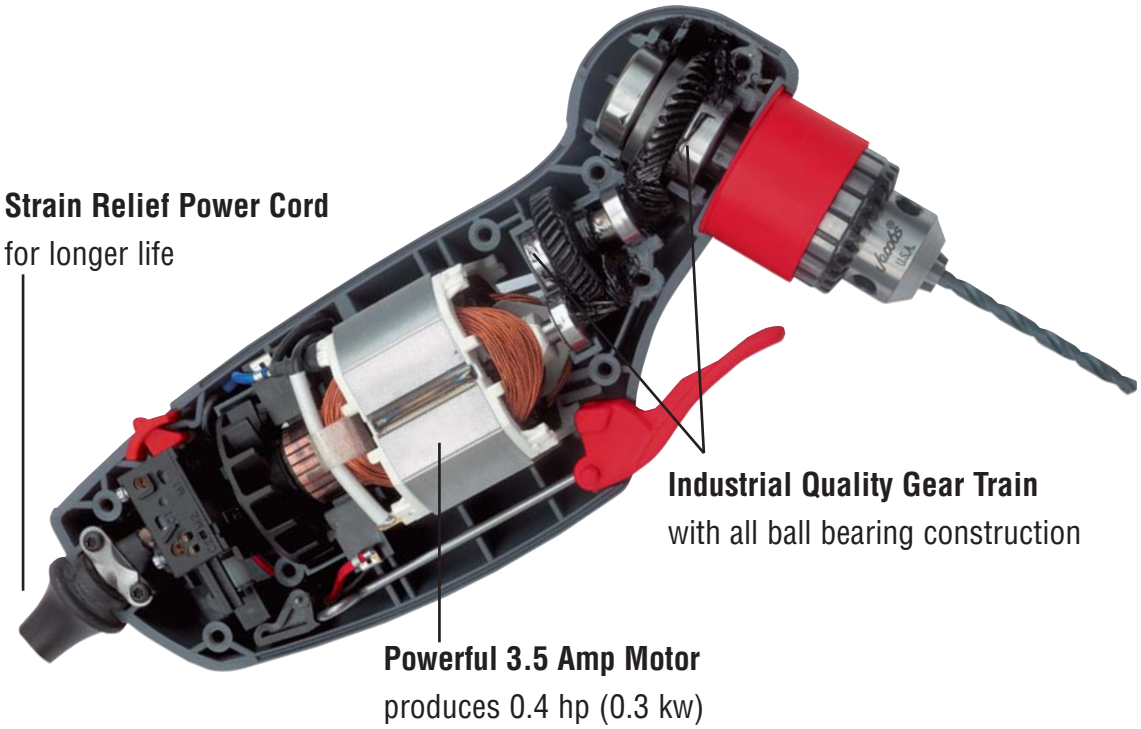
Power: 1.0 HP

Speed: 20,000 RPM & 25,000 RPM

Blade Diameter: 3" & 4"

SC010S253F

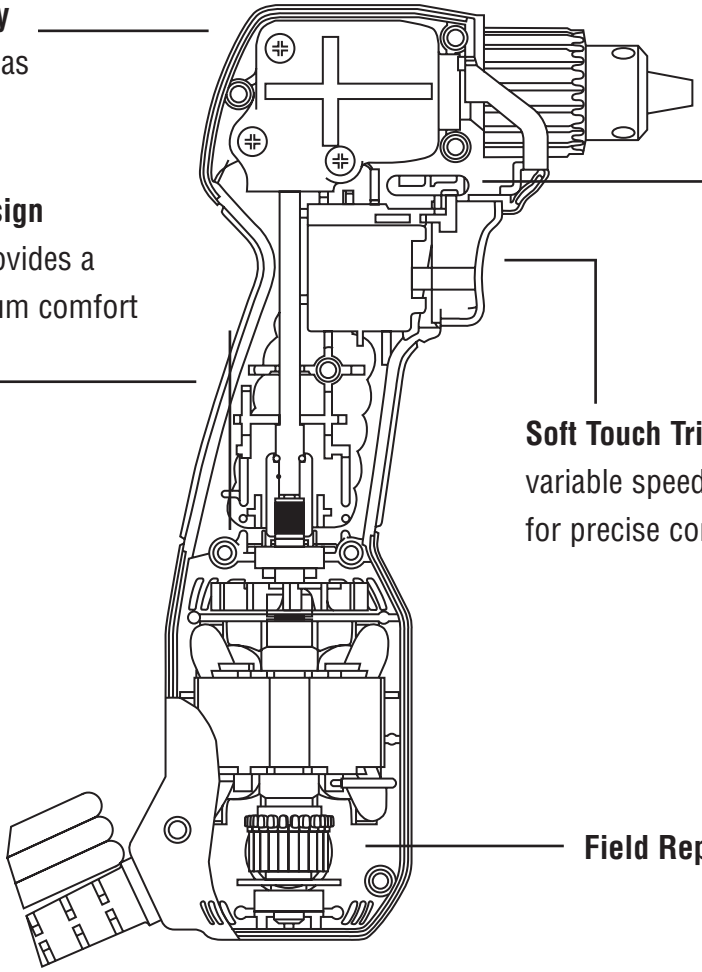
8000 Series



The 8000ES Series drills are designed to fit tight angles, but their power and comfort make them an excellent choice for all drilling applications. Operators like the feel and handling of these drills, and find them easy to control and comfortable to use over long periods of time.

The double insulated motor ensures operator safety and eliminates the need for grounding. From top to bottom the 8000ES provides high-tech design that allows you to handle any application as efficiently as possible.

8800 Series



The ergonomically designed smaller handle and cushioned grip provides thermal insulation and vibration dampening for an extremely comfortable no-slip grip. And the one-hand reversing makes changing directions easy especially in those tight situations.

The Sioux Tools 8800ES electric drill is perfect for woodworking and furniture manufacturing, automotive maintenance, construction and general industrial applications.

Section 11

Quiz Section

Sioux Tool Industrial Training Manual

Section 11.1

Quiz #1

Sioux Tool Industrial Training Manual

Name: _____

1. Rotary motors began to replace piston air motors to reduce vibration.

True False

2. The fan blades in the air motor keep the air pressure at 90 PSI.

True False

3. The higher the air pressure, the greater the performance of the tool.

True False

4. Air tools are designed to be re-built only one time and replaced

True False

5. A Home Depot 3/4" h.p. portable air compressor will drive most air tools.

True False

6. An adjustable clutch tool shuts off the air to the motor when preset torque is reached.

True False

7. In drilling of molded plastics such as: resins, phenolics, or acrylics, the most important thing is low cutting speeds.

True False

8. It is generally better to use a slower RPM tool when installing fasteners in soft material to prevent stripping threads or a pull-out.

True False

9. Positive clutch tools are usually specified where close torque tolerance is required in fastener installation.

True False

10. Choosing the correct drill speed and feed will provide the highest rate of production.

True False

11. When recommending a portable drill, the most important thing to know is how many holes a day will be drilled.

True False

12. A soft pull-up is one where a gasket or spring is found between two plates being fastened.

True False

13. A pistol grip tool is best suited for installing fasteners into a work surface which is horizontal.

True False

14. Soft pull-up jobs tend to take less time to reach final torque than hard pull-up applications.

True False

15.Pulse tool technology has been around since 1985 and introduced to the U.S. by the Japanese.

True False

16.Hardened chrome sockets are designed to withstand the forces of the impact wrench.

True False

17.Air tools must never be used under-water as that will make them rust.

True False

18.The flutes of a drill provide cutting lips at the point of the drill bit, and permit removal of chips.

True False

19.The drill flutes can be helical or straight groves cut into the body of the drill.

True False

20. Explain 5 of the following: Torque, Clamp Load, Friction, Prevailing Torque, Tension, Pre-load, Yield, Dynamic Torque, Static Torque, Hard pull-up, Soft pull-up.

1.

2.

3.

4.

5.

Section 11.2

Quiz #2

Sioux Tool Industrial Training Manual

Name: _____

1. Which of the following clutches are best suited for a soft pull-up?

Rocking Dog Pin Twin hammer

2. Products of Sioux Tools, Inc. are warranted to be free from defects in material and workmanship for_____?

One Year Two Years Lifetime

3. Soft pull-up jobs tend to take less time to reach f nal torque than hard pull-up applications.

True False

4. Maximum force of a tandem 1-1/2" pneumatic riveter is found through out the stroke.

True False

5. Low torque to the fastener can occur if the operator releases the throttle before the motor reaches stall.

True False

6. The faster the screw is driven, the greater accuracy is achieved in plastics.

True False

7. Clamping torque is the amount of tension applied to the turning torque.

True False

8. Friction is what keeps nuts from falling off.

True False

9. If operator "wrenches" the shut-off screwdriver, additional torque can be transmitted to the fastener.

True False

10. A soft pull-up joint is one in which the fastener turns only 90˚ after initial joint resistance is met.

True False

11. A self-threading screw may require greater torque to cut the thread than the joint may ultimately require upon seating the head of the screw.

True False

12. When recommending a portable drill, the most important things to know are how many holes and what size will be drilled.

True False

13. The formula for Torque is T= S x R

True False

14. Explain four of the following: Torque, Clamp Load, Friction, Prevailing Torque, Tension, Pre-load.

1.

2.

3.

4.

15. Explain four of the following. Yield, Dynamic Torque, Static Torque, Torque rate, Hard pull-up, Soft pull-up.

1.

2.

3.

4.

16. Describe and identify strengths and weaknesses. Twin hammer, Rocking Dog, Pin type, Three-Jaw.

1.

2.

3.

4.

17. Explain benefits of pulse tools vs. impact wrenches. Torque control, Vibration, Noise, Maintenance, Purchase price.

1.

2.

3.

4.

5.

18. Explain the relationship between bore & stroke vs. power of hammers.

1.

19. Explain: Direct drive, Positive clutch, Adjustable clutch, Torque control clutch

1.

2.

3.

4.

Section 11.3

Quiz #3

Sioux Tool Industrial Training Manual

Name: _____

Select the proper tool for the following applications:

1. Mobile Home plant
   #12 machine screws
   112 in/lbs
   Screwing through aluminum / fiberglass / wood

2. Aircraft manufacturing
   #12 screws
   40 in/lbs
   Pistol screwdriver

3. Lawnmower manufacturing
   Transmission to Chassis 38 ft/lbs
   Motor to Chassis 43 ft/lbs
   + less than 20%
   Option #2
   + less than 15%

4. Television assembly
   #10 screw thru plastic
   20 in/lbs
   Need torque control
   Need pistol and straight tools

5. Bush Hog Manufacturing
   Blade to Transmission
   300 ft/lbs + 8-10%

6. Communication repair
   45 ft/lbs
   3/8" impact
   Straight tool
   Operate off of nitrogen

7. Aluminum window manufacturing
   #8 self-tapping screw
   Low striping torque
   Used throughout plant

8. Drilling hole underwater
   50' below surface
   1/2" hole
   Hard to hold

9. Stadium construction
   1000 ft/lbs
   A490 1" bolts
   + 20%

10. Wood furniture plant
    Dust-free environment
    Random orbital plan
    12,000 rpm