GRANITE 1300 SERIES
COMBINATION LATHE/MILL/DRILL

OPERATOR'S MANUAL

Updated April, 2008

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All images shown are from Granite Classic 1324 model.
All other images for other Granite models are specified.

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While every precaution has been taken in the preparation of this manual, Smithy Co. shall not have any liability to any person or entity with respect to any loss or damage caused or alleged to be caused directly or indirectly by the instructions contained in this manual. Please see section on warranty and safety precautions before operating the machine.

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Introduction 1

Welcome

Congratulations on the purchase of your Smithy Granite machine. We welcome you to the Smithy family. Smithy strives to provide you with the best in machine tools. Please read through this manual carefully to ensure that you get the most out of your Granite 3-in-1 lathe-mill-drill.

The purpose of this manual is to give beginning thru advanced machinists the information needed to operate the Smithy Granite 1300 series. It will teach you about the machine's parts and how to care for them. Most of the photographs in this manual show the GN-1324 model. Individual model variations will be noted as necessary. This manual is complete and current at the time of printing*. In our continuing effort to bring you the best in machine tools, changes may be made. Please visit us at **www.smithy.com** for the latest updates.

This manual—and any other manuals associated with this Smithy machine—should remain with the machine. If ownership changes, please include the Quick Start Manual and the Operating Manual with the machine.

Please read the operating manual carefully and closely follow the procedures described. If you don't understand how your machine works, you risk injury to yourself or others. Misuse of the machine can lead to damaging it or your project. To learn more about general machining practices, Smithy offers books that meet the needs of machinists with varying levels of experience. We also suggest your local library as a resource. Enrolling in a machining class will give you the best knowledge of machining.

*Last Update: 06/16/2008
Version 1.02

Suggestions or Comments

We are interested in any suggestions you might have to improve our products and services. Feel free to contact us with your suggestions by phone or in writing. If you have comments about this operator's manual, or if you have a project you'd like to share with other Smithy owners, contact the Smithy Company, P.O. Box 1517, Ann Arbor, MI 48106-1517. You can also e-mail info@smithy.com 24 hours a day.

Questions?

If you have questions not covered in the manuals, please call our toll-free number:

1-800-476-4849

Our friendly service technicians are available Monday through Friday from 8:00 a.m. to 5:00 p.m. Eastern Standard Time. You can also e-mail your questions 24 hours a day to **info@smithy.com**.

Customer Information

Please record the information below about your Smithy machine. Having this information readily available will save time if you need to contact Smithy for questions, service, accessories, or replacement parts.

Model number:___________________________________

Serial Number: __________________________________

Purchase Date: __________________________________

Delivery Date: __________________________________

We look forward to a long working relationship with you, and thank you again for putting your trust in Smithy.

Safety 2

Overview

Smithy machines are proven to be safe and reliable; however, if abused or operated improperly, any machine can cause injury. Please read this manual carefully before you start machining. Proper use will create a safe working environment and prolong the life of your machine.

Symbols Used In This Manual

In this manual, the symbols below draw attention to specific operating issues.

⚠ CAUTION	Potential hazard, unsafe situation, or potential equipment damage that may result in injury to yourself or damage to your machine.
⚠ DANGER	Hazardous situation which if not avoided could result in series injury or death.
⚠ WARNING	Potential hazard, unsafe situation, or equipment damage could result in death or serious injury.
! NOTICE !	Alerts user to helpful and proper operating instructions.

Shop Safety Rules

Your workshop is only as safe as you make it. Take responsibility for the safety of those who use or visit it. This list of rules is by no means complete, so remember that common sense is a must.

DANGER

Smithy strongly discourages the use of casters or wheels on metal-working machine benches. The weight of the machine could result in the bench tipping while being moved. Once the machine is mounted, consider your workbench to be permanent. If you must move the machine, first remove it from the bench

WARNING

1. **Read this manual thoroughly before operating your machine**. Don't try to do more than you or your machine can handle. Understand the hazards of operating a machine tool. In particular, remember never to change speeds or setups until the machine is completely stopped and never operate it without first rolling up your sleeves.

2. **Wear proper clothing.** Avoid loose-fitting clothes, gloves, neckties, or jewelry that could get caught in moving parts. If you have long hair, tie it up or otherwise keep it from getting into the machine. Always wear non-slip footwear.

3. Protect yourself. Use ANSI approved safety glasses, goggles, or a face shield at all times. Use safety glasses designed for machinery operation; regular glasses will not do. Have extras available for visitors. Know when to wear a face mask or earplugs as well.

4. Keep your work area clean and organized. Cluttered work areas and benches invite accidents. Have a place for everything and put everything in its place.

5. Childproof your work area and keep children away from the machine while it is in use. Childproof your shop with padlocks, master switches, and starter keys or store the machine where children do not have access to it.

6. Never operate your machine under the influence of drugs and alcohol.

7. Keep track of tools. Remove adjusting keys and wrenches from the machine before operating. A chuck key or misplaced Allen wrench can be a safety hazard.

8. Avoid accidental starts. Turn the switch to the **OFF** position before plugging in the machine. Turn the speed dial to zero before starting your machine.

9. Ground your machine. The machine has a three-conductor cord and three-prong, grounding-type plug. Never connect the power supply without proper grounding

10. Keep your mind on your work. By paying attention to what you are doing and avoiding distractions you will spend many safe, enjoyable hours in your workshop.

11. Never leave your machine running unattended.

Machine Safety Rules

⚠ WARNING

1. Stop the machine before servicing. Stop the machine before making changes, removing debris, or measuring your work.

2. Don't over reach. Don't reach over the machine when it's operating. Keep your hands out of the way.

3. Turn the switch OFF. Turn the switch to off before plugging in the machine. Turn the speed dial to zero before starting your machine.

4. Use proper tooling. Use only recommended accessories and understand how they should be used before trying them out. Don't try to make a tool into something it isn't or attempt to use a tool in inappropriate ways. Remember to always use the proper tooling for the material you are cutting. Reference a general machining guide such as Machinist Ready Reference for recommended tooling for your material.

5. Secure your work. Before starting your machine, be certain that your workpiece is properly and securely mounted. Flying metal is dangerous!

6. Do not run you machine beyond its limits of travel. Before starting your project, ensure that your work area does not go beyond the limits of travel on your machine. Going beyond the limits of travel will cause serious damage to your machine which will not be covered by your warranty.

7. Run your machine at recommended spindle speeds and feed rates. Always cut at the recommended speed and feed rates for the type of metal that you are cutting for optimum performance. Do not begin your cut until the machine has reached the full and proper speed.

8. Do not change the direction of the spindle rotation or leadscrew rotation while your machine is running. Changing the rotation direction of the spindle or leadscrew while your machine is running could cause serious damage to your machine.

9. Do not stop the spindle by hand. Always use your on/off switch to stop the spindle from rotating.

10. Do not clear chips by hand. Metal chips are very sharp and can easily cut your hand. Use a brush to clear chips.

11. Protect bed ways. When removing or installing tooling from your lathe spindle, place a piece of wood or other material across the bed to protect the ways from being damaged if the tooling is dropped.

12. Keep your machine maintained. Always replace worn or damaged parts before using your machine to prevent damage to your machine or the operator. Follow the maintenance schedule outline in this manual for peak performance.

3 Inventory Check List

Overview

It is a good idea to take inventory of the parts of your machine soon after it is unpacked. By doing so, you can quickly determine if any parts are missing. In addition, should you find it necessary to return the machine to Smithy for any reason, the inventory will ensure that all the parts you received have been returned.

A third reason to perform an inventory is to become familiar with the names of all of the parts of your Smithy machine. To aid with this, the following parts lists have individual photos of the items listed.

Items Mounted To Your Machine

The items listed below are shipped mounted on the Smithy Granite. Kindly check if the following items are present. Use the box before the item as your reference.

❑ **6” 3 Jaw Chuck**
Part # G03046
Quantity 1

❑ **Compound Angle Toolpost**
Part # 45-110
Quantity 1

❑ **7/16” Drawbar**
Part # K99-168
Quantity 1

Items Packed in the Larger Smithy Box

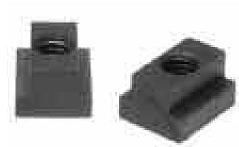
The following items are packed in the larger of the two Smithy boxes.

❑ **Air Mask**
Part # 15-020
Quantity 1

❑ **Protective Goggles**
Part # 15-015
Quantity 1

❑ **Ear Plugs**
Part # 15-025
Quantity 1 Set

❑ **Oil Can**
Part # 80-100
Quantity 1



❑ **7/16" T-Slot Nuts**
Part # 35-105
Quantity 2

❑ **Vise, 0-90º Adjustable Angle**
Part # 32-110
Quantity 1

❑ **End Mill, 4 FL HSS 1/4" w/3/8" Shank**
Part # 50-402
Quantity 1

❑ **End Mill, 4 FL HSS 3/8" w/3/8" Shank**
Part # 50-406
Quantity 1

❑ **End Mill, 4 FL HSS 1/2" w/3/8" Shank**
Part # 50-410
Quantity 1

❑ **End Mill Adapter R-8**
Part # 65-028
Quantity 1

❑ **Lathe Bit Set**
Part # 43-000
Quantity 1 Set
(AR-8,AL-8,BR-8, BL-8 & E8)

❑ **Lathe Chuck Key**
Part # C30532
Quantity 1

- [ ] **Drill Chuck, JT3, 0.8-16 mm with key (for millhead)**
Part # 72-003
Quantity 1

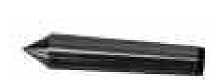
- [ ] **Drill Chuck Arbor, R-8/JT3**
Part # 73-080
Quantity 1

- [ ] **Drill Chuck, JT33, 0.8-13 mm with key (for tailstock)**
Part #72-001
Quantity 1

- [ ] **Drill Chuck Arbor, MT3/JT33**
Part # C30523
Quantity 1

- [ ] **Arbor Plug (M12 x 1.5 x 20 mm setscrew)**
Part # S12898
Quantity 1

- [ ] **MT3 Dead Center**
Part #41-003
Quantity 1



- [ ] **MT4 Dead Center**
Part # 41-004
Quantity 1

- [ ] **6" Adjustable Wrench**
Part # G20006
Quantity 1

- [ ] **13/16 mm Open End Wrench**
Part # G20131
Quantity 1

- [ ] **10/12 mm Open End Wrench**
Part # G20101
Quantity 1

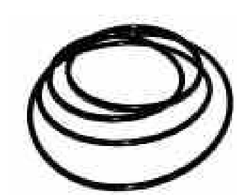
- [ ] **Allen Wrench, 3 mm**
Part # G20003
Quantity 1

- [ ] **Allen Wrench, 4 mm**
Part # C30540
Quantity 1

- [ ] **Allen Wrench, 5 mm**
Part # C30542
Quantity 1

- [ ] **Allen Wrench, 8 mm**
Part # C30536
Quantity 1

- [ ] **Allen Wrench, 10 mm**
Part # G20002
Quantity 1



- [ ] **Belt Set Millhead Belt (Shipped On Machine)**
Part # G05042 -A900 Or
Part # G05042A 1/2"
Quantity 1

❑ **Spindle to Speed Reduction Pulley Belt**
Part # G02043-A630 Or
Part # G02043A 1/2” x 27
Quantity 1

❑ **Speed Reduction Pulley To Motor Pulley Belt**
Part # G02034-A710 Or
Part# G02034A-1/2” X 30
Quantity 1

❑ **Spindle to Motor Pulley Belt (Shipped On Machine)**
Part # G03020 Or
Part # G03020A-1/2” x 41”
Quantity 1

❑ **Crossfeed Handle & Rack & Pinion Travel Handle**
Part # G08031
Quantity 2

Items Packed in Smaller Smithy Box

❑ **Outside Jaws for Lathe Chuck**
Part #
Quantity 1

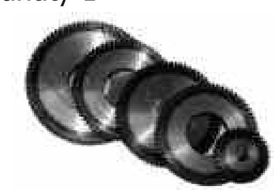
❑ **Spindle Cover**
Part # G05057
Quantity 1

❑ **Millhead Crank**
Part # G05123
Quantity 1

❑ **Handle for Leadscrew Handwheel**
Part # G01028
Quantity 1

❑ **Wrench, Compound Angle Toolpost**
Part # G06039
Quantity 1

❑ **Spanner Wrench**
Part # G20001
Quantity 1



❑ **Metric Gear Set**
Gear,33 Teeth
Part # G10116
Quantity 1

❑ **Gear,63 Teeth**
Part # G10117
Quantity 1

❑ **Gear,64 Teeth**
Part # G10118
Quantity 1

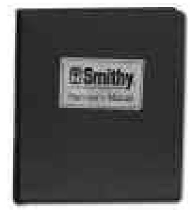
❑ **Gear,66 Teeth**
Part # G10119
Quantity 1

❑ **Gear,80 Teeth**
Part # G10120
Quantity 1

Items Packed in Plastic Bag

❑ **DVD, Machine Tool Basics**
Part # 12-003
Quantity 1

❑ **Manual Cover**
Part # 83-942
Quantity 1

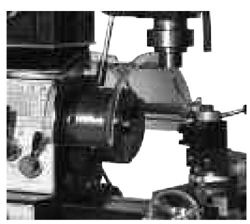


❑ **Operator's Manual**
Part # 83-950
Quantity 1

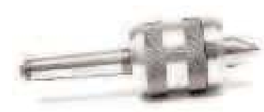
Additional Items for GN-IMX Series

❑ **Quick Change Toolpost* (Mounted)**
Part # 45-271
Quantity 1

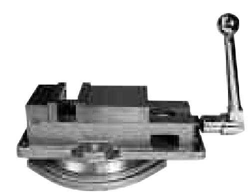
❑ **Chuck Guard (Mounted)**
Part # 15-610
Quantity 1



❑ **Live Center** (Large Box)**
Part # 41-103
Quantity 1



❑ **3" Superlock Vise*** (Large Box)**
Part # K99-310
Quantity 1



* Quick Change Toolpost replaces standard turret for IMX series.
** Live Center additional item for IMX series.
*** Superlock Vise replaces angle vise for IMS series.

Missing Items?

If you find that an item is missing or defective from your Quick Start Tool Pack

Call Us TOLL FREE 1-800-476-4849
or send an e-mail to info@smithy.com

within 30 days of receiving your machine so that we may assist you immediately.
Our sales and service technicians are available 8am to 5pm ET, Mondays to Fridays.

Machine Overview 4

Overview

This chapter will help you to familiarize yourself with the Smithy Granite 1300 models and standard accessories. Figures 4.1 through 4.15 identify the major components and functions of your machine. The photographs in this section depict a Granite 1324 model. Distinguishing features are noted.

Major Features Identified

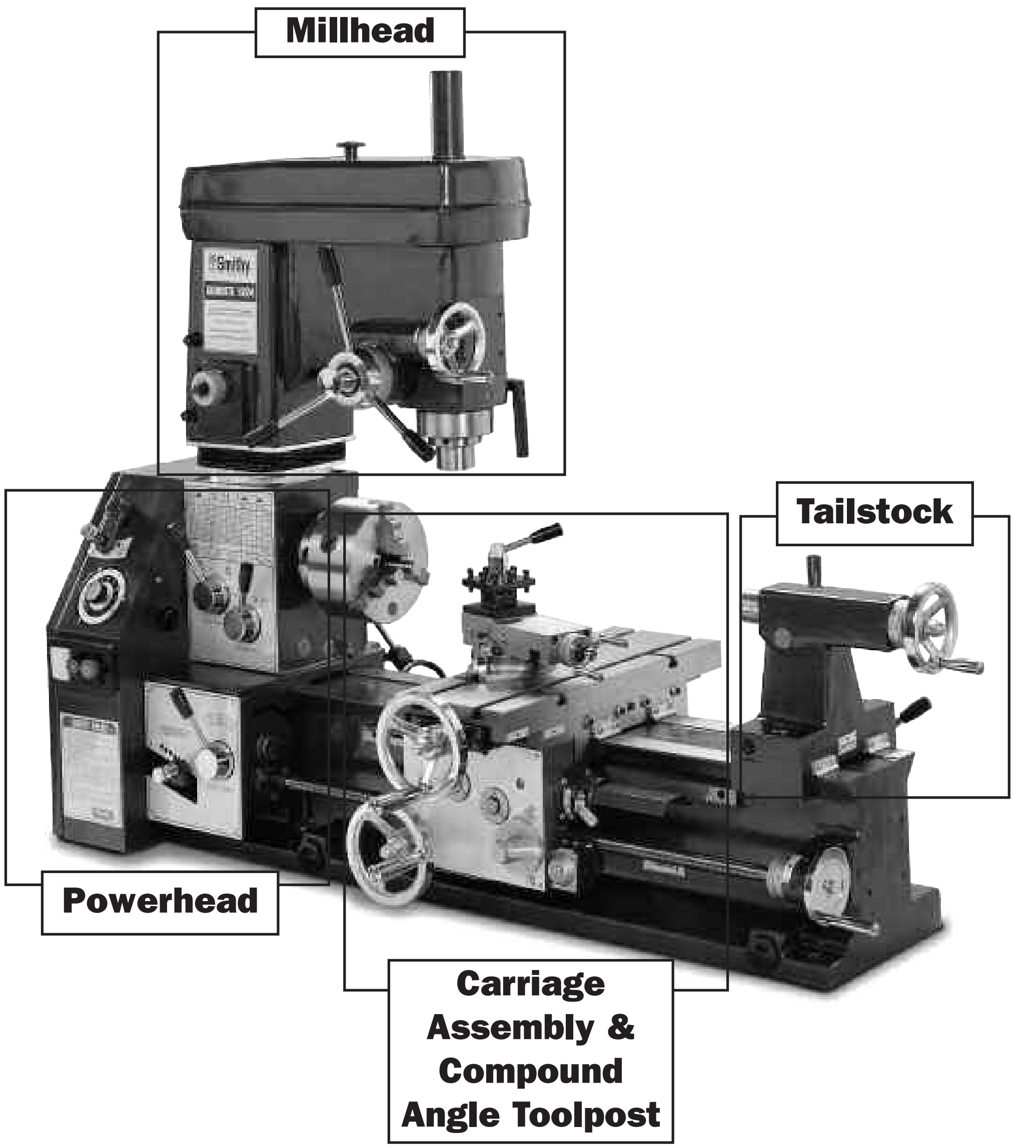


Figure 4.1 Granite 1324 Front View

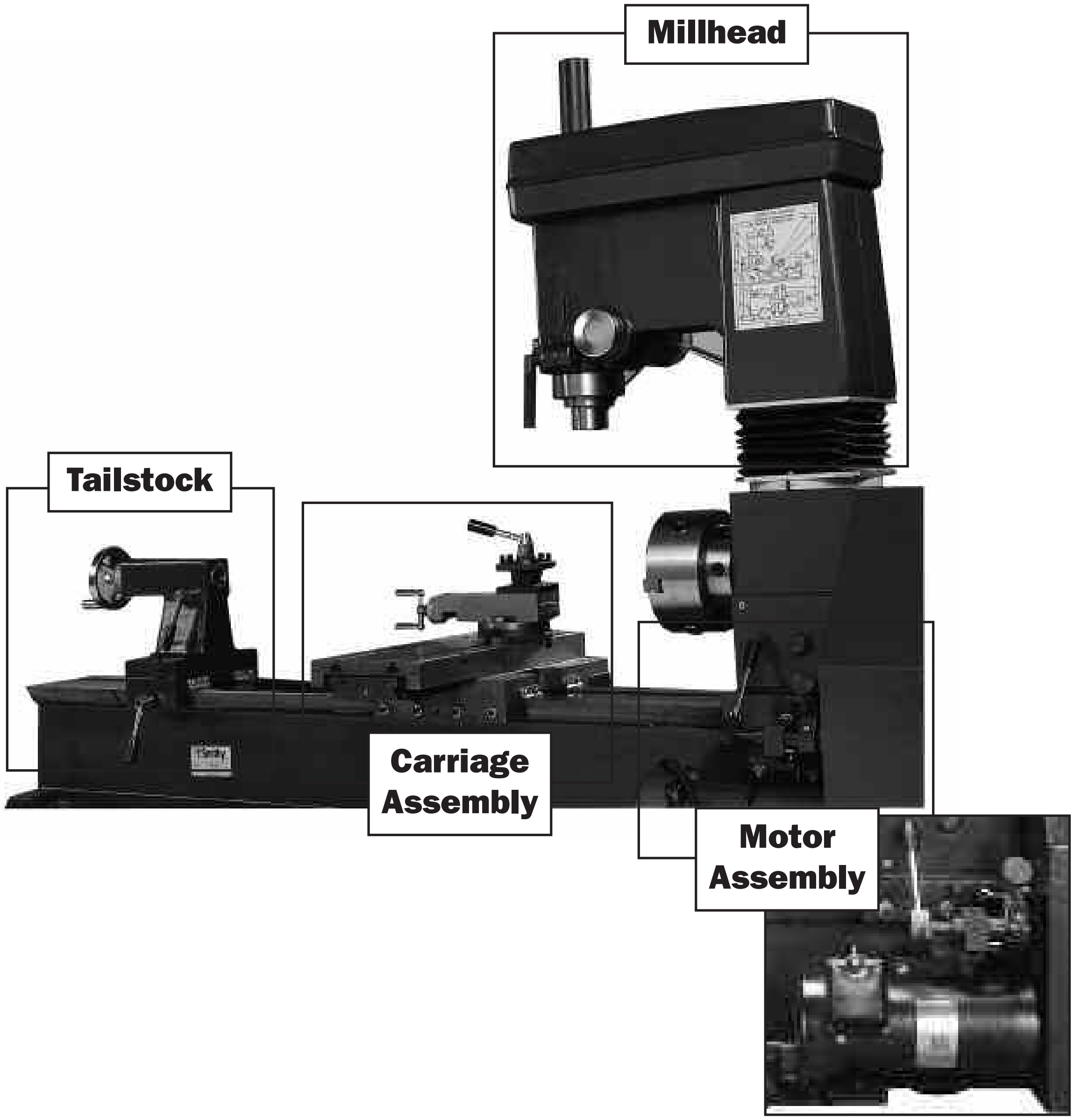


Figure 4.2 Granite 1324 Back View

Millhead Components & Functions

The photos below show the front and back of the millhead of the Smithy Granite machine. The millhead holds the tooling necessary to perform milling and drilling operations. The following section identifies the components and functions of the millhead.

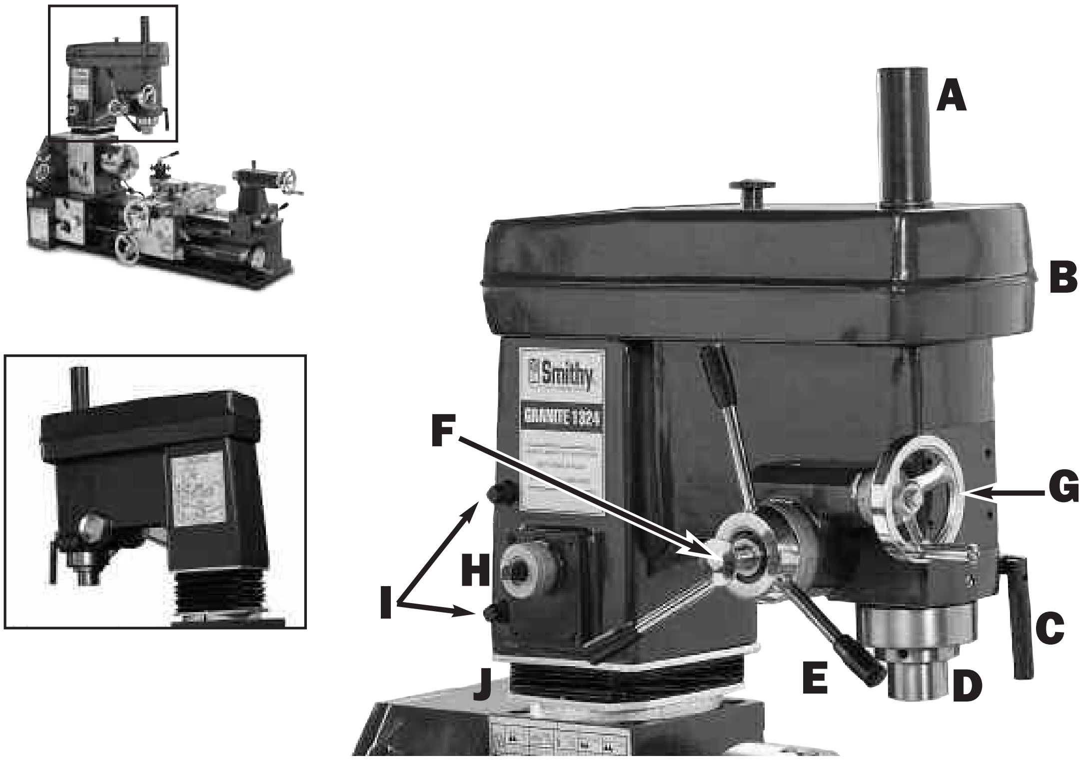


Figure 4.3 Granite Millhead (Front & Back)

A. Spindle Cover - The spindle cover protects the spindle from dust and debris. It also protects the operator from injury. The spindle cover should be in place whenever the machine is in operation. The drawbar is located under the spindle cover.

B. Millhead Cover - The Millhead cover protects the belt and pulleys of the millhead. The cover should always be in place when the machine is in operation.

C. Quill Lock - The quill lock locks the mill/drill quill in place during a horizontal milling operation or while changing tools.

D. Mill/Drill Spindle - The mill drill spindle is an R-8 taper. It holds and rotates the the tooling used during milling and drilling operation. The spindle also moves in and out of the millhead quill. The quill is an internal part which is not seen in this picture.

E. Drill Press Handles - The drill press handles move the quill in and out of the mill head during a drilling operation. Rotating the handles in a clockwise direction moves the quill downward, out of the millhead casting.

F. Coarse Feed/Fine Feed Clutch - Pulling out the coarse feed/fine feed clutch knob engages the drill press handles/coarse feed. Pressing the knob in engages drill/mill fine feed hand wheel. To easily engage/disengage the clutch, rotate the drill press handles slightly while pulling/pushing the knob.

G. Drill/Mill Fine Feed Handwheel - The handwheel controls the fine feed movement of the quill in and out of the millhead.

H. Height Adjustment Drive - The height adjustment drive works with the millhead crank to raise and lower the millhead. Insert the millhead crank over the stud, as in Figure 4.4, rotate clockwise to raise the millhead and counter clockwise to lower the millhead.

One revolution of the crank handle will move the millhead 0.25 inches.

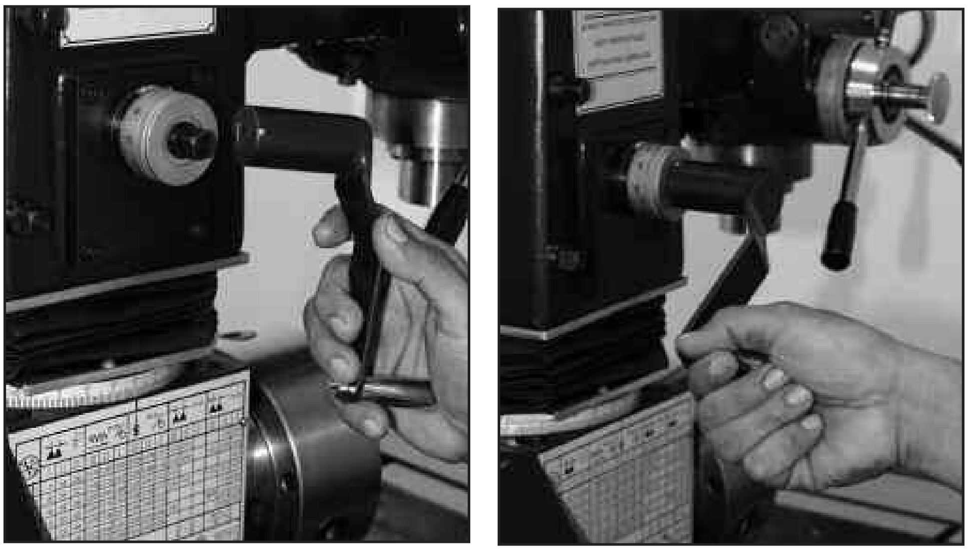
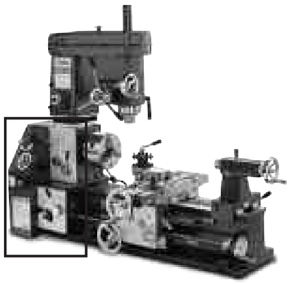


Figure 4.4 Adjusting Millhead Height

I. Millhead Locking Studs - The locking studs secure the millhead in position. Insert the millhead crank over the upper stud, rotate counterclockwise to unlock the stud. Repeat the process on the lower stud. Position the millhead in the desired position and lock BOTH locking studs before starting your machine.

J. Bellows - Bellows keep debris off of the Z-Axis column and rack.

Powerhead Components & Functions



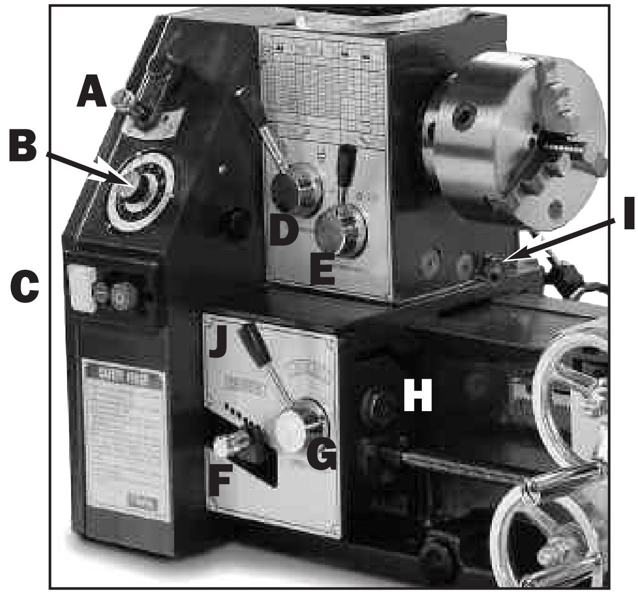


Figure 4.5 Granite Powerhead Parts (Front View)

A. Lathe/Mill Clutch - This clutch engages the mill portion of the Smithy Granite Lathe-Mill-Drill when pulled out and moved to the left. When moved to the right the lathe is engaged. Center position is neutral.

B. Speed Dial - The speed dial controls the motor rpm. Rotating clockwise increases the speed.

C. Forward/Reverse & On/Off Switch - The red toggle button underneath the yellow cover reverses the direction of the motor. The green middle button is the "power-on" button. The large red button is the stop button and cuts power to the machine.

D. Powerfeed Function Lever - Moving the lever to the left, powers the lathe powerfeed. Moving the lever to the right powers the mill powerfeed.

E. Leadscrew Rotation Direction Handle - Positioning this handle to the right causes the leadscrew to rotate clockwise. Positioning to the left causes the leadscrew to rotate counterclockwise.

F. Selector Lever 1-7 - Used in conjunction with Selector Lever I-III to set feed rate or pitch setting for cutting threads.

G. Selector Lever I-III - Used in conjunction with Selector Lever I-7 to set feed rate or pitch setting for cutting threads.

H. Jog Knob - Assists in meshing gears inside the quick change gear box which is controlled by selector levers 1-7 and I-III. Rotating the knob helps align gears

I. Oil Level/Sight Glass - Normal oil level is at the half way point, add oil if the level of oil in the sight glass drops below this level.

J. Quick Change Gear Box - Houses the gears that determine feed rates and gear settings for cutting threads.

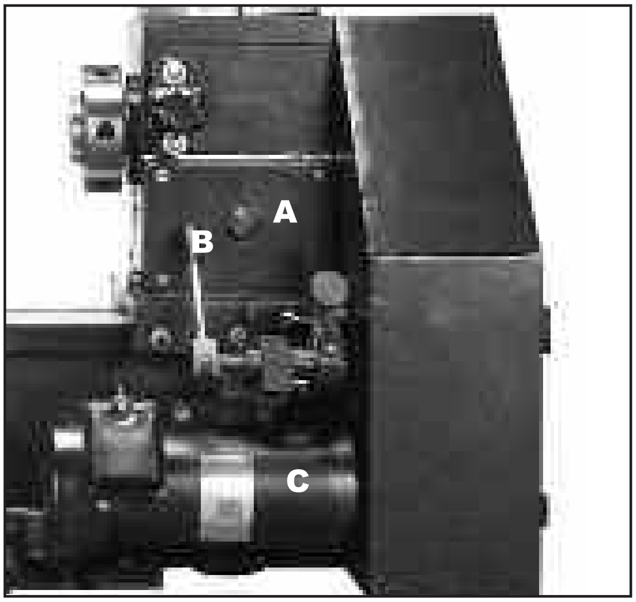


Figure 4.6 Granite Powerhead Parts (Back View)

A. Oil Fill Port - Located directly above the motor, it holds 8-10 oz of 30 weight oil. Remove the screw to add oil as necessary.

B. Belt Tension - Moves the motor pulley up and down releasing tension on the belts. Pull the lever down to loosen the tension on the belt and push the lever up to add tension to the belts.

C. DC Motor - Runs on standard 110 volt power.

Pulley Box

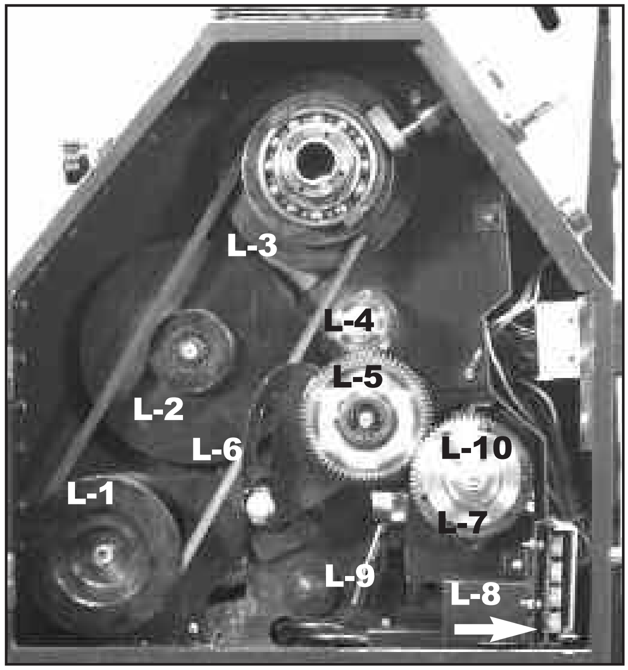


Figure 4.7 Granite Pulley Box (Inside)

The pulley box houses the drive pulleys, gears and power components.

L-1. Motor Pulley - A three-step pulley attached to the shaft of the motor.

L-2. Speed Reduction Pulley - Sits between the motor and spindle pulley and is used for low speed operations when increased torque is desired.

L-3. Spindle Pulley - A two-step pulley attached to the main lathe spindle.

L-4. Change Gear A - A 30-tooth gear installed at the factory. The change gears only need to be reconfigured when cutting metric threads.

L-5. Change Gear B - A 60 tooth gear installed at the factory. The change gears only need to be reconfigured when cutting metric threads.

L-6. Change Gear C - A 66 tooth gear that rides behind change gear B (60 tooth gear) and is installed at the factory. The change gears only need to be reconfigured when cutting metric threads.

L-7. Change Gear D - A 60 tooth gear installed at the factory.

L-8. SCR Module - Converts the AC power coming into the machine to DC power for the motor.

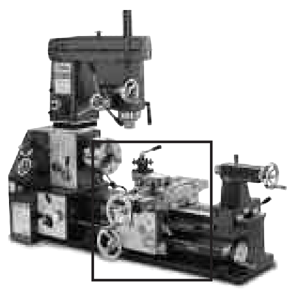
L-9. Inch/Metric Selector - Used when cutting threads. Pull the lever out toward the operator when cutting metric threads. When cutting inch (SAE) threads, make sure the lever is pushed in toward the machine.

! NOTICE !

There is a neutral position with this selector. Be sure that it is completey engaged in either the metric or inch mode before you begin your threading operation.

L-10. Leadscrew Clutch- Is designed to slip to reduce damage to the machine apron if the carriage is accidentally run into the head of the machine.

Carriage Assembly



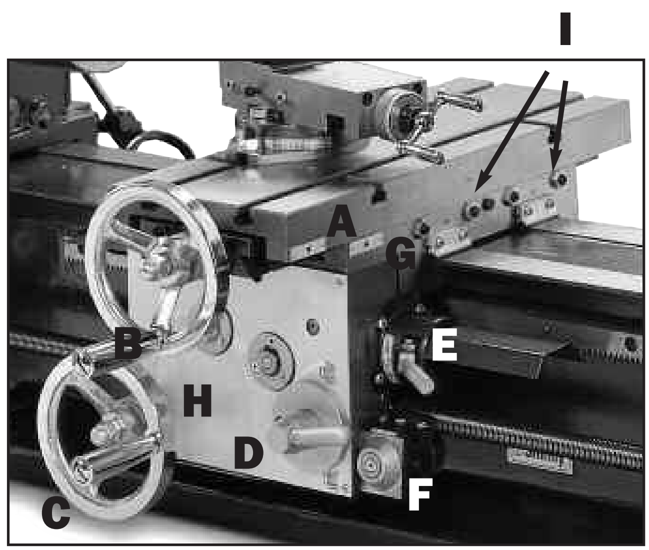


Figure 4.8 Granite Carriage Assembly

The carriage assembly consists of:

- Crossslide table
- Carriage; the lower portion of the table that rides on the bed ways,
- Apron; the portion that hangs from the cross-slide table in front of the machine.

The carriage moves by hand or by power along the bed ways. Its function is to support the cutting tool rigidly while in the lathe mode and to secure the workpiece while in the mill mode. The carriage can be locked into place with the lock found on the back of the carriage.

The figure to the above right identifies and defines the major components of the carriage assembly.

A. Cross-SlideTable - The top portion of the carriage assembly. It supports the compound angle toolpost (not pictured) which holds the lathe cutters and tooling. The table also supports your workpiece when operating the mill. The cross-slide table has four, 7/16" sized t-slots for securing tooling and mounting workpieces.

B. Cross-Slide Handwheel - This handwheel moves the table toward and away from the operator along the Y-Axis. Rotating the handwheel clockwise moves the table away from the operator while moving it counterclockwise moves the table toward the operator.

C. Longitudinal Handwheel - This handwheel is located at the bottom left of the carriage assembly. Manually rotating the handwheel clockwise will move the carriage assembly along the X-Axis towards the tailstock end of the machine. Rotating the handwheel counter clockwise will move the the carriage assembly towards the headstock end of the machine.One revolution moves the assembly approximately .040".

NOTE: This handwheel is for coarse movements only. Use the handwheel at the end of the leadscrew for fine movement (0.001")

D. Half-Nut Engagement Lever - This lever closes the half-nut on to the leadscrew. When the half-nut is engaged, in the down position, the table assembly will be powered to move right and left along the X-Axis leadscrew.

! NOTICE !

The half-nut engagement lever is only engaged for rapid travel or threading operations.

E. Longitudinal and Lateral Powerfeed Selector - This selector determines whether the carriage will be powered to move along the X-Axis (longitudinal axis) or the Y-Axis (lateral axis). When the lever is in the upper position the table will move along the Y-Axis. When moved into the lower position, the table will move along the X-Axis. Center position is neutral.

F. Threading Dial - The threading dial is used to coordinate consecutive cuts when cutting threads. Restarting each cut from the same point on the dial ensures that each cut follows the same path, leading to accurately machined threads.

! NOTICE !

The threading dial can only be used when cutting inch (SAE) threads.

G. Saddle - The saddle supports the cross-slide table and moves along the X-Axis of the machine.

H. Apron - The apron houses the gear mechanism for the X and Y-Axis powerfeed.

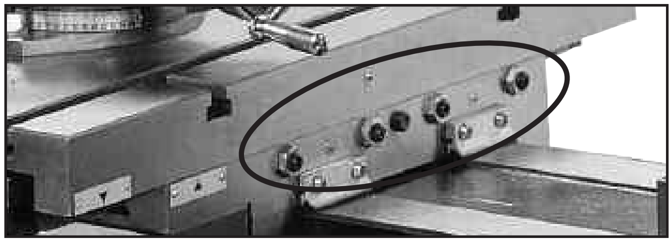


Figure 4.9 Granite Carriage Gib Adjustment Screws (Quantity 4)

I. Carriage Gib Adjustment Screws - These screws press a small metal plate (the gib) to the ways of the bed, increasing or decreasing the tension when moving the cross-slide assembly. (Figure 4.9)

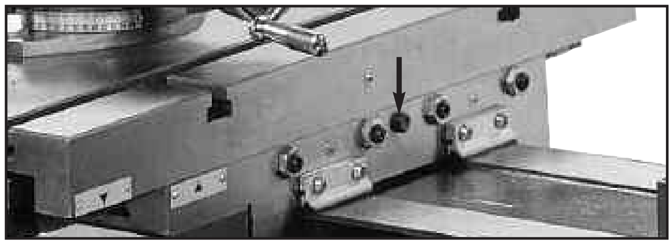


Figure 4.10 Granite Carriage Lock Y-Axis

J. Carriage Lock (Y-Axis) - is an M8 screw. Turning the screw clockwise will prohibit movement of the carriage along the Y-Axis. (Figure 4.10)

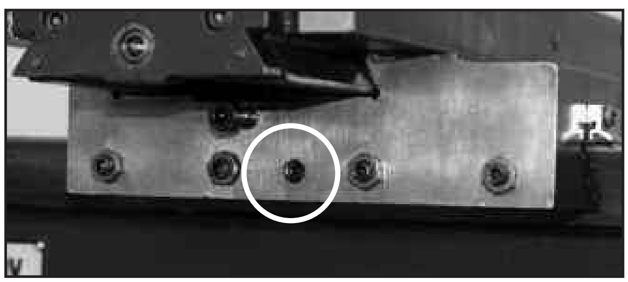


Figure 4.11 Granite Carriage Lock X-Axis (Rear View)

K. Carriage Lock X-Axis - is an M8 screw located on the back side of the carriage. Turning this screw clockwise locks the carriage to the bedways.

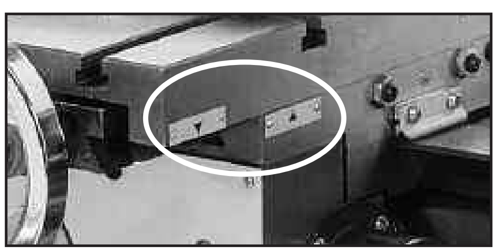


Figure 4.12 Granite Carriage Travel Indicators

L. Travel Indicators - mark the limit of travel on the crossfeed table. Running the top portion of the indicator located on the tailstock side of the cross-slide table past the lower indicator on the bottom portion of the table (carriage) will cause serious damage to your machine.

⚠ WARNING

Do not let the top indicator mark travel past the bottom indicator mark on the right side (side facing tailstock) of the carriage assembly.

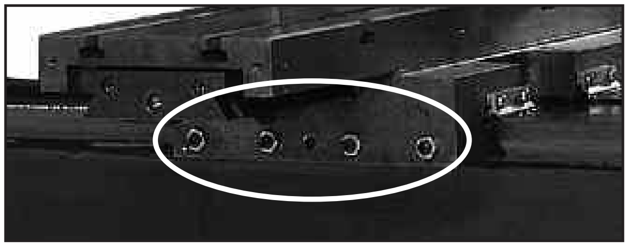


Figure 4.13 Granite Carriage Gib Adjustment Screws (Rear View)

M. Carriage Gib Adjustments Screws - when screwed in, these screws press a small metal plate (the gib) to the ways of the bed, increasing or decreasing the tension when moving the carriage assembly along the bed ways.

Carriage Assembly-Compound Angle Toolpost

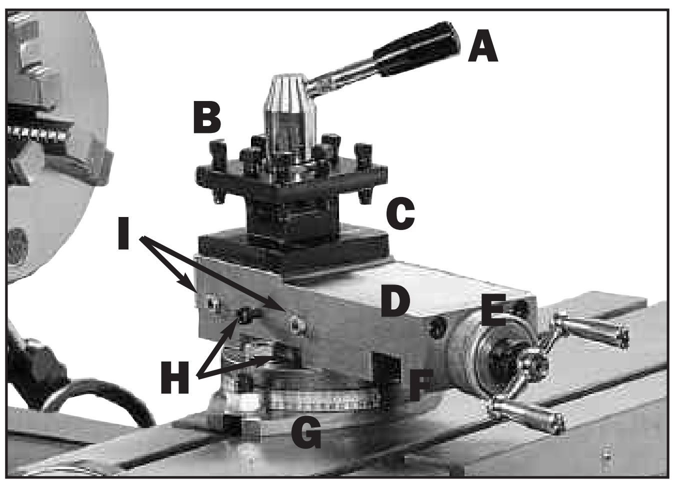


Figure 4.14 Granite Compound Toolpost

The compound angle toolpost is bolted to the cross-slide table with 10mm T-Bolts. The compound angle toolpost swivels to any angle horizontal to the lathe axis. The calibrations on the swivel base are in degrees, (60º-0º-60º). The following section identifies and explains the functions of the toolpost.

A. CATP (Compound Angle Toolpost) Lock down handle - The handle rotates counterclockwise to loosen the tension on the four position turret, allowing the user to turn the turret 90º per turn.

B. Turret Bolts - These bolts secure your tooling to the turret.

C. 4 Position Turret - The turret holds up to 1/2" tooling. The turret can support up to 4 tools.

D. Compound Slide - The compound slide moves the tooling in towards and away from the workpiece.

E. Floating Dial - The floating dial can be repositioned to zero at any point to measure tool feed in or out.

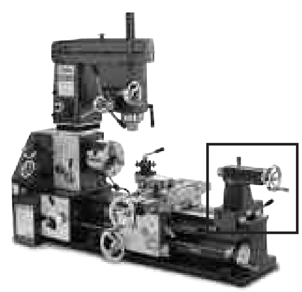
F. CATP Carriage -The carriage supports the compound slide and is bolted directly to the swivel base.

G. Swivel Base - The swivel base secures the CATP and allows it to rotate 360º in either direction. A calibrated scale at the bottom of the base shows positioning in degrees from 60º-0º-60º.

H. Slide lock - This slide lock locks the compound slide to the carriage to secure the slide in position.

I. Compound Gib Adjustment Screws - These screws press a small metal plate (the gib) to the ways of the bed, increasing or decreasing the tension when moving the compound slide.

Tailstock



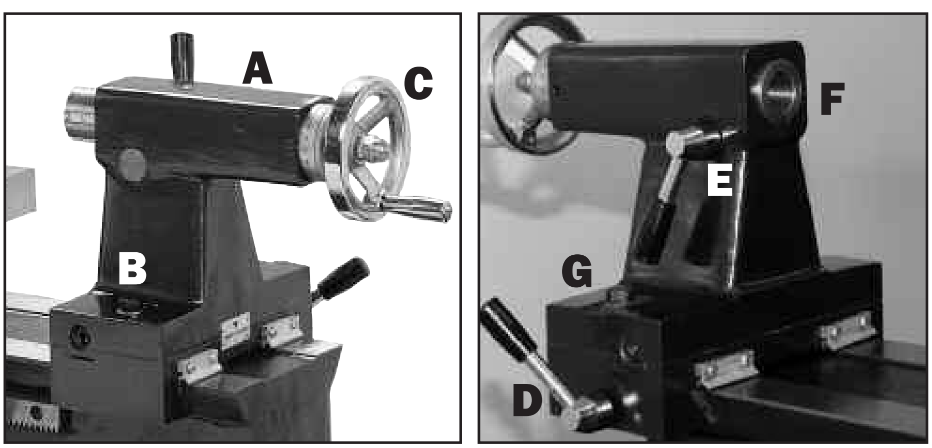


Figure 4.15 Granite Tailstock (Front & Back)

The tailstock holds tooling that supports the end of a workpiece. It also holds tooling such as center drills, reamers and taps. It moves along the bed of the machine and can be stopped and locked in position at any point on the bedways. The photos above depict the tailstock of the Granite machine. This section will identify and define major components and functions of the Granite tailstock.

A. Tailstock Body - This is the main casting of the tailstock.

B. Off-Setting Lock Bolts -These bolts lock the top base of gthe tailstock and prevent it from moving off center.

C. Tailstock Handwheel -This handwheel moves the tailstock barrel in and out of the tailstock body.

D. Tailstock Lock -This locks the tailstock body to the bed ways.

E. Tailstock Barrel Lock -This locks the barrel into position.

F. Tailstock Barrel -The barrel holds the MT3 tooling that supports the end of the workpiece.

G. Tailstock Off-Setting Bolts -These bolts allow the user to offset the toolpost for cutting tapers.

For Granite MAX and I-MAX Series Machines

The following are some of the modifications and improvements for the Granite MAX and Granite Industrial MAX machine series.

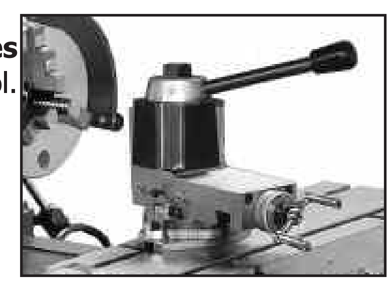
A. 30% Longer Millhead - An extended millhead to accept larger workpieces for more efficient milling operations.

B. Crash Protection System (Y-Axis) - A unique shear pin design that protects your machine from major damage if the machine is run past its limits of travel. Found inside the carriage assembly.

C. Electrical Overload Protection - Improvement on the powerhead section of the machine that safely shut offs the machine for prolonged motor life.

D. Extended Tailstock Travel - Drill or ream deeper with 3” travel, also reach farther across the table with the center securely placed in the tailstock.

E. Quick Change Toolpost (For Idustrial MAX Series Only) - The fastest, most convenient way to change a tool.



5 Preparing Your Machine For Operation

Overview

The Quick-Start Manual you received before delivery of your Smithy machine provides detailed instructions for mounting and locating your machine. Please complete those instructions if you have not already done so. As you unpack, it is a good idea to inventory the parts. (See chapter 3 for a complete list.) Before operating your machine, you should assemble the remaining components of your machine, clean the machine, and lubricate it. This section will guide you through those steps.

Assembly of Minor Components

The installation of the drill chuck, arbor and arbor plug; mill spindle covers; and several handles should be completed according to the procedures described below.

Drill Chuck and Arbor

Before proceeding both the arbor and the chuck should be thoroughly cleaned to ensure a good fit. Once cleaned attach the chucks to the respective arbors. Follow the steps below to achieve the best possible fit.

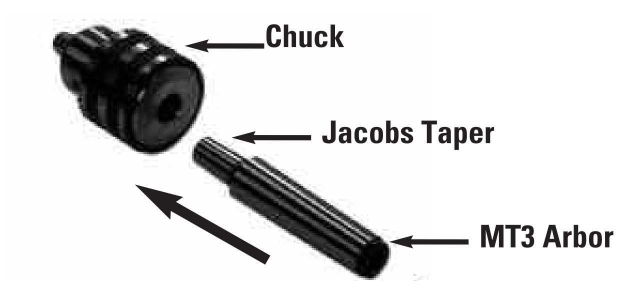


Figure 5.1 Installing Arbor into Chuck

Step 1: Place the arbor in a freezer for about 1 hour to slightly shrink the metal.

Step 2: Remove the cold arbor from the freezer and place it into the drill chuck.

Step 3: Use a soft mallet or a block of wood to tap the end of the arbor.

Step 4: Allow the arbor to return to room temperature.

! NOTICE !

Arbor Plug

Figure 5.2 Installing Arbor Plug

Install the plug setscrew (S12898 into the tailstock arbor before inserting the arbor into the tailstock. A plug is installed in the tailstock arbor (the MT3 to JT33 arbor, part number C30523), which allows the ejector pin inside the tailstock to eject the arbor when the tailstock barrel is retracted.

Morse Taper 3 (MT3) tooling is used in the tailstock of the machine. R-8 tooling is used in the millhead of the machine and used in conjunction with a drawbar.

Mill Spindle Cover

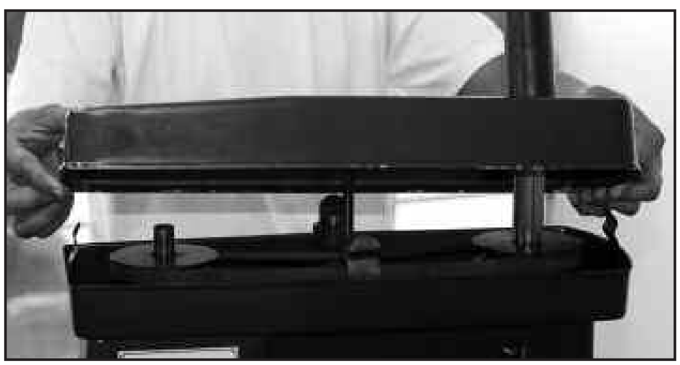


Figure 5.3 Installing Mill Spindle Cover

The mill spindle cover slides over the flange on the top of the millhead.

⚠ WARNING

Do not operate your machine without the mill spindle cover. Doing so could cause harm to yourself or your machine.

Handles

Figure 5.4 Installing Handles

Install any handles or handwheels that have been removed for shipping. Handles can be hand installed and tightened with a flat-head screwdriver. Remove and reverse the tailstock handwheel.

Cleaning & Lubricating Your Machine

Smithy machines are shipped with a light protective grease coating that must be removed prior to use. Use a noncorrosive kerosene or white mineral spirits to remove the coating. WD-40® also works well.

Once cleaned, your Smithy must be lubricated. Make sure to lubricate carefully and thoroughly before starting the machine. Use a pump oil can and a supply of good quality SAE30 weight nondetergent oil or 30-weight compressor oil. Lubricants can be obtained at most home and building supply stores. A lubrication point chart can be found on the backside of the millhead.

Lubrication Schedule

Lubrication depends a lot on the use of your machine and your climate. The schedule below is intended to be used as a guide, use your best judgement for lubricating your machine based on your use and environment.

Check Oil	**Before each use**
Oil Ports	**Before each use**
Add Oil	**As Needed**

See **Chapter 11** for a complete maintenance schedule.

Lubrication Points

Follow the instructions on the next page and refer to the lubrication chart on the backside of the millhead.

Gearbox

Open the gearbox door. Lightly grease the gears with a good quality molybdenum or lithium grease or motorcycle-chain lubricant.

Figure 5.5 Brush a thin layer of lithium grease over the gear quadrant in the pulley box

Check the oil sight glass under the chuck. If necessary, add oil until the sight glass is half full. The oil-fill plug is at the back of the headstock above the motor. Be careful not to overfill, the gearbox requires only 8 to 10 ounces of oil.

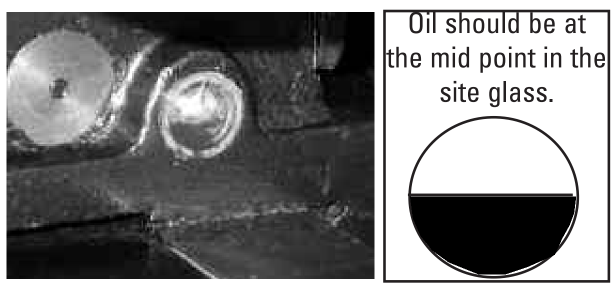


Figure 5.6 The oil level should be half way in the oil site glass located under the lathe spindle.

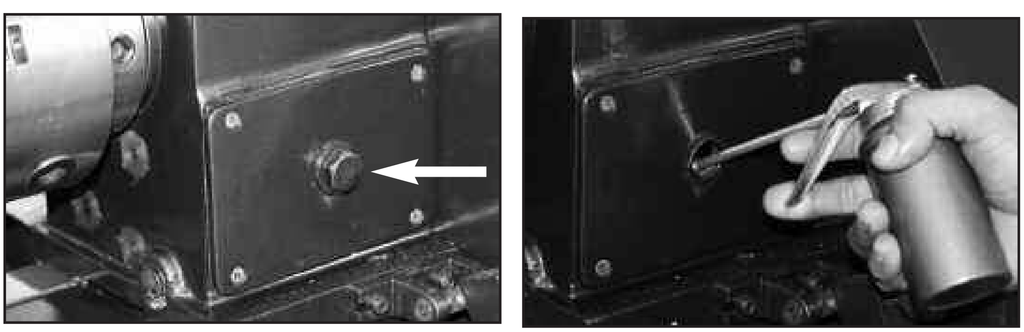


Figure 5.7 Add oil through the oil port located on the back side of the headstock.

Ways

Run the carriage as far to the left as possible. Put a few drops of oil on the ways. Run the carriage to the extreme right and repeat.

Carriage Assembly-Saddle

Lubricate the four oil buttons of the cross-slide table

There are two buttons on both the right (tailstock) side and left side (head stock) of the carriage for the ways.

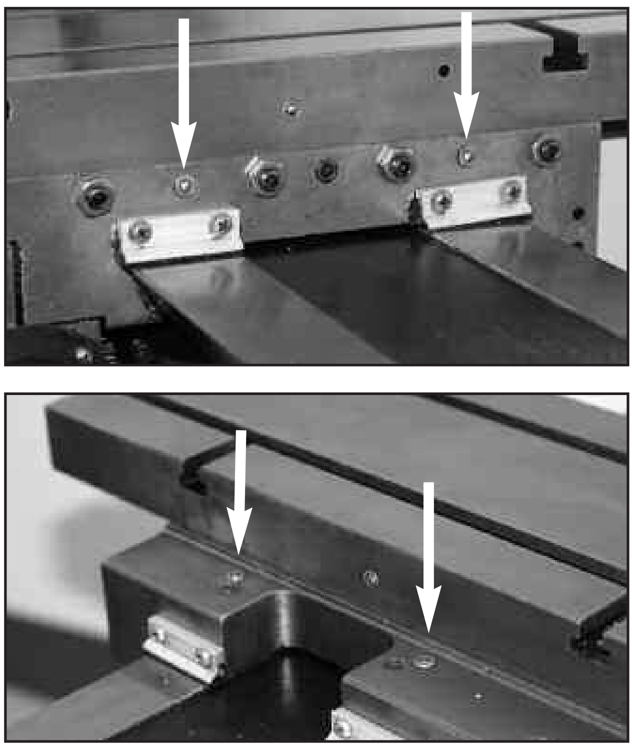


Figure 5.8 Carriage Assembly Saddle Oil Points

Carriage Assembly-Cross-Slide Table

There is one button on each side of the cross slide for the cross-slide ways.

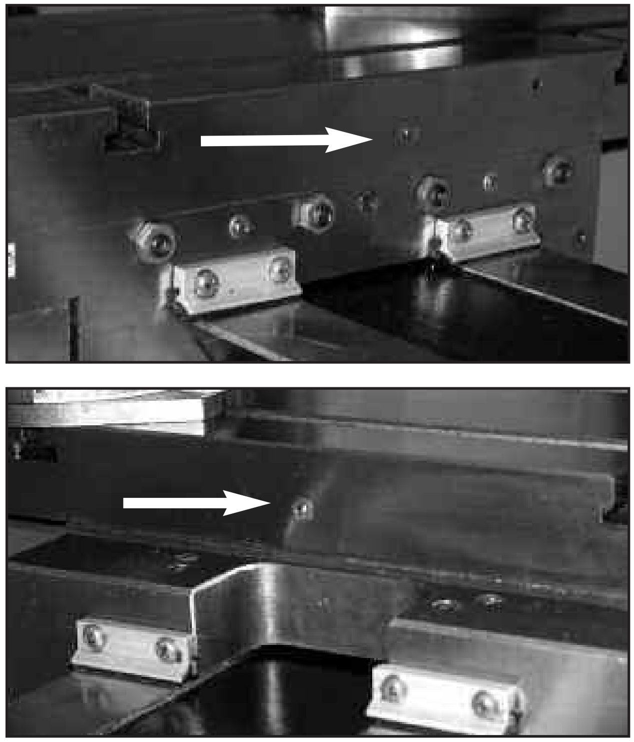


Figure 5.9 Carriage Assembly Cross Slide Table Points

Compound Angle Toolpost

Oil the two buttons on the top of the compound rest.

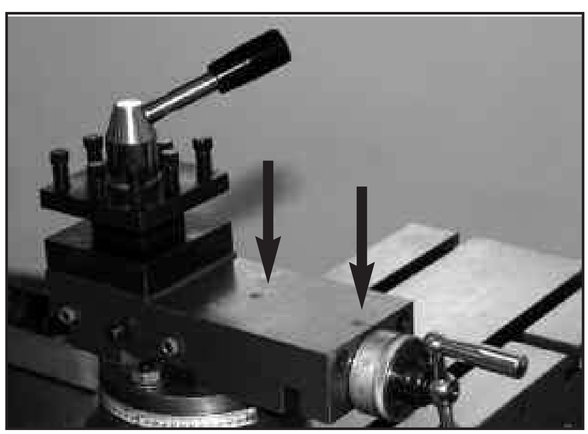


Figure 5.10 Oil the Compound Angle Toolpost at its oil points

Cross-Slide Screw

Oil the cross-slide screw. The first oil button is located on the apron next to the cross-slide dial and the other is found on the top of the cross-slide table.

Oil the buttons between the cross-slide and longitudinal-feed handwheels (at right).

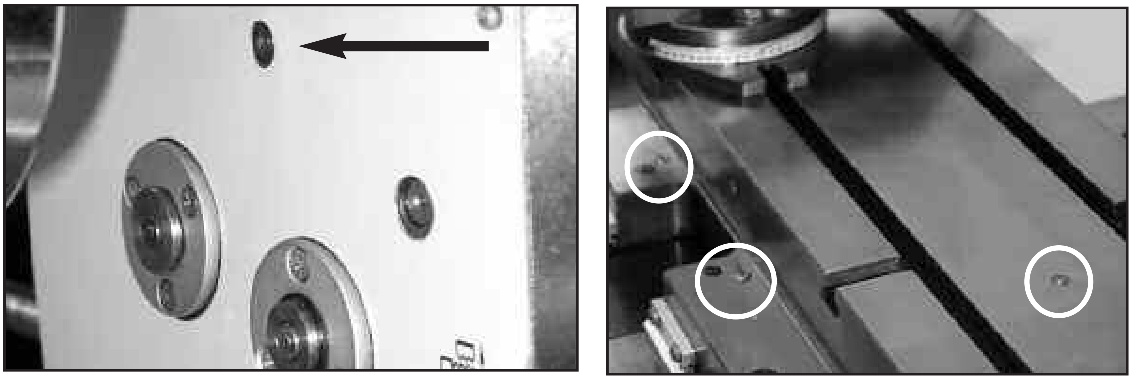


Figure 5.11 A & B Cross-Slide Screw Apron Oil Points and Cross-Slide Screw Table Oil Points

Leadscrew

Oil the support for the right end of the leadscrew. Put a few drops of oil along the leadscrew itself.

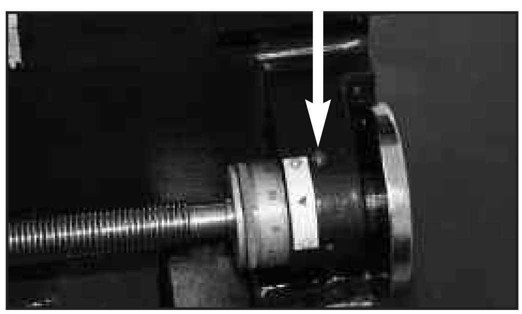


Figure 5.12 Leadscrew Oil Point

Oil Drip

Oil the end of the oil-drip trough from inside the gear box.

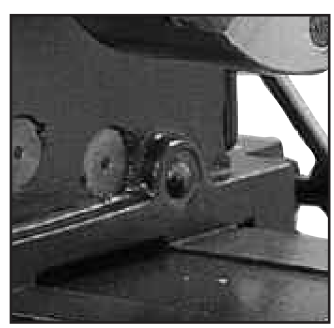


Figure 5.13 Oil Drip

Quick Change Gear Box

Use a spray can of lithium grease or motorcycle-chain lubricant. Spray inside the quick-change gearbox through the slot for the powerfeed (1-7) selector.

Figure 5.14 Oil the Quick Change Gear Box through the Powerfeed Slot

Tailstock Barrel

Oil the two buttons on top of the tailstock.

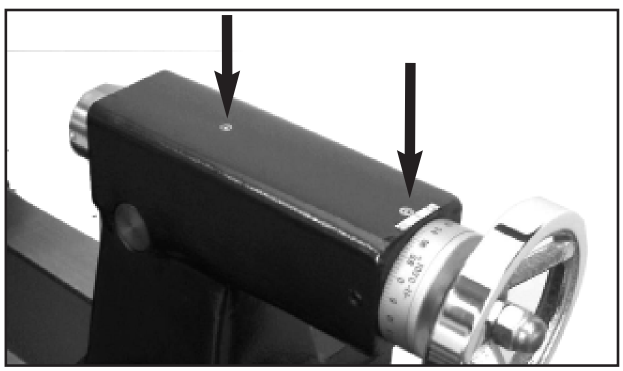


Figure 5.15 Tailstock Barrel Oil Points

Mill/Drill Clutch, Fine Feed

Oil the button on top of the mill/drill clutch housing.

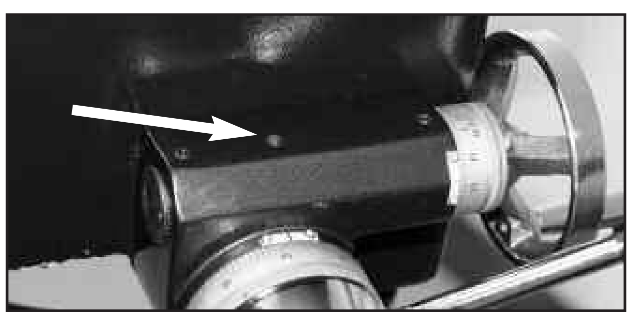


Figure 5.16 Mill/Drill Clutch Oil Points

Adjusting Gibs

The Granite 1300 models have a series of straight gibs. The gibs are found on the carriage, the cross-slide table, compound angle toolpost and the tailstock. These gibs should be adjusted periodically to maintain accuracy and smooth operation.

! NOTICE !

Always make sure your machine is well lubricated before adjusting the gibs.

Carriage Assembly-Saddle

Adjust the gibs on the saddle assembly using the procedure below.

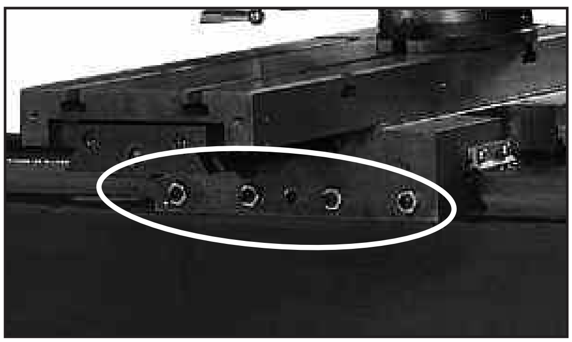


Figure 5.17 Carriage Gibs

Step1: Loosen the four jam nuts on the back side of the saddle with the 6" adjustable wrench that was shipped with your machine.

Step 2: Back out the gib adjusting screws found on the back side of the saddle two turns with the 4 mm allen wrench.

Step 3: Using the 4 mm Allen wrench, tighten each of the four gib adjustment screws until they are lightly touching the gib.

⚠ CAUTION

Do not apply excessive force.

Step 4: Back the gib adjustment screws out 1/8 to 1/4 turn.

Step 5: With the adjustment screws now set at roughly the same position, make the fine adjustments on each individual screw. Starting with one of the inner screws, slowly tighten the screw while moving the carriage assembly by turning the leadscrew handwheel until you feel slight resistance.

Step 6: Once slight resistance is felt, hold the gib adjustment screw in position and tighten the jam nut.

Step 7: Repeat steps 5 and 6 with the other inner screw and then with the two outer screws.

Adjusting the Gibs on the Carriage Assembly - Cross-Slide Table

Adjust the gibs on the cross-slide table using the procedure below.

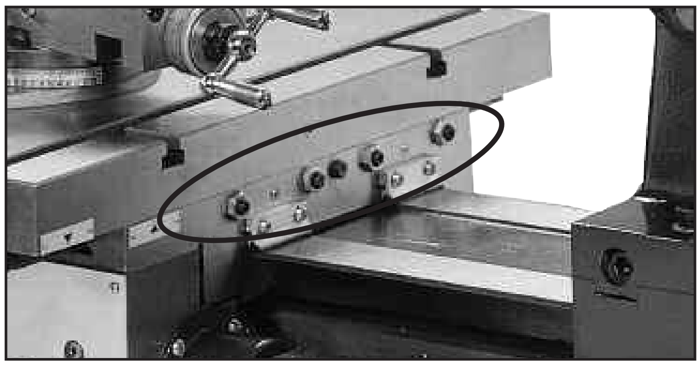


Figure 5.18 Gib Adjustment Screws - Cross-Slide Table

Step 1: Loosen the four jam nuts on the tailstock side on the table with the 6” adjustable wrench that was shipped with your machine.

Step 2: Back out the gib adjusting screws two turns.

Step 3: Using the 4 mm Allen wrench, tighten each of the four gib adjustment screws until they are lightly touching the gib.

> **CAUTION**
>
> Do not apply excessive force.

Step 4: Back the gib adjustment screws out 1/8 to 1/4 turn.

Step 5: With the adjustment screws now set at roughly the same position, make the fine adjustments on each individual screw. Starting with one of the inner screws, slowly tighten the screw while moving the cross-slide table by turning the cross-slide handwheel until you feel slight resistance.

Step 6: Once slight resistance is felt, hold the gib adjustment screw in position and tighten the jam nut.

Step 7: Repeat steps 5 and 6 with the other inner screw and then with the two outer screws.

Adjusting the Gibs on the Compound Angle Toolpost

Adjust the gibs on the compound-angle toolpost using the procedure below.

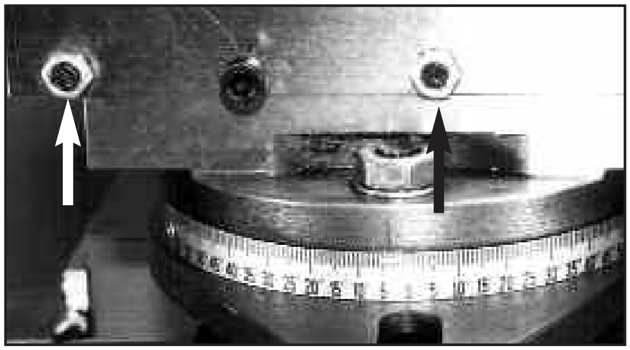


Figure 5.19 Gib Adjustment Screws - Compound Angle Toolpost

Step 1: Loosen the jam nuts on the side of the compound-angle toolpost with the 6 inch adjustable wrench.

Step 2: Back out the gib adjustment screws out two turns .

Step 3: Using the a flat-head screw driver, tighten the two gib adjustment screws until they are lightly touching the gib.

CAUTION

Do not apply excessive force.

Step 4: Back the gib adjustment screws out 1/8 to 1/4 turn.

Step 5: With the adjustment screws now set at roughly the same position, make the fine adjustments on each individual screw. Starting with the screw closest to the handle, slowly tighten the screw while moving the compound angle toolpost by turning the compound-slide handle until you feel *slight* resistance.

Step 6: Once slight resistance is felt, hold the gib adjustment screw in position and tighten the jam nut.

Step 7: Repeat steps 5 and 6 with the remaining gib adjustment screw.

Adjusting the Gibs on the Tailstock

Adjust the gibs on the tailstock using the procedure below.

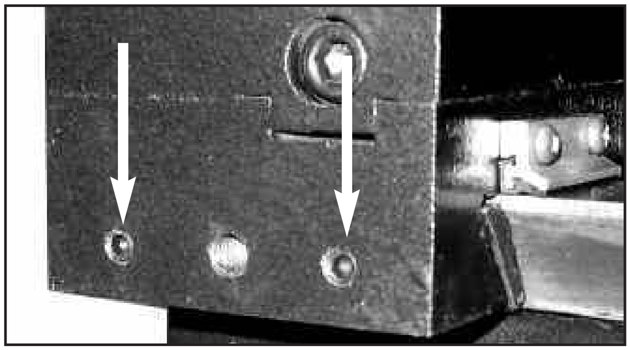


Figure 5.20 Gib Adjusting Screws - Tailstock (Shown with tailstock lock removed)

Step 1: Unlock the tailstock.

Step 2: Remove the outer setscrews with the 4 mm Allen wrench provided.

> **! NOTICE !**
>
> There are two setscrews in each hole. To tighten the tailstock gibs the outer setscrews need to be removed.

Step 3: Using the 4 mm Allen wrench, tighten each gib adjustment screw until it touches the gib lightly.

Step 4: Back each gib adjustment screw out 1/4 turn.

Step 5: Reinstall each outer setscrew and bottom it against the inner screws to lock the corresponding inner screw in place.

Step 6: Repeat steps 2 through 5 on the remaining screw.

> **! NOTICE !**
>
> Unlike the carriage, cross-slide and compound-angle toolpost gib adjustments, you will not feel a slight resistance when moving the tailstock. The tailstock will be locked to the ways with the tailstock lock. The objective of adjusting the tailstock is to ensure that the tailstock remains parallel to the ways.

Adjusting Backlash

Backlash is lost motion in the screw. The user will notice an initial small movement in the handwheel before the screw responds. The procedures in this section will help minimize backlash.

Adjusting Backlash from the Cross-Slide Screw

Before making any adjustments to the cross-feed screw system, all the gibs on the table and carriage system should be checked and adjusted as described previously.

Excessive backlash in the cross-slide can come from three different places.

- The fit of the cross-slide screw to the front screw mount
- The fit of the cross-slide screw into the brass crossfeed nut
- The fit of the brass cross-feed nut into the carriage casting

There are adjustments for each of these areas. Follow the procedures below to make each adjustment.

Adjusting Backlash Cross-Slide Screw to the Front Screw Mount

Step 1: Loosen the two nuts that hold the cross-slide handwheel on to the end of the cross-slide screw.

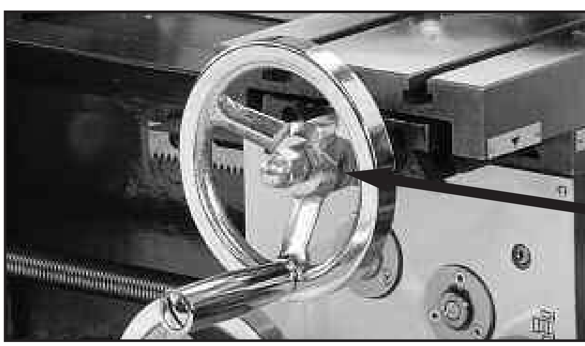


Figure 5.21 Loosen the two outer nuts holding the handwheel

Step 2: Tighten the inner nut slowly while checking the ease of movement of the cross-slide handwheel. When the screw starts to become difficult to turn, loosen the nut slightly so that the screw turns freely.

Step 3: Hold the inner nut in place with a wrench and tighten the outer nut against the inner nut to lock both nuts in position.

Step 4: Recheck the backlash.

Cross-Slide Screw to Brass Nut & Nut to Saddle

If there is still excess backlash after the previous adjustment, the backlash is either between the cross-slide screw and the brass nut or between the brass nut and the saddle. The following procedure covers both adjustments.

Step 1: Remove the rear support on the backside of the cross-slide table.

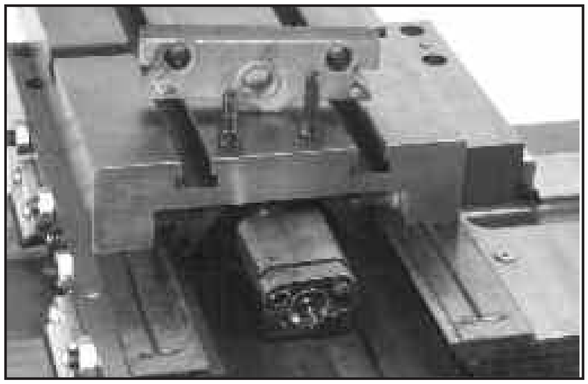


Figure 5.22 Remove mount on backside of the table to access the brass cross slide nut

Step 2: Loosen the allen bolt that locks the brass nut into the saddle. (See Figure 5.23)

Step 3: Use the handwheel to move the cross-slide table toward the operator side of the machine. Watch under the table from the backside and stop before the cross-slide screw comes out of the brass nut.

Step 4: Slowly tighten the four adjusting screws on the brass nut, one at a time, until a slight drag is felt while turning the cross-slide handwheel. It is best to continue turning the handwheel back and forth while adjusting the nut to balance ease of operation and backlash.

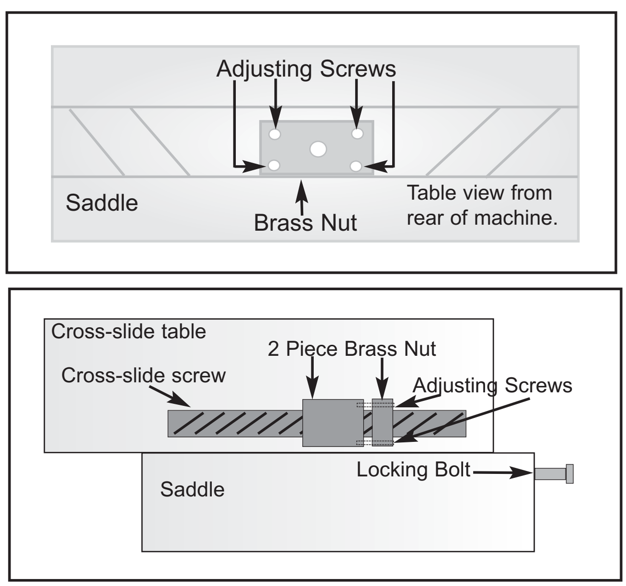


Figure 5.23 Tighten the adjusting screws on the brass nut

Step 5: Reinstall the rear support and tighten the locking bolt for the brass nut.

Step 6: Recheck the backlash on the cross-slide.

! NOTICE !

If you find that the four adjusting screws will not stay in place, use a small amount of thread-locking compound to keep the screws tight. If you use a Lock-Tite® product, use the Lock-Tite® Purple, not Red which will not allow for future adjustments

Adjusting Backlash from the Longitudinal Leadscrew

Excessive backlash in the longitudinal feed can come from two places.

- The fit of the longitudinal feed screw to the right-hand mounting trestle
- The fit of the half-nut to the feed screw

Engage the half-nut lever. Slowly turn the longitudinal handwheel clockwise as viewed from the right end of the machine and watch the gap between the dial and the feed screw mounting trestle. Reverse the direction you are turning the feed screw and see if the gap increases slightly. If so then there is some backlash in the mounting. Follow the procedure below to reduce the backlash.

Adjusting the fit of the longitudinal feed screw to the right-hand mounting trestle

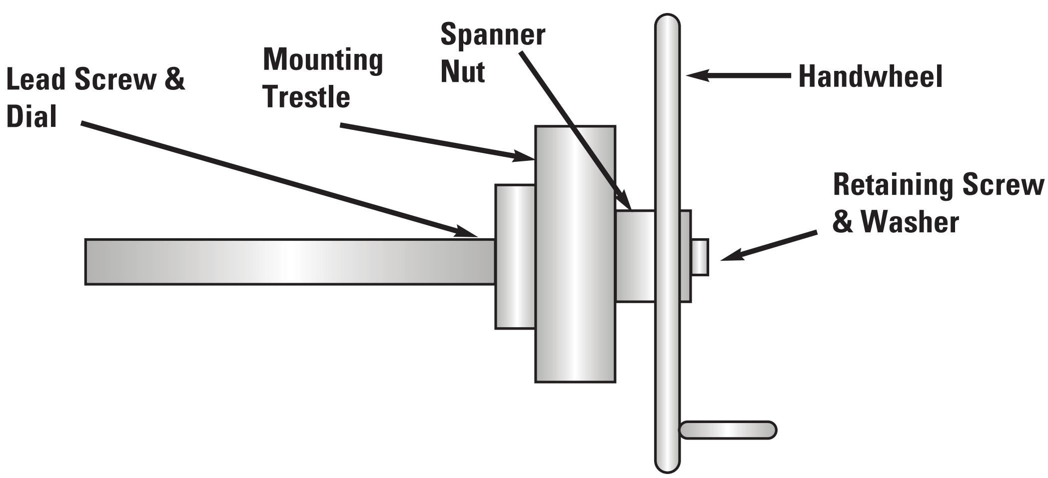


Figure 5.24 Adjusting backlash from the leadscrew

Step 1: Remove the retaining screw and washer in the right end of the longitudinal feed handwheel.

Step 2: Unscrew the handwheel from the end of the feed screw.

Step 3: Using a punch and a small hammer, tighten the spanner nut about one-eighth of a turn and recheck the backlash in the leadscrew.

Step 4: If backlash is acceptable, replace the handwheel, washer, and retaining screw. If more adjustment is needed, repeat step 3 above.

Half-Nut to Leadscrew Backlash

Worn threads on the half-nut can cause excessive backlash in the longitudinal direction. Half nuts are made of a brass-like material and do wear out over a period of time. The only fix for a worn half nut is to replace the worn nut with a new one.

> **! NOTICE !**
>
> The longitudinal handwheel (Rack & Pinion) is intended for rapid, coarse feed and is not calibrated for fine measurement. There is no backlash procedure for this mechanism.

Adjusting Mill Feed Backlash

Excessive backlash in the vertical fine feed can come from two places.

- The fit between the worm gear and the pinion gear shaft
- The fit of the quill gear to the quill rack

Adjusting the Fit Between the Worm Gear and Pinion Gear Shaft

Follow the procedure below to adjust the fit between the worm gear and pinion gear.

Step 1: Remove the fine-feed handwheel and dial.

Step 2: Loosen the two setscrews that hold the left and right worm gear bearing supports in place. They are located on top of the vertical feed housing at the left and right end of the worm gear.

> **! NOTICE !**
>
> The bearing housing has two holes in the outside surface to allow a punch or spanner wrench to turn the housing.

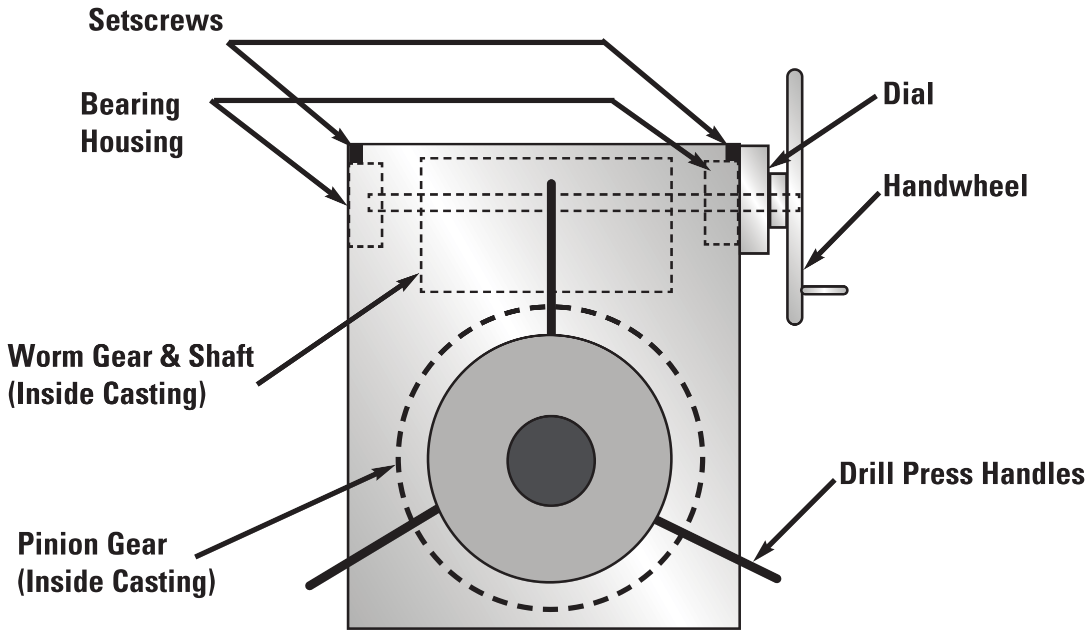


Figure 5.25 Adjusting backlash from the mill feed

Step 3: Use a small spanner wrench or a punch with a small mallet to rotate the bearing supports one at a time. The support bearings are mounted slightly off center in these housings and rotation of the housings will raise or lower the worm gear down towards the pinion gear. The bearing support on the right should be rotated clockwise and the left should be rotated counter clockwise. Rotating the right and left bearing supports should be done in conjunction with each other.

Step 4: Turn the right housing and watch the worm gear shaft to see in which direction it moves. Turn the housing in the direction that will move the worm gear down towards the pinion gear.

Step 5: Move to the left housing and repeat step 4.

Step 6: Alternate moving the front a little and then the rear a little while turning the worm gear to check for binding.

Step 7: Stop as soon as resistance is felt in the rotation of the worm gear. The adjustment is completed.

Step 8: Tighten the setscrews to the bearing housings to lock adjustment in place.

Adjusting the fit of the Quill Gear to the Quill Rack

Adjusting the fit between the quill shaft feed gear and the quill rack is done using the split section of the feed gear. The feed gear is made up of two parts.

- A wide section that is locked to the feed shaft by a key and has a fixed position on the shaft

- Another section that is not as wide and is not keyed to the shaft. It is held in place on the shaft via a locking nut and can be repositioned as desired.

The narrow section can be offset from the wide section to give the effect of a gear with thicker teeth. This in turn will give a tighter tooth-to-tooth fit between the feed shaft gear and the rack on the spindle.

Adjustments are made on the split gear from up inside the mill head casting. This is accessible from under the mill head between the quill and the support column. Follow the procedure below to make these adjustments.

Step 1: Look into the millhead casting and locate the items shown in the drawing 5.26.

Step 2: Turn the feed shaft with the coarse feed handwheel until the locking tab of the locking washer is accessible. Lock the quill in that position with the quill lock lever on the rear of the millhead.

Step 3: Bend the locking tab straight and use a small punch to loosen the spanner nut just enough to be able to rotate the adjustable gear with the same punch and small hammer.

Step 4: With the quill still locked in position, have someone turn the coarse feed handwheel clockwise until it removes any backlash. Then have them *hold the handle in this position until the completion of step 6*. This will move the bottom part of the wide fixed gear to the left as viewed from below.

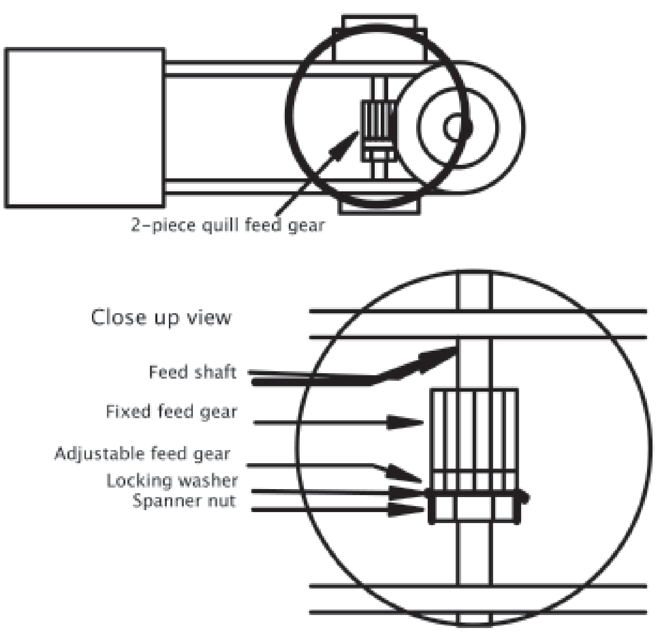


Figure 5.26 Adjusting the quill gear to the quill rack

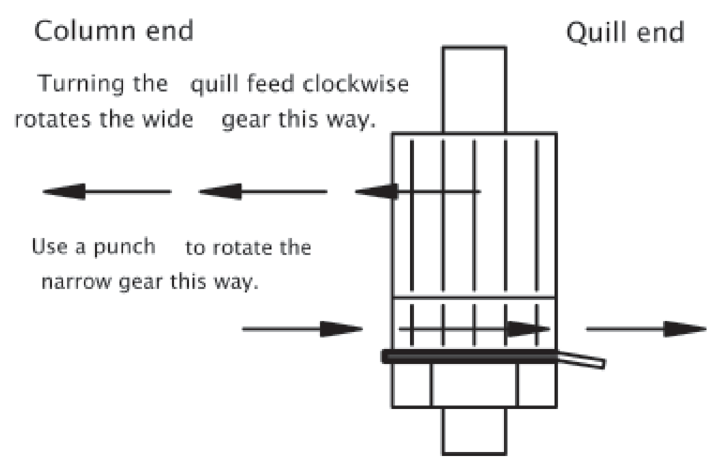


Figure 5.27 Adjusting the quill gear to the quill rack

Step 5: Using the punch and small hammer, tap the narrow movable gear toward the right. This will make the gear assembly appear to have thicker teeth.

Step 6: Tighten the spanner nut with the punch and hammer.

Step 7: With the quill still locked, move the coarse feed handle and check for a reduction in backlash.

Step 8: Bend the locking tab back into one of the slots in the spanner nut.

Adjusting Drive Belt Tension

Adjust the belt tension before using your machine and recheck it periodically.

Adjusting Millhead Belt Tension

Figure 5.28 Adjusting Millhead Belt Tension

Step 1: Remove the millhead cover.

Step 2: Position the roller to the outside of the belt.

Step 3: Loosen the shaft with a wrench on the two flats at the top of the shaft.

Step 4: Position the roller against the flat side of the belt and apply light thumb pressure to tension the belt.

Step 5: Tighten the roller shaft.

Adjusting Lathe Belt Tension

The lathe-belt tensioner is made up of a Quick Release Handle and the Tension Adjustment Knobs. Raise the Quick Release Handle to apply tension and down to release tension. Proper setting of the tension follows:

Step 1: Raise Quick Release Tension handle all the way up

Step 2: Adjust the tension by turning the knurled knob clockwise to increase tension or counter clockwise to loosen tension. Once the belt tension is adjusted the Quick Release Handle can be used to release and apply tension for positioning belts.

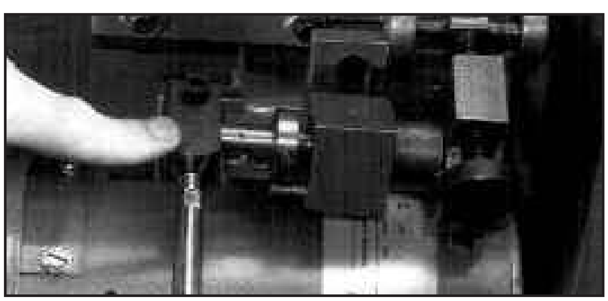


Figure 5.29 Adjusting Lathe Belt Tension - Shown in the down position

Becoming Familiar with Operating Your Smithy Granite

Once the machine has been lubricated and adjusted and before you begin working, take time to become familiar with the operation of your Smithy machine.

Although all Smithy machines are run at the factory, it is wise to put your machine through a break-in run before putting it to work.

Follow the steps below.

Step 1: With the machine unplugged, set the variable speed selector to 0.

Step 2: Set the leadscrew direction selector in neutral and disengage the powerfeed/ thread selector (1-7).

Step 3: Verify that the single belt on the machine in the pulley box is on the medium-speed range. (Granite machines are shipped in this position, but it is always best to confirm this before starting your machine.)

Step 4: Place the lathe/mill clutch selector into the lathe position.

Step 5: Plug the machine into an appropriately grounded circuit.

Step 6: Push the green button to start the motor. There is an intentional 6 to 8 second delay before the lathe chuck begins turning.

To reverse the motor, **push the red button to stop the button.** Lift the cover over the rocker switch only after the motor has stopped, and push the rocker switch only after the motor has stopped. Press the rocker switch either up or down to reverse the motor rotation. Set the variable speed selector to zero and then push the green button to start the machine

⚠ **CAUTION**

Do not change motor rotation until the motor and spindle are fully stopped. Changing directions while the motor is running can damage the motor.

Step 7: Use the variable speed selector to increase the speed *gradually* to approximately 1000 rpm and let the lathe run for 15 minutes.

Step 8: Turn the variable speed selector to zero and push the red stop button.

Running in the Lathe

Perform these operations to familiarize yourself with lathe operation.

Step 1: Position the carriage and cross-slide table to a mid-range position.

Step 2: Keep the lathe/mill clutch in the lathe position from the previous steps.

Step 3: Position the powerfeed function selector to lathe operation.

Step 4: Position the leadscrew direction selector. This is just an operation check, it doesn't matter if the position is in the clockwise or counter clockwise position.

Step 5: Position the powerfeed/thread selector lever (1-7) in position 7.

Step 6: Position the powerfeed/thread selector lever (I-III) in position III.

Step 7: Push the green button to start the motor.

Step 8: Use the variable speed selector to slowly increase motor speed to between 150 and 200 rpm.

Step 9: Engage the half nut engagement lever and observe the longitudinal movement of the carriage assembly. Disengaged the half nut.

! NOTICE !

The half nut engagement lever is used primarily for threading operations and for manual longitudinal feed movement.

Step 10: Move the longitudinal and lateral powerfeed selector to the longitudinal position. (Move the handle to the left and down.) Observe the slower longitudinal movement of the carriage assembly.

Step 11: Move the longitudinal and lateral powerfeed selector to the neutral position.

! NOTICE !

The longitudinal and lateral powerfeed selector is used to move the carriage assembly for all lathe operations except threading.

Step 12: Move the longitudinal and lateral powerfeed selector to the lateral position. (Move the handle to the right and up.) Observe the lateral movement of the cross-slide table.

Step 13: Move the longitudinal and lateral powerfeed selector to the neutral position.

Step 14: Turn the variable speed selector to zero.

Step 15: Push the red mushroom stop switch to stop the lathe.

CAUTION

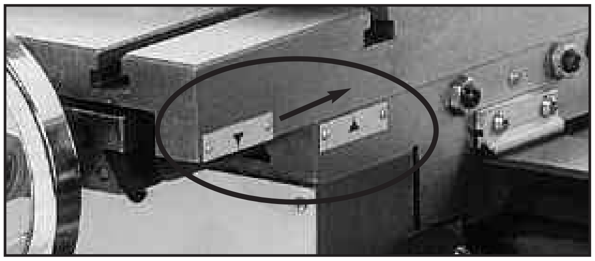


Figure 5.30 Travel indicator marks

Remain aware of the travel limits, Figure 5.30, during the initial running in. To prevent damage to your machine, do not run the table past the travel indicator marks.

Running in the Mill/Drill

Perform these operations to familiarize yourself with mill and drill press operation.

Step 1: Position the carriage and cross-slide table to a mid-range position.

Step 2: Engage the mill with the lathe/mill clutch.

Step 3: Position the powerfeed function selector to mill operation.

Step 4: Push the green button to start the motor.

Step 5: Use the variable speed selector to slowly increase motor speed rpm. Verify that the speed rotation is correct. It the rotation is not correct, the STOP the machine, reverse the toggle switch under the yellow cover on the main switch panel and then restart.

Step 6: Move the longitudinal and lateral powerfeed selector to the longitudinal position. (Move the handle to the left and down.) Observe the slower longitudinal movement of the carriage assembly.

Step 7: Move the longitudinal and lateral powerfeed selector to the neutral position.

Step 8: Move the longitudinal and lateral powerfeed selector to the lateral position. (Move the handle to the right and up.) Observe the lateral movement of the cross-slide table.

Step 9: Move the longitudinal and lateral powerfeed selector to the neutral position.

Step 10: Turn the variable speed selector to zero.

Step 11: Push the red mushroom stop switch to stop the machine.

6 Tooling Installation

Overview

This section contains information on installing tooling for your lathe and mill.

Setting-up Lathe Tooling

There are three main areas to set-up tooling when you are using the lathe portion of your Granite 1300 series tool:

- •Lathe Spindle
- •Compound Angle Toolpost
- •Tailstock

Lathe Spindle

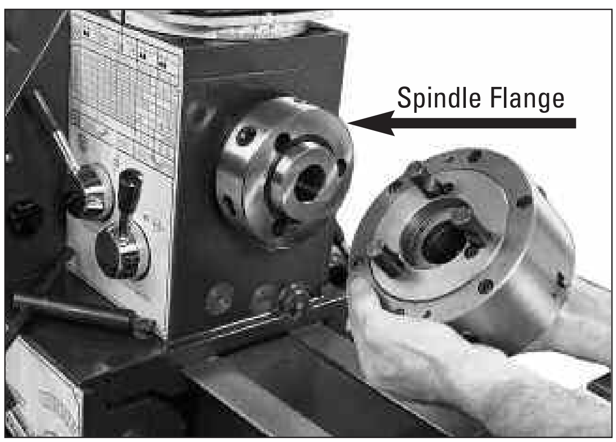


Figure 6.1 D1-4 Lathe Chuck

Any tooling that is mounted to the lathe spindle will use the D1-4 camlock mounting system.

Three studs on each attachment are inserted into matching holes in the lathe spindle. (See figure 6.1 for example.) A camlock socket for each stud is rotated with the lathe chuck key to lock it securely in place. Index marks on the spindle as well as the camlock sockets must be aligned properly for installation or removal of the studs from the holes.

The position of the index marks on the spindle flange and on the tooling should meet at the 12 o'clock position when they are in the unlocked position. Standard rotation is clockwise to lock the studs into postion and counter clockwise to loosen. Each cam should turn approximately 140º to 180º for a secure lock on the stud. Adjustment of stud depths can be made if necessary to obtain proper rotation.

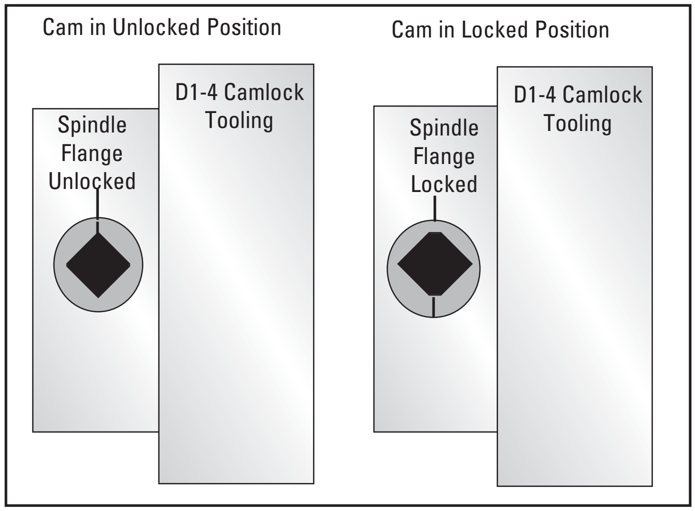


Figure 6.2 D1-4 Lathe Spindle in Locked & Unlocked Positon

Removing D1-4 Camlock Tooling From the Lathe Spindle

Step 1: Protect the ways by placing a wooden board or protective material such as styrofoam on the ways below the lathe spindle.

Step 2: Insert the chuck key provided into each of the three camlock sockets on the spindle nose and turn counterclockwise to the unlocked position.

Step 3: Using a soft mallet, tap the tooling off the spindle.

If you prefer you can also mount a piece of stock in the chuck and then "wiggle" the tooling loose.

> ⚠ **WARNING**
>
> When the tooling comes loose, be prepared to support it immediately.

Installing D1-4 Camlock Tooling

Tooling attaches quickly to the lathe spindle with three camlocks.

Step 1: Check the sockets on the spindle flange to make sure the index marks are at the 12 o'clock/unlocked position.

Step 2: Align the three mounting studs to the spindle nose and slide the chuck into place.

Step 3: With the chuck in position, insert the chuck key provided into each socket on the spindle flange and rotate each camlock clockwise to the locked position. The indicator hashmark on each camlock socket should be somewhere between the 5 and 6 o'clock position.

If the desired rotation on any cam lock cannot be obtained, the mounting studs may need to be adjusted. (See Troubleshooting in chapter 12.)

Tailstock

The tailstock will accept any tooling with a Morse Taper #3 shank or arbor. This type of mount is a friction-fit taper, so it is important that the mounting surfaces be clean and dry. You will need to extend the tailstock barrel approximately 1/2 to 3/4 inches before inserting any tooling, and then firm hand pressure is all that is needed to lock tooling into the taper.

Figure 6.3 Install a plug into MT3 arbors when using them in the tailstock of a Granite machine

> **! NOTICE !**
>
> You can use either the tang or drawbar style arbors, however, it is important that the threaded drawbar hole be plugged with a bolt or setscrew before inserting into the barrel so that the item will be automatically ejected when you retract the barrel.

Installing Compound Angle Toolpost

The compound-angle toolpost (CATP) is mounted to the top of the cross-slide table using 10mm t-bolts, washers and nuts. You can substitute t-nuts and the proper length studs in place of the t-bolts if desired. Mount the toolpost on the table surface wherever there is a t-slot that allows the tooling to reach your workpiece.

Installing Tooling into the Compound Angle Toolpost

The four-sided turret can hold up to four individual cutters up to a 1/2 inch in size. To insert tooling, loosen the screws on top of the turret with the provided wrench. Insert tooling and tighen the screws again. Each cutter can be moved into place by loosening the top turret lock and rotating the turret counter clockwise 90º. Each cutter in the turret must be adjusted so that the cutting tip is aligned with the center line of the workpiece. This is achieved by installing shims or feeler gauges under the cutter before tightening it in place.

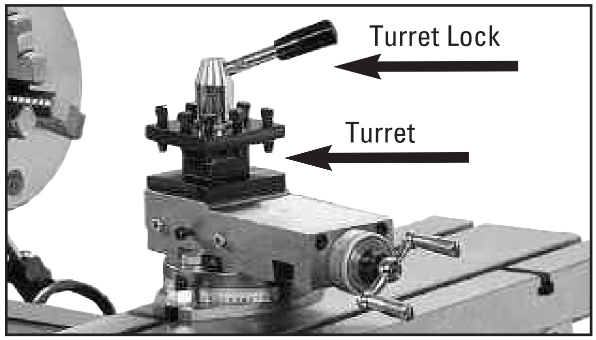


Figure 6.4 Compound Angle Toolpost Installed on Cross-Slide Table

Setting-up Tooling in the Mill/Drill Spindle

This section will explain tool mounting in the mill/drill spindle.

The mill spindle of the Granite 1300 series machines is an R-8 (Bridgeport®) standard. It features a straight shank with a flared nose for centering the tool and a keyway for alignment.

Aligning Tooling

Use the procedure below to align your tooling in the R-8 spindle:

Step 1: Select the appropriate tool or fixture.

Step 2: Wipe the surfaces of the tooling and spindle interior to ensure a proper fit. Grease or debris on either surface will cause misalignment.

Step 3: Align the keyway in your tooling with the key inside the mill spindle and insert the fixture in the lower mill spindle opening.

You can feel the key in the mill spindle with your finger. It is located just beyond the tapered portion of the spindle.

Securing R-8 Tooling with the Drawbar

Use the procedure below for the drawbar:

Step 1: Remove the mill spindle cap located on the top of the mill belt cover and insert a drawbar (SAE standard 7/16-20) from the top of the spindle.

Step 2: Tighten the drawbar clockwise into the fixture or tooling that is inserted into the mill spindle opening. Use the spanner wrench to stabilize the spindle while tightening the drawbar.

Step 3: Use a wrench to apply torque to the drawbar. This will draw the fixture firmly into the spindle.

Step 4: Reinstall the spindle cap when the fixture/tooling is in place.

Figure 6.5 Use the supplied spanner wrench to hold the spindle in place while tightening the drawbar

! NOTICE !

When installing or removing tooling with sharp edges, always cover the sharp edges with a shop towel or appropriate covers or guards to prevent injuries. Always shield yourself appropriately when using hammers.

Removing R-8 Tooling from the Drawbar

Use the procedure below to remove tooling using the drawbar method:

Step 1: Stabilize the drawbar with the spanner wrench and use a wrench to apply force counterclockwise to the drawbar nut.

Step 2: Loosen the drawbar two to three turns counterclockwise.

Step 3: Use a deadblow or brass hammer to strike a downward blow on the top of the drawbar to loosen the fixture from the spindle.

Unscrew the drawbar only two to three turns before striking. Unscrewing it further before striking the drawbar can damage the threads on the drawbar or the fixture.

Step 4: Continue turning the drawbar until it unscrews from the tooling.

Step 5: After the tool is free from the spindle, hold the fixture with your free hand or use a catch box to prevent the tooling from dropping onto your machine or workpiece.

A common catch box consists of a cardboard or wooden box eight to ten inches square with four- to six-inch high sides. Rags loosely thrown in the bottom of the box provide padding for the tool to land in when the drawbar is removed from the fixture and the fixture falls from the mill spindle.

NOTES:

7 Manual Operations

Overview

This section contains information on manual machine operations that are specific to the Granite 1300 series machines. General machining practices can be found in one of the many machining reference books that Smithy carries such as the <u>Home Machinist Handbook</u>, item 10-005. Appendix A includes a machining guide.

General Safety Operations

⚠ CAUTION

For your own safety and the safety of those around you, follow the rules below.

⚠ DANGER

Never leave or walk away from an operating machine.

⚠ DANGER

Do not change motor rotation direction until the motor and spindle are fully stopped. Changing directions while the motor is running can damage the motor.

! NOTICE !

Observe all general safety rules as presented in Chapter 2.

Instructions in this section apply to both lathe and mill operations.

Changing Between Lathe and Mill Operation

The lathe/mill clutch lever is located on the upper front surface of the lathe pulley box. Turning the spindle slowly by hand will help align the drive gears smoothly when engaging the lathe/mill clutch.

To change the position of the selector, pull the knob outward and move the selector to the desired position. There are three positions for the selector.

- The center position is marked with an “O.” This is the neutral position where neither the mill or lathe spindle are engaged.

- The right position is marked with a lathe-chuck icon. This position engages the lathe spindle for all lathe operations.

- The left position is marked with a mill-spindle icon. This position engages the mill spindle for all mill operations

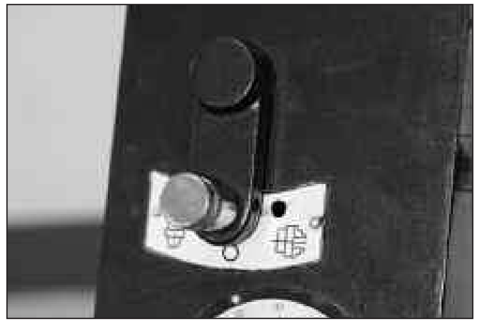


Figure 7.1 Lathe/Mill Clutch Shown in the Neutral Position

WARNING

Turn the machine off and wait for the motor and spindle to stop turning before shifting between positions.

Manual Feeding

Feeding is the act of moving the cutter through the workpiece or moving the workpiece along the cutter while the machine is in operation.

Manual feeding uses a handwheel to move the quill or the carriage and cross-slide table.

When manually feeding your machine, make sure the selector lever (1-7) is not engaged into any position before attempting to manually feed the carriage assembly or cross-slide table.

Position the carriage assembly and table in the mid-range position at the beginning of any setup to ensure the pending operation will not proceed past the mechanical limits of travel on any moveable axis.

Mill/Drill Spindle

When in the mill mode, the rotating cutter can be fed down into the stationary workpiece one of two ways:

- The spindle coarse feed is used for positioning during setup and for feeding drill-press operations.

- The spindle fine feed is used for milling operations and can also be used for drilling where a more precise control of the drill bit may be required.

Coarse Feed Operation

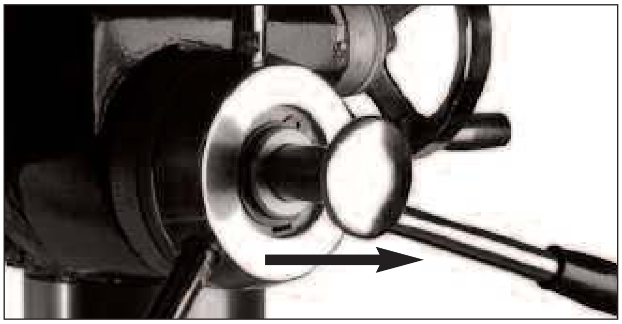


Figure 7.2 Mill/Drill Press Clutch pulled out, engaging the Drill Press

Pull the fine-feed clutch knob outward while slowly rotating the drill press handles back and forth. Once the knob is pulled out, the drill press handles can be used for coarse feeding by rotating the handles clockwise to feed into the workpiece and counter clockwise to feed away from the workpiece.

Fine Feed Operation

Figure 7.3 Mill/Drill Clutch pushed in engaging the Fine Feed

Push the fine-feed clutch knob inward while slowly rotating the drill press handles to engage the fine feed. Turning the fine-feed handwheel allows for slow and precise movement of the spindle up or down. The dial behind the handwheel indicates the amount of vertical movement. The dial is calibrated in 0.001”

There is no powerfeed available for vertical movement of the mill spindle.

Cross-Slide Table and Carriage Assembly

In milling, the crossfeed table and carriage assembly feed the workpiece into the rotating cutter. In lathe work, the same mechanisms move the tool into the rotating workpiece.

Cross-Slide Table

The cross-slide table is moved laterally by rotating the cross-slide handwheel. Rotate the handwheel clockwise to move the cross-slide table away from the operator or counterclockwise to move it toward the operator.The dial is calibrated in 0.001”. One rotation moves the table 0.10”.

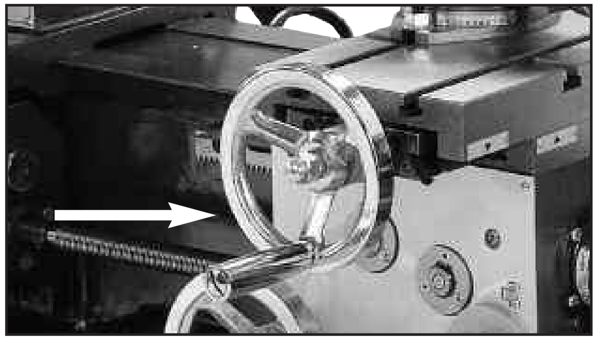


Figure 7.4 The Cross-Slide Table Handwheel

Carriage Assembly

The carriage assembly (crossfeed table and saddle) is moved left and right by the longitudinal handwheel (coarse feed) on the front of the apron or the fine-feed handwheel on the right end of the leadscrew.

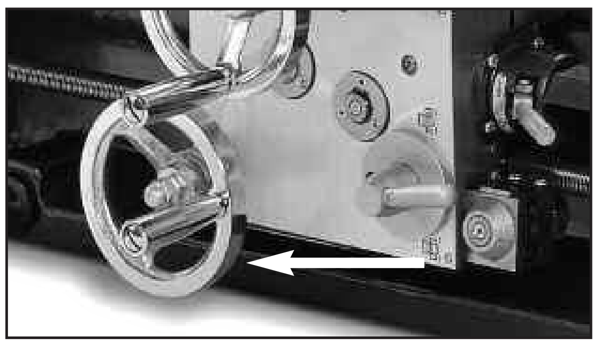


Figure 7.5 Manually moving the carriage assembly for coarse feed

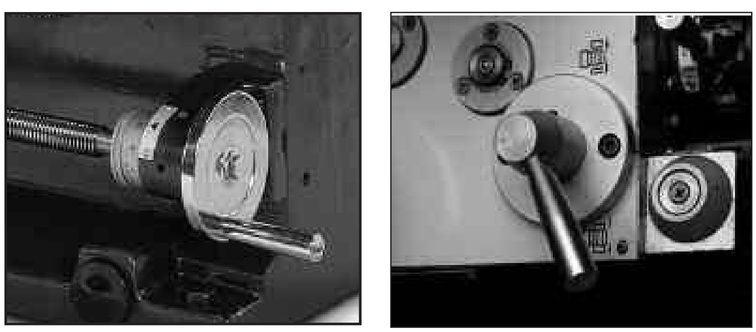


Figure 7.6 Longitudinal Fine Feed Handwheel (Left) & Half-Nut Engaged (Right)

Rotate the handwheel clockwise to move the carriage assembly toward the tailstock end of the machine and counter-clockwise to move the carriage assemble toward the headstock end of the machine.

The longitudinal handwheel is always engaged and movement is measured by the dial behind the handwheel. This feed is typically used for rapid movement of the carriage assembly.

Before using the longitudinal fine feed handwheel disengage Selector Lever (1-7) and the Selector Lever (I-III). Move the half-nut engagement lever to the engaged position (handle pointing down). Turn the leadscrew handwheel to feed the carriage assembly left or right. The movement is measured by the dial on the right end of the leadscrew. This is a very precise feed that is used for most lathe and mill operations.

NOTES:

Speeds and Feeds 8

Overview

Before using the more advance features of your Granite 1300 Series Lathe-Mill-Drill, it is important to have a basic understanding of feeds and speeds. This section contains information on how to set the speed and feeds rates for your machine. We encourage you to learn and understand as much as you can about this fundamental element of machining. A general reference guide such as the Home Machinist Handbook or the Ready Reference are good reference guides to assist you with this task. As always, remember to follow the general safely rules listed below and in Chapter 2 of this manual.

⚠ CAUTION

For your own safety and the safety of those around you, follow the rules below.

⚠ DANGER

Never leave or walk away from an operating machine.

⚠ WARNING

Do not change motor rotation direction until the motor and spindle are fully stopped. Changing directions while the motor is running can damage the motor.

Speed and Feed Rates Defined

Speed is how fast the spindle rotates. Feed rate is how fast the cutter moves along the workpiece.

Speed and feed rates are calculated based on the type of material you are cutting, the size of the material and the type of cutter being used. Refer to the Home Machinist Handbook (Item # 10-005) or Ready Reference (Item #10-015) for more detail. Remember, speed and feed rates are given in a range and you will need to adjust within that range for your machine's size and power.

Setting the Spindle Rotational Speed

Once you have determined the proper speed and feed rate for the material that you are cutting and the type of cutter that you will be using, you will need to setup your machine to cut within the range of the selected speeds and feed rates.

Setting the spindle speed is a two-stage operation consisting of an initial belt position setting and a final adjustment with the variable speed selector on the front of the gearbox.

The drive system on your machine is much like a car with a manual transmission. It has a "transmission" with several gear ranges and a "throttle" to vary the speeds within each gear selection.

The belt positions give you three speed ranges and the electronic control gives fine adjustments within the selected range. The variable speed selector dial shows the speeds for each of the three speed ranges. These speeds are applicable to both the lathe and mill spindles.

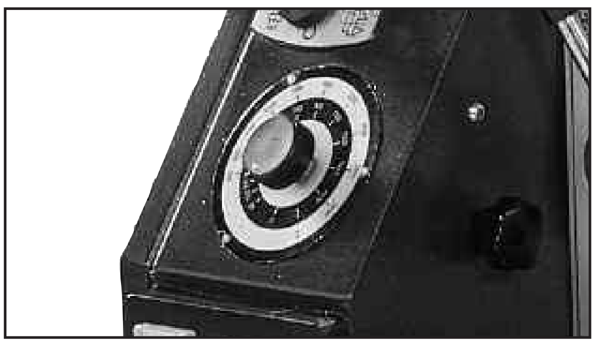


Figure 8.1 Use the Granite Speed Dial for fine adjustments

Step 1: Refer to a machining reference guide such as the Home Machinist Handbook or Ready reference to determine the optimal rotational spindle speed for the materials and tooling you are using.

! NOTICE !

Many reference charts give feed and speed rates for high speed steel cutters. Most work today is done with carbide cutters which can cut at much faster rates. If you are using carbide cutters, make sure the charts you are referencing are for carbide cutters.

Step 2: Examine the decal that surrounds the variable speed selector dial to determine which of the three belt positions need to be selected inside of the gearbox. The low-speed range located on the inner ring of the dial (0-400 rpm) will require using the low-speed idler pulley and a dual-belt setup. The mid and high-speed ranges will use a single belt that bypasses the center idler pulley.

Step 3: Set up the belts as necessary to obtain the desired speed range. The variable speed selector dial can be used to adjust the speed within the range.

! NOTICE !

The life of the electrical system will be greatly extended and available machine torque increased by using the lower pulley setting and keeping the motor speed up.

Machines purchased after mid-2003 have the speed reducer pulley installed on the machine. A retrofit kit, part number 40-300G, to add this feature to earlier machines is available from the Smithy Sales Department at 1-800-476-4849 or at www.smithy.com.

High Range-Speed Set-up

Use the procedure below to set up for high speed (1500 to 3000 RPM) operations.

Step 1: Release the belt tensioned at the motor by rotating the tension lever down.

Step 2: Position the belt around the largest sheave of the motor and the smallest sheave on the spindle pulley.

Step 3: Tension the belt by rotating the tension lever on the motor all the way up.

Mid Range-Speed Set-up

Use the procedure below to set up for middle speed (400 to 1500 RPM) operations.

Step 1: Release the belt tensioned at the motor by rotating the tension lever down.

Step 2: Position the belt around the center sheave of the motor and the largest sheave on the spindle pulley.

Step 3: Tension the belt by rotating the tension lever on the motor all the way up.

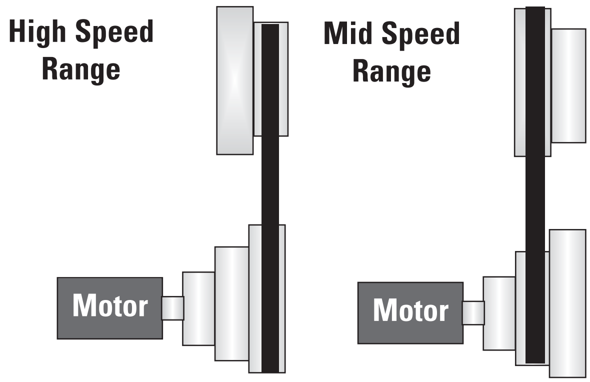


Figure 8.2 The high & mid-speed ranges only require the use of one belt

Low Range-Speed Set-up

For low-speeds (optional on early machines), you must convert to a double drive belt configuration. Use the procedure below to set up for low speed (400 RPM or less) operations.

Step 1: Release the belt tensioned at the motor by rotating the tension lever down.

Step 2: Remove the belt from the motor pulley by following steps 3-6 below.

Step 3: Loosen the cap screw on the shaft of the lathe/mill clutch inside the pulley box and pull the selector lever outward to move the shifter fork arm away from the shifter fork.

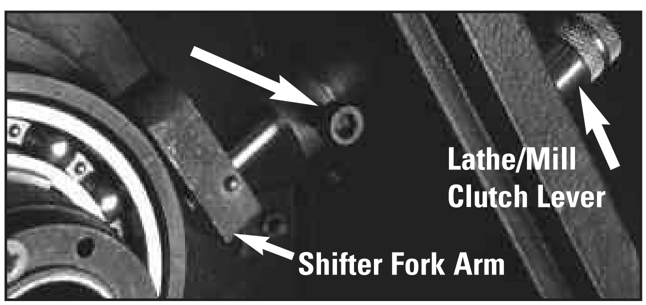


Figure 8.3 Loosen the cap screw from the lathe-mill clutch lever

Step 4: Slide the single belt off the spindle pulley and the end of the main drive spindle.

Step 5: Loosen the bolt that holds the gear quadrant and the reduction pulley bracket in place. This will allow the two belts you are about to install to be properly tensioned.

Step 6: Place the larger of the two belts on the smallest motor pulley sheave and on the largest pulley sheave of the speed reduction pulley. Place the smaller belt on the smallest sheave on the speed reduction pulley and the largest sheave on the main drive spindle pulley.

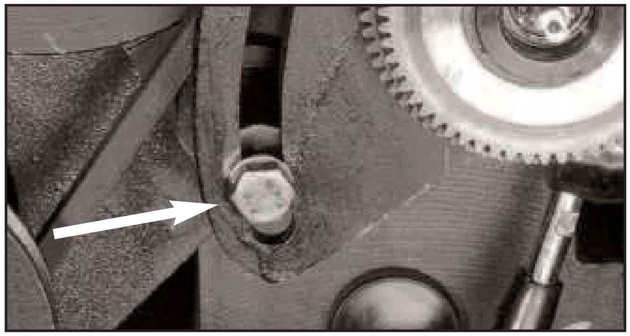


Figure 8.4 Loosen the bolt of the speed reduction pulley bracket when installing belts for the low speed

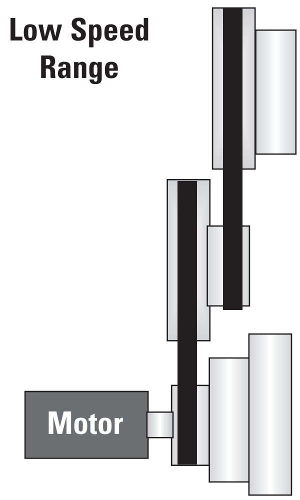


Figure 8.5 Low Range Belt Setting

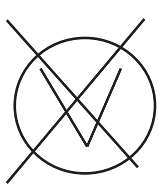
Step 7: Tension the belts by rotating the tension lever on the motor all the way up. Tighten the bolt on the gear quadrant to lock the quadrant and the reduction pulley in place.

Step 8: Reassemble the lathe/mill selector arm and tighten the cap screw to secure the selector shaft in place.

Feed Chart Explained

Before setting the feed rates, it is important to know how to correctly read the feed rate and threading chart found on the headstock of your Granite 1300 series machine.

The chart is comprised of six vertical sections (one header and five data sections) and four horizontal sections (one header and three data sections).



Section 1 is headed by the symbol at the left. T**he meaning is "Do NOT change selector handle positions while the machine is running".** Please stop the machine while changing feed directions, gear selections, feed-rate selections, etc."

Below the symbol is a representation of the feed gears, A, B, C, and D on the gear quadrant. These gears are located inside the pulley box. Immediately to the right of the gear symbols are the numbers 1 through 7, which refer to the position of the powerfeed selection lever (1-7) on the feed transmission.

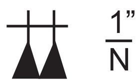
$\frac{A}{B} \times \frac{C}{D}$ Below the gear symbols is the location guide for the gear numbers which are stamped on the face of the gears. This formula refers to which gear number belongs in which location in order to move the carriage or table for threading and powerfeeding.

Header	Section 1			Section 2			Section 3			Section 4			Section 5		
	1”/N			in			in			in			in		
	I	II	III	III	II	I	III	II	I	III	II	I	III	II	I
1	7	14	28	0.125	0.250	0.500	0.039	0.079	0.157	0.35	0.70			1.75	3.50
2	8	16	32	0.109	0.218	0.437	0.034	0.069	0.138	0.40	0.80		1.00	2.00	4.00
3	9	18	36	0.097	0.194	0.388	0.031	0.061	0.122	0.45					4.50
4	10	20	40	0.087	0.175	0.349	0.028	0.055	0.110	0.50	1.00		1.25	2.50	5.00
5	11	22	44	0.079	0.159	0.317	0.025	0.050	0.100					2.75	5.50
6	12	24	48	0.073	0.146	0.291	0.023	0.046	0.092	0.60			1.50 (0.75)	3.00	6.00
7	13	26	52	0.067	0.134	0.269	0.021	0.042	0.085					3.25	6.50
A/B X C/D	30/66 X 60/60									33/80 X 63/60			(33)66/64 X 63/60		
	INCH						METRIC			INCH			METRIC		

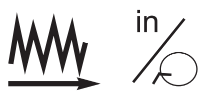
Figure 8.6 Feed Rate Chart

Below the gear formula is a repetition of the **“Do not change selector handle positions while the machine is running”** symbol.

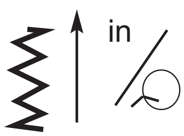
The Header Row contains a number of symbols explained below:



This symbol refers to inch thread pitches (threads per inch). The “N” represents the distance the carriage assembly travels for each rotation of the spindle based on the positions of the selector lever (I-III) and selector lever 1-7. For example, if the distance traveled in one rotation of the spindle is 1/10 inch per rotation, the machine will travel 1 inch in 10 rotations, yielding 10 threads per inch (tpi).



This symbol represents the longitudinal (X-Axis Travel) in inches per spindle revolution.



This symbol represents the lateral Y-Axis Travel) in inches per spindle revolution.

This symbol refers to the the inch thread pitch. Inch pitches measures the distance between each thread peak.

Directly below this set of symbols is a row of Roman Numbers I-III, This row represents the position of the selector lever (I-III) when cutting a threads or determining a feed rate.

Section one of the chart list the inch thread pitches that can be cut with the Granite series machines. The last row corresponding with the gear location guide shows the position of the gears inside the pulley box. When cutting inch threads the following gears are required:

A=30
B=66
C=60
D=60

This is the default setting from the factory.

Section two of the chart list the feed rates for the X-Axis (longitudinal feed). The same gear set-up is required as for cutting inch threads.

Section three of the chart list the feed rates for the Y-Axis (lateral feed). The same gear set-up is required as for cutting inch threads.

Section four and five of the chart list the metric thread pitches when using the following gear set-up:

Section 4	Section 5
A=33	A=66
B=80	B=64
C=63	C=63
D=60	D=60

Changing gears will be covered in the Threading chapter.

Sample Settings

Here are a couple of examples to illustrate the speed/feed chart.

Example 1
Settings to thread 10 threads per inch.

In section 1, locate number 10. Follow the row over to the column next to the meshing gears which is the number 4. Follow the column up to the Roman Numerals which is Roman Numeral I. To cut this thread you will need:

1. Selector lever (1-7) in position 4
2. Selector lever (I-III) in position I
3. 30 tooth gear in position A
4. 66 tooth gear in position B
5. 60 tooth gear in position C
6. 60 tooth gear in position D.
7. Set the Inch/Metric selector, found in the pulley box, to Inch.

Example 2
Setting to move the carriage assembly 0.0069 in per spindle revolution.

Locate the rate 0.159 in section 2. Follow the row over to the column next to the diagram of the meshing gears which is 5. Follow the column up to the Roman Numerals which is II. To feed your carriage at this rate you will need to:

1. Selector lever (1-7) in position 5
2. selector lever (I-III) in position II
3. 30 tooth gear in position A
4. 66 tooth gear in position B
5. 60 tooth gear in position C
6. 60 tooth gear in position D.
7. The Inch/Metric selector found in the gear box would need to be set to Inch.

These example settings will aid you in correctly setting up your machine for powerfeeding which will be covered in the next section of this manual.

! NOTICE !

The feed chart on your machine is in millimeters per spindle revolution. Please see **Appendix B** for feed rates based in inches per spindle revolution.

NOTES:

9 Using Powerfeeds

Overview

The previous section of this manual explained speeds and feed and how they are determined. This section will give you step by step instructions for using the powerfeed on your Granite 1300 series lathe-mill-drill.

General machining practices can be found in the one of the many machining reference books that Smithy carries such as the Home Machinist Handbook, item 10-005.

General Safety Operations

⚠ CAUTION

For your own safety and the safety of those around you, follow the rules below and those listed in chapter 2 of this manual.

⚠ DANGER

Never leave or walk away from an operating machine.

⚠ CAUTION

Do not change motor rotation direction until the motor and spindle are fully stopped. Changing directions while the motor is running can damage the motor.

Powefeeding Defined

Power feeding is using the motor and gear train of the machine to provide power to move the cross-slide table and carriage assembly along the X and Y-axes.

The carriage can be moved longitudinally and the cross-slide table laterally using the powerfeed capabilities of the machine. Power feeding will give a more uniform finish on the workpiece and is available for both milling and lathe work.

⚠ CAUTION

The two-position powerfeed function selector must be in either the lathe or mill position according to which machine function is being used at the time.

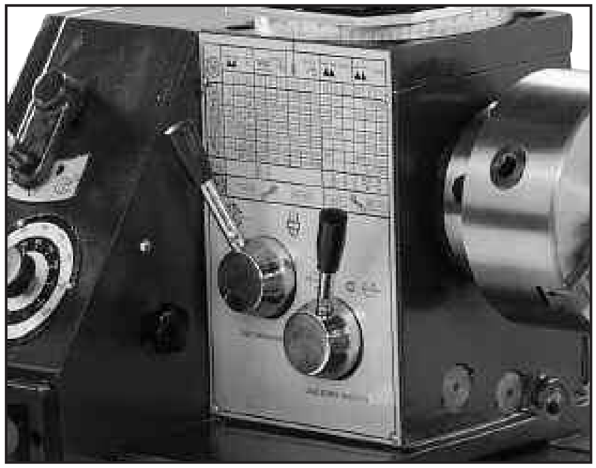


Figure 9.1 Always match the Powerfeed Function lever to the appropriate operation

! NOTICE !

If the mill/lathe clutch is in the mill position, you must also position the powerfeed function selector in the mill position to enable the machine to move the table.

The powerfeed operates in either the x- or y-axis. It incorporates the quick change gear box by engaging the Selector Lever (1-7) and Selector Lever (I-III) as well as the carriage gearing by engaging the powerfeed lever into the proper position.

Figure 9.2 Selector Lever (1-7) & Selector Lever (I-III)

The powerfeed engagement lever is located on the upper right side of the apron and has a three-position gate with neutral, longitudinal (x axis) and cross feed (y axis). The powerfeed engagement lever can be operated while the machine is running.

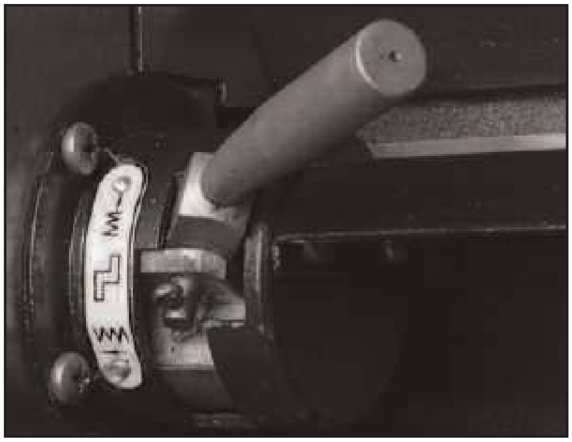


Figure 9.3 Powerfeed Engagement Lever Shown with Y-Axis powerfeed engaged

Engagement of the x axis is achieved by moving the lever to the left and pushing down and the engagement of the y axis is to the right and lifting up.

DANGER

Don't allow the table to move beyond the travel limitations. Before running the powerfeed, do a "dry run" by manually feeding the cross-slide table and carriage assembly the distance that you will be feeding your project. This will prevent any unnecessary crashes that can cause serious damage to your machine.

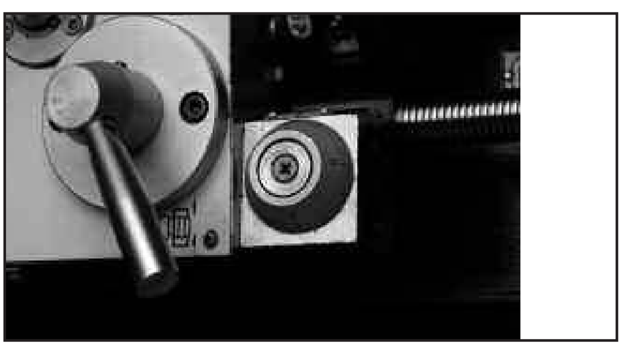


Figure 9.4 Half Nut Disengaged

! NOTICE !

When using the X-Axis powerfeed for a given feed rate, make sure the the half nut is DISENGAGED.

! NOTICE !

If the powerfeed lever will not engage, first check the half-nut lever. The powerfeed will not engage if the half-nut is engaged (down position). You may also have a situation where the teeth on the respective gears are not meshing. Rotate the leadscrew handwheel slightly to allow the teeth to mesh.

The Jog Knob

The chrome knurled knob located on the upper right side of the gearbox can be used to manually turn the gear shafts and allow the straight cut gears to mesh easier when moving the powerfeed selector levers.

Figure 9.5 Jog Knob

Step-By-Step Lathe Powerfeeding

Step 1: Determine the proper speed and feed rate for the material you are cutting and the cutter you will be using from a general reference guide such as the Machinist Ready Reference.

Step 2: With your workpiece and tooling properly mounted, place the power-feed selection lever in the lathe mode by moving the lever to the lathe chuck icon all the way to the left.

Step 3: Referencing the chart on the front of the machine's headstock, find the desired feed rate (or the closest to the listed range for your work material cutter.) See section 8 for a detailed chart explanation.

Step 4: Position the selector (1-7) into the position listed on the chart for the desired feed rate.

Step 5: Position the selector (I-III) into the position listed on the chart for the desired feed rate.

Step 6: Set the recommeded speed for the work stock material and cutter that you are using. (See chapter 8 for setting speeds.)

! NOTICE !

For optimum performance, be certain to set the belts to run in the upper portion of the suggested spindle rotation speed range.

Step 7: Before running the powerfeed do a "dry run" by manually feeding the cross-slide table and carriage assembly the distance that you will be feeding your project. Also, rotate the chuck by hand to verify tool clearances. This will prevent any unnecessary crashes.

Step 8: Once your speed has been set start the machine and engage the powerfeed selector into the desired position. (Pushing the lever up will run the powerfeed along the Y-Axis. Pushing the lever down will engage the X-Axis powerfeed.)

Step 9: To stop powerfeeding, disengage the powerfeed by moving the lever into the neutral position which is half way between the Y-Axis and X-Axis engagement.

Step I0: If you wish to reverse the direction of your cut,stop the machine and move the leadscrew rotation lever into the opposite direction. Restart the machine and engage the powerfeed selector lever.

Step-By-Step Mill Powerfeeding

Step 1: Determine the proper speed and feed rate for the material your cutting and the cutting material you will be using from a general reference guide such as the Machinist Ready Reference.

Step 2: With your workpiece and tooling properly mounted, place the powerfeed selection lever in the mill mode by moving the lever to the mill spindle icon all the way to the right. (Reference figure 9.1 above.)

Step 3: Referencing the chart on the front of the machine's headstock, find the desired feed rate (or the closest to the listed range for your work material and cutter.)

Step 4: Position the selector (1-7) into the position listed on the chart for the desired feed rate.

Step 5: Position the selector (I-III) into the position listed on the chart for the desired feed rate.

Step 6: Set the recommended speed for the work stock material and cutter that you are using. (See chapter 8 for setting speeds.)

! NOTICE !

For optimum performance be certain to set the belts to run in the upper portion of the suggested spindle rotation speed range.

Step 7: Before running the powerfeed do a "dry run" by manually feeding the cross-slide table and carriage assembly the distance that you will be feeding your project. This will prevent any unnecessary crashes.

Step 8: Once your speed has been set start the machine and engage the powerfeed selector into the desired position. (Pushing the lever up will run the powerfeed along the Y-Axis. Pushing the lever down will engage the X-Axis powerfeed.)

Step 9: To stop powerfeeding, disengage the powerfeed by moving the lever into the neutral position which is half way between the Y-Axis and X-Axis engagement.

10 Threading

Overview

This section of your manual covers threading operations on your Granite 1300 series lathe-mill-drill. This section will build the information presented in chapters 8 and 9. If you have not read these sections, please do so before continuing.

General Safety Operations

⚠ CAUTION

For your own safety and the safety of those around you, follow the rules below and those listed in chapter 2 of this manual.

⚠ DANGER

Never leave or walk away from an operating machine.

⚠ CAUTION

Do not change motor rotation direction until the motor and spindle are fully stopped. Changing directions while the motor is running can damage the motor.

Leadscrew Safety Clutch Adjustment

Before begining your threading operation, note the leadscrew safety clutch may need to be adjusted.

The lead screw safety clutch is functioning in the threading mode. It will slip to prevent damage to the machine apron if the carriage is accidentally run into the head of the machine.

NOTE: The clutch will not prevent damage if the carriage or cross-slide table pass the end of their mechanical limits

The clutch assembly is located inside the lathe pulley box. It is a round flat nub in the change gear shaft with the “D” gear. There are six setscrews above the springs and ball bearings located radially around the clutch in front of the gear. The setscrews screw inward toward the center of the clutch.

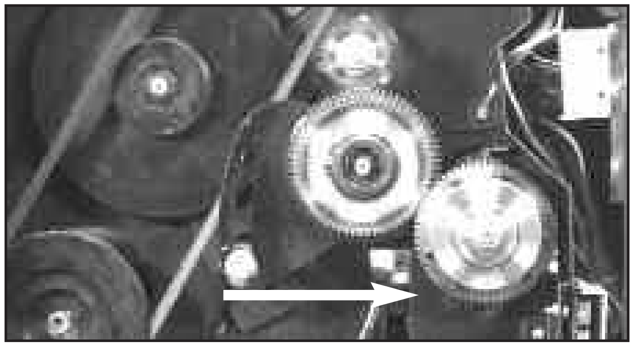


Figure 10.1 Leadscrew Safety Clutch

If slippage occurs during your threading operation adjust the safety clutch by turning each setscrew one at a time a half turn each time untill the clutch is solid and no slippage occurs. Do not bottom the screws completely of the clucth will not work.

An approximate initial setting is when the set screws have two threads exposed from the surface of the clutch housing.

Basic Threading

Refer to a machining reference guide such as the Machinist Ready Reference for threading theory and spindle speeds based on the material type and diameter that you will be machining.

Step 1: Select the thread pitch which you want to cut from the chart located on the headstock of your Granite series machine (The is also reprinted on page 8-5 of this manual.) Chose the desired pitch from the chart and follow the horizontal row and vertical columns to set the correct positions for selector levers (1-7) and selector lever (I-III).

Figure 10.2 Selector Lever (1-7) & Selector Lever (I-III)

Step 2: Consult the thread chart on the headstock support column for the thread pitch that you wish to cut. The bottom row of the chart will show you the gear set-up inside the pulley box that is required to cut the desired thread pitch.

Step 3: If changing the gear set-up is necessary to achieve the desired thread pitch, follow the procedure under the title "Changing Gears" in the next section.

Changing Gears

Step 1: The A gear is secured with a bolt and washer assembly and the location is fixed. To remove the gear remove the bolt and washer.

Step 2: The B and C gears share the same shaft and are secured with a snap ring. Remove the snap ring from the shaft to remove the gears.

Step 3: Place the proper gear in the A position for cutting the desired thread pitch. Reinstall the washer and bolt.

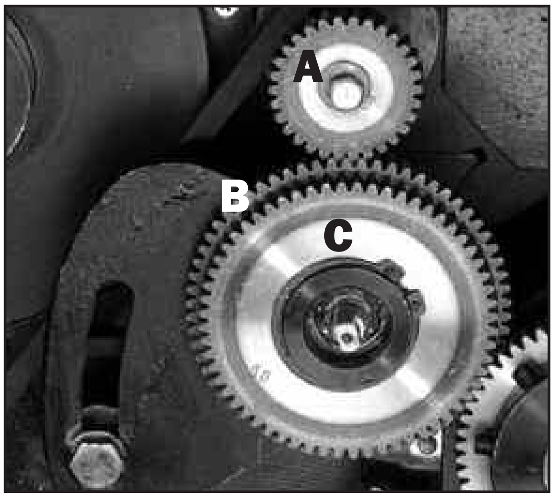


Figure 10.3 Make certain that your gears are properly set-up to obtain the desired thread pitch

Step 4: The shaft for the B/C gears mounts on a slotted plate to adjust for the different diameters of the gears. There are two flats on the end of the shaft to loosen and tighten the assembly to allow for adjustment. Adjust the B/C gear shaft as needed to accommodate the B and C gears needed for cutting your desired thread pitch.

Figure 10.4 Inch/metric Selector located inside the pulley box

Step 5: Loosen the hex head bolt. This allows the assembly to drop down.

Step 6: Position the installed B/C gear unit to mesh with the D gear.

Step 6: Rotate the gear assembly until the B gear meshes with the A gear. Lock the assembly in place by tightening the hex head bolt.

The hex head bolt also tensions the speed reduction pulley support arm. Be sure the belts are in the appropriate position before tightening the hex head bolt.

Cutting Inch Threads

Step 1: Select the desired thread pitch that you wish to cut from the chart located on the headstock of the Granite 1300 series lathe-mill-drill.

Step 2: Engage selector levers (1-7) and selector lever (I-III). Remember, you can use the jog knob located on the right side of the gear box to help align the gears if the levers are difficult to engage.

Step 3: Check the gear set-up inside the pulley box to confirm the gearing is set-up correctly to cut your desired thread pitch. If the gears are not correct, change gears using the previous procedure.

NOTE: The default factory setting is for cutting inch, SAE, threads.

Step 4: Confirm that your belts inside the pulley box are properly set-up to reach the recommended spindle speed for cutting your work piece material with your specific cutter.

Step 5: Set your compound angle toolpost to 29-1/2º and install the E8 carbide bit that came with your machine.

Step 6: Inside the pulley box at the left lower side of the gear cluster is the inch/metric lever, which must be pushed away from you for inch threading.

Step 7: Turn your machine on and adjust variable speed to the recommended speed.

Step 8: Once you have made all of your tooling and machine settings, you are ready to begin the first pass. Set the dials on the compound angle toolpost and cross-slide table to zero. Move the compound angle toolpost into the desired position and feed the cutter into your workpiece using the small CATP feed handle. Watch the threading dial rotate until one of the numbers is just about to the reference mark. At this point apply firm constant downward pressure on the half-nut engagement lever until you feel the lever drop into position and the carriage begins to move. (More information to follow on the threading dial.)

Figure 10.5 Half Nut Engaged

Step 9: When you reach the end of the first cut, lift up on the half-nut engagement lever, back the cutter out using the CATP feed and return the cutter to the starting point.

Step 10: Feed the cutter in the desired amount for the next cut, wait for the same number as before to come up on the dial and engage the half nut. Continue making passes until you have completed the full depth of cut.

Using the Threading Dial to Cut Inch Threads

The threading dial is used for cutting inch threads only. Special procedures for cutting metric threads can be found in the section under " Cutting Metric Threading" on the next page.

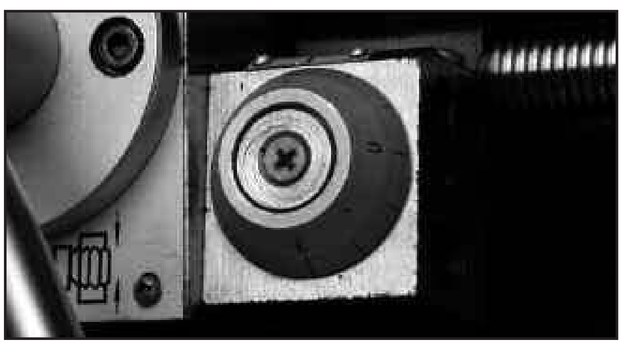


Figure 10.6 Note the number on the threading dial as your halfnut engages

The threading dial is a mechanical indicator for engaging the cutter at the exact same point for each consecutive pass. The numbers on the dial have no specific reference to pitch, but they provide a reference point so you can start at the earliest available point and use the same number again for each consecutive pass.

Note: When the carriage is moving and the half nut is engaged, you will notice that the dial no longer rotates. This is normal.

Cutting Metric Threads

Step 1: Select the desired thread pitch that you wish to cut from the chart located on the headstock of the Granite 1300 series lathe-mill-drill.

Step 2: Engage selector levers (1-7) and
selector lever (I-III). Remember, you can use the jog knob located on the right side of the gear box to help align the gears if the levers are difficult to engage.

Step 3: Check the gear set-up inside the pulley box to confirm the gearing is set-up correctly to cut your desired thread pitch. If the gears are not correct, change gears using the previous procedure.

Step 4: Confirm that your belt set-up inside the pulley box is properly set-up to reach the recommended spindle speed for cutting your work piece material with your specific cutting tool material.

Step 5: Set your compound angle toolpost to 29-1/2º and install the E8 carbide bit that came with your machine.

Step 6: Inside the pulley box at the left lower side of the gear cluster is the inch/metric lever, which must be pulled toward you for metric threading.

Step 7: Turn your machine on and adjust the variable speed to the recommended rpm.

Step 8: Once you have made all of your tooling and machine settings, you are ready to begin the first pass. Apply firm constant downward pressure on the half-nut engagement lever until you feel the lever drop into position and the carriage begins to move.
.
Step 9: Do not disengage the half nut at the end of the pass, stop your machine and reverse the feed direction. Rotate the handle on the compound angle toolpost counter clockwise to back out your cutter.

Step 10: Restart your machine and bring the cutter back to is original position. Stop your machine, reverse the direction again.

Step 11: Feed the cutter in the desired amount for the next cut using the CATP and restart your machine. Continue this process until you have reached the desired depth of cut.

11 Machine Maintenance Schedule

Overview

To keep your Smithy Granite machine running at optimum performance, follow this basic maintenance schedule:

Before Each Use

1. Make sure your work area is clean and free of all obstructions.

2. Clear machine cross-slide table, bed ways and tool post of all chips built up from your previous job.

> **⚠ CAUTION**
>
> Do not clear chips by hand. Metal chips are very sharp and can easily cut your hand. Use a brush or shop vaccum to clear chips.

3. Oil all oil buttons.

4. Clean tailstock barrel taper and mill spindle taper with a clean shop towel.

5. Check the oil site gauge under the lathe chuck and add oil if the level is below the half-way point.

6. Check all tooling and holding devices for tightness before you turn on the machine.

7. Check the condition and tension of the drive belts.

After Each Use

1. Clean chip build up from machine.

2. Brush chips off the longitudinal feed screw.

3. Remove any excess cutting fluid that may have accumulated on the machine.

4. Apply protective oil coating to all bare metal surfaces that may rust or corrode.

10 Hours (Daily)

1. Clean chip build up from machine.

2. Brush chips off the longitudinal feed screw.

3. Check the oil site gauge under the lathe chuck and add oil if the level is below the half-way point.

4. Oil all oil buttons

25 Hours (Monthly)

1. Check the oil site gauge under the lathe chuck and add oil if the level is below the half-way point.

2. Oil all oil buttons

3. Apply a light coating of oil to the outside of the mill spindle and the top of the mill spindle splines.

4. Lubricate the change gears in the lathe pulley box with an aerosol chain lubricant.

5. Lubricate the inside of the quick change gearbox with an aerosol chain lubricate by spraying through the openings in the front of the gearbox.

6. Remove and clean the lathe chuck and the spindle nose. Lubricate the chuck and the cam locks with oil.

7. Check all gib adjustments.

8. Check and adjust backlash as necessary.

9. Check the condition of all drive belts and replace if necessary.

100 Hours (Yearly)

1. Change oil in the headstock.

2. Remove the X and Y-Axis gibs and clean with solvent. Coat gibs with way oil and reinstall.

12 Troubleshooting

Powerfeed and Thread Cutting

1. Powerfeed does not move carriage

Cause	*Solution*
• Carriage locked	• Unlock carriage
• Speed selector not engaged	• Select speed I or II or III, engage drive selector
• Sheared pin	• Replace pin
• Gears not meshing or teeth missing	• Check gears and adjust
• Inch/metric lever in neutral	• Engage fully

2. Cut is not smooth

Cause	*Solution*
• Tool dull	• Sharpen or replace tool
• Tool not on center	• Center tool (shim, if needed)
• Tools not mounted tightly in post	• Remount tools
• Cross-slide gibs to bed and base loose	• Adjust gibs
• Gibs in toolpost loose	• Adjust gibs in toolpost
• Tool turret not tight	• Tighten toolpost
• Feed rate too fast	• Choose correct setting
• Gear loose	• Tighten gears and posts

3. Thread is not smooth

Cause	*Solution*
• Tool dull	• Sharpen tool
• Tool not centered	• Center tool
• Tools not mounted tight in post	• Remount tool
• Cross-slide gibs to bed and base loose	• Adjust gibs
• Gibs in compound loose	• Adjust gibs
• Tool turret not tight	• Tighten toolpost
• Gears loose	• Tighten gears and posts

4. Tools is not cutting “on thread”

Cause	*Solution*
• Powerfeed slipping	• Engage halfnut fully
• Clutch slipping	• Tighten screws (6)

For Assistance: Call Toll Free 1-800-476-4849

Carriage/Milling Table

1. Table won't move

Cause	*Solution*
• Table locks engaged	• Loosen locks
• Gibs too tight	• Loosen gibs

2. Horizontal and vertical movement in cross-slide table

Cause	*Solution*
• Carriage gib improperly adjusted	• Adjust carriage gib
• Table gib improperly adjusted	• Adjust table gib

3. Carriage moves smoothly in only one direction

Cause	*Solution*
• Debris on way or gib	• Remove debris
• Burr on gib	• Remove burr with fine file
• Gib improperly tensioned	• Loosen gib and re-tension
• One or more wipers mounted too low	• Reposition wiper(s)

4. Cross-slide handwheel turns during cutting operations

Cause	*Solution*
• Cross-slide brass nut worn	• Tighten or replace brass nut
• Carriage lock not tight	• Tighten carrriage locks
• Gibs too loose	• Readjust gibs

5. Too much backlash in the cross-slide

Cause	*Solution*
• Loose screw	• Tighten screw, review how to eliminate backlash
• Loose brass nut	• Put a shim between the stud on the nut and the side of the hole
• Worn brass nut	• Replace brass nut or adjust screw at end of nut
• Excessive space between bearing	• Add shim washer and dial

Lathe Turning

Cause	*Solution*
• Tool dull	• Sharpen or replace tool
• Tool not ground properly	• Regrind tool
• Tool at wrong angle	• Correct tool position
• Tools not held tightly	• Tighten toolholder
• Wrong cutter for material	• Use correct cutter
• Cutting speed incorrect	• Increase or reduce speed

2. Work has unwanted taper

Cause	*Solution*
• Work improperly aligned	• Realign centers on work
• Debris in spindle, setup, or tools	• Clean and reset setup, work, or tool
• Offset tailstock incorrectly positioned	• Correct position of tailstock
• Spindle bearings loose	• Tighten taper bearings to return to alignment, replace spindle bearings

3. Machine vibrates

Cause	*Solution*
• Work mounted wrong	• Remount work
• Speed too high	• Reduce Speed
• Too much pressure at tailstock	• Reduce pressure and increase lubrication

4. Work stops turning but machine continues to run

Cause	*Solution*
• Work not mounted securely	• Remount work
• Tools forced into work/ excessive cut	• Reduce force on tools
• Belts slipping	• Tension belts, use belt dressing, or replace belts

5. Diameter of work is not consistent

Cause	*Solution*
• Too much flex in workpiece	• Use a follow rest, use tailstock center
• Too much flex compound rest, cross slide, or carriage	• Tighten gibs, clean ways

6. Too much backlash in the compound

Cause	*Solution*
• Loose spanner nuts	• Tighten spanner nuts
• Worn Nut	• Replace nut

7. Machine slings oil from behind the chuck or in belt box

Cause	*Solution*
• Oil reservior overfilled	• Check oil lever
• Worn oil seal	• Replace felt in seal

Milling

1. Tool chatter

Cause	*Solution*
• Gibs too loose on cross slide, compound, or carriage	• Readjust gibs
• Unused feeds not locked	• Lock all axes but the one moving
• Millhead not locked	• Lock millhead
• Quill too loose	• Tighten quill lock
• Tool not on center	• Center tool
• Improper tool shape, tool dull	• Reshape, sharpen, or replace tool
• Feed too light or slow	• Adjust feed rate

2. Depth of cut is not consistent

Cause	*Solution*
• Quill moving	• Lock quill
• Setup wrong	• Make sure setup is parallel to table

Drilling

1. Hole is off center or bit wanders

Cause	*Solution*
• Bit dull	• Use sharp bits
• Bit not mounted correctly in chuck	• Remount tool
• Bit bent	• Replace bit
• Chuck loose in spindle	• Remount chuck on arbor
• Drawbar not secured	• Tighten drawbar
• Debris on spindle	• Clean debris and arbor and remount tool
• Bearing loose or worn	• Tighten or replace bearings

Cause	Solution
• Cutting too fast	• Reduce speeed
• Incorrect bit	• Use correct bits
• No pilot hole	• Drill small pilot hole

2. Entrance hole is out of round

Cause	*Solution*
• Bit dull	• Use sharp bit
• Incorrect drill bit	• Use correct drill bit

3. Bit turns erratically or stops

Cause	*Solution*
• Bit fed into work too fast	• Reduce feed rate
• Belts slipping	• Reduce feed rate, re-tension belts

4. Chuck is difficult to tighten or loosen

Cause	*Solution*
• Chuck sticking	• Apply lubricant
• Debris in chuck	• Clean chuck

5. Chuck wobbles

Cause	*Solution*
• Chuck loose on arbor	• Clean arbor and remount
• Drawbar not tight	• Clean spindle and replace drawbar

Drive System

1. Turn on the machine and nothing happens

Cause	*Solution*
• Breaker Blown	• Re-set circuit breaker
• Machine unplugged	• Plug in the machine
• Loose electrical connections	• Tighten wiring connections
• Electrical components bad	• Replace defective parts

2. Motor and pulleys turn, but not lathe or mill

Cause	*Solution*
• Mill or lathe not selected	• Select proper function

Motor

How to check a Motor

Get a car battery and attach the two wires coming from the motor to the terminals of the battery. If the motor runs, the motor is okay, if not it needs to be replaced.

Uncscrew brush caps and inspect the brush carbon, spring and wire. If damaged or worn out replace it.

Chuck and Accessories

If the chuck does not seat properly.

Adjusting the chuck mounting studs

The D1-4 mounting system used on all Granite machines consists of three adjustable studs mounted on the chuck and three rotating cam locks on the spindle flange. This is a very fast and accurate method of chuck mounting; however, there are some adjustments to be made to insure optimum fit and accuracy.

Removing the chuck

1. The first step in removing the chuck is to place a piece of wood on top of the machine bed underneath the chuck. This will protect the bed if the chuck accidentally slips out of your hand and falls onto the machine.

2. There is an alignment mark on each cam and on the spindle flange adjacent to each cam. Using the chuck key, turn the cam counter clockwise until the two marks align with each other as shown below.

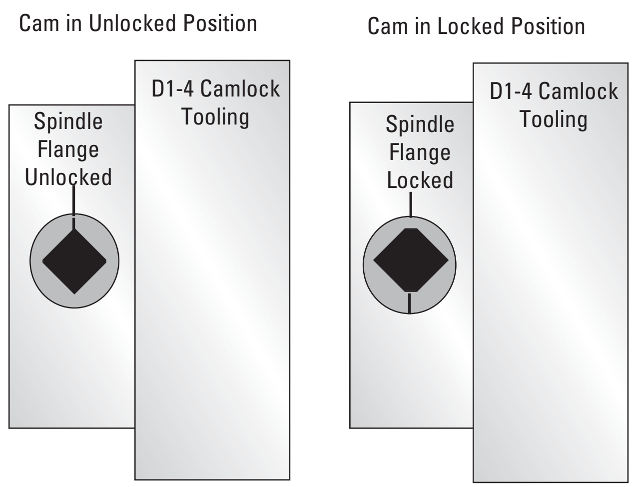


Figure 12.1 D1-4 Lathe Chuck in Locked & Unlocked Position

3. Position all three cams in the unlocked position, put your right hand under the chuck for support and tap the chuck with a block of wood to break it loose from the spindle.

4. Inspect the mating surfaces on the end of the spindle and the back of the chuck for burrs or foreign matter. Clean and deburr these areas as necessary.

Installing and Adjusting the chuck

1. Make sure that the cams are aligned in the unlocked position and slide the chuck onto the spindle.

2. Turn each cam clockwise to lock the chuck in place.

3. Each cam should turn between 140° to 180° of a turn to lock correctly. See the diagram below.

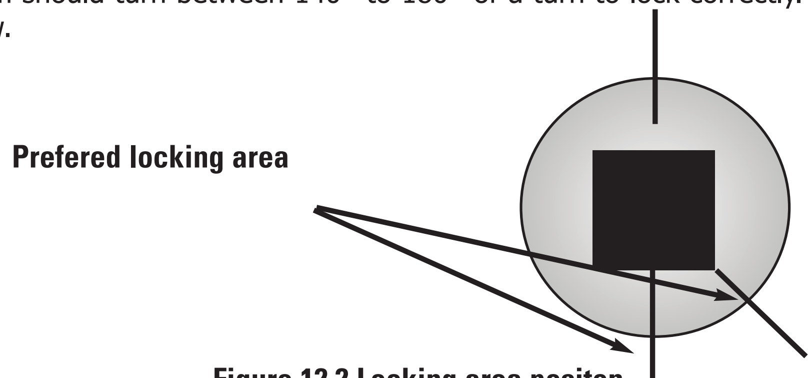


Figure 12.2 Locking area positon

4. If the cam turns less than one fourth of a turn, it will be necessary to remove the chuck and adjust the corresponding chuck stud.

5. Before removing the chuck, mark each location **on the chuck** that will need adjusting.

6. Remove the chuck and place it face down on a work surface.

7. There is a locking screw along side each chuck stud. Remove the locking screws for the studs that need adjusting.

8. Unscrew the studs one turn and install the locking screws.

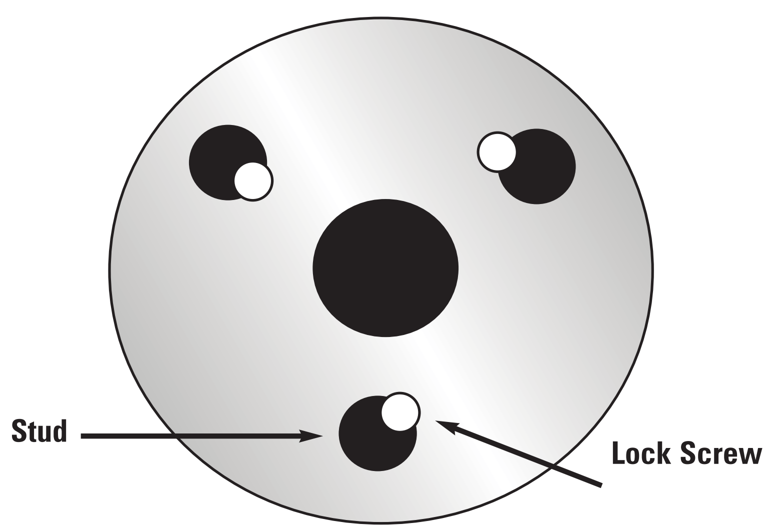


Figure 12.3 Back of the chuck

9. Install the chuck and check the cam rotation. Repeat as necessary.

Since there are three studs and cam mounts on the chuck, there are three possible position that the chuck may be mounted. You will find that one of these positions will be slightly more accurate than the others. Try the chuck in all three possible positions. Once the most accurate position is determined, mark the chuck and spindle flange so that the chuck can be installed in the same position each time that it is mounted onto the machine. This is best done by putting a punch mark on the chuck and a corresponding mark on the spindle flange.

This next step is only for the 3-jaw self centering chuck.

Mark each of the three jaws, and the slot it is in. Remove the jaws, and keeping them in the same order, reinsert them into the next slot over making sure the scroll plate engages the first thread on the first jaw. Try the jaws in all three positions; one should be more accurate than the other two.

Leadscrew

Having trouble on the leadscrew backlash particularly on engaging the half nut?

Leadscrew Backlash Adjustment

Excessive backlash in the longitudinal feed can come from two places:

1. The fit of the longitudinal feed screw to the right hand mounting trestle.

2. The fit of the half nut to the feed screw.

Screw to mount backlash

Engage the half nut lever. Slowly turn the longitudinal feed screw clockwise as viewed from the right end of the machine and watch the gap between the dial and the feed screw mounting trestle. Reverse the direction you are turning the feed screw and see if the gap increases slightly. If so then there is some play in the mounting. To reduce the play, accomplish the following.

1. Remove the bolt/ washer from the right end of the longitudinal feed screw.

2. Unscrew the handle from the end of the feed screw.

3. Using a punch and a small hammer, tighten the spanner nut about one eigth of a turn and recheck the play in the screw.

4. If the play is acceptable, replace the handle and retaining bolt. If more adjustment is needed, repeat the step above.

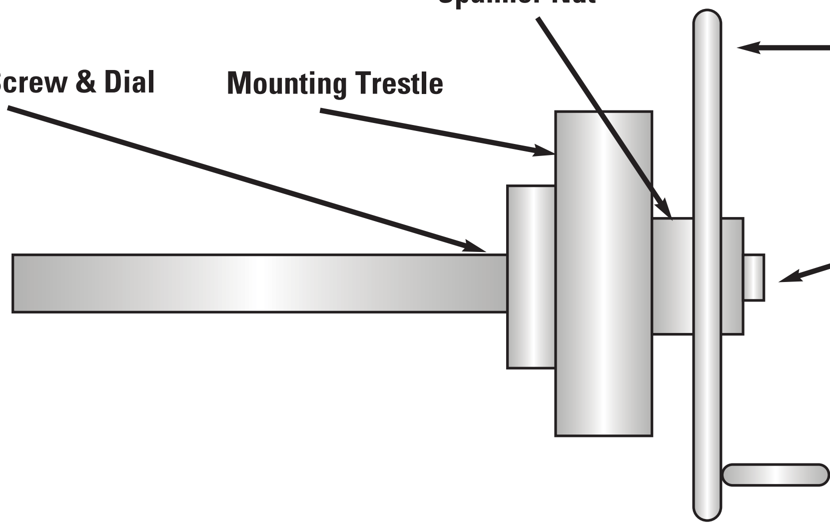


Figure 12.4 Parts of the Handwheel

Half nut to screw backlash

Worn threads on the half nut can cause excessive backlash in the longitudinal direction. Half nuts are made of brass and do wear out over a period of time. The only fix for a worn half nut is to replace the worn nut with a new one.

Crossfeed Backlash Adjustment

Excessive backlash in the crossfeed can be coming from three different places:

1. The fit of the crossfeed screw to the front screw mount.

2. The fit of the crossfeed screw into the brass crossfeed nut.

3. The fit of the brass crossfeed nut into the carriage casting.

There are adjustments for each of the above areas. Before making any adjustments to the crossfeed screw system, it is recommended that all the gibbs on the table and carriage system be checked and adjusted as per the owners' manual.

Crossfeed Screw To Front Mount

Slowly turn the crossfeed handle clockwise and watch the gap between the dial and the front screw support mount. Change directions and note if the gap increases slightly. If so this is a sign that there is some play in the mounting. To reduce this play, follow the procedure below.

1. Loosen the two nuts that hold the crossfeed handle on the end of the screw.

2. Tighten the inner nut slowly while checking the ease of movement of the crossfeed

handle. When the screw starts to get hard to turn, loosen the nut slightly so the screw turns free.

3. Hold the inner nut in place and tighten the outer nut against it to lock the nuts in position.

4. Recheck the backlash.

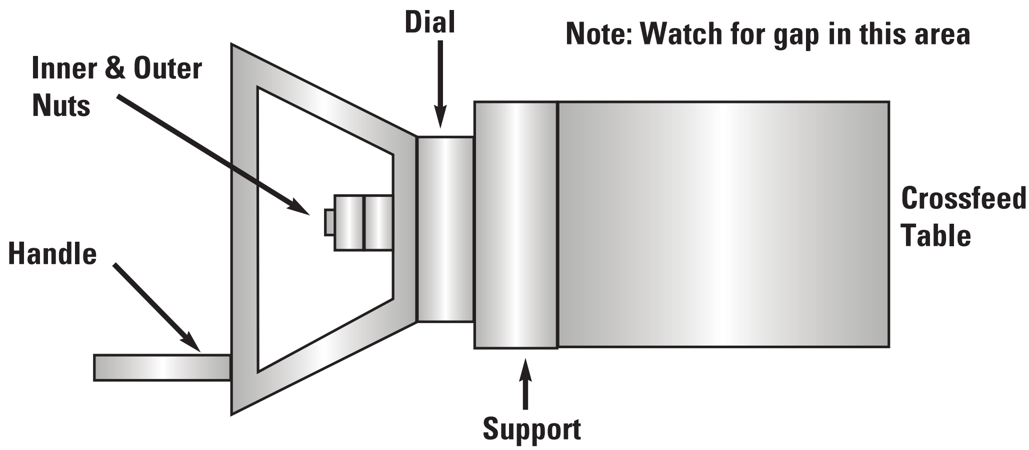


Figure 12.5 Crossfeed Screw Parts

Crossfeed Screw to Brass Nut & Nut to Carriage (Locking Bolt)

If there is still an excess of backlash after the above adjustments are made, the play will be either between the crossfeed screw and the brass nut or between the brass nut and the carriage. The following procedure covers both adjustments at the same time:

1. Remove the crossfeed screw rear support.

2. Loosen the Allen head bolt that locks the brass nut into the carriage.

3. Crank the crossfeed table toward the operator side of the machine. Watch under the table from the backside and stop before the crossfeed screw comes out of the brass nut.

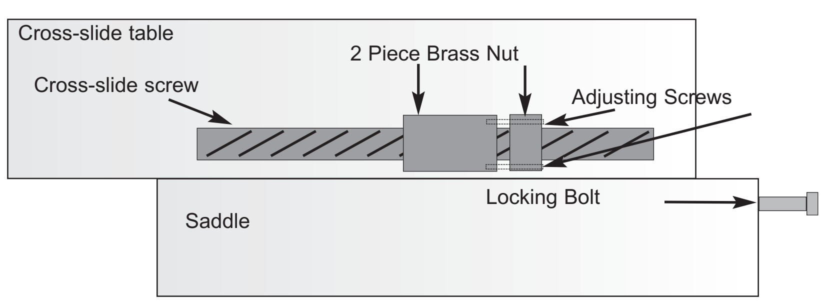


Figure 12.6 Crossfeed Table Cross Section

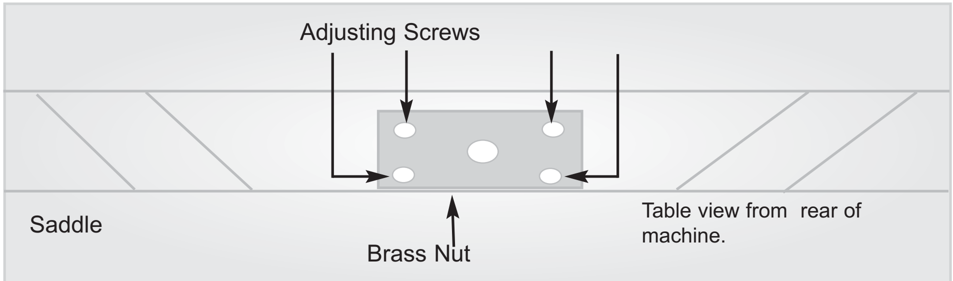


Figure 12.7 Crossfeed Table Rear View Cross Section

4. Slowly tighten the four adjusting screws on the brass nut, one at a time, until a slight drag is felt while turning the crossfeed handle.

5. Install the rear crossfeed support and tighten the locking bolt for the brass nut.

6. Recheck the backlash on the crossfeed.

If you find that the four adjusting screws are not staying in place, you can use a small amount of a thread-locking compound to keep the screws tight.

Granite Series Leadscrew Handwheel Fabrication & Installation (Earlier Machines)

Purchase part # G91027 or use the instructions below.

Installation of a handwheel to the right end of the leadscrew will allow a more precise lateral feeding of the carriage travel than is now possible using the carriage feed handwheel. The following is a simple handwheel plan that can be made using the Granite machine. The wheel portion can be made from a piece of mild steel, aluminum, or cast iron. The handle portion should be made of mild steel.

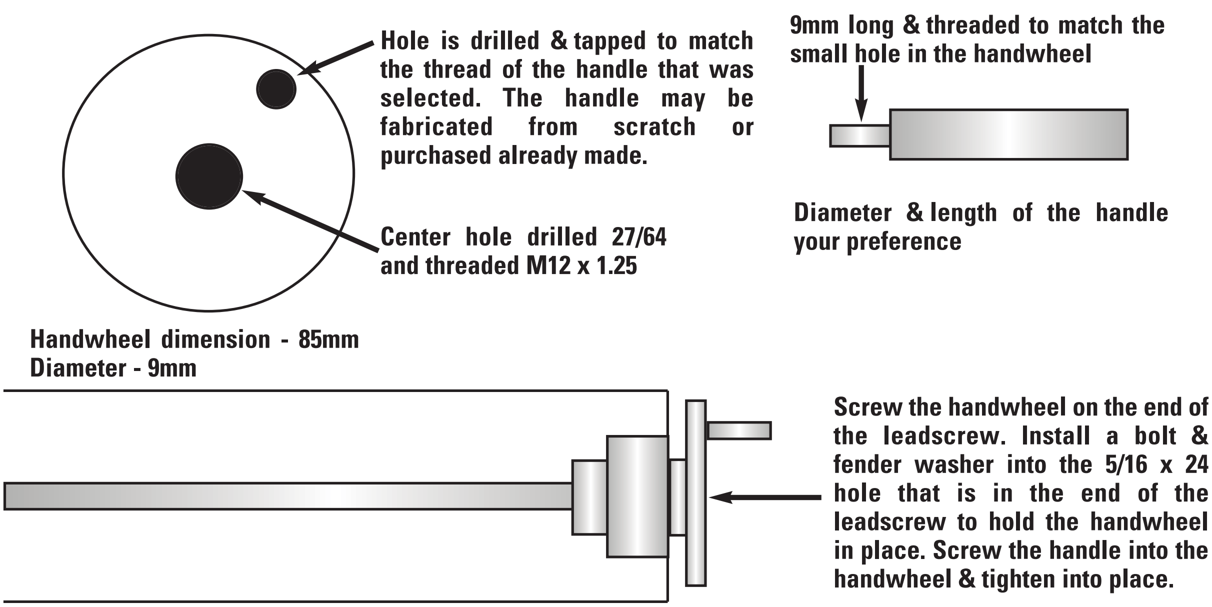


Figure 12.8 Handwheel Fabrication & Installation

Note: If you have an older Granite model, the end of the lead screw may not be drilled and tapped. This is a very simple process. You will need a 5/16 x 24 tap, a 17/64 or a “I” drill bit, and an electric hand drill. Set up your machine on the slow speed pulley, full RPM, with leadscrew turning counter clockwise as viewed from the right end and the gearbox set on 1 and “I”. By having the leadscrew turning as well as the drill, the drill bit will center itself and go straight down the center of the lead screw. Drill the hole about 5/8 inch deep. Tap the hole with the 5/16 tap. Do not forget to use oil when drilling and tapping.

NOTES:

13 Machine Specifications

Granite 1324 Series Machine

General Specifications	
General Dimension:	39″ height X 46″ length X 22-1/2″ width
Machine Weight:	Shipping 770 lbs, Machine 661 lbs
Crate Size:	49-1/2″ X 22-3/4″ X 44″
Footprint (static):	48″ X 36″
Footprint (operating):	72-1/2″ X 45-1/4″
T-Slot Size:	7/16″
Spindle Accuracy TIR:	0.00078″
Powerfeed (X-Axis):	Yes
Powerfeed (Y-Axis):	Yes
Powerfeed (Z-Axis):	No
Table Size:	6-3/4″ X 17-3/4″
Threading Dial:	Yes
Lathe Specifications	
Distance Between Centers:	24″
Dial Calibration on Crossfeed:	0.001″
Dial Calibration on Toolpost:	0.001″
Dial Calibration on Leadscrew:	0.001″
Dial Calibration on Tailstock:	0.001″
Dial Calibration on Longfeed Rack:	0.01″
Headstock Taper:	MT4
Lathe Chuck- Max. diameter workpiece:	6″
Lathe Chuck- Min. diameter workpiece:	1/8″
Lathe Chuck Bore:	1.6″
Lathe Chuck Diameter:	6″
Lathe Chuck Mount:	D1-4 Camlock
Lathe Chuck Type:	3 Jaw Self Centering
Spindle Bore:	1.125″
Spindle Speeds:	Variable (Range 0-2800 RPM)
X-Axis Travel (w/ tailstock installed):	20″
Y-Axis Travel:	7-5/8″
Feed Rate (X-Axis):	0.003″- 0.020″
Feed Rate (Y-Axis):	0.001″- 0.006″
Tailstock Offset:	19/32″
Tailstock Barrel Travel:	3″
Tailstock Taper:	MT3
Swing Over Bed:	13″
Swing Over Work Table:	7-1/2″
Threads:	SAE 7-52 TPI
Toolbit Size:	1/2″
Toolpost Travel:	3-3/16″

Mill Specifications

Column Diameter:	3-3/16″
Dial Calibration Drill-Coarse Feed:	0.05″
Dial Calibration Mill-Fine Feed:	0.001″
Drawbars Size (included):	7/16″
Drill Chuck Size (included):	5/8″
Drill Chuck Arbor Size (included):	R-8/JT3
Head Rotation:	360 Degrees
Quill Diameter:	2-3/4″
Quill Travel:	4-7/8″
Spindle Taper:	R-8
Spindle to Table Distance (min-max):	4″ to 13-3/8″
Tool Size Limits:	1″
X-Axis Travel:	9-1/2″
Y-Axis Travel:	7-5/8″
Head Travel (Z-Axis):	4-3/8″
Feed Rate (Y-Axis):	0.001″- 0.006″
Feed Rate (X-Axis):	0.003″- 0.020″
Spindle Speeds:	Variable (Range 0-2800 RPM)
Spindle Center to Front of Chuck:	
GN Classic:	4-5/8″
GN-MAX & GN-IMX:	8-1/2″
Spindle Center to Lathe Spindle Flange:	
GN Classic:	7-1/4″
GN-MAX & GN-IMX:	11-1/4″
Spindle Center to Support Column:	
GN Classic:	9-1/2″
GN-MAX & GN-IMAX:	13-3/8″

Electrical Specifications

Amperage:	
GN Classic & GN-MAX:	15 amps
GN-IMAX:	8-10 amps
Horsepower:	
GN Classic:	1.5 HP
GN-MAX & GN-IMX:	2.0 HP
Motor Type:	
GN Classic:	D/C Variable Speed (Permanent Magnet)
GN-MAX & GN-IMX:	D/C Variable Speed (Brushless Servo)
Voltage:	
GN Classic & GN-MAX:	110 Volts A/C
GN-IMX:	220 Volts A/C
Phase:	Single

Recommended Oil for Lubricant

For Gear Box:	SAE30 weight non-detergent oil or 30 weight compressor oil
For External :	Regular Oil
For Cleaning:	Noncorrosive Kerosene or White Mineral Spirits or even WD-40

Granite 1340 Series Machine

General Specifications

General Dimention:	39" height X 62" length X 22-1/2" width
Machine Weight:	Shipping 910 lbs, Machine 728 lbs
Crate Size:	64-1/2" X 22-3/4" X 44"
Footprint (static):	64" X 36"
Footprint (operating):	88-1/2" X 45-1/4"
T-Slot Size:	7/16"
Spindle Accuracy TIR:	0.00078"
Powerfeed (X-Axis):	Yes
Powerfeed (Y-Axis):	Yes
Powerfeed (Z-Axis):	No
Table Size:	6-3/4" X 17-3/4"
Threading Dial:	Yes

Lathe Specifications

Distance Between Centers:	40"
Dial Calibration on Crossfeed:	0.001"
Dial Calibration on Toolpost:	0.001"
Dial Calibration on Leadscrew:	0.001"
Dial Calibration on Tailstock:	0.001"
Dial Calibration on Longfeed Rack:	0.01"
Headstock Taper:	MT4
Lathe Chuck- Max. diameter workpiece:	6"
Lathe Chuck- Min. diameter workpiece:	1/8"
Lathe Chuck Bore:	1.6"
Lathe Chuck Diameter:	6"
Lathe Chuck Mount:	D1-4 Camlock
Lathe Chuck Type:	3 Jaw Self Centering
Spindle Bore:	1.125"
Spindle Speeds:	Variable (Range 0-2800 RPM)
X-Axis Travel (w/ tailstock installed):	20"
Y-Axis Travel:	7-5/8"
Feed Rate (X-Axis):	0.003"- 0.020"
Feed Rate (Y-Axis):	0.001"- 0.006"
Tailstock Offset:	19/32"
Tailstock Barrel Travel:	3"
Tailstock Taper:	MT3
Swing Over Bed:	13"
Swing Over Work Table:	7-1/2"
Threads:	SAE 7-52 TPI
Toolbit Size:	1/2"
Toolpost Travel:	3-3/16"

Mill Specifications

Column Diameter:	3-3/16"
Dial Calibration Drill-Coarse Feed:	0.05"
Dial Calibration Mill-Fine Feed:	0.001"
Drawbars Size (included):	7/16"

Drill Chuck Size (included):	
GN Classic:	1/2″
GN-MAX & GN-IMX:	5/8″
Drill Chuck Arbor Size (included):	R-8/JT3
Head Rotation:	360 Degrees
Quill Diameter:	2-3/4″
Quill Travel:	4-7/8″
Spindle Taper:	R-8
Spindle to Table Distance (min-max):	
GN Classic:	4″ to 13-1/3″
GN-MAX & GN-IMX:	4″ to 13-3/8″
Tool Size Limits:	1″
X-Axis Travel:	9-1/2″
Y-Axis Travel:	7-5/8″
Head Travel (Z-Axis):	4-3/8″
Feed Rate (Y-Axis):	0.001″- 0.006″
Feed Rate (X-Axis):	0.003″- 0.020″
Spindle Speeds:	Variable (Range 0-2800 RPM)
Spindle Center to Front of Chuck:	
GN Classic:	4-5/8″
GN-MAX & GN-IMX:	8-1/2″
Spindle Center to Lathe Spindle Flange:	
GN Classic:	7-1/4″
GN-MAX & GN-IMX:	11-1/4″
Spindle Center to Support Column:	
GN Classic:	9-1/2″
GN-MAX & GN-IMX:	13-3/8″

Electrical Specifications

Amperage:	
GN Classic & GN-MAX:	15 amps
GN-IMX:	8-10 amps
Horsepower:	
GN Classic:	1.5 HP
GN-MAX & GN-IMX:	2.0 HP
Motor Type:	
GN Classic:	D/C Variable Speed (Permanent Magnet)
GN-MAX & GN-IMX:	D/C Variable Speed (Brushless Servo)
Voltage:	
GN Classic & GN-MAX:	110 Volts A/C
GN-IMAX:	220 Volts A/C
Phase:	Single

Machining Reference Guide

How to Determine Speeds and Feeds for Lathe Turning (machine, materials, and tools)

The lathe rotates a workpiece against a cutting edge. With its versatility and numerous attachments, accessories, and cutting tools, it can do almost any machining operation.

The modern lathe offers the following:

- The strength to cut hard, tough materials
- The means to apply power
- The means to hold the cutting point tight
- The means to regulate operating speed
- The means to feed the tool into or across, or into and across, the work, either manually or by engine power, under precise control
- The means to maintain a predetermined ratio between the rates of rotating works and the travel of the cutting point or points

Turning Speed

When metal cuts metal at too high a speed, the tool burns up. You can machine soft metals like aluminum at fast speeds without danger or trouble, but you must cut hard steels and other metals slowly.

You must also consider the diameter of the workpiece. A point on a 3″ diameter shaft will pass the cutting tool three times as fast as a point an a 1″-diameter shaft rotating at the same speed. This is because the point travels a tripled circumference. For work in any given material, the larger the diameter, the slower the speed in spindle revolutions needed to get the desired feet-per-minute (fpm) cutting speed.

Lathes cut threads in various numbers per inch of materials threaded, according to the operator's needs. The Smithy Granite Series machine cuts threads to metric or inch standards.

In thread cutting, the carriage carries the thread-cutting tool and moves by the rotating leadscrew. The basic principle is that the revolving leadscrew pulls the carriage in the desired direction at the desired speed. The carriage transports the toolrest and the threading tool, which cuts the screw thread into the metal being machined.

The faster the leadscrew revolves in relation to the spindle, the coarser the thread. This is because the threading tool moves farther across the revolving metal with each workpiece revolution.

The lathe spindle holding the workpiece revolves at a selected speed (revolution per minute, or rpm) according to the type and size of the workpiece. The leadscrew, which runs the length of the lathe bed, also revolves at the desired rpm. There is a definite and changeable ration between spindle and leadscrew speeds.

Cutting Speeds for Various Diameters

FPM	50	60	70	80	90	100	110	120	130	140	150	200	300
DIAM	RPM												
1/16"	3056	3667	4278	4889	5500	6111	6722	7334	7945	8556	9167	12229	18344
1/8"	1528	1833	2139	2445	2751	3056	3361	3667	3973	4278	4584	6115	9172
3/16"	1019	1222	1426	1630	1833	2037	2241	2445	2648	2852	3056	4076	6115
1/4"	764	917	1070	1222	1375	1538	1681	1833	1986	2139	2292	3057	4586
5/16"	611	733	856	978	1100	1222	1345	1467	1589	1711	1833	2446	3669
3/8"	509	611	713	815	917	1019	1120	1222	1324	1426	1528	2038	3057
7/16"	437	524	611	698	786	873	960	1048	1135	1222	1310	1747	2621
1/2"	382	458	535	611	688	764	840	917	993	1070	1146	1529	2293
5/8"	306	367	428	489	550	611	672	733	794	856	917	1223	1834
3/4"	255	306	357	407	458	509	560	611	662	713	764	1019	1529
7/8"	218	262	306	349	393	426	480	524	568	611	655	874	1310
1"	191	229	267	306	366	372	420	458	497	535	573	764	1146
1-1/8"	170	204	238	272	306	340	373	407	441	475	509	679	1019
1-1/4"	153	183	216	244	275	306	336	367	397	428	458	612	918
1-3/8"	139	167	194	222	250	278	306	333	361	389	417	556	834
1-1/2"	127	153	178	204	229	255	280	306	331	357	382	510	765
1-5/8"	117	141	165	188	212	235	259	282	306	329	353	470	705
1-7/8"	102	122	143	163	183	204	224	244	265	285	306	408	612
2"	95	115	134	153	172	191	210	229	248	267	287	382	573
2-1/4"	85	102	119	136	153	170	187	204	221	238	255	340	510
2-1/2"	76	91	107	122	137	153	168	183	199	214	229	306	459
2-3/4"	69	82	97	111	125	139	153	167	181	194	208	278	417
3"	64	76	89	102	115	127	140	153	166	178	191	254	371

! NOTICE !

The data table provides exact speeds (RPM). It does not take machine speed limitations into account. Determine the desired rate of speed and find the closest speed available on your machine.

Cutting Speed and Feeds for High Speed Steel Tools

The energy expended at the lathe's cutting point converts largely into heat, and because the energy expended is great, the heat is intense. Before today's HSS, carbide, and ceramic tool, this heat created a serious machining problem. Machining could be done only under a steady flow of coolant, which kept the tool from heating to its annealing point, softening, and breaking down.

With HSS, you can cut dry on cast iron or non-ferrous metals unless a small lathe is running at extremely high speed on continuous, heavy-duty production work. Because steel expands when heated, it is a good idea, especially when working on long shafts, to check the tightness of the lathe centers frequently and make sure workpiece expansion does not cause the centers to bind.

Cutting Speeds and Feeds for High Speed Steel Tools

	Low-Carbon Steel	High-Carbon Steel Annealed	Alloy Steel Normalized	Aluminum Alloys	Cast Iron	Bronze
Speed (sfm) Roughing Finishing	90 120	50 65	45 60	200 300	70 80	100 130
Feed (ipr) Roughing Finishing	0.010-0.202 0.003-0.005	1.101-0.020 0.003-0.005	0.010-0.020 0.003-0.005	0.015-0.030 0.005-0.010	0.010-0.020 0.003-0.010	0.010-0.020 0.003-0.10

In everyday lathe operations like thread cutting and knurling, always use a cutting oil or other lubricant. On such work, especially if the cut is light and lathe speed low, dipping a brush in oil occationally and holding it against the workpiece will provide sufficient lubrication. For continuous, high-speed, heavy-duty production work, however, especially on tough alloy steels, using a cutting oil or coolant will increase cutting efficiency. It's essential if you're using a non-HSS cutting tool. When you use coolant, direct it against the cutting point and cutter. Consider installing a coolant system if you don't have one.

To set up safe rpm rates, you should follow the list for cutting speeds and feeds for HSS cutters. The formula is as follows:

rpm = CS x 4 / D"

where:

CS - cutting speed in surface feet per minute (sfm)
D" - diameter of the workpiece in inches.

To use this formula, find the cutting speed you need on the chart and plug that number into the CS portion of the formula. After calculating the rpm, use the nearest or next-lower speed on the lathe and set the speed.

If you were to make a finish cut on a piece of aluminum 1" in diameter, for example, you would see the desired sfm is 300. Then

rpm = 300 sfm x 4 / 1

rpm = 1200 / 1

rpm = 1200 or next lower speed.

For high-carbon steel, also 1" in diameter,

rpm = 50 sfm x 40 / 1

rpm = 200 / 1

rpm = 200 or next slower speed.

The four-turret toolpost lets you mount up to four different tools at the same time. You can install all standard-shaped turning and facing tools with 1/2" or smaller shanks. The centerline is approximately 5/8" above the bottom of the turret. Smithy also offers quick-change tool sets that greatly speed up lathe operations. Contact a Smithy technician for details.

How to Determine Speeds and Feeds for Milling (machine, materials, and tools)

Speeds

Milling cutting rates vary according to the machinability of the material being cut; whether cutting fluid is used and, if so, what kind; the type, size, and material of the cutter and the coarseness of its teeth; and the amount of metal being removed. Cutting speed for milling is the distance the cutting edge of a tooth travels in one minute. If cutting speed is too high, the cutter overheats and becomes dull. If it's too low, production is inefficient and rough.

There is no exact right cutting speed for milling a particular material. Machinist usually start with an average speed, then increase or decrease it as needed. For light cuts, use the upper end. Use the lower end for heavy cuts and when you don't use cutting fluid.

Determining rpm. To set the spindle speed, you have to know the cutter rpm (revolutions per minute). For inch measurements, use this formula:

rpm = 12 x CS (fpm) / D” x π

where:
CS - cutting speed
fpm - feet per minute
D” - diameter of the cutter in inches
π - 3.14 You can use an rpm chart for selected diameters of cutting tools at different cutting speeds.

For metric measurement, use this formula:

rpm = CS (mpm) x 1000 / D (mm) x π

where:
CS - cutting speed
mpm - meters per minute
D (mm) - diameter of the cutter in millimeters
π - 3.14. You can use an rpm chart for selected diameters of cutting tools at different cutting speeds.

Change Speeds by selecting the belt location and turning the speed dial

Feeds

Set the direction of feed before you begin milling. Up milling, or conventional milling, is when the direction of feed is opposite to the direction of cutter rotation. Down milling, or climb milling, is when the direction of feed is the same as the direction of cutter rotation.

Up Milling

In up milling, forces on the workpiece tend to pull it out of the vise or fixture holding it, so fasten it securely. These forces also push the workpiece away from the cutter, which eliminates backlash. Up milling is advised for milling cast iron, softer steels, and other ductile materials. In general, it's how you should perform milling operations.

Down Milling

Down milling usually produces good surface finishes because chips do not sweep back into the cut. Setups are more rigid, an advantage when cutting thin workpieces held in a vise or workpieces held in a magnetic chuck. Down milling also produces straighter cuts. We recommend down milling when using carbide cutters because there is less wear on the cutting tool. In general, however, avoid it because of the backlash problems associated with it.

Feed Rates

Your feed rates should be as high as your machine, cutting tool, workholding method, and workpiece can tolerate while giving a good finish. Feed rate is usually given in inches per minute (ipm). You determine feed rate by the speed of the cutter in rpm and the number of teeth in the cutter.

There are many factors to consider in selecting the feed per tooth, and there is no easy formula to follow. Here are several principles to guide you:

- Use the highest feed rate conditions allow
- Avoid using a feed rate below 0.001" per tooth
- Harder materials required lower feed rates than softer materials
- Feed wider, deeper cuts more slowly than narrow, shallow cuts
- Slower feed rates gives a better surface finish
- Never stop the feed before finishing the cut

If you know the feed in inches per tooth, use the formula to calculate table feed rate in inches per minute (ipm):

ipm = ipt x N x rpm

where:
ipt - inches per tooth
N - number of teeth in the milling cutter
rpm - spindle speed of the milling machine.

High-speed-steel Cutters

The advantage of HSS cutter bits is you can shape them to exact specifications through grinding. This lets you grind a stock shape into any form. Stock shapes come in an assortment of types, including squares, flats, and bevels. Many shops buy their cutters as ready-ground or ready-to-grind bits or blades.

Ready-to-grind bits and blades are of specially selected HSS, cut to length and properly heat-treated. They are fine tools in the rough and generally superior to HSS shapes sold by the pound.

In grinding HSS cutter bits, you have five major goals:

- A strong, keen cutting edge or point
- The proper cutting form (the correct or most convenient shape for a specific operation)
- Front clearance away from the toolpoint
- Clearance away from the side of the tool (side rake)
- Free chip movement over the tool and away from the cutting edge

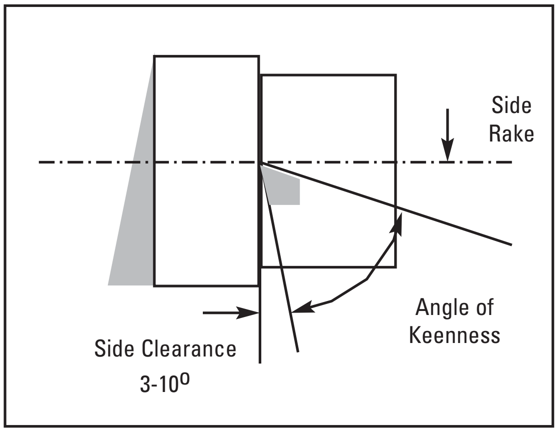


Figure A.1 Keenness angles vary from 60° to 90°.

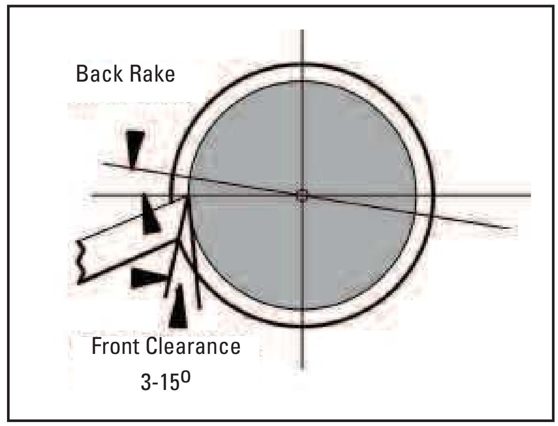


Figure A.2 The edge weakens if front clearance is too great.

Keenness angles can vary from 60° for mild softness to 90° for hard steels and castings (Figure A.1).

Front clearance must always be sufficient to clear the work. If it is too great, however, the edge weakens and breaks off (Figure A.2). Side and back-rate requirements vary with the material used and operation performed. Back rake is important to smooth chip flow, which is needed for a uniform chip and good finish, especially in soft materials. Side rake directs the chip flow away from the point of cut.

Grind cutters on a true-surfaced, good-quality, medium-grit grinding wheel (preferably an 8”, 46-60A-grit or 68A-grit Carborundum wheel) at 3000 or 3500 rpm. When starting with an unground cutter bit, the procedure in Figure A.3 is usually to:

1. grind the left-side clearance
2. grind the right-side clearance
3. grind the end form or radius
4. grind the end clearance
5. grind the top rake, touching in a chipbreaker.

If you are honing the cutting edge (for fine finishing or machining soft materials), draw the cutter away from the cutting edge across the oilstone (Figure A.4).

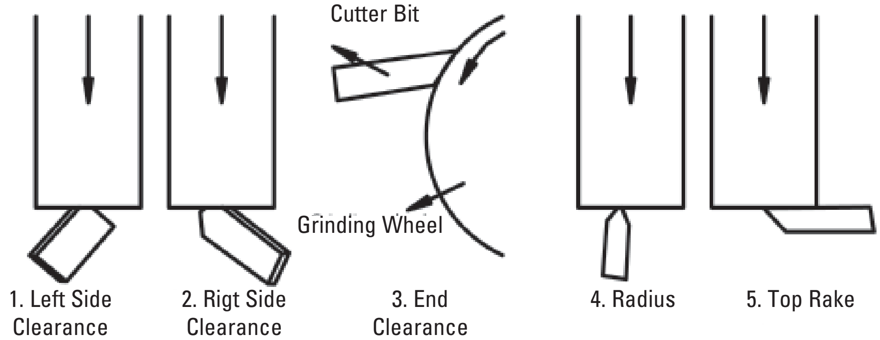


Figure A.3 Grinding sequence for an unground cutter bit

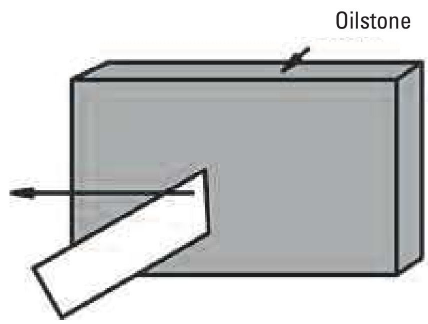


Figure A.4 When honing, draw the cutter away from the cutting edge across the oilstone

Materials other than Steel

As pointed out earlier,when grinding HSS cutters, we determine cutting angles primarily by strength requirements, not keenness requirements. Angles and rakes for general industrial shops use are established. In machining steel, the softer the steel, the keener the angle of the cutting edge. For soft steels, angles as acute as 61° are possible (Figure A.5).

The same general rule applies to cast iron. Chilled or very hard cast iron requires tools with cutting-edge angles as great as 85°. For ordinary cast iron, you obtain greatest efficiency with a more accurate cutting edge – approximately 71° (Figure A.6).

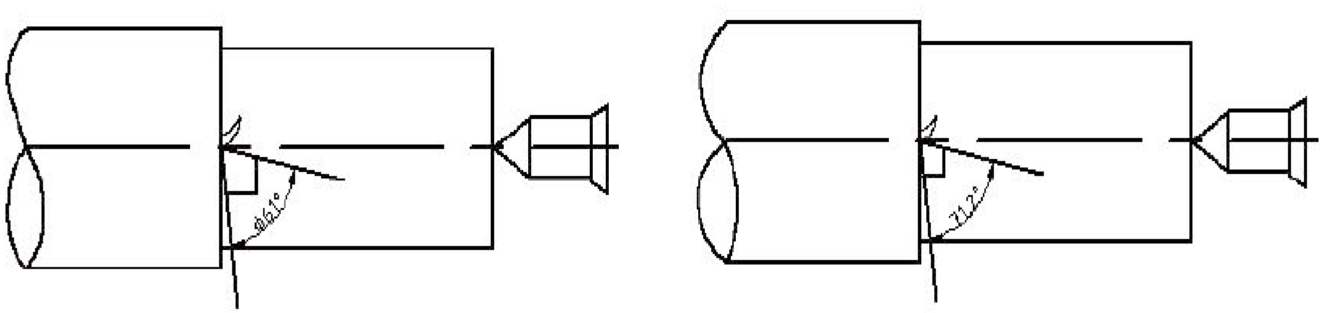


Figure A.5 With soft steels, 61° angles are possible
Figure A.6 With cast iron, a 71° angle is most efficient

Bits for Turning and Machining Brass

Brass tends to pull or drag when machined. It's best to machine it on dead center with the top rake in the horizontal plane of the lathe centers. Softer than steel, brass needs less support for the cutting edge. Brass cutters require an almost flat top angle and can gain greater angle keenness only in increased side and end rakes. It is often advisable to hone the cutting edges of cutters used to machine brass.

Note: All roundnose cutters are ground with flat tops and equal side rake because they are fed across the work, to both right and left.

Special Chip Craters and Chip Breakers

When grinding cut-off blades, and occasionally on other cutter bits where the material's extreme hardness or toughness makes it difficult to control the chip leaving the work, it sometimes helps to grind a smooth, round crater just behind the cutting edge. This serves as a chip guide and starts the chip curling smoothly (Figure A.7).

Figure A.7 A crater starts the chip curling smoothly

Using a Center Gauge to Check V-Thread Form

It may be convenient to grind a standard cutter bit for thread cutting, especially for cutting standard 60° V-threads. When grinding an ordinary square cutter into a thread-cutting tool, take care to ensure a true thread form. The easiest way is to use an ordinary center gauge for a standard V-thread tool or a special thread gauge for special thread forms.

To grind a cutter for an ordinary V-thread, grind first the left side of the tool, then the right side, to 30°. Be careful to grind equally from both sides to center the toolpoint. Then test for true form by inserting the newly ground point in the closest-sized V in a standard center gauge (Figure A.8)

Examine the gauge and cutter above a light. When the cutter is ground perfectly, no light streak shows between the tool and gauge. Use a grinding chart for other rakes.

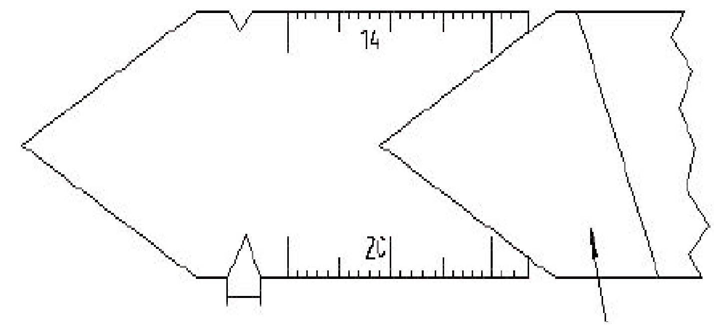


Figure A.8 Insert the point into the nearest-sized V in the center gauge

Acme or Other Special Thread

Thread gauge are available for all standard threads. Before grinding such cutters, ascertain the correct pitch angle of the particular thread profile. For example, the pitch of an acme thread is 29° to a side, and the toolpoint is ground back square to an exact thread profile that requires a different end width for each thread size.

Thread forms must be accurate if threads are to fit snugly and smoothly. Every resharpening of this type of cutter requires regrinding the entire form. It is far better, when doing any amount of threading, to use a threading tool with a special form cutter. Sharpening such cutters requires only flat, top grinding, whch does not alter the cutting profile.

Carbide-Tipped Cutters and Cutter Forms

Carbide is a compound of carbon and a metal. In cutting tools, it is usually carbon and tungsten. The hardness of carbide cutting materials approaches that of diamond. While carbides permit easy machining of chilled cast iron, hard and tough steels, hard rubber, bakelite, glass, and other difficult or "unmachinable" materials, its primary use in industry is for long production runs on ordinary steel. On such work, carbide-tipped tools permit higher running speeds and much longer runs between resharpenings. The cutting edge of carbide tools stands up 10 to 200 times as long as the edge of HSS tools.

The advantage of carbide is that it tolerates much higher heat than HSS or other alloys so you can run at higher speeds. The disadvantage is that it is more brittle than HSS and must have adequate support in the toolpost to prevent vibration and breakage.

The table on the next page shows the different Carbide grades used in different applications and uses.

Application	Use	Grade
Cast Iron	Roughing cuts	C-1
Non-ferrous, non-metallic, high-temperature alloys	General purpose	C-2*
200 and 300 Series stainless steels	Light finishing Precision boring Roughing cuts General Purpose	C-3 C-4 C-5 C-6*
Alloy steels	Finishing cuts	C-7
400 Series stainless steel, high velocity	Precision boring	C-8
***C-2 and C-6 are the most commonly used carbides.**		

When to Use Different Kind of Endmills

Choose milling cutters for the type of cut, the number of parts, and the material. Rake angles depend on both cutter and work material. Clearance angles range from 3° to 6° for hard or tough materials to 6° to 12° for soft materials.

To determine the number of teeth you want, consider the following:

- There should not be so many teeth that they reduce the free flow of chips.
- The chip space should be smooth so chips don't clog.
- Don't engage more than two teeth at a time in a cut.

Endmill Cutters

Endmill cutters cut on their ends and sides. They are either solid (cut from a single piece of material) or shell (separate cutter body and shank). They have two, three, four, or more teeth and may do right or left-handed cutting. Their flute twist or helix may also be right or left-handed. Solid endmills have straight or tapered shanks; shell endmill adapters have tapered shanks.

Endmills machine horizontal, vertical, angular, or irregular surfaces in making slots, keyways, pockets, shoulders, and flat surfaces.

- **Two-flute or center-cutting endmills** have two teeth that cut to the center of the mill. They may feed into the work like a drill (called plunge milling), then go lengthwise to form a slot. Teeth may be on one end (single-ended) or both ends (double-ended).

- **Multiple-flute endmills** have three, four, six, or eight flutes and may be single or double-ended. Multiple-flute mills are center-cutting or non-center cutting. Don't use noncenter-cutting endmills for plunge milling.

- **Geometry-forming endmills** form particular geometries. They include ball endmills, roughing endmills, dovetail endmills, T-slot cutters, keyseat cutters, and shell endmills.

- **Ball endmills** cut slots or fillets with a radius bottom, round out pockets and bottoms of holes, and do diesinking and diemaking. Four-flute ball endmills with center cutting lips are available.

- **Roughing endmills** remove large amounts of metal rapidly with minimum horsepower. They have three to eight flutes. Also called hogging endmills, they have wavy teeth on their periphery that provide many cutting edge, minimizing chatter.

- **T-slot Cutters** cut T-slots. After machining a groove for the narrow part of the T-slot with an end or side mill, finish up with the T-slotcutter.

- **Keyseat cutters** cut keyseats for Woodruff keys (shaped like a half circle)

- **Shell endmills**, which mill wide, flat surfaces, have a hole for mounting on a short arbor. The center of the shell is recessed to provide space for the screw or nut that fastens the cutter to the arbor. The teeth are usually helical, and diameters are as large as 6”.

- **Insert-type endmills** use replaceable HSS or carbide inserts. Small endmills use two inserts; larger endmills, three or more.

- **Face milling cutters** start in size at 2” and have inserted teeth on the periphery and face. Most of the cutting takes place on the periphery. They are similar to, but larger than, shell endmills.

Plain Milling Cutters

Plain milling cutters have teeth only on their periphery. Used to mill plain, flat surfaces, they may combine with other cutters to produce various shapes. Thay are cylindrical and come in many widths and diameters.

- **Light-duty plain cutters** for light cuts and fine feeds come in two forms. Narrow ones have straight teeth parallel to the cutter axis. Wide ones have helical teeth at a 25° angle. Features include ease of starting cuts, little chatter, and good surface finishes.

- **Heavy-duty plain cutters**, or coarse-tooth cutters, come in a larger widths and have larger and fewer teeth. Strongly supported cutting edges and wide flutes provide strength and space for heavy chip removal. The helix angle of their teeth is 25° to 45°.

- **Helical plain milling cutters** have even fewer and coarser teeth with a helix angle of 45°-60° or greater. These cutters are for wide, shallow profiling cuts on brass or soft steel.

Side Milling Cutters

Similar to plain milling cutters, side milling cutters also have teeth on one or both sides. The teeth on the periphery do most of the cutting; those on the sides finish the side of the cut to size. They cut grooves or slots and often work with other cutters to mill special shapes in one operation.

- **Plain side milling cutters** have straight teeth on the periphery and both sides. Side teeth taper toward the center of the cutter, giving side relief or clearance.

- **Half side milling cutters** have helical teeth on the periphery and one side. These cutters do heavy-duty face milling and straddle milling where teeth are needed on only one side. The side teeth are deeper and longer for more chip clearance.

- **Staggered-tooth side milling cutters** are narrow cutters with teeth alternating on opposite sides. There is less dragging and scoring and more space for chip removal. These cutters do heavy-duty keyway and slotting cuts.

Slitting Saws

Slitting saws do narrow slotting and cut-off operations.

- **Plain slitting saws** are thin, plain milling cutters with only peripheral teeth. The teeth are fine, and the sides taper slightly toward the hole, giving side relief.

- **Slitting saws** with side teeth are like side milling cutters and are for deeper slotting and cut-off operations normally done with plain slitting saws.

- **Staggered-tooth slitting saws** have peripheral teeth with alternate right and left hand helix and alternate side teeth. They are for 0.2” and wider cuts and may do deeper cuts with standard feeds.

- **Screw-slotting cutters** are plain slitting saws with fine-pitch teeth that cut slots in screwheads. Their sides are straight and parallel and offer no side relief.

Angle Milling Cutters

Angle milling cutters, for such operations as cutting V-grooves, dovetails, and reamer teeth, come as single and double-angle cutters.

- **Single-angle cutters** have one angular surface. Teeth are on the angular surface and the straight side, and they usually have 45° or 60° angles.

- **Double-angle cutters** machine V-grooves. Those with equal angles on both faces usually have an included angle of 45°, 60°, or 90°.

Form-relieved Cutters

- **Formed-tooth cutters** machine surfaces with curved outlines. You can sharpen them without changing the tooth outline. Concave cutters mill convex half-circles; Convex cutters cut concave surfaces.

- **Corner-rounding cutters** round outside corners. Gear cutters cut gear teeth. Fluting cutters cut flutes in reamers and milling cutters. Formed-tooth cutters come in right and left-hand styles various special shapes.

Flycutters

With one or more single-point toolbits or cutters, flycutters perform end milling even though they're not endmills. They take light face cuts from large surface areas. You must grind the toolbit properly to get correct rake and clearance angles. Grind toolbits for flycutters as you grind lathe tools. You can also use flycutters for boring.

Note: When the tool revolves, the cutting tool becomes almost invisible, so be careful.

How To Do Threading

Before beginning to cut threads, it's useful to learn the major terms used in thread cutting:

- **Pitch**. Metric pitch is the distance from the center of a thread to the center of the next thread. To measure pitch in inches, measure an inch on a bolt and count the threads.

- **Pitch Diameter.** This is the diameter of an imaginary cylinder superimposed on a straight screw thread, the surface of which would make an equal width of the thread and the spaces cut by the cylinder.

- **Lead.** The lead is the distance a screw thread advances axially (as through a nut) with one complete revolution.The lead and pitch of a single thread are identical, but they differ on multiple threads (the lead of a double thread is twice its pitch; of a triple thread, three times its pitch).

Because screw-thread cutting is generally a part of machine work, anyone interested in building things of metal should master it. Threading requires a bit of patience and skill. Before attempting to cut a thread on a workpiece, cut a few practice threads on odd bits of steel, iron, and aluminum.

Built for thread cutting, the Smithy Granite Series machine, cuts standard internal and external threads, as well as special threads. You may cut coarse or fine threads in a great range of threads per inch, in V or square shapes, in established profiles like Unified National, acme, and metric. You can cut single threads or multiple threads that are concurrently along the shaft. You determine the type of thread by how you'll use the screw. Each thread form requires a different shaped tool to cut or chase it.

For most work, the beginner will use the Unified National Standard, which is a V-form thread slightly flat on top and at the root. Screw threads are usually referred to by pitch numbers, such as 18 or 24, meaning 18 or 24 threads per inch (tpi). The Smithy Granite Series machine cuts standard threads in pitches from 7 to 52 tpi and metric threads from 0.35 to 6.5 mm.

Because the lathe spindle, which carries the work, connects by gearing to the leadscrew, which moves the cutting tool along the lathe bed, a ratio exist between spindle speed in revolutions per minute and cutting tool movement in inches. When you change the gearing, you change this ratio. For this reason you can cut screw threads of various pitches by changing both the thread selection lever and the rate-of-feed selection lever at the head of the lathe.

Thread charts on the machine show both inch and metric measures. The inch chart on the headstock shows the tpi from 7 to 52. The metric chart show the distance from thread crest to crest from 0.35 to 6.5 mm.

For right-hand threads, start the threading or chasing tool at the right end of the workpiece and feed it toward the headstock. For left-hand threads, reverse the leadscrew's rotation direction using the direction lever on the headstock and feed the threading tool from left to right. (You actually have the choice of changing the spindle rotation and/or cutting off the backside).

With practice, you can grind cutters to almost any profile. It is difficult, however, to sharpen such cutters without altering the cutting form, and almost every resharpening requires a complete regrinding of profile and clearance angles.

After turning the work to be threaded to the outside diameter of the thread and setting the gears for the desired thread, put a threading tool in the toolpost. Set it exactly on the dead center of the workpiece you'll be threading, using a center gauge as a guide.

To make sure your cutter is on dead center, place a credit card or shim between the cutter point and workpiece. When the tool is on dead center, the credit card or shim will remain vertical. With a credit card, there in no possibility of chipping the cutter as the workpiece and cutter come together.

Set the compound perpendicular to the line of centers and rotate it 29-1/2° to the right. Place the thread gauge on the point of the threading tool and feed the tool toward the workpiece (Figure A.9). Adjust the tool so the edge of the gauge is exactly parallel to the workpiece. A slip of white paper held below the gauge will help check the parallel of the gauge to the shaft and the fit of the tool point in the V of the gauge. Placing the threading tool perpendicular to the surface of the workpiece assures a true-form thread.

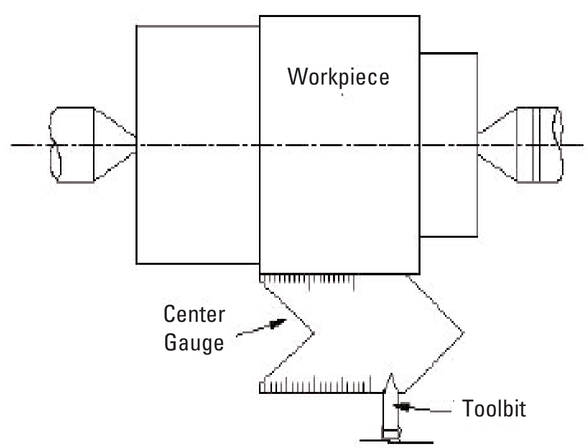


Figure A.9 Using a center gauge, set the threading tool at exactly dead center on the workpiece

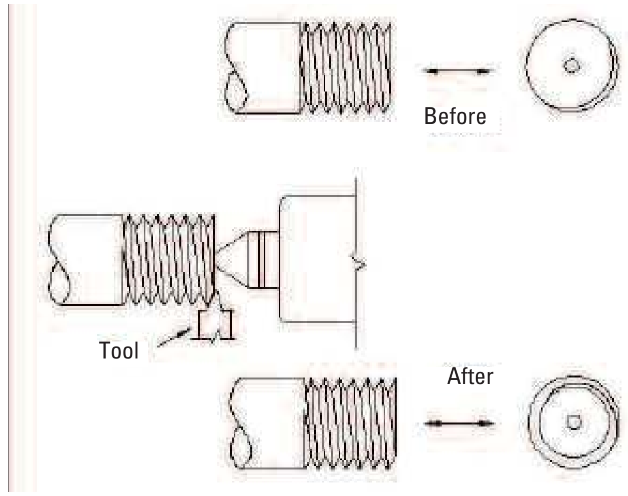


Figure A.10 Chamfer the end of the thread to protect it from damage

Cutting Right-hand Threads

Now you are ready to cut right-hand threads. First, advance the tool so it just touches the workpiece and turn the compound calibration to zero. Then, using the compound feed, feed in the tool 0.002". Turn on the motor, engage the power feed (lever located on the lower right hand face of the headstock) at the speed as indicated on the threading chart. (You'll choose, I, II or III depending on the chart). With the leadscrew turning, engage the half-nut by pushing the lever down and note the number lined up wiht the mark on the threading dial. This closes the half-nut on the leadscrew and the powers the cross-slide table to the left or right on the lathe bed ways. When you have finished the cut, disengage the half-nut by lifting up on the handle.

It is best to take a light, scratch cut first without using cutting fluid. After the tool runs the desired length, disengage the half-nut and back the tool out of the work. Then return the tool to the starting position. Do not engage the half-nut until the threading dial is at the same point as when you began. (If you began cutting at zero, do not re-engage until zero on the threading dial once again matches the hashmark. Using a screw-pitch gauge, check the thread pitch. The benefit of taking the light cut is that you can correct any mistakes you might have made.

It's time to take the real cut now, so apply the appropriate cutting fluid to the work. Feed the compound feed in 0.005-0.020" for the first run, depending on the pitch of the thread you have to cut. If you are cutting a coarse thread, start by taking a few heavy cuts. Reduce the cut depth for each run until it is about 0.002" at the final run. Bring the cross-feed calibration to zero, then make the second cut.

Continue this process until the tool is within 0.010" of the finished depth. Brush the threads regularly to remove chips. After the second cut, check the thread fit using a ring gauge, a standard nut or mating part, or a screw thread micrometer. It is required to leave the piece in the chuck and not remove it for testing.

Continue taking 0.002" cuts. Then check the fit between each cut. when you thread the nut, it should go on easily but without end play. When you have the desired fit, chamfer the end of the thread to protect it from damage. To chamfer is to take a 45° cut off the end of the bolt.

Cutting Left-hand Threads

Cut left-hand threads exactly as you cut right-hand threads, except feed the carriage toward the tailstock instead of away from it. Or the spindle rotation is reversed. Reverse the cutter clearance and grind the cutters back with a clearance angle on the left side. swing the compound rest to the left rather than to the right.

Cutting Multiple Threads

Cut multiple threads one at a time exactly as you cut single threads, except increase the lead to make room for succeeding threads (a double lead for a double thread, a triple lead for a triple thread, etc.). After completing the first thread, remove the work from the centers without loosening the lathe dog. Then put it back in the lathe with the tail of the lathe dog in the correct slot to index the work for the next thread. This work requires a faceplate with accurately positioned slot, uniformly spaced and equal in number to the number of threads to be cut.

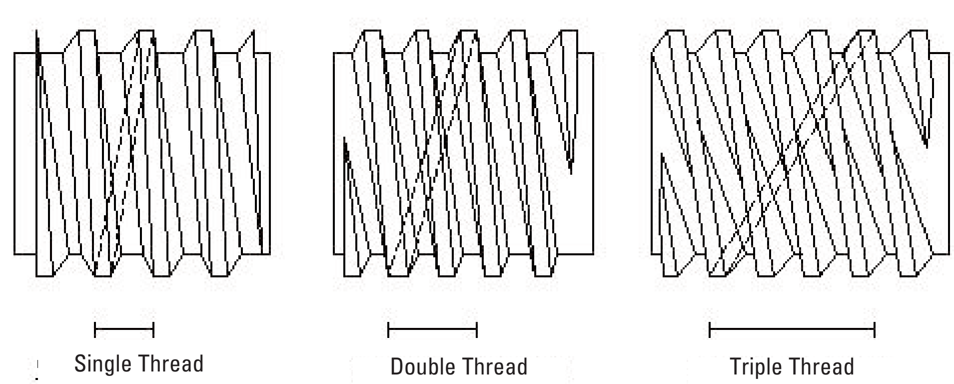


Figure A.11 When cutting multiple threads, increase the lead to make room for succeesding threads.

Cutting Internal Threads

Internal thread cutting is like external thread cutting, except you have the clearance restrictions and tool problems of boring. You use the same toolholders, but the cutters have thread forms and are fed at thread-cutting ratios of feed to spindle revolutions.

Another difference between boring and inside threading is the cutting angle at which the cutter approaches the workpiece. As with external thread cutting, the internal threading tool must engage the work on dead center and be held so the cutter coincides with the workpiece's center radius.

In squaring the cutter with the work, use a center gauge or thread gauge. Internal cutters require greater end and side clearance, and cutter length is also restricted because internal thread cutters must have enough end clearance that the cutter lifts clear of the thread for removal. Before cutting an internal thread, bore the workpiece to the exact inside diameter.

Because the feed of successive cuts is toward, not away from the operator, the thread-cutting set is reversed. Also, you must take lighter cuts because of the cutter's extension from the toolpost. Take an extra finishing cut without changing the setting of the compound rest.

Cutting Special-form Internal Threads

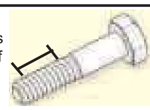
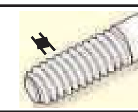
You can cut internal forms in all the thread forms used for external threads. There is only one factor that calls for special attention in cutting special-shaped internal threads: the difference of clearances between the nut and screw recommended for different thread types. If you don't have recommended clearances, it is safe to cut a nut (internal thread) thread 0.005" to 0.010" per inch larger than the screw's outside diameter.

Cutting Threads on a Taper

Cut thread on a taper the same as on a straight shaft, except in the setup of the tools. set the threading tool at 90° to the axis of the taper, rather than at 90° to its surface.

Appendix B

Inch Feed Rates

THREADING CHART		INCH THREADS			FEED RATES =			Distance traveled per Spindle Revolution			METRICTHREADS					
		Inch threads are defined as the number of threads in one inch. 			Longitudinal Feed ”/			Cross Feed ”/			Metric threads are defined as the distance between two adjacent crests. 					
Selector I - III		I	II	III	I	II	III	I	II	III	I	II	III	I	II	III
SELECTOR 1-7	1	7	14	28	0.0197”	0.0098”	0.0049”	0.0062”	0.0031”	0.0015”		0.70	0.35	3.50	1.75	
	2	8	16	32	0.0172”	0.0086”	0.0043”	0.0054”	0.0027”	0.0014”		0.80	0.40	4.00	2.00	1.00
	3	9	18	36	0.0153”	0.0076”	0.0038”	0.0048”	0.0024”	0.0012”			0.45	4.50		
	4	10	20	40	0.0137”	0.0069”	0.0034”	0.0043”	0.0022”	0.0011”		1.00	0.50	5.00	2.50	1.25
	5	11	22	44	0.0125”	0.0062”	0.0031”	0.0039”	0.0020”	0.0010”				5.50	2.75	
	6	12	24	48	0.0115”	0.0057”	0.0029”	0.0036”	0.0018”	0.0009”			0.60	6.00	3.00	1.50
	7	13	26	52	0.0106”	0.0053”	0.0026”	0.0033”	0.0017”	0.0008”				6.50	3.25	
Gear Selection		X = Teeth per gear A = 30 B = 66 C = 60 D = 60									A = 33 C = 63 B = 80 D = 60			A = 66 C = 63 B = 64 D = 60		
Lever located inside Pully Box below gear cluster		INCH						METRIC			INCH			METRIC		

Machine Warranty

30 Day Trial Offer

Try a Smithy for 30 days. If, for any reason within that time, you decide to return your Smithy, just call our Customer Service department at 1-800-476-4849. We will help you arrange shipping back to us. When we receive the machine back, we'll refund your full purchase price. Please note: return shipping charges and any shipping damage from improper repacking is your responsibility.

Smithy Warranty

Smithy 3-in-1 and Dedicated Machines are warranted for two years (unless otherwise noted)to the original purchaser against defects in materials and workmanship. During that time, Smithy will replace any defective parts that are returned to our warehouse, free of charge. Upon receipt of the defective parts, Smithy technicians will arrange with you to send replacement parts immediately. This warranty does not cover parts that are worn out through the negligence on the part of the operator nor does it cover consequential damages resulting from defects in material or workmanship.

SmithyCNC warrants its machines and control systems for a period of one (1) year to the original purchaser from the date of purchase. If within one (1) year form the date of purchase a SmithyCNC machine and/or control system fails due to defect in material or workmanship, SmithyCNC will at their choice repair and/or replace components with new or remanufactured parts free of charge.

(Some have asked why SmithyCNC machines have a shorter warranty period than Smithy manual machines. There are several reasons, but the greatest factor is that, on average, CNC automated machine tools, are operated a significantly greater number of hours per day than the average manual machine. Also, by comparison, most of our competitors selling benchtop CNC machines only offer a six (6) months warranty. Whereas SmithyCNC machine have a full one (1) year warranty.)

Most warranty repairs and/or replacements are handled routinely, but sometimes request for warranty service many not be appropriate. This warranty does not apply to defects due directly or indirectly to misuse, abuse, negligence, accidents, repairs, or lack of routine maintenance. This warranty is also void if the serial number of the machine or SmithyCNC control system has been removed or has been altered or modified.

In no event shall Smithy be liable for indirect, incidental or consequential damages for the sale or use of the product. This disclaimer applies to both during and after the term of this warranty.

We do not warrant or represent that the merchandise complies with the provisions of any law or acts unless Smithy Company so warrants. In no event shall Smithy's liability under this warranty exceed the purchase price paid for the product. Legal actions brought against Smithy Co. shall be tried in the State of Michigan, County of Washtenaw.

Smithy Co. shall in no event be liable for death, injuries to persons or property for incidental, contingent, special or consequential damages arising from the use of our products.

This is Smithy Co.'s sole warranty and any and all warranties that may be implied by law, including any merchantability or fitness, for any particular purpose, are hereby limited to the duration of this written warranty.

This warranty gives you specific legal rights, and you may also have other rights, which vary from state to state. Some states do not allow the exclusion or limitation of incidental or consequential damages, so the above limitation or exclusions may not apply to you.

Telephone Support (Service engineers are available 8 am to 5 pm EST)

Service and Parts

Tel No. 1-800-476-4849
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Email Address: sales@smithy.com

Software and Programming Consultancy Services

In addition to our customary technical support for the machines and controls, we also provide technical consulting support to our customers by providing engineering and G-code programming services. The standard rate for these services is $28.00 per hour. Our principal objective is to support you and to increase your productivity while reducing the machining cost. Give us a call for such support as and when required.

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