Installation, Setup and Operation

INSTRUCTIONS

for

CE

SUNNEN® HONING MACHINE

Model MBB-1660

READ THE FOLLOWING INSTRUCTIONS THOROUGHLY AND CAREFULLY BEFORE UNPACKING, INSPECTING, OR INSTALLING THE SUNNEN® HONING MACHINE.

SUNNEN® PRODUCTS COMPANY • 7910 MANCHESTER ROAD • ST. LOUIS, MO 63143, U.S.A. • PHONE: 314-781-2100

GENERAL INFORMATION

The Sunnen® equipment has been designed and engineered for a wide variety of parts within the capacity and limitation of the equipment. With proper care and maintenance this equipment will give years of service.

READ THE FOLLOWING INSTRUCTIONS CAREFULLY AND THOROUGHLY BEFORE UNPACKING, INSPECTING, OR INSTALLING THIS EQUIPMENT.

IMPORTANT: Read any supplemental instructions BEFORE installing this equipment. These supplemental instructions give you important information to assist you with the planning and installation of your SUNNEN® equipment.

Sunnen Technical Service Department is available to provide telephone assistance for installation, programming, & troubleshooting of your Sunnen equipment. All support is available during normal business hours, 8:00 AM to 4:30 PM Central Time.

Review all literature provided with your Sunnen equipment. This literature provides valuable information for proper installation, operation, and maintenance of your equipment. Troubleshooting information can also be found within the Instructions. If you cannot find what you need, call for technical support.

Where applicable, programming information for your Sunnen equipment is also included. Most answers can be found in the literature packaged with your equipment.

Help us help you. When ordering parts, requesting information, or technical assistance about your equipment, please have the following information available:

- Have ALL MANUALS on hand. The Customer Services Representative or Technician will refer to it.
- Have Model Number and Serial Number printed on your equipment Specification Nameplate.
- Where Applicable: Have Drive model and all nameplate data. Motor type, brand, and all nameplate data.

For Troubleshooting, additional information may be required:

- Power distribution information (type - delta, wye, power factor correction; other major switching devices used, voltage fluctuations)
- Installation Wiring (separation of power & control wire; wire type/class used, distance between drive and motor, grounding).
- Use of any optional devices/equipment between the Drive & motor (output chokes, etc.).

For fast service on your orders call:

Sunnen Automotive Customer Service toll free at: 1-800-772-2878

Sunnen Industrial Customer Service toll free at: 1-800-325-3670

Customers outside the USA, contact your local authorized Sunnen Distributor.

Additional information available at: http://www.sunnen.com or e-mail: sunnen@sunnen.com

NOTE: Sunnen reserves the right to change or revise specifications and product design in connection with any feature of our products contained herein. Such changes do not entitle the buyer to corresponding changes, improvements, additions, or replacements for equipment, supplies or accessories previously sold. Information contained herein is considered to be accurate based on available information at the time of printing. Should any discrepancy of information arise, Sunnen recommends that user verify the discrepancy with Sunnen before proceeding.

ESD PREVENTION REVIEW

Let's review the basics of a sound static control system and its effective implementation. First, in the three step plan:

1. Always ground yourself when handling sensitive components or assemblies.
2. Always use a conductive or shielded container during storage or transportation. These materials create a Faraday cage which will isolate the contents from static charges.
3. Open ESD safe containers only at a static safe work station.

At the static safe work station, follow these procedures before beginning any work:

A. Put on your wrist strap or foot grounding devices.

B. Check all grounding cords to make sure they are properly connected to ground, ensuring the effective dissipation of static charges.

C. Make sure that your work surface is clean and clear of unnecessary materials, particularly common plastics.

D. Anti-static bubble wrap has been included for use at the machine when an ESD safe workstation is not available.

You are now properly grounded and ready to begin work. Following these few simple rules and using a little common sense will go a long way toward helping you and your company in the battle against the hazards of static electricity. When you are working with ESD sensitive devices, make sure you:

GROUND

ISOLATE

NEUTRALIZE

SUNNEN® LIMITED PRODUCT WARRANTY

SUNNEN® Products Company and its subsidiaries (SPC) warrant that all new SPC honing machines, gaging equipment, tooling, and related equipment will be free of defects in material and/or workmanship for a period of one year from the date of original shipment from SPC.

Upon prompt notification of a defect during the one-year period, SPC will repair, replace, or refund the purchase price, with respect to parts that prove to be defective (as defined above). Any equipment or tooling which is found to be defective from improper use will be returned at the customer's cost or repaired (if possible) at customer's request. Customer shall be charged current rates for all such repair.

Prior to returning any SPC product, an authorization (RMA#) and shipping instructions must be obtained from the Customer Service Department or items sent to SPC will be returned to the customer.

Warranty Limitations and Exclusions This Warranty does not apply to the following:

- Normal maintenance items subject to wear and tear: (belts, fuses, filters, etc).
- Damages resulting from but not limited to:
  - › Shipment to the customer (for items delivered to customer or customer's agent F.O.B., Shipping Point)
  - › Incorrect installation including improper lifting, dropping and/or placement
  - › Incorrect electric power (beyond +/- 10% of rated voltage) including intermittent or random voltage spikes or drops
  - › Incorrect air supply volume and/or pressure and/or contaminated air supply
  - › Electromagnetic or radio frequency interference from surrounding equipment (EMI, RFI)
  - › Storm, lightning, flood or fire damage
  - › Failure to perform regular maintenance as outlined in SPC manuals
  - › Improper machine setup or operation causing a crash to occur
  - › Misapplication of the equipment
  - › Use of non-SPC machines, tooling, abrasive, fixturing, coolant, repair parts, or filtration
  - › Incorrect software installation and/or misuse
  - › Non-authorized customer installed electronics and/or software
  - › Customer modifications to SPC software

THE LIMITED WARRANTY DESCRIBED HEREIN IS EXPRESSLY IN LIEU OF ALL ANY OTHER WARRANTIES. SPC MAKES NO REPRESENTATION OR WARRANTY OF ANY OTHER KIND, EXPRESS OR IMPLIED, WHETHER AS TO MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR ANY OTHER MATTER. SPC IS NOT RESPONSIBLE FOR THE IMPROPER USE OF ANY OF ITS PRODUCTS. SPC SHALL NOT BE LIABLE FOR DIRECT, INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES INCLUDING BUT NOT LIMITED TO: LOSS OF USE, REVENUE, OR PROFIT. SPC ASSUMES NO LIABILITY FOR PURCHASED ITEMS PRODUCED BY OTHER MANUFACTURERS WHO EXTEND SEPARATE WARRANTIES. REGARDLESS OF ANY RIGHTS AFFORDED BY LAW TO BUYER, SPC's LIABILITY, IF ANY, FOR ANY AND ALL CLAIMS FOR LOSS OR DAMAGES WITH RESPECT TO THE PRODUCTS, AND BUYER'S SOLE AND EXCLUSIVE REMEDY THEREFORE, SHALL IN ALL EVENTS BE LIMITED IN AMOUNT TO THE PURCHASE PRICE OF THAT PORTION OF THE PRODUCTS WITH RESPECT TO WHICH A VALID CLAIM IS MADE.

Shipping Damages

Except in the case of F.O.B., Buyer's destination shipments, SPC will not be liable for any settlement claims for obvious and/or concealed shipping damages. The customer bears the responsibility to unpack all shipments immediately and inspect for damage. When obvious and/or concealed damage is found, the customer must immediately notify the carrier's agent to make an inspection and file a claim. The customer should retain the shipping container and packing material.

SUNNEN® SOFTWARE LICENSE AGREEMENT

This document is a Legal Agreement between you, as user and licensee (Licensee), and Sunnen® Products Company (SPC) with respect to preprogrammed software (Software) provided by SPC for use on SPC Equipment. By using the Software, you, as Licensee, agree to become bound by the terms of this Agreement.

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Any alteration or reverse engineering of the software is expressly forbidden and is in violation of this agreement.

SPC reserves the right to update the software covered by this agreement at any time without prior notice and any such updates are covered by this agreement.

SAFETY INSTRUCTIONS

READ FIRST

This machine, like any equipment, may be dangerous if used improperly. Please read all warnings and instructions before attempting to use this machine.

Always disconnect power at main enclosure before servicing machine.[1]

Always wear eye protection when operating this machine.

WARNING: Do not wear cotton or heavy gloves while operating this equipment! If gloves must be worn, wear only the tear-away type

NEVER open or remove any machine cover or protective guard with power "ON." Always disconnect power at main enclosure before servicing this equipment.[1]

DO NOT attempt any repair or maintenance procedure beyond those described in this book. Contact your Sunnen® Field Service Engineer or Technical Services Representative for repairs not covered in these instructions.

Due to the wide variety of machine configurations, all possibilities cannot be described in these instructions. Instructions for safe use and maintenance of optional equipment ordered through Sunnen, will be provided through separate documentation and/or training provided by your Sunnen Field Service Engineer or Technical Services Representative.

DO NOT attempt to defeat any safety device on this machine or on any of the optional equipment.

If specially built automation components are added to this system, be sure that safety is not compromised. If necessary, obtain special enlarged work area safety system from Sunnen Products Co.

CE Indicates CE version ONLY.

[1] DO NOT touch electrical components until main input power has been turned off and *CHARGE* lamps are extinguished. WARNING: The capacitors are still charged and can be quite dangerous, after power has been turned off.

IMPORTANT NOTE

The temperature requirements of Sunnen® Honing Machines, equipped with electronic components, have been established as 35 degrees C (95 degrees F). Above this temperature, an optional cooler will be available to handle temperatures from 35º to 46º C (95º to 115º F). IT IS NOT recommended that Machine, equipped with electronic components, be operated at temperatures above 46º C (115º F). Sunnen Products Company warrants Machine, equipped with electronic components, for operating environments up to 35ºC (95º F). For operating environments of 35º to 46º C (95º to 115º F) the warranty only applies if the optional cooler is installed on Machine, equipped with electronic components. No warranty coverage is offered for operating environments above 46º C (115º F).

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GENERAL INFORMATION & SPECIFICATIONS

Sunnen® Honing Machine - Model MBB-1660

DIAMETER RANGE (ID)[1]-	
Manual Stroking:	1,5 to 165 mm (.060 - 6.500 in.)
Power Stroking:	1,5 to 95 mm (.060 - 3.750 in.) w/optional KKN-100
Workpiece Weight[1]:	2,7 kg (6 lbs.)
Stroke Length Range[1]:	Up to 406 mm (16 in.)
Spindle Speeds:	200, 250, 320, 400, 500, 640, 800, 1000, 1270, 1600, 2000, & 2500 rpm
Spindle Motor:	0,37 kw (1/2 hp)
Coolant Pump:	Centrifugal pump driven off spindle motor.
Coolant Capacity:	60 liters (16 gallons)
Coolant Requirements:	Sunnen Industrial Honing Fluids
Floor Space:	1524 D x 813 W x 1600 H mm (60 x 32 x 63 in.)
Floor Weight (W/Coolant):	287 kg (630 lbs)
(W/Coolant & KKN-1002[2]):	306 kg (675 lbs)
Floor Load:	739 kg/sq meter (151 lbs/sq ft)
Electrical Requirements:	230/460 V, 60 Hz, 3 Ph; 115/230, 60, 1 220/380/440 V, 50 Hz, 3 Ph; 220, 50, 1
Color:	Pearl Gray / Pewter Gray / Black Trim
Noise Emission:	Less than 70 dB(A) continuous Load (max. noise) condition in a typical factory environment.

[1] Diameter range, length range, and workpiece weight are contingent on workpiece and application.
[2] KKN-100 Square Honing Fixture (see Sunnen Bore Sizing and Finishing Catalog, X-SP-5500).

INTRODUCTION

This Instruction Manual provides information required to install, operate, and maintain Sunnen® Honing Machine.

When ordering parts for, or requesting information about your Machine, include model and serial numbers, located on Electrical Enclosure of your Machine.

As there are numerous workpieces which can be honed on this machine, all the possible combinations cannot be discussed here. The determining factor as to whether a particular part or material can be honed in the machine will come with experience from working with the machine in your shop.

In this Manual, the symbol CE indicates steps or information that are only for CE version of this machine. The CE version is constructed to meet highest level of safety standards as required by European Machinery Directive. Required for European market, this CE version is available for any customer. The regular version of this machine is quite safe for any operator exercising a normal degree of caution associated with machine tool use. The CE version provides an extra level of protection by minimizing risks of operator carelessness.

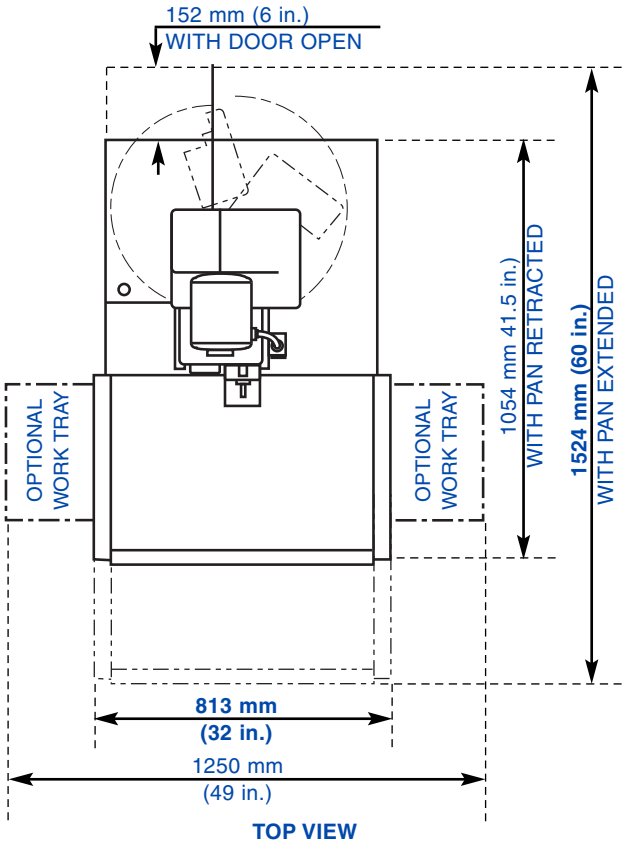
READ THE FOLLOWING INSTRUCTIONS THOROUGHLY BEFORE UNPACKING, INSPECTING, OR INSTALLING THE HONING MACHINE.

Diameters as small as 1,5mm (.060in.) and as large as 165mm (6.5in.) have been honed on the MBB-1660 Honing Machine.

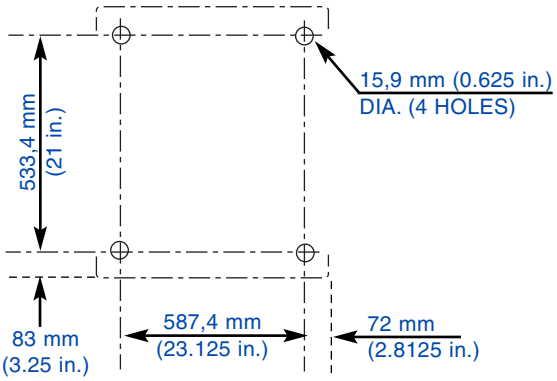
The MBB-1660 is a manually stroked honing machine, The operator starts and stops the honing cycle with the pedal while he continuously strokes the workpiece across the full length of the rotating honing stone. The machine rotates the honing tool and expands the honing stone until a preset limit of stone expansion has been reached. This limit of stone expansion is indicated by a reading of zero on the honing dial (the dial immediately above the spindle).

External honing tools may also be used with the MBB-1660. OD sizes range from 3-115 mm(.120-4.500 in.). In most all external honing operations, the requirements for stock removal are very light compared to that of internal honing.

The Grit Guard Filter System may be added to your honing machine installation to continuously filter the honing oil. The filter removes all dirt, grit, and chips down to 5 micron size before the honing oil is applied to the workpiece.

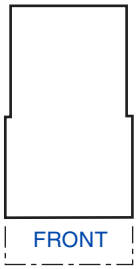


TOP VIEW



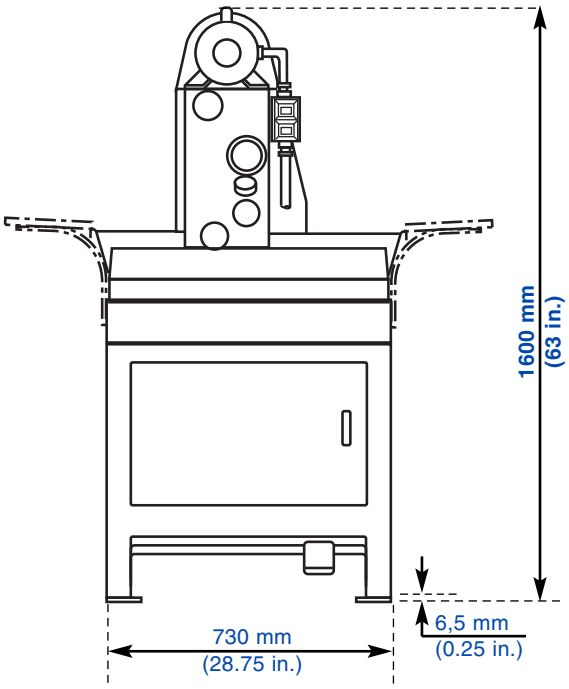
OUTLINE LAYOUT

Scale:
1 mm = 48 mm
1/4 in. = 1 ft.

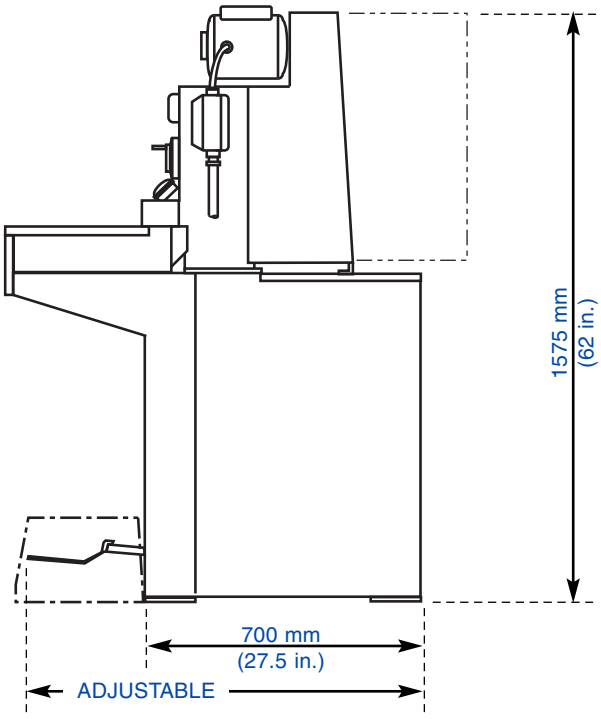


Weight Installed:
Approximately 287 kg. (630 lbs.) including coolant.

Floor Loading:
Less than 739 kg/sm (151 lbs/sf).



FRONT VIEW



SIDE VIEW

NOTES

SECTION 1
INSTALLATION

PURPOSE

This Section is designed to aid user in unpacking, inspecting, and installing Sunnen® Honing Machine, model MBB-1660. Hereafter, referred to as Machine (see Figure 1-1).

TOOLS & MATERIALS

The following tools and materials are required for unpacking and installing machine:

Wire Cutters/Strippers	Knife
Screw Driver (Std. nose)	Hammer
Slip-Joint Pliers	Crow Bar
Open End Wrenches	Tin Strips
Cleaning Solvent	Hex Wrenches

INSTALLATION

Read following instructions carefully and thoroughly before unpacking, inspecting and installing Machine. All references to right and left in these instructions are, unless otherwise noted, as seen by operator as one looks at front of Machine.

1. Remove top and front of shipping carton by cutting along edges.

2. Remove Components shipped inside carton. Then, unbolt and remove Machine.

FIGURE 1-1, Precision Honing Machine

3. Inspect Machine and Components for dents, scratches, or damage resulting from improper handling, by carrier. If damage is evident, ***immediately*** file a claim with carrier.

4. Place Machine in desired location.

5. Level Machine in both left to right and front to back directions. Shim as required.

NOTE: For permanent installation, secure Machine's Support Feet to Floor with Four (4) Fasteners.

6. Open access Door on front of Machine.

7. Remove Reservoir Retainers, by removing two (2) Screws (see Figure 1-2).

8. Remove and discard cardboard packing.

9. Push Drain Pipe to left and up.

10. Loosen Clamp Knob and move Pump back to loosen oil pump Belt. Then slip belt off pulley.

11. Pull Reservoir out far enough to remove all packing paper and tape from reservoir.

12. Remove packing material and tape from Settlement Tray, and install tray in Reservoir.

13. Push Reservoir all way in and install Reservoir Retainers, removed in step 7.

14. Reinstall oil pump Belt on pulley, removed in step 10.

15. Pull Pump forward until belt is under tension; then tighten Clamp Knob.

16. Pull Drain Pipe down and to right.

17. Close access Door to Reservoir.

18. Remove paper and tape from Work Tray.

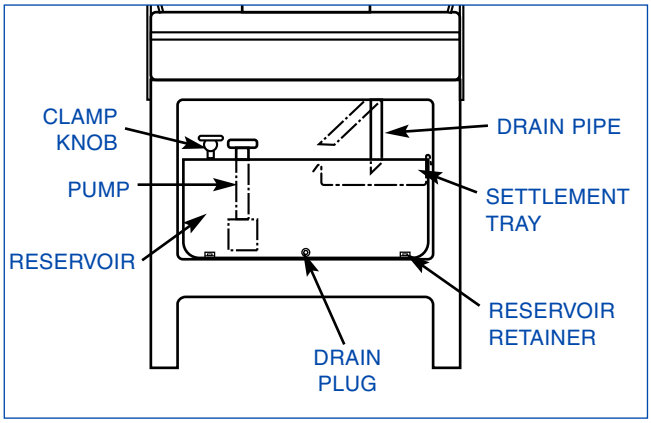


FIGURE 1-2, Coolant Reservoir

FOOT PEDAL

The following instructions cover installation of Foot Pedal Assembly on Sunnen Pedestal Honing Machines. To install Foot Pedal Assembly, proceed as follows (see Figure 1-3):

NOTE: DO NOT attempt to fork machine with Pedal Tube Assembly and Pedal Assembly installed.

1. Loosen Socket Head Screw (1/4 in. Hex Wrench) securing Extension Bar to Cross Bar, and slide Extension Bar out of Cross Bar.

2. Slide Cross Bar under machine so U-Shade Hook on end of Bar engages Machine's Foot Pedal Extension Bars. Slide Bar in at an angle; engage one side, then straighten out Bar to engage other side.

3. Slide Cross Bar back and hook over Machine's Cross Arm.

4. Remove Foot Pedal from Accessory Pack.

5. Lay Foot Pedal Assembly (Extension Bar) on its side.

6. Slide Foot Pedal over Cross Arm on Extension Bar and tighten Socket Head Screw (1/4 in. Hex Wrench).

7. Slide Extension Bar into Cross Bar and tighten Socket Head Screw (1/4 in. Hex Wrench).

ELECTRICAL GROUNDING

In event of a malfunction or breakdown, grounding provides a path of least resistance for electric current to reduce risk of electric shock. Single-phase machines are equipped with an electric cord having an equipment-grounding conductor and a grounding plug. Plug must be plugged into a matching outlet that is properly installed and grounded in accordance with all local codes and ordinances (see Table 1-1).

Do not modify plug provided on single-phase machines; if it will not fit outlet, have a proper outlet installed by a qualified electrician.

Improper connection of equipment-grounding conductor can result in a risk of electric shock. Conductor with insulation having an outer surface that is green with or without yellow stripes is a grounding conductor. If repair or replacement of electric cord or plug is necessary, do not connect equipment-grounding conductor to a live terminal.

Check with a qualified electrician or service-man if grounding instructions are not completely understood, or if in doubt as to whether machine is properly grounded.

Use only 3-wire extension cords that have 3-prong grounding plugs and 3-pole receptacles that accept single-phase machine's plug.

Repair or replace damaged or worn cords immediately.

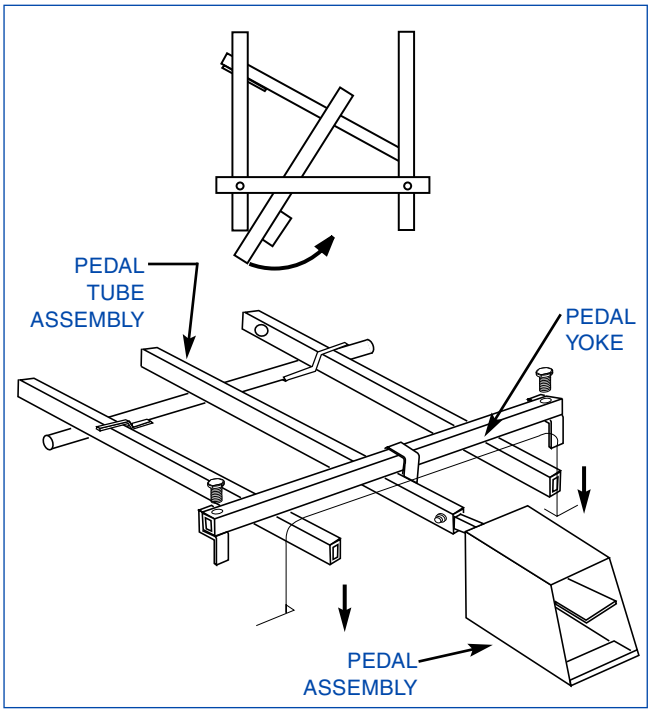


FIGURE 1-3, Pedal Assembly

ELECTRICAL

Electrical Supply Cord comes installed on most single-phase Machines. The electrical data plate provides helpful data including maximum current requirements and wiring diagram number for your machine (see Figure 1-4).

If Electrical Supply Cord is not supplied or in case of three-phase machines, a cord will need to be connect as follows:

NOTE: 110/230V machines require a #10/4, Type SO, 600 Volts (5,3mm^2) electrical supply cord. 460V machines require a #12/4, Type SO, 600 Volts (3,3mm2) electrical supply cord (see Specifications at front of manual).

1. Loosen Safety Latches on Electrical Enclosure. Remove padlock if installed.

2. Turn OFF Main Power Disconnect and open door to Enclosure.

3. Cut, drill or punch a 22mm (7/8in) Diameter Hole through bottom of Enclosure.

4. Insert Electrical Supply Cord through Entrance Hole, using a Cord Connector (not supplied) to provide an oil tight fitting. Allow for approximately 610 mm (24 in) of cable from where it enters enclosure and cut off excess.

5. Strip 250 mm (10 in) off cable's outer jacket

6. Strip 10 mm (3/8 in) of insulation from each wire.

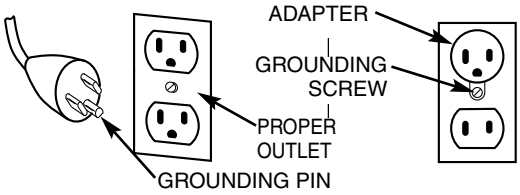
7. Connect green wire (electrical supply cord) to Terminal E (Earth Ground).

8. Connect other three wires (electrical supply cord) to top of Disconnect Block as noted on block.

TABLE 1-1, Electrical Connection

115V UNIT

Outlet for 115 volt unit should look like following.

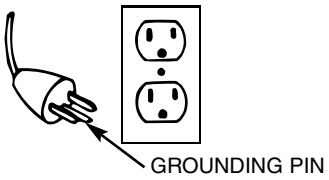


Electrical supply cord is equipped with a grounding pin. A temporary adapter, may be used to connect this plug to a 2-pole receptacle, if a properly grounded outlet is not available. Temporary adapter should ONLY be used until a properly grounded outlet can be installed by a qualified electrician. Green-colored rigid ear, lug, etc., extending from adapter MUST be connected to a permanent ground, such as a properly grounded outlet box.

Unit wiring should comply with all local, state, and federal codes and ordinances.

230V UNIT

Outlet for 230 volt unit should look like following.



Electrical supply cord is equipped with a grounding type plug. Make sure unit is connected to an outlet having same configuration as plug. No adapter is available or should be used with this unit. If unit MUST be reconnected for use on a different type of electrical circuit, reconnection should be made by a qualified electrician.

Unit wiring should comply with all local, state, and federal codes and ordinances.

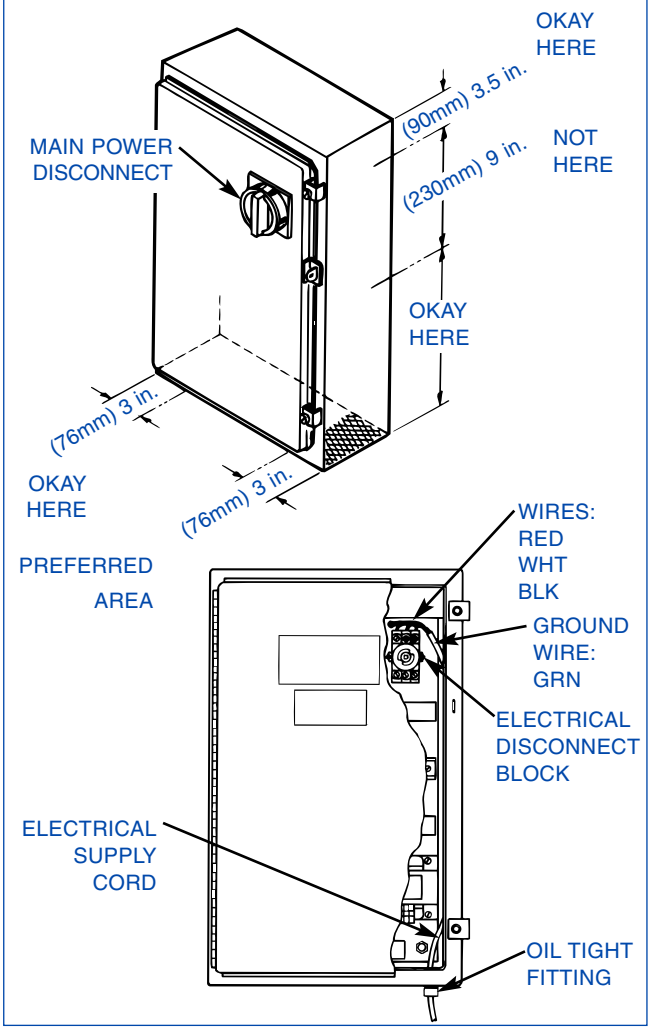


FIGURE 1-4, Electrical Control Enclosure

9. Close and lock door to Enclosure.
10. Connect Electrical Supply Cord to factory power source.

COOLANT

Fill Coolant Reservoir with Sunnen Honing Oil or Water-Based Coolant as follows (see Figure 1-5):

NOTE: Maximum capacity of Reservoir is 19 gallons (72 liters) without filter; or 22 gallons (83 liters) with filter. Minimum capacity of 8 gallons (30 liters) is needed for proper pump operation.

1. Open Door on front of Machine.
2. Remove Settlement Tray from Reservoir.
3. Pull Work Tray to fully extended position and pour coolant into Work Tray; or pump/pour coolant into Reservoir.
4. Replace Settlement Tray and close door.

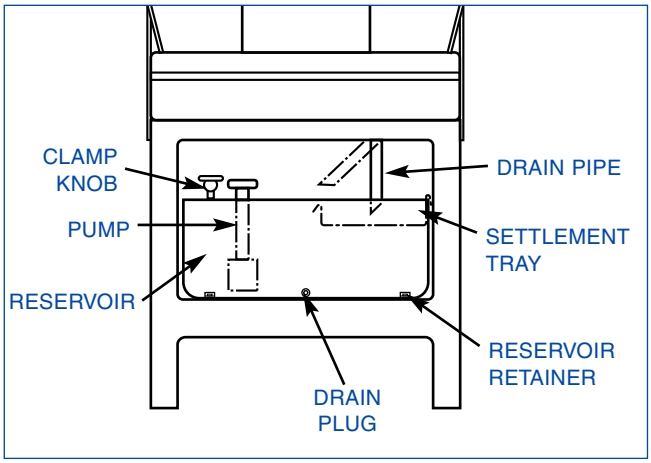


FIGURE 1-5, Coolant Reservoir

OPERATIONAL CHECK

Read Section 2 and 3 thoroughly and carefully before performing Operational Check.

1. CE Turn ON power at Main Power Disconnect.

2. Direct Coolant Nozzles downward, toward anti-splash pad.

3. Push START Button to start Coolant Pump Motor. Wait a few seconds for coolant pressure to build up.

4. With Coolant Nozzles directed downward; open Total Volume Valve, on Flow Control Manifold, by turning Valve counterclockwise.

5. Adjust coolant flow to each of nozzles with Individual Nozzle Control Valves.

6. Check that motors and spindle are operating properly. With machine turned on; slowly press pedal down. Check that spindle rotates counterclockwise as shown by arrow on spindle nose.

NOTE: Rotation of Spindle Shaft should be counterclockwise, as viewed from output end of spindle drive motor. If rotation is incorrect (spindle rotates clockwise): On single-phase machine, follow instructions on inside of motor terminal box cover plate to reverse motor rotation. On 3-phase machines, reverse any two of three wires connected to Disconnect Block (refer to Figure 1-4).

7. Push STOP Button.

8. CE Turn OFF power at Main Power Disconnect.

9. Close Total Volume and Individual Control Valves on Flow Control Manifold.

NOTE: Total Volume Valve may now be used to shut entire supply off, leaving individual settings unchanged.

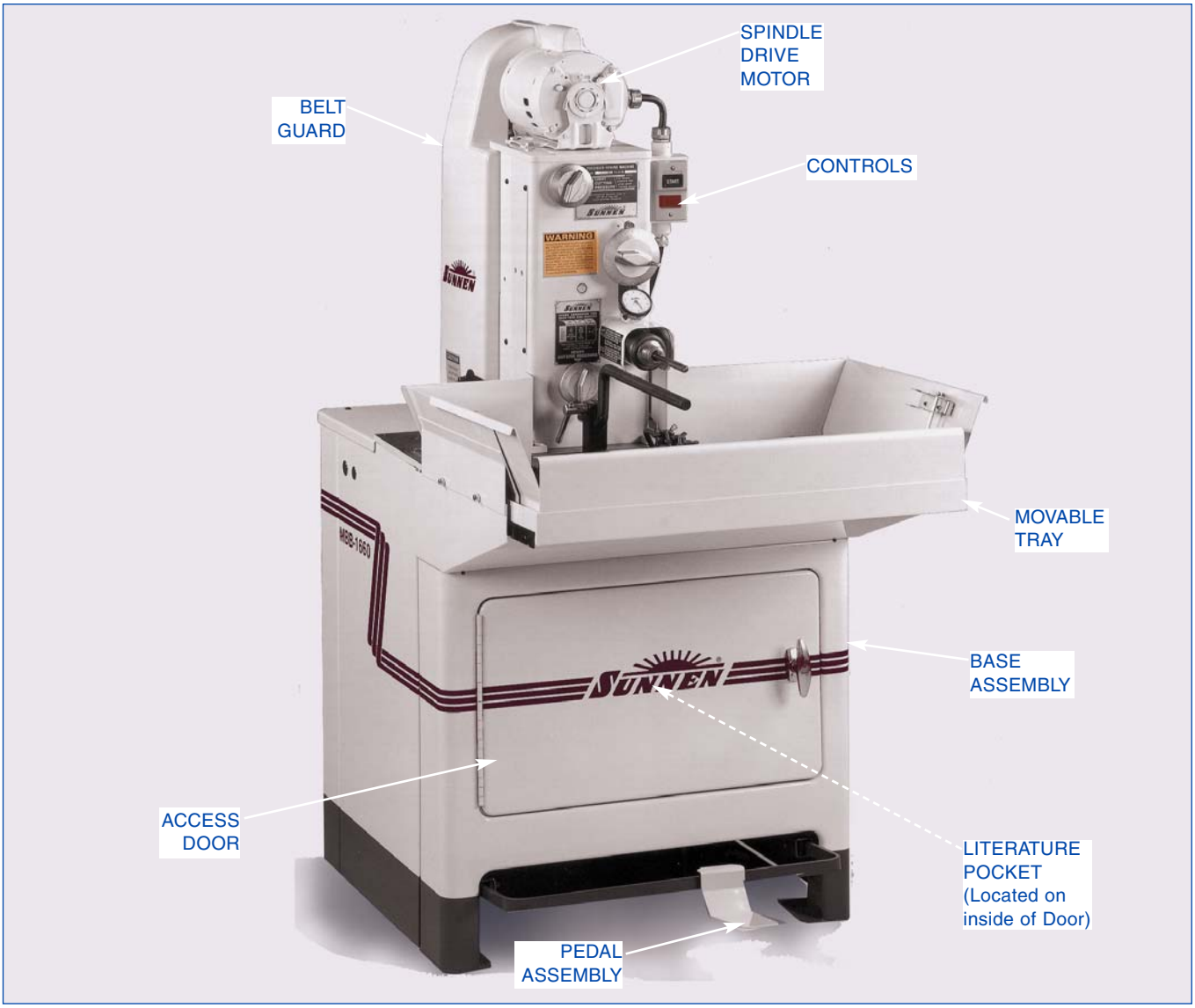


FIGURE 2-1, Major Components

SECTION 2
PREPARING FOR OPERATION

GENERAL

Consult this section when preparing Machine for operation.

MAJOR COMPONENTS

For location of major components on machine see Figure 2-1. (All directional references are as viewing assembly from left side of machine.)

1. BASE ASSEMBLY. Base Assembly consists of following components (refer to Figure 2-1):

Machine Base. Honing Machine is equipped with a heavy base to support Hone Head Assembly and houses operating components.

Access Doors are located on top and front of machine to provide easy access to machine operating components.

Literature Pocket is located inside front access Door. Used for storage of literature.

Movable Tray is located on top front of machine. It adjusts to accommodate honing units and work-pieces of varying lengths.

Two (2) optional Work Trays can be mounted to left and right of Movable Tray.

Adjustable Work Support is located in Movable Tray. It assures more accurate results when honing and help prevents operator fatigue by carrying weight of workpiece and absorbing honing torque. Especially useful for honing large or bulky parts.

Horizontal Adjustment Knobs must be loosened to move Work Support to left or right. Four tapped holes allow you to place Support in any horizontal position.

Universal Adjustment Handle loosens to position Work Support vertically and horizontally.

2. PEDAL ASSEMBLY. Pedal Assembly is located on front and inside of Machine Base (see Figure 2-2). When depressed, assembly starts spindle drive motor, stroking drive motor, and expands stones. Assembly consist of following components:

Adjustable Pedal Bar & Pedal is located on lower front of machine. Both Bar and Pedal are adjustable to accommodate individual operator.

CE Pedal Guard covers Pedal, preventing pedal from inadvertently being depress during setup and machine spindle rotating.

3. HONE HEAD ASSEMBLY Hone Head Assembly consist of following components (see Figure 2-3):

(CE) Disconnect Switch is located on left side of Belt Guard. Switch shuts off power to Hone Head Drive Pulley.

Light Cutting Pressure Control Dial is located on top left of assembly. It is used to adjust cutting pressure of honing stone in small diameter bores, in soft materials, for rough bores or for fine finishes. Use in conjunction with Feed Dial and Honing Dial to ensure maximum efficiency.

Feed Dial is located on top left of assembly below Light Pressure Control Dial. Setting of this dial limits maximum honing stone expansion, and allows honing stone to feed out automatically during honing operation until preset point is reached.

Honing Dial is located on front center of assembly. It measures expansion of stone as wedge moves forward, and indicates that maximum stone expansion point has been reached when needle reads "0". Works in conjunction with Feed Dial. With work-piece on honing unit and Feed Dial set for desired stock removal, Honing Dial needle shows amount of stock to be removed.

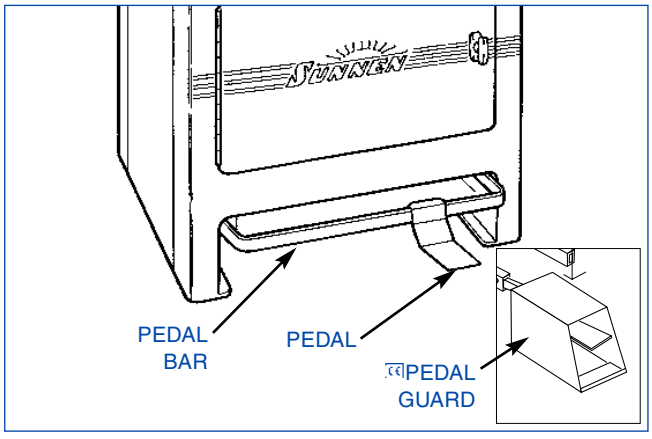


FIGURE 2-2, Base Assembly

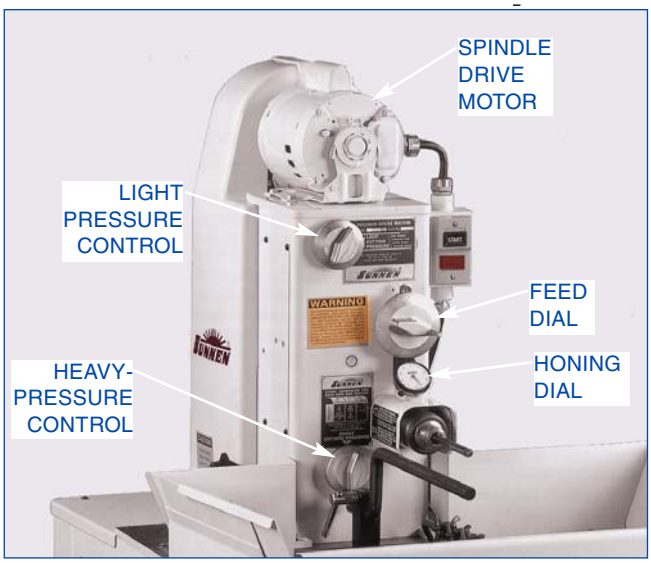


FIGURE 2-3, Hone Head Assembly

Heavy Cutting Pressure Control Dial is located on lower left of assembly. It is used to adjust cutting pressure of honing stone where heavy stock removal is required. Use in conjunction with Feed Dial and Honing Dial to ensure maximum efficiency.

Spindle Drive Motor is located on top of assembly. It supplies power for honing operation.

4. COOLANT PUMP SYSTEM. Applies coolant to workpiece and mandrel. Three independently controlled nozzles are easily positioned to assure an even flow of coolant through workpiece being honed and over full length of mandrel. Two nozzles are used to feed coolant to each end of mandrel. The third may be used to feed additional coolant to either end of workpiece, for externally cooling workpiece or for flushing workpiece before gaging. Coolant Pump System is located inside top left of machine (see Figure 2-4). It consists of following components:

Centrifugal Coolant Pump is located inside coolant reservoir and is driven by spindle motor.

Coolant Flow Control Manifold is located on left front of machine. It provides independent regulation of coolant flow to each Coolant Nozzle through Total Volume Control Valve and Individual Coolant Nozzle Control Valves. Total volume valve is used to turn on and off supply of coolant, eliminating readjustment of individual coolant nozzle control valve setting.

Coolant Nozzles attaches to Coolant Support Arm located on front of machine in Movable Tray. Nozzles supply coolant to workpiece and mandrel. Three independently controlled coolant nozzles are easily positioned to assure an even flow of coolant through workpiece and over full length of mandrel.

6. ELECTRICAL COMPONENTS Sunnen Honing Machine is available in 110/230 Volt, single phase, 60 Hz.; or 220//380/440 Volt, 50 Hz, 3 Phase. Its major components are as follows (see Figure 2-5):

Operator Controls are located on right front of Hone Head Assembly.

CE Electrical Control Enclosure is located on right side of machine base. Electrical power to machine is controlled at this by Main Power Disconnect.

7. ACCESSORIES The following items are supplied as standard equipment with your machine:

Hex Key Wrenches, Metric Wrenches, and T-Wrench.

MAN-700 Diamond Dresser. Used to break glaze on aluminum oxide and silicon carbide honing stones.

Manual Torque Support. Adjustable support used to absorb torque from holding fixture (or workpiece) when honing manually. Manual Torque Support Arm. Used to hold Manual Torque Support when manually honing.

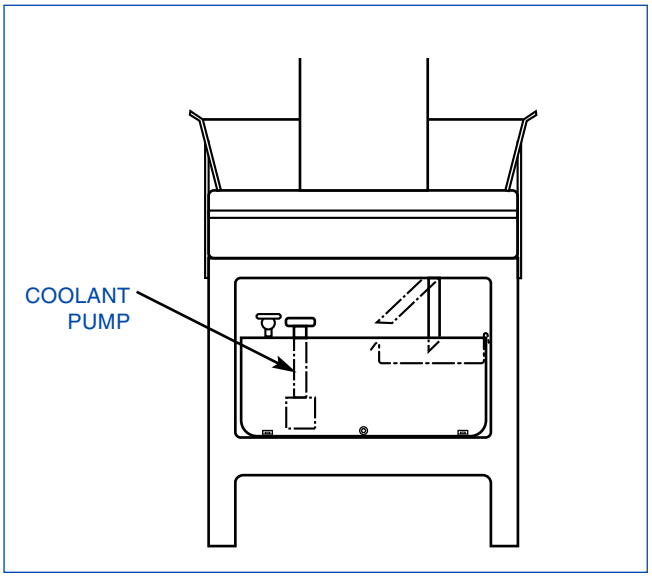


FIGURE 2-4, Coolant Pump Assembly

FIGURE 2-5, Electrical Components

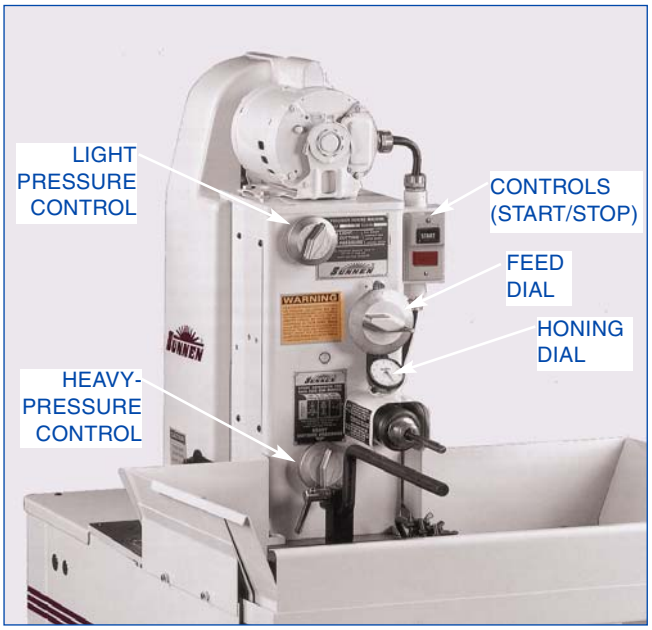


FIGURE 2-6, Controls

10. OPTIONS. The following is a list of optional equipment available for machine:

Adjustable Stroking Stop mount on Work Support and limits honing stroke; especially useful when honing blind holes.

Gage Mount, Model MB-2370A. Mounts on left front of machine and is used to rest Sunnen AG/PG Gage on for easy access during honing.

Optional Work Light, model MBC-200, mounts on top left of Hone Head Assembly and provides glare-less illumination for honing and gaging.

SAFETY SYMBOLS

For a description of safety symbols used on this machine, refer to Table 2-1.

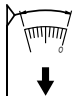
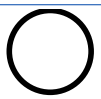
MACHINE CONTROLS

For location and function of machine controls refer to Figure 2-6 and Table 2-2.

TABLE 2-1, Safety Symbols

SYMBOL	DESCRIPTION	FUNCTION
	Warning Label	Warns that an electrical hazard exists.
	Warning Label	Warns that an arc flash hazard exists.
	Warning Label	Warns that safety glasses should be worn at all times when operating this machine.
	Warning Strip	Warns that a *physical hazard exists*, and that proper precautions should be taken.
	Label	Designates this machine is *"CE" compliance*.
	Warning Label	Warns not to hold workpiece in hand without a torque resisting fixture.
	Foot Pedal	Starts honing cycle and controls stone expansion.

TABLE 2-2, Machine/Operator Controls

SYMBOL	DESCRIPTION	FUNCTION
	(Light Cutting Pressure) Rotatory Dial	Adjusts to controls Cutting Pressure of stones against workpiece when honing small diameter bores, soft material, rough bores, or for fine finishes.
	(Heavy Cutting Pressure) Rotatory Dial	Adjusts to controls Cutting Pressure of stones against workpiece for Heavy stock removal.
	(Feed Dial) Rotatory Dial	Expands or retracts stones in honing tools. Setting on dial indicates amount of stone feed per dial graduation for various tools. (See Stone Expansion Chart.)
	(Honing Dial) Indicator Gauge	Indicates amount of stock to be removed from workpiece. Used in conjunction with Feed Dial.
	START (Black) Pushbutton	Turns ON Power to the Machine. Used in conjunction with Foot Pedal, STARTS honing cycle.
	STOP (Red) Pushbutton	Turns OFF Power to the Machine. STOPS honing cycle.
	Rotation Arrow	Indicates proper direction of rotation.
	Disconnect Switch	(CE Machines ONLY) Shuts OFF power to Drive Pulley.

SETUP, GENERAL

To setup the machine for manual stroke honing, proceed as follow:

1. Turn ON power at Main Power Disconnect.

2. Turn OFF Coolant supply by turning Total Volume Control Valve fully clockwise.

3. Select Honing Unit from Sunnen Bore Sizing and Finishing Supplies Catalog (X-SP-5500).

Depending on your part configuration, select a honing unit type and size most suitable.

Assemble honing unit by using instructions included with your new mandrel and/or adapter.

4. Select Stone from Sunnen Bore Sizing and Finishing Supplies Catalog (X-SP-5500).

Determine amount of stock to be removed and number of operations required to getting workpiece to proper size and surface finish. Many times a three stone operation is the most economical - that is: deburring, fast stock removal, and fine finishing. If deburring is attempted with a stock removal stone, excessive stone wear will result. If stock removal is attempted with a deburring stone or finishing stone, honing time will be excessive.

Use a harder stone to improve stone life. Use a softer stone to promote freer cutting.

Use a coarse stone for fast stock removal and a fine stone for finishing. Always use the coarsest stone that will produce an acceptable surface finish.

Short open bores, blind bores, and tandem bores may require minor alterations of standard stones.

5. Assemble Honing Unit: According to instructions packed with Honing Unit.

6. Turn Feed Dial counterclockwise until you meet resistance, then advance dial clockwise about five turns (see Figure 2-7).

7. Pull Mandrel Wedge straight back as far as possible, using hook on end of T-Wrench (see Figure 2-8).

8. If required, install Spindle Sleeve (LN-570A) on honing unit. If honing unit fits into spindle very loosely, use a Spindle Sleeve (see Figure 2-9).

9. Remove Spindle Cover.

10. With motor off, depress pedal slightly to release spindle brake and rotate spindle so Large Setscrew points up (12 o'clock position).

11. With setscrew indentation on honing unit at 9 o'clock position, insert Honing Unit into Spindle Nose as far as it will go; rotate unit 1/4 turn clockwise to engage Wedge with Feed Rod; then push Honing Unit all way in until it bottoms (see Figure 2-10).

TABLE 2-3, Cutting Pressure Setting

BORE SIZE		PRESSURE CONTROL
inches	millimeters	INITIAL SETTING
1,5 - 2,5	.060 - .100	0
2,5 - 5,0	.100- .185	1/8
5,0 - 6,0	.185 - .245	1/4
6,0 - 9,0	.245 - .370	1/2
9,0 - 12,0	.370 - .495	3/4
12,0 - 25,0	.495 - 1.000	1
25,0 - 92,0	1.000 - 3.625	2
92,0 - 165,0	3.625 - 6.500	2-1/2

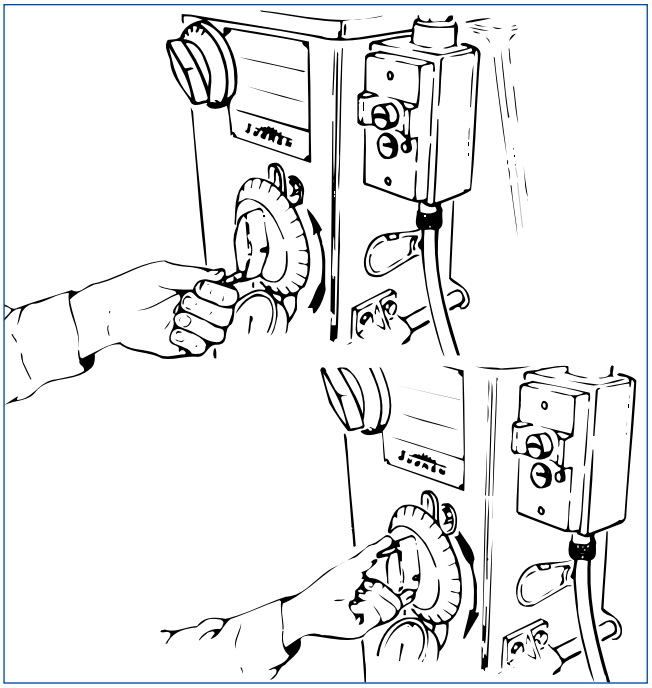


FIGURE 2-7, Cutting Pressure Settings

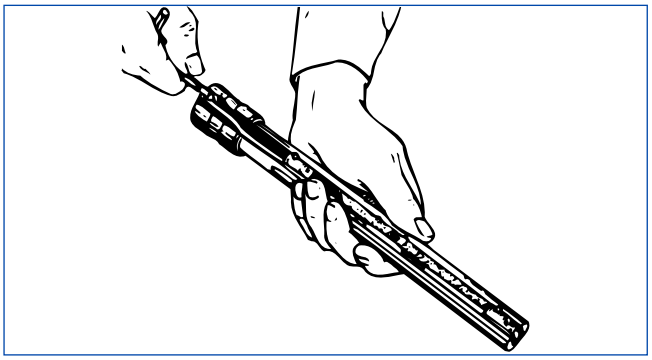


FIGURE 2-8, Mandrel Wedge

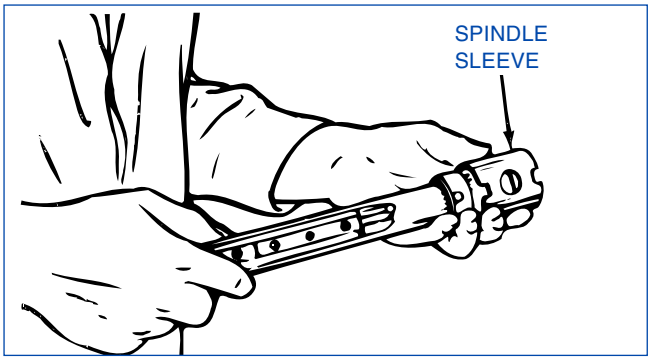


FIGURE 2-9, Spindle Sleeve

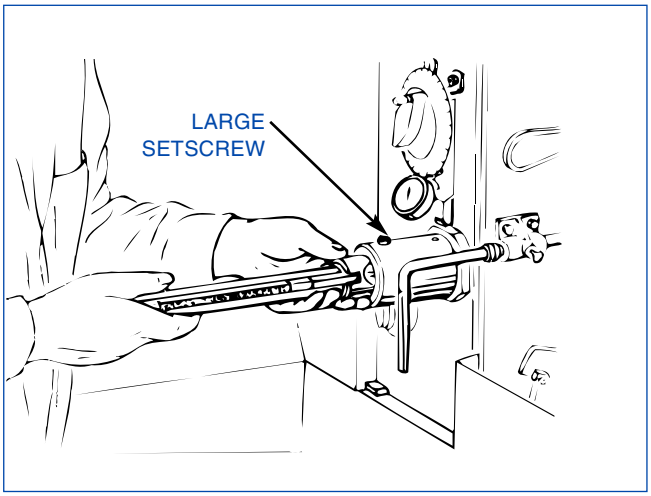


FIGURE 2-10, Install Mandrel

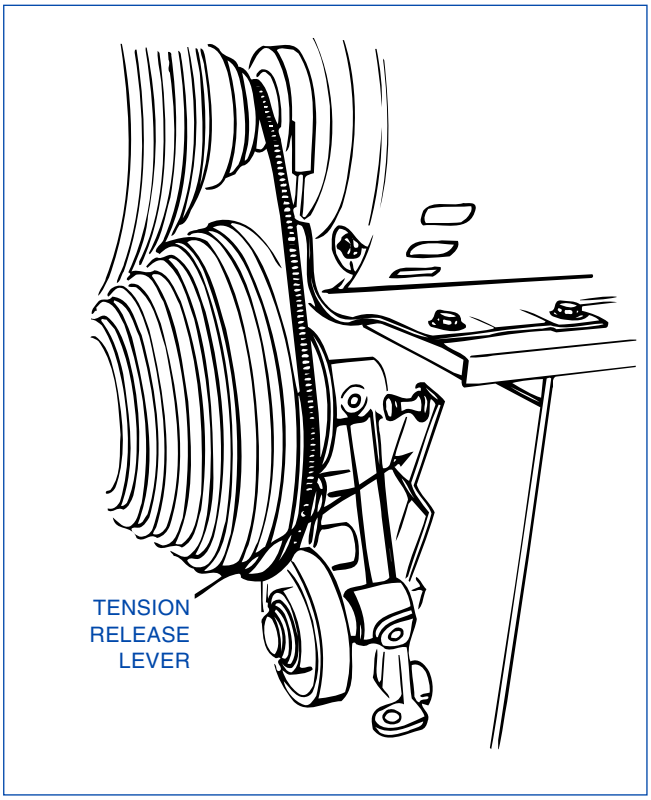


FIGURE 2-11, Idler Handle

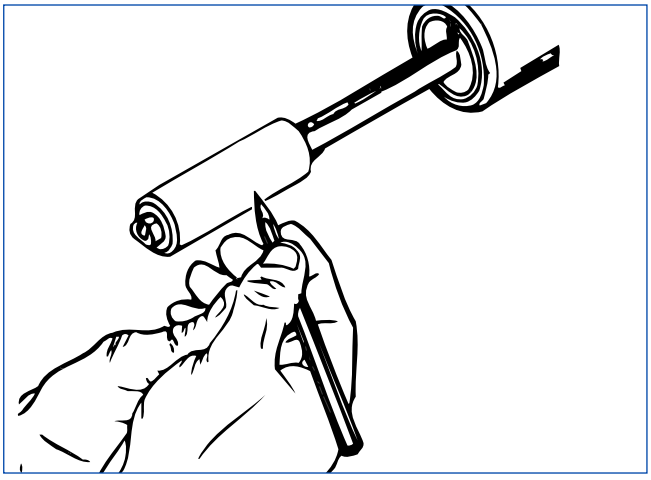


FIGURE 2-12, Mandrel Runout

12. Test Wedge hookup by pulling Honing Unit straight out; if Wedge comes out repeat steps 9 thru 12. If wedge is hooked up, it will not allow unit to come out of spindle.

13. Push unit back into Spindle Nose until it bottoms.

14. Tighten Large Set Screw with T-Wrench.

SPINDLE SPEED

15. With motor OFF, open Belt Guard, by loosening Safety Latch Pin and raising Belt Cover Latch.

NOTE: CE machines requires Disconnect Switch to be turned to Off posisiont before doors can be open.

16. Using Chart on inside of Belt Guard (see Table 2-3), position belts for a Spindle Speed of 200 rpm (setup speed).

17. Pull Idler Handle down (see Figure 2-11).

18. Move upper V-Belt to 200 rpm position.

19. Move lower V-Belt to Low Speed Range groove.

20. Release Idler Handle by pulling and raising.

21. Close and secure Belt Guard.

22. Set Light Cutting Pressure Control to "1"; and set Heavy Cutting Pressure Control to "0".

23. Turn Feed Dial counterclockwise to end of range.

MANDREL RUNOUT

NOTE: CR-Series of Honing Units do not require mandrel runout adjustment. Instead adjust radius of mandrel as follows: With motor off, depress Pedal and feed up stone until there is a reading of approximately 5 on Honing Dial. Loosen shoe setscrew and adjust mandrel shoes to curative of rod by tapping rod lightly. Tighten shoe setscrew (do not overtighten). Go to step 31.

24. Place a concentric Truing Sleeve on Honing Unit, with an inside diameter the same size as workpiece to be honed.

25. Depress Pedal and turn Feed Dial clockwise until Honing Dial reads "5 or 6"; release Pedal.

WARNING

Power to Machine is ON. Machine will begin operating when START Switch is pressed.

26. Push START Button.

27. Depress Pedal all way down (allow Truing Sleeve to rotate with Honing Unit).

WARNING

Power to Machine is ON. Keep hands clear of moving parts.

28. Hold marking pencil to front of Sleeve (see Figure 2-12), so it will just touch high points of sleeve as honing unit is rotating. Repeat on rear of Sleeve. Resulting marks indicate high point(s).

27. Push STOP Button, but continue to hold pedal down.

NOTE: A small amount of runout will not affect accuracy of workpiece. The heavier workpiece/fixture combination, the less runout can be tolerated.

28. Loosen Numbered Set Screws in Spindle Nose on same side as pencil marks; and tighten Numbered Set Screws on opposite side (see Figure 2-13).

29. Wipe Truing Sleeve and repeat steps 24 thru 29 as required, until minimum runout is obtained.

30. Push STOP Button and remove Truing Sleeve.

31. Press START Button.

CAUTION

Use only undiluted Sunnen Industrial Honing Oil. This oil will ensure free cutting, reliable stone performance, and consistent surface finish.

32. Attach and adjust position of Coolant Nozzles (see Figure 2-14). Coolant should contact front and rear of Stone, parallel to mandrel. Adjust Total Volume and Individual Control Valves.

33. Press STOP Button.

34. Set Light Cutting Pressure Control according to Table 2-4 or Your Sunnen SMOPS Guide (see Figure 2-15).

NOTE: CR-Series of Honing Units stones and shoes are self truing; no truing sleeve is furnished or required. Go to step 49. TRUE IN MANDREL AND STONE

35. Turn Feed Dial counterclockwise until you feel resistance.

36. Place a Truing Sleeve or an undersized workpiece in a torque absorbing workholding fixture.

37. Install Truing Sleeve (in Workholding Fixture) on mandrel.

38. With motor off, depress Pedal and turn Feed Dial clockwise until Honing Dial Needle reads "3".

39. Release Pedal.

WARNING

Power to Machine is ON. Machine will begin operating when START Switch is pressed.

40. Push START Button.

41. Slowly open Total Volume Control Valve on coolant Flow Control Manifold. Generously apply Coolant to honing stone, guide shoes, and bore of Truing Sleeve. Close Total Volume Control Valve.

42. Center Truing Sleeve over stone and shoes.

43. Grasp Workholding Fixture and Truing Sleeve firmly and depress Pedal slowly.

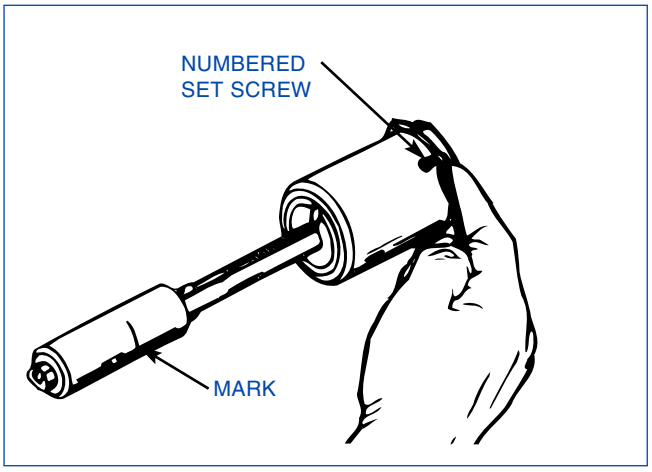


FIGURE 2-13, Numbered Set Screws

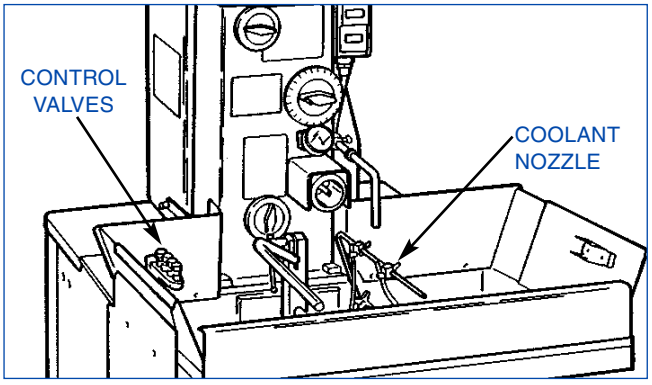


FIGURE 2-14, Coolant

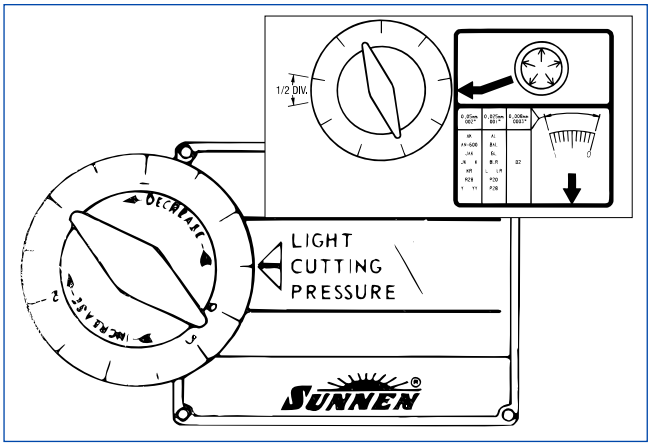


FIGURE 2-15, Light Cutting Pressure

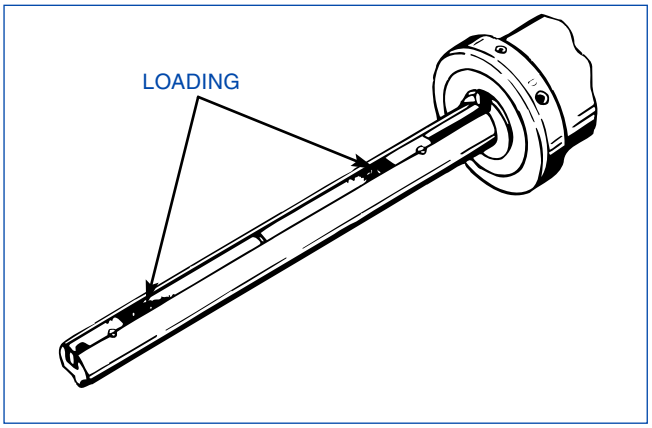


FIGURE 2-16, Stone Loading

TABLE 2-4, Cutting Pressure Setting

BORE SIZE		PRESSURE CONTROL
inches	millimeters	INITIAL SETTING
1,5 - 2,5	.060 - .100	0
2,5 - 5,0	.100- .185	1/8
5,0 - 6,0	.185 - .245	1/4
6,0 - 9,0	.245 - .370	1/2
9,0 - 12,0	.370 - .495	3/4
12,0 - 25,0	.495 - 1.000	1
25,0 - 92,0	1.000 - 3.625	2
92,0 - 165,0	3.625 - 6.500	2-1/2

TABLE 2-5, Spindle Speed Selection

WORK DIAMETER		SPINDLE
inches	millimeters	SPEED
UNDER .308	UNDER 8	2500
.308 - .432	8-11	2000
.432 - .495	11-13	1600
.495 - .619	13-16	1270
.619 - .744	16-19	1000
.744 - 1.000	19-25	800
1.000 - 1.250	25-32	640
1.250 - 1.625	32-41	500
1.625 - 2.000	41-51	400
2.000 - 2.500	51-64	320
2.500 - 3.250	64-83	250
OVER 3.250	OVER 83	200

CAUTION: Power MUST be OFF when Guard is open.

CAUTION

Always release Pedal before removing Truing Sleeve from mandrel.

44. As mandrel begins its rotation, stroke Truing Sleeve forward and back. Use short strokes at first, then gradually lengthen stroke until stroke length is about as long as stone or Truing Sleeve, whichever is longer. Reverse Truing Sleeve frequently.

If Truing Sleeve is too hard to hold or Honing Dial Needle moves too rapidly, reduce cutting pressure. Honing Dial Needle does not move or moves too slowly, increase cutting pressure.

45. As soon as the truing sleeve and stone become saturated with oil, adjust Total Volume Control Valve so that the oil no longer reaches the mandrel or truing sleeve.

The coolant on Truing Sleeve and stone create a lapping paste as you are honing; as paste dries out, add a small amount of Coolant.

Always hone workpiece most where you feel most pull or resistance.

46. When Honing Dial Needle reaches "0", release Pedal.

47. Advance Feed Dial four (4) numbers; Depress Pedal and continue honing until Honing Dial Needle reaches "0"; then release Pedal.

CAUTION

Always release Pedal before removing Truing Sleeve from mandrel.

48. Reverse Truing Sleeve frequently. After reversing Truing Sleeve several times stop and examine stone and shoes.

NOTE: High spots on stones will be loaded (see Figure 2-16). Use the LBN-700 Abrasive Stick to remove high spots on stone. High spots on shoe will be bright and shiny. A few light strokes with a file will remove these high spots (use an abrasive stick like the LBN-700 to true hardened steel guide shoes).

49. Repeat above operation, until at least a line contact is achieved on each shoe and on stone.

NOTE: The objective of truing the mandrel and stone is to make the shoes and stones parallel. However, when honing to very close tolerances or when honing holes with keyways, the honing unit should also be trued to the finish bore diameter as closely as possible. When truing Keyway (Y-type) mandrels, refer to instruction sheet packed with mandrel. Keyway mandrels should be fully radiused to within .005" (0.13 mm) of workpiece finish bore size.

50. When mandrel is trued in, push STOP Button.

51. Replace Spindle Cover.

SPINDLE SPEED

52. Open Belt Guard, by loosening Safety Latch Pin and raising Belt Cover Latch.

NOTE: CE machines require no tools to open doors.

53. Using Chart on inside of Belt Guard, select Spindle Speed according to bore diameter (see Table 2-5).

If the part is heavy enough to exert a considerable force on honing unit/mandrel, use a slower speed than shown. For external honing, use two speeds slower than shown

CAUTION

Extra long mandrels should be run at a slower speed than shown.

54. With motor OFF, pull Idler Handle down.

55. Move V-Belt to appropriate groove. Use 320 rpm for most passenger car and light truck rods in 1.4 to 2.6 in (36-66 mm) diameter range. Use 250 rpm for large truck rods over 2.6 in (66 mm) in diameter.

For easiest belt shifting, always move the belt from the larger to the-smaller diameter groove first.

56. Release Idler Handle by pulling and raising.

57. Close and secure Belt Guard.

58. Set Light Cutting Pressure Control according to bore diameter (refer to Table 2-4.or your Sunnen SMOPS Guide). Always start a new honing job with light pressure. Increase pressure as needed.

59. Set Heavy Cutting Pressure Control to "0". Heavy Cutting Pressure Control is always set to zero when using Light Cutting Pressure Control.

Heavy Cutting Pressure Control is used for fast stock removal in larger bores.

MANUAL STROKE HONING

Refer to this step when setting up your Machine for MANUAL STROKE HONING.

1. Position Work Support. Support should be placed approximately under center of gravity of work if the part is very heavy, other-wise position the bar as far from the mandrel as the part or holding fixture will allow. Position Work Support as close as possible to end of Rod without locating on curved portion of rod.

CAUTION

All workpieces MUST be in a Holding Fixture to avoid injury and damage to machine (see Sunnen Data Files 107 and 108 for fixturing suggestions).

2. Place workpiece in Holding Fixture.

3. Install workpiece on mandrel.

4. If used, adjust optional stroking stop. Measure length of bore to be honed and measure length of honing stone. The longer of two is maximum stroke length. If workpiece have large counterbores or large overhangs, shorten stroke length to gain stability.

NOTE: For blind holes, stroke length should be bore length (including relief) minus 1/2 stone length. Shorten stroke if stability becomes a problem.

For tandems using a solid line of stones, the stroke length is equal to the total stone length minus the tandem distance. For tandems using separated tandem stones; the stroke length is equal to the tandem land length or individual stone length, whichever is longer.

5. Setup is complete, proceed to Section 3, Operation.

WARNING

DO NOT WEAR COTTON OR HEAVY GLOVES WHILE OPERATING THIS EQUIPMENT! IF GLOVES MUST BE WORN, WEAR ONLY THE TEAR-AWAY TYPE.

WARNING

(CE MACHINES ONLY.) USE CAUTION WHEN OPENING BELT GUARDS ONCE POWER IS SHUT OFF; PULLEYS MAY STILL BE TURNING AS MOTOR COAST TO A STOP.

WARNING

AN ARC FLASH HAZARD EXISTS. FOLLOW SAFE WORK PRACTICES AND WEAR APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT. FOLLOW PROPER LOCKOUT / TAGOUT PROCEDURES. *FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY.*

SECTION 3
SETUP & OPERATION

GENERAL

This section describes a step-by-step operating procedure for Machine.

• Prior to starting Machine, Operator shall ensure:
• All prerequisites described in sections 1 and 2 are complete.
• All personnel are clear of machine.

SAFETY PRECAUTIONS

The following precautions should be followed to ensure maximum safety of personnel while working on or around Machine.

• Ensure all guards are in place before operating.
• Ensure area is clear of other personnel before operating machine.
• Keep machine clear of tools or other foreign objects.
• Wear proper safety items such as, safety glasses, gloves, non-slip safety shoes and other personal safety equipment as necessary or required.
• Do not wear cotton or heavy gloves while operating this equipment! Wear only tear-away type gloves.
• DO NOT wear loose clothing or jewelry while working on or around machine.
• Keep area around machine free of paper, oil, water and all other debris at all times.
• When lifting part or tooling use proper lifting procedures. DO NOT overreach; keep proper footing and balance at all times.
• CE Turn OFF electrical power at Disconnect Switch, on Electrical Control Enclosure when preforming service not requiring power.
• CE Turn OFF electrical power at Disconnect Switch on side of Belt Guard.
• CE Turn OFF electrical power at Main Power Source when performing maintenance on, or cleaning of Electrical Control Enclosure.
• Clear area of excessive lubricant or lubricant spills.
• DO NOT adjust stroke length while honing.
• KEEP hands clear of all moving parts. Stay clear of all moving parts.
• Remove keys & wrenches from machine before honing.
• DO NOT hand hold parts while honing. To prevent personal injury and machine damage, DO NOT hone without installing part in workholding fixture.
• To avoid personal injury, allow spindle and stroking arm to come to a complete stop before removing part.
• Keep all visitors a safe distance from work area.
• DO NOT use in dangerous environment. DO NOT use machines in damp or wet locations, or expose them to rain. Keep work area well lighted.

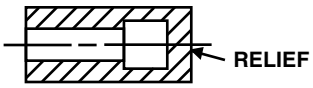
OPERATING HINTS

ALWAYS DEBURR A ROUGH HOLE - If a bore is rough or has burrs prior to honing, a quick deburring operation with a very hard "deburring" stone prevents damage to stock removal or finishing stone, reduces stone costs and speeds tip production.

HONE BEFORE HARDENING - When a part is to be hardened, always hone first, leaving only as little stock as necessary to correct heat-treat distortion. When needed, use a deburring stone to remove hear treat scale prior to sizing and finishing operation.

AMOUNT OF STOCK FOR HONING - Previous operation should leave just enough stock so that tool marks can be cleaned up and bore inaccuracies corrected. Less stock allowance is needed for Sunnen honing because Sunnen Honing Units are self-centering in bore. When going from a stock removal to a. surface finishing operation leave only enough stock to remove cross-hatch pattern of coarser stone, usually only a few ten-thousandths of an inch.

PROVIDE RELIEF IN BLIND HOLES - Honing of a blind hole can be greatly assisted by providing Relief in bottom corner of bore. This allows for at least some overstroking. Relief need be only a few thousandths deep, can even "blend in" as hole is honed. Ideal length of relief is 1/3 stone length. Any length of Relief is much better than none.



PARTS CAN BE STACKED - Frequently parts with short bores can be "stacked" and honed as one long bore. Parts must have flat and parallel faces.

KEEP YOUR HONINGTOOLS TRUE - Cutting surface of stone and guide surfaces of shoes must be kept straight and parallel to produce accurate work. Occasional use of a truing sleeve will assist in keeping tools true.

USE ONLY PROPER HONING OIL - Best honing results are obtained only when proper Sunnen Industrial Honing Oil is used. Cutting oils, coolants, and other fluids are generally not satisfactory for honing and may result in excessive stone wear or glazing, low stock removal rates and poor surface finish ... and frequently cause galling or scoring of part. Sunnen Industrial Honing Oil Is especially compounded for honing needs. It keeps stone clean and sharp, reduces stone wear,

increases rate of stock removal, and is invaluable in producing fine surface finishes. A free flow of honing oil should be provided, both for Sunnen Honing Machines and for Sunnen Portable Hones. Do not dilute, cut, or change honing oil in any way.

LONGER STONE LIFE - May be obtained by easing" stone into bore when starting honing operation. "Tramping" on pedal can damage stone, especially in a rough bore.

KEEP STONE CUTTING PRESSURE L1GHT - Just heavy enough to get good cutting action. Excessive stone pressure will only increase stone wear; it will not make stone cut faster.

UNUSUAL HONING PROBLEMS - Can be referred to Sunnen Honing Laboratory. Be sure to include all data concerning problem, such as tolerances, surface finish requirements, stock removal, type of material and production quantities.

REMOVING WORKPIECE FROM MANDREL - Never begin removing workpiece from mandrel until spindle stops. When pedal is released your spindle should also stop. If it doesn't, check spindle brake adjustment in Section IV.C.7.

HONING DIAL - Each number on dial in-dicator is equal to a certain amount of stone expansion. To determine this, refer to chart on nameplate nearest honing machine spindle.

PEDAL TRAVEL - In extreme down position, pedal should be at least 1/4 inch (6 mm) off floor. If not, adjust.

HONING STONE - Select from Page 4 of Honing Supplies Catalog, from stone cabinet, or from SMOPS Guide.

WORN-OUT MANDRELS - When truing sleeve or workpiece makes contact with any part of mandrel other than shoe, replace mandrel or guide shoes.

STONES FOR HARD STEEL - Use a CBN/ Borazon abrasive on hard steel only when aluminum oxide (A) fails to remove stock efficiently.

MANUAL HONING OPERATION

To manual hone bores, proceed as follow:

1. Follow Setup procedures (see Section 2).

Assemble and install Honing Unit in spindle.

Set cutting pressure and spindle speed. Refer to Tables 3-1 and 3-2 for pressure and speed settings.

4. With motor OFF, back off Feed Dial (counter-clockwise) until workpiece slides on honing unit.

WARNING

To avoid serious injury to hands or fingers, never try to absorb torque by holding workpiece in your hand. Machine MUST always absorb honing torque. Install workpiece in a Workholding Fixture and use Work Support at all times.

TABLE 3-1, Cutting Pressure Setting

BORE SIZE		PRESSURE CONTROL
inches	millimeters	INITIAL SETTING
1,5 - 2,5	.060 - .100	0
2,5 - 5,0	.100- .185	1/8
5,0 - 6,0	.185 - .245	1/4
6,0 - 9,0	.245 - .370	1/2
9,0 - 12,0	.370 - .495	3/4
12,0 - 25,0	.495 - 1.000	1
25,0 - 92,0	1.000 - 3.625	2
92,0 - 165,0	3.625 - 6.500	2-1/2

TABLE 3-2, Spindle Speed Selection

WORK DIAMETER		SPINDLE
inches	millimeters	SPEED
UNDER .308	UNDER 8	2500
.308 - .432	8-11	2000
.432 - .495	11-13	1600
.495 - .619	13-16	1270
.619 - .744	16-19	1000
.744 - 1.000	19-25	8000
1.000 - 1.250	25-32	640
1.250 - 1.625	32-41	500
1.625 - 2.000	41-51	400
2.000 - 2.500	51-64	320
2.500 - 3.250	64-83	250
OVER 3.250	OVER 83	200

CAUTION: Power MUST be OFF when Guard is open.

TABLE 3-3, Stone Expansion

STONE EXPANSION PER HONING DIAL & FEED DIAL		
millimeters	inches	HONING UNIT TYPE
0,025	.001	AN-600, AL-, ALH-, LH-, LJ-, ML-, PL-, UL-, SL-0720 thru 1600
0,050	.002	CR-, HB-, KL-, RL-, RYY-, SC-

TYPE OF HONING UNIT	TYPE OF WORK
RRY-, SL-, SYY-, LH-, LJ-, 3ML-, 3PL-	Pin fitting in psitons (both bushing at the same end.
KL-, 1PL-, RL-	Pin fitting in con rods and cylinder reconditioning in small bore engines.
3ML-, 4ML-, 5ML-, 4PL-, 5PL-, UL-	Kin pin fitting.
RL-, KL-	Reconditioning hydraulic brake cylinders.
CR-	Con rod reconditioning.

NOTE: This information is also on machine stone feed chart on front of machine.

5. Gage hole size, using Sunnen Hole Gage, to determine amount of stock to be removed.

6. Install part in Workholding Fixture.

7. Depress Pedal and slide part on Mandrel, so part is centered over stone.

8. While holding down on Pedal, turn Feed Dial clockwise until Honing Dial readings is equal to amount of stock to be removed, per step 5. Refer to Stone Expansion Chart for various Mandrel types. (See Table 3-3, or Chart located on your Machine above Heavy Cutting Pressure Dial.)

9. Turn workpiece several revolutions on Mandrel, to seat workpiece on stone.

10. Release Pedal.

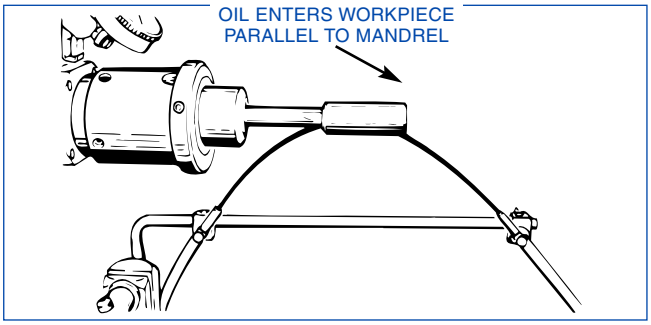


FIGURE 3-1, Coolant

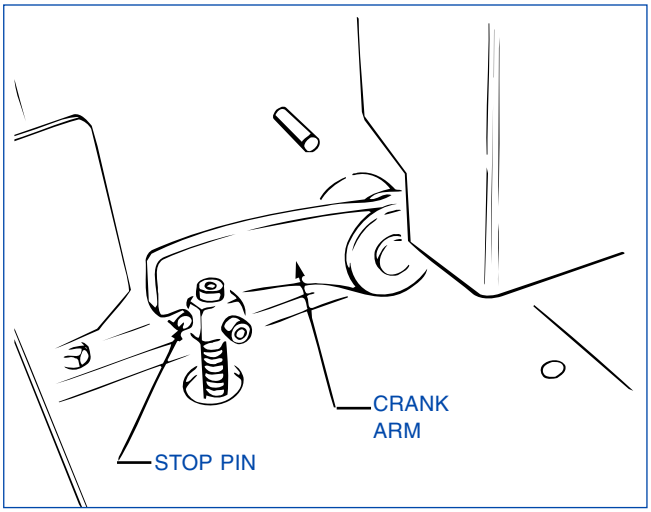


FIGURE 3-2, Stop Pin

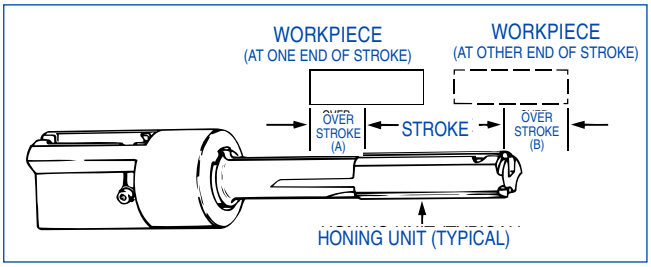


FIGURE 3-3, Overstroke

CAUTION

Machine MUST be set at proper Spindle Speed and Pressure Control Setting.

11. Press START Button.

12. Adjust Coolant Nozzles. Direct coolant stream onto both ends of honing unit so flow of coolant will enter bore being honed (see Figure 3-1).

Use a continuous and ample supply of Sunnen Industrial Honing Oil to ensure accurate, fast honing and desired finish. Do not dilute, cut, or change honing oil in any way. Consistent results cannot be expected if anything except the full strength recommended oil is used.

13. Slowly depress Pedal until Crank Arm hits Stop Pin (see Figure 3-2), meanwhile stroking fixture forward and back on honing unit. If bore is rough or out-of-round do not depress Pedal fully until bore has smoothed up, as evidenced by demising vibration.

Overstroke each end of Stone by 1/4 to 1/2 bore length or stone length, whichever is shorter (see Figure 3-3).

Reverse the part on the honing unit frequently (be sure spindle is stopped before putting workpiece on or taking workpiece off the honing unit).

NOTE: If Honing Dial Needle moves too slowly, increase Cutting Pressure. If Needle moves too rapidly, decrease Cutting Pressure (refer to step 24).

19. When Honing Dial reads "0", release Pedal and press Stop Button. Do not hone beyond (to right of) “0”:
You will lose your reference point and will not be able to repeat size on succeeding parts.
Possible stone glazing and unpredictable finish.
Unnecessarily prolonged honing operation.
Loss of accuracy because of stone becoming loose in bore.

20. Gage bore size.

21. Advance Feed Dial for amount of stock to be removed, hone to “0” (zero), and gage.

22. Repeat as necessary until desired hole size is reached.

23. Repeat honing operation for remaining parts. When honing several parts, with each honing operation bore diameter will be undersize by amount of stone wear. But by noting Honing Dial reading as you start honing each part, you can tell whether stock to be removed is uniform from part to part.

When parts have a uniform amount of stock to be removed, you can accurately estimate how much stone feed-up is needed before starting to hone. Reset Feed Dial accordingly and hone until Honing Dial reads "0". If you accurately estimated rate of stone wear, when dial reads "0" part will be honed to size. This allows part to be honed in one peration, without having to gage and hone each part several times until it is to size.

When parts vary widely in amount of stock to be removed, you can NOT estimate how much stone feed-up is needed. Generally it is better to hone part until Honing Dial reads "0", gage hole, advance Feed Dial accordingly to compensate for stone wear, and then continue honing until hole size is reached.

24. The cutting pressure should be just enough to produce good cutting action. Heavier pressure may cause excessive stone wear; lighter pressure may result in stone glazing instead of cutting. Increase or decrease cutting pressure no more than 1/2 division at a time (see Figure 3-4) until most efficient pressure is established. Changing cutting pressure will cause a slight change in reading of Honing Dial. Increasing pressure results in a smaller reading and decreasing it could cause bore to go oversize. For additional troubleshooting information, see Section 5. Troubleshooting.

25. If the Honing Dial needle moves:

Too fast - stone is too soft or cutting pressure too high or spindle speed is too slow.

Too slowly, or not at all - stone is too hard or is glazed, or cutting pressure is not high enough, or spindle speed is too high.

CAUTION

Do not increase cutting pressure for purpose of breaking a glaze until you have tried dressing the stone (see Sunnen Trouble-shooting Guide on next page). Excessive pressure can cause unnecessary stone wear, workpiece distortion and possibly cause the bore to go oversize.

NOTE: Whenever Honing Dial needle reaches zero, stop honing and gage.

26. As guide shoes wear, runout may again occur. To correct this, loosen set screw No. 3 on the spindle nose and tighten No. 1.

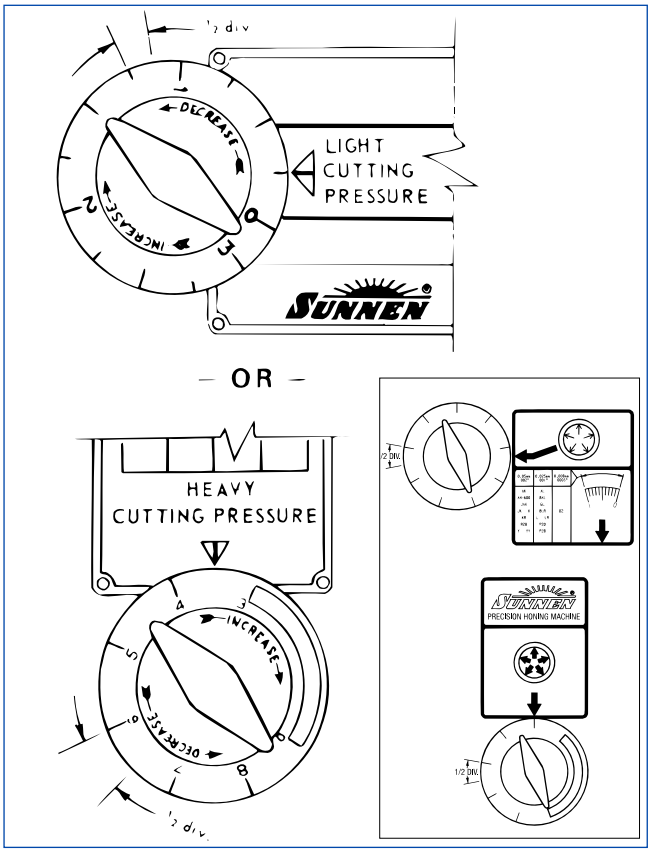


FIGURE 3-4, Cutting Pressure

WARNING

(CE MACHINES ONLY.) USE CAUTION WHEN OPENING BELT GUARDS ONCE POWER IS SHUT OFF; PULLEYS MAY STILL BE TURNING AS MOTOR COAST TO A STOP.

WARNING

AN ARC FLASH HAZARD EXISTS. FOLLOW SAFE WORK PRACTICES AND WEAR APPROPRIATE PERSONAL PROTECTIVE EQUIPMENT. FOLLOW PROPER LOCKOUT / TAGOUT PROCEDURES. *FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY.*

SECTION 4
ROUTINE MAINTENANCE

GENERAL

The following procedures and suggested maintenance periods are given as guides only and are not to be construed as absolute or invariable. Local conditions must always be considered. Each machine must be maintained individually according to its particular requirements.

CLEANING

Daily: Wipe exterior of Machine with a clean dry cloth.

Monthly: Wipe exterior of Machine with a clean dry cloth; Wash exterior of Machine with warm water and a mild detergent (or mild industrial solvent); Rinse thoroughly with clean hot water; Wipe dry with a clean dry cloth.

TABLE 4-1, Lubrication

ITEM	DESCRIPTION	LUBRICANT	PROCEDURE	INTERVALS
1	Brake Linkage (2)	SAE #20 Oil	Brush On	Mthly
2	Feed Screw (3)	SAE #20 Oil	Brush On	Mthly
3	Feed Rod (1)	SAE #20 Oil	Brush On	Mthly
4	Light Press. Control Fork (1)	SAE #20 Oil	Brush On	Mthly
5	Pedal Linkage (3)	SAE #20 Oil	Brush On	Mthly

LUBRICATION

Hand lubricate various machine components called out in Figure 4-1, according to suggested intervals called out in Table 4-1.

NOTE: The intervals between lubrication will vary with amount of use your Machine receives. Lubricate all components at least once every six months.

CAUTION

Be careful not to get oil on drive belts, pulleys, or brake strap.

Oil or grease motor in accordance with manufacturer's instructions. Avoid over-lubrication.

Spindle bearings are sealed and require no lubrication.

Coolant Pump requires no lubrication.

COOLANT LINES CHECK

Monthly inspect Coolant Lines and Fittings for leaks, severe dents or kinks. Tighten any leaking Fittings and replace damage parts as required.

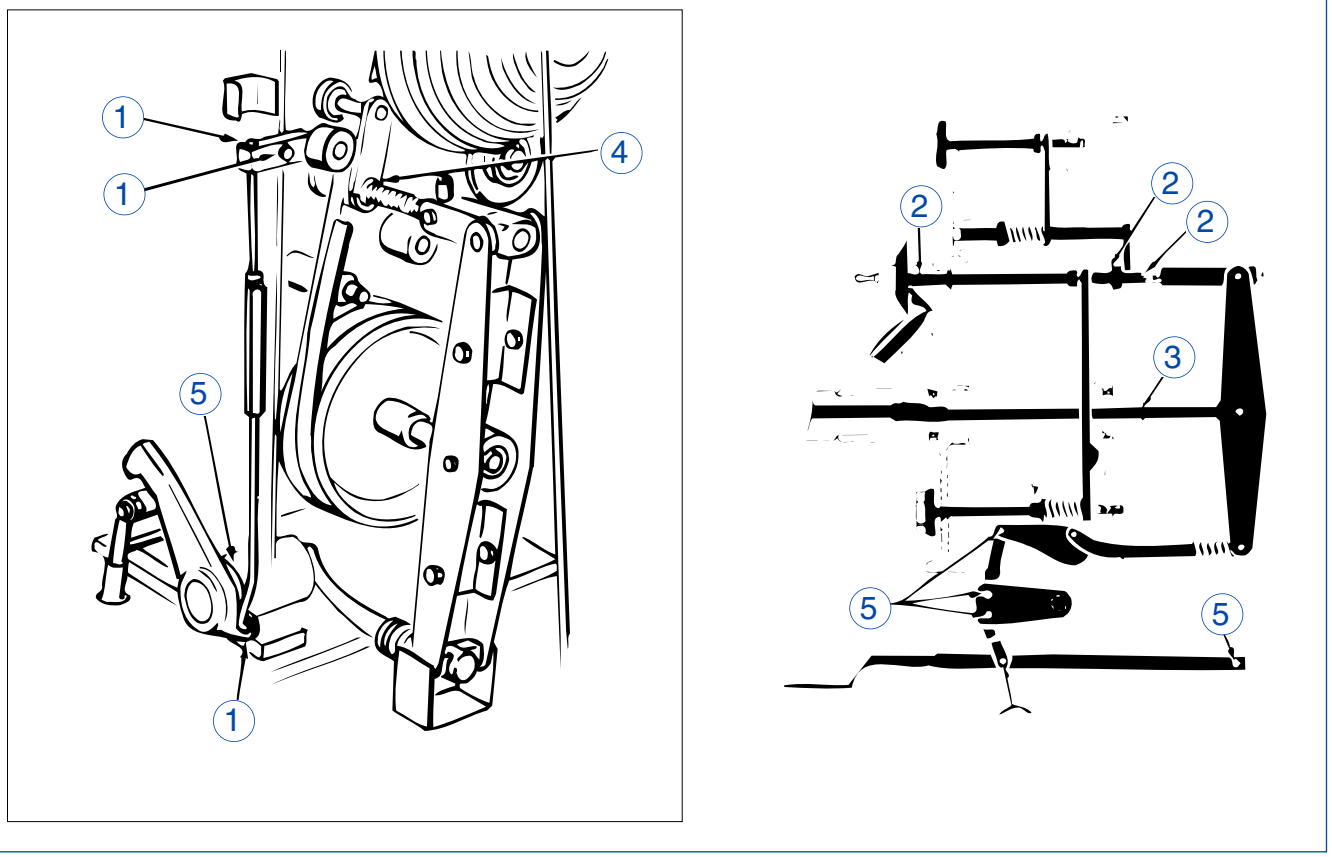


FIGURE 4-2, Lubrication

COOLANT LEVEL CHECK

Monthly check level of Coolant in Coolant Reservoir and add Coolant as required by pouring coolant into Work Tray (refer to Appendix A). Replace Coolant using ONLY Sunnen Industrial Honing Oil or Sunnen Water-Based Coolant.

If the machine is low on coolant, order more Sunnen Industrial Honing Oil. Do Not .add kerosene, cutting fluids, or any other fluids to coolant that is left - it will ruin coolant. If you must operate machine before you receive you new coolant, temporarily drain and remove Sediment Tray. If necessary, place a large chunk of metal in reservoir to raise coolant level above pump inlet - but remember this is a temporary expedient, and remove chunk of metal when you refill reservoir. Also, reinstall Sediment Tray.

SEDIMENT TRAY

Clean Sediment Tray as follows (see Figure 4-2):

WARNING

Turn electrical power OFF at main buss box or main power source when performing any maintenance not requiring power.

1. Turn OFF all electrical power to machine.
2. Open Access Door on front of machine.
3. Push Drain Pipe up to left.
4. Grasp Sediment Tray lip, which over-hangs right side of Reservoir and tip tray to left, allowing coolant to drain from sludge.
5. Remove Sediment Tray and dispose of sludge. If not cleaning Reservoir, install Sediment Tray with lip overhanging right side of Reservoir.
6. Pull Drain Pipe down and to right.
7. Close Doors on top and front of machine.

.8. Dispose of sludge according to local codes.

COOLANT RESERVOIR

Clean Coolant Reservoir as follows (see Figure 4-2):

1. Direct one or more Coolant Nozzles into a separate container.
2. Press START Button, and pump coolant from Reservoir.

WARNING

Turn electrical power OFF at main buss box or main power source when performing any maintenance not requiring power.

3. Press STOP Button, and turn off all power to machine.
4. Open Access Door on front of machine.

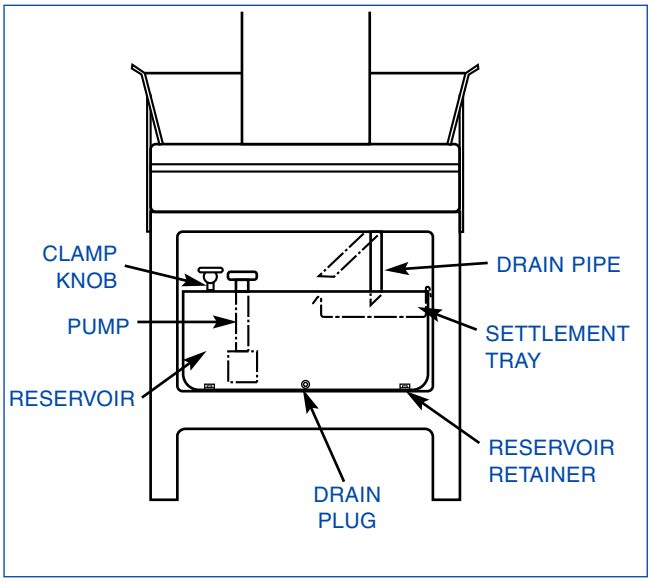


FIGURE 4-2, Coolant Reservoir

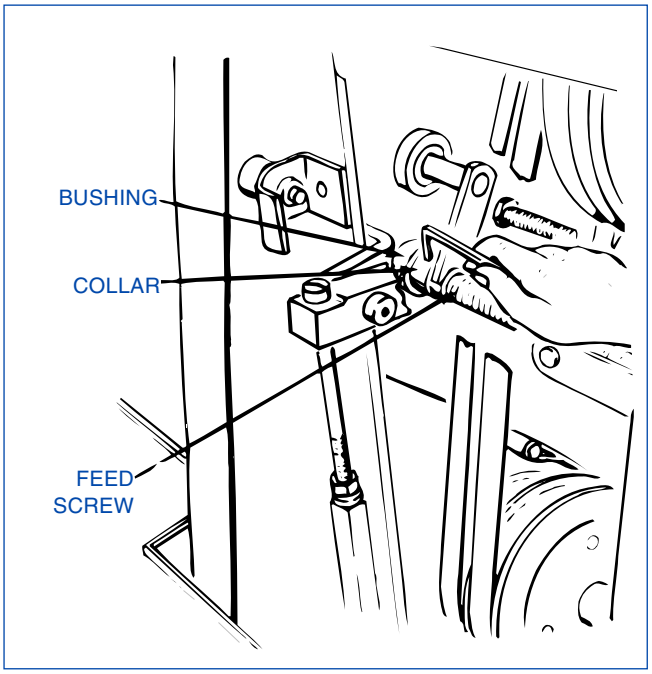


FIGURE 4-3, Feed Dial

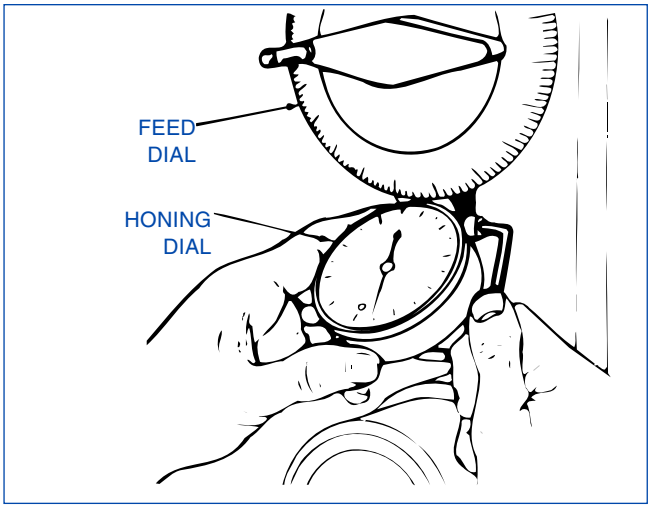


FIGURE 4-4, Honing Dial

5. Push Drain Pipe up to left.

6. Tip Settlement Tray and allow oil to drain into Reservoir.

7. Remove Settlement Tray and clean.

8. Uncouple flexible coolant line from coolant manifold pipe near upper left corner of door opening by pulling and twisting on line.

CAUTION

Be careful not to get oil on drive belts, pulleys, or brake strap.

9. Loosen Clamp Knob and remove belt from Coolant Pump pulley.

10. Remove Coolant Reservoir by removing two (2) 1/4" Screws and Reservoir Retainers, then slide Reservoir out of machine out 4-6 in. (100-150 mm).

11. Place a suitable container under Drain Plug.

12. Remove Plug and drain coolant from Reservoir.

NOTE: Drain hole may be clogged with sludge if honing oil system has not been cleaned for a year or more. Open hole with a 3/8 in. (10 mm) rod to unclog it and drain the oil.

13. After coolant is drained, replace Drain Plug.

14. If necessary, remove Coolant Reservoir by sliding Reservoir out of machine.

15. Dip or pour out any coolant remaining in Reservoir.

16. Scrape or flush any remaining sludge from Reservoir and Settlement Tray. If necessary, use a mild industrial solvent.

17. Wipe reservoir and tray dry.

18. Pump screen is held in place by means of a thumb screw underneath. Remove screen and clean.

20. Uncouple coolant line from pump and use air pressure to blow out pump.

21. Reattach coolant line and reinstall screen.

22. Reinstall Coolant Reservoir in machine and secure with two (2) Screws and Reservoir Retainers.

23. Pull Drain Pipe down and to right.

24. Reattach flexible coolant line to coolant manifold pipe (refer to step 8).

25. Re-install belt and adjust for proper tension.

26. Pump Sunnen Honing Oil or Sunnen Water-Based Coolant into Coolant Reservoir or pour into Work Tray.

27. Reinstall Settlement Tray.

28. Pull Drain Pipe down and to right.

29. Direct Coolant Nozzles into Work Tray and close Total Volume Control Valve.

30. Close Door on front of machine.

31. Dispose of coolant and sludge according to local codes.

CHECK FOR PROPER OPERATION

WARNING

Turn electrical power OFF at main buss box or main power source when performing any maintenance not requiring power.

FEED DIAL

To check Feed Dial end play, proceed as follows (see Figure 4-3):

1. Set Light Cutting Pressure Control to zero.

2. Set Heavy Cutting Pressure Control to 4.

3. Push Feed Dial toward machine until you encounter resistance. If Honing dial needle moves more than one or two tenths during this check, there is too much end play. To adjust go to step 4.

4. Open right-hand belt guard.

5. Loosen set screw in Collar at rear of housing.

6. While lightly pushing in on Feed Dial, hold Collar against rear of Bushing with light finger pressure.

7. Rotate Collar slightly on shaft to give set a new contact point and tighten set screw. Feed Screw must rotate freely in Bushing.

If any binding occurs or if Bushing rotates with Feed Screw, reset Collar.

HONING DIAL

To check for proper setup of Honing Dial, proceed as follows (see Figure 4-4):

1. Set the Light Cutting Pressure Control to 2.

2. Set Heavy Cutting Pressure Control to zero.

3. With zero on Honing Dial at the 6 o'clock position, Honing Dial needle should be on red line.

If the honing dial needle is set to left of red line, pressure on stone will decrease as you hone a part close to zero, resulting in a drastic slowdown of cutting action. To adjust go to step 4.

With needle set on red line, you hone a part to zero under full load. To adjust go to step 4.

It is all right if needle is set slightly to right of red line.

4. If zero on Honing Dial is not at 6 o'clock position, loosen bezel clamp and turn to correct position.

5. If needle is not on red line, loosen cap screw on side of honing dial bracket and slide Honing Dial up as far as it will go. Then move it down so that needle makes one full turn. Continue moving indicator down until needle is on red line. Tighten cap screw to hold Honing Dial in this position.

6. Push Feed Dial in. Needle should return to red line when Feed Dial is released.

7. If needle does not return to red line or if sluggish: Remove Honing Dial from machine.

8. Make sure the honing dial plunger is clean and works freely. Reinstall Honing Dial and adjust as above.

9. If needle is still sluggish, clean and lubricate body assembly.

CUTTING PRESSURE CONTROL

To check Cutting Pressure Control, proceed as follows:

CAUTION

Remove honing tool before checking or adjusting. Also adjust the numbered set setscrews on the spindle nose so that spindle nose is visually concentric with spindle flange.

1. Hold Light Pressure Control Fork back so it does not touch Collar during entire heavy pressure check (see Figure 4-5).

2. Rotate Feed Dial all of the way in either direction; then back off six turns.

3. Set Heavy Cutting Pressure Control to zero.

4. Set Light Cutting Pressure Control to zero.

5. Push Feed Dial in and release very slowly. Honing dial needle should read at some point greater than 5 on dial.

6. Rotate Heavy Cutting Pressure Control so handle is in line with upper surface of Spindle Nose (see Figure 4-6). Honing dial needle should move to between 4 and 5.

7. Continue rotating Heavy Cutting Pressure Control until handle is in line with spindle centerline (see Figure 4-7). Honing dial needle should move past zero to the red line.

If everything is okay, skip to step 25.

To adjust, proceed with step 8.

8. Turn machine OFF.

9. Make sure Feed Dial is not at either extreme end of travel.

10. Loosen Locknut (A) on Light Cutting Pressure Control shaft (see Figure 4-8).

11. Rotate Light Cutting Pressure Control all the way counterclockwise against stop (to zero).

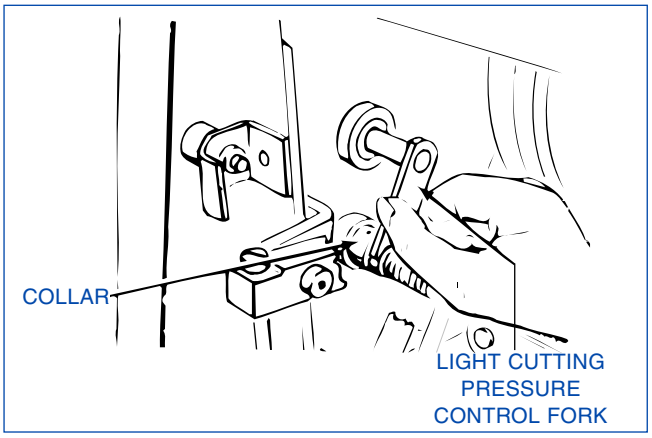


FIGURE 4-5, Light Pressure Control Fork

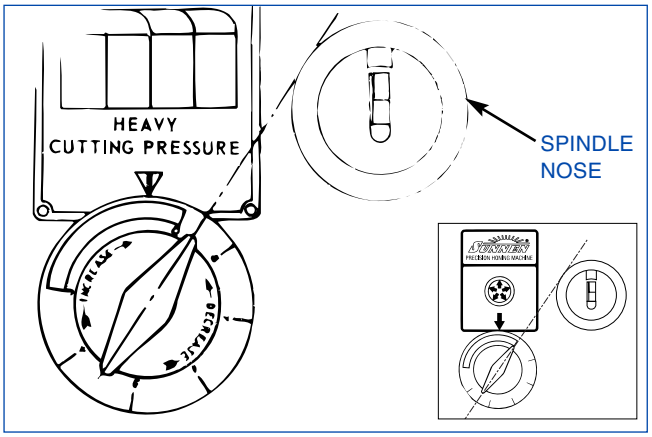


FIGURE 4-6, Heavy Cutting Pressure Control

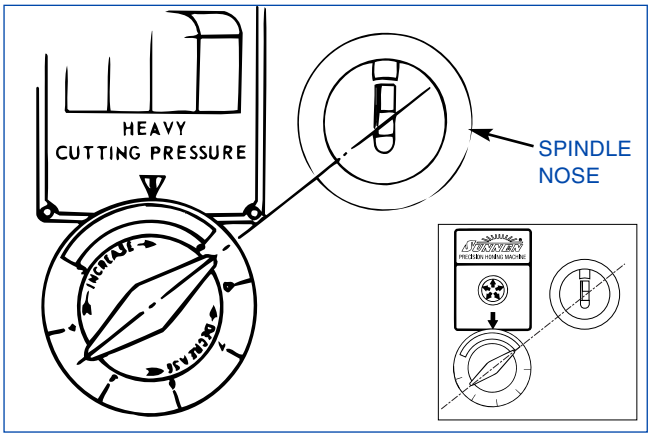


FIGURE 4-7, Heavy Cutting Pressure Control

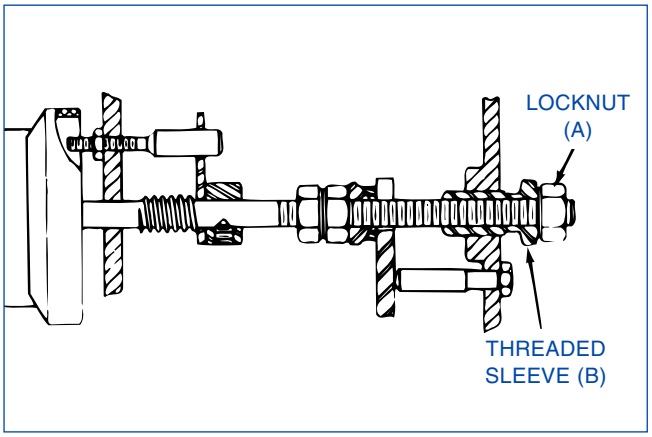


FIGURE 4-8, Light Cutting Pressure Control

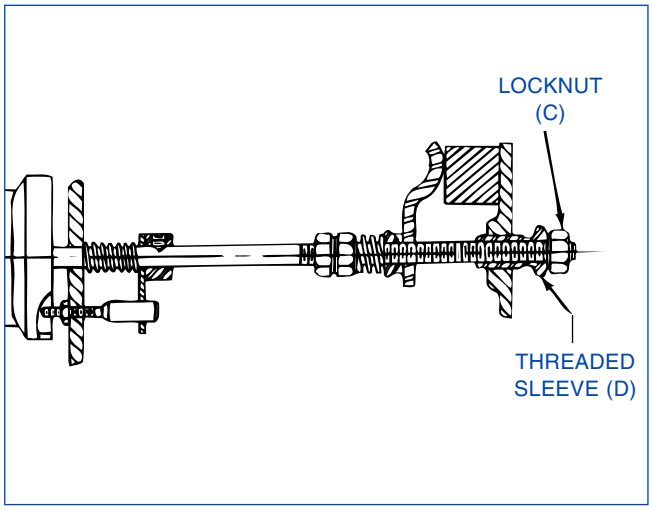


FIGURE 4-9, Heavy Cutting Pressure Control

12. Turn Threaded Sleeve (B) clockwise (as viewed from rear of machine) until light pressure control fork will not return to contact collar when it is pulled away (refer to Figure 4-5).

13. Loosen Locknut (C) on Heavy Cutting Pressure Control shaft (see Figure 4-9).

14. Rotate Heavy Cutting Pressure Control all the way counterclockwise against stop (to zero).

15. Turn Threaded Sleeve (D) clockwise (as viewed from rear of machine) until honing dial needle will not return to zero when Feed Dial is pushed all the way in and slowly released.

16. Set Heavy Cutting Pressure Control so that handle is in line with upper surface of spindle nose (refer to Figure 4-6).

17. Push Feed Dial in as far as you can and release slowly.

18. While holding Heavy Cutting Pressure Control in position set in step 21, watch Honing Dial and turn threaded sleeve D counterclockwise slowly until honing dial needle moves to between 4 and 5.

If honing dial needle suddenly moves to red line, stop adjusting threaded sleeve D. Push in on Feed Dial again and release slowly. If needle stops between 4 and 5, adjustment of threaded sleeve D is correct.

If needle still moves quickly to red line, turn threaded sleeve D clockwise a small amount and again push Feed Dial in and release slowly.

Continue adjusting threaded sleeve D until needle stops between 4 and 5 when Feed Dial is pushed are released slowly.

19. Tighten locknut C against threaded sleeve D.

20. Recheck threaded sleeve D adjustment by pushing Feed Dial in as far you can and releasing slowly . . . honing dial needle should stop between 4 and 5. If it doesn't, loosen locknut C and repeat step 18.

21. Make sure both pressure controls are turned all the way counterclockwise against stops (to zero).

22. Push Feed Dial in as far as you can and release slowly.

23. While holding light cutting pressure control against stop (at zero) watch honing dial and turn Threaded Sleeve B slowly counterclockwise until the needle moves to between 8 and +1 (refer to Figure 4-8).

If needle suddenly moves past 8 toward red line, stop adjusting Threaded Sleeve B. Push in on Feed Dial again and release slowly.

If honing dial needle stops between 8 and +1, adjustment of Threaded Sleeve B is correct. If honing dial needle still moves quickly past 8 toward red area, turn Threaded Sleeve B clockwise, a. small amount and again push Feed, Dial in and release slowly.

Continue adjusting Threaded Sleeve B until needle stops between 8 and +11 when Feed Dial is pushed in and released slowly.

24. Tighten Locknut A against Sleeve B. Approximate adjustment of Light Pressure Control is now complete.

8. Set Heavy Cutting Pressure Control to zero.

9. Set Light Cutting Pressure Control to zero.

10. Check light pressure control fork to make sure it is seated on shoulder of collar (refer to Figure 4-5).

IMPORTANT

Turn machine ON but do not run spindle while Steps 11 and 12 are performed.

CAUTION

Belt guard must be closed when motor is on.

11. Push Feed Dial in. Slowly release. Honing dial needle should move toward red line and stop between 0 and 2, or just barely continue to move.

12. Rotate Light Cutting Pressure Control to 1/2. Honing dial needle should move to red line.

If everything is okay, continue with step 8.

If not, skip to step 13.

25. Recheck Light Cutting Pressure Control (Sleeve B) as instructed in steps 8-12.

If the honing dial needle moves quickly to the red line in Step b.(5). push the Stop button and allow motor to stop. Open belt guard. Loosen Locknut A and turn Sleeve B clock-wise a small amount. Tighten Locknut A against Sleeve B.

Recheck Sleeve B adjustment as necessary using the procedure in Step (18) above.

COOLANT SYSTEM

Oil Flow

TO CHECK the oil flow, point oil jets to direct flow into Work Tray. Turn machine ON. Open Total Volume Control Valve slightly. Adjust Individual Oil jet Control Valves for desired volume of oil, opening Total Volume Valve further as needed. Total Volume Valve may then be used to shut entire supply off, leaving individual settings unchanged.

TO ADJUST the oil flow, check first to be sure oil level covers the pump housing. Make sure the oil pump belt is taut and in good condition. Also check screen on oil pump to make sure it is not clogged (see Figure 4-10).

NOTE: If the machine is low on oil, order more Sunnen Industrial Honing Oil. DO NOT ADD KEROSENE, CUTTING FLUIDS, OR ANY OTHER FLUID TO THE OIL THAT'S LEFT - IT WILL BE RUINED. If you must operate the machine before you receive your new oil, temporarily drain and remove Sediment Tray. Place a large chunk of metal in the reservoir if necessary to raise the oil level above the pump inlet - but remember this is a temporary expedient, and remove the chunk of metal when you refill the reservoir. Also, reinstall the Sediment Tray.

Oil Pump Belt

TO CHECK the oil pump belt, it should be just tight enough to turn the oil pump pulley without slipping. If oil pressure falls excessively when spindle rotates, oil pump belt may be too loose.

TO ADJUST the oil pump belt, make sure reservoir is pushed back into the machine as far as it will go. If belt needs adjusting, loosen Clamp Knob in top of Pump Bracket and move Bracket as needed. Retighten Clamp Knob.

Installing New Oil Pump Belt (Part No. MB-2292)

Remove left rear cover (see Figures 4-10 and 4-11). Loosen Clamp Knob in top of Pump Bracket. Remove oil pump belt. Thread new oil pump belt around drive pulley, idler pulleys, and pump pulley. Adjust tension and tighten clamp knob.

PEDAL ADJUSTMENT

The Pedal can be adjusted in or out; up or down; and for standing or sitting. Pedal when fully depressed MUST be at least 6 mm (.25 in.) from floor and not higher than 50 mm (2 in.) from floor.

To check: Crank Arm must hit Lower Stop Pin when Pedal is between 6-13 mm (.25-.50 in.) from floor. When Pedal is released, Crank Arm should hit Upper Stop Pin.

To adjust, proceed as follows (see Figure 4-12):

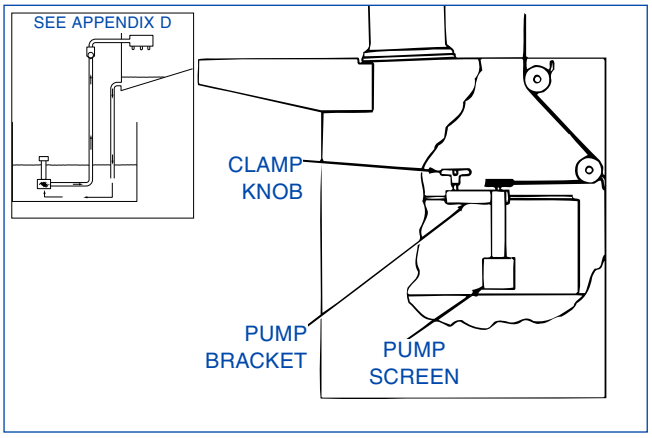


FIGURE 4-10, Pump

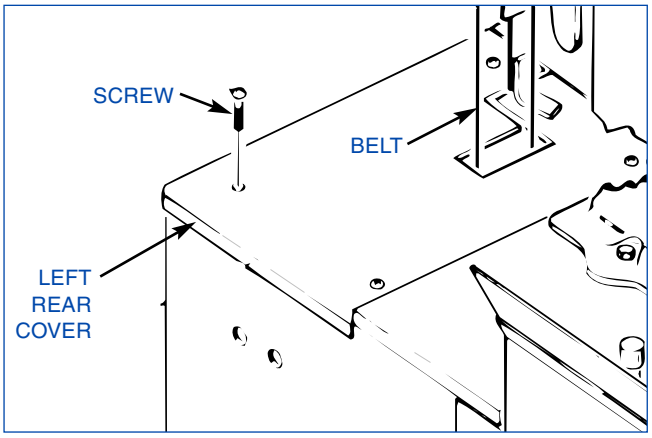


FIGURE 4-11, Belt

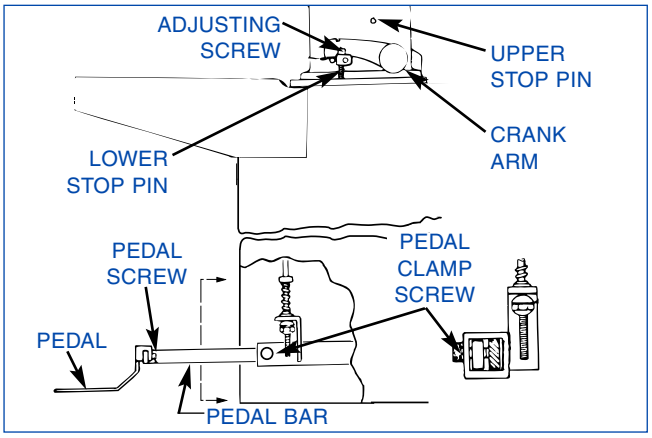


FIGURE 4-12, Pedal

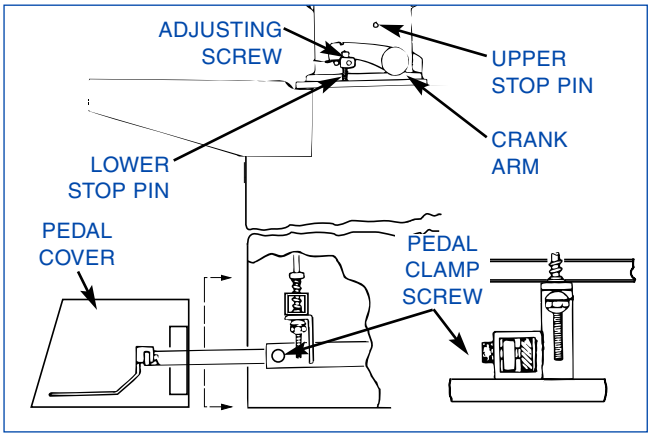


FIGURE 4-13, Pedal

WARNING

Turn electrical power OFF at Main Buss Box or main power source when performing any maintenance not requiring power.

1. Turn OFF all electrical power to machine.
2. Loosen Socket Head Capscrews in Foot Pedal Assembly, using T-Wrench furnished with machine or 1/4 in. hex wrench.

NOTE: If machine is to be operated from a sitting position, invert Pedal (Tread Assembly).

3. Adjust pedal "U" Bar in or out to a convenient operating position. Bar should be adjusted evenly on both sides.
4. Tighten Socket Head Capscrews.
5. Adjust Pedal height, by turning Self Locking Nuts on end of Pedal Link Assembly. Assembly should be adjusted evenly on both sides.

PEDAL ADJUSTMENT CE

Pedal can be adjusted side to side, in or out, or up and down. Pedal assembly slides freely side to side. To adjust, proceed as follows (see Figure 4-13):

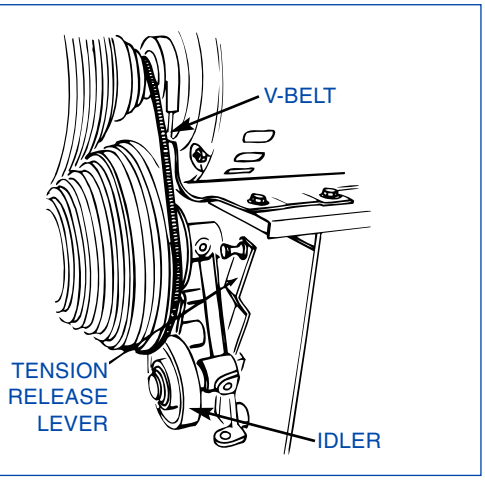


FIGURE 4-14, Motor V-Belt

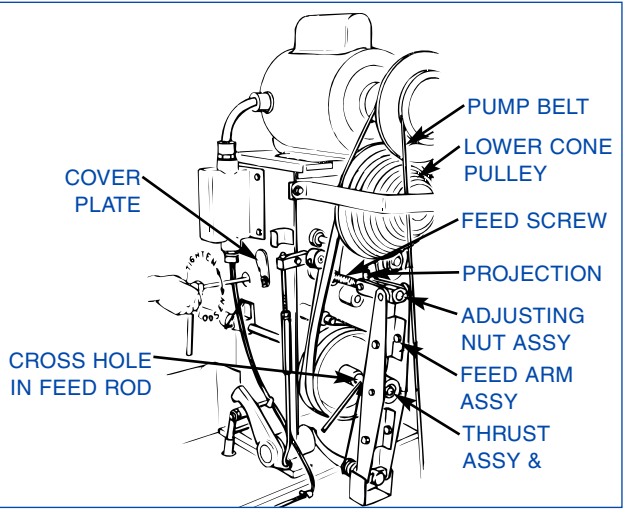


FIGURE 4-15, Spindle Drive Belt

WARNING

Turn electrical power OFF at main buss box or main power source when performing any maintenance not requiring power.

1. Turn OFF all electrical power to machine.
2. Pedal, when fully depressed, MUST be at least 6 mm (.25 in.) from floor and not higher than 50 mm (2 in.) from floor. Adjust Pedal height by turning Self Locking Nuts on end of Pedal Link Assembly. Assembly should be adjusted evenly on both sides.
3. The Pedal Assembly may be adjusted in or out by loosening pedal clamp screw, sliding Pedal Assembly in or out, and tightening pedal clamp

REPLACE MOTOR V-BELT

To inspect and replace Motor V-Belt, proceed as follows (see Figure 4-14).

WARNING

Turn electrical power OFF at main buss box or main power source when performing any maintenance not requiring power.

1. Turn OFF all electrical power to machine.
2. Loosen safety latch pin, raise belt cover latch and open belt guard.
3. Inspect Motor V-Belts for signs of wear and/or damage. Replace as required, proceed with step 4.
4. Pull Tension Release Lever down.
5. Remove Motor V-Belts.
6. Install New Motor V-Belt. Align on upper and lower pulleys.
7. Pull out and up on Tension Release Lever.
8. Close and secure belt guard.
9. Turn ON power.

ADJUST SPINDLE DRIVE BELT

To check flat spindle drive belt adjustment, tension should be such that with motor ON, spindle starts rotating an instant after the brake releases, as the Pedal is slowly depressed.

NOTE: If Motor V-belt is excessively worn, replace it before attempting to adjust the flat drive belt.

To inspect and adjust the flat spindle drive belt tension, proceed as follows (see Figure 4-15):

WARNING

Turn electrical power OFF at main buss box or main power source when performing any maintenance not requiring power.

1. Turn OFF all electrical power to machine.

2. Loosen safety latch pin, raise belt cover latch and open belt guard to expose the belt adjusting screw.

4. Pull out and up on Tension Release Lever. Lever must be in up position to properly adjust belt.

5. Turn the adjusting screw clockwise to loosen belt, counterclockwise to tighten.

Idler should travel 11/16 to 3/4 in. (17-19 mm) as Pedal is depressed.

NOTE: Adjusting belt may cause the brake to require adjusting.Refer to Brake Operation.

6. Close and secure belt guard.

7. Turn ON power.

REPLACE SPINDLE DRIVE BELT

To inspect and replace Flat Spindle Drive Belt, proceed as follows (see Figure 4-16):

WARNING

Turn electrical power OFF at main buss box or main power source when performing any maintenance not requiring power.

1. Turn OFF all electrical power to machine.

2. Loosen safety latch pin, raise belt cover latch and open belt guard.

3. Inspect Spindle V-Belts for signs of wear or damage. Replace as required, proceed with step 4.

4. Remove Oil Pump Belt from motor pulley and carefully drape it over side of machine so it doesn't get oil on it or come off the idlers or the oil pump pulley (Installing New Oil Pump Belt).

5. Pull tension release lever (see Figure 4-17) down.

5. Remove Motor V-Belt. Slip Motor V-Belt off Lower Cone Pulley.

6. Remove two Bolts and Nuts securing Feed Arms as follows:

Insert 3/16 in. (5 mm) rod in Cross Hole in Feed Rod to keep Feed Rod from turning (refer to Figure 4-16).

Using 5/16 in. hex wrench, remove Screw and washer from Thrust Assembly.

7. Turn Feed Dial counterclockwise all the way until Adjusting Nut Assembly is clear of Feed Screw.

8. Separate Arms and remove. Pull Feed Arm Assembly with Thrust Assembly off Feed Rod.

9. Push tension release lever up and remove old flat drive belt.

10. Remove old Flat Spindle Drive Belt and install new Belt.

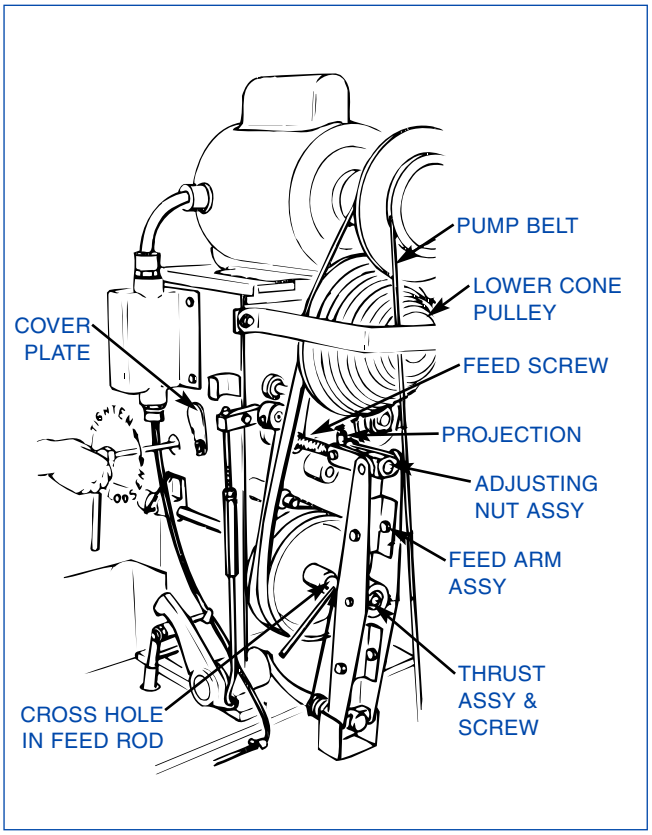


FIGURE 4-16, Spindle Drive Belt

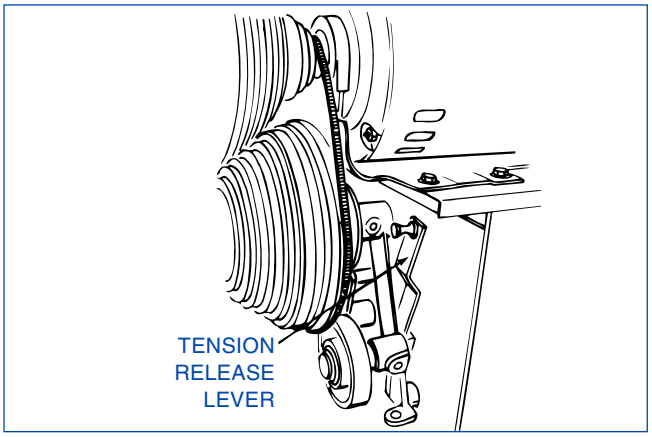


FIGURE 4-17, Tension Release Lever

11. Ensure projection on Adjusting Nut Assembly is pointed upward; then, install Feed Arms and secure with Nuts and Bolts removed in step 6.

Reassemble Feed Arm Assembly to Feed Rod by engaging Adjusting Nut Assembly with Feed Screw and turning Feed Dial clockwise while inserting Feed Rod into Thrust Assembly. Projection on Adjusting Nut Assembly must point upward. Bearing retaining screws in Thrust Assembly must face back of machine head.

12. Pull tension release lever down.

13. Install Motor V-Belt. Align on Lower Cone Pulley and motor pulley.

14. Pull out and up on Idler Handle.

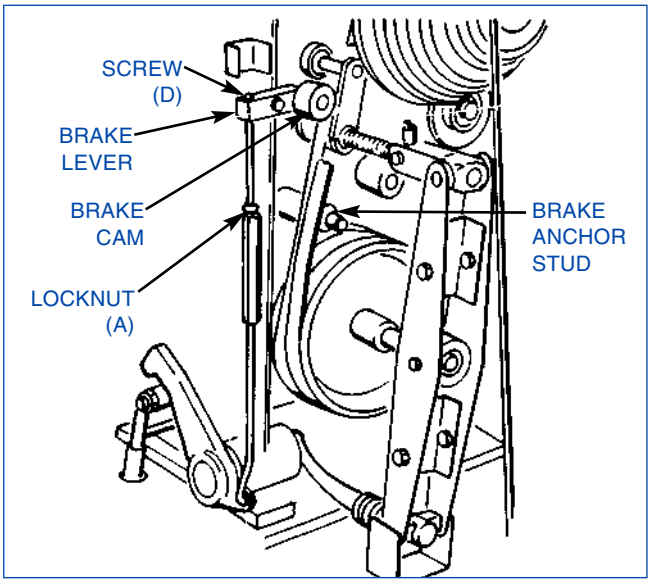


FIGURE 4-18, Brake

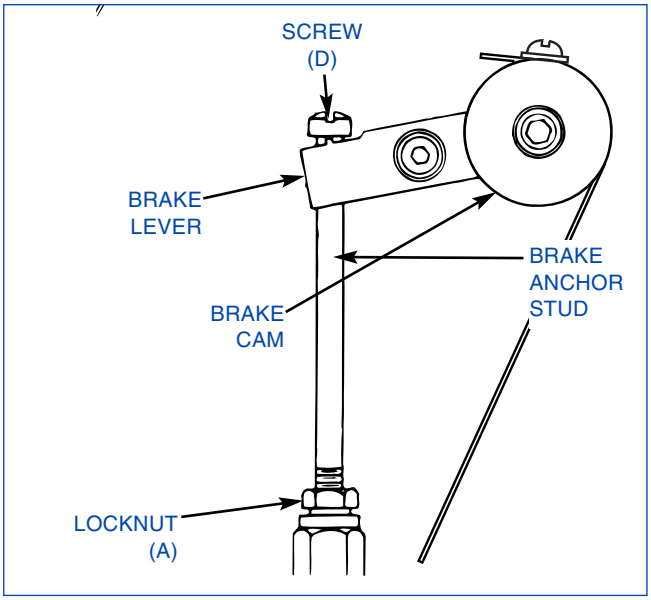


FIGURE 4-19, Brake

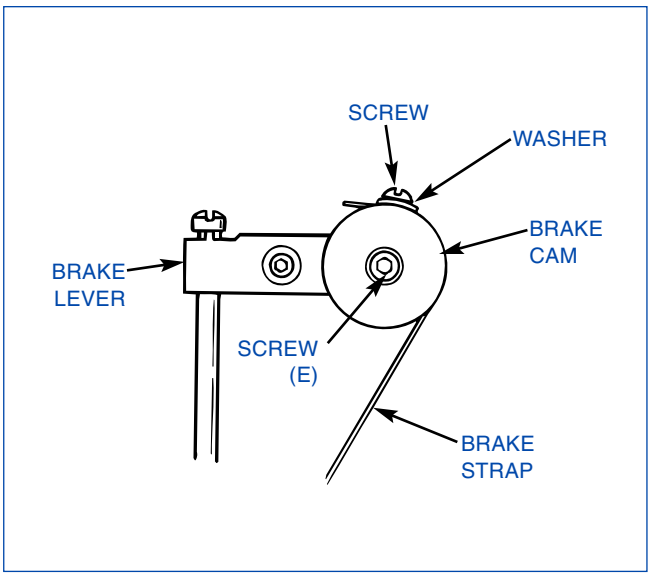


FIGURE 4-20, Brake

15. Replace Oil Pump Belt.

16. Close and secure belt guard.

17. Turn ON power.

ADJUST BRAKE STRAP

To check brake operation, observe spindle when pedal is released, the honing machine spindle should stop instantly.

Adjusting Brake Strap Tension will increase or decrease time required for spindle to come to a complete stop after honing operation is completed. Adjust tension as follows (see Figure 4-18):

WARNING

Turn electrical power OFF at main buss box or main power source when performing any maintenance not requiring power.

1. TURN OFF all electrical power to machine.

2 Push E-STOP Button.

3. Open right side of Belt Guard by removing one (1) Button Head Capscrew, using 5/32" hex wrench.

4. Loosen Socket Head Capscrew (E) in Brake Cam, using 1/4" hex wrench (see Figure 4-20).

5. Rotate Brake Cam until Brake Strap is loose.

6. Loosen 7/16" Locknut (A) on Brake Adjusting Screw.

7. While holding Brake Cam up as far as possible, adjust Brake Adjusting Screw (D) until screw head just contacts Ridge on Brake Lever. Then tighten Locknut.

8. Rotate Brake Cam counterclockwise to take up slack in Brake Strap; and Brake Lever is horizontal (refer to Figure 4-20). Then tighten Capscrew (E).

9. Close right side of Belt Guard and reinstall Button Head Capscrew removed in step 4.

10. Recheck Brake Strap Tension Adjustment after 10 hours of operation and readjust as required.

REPLACE BRAKE STRAP

To replacement worn or broken Brake Strap proceed as follows (refer to Figures 4-19 & 20):

WARNING

Turn electrical power OFF at main buss box or main power source when performing any maintenance not requiring power.

1. Turn OFF all electrical power to machine.

2. Push E-STOP Button.

4. Open right side of Belt Guard by removing one (1) Button Head Capscrew, using 5/32" hex wrench.

5. Step on Pedal and remove Brake Strap from Brake Anchor stud (refer to Figure 4-18). Then release pedal.

6. Loosen Locknut (A).

7. Loosen Socket Head Capscrew (D) in Brake Cam, using 1/4" hex wrench.

8. Remove Slotted Head Screw (C) and Washer from Brake Cam. Discard worn Brake Strap (refer to Figure 4-19).

9. Clean groove in which strap rides on Spindle Pulley.

CAUTION

Brake Strap must, be positioned on Brake Cam and spindle pulley as shown.

10. Install new Brake Strap on Brake Cam, using Screw and Washer removed in step 6.

11. Wrap Brake Strap around groove in Spindle Pulley and install on Brake Anchor. Position strap loop on Brake Anchor Stud so Strap is aligned with the brake strap groove in the spindle pulley.

12. Adjust Brake Strap Tension as required (see Adjust Brake Strap Tension).

13. Close right side of Belt Guard and reinstall Button Head Capscrew removed in step 4.

13. Recheck Brake Strap Tension Adjustment after 10 hours of operation and readjust as required.

SECTION 5
TROUBLESHOOTING

GENERAL

This section contains Troubleshooting information in table form which should be used when problems occur with machine. The table lists problems encountered, possible causes, and solutions for problems along with reference to section of manual where detailed instructions may be found to correct problems.

OPERATIONAL TROUBLESHOOTING

For suggestions on correcting problems with bore conditions or with honing operation; consult Table 5-1.

TABLE 5-1, Operational Troubleshooting Index

PROBLEM	PROBABLE CAUSE	SOLUTIONS	SEC.
Stone not cutting (Honing Dial Needle moves too slowly	1. Stone Glazing	A. Dress stone B. Increase cutting pressure C. Increase stroking speed D. Use softer stone E. Check coolant*	 4
	2. Stone Loading	A. Dress stone B. Increase stroking speed C. Use softer stone D. Use coarser stone E. Check coolant*	 4
Slow stock removal (Honing Dial Needle moves too slowly)	1. Improper spindle speed 2. Inadequate stone feed up 3. Improper stone	A. Increase spindle speed A. Increase cutting pressure A. Use softer stone B. Use coarser stone	
	4. Improper or diluted coolant*	A. Check coolant*	4
Poor stone life (Honing Dial Needle moves) too fast)	1. Excessive stone feed up 2. Inadequate spindle speed 3. Improper stone	A. Decrease cutting pressure A. Increase spindle speed A. Use harder stone B. Use coarser stone	2 2
	4. Improper or dilute coolant*	A. Check coolant*	4
Bellmouth (Bore longer than 2/3 stone length)	1. Mandrel not trued 2. Short or unbalanced part 3. Improper stone 4. Improper stone length	A. True stone & shoes A. Shorten stroke length A. Use softer stone A. Shorten stone only slightly on each end	 2
Bellmouth (Bore shorter than 2/3 stone length)	1. Mandrel not trued 2. Short or unbalanced part 3. Improper stone 4. Improper stone length	A. True stone & shoes A. Shorten stroke length A. Use softer stone A. Shorten stone & shoes equally to 1-1/2 times bore length	 2

*NOTE: Many honing problems, such as poor stone life, and rough finish, are caused by wrong coolant; insufficient coolant, dirty coolant, or contaminated coolant. Use ONLY clean, Sunnen Industrial Honing Oils or Water-Based Coolant. Make sure that coolant is neither diluted nor "cut" with other coolants. Keep solvents and cleaning fluids away from Machine.

PROBLEM	PROBABLE CAUSE	SOLUTIONS	SEC.
Barrel	1. Mandrel not trued	A. True stone & shoes	
	2. Improper stone length	A. Use longer stone or shorten guide shoes on both ends	
		B. Use mandrel with longer stone & shoes	
	3. Improper stone	A. Use finer stone	
Taper in Open Hole	1. Workpiece is not being reversed	A. Reverse workpiece on mandrel	
	2. Mandrel not trued	A. True stone & shoes	
	3. Improper stroke	A. Lengthen overstroke on tight end	
	4. Stroker Arm and Spindle not aligned	A. Align Stroker Arm and Spindle	
Taper in Blind Hole	1. Improper stone length	A. Shorten stone and shoes to 3/4 length of bore	
		B. True stone & shoes frequently	
	2. Inadequate oil flow	A. Adjust Oil Nozzle	
	3. Inadequate relief in blind end	A. Provide sufficient relief	
		B. Short stroke tight end	
		C. Use hard tip stone	
Out-Of-Round	1. Undersize honing tool	A. Change honing tool	2
	2. Mandrel not true	A. True stone & shoes	
	3. Workpiece flexing (thinwall)	A. Decrease cutting pressure	2
	4. Improper stone	A. Use softer stone	
Waviness	1. Improper mandrel or stone length	A. Use mandrel with sufficient stone length to bridge waviness in bore	
Rainbow	1. Improper mandrel	A. Use L, BL or multi-stone mandrel (stone length should be 1-1/2 times bore length	
	2. Improper stroke	A. Shorten overstroke	
	3. Improper stone	A. Use softer stone	
Rough Finish	1. Improper feed	A. Decrease cutting pressure	2
	2. Mandrel not trued	A. True stone & shoes to exact hole dia.	
	3. Improper stone	A. Use finer stone	
	4. Improper or diluted coolant*	A. Check coolant*	4
	5. Soft or exotic materials	A. Use bronze mandrel or bronze shoes	
Scratches in Bore (Random)	1. Improper feed	A. Decrease cutting pressure	2
	2. Improper stone	A. Use finer stone	
		B. Use softer stone	
	3. Improper mandrel	A. If using hard steel mandrel, change to soft steel mandrel; If using soft steel mandrel, change to bronze mandrel	
	4. Improper or diluted coolant*	A. Check coolant*	4

*NOTE: Many honing problems, such as poor stone life, and rough finish, are caused by wrong coolant; insufficient coolant, dirty coolant, or contaminated coolant. Use ONLY clean, Sunnen Industrial Honing Oils or Water-Based Coolant. Make sure that coolant is neither diluted nor "cut" with other coolants. Keep solvents and cleaning fluids away from Machine.

CHECKLIST
SETUP & OPERATION SEQUENCE

SETUP - GENERAL (Section 2)

- ☐ 1. Press STOP Switch.
- ☐ 2. Turn OFF oil supply.
- ☐ 3. Select Stone.
- ☐ 4. Select Honing Unit.
- ☐ 5. Assemble Honing Unit.
- ☐ 6. Adjust Feed Dial.
- ☐ 7. Install Honing Unit.
- ☐ 8. Set Spindle Speed to 200 rpm.
- ☐ 9. Adjust Cutting Pressure.
- ☐ 10. Press START Button.
- ☐ 11. Adjust Light Cutting Pressure.
- ☐ 12. Reduce Mandrel Runout.
- ☐ 13. Set Spindle rpm to desired operating speed.
- ☐ 14. Adjust Stroke Stops (if used).
- ☐ 15. Adjust Cutting Pressure.
- ☐ 16. Adjust oil supply.
- ☐ 17. True Mandrel and Stone.
- ☐ 18. Adjust Work Support Arm.

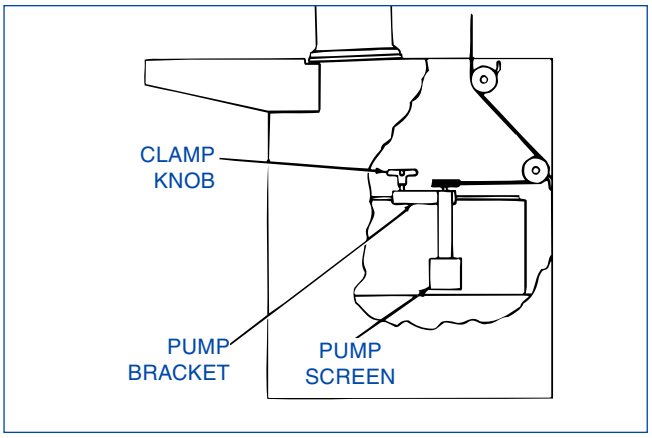
OPERATION - MANUAL STROKE HONING (Section 3)

- ☐ 19. Press STOP Button.
- ☐ 20. Back off Feed Dial.
- ☐ 21. Gage bore size.

WARNING: To avoid serious injury to hands or fingers, never try to absorb torque by holding workpiece in your hand. Machine MUST always absorb honing torque. Install workpiece in a Workholding Fixture and use Work Support at all times.

- ☐ 22. Install part in workholding fixture.
- ☐ 23. Slide part and fixture on mandrel.
- ☐ 24. Depress Pedal.
- ☐ 25. Adjust Feed Dial for stock to be removed.
- ☐ 26. Release Pedal.
- ☐ 27. Press START Button.
- ☐ 28. Adjust Oil Nozzles.
- ☐ 29. Depress Pedal and hone until Honing Dial reads "0".
- ☐ 30. Release Pedal and remove part.
- ☐ 31. Gage bore size.
- ☐ 32. Continue to hone until desired bore size is reached.
- ☐ 33. Repeat honing operation for remaining parts.

COOLANT FLOW DIAGRAM



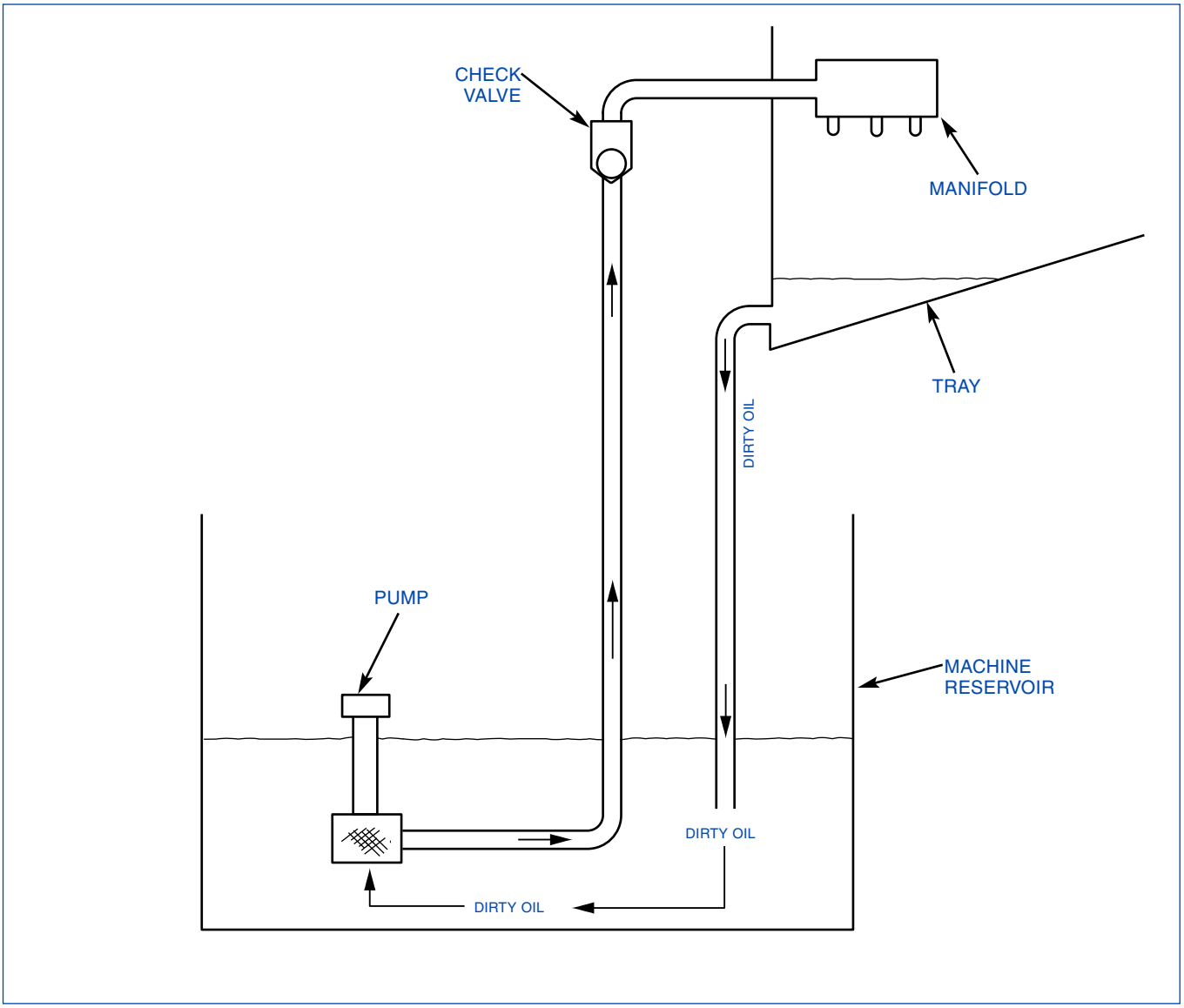


FIGURE B-1, Coolant Flow Diagram

IMPORTANT INFORMATION

TECHNICAL DATA

GUIDE SHOES: INTEGRAL SHOE MANDRELS - Soft shoe mandrels are recommended for all general honing operations. Mandrels with hardened steel shoes can be used for honing carbide, ceramic, or glass; for extremely rough holes; and for some long production jobs. Where extremely fine finishes are required and a 600-grit stone is used, solid bronze mandrels with integral shoes are required. Occasionally unusual spec-ifications do not permit use of honing oils that contain sulfur, and it may be necessary to use bronze mandrels to prevent galling.

GUIDE SHOES: REPLACEABLE SHOE MANDRELS - General purpose guide shoes are supplied as original equipment on mandrels with replaceable shoes. Guide shoes of other materials are available and can frequently be beneficial in certain specific applications.

While it is desirable to provide guide shoes of material with long wearing qualities, they must be soft enough to be trued in for any particular job. Sunnen general purpose shoes meet these requirements.

When work being honed is unusually rough or out-of-round or has burrs or wire edges, hardened steel guide shoes are usually more economical. Hardened shoes are also more economical when CBN/Borazon or diamond honing stones are being used.

When material being honed is very soft or subject to galling or if very fine finish is required, bronze guide shoes are recommended.

Should your particular application require special guide shoes not described in our catalog, please contact Industrial Division in St. Louis or your local Field Engineer.

IMPORTANT

Guide shoes of different mate-rials should never be mixed on a multi-stone length mandrel. When shoes are removed from a mandrel to be used later, they should be re-assembled in their original position.

PROPER USE OF TRUING SLEEVES - It is essential that honing tools be kept accurate and true, same as any other precision tool. The stone and guide shoes must remain parallel to each other and parallel with axis of mandrel. It is also important that stone and guide shoe be radiused to approximate diameter of work to be honed. This is espe-cially true when job being honed requires good surface finish or high accuracy, and for smooth operation in bores containing keyways.

To true a stone and mandrel, use a truing sleeve or a workpiece. Saturate stone with honing oil. Hone as you would during a normal honing operation, but without a flow of honing oil. Reverse truing sleeve frequently.

Because a honing unit must be trued close to diameter of work, excessively worn truing sleeves should be discarded.

WEDGES - Wedges are subject to wear, and to assure best performance they should be replaced when they show signs of wear. Old wedges should be discarded. Wedges supplied with all permanent type mandrels have long life but should be inspected regularly and replaced if showing any wear. This is especially important in AK20, BAL20, AL20, and Y32 honing unit groups.

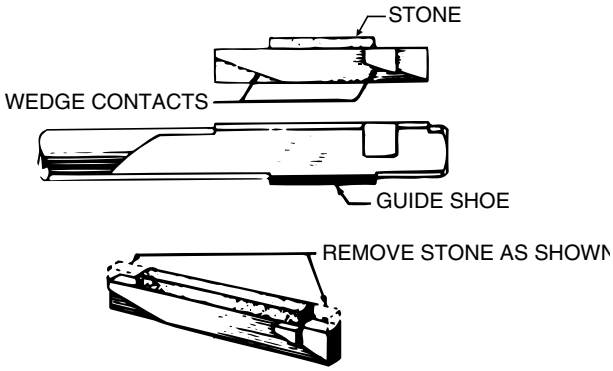
WEDGE PLATES - High and low wedge plates are supplied with Y (Keyway) mandrels of 1.365 in. (35 mm) size and larger to provide coverage of mandrel diameter range, even with worn guide shoes and stones. Use low wedge plate (e.g., Y56L-W) unless stone cannot be ex-panded far enough to reach diameter to be honed (within range of honing unit). Use high wedge plate (e.g., Y56H-W) when necessary

to reach diameter to be honed.

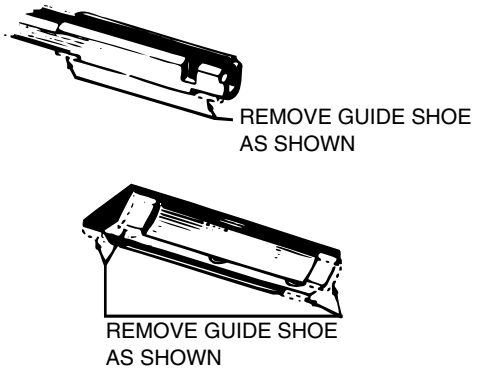
MANDREL SHIMS - Shims are furnished with all P28 and some AK20 honing units. They are inserted between mandrel body and guide shoe when necessary to reach maximum diameter, especially when guide shoes are worn. They can also be used to help compensate for mandrel runout.

ALTERATION OF HONING UNITS

HOW TO ALTER STONES, MANDREL & SHOES - When alteration of honing stone is necessary, cut through abrasive with an old hacksaw blade and break unwanted section of stone from stoneholder with a pair of pliers. Do not cut into die cast stoneholder (except as described under blind hole alterations). Use a file or bench grinder to shorten guiding surfaces of shoe. Both stone and guide shoe should be altered identically and in same relative position.



ALTERATION OF HONING STONE



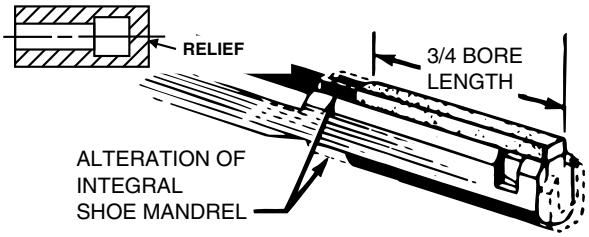
Alteration for Short Open Holes

ALTERATIONS FOR SHORT OPEN HOLES - Always consider possibility of stacking parts with short bores so that they may be honed as one long bore using standard honing units. Individual parts (if they have at least one flat face) with bore lengths of 1/4 diameter, or less, can also be honed by holding parts flat against face plate of square honing fixture. For precision sizing of short open holes, THE STONE AND GUIDE SHOE LENGTH SHOULD BE BETWEEN 2/3 and 1-112 TIMES THE BORE LENGTH to be honed

When alteration is necessary, both stone and guide shoe must be shortened by same amount. Any alteration of this type should shorten stone and shoe equally from both ends so that honing area remaining is cen-tered over wedge contacts on stoneholder.

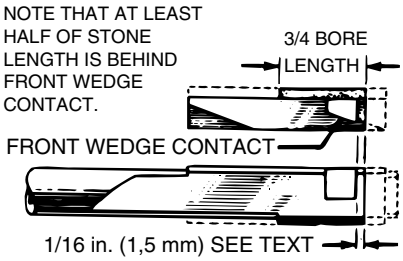
If greater accuracy is required than is obtained after alteration, refer to Sunnen Technical Data Sheet 102, "Honing Short Bores".

ALTERATIONS FOR BLIND HOLES - If at all possible, provide a relief (undercut) at closed end of hole to permit stone to overstroke honed surface. The relief does not have to be more than a few thousandths deep and can actually blend in with bore when finish honed, but it should be as long as possible, preferably 1/3 length of stone.



Alteration for Blind Holes

Sunnen honing units in K, J-K, AK, J-AK, BL, L, BAL, AL and P28 groups can be utilized for honing bores that have one end close d. In honing blind holes, it is necessary for stone and guide shoe to extend flush with tip of honing unit. If your application utilizes one of P28 group of honing units, install blind hole wedge and R28 honing stones (see *Sunnen Bore Sizing & Finishing Supplies Catalog*). The remaining mandrel groups have a tip, which extends slightly beyond front end of stone and guide shoe. For all blind hole work this tip must be cut off, as illustrated above. Mandrels, which have been altered in this manner, can still be used for honing open holes using a full length stone and guide shoe. Blind hole Y mandrels are available on special order, but P20 and D Honing Unit groups are not adaptable for honing blind holes.



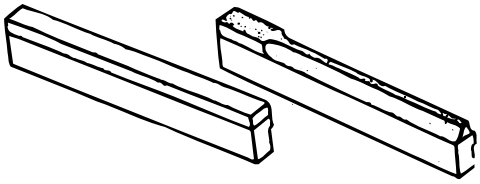
Alteration for Extremely Short Blind Holes

In honing blind holes, STONE AND GUIDE SHOE LENGTH SHOULD BE 2/3 TO 3/4 OF THE BLIND HOLE LENGTH (including relief length). This is necessary to provide for proper stroking. When alteration of stone and shoe length is necessary, remove material only from back end as shown. To maintain stability of stone in mandrel, it is important that at least 50% of stone be behind forward wedge contact on stoneholder. Otherwise stone could rock, causing bore inaccuracies as work is stroked over honing unit. To avoid any chance for stoneholder to "rock" when honing extremely shallow or short blind holes, it may be necessary to cut back die cast stoneholder (as well as abrasive), mandrel, shoes and wedge tip so that only 1/16 in. (1,5 mm) extends beyond front wedge contact. Pressure from wedge is then applied evenly to stone-holder.

Some improvement can be obtained in honing blind holes where no relief is possible at blind end by using a "HARD-TIP" stone. Front section of abrasive has a harder bond than rest of stone. This harder abrasive reduces excessive wear that stone tip is exposed to

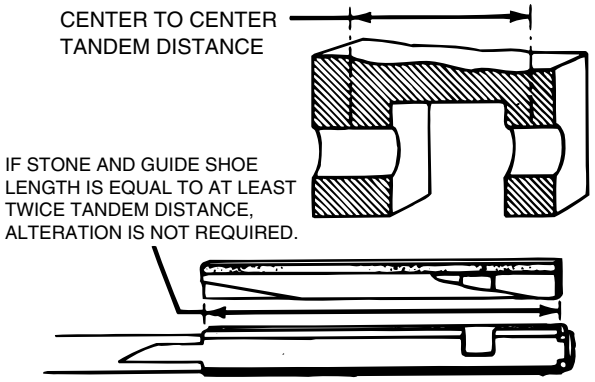
when no relief is present. We can supply hard-tip stones in most stone sizes. Minimum order quantity is one standard package of any individual part number. Allow one week for shipment. A "customer made" alteration can achieve same results as a hard-tip stone. Select a stone considerably harder than one normally used for job, and alter as illustrated (see next page)

For additional technique on blind hole honing, refer to Sunnen Technical Data Sheets 102 and 103.



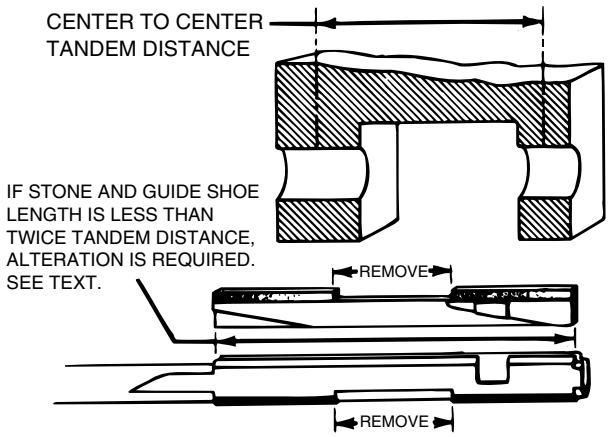
Alteration of Harden Stone for Blind Holes

ALTERATIONS FOR TANDEM HOLES - Sunnen honing units can be used to size two or more "in-line" or tandem bores in perfect align-ment. Stone and guide shoes must be of proper length so that entire stone surface will contact hone or other of bores at some time during honing stroke. To keep honing unit true during operation, STONES AND GUIDE SHOE LENGTH MUST BE AT LEAST TWICE THE CENTER-TO-CENTER TANDEM DISTANCE OF THE BORES (see illustration). When honing unit meets this requirement, alteration is not required. It may be necessary to reverse part end for end on honing unit to obtain identical bore sizes. Never stroke either of tandem bores completely off stone and guide shoes.



Tooling for Tandem Bores

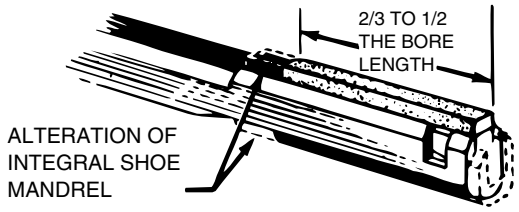
Should stone and guide shoe length be less than twice tandem distance, center area of stone and guide shoe will not wear and a resulting "hump" in honing unit will bellmouth inside ends of both bores of tandem. In some tandem applications, it is necessary to alter honing unit by cutting away area of stone and guide shoe that would become the "hump". Remove from center of both stone and guide shoe, an amount equal



Alteration for Tandem Bores

to amount stone (and guide shoe) is short of being twice tandem distance. For example, a part having a 2-3/4 in. tandem spacing would require a 5-1/2 in. stone and guide shoe, but honing unit has a stone and guide length of only 4-1/2 in. This honing unit can be used by removing I" from center of 4-1/2 in. stone and guide shoe length. Multiple-stone honing units (P20 and P28) can sometimes be used by setting up honing unit to leave out center stones and shoes.

Special tandem type mandrels can generally be supplied for those applications, which have too long a tandem distance for honing with altered honing units. Contact your Sunnen Field Engineer or factory. Additional discussion on honing tandem and multiple land bores is contained in Sunnen Technical Data Sheet 106.



Alteration of Short Bores w/ASC

ALTERATIONS FOR SHORT BORES USING AUTOMATIC SIZE CONTROL - Always consider possibility of stacking parts with short bores so that they may be honed as one long bore using standard honing units. For precision sizing of open holes, stone and guide shoe length should be between 2/3 and 1-1/2 times bore length to be honed.

Mandrels can be altered as illustrated to hone short bores using automatic size control. Alteration allows sensing tip to be positioned closer to end of honing stone. Alteration is necessary if overstroke of a short bore does not depress sensing tip a sufficient amount to allow automatic size control to work.

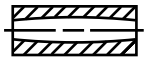
NOTES

GLOSSARY OF TERMS

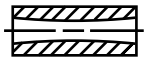
ADAPTER - A part used with certain mandrels to adapt them to fit spindle on honing machine.

ALTERED STONE - A standard honing stone, which has been shortened or otherwise changed for a specific application.

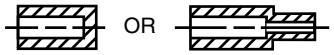
ALUMINUM OXIDE - An abrasive material generally most suitable for fast stock removal in tough materials such as most types of steel. The letter "A" in Sunnen stone code designates it. (ie: K12-A57)



BARREL SHAPE - A condition where extreme ends of a bore are smaller in diameter than middle.



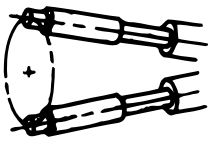
BELLMOUTH - A condition where ex-treme end or ends of a bore are larger in diameter than middle.



BLIND HOLE - A bore that is constricted or closed at one end.

BOND - The material that holds abrasive grains together in a honing stone. This can be a vitrified bond, resin bond, or metal bond.

CBN (Cubic Boron Nitride) - A synthetic abrasive that is second in hardness to, more chemically stable than, and as costly as diamond. CBN is best suited for steels, especially tool steels, high-speed steels and superalloys. The General Electric tradename for CBN is Borazon. The letter "N" in Sunnen stone code designates CBN (example: K12-NR55).



CONICAL RUNOUT - Honing unit not parallel to rotation centerline which causes eccentric motion of one end of workpiece.

CORK BOND - A bonding material for abra-sives, composed of powdered cork and a phenolic resin. Cork bonded honing stones are used where extremely fine finishes (say, 2 to 4 microinches) are required.

DEBURRING - A honing process used to remove burrs, sharp edges or similar material from rough bores.

DIAMOND - The hardest abrasive known to man, but chemically not suited for honing steel. Diamond is only Sunnen abrasive capable of honing very hard materials such as tungsten carbide, ceramics, and glass. It is designated by the, -D" in Sunnen stone code. (example: K12-DV57).

DIAMOND STONES - A honing stone made with crushed diamond particles bonded together. It is only abrasive material capable of honing very hard materials such as tungsten carbide, glass, and ceramics.

DIAMOND DRESSER - A diamond abrasive used to dress aluminum oxide and silicon carbide honing stones.

GLAZED STONE - A stone with cutting action impaired because abrasive particles failed to break out of bond when cutting edges wore off. This condition shows up when bond is too hard and/or cutting pressure is too low.

GUIDE SHOES - A part of honing unit that stabilizes bore being honed on tool.

HARDNESS - As applied to a honing stone, describes strength of bond that holds abrasive particles together. A hard bond will hold abrasive grains longer, a soft bond will permit stone to "break down" faster, exposing new sharp abrasive grains.

HARD-TIP STONE - A honing stone having a tip or end of harder abrasive than remaining length of stone. Used for honing blind holes where sufficient relief cannot be provided. See "Alterations for Blind Holes" for how to make hard-tip stones.

HONING - An abrasive machining process primarily used for stock removal ' precision sizing, and surface finishing of internal and external cylindrical surfaces. It is characterized by use of a self-sharpening abrasive stone, a relatively large area of contact with work, and relatively low cutting speeds.

HONING LENGTH - The actual length of surface being honed.

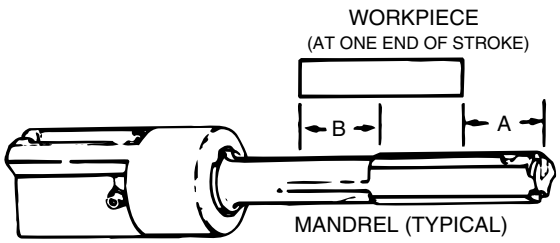
HONING STONE - An abrasive stick con-sisting of thousands of small abrasive grains bonded together, cemented to a metal holder.

HONING UNIT - A complete honing tool consisting of an adapter (if required), a mandrel and wedge, stone(s), guide shoe(s), truing sleeve, and stone retainer or tension block.

LOADED STONE - A honing stone with cutting action impaired due to cutting surface being partially covered with a foreign material, usually material being honed. This condition is sometimes encountered when honing soft materials.

MANDREL - That part of a honing unit which holds and positions honing stone and guide shoes in their correct relative positions.

METAL BOND - A metallic bond used with diamond or CBN/Borazon grit to provide a very long lasting honing stone.

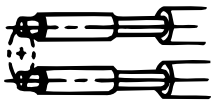


A = STONE OVERSTROKE
B = PART OVERSTROKE

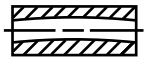
OVERSTROKE - The distance that work-piece is stroked over end of stone; it can also be distance stone extends beyond end of workpiece at end of each stroke. This distance is generally one-half length of stone (or part, whichever is shortest). If for any reason a shorter stroke is used, these formulas are useful:

$$\text{Stone (or shoe) overstroke (on either end)} = \frac{\text{Stroke length} + \text{Stone length} - \text{Part length}}{2}$$

$$\text{Part overstroke (on either end)} = \frac{\text{Stroke length} + \text{Part length} - \text{Stone length}}{2}$$



PARALLEL RUNOUT - Off-center rotation of honing unit which causes eccentric motion of workpiece.



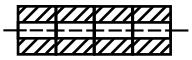
RAINBOW (or bow) - Sometimes called camber or banana shape. A condition where a bore's diameter may be same over its full length but whose axis or center-line is curved.

RELIEF - An enlargement of diameter at bottom of a blind hole which makes it possible for end of honing stone to pass beyond bottom end of surface being honed.

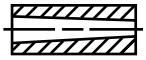
RUNOUT - Off-center rotation of honing unit which causes eccentric motion of work-piece.

SILICON CARBIDE - A hard and brittle synthetic abrasive for stock removal in materials such as brass, bronze, aluminum, cast iron, etc., and in extremely hard materials such as tool steel.

Silicon Carbide is also used for obtaining fine finishes in all materials. The letter "J" in Sunnen stone code designates it. (ie: K12-J85)

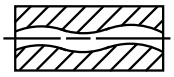


STACKING - A technique for honing short parts. Faces of parts must be square with bore prior to-honing. A holding fixture is nec-essary for aligning and holding parts on a common center.



TAPER - A bore condition where diameter of a bore gradually increases from one end of bore to other.

TRUING SLEEVE - A cylinder or workpiece whose purpose is to make guide shoes and stone straight and parallel to each other, and radiused to approximate diameter to be honed.



WAVINESS - A longitudinal wave, series of waves or ripple in a bore surface.

WEDGE - The part of Honing Unit that expands honing stone and applies cutting pressure.

DECLARATION OF CONFORMITY (CE)

EC declaration of conformity

according to the EU Machinery Directive 2006/42/EG, Annex II, 1.A

Manufacturer:
Sunnen Products Co.,
7910 Manchester
63143 St. Louis, Missouri USA

Person residing within the Community authorised to compile the relevant technical documentation:
Julian Hooper
Sunnen Products Ltd.,
Centro 1 Maxted Rd
HP2BL Hemel Hempstead, Hertfordshire

Description and identification of the machinery:

Make: MBB-1660C[ ] Horizontal Honing Machine
Serial no: XXXX

It is expressly declared that the machinery fulfils all relevant provisions of the following EU Directives:

2006/42/EG:2006-05-17	EU Machinery Directive 2006/42/EG
2004/108/EG:2004-12-15	Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC

Reference to the harmonised standards used, as referred to in Article 7(2):

EN 60204-1:2006	Safety of machinery – Electrical equipment of machines – Part 1: General requirements

St. Louis, Missouri USA, 2011.11.07

Place, date

Signature
Michael C. Haughey
Chief Operating Officer

NOTES

MANUFACTURED UNDER ONE OR MORE OF THE FOLLOWING UNITED STATES PATENTS

4,428,160	5,022,196	5,234,295	5,443,417	6,780,084
4,796,363	5,178,643	5,243,792	5,663,886	7,371,149
4,809,440	5,185,969	5,255,476	5,707,278	7,575,502
4,866,855	5,209,615	5,390,448	6,074,282	7,727,051
4,993,189	5,222,625	5,433,656	6,527,620	

OTHER U.S. AND FOREIGN PATENTS PENDING

SUNNEN®

SUNNEN PRODUCTS COMPANY, ST. LOUIS, MO U.S.A.

LTA1015T / IL0437T

Like any machinery, this equipment may be dangerous if used improperly. Be sure to read and follow instructions for operation of equipment.

FRACTION / DECIMAL / MILLIMETER EQUIVALENTS CHART

INCH FRACTION	INCH DECIMAL	MILLIMETER	INCH FRACTION	INCH DECIMAL	MILLIMETER	INCH FRACTION	INCH DECIMAL	MILLIMETER
. . . .	.003937	0,1000	9/32	.281250	7,1438	21/32	.656250	16,6688
. . . .	.007874	0,2000	19/64	.296875	7,5406	. . . .	.669291	17,0000
. . . .	.011811	0,3000	5/16	.312500	7,9375	43/64	.671875	17,0656
1/64	.015625	0,3969	. . . .	.314961	8,0000	11/16	.687500	17,4625
. . . .	.015748	0,4000	21/64	.328125	8,3344	45/64	.703125	17,8594
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. . . .	.023622	0,6000	. . . .	.354331	9,0000	23/32	.718750	18,2563
. . . .	.027559	0,7000	23/64	.359375	9,1281	47/64	.734375	18,6531
1/32	.031250	0,7938	3/8	.375000	9,5250	. . . .	.748031	19,0000
. . . .	.031496	0,8000	25/64	.390625	9,9219	3/4	.750000	19,0500
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5/32	.156250	3,9688	33/64	.515625	13,0969	57/64	.890625	22,6219
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13/64	.203125	5,1594	37/64	.578125	14,6844	. . . .	.944882	24,0000
7/32	.218750	5,5563	. . . .	.590551	15,0000	61/64	.953125	24,2094
15/64	.234375	5,9531	19/32	.593750	15,0813	31/32	.968750	24,6063
. . . .	.236220	6,0000	39/64	.609375	15,4781	. . . .	.984252	25,0000
1/4	.250000	6,3500	5/8	.625000	15,8750	63/64	.984375	25,0031
17/64	.265625	6,7469	. . . .	.629921	16,0000	1	1.000000	25,4000
. . . .	.275591	7,0000	41/64	.640625	16,2719	1-1/16	1.062500	26,9880

FORMULAS:

MULTIPLY		BY		TO GET
INCHES (in)	x	25.4	=	MILLIMETERS (mm)
FEET (ft)	x	0.3048	=	METERS (m)

MULTIPLY		BY		TO GET
MILLIMETERS (mm)	x	0.03937	=	INCHES (in)
METERS (m)	x	3.281	=	FEET (ft)

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