



Installation, Setup and Operation INSTRUCTIONS



for

**SUNNEN® COMPUTERIZED VERTICAL
HONING MACHINE**



Model: CK-21

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

"SUNNEN AND THE SUNNEN LOGO ARE REGISTERED TRADEMARKS OF SUNNEN PRODUCTS COMPANY."

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.

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

DO NOT remove or defeat any safety device.

Always disconnect power at main enclosure before servicing machine.¹

Always wear eye protection when operating this machine.

DO NOT attempt any repair or maintenance procedure beyond those described in this book. Contact your Sunnen® Service Representative for repairs not covered in this book. Much of the safety of honing operation is dependent upon how workpiece is fixtured. Several standard fixturing components are available, but each is limited to certain types of applications. “Homemade” fixtures are also not uncommon and can be quite effective if designed and used properly. Sometimes it is necessary to clamp workpieces lightly when honing with special fixtures, in order to minimize bore distortion. Likewise, tooling for small diameter honing is inherently fragile. Therefore: ***Always start a new setup with a pressure that is much lower than recommended, to test stability of tooling and fixturing.*** After that, pressure may be increased slowly to recommended values.

CAUTION: *To ensure parts meet machine's specifications and do not cause damage, use **ONLY** replacement parts supplied by Sunnen.*

 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.

IMPORTANT NOTE

The temperature requirements of the Sunnen® CK-21 Vertical Honing Machine have been established as 35 degrees C (95 degrees F). Above this temperature, an optional cooler will be available to handle temperatures from 35° to 46° C (95° to 115° F). IT IS NOT recommended that the CK-21 Machine be operated at temperatures above 46° C (115° F). Sunnen Products Company warrants the CK-21 Machine for operating environments up to 35°C (95° F). For operating environments of 35° to 46° C (95° to 115° F) the warranty only applies if the optional cooler is installed on the Machine. No warranty coverage is offered for operating environments above 46° C (115° F).

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GENERAL INFORMATION & SPECIFICATIONS

Sunnen® CK-21 Computerized Vertical Honing Machine

Diameter (ID) Range*: 19,0 to 203,0 mm (.75 to 8.00 in.)
For diameters below 19,0 mm (.75 in)
or above 203,0 mm (8,00 in) call Sunnen in St. Louis

Work Area: 1450 x 890 x 812 mm (57 x 35 x 32 in.)

Workpiece Weight (Max)*: 680 Kg (1500 lbs)

Spindle -

Drive: 3,0 kW (4 hp)
Range: LO 90-240 RPM; HI 170-550 RPM

Stroker -

Drive: 0,55 kW (3/4 hp)
Rate: 40-100 spm (Strokes Per Minute)
Length*: 19,05-305,0 mm (.75-12 in.)

Feed System -

Operating Torque: 7,4 Nm (10 ft-lb) max.
Rate: 0,75 mm/min (0.030 in/min) max.

Honing Fluid System -

Coolant Pump: 18,9 LPM (5 GPM)
Pump Pressure: 0,310 Mpa (45 psi) max.
Coolant Capacity: 246 liters (63.5 gal) max.

Electrical Requirement: See nameplate

Pneumatic Requirement: 0,552 Mpa (80 psi) Compressed air

Floor Weight : 1360 Kg (3000 lbs) Dry weight


Floor Space (Approx): 2200 x 2180 x 2225 mm (87 x 86 x 88 in.)

*Stroke length, diameter range, and workpiece weight are contingent on machine configuration, workpiece, and application.

INTRODUCTION

This Instruction Manual provides information required to install, operate, and maintain Sunnen® CK-21 Computerized Vertical Honing Machine.

When ordering parts for, or requesting information about your Machine, include Model Number and Serial Number printed on Nameplate.

In this book, the symbol  indicates steps or information that are only for the CE version of this machine. The CE version is constructed to meet the highest level of safety standards, as required by the European Machinery Directive. Required for the 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 the risks of operator carelessness.

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

SECTION 1

INSTALLATION

PURPOSE

Consult this section when unpacking, inspecting and installing Sunnen® CK-21 Computerized Vertical Honing Machine (see Figure 1-1), hereafter referred to as the Machine.

SUGGESTED TOOLS & MATERIALS

The following tools and materials are required for unpacking and installing your Machine.

Knife	Hammer
Crow Bar	Tin Snips
Slip Joint Pliers	Cleaning Solvent
Screwdriver (Std)	Hex Wrenches
Open End Wrenches	

INSTALLATION

Read the following instructions carefully and thoroughly before unpacking, inspecting, installing or operating your machine.

All references to right and left in these instructions, unless otherwise noted, are as seen by operator as one looks at machine or assembly being described (refer to Figure 1-1).

NOTE: When ordering parts for, or requesting information about your Machine, include Model and Serial Numbers printed on Nameplate of your Machine. The Nameplate is located on Electrical Control Enclosure.

1. Unpack machine and packaged components carefully. Check contents against packing list before discarding any packing material.
2. Move machine to desired location.
3. Remove four (4) Leveling Feet from accessory pack.



FIGURE 1-1, Computerized Vertical Honing Machine

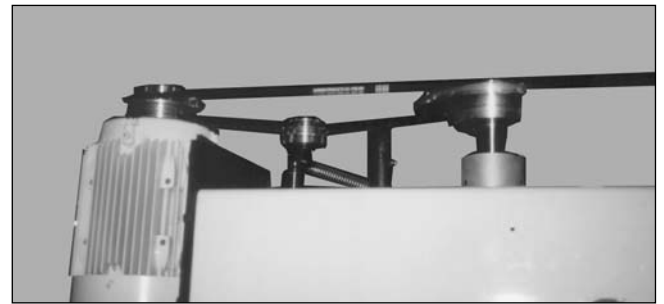


FIGURE 1-2, Belt System

4. Remove Jam Nuts from threaded shafts of leveling feet.
5. While machine is on forklift, thread leveling feet in holes provided in bottom corners of machine base.
6. Position machine and lower into place.
7. Stabilize machine using leveling feet.
8. Screw Jam Nuts over top of threaded shaft, and tighten to lock feet in place.
9. Unlatch rear left belt cover using 4 mm hex wrench (see Figure 1-2). Open cover and check to see that all belts are properly seated in their respective grooves after shipment. It is advised that HI/LO Range be on LO setting for initial setup. (Refer to Decal location inside cover.)
10. Remove Shipping Bracket form rear of machine.

TRANSFORMER INSTALLATION

Most machine models are shipped wired for 230 volt. To install optional transformer for other voltages, refer to wiring instructions on front of transformer (see Figure 1-3).

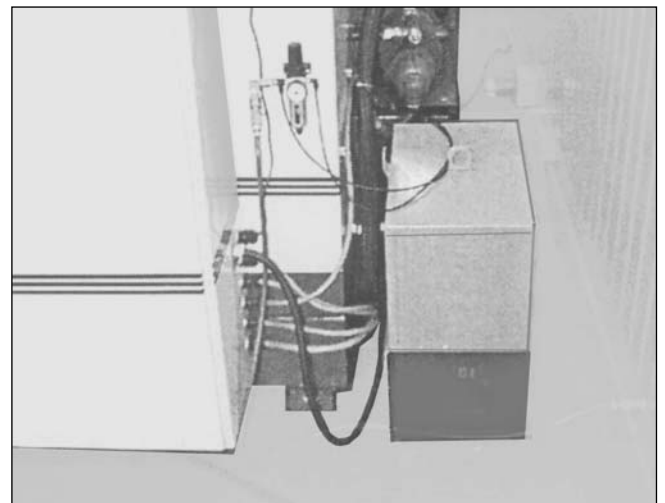


FIGURE 1-3, Transformer

CAUTION

A step-down transformer is optional on some machine models. Be certain to verify transformer Kva rating (where applicable), as well as local electrical code requirements before sizing and installing the incoming power wiring. End user must use a step-down transformer where factory electrical power varies more than $\pm 10\%$ of machine's nameplate voltage.

All wiring is to be preformed by a competent, licensed electrician.

Note: Step-down or voltage regulating transformers are external (peripheral) to machine tool and are considered primary input line (source) for machine. Local electrical code or practice may require a circuit breaker or other switching device for isolation of electrical power when this type of transformer is used. In such cases, machine tool end user is required to supply necessary circuit breaker or switching device.

FAILURE TO COMPLY CAN RESULT IN PERSONAL INJURY AND/OR DAMAGE TO MACHINE.

ELECTRICAL CONNECTIONS

All wiring is to be performed by a competent, Licensed Electrician in accordance with all local, state, and federal codes and regulations; along with any special information provided on machine nameplate or electrical specification plate.

1. Verify supply voltage is same as voltage listed on ELECTRICAL SPECIFICATION PLATE located on side of Electrical Enclosure.

CAUTION

Doors are equipped with lockable Safety Door Latches. Doors should be closed and latched during operation to prevent accidental interruption of operation from doors being opened. Doors Latches should be Locked-Out and Tagged during servicing to prevent machine from being powered up.

2. If applicable: Loosen Safety Latches on door(s) to enclosure, using a screwdriver. Or, on CE models, unlock doors to Electrical Control Enclosure using key supplied with machine. Door(s) to enclosure is equipped with Key-Lock Safety Latches.

WARNING

Residual Voltage exists for 2-3 minutes after Master ON/OFF Switch is turned OFF. Before working inside Enclosure, wait for all fans to stop running to allow drives to discharge.

3. Turn Master ON/OFF Switch to OFF position and open Doors (see Figure 1-4). (Doors WILL NOT open unless Master ON/OFF Switch is in OFF position.)

WARNING

You must use hole provided. Drilling any new holes in electrical enclosure may void machine warranty.

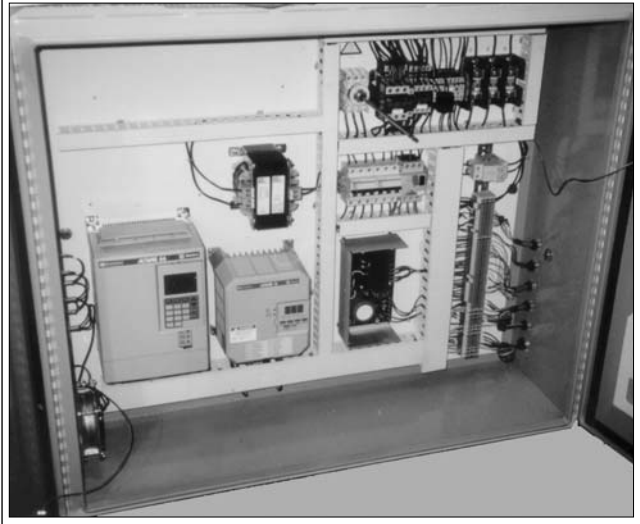
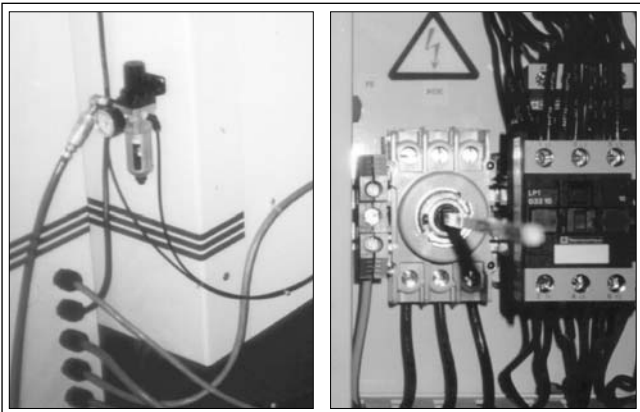


FIGURE 1-4, Back of Electrical Enclosure

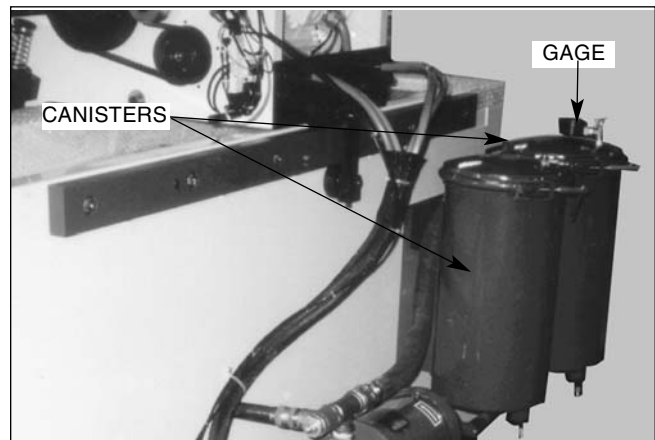


FIGURE 1-5, Filter Canister

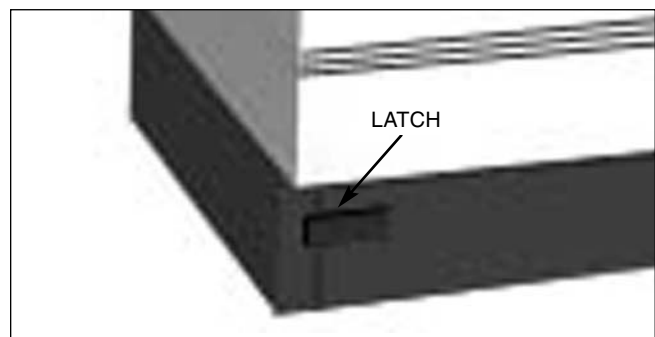


FIGURE 1-6, Coolant Reservoir

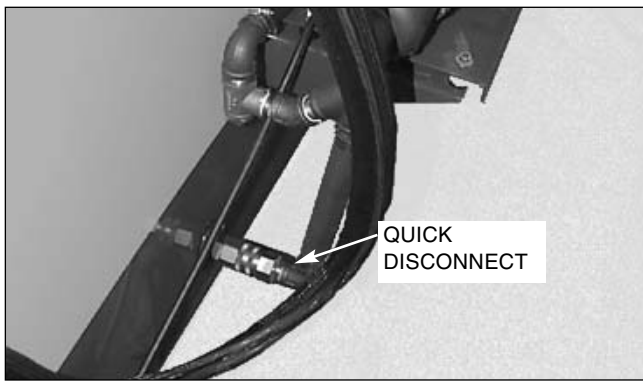


FIGURE 1-7, Quick Disconnect



FIGURE 1-8, Operator Controls

4. If not provided: Remove hole plug from entrance hole in enclosure and install an approved oil tight fitting.
5. Insert Electrical Supply Cord through Oil Tight Fitting and route to Electrical Disconnect Block.
6. Strip 250 mm (10 in.) off cable's outer jacket.
7. Strip 6 mm (1/4 in.) of insulation off each wire.
8. Connect Green Wire (GRN) to ground terminal PE.
9. Connect other three (3) wires to electrical disconnect block.
10. Route and secure cord inside of enclosure. Tighten oil tight fitting.

NOTE: If supply voltage matches voltage stated on electrical specification plate, skip to step 14. If supply voltage does not match voltage stated on electrical specification plate, but is within acceptable limits, then proceed.

WARNING

Do not attempt to convert machine to a voltage outside $\pm 10\%$ of machine's nameplate voltage.

11. Set Overload (IOL) to:
 - 2.4 A (for 208V supply)
 - 1.3 A (for 380V supply)
 - 500/voltage (for other voltages)
12. For Model CK-21G and CK-21CG, wires on primary side of transformer may need to be moved. Check transformer connections and move as required.

Voltage Range	Req. Transformer Connections
380V-420V	Terminals 1 and 2
420V-440V	Terminals 1 and 3
440V-480V	Terminals 1 and 4

13. Close and lock doors to electrical enclosure.
14. Route and connect Electrical Supply cord to power source.

FLUIDS

This machine is shipped without filter elements installed in Filter Canisters. Install filter elements as follows (see Figure 1-5):

WARNING

☑ Check all guards and ensure they are in place and locked before operating machine.

1. Remove Canister Cover Clamps and Covers. (Note orientation of clamp handles.)
2. Remove filter elements from protective bag and insert elements into Filter Canisters, rotating elements slightly while inserting to make them slide down center post more easily.
3. Replace Covers, centering carefully on rubber gaskets to assure no leakage.
4. Replace Clamps and tighten. Tighten Hex Bolt in Clamp Halves until halves meet, then tighten T-Handle.
5. Check to be sure that two latches on front of machine are securely latched (see Figure 1-6).
6. Check Quick Disconnect to be sure that it is coupled into reservoir in back of machine (see Figure 1-7).
7. Fill machine base reservoir with 210 liters (55 gal) of Sunnen coolant. Dump coolant into front of machine.

WARNING

☑ Check all guards and ensure they are in place and locked before operating machine.

OPERATIONAL CHECK

1. Partially open Air Vents on Filter Canisters.
2. Turn main disconnect on main electrical panel to "on" position.
3. Release "E-Stop" button by turning red knob as arrow indicates.

CAUTION

Machine will not operate unless both of following conditions are met.

4. Raise doors and lower lift handle to honing position.
5. Direct oil spout into reservoir and open oil shut off valve, on front of machine.
6. Push WHITE power ON/OFF button (see Figure 1-8).

7. Display will light up with CK-21 Logo and prompt you to clear above error conditions. It will ask you to hit GREEN cycle start button to initialize stroker. machine will then cycle stroking motor to find its Top Dead Center position. When it has completed this exercise, setup screen will be displayed.

CAUTION

To prevent damage to pump, a second person is needed at rear of machine to observe pump rotation at fan end of motor (see Figure 1-9).

8. Push Down arrow on numeric keypad until word COOLANT is highlighted. To right of word COOLANT, it will say AUTO. Push right arrow key to change word AUTO to ON.

At this point, coolant pump will begin to run. Immediately toggle to OFF. DO NOT run pump dry observer will note pump rotation.

If rotation is in direction of indicating arrow, pump can be toggled back to ON and run.

If rotation is incorrect, turn OFF main power coming into machine. Then reverse two leads on main power cable. Restart pump to verify rotation.

9. Open manual control valve to wide open position and allow pump to purge air from honing fluid filtering system.

10. As oil fills filter canisters, air will escape through air vents. When oil appears in air vents, close vents.

NOTE: Coolant should flow from oil spout. Control amount of oil by regulating oil shut-off valve.

11. Turn OFF power.

12. Wipe oil from around air vents.

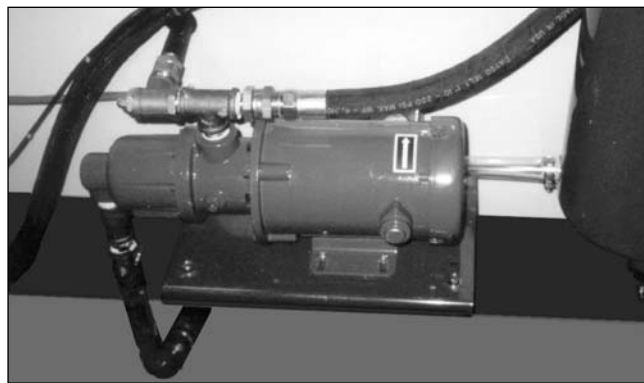


FIGURE 1-9, Pump Rotation

OVERARM SAFETY GUARD

 Install Overarm Safety Guard as follows:

1. Unpack Overarm Safety Guard and hardware, and check contents against packing list before discarding any packaging materials.
2. Use hoist to lift guard into position and align hole in guard bracket with threaded holes in machine.
3. Secure guard to machine using bolts and lock washers provided. Tighten bolts.
4. Attach left and right Guard Extensions using bolts provided. Tighten bolts.
5. Attach left and right Carriage Extensions using bolts and washers provided. Tighten bolts.

NOTE: Use washers (provided) as spacers between Carriage Extensions and Carriage.

[illegible]

NOTES

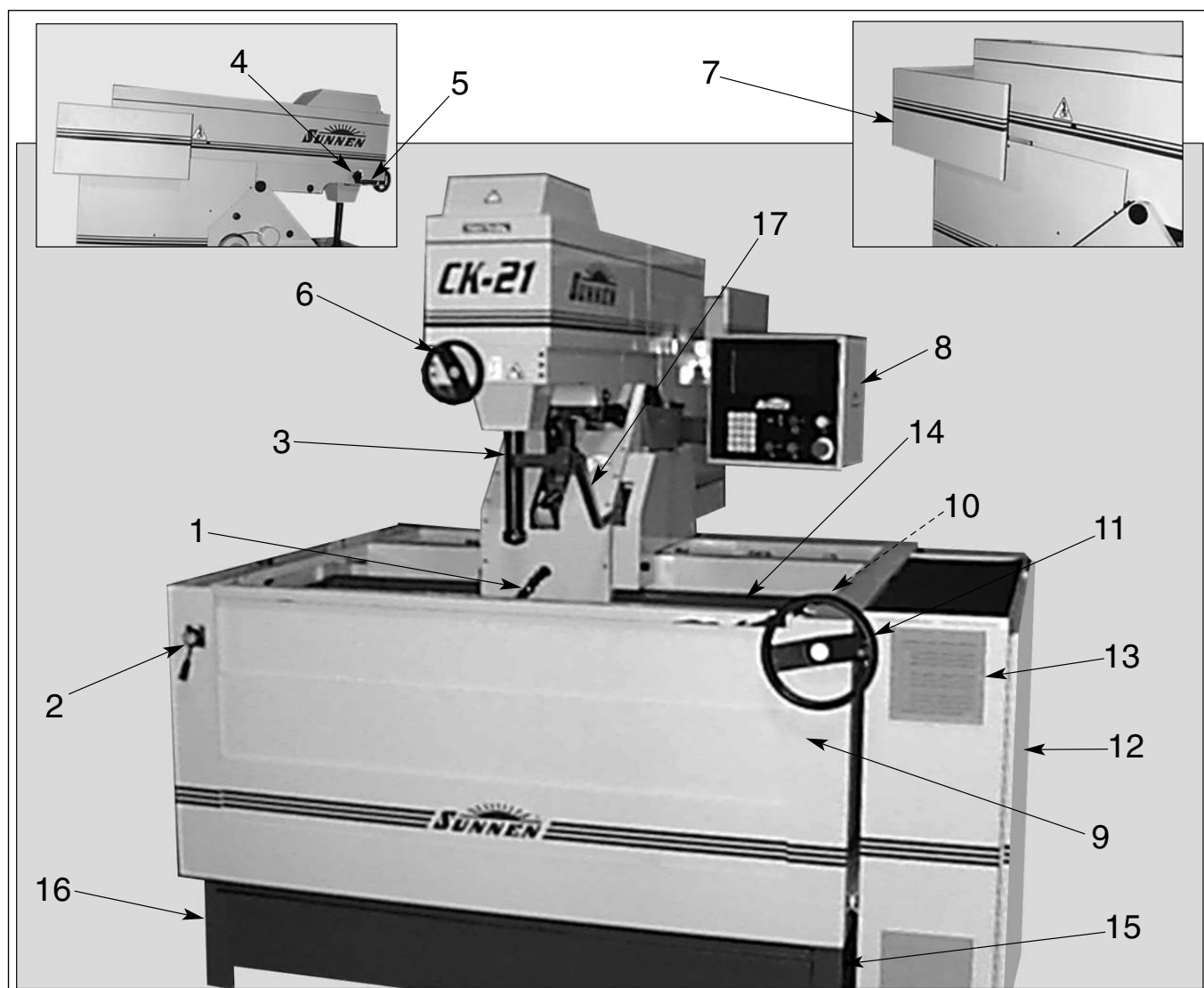


FIGURE 2-1, Computerized Vertical Honing Machine (1 of 2)

SECTION 2

GENERAL DESCRIPTION

GENERAL

Consult this section when preparing Machine for operation.

MAJOR COMPONENTS

For location of major components on your machine see Figures 2-1.

1. Adjustable oil spout.
2. Oil Shut Off Valve. Allows manual regulation of honing fluid flow.
3. Drive Tube. Imparts stroking and rotational motion from drive arm to honing tool . Houses feed rod.
4. Stroke Length Lock Knob.
5. Stroke Length Indicator.
6. Stroke Length Adjustment Hand Wheel. Allows for adjustment of stroke length without opening any covers.
7. Optional CE Version cover.
8. Operator Station. Houses all electronic hardware and software for hone control. It is also main operator interface with machine.
9. Work Area Doors.
10. Gage Hangers. One at each end of tank. Integral with base.
11. Traverse Hand Wheel. Moves carriage, drive arm, and control station.
12. Electrical Enclosure.
13. Enclosure cooling vents.
14. Stainless steel door guard
15. Reservoir Latch. One on each side.
16. Roll Out Reservoir. Pulls out like a drawer for easy cleaning.
17. Lift Handle. Lifts honing tool from work piece.
18. Bleed Valve.
19. Cover
20. Dual Filter Canisters. Hold all Sunnen filter cartridges.
21. Cover Clamp.
22. Pressure gage.
23. Drain valves.
24. Pump and Motor assembly.
25. Quick Disconnect to Reservoir.

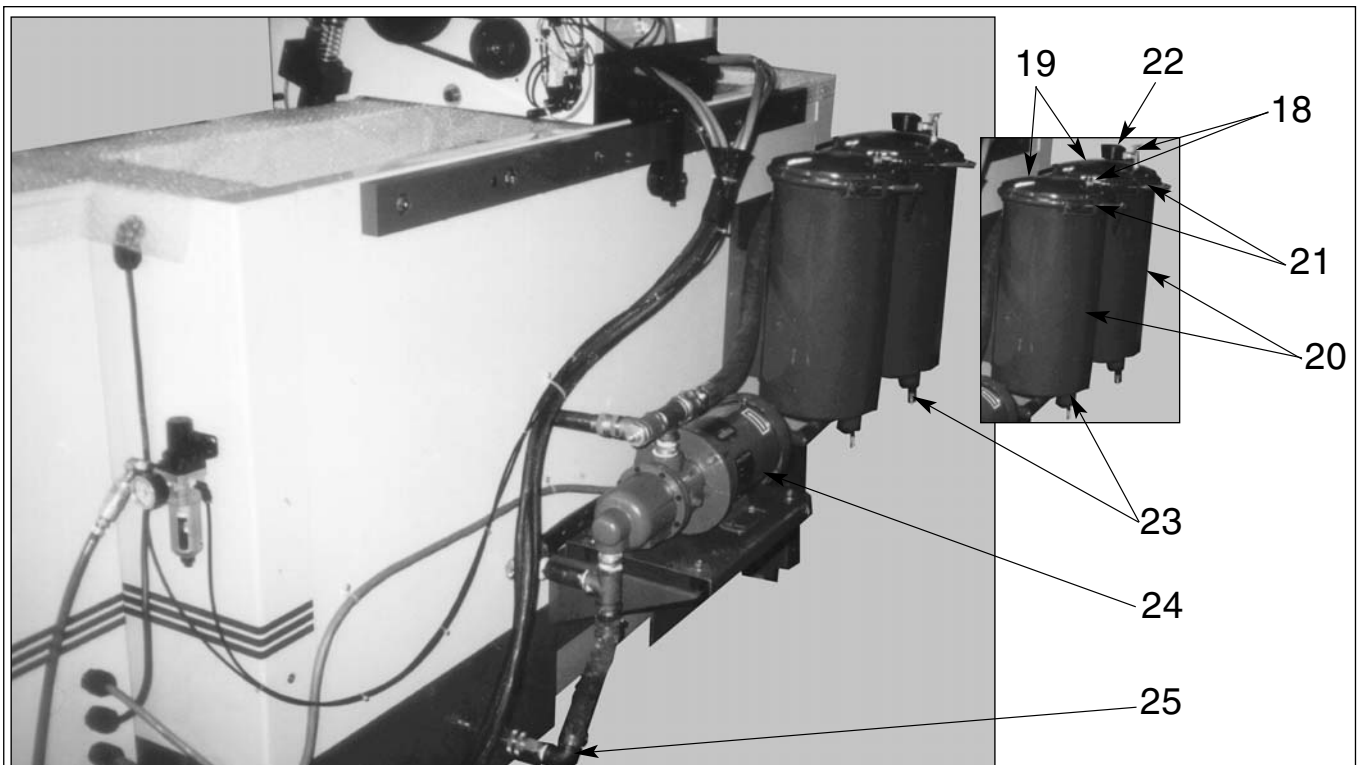


FIGURE 2-1, Computerized Vertical Honing Machine (2 of 2)

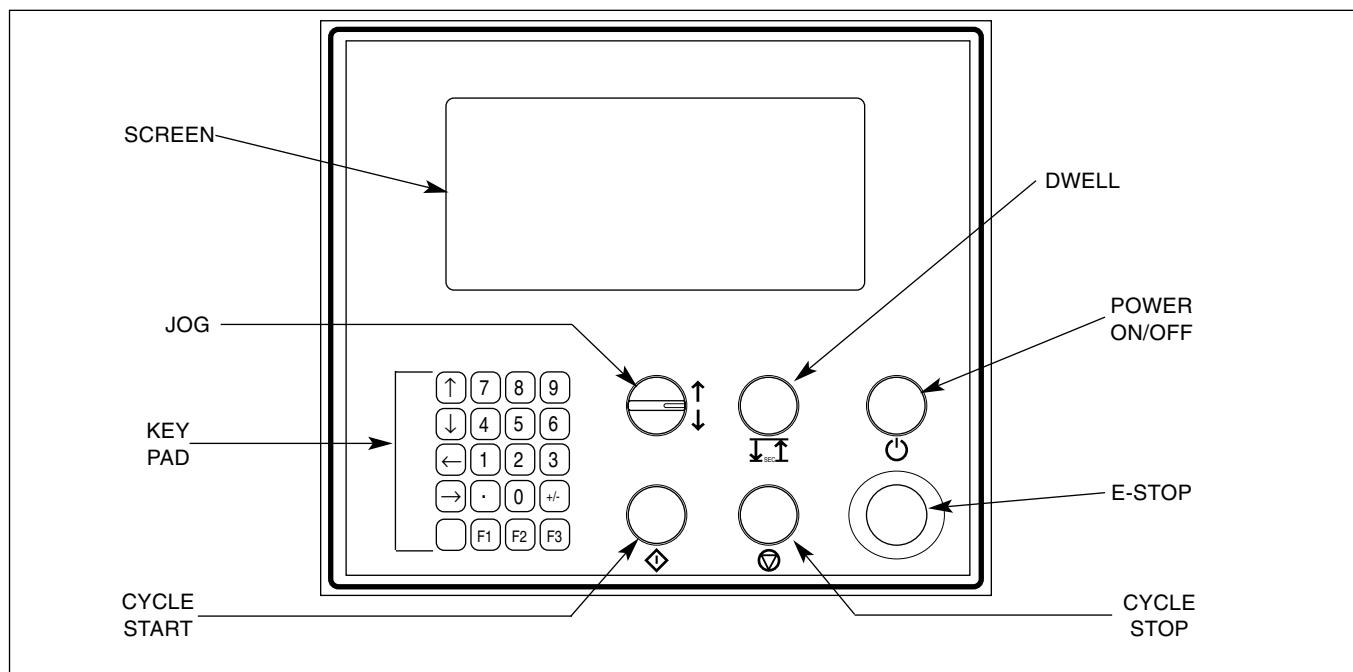












FIGURE 2-2, Operator Controls

OPERATOR CONTROLS

For function and location of operator controls, refer to Table 2-1 and Figure 2-2.

TABLE 2-1, Operator Controls

SYMBOL	DESCRIPTION	FUNCTION
	Screen	Displays machine setting.
	Keypad	Used in conjunction with display screen.
(JOG) 	Selector Switch	Switch moves up and down. Switch performs following operations depending on which item is selected: STROKER: - moves stroker up;  - moves stroker down. TOOL: - expands tool;  - retract tool.
(POWER ON/OFF) 	White Pushbutton Switch	Switch is used to toggle electrical power to machine ON and OFF. When ON, button will be laminated and run screen will have a light on in background which will allow you to read display.
(CYCLE START) 	Green Pushbutton Switch	Starts honing operation. It is also used to initialize stroker.
(CYCLE STOP) 	Red Pushbutton Switch	Stops honing operation, by bringing machine to a controlled stop during honing or stroker initialization cycle.
(E-STOP) 	Red Locking Pushbutton Switch	Emergency stop button. Shuts OFF all power to machine and causes an immediate stop in motion of machine regardless of where machine is in it's cycle.
(DWELL) 	Blue Pushbutton Switch	Switch is used to make stroker dwell while machine is honing. (NOTE: On Run screen, there are 5 marks in middle of screen that represent five locations in bore. Using up  and down  ARROW keys, you can move this marker to place where you would like to dwell. When you press dwell button, stroker will dwell in location that you selected with arrow keys for 2 seconds.) For continuous dwell, hold Dwell Button in for desired length of time.

SAFETY SYMBOLS

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

SCREENS

Operator Interface and Control Station Screen options are as follows:

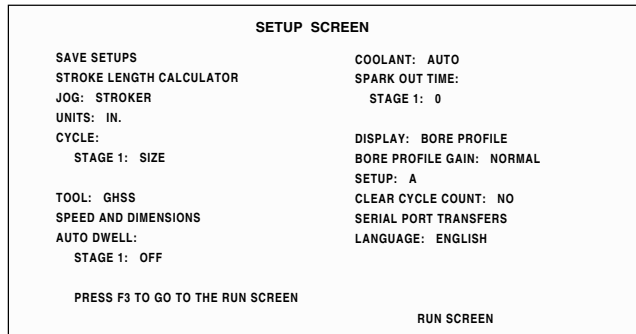


FIGURE 2-3, Setup Screen

TABLE 2-2, Machine Safety Symbols

SYMBOL	DESCRIPTION	FUNCTION
	CAUTION ELECTRICAL	Warns that an electrical hazard exists.
	CAUTION MOVING PARTS	Warns that a finger hazard exists.
	CAUTION DO NOT HIT HEAD	Warns of possible head injury from move arm.
	WARNING LIGHT	Warns that power must be OFF when belt guard is opened, to prevent injury.
	WARNING SAFETY GLASSES	Warns that safety glasses should be worn at all times when operating this machine.
	CAUTION DO NOT TOUCH	Warns that a finger hazard exists. Do not touch while stroker is operating.
	DIRECTION OF ROTATION TO RAISE PART	Indicates direction to turn elevating crank to raise cradle.
	DIRECTION OF ROTATION	Indicate the direction that motor or part is rotating.
	DIRECTION OF ROTATION INCREASE/DECREASE	Direction of rotation to increase and decrease the Stroke Length Adjustment.
	DIRECTION OF ROTATION LOCK/UNLOCK	Direction of rotation to lock and unlock the Stroke Length Adjustment.
	DIRECTION TO INCREASE COOLANT FLOW	Indicates to turn counter clockwise to increase the coolant flow.
	"CE" LABEL	Indicates that machine is in "CE" compliance.

NOTE: Starting in this section and continuing throughout remainder of manual, references may be made to a two-stage hone head (GHTS). These features can be enabled as an option. Please contact your Sunnen representative for more information.

SETUP SCREEN OPTIONS

This screen will allow operator to enter Setup options (see Figure 2-3). Below is a list of items and a description of each item on screen.

1. **SAVED SETUPS:** This option allows operator to go to save setups screen. This screen will be explained later in this manual.
2. **STROKE LENGTH CALCULATOR:** This option allows operator to calculate recommended stroke length.

3. JOG: This option allows operator to select either stroker or tool to jog. Once correct item is selected, jog switch on operator station will jog selected item. When jogging stroker, turning switch in up position will jog stroker to top of stroke, and turning switch in down position will jog stroker to bottom of stroke. When jogging tool, turning switch in up position will expand tool, and turning switch in down position will retract tool.

NOTE TO CV-616 OPERATORS: Jogging tool is same as rotating hand wheel to expand or retract hone head. Jogging stroke is same as slowly engaging clutch level and letting hone stroke through cylinder without fully engaging clutch lever.

4. UNITS: This option allows operator to enter values in either inches or millimeters.

5. CYCLE: This option allows operator to select one of three types of cycles.

The First cycle type is SIZED. This allows operator to enter amount of material that needs to be removed. This value is entered on run screen.

The second cycle type is TIMED. This allows operator to run a cycle for a set time, e.g., plateau honing.

The third cycle type is 2-STAGE. This cycle type allows operator to run a sized type cycle with two feed rates, two spindle speeds, and two stroke speeds. Note that when using GHTS tool, a different cycle type can be used for each set of stones.

6. TOOL: This option allows operator to select type of tool that will be used. 13 options are as follows: GHSS, Y/YY, R28, P20, P28, CK/CV, ANR, MPS-H, BAL20, AK20, ANR/FL6X, MPS/FL6X, and, possibly, GHTS. The correct tool family needs to be selected in order for feed system to operate properly.

NOTE TO CV-616 OPERATORS: This is equivalent to setting index plate to indicate honing tool that is being used.

7. SPEEDS AND DIMENSIONS: This option allows operator to go Speeds and Dimensions screen. It is there that operator can adjust items such as spindle and stroke speeds. This screen is described in a later section.

8. AUTO DWELL: This option allows operator to automatically dwell at tight spot in bore during honing. This option can be turned on or off. There are a few parameters that can be modified to improvement performance of auto dwell feature. Highlighting AUTO DWELL option for proper stage and pressing F I can enter Auto Dwell Setup Screen. When using GHTS tool, this feature can be enabled or disabled for each set of stones independently. The parameters for each set of set of stones can be set independently. Auto Dwell Setup Screen will be explained later in this manual.

9. COOLANT: This option allows operator to select how coolant motor should be run. Operator can turn coolant always on or off (for dry honing). The third option is AUTO which turns coolant on only when machine is running a cycle and shuts off at end of cycle.

10. SPARK OUT TIME: Spark out time is an amount of time that machine will run with a "0" feed rate. Spark out time will start after stones have fed up total amount that they need to reach size. Value entered will be numbers of seconds that spindle and stroker motors will run after stones have fed up to ending position. Range of time is 0 to 255 seconds. Using GHTS tool, this option allows operator set spark out time for each set of stones differently.

11. DISPLAY: There are three types of displays that are available on machine. The first is BORE PROFILE. This display shows a picture of spindle load vs. stroke through bore. In most cases, it will display condition of bore (e.g., taper, barrel, or bellmouth) during cycle. The second type of display is a BAR GRAPH. This display shows a bar graph of machine load as cycle progresses. last display is LOAD GRAPH. This display will show machine load versus time. This last display will help in optimizing Spindle Torque Preload (STP) value.

NOTE TO CV-616 OPERATORS: BAR GRAPH is similar to bar graph on current model CV-616 machines.

12. BORE PROFILE GAIN: This option allows operator to adjust sensitivity of bore profile display. In LOW mode, it will show a full scale from 0 to 200 percent of full load. In NORMAL mode, it will show a full scale from 0 to 100 percent of full load. In HIGH mode, it will show a full scale of 0 to 30 percent of full load.

13. SETUP: This option allows operator to select between three different setups that are stored in machine. These setups can be switched either here or in run screen. Left and right arrows will toggle between three setups.

14. CLEAR CYCLE COUNTER: This option will allow operator to clear cycle counter. When option is set to a YES, cycle counter will be set to 0.

15. SERIAL PORT TRANSFERS: This option allows operator to go to serial port transfer screen. This screen will be explained later in this manual.

16. LANGUAGE: This option allows operator to change language that all options are displayed in.

SPEEDS & DIMENSIONS SCREEN

This screen will allow operator to enter all of variables having to do with speeds and dimensions for a cycle (see Figure 2-4). Below is a list of items and a description of each item on screen.

SPEED AND DIMENSIONS		
SPINDLE SPEED 1 (RPM)	:	170
SPINDLE SPEED 2 (RPM)	:	170
STROKE SPEED 1 (SPM)	:	60
STROKE SPEED 2 (SPM)	:	60
FEED RATE 1 (IN/MIN)	:	0.0050
FEED RATE 2 (IN/MIN)	:	0.0025
SPINDLE TORQUE PRELOAD 1	:	20
RETRACT AMOUNT (IN)	:	0.025
% FEEDUP FOR FEED RATE 1	:	50
RAPID SPINDLE SPEED	:	200
RAPID FEED RATE	:	0.0050
SETUP SCREEN		

FIGURE 2-4, Speeds & Dimensions Screen

NOTE: If GHTS tool is selected, there will be another column of numbers for second set of stones. column will be titled STAGE 2.

1. SPINDLE SPEED #1: This is speed that spindle will rotate during honing cycle. This speed will be used during complete cycle if you run a SIZED or TIMED cycle. It will be used during first stage during a 2-STAGE cycle. Overall speed range of machine is 90 to 550 RPM. Speeds are broken down into two ranges: 90 to 240 and 170 to 550 RPM. To change from one speed range to another, speed select belt must be changed on top of machine.

NOTE: This speed must be in same range as Spindle Speed 42.

CAUTION

Belt change should only be done in setup screen.

2. SPINDLE SPEED #2: This spindle speed will only be used during second stage of a 2-STAGE cycle. Overall speed range of machine is 90 to 550 RPM. Speeds are broken down into two ranges: 90 to 240 and 250 to 550 RPM. To change from one speed range to another, speed select belt must be changed on top of machine.

NOTE: This speed must be in same speed range as Spindle Speed #1. This option is only visible when 2-STAGE cycle is selected.

3. STROKER SPEED #1: This is speed that stroker will move during a honing cycle. Range of stroke speeds is 40 to 100 strokes per minute in increments of 10 strokes per minute.

NOTE FOR CV-616 OPERATORS: Stroker speed is equivalent to setting strokes per minute using bottom three pulleys.

4. STROKER SPEED #2: This stroke speed will only be used during second stage of a 2-STAGE cycle. Range of speeds is 40 to 100 strokes per minute in increments of 10 strokes per minute.

NOTE: This option is only visible when 2-STAGE cycle is selected.

5. FEED RATE #1: This option allows operator to enter rate at which stones will expand during honing.

NOTE TO CV-616 OPERATORS: Feed rate is same as setting selector cover for feed rate.

6. FEED RATE #2: This feed rate is used only when 2 stage feed cycle is selected. This is feed rate that will start after Feed Rate #1 is completed.' location where this feed rate is started is selected in run screen.

NOTE: This option is only visible when 2-STAGE cycle is selected.

7. SPINDLE TORQUE PRELOAD 1 (STP): This is percentage of spindle's full load that machine waits to see before machine stops rapid advancing tool and starts to use programmed feed rate.

NOTE TO CV-616 OPERATORS: STP is equivalent to how fast or hard operator feeds hand wheel out during operation.

8. RETRACT AMOUNT: This is distance that tool will retract at end of a cycle. This will be distance that stones will travel after they have passed point where stones first came in contact with bore.

NOTE TO CV-616 OPERATORS: Retract amount is equivalent to rotating hand wheel to right.

9. % FEEDUP FOR FEED RATE 1: This option allows operator to set a position in cycle where feed rate, spindle speed, and stroke speed will change to a second set of speeds. Percentage that is entered is percentage of total feedup amount that will be run with first set of speeds. Once this percentage of cycle has been run, feed rate, spindle speed, and stroke speed will change to second set of speeds. If operator enters a feedup amount that is less than 0.001 in. machine will not use a 2-stage feed process. Machine will compare two feed rates and use smaller of two feed rates. Machine will run entire cycle with smaller feed rate.

10. RAPID SPINDLE SPEED: Spindle speed used during rapid advance.

11. RAPID FEED RATE: Rate at which stones expand during rapid advance.

12. STONE TYPE: This option is only available for GHTS tool. This option allows operator to enter type of material that is being used for second set of stones. The available selections are ABRASIVE or PTH BRUSHES. This value is used during calculation of feedup amount for two different sets of stones in GHTS hone head.

SAVE SETUPS SCREEN

This screen allows operator to save current -setups to memory of machine (see figure 2-5). Operator can save up to 20 setups in machine. If setup is saved using this screen, setup will be able to be retrieved after power has been removed from machine. Operator can load a program into current setups, save current setups, or delete a setup.

To load a setup, operator should highlight setup that needs to be loaded and then hit F I. This will load all values into current setup of machine.

To save a setup, use should highlight an empty slot on setup screen and then hit F2. This saves all value in memory of machine. operator is asked to enter a setup name. Name can be from 1 to 10 characters long. Any information pertaining to size lock is not saved with setup. If stroke length calculator has been used, stroke length will be saved along with setup.

To delete a setup, operator should highlight setup that needs to be deleted and then hit F3. This deleted setup from machine's memory.

In order to get to other setups, just hit down arrow while cursor is on bottom setup to go to next higher block of 10 setups. If up arrow is pressed while first setup is selected, machine will display previous block of 10 setups.

STROKE LENGTH CALCULATOR SCREEN

This screen allows operator to calculate suggested stroke length, spindle speed, and stroke speed for a particular application (see Figure 2-6). Operator will need to enter four items in this screen, using arrow keys to select each item. To edit any of values, press F1 and then edit value that is in highlighted area.

Once bore length has been entered, a suggested stroke length and stroke speed will be displayed on right hand side of screen. Once bore diameter has been entered, a suggested spindle speed will be displayed. Once bore diameter has been entered and GHC tooling has been entered, a recommended tool will be displayed based on bore diameter. If two different tools could be used, both tools will be displayed. stroke length takes into account bore length, stone length, and over-stroke amount. Make sure that all numbers are entered correctly. Once all values are entered, operator would then set stroke length to calculated value.

This screen also displayed crosshatch angle that in center of part using spindle and stroke speeds that have been set in speeds and dimensions screen. If a 2-STAGE cycle is selected, only second spindle and second stroke speeds will affect crosshatch angle.

SAVE SCREEN		
SETUP NUMBER	NAME	STROKE LENGTH 000
1	52	2.0 IN.
2		
3		
4		
5		
6		
7		
8		
9		
10		

USE UP/DOWN ARROWS TO SELECT SETUP
PRESS F1 TO LOAD SELECTED SETUP
PRESS F2 TO SAVE SELECTED SETUP
PRESS F3 TO DELETE SELECTED SETUP
PRESS ANY OTHER KEY TO GO BACK TO THE SETUP SCREEN

FIGURE 2-5, Save Setups Screen

STROKE LENGTH CALCULATOR	
ENTER THE CYLINDER LENGTH: 4.000 IN.	RECOMMENDED TOOL: GHSS-3410
PRESS F1 TO EDIT CYLINDER LENGTH	HOLDER: GHG14C233-349
	ALTERNATE TOOL: GHSS-3410
ENTER THE BORE DIAMETER: 4.000 IN.	HOLDER: GHG14C233-348
	SUGGESTED SETTINGS:
ENTER THE STONE LENGTH: 3.000 IN.	STROKE LENGTH: 2.0 IN.
	SPINDLE SPEED: 190 RPM
OVER-STROKE AMOUNT: 0.5000 IN.	STROKE SPEED: 80 SPM
	CROSSHATCH ANGLE: 21.2 DEG.
	SETUP SCREEN

FIGURE 2-6, Stroke Length Calculator Screen

SERIAL PORT TRANSFER SCREEN
BAUD RATE: 9600
BACKUP SETUPS
RESTORE SETUPS
LOAD FIRMWARE INTO MEMORY
LOAD BOOT LOADER INTO MEMORY
SETUP SCREEN

FIGURE 2-7, Serial Port Transfer Screen

SERIAL PORT TRANSFER SCREEN

This screen allows operator to backup saved setups to a PC, restore setups from a PC, and allow new firmware to be loaded if upgrades to software are available (see Figure 2-7). In order to use any of features on this screen, operator will need to have 9 pin serial cable that was shipped with machine. This cable must be plugged into a serial port on back of a PC and other end must be plugged into connector labeled P1 on left side of board.

All of PC software that is described below will is provided on software disk supplied with machine.

For all of these options, recommended baud rate is 9600. Machine can transfer as fast as 57600, but 9600 is recommended. Speed that is selected is PC dependent. All PCs are capable to run at 9600.

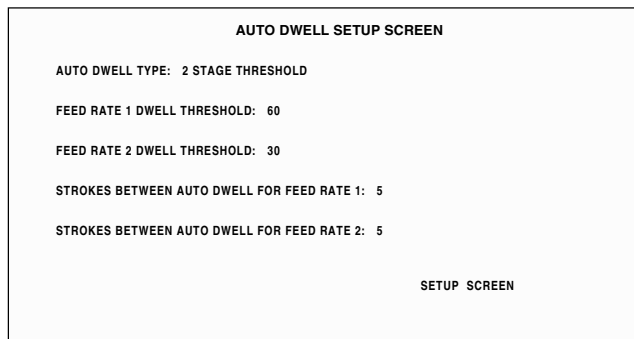


FIGURE 2-8, Auto Dwell Setup Screen

To backup saved setups, select **BACKUP SETUPS** option using up and down arrow keys. Once **BACKUP SETUPS** is highlighted, press either left or right arrow. Then go over to PC and from a DOS prompt, type following command:

BACKUP [filename] COM[x] [baudrate]

Where filename is name of file that will store saved setups:

COM[x] is COM port that PC will use for communication

Valid options for COM[x] are COM1, COM2, COM3, or COM4. Baudrate is an optional parameter, which can be used to select baud rate at which transfer will be done. If a baud rate is not specified, baud rate will default to 9600.

This will send all of setups to PC and store them in specified file.

To restore setups that have previously been saved by backup routine can be restored in a similar fashion as setups were backed up. To restore setups, select **RESTORE SETUPS** option using up and down arrow keys. Once **RESTORE SETUPS** is highlighted, press either left or right arrow keys. Then go to PC and, from DOS prompt, type following command:

BACKUP [filename] COM[x] [baudrate]

Where filename is name of file where setups are stored.

COM[x] is COM port that PC will use for communication.

Valid options for COM[x] are COM1, COM2, COM3, or COM4. Baudrate is an optional parameter which can be used to select baud rate at which transfer will be done. If a baud rate is not specified, baud rate will default to 9600.

This will send all of setups from file on PC to saved setups in machine.

In order to load new firmware into machine, boot loader must already be installed in system. If **LOAD FIRMWARE INTO MEMORY** selection is not displayed on screen, you will need to load boot loader first.

To download boot loader into machine, select **LOAD BOOT LOADER INTO MEMORY** option.

Pressing either left or right arrow will display message

LOADING BOOT LOADER INTO MEMORY. At this point, go to PC and type following command:

BL ?

This will give you a description of options available with this program. To start the download, type following command:

BL [comx] [baudrate]

Where comx is communication port being used, baudrate is speed of transfer.

NOTE: Default setting for comx parameter is COM 1 and default baud rate is 9600. If these parameters are acceptable, you do not have to enter parameters on command line.

To download new firmware into machine, select **LOAD FIRMWARE INTO MEMORY** option. Pressing either left or right arrow will display message **LOADING NEW FIRMWARE**. At this point, go to PC and type following command:

FL ?

This will give you a description of options available with this program. To start download, type following command

FL [comx] [baudrate]

Where comx is communication port being used, baudrate is speed of transfer

NOTE: Default setting for comx parameter is COM 1 and default baud rate is 9600. If these parameters are acceptable, you do not have to enter parameters on command line.

If PC program is waiting and message "Approximate download time: xx seconds" is last message on screen, you will have to turn off CK-21 at main disconnect and restart download. This may happen if baud rate of PC is not same as baud rate of CK-2 1. You will need to wait for PC to time-out before starting download again.

AUTO DWELL SETUP SCREEN

This screen allows operator to modify parameters that will describe manner in which auto dwell feature will operate. screen shown in Figure 2-8 shows all possible options. Screen will only show those options, which are required for selected auto dwell type. If operator is using either a **SIZED** honing cycle or a **TIMED** honing cycle, only dwell type that will be available is **FEED RATE 1 THRESHOLD**. If a **2 STAGE** cycle is being used, there are 3 auto dwell types available: **2 STAGE THRESHOLD**, **THRESHOLD FOR FEED RATE 1 ONLY**, and **THRESHOLD FOR FEED RATE 2 ONLY**. **2 STAGE THRESHOLD** will allow operator to set a threshold for each feed rate during honing cycle. This option will enable auto

dwell throughout entire honing cycle. **THRESHOLD FOR FEED RATE 1 ONLY** will allow operator to set a threshold for first feed rate only. Option will only turn on auto dwell during feed rate 1. **THRESHOLD FOR FEED RATE 2 ONLY** will allow operator to set a threshold for feed rate 2 only. This option will only turn on auto dwell during second feed rate. Regardless of which option is selected, operator can always use manual dwell button. Auto dwell feature does not work during Spark Out.

Auto dwell feature works by checking load every few strokes. Number of strokes is selectable by operator. If Auto Dwell Index is larger than threshold for active Feed Rate, then machine will automatically dwell at tight spot during that stroke (see Figure 2-9). We will use numbers in Figures 2-8 and 2-9 in an example. If honing cycle is using feed rate 1, machine will not automatically dwell because auto dwell index is 40 and feed rate 1 threshold is set at 60. If honing cycle is using feed rate 2, machine will automatically dwell because auto dwell index is 40 and feed rate 2 threshold is set to 30. auto dwell index will change during honing cycle.

During first few cycles with auto dwell on, watch trend of Auto Dwell Index. If operator feels that machine should be dwell more, operator should decrease dwell threshold. If operator feels that machine is dwelling too much, operator should increase dwell threshold.

RUN SCREEN OPTIONS

Run Screen will have different options, depending on cycle type that was selected (see Figure 2-10 for all options with Sizeloc off).

1. **SIZED cycle type - FEEDUP AMOUNT:** This option allows operator to enter amount of material that needs to be removed. Range of values is 0.0001 to 0.2500 in. for English measuring system and 0.0025-6.350 mm for metric measuring system. operator can edit value in between cycles. In order to edit value, you need to hit F I button. It will position cursor on current value. Value can be entered using numeric keypad. feedup amount can be adjusted while machine is running.

NOTE TO CV-616 OPERATORS: feedup amount is same as when operator holds feed wheel and advances feed dial.

2. **TIMED cycle type: CYCLE LENGTH:** This option allows operator to enter amount of time that they want machine to hone. Range of time that is allowed is 1-99 seconds.

3. **2-STAGE cycle type: - FEEDUP AMOUNT:** This option allows operator to enter amount of material that needs to be removed. Range of values is 0.0001 to 0.2500 in. for English measuring system and 0.0025-6.350 mm for metric measuring system.

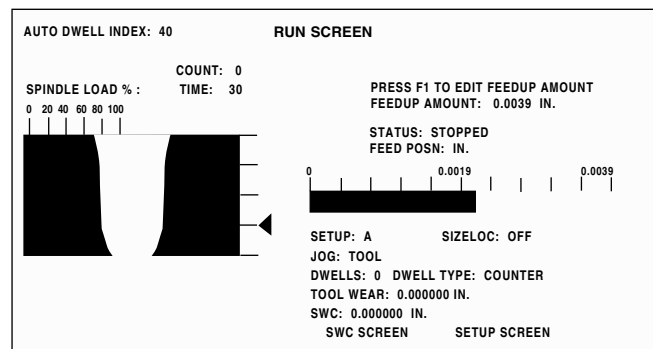


FIGURE 2-9, Run Screen with Auto Dwell ON

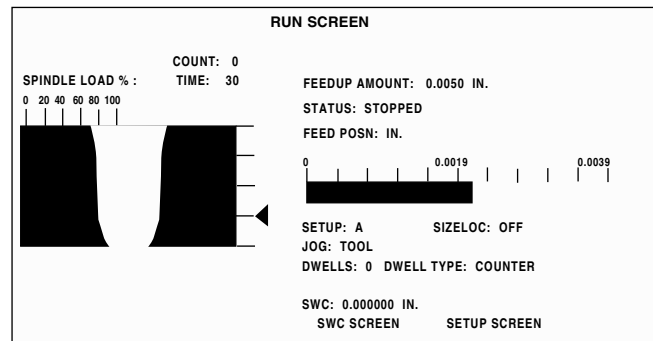


FIGURE 2-10, Run Screen with Sizeloc OFF

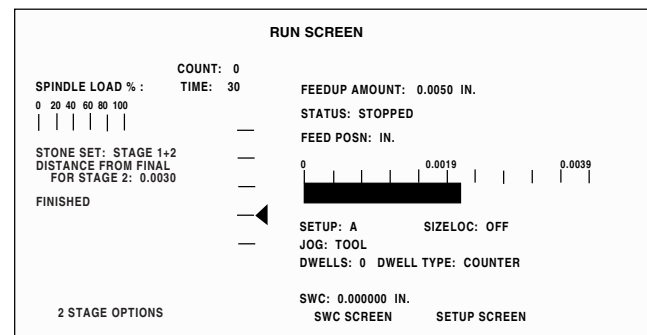


FIGURE 2-11, Run Screen with 2-Stage Opt.

Operator can edit value in between cycles. In order to edit value, you need to hit F I button. It will position cursor on current value. Value can be entered using numeric keypad. Feedup amount can be adjusted while machine is running (see figure 2-11).

The following options are available on run screen regardless of cycle type selected.

1. **DWELLS:** This option allows operator to enter a number of dwells that is needed for current bore. This number will be decremented by 1 after every dwell. This option is only active when dwell type is set to **COUNTED**. Number is adjusted by using left and right arrow keys. right arrow key will increase count by 1 and left arrow key will decrease count by 1.

2. **DWELL TYPE:** This option allows operator to change type of dwell. two options are **COUNTED** and **CONTINUOUS**. **COUNTED** dwell type is used to dwell for a number of consecutive cycles until dwell counter reaches 0. **CONTINUOUS** dwell type is used to dwell every cycle. During a cycle, dwell

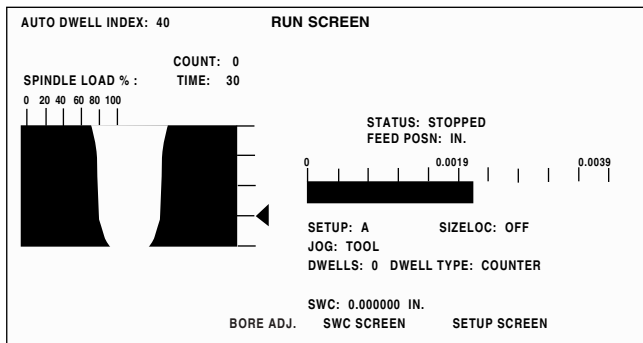


FIGURE 2-12, Run Screen with Sizeloc ON

type can be modified. If operator presses F3 key, dwell type is highlighted. Operator then can press either left or right arrow key to change dwell type. Operator **MUST** then press ENT key in order for dwell type to take effect. In between time that operator presses F3 key and time that operator presses ENT, machine will not dwell.

3. JOG: This option allows operator to jog either stroker or tool. It operates the same way that jog feature worked in setup screen. This option is disabled while machine is running.

4. SETUP: This option allows operator to toggle between one of three setups. Left and right arrow keys change setup from A to B to C.

5. SIZELOC: This option allows operator to turn on size lock for current setup. Sizeloc will be explained later in this manual. left and right arrow keys will toggle between turning on Sizeloc and turning off Sizeloc.

6. STONE WEAR (SWC): This option allows operator to enter amount of stone wear. Stone wear is measured in amount of stone wear per 0.001 in. (0.01 mm) of stock removal. Machine will take stone wear number into account when it determines when to stop feeding out stones.

7. BORE ADJ: This option is only available when size lock is on. This option allows operator to increase amount of stock that is being removed. This is useful if operator is not using stone wear and starts to lose size because of stones wearing away. Operator can enter a small amount of bore adjustment and be back within tolerance on next part.

8. SWC CALC: This option allows operator to calculate stone wear value. To use this function, operator must first run a cycle. Operator must then measure how much stock has been removed from bore. Next, operator highlights SWC CALC option and presses ENT. Operator is prompted for an amount of stock that was removed. The program will use that number and calculate SWC number and store that number on run screen.

9. 2 STAGE OPTIONS: This option is only available when using GHTS tool. In order to select this option, move cursor to 2 STAGE OPTION and then press ENTER. This will bring up a few lines of text that will allow operator to select which stone set to use and, if both sets of stones have been run, amount of stock to remove with second set of stones when running a two stage cycle. The operation of GHTS tool will be explained in operation section of instructions.

10.TOOL WEAR: This option is only available with Sizeloc ON. This option allows operator to add a specific amount of stone wear in addition to amount of stone wear that is calculated using SWC.

The following two items are displayed on screen for informational purposes.

1. TIME: This is amount of time that has elapsed since cycle has started. Timer starts when start button is pressed.

2. COUNT: This is number of cycles that have been run on machine since either power has been removed or cycle counter has been cleared from run screen.

SIZELOC

Sizeloc is a feature of machine that allows operator to run parts to same dimension without determining starting diameter. To use Sizeloc, operator needs to run first part and hone it to correct size. Once this first part is sized properly, operator would then turn Sizeloc ON. On run screen, FEEDUP AMOUNT message will be erased from screen to remind operator that Sizeloc is on and that he cannot adjust feedup amount (see Figure 2-12). In order for Sizeloc to operate properly, operator may need to enter amount of stone wear that he is experiencing. This value can be adjusted from cycle to cycle. Once stone wear has been entered and operator has run first part, and obtained proper size, operator would only need to put tool into next hole and press cycle start. Machine will determine amount of stock that will need to be removed during cycle, in order to match size of first part. Stone wear will be taken into consideration when determining final position. If any of following items need to be modified while Sizeloc is on, system will turn size lock off. Cycle Type, any Feed Rate, any Spindle Speed, any Stroker Speed, Spindle Torque Preload, Tool, Coolant, Spark Out Time. reason that size lock is turned off is that any of above listed items can affect final size. Size lock will need to be set again after first cycle.

[illegible]

SECTION 3

SETUP & OPERATION

GENERAL

This section gives a step-by-step overview of setup & operation procedures for this machine.

SAFETY PRECAUTIONS

The following precautions should be observed to ensure maximum safety while working on or around your Machine.

CAUTION

Use **ONLY** replacement parts supplied by Sunnen, to ensure parts meet machine's specifications.

1. Wear proper Safety Items (such as safety glasses and other personal safety equipment as necessary or required).
2. **DO NOT** wear loose fitting clothes or jewelry while working on or around Machine.
3. Keep area around Machine free of paper, oil, water and other debris at all times.
4. Keep Machine and area cleaned of excessive lubricant and lubricant spills.
5. Keep Machine clear of tools and other foreign objects.
6. Keep Tools clean and in their proper storage compartments to maintain them in proper working condition and to prolong tool life.
7. Inspect Tools before using. Check for cracks, burrs or bent parts that might effect operation.
8. **DO NOT** force Tools when operating. Tools will do a better and safer job when operated at rate for which they were designed.
9. Turn **OFF** electrical power when performing service on your machine which does not require power.
10. Disconnect Machine from main power supply before any work is performed inside of Electrical Control Enclosure.

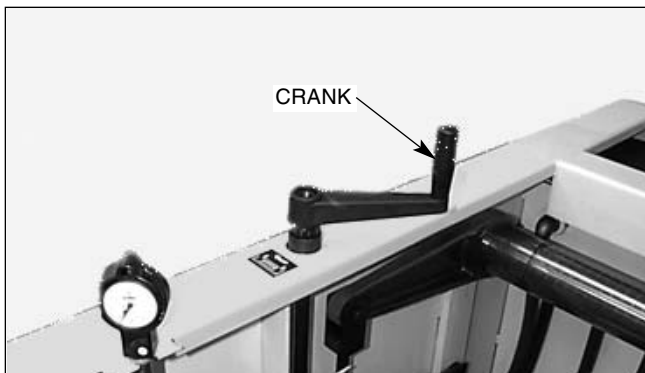


FIGURE 3-1, Elevating Crank

11. Ensure all Guards are in place and are in proper working order.

12. Use proper lifting procedures when loading and unloading Machine.

13. Keep all non-essential persons clear of work area. Visitors, especially children, should not be permitted near work area.

14. **DO NOT** use Machine for other than its intended use. Using machine for other purposes, could result in loss of warranty or damage to Machine.

15. Use **ONLY** factory authorized or recommended parts or replacement accessories. Using parts or accessories other than those approved by manufacturer, could result in damage to Machine and loss of warranty.

16. Ensure Machine is properly grounded; use **ONLY** recommended voltage; and observe all local, state and federal electrical safety codes and regulations.

WARNING

Ensure all guards, shields and safety switches are in place and in proper working order before operating this machine. Further ensure that all other personnel are clear of machine and that your hands are clear of any moving part before turning on and operating machine. Wear proper safety equipment when operating machine.

OPERATING TIPS

If load meter is indicating loads of over 95% consistently, reduce spindle speed. If lowest speed is being used, increase feed rate to break down stone, or use a softer stone. Also verify that STP is set correctly by reviewing Load graph and observing trend. Remember, if starting load is higher than steady state operating load, result is stone wear without corresponding stock removal.

If honing technique above does not result in greater stone life, use a lower feed rate setting.

If a low operating load accompanies poor stone life, increase spindle speed or use a harder grade stone.

If stock removal rates are too low:

- Increase stroking rate.
- Use a higher feed rate.
- Use a coarser stone.
- Use a harder stone.

If bore is tapered, remove taper as follows:

If bore is tight at bottom, raise workpiece with elevating crank (see Figure 3-1).

If bore is tight at top, lower workpiece.

There is also dwell feature activated by pushing BLUE dwell button. You can push this button while machine is honing. On RUN screen, there are five marks in middle of screen that represent five locations in bore (see Figure 3-2). Using up ↑ and down ↓ ARROW keys, you can move this marker to a place in bore that you would like to dwell. When you press dwell button, stroker will dwell for two seconds in location that you selected with arrow keys. This button can be held in to make machine dwell longer.

Mandrel Adapter

If workpiece gets bellmouthed during honing, shorten stone only; do not shorten shoe. If workpiece gets barrel shaped during honing, shorten shoe only; do not shorten stone. If mandrel runout is excessive, replace concentric sleeve on mandrel adapter with an eccentric sleeve (see Figure 3-3). If runout is still excessive, turn sleeve around.

CV/CK or GH-Series Hone Heads

If hole is bellmouthed, shorten stroke. If hole is barrel shaped, lengthen stroke. If stone becomes tapered, check alignment guides for proper setting (CV/CK head only). Also check Main guide #3 for taper. If guide is tapered, shorten guide on thick end and place #1 stone in #2 position and vice-versa.

Stone Wear

Stone wear can be dealt with in two ways:

1. First way is for operator to calculate stone wear per stock removed, and through operator interface, tell machine how far to advance feed rod. This is same method that was used on CV-616 or other manual honing machines. method is as follows:

To calculate stone wear ratio, divide amount of stone wear by stock removed. You get amount of stock removed by gaging last cylinder honed. To get stone wear, subtract stock removed from base number from last cylinder.

Example:

$$\begin{array}{r} 10\text{-}1/2 \text{ Base number (from last cylinder)} \\ - 6 \text{ Stock removed (from last cylinder)} \\ \hline 4\text{-}1/2 \text{ Difference (stone wear: } 10\text{-}1/2 - 6 = 4\text{-}1/2) \end{array}$$

$$\text{STONE WEAR RATIO} = \frac{\text{STONE WEAR}}{\text{STOCK REMOVED}} = \frac{4\text{-}1/2}{6} = .75 \text{ OR } 3/4$$

2. Second way of dealing with stone wear is through use of SWC option on run screen along with SWC calculator. The stone wear calculator allows operator to enter amount of stock that has been removed and machine will determine how much stone wear has occurred. This number is then stored on run screen. By using SWC number, operator will only need to enter amount of stock that needs to be removed. The machine will take into account SWC number when it determines where it needs to stop in order to remove correct amount of stock. The SWC feature works with size lock. With size lock on, machine will determine how much stock to remove and then add in extra feed out due to stone wear.

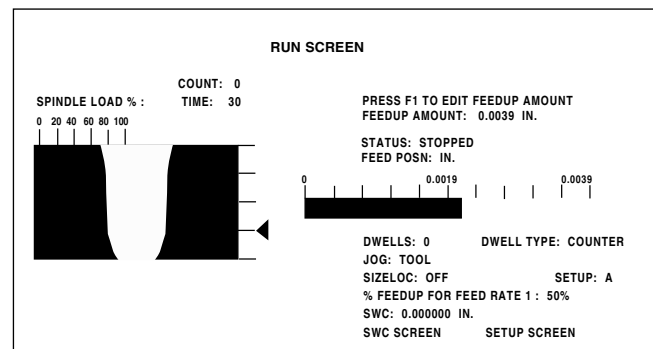


FIGURE 3-2, Run Screen

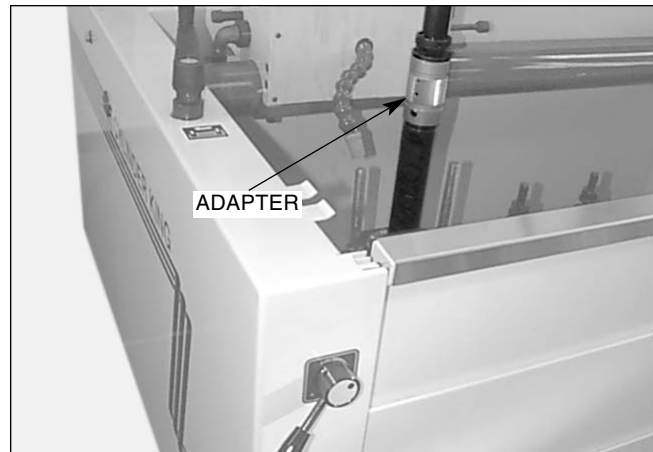


FIGURE 3-3, Mandrel Adapter

Extra Fine Stones

Finishing stones, 280 grit and finer, are available for applications where a finer finish is required. When these fine grit stones use a *conventional or vitrified* bond, there is a delicate balance between glazing, which is caused by insufficient stone pressure, and stone crumbling, which is caused by excessive feed rates.

CK-21 has several features to aid in finding this balance and maintaining consistent honing performance. first of these is *Spindle Torque Preload* feature, which is found in setup screen. This is percentage of spindle's full load that machine waits to see, before machine stops Rapid advancing and starts to use programmed feed rate. This is equivalent of how hard or soft a operator, of CV-616, advances wheel at start of cycle. Another feature is *Load Meter* and its display characteristics. There are three displays that are available to operator. First is **BORE PROFILE**. This display shows a picture of load vs. stroke position through bore. In most cases it will display condition of bore (i.e., taper, barrel, or bellmouth) during cycle. Second type of display is **BAR GRAPH**. This display shows a bar graph of machine load as cycle progresses. Last display is **LOAD GRAPH**. This display will show machine load vs. time. Last display will help in optimizing Spindle Torque Preload (STP) value. If you use load graph to determine STP, ideal condition is to have trend of graph be horizontal. If trend is upward, STP is too low. If trend is downward, STP is too high.

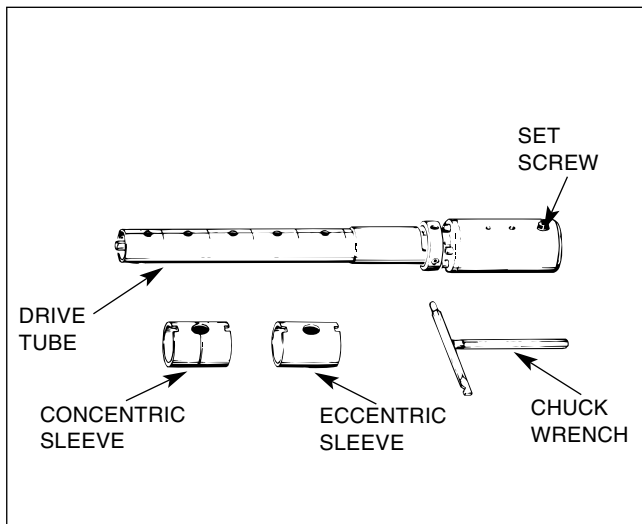


FIGURE 3-4, CV Mandrel Adapter

TABLE 3-1, P28 Mandrels

P28 MANDREL	STONE USED	STONE LENGTH		MINIMUM OVERSTROKE		MAX. BORE* LENGTH POSSIBLE		MAX. BORE LENGTH FOR EASY LIFT-OUT	
		mm	in	mm	in	mm	in	mm	in
2-Stone	1	83	3.3	25	1.0	201	7.9	201	7.9
2-Stone	2	167	6.6	25	1.0	201	7.9	201	7.9
3-Stone	1	83	3.3	25	1.0	284	11.2	284	11.2
3-Stone	2	167	6.6	25	1.0	284	11.2	310	12.2
3-Stone	3	250	9.8	25	1.0	284	11.2	206	8.1
4-Stone	2	167	6.6	25	1.0	368	14.5	368	14.5
4-Stone	3	250	9.8	25	1.0	368	14.5	292	11.5
4-Stone	4	330	13.1	25	1.0	368	14.5	NA	NA
5-Stone	2	167	6.6	25	1.0	422	16.6	450	17.7
5-Stone	3	250	9.8	25	1.0	452	17.8	366	14.4
5-Stone	4	330	13.1	25	1.0	452	17.8	NA	NA
5-Stone	5	420	16.4	25	1.0	452	17.8	NA	NA

* These Maximum Bore Lengths can be honed, but it may be impossible to withdraw the mandrel without first lowering the workpiece or removing the tool from the workpiece.

TABLE 3-2, CV/CK-Series Hone Heads (CK-21)

HONE HEAD	DIAMETER RANGE		STONE LENGTH		MINIMUM OVERSTROKE		MAX. BORE LENGTH	
	mm	in	mm	in	mm	in	mm	in
CV-2400	71- 76	2.0-3.0	76	3.0	13	.5	356	14.0
CV-3000	76-102	3.0-4.0	89	3.5	15	.6	363	14.3
CV-3300	84-127	3.3-5.0	89	3.5	15	.6	363	14.3
CV-4000	102-203	4.0-8.0	152	6.0	25	1.0	406	16.0
CK-2000	51- 76	2.0-3.0	76	3.0	13	.5	356	14.0
CK-2600	66- 86	2.6-3.5	89	3.5	15	.6	363	14.3
CK-3000	76-127	3.0-5.0	89	3.5	15	.6	363	14.3
CK-4000	102-203	4.0-8.0	152	6.0	25	1.0	406	16.0

SETUP SCREEN	
SAVE SETUPS	SPINDLE TORQUE PRELOAD: 20
STROKE LENGTH CALCULATION	TOOL: GHC
JOG: STROKER	COOLANT: AUTO
UNITS: IN.	RETRACT AMOUNT: 0.020 IN.
CYCLE: 2 STAGE	SPARK OUT TIME: 0 SEC
FEED RATE #1: 0.0050 IN./MIN.	DISPLAY: BORE PROFILE
FEED RATE #2: 0.0025 IN./MIN.	SETUP: A
SPINDLE SPEED #1: 250 RPM	CLEAR CYCLE COUNT: NO
SPINDLE SPEED #2: 250 RPM	SERIAL PORT TRANSFERS
STROKE SPEED #1: 60 SPM	AUTO DWELL: OFF
STROKE SPEED #2: 60 SPM	CROSSHATCH ANGLE: 12.1 DEG.
	LANGUAGE: ENGLISH

FIGURE 3-5, Setup Screen

TOOLING

Refer to Sunnen Industrial or Automotive Honing Supplies Catalog for all your honing needs.

CAUTION

Use of tooling other than Sunnen tooling will render all of features of computerized honing system useless, due to fact that machine and all its parameters are calibrated to Sunnen Tooling only.

For bores with diameters smaller than 60 mm (2.4 in.) or bores over 280 mm (11 in.) long with diameters smaller than 66 mm (2.6 in.), use Sunnen CV-1010 Mandrel Adapter and an appropriate Sunnen mandrel (see Figure 3-4; and Tables 3-1 & 3-2).

For larger diameter bores, use Sunnen CV/CK or GHSS Series Hone Heads.

NOTE: On SETUP screen, there is a TOOL option. This option allows operator to select type of tool that will be used. 10 options are as follows: CK/CV, P28, P20, R28, Y/YY, GHC, MPS, AK-20, BL20, and MPS/FL6X. correct tool family needs to be selected in order for feed system to operate properly (see Figure 3-5).

SETUP

When using CV Mandrel Adapter and Mandrel proceed with following step, Installing CV Mandrel Adapter & Mandrel. When using CV/CK Hone Head proceed to, Installing Hone Head.

Installing Mandrel Adapter & Mandrel

following is a setup guide using mandrel adapter.

1. Using an adjustable wrench, turn feed rod in Mandrel Adapter counterclockwise until wedge hook in adapter nose is fully extended.
2. Slide drive tube end of Mandrel Adapter into drive tube of machine, and tighten set screw into one of holes (see Figure 3-6).
3. Rotate mandrel adapter by hand until its set screw points toward you.
4. Insert stones into mandrel.
5. Pull back on mandrel wedge, using "V" notch in chuck wrench.

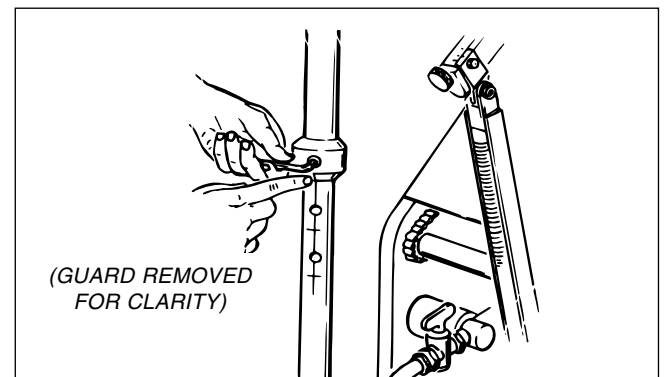


FIGURE 3-6, Install Mandrel Adapter

6. If required, place concentric sleeve on mandrel. If runout is excessive during honing, replace sleeve with eccentric sleeve. If runout remains excessive, turn sleeve around.

7. Insert mandrel into adapter.

For all “Y” series mandrels and “P” series mandrels under 66 mm (2.6 in.), stones should be 90° to right of set screw.

For all “P” mandrels over 66 mm (2.6 in.), stones should be 90° to left of set screw.

8. Push mandrel up into Adapter until it bottoms, rotate it 1/4 turn to right, and push up until it bottoms again.

9. Tighten Set Screw securely with chuck wrench.

Installing Hone Head

Install CV/CK or GHC-Series Hone Head by sliding Hone Head Drive Tube into Machine Drive Tube; align Locating Screw in Hone Head Drive Tube with one of holes Machine Drive Tube; then, tighten screw (see Figure 3-7).

NOTE: Locating Screw can be screwed into hole in lower part of Drive Tube when index lines are in line.

Replacing Stones

To replace stones in CV/CK-Series Hone Head, proceed as follows:

1. Slide Movable Stop to OUT position. Insert Stone Assembly with worn-out stone into fixture and pull lever toward you until stone is free from master stoneholder.

2. Brush chips and grit from Master Stoneholder slots; slide Moveable Stop to IN position; move lever to open position. Fixture is now ready for inserting new stone.

3. Move Lever to open position and slide Movable Stop to IN position (see Figure 3-8).

4. Place Master Stoneholder in fixture. Brush all loose chips from Stoneholder grooves and slots.

5. Place Stone in Master Stoneholder (see Figure 3-9). Lugs on stone sides should fit into cross slots of Master Stoneholder.

6. Seat Stone in Master Stoneholder by pressing down with fingers. Pull lever forward until Stoneholder hits stop. Stone is now in place.

Install Guide/Stone Shims

7. Place Setting Gage in bore to be honed; then snug, making sure to center (see Figure 3-10).

NOTE: On CK-3155 Setting Gage, make sure proper side of Turret faces Opening.

8. Place Guide/Stone Assembly in Setting Gage with graduated slide set at “0” (see Figure 3-11).

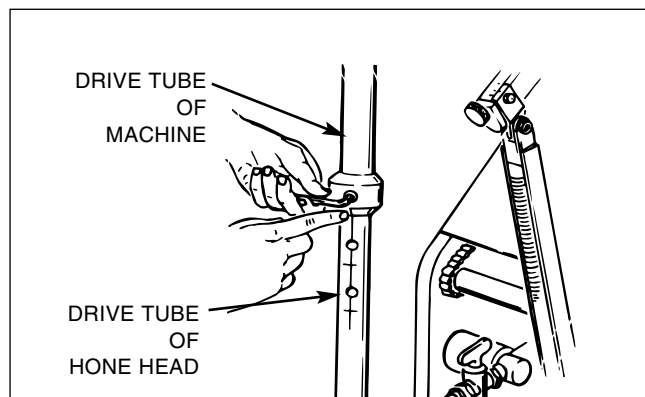


FIGURE 3-7, Install Hone Head

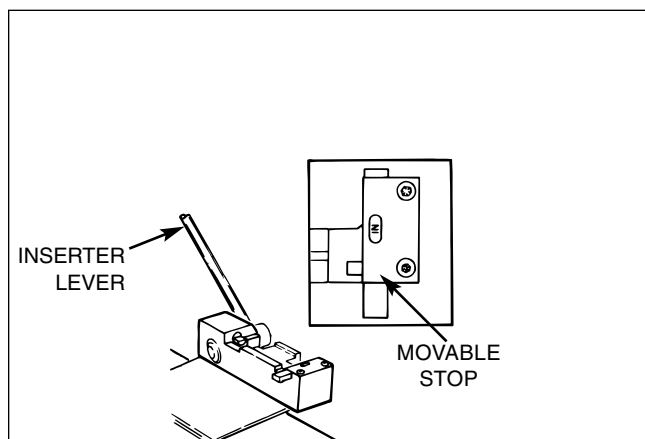


FIGURE 3-8, Open Position

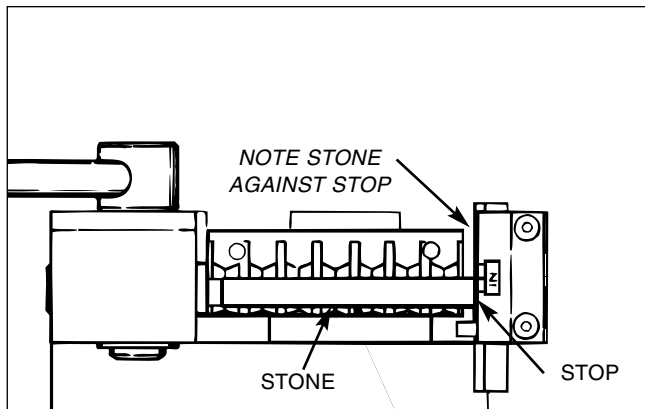


FIGURE 3-9, Install Stone

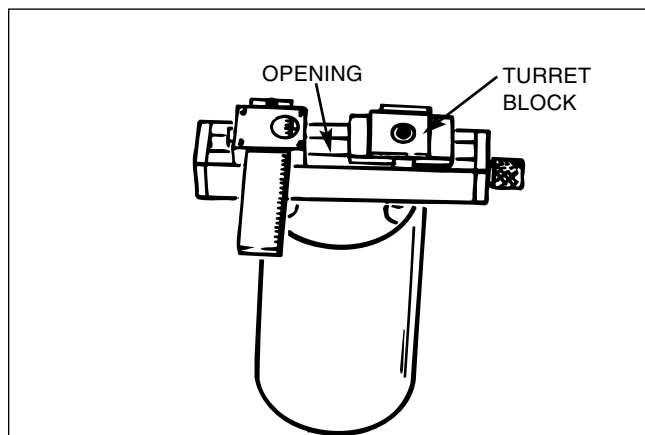


FIGURE 3-10, Setting Gage

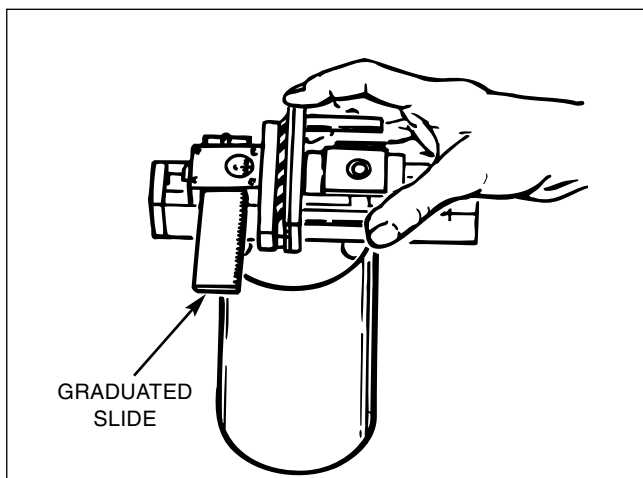


FIGURE 3-11, Stone Assembly

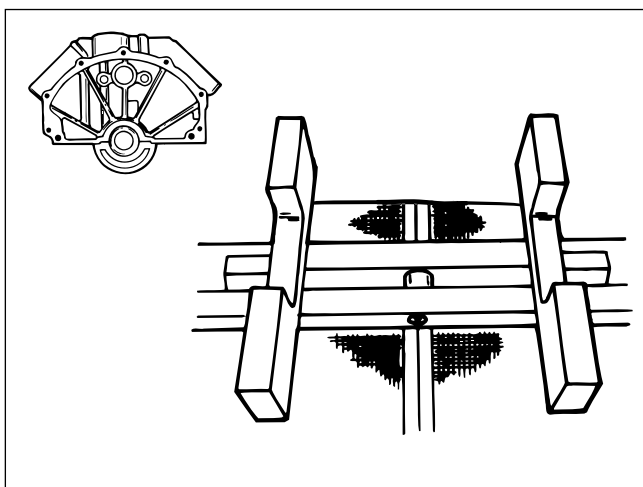


FIGURE 3-12, Position Riser Blocks

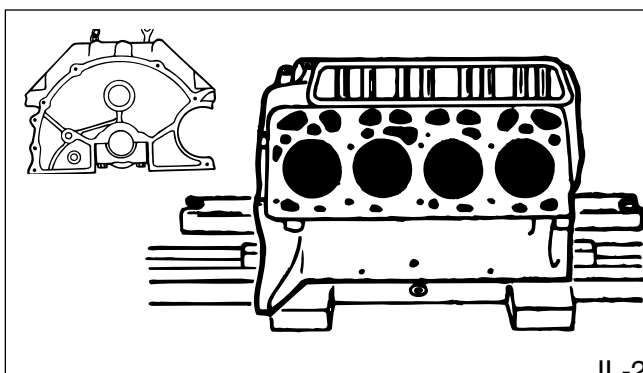


FIGURE 3-13, Position Riser Blocks

9. Move graduated slide so that pin contacts guide. If pin does not contact guide, add a No. 19 shim and try again. Now add necessary shims as indicated on slide. Looseness less than thickness of one shim is acceptable.

Special instructions for using CK-4155 Setting Gage for large hone head in 102-203 mm (4-8 in.) range: Move graduated slide so that pin contacts assembly. If graduated slide reads "15" or less, no additional shims should be added; if slide reads over "15", remove assembly from Gage and add one shim.

NOTE: A properly shimmed assembly will slip into gage easily. Both Guide/Stone Assemblies must have same thickness of shims, and each must fit in Setting Gage when assembled with shims.

10. Rotate Drive Tube until numeral "1" appears on Hone Body. Insert one stone assembly with shims in left-hand set of holes beneath numeral.

11. Insert other shimmed Stone Assembly beneath numeral "2", using procedure above.

12. Insert shimmed Main Guide beneath numeral "3" on Hone Body.

13. Place shimmed Centering Guide beneath numeral "4" on Hone Body.

Alignment Guide

NOTE: DO NOT use alignment guides when honing ported or keyway bores.

14. Place Alignment Guide in setting gage with graduated slide set at "0". Loosen Clamp Screw on alignment guide with hex key wrench and slide to Shoulder. Tighten Clamp and repeat procedure with second alignment guide.

15. Place one of alignment guides in left-hand set of holes above numeral "1" in hone body, so guide and stone are in line.

16. Place other alignment guide in left-hand set of holes above numeral "2" in hone body, so guide and stone are also in line.

Automotive Applications ONLY

1. Position Riser blocks for in-line or V-block.
 - If engine block's main bearing centerline is in line with pan rails, position riser so that it is in a vertical position (see Figure 3-12). large notch in center will provide clearance for main bearing housings. If pan rails are below centerline, position risers so they are in a flat configuration.
 - If main bearing centerline is above pan rails, turn riser blocks 90 degrees to flat position, so that pan rails sit on flat part of risers (see Figure 3-13).

NOTE: To clamp engine block in place, there must be at least 2 main caps in place. Block distortion will be kept to a minimum if all caps are in place and tightened to proper specification.

2. Place clamp bar through main bearing bores.
3. Move carriage to extreme right and raise arm.
4. Make sure that pan rails are clean and free of any gasket material.
5. Slide riser blocks to approximate position near ends of engine block, with proper orientation for that type block.

6. Place engine on riser blocks.
7. Slide clamps to slots in ends of clamp bar. It may be necessary to shift position of engine block so that both clamps will slide into slots at ends of clamp bar.
8. With both clamps in position, tighten clamp nuts evenly – first by hand, and then with clamp crank provided in fixturing package.
9. If engine is of in-line type, it is now ready to be honed. If it is of “V” type, release cradle index latch at right end of cradle and rotate engine block into position for honing. notches are at 15, 30, 45, and 90 degrees. There is a notch at 135 degrees to help drain honing oil from engine block.
10. For setup of CK type hone head, refer to Installing Hone Head.

Machine Setup

Set Stroke Length

1. Measure length of bore to be honed.
2. Measure length of honing stones.
3. Determine how much overstroke is desired for cycle.
4. Using Stroke Length Calculator (see Figure 3-14), operator just needs to enter three values found in steps 1-3 into stroke length calculator and machine will tell operator recommended stroke length and a stroke speed.

The formula to determine stroke length is :

$$\text{stroke length} = 2 * \text{over stroke} + \text{bore length} - \text{stone length}$$

By adding bore diameter into calculator, operator is given a suggestion as to where operator can set spindle speed.

NOTE: Application specific parameters may require this value to be altered. It is only a recommendation.

5. Unlock stroke length lock knob (see Figure 3-15).
6. Turn large handwheel on drive arm until indicator points to required stroke length.
7. Lock Stroke Length Lock Knob.

Set Stroke Position/Overstroke

1. Toggle JOG indicator on Setup Screen to STROKER, using UP/DOWN arrow keys. Hold jog button in UP position until stroker stops. machine knows that this is TDC position.
2. Using Elevating Crank, position workpiece so that stone protrudes from top of workpiece by amount of top overstroke desired.
3. If Elevating crank will not raise or lower workpiece sufficiently to produce required top overstroke, loosen Set Screw in drive tube and adjust length of drive tube as required. Remember to tighten Set Screw.

STROKE LENGTH SCREEN	
ENTER THE CYLINDER LENGTH: 4.000 IN. PRESS F1 TO EDIT CYLINDER LENGTH	RECOMMENDED TOOL: GHSS-3410 HOLDER: GHG14C233-349
ENTER THE BORE DIAMETER: 4.000 IN.	ALTERNATE TOOL: GHSS-3410 HOLDER: GHG14C233-348
ENTER THE STONE LENGTH: 3.0000 IN.	SUGGESTED SETTINGS STROKE LENGTH : 2.0 IN. SPINDLE SPEED : 190 RPM STROKER SPEED : 80 SPM
OVER STROKE AMOUNT: 0.5000 IN.	CROSSHATCH ANGLE: 30.0 DEG
SETUP SCREEN	

FIGURE 3-14, Stroke Length Calculator Screen

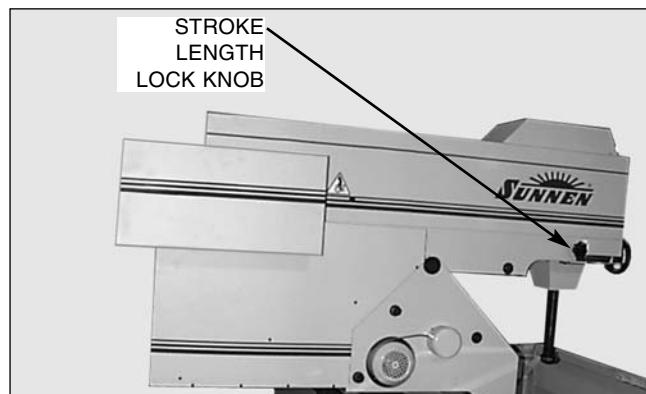


FIGURE 3-15, Stroke Length

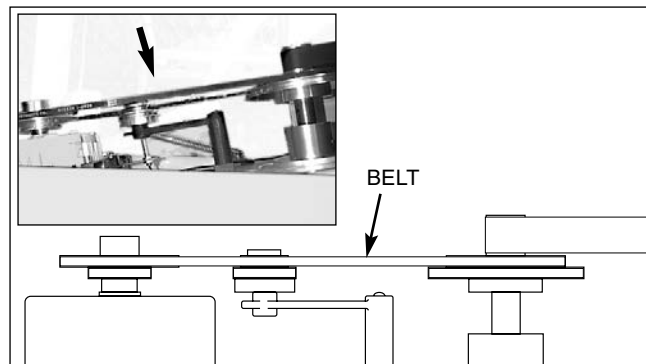


FIGURE 3-16, Spindle Speed

4. Check setup by again holding JOG button until tool stops at bottom of stroke. Rotate tube manually to check for interference.

Set Spindle Speed and Stroking Rate

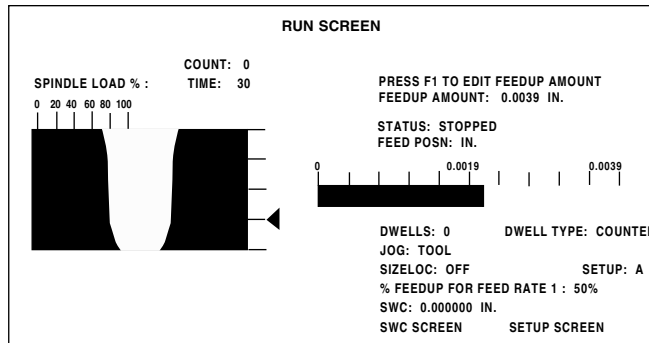
CAUTION

Belt changes should only be done while display is showing SETUP SCREEN. If changed while any other screen is showing, machine will display a FAULT message, and a setup could be lost.

1. Measure bore diameter to nearest 1 mm (.040 in).
2. If bore measures 85 mm (3.5 in) or more, put belt on lower step (see Figure 3-16).
3. RPM range here is 90-240.
4. Check that pulley step on idler assembly is correct.
5. Close and lock left rear belt cover .

TABLE 3-3, Equivalent Feed Rates (in/min)

FEED RATE	TOOLING (41 SPM)				
	CV	P28	R28	Y/YY	P20
1	0.0015	0.0005	0.0015	0.0010	0.0005
2	0.0030	0.0015	0.0030	0.0025	0.0010
3	0.0040	0.0020	0.0045	0.0035	0.0020
4	0.0055	0.0030	0.0060	0.0045	0.0025
5	0.0070	0.0035	0.0075	0.0060	0.0030
6	0.0085	0.0045	0.0090	0.0070	0.0035
7	0.0100	0.0050	0.0105	0.0085	0.0040
8	0.0115	0.0060	0.0120	0.0095	0.0050
9	0.0130	0.0065	0.0140	0.0105	0.0055
FEED RATE	TOOLING (57 SPM)				
	CV	P28	R28	Y/YY	P20
1	0.0020	0.0010	0.0020	0.0015	0.0010
2	0.0040	0.0020	0.0040	0.0035	0.0015
3	0.0060	0.0030	0.0065	0.0050	0.0025
4	0.0080	0.0040	0.0085	0.0065	0.0035
5	0.0100	0.0050	0.0105	0.0085	0.0040
6	0.0120	0.0060	0.0125	0.0100	0.0050
7	0.0140	0.0070	0.0150	0.0115	0.0060
8	0.0160	0.0080	0.0170	0.0135	0.0065
9	0.0180	0.0090	0.0190	0.0150	0.0075
FEED RATE	TOOLING (80 SPM)				
	CV	P28	R28	Y/YY	P20
1	0.0025	0.0015	0.0030	0.0025	0.0010
2	0.0055	0.0030	0.0060	0.0045	0.0025
3	0.0085	0.0045	0.0090	0.0070	0.0035
4	0.0110	0.0055	0.0120	0.0095	0.0045
5	0.0140	0.0070	0.0150	0.0115	0.0060
6	0.0165	0.0085	0.0180	0.0140	0.0070
7	0.0195	0.0100	0.0210	0.0165	0.0080
8	0.0220	0.0115	0.0240	0.0185	0.0095
9	0.0250	0.0130	0.0270	0.0210	0.0105

**FIGURE 3-17, Run Screen**

6. Go to **SETUP SCREEN** on operator interface and highlight **SPINDLE SPEED**. This is speed at which spindle will rotate during cycle. Overall range of machine is 90-550, but you can only set speed according to position of idler. One range is 90-240 RPM; other is 250-550 RPM.

7. Use **DOWN ARROW** to select **STROKER SPEED** on Operator Interface. Range here is 40-100 Strokes per Minute (SPM).

CAUTION

Stroke rates of over 70 SPM are not recommended on stroke lengths over 160 mm (6-1/4 in).

Select Feed Rate

For equivalent CV-616 feed rates, refer to Table 3-3.

1. Use **UP/DOWN Arrow** to highlight Cycle type. This option allows operator to select one of three types of cycles:

The first cycle type is **SIZED**. This allows operator to enter amount of material that needs to be removed. This value is entered on **RUN screen**.

The second cycle type is **TIMED**. This allows operator to run for a specified time (i.e., Plateau Honing).

The last type is **2-STAGE**. This allows operator to run a sized type cycle with two different feed rates, two different spindle speeds, and two different stroke speeds during same cycle.

2. **FEED RATE 1**: This option allows operator to enter a specified feed rate for first part of cycle. It remains for a preset percentage of total cycle's stock removal.

3. **FEED RATE 2**: This is ending feed rate. It is only active when 2-Stage is selected.

4. For faster stock removal or rougher finish, use a faster feed rate.

5. For greater stone life or smoother finish, choose a slower feed rate.

6. Be sure that appropriate tool family has been chosen in **TOOL** area of Setup Menu.

7. Be sure that a full stream of Sunnen Honing Fluid is in full contact with bore.

OPERATION

There are several methods for operating CK-21 depending on your application.

First Method

The first method of using this machine is very similar to that used on CV-616, allowing operator to enter amount of stock that needs to be removed.

- If Stone Wear Compensation feature *is not used*, operator will have to manually calculate how much stone wear will occur and add that amount to amount of stock that needs to be removed. The operator presses **F1** and enters this amount into system as Feed up Amount.

- If Stone Wear Compensation feature *is used*, operator will enter amount of stone wear that occurs for 0,01 mm (0.001 in.) of stock removal. This number can be found by using SWC calculator. After one cycle is run, operator will enter amount of stock that was removed during that cycle. The system will calculate SWC number. From that point on, operator will only need to enter amount of stock that will need to be removed. The SWC number may need to adjusted slightly during operation.

Second Method

The second method of using this machine employs the **SIZELOC** feature. This is a very efficient method of removing varying amounts of stock. The procedure is as follows.

- Gage bore to be honed and determine amount of stock that needs to be removed. If you are rough honing, plan to leave 0,08 mm (0.003 in) for finish honing.

NOTE: In this example, assume that 0,18 mm (0.007 in) of stock needs to be removed.

- Adjust all of parameters on setup screen that are required.

- Toggle to **RUN screen** (see Figure 3-17).

4. Toggle JOG option to TOOL.

5. Retract stones enough so that tool can enter bore. Then lower tool into bore.

NOTE: Generally 0,8 mm (0.030 in) is enough for tool to enter bore. If more is used, there is a greater chance that head will bounce around in cylinder and damage stones and increase cycle time.

6. Set amount of stock to be removed by using F1 command indicated on Operator Interface. In our example, that would be 0,18 mm (0.007 in).

7. To begin honing, press GREEN cycle start button.

8. When machine starts, check to see that there is a good supply of honing fluid in contact with bore. Adjust flow rate by using manual oil shut off valve on front left-hand side of machine.

9. If there is a tight spot in bore, you may elect to have tool stay (dwell) in one area of bore longer than in other areas. To set dwell to a specific spot; move dwell indicator (<), on side of bore profile display on screen, using UP/DOWN arrows; then press BLUE dwell button.

NOTE: If tight spot is consistently at top or bottom, lower or raise workpiece using elevating crank.

10. When machine has expanded tool to value that you have entered in step 7, it will turn off feed motor and stop spindle and stroker motors at TDC (top dead center). It will also automatically retract stones. If there is not enough clearance in bore to prevent scratching, or if status area of run screen takes a while to change from RAPID ADVANCE to STOPPED, retract amount can be changed on setup screen.

11. Lift tool from bore and gage part.

12. Depending on type of stones that is used, machine may remove amount of stock required or not. The material that is left in bore is amount of stone wear that has occurred. This can be compensated for in next cycle through use of Stone Wear Calculator.

13. Sizeloc is a feature of machine which allows operator to run parts to same dimension, without determining starting diameter. Once bore has been honed to correct size, Sizeloc should then be turned ON.

NOTE: On Run Screen, Feed up Amount message disappears from screen to remind operator that Sizeloc is ON, and feed up amount cannot be adjusted.

In order for Sizeloc to work properly, operator will need to enter amount of stone wear that is being experienced. This value can be adjusted from cycle to cycle. Once stone wear has been entered and

operator has run first part and obtained correct size, operator would only need to put tool into next bore and press cycle start. Machine will determine amount of stock which will need to be removed during cycle, in order to match size of first part. Stone wear will automatically be taken into consideration when machine determines final position.

NOTE: If amount of stone wear is very small, it is easier to compensate for size differences by using bore adjustment feature instead of stone wear compensator. This option is on screen only when size lock is turned ON.

14. If tool is starting to loose size over a few bores, this can be compensated for through a bore adjustment. A bore adjustment will add or subtract an amount of stock removal from final position. A bore adjustment can be done between cycles.

Notes for operators of GHTS hone head.

1. You must run one single stage cycle with each set of stones before you can run a full two-stage cycle. This is because machine needs to learn a point where it needs to retract to in order to start set of stones. In order to select which set of stones you are using, you will need to go to 2 STAGE OPTIONS selection on run screen. This option will allow you to select which set of stones you want to run. If you have run both sets, you are given option of using both sets of stones. When both sets of stones are selected, you are given DISTANCE FROM FINAL FOR STAGE 2 value.

2. When running a cycle with Sizeloc turned off and both sets of stones selected, value that you enter in Feedup Amount is total amount of stock that will be removed using both sets of stones. If, for example, Feedup amount is 0.0050" and distance from final for stage 2 is set to 0.0030", machine will run a cycle that will remove 0.0020" with first set of stones and then run a cycle that will remove 0.0030" with second set of stones. same holds true when running a Sizeloc cycle, except that amount of stock removed with second set of stones will be around 0.0030". It will depend on exactly how much stock was removed with first set of stones and location where second set of stones picks up load.

3. One thing that is different about GHTS cycle is that there is now a 2 STAGE CHANGEOVER portion of cycle. During this time, spindle and stroker will stop while tool retracts first set of stones and expands second set of stones out to start position. During this time, the alarm on the stack light will sound, just to let operator that cycle is still running. button in handle to lift tool out of hole will not operate.

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

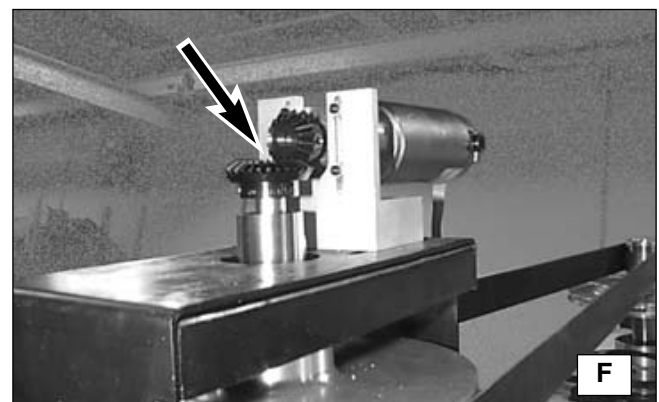
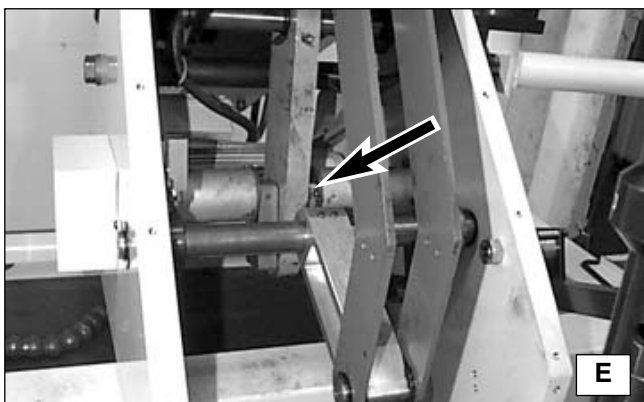
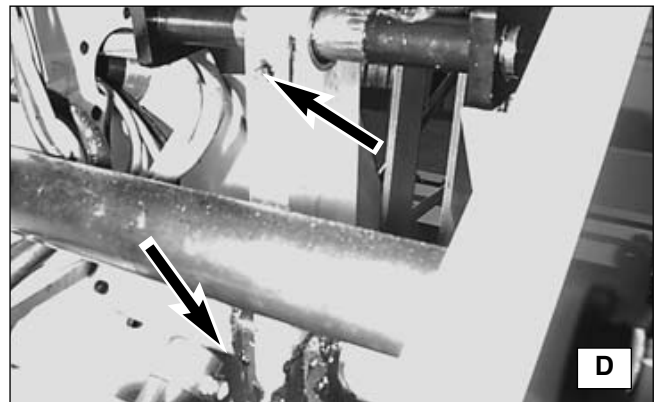
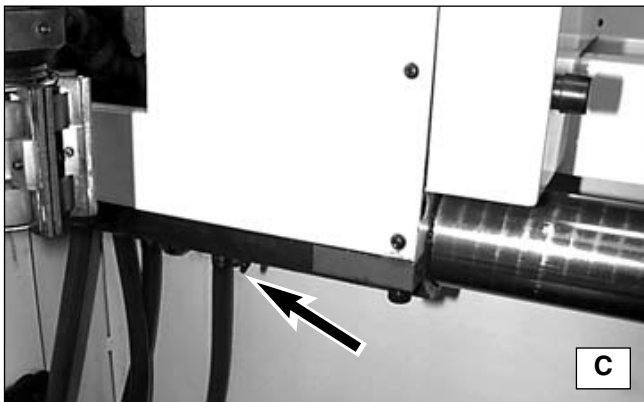
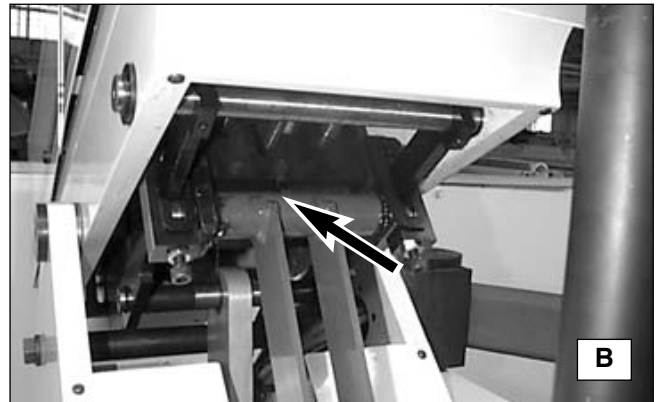
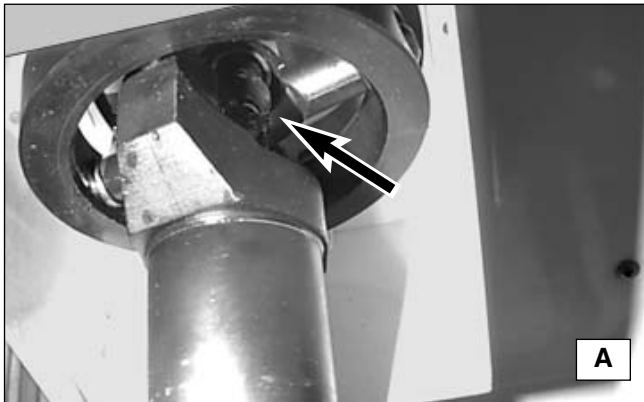


FIGURE 4-1, Lubrication

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

If using Honing Oil – Monthly, wipe exterior of machine with a clean, dry cloth; then, clean exterior with warm water and a mild detergent or mild industrial solvent. Rinse thoroughly with clean, hot water and wipe dry.

If using Water Based Coolant – Daily, wipe ALL surfaces that have been in contact with coolant with a clean, dry cloth. Clean exterior of machine with hot water and a mild detergent. Wipe all surfaces dry.

LUBRICATION

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

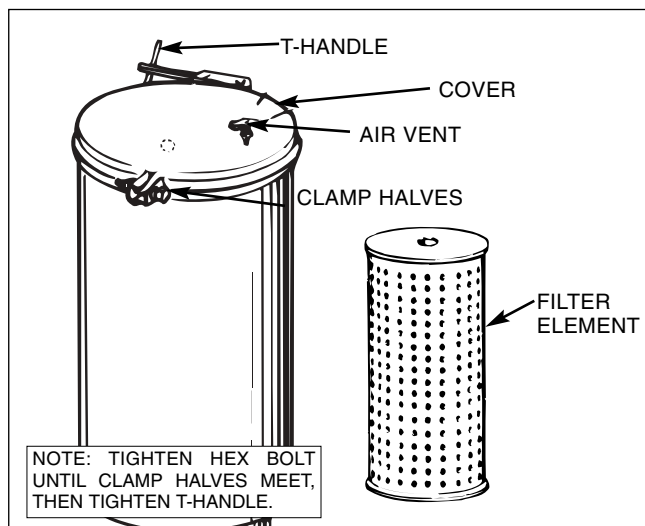


FIGURE 4-2, Filter Element

COOLANT LINES CHECK

Monthly, inspect coolant lines and fittings for leaks, severe dents or kinks. Tighten any loose fittings and replace damaged parts as required.

COOLANT LEVEL CHECK

Weekly, check level of coolant in reservoir, and add coolant as required by pouring coolant into reservoir through splash screens. Use ONLY Genuine Sunnen coolants in CK-21. Many poor honing performance indicators can be traced to incorrect honing fluids. Incorrect honing fluids may also damage pump or related components. minimum operating depth in reservoir is 89 mm (3-1/4 in.). Maximum capacity is 240 L (63.5 gal). Minimum capacity is 144 L (38 gal).

FILTER REPLACEMENT

Replace Filter Element in Filter Canisters as follows (see Figure 4-2):

1. While operating coolant pump, observe reading of gage on top of filter canisters on back of machine. If reading exceeds 38 PSI, filter element is nearing or is at capacity.
2. Turn OFF all electrical power to machine.
3. Open air vents on top of canisters (turn counterclockwise).
4. Place a bucket or other suitable container under draincocks that are located on bottom of filter canister. Open draincocks and drain about 2 liters (2 quarts) from each canister, to prevent spillage when removing elements.
5. Close draincocks and air vents.
6. Note Orientation of clamps, and remove clamps and canister covers.
7. Slowly pull out dirty filter element and place in a bucket to drain. Dispose of filter elements in accordance with local requirements.

TABLE 4-1, Lubrication

Fig.	Description	Lubricant	Amount	Frequency
A	U-Joint Assembly	#2 Grease	Fill Boot	Monthly
B	Upright Fitting on back of tube	SML-100	2 pumps	Monthly
C	Carriage Bushing	SML-100	4 pumps	Monthly
D	Connecting Rod (2 places)	SML-100	1 pump	Monthly
E	Connecting Rod Thrust Faces	SAE 20 oil	Coat Crank Faces	Daily
F	Bevel Gears	SML-100	Coating on Teeth	6 Months

NOTE: SML-100 is Sunnen Part Number for 1 tube of Mobil SHC-32.

8. Clean canisters as required.
9. Remove new elements from protective bags and insert into canisters. A slight twisting action will aid in sliding filter down over post in center.
10. Replace Covers, centering carefully on rubber gaskets to assure no leakage. Then replace Clamps and tighten Hex Bolt in Clamp Halves until halves meet, then tighten T-Handle.

Bleed Coolant System.

11. Release “E-Stop” button by turning red knob as arrow indicates. (See Figure 4-8, on page 28.)

CAUTION

Machine will not operate unless both of following conditions are met.

12. Raise doors and lower lift handle to honing position.
13. Direct oil spout into reservoir and turn on oil shut-off valve.
14. Push WHITE power ON/OFF button.
15. Display will light up with CK-21 Logo and prompt you to clear above error conditions. It will ask you to hit GREEN cycle start button to initialize stroker. machine will then cycle stroking motor to find its Top Dead Center position. When it has completed this exercise, setup screen will be displayed.
16. Push Down arrow on numeric keypad until word COOLANT is highlighted. To right of word COOLANT, it will say AUTO. Push right arrow key to change word AUTO to ON. At this point, coolant pump will begin to run.
17. Open manual control valve to wide open position and allow pump to purge air from honing fluid filtering system.
18. As oil fills filter canisters, air will escape through air vents. When oil appears in air vents, close vents.

NOTE: Coolant should flow from oil spout. Control amount of oil by regulating oil shut-off valve.

19. Turn OFF power.
20. Wipe oil from around air vents.

COOLANT RESERVOIR CLEANING

Periodically clean reservoir as follow (see Figure 4-3):

1. Turn OFF all electrical power to machine.
2. Lower access doors on front of machine.
3. At rear of machine, unhook quick disconnect found on lower left side of back of machine. It is check valved on both sides, but there will be a minimal amount of oil that has been trapped in fitting.
4. Unlatch two latches found below door on front of machine. Gently pull Roll Out Reservoir forward until contact is made with stops on front of machine.

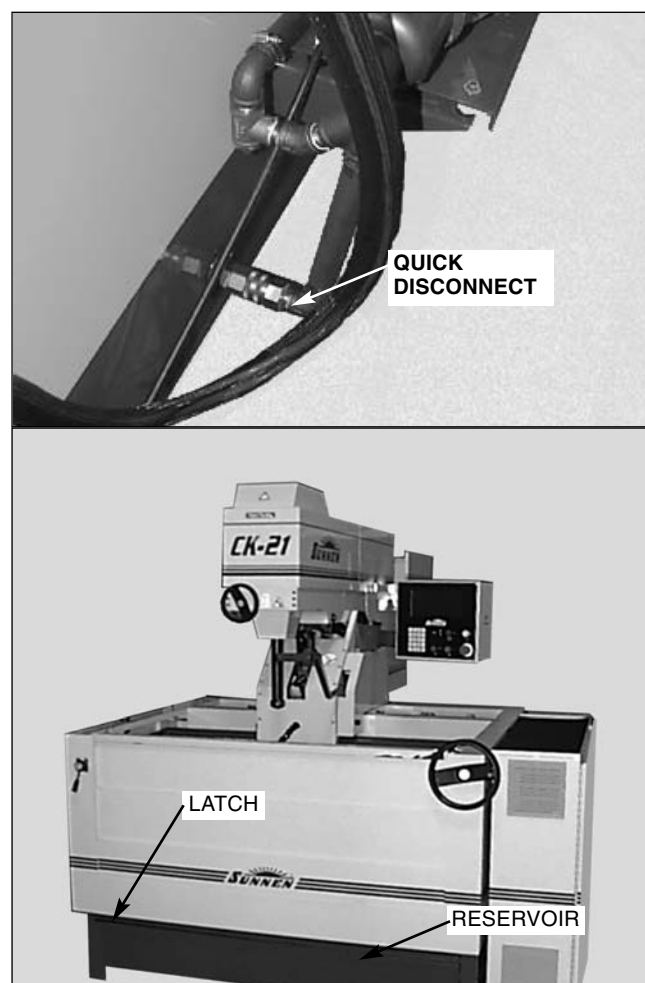


FIGURE 4-3, Coolant Reservoir Cleaning

5. Remove old coolant from reservoir.
6. Scrape sludge from reservoir with a shovel or some other similar tool.
7. Flush any remaining sludge from reservoir with a mild industrial solvent, if required.
8. Wipe reservoir dry to prevent contamination of new honing fluid.
9. Push reservoir back in and re-latch.
10. Connect quick disconnect, on rear of machine.
11. Pour honing fluid into reservoir through splash screen.

Bleed Coolant System.

12. Release “E-Stop” button by turning red knob as arrow indicates.

CAUTION

Machine will not operate unless both of following conditions are met.

13. Raise doors and lower lift handle.
14. Direct oil spout into reservoir and turn on oil shut-off valve.
15. Push WHITE power ON/OFF button.

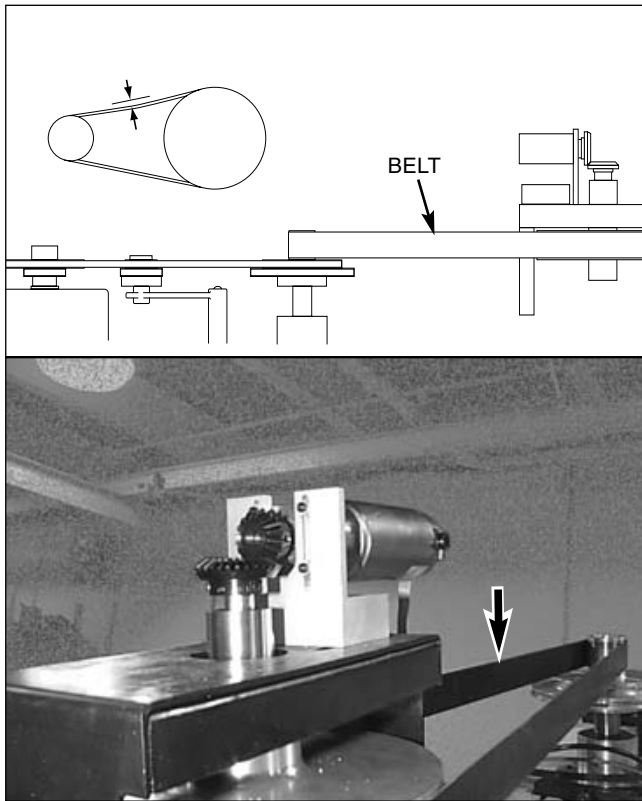


FIGURE 4-4, Poly V-Belt

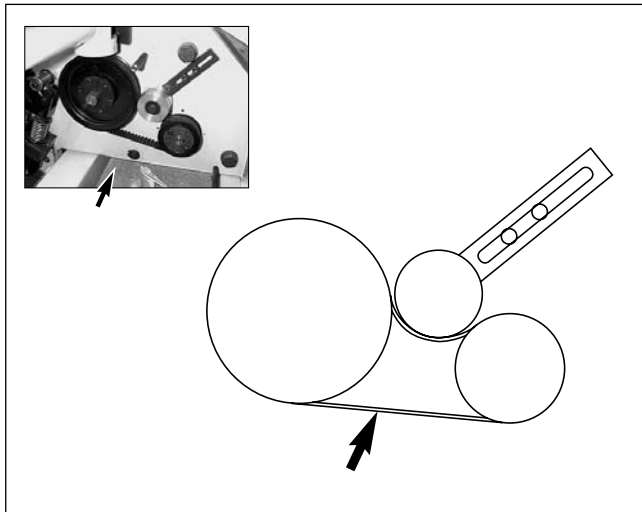


FIGURE 4-5, Stroker Belt

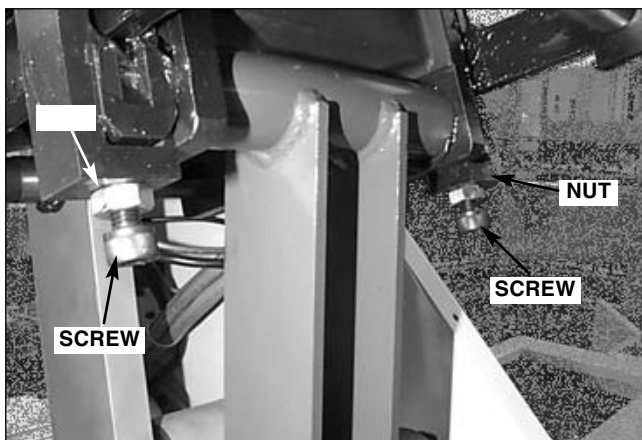


FIGURE 4-6, Rocker Arm

16. Display will light up with CK-21 Logo and prompt you to clear above error conditions. It will ask you to hit GREEN cycle start button to initialize stroker. machine will then cycle stroking motor to find its Top Dead Center position. When it has completed this exercise, setup screen will be displayed.

17. Push Down arrow on numeric keypad until word COOLANT is highlighted. To right of word COOLANT, it will say AUTO. Push right arrow key to change word AUTO to ON. At this point, coolant pump will begin to run.

18. Listen for air being blown through honing fluid.(a Gurgling sound in reservoir). If none is heard, open manual control valve to wide open position and allow pump to purge air from honing fluid filtering system.

19. As oil fills filter canisters, air will escape through air vents. When oil appears in air vents, close vents.

NOTE: Coolant should flow from oil spout. Control amount of oil by regulating oil shut-off valve.

20. Turn OFF power.

21. Wipe oil from around air vents.

POLY V-BELT TENSION

Adjust Poly V-Belt tension (wide belt) as follows (see Figure 4-4):

1. Loosen two screws that attach bearing housing to drive arm.
2. Loosen locknut on belt tension adjuster on top side of drive arm.
3. Turn adjustment screw until belt is deflected 7/16 in. at mid span on either side. It requires approximately 8 lbs. of force to deflect belt.
4. Tighten fasteners loosened in steps 1 & 2.

STROKER BELT TENSION

Adjust Stroker Belt tension as follows (see Figure 4-5):

1. Remove two attachment screws from Belt Cover on left side of machine. Remove one rubber stop.
2. Loosen two screws holding tensioner.
3. With a large pry bar, force tensioner into belt.
4. When all slack has been removed from belt, tighten two Tensioner Screws.
5. Replace Belt Guard.

ROCKER ARM ADJUSTMENT

Adjust Rocker Arm as follows (see Figure 4-6):

1. Loosen Locknut.
2. Tighten Socket Head Capscrew until total amount of movement is about 6 mm (1/4 in.).

3. Tighten Locknut.
4. Repeat for other side.

FAN FILTER

Monthly, clean fan and exhaust filters on electrical enclosure as follows (see Figure 4-7):

NOTE: Filter elements may need to be cleaned more often depending on shop environment and your use of machine.

1. Remove fan and exhaust covers on front of enclosure (covers pop off).
2. Remove filter elements.
3. Clean filter elements as follows:
 - Using air pressure to blow dirt from filter element.
 - If filter element is excessively dirty, clean using soap and water; wring out and blow dry.

CAUTION

Filter element **MUST** be dry before reinstall to ensure excess moisture does not get into enclosure.

4. Replace filter elements and replace covers.

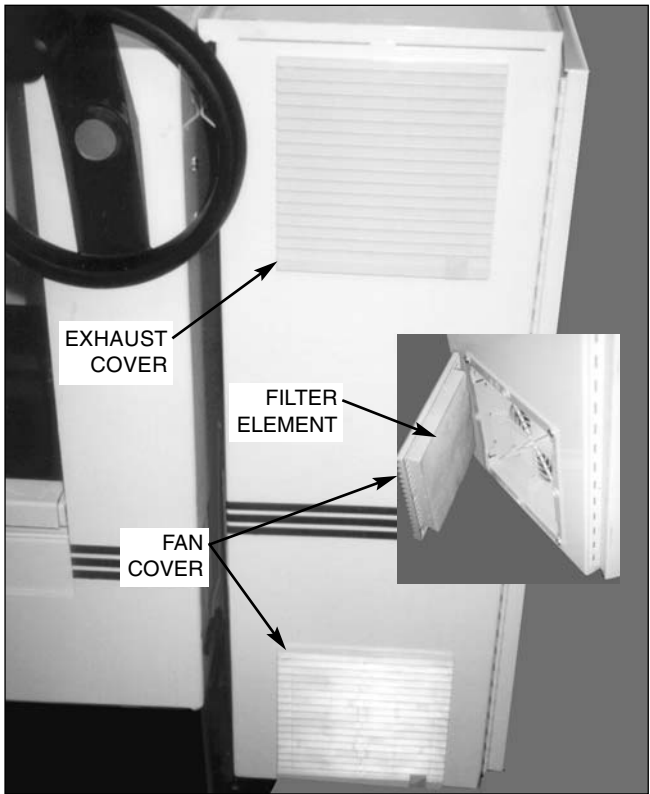


FIGURE 4-7, Electrical Enclosure

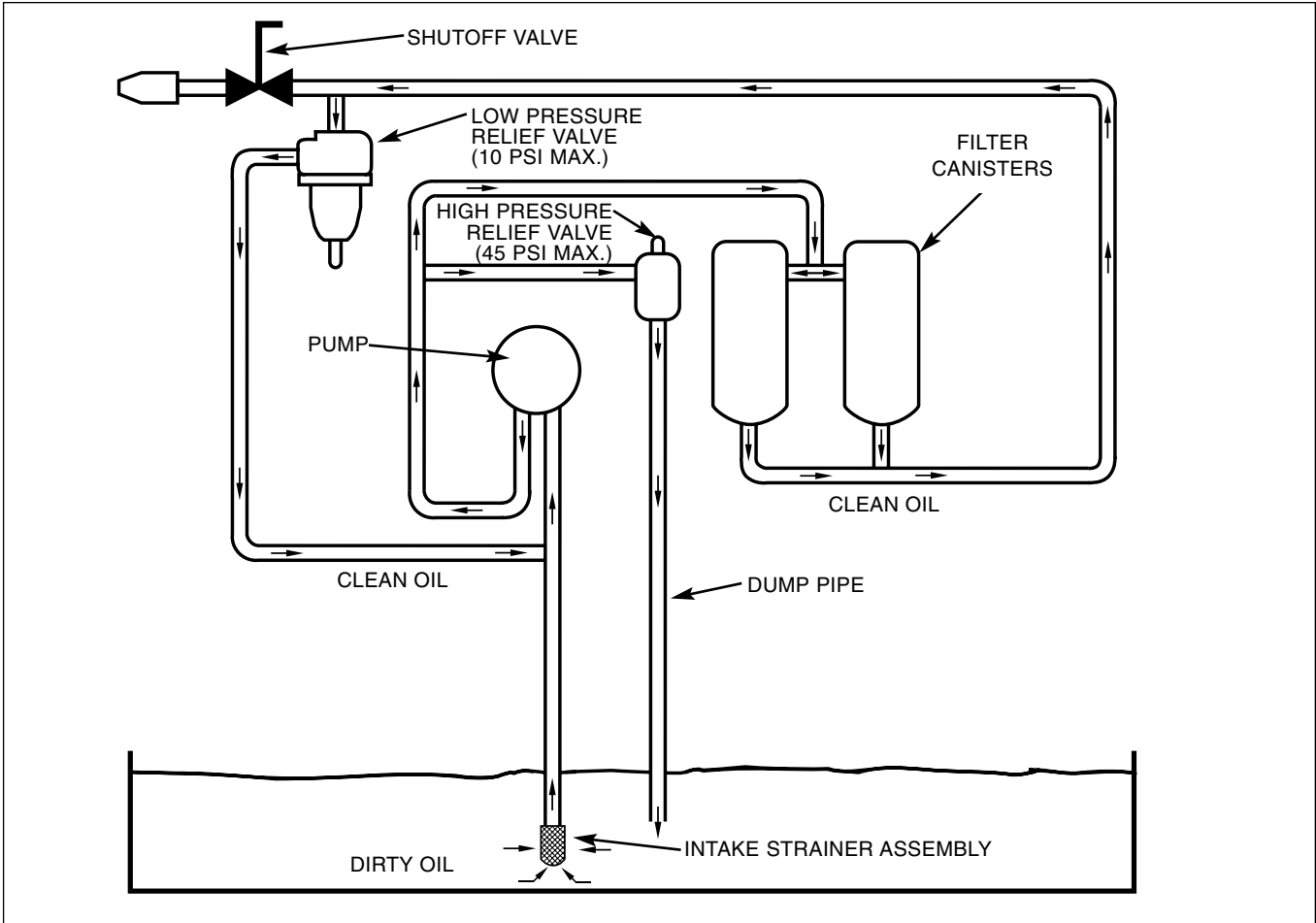


FIGURE 4-8, Coolant Flow Diagram

SECTION 5

TROUBLESHOOTING

GENERAL

This section contains Frequently Asked Questions. Refer to it when problems occur with machine.

FREQUENTLY ASKED QUESTIONS

Q. It seems as if stroker changes speeds during cycle. Why is this?

A. stroker drive on CK-21 is programmed to optimize reversal points in stroke. It is also attempting to maintain a constant crosshatch. To accomplish these things, computer continually updates speed of stroker.

Q. filters on my CK-21 do not seem to last as long. Why?

A. CK-21 removes much more stock in a given time than other honing machines. Check filter life in parts per filter and performance of filters should be about same.

Q. tool got locked up in bore. How do I clear faults safely?

A. More than likely you are showing a STROKER FAULT. computer saw an unacceptable load going to stroker motor, so it shut down machine. order of clearing faults is VERY important for your safety. *Follow this procedure EXACTLY!*

- 1.) DO NOT try to raise handle at this time.
- 2.) Clear faults indicated on RUN Screen.
- 3.) Toggle to SETUP screen.
- 4.) Use UP/DOWN Arrow to JOG.
- 5.) Use LEFT/RIGHT Arrow until field reads TOOL.
- 6.) Retract tool. When tool is loose in bore, there is no more stored energy in system. You may now lift tool from bore.

Q. There seems to be a metallic whine coming from front of drive arm. What is this?

A. spindle drive in your CK-21 utilizes a Planetary Differential to – in part – drive spindle and feed rod. This transmission uses straight cut spur gears to insure longevity and durability. noise you are hearing is normal for this type of gear.

Q. What does Bore display really show me?

A. bore display is meant to be REPRESENTATIVE of shape of hole. This is generally a very accurate depiction. Some very long mandrels will fool display, but these cases are rare. magnitude of taper or barrel shape will differ with stone type and grit hardness. For example, a .003 taper using metal bonds will be more dramatic than EHU-525. You will get a better idea what to expect from different stone sets as you use your CK-21 more; but do not try to MEASURE with this display.

Q. Can I run water based coolant in CK-21?

A. Yes. coolant system components are all compatible with Sunnen Water Based Honing Fluids. To minimize effect that all water based coolants have on painted surfaces, wipe down all surfaces that come into contact with coolant. Do this at end of each shift.

Q. I cannot get my spindle speed selector to change from High to Lo speed. What is causing this?

A. One of two things. First, check to see that belt was changed to appropriate sheave. If this has been done, prox switch may be out of adjustment. There should be a clearance of 1 mm (.040 in.) between solid surface on bottom of idler and face of switch. This is true only on Lo speed setting. red LED will light when prox “sees” target.

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

[illegible]

COOLANT FLOW DIAGRAM

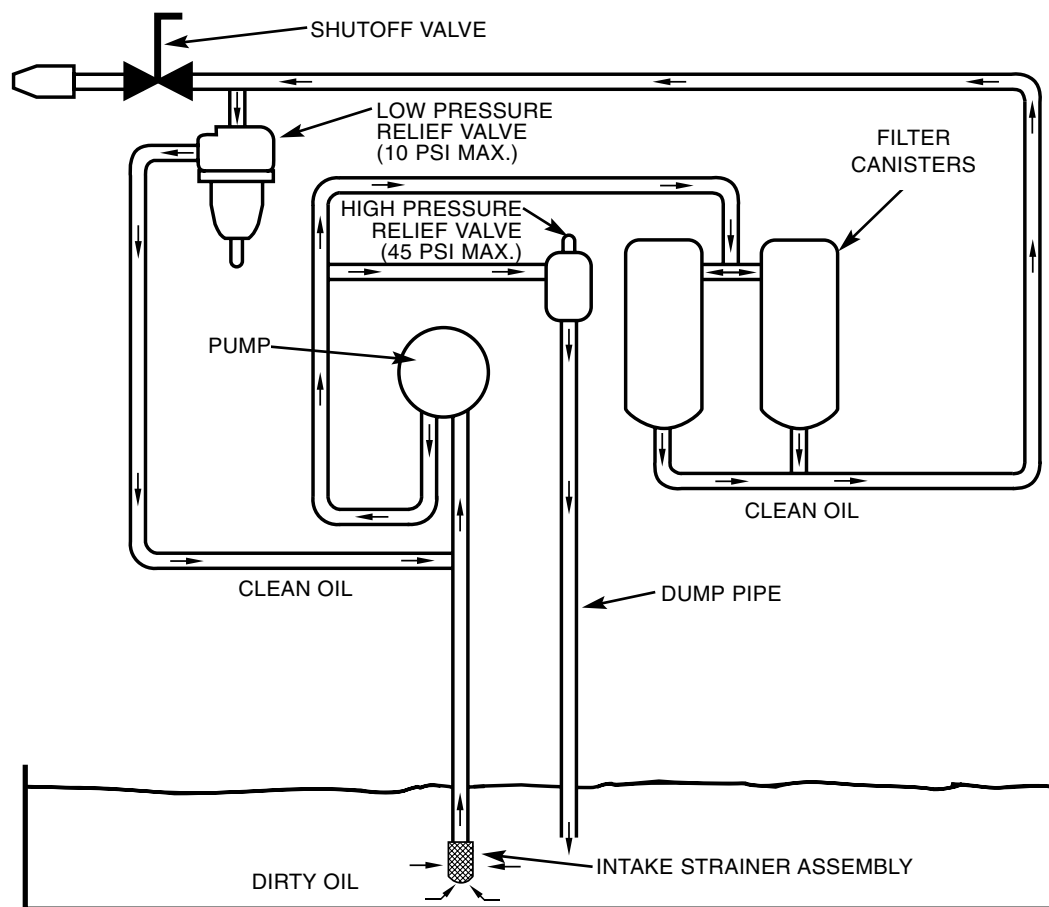


FIGURE A-1, Coolant Flow Diagram

FRACTION / DECIMAL / MILLIMETER EQUIVALENTS CHART

INCH			INCH			INCH		
FRACTION	DECIMAL	MILLIMETER	FRACTION	DECIMAL	MILLIMETER	FRACTION	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
....	.019685	0,5000	11/32	.343750	8,7313	....	.708661	18,0000
....	.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
....	.035433	0,9000	....	.393701	10,0000	49/64	.765625	19,4469
....	.039370	1,0000	13/32	.406250	10,3188	25/32	.781250	19,8438
3/64	.046875	1,1906	27/64	.421875	10,7156	....	.787402	20,0000
1/16	.062500	1,5875	....	.433071	11,0000	51/64	.796875	20,2406
5/64	.078125	1,9844	7/16	.437500	11,1125	13/16	.812500	20,6375
....	.078740	2,0000	29/64	.453125	11,5094	....	.826772	21,0000
3/32	.093750	2,3813	15/32	.468750	11,9063	53/64	.828125	21,0344
7/64	.109375	2,7781	....	.472441	12,0000	27/32	.843750	21,4313
....	.118110	3,0000	31/64	.484375	12,3031	55/64	.859375	21,8281
1/8	.125000	3,1750	1/2	.500000	12,7000	....	.866142	22,0000
9/64	.140625	3,5719	....	.511811	13,0000	7/8	.875000	22,2250
5/32	.156250	3,9688	33/64	.515625	13,0969	57/64	.890625	22,6219
....	.157480	4,0000	17/32	.531250	13,4938	....	.905512	23,0000
11/64	.171875	4,3656	35/64	.546875	13,8906	29/32	.906250	23,0188
3/16	.187500	4,7625	....	.551181	14,0000	59/64	.921875	23,4156
....	.196850	5,0000	9/16	.562500	14,2875	15/16	.937500	23,8125
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
 INCHES (in) x **BY** 25.4 = **TO GET** MILLIMETERS (mm)
 FEET (ft) x 0.3048 = METERS (m)

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

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SUNNEN PRODUCTS COMPANY
 7910 Manchester Ave., St. Louis, MO 63143 U.S.A.
 Phone: 314-781-2100 Fax: 314-781-2268
 U.S.A. Toll-Free Sales and Service –
 Automotive: 1-800-772-2878 • Industrial: 1-800-325-3670
 International Division Fax: 314-781-6128

<http://www.sunnen.com>
 e-mail: sunnen@sunnen.com

SUNNEN PRODUCTS LIMITED

No. 1 Centro, Maxted Road
 Hemel Hempstead, Herts HP2 7EF ENGLAND
 Phone: ++ 44 1442 39 39 39 Fax: ++ 44 1442 39 12 12

SUNNEN AG

Fabrikstrasse 1
 8586 Ennetach-Erlen, Switzerland
 Phone: ++ 41 71 649 33 33 Fax: ++ 41 71 649 34 34

SHANGHAI SUNNEN MECHANICAL CO., LTD.

889 Kang Qiao East Road, PuDong
 Shanghai 201319, P.R. China
 Phone: 86 21 5 813 3322 Fax: 86 21 5 813 2299

SUNNEN ITALIA S.R.L.

Viale Stelvio 12/15
 20021 Ospiate di Bollate (MI) Italy
 Phone: 39 02 383 417 1 Fax: 39 02 383 417 50