ROTTLER

SG7MTS CYLINDER HEAD SEAT & GUIDE MACHINE

OPERATION AND MAINTENANCE MANUAL

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ORDERING PROCEDURE

Contact your regional Rottler sales rep for assistance in ordering optional equipment, replacement parts, or tooling.

If you are unable to contact your regional Rottler sales rep, call the factory at 253-872-7050 and ask to speak to the parts sales specialist.

Have the following information handy to expedite the ordering process:

1. Your name, business name, and contact number
2. Customer number
3. If you don't have a customer number, your billing address
4. Shipping address if different from billing address
5. Machine model and serial number
6. Part number and description of what you want to order
7. Preferred method of shipment
8. You may also contact us via e-mail with the above information. Send e-mail requests to: parts@rottlermfg.com or intlparts@rottlermfg.com

In some cases you may be requested to send a photo of the part you are ordering if it is a replacement part, or doesn't appear in the database.

If you are unsure which part you need to order, contact our service department and ask to speak to one of our service consultants. They will assist you in determining which part you require.

THERE IS A MINIMUM ORDER OF $25.00

INTRODUCTION

Contents

Introduction

READ THE SAFETY CHAPTER BEFORE INSTALLING MACHINE. THOROUGHLY UNDERSTAND ALL SAFETY ISSUES BEFORE OPERATING MACHINE.

ATTENTION OWNER/BUSINESS MANAGER

To validate the warranty on your new Rottler machine, please be sure to sign and complete the "Installation Report" located in the Installation Chapter of this manual.

We suggest that the new user of the SG7MTS read the CONTROL DEFINITIONS to get an idea how the machine operates.

The Operating Instructions chapter should be read in order to familiarize the user with the actual button pushing sequences required to carry out a job. These chapters in the manual should be considered an introduction. As the operators of the SG7MTS series machines gain experience with using the different functions of the machine, complicated setups and programs will make more sense.

The rest of the manual contains information and part number reference on fixtures, cutting tools, and machine maintenance. The operator should read and become familiar with these areas as well.

Description

The SG7MTS uses the same proven fixed carbide pilot tooling as SG7M but now has a front mount steering wheel for spindle downfeed.

The machine have 2 modes of operation:

MANUALMATIC – a brand new concept has been added to these machines which should increase productivity by 30-50%. During seat cutting, the operator does not have to operate any buttons or switches, simply turn the spindle feed steering wheel up and down and the control takes care of all the functions like workhead float/clamp, pilot centering in the valve guide and spindle on/off. When depth of seat is reached, the control automatically changes spindle RPM to high/finish speed to give equal depth of every seat and consistent surface finish results.

MANUAL – the buttons on touch screen are the same as the previous SGM machines. There is no external dial gauge, the spindle vertical position is displayed on the touch screen. Simply feed the spindle down until the cutting insert touches the valve seat, touch set zero button and then the digital display will show exactly where the spindle is at all times. The change from low to high/finishing speed is easier as there are 2 separate buttons. The foot pedal for clamp and float of workhead has been eliminated and now controlled on touch screen for manual and automatically for MANUALMATIC.

The SG7MTS features Rottler's trademark CONCEN that guarantees you get the most accurate and versatile machine possible. Rottler combines precision carbide centering pilots with a light weight air float workhead to give you perfect centering with the valve guide - every time. This guarantees the best CONCEN of valve seat to valve guide centerline in the industry.

Disclaimer

The SG7MTS Manual (henceforth to be referred to as the "Manual") is proprietary to Rottler Manufacturing LLC. ("Rottler Manufacturing") and no ownership rights are hereby transferred. No part of the Manual shall be used, reproduced, translated, converted, adapted, stored in a retrieval system, communicated or transmitted by any means, for any commercial purpose, including without limitation, sale, resale, license, rental or lease, without the prior express written consent of Rottler Manufacturing.

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Rottler Manufacturing and its employees or representatives are not responsible for any information regarding final specifications of any workpiece that is created as a final product when using Rottler equipment. It is the responsibility of the end user of Rottler equipment to determine the final dimensions and finishes of the workpiece that they are working on. Any information regarding final dimensions and finishes that appears in any Rottler literature or that is expressed by anyone representing Rottler is to be regarded as general information to help with the demonstration of or for operator training of Rottler equipment.

Limited Warranty

Rottler Manufacturing Company Model SG7MTS parts and equipment is warranted as to materials and workmanship. This limited warranty remains in effect for one year from the date of installation or two years from the date of the original shipment from Rottler or whichever date occurs first. This only applies is the machine is owned and operated by the original purchaser and is operated and maintained as per the instructions in the manual. A machine is warranted only if the Installation Report has been properly executed by a certified installation person and received by Rottler at the time of actual installation.

The products are warranted upon delivery to conform to their published specifications and to be free from defects in material and workmanship under normal use for a period of one year from shipment. Should a product not be as warranted, Rottler sole obligation shall be, at its option, to repair, correct or replace the product or to refund the amounts paid for the Product upon its return to a location designated by Rottler. No warranty shall extend to rapid wear Products (including tooling) or to Products which have been subject to misuse (including any use contrary to Rottler instructions), neglect, accident (including during shipment), improper handling or installation, or subject to any modification, repair or service not certified by Rottler. Rottler shall not be liable for any consequential, direct or indirect damages or for any other injury or loss. Buyer waives any right, beyond the foregoing warranty, to make a claim against Rottler. No warranty is provided for any Products not paid in full.

Merchandise cannot be returned to Rottler without prior approval. Customer must contact the Parts Department to get approval and to be issued a Return Goods Authorization number **(RGR#).** Merchandise authorized for return must be returned prepaid. If merchandise is returned with shipping charges collect, the actual amount of these charges may be deducted from any credit which may be due the customer. The **RGR #** assigned by the Parts Department should be written on the shipping label and must appear on a copy of the invoice(s) covering the original shipment. This invoice copy must be included in the box with the parts. Shipment must contain ONLY those items on the **RGR** as approved for return. Merchandise must be received within 10 days of the date of **RGR** or the **RGR** will be canceled. All returned merchandise may be subject to a 20% restocking fee on under $1,000.00 amount or 10% on any items over $1,000.00. Parts or tooling over 30 days old are considered as customer property and can only be returned with prior approval from Rottler Corporation Management.

The issuance of a **RGR DOES NOT** guarantee credit - it is only authorization for the return of the goods. Credit for return merchandise is at the sole discretion of Rottler. Credit will be issued only after inspection of returned goods.

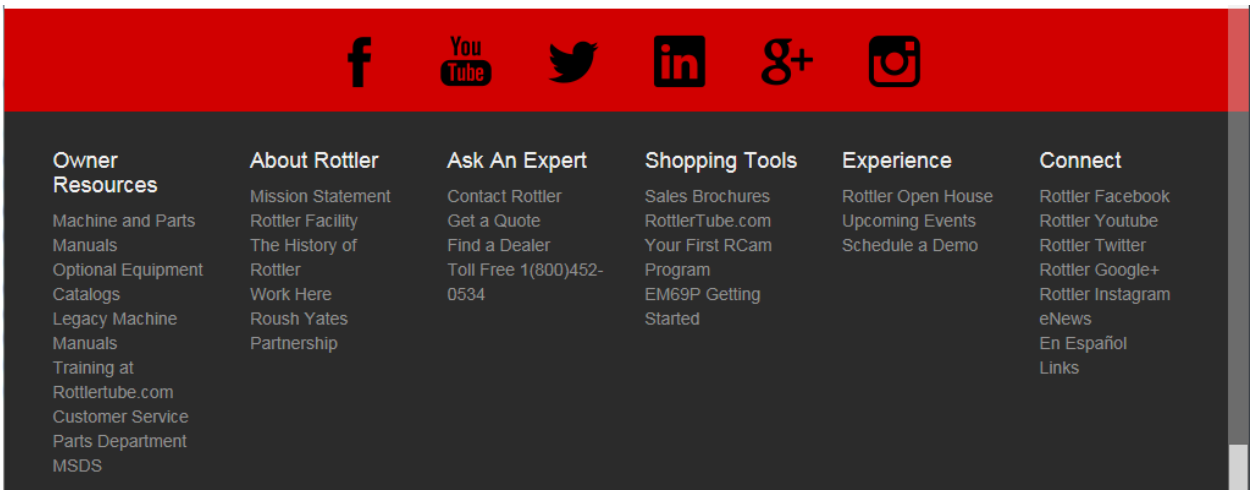
Tools proven to be defective within the warranty period will be repaired or replaced at the factory's option.

We accept no responsibility for defects caused by external damage, wear, abuse, or misuse, nor do we accept any obligation to provide compensation for direct or indirect costs in connection with cases covered by the warranty.

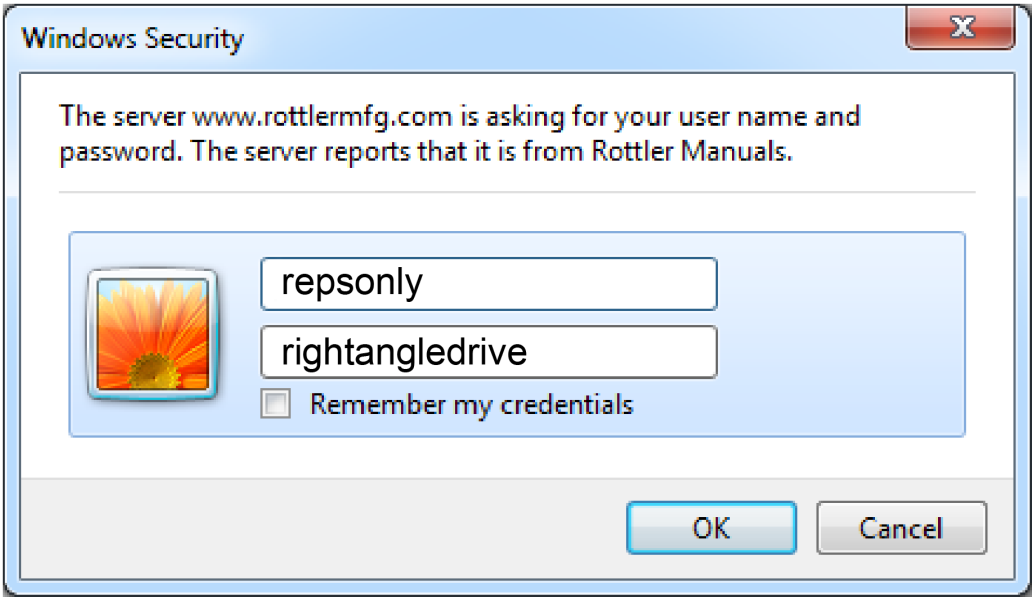
Online Documentation Access

Online documentation for machines and optional equipment can be accessed at the Rottler website. To access documentation open your browser and navigate to https://www.rottlermfg.com.

Scroll to the bottom of the page and under the Owner Resources title click the type of documentation you want to access.



If a log in window pops up asking for user name and password fill in the blanks as shown.



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INSTALLATION

Contents

ATTENTION OWNER/BUSINESS MANAGER

To validate the warranty on your new Rottler machine, please be sure to sign the installation report after the installation technician has installed the machine and verified the machine is operating correctly and given the operators operation and maintenance training.

Thank you for your cooperation and the opportunity to be of service to you.

ROTTLER MANUFACTURING

ROTTLER

INSTALLATION REPORT
SG7MTS
REV 110519

OFFICE USE ONLY

Route to: Parts _____ Service Mgr _____ Assembly Mgr _____ Parts _____ Andy _____ Parts _____

Warranty Exp Date _____

ROTTLER MANUFACTURING MUST HAVE THIS REPORT RETURNED TO PROPERLY QUALIFY WARRANTY ON EQUIPMENT

Customer:_____ Address:_____
City:_____ State:_____ Zip:_____ Phone:_____
Country:_____
Machine Model:_____ Serial Number:_____ Representative:_____

MACHINE INSTALLATION: Electrical information MUST be complete to validate this report.

Customer is responsible for providing electricity to machine in a manner that meets the local electrical code requirements.

_____Check machine level for equal support on feet.
_____This machine requires between 208 and 240 Volts AC, Single Phase, 50/60 Hz power supply. Measure the incoming voltage between L1 and L2. Current requirements for this machine are 15 amps. Measure the incoming AC voltage at least twice during installation.
1) _____VAC 2) _____ VAC
_____Measure each leg of the incoming supply to ground. When using a one leg and neutral of a 380 VAC three phase supply L1 should measure 240 VAC and Neutral should measure almost 0 VAC.
L1 to ground _____VAC L2 to ground _____VAC.

Make sure all electrical equipment has the proper overload protection. The SG7MTS should have a stable power supply to prevent damage and uncontrolled movement of the machine.

⚠ CAUTION Neutral and machine ground are not the same thing. You should measure an open circuit between Neutral and ground.

⚠ CAUTION **IF VOLTAGE IS OUTSIDE THE CORRECT RANGE AT ANY TIME THE MACHINE WILL NOT OPERATE PROPERLY AND MAY BE DAMAGED.**

_____Relocate electrical enclosure from shipping location to operating location on lower right side of machine.
_____Air of the proper pressure and capacity connected to the machine. Air supply must be free from oil and water. Oil or water will damage electrical and air components. Air pressure should never drop below 90 PSI at any time. Failure to provide adequate air supply may cause improper floating and clamping.
_____**BEFORE** turning power on to the machine. Check all wires for security by using the correct screw driver and turning CW until movement stops. Stranded wire can “spread” slightly from vibration during transport.
_____Remove all shipping brackets in accordance with the machine manual.
_____Clean any rust inhibitor from the machine surfaces. Slide the spindle base from side to side continually cleaning the machine base until all inhibitor is removed.

_____Have the operator read through the operation manual before training begins. This will help him be familiar with the button pushing sequences. Have the operator read through the manual again after training and some of the sequences will make more sense.
_____Calibrate angle sensor

MACHINE START-UP

⚠ CAUTION When starting the machine for the first time, it may move out of control. Make sure all hands are clear of machine parts. Be ready to press the Emergency Stop button if needed.

_____Turn main power on from the main incoming breaker box.

MACHINE MOVEMENTS

_____Make sure there is nothing obstructing the full vertical travel of the machine.
_____When the machine is on the clamp mode and the air pressure is with the requirements, try to move workhead to verify that you have a solid clamp of Work head.
_____Place the level on the leveling post. The level assembly is referenced to the spindle via the level pin. It is therefore important to check alignment of the pin in reference to the spindle. Even though the level has been carefully calibrated at the factory, it is a good idea to recheck calibration before putting the machine into service. In the event that the level is dropped or handled roughly then the following recalibration methods should be implemented. If calibration is required refer to manual for Calibrating the Digital Level
_____Start the spindle and verify operation.

INSTRUCTING THE OPERATOR:

Note: Rotter employees and representatives per company policy are not permitted to provide end user of Rottler equipment with any OEM specifications for the workpiece that is created by end user using Rottler equipment.

_____Using the operating manual as a guide explain the function of all buttons.
_____Cycle all machine movements and supervise the handling of same by operator.
_____Demonstrate the engaging of the fine feed system.
_____Point out safety features to customer and operator.

Do not push any buttons without thinking of safety first.

⚠ CAUTION Do not assume the Digital level has been calibrated rotate 180 to verify alignment.

_____The following is a checklist to go through every time the machine is started to begin machining a seat.

- Work piece secure
- RPM set
- Tool holder adjusted to the correct setting base on the type of seat you will be machining
- Tool holder locked in place
- Floating of the Workhead and clamping

_____Proceed to have operator to machine a seat under you control.
_____**Parts ordering, refer to the operating manual for part numbers and description.**
_____Review Emergency stop procedure and with operator per operating manual.

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Note: Rotter employees and representatives per company policy are not permitted to provide end user of Rottler equipment with any OEM specifications for the workpiece that is created by end user using Rottler equipment.

General remarks on machine performance, adjustments as received and any further organization or parts required to complete the installation.

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Instructions given to:_____

Sales/Service Engineer: _____ Date_____

Shop Foreman/Superintendent or Owner: _____ Date_____

Once completed send this form to:
Rottler Manufacturing
attn: Parts Department
8029 S 200 St
Kent, WA 98032 USA

Alternately you may send this form via fax or e-mail:
fax: [+1] 253-395-0230
e-mail: parts@rottlermfg.com

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Installation Procedure

Location

The productivity of the SG7MTS will depend a great deal on the proper initial installation. Pay particular attention to the means by which work pieces are lifted into and out of the machine as well as the material handling to and from other operations in your shop. The proper loading arrangements and work location for your SG7MTS is extremely important.

For shops where large production runs are anticipated, the work pieces should be loaded and unloaded directly from a conveyor. If this is not the case, we suggest you pay considerable attention to the crane so that it covers an adequate area to allow the operator to back up and remove work pieces without creating a cluttered, dangerous work area.

Unpacking and Lifting

Use care when removing the crate materials from the machine. Be careful not to use force on any part of the machine.

Remove the shipping screws (4) from the skid; the shipping brackets will be painted red for easy identification. These screws are located at the four bottom corners of the Main Base.

⚠ CAUTION **THIS MACHINE IS TOP-HEAVY.** Use care when lifting and moving Machine. Approximate shipping

Weight of Machine is 1800 lbs. (1258 kg).

Positioning the Machine

⚠ WARNING Lift Machine using a fork lift. Move fork lift to front of Machine and separate forks so they are visually centered. Insert forks under front-center of Machine, using care not to damage Foot Pedals Valve or Air Lines. Tilt forks slightly upward so Machine will lean toward fork lift and lift Machine.

While Machine is on fork lift, install five (6) Leveling Screws and Jam Nuts in holes provided in bottom of Machine Base. Two (2) Screws installed in rear-corners and one (2) Screw installed in front and rear -center of Machine Base will serve as Leveling Screws; while two (2) Screws installed in front-corners of Machine Base will serve only as Support Screws. Move Machine to desired location and placed leveling bolts over the center hole of the Leveling Pad. Be certain to allow sufficient clearance to allow access for leveling and also for connecting air and electrical lines. Lower machine onto leveling pads making certain that the leveling bolts align into counterbore on leveling pads. Be certain nothing interferes with air or electrical lines running from the floating head assembly to the cabinet. Determine there is no possibility of air or electrical lines dragging on wall surfaces or adjacent machinery. Wipe top Rails with a clean, dry cloth to remove protective shipping oil.

CAUTION Do not attempt to move the Work Head unless Air Supply is connected, and air valve is turned on, and foot Pedal is depressed, allowing Head to float on Rails apply (WD40) or similar degreaser and flow the work Head side by side to remove all the shipping oil from under the work head. (Top Upper surfaces rails should be clean and free of oil).

CAUTION Do not attempt to move the Work Head unless Air Supply is connected, and air valve is turned on, and foot Pedal is depressed, allowing Head to float on Rails apply (WD40) or similar degreaser and flow the work Head side by side to remove all the shipping oil from under the work head. (Top Upper surfaces rails should be clean and free of oil).

Removing Shipping Brackets

Before leveling the machine, loosen and remove the all shipping brackets and bolts. (Figures 1 – 5)

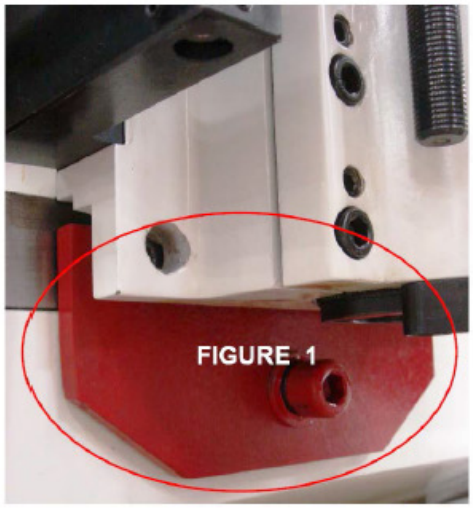


FIGURE 1

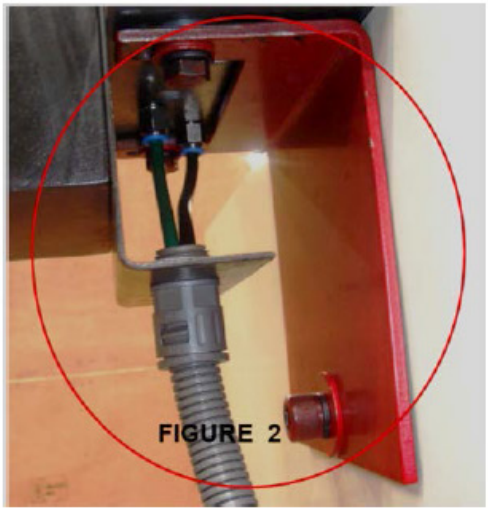


FIGURE 2

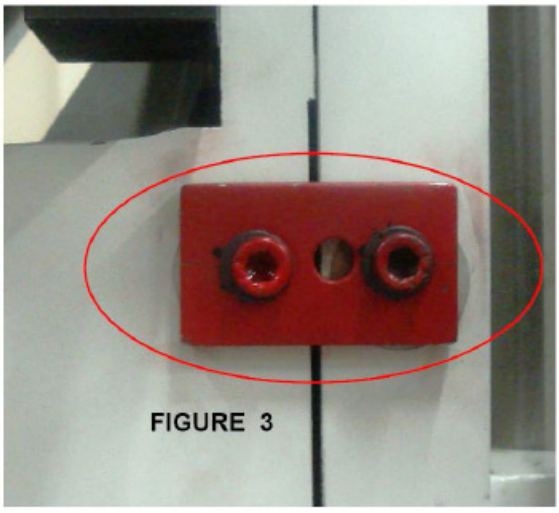


FIGURE 3

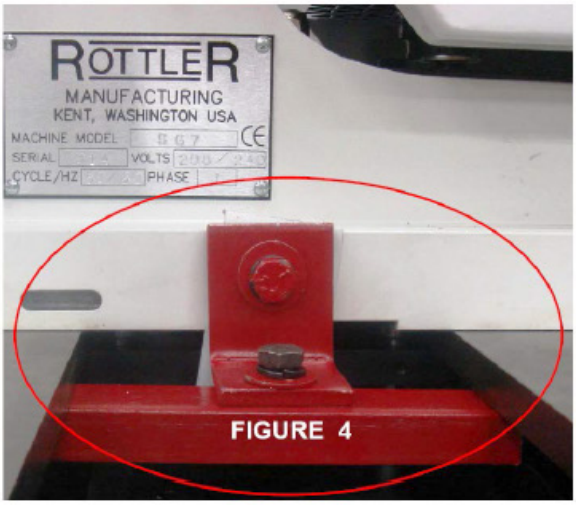


FIGURE 4

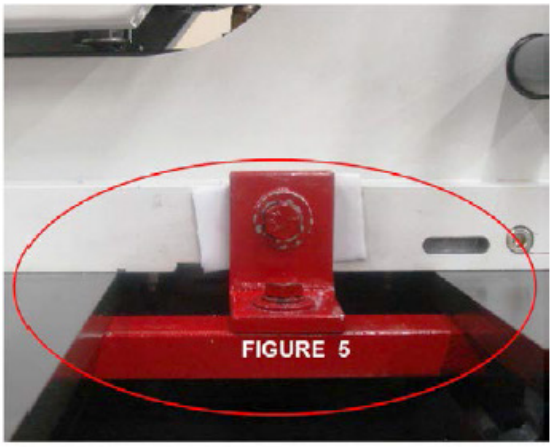


FIGURE 5

Leveling the Machine

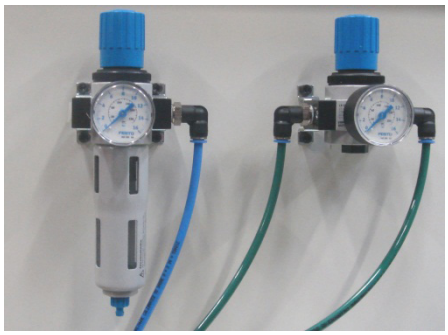
Use required machinist level. (Starret 98 or better).

NOTE: Rotate Level 180º to check that Level is properly adjusted. If Level does not read same in both directions, recalibrate level.

Use the level on the upper float surface, level the machine as precisely as possible, front to back and side to side.

Adjust 4 corners until level and then extend the 2 center leveling bolts to support machine. Tighten jam nuts on leveling bolts and recheck level

Air Supply



It is very important the air source for the SG7MTS machine be moisture free. Water and oil in the line will result in early cylinder and valve failure. The factory recommends installing a water trap at the machine.

Attach a 100 PSI air source to the appropriate intake in the small enclosure located on the left rear of the machine near the bottom.

Bellow you will see the Air regulator panel for the different settings on the flouting planes on the machine. And cabinet cooler air regulator.

Air Adjustments

Float

The float regulator is located at the rear of the spindle base on the bottom of the interconnect box.

If the machine is not floating properly, it could be from too much or too little air from the regulator. Turn the regulator all the way off (full counter clockwise). Start turning the regulator slowly clockwise while continually checking the Work Head for proper floatation. Once the correct float is established, lock the regulator into place by pushing in on the blue adjusting knob.

CAUTION

Use as little air as possible to achieve correct floatation. Using too much air will could cause the spindle base to move slightly to the right when going into tilt. This will cause a scratch up the side of the cylinder.

Power Supply

This machine has the following power requirements:

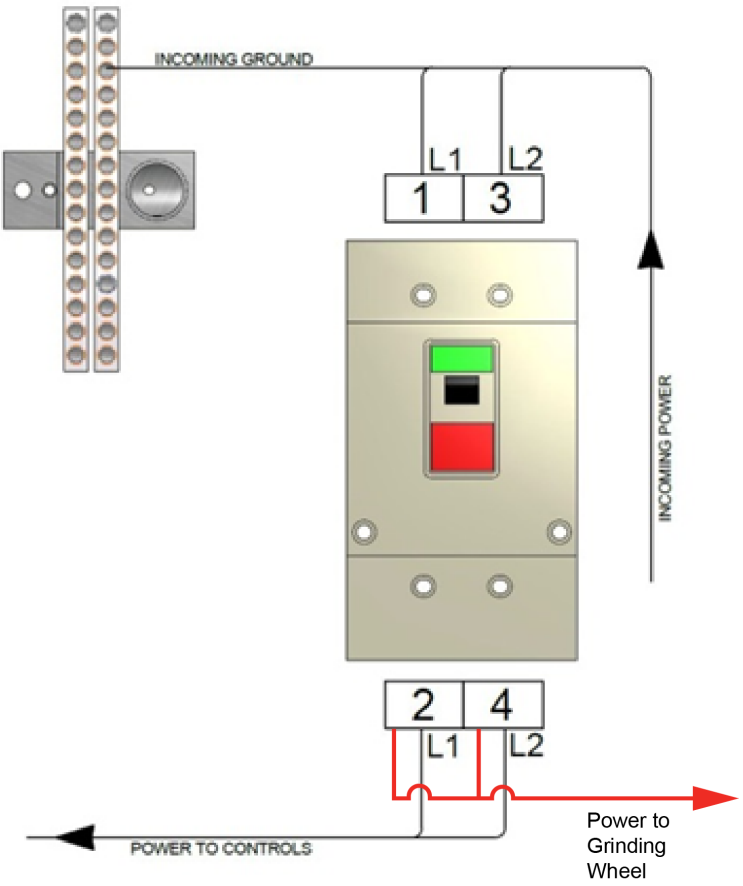
- 208 to 240 VAC
- Single Phase Power
- 50 or 60 Hz
- 15 Amps

See illustration below for correct connection of incoming power. Measured power at the machine's main breaker must be within the required range listed above. If incoming power is not within range, a transformer must be used. Failure to do so will cause the machine to function abnormally and cause permanent damage to the electronic control system.

Some electrical services contain a "Hot Leg, High Leg, or Wild Leg", where single phase is derived from a three phase connection and one leg measures 208VAC to Ground instead of 120VAC. It is not permitted to use the "Hot Leg" for providing power to this machine. Voltage measured between the phases must be between 208VAC and 240VAC, while each phase to ground must be ~120VAC.

IMPORTANT ***Electrically connect in accordance with national and local electrical codes.***

⚠ CAUTION ***Do not attempt to connect more 240VAC to this machine.***
Do not attempt to connect to Three Phase Power.



Grounding

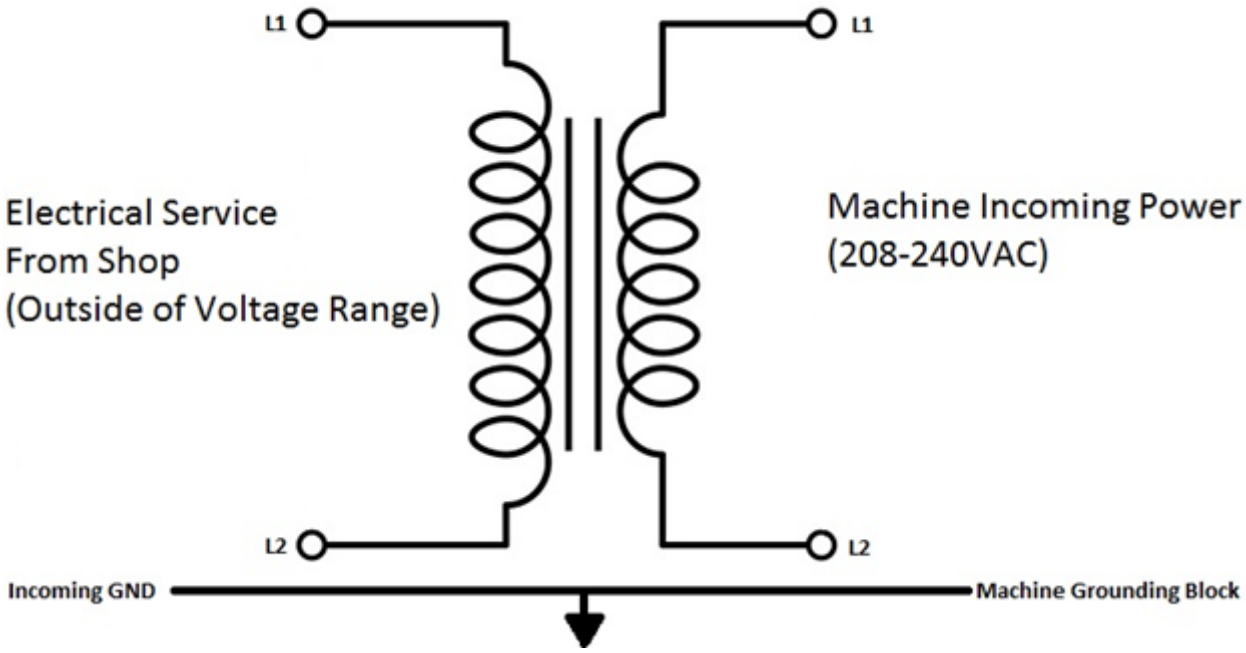
The machine requires a good earth ground. The grounding conductor from the incoming power source must be connected to the grounding block located inside of the electrical cabinet. A ground rod installed in addition to the electrical service grounding conductor is permitted, but must be connected directly to the grounding block inside of the electrical cabinet. Connecting the ground rod to the machine base is not permitted. Consult a Licensed Electrician in your area to assess the installation, and install the appropriate ground rod if necessary. Failure to do so may lead to an installation that is unsafe and does not meet national and local electric codes.

Transformer Connections

This machine has the following minimum transformer size requirement:

- 5 kVA

If a transformer is necessary for machine installation, please refer to the diagram below for connection information. Transformers must be sized to meet the minimum power requirements listed above. Consult a Licensed Electrician in your area for transformer selection and installation.



SAFETY

Contents

Safety Information

⚠ WARNING For Your Own Safety Read This Instruction Manual Before Operating This Machine.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

⚠ DANGER **DANGER** indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

⚠ WARNING **WARNING** indicates a potentially hazardous situation which, if not avoided, could result in serious injury.

⚠ CAUTION **CAUTION** indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

CAUTION **CAUTION** used without the safety alert symbol indicates a potentially hazardous situation which, if not avoided, may result in property damage.

⚠ WARNING This machine is capable of causing severe bodily injury.

Safety Instructions for Machine Use

ONLY A QUALIFIED, EXPERIENCED OPERATOR SHOULD OPERATE THIS MACHINE. NEVER ALLOW UNSUPERVISED OR UNTRAINED PERSONNEL TO OPERATE THE MACHINE. Make sure any instructions you give in regards to machine operation are approved, correct, safe, and clearly understood.

KEEP GUARDS IN PLACE and in proper working order.

KEEP WORK AREA CLEAN. Cluttered areas and benches invite accidents.

KEEP CHILDREN AND VISITORS AWAY. All children and visitors should be kept a safe distance from work area.

WEAR THE PROPER APPAREL. DO NOT wear loose clothing, gloves, rings, bracelets, or other jewelry which may get caught in moving parts. Non-Slip safety shoes are recommended. Wear protective hair covering to contain long hair.

ALWAYS USE SAFETY GLASSES. Also use face or dust mask if cutting operation is dusty. Everyday eye glasses only have impact resistant lenses, they are NOT safety glasses.

DO NOT OVER-REACH. Keep proper footing and balance at all times.

USE THE RECOMMENDED ACCESSORIES. Consult the manual for recommended accessories. The use of improper accessories may cause risk of injury.

CHECK DAMAGED PARTS. Before further use of the machine, a guard or other part that is damaged should be checked to determine that it will operate properly and perform its intended function. Check for alignment of moving parts, breakage of parts, mounting, and other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced.

NEVER OPERATE A MACHINE WHEN TIRED, OR UNDER THE INFLUENCE OF DRUGS OR ALCOHOL. Full mental alertness is required at all times when running a machine.

IF AT ANY TIME YOU ARE EXPERIENCING DIFFICULTIES performing the intended operation, stop using the machine! Then contact our service department or ask a qualified expert how the operation should be performed.

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Machine Capacity:

Do not attempt to use the machine beyond its stated capacity or operations. This type use will reduce the productive life of the machine and could cause the breakage of parts, which could result in personal injury**.**

Avoid Accidental Starting:

Make certain the main switch is in the OFF position before connecting power to the machine.

Careless Acts:

Give the work you are doing your undivided attention. Looking around, carrying on a conversation and horseplay are careless acts that can result in serious injury.

Job Completion:

If the operation is complete, the machine should be emptied and the work area cleaned.

Replacement Parts:

Use only Rottler replacement parts and accessories; otherwise, warranty will be null and void.

Misuse:

Do not use the machine for other than its intended use. If used for other purposes, Rottler Manufacturing disclaims any real or implied warranty and holds itself harmless for any injury or loss that may result from such use.

⚠ CAUTION No list of safety guidelines can be complete. Every shop environment is different. Always consider safety first, as it applies to your individual working conditions. Use this and other machinery with caution and respect. Failure to follow guidelines could result in serious personal injury, damage to equipment or poor work results.

Electrical Power

Make sure all electrical equipment has the proper overload protection. The SG7MTS should have a ***fully isolated*** power supply to prevent damage and uncontrolled movement of the machine.

If the SG7MTS is on the same power lines that are running to other electrical equipment (grinders, welders, and other AC motors) electrical noise can be induced into the SG7MTS electrical system.

Electrical noise can cause the controller to see false signals to move. Not supplying a fully isolated supply to the machine may void factory warranty. Refer to the Power supply section later in this chapter for voltage and amperage requirements of the SG7MTS.

⚠ WARNING Electrocution or a fire can result if the machine is not grounded correctly. Make sure the ground is connected in accordance with this manual. DO NOT operate the machine if it is not grounded. In the event of an electrical short, grounding reduces the risk of electric shock by providing a path of least resistance to disperse electric current.

⚠ WARNING All electrical power should be removed from the machine before opening the rear electrical enclosure. .

CAUTION When you doing any operation on the cylinder head; the machine is capable of throwing metal chips. Eye protection must be worn at all times by the operator and all other personnel in the area of the machine.

⚠ WARNING The operator and nearby personnel should be familiar with the location and operation of the Emergency Stop Button.

CAUTION No single list of electrical guidelines can be comprehensive for all shop environments. Operating this machinery may require additional electrical upgrades specific to your shop environment. It is your responsibility to make sure your electrical system comply with all local codes and ordinances.

Machine Operator

The operator of the SG7MTS should be a skilled machinist craftsman who is well versed in the caution, care, and knowledge required to safely operate metal cutting tools.

If the operator is not a skilled machinist he/she must pay strict attention to the Operating Instructions outlined in this manual, and get instruction from a qualified machinist in both production and operation of this machine.

The SG7MTS machines have the following areas of exposed moving parts that you must train yourself to respect and stay away from when they are in motion.

⚠ WARNING

Cutting Tool Area – Any operation involving hands in the tool holder, such as inspection or alignment of the tool holder or tools, changing tool holder or insert holders, tool insertion, and removal, tool holder changes, and size checking etc. requires the machine to be in neutral or on the off position.

CAUTION

Machining – Eye protection must be worn during all operations of the machine. Hands must be kept completely away from the cutter head.

CAUTION

Work Loading and Unloading – Carefully develop handling methods of loading and unloading work pieces so that no injury can result if hoist equipment or lift connection should fail. Periodically check lift components for damage that may cause failure of Cylinder head Handler Assembly.

CAUTION

Machine Maintenance – Any machine adjustment, maintenance or parts replacement absolutely requires a complete power disconnection from the machine.

Emergency Procedure

Assuming one of the following has occurred: tool bit set completely off size, work piece or spindle base not clamped, spindle is not properly centered, and these mistakes will become obvious the minute the cut starts

PRESS THE EMERGENCY STOP BUTTON (on the front control panel) **IMMEDIATELY!**

Find out what the problem is; return the spindle to its up position without causing more damage. To restart the machine, turn the Emergency Stop Button CW until the button pops out

Be alert to quickly stop the machine in the event of a serious disruption of the boring process either at the top or bottom of the bores.

“REMEMBER” metal cutting tools have the speed and torque to severely injure any part of the human body exposed to them.

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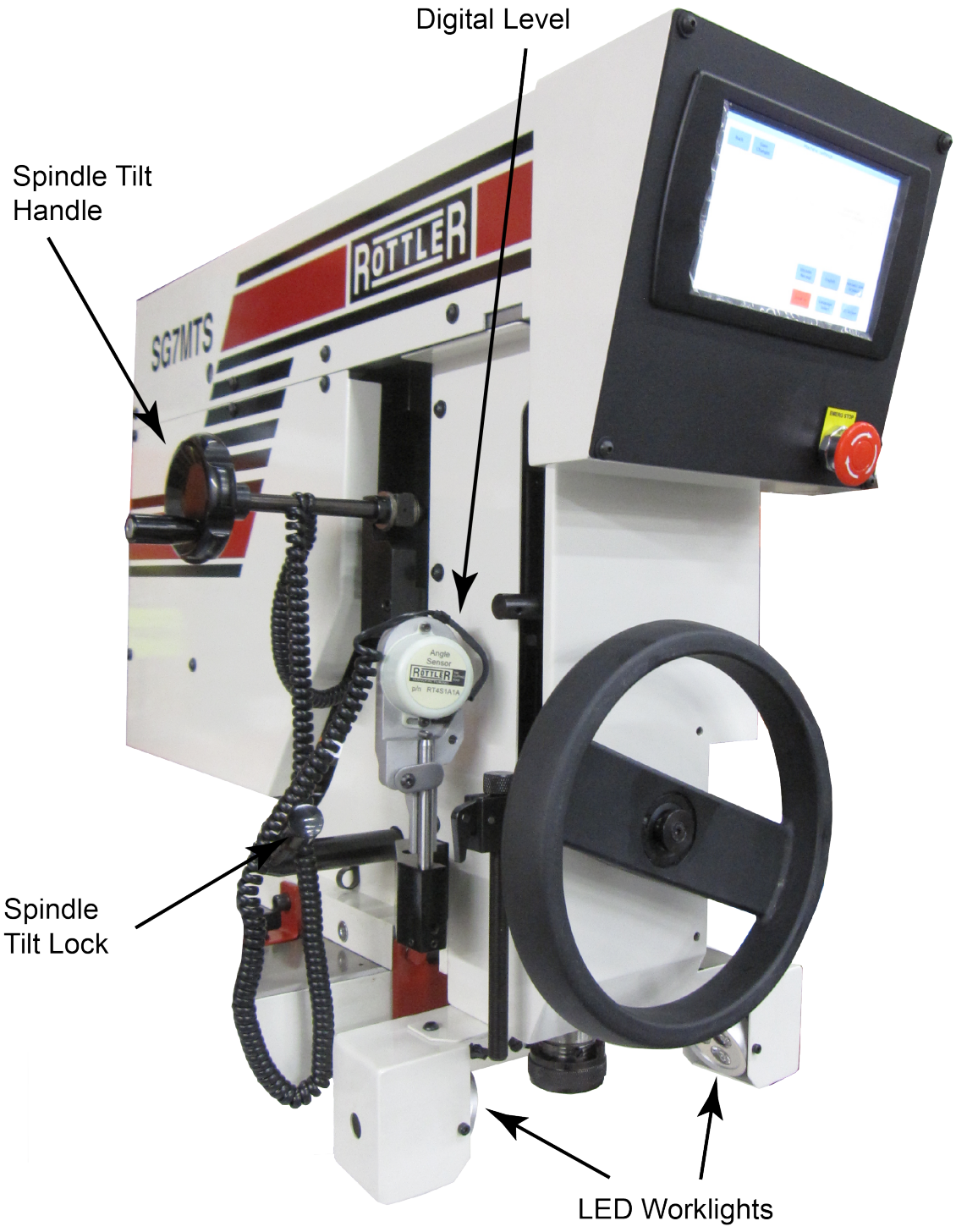
CONTROL DEFINITIONS

Left Side Controls



Right Side Controls

OPERATING INSTRUCTIONS

Contents

Operating Instructions

Mounting Tool Sharpener

Mount tool sharpener on right hand side of machine using the cap screw provided with machine.

Sharpening the Rottler form Carbide bits, consists of restoring the tool cutting angle by grinding the face.

To sharpen the carbide bit must be fitted on the bit holder also fitted on the tool holder.

The tool holder will be placed on the adjustable 3/8 fixture of the tool sharpener.

Slide the tool holder on the fixture, and release the adjusting knob.

Adjust the fixture to bring the carbide bit flat against the grinding wheel.

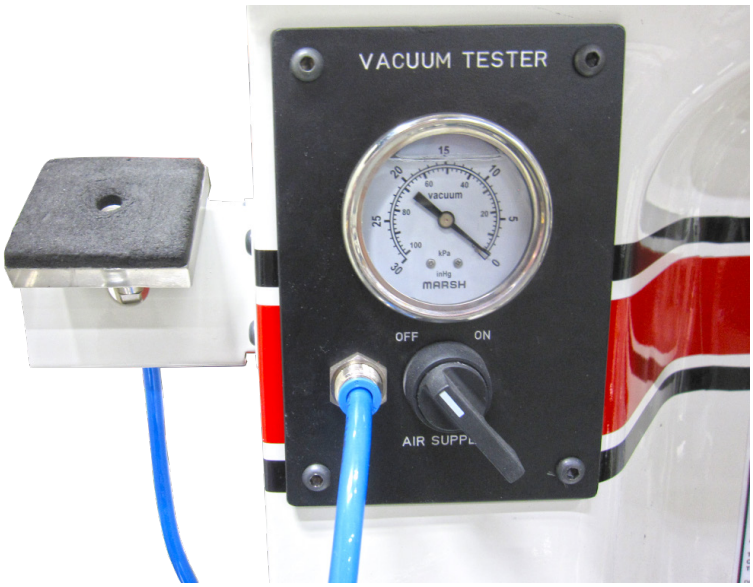
Make sure the carbide tip face is perfectly parallel to the wheel face by pushing it with the thumb. Once a good setting is achieved, lock the adjusting knob.

Before starting the grinding motor, move the carbide bit away from the wheel by rotating the tool holder. The motor should then be started and the carbide tip face moved into the wheel until contact is made.

There is no need to remove a lot of stock from the carbide bit. Sharpening only consists in providing a new cutting face.

Built In Venturi Vacuum Tester

Designed to test valve seat and seat surface seal, and particularly to measure the value seat surface quality after machining. Including a set of 7 pads and connecting extension.



Mounting Cylinder Heads

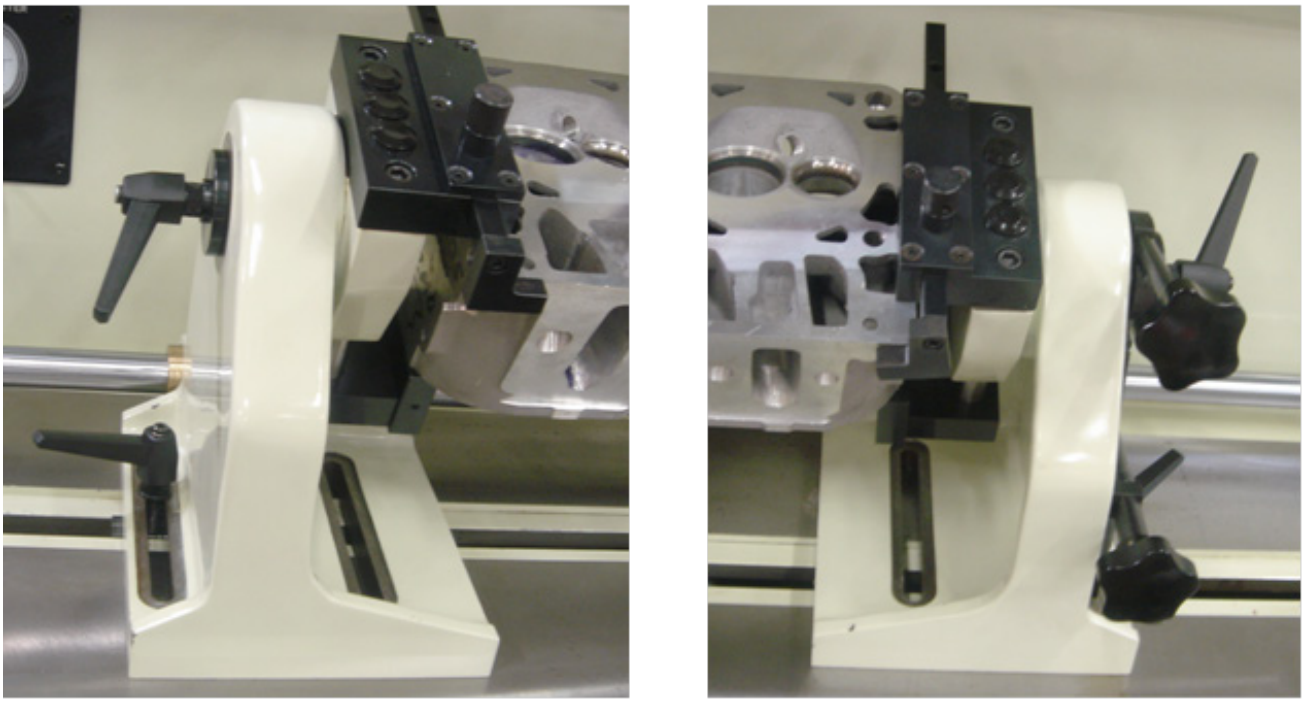
360 Degree Rollover Fixtures

Initial clamp height adjustments to the head trunnions can be accomplished by measuring the head thickness then raising the turning clamping block assembly to the appropriate height using the clamping block acme screws. A 10mm T-handle allen wrench works well.

Measure the length of the cylinder head. Spread the trunnion assemblies apart from each other so that the cylinder head can be clamped in between the trunnions.

Each support has an adjustable stop, located to the front. The stops have indents, allowing a number of different settings. Position of the stops must be checked for each cylinder head put on the supports. In most cases we will install the cylinder head deck side down with the exhaust side of the head against the adjustable stops. This is particularly true of wedge style heads. It is necessary for the clamps to thrust the cylinder head against the stops when clamped. When heads are mounted in this fashion, the tallest portion of the combustion chamber will be at the rear of the machine when the head is rotated into the working position. Try to keep the valve guide center line parallel to the trunnion centerline. (Figure 4)

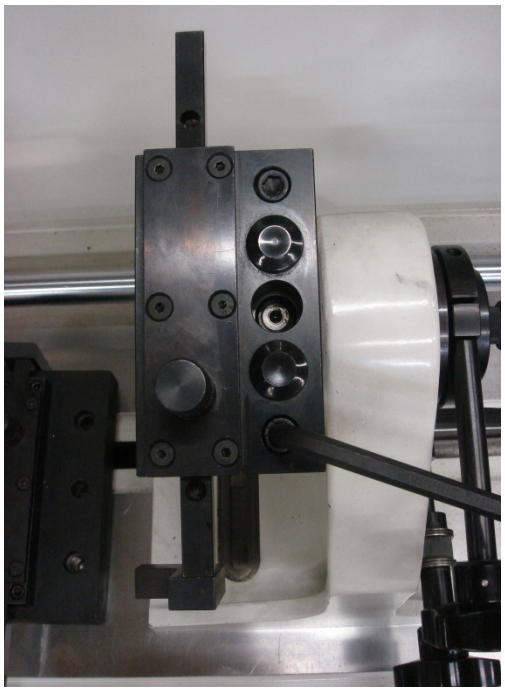
FIGURE 4

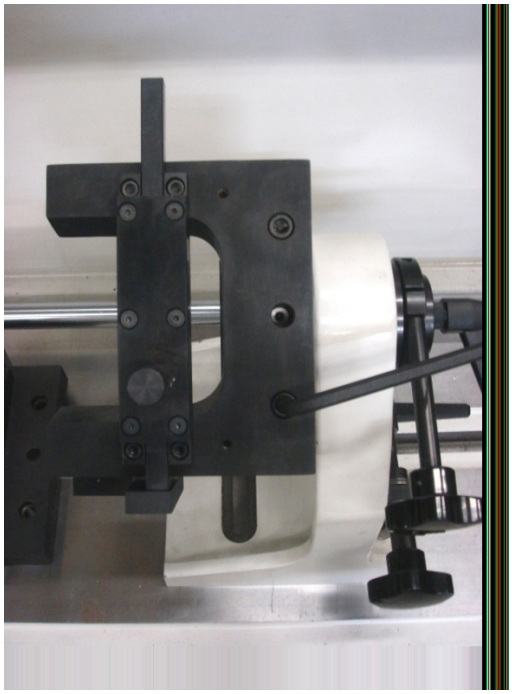


Utilize the grooves in the table to align the trunnion supports square to the machine.

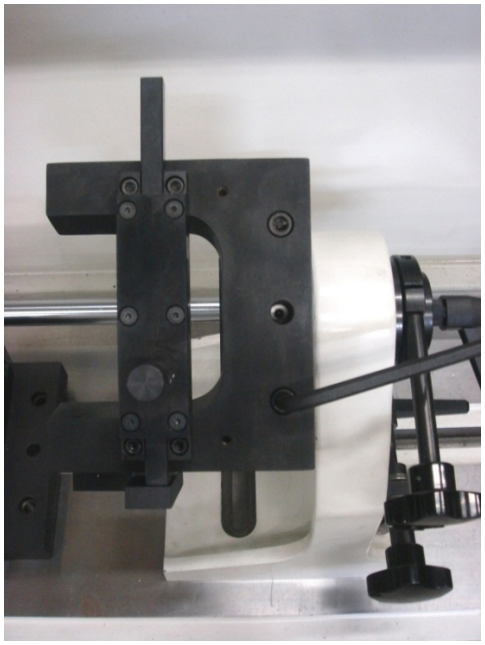
Overhead Cam C Clamp System

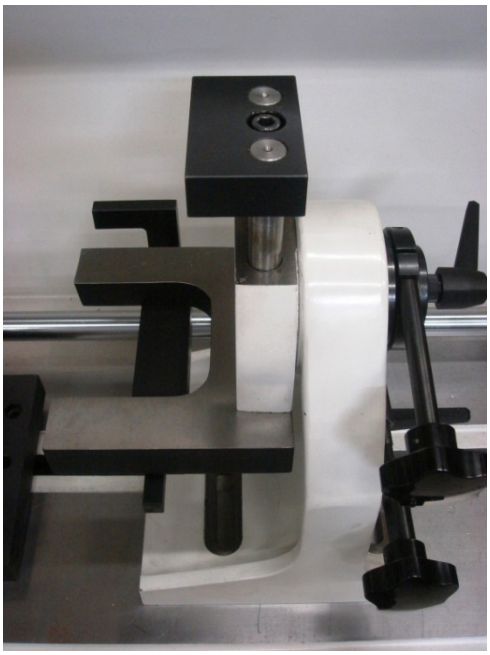
Using 10mm Allen wrench, remove the existing lower fixed plate on the 360 degree fixture (left and right)





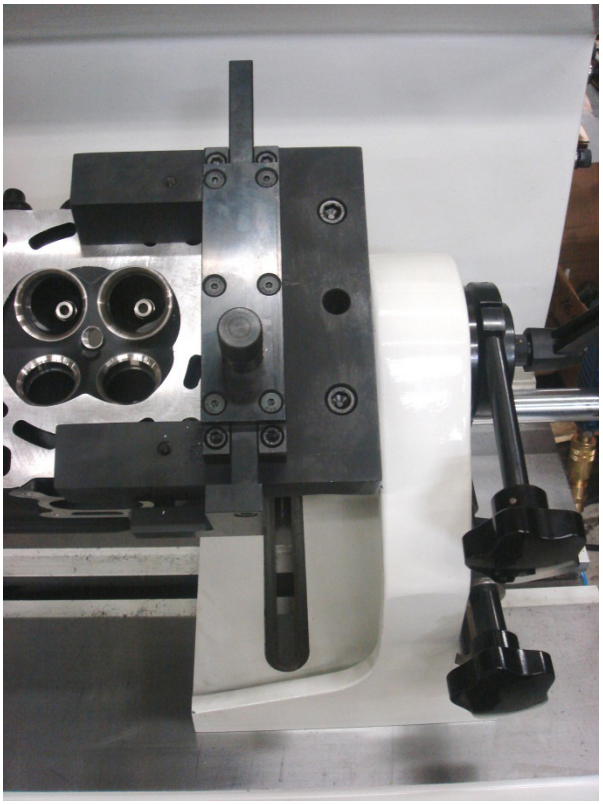
Install the C Clamp, you must use the two bolts included with the fixture and make sure is good and tight

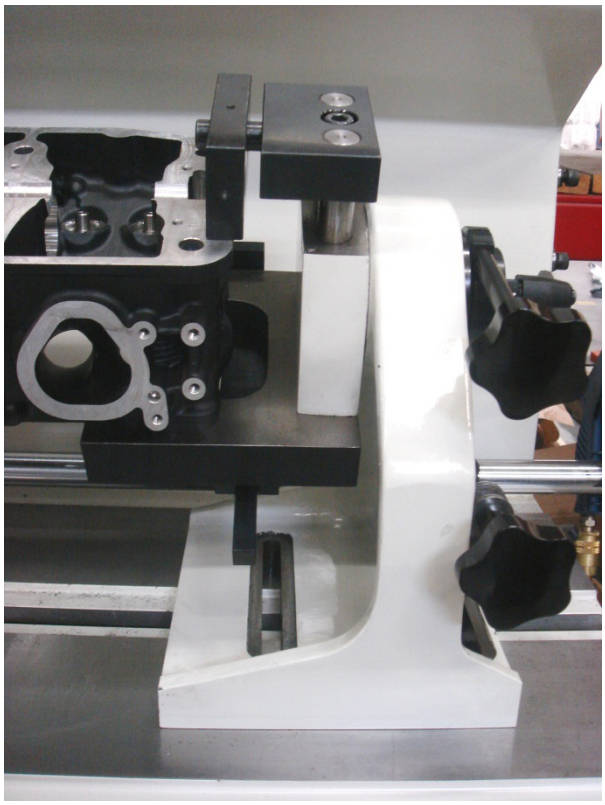




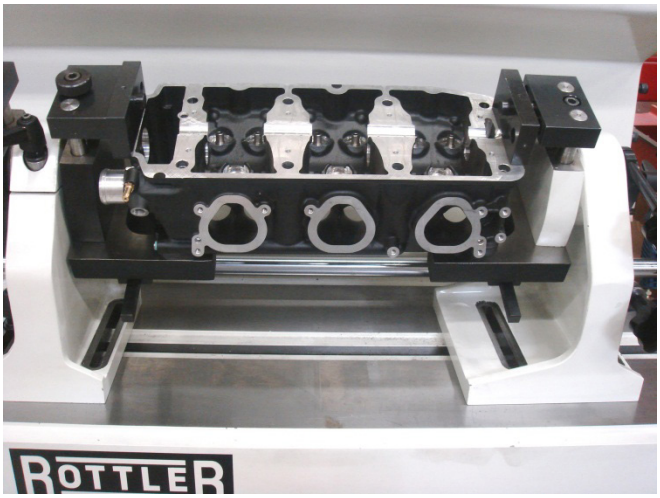
The cylinder head gasket surface must be against the machined surface of the U Clamp Fixture; Slide the stopper rod equally and push the cylinder heads against the stopper rods.

Note: for some cylinder heads, you make need a spacer against between the cylinder head and the stopper rod (not included)





The Quick-Clamp frame is mounted between the trunnions and clamped using the clamping plates. (See Pictures) The cylinder head is then held to the frame with the swivel clamp assemblies through the appropriate head bolt holes or used the standard clamp plates.



On This cylinder head they using both C frames

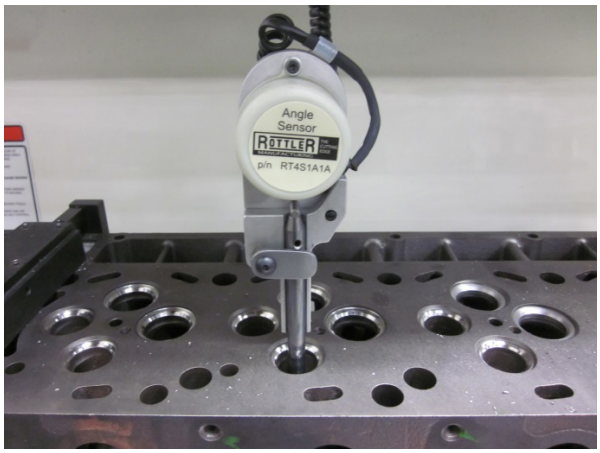
Alignment and Setup

Alignment and setup applies to both the cylinder head and the machine's floating head. The goal is to get perfectly align to the spindle centerline of the area of the head to be machined. Most machining operations on cylinder heads use the valve guide centerline as the reference point so we will use that as an example.

Note: think of the digital electronic level as a comparator. Because the leveling pin is square to the machines spindle, as long as you achieve the same readings front to rear and side to side then the spindle will be in perfect alignment.

Front to Rear Cylinder Head Alignment

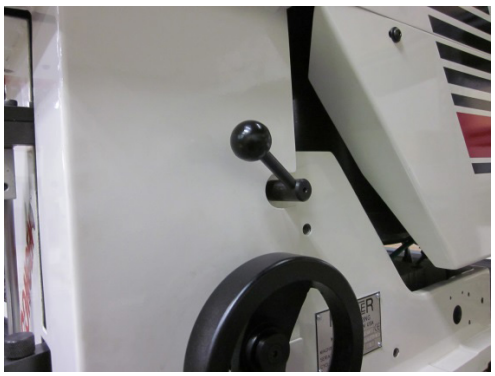
Position the level on level pin to read front to rear and take a reading. Rotate the cylinder head so that the valve seats are facing up. Now place the level on a pilot in the cylinder head and position the level to read front to rear. Loosen the lock levers on the supports. Be certain the fine adjustment lock screw is loosened. Coarse adjustment is made by turning the work piece manually, until the level reading is within a couple of degrees of the reading on the leveling post.



Lightly tighten the lock levers on the supports to remove any play. Now tighten the clamp on the fine adjustment screw. Turn the adjustment knob to achieve the exact reading that was observed on the leveling post. You can now completely tighten both the left and right support locks.

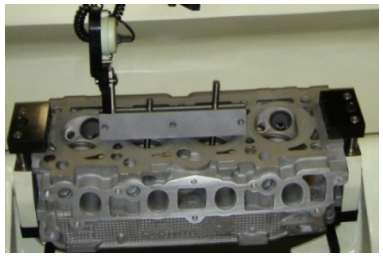
Left to Right Alignment

Obtain the left to right reading from a pilot mounted in a guide in the cylinder head. Now place the level on the leveling post. Loosen both of the tilt lock levers on each side of the quill housing. Use the tilt adjusting hand wheel to adjust the reading to be the same as that found on the pilot in the cylinder head. Tighten the tilt lock levers.



Canted Valve Cylinder heads (Automotive Application)

An optional alignment bar is available that helps establish the front to back alignment on canted valve cylinder heads. The bar is held against two pilots in two adjacent guides. Use the alignment post to adjust the angle. (See Picture)



Three Angle Seat Cutting

Place the ball drive adapter in the spindle. Align spindle to valve guide.

Place a valve in the setting fixture. Position the pointer on the valve where you wish to place the top of the seat.

Remove the valve; replace it with the correct pilot.

Select the proper diameter tool holder. Place the carbide insert in tool holder. Slide tool holder onto ball head.

Place ball head over the pilot in setting fixture. Use radial adjusting screw to set diameter of cutter to correspond to position of pointer on setting fixture.

Tighten hex socket screws on bottom of ball head. See figure 9

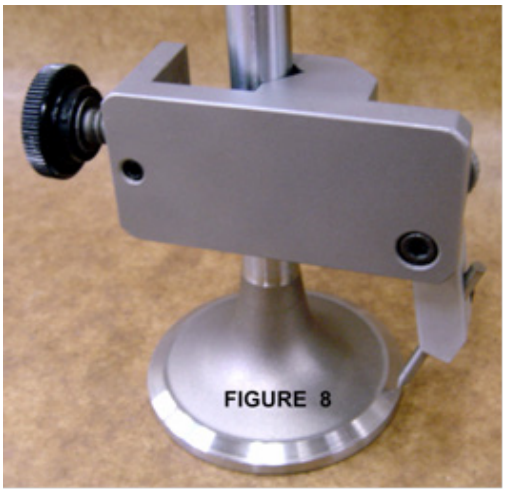


FIGURE 8

Remove ball head assembly from setting fixture. Place fixed carbide pilot in cylinder head.

Center the spherical ball head tool holder over the pilot shank.

Required spindle rotation speed will vary, depending on seat hardness. As seat hardness increases, so does the required spindle speed. Some will require full speed.

Special care should be taken in centering the floating head above the valve guide, to achieve a concentric seat.

Cut seat only enough to clean up surface.

Too much cutting will sink the valve too far in the head. Many operators prefer to use the spindle fine feed when machining seats as extreme control of spindle down feed can be accomplished.

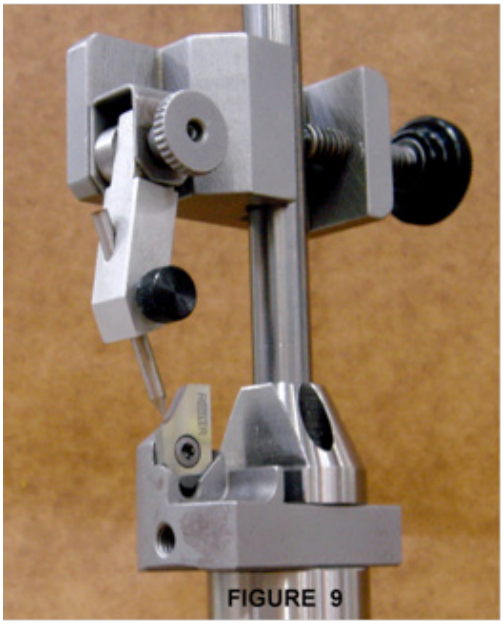


FIGURE 9

The capacity of the Rottler SG80MTS associated with a complete tooling range allow working on seats of diameters between 14 and 120 millimeters (0.55”- 4.7’’).

Three tooling ranges are possible:

1) For seats diameters between 14 and 25 mm (0.55”- 1’’): tool holder BH600R1 and Mini tip holder TH1999 for seat range .551” - .984” (14mm-25mm) with pilots with 6.00mm shank diameter.

2) For seats diameters between 18 and 60 mm (0.71”- 2.4’’): tool holder BH375R1, or UPT5100 (SG10A,9M only) and tip holder TH2000 for seat range .710” - 1.180” (18mm-30mm) or TH2001 for seat range 1.100” - 1.570” (28mm-42mm) or TH2002 for seat range 1.570” - 2.360” (40mm-60mm), with 9,52 mm (3/8 ’’) pilots of shank diameter

3) For seats diameters between 40 and 80 mm (1,570”- 3.150”): tool holder BH375WR1 or UPT5300 (SG10A,9M only) and tip holder TH2003 for seat range . 1.570’’ - 2.360’’ (40mm - 60mm) or TH2004 for seat range 2.280” - 3.150” (58mm - 80mm), with pilots with 9,52 mm (3/8 ’’) shank diameter.

IMPORTANT: When the form tips, the square tips or the triangle inserts are fitted, check that their reference faces are perfectly clean.

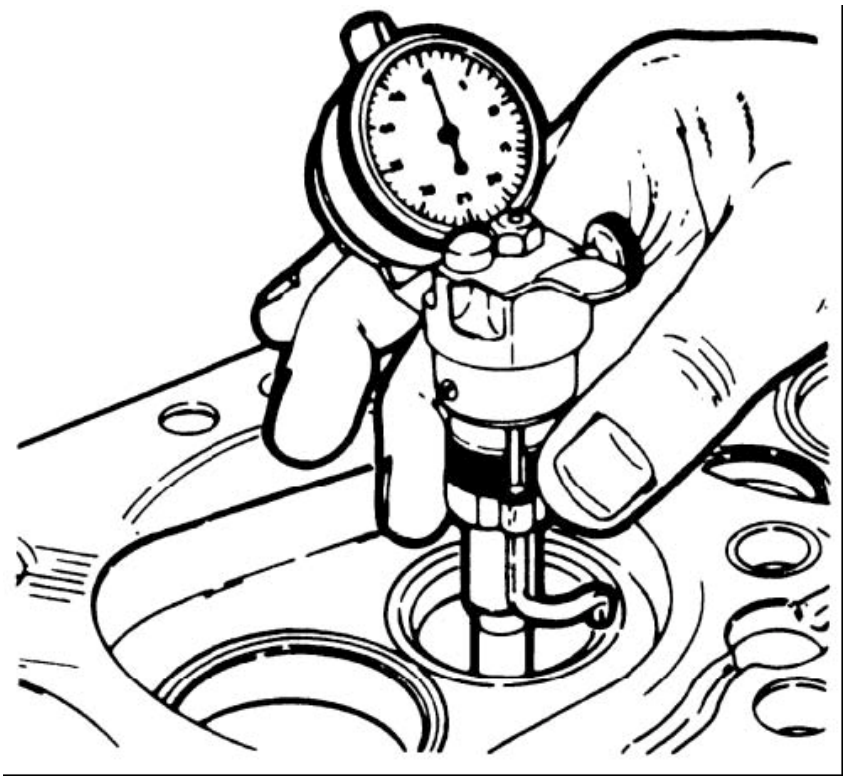
Checking Valve Seat Concentricity

Make sure pilot and valve seat to be measured are free from dust, burrs, etc. A drop of oil or similar lubricant on valve seat will aid measuring. Loosen brass locking screw and lower dial gauge down over pilot. Make certain the tip of the probe is centered on the valve seat to be inspected.

Grasp brass frame in middle of gauge and move upward approximately 1/8". The dial pointer should move as this is done. Center the pointer of the indicator pointing upward and lock the gauge to the pilot using the brass locking screw. Test proper alignment by moving the brass frame up and down. The pointer should move.

Set the pointer at (0) by turning the dial face.

Inspect the seat run out by rotating the probe around the valve seat by twisting the knurled sleeve with your fingers. Each number on the dial indicator is equal to 0.001", (0.0254mm) run out of the valve seat. Each mark on the dial indicator is equal to 0.0001", (0.00254mm) run out of the valve seat.



Machining valve seats and Counter Boring

Aligning Spindle to Work

Most machining operations require the spindle to be directly centered over the work to be performed. This is usually accomplished by air floating the work head above the area to be machined then manually lowering the spindle to engage the tooling that's going to be used. Most of the tooling used with the SG9M has been engineered with this centering feature incorporated into the design

CAUTION If the pedal is released too quickly, the floating head may bounce. True centering may not be achieved, if this happens. Slowly releasing the air float pedal gives the best results. Removing your hands completely from the work head during the final seconds of centering will insure that you do not negatively influence centering accuracy.

Changing the Spindle Adapters

Once that you have the tool holder setup, fit the ball head tool holder into the spring free spindle adapter.

The SG9MTS spindle has been engineered to allow ultra-fast tooling changes.

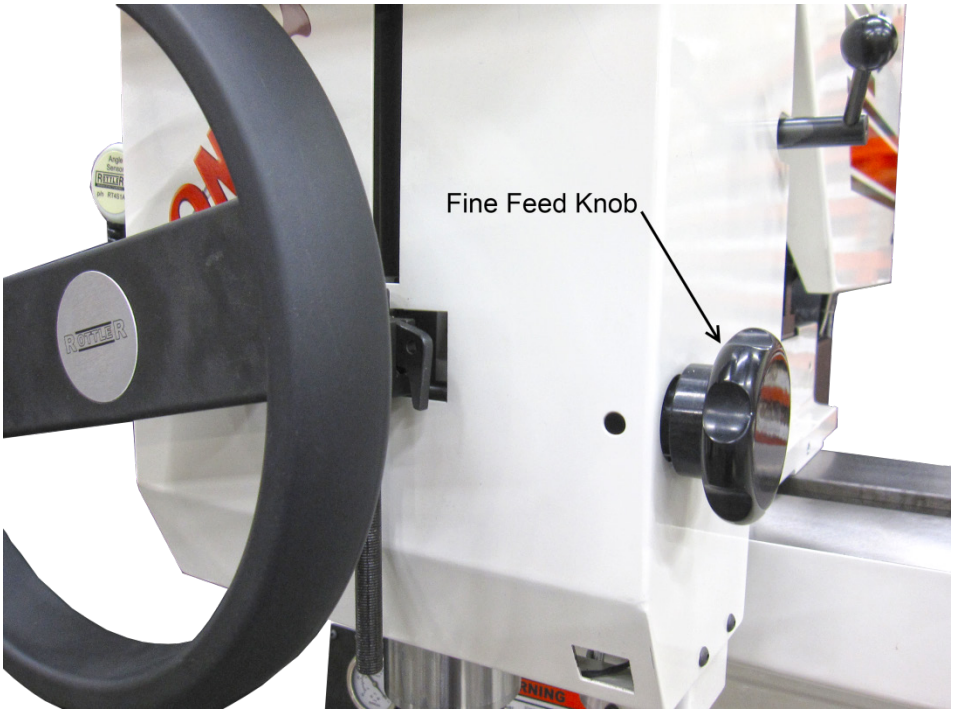
Make sure the spindle spring free locking nut is in the off lock position, line up the two ears of the spindle adapter and insert into the spindle ISO 30 taper. The locking nut automatically will be on the lock position, to remove turn the self-locking nut to the left position, hold the spindle adapter, it may drop on the machine table. Damage will result.

Installing the Spherical self Aligning Toolholder

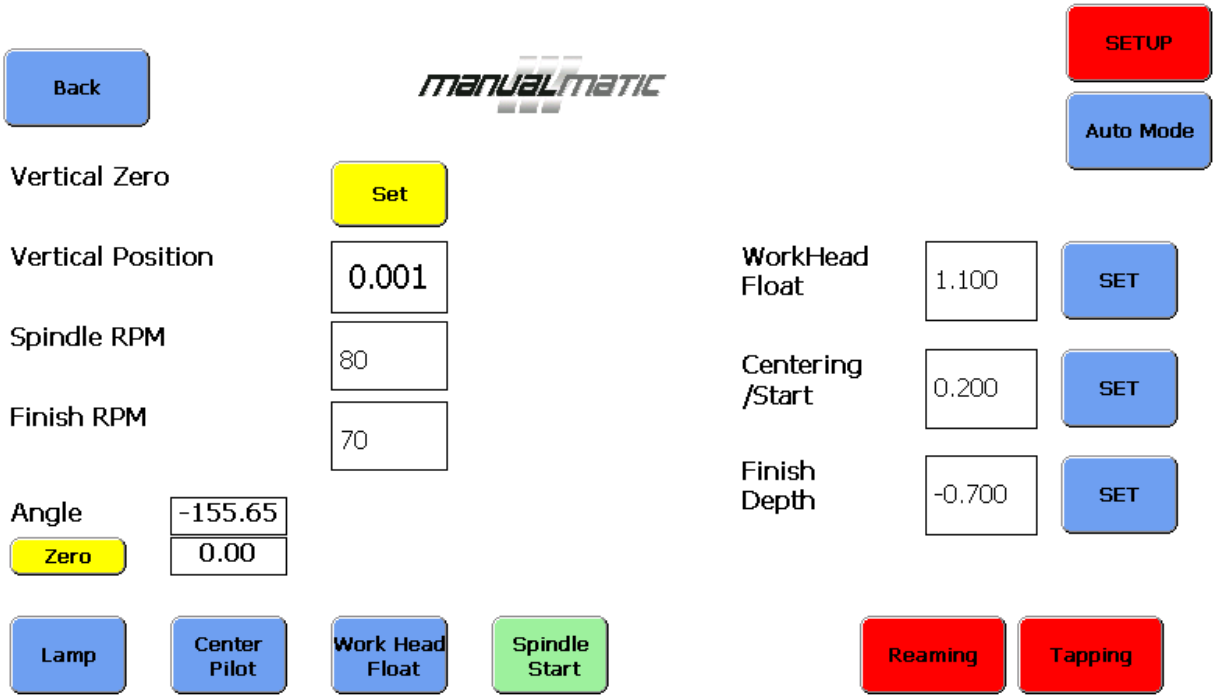
Once the spring free adapter is in the spindle, fit the Rottler Spherical Self aligning Tool holder assembly into the spindle adapter. Make sure to align the locator pins before you fit it into the spindle adapter and push it until you feel it lock.

Fine Feed Engagement

To engage the fine feed mechanism it is necessary to push inward on the steering handwheel while rotating the fine feed handwheel until engagement is achieved. To disengage the fine feed simply pull outward on the steering handwheel



Rottler SG7MTS MANUALMATIC Touch Screen Control Panel



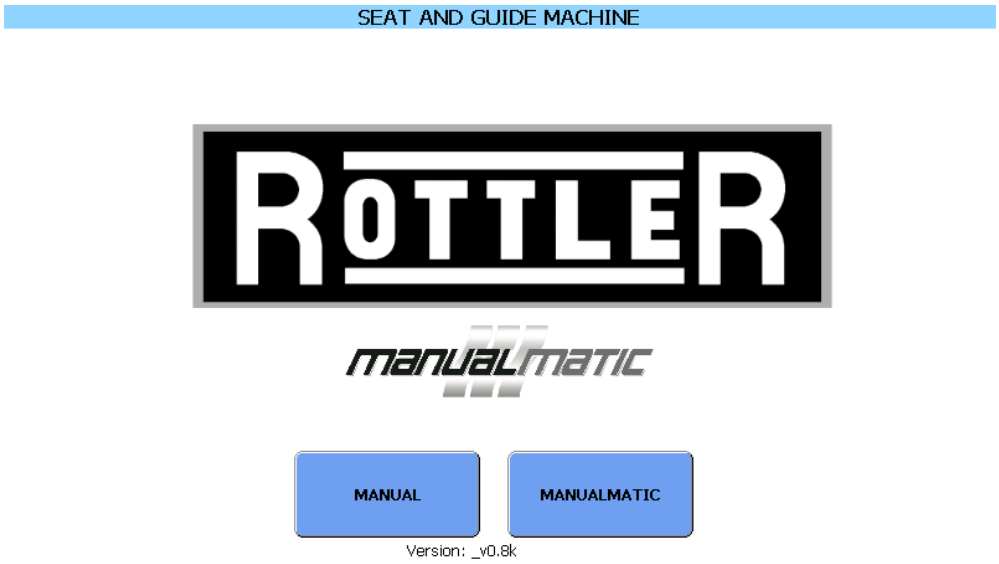
Safety Tips Before Machining

- Always wear proper Safety Items (such as safety glasses and other personal safety equipment as necessary or required).
- Never wear loose fitting clothes or jewelry while working on or around Machine.
- Use proper lifting procedures when moving Cylinder Head.
- Use care when installing and/or removing Cylinder Head from Machine. Lock Head Support Assembly before loading or unloading Cylinder Head.
- Keep area around Machine free of paper, oil, water and other debris at all times.
- Keep Machine and area cleaned of excessive lubricant and lubricant spills.
- Keep Machine clear of tools and other foreign objects not needed for the operation.
- Maintain all tools clean and in their proper storage compartments to maintain them in proper working condition and to prolong tool life.
- Before machining always Inspect tooling for cracks, burrs or bent parts that might affect operation. Inspect Carbide Inserts (Seat Pocket Cutter) and Carbide Cutters (Seat Angle Cutter) to ensure they are sharp, firmly attached and are not damaged.
- NEVER force tools when operating. Tools will do a better and safer job when operated at speed rate for which they were designed.
- Always turn OFF electrical power when performing service on your machine, if service does not require power.
- High Voltage exists inside Electrical Control Enclosure – use caution when working on or around Enclosure. Machine must be disconnected from main power supply before any work can be performed inside of Enclosure.
- Machine must ONLY be operated with all Safety Guards in place and locked.

Operation

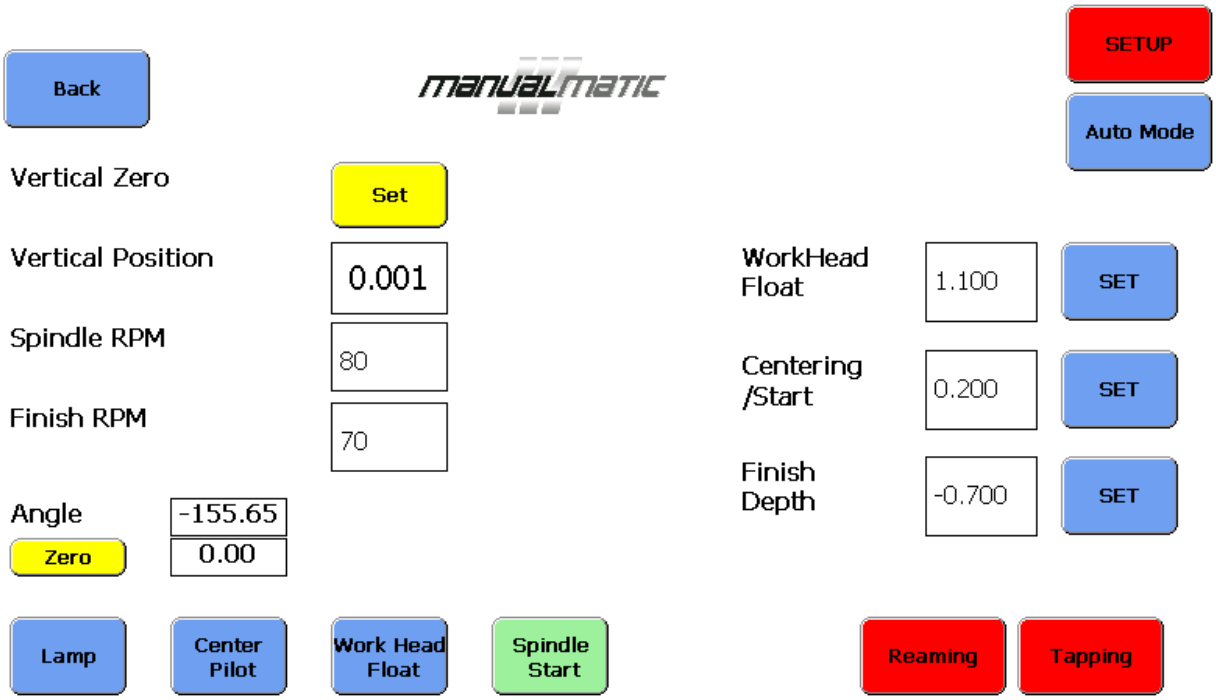
Make sure E Stop is in.

Flip switch on Electrical enclosure to ON (up) position, wait for screen to boot up, this may take a few seconds. This is the screen that will appear



Tap MANUALMATIC for auto mode. Tap MANUAL for manual mode.

MANUALMATIC



Buttons

BACK - goes 1 page back.
VERTICAL ZERO - tap the SET button to set the vertical spindle height.
VERTICAL POSITION - height spindle is at from VERTICAL ZERO height set.
SPINDLE RPM - tap the box and a keyboard will pop up, enter RPM you would like to run and tap enter.
FINISH RPM - this will be activated as soon as spindle reaches finish cutting depth. Set same as above.
ANGLE - this is the actual angle the angle sensor is in.
ZERO - buy taping this button you can ZERO the angle reading for easier setup.
LAMP - turns ON and OFF the LED work lights
CENTER PILOT – locks and unlocks the spindle sphere
WORKHEAD FLOAT - floats the workhead
SPINDLE START - turns ON and OFF the spindle
SET UP – turns off auto mode for setup
AUTO MODE - turns on MANUALMATIC mode

WORKHEAD FLOAT – Vertical height the spindle is at when workhead will float. Set buy taping the set button, or tapping display box and entering height wanted.

CENTERING/START – Vertical height the spindle will be at when the workhead centers itself on pilot. As soon as workhead clamps the spindle will start. Set buy taping the set button, or tapping display box and entering height wanted.

FINISH CUTTING DEPTH - Depth Finish RPM activates. Set by tapping the display box and entering in the amount you want to remove from the seat.

TAPPING – locks spindle sphere, instantly reverses spindle at finish cutting depth, will also change to FINISH RPM.
REAMING – locks spindle sphere for reaming and drilling.

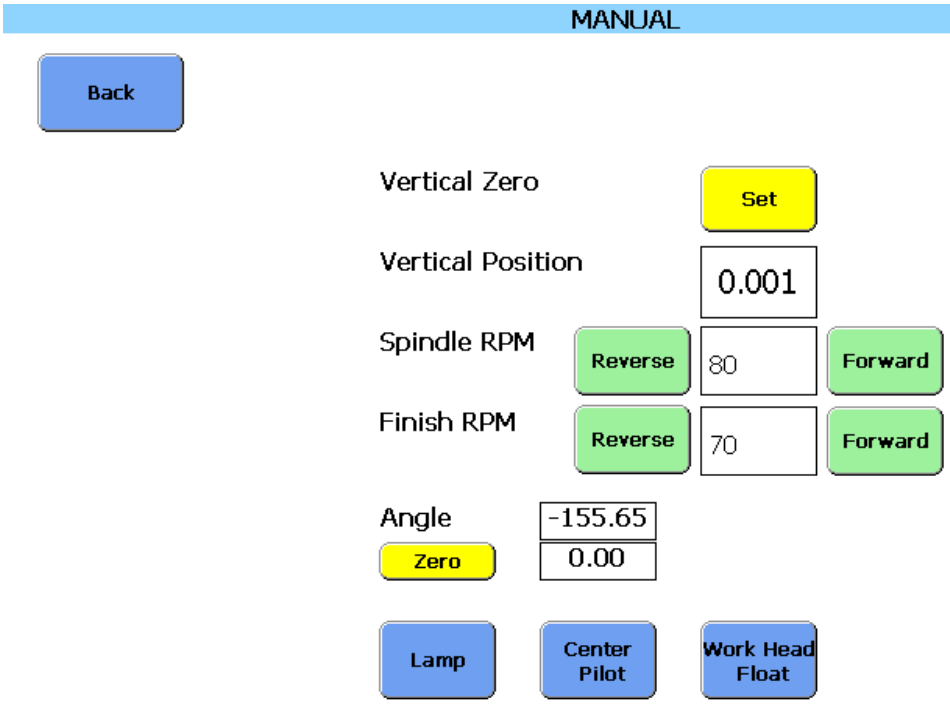
MANUALMATIC Operation

1. Level cylinder head, set all tooling and install in spindle.
2. Tap the SETUP button, this turns off the AUTO MODE for setting up.
3. Press WORKHEAD FLOAT so workhead is floating. Float over guide and lower tool holder until cutter is touching seat and press the VERTICAL ZERO, “SET” button. This will change the VERTICAL POSITION height display to read 0.000. The Vertical Zero height, this is the height all of the Auto functions are set off of.
4. Next raise the spindle all the way to the top, then lower about 1/2” and press the WORKHEAD FLOAT “SET” button, anything above this height the workhead will be clamped, below it will float.
5. Next lower the spindle down to about ½” above the VERTICAL ZERO height and press the CENTERING/START “SET” button, when this height is met the spindle will center itself on pilot, clamp and spindle will turn on.
6. NOTE: The default settings for WORKHEAD FLOAT and CENTERING/START will work for most heads. You can also tap the display box and enter in a height manually if wanted.
7. Next manually set the amount needed to be removed from seat buy taping the FINISH CUTTING DEPTH “display box” and entering in the amount you want to remove, you must make this a negative number as it will be below the VERTICAL ZERO.
8. Raise spindle to the top and then turn on the AUTO MODE. You’re ready to cut.

NOTE: each time a height is met the LED WORK LIGHTS will flash.

- When spindle is lowered it will automatically float when the WORKHEAD FLOAT height is met.
- When you reach the CENTRING/START height it will automatically dwell to center, clamp and start spindle. Remove hands from steering wheel when lights flash for perfect centering.
- When finish cutting depth is met the spindle will automatically change to the FINISH RPM previously entered.
- When raised it will automatically float and stop spindle at the CENTERING/START height.
- This program will be saved automatically. All you will need to do is set your vertical zero.

MANUAL



Buttons

BACK - goes 1 page back.
VERTICAL ZERO - tap the SET button to set the vertical spindle height.
VERTICAL POSITION - height spindle is at from VERTICAL ZERO height set.
SPINDLE RPM REVERSE – runs spindle Counter Clockwise
FORWARD – runs spindle Clockwise
Tap display and enter desired RPM
FINISH RPM – same as above, you can instantly change RPSMs to the programed setting buy tapping the forward or reverse button. You can instantly change from forward to reverse if needed.
ANGLE - this is the actual angle the angle sensor is in.
ZERO - buy taping this button you can ZERO the angle reading for easier setup.
LAMP - turns ON and OFF the LED work lights
CENTER PILOT – locks and unlocks the spindle sphere
WORKHEAD FLOAT - floats the workhead

Operation Tips before Machining Valve Seats

Clean valve guide with a brush to remove foreign matter.

Required spindle rotation speed will vary, depending on seat hardness. As seat hardness increases, so does the spindle speed will change. Some will require full speed

NOTE: If valve guides are so badly worn that the proper centering will be impossible, it will be necessary to replace that valve guide to achieve the a concentric valve seat.

See following suggested machining speed chart .

SEAT MACHINING SUGGESTED RPM CHART

VALVE SEAT DIAMETER		SPINDLE SPEED
INCH	METRIC	RPM
15/16"	24	175
1.000"	25.4MM	150
1.125"	29MM	150
1.250"	32MM	125
1.375"	35MM	100
1.500"	38MM	100
1.625"	41MM	100
1.750"	44.5MM	100
1.875"	47.5MM	75
2.000"	51MM	75
2.125"	54MM	75
2.250"	57MM	75
2.375"	60MM	50
2.500"	63.5MM	50

Valve Seat Machining Procedure

Seat Pocket and valve guide must be clean to ensure proper fit of the carbide pilot.

Select the correct Carbide pilot for the valve guide ID Diameter

At this point, the spindle and work head should be level according to the position of the cylinder head.

Fit the Rottler Tool Holder and pilot assembly into the spindle cone; make sure to align the locator pins before you fit it into the spindle adapter and push it until you feel that is lock.

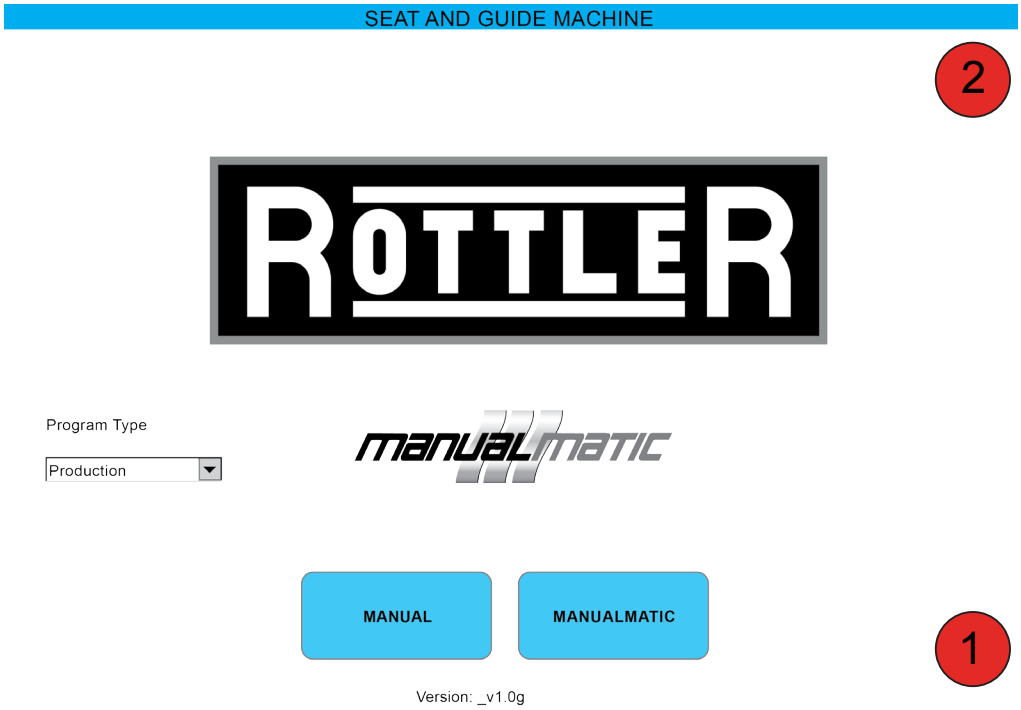
The spindle has been engineered to allow ultra fast tooling changes.

Make sure the that spindle Self locking nut is in the off lock position; line up the two ears of the spindle adapter and insert into the spindle ISO 30 taper, the locking nut automatically will be on the lock position

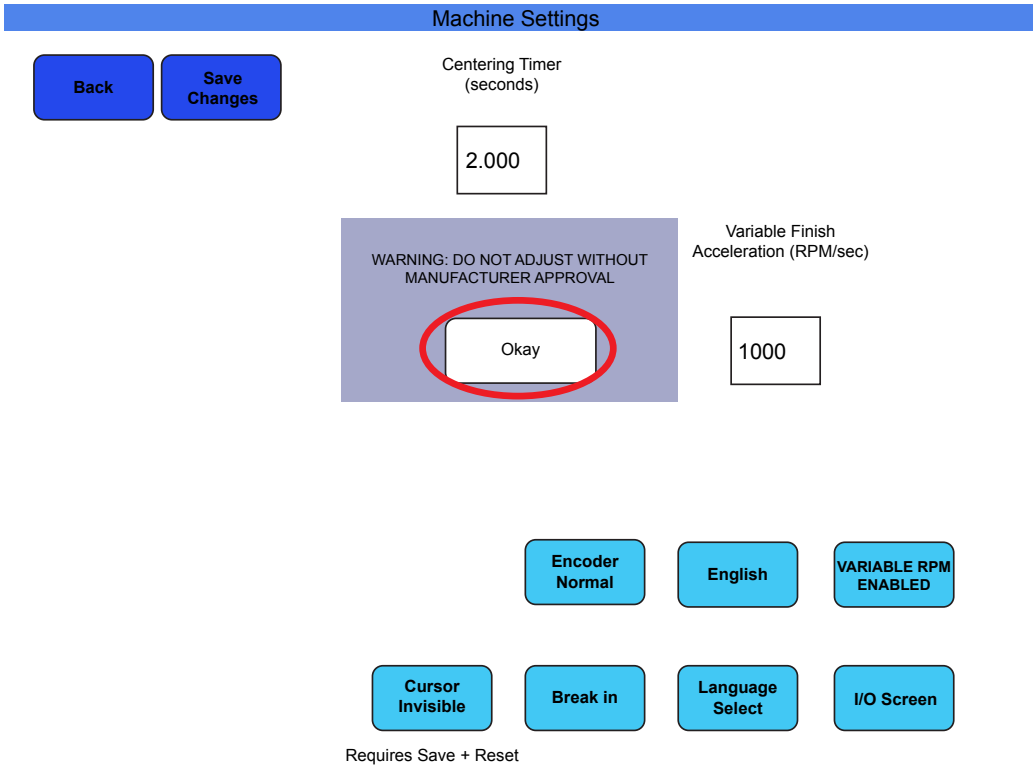
To remove turn the self-locking nut to the left position, hold the spindle adapter, it may drop on the machine table. Damage will result

Changing Language

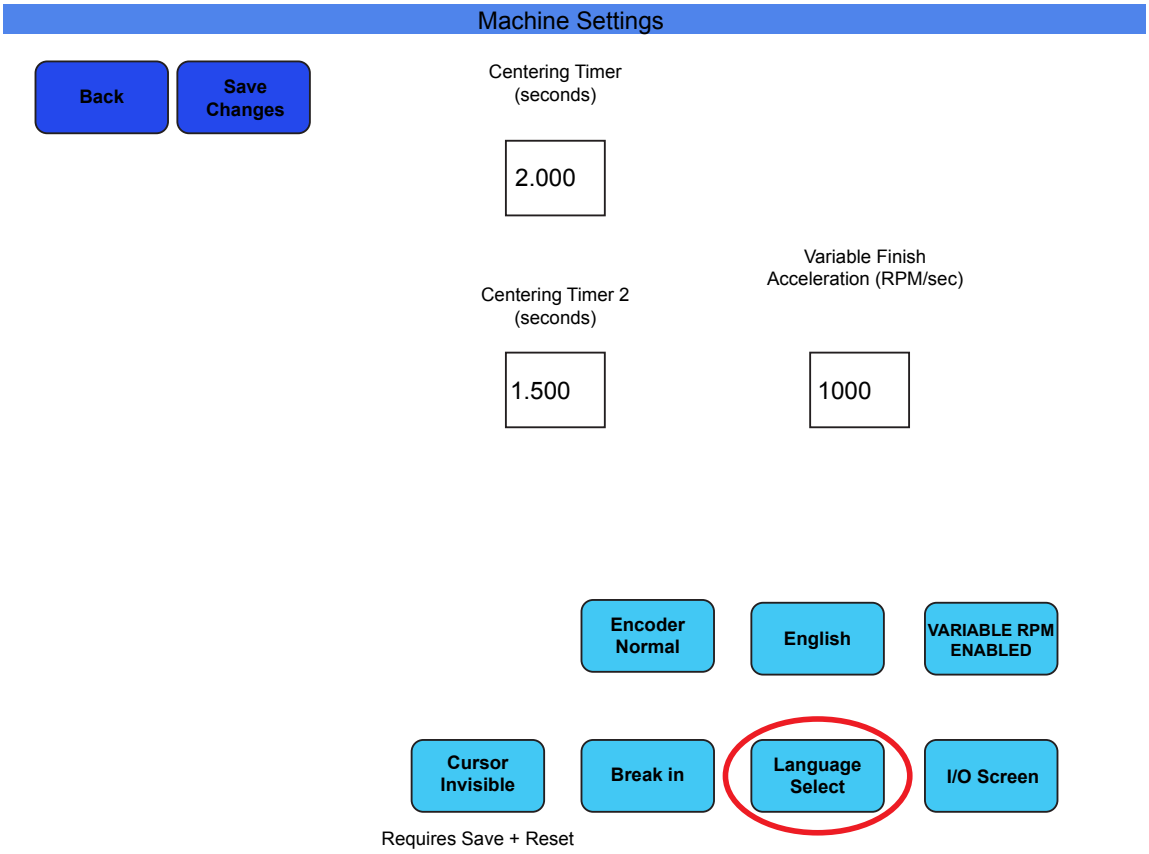
Press the screen in the lower right hand corner, then press the screen in the upper right hand corner to bring up the Machine Settings screen. Be sure to press the screen with your finger and not just tap it.



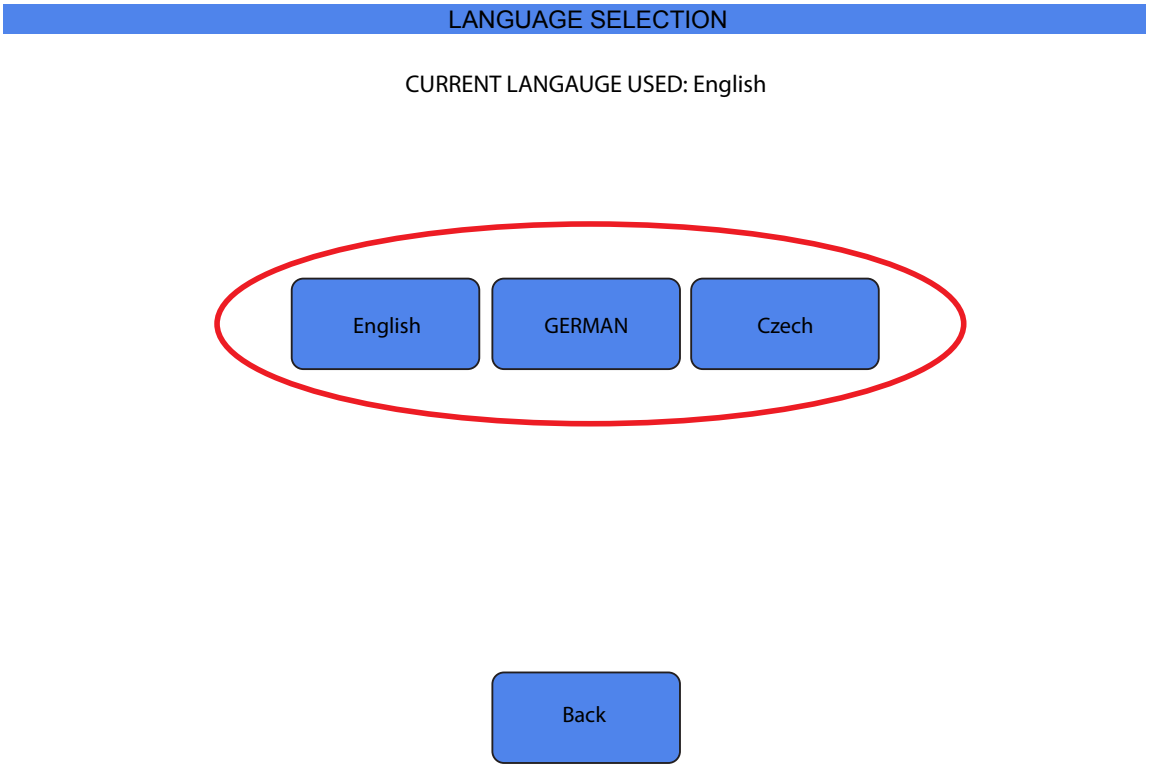
Press the Okay button on the pop up warning box to continue.



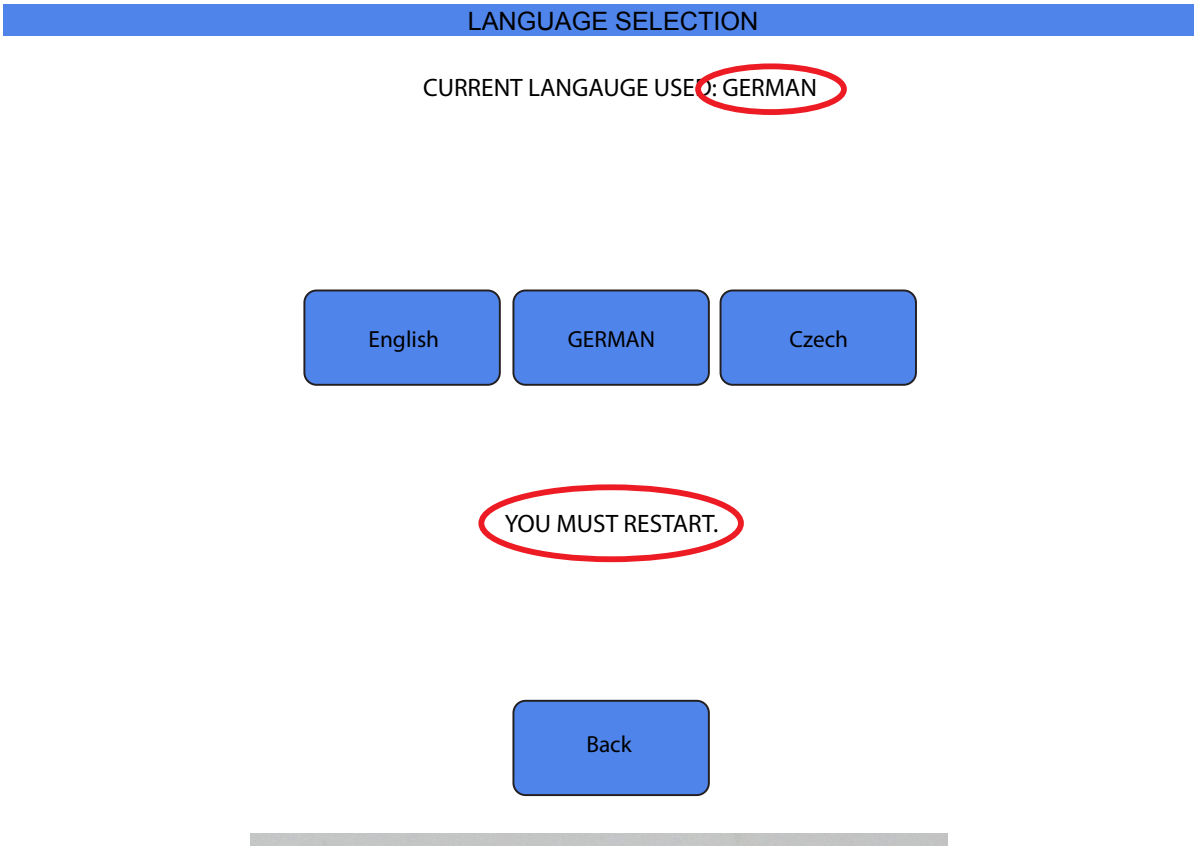
Press the Language Select button.



Select the language you want to switch to and press the button.



Confirm that the language you have selected is indicated and then restart the machine for the change to take effect. Turn the main power switch located on the electrical cabinet off and then back on to restart the machine.



UNIPILOT Centralizing Pilots

Rottler UNIPILOT Solid Carbide Centralizing Pilots are manufactured from fine grain, sintered tungsten carbide and are ground to a very high degree of accuracy, straightness, and surface finish. They are designed for a lifetime of precision machining

Pilot Diameter

The straight/parallel part of the pilot that fits in to the valve guide is referred to as the pilot diameter. Rottler pilots are available in 0.01mm (0.0004”) increments. For best results, the clearance between the pilot and valve guide should not be more than 0.01mm (0.0004”)

Most new valve guides are manufactured to a nominal size and the valve stem diameters are manufactured to be smaller than the nominal size to allow clearance for heat expansion of the valve stem when the engine is operating. For example: a 7mm valve guide has an internal diameter of exactly 7.00mm (.2756”) The valve stem diameter of the intake valve is 6.98mm (.2748”) and the exhaust is 6.96mm (.2740”). In order for the pilot to fit most of the valve guides, the first choice could be UCP0699 to give .01mm (0.0004”) clearance. If the valve guide is used and has some wear, then the second choice of pilot could be UCP0700 (0.2756”).

Shank Diameter

The part of the pilot that fits inside the tool holder is referred to as the shank. Rottler offers three different shank sizes (6.00mm, 9.52mm, and 20.00mm). For longest tool life and best seat cutting results, the shank needs to go as far as possible inside the tool holder when cutting valve seats or boring out valve seat housings.

Extended Length (EL) Pilots

Some cylinder heads require extended length pilots because the distance from the top of the valve guide to the head gasket surface is longer than normal. Normally this distance is about 1.0” - 1.5”, it is when this distance becomes greater that extended length pilots are needed. The pilots are extended by adding material below the shank and above the tapered section of the pilot.

If you think you need an extended length pilot, please see the order form in the back of the catalog and contact Rottler for ordering assistance.

PILOT DIAMETER SHOULD ALWAYS BE GREATER THAN VALVE STEM DIAMETER FOR BEST CONCENTRICITY

Modular Carbide Centralizing Pilot System for Valve Guides Over 0.875” (22.23mm)

Rottler also offers a modular carbide centralizing pilot system for very large engine applications. This system is versatile because it allows you to use different size sleeves, which are adjustable for different lengths, for different applications while using only one pilot. These sleeves are MADE TO ORDER. Contact Rottler for more information and ordering assistance.

FCM20EL380

Modular Carbide Centralizing Pilot for Valve Guides Over 0.875” (22.23mm). Requires a set of Interchangeable Sleeves (FCMSLXXX & FCMSUXXX) - 20mmShank Pilot

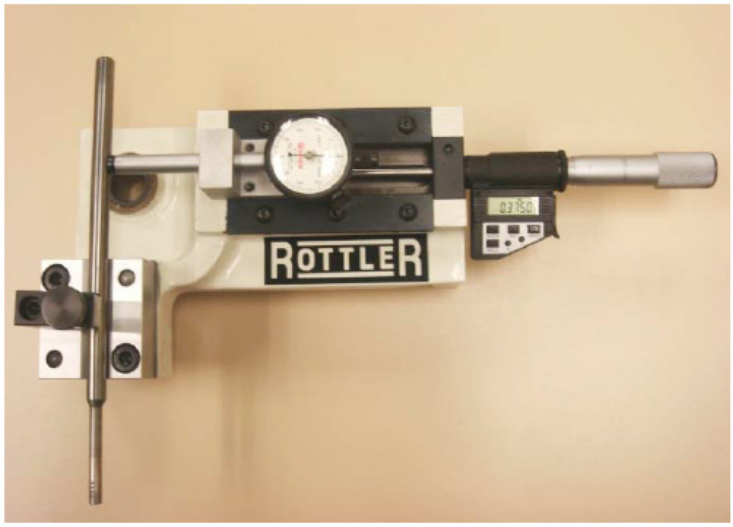
FCMSUXXX

Modular Pilot Upper (Tapered) Sleeve - Hardened and Heat Treated - For .XXX” (XX.XXmm) Guide ID

FCMSLXXX

Modular Pilot Lower (Straight) Sleeve - Hardened and Heat Treated - For .XXX” (XX.XXmm Guide ID - 3.0” Overall Length

Rottler Six and One Instructions



1- Checking the calibration of the six and one Setting Fixture included two tool setting fixtures, 1.250" / 31.750MM and .375" / 9.52MM and on the other end is 6.00MM. On the picture you will see master setting tool (.375" / 9.52MM) this one also will be using it to set you tool holders, for.375" (9.52mm) and 6.00MM ID tooling.,

Fig.1

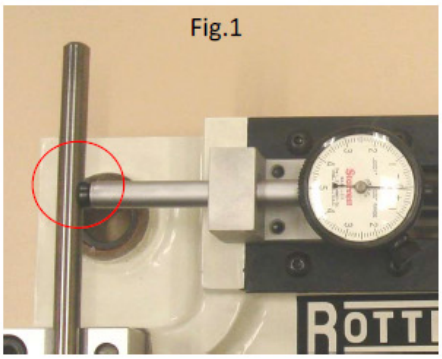
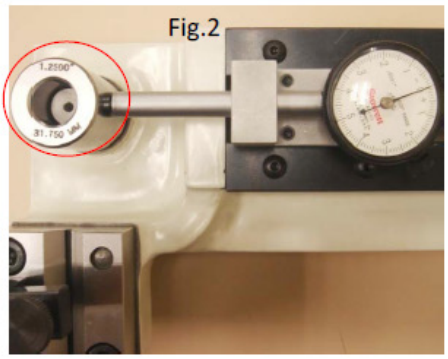
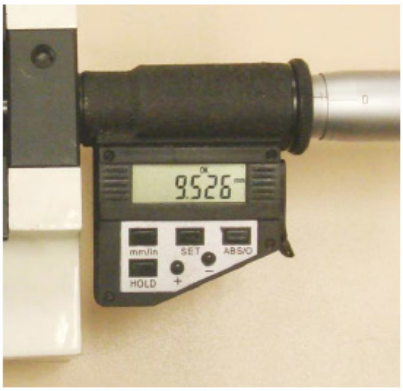


Fig.2



Calibrating the Digital Micrometer

2- Turn the digital micrometer thimble in until the end of the micrometer is flush with the edge of the micrometer frame. Then turn the thimble out until the '0' mark on the thimble lines up exactly with the line on the barrel (see fig.1).



a. Select mode: Press the **mm/in** button until the desired mode is shown in the digital display.
Note: *use a small instrument such as a pen to gently push the buttons; they are quite small and a bit delicate.*

b. Determine which calibrating setting tool you will be using to calibrate the micrometer is going to be used on. (example; calibrating pilot .375" / 952mm side)

c. Press and hold the **SET** button, then press **+** or **–** button. "SET" will be flash in the display. This will places the micrometer in the edit mode

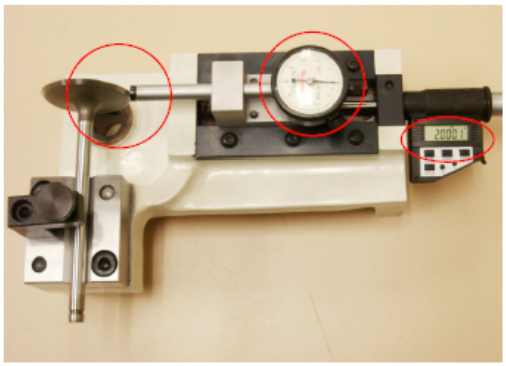
d. Press and hold the **+** or **–** buttons to change the display number to the minimum set diameter Determined earlier (example; setting tool, pilot .375" / 9.52mm side).

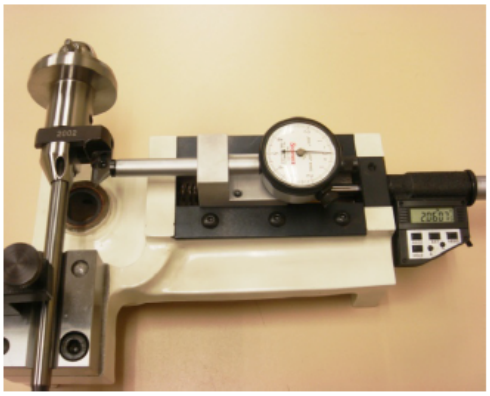
e. After it reach the proper reading, press the **SET** button to exit the edit mode. "**SET**" should no longer be shown in the display. The digital micrometer head is now set to the setting tool. (After initial setting, there is no need to press the SET button again unless display is lost at which time the micrometer must be reset)

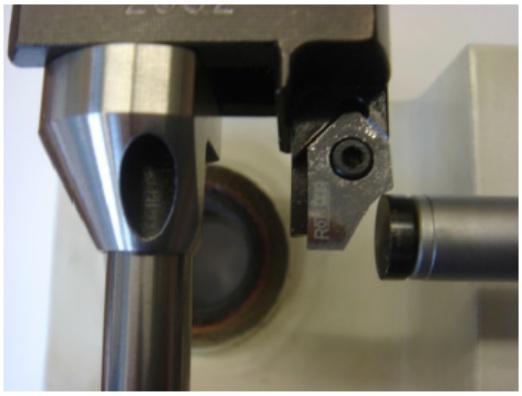
3- MEASURE THE HEAD OF THE VALVE

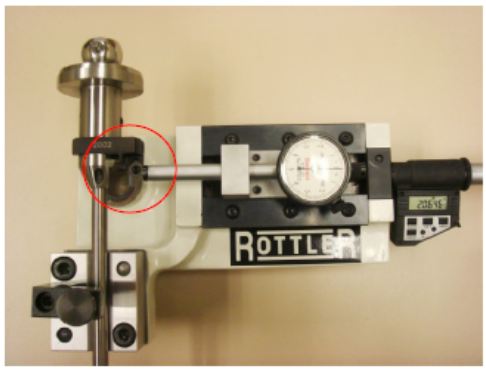
a. Position the Valve Stem on V Block and bring the Indicator tip to may contact with the head of the Valve until zero show on the indicator dial, the amount showing of the digital micrometer display is the actual diameter of the Head of the Valve.

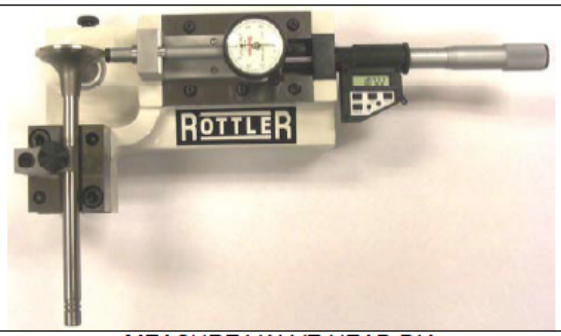
b. From that reading 2.0001"



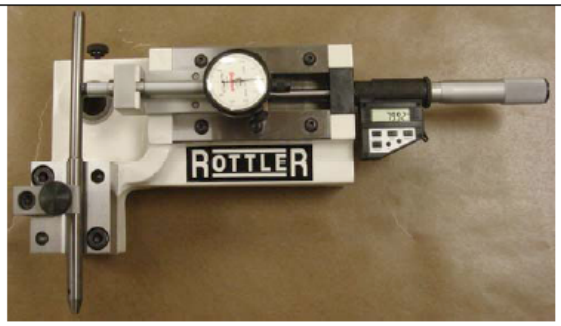




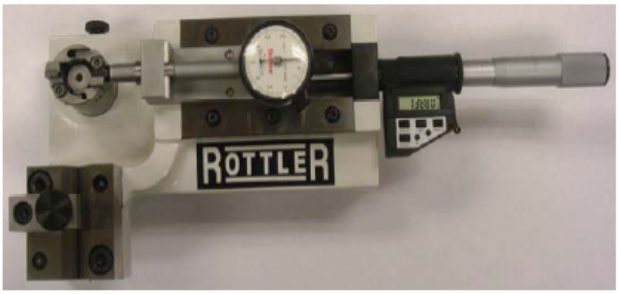




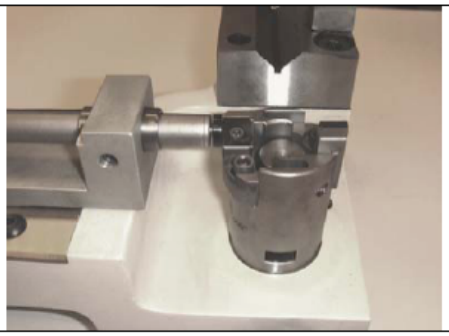
MEASURE VALVE HEAD DIA



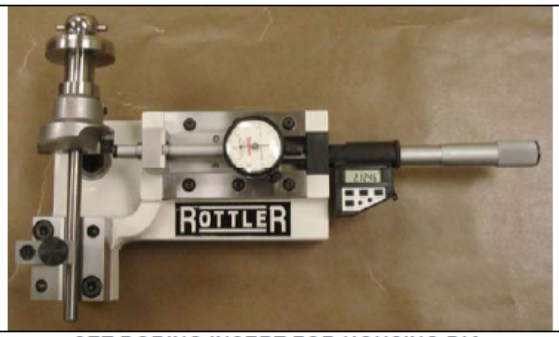
MEASURE VALVE STEM AND PILOT DIA.



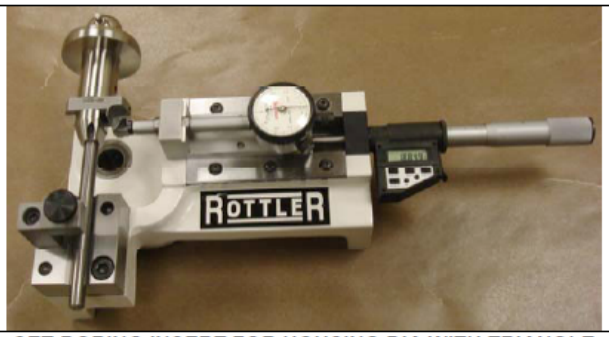
SET ADJUSTABLE DOUBLE INSERT MILLING CUTTERS



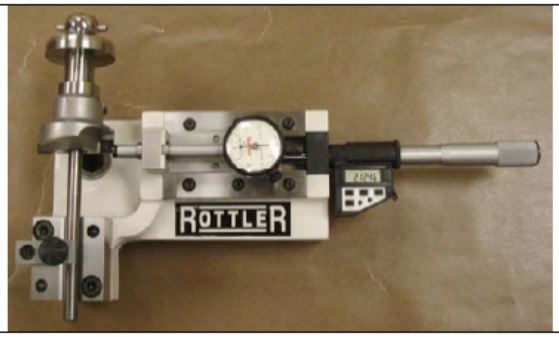
SET ADJUSTABLE DOUBLE INSERT MILLING CUTTERS



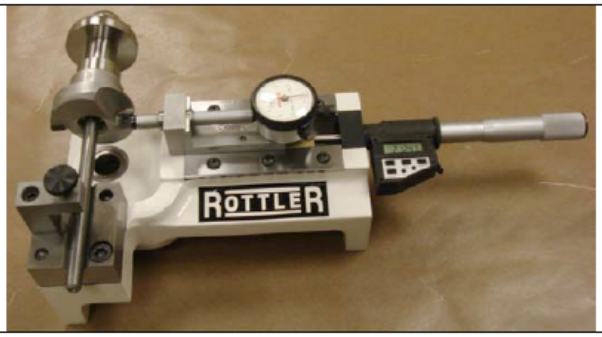
SET BORING INSERT FOR HOUSING DIA.



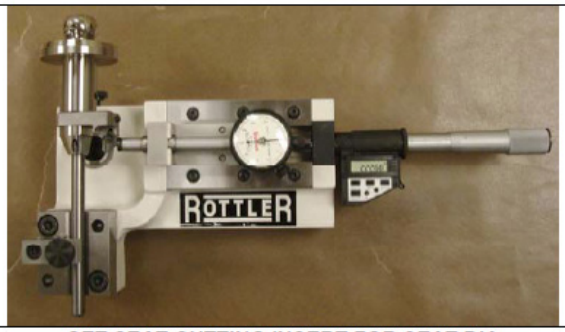
SET BORING INSERT FOR HOUSING DIA WITH TRIANGLE



SET BORING INSERT FOR HOUSING DIA.

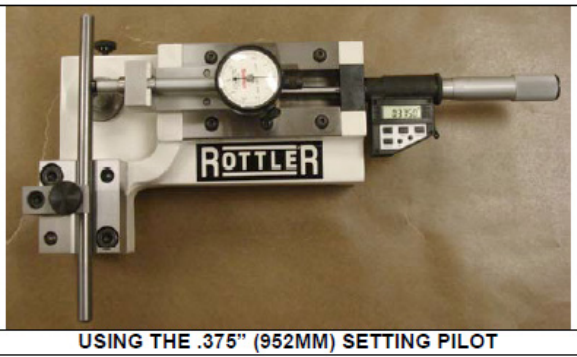


SET BORING INSERT FOR HOUSING DIA

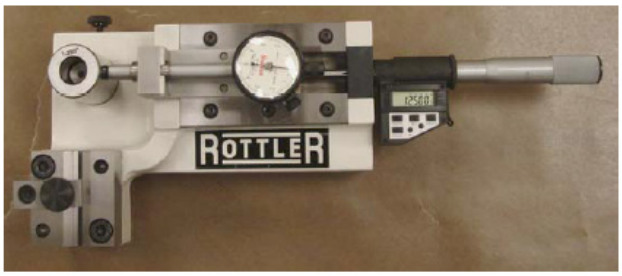


SET SEAT CUTTING INSERT FOR SEAT DIA

SET SEAT CUTTING INSERT FOR SEAT DIA ON



USING THE .375" (952MM) SETTING PILOT



SIX IN ONE WITH STD 1.250"

Adjusting the Square Carbide Inserts

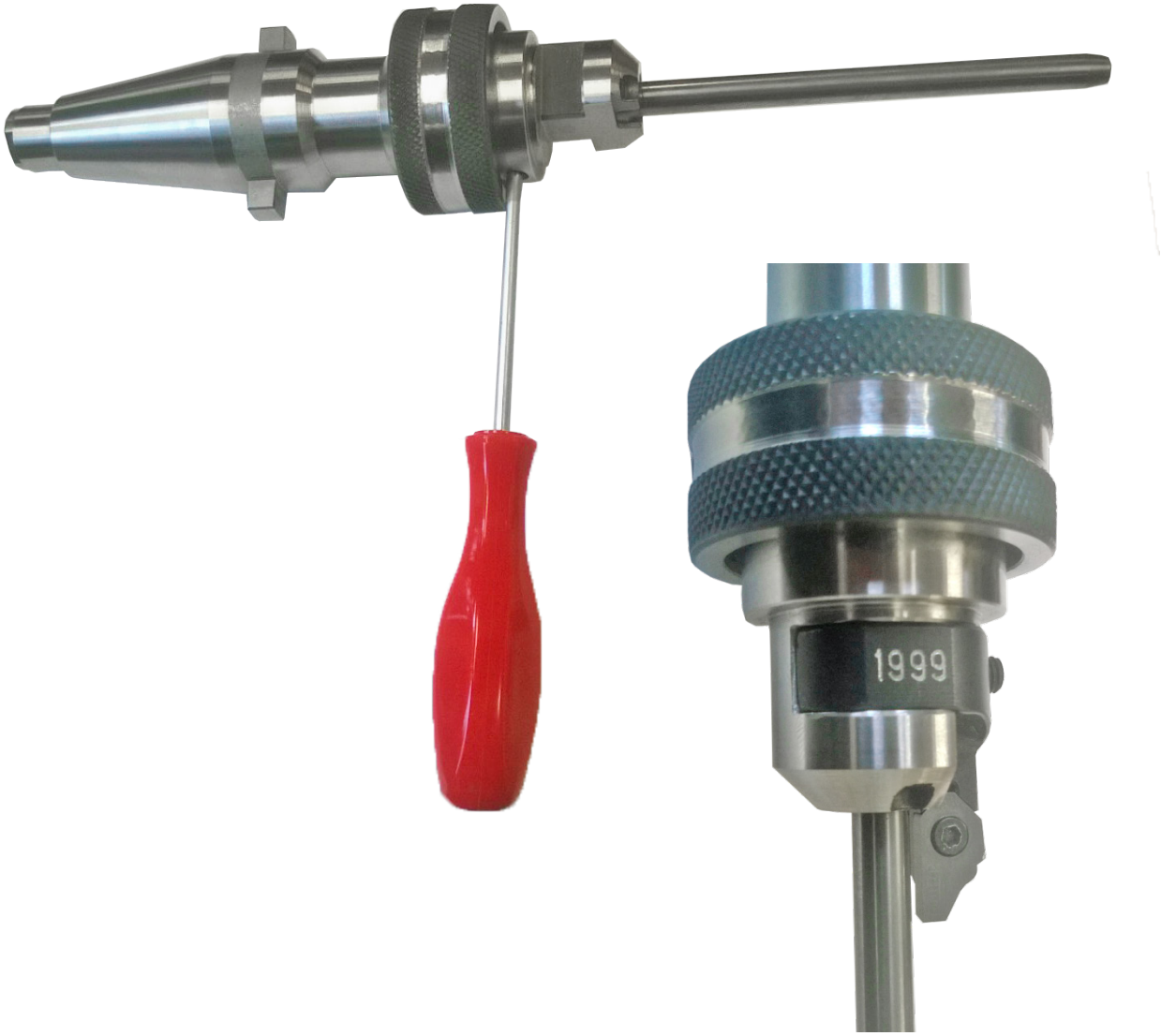
- The micrometer should be used.
- Set the Digital micrometer (BM) according to the valve seat insert diameter and the required interference.
- Slide the tool holder without the pilot on the micrometer.
- With the setting screw, adjust the square tip holder offset.

IMPORTANT: When 90 degreed bits (RCA512) or the Triangle bits are fitted, check that their reference faces are perfectly clean.

The accuracy of the seat angles depends on this.
While rotating the assembly tool holder/carbide tip holder, the carbide bit's cutting edge should just touch the micrometer spindle.
Once in contact with the micrometer spindle, the carbide tip should not be moved at all. If this is not observed, the cutting edge may be damaged and the resulting surface quality, when machining, will be deteriorated.

Cutting Small Diameter Valve Seats

The UPT5200 adapter has a set screw as shown in photo below – push pilot all the way into the UPT5200 and tighten set screw to hold pilot inside the UPT5200. Install the Tip Holder TH1999, adjust diameter, release set screw, and remove pilot. Be sure to use special small diameter cutting inserts such as RCA625 or RCA628 where the seat is close to the pilot side of the insert.



Tooling for Counterboring Small Diameter Valve Seat Pockets

Rottler offers two options for counterboring small diameter valve seat pockets:

6 mm Pilots Boring Combos

BH600R1 Mini Spherical Toolholder TH2000-00 Tip Holder RT211 Triangular Insert Bore diameter: 1.055” – 1.400” (26.80 mm – 35.55 mm) 	BH600R1 Mini Spherical Toolholder TH1999 Tip Holder RCA513 Seat Cutting Insert Bore diameter: .800” – 1.200” (20.80 mm – 30.48 mm) 

.375” Pilot Combos

BH375R1 Spherical Toolholder TH2000-00 Tip Holder RT211 Triangular Insert Bore diameter: 1.270” – 1.580” (32.26 mm – 40.15 mm) 	BH375R1 Spherical Toolholder TH1999 Tip Holder RCA513 Seat Cutting Insert Bore diameter: 1.000” – 1.280” (25.42 mm – 32.51 mm) 

Rottler can also provide Fixed Milling Heads to cut valve seat pockets. They are available in fixed diameters from 1.000” to 2.250” in .0625” increments

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MAINTENANCE

Contents

Maintenance

Quick Reference Lubrication Chart

Refer to the maintenance section in the manual for lubrication location points and instruction.

Assembly	Frequency	Lube Operation	Recommended Lubricant	Date Serviced
Outer Spindle	8 Hours	Clean and Wipe with oil	ISO VG 68 Way Oil	
Brass guide shoes/slide	500 Hours	Clean and wipe with oil	ISO VG 68 Way Oil	
Grease spindle Rack and pinion	500 Hours	Clean and grease	NLGI #2 White Lithium Grease	
Grease spindle worm wheel and worm shaft	500 Hours	Clean and grease	NLGI #2 White Lithium Grease	
Grease spindle drive shaft	500 Hours	Clean and grease	NLGI #2 White Lithium Grease	
Grease rollover clamp fixture bearings	200 Hours	Clean and grease	NLGI #2 White Lithium Grease	
Grease clamp fixture Pins and Acme screw	200 Hours	Clean and grease	NLGI #2 White Lithium Grease	

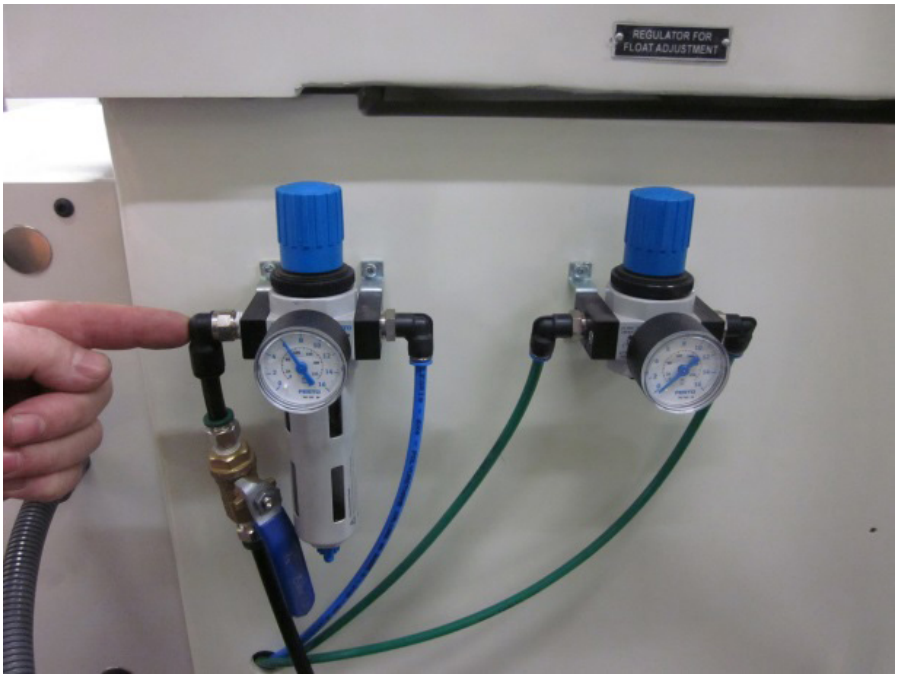
Preventative Maintenance Quick Reference Chart

Refer to the procedures in the maintenance section of the manual to make or check these adjustments. Not all of the items listed in the table below have adjustment. The information should be recorded and the amount of wear tracked so the part can be replaced before down time on the machine occurs.

Procedure	Frequency	Date Serviced/Comments
Clean top and bottom float tables	8 Hours	
Outer Spindle Bushing Adjustment	500 Hours	
Brass Shoe Adjustment	500 Hours	
Angle sensor calibration	500 Hours	
Spindle Drive Belt Adjustment	1000 Hours	
Adjust workhead clamp plate bearings	1000 Hours	
Rack and pinion adjustment.	1000 Hours	
Machine Level Adjustment	1000 Hours	

CAUTION All floating surfaces should be dry and clean do not oil the surfaces, oil will cause the work heat not to float properly.

Air Adjustments



Float

The float regulator is located at the right rear of the main base on the bottom.
If the machine is not floating properly, it could be from too much or too little air from the regulator. Turn the regulator all the way off (full counter clockwise). Start turning the regulator slowly clockwise while continually checking the spindle base for proper floatation. Once the correct float is established, lock the regulator into place by pushing in on the black adjusting knob.

CAUTION Use as little air as possible to achieve correct floatation. Using too much air will could cause the spindle base to vibrate and not center properly on the on the pilot.

Float surfaces

CAUTION Wipe clean daily
All floating surfaces should be dry and clean do not oil the surfaces, oil will cause the work heat not to float properly.

Calibrating the Digital Level

NOTE: Even though the level has been carefully calibrated at the factory, it is a good idea to recheck calibration before putting the machine into service. In the event that the level is dropped or handled roughly then the following recalibration methods should be implemented.

The level assembly is referenced to the spindle via the level pin. It is there for important to check alignment of pin in reference to the spindle. This is accomplished by mounting a magnetic base dial indicator to the machine spindle and sweeping the pin vertically by raising or lowering spindle to check alignment. Pin alignment should be checked in two positions at 90 degrees to each other. If the pin alignment needs correcting, do so with the set screws located at base of pin block.

Install level on pin. Orient level to read left to right. Tilt head left or right until level reads 0.00. Now rotate level 180 degrees. The reading should be 0.00, if not then it will be necessary to calibrate the inclinometer to the level body. This is accomplished by loosening the inclinometers two retaining screws and pivoting the inclinometer until it repeats when level is rotated 180 degrees.

Example: level reads 0.05 to the left, when rotated 180 degrees to the right it should read minus 0.05.

Check the level reading with the pickup oriented front to back. It should read 0.00 if the machine has been properly leveled with a machinist level.

If the LED does not read 0.00 then chances are the machine's leveling procedures have not been properly followed or there are internal problems with the levels electronics.

The sensitivity of the level is so great that it may not zero totally, even while the machine is not being touched. The alignment tolerance for installing guides is plus or minus .05 degrees, and for forming three angle seats is plus or minus .05 degrees.

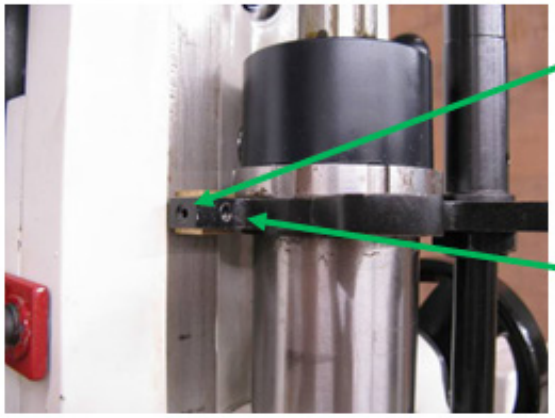
Adjusting And Aligning The Outer Spindle On SG Models

There are 2 brass guide shoes located on the guide plate on top of the spindle that align the rack gear on the back of the spindle with the pinion gear that moves the spindle up and down.

Lower the spindle to the center position of travel.

Check the guide plate at the top of the spindle, tighten if necessary.¶

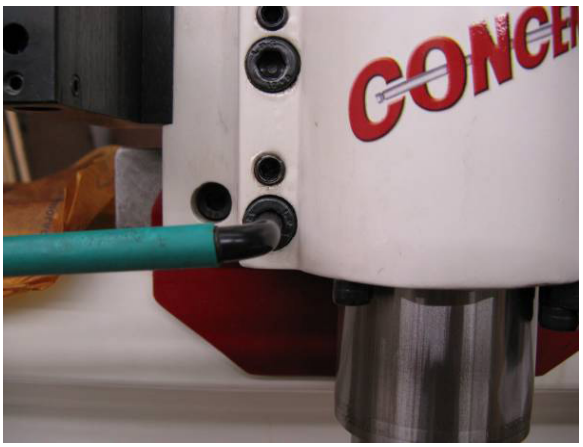
Clean and lightly lubricate sliding guide surfaces with grease. Adjust brass guide shoes on guide plate so that there is no twisting movement. Run the spindle through its full travel to confirm that there is no binding.



Loosen locking screw to adjust brass guide shoe. Tighten after adjusting.¶

Use adjusting screw to adjust brass guide shoe.

Adjusting outer spindle clearance.



Loosen the 4 lock bolts.

Loosen the 4 adjusting set screws.

Clean outer spindle and lubricate – add a few drops of oil to a clean cloth and wipe outer spindle.

Starting with the bottom set of lock bolt and adjusting set screws, tighten the lock bolt until there is drag on the spindle when it is move through its range of travel.

Then tighten the adjusting set screw until the amount of drag on the spindle is reduced to the point that there is a slight drag on the spindle through its range of travel.

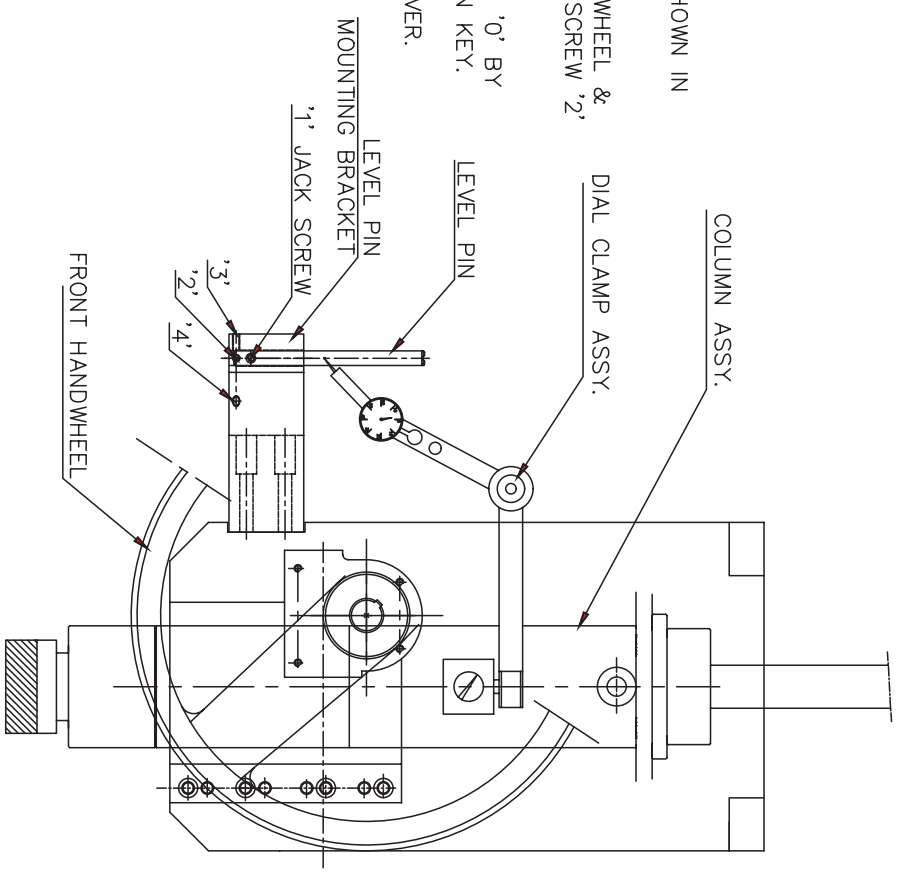
You may have to make further adjustment to the lock bolt and set screw the get the spindle adjusted properly.

Repeat the above procedure the other 3 sets of lock bolts and set screws.

Level Pin Setting

INSTRUCTIONS TO SET LEVEL PIN
MODEL : SG-7MTS, SG-8MTS & SG-9MTS

1. REMOVE FRONT COVER
2. HOLD DIAL CLAMP ASSY. ON COLUMN ASSY. AS SHOWN IN FIG. & SET DIAL ON LEVEL PIN.
3. MOVE COLUMN ASSY UP & DOWN BY FRONT HANDWHEEL & SET DIAL TO '0' BY ADJUSTING JACK SCREW '1' & SCREW '2' FOR FRONT & BACK POSITION OF LEVEL PIN
4. HOLD DIAL ON LEVEL PIN SIDEWISE & SET DIAL TO '0' BY ADJUSTING SCREW '3 & '4' BY USING 2.5MM ALLEN KEY.
5. REMOVE DIAL ASSY. & RE-PLACE THE FRONT COVER.



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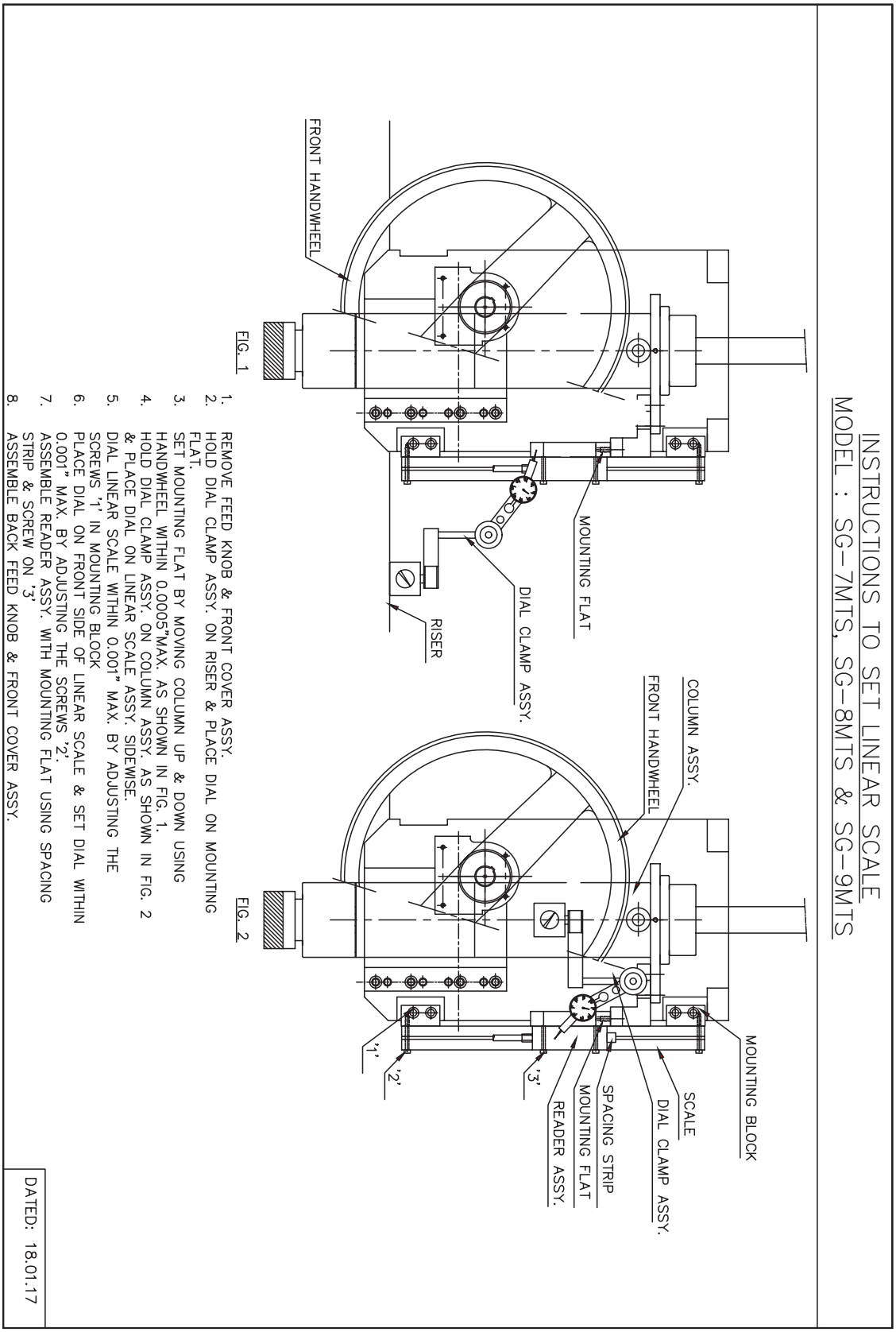
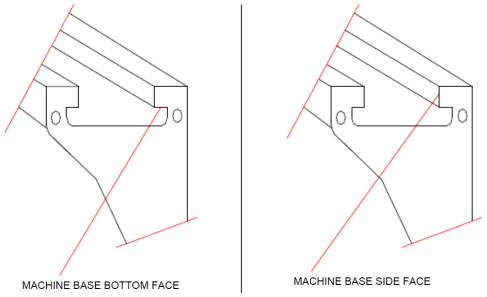
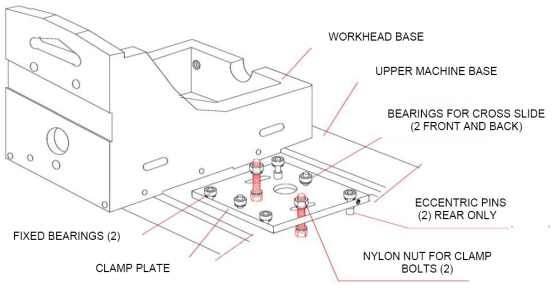
Linear Scale Setting



TROUBLESHOOTING

Contents

Troubleshooting

Problem	Possible Cause	Solution
Workhead base does not float	Insufficient air pressure	Set air pressure of supplied line should be minimum 85 PSI (6 Bars)
	Clamping plate does not drop when unclamped due to less clearance between upper floating base and ball bearings mounted on clamping plate	Take the workhead to one end of the of the upper floating surfaces (Left or Right side) float the workhead and pull it against the front on the T Slatted guide surfaces, then loose the set screws of the eccentric pin to increase clearance by using a feeler gage of 0.008” to 0.010” (0.20mm to 0.25mm) in between the T slotted guide surfaces of the upper base and the eccentric ball bearing; (see fig. below)  Lock the setscrews, remove the feeler gage and inspect if is with the tolerance across the all surfaces. Repeat if it is necessary.
	Clamping plate does not drop when unclamped due to the improper adjustment of the four clamping bolts	Adjust nylock nuts to set he correct clearance between the bottom side face of the locking T-Slot of the floating base (Riser) and the top part of the clamping plate. They are two on the SG7. The dropping clearance when is on the floating mode should be 0.015” (0.38mm)on all the four corners of the workhead clamping plate **SG7 MACHINE** **ADJUSTMENT OF CLAMPING PLATE BETWEEN UPPER MACHINE BASE AND WORKHEAD BASE** 

Problem	Possible Cause	Solution
Eccentricity Problems when Cutting Three Angle Seats	Machine is not level	Level machine per instructions in Installation section of this manual
	Workhead is not floating smoothly	Be sure that the work head and main base are clean and floating smoothly side by side and front to back
	Spindle floated to improper center location	Reposition workhead to ensure proper alignment
	Foot pedal released to quickly	On this model there's a foot pedal that controls the workhead float and this switch has 3 positions: Float, Neutral and Clamp. If the pedal is released to fast, it can cause the spindle to shift or move at the time of clamping. Release foot pedal slowly when positioning workhead
	Improper setup procedure	The centering switch that is located on the left side of the front panel needs to be on the centering position at the time of centering and machining the vale seat. The Spherical pneumatic switch needs to be on the OFF position and the pilot into the valve guide until reach the proper height or the cutting insert is a few thousands from the valve seat face. Let Workhead flow for few seconds to achieve maximum alignment over the pilot. Be sure there's no contact with the Workhead to allow spindle to stabilize and Cutter to center itself on the valve guide. Release Foot Pedal. Note: Spherical Pneumatic switch should be on the OFF position all the time that you are machining the valve seat; this will give you a positive live centering.
	Toolholder cone dirty	The toolholder cone must be clean before is attached to the spindle and also be sure that the inner spindle cone is clean
	Excessive pressure when cutting seat	Use less pressure when cutting the seat
	Incorrect spindle speed	Adjust spindle speed

Problem	Possible Cause	Solution
Eccentricity Problems when Cutting Three Angle Seats	Worn or improperly selected pilot	Check pilot for wear and straightness
	Dull or damaged cutter insert	Replace insert
	Incorrect pilot selection	Follow directions in manual for selecting pilots
	Worn tool holder	Check tool holder with bore gauge to determine if there wear
	Worn valve guide	Service valve guides before attempting to cut valve seats

SG Fault and Error Codes

Errors are sensed by the SG controller. The left display shows Err.

Faults are sensed by the motor driver. The left display shows FLt.

Alarms are sensed by the motor driver. The left display shows ALr.

To clear an error requires the condition be resolved (correct wiring...) and cycle the e-stop.

To clear fault requires the condition be resolved (correct wiring...), press the reset key on the drive front panel, and cycle the e-stop. If e-stop is cycled long enough the drive will power down and that will clear the fault too.

Alarms clear as the condition that caused them disappears (the over torque is relieved...).

Error Display	Description
C bUS	Communications lost with drive
Fault Display	**Description**
Uv1	Undervoltage
Uv2	Control Power Supply Undervoltage
Uv3	Soft Charge Circuit Fault
GF	Ground Fault
oC	Overcurrent
ov	Overvoltage
oH	Heatsink Overheat
oH1	Heatsink Overheat
oH3	Motor Overheat (PTC input)
oH4	Motor Overheat (PTC input)
rH	Braking Resistor Overheat
oL1	Motor Overload
oL2	Drive Overload
oL3	Overtorque Detection 1

oL4	Overtorque Detection 2
oL7	High Slip Braking Overload
rr	Dynamic Braking Transistor
EF1	External Fault 1, input terminal S1
EF2	External Fault 2, input terminal S2
EF3	External Fault at input terminal S3
EF4	External Fault at input terminal S4
EF5	External Fault at input terminal S5
EF6	External Fault at input terminal S6
EF7	External Fault at input terminal S7
oS	Overspeed
dEv	Excessive Speed Deviation
PGo	PG Disconnect
PF	Input Phase Loss
LF	Output Phase Loss
oPr	Digital Operator Connection
Err	EEPROM Write Error
CE	MEMOBUS/Modbus Communication Error
bUS	Option Communication Error
CF	Control fault
EF0	PROFIBUS-DP Option External Fault
FbL	PID Feedback Loss
UL3	Undertorque Detection 1
UL4	Undertorque Detection 2
oF1	Hardware Fault
LF2	Output Current Imbalance
Sto	Pullout Detection
PGo	PG Disconnected
SEr	Too many speed search restarts
FbH	PID Feedback Loss
oL5	Mechanical Weakening Detection 1
UL5	Mechanical Weakening Detection 2
CoF	Current Offset Fault
dWFL	DriveWorksEZ Fault
CPF02	A/D Conversion Error
CPF03	PWM Data Fault
CPF06	Drive specification mismatch during Terminal Board or Control Board replacement
CPF07	Terminal Board Communication Fault
CPF08	EEPROM Serial Communication Fault
CPF11	RAM fault
CPF12	Flash memory circuit exception
CPF13	Watchdog circuit exception
CPF14	Control Circuit Fault
CPF16	Clock Fault
CPF17	Timing Fault
CPF18	Control Circuit Fault
CPF19	Control Circuit Fault
CPF20	Hardware fault at power up

CPF21	Hardware fault at communication start up
CPF22	A/D Conversion Fault
CPF23	PWM Feedback Fault
CPF24	Drive capacity signal fault
oFA00	Option compatibility error
oFA01	Option not properly connected
oFA03	Option Self-diagnostics Error
oFA04	Option Flash Write Mode Error
Alarm Display	**Description**
Uv	Undervoltage
ov	Overvoltage
oH	Heatsink Overheat
oH2	Drive Overheat
oH3	Motor Overheat
oL3	Overtorque 1
oL4	Overtorque 2
EF	Run commands input error
bb	Drive Baseblock
EF1	External Fault 1, input terminal S1
EF2	External Fault 2, input terminal S2
EF3	External Fault 3, input terminal S3
EF4	External Fault 4, input terminal S4
EF5	External Fault 5, input terminal S5
EF6	External Fault 6, input terminal S6
EF7	External Fault 7, input terminal S7
FAN	Cooling Fan Error
oS	Overspeed
dEv	Excessive Speed Deviation
PGo	PG Disconnected
oPr	Digital operator connection fault
CE	Modbus Communication Error
bUS	Option Communication Error
CALL	Serial Communication Transmission Error
oL1	Motor Overload
oL2	Drive Overload
EF0	Option Card External Fault
rUn	Motor Switch command input during run
UL3	Undertorque Detection 1
UL4	Undertorque Detection 2
SE	MEMOBUS/Modbus Test Mode Fault
FbL	PID Feedback Loss
FbH	PID Feedback Loss
dnE	Drive Disabled
PGo	PG Disconnected
HCA	High Current Alarm
HbbF	Safe Disable Input
Hbb	Safe Disable Input
oL5	Mechanical Weakening Detection 1

UL5	Mechanical Weakening Detection 2
dWAL	DriveWorksEZ Alarm
RT4 Error Codes	**Description**
1	failed communication to display boardd
2	no motor voltage (blown fuse)
3	no motor current (lost motor conn)
4	over current >6.8 amps (short)
5	over current, >4.5 amp for 2 sec (slow)
6	over current >10 amp for 1/100 sec (fast)

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MACHINE PARTS

Contents

Machine Parts

Consumable Parts

REFERENCE	DESCRIPTION
SLEEVE R1	Spindle adapter replacement sleeve
BSW002	Diamond Wheel Cutting Bit Sharpener replacement Wheel (3.000" Diameter OD by .375" ID)
PRW600PIN	Replaceable Pins for PRW600 Pilot Removable wrench tool
PRW375PIN	Replaceable Pins for PRW375 Pilot Removable wrench tool
PRW20PIN	Replaceable Pins for PRW375 Pilot Removable wrench tool
VT-FP1562	Replacement Foam Pad for Round Vacuum Pad 1.562" diameter
VT-FP1875	Replacement Foam Pad for Round Vacuum Pad 1.875" diameter
VT-FP2125	Replacement Foam Pad for Round Vacuum Pad 2.125" diameter
VT-FP3125	Replacement Foam Pad for Round Vacuum Pad 3.125" diameter
VT-FP25X22	Replacement Foam Pad for Square Vacuum Pad 2.500" x 2.250" square
VT-FP31X20	Replacement Foam Pad for Square Vacuum Pad 3.125" x 2.000" square
VT-FP33X27	Replacement Foam Pad for Square Vacuum Pad 3.375"x 2.750" square
511-29-12F	T7 Torx driver for 1/4" insert (straight angle insert holders only)
511-29-12E	TORX SCREW M2.5 X 0.45 X (straight angle insert holders only)
T8S	T8 Torx Tip Holding Screws
T15S	T15 Torx Tip Holding Screws
MHS-375	Fixed Double Replaceable Insert Milling Head Screws for Large diameter milling Head (3/8” insert)
MHS-250	Fixed Double Replaceable Insert Milling Head Screws for Small diameter milling Head (1/4” insert)
S1032-250	BH375R1 and BH600R1 Tip Holder Looking Screw (10/32" X 1/4") **Req. 2**
S250-28-250	BH375WR1 Tip Holder Looking Screw 1/4"-28" X 1/4" **Req. 2**
S1032-437	TH1999 Adjusting Screw (10/32" X 7/16")
S1032-375	TH2000 Adjusting Screw (10/32" X 3/8")
S1032-500	TH2001 Adjusting Screw (10/32" X 1/2")
S1032-625	TH2002 Adjusting Screw (10/32" X 5/8")
S600-1570	TH2003 Adjusting Screw (6.00mm X 15.70mm)
S600-2015	TH2004 Adjusting Screw (6.00mm X 20.15mm)
M10X15X35	SG7 Rollover Fixture Hold down swivel Handle Zinc Handle 35mm (1.375") Long stud (KHF-725)
500-13X2	SG8 Rollover Fixture Hold down swivel Handle Zinc Handle 2.000" Long stud (KHF-162)
500-13X1375	SG7- SG8 Rollover Fixture Lock swivel Handle Zinc Handle 1.375" Long stud (KHF-158)
ICC003	Insert, Indexable carbide, for Fixed milling heads - large size - for 1.562" and larger cutters
ICC002	Insert, Indexable, carbide, for Fixed milling heads - small size - for 1.250" to 1.500" cutters

Carbide Inserts

See Carbide Insert Catalog for a complete list of Insert Profiles available from Rottler Manufacturing.

Special Profiles

Special Profile Cutter Inserts can be manufactured to your exact specifications and can include a combination of angles and radius blends.

There is three different style insert blanks.

A - Style Blank insert, RCA is a small insert for all standard applications.

B - Style Blank insert, RCB in design for long profiles like High Performances profiles with multi angles o Radius or other special applications

C - Style Blank insert, RCC is a much thicker insert for Heavy Duty tooling and can be use for hard seat materials (will work only on the Large Inserts holders series 3000 style insert holders, for the 20.00mm tooling)

Special Order - Special Profile Carbide Cutter Bits are generally considered to be “Customer Proprietary”. These are uniquely numbered, exclusively for the ordering customer; prices will vary depending on quantities and additional charge for initial run.

Call us for a quote.

RT312 Insert, triangular positive rake, 3/8 1/32” (.787mm) radius, for the TH3000 series insert holder and RT212 Insert, triangular positive rake, 1/4” (6.35mm) 1/32 “ radius for the TH2000 series, for hard seat materials applications (Counterboring and straight angles only)

Carbide Pilots

See Carbide Pilot catalog for a complete list of Pilots available.

Rottler Solid Fixed Carbide Pilots are manufactured from fine grain sintered tungsten carbide and are ground to a very high degree of accuracy, straightness and surface finish - designed for a life time of precision machining!

The part number of the pilot represents the actual diameter in metric of the straight/parallel part of the pilot where the pilot fits into the valve guide.

For example:

UCP0700 means that the diameter of the part of the pilot that goes into the valve guide is 7.00mm (0.2756”)

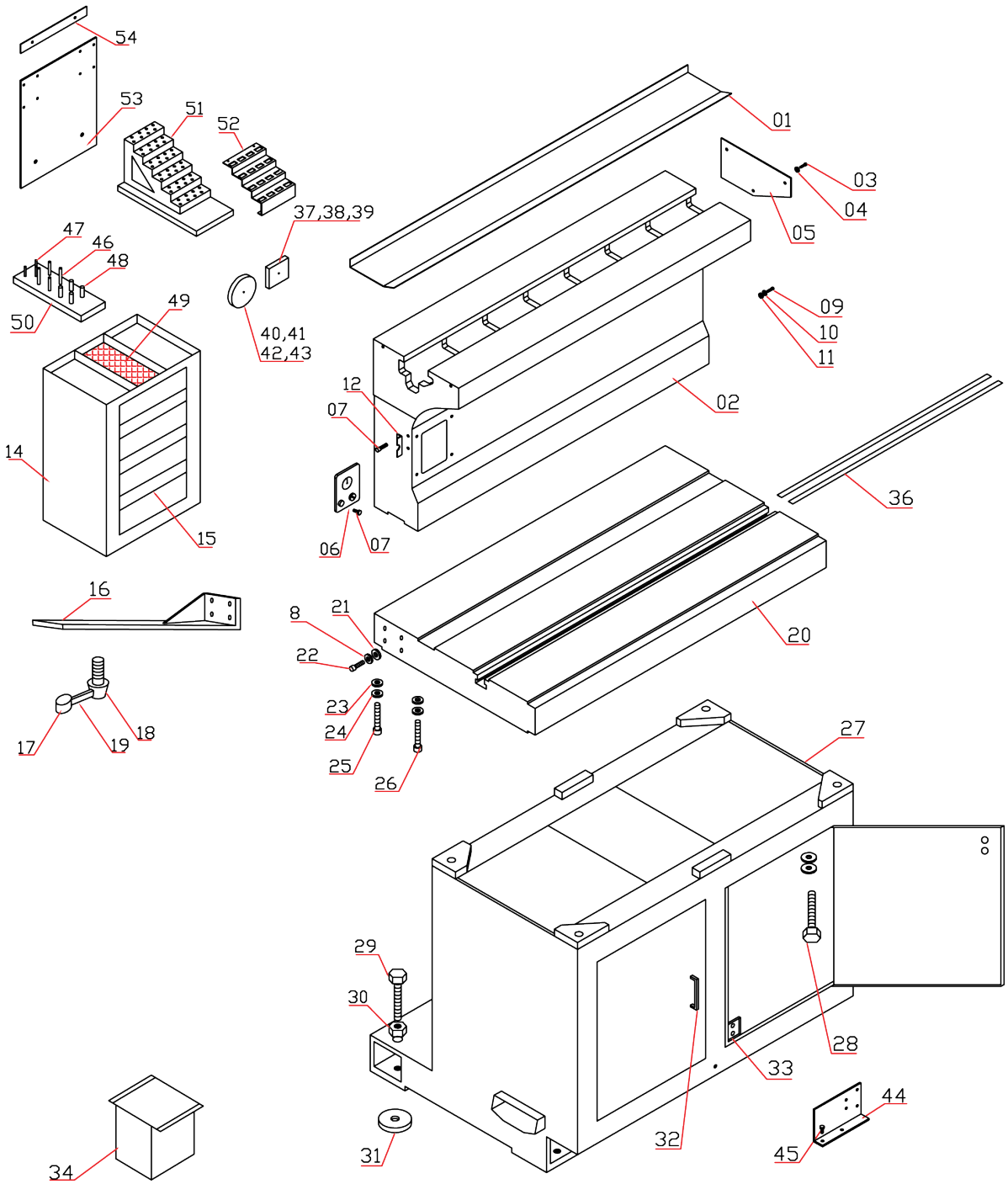
UCP1270 means that the diameter of the part of the pilot that goes into the valve guide is 12.70mm (0.5000”)

Pilots are available in increments of .01mm (0.0004”). Normally, a small amount of clearance approx .01mm (0.0004”) is required between the pilot and the valve guide.

Most new valve guides are manufactured to a nominal size and the valve stem diameters are manufactured to be smaller than the nominal size to allow clearance for heat expansion of the valve stem when the engine is operating. For example: a 7mm valve guide has an internal diameter of exactly 7.00mm (.2756”) The valve stem diameter of the intake valve is 6.98mm (.2748”) and the exhaust is 6.96mm (.2740”). In order for the pilot to fit most all valve guides, the first choice could be UCP0699 to give .01mm (0.0004”) clearance. If the valve guide is used and has some wear, then the second choice of pilot could be UCP0700(0.2756”).

Rottler makes 3 sizes of shanks of pilots:
6.00mm (0.2362”) for small valves guides 6mm (0.236”) and below. The part number for these pilots is UCPM.
0.375” (9.52mm) for common size valve guides, 6-14mm (.236-.625”). The part number for these pilots is UCP.
20mm (0.7874mm) for large valve guides for SG8M0A machine. These pilots are made to order specifications.

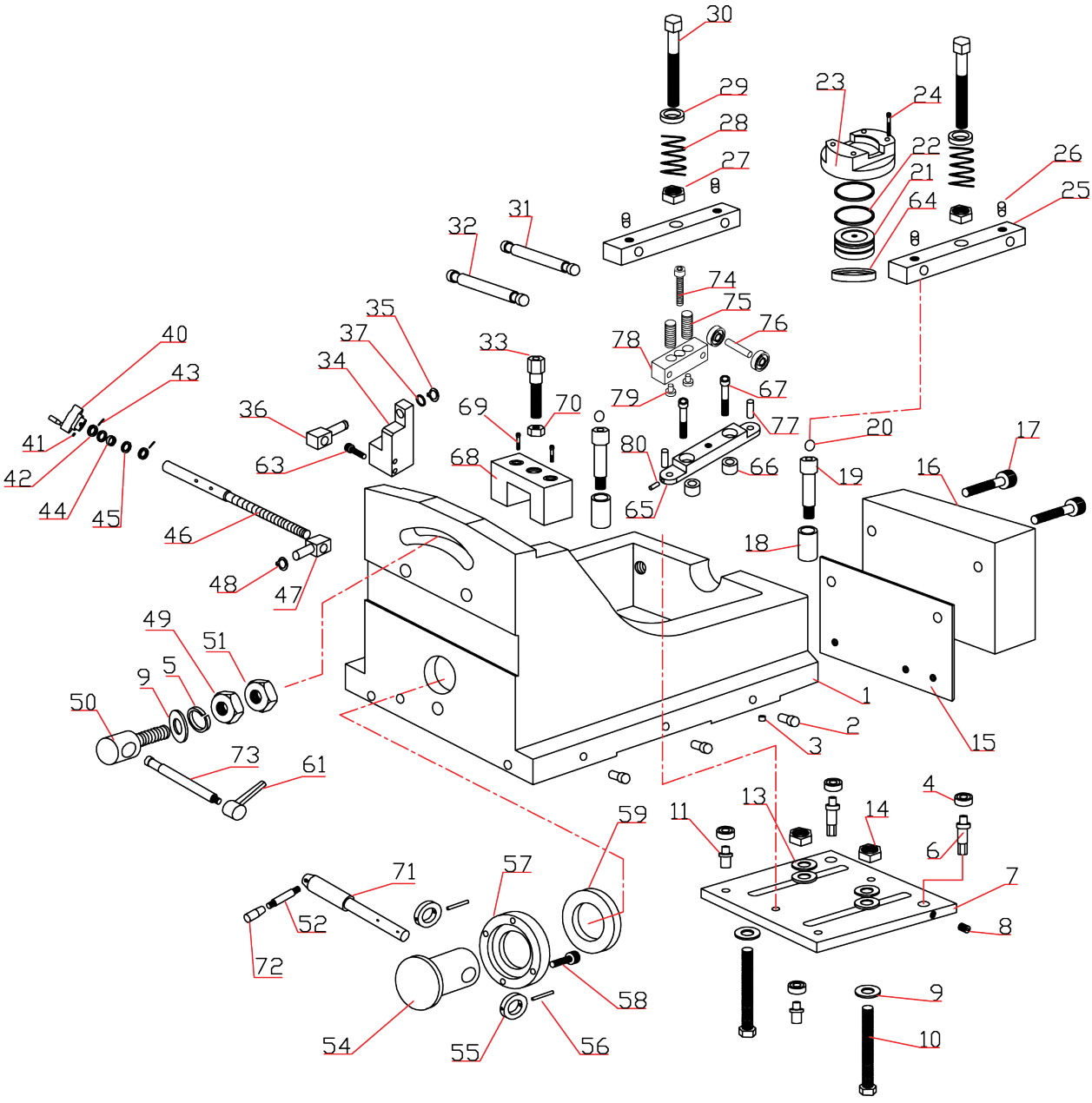
CABINET TABLE & RISER ASSEMBLY



CABINET TABLE & RISER ASSEMBLY PARTS DESCRIPTION

S. NO.	PART NO.	NEW BIN NO. SG-7MTS	DESCRIPTION	QTY
1	033-070	7-MTS-101	RISER PAN	1
2	033-043	7-MTS-102	RISER	1
3		7-MTS-103	BUTTON HEAD SCREW M6 x 10	6
4		7-MTS-104	WASHER M6	6
5	033-529-W	7-MTS-105	RISER COVER	2
6	033-071	7-MTS-106	PLATE	1
7	430-822		BUTTON HEAD SCREW M6 x 12	10
8		7-MTS-108	LOCK WASHER M8	1
9		7-MTS-109	SCREW M10 x 25	4
10		7-MTS-110	PLAIN WASHER M10	4
11		7-MTS-111	LOCK WASHER M10	4
12	033-069	7-MTS-112	BRACKET	1
13	------	------	------	------
14	430-807		TOOL CABINET	1
15	430-816		TOOL TRAY	4
16	430-806		MOUNTING BRACKET	1
17	430-802		KNOB	1
18	430-817-1		CLAMP PIN	1
19	430-823		CLAMP LEVER	1
20	033-042	7-MTS-120	TABLE	1
21		7-MTS-121	WASHER M8	4
22		7-MTS-122	SCREW M8 x 30	4
23	430-811		PLAIN WASHER M12	6
24	430-810		LOCK WASHER M12	6
25	430-812		HEX. HEAD SCREW M12 x 50	3
26		7-MTS-126	HEX. HEAD SCREW M12 x 45	3
27	033-049	7-MTS-127	CABINET	1
28		7-MTS-128	ALLEN HEAD SCREW M12 x 30	4
29	430-818		LEVELING BOLT	4
30	430-818-A		HEX NUT M16	4
31	430-819		PAD	4
32	430-825		HANDLE	2
33	430-827		MAGNET BLOCK	2
34	430-824		CHIP TRAY	1
35	------	------	------	------
36	033-042-S	7-MTS-136	TABLE SCALE	1 SET
37	101A-109		VACUUM PAD	1
38	101A-110		VACUUM PAD	1
39	101A-111		VACUUM PAD	1
40	101A-112		VACUUM PAD	1
41	101A-113		VACUUM PAD	1
42	101A-114		VACUUM PAD	1
43	101A-115		VACUUM PAD	1
44	055A-770		BRACKET	1
45		7-MTS-145	ALLEN HEAD SCREW M6 x 12	2
46	430-841		PIN	4
47	430-842		PIN	3
48	430-843		PIN	4
49	430-826-1		RUBBER SHEET	1
50	430-829-1		TOOL BOARD (L.H)	1
51	430-839-1		PILOT STAND	1
52	430-839-3		RACK (INSERT HOLDER)	1
63	430-839-2		SUPPORT PLATE	1
65	430-839-4		NAME PLATE	2

BASE ASSEMBLY

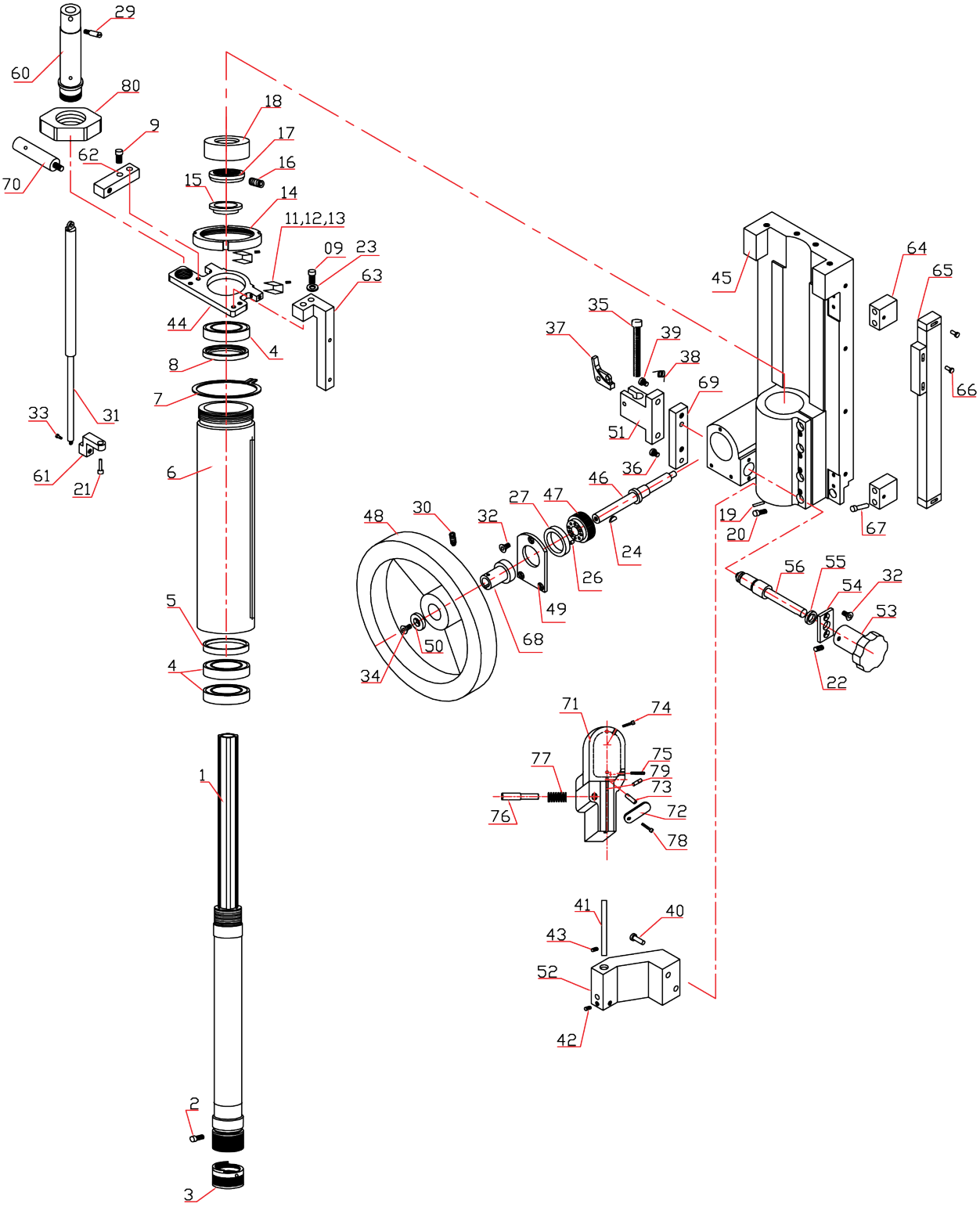


BASE ASSEMBLY - PARTS DESCRIPTION

S. NO.	PART NO.	NEW BIN NO. SG-7MTS	DESCRIPTION	QTY
1	033-427	7-MTS-201	BASE	1
2		7-MTS-202	PLUG TYPE B-1/8 (FESTO)	4
3	VGS-513		PLUG (BRASS)	14
4		7-MTS-204	BALL BEARING (6x19x6) 626-2Z	6
5		7-MTS-205	SPRING WASHER M10	1
6	033-421	7-MTS-206	ECCENTRIC PIN	2
7	033-428	7-MTS-207	CLAMPING PLATE	1
8		7-MTS-208	ALLEN GRUB SCREW M5 X 6	2
9	033-438	7-MTS-209	WASHER	3
10	033-425	7-MTS-210	HEX. BOLT	2
11	033-434	7-MTS-211	BEARING PIN	2
12	------	------	------	------
13	033-414	7-MTS-213	SPHERICAL WASHER	2 SETS
14		7-MTS-214	NYLOCK NUT M10	2
15	033-410	7-MTS-215	CONNECTION PLATE	1
16	033-409	7-MTS-216	DEAD WEIGHT	1
17		7-MTS-217	ALLEN SCREW M10 X 100	2
18	033-411	7-MTS-218	SPACER	2
19		7-MTS-219	ALLEN SCREW M10 X 35	2
20		7-MTS-220	STEEL BALL ø3/8” (OR DIA 10mm)	2
21	033-412	7-MTS-221	PISTON	1
22		7-MTS-222	‘O’ RING NIRTILE 70 DUROMETER 2-3/8” X 2-5/8” X 1/8”	2
23	033-432	7-MTS-223	CYLINDER	1
24		7-MTS-224	ALLEN SCREW M6 X 60	4
25	033-429	7-MTS-225	CLAMP ARM	2
26		7-MTS-226	ALLEN SET SCREW M6 X 6	4
27		7-MTS-227	HEX. NUT M8	2
28	282580		COMP. SPRING	2
29		7-MTS-229	WASHER M8	2
30		7-MTS-230	HEX. HEAD SCREW M8 X 80	2
31	033-406	7-MTS-231	CLAMP ARM TIE ROD	1
32	033-407	7-MTS-232	CLAMP ARM TIE ROD	1
33	033-430	7-MTS-233	SUPPORT SCREW	1
34	033-129	7-MTS-234	SCREW BLOCK	1
35		7-MTS-235	EXT. CIRCLIP A 1/2"	2
36	033-123	7-MTS-236	ADJUSTING PIN	1
37	033-129-1	7-MTS-237	SPACER	1
38	------	------	------	------
39	------	------	------	------
40	555-301		HAND WHEEL	1
41		7-MTS-241	ALLEN GRUB SCREW M5 X 10	1
42	033-124	7-MTS-242	SPACER	2
43		7-MTS-243	SPRING DOWEL Ø 1/8” X 3/4” LONG	2
44		7-MTS-244	NEEDLE CAGE BEARING 12 X 16 X 10	1
45		7-MTS-245	THRUST NEEDLE BEARING 12 X 26 X 4	2
46	033-121	7-MTS-246	INCLINATION ROD	1
47	033-122	7-MTS-247	ADJUSTING NUT	1
48		7-MTS-248	CIRCLIP A ½”	1
49		7-MTS-249	HEX NUT M10	1
50	033-107	7-MTS-250	EYE BOLT	1
51		7-MTS-251	NYLOK HEX. NUT M10	1
52	033-108	7-MTS-252	LEVER	1

S. NO.	PART NO.	NEW BIN NO. SG-7MTS	DESCRIPTION	QTY
53				
54	033-102	7-MTS-254	PIVOT PIN	1
55	033-105	7-MTS-255	ECCENTRIC COLLAR	2
56		7-MTS-256	TAPER PIN ø 3/16" X 1-1/8" LONG	2
57	033-103	7-MTS-257	RING	1
58		7-MTS-258	ALLEN SCREW M6 x 12	4
59	033-104	7-MTS-259	WASHER	1
60	------	------	------	------
61		7-MTS-261	HANDLE MR. 63A-M8 BLACK 41421	1
62	------	------	------	------
63		7-MTS-263	ALLEN HEAD CAP SCREW M6 x **35**	2
64	033-431	7-MTS-264	CYLINDER PLATE	1
65	033-433	7-MTS-265	BEARING PLATE	1
66	033-435	7-MTS-266	SPACER	2
67		7-MTS-267	ALLEN SCREW M8 x 35	2
68	**NC-115**		**PIVOT SUPPORT**	**1**
69		7-MTS-269	ALLEN HEAD SCREW M6 x 20	2
70		7-MTS-270	HEX. NUT M10	1
71	033-374	7-MTS-271	CLAMPING LEVER	1
72		7-MTS-272	HANDLE	1
73	033-127	7-MTS-273	ECCENTRIC CLAMP	1
74			**ALLEN HEAD SCREW (M6x35)**	**1**
75	**NC-121**		**JACK SCREW**	**2**
76	**NC-120**		**ROD**	**2**
77	**430-504-1**		**PIN**	**2**
78	**NC-119**		**BEARING BLOCK**	**1**
79	**NC-121-1**		**THRUST PAD**	**2**
80	**NC-139**		**NYLON STOPPER (Ø0.130"x0.250")**	**2**

SPINDLE ASSEMBLY

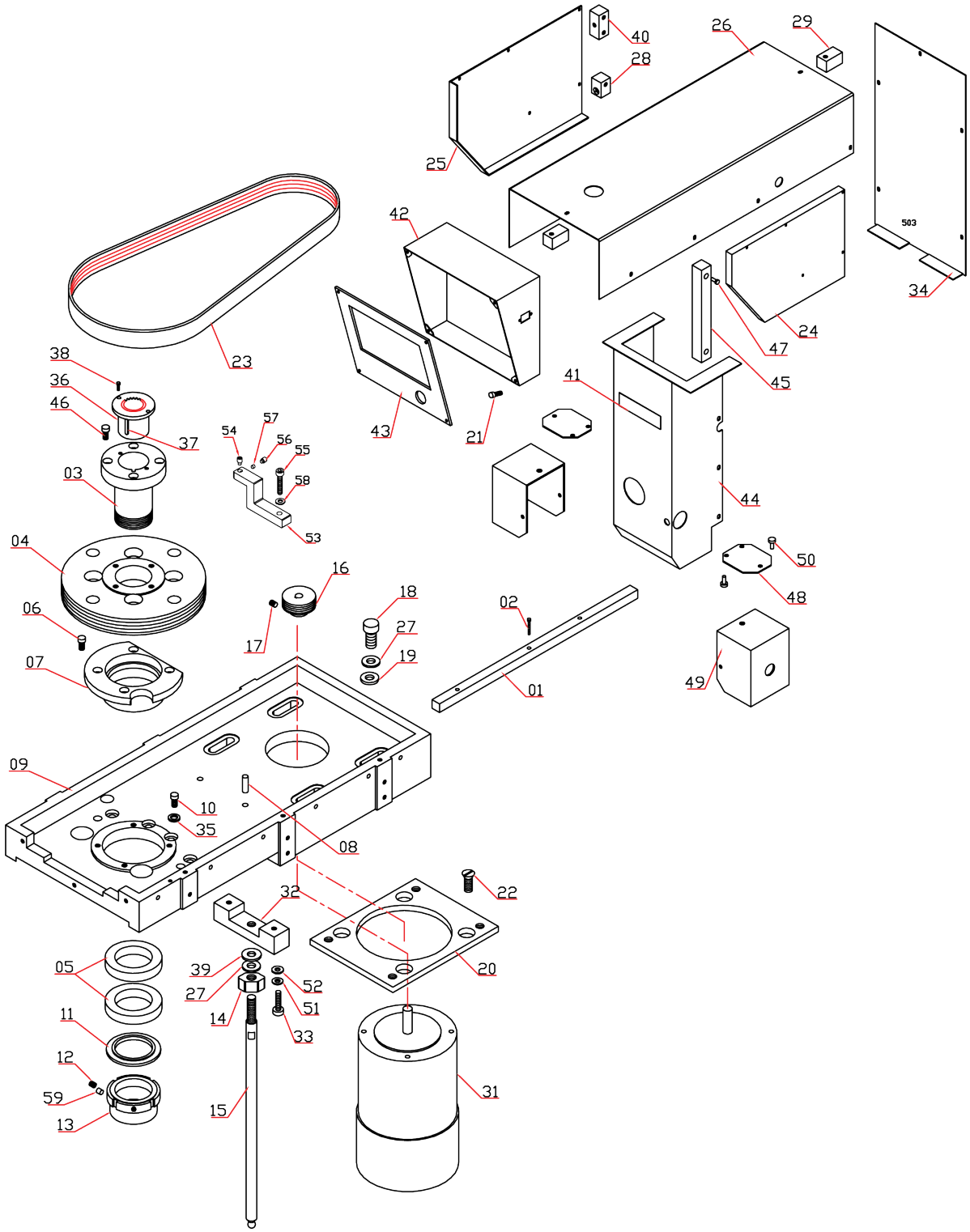


SPINDLE ASSEMBLY - PARTS DESCRIPTION

S. NO.	PART NO.	NEW BIN NO. SG-7MTS	DESCRIPTION	QTY
1.	033-359	7-MTS-301	MAIN SPINDLE	1
2.	033-320	7-MTS-302	STOPPER	1
3.	033-313	7-MTS-303	SPINDLE NUT	1
4.		7-MTS-304	ANG. CONT. BALL BRG. NO. 7906(30x47x9)	3
5.	033-342	7-MTS-305	BEARING SPACER	1
6.	033-302	7-MTS-306	COLUMN	1
7.		7-MTS-307	EXT. CIRCLIP A55	1
8.	033-303	7-MTS-308	BEARING SPACER	1
9.		7-MTS-309	**ALLEN HEAD CAP SCREW M6x25**	**4**
10.				
11.	033-376	7-MTS-311	PAD	2
12.		7-MTS-312	ALLEN GRUB SCREW M5x12	2
13.		7-MTS-313	ALLEN GRUB SCREW M5x8	2
14.	033-314	7-MTS-314	COLUMN NUT	1
15.	033-311	7-MTS-315	BEARING SPACER	1
16.		7-MTS-316	ALLEN HEAD GRUB SCREW M6 x 6	2
17.	033-349	7-MTS-317	LOCK NUT	1
18.	033-344	7-MTS-318	COVER	1
19.		7-MTS-319	ALLEN GRUB SCREW M8x16 (DOG POINT)	4
20.		7-MTS-320	ALLEN HEAD SCREW M8 x 25	4
21.		7-MTS-321	ALLEN HEAD CAP SCREW M6 x 16	1
22.		7-MTS-322	ALLEN GRUB SCREW M6 x 10	1
23.	033-360-1	7-MTS-323	SPACER	2
24.		7-MTS-324	WOODRUF KEY ¾" x 1/8"	1
25.	---		---	---
26.		7-MTS-326	CY. PIN Ø4 x 12mm LONG	2
27.	033-307	7-MTS-327	SPACER	1
28.	---		---	---
29.	033-345	7-MTS-329	GAS SPRING PIN	1
30.		7-MTS-330	BALL SPRING PLUNGER (M4)	1
31.		7-MTS-331	GAS SPRING	1
32.		7-MTS-332	ALLEN CSK SCREW M5 x 12	5
33.	033-339	7-MTS-333	GAS SPRING SCREW	1
34.		7-MTS-334	ALLEN CSK SCREW M6 x 12	1
35.	430-615		CONTROL STOP SCREW	1
36.		7-MTS-336	ALLEN HEAD CAP SCREW M5 x 12	2
37.	430-620		CONTROL STOP LATCH	1
38.	430-618		SPRING	1
39.		7-MTS-339	ALLEN HEAD CAP SCREW M6 x 12	2
40.		7-MTS-340	ALLEN SCREW M6 x 30	2
41.	430-616		LEVELING PIN	1
42.		**7-MTS-342**	**ALLEN GRUB SCREW M5 x 8**	**3**
43.		**7-MTS-343**	**ALLEN GRUB SCREW M5 x 10**	**1**
44.	033-354	7-MTS-344	STOP PLATE	1
45.	033-130	7-MTS-345	SPINDLE HOUSING	1
46.	033-318	7-MTS-346	PINION	1
47.	033-317	7-MTS-347	HELICAL GEAR	1
48.	033-351	7-MTS-348	HAND WHEEL	1
49.	033-362	7-MTS-349	END COVER	1
50.	033-364	7-MTS-350	PINION WASHER	1
51.	055A-274		LATCH STOP	1
52.	033-128	7-MTS-352	LEVEL PLATE	1

S. NO.	PART NO.	NEW BIN NO. SG-7MTS	DESCRIPTION	QTY
53.	033-375	7-MTS-353	FEED KNOB	1
54.	033-361	7-MTS-354	END COVER	1
55.	033-365	7-MTS-355	WORM SPACER	1
56.	033-319	7-MTS-356	WORM SHAFT	1
57.	---		----	
58.	----		----	
59.				
60.	033-343	7-MTS-360	GAS SPRING SUPPORT	1
61.	033-379	7-MTS-361	GAS SPRING SUPPORT	1
62.	033-372	7-MTS-362	STOP ROD	1
63.	033-360	7-MTS-363	READER HEAD BRACKET	1
64.	033-355	7-MTS-364	SCALE BLOCK	2
65.		7-MTS-365	OPTICAL SCALE	1
66.		7-MTS-366	ALLEN HEAD CAP SCREW M4 x 20	4
67.		**7-MTS-367**	**ALLEN HEAD CAP SCREW M6 x 35**	**4**
68.	033-350	7-MTS-368	HAND WHEEL BUSH	1
69.	033-352	7-MTS-369	STOP PLATE	1
70.	033-377	7-MTS-370	STOP ROD	1
71.	430-1049 B		LEVEL BLOCK	1
72.	430-1025		CLAMP	1
73.		7-MTS-373	GRUB SCREW (M5 x 16)	1
74.		7-MTS-374	ALLEN HEAD SCREW (M3 x 12)	2
75.		7-MTS-375	DOWEL PIN (Ø3/16 x 3/4 LONG)	1
76.	430-1026		CLAMP PIN	1
77.	430-1026-1		SPRING	1
78.		7-MTS-378	BUTTON HEAD (SCREW M5 x 10)	1
79.	430-1049 C		SLIDE PIN	1
80.	033-346	7-MTS-380	HEX NUT	1

TRANSMISSION ASSEMBLY

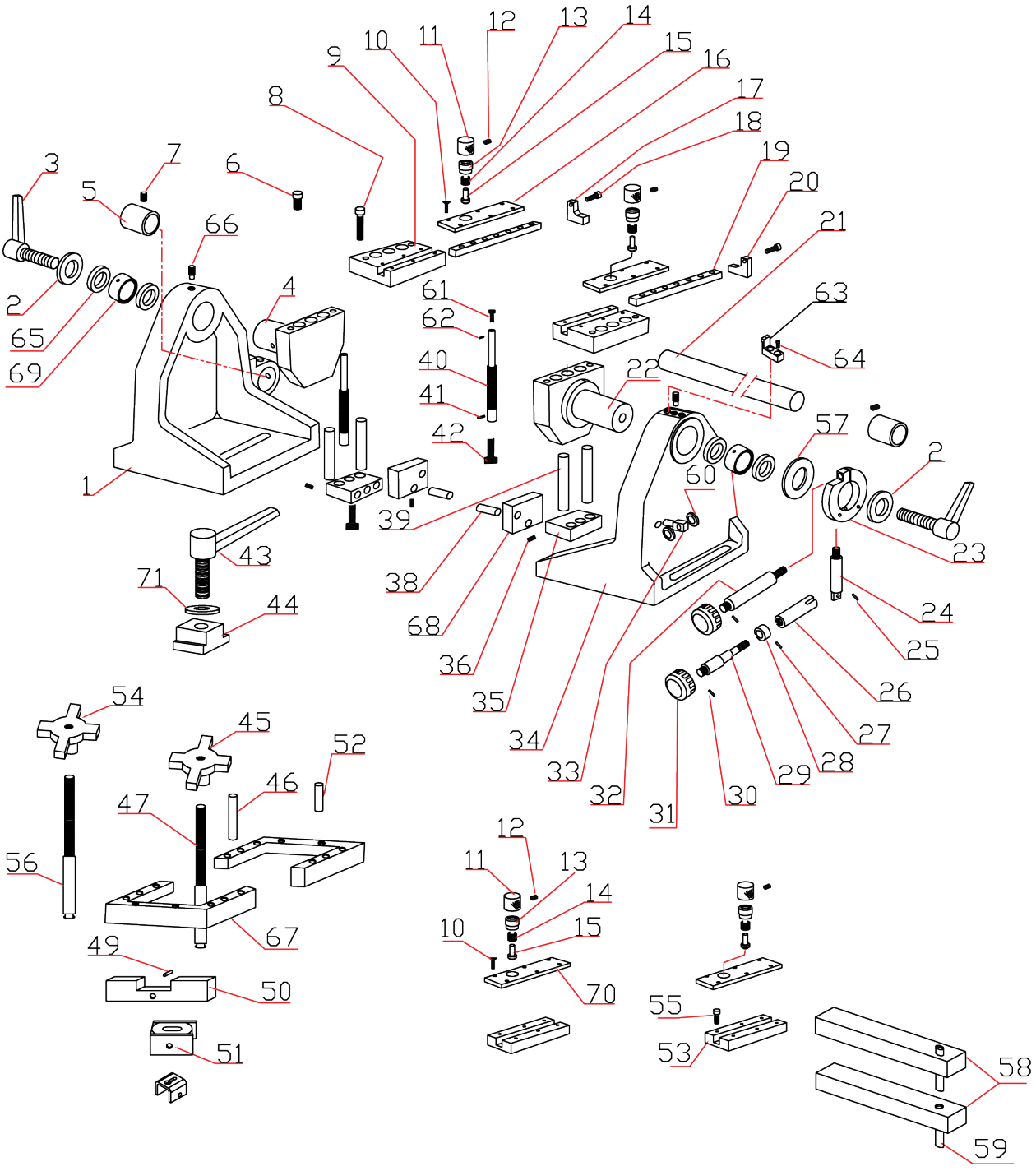


TRANSMISSION ASSEMBLY - PARTS DESCRIPTION

S. NO.	PART NO.	NEW BIN NO. SG-7MTS	DESCRIPTION	QTY
1	033-223	7-MTS-401	COVER SPACER	1
2		7-MTS-402	ALLEN HEAD SCREW M4 x 20	3
3	033-217	7-MTS-403	FLANGE	1
4	033-218	7-MTS-404	DRIVE PULLEY	1
5		7-MTS-405	BALL BEARING 45 x 68 x 12, NO.6909- 2RS	2
6		7-MTS-406	ALLEN SCREW M6 x 12	4
7	033-215	7-MTS-407	BEARING HOUSING	1
8		7-MTS-408	CYL. PIN DIA 10 x 30MM	2
9	033-200	7-MTS-409	TOP PLATE	1
10		**7-MTS-410**	**ALLEN SCREW M8 x 30**	**4**
11	033-219	7-MTS-411	BEARING SPACER	1
12		7-MTS-412	ALLEN HEAD GRUB SCREW M6 x 6	2
13	033-220	7-MTS-413	LOCK NUT	1
14		7-MTS-414	HEX NUT M10	1
15	033-206	7-MTS-415	SUPPORT ROD	1
16	033-204	7-MTS-416	MOTOR PULLEY	1
17		7-MTS-417	ALLEN SET SCREW M6 x 8	1
18		7-MTS-418	ALLEN SCREW M10 x 25	4
19	033-222	7-MTS-419	WASHER	4
20	033-205	7-MTS-420	MOTOR PLATE	1
21		7-MTS-421	BUTTON HEAD SCREW M6 x 10	8
22		7-MTS-422	C'SINK SCREW 3/8" BSW x ¾" LONG	4
23		7-MTS-423	POLY V-BELT 360-J-8	1
24	033-502	7-MTS-424	RIGHT SIDE COVER	1
25	033-501	7-MTS-425	LEFT SIDE COVER	1
26	033-515	7-MTS-426	TOP COVER	1
27		7-MTS-427	LOCK WASHER M10	2
28	033-512	7-MTS-428	FIXING BLOCK	2
29	033-539	7-MTS-429	FIXING BLOCK	**2**
30				
31		7-MTS-431	3 PH AC MOTOR 1 HP, 1725 RPM	1
32	033-221	7-MTS-432	ROD SUPPORT	1
33		7-MTS-433	SOCKET HEAD SCREW M6 x 25	2
34	033-503	7-MTS-434	BACK SIDE COVER	1
35	033-212	7-MTS-435	SPACER	4
36	033-216	7-MTS-436	SPLINE BUSH	1
37		7-MTS-437	PARALLEL KEY 5 x 5 x 25MM	1
38		7-MTS-438	ALLEN HEAD CAP SCREW M4 x 10	2
39		7-MTS-439	MACHINE WASHER M10	1
40	033-511	7-MTS-440	FIXING BLOCK	2
41	033-371	7-MTS-441	NAME PLATE	1
42	033-533	7-MTS-442	NAME PLATE BOX	1
43	033-521	7-MTS-443	NAME PLATE	1
44	033-528	7-MTS-444	FRONT COVER	1
45	033-535	7-MTS-445	COVER SPACER	2
46		7-MTS-446	ALLEN HEAD CAP SCREW M6 x 20	4
47		7-MTS-447	ALLEN HEAD CAP SCREW M6 x 25	4
48	033-534	7-MTS-448	LIGHT BRACKET	2
49	033-537	7-MTS-449	LIGHT BRACKET	2
50		7-MTS-450	SOCKET HEAD CAP SCREW M6 x 10	6
51		7-MTS-451	LOCK WASHER M6	1
52		7-MTS-452	PLAIN WASHER M6	1

S. NO.	PART NO.	NEW BIN NO. SG-7MTS	DESCRIPTION	QTY
53	445-738-1		HEIGHT GAUGE	1
54			F.PT GRUB SCREW M6 x 10	1
55			ALLEN HEAD SCREW (M6x30)	1
56			GRUB SCREW FLAT POINT M5x6	1
57			NYLON PLUG DIA. 0.140" x0.080"	1
58			PLAIN WASHER (Ø6MM)	1
59		7-MTS-459	NYLON PLUG	2

HEAD SUPPORT ASSEMBLY

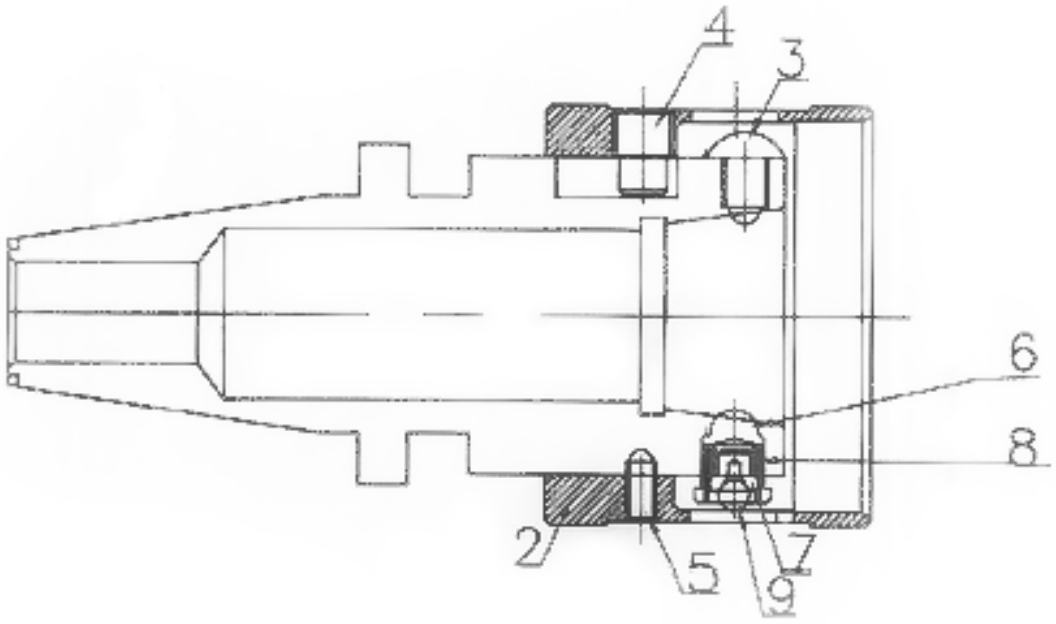


HEAD SUPPORT ASSEMBLY - PARTS DESCRIPTION

S. NO.	PART NO.	NEW BIN NO. SG-7MTS	DESCRIPTION	QTY
1	033-067	7-MTS-501	CRADLE LEFT	1
2	033-023	7-MTS-502	WASHER	2
3	**42321**	7-MTS-503	ADJUSTABLE HANDLE	1 EACH
4	033-007	7-MTS-504	HOLDER LEFT	1
5	033-046	7-MTS-505	BEARING BUSH	2
6	430-911		KNOB	2
7		7-MTS-507	GRUB SCREW M8 X 10	1
8		7-MTS-508	ALLEN SCREW M10 X 30	4
9	033-057	7-MTS-509	SUPPORT PLATE	2
10		7-MTS-510	ALLEN C'SINK SCREW M5 X 12	24
11	430-918		KNURLING COLLAR	4
12	430-917		ALLEN GRUB SCREW M6 X 6	4
13	430-916		PIN HOLDER	4
14	430-921		SPRING	4
15	430-919		PLUNGER	4
16	033-058	7-MTS-516	COVER PLATE	2
17	430-937-1		STOP PLATE (LH)	1
18		7-MTS-518	ALLEN SCREW M6 X 12	2
19	SF-108		FLAT	2
20	430-935-1		STOP PLATE (RH)	1
21	033-059	7-MTS-521	GUIDE ROD	1
22	033-006	7-MTS-522	HOLDER (RH)	1
23	033-051	7-MTS-523	COLLAR	1
24	033-053	7-MTS-524	ARM	1
25		7-MTS-525	SPRING DOWEL Ø 1/8" X 5/8" LONG	1
26	033-054	7-MTS-526	CLAMP	1
27		7-MTS-527	SPRING DOWEL Ø 3/32" X 3/4" LONG	1
28	033-028	7-MTS-528	SPACER	1
29	033-055	7-MTS-529	ADJUSTING SCREW	1
30		7-MTS-530	SPRING DOWEL Ø 1/8" X 5/8" LONG	2
31	430-923		KNOB	2
32	033-052	7-MTS-532	COLLAR SCREW	1
33	033-056	7-MTS-533	PIVOT BLOCK	1
34	033-066	7-MTS-534	CRADLE RIGHT	1
35	033-018	7-MTS-535	CLAMPING PLATE	2
36		7-MTS-536	GRUB SCREW M5 X 6	2
37	**430-965-1**		**CLAMPING PIN (NOT SHOWN)**	**4**
38	430-949		PIVOT PIN	2
39	033-017	7-MTS-539	PIN	4
40	033-015	7-MTS-540	SCREW	2
41		7-MTS-541	SPRING DOWEL Ø 1/8" X 5/8" LONG	2
42		7-MTS-542	ALLEN HEAD SCREW M10 X 25	2
43	**42231**	7-MTS-543	ADJUTABLE HANDLE	2
44	033-024	7-MTS-544	T-NUT	2
45	430-942		KNOB	2
46	430-943		TUBE	2
47	430-948		TAKE UP ROD	2
48	-----		------	------
49	430-946		ROLL PIN	2
50	430-945		BAR	2

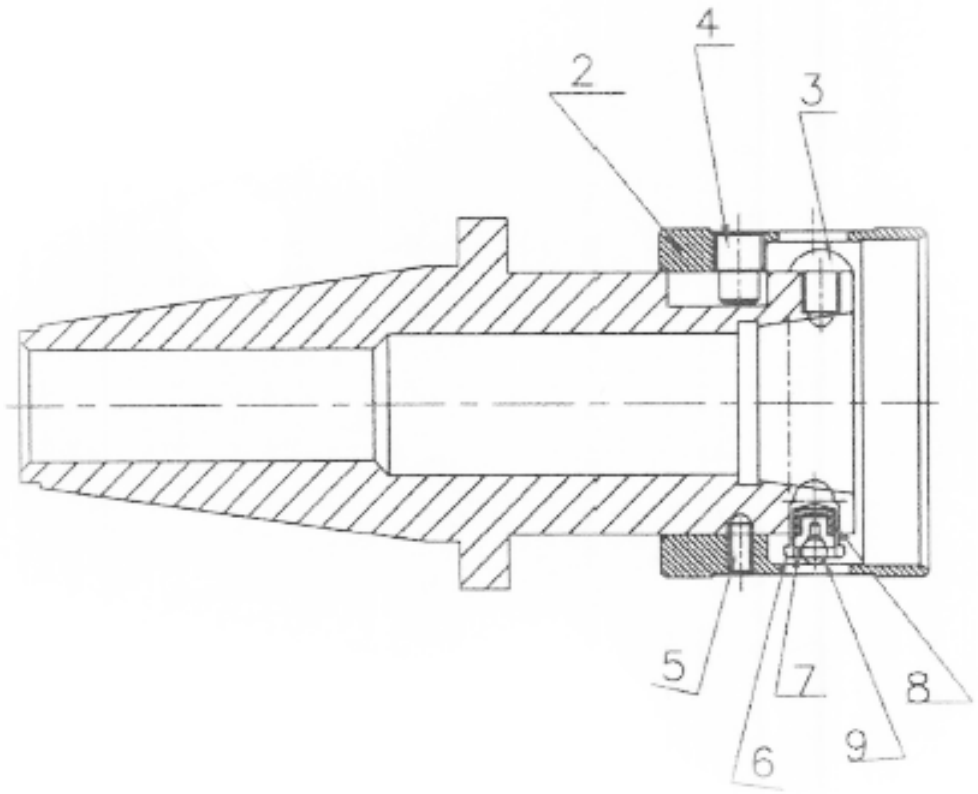
S. NO.	PART NO.	NEW BIN NO. SG-7MTS	DESCRIPTION	QTY
51	430-947		SWIVEL CLAMP	2
52	430-943-S		TUBE (SMALL)	2
53.	430-944-II		LOCATING BLOCK	2
54.	430-942-A		KNOB	2
55.		7-MTS-555	AL. HEAD SCREW M6 X 25	8
56.	430-948-A		TAKE UP ROD (1/4")	2
57.	033-074	7-MTS-557	SPACER	1
58.	430-944-S		PARALLEL FLAT	2
59.		7-MTS-559	DOWEL PIN 1/4" X 1.0" LONG	2
60.		7-MTS-560	THRUST NEEDLE ROLLER BEARING.	2
61		7-MTS-561	ALLEN HEAD SCREW M8x10	2
62.		7-MTS-562	CYL. PIN Ø3/32 x 0.500"	2
63.	033-061	7-MTS-563	ZERO MARK	1
64.		7-MTS-564	ALLEN HEAD CAP SCREW M6x16	2
65.		7-MTS-565	BALL BEARING 6906-2RS	4
66.	033-065	7-MTS-566	SET SCREW	2
67.	033-076	7-MTS-567	HEAD SUPPORT	2
68.	055A-648		CLAMP PLATE	2
69.	033-080	7-MTS-569	BEARING SPACER	2
70.	430-915		COVER PLATE	2
71.	033-222-1	7-MTS-571	WASHER	2

RBHAR1KIT Repair Kit for RBHAR1



Item	Part #	Description	Quantity
2	RBHAR1COL	Collar	1
3	555-19-19	Stop Screw	2
4	555-19-20	Dog Point Screw	2
5	555-19-21	Ball Point	2
6	555-19-22	Detent	4
7	555-19-23	Ball Seat	4
8	555-19-24	Spring	4
9	555-19-25	Ball (4mm)	4

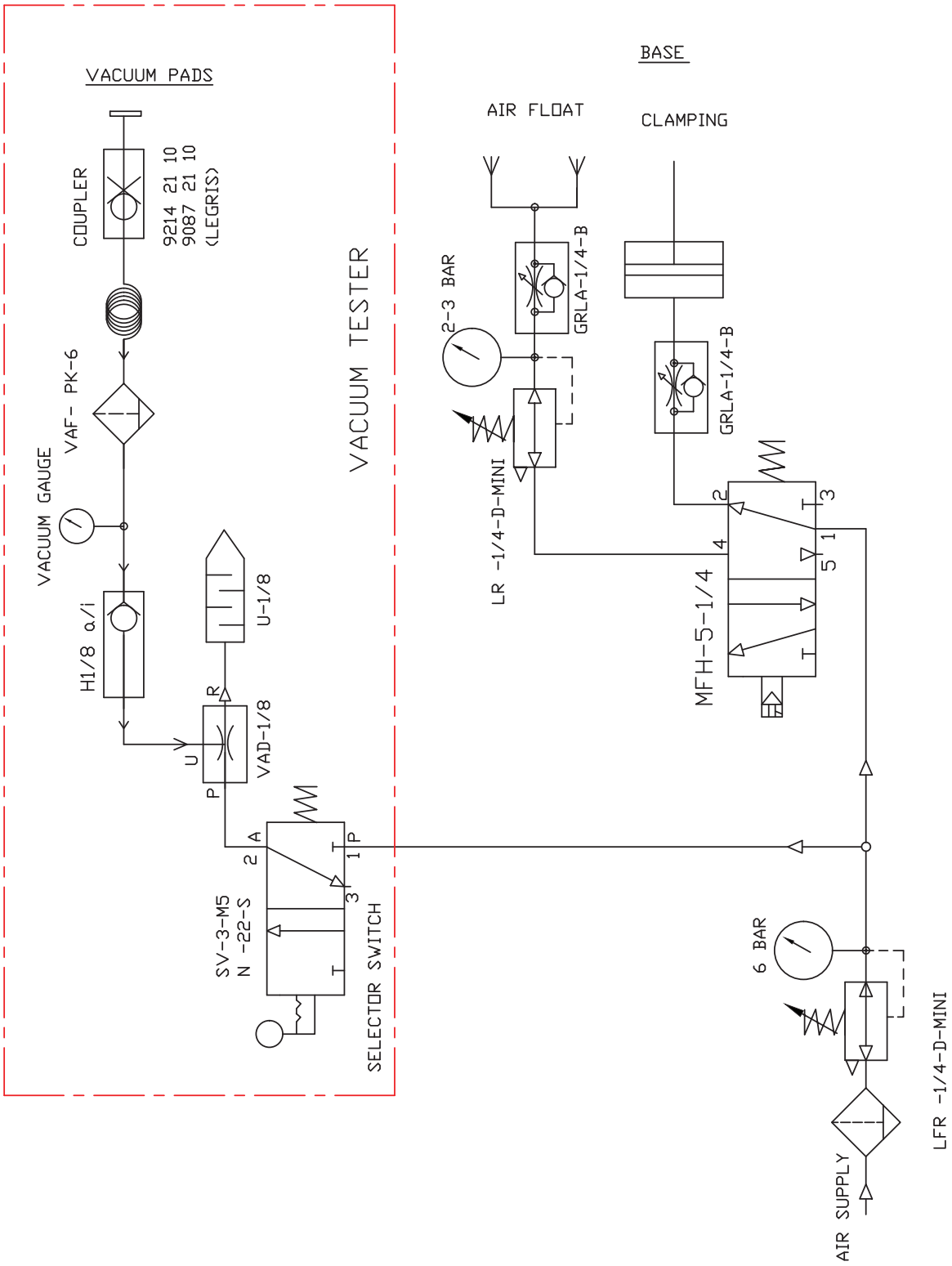
RBHAR40UPCKIT Repair Kit for RBHAR40UPT



Item	Part #	Description	Quantity
2	RBHAR40UPCCOL	Collar	1
3	555-19-19	Stop Screw	2
4	555-19-20	Dog Point Screw	2
5	555-19-21	Ball Point	2
6	555-19-22	Detent	4
7	555-19-23	Ball Seat	4
8	555-19-24	Spring	4
9	555-19-25	Ball (4mm)	4

SG7MTS Pneumatic Drawing

SEAT & GUIDE MACHINE MODEL: SG7-MTS
PNEUMATIC CIRCUIT DIAGRAM



DECIMAL TO METRIC CONVERSION CHART

Units of Length

To Convert	Multiply by	To Obtain
mm	0.03937	in.
cm	0.3937	in.
meters	39.37	in.
meters	3.281	ft.
meters	1.0936	yd.
km	3,281	ft.

To Convert	Multiply by	To Obtain
km	1093.6	yd.
km	0.6214	miles
microns	0.00003937	in.
in.	25.4	mm
in.	2.54	cm
in.	0.0254	meters

To Convert	Multiply by	To Obtain
ft.	0.3048	meters
ft.	0.0003048	km
yd.	0.9144	meters
yd.	0.0009144	km
miles	1.609	km
in.	25,400	microns

fraction	decimal	mm
1/64	0.0156	0.3969
1/32	0.0313	0.7938
3/64	0.0469	1.1906
1/16	0.0625	1.5875
5/64	0.0781	1.9844
3/32	0.0938	2.3813
7/64	0.1094	2.7781
1/8	**0.1250**	**3.1750**
9/64	0.1406	3.5719
5/32	0.1563	3.9688
11/64	0.1719	4.3656
3/16	0.1875	4.7625
13/64	0.2031	5.1594
7/32	0.2188	5.5563
15/64	0.2344	5.9531
1/4	**0.2500**	**6.3500**
17/64	0.2656	6.7469
9/32	0.2813	7.1438
19/64	0.2969	7.5406
5/16	0.3125	7.9375
21/64	0.3281	8.3344
11/32	0.3438	8.7313
23/64	0.3594	9.1281
3/8	**0.3750**	**9.5250**
25/64	0.3906	9.9219
13/32	0.4063	10.3188
27/64	0.4219	10.7156
7/16	0.4375	11.1125
29/64	0.4531	11.5094
15/32	0.4688	11.9063
31/64	0.4844	12.3031
1/2	**0.5000**	**12.7000**
33/64	0.5156	13.0969
17/32	0.5313	13.4938
35/64	0.5469	13.8906

fraction	decimal	mm
1 1/64	1.0156	25.7969
1 1/32	1.0313	26.1938
1 3/64	1.0469	26.5906
1 1/16	1.0625	26.9875
1 5/64	1.0781	27.3844
1 3/32	1.0938	27.7813
1 7/64	1.1094	28.1781
1 1/8	**1.1250**	**28.5750**
1 9/64	1.1406	28.9719
1 5/32	1.1563	29.3688
1 11/64	1.1719	29.7656
1 3/16	1.1875	30.1625
1 13/64	1.2031	30.5594
1 7/32	1.2188	30.9563
1 15/64	1.2344	31.3531
1 1/4	**1.2500**	**31.7500**
1 17/64	1.2656	32.1469
1 9/32	1.2813	32.5438
1 19/64	1.2969	32.9406
1 5/16	1.3125	33.3375
1 21/64	1.3281	33.7344
1 11/32	1.3438	34.1313
1 23/64	1.3594	34.5281
1 3/8	**1.3750**	**34.9250**
1 25/64	1.3906	35.3219
1 13/32	1.4063	35.7188
1 27/64	1.4219	36.1156
1 7/16	1.4375	36.5125
1 29/64	1.4531	36.9094
1 15/32	1.4688	37.3063
1 31/64	1.4844	37.7031
1 1/2	**1.5000**	**38.1000**
1 33/64	1.5156	38.4969
1 17/32	1.5313	38.8938
1 35/64	1.5469	39.2906

fraction	decimal	mm
2 1/64	2.0156	51.1969
2 1/32	2.0313	51.5938
2 3/64	2.0469	51.9906
2 1/16	2.0625	52.3875
2 5/64	2.0781	52.7844
2 3/32	2.0938	53.1813
2 7/64	2.1094	53.5781
2 1/8	**2.1250**	**53.9750**
2 9/64	2.1406	54.3719
2 5/32	2.1563	54.7688
2 11/64	2.1719	55.1656
2 3/16	2.1875	55.5625
2 13/64	2.2031	55.9594
2 7/32	2.2188	56.3563
2 15/64	2.2344	56.7531
2 1/4	**2.2500**	**57.1500**
2 17/64	2.2656	57.5469
2 9/32	2.2813	57.9438
2 19/64	2.2969	58.3406
2 5/16	2.3125	58.7375
2 21/64	2.3281	59.1344
2 11/32	2.3438	59.5313
2 23/64	2.3594	59.9281
2 3/8	**2.3750**	**60.3250**
2 25/64	2.3906	60.7219
2 13/32	2.4063	61.1188
2 27/64	2.4219	61.5156
2 7/16	2.4375	61.9125
2 29/64	2.4531	62.3094
2 15/32	2.4688	62.7063
2 31/64	2.4844	63.1031
2 1/2	**2.5000**	**63.5000**
2 33/64	2.5156	63.8969
2 17/32	2.5313	64.2938
2 35/64	2.5469	64.6906

9/16	0.5625	14.2875
37/64	0.5781	14.6844
19/32	0.5938	15.0813
39/64	0.6094	15.4781
5/8	**0.6250**	**15.8750**
41/64	0.6406	16.2719
21/32	0.6563	16.6688
43/64	0.6719	17.0656
11/16	0.6875	17.4625
45/64	0.7031	17.8594
23/32	0.7188	18.2563
47/64	0.7344	18.6531
3/4	**0.7500**	**19.0500**
49/64	0.7656	19.4469
25/32	0.7813	19.8438
51/64	0.7969	20.2406
13/16	0.8125	20.6375
53/64	0.8281	21.0344
27/32	0.8438	21.4313
55/64	0.8594	21.8281
7/8	**0.8750**	**22.2250**
57/64	0.8906	22.6219
29/32	0.9063	23.0188
59/64	0.9219	23.4156
15/16	0.9375	23.8125
61/64	0.9531	24.2094
31/32	0.9688	24.6063
63/64	0.9844	25.0031
1	**1.0000**	**25.4000**

1 9/16	1.5625	39.6875
1 37/64	1.5781	40.0844
1 19/32	1.5938	40.4813
1 39/64	1.6094	40.8781
1 5/8	**1.6250**	**41.2750**
1 41/64	1.6406	41.6719
1 21/32	1.6563	42.0688
1 43/64	1.6719	42.4656
1 11/16	1.6875	42.8625
1 45/64	1.7031	43.2594
1 23/32	1.7188	43.6563
1 47/64	1.7344	44.0531
1 3/4	**1.7500**	**44.4500**
1 49/64	1.7656	44.8469
1 25/32	1.7813	45.2438
1 51/64	1.7969	45.6406
1 13/16	1.8125	46.0375
1 53/64	1.8281	46.4344
1 27/32	1.8438	46.8313
1 55/64	1.8594	47.2281
1 7/8	**1.8750**	**47.6250**
1 57/64	1.8906	48.0219
1 29/32	1.9063	48.4188
1 59/64	1.9219	48.8156
1 15/16	1.9375	49.2125
1 61/64	1.9531	49.6094
1 31/32	1.9688	50.0063
1 63/64	1.9844	50.4031
2	**2.0000**	**50.8000**

2 9/16	2.5625	65.0875
2 37/64	2.5781	65.4844
2 19/32	2.5938	65.8813
2 39/64	2.6094	66.2781
2 5/8	**2.6250**	**66.6750**
2 41/64	2.6406	67.0719
2 21/32	2.6563	67.4688
2 43/64	2.6719	67.8656
2 11/16	2.6875	68.2625
2 45/64	2.7031	68.6594
2 23/32	2.7188	69.0563
2 47/64	2.7344	69.4531
2 3/4	**2.7500**	**69.8500**
2 49/64	2.7656	70.2469
2 25/32	2.7813	70.6438
2 51/64	2.7969	71.0406
2 13/16	2.8125	71.4375
2 53/64	2.8281	71.8344
2 27/32	2.8438	72.2313
2 55/64	2.8594	72.6281
2 7/8	**2.8750**	**73.0250**
2 57/64	2.8906	73.4219
2 29/32	2.9063	73.8188
2 59/64	2.9219	74.2156
2 15/16	2.9375	74.6125
2 61/64	2.9531	75.0094
2 31/32	2.9688	75.4063
2 63/64	2.9844	75.8031
3	**3.0000**	**76.2000**

OPTIONS

Optional Equipment

Optional Equipment Catalog and Parts Manual are located on the Manual CD shipped with machine.

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SDS

The Safety Data Sheets list shown in this section are the substances and materials that an operator is most likely to come in contact with while using this machine.

Other substances and materials are used in the manufacture, testing, and shipping of this machine. A complete list of the Safety Data Sheets of substances and materials used by Rottler Manufacturing during manufacturing, testing, and shipping is located on the Manual flash drive shipped with the machine. Safety Data Sheets are also located on the company web site: http://www.rottlermfg.com/documentation.php

1) Way Oil

2) Multi-Purpose EP Grease

Safety Data Sheet

According to OSHA HCS 2012 (29 CFR 1910.1200), Health Canada HPR (SOR/2015-17), and Mexico NOM-018-STPS-2015

SECTION 1: Identification

Product Identifier **Multi-Way Oil HD**

Other means of identification Phillips 66 Multi-Way Oil HD 32
Phillips 66 Multi-Way Oil HD 68
Phillips 66 Multi-Way Oil HD 220

Code **LBPH817776**

Relevant identified uses Way Oil

Uses advised against All others

24 Hour Emergency Phone Number CHEMTREC: 1-800-424-9300
CHEMTREC México 01-800-681-9531

Manufacturer/Supplier
Phillips 66 Lubricants
P.O. Box 4428
Houston, TX 77210

SDS Information
URL: www.phillips66.com/SDS
Phone: 800-762-0942
Email: SDS@P66.com

Customer Service
U.S.: 800-368-7128 or International: 1-832-765-2500
Technical Information
1-877-445-9198

SECTION 2: Hazard identification

Classified Hazards

No classified hazards

Hazards Not Otherwise Classified (HNOC)

PHNOC: None known

HHNOC: None known

Label elements

No classified hazards

SECTION 3: Composition/information on ingredients

Chemical Name	CASRN	Concentration
Distillates, petroleum, hydrotreated heavy paraffinic	64742-54-7	>40
Distillates, petroleum, solvent-dewaxed heavy paraffinic	64742-65-0	>45
Residual oils, petroleum, solvent-dewaxed	64742-62-7	>10

[1] All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

SECTION 4: First aid measures

Eye Contact: If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention.

Skin Contact: Remove contaminated shoes and clothing and cleanse affected area(s) thoroughly by washing with mild soap and water or a waterless hand cleaner. If irritation or redness develops and persists, seek medical attention.

Inhalation: First aid is not normally required. If breathing difficulties develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. Seek immediate medical attention.

Ingestion: First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

Most important symptoms and effects, both acute and delayed: Inhalation of oil mists or vapors generated at elevated temperatures may cause respiratory irritation. Accidental ingestion can result in minor irritation of the digestive tract, nausea and diarrhea. Prolonged or repeated contact may dry skin and cause irritation.

Notes to Physician: Acute aspirations of large amounts of oil-laden material may produce a serious aspiration pneumonia. Patients who aspirate these oils should be followed for the development of long-term sequelae. Inhalation exposure to oil mists below current workplace exposure limits is unlikely to cause pulmonary abnormalities.

SECTION 5: Firefighting measures

NFPA 704: National Fire Protection Association

Health: 0 **Flammability:** 1 **Instability:** 0

0 = minimal hazard
1 = slight hazard
2 = moderate hazard
3 = severe hazard
4 = extreme hazard

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F / 100°C. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Specific hazards arising from the chemical

Unusual Fire & Explosion Hazards: This material may burn, but will not ignite readily. If container is not properly cooled, it can rupture in the heat of a fire.

Hazardous Combustion Products: Combustion may yield smoke, carbon monoxide, and other products of incomplete combustion. Oxides of sulfur, nitrogen or phosphorus may also be formed.

Special protective actions for fire-fighters: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8). Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Stop spill/release if it can be done safely. Move undamaged containers from immediate hazard area if it can be done safely. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely. Avoid spreading burning liquid with water used for cooling purposes.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures: This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

Environmental Precautions: Stop and contain spill/release if it can be done safely. Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If spill occurs on water notify appropriate authorities and advise shipping of any hazard. Spills into or upon navigable waters, the contiguous zone, or adjoining shorelines that cause a sheen or discoloration on the surface of the water, may require notification of the National Response Center (phone number 800-424-8802).

Methods and material for containment and cleaning up: Notify relevant authorities in accordance with all applicable regulations. Immediate cleanup of any spill is recommended. Dike far ahead of spill for later recovery or disposal. Absorb spill with

inert material such as sand or vermiculite, and place in suitable container for disposal. If spilled on water remove with appropriate methods (e.g. skimming, booms or absorbents). In case of soil contamination, remove contaminated soil for remediation or disposal, in accordance with local regulations.

Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken. See Section 13 for information on appropriate disposal.

SECTION 7: Handling and storage

Precautions for safe handling: Keep away from flames and hot surfaces. Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8). Spills will produce very slippery surfaces. Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Do not wear contaminated clothing or shoes.

Conditions for safe storage: Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well-ventilated area away from heat and all sources of ignition. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

SECTION 8: Exposure controls/personal protection

Occupational exposure limits
The following constituents are the only constituents of the product which have a PEL, TLV or other recommended exposure limit. At this time, the other constituents have no known exposure limits.

Chemical Name	ACGIH	OSHA	Mexico	Phillips 66
Distillates, petroleum, hydrotreated heavy paraffinic	TWA: 5mg/m³ STEL: 10 mg/m³ as Oil Mist, if Generated	---	---	---
Distillates, petroleum, solvent-dewaxed heavy paraffinic	TWA: 5mg/m³ STEL: 10 mg/m³ as Oil Mist, if Generated	---	---	---
Residual oils, petroleum, solvent-dewaxed	TWA: 5mg/m³ STEL: 10 mg/m³ as Oil Mist, if Generated	---	---	---

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

Biological occupational exposure limits
Note: This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

Eye/Face Protection: The use of eye/face protection is not normally required; however, good industrial hygiene practice suggests the use of eye protection that meets or exceeds ANSI Z.87.1 whenever working with chemicals.

Skin/Hand Protection: The use of skin protection is not normally required; however, good industrial hygiene practice suggests the use of gloves or other appropriate skin protection whenever working with chemicals. Suggested protective materials: Nitrile rubber

Respiratory Protection: Where there is potential for airborne exposure above the exposure limit a NIOSH certified air purifying respirator equipped with R or P95 filters may be used.

A respiratory protection program that meets or is equivalent to OSHA 29 CFR 1910.134 and ANSI Z88.2 should be followed whenever workplace conditions warrant a respirator's use. Air purifying respirators provide limited protection and cannot be used in atmospheres that exceed the maximum use concentration (as directed by regulation or the manufacturer's instructions), in oxygen

deficient (less than 19.5 percent oxygen) situations, or under conditions that are immediately dangerous to life and health (IDLH).

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

SECTION 9: Physical and chemical properties

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

Appearance: Amber, Transparent
Physical Form: Liquid
Odor: Petroleum
Odor Threshold: No data
pH: Not applicable
Vapor Density (air=1): >1
Upper Explosive Limits (vol % in air): No data
Lower Explosive Limits (vol % in air): No data
Evaporation Rate (nBuAc=1): No data
Particle Size: Not applicable
Percent Volatile: No data
Flammability (solid, gas): Not applicable
Solubility in Water: Insoluble

Flash Point: > 320 °F / > 160 °C
Test Method: Pensky-Martens Closed Cup (PMCC), ASTM D93, EPA 1010
Initial Boiling Point/Range: No data
Vapor Pressure: <1 mm Hg
Partition Coefficient (n-octanol/water) (Kow): No data
Melting/Freezing Point: < 5 °F / < -15 °C
Auto-ignition Temperature: No data
Decomposition Temperature: No data
Specific Gravity (water=1): 0.86 - 0.89 @ 60ºF (15.6ºC)
Bulk Density: 7.2 - 7.4 lbs/gal
Viscosity: 5 - 20 cSt @ 100°C; 29 - 235 cSt @ 40°C
Pour Point: < 5 °F / < -15 °C

SECTION 10: Stability and reactivity

Reactivity: Not chemically reactive.

Chemical stability: Stable under normal ambient and anticipated conditions of use.

Possibility of hazardous reactions: Hazardous reactions not anticipated.

Conditions to avoid: Extended exposure to high temperatures can cause decomposition. Avoid all possible sources of ignition.

Incompatible materials: Avoid contact with strong oxidizing agents and strong reducing agents.

Hazardous decomposition products: Not anticipated under normal conditions of use.

SECTION 11: Toxicological information

Information on Toxicological Effects

Substance / Mixture

Acute Toxicity	Hazard	Additional Information	LC50/LD50 Data
Inhalation	Unlikely to be harmful		>5 mg/L (mist, estimated)
Dermal	Unlikely to be harmful		> 2 g/kg (estimated)
Oral	Unlikely to be harmful		> 5 g/kg (estimated)

Likely Routes of Exposure: Inhalation, eye contact, skin contact

Aspiration Hazard: Not expected to be an aspiration hazard

Skin Corrosion/Irritation: Not expected to be irritating. Repeated exposure may cause skin dryness or cracking.

Serious Eye Damage/Irritation: Not expected to be irritating.

Skin Sensitization: No information available on the mixture, however none of the components have been classified for skin sensitization (or are below the concentration threshold for classification).

Respiratory Sensitization: No information available.

Specific Target Organ Toxicity (Single Exposure): No information available on the mixture, however none of the components have been classified for target organ toxicity (or are below the concentration threshold for classification).

Specific Target Organ Toxicity (Repeated Exposure): No information available on the mixture, however none of the components have been classified for target organ toxicity (or are below the concentration threshold for classification).

Carcinogenicity: No information available on the mixture, however none of the components have been classified for carcinogenicity (or are below the concentration threshold for classification).

Germ Cell Mutagenicity: No information available on the mixture, however none of the components have been classified for germ cell mutagenicity (or are below the concentration threshold for classification).

Reproductive Toxicity: No information available on the mixture, however none of the components have been classified for reproductive toxicity (or are below the concentration threshold for classification).

Information on Toxicological Effects of Components

Lubricant Base Oil (Petroleum)

Carcinogenicity: The petroleum base oils contained in this product have been highly refined by a variety of processes including severe hydrocracking/hydroprocessing to reduce aromatics and improve performance characteristics. All of the oils meet the IP-346 criteria of less than 3 percent PAH's and are not considered carcinogens by NTP, IARC, or OSHA.

SECTION 12: Ecological information

GHS Classification:
No classified hazards

Toxicity: All acute aquatic toxicity studies on samples of lubricant base oils show acute toxicity values greater than 100 mg/L for invertebrates, algae and fish. These tests were carried out on water accommodated fractions and the results are consistent with the predicted aquatic toxicity of these substances based on their hydrocarbon compositions.

Persistence and Degradability: The hydrocarbons in this material are not readily biodegradable, but since they can be degraded by microorganisms, they are regarded as inherently biodegradable.

Bioaccumulative Potential: Log Kow values measured for the hydrocarbon components of this material are greater than 5.3, and therefore regarded as having the potential to bioaccumulate. In practice, metabolic processes may reduce bioconcentration.

Mobility in Soil: Volatilization to air is not expected to be a significant fate process due to the low vapor pressure of this material. In water, base oils will float and spread over the surface at a rate dependent upon viscosity. There will be significant removal of hydrocarbons from the water by sediment adsorption. In soil and sediment, hydrocarbon components will show low mobility with adsorption to sediments being the predominant physical process. The main fate process is expected to be slow biodegradation of the hydrocarbon constituents in soil and sediment.

Other adverse effects: None anticipated.

SECTION 13: Disposal considerations

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations. This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste and is not believed to exhibit characteristics of hazardous waste. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the SDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste.This material under most intended uses would become "Used Oil" due to contamination by physical or chemical impurities. Whenever possible, Recycle used oil in accordance with applicable federal and state or local regulations. Container contents should be completely used and containers should be emptied prior to discard.

SECTION 14: Transport information

U.S. Department of Transportation (DOT)
UN Number: Not regulated
UN proper shipping name: None

Transport hazard class(es): None
Packing Group: None
Environmental Hazards: This product does not meet the DOT/UN/IMDG/IMO criteria of a marine pollutant
Special precautions for user: If shipped by land in a packaging having a capacity of 3,500 gallons or more, the provisions of 49 CFR, Part 130 apply. (Contains oil)
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable

SECTION 15: Regulatory information

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds)
This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372.

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)
Should this product meet EPCRA 311/312 Tier reporting criteria at 40 CFR 370, refer to Section 2 of this SDS for appropriate classifications.

CERCLA/SARA - Section 313 and 40 CFR 372
This material does not contain any chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372.

EPA (CERCLA) Reportable Quantity (in pounds)
This material does not contain any chemicals with CERCLA Reportable Quantities.

California Proposition 65
This material does not contain any chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the warning requirements of California Proposition 65.

International Inventories
All components are either listed on the US TSCA Inventory, or are not regulated under TSCA.
All components are either on the DSL, or are exempt from DSL listing requirements.

SECTION 16: Other information

Issue Date:	Previous Issue Date:	SDS Number	Status:
16-Apr-2018	23-Jun-2016	LBPH817776	FINAL

Revised Sections or Basis for Revision:
Exposure limits (Section 8); Regulatory information (Section 15)

Legend (pursuant to NOM-018-STPS-2015):
The information within is considered correct but is not exhaustive and will be used for guidance only, which is based on the current knowledge of the substance or mixture and is applicable to the appropriate safety precautions for the product.

Guide to Abbreviations:
ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; GHS = Globally Harmonized System; HPR = Hazardous Products Regulations; IARC = International Agency for Research on Cancer; INSHT = National Institute for Health and Safety at Work; IOPC = International Oil Pollution Compensation; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

Disclaimer of Expressed and implied Warranties:
The information presented in this Safety Data Sheet is based on data believed to be accurate as of the date this Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.

Safety Data Sheet

According to OSHA HCS 2012 (29 CFR 1910.1200), Health Canada HPR (SOR/2015-17), and Mexico NOM-018-STPS-2015

SECTION 1: Identification

Product Identifier **Alco Super-Lube Multi-Purpose EP-0 Grease**
Code **829364**
Relevant identified uses Lubricating Grease
Uses advised against All others
24 Hour Emergency Phone Number CHEMTREC 1-800-424-9300
CHEMTREC México 01-800-681-9531

Manufacturer/Supplier
Phillips 66 Spectrum Corporation
500 Industrial Park Drive
Selmer, TN 38375-3276
United States of America

SDS Information
URL: www.Phillips66.com
Phone: 800-762-0942
Email: SDS@P66.com

Technical Information
1-800-264-6457 or +1-731-645-4972

SECTION 2: Hazard identification

Classified Hazards

No classified hazards

Hazards Not Otherwise Classified (HNOC)

PHNOC: None known

HHNOC: None known

Label Elements

No classified hazards

SECTION 3: Composition/information on ingredients

Chemical Name	CASRN	Concentration[1]
Distillates, petroleum, hydrotreated heavy naphthenic	64742-52-5	40-70
Distillates, petroleum, hydrotreated heavy paraffinic	64742-54-7	20-40
Boron lithium oxide	12007-60-2	<4

[1] All concentrations are percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

SECTION 4: First aid measures

Eye Contact: If irritation or redness develops from exposure, flush eyes with clean water. If symptoms persist, seek medical attention.

Skin Contact: Remove contaminated shoes and clothing and cleanse affected area(s) thoroughly by washing with mild soap and water or a waterless hand cleaner. If irritation or redness develops and persists, seek medical attention. If product is injected into or under the skin, or into any part of the body, regardless of the appearance of the wound or its size, the individual should be evaluated immediately by a physician. (see Note to Physician)

Inhalation: First aid is not normally required. If breathing difficulties develop, move victim away from source of exposure and into fresh air in a position comfortable for breathing. Seek immediate medical attention.

Ingestion: First aid is not normally required; however, if swallowed and symptoms develop, seek medical attention.

Most important symptoms and effects, both acute and delayed: Inhalation of oil mists or vapors generated at elevated temperatures may cause respiratory irritation. Accidental ingestion can result in minor irritation of the digestive tract, nausea and diarrhea. Prolonged or repeated contact may dry skin and cause irritation

Notes to Physician: When using high-pressure equipment, injection of product under the skin can occur. In this case, the casualty should be sent immediately to the hospital. Do not wait for symptoms to develop. High-pressure hydrocarbon injection injuries may produce substantial necrosis of underlying tissue despite an innocuous appearing external wound. These injuries often require extensive emergency surgical debridement and all injuries should be evaluated by a specialist in order to assess the extent of injury. Early surgical treatment within the first few hours may significantly reduce the ultimate extent of injury.

SECTION 5: Firefighting measures

NFPA 704 Hazard Class

Health: 0 **Flammability:** 1 **Instability:** 0

0 (Minimal)
1 (Slight)
2 (Moderate)
3 (Serious)
4 (Severe)

Extinguishing Media: Dry chemical, carbon dioxide, foam, or water spray is recommended. Water or foam may cause frothing of materials heated above 212°F / 100°C. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Specific hazards arising from the chemical

Unusual Fire & Explosion Hazards: This material may burn, but will not ignite readily. If container is not properly cooled, it can rupture in the heat of a fire.

Hazardous Combustion Products: Combustion may yield smoke, carbon monoxide, and other products of incomplete combustion. Oxides of sulfur, nitrogen or phosphorus may also be formed.

Special protective actions for fire-fighters: For fires beyond the initial stage, emergency responders in the immediate hazard area should wear protective clothing. When the potential chemical hazard is unknown, in enclosed or confined spaces, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8). Isolate the hazard area and deny entry to unnecessary and unprotected personnel. Stop spill/release if it can be done safely. Move undamaged containers from immediate hazard area if it can be done safely. Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done safely. Avoid spreading burning liquid with water used for cooling purposes.

See Section 9 for Flammable Properties including Flash Point and Flammable (Explosive) Limits

SECTION 6: Accidental release measures

Personal precautions, protective equipment and emergency procedures: This material may burn, but will not ignite readily. Keep all sources of ignition away from spill/release. Stay upwind and away from spill/release. Avoid direct contact with material. For large spillages, notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Wear appropriate protective equipment, including respiratory protection, as conditions warrant (see Section 8). See Sections 2 and 7 for additional information on hazards and precautionary measures.

Environmental Precautions: Stop and contain spill/release if it can be done safely. Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Use water sparingly to minimize environmental contamination and reduce disposal requirements. If spill occurs on water notify appropriate authorities and advise shipping of any hazard. Spills into or upon navigable waters, the contiguous zone, or adjoining shorelines that cause a sheen or discoloration on the surface of the water, may require notification of the National Response Center (phone number 800-424-8802).

Methods and material for containment and cleaning up: Notify relevant authorities in accordance with all applicable regulations. Immediate cleanup of any spill is recommended. Dike far ahead of spill for later recovery or disposal. Absorb spill with inert material such as sand or vermiculite, and place in suitable container for disposal. If spilled on water remove with appropriate methods (e.g. skimming, booms or absorbents). In case of soil contamination, remove contaminated soil for remediation or disposal, in accordance with local regulations.

Recommended measures are based on the most likely spillage scenarios for this material; however local conditions and regulations may influence or limit the choice of appropriate actions to be taken. See Section 13 for information on appropriate disposal.

SECTION 7: Handling and storage

Precautions for safe handling: Keep away from flames and hot surfaces. Wash thoroughly after handling. Use good personal hygiene practices and wear appropriate personal protective equipment (see section 8). High pressure injection of hydrocarbon fuels, hydraulic oils or greases under the skin may have serious consequences even though no symptoms or injury may be apparent. This can happen accidentally when using high pressure equipment such as high pressure grease guns, fuel injection apparatus or from pinhole leaks in tubing of high pressure hydraulic oil equipment.

Do not enter confined spaces such as tanks or pits without following proper entry procedures such as ASTM D-4276 and 29CFR 1910.146. Do not wear contaminated clothing or shoes.

Conditions for safe storage: Keep container(s) tightly closed and properly labeled. Use and store this material in cool, dry, well-ventilated area away from heat and all sources of ignition. Store only in approved containers. Keep away from any incompatible material (see Section 10). Protect container(s) against physical damage.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations. Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSI Z49.1, and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

SECTION 8: Exposure controls/personal protection

Chemical Name	ACGIH	OSHA	Mexico	Phillips 66
Distillates, petroleum, hydrotreated heavy naphthenic	TWA: 5mg/m³ STEL: 10 mg/m³ as Oil Mist, if Generated	---	---	---
Distillates, petroleum, hydrotreated heavy paraffinic	TWA: 5mg/m³ STEL: 10 mg/m³ as Oil Mist, if Generated	---	---	---

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentrations below the established exposure limits, additional engineering controls may be required.

Eye/Face Protection: The use of eye protection that meets or exceeds ANSI Z.87.1 is recommended to protect against potential eye contact, irritation, or injury. Depending on conditions of use, a face shield may be necessary.

Skin/Hand Protection: The use of gloves impervious to the specific material handled is advised to prevent skin contact. Users should check with manufacturers to confirm the breakthrough performance of their products.

Respiratory Protection: Respiratory protection is not normally required under intended conditions of use. Emergencies or conditions that could result in significant airborne exposures may require the use of NIOSH approved respiratory protection. An industrial hygienist or other appropriate health and safety professional should be consulted for specific guidance under these situations.

Suggestions provided in this section for exposure control and specific types of protective equipment are based on readily available information. Users should consult with the specific manufacturer to confirm the performance of their protective equipment. Specific situations may require consultation with industrial hygiene, safety, or engineering professionals.

SECTION 9: Physical and chemical properties

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1 atm). Data represent typical values and are not intended to be specifications.

Appearance: Green
Physical Form: Semi-Solid
Odor: Slight hydrocarbon
Odor Threshold: No data
pH: Not applicable
Vapor Density (air=1): <1
Upper Explosive Limits (vol % in air): No data
Lower Explosive Limits (vol % in air): No data
Evaporation Rate (nBuAc=1): No data
Particle Size: Not applicable
Percent Volatile: No data
Flammability (solid, gas): Not applicable

Flash Point: 257 °F / 125 °C
Test Method: Cleveland Open Cup (COC), ASTM D92
Initial Boiling Point/Range: No data
Vapor Pressure: <1 mm Hg
Partition Coefficient (n-octanol/water) (Kow): No data
Melting/Freezing Point: No data
Auto-ignition Temperature: No data
Decomposition Temperature: No data
Specific Gravity (water=1): 0.87 @ 60ºF (15.6ºC)
Bulk Density: 7.5 lbs/gal
Viscosity: No data
Solubility in Water: Negligible

SECTION 10: Stability and reactivity

Reactivity: Not chemically reactive.

Chemical stability: Stable under normal ambient and anticipated conditions of use.

Possibility of hazardous reactions: Hazardous reactions not anticipated.

Conditions to avoid: Extended exposure to high temperatures can cause decomposition. Avoid all possible sources of ignition.

Incompatible materials: Avoid contact with strong oxidizing agents and strong reducing agents.

Hazardous decomposition products: Not anticipated under normal conditions of use.

SECTION 11: Toxicological information

Information on Toxicological Effects

Substance / Mixture

Acute Toxicity	Hazard	Additional Information	LC50/LD50 Data
Inhalation	Unlikely to be harmful		>5 mg/L (mist, estimated)
Dermal	Unlikely to be harmful		> 2 g/kg (estimated)
Oral	Unlikely to be harmful		> 5 g/kg (estimated)

Aspiration Hazard: Not expected to be an aspiration hazard

Skin Corrosion/Irritation: Causes mild skin irritation. Repeated exposure may cause skin dryness or cracking.

Serious Eye Damage/Irritation: Causes mild eye irritation.

Skin Sensitization: No information available on the mixture, however none of the components have been classified for skin sensitization (or are below the concentration threshold for classification).

Respiratory Sensitization: No information available.

Specific Target Organ Toxicity (Single Exposure): No information available on the mixture, however none of the components have been classified for target organ toxicity (or are below the concentration threshold for classification).

Specific Target Organ Toxicity (Repeated Exposure): No information available on the mixture, however none of the components have been classified for target organ toxicity (or are below the concentration threshold for classification).

Carcinogenicity: No information available on the mixture, however none of the components have been classified for

carcinogenicity (or are below the concentration threshold for classification).

Germ Cell Mutagenicity: No information available on the mixture, however none of the components have been classified for germ cell mutagenicity (or are below the concentration threshold for classification).

Reproductive Toxicity: No information available on the mixture, however none of the components have been classified for reproductive toxicity (or are below the concentration threshold for classification).

Information on Toxicological Effects of Components

Lubricant Base Oil (Petroleum)

Carcinogenicity: The petroleum base oils contained in this product have been highly refined by a variety of processes including severe hydrocracking/hydroprocessing to reduce aromatics and improve performance characteristics. All of the oils meet the IP-346 criteria of less than 3 percent PAH's and are not considered carcinogens by NTP, IARC, or OSHA.

SECTION 12: Ecological information

GHS Classification:
No classified hazards

Toxicity: All acute aquatic toxicity studies on samples of lubricant base oils show acute toxicity values greater than 100 mg/L for invertebrates, algae and fish. These tests were carried out on water accommodated fractions and the results are consistent with the predicted aquatic toxicity of these substances based on their hydrocarbon compositions.

Persistence and Degradability: The hydrocarbons in this material are not readily biodegradable, but since they can be degraded by microorganisms, they are regarded as inherently biodegradable.

Bioaccumulative Potential: Log Kow values measured for the hydrocarbon components of this material are greater than 5.3, and therefore regarded as having the potential to bioaccumulate. In practice, metabolic processes may reduce bioconcentration.

Mobility in Soil: Volatilization to air is not expected to be a significant fate process due to the low vapor pressure of this material. In water, base oils will float and spread over the surface at a rate dependent upon viscosity. There will be significant removal of hydrocarbons from the water by sediment adsorption. In soil and sediment, hydrocarbon components will show low mobility with adsorption to sediments being the predominant physical process. The main fate process is expected to be slow biodegradation of the hydrocarbon constituents in soil and sediment.

Other adverse effects: None anticipated.

SECTION 13: Disposal considerations

The generator of a waste is always responsible for making proper hazardous waste determinations and needs to consider state and local requirements in addition to federal regulations. This material, if discarded as produced, would not be a federally regulated RCRA "listed" hazardous waste and is not believed to exhibit characteristics of hazardous waste. See Sections 7 and 8 for information on handling, storage and personal protection and Section 9 for physical/chemical properties. It is possible that the material as produced contains constituents which are not required to be listed in the SDS but could affect the hazardous waste determination. Additionally, use which results in chemical or physical change of this material could subject it to regulation as a hazardous waste. Container contents should be completely used and containers should be emptied prior to discard.

SECTION 14: Transport information

U.S. Department of Transportation (DOT)
UN Number: Not regulated
UN proper shipping name: None
Transport hazard class(es): None
Packing Group: None
Environmental Hazards: This product does not meet the DOT/UN/IMDG/IMO criteria of a marine pollutant
Special precautions for user: None
Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not applicable

SECTION 15: Regulatory information

CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs (in pounds)

This material does not contain any chemicals subject to the reporting requirements of SARA 302 and 40 CFR 372.

CERCLA/SARA - Section 311/312 (Title III Hazard Categories)
US EPA has published a final rule aligning hazardous chemical reporting under sections 311 and 312 of the Emergency Planning and Community Right-to-Know Act (EPCRA) with OSHA HCS. See Section 2 for hazard classifications under EPCRA.

CERCLA/SARA - Section 313 and 40 CFR 372
This material does not contain any chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372.

Chemical Name	Concentration[1]	de minimis
Zinc Compound(s)	<2	1.0%

EPA (CERCLA) Reportable Quantity (in pounds)
This material does not contain any chemicals with CERCLA Reportable Quantities.

California Proposition 65
This material does not contain any chemicals which are known to the State of California to cause cancer, birth defects or other reproductive harm at concentrations that trigger the warning requirements of California Proposition 65.

International Inventories
All components are either listed on the US TSCA Inventory, or are not regulated under TSCA.
All components are either on the DSL, or are exempt from DSL listing requirements.

SECTION 16: Other information

Issue Date:	Previous Issue Date:	SDS Number	Status:
02-May-2017	31-Jul-2015	829364	FINAL

Revised Sections or Basis for Revision:
Identified Hazards (Section 2); Composition (Section 3); Format change

Legend (pursuant to NOM-018-STPS-2015):
The information within is considered correct but is not exhaustive and will be used for guidance only, which is based on the current knowledge of the substance or mixture and is applicable to the appropriate safety precautions for the product.

Guide to Abbreviations:
ACGIH = American Conference of Governmental Industrial Hygienists; CASRN = Chemical Abstracts Service Registry Number; CEILING = Ceiling Limit (15 minutes); CERCLA = The Comprehensive Environmental Response, Compensation, and Liability Act; EPA = Environmental Protection Agency; GHS = Globally Harmonized System; HPR = Hazardous Products Regulations; IARC = International Agency for Research on Cancer; INSHT = National Institute for Health and Safety at Work; IOPC = International Oil Pollution Compensation; LEL = Lower Explosive Limit; NE = Not Established; NFPA = National Fire Protection Association; NTP = National Toxicology Program; OSHA = Occupational Safety and Health Administration; PEL = Permissible Exposure Limit (OSHA); SARA = Superfund Amendments and Reauthorization Act; STEL = Short Term Exposure Limit (15 minutes); TLV = Threshold Limit Value (ACGIH); TWA = Time Weighted Average (8 hours); UEL = Upper Explosive Limit; WHMIS = Worker Hazardous Materials Information System (Canada)

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The information presented in this Safety Data Sheet is based on data believed to be accurate as of the date this Safety Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THIS PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.