



MACHINE SHOP MANUAL

HIGHER EDUCATION CENTER AT MCALLEN



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JET Horizontal Band Saw

Operating Controls

- Button A >> Start Saw
- Button B >> Stop Saw
- Button C >> Emergency Stop
- Valves D >> Controls Coolant (3 gallons)

General Operating Procedures

1. Raise bow until it will clear workpiece by a few inches, and close hydraulic cylinder valve secure it in place.
2. Place workpiece in vise and tighten.
3. Move speed setting handle to desired position.
4. Set downfeed rate (on the hydraulic cylinder dial).
5. Push start button.
6. Turn on coolant flow.
7. Open valve on hydraulic bow to descend.
8. Turn off coolant flow and remove workpiece.
9. Return bow to raised position.

Requirements

Blade_{manual}: $\frac{3}{4}$ " Wide, 0.032" Thick, 93" Long

Blade_{stickler}: $\frac{1}{2}$ " Wide, 0.035" Thick, 7'9" Long, M42 Material

Blade_{tension}: 1550 to 1760 kg/cm²

Chip Formation

- Powdery >> Feed Rate = Light or Dull Blade
- Curled + Colored by Heat >> Feed Rate = Too High
- Curled – Colored by Heat >> Feed Rate = Most Efficient Rate and Sharp Blade

Feed Rate

- Dial A >> CCW >> increase
- Dial A >> CW >> decrease

Hydraulic Flow

- Hydraulic Flow >> OFF >> Turn Lever (Dial B) Down
- Hydraulic Flow >> ON >> Raise Lever (Dial B) Parallel to Cylinder

Blade

- Thinner workpiece = more teeth
- Workpiece engagement 3 teeth minimum

Safety Rules and Regulations

- Never start a cut with blades contacting workpiece.
- Keep fingers clear of blade and wheel to avoid injury.
- Do not overtighten blade; this may cause it to stretch or warp.
- Never hold a workpiece by hand cutting it – the workpiece should be firmly secured in the vise.

- Do not reach during cutting operations.
- Before doing maintenance on the machine, disconnect it from the electrical supply by pulling out the plug or switching off the main switch! Failure to comply may cause serious injury.
- Depending on the material being cut, harder materials are best cut at 1/3 rated capacity.

Potential Videos

- Operation of Band Saw – Operating Controls: [JET Mitering Horizontal Bandsaw Metalworking Demo - YouTube](#)
- Blade Replacement: [JET 414559 Metalworking 7" x 12" Horizontal/Vertical Bandsaw- Replacement Parts - YouTube](#)

Potential Documents

Machine shop supervisor will discuss the following:

- Acceptable/unacceptable profile sections for clamping positions
NOTE: When cutting odd-shaped material (I-beams, Channel, Tubing), the main point is to arrange the materials in such a way that the blade cuts through as uniform a width as possible through the entire distance of the cut.
- Safety Warnings/Rules
- Bi-metal Speed Chart
- Lubrication Schedule

Additional Accessories

- Tension Meter
- Material Support Stand (V Roller & Flat Roller)
- Lenox BAND-ADE Sawing Fluid (it is the only fluid exclusively designed for band sawing)

JET Vertical Band Saw

Operating Controls

- Top Switch >> Guarded **START** Switch
- Bottom Switch>> Emergency **STOP**

General Operating Procedure

1. Turn on the band saw (let blade reach full speed before attempting to cut).
2. Start cutting – apply steady pressure against blade while following your cutting plan-do relief cuts first.
3. Use push blocks, miter guide or appropriate scraps of material to maintain a safe distance from the blade.

Notes

- For straight cuts, use the widest available saw blade.
- To avoid tooth breakage, select a blade-tooth pitch that will have two or more teeth in contact with the workpiece at all times.
-

Potential Videos

- Operation of Band Saw: [JET 414559 Metalworking 7" x 12" Horizontal/Vertical Bandsaw- Assembly and Set Up - YouTube](#)

Potential Documents

Machine shop supervisor will discuss/share the following:

- Periodic Maintenance Schedule
- Machinery General Safety Warnings/Rules
- Blade Speed to Material Chart [blade guide]
- Lubrication Schedule

Additional Accessories

- Bandsaw Guard
- Vertical Band Saw Resaw Feather Board Guide
- Magswitch Workholding System
- Tension Meter
- Toggle Clamps
- Miter guide

National Foot Shear

General Operating Procedure

1. Slide in sheet metal
2. Make sure its tight along the straight edge (scale)
3. Line up to blade
4. Press down
5. Collect cuts from rear

Design Standards

DO NOT cut materials that are not within the specified tolerances of this machine

Carbon Composition	Thickness Tolerance		Tensile Strength	Yield Strength	Rockwell (Hardness)
GAUGE			(Ksi)	(Ksi)	(Ksi)
16 ga.	20-25	.053 - .067	50	30	B65

Mild Steel Capacity: 16 gauge

Stainless Steel Capacity: 20 gauge

Cutting Length: 52"

Cutting Width: 52"

Preventative Maintenance

1. Lubricate machine often.
2. Always keep blades clean. Wipe DAILY with light weight Lubricant. Keep blades SHARP, rotate as often as necessary and replace or resharpen when necessary. Sharp blades REDUCE STRESS on machine parts and helps to insure a long, trouble-free life for your machine.
3. Drain air supply line Daily, more often if heavy condensation is evident.

Recommended Lubricants

- Cutterhead (#3) or Hold down Assembly (#4)
VALVOLINE Multi-Purpose Lithium Grease PN:609 Or Equivalent
- TREAD ASSEMBLY (#28 OR #47)
NAPA Dripless Oil. 3 in 1 Oil, or Equivalent
- SPRING ASSEMBLY (N5216 ONLY) (#19)
VALVOLINE Multi-Purpose Lithium Grease PN:609 Or Equivalent

Layout Considerations

- Allow a minimum five (5) feet of operated area, free of materials, and machinery on BOTH sides (left and right) of machine.
- Allow a minimum of ten (10) feet of open area, free of obstructions, etc. in REAR OF machine.

Notes:

- Do NOT place hands or fingers under Hold down Assembly or near blade area
- NEVER allow anyone to support material being cut from the rear position
- DO NOT stack material to be cut, design is for single layer only

Potential Videos:

- Operation of Foot Shear: [National 52 Inch Air Shear - Trick-Tools.com - YouTube](#)

Potential Documents:

Machine shop supervisor will discuss/share the following:

- Lubrication Schedule
- Lubrication Points
- Parts list/Machine image

Additional Accessories

- Squaring arms
- Front Operated Digital Back gauge
- Layout tools (Metal Sheet thickness gauge, scribe, framers square/speed square)

National Brake Machine

General Operating Procedure

1. Insert sheet metal under clamping bar.
2. Adjust clamping handle cam for metal thickness.
3. Measure and position the sheet metal edge the correct distance parallel to the clamping bar.
4. Pull down the clamping handles at each end to clamp the metal in place.
5. Set the stop rod to stop the bend apron at the angle you want (usually 90 degrees).
5. Bend at your knees and lift the 2 handles under the apron until the stop rod stops the apron.
6. Slowly bring the apron back down. Release the clamping handles.

Preventative Maintenance

1. Lubricate machine as recommended. Lubrication points are shown on Parts List. Recommended **WEEKLY** lubrication to **ALL** lubrication points. Lasting accuracy **DEPENDS** on proper lubrication.

Troubleshooting

1. Brake "Overbending" Material
 - A.) See Set-Up Procedures
2. Brake "Underbending" Material
 - B.) See Set-Up Procedures

Recommended Lubricants

- Lubricate ALL moving parts of the machine with Light Grease or Heavy Oil, such as Mobil Mobility AW-1 or Equivalent.

Layout Considerations

- Allow a minimum five (5) feet of operated area, free of materials, and machinery on BOTH sides (left and right) of machine.
- Allow a minimum of ten (10) feet of open area, free of obstructions, etc. in REAR of machine.
- Allow a minimum of ten (10) feet of open area, free of obstructions, etc. except operator in FRONT of machine.

Notes:

- NEVER place any part of your body under the blade area
- NEVER stack material to be bent. Design is for one (1) piece at a time.

Potential Documents:

Machine shop supervisor will discuss/share the following:

- Lubrication Points
- Parts list/Machine Pictures [Left, Right, Front, Rear]
- Bending Capacity CHART [Mild Steel, Stainless Steel, etc.]
- Pictures of same angle bend for different gauges

Piranha Iron Worker

Machine Specifications

Hydraulic System

Hydraulic Tank Capacity – 12 Gallons

Hydraulic Oil – Mobile DTE 13M or Equivalent

Capacities

Punch

Bending

Punch End

Bar

Plate

Angle

Coper-Notcher

General Operating Procedure

Control Procedures

All single slide Piranha models may be controlled from either the front or rear electrical control box. A safety feature of the Piranha is the control box selector switch, located on the front control box. The switch has two positions, “front” and “rear,” and will allow the Ironworker to be operated only from the selected control box. The Ironworker may be shut off from either control box.

The rear control box which is located at the rear coper/notcher station and is operated with the foot control only.

The front control box is located to the right of the punch station and contains the following components: control box selector switch, emergency start/stop button, foot control receptacle, foot control toggle switch, “up” and “down” push-buttons, and 2 limit switches set the control box selector.

Set the control box selector switch to the “front” position and ensure both emergency stop buttons are pulled in the “up” position to start the machine.

The “up” and “down” push-buttons are used for aligning tooling. The foot control can be used in lieu of the “up” and “down” push-buttons. This requires the use of the foot control toggle switch, limit switches, and the control arms mounted to the on-side pull arm. This greatly reduces the machine stroke time, thus increasing productivity and allowing hands-free operation.

Never use the foot control without setting the limit switches.

Prior to any tooling changes, push one of the emergency stop buttons and shut the machine off.

Remove all tooling from the workstations not being used.

Shearing Station – FLAT

Using the up button, raise the upper beam to its full “up” position and loosen the adjusting nuts. Insert the material under the hold-down and through the knives. Tighten the adjusting nuts to lower the hold-down, stopping just as the material is secured. This will allow the material to feed freely. Use the material adjustment guide, which is perpendicular to the knives to ensure a square cut

Shearing Station – ANGLE

Using the up button, raise the upper beam to its full “up” position and loosen the adjusting nuts. Insert the material under the hold-down and through the knives. Tighten the adjusting nuts to lower the hold-down, stopping just as the material is secured. This will allow the material to feed freely. Be sure the angle hold-down pad meets the angle iron squarely prior to shearing.

The upper angle shear knife is square. Each corner has a different radius to accommodate various sizes of angle. For the best cut matched the knife radius to the angle fillet radius.

Remember, never attempt to shear any material which is not completely held down to the shear table and is not at least flush with the operator side of the hold-down. Failure to follow these precautions may result in serious machine damage.

Coper/Notcher Station

Operate this station only from the rear control box.

The foot control, with a limit switch, is used to operate this station. Setup of the stroke control is done using the front control box. Set the control box selector switch to the "front" position. Start the iron worker using the down button on the front box. Lower the punch into the beam, stopping just prior to the bottom of stroke. Set the front control arm by loosening the thumbscrew on the front control arm and slide it until it rests on top of the front limit switch. Tighten the thumbscrew.

The coper/notcher station uses only the front control arm to set the upstroke of the coper/notcher. There is no limit switch for the down stroke of the coper/notcher station.

Raise the safety shield and turn the control box selector switch to the "rear" position. Plug in the foot control and switch the foot control toggle switch to the "on" position. Adjust the front control arm to just allow material being sheared to be inserted between the knives.

Always return the safety guard to the "down" position when work is completed.

Preventative Maintenance

- Follow Maintenance Chart

Troubleshooting

1. Machine will not start [found on pg. 20 of manufacturer's manual]
2. Machine starts but will not operate [found on pg. 21 of manufacturer's manual]
3. Machine overheats [found on pg. 22 of manufacturer's manual]
4. Reset on motor starter kicks out [found on pg. 22 of manufacturer's manual]
5. Edges on knife blade chipped by material [found on pg. 22 of manufacturer's manual]
6. Machine leaves burr when shearing [found on pg. 23 of manufacturer's manual]
7. Machine does not seem to have enough pressure to punch or cope [found on pg. 23 of manufacturer's manual]

Recommended Lubricants

- Mobile Multipurpose Grease

Notes:

- Make sure that all guards and cover shields are down before starting machine.
- Keep hands off working tables and out of the path of moving parts during operation. Remove all material from the tables except for the workpiece.
- Remove all tooling from the punch end before starting shearing or coping operations.

Potential Videos:

- Operation: [How to Use an Ironworker - YouTube](#)

Potential Documents:

Machine shop supervisor will discuss/share the following:

- Lubrication Schedule/Points
- Parts list/Machine Pictures [Left, Right, Front, Rear]
- Pictures of tooling attachments and their cut(s)

Additional Accessories

- n/a

KENT Grinder

Capacities

Table Travel: 17"

Saddle Travel: 8.25"

Spindle Speed: 3450 RPM

Grinding Wheel: 8" x ½" x 1 ¼"

General Operating Procedure

1. Place workpiece on table
2. Turn on machine and/or coolant
3. Lower grinding wheel
4. Move workpiece for specified grinding condition

Preventative Maintenance

- Provided by Shop supervisor

Troubleshooting

- Grinding Bugs and Eliminations (found in the manufacturer's manual page 40)
- Distortion Factors of Workpiece (found in the manufacturer's manual page 12)

Recommended Lubricants

- Lubricant System and Diagram (found in the manufacturer's manual page 19)

Notes:

- When mass cutting, the grinding wheel roughness is at about 30-40, high speed is required for wheel dressing.
- For fine finish, the grinding wheel roughness is at about 40-80, slow speed is required for wheel dressing.

Potential Videos:

- Operation: [Kent USA KGS 818AH Automatic Surface Grinder Operation - YouTube](#)

Potential Documents:

Machine shop supervisor will discuss/share the following:

- Wheel selection table
- Lubrication Schedule/Points

Additional Accessories

- DRO203 LCD Digital Readout Systems
- Extra Wheel Flange

KENT Lathe

Capacities

Cross Slide Travel: 7"

Top Slide Travel: 4"

Number of Speeds: 16

PRECISE UP TO 0.0006"

Lathe Controls

- Electrical Controls (left to right)
 1. Coolant pump ON/OFF switch
 2. Power ON light
 3. RED - Emergency Stop
 4. GREEN – Inching
- Headstock Selectors
 1. Top Lever (toggles between H or L gear) [2 section speed] >>>> Spindle Speed
 2. Top Lower Lever (A,B,C,D) [Four section speed] >>>> Spindle Speed
 3. Left Side Top Lever (Low – N – High selector for gearbox)
 4. Left Side Bottom Lever (Apron orientation selector)
Forward (CCW rotation of the feed rod)/Reverse (CW rotation of the feed rod)
- Gearbox Selectors (threads and feeds)
 1. Left Bottom Lever (A,B,C three section selection)
 2. Center Bottom Lever (R,S,T three section selection)
 3. Right Bottom Lever (V~Z five section selection)
 4. Gear Stick? (1~8 eight section selection)
- Apron Controls
 1. Starting Lever for Spindle Rotation (Up position is Reverse, Down position is Forward)
 2. Middle Lever [Up position controls longitudinal feed (x), Down position controls cross feed (y)]
 3. Direction selection push button [reverse feed directions]
 4. Carriage Handwheel – is used to manually position and/or feed the carriage in the longitudinal axis
 5. Cross slide Handwheel – allows for tool to travel perpendicular to the bed of the lathe.
 6. Compound Rest Handwheel
 7. Half-nut Lever – when it is pressed downward, the half-nut will be engaged with leadscrew for thread cutting

Charts [Left to Right on the lathe]

1 – Metric Threads

2 – Imperial Threads

3 – Whitworth Threads [gears need to be changed to bottom configuration diagram on CHANGE GEAR TABLE]

4 – Feeds

Diagrams [Top to Bottom on the lathe]

1 – Diagram 1

2 – Change Gear Table

General Operating Procedures

1. Release E Stop
2. Select lever combination
3. Properly secured stock in the lathe chuck
4. Perform cutting action
5. Switch off the machine
6. Allow all parts to come to a stop before making alterations or at completion of work.

7. Remove work from chuck

Preventative Maintenance

- Provided by shop supervisor

Troubleshooting

- Trouble or Failure/Possible Causes/Correction (found in the manufacturer's manual page C401)

Recommended Lubricants

- Lubrication Checks for Headstock, Gearbox, Carriage, Apron and Tails (found on page 10)

Safety Rules and Regulations:

- Provided by shop supervisor

Potential Videos:

- Operation(s) of Lathe Machine: [Kent USA TRL-1340 Precision Lathe Operation - YouTube](#)

Potential Documents:

Machine shop supervisor will discuss/share the following:

- Cutting Speeds and Feeds
- Lubrication Schedule/Points [potential mark these points on machine]

Additional Accessories

- Digital Readout System

SHARP Mill

Capacities

Longitudinal Travel: 970mm

Cross Travel: 420mm

Vertical Travel (knee): 450mm

Mill Controls

- Electrical Switches
(Left to Right)
 1. Motor direction
 2. Power indicator(Top to Bottom) (Left to Right)
 1. Vertical spindle power ON switch
 2. Horizontal spindle power ON switch
 3. Table power feed power ON switch
 4. Electric source ON switch
 5. Vertical spindle power OFF switch
 6. Horizontal spindle power OFF switch
 7. Table power feed up-down switch
 8. Table power feed power OFF switch
 9. Emergency stop switch
 10. Forward/Reverse Switch
 11. Cooling select switch
 12. Table power feed Hi/Low select switch
- Movement/Turning
 - Vertical Knee Traverse Crank (Z-direction)
 - Table Traverse Crank Handle (X-direction)
 - Saddle traverse crank (Y-direction)
 - Quill Feed Hand Lever (allows the milling cutter to be raised and lowered)

Preventative Maintenance

- Maintenance (found in the manufacturer's manual page 48)

Troubleshooting

- Trouble, Cause, and Correction (found in the manufacturer's manual page 49)

Recommended Lubricants

- Headstock lubrication (found in the manufacturer's manual page 6)
- Machine lubrication (found in the manufacturer's manual pages 28-29)

Safety Rules and Regulations:

- Provided by shop supervisor

Potential Videos:

- Operation of Mill: [Manual Mill Tutorial - YouTube](#)

[Sharp LMV Vertical Mill - YouTube](#)

Potential Documents:

Machine shop supervisor will discuss/share the following:

- Speeds
- Lubrication Schedule/Points

Additional Accessories

- Digital Readout System

JET Drill Press

MODEL J-A5818

Capacities

Maximum Chuck Capacity (Inch): ½

Table Length (Inch): 15

Table Load Capacity (Lb.): 90

Minimum Spindle Speed (RPM): 400

Maximum Spindle Speed (RPM): 5000

Operating Controls

- Drill Head
 - On/Off Switch
 - Speed Control Handwheel – Increase RPM (CW)/Decrease RPM (CCW)
 - Feed Handle
 - LED Speed Display
- Column
 - Table Raising Handle - Table Height Adjustment

Operating Precautions (pulled directly from manual pg.#)

1. The head assembly must be locked to the column so the thrust produced by drilling will not force the head assembly up the column.
2. The worktable must be locked to the column so it will not be forced down the column.
3. Be sure the belt is tightened to the proper tension.
4. **DO NOT** start to drill the workpiece until making certain the workpiece is held down securely.
5. **BEFORE** turning the speed control handwheel in either direction
6. Point of operation protection is required for maximum safety. This remains the responsibility of the user/purchaser since conditions differ between jobs.
7. Make sure the drill is secured in the spindle or check before attempting to use the drill press.
8. Make sure the spindle taper is clean and free of burrs, scoring, and galling to assure maximum gripping.

Speeds for Drilling

SFM = 0.26 X RPM X Drill Diameter (in Inches)

$$RPM = 3.8 \times \frac{SFM}{\text{Drill Diameter (in Inches)}}$$

Table Adjustments

- The table can be raised or lowered to accommodate the height of the component being drilled. To raise or lower the table, loosen the lock handle. Then use the hand crank to move the table to the desired height. Then retighten the lock handle.

Maintenance

Make sure to disconnect electrical power to the drill press to avoid the possibility of inadvertent operation and exposure to potentially lethal voltage levels (found in the manufacturer's manual page 11)

- Replacement of Drive Belt (found in the manufacturer's manual page 11)
- Replacement of Motor (found in the manufacturer's manual page 11)

Troubleshooting

- Trouble, Cause, and Correction (found in the manufacturer's manual page 49)

Lubrications

Following are lubrication recommendations for drill press components (found in the manufacturer's manual page 11)

- Spindle pulley drive: Lubricate spindle splines occasionally with light grease.
- Quill, Table, and Column: Lubricate with light film and oil.
- Table lift rack: Lubricate regularly with SAE20 oil (clean rack with solvent before applying oil.)
- Variable speed drive fork: Lubricate contact points occasionally with grease.

Safety Rules and Regulations:

- Provided by shop supervisor

Indication of Extreme Speeds and Feeds:

- A drill that splits up the web is evidence of too much feed or insufficient tip clearance at the center as a result of improper grinding.
- The rapid wearing away of the extreme outer corners of the cutting edges indicates that the speed is too high.
- A drill chipping or breaking out at the cutting edges indicates that either the feed is too heavy or the drill has been ground too much chip clearance.

Potential Videos:

- Operation of Drill Press: [JET 15" Variable Speed Floor Model Drill Press - YouTube](#)

Potential Documents:

Machine shop supervisor will discuss/share the following:

- Speeds for Drilling

Additional Accessories

- Lock for Switch Padlock
- Forstner bit
- Sawtooth
- Grinder
- Polisher
- TCT forstner style boring bit

HAAS CNC

MODEL VF2

Capacities

30" (X Axis) x 16" (Y Axis) x 20" (Z Axis) travels

Maximum Speed (RPM): 8100

Tool changer capacity: 20

Control Pendant

- Keyboard
 1. Function (11 keys)
 2. Cursor (8 keys)
 3. Display (8 keys)
 4. Mode (keys)
 5. Numeric (15 keys)
 6. Alpha (30 keys)
 7. Jog (15 keys)
 8. Overrides (15 keys)

Operations (pulled directly from manual pg. 97)

- Machine Power-On
 1. Press **[Power On]** until you see the Haas logo on the screen. After a self-test and boot sequence, the display shows the machine.
 2. Turn **[EMERGENCY STOP]** to the right to reset it.
 3. Press **[RESET]** to clear the startup alarms. If you cannot clear an alarm, the machine may need service. Contact your Haas Factory Outlet (HFO) for assistance.
 4. If your machine is enclosed, close the doors.
*Before you do the next step, remember that automatic motion begins immediately when you press **[POWER UP]**. Make sure the motion path is clear. Stay away from the spindle, machine table, and tool changer.*
 5. Press **[POWER UP]**.
*After the first **[POWER UP]**, the axes move toward their home positions. The axes then move slowly until the machine finds the home switch for each axis. This establishes the machine home position.*
 6. Press any of the following:
 - a. **[CANCEL]** to dismiss the screen.
 - b. **[CYCLE START]** to run program.
 - c. **[HANDLE JOG]** for manual operation.

Maintenance

- Spindle Warm-Up [pg. 98]
 - If your machine's spindle has been idle for more than (4) days, run the spindle warm-up program before you use the machine. This program brings the spindle up to speed slowly to distribute the lubrication and let the spindle reach a stable temperature.
 - Your machine includes a 20-minute warm-up program (009220) in the program list. If you use the spindle at consistent high speeds, you should run this program every day.
- Routine Maintenance [pg. 6]
 - Visually inspect the enclosure and safety glass for any signs of distortion, breakage or other damage.
 - Replace the Lexan windows after 7 years or if they are damaged or severely scratched.
 - Keep all safety glass and windows clean to allow proper viewing of the machine during operations.

- A daily visual inspection of the machine enclosure to verify all panels are in place should be performed.

Coolants (found in manufacturer's manual page 11)

Coolants is an important part of many machining operation. When it is correctly used and maintained, coolant can improve part finish, lengthen tool life, and protect machine components from rust and other damage. Improper coolants, however, can cause significant damage to your machine.

Improper coolant use includes, but is not limited to, these points:

- Do not use plain water. This causes machine components to rust.
- Do not flammable coolants.
- Do not use straight or "neat" mineral-oil products. These products cause damage to rubber seals and tubing throughout the machine. If you use a minimum-quantity lubrication system for near-dry machining, use only the recommended oils.

Machine coolant must be water-soluble, synthetic oil-based or synthetic-based coolant or lubricant.

NOTE: Be sure to maintain your coolant mixture to keep the coolant concentrate at acceptable levels. Improperly maintained coolant mixtures can allow machine components to rust.

Operation Safety (pg. 5):

- Do not operate the machine unless the doors are closed and the door interlocks are functioning correctly.
- Check for damaged parts and tools before you operate the machine. Any part or tool that is damaged should be properly repaired or replaced by authorized personnel. Do not operate the machine if any component does not appear to be functioning correctly.
- Rotating cutting tools can cause severe injury. When a program runs, the mill table and spindle head can move rapidly at any time.
- Improperly clamped parts machined at high speeds/feeds may be ejected and puncture the enclosure. It is not safe to machine oversized or marginally clamped parts.

Potential Videos:

- Operation of CNC: [The Haas VF-2 - Small VMC Workhorse - Haas Automation, Inc. - YouTube](#)

Potential Documents:

- Provided by shop supervisor

Additional Accessories

- Provided by shop supervisor

MITUTOYO Profile Projector

Model: PH-A14

Serial No.:128951809

Capacities

Range X -Axis: 8"/203.2mm

Range Y-Axis: 4"/101.6mm

Resolution 0.00005"/0.001mm

Screen Diameter: 353mm/14"

Control Pendant

- Keyboard

Operations

- Turn on Power switch

When turning on the power switch the pilot lamp on the switch lights up. The illumination lamp os lit simultaneously. The contour of the workpiece is projected onto the screen. The contour illumination can be selected with the illumination selection knob. Be sure to use the condenser lens which corresponds to the magnification (50x, 100x) of the projection lens to be used.

This profile projector has a wide range of measuring applications. Select a measuring method that suits the shape, size, quantity of the workpiece, and the measuring purpose and requirements.

Maintenance

- Provided by shop supervisor

Coolants

- Provided by Shop supervisor

Potential Videos:

- Operation: [14" MITUTOYO PH14LS 14 Optical Comparator - YouTube](#)

Potential Documents:

Machine shop supervisor will discuss/share the following:

- Interface/software usage

Additional Accessories

- Mitutoyo Counter Digital Display
- Rotary Vise

MITUTOYO CMM

Model: Crysta-Plus M443

Serial No.: 48090121

Capacities

Measuring Range

- X-axis: 400mm (15.75")
- Y-axis: 400mm (15.75")
- Z-axis: 300mm (11.81")

Resolution: 0.0005mm (0.00002")

Workpiece

- Maximum height: 480mm (18.89")
- Maximum weight: 180kg

Air Supply

- Air Pressure: 0.35Mpa (required 0.5-0.7MPa for the air source)

Machine Parts

- Rapid Traverse in all axes
X&Y-axis fine feed knob
Clamp switch
- Measuring System
Probe adapter

Operations/Measurements

- Provided by shop supervisor

Inspection, Maintenance, and Accuracy Check [4.1 – 4.6]

- **Air pressure**

Make sure that the regulator's pressure gage reads 0.35MPa. Do not attempt to move any axis when the pressure reading is below the rated value.

- Inspection: Daily-before starting operation

- **Air filter and mist separator**

Since this is an auto-drained, water or oil mist accumulated in the air filter or mist separator will be automatically drained. However, the user is required to make sure its proper operation. If water or oil mist is accumulated so much, turn the drain clock located under the air filter and mist separator counterclockwise to drain the moisture.

- See page 4.2 – 4.4

- **X – and Y – axis guide faces, and Z-axis spindle**

When the exposed guide surfaces are stained with moisture or rust, clean them with a soft, lint-free cloth and paper. If the stain is oil or hard to remove, use benzine or alcohol.

- Inspection: Daily
- Maintenance: Weekly (varies depending on the environment conditions)

- **Measuring table**

Since the measuring table serves as a reference surface for measurement, great care should be taken so as not to damage its surface when mounting a workpiece. This machine uses a granite surface plate which is not subject to rust. However, moisture or oil film coatings on the tabletop are undesirable, so wipe off with a cloth dampened with benzine or alcohol.

- Maintenance: As required

Inspection and Maintenance [found on page 6-10 in manufacturer's manual]

- Troubleshooting
- Replacing the Fuse

Coolants

- Provided by shop supervisor

Potential Videos:

- Operation: [Mitutoyo Crysta Plus M CMM - YouTube](#)

Potential Documents:

Machine shop supervisor will discuss/share the following:

- Software usage

Additional Accessories

- TBD