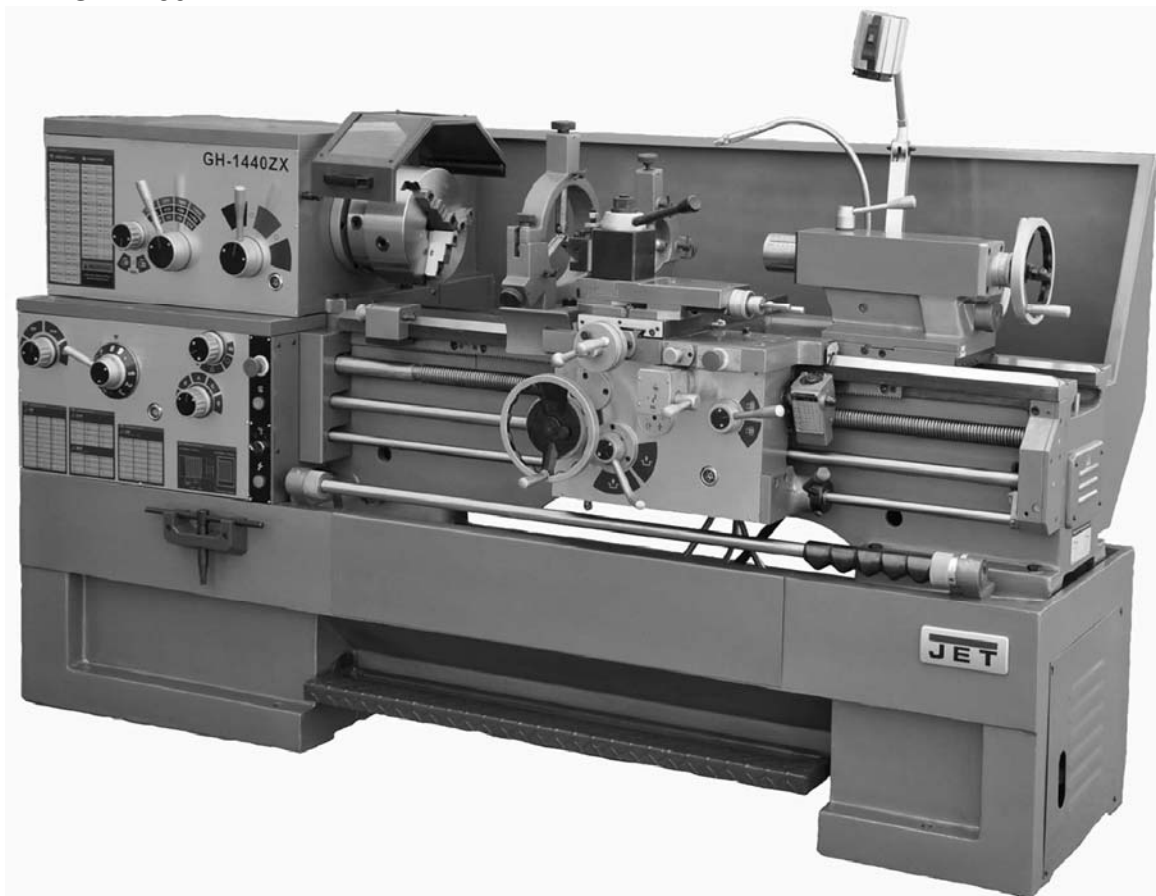




Operation and Maintenance Instructions ZX-Series Large Bore Lathes

Models GH-1440ZX
GH-1640ZX/1660ZX
GH-1860ZX/1880ZX
GH-2280ZX



Model GH-1440ZX shown

*** For ZX-Series Lathes Parts List & Electrical Diagrams, see document M-321910-1**

JET

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Part No. M-321910
Revision J2 08/2018
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1.0 IMPORTANT SAFETY INSTRUCTIONS

1. Read and understand the entire owner's manual before attempting assembly or operation.
2. Read and understand the warnings posted on the machine and in this manual. Failure to comply with all of these warnings may cause serious injury.
3. Replace the warning labels if they become obscured or removed.
4. This lathe is designed and intended for use by properly trained and experienced personnel only. If you are not familiar with the proper and safe operation of a lathe, do not use until proper training and knowledge have been obtained.
5. Do not use this lathe for other than its intended use. If used for other purposes, JET disclaims any real or implied warranty and holds itself harmless from any injury that may result from that use.
6. Always wear approved safety glasses/face shields while using this lathe. Everyday eyeglasses only have impact resistant lenses; they are not safety glasses.
7. Before operating this lathe, remove tie, rings, watches and other jewelry, and roll sleeves up past the elbows. Remove all loose clothing and confine long hair. Non-slip footwear or anti-skid floor strips are recommended. Do **not** wear gloves.
8. Wear ear protectors (plugs or muffs) during extended periods of operation.
9. Do not operate this machine while tired or under the influence of drugs, alcohol or any medication.
10. Make certain the switch is in the **OFF** position before connecting the machine to the power supply.
11. Make certain the machine is properly grounded.
12. Make all machine adjustments or maintenance with the machine unplugged from the power source.
13. Remove adjusting keys and wrenches. Form a habit of checking to see that keys and adjusting wrenches are removed from the machine before turning it on.
14. Keep safety guards in place at all times when the machine is in use. If removed for maintenance purposes, use extreme caution and replace the guards immediately.
15. Check damaged parts. Before further use of the machine, a guard or other part that is damaged should be carefully checked to determine that it will operate properly and perform its intended function. Check for alignment of moving parts, binding of moving parts, breakage of parts, mounting and any other conditions that may affect its operation. A guard or other part that is damaged should be properly repaired or replaced.
16. Provide for adequate space surrounding work area and non-glare, overhead lighting.
17. Keep the floor around the machine clean and free of scrap material, oil and grease.
18. Keep visitors a safe distance from the work area. **Keep children away.**
19. Make your workshop child proof with padlocks, master switches or by removing starter keys.
20. Give your work undivided attention. Looking around, carrying on a conversation and "horse-play" are careless acts that can result in serious injury.
21. Maintain a balanced stance at all times so that you do not fall or lean against moving parts. Do not overreach or use excessive force to perform any machine operation. Never force the cutting action.
22. Use the right tool at the correct speed and feed rate. Do not force a tool or attachment to do a job for which it was not designed. The right tool will do the job better and safer.
23. Use recommended accessories; improper accessories may be hazardous.
24. Maintain tools with care. Keep cutting tools sharp and clean for the best and safest performance. Follow instructions for lubricating and changing accessories.
25. Do not attempt to adjust or remove tools during operation.
26. Turn off the machine and disconnect from power before cleaning. Use a brush to remove shavings or debris — do not use your hands.
27. Do not stand on the machine. Serious injury could occur if the machine tips over.
28. Never leave the machine running unattended. Turn the power off and do not leave the machine until it comes to a complete stop.
29. Remove loose items and unnecessary work pieces from the area before starting the machine.

⚠ WARNING: This product can expose you to chemicals including lead and cadmium which are known to the State of California to cause cancer and phthalates which are known to the State of California to cause birth defects or other reproductive harm. For more information go to <http://www.p65warnings.ca.gov>.

⚠ WARNING: Some dust, fumes and gases created by power sanding, sawing, grinding, drilling, welding and other construction activities contain chemicals known to the State of California to cause cancer and birth defects or other reproductive harm. Some examples of these chemicals are:

- lead from lead based paint
- crystalline silica from bricks, cement and other masonry products
- arsenic and chromium from chemically treated lumber

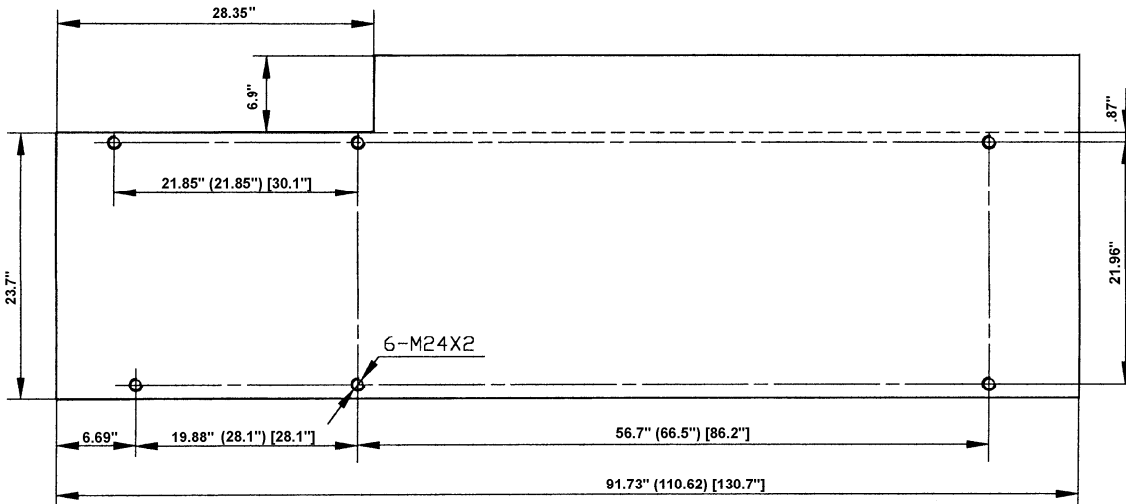
Your risk of exposure varies, depending on how often you do this type of work. To reduce your exposure to these chemicals, work in a well-ventilated area and work with approved safety equipment, such as dust masks that are specifically designed to filter out microscopic particles. For more information go to <http://www.p65warnings.ca.gov/> and <http://www.p65warnings.ca.gov/wood>.

Familiarize yourself with the following safety notices used in this manual:

⚠ CAUTION This means that if precautions are not heeded, it may result in minor injury and/or possible machine damage.

⚠ WARNING This means that if precautions are not heeded, it may result in serious injury or possibly even death.

2.0 Dimensions and mounting hole centers



Sizes before () are for 40" Machines Sizes in () are for 60" Machines
 Sizes in [] are for 80" Machines

Figure 1

3.0 Warranty and service

JET warrants every product it sells against manufacturers' defects. If one of our tools needs service or repair, please contact Technical Service by calling 1-800-274-6846, 8AM to 5PM CST, Monday through Friday.

Warranty Period

The general warranty lasts for the time period specified in the literature included with your product or on the official JET branded website.

- JET products carry a limited warranty which varies in duration based upon the product. (See chart below)
- Accessories carry a limited warranty of one year from the date of receipt.
- Consumable items are defined as expendable parts or accessories expected to become inoperable within a reasonable amount of use and are covered by a 90 day limited warranty against manufacturer's defects.

Who is Covered

This warranty covers only the initial purchaser of the product from the date of delivery.

What is Covered

This warranty covers any defects in workmanship or materials subject to the limitations stated below. This warranty does not cover failures due directly or indirectly to misuse, abuse, negligence or accidents, normal wear-and-tear, improper repair, alterations or lack of maintenance.

Warranty Limitations

Woodworking products with a Five Year Warranty that are used for commercial or industrial purposes default to a Two Year Warranty. Please contact Technical Service at 1-800-274-6846 for further clarification.

How to Get Technical Support

Please contact Technical Service by calling 1-800-274-6846. **Please note that you will be asked to provide proof of initial purchase when calling.** If a product requires further inspection, the Technical Service representative will explain and assist with any additional action needed. JET has Authorized Service Centers located throughout the United States. For the name of an Authorized Service Center in your area call 1-800-274-6846 or use the Service Center Locator on the JET website.

More Information

JET is constantly adding new products. For complete, up-to-date product information, check with your local distributor or visit the JET website.

How State Law Applies

This warranty gives you specific legal rights, subject to applicable state law.

Limitations on This Warranty

JET LIMITS ALL IMPLIED WARRANTIES TO THE PERIOD OF THE LIMITED WARRANTY FOR EACH PRODUCT. EXCEPT AS STATED HEREIN, ANY IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE EXCLUDED. SOME STATES DO NOT ALLOW LIMITATIONS ON HOW LONG AN IMPLIED WARRANTY LASTS, SO THE ABOVE LIMITATION MAY NOT APPLY TO YOU.

JET SHALL IN NO EVENT BE LIABLE FOR DEATH, INJURIES TO PERSONS OR PROPERTY, OR FOR INCIDENTAL, CONTINGENT, SPECIAL, OR CONSEQUENTIAL DAMAGES ARISING FROM THE USE OF OUR PRODUCTS. SOME STATES DO NOT ALLOW THE EXCLUSION OR LIMITATION OF INCIDENTAL OR CONSEQUENTIAL DAMAGES, SO THE ABOVE LIMITATION OR EXCLUSION MAY NOT APPLY TO YOU.

JET sells through distributors only. The specifications listed in JET printed materials and on official JET website are given as general information and are not binding. JET reserves the right to effect at any time, without prior notice, those alterations to parts, fittings, and accessory equipment which they may deem necessary for any reason whatsoever. JET® branded products are not sold in Canada by JPW Industries, Inc.

Product Listing with Warranty Period

90 Days – Parts; Consumable items
1 Year – Motors; Machine Accessories
2 Year – Metalworking Machinery; Electric Hoists, Electric Hoist Accessories; Woodworking Machinery used for industrial or commercial purposes
5 Year – Woodworking Machinery
Limited Lifetime – JET Parallel clamps; VOLT Series Electric Hoists; Manual Hoists; Manual Hoist Accessories; Shop Tools; Warehouse & Dock products; Hand Tools; Air Tools

NOTE: JET is a division of JPW Industries, Inc. References in this document to JET also apply to JPW Industries, Inc., or any of its successors in interest to the JET brand.

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Specifications were current at the time this manual was published, but because of our policy of continuous improvement, JET reserves the right to change specifications at any time and without prior notice, without incurring obligations.

5.0 Specifications

5.1 Specifications: 14-inch lathe

Model Number **GH-1440ZX**
 Stock Number 321910

Capacities:

Swing over Bed (in.) 14
 Swing over Cross Slide (in.) 7-5/8
 Swing Through Gap (in.) 23-5/8
 Length of Gap (in.) 12
 Distance between Centers (in.) 40

Headstock:

Spindle Bore (in.) 3-1/8
 Spindle Mount D1-8
 Spindle Taper with Sleeve MT-7(MT-5)
 Number of Spindle Speeds 12
 Range of Spindle Speeds (RPM) 42 to 1800

Gearbox:

Number of Longitudinal and Cross Feeds 46/31
 Range of Longitudinal Feeds (in./rev.) 0.0015 to 0.0900
 Range of Cross Feeds (in./rev.) 0.0010 to 0.0360
 Number of Inch Threads 61
 Range of Inch Threads (in.) 1-5/8 to 72
 Number of Metric Threads 24
 Range of Metric Threads (mm) 0.50 to 20.0
 Number of Diametral Threads 45
 Range of Diametral Threads 3-1/4 – 96DP
 Number of Module Threads 20
 Range of Module Threads 0.25 – 10MP

Compound and Carriage:

Maximum Compound Slide Travel (in.) 5-1/8
 Maximum Cross Slide Travel (in.) 9
 Carriage Travel (in.) 36

Tailstock:

Tailstock Spindle Travel (in.) 6
 Tailstock Taper MT-4

Steady Rest Capacity (in.) 3/8 to 7
 Follow Rest Capacity (in.) 1/2 to 3-1/2
 Width of Bed (in.) 13-1/8
 Overall Dimensions (in.)(LxWxH) 91-5/16 x 41-5/16 x 50-5/16
 Motor 7-1/2HP, 3PH, 230/460V (prewired 230V)
 Approximate Net Weight (lbs.) 4667

5.2 Specifications: 16-inch lathe

Model Number.....	GH-1640ZX	GH-1660ZX
Stock Number	321930.....	321940

Capacities:

Swing over Bed (in.).....	16.....	16
Swing over Cross Slide (in.).....	10.....	10
Swing Through Gap (in.).....	25.....	25
Length of Gap (in.).....	12.....	12
Distance between Centers (in.).....	40.....	60

Headstock:

Spindle Bore (in.).....	3-1/8.....	3-1/8
Spindle Mount.....	D1-8.....	D1-8
Spindle Taper with Sleeve.....	MT-7(MT-5).....	MT-7(MT-5)
Number of Spindle Speeds.....	12.....	12
Range of Spindle Speeds (RPM).....	25 to 1800.....	25 to 1800

Gearbox:

Number of Longitudinal and Cross Feeds.....	46/31.....	46/31
Range of Longitudinal Feeds (in./rev.).....	0.0015 to 0.0900.....	0.0015 to 0.0900
Range of Cross Feeds (in./rev.).....	0.0010 to 0.0360.....	0.0010 to 0.0360
Number of Inch Threads.....	61.....	61
Range of Inch Threads (in.).....	1-5/8 to 72.....	1-5/8 to 72
Number of Metric Threads.....	24.....	24
Range of Metric Threads (mm).....	0.50 to 20.0.....	0.50 to 20.0
Number of Diametral Threads.....	45.....	45
Range of Diametral Threads.....	3-1/4 – 96DP.....	3-1/4 – 96DP
Number of Module Threads.....	20.....	20
Range of Module Threads.....	0.25 – 10MP.....	0.25 – 10MP

Compound and Carriage:

Maximum Compound Slide Travel (in.).....	5-1/8.....	5-1/8
Maximum Cross Slide Travel (in.).....	9.....	9
Carriage Travel (in.).....	36.....	55

Tailstock:

Tailstock Spindle Travel (in.).....	6.....	6
Tailstock Taper.....	MT-4.....	MT-4

Steady Rest Capacity (in.).....	3/8 to 7.....	3/8 to 7
Follow Rest Capacity (in.).....	1/2 to 3-1/2.....	1/2 to 3-1/2
Width of Bed (in.).....	13-1/8.....	13-1/8
Overall Dimensions (in.)(LxWxH).....	91-5/16 x 41-5/16 x 50-5/8.....	111-3/8 x 41-5/16 x 50-5/8
Motor.....	7-1/2HP, 3Ph, 230/460V*.....	7-1/2HP, 3Ph, 230/460V*
Approximate Net Weight (lbs.).....	4689.....	5218

*pre-wired 230V

5.3 Specifications: 18-inch lathe

Model Number.....	GH-1860ZX	GH-1880ZX
Stock Number	321960.....	321970

Capacities:

Swing over Bed (in.).....	18.....	18
Swing over Cross Slide (in.).....	11.....	11
Swing Through Gap (in.).....	27.....	27
Length of Gap (in.).....	12.....	12
Distance between Centers (in.).....	60.....	80

Headstock:

Spindle Bore (in.)	3-1/8.....	3-1/8
Spindle Mount	D1-8.....	D1-8
Spindle Taper with Sleeve	MT-7(MT-5).....	MT-7(MT-5)
Number of Spindle Speeds	12.....	12
Range of Spindle Speeds (RPM).....	.25 to 1800.....	25 to 1800

Gearbox:

Number of Longitudinal and Cross Feeds.....	46/31.....	46/31
Range of Longitudinal Feeds (in./rev.)	0.0015 to 0.0900.....	0.0015 to 0.0900
Range of Cross Feeds (in./rev.)	0.0010 to 0.0360.....	0.0010 to 0.0360
Number of Inch Threads	61.....	61
Range of Inch Threads (in.)	1-5/8 to 72.....	1-5/8 to 72
Number of Metric Threads	24.....	24
Range of Metric Threads (mm)	0.50 to 20.0.....	0.50 to 20.0
Number of Diametral Threads.....	45.....	45
Range of Diametral Threads.....	3-1/4 – 96DP.....	3-1/4 – 96DP
Number of Module Threads	20.....	20
Range of Module Threads.....	0.25 – 10MP.....	0.25 – 10MP

Compound and Carriage:

Maximum Compound Slide Travel (in.).....	5-1/8.....	5-1/8
Maximum Cross Slide Travel (in.)	9.....	9
Carriage Travel (in.)	55.....	74

Tailstock:

Tailstock Spindle Travel (in.).....	6.....	6
Tailstock Taper.....	MT-5.....	MT-5

Steady Rest Capacity (in.)	3/8 to 7-3/4.....	3/8 to 7-3/4
Follow Rest Capacity (in.)	1/2 to 3-1/2.....	1/2 to 3-1/2
Width of Bed (in.)	13-1/8.....	13-1/8
Overall Dimensions (in.)(LxWxH).....	111-3/8 x 41-5/16 x 51-7/8.....	130-5/8 x 41-5/16 x 51-7/8
Motor	7-1/2HP, 3PH, 230/460V*.....	7-1/2HP, 3PH, 230/460V*
Approximate Net Weight (lbs.)	5320.....	5949

*pre-wired 230V

5.4 Specifications: 22-inch lathe

Model Number..... **GH-2280ZX**
 Stock Number 321980

Capacities:

Swing over Bed (in.) 22
 Swing over Cross Slide (in.) 13
 Swing Through Gap (in.) 29
 Length of Gap (in.) 12
 Distance between Centers (in.) 80

Headstock:

Spindle Bore (in.) 3-1/8
 Spindle Mount D1-8
 Spindle Taper with Sleeve MT-7(MT-5)
 Number of Spindle Speeds 12
 Range of Spindle Speeds (RPM) 25 to 1800

Gearbox:

Number of Longitudinal and Cross Feeds 46/31
 Range of Longitudinal Feeds (in./rev.) 0.0015 to 0.0900
 Range of Cross Feeds (in./rev.) 0.0010 to 0.0360
 Number of Inch Threads 61
 Range of Inch Threads (in.) 1-5/8 to 72
 Number of Metric Threads 24
 Range of Metric Threads (mm) 0.50 to 20.0
 Number of Diametral Threads 45
 Range of Diametral Threads 3-1/4 – 96DP
 Number of Module Threads 20
 Range of Module Threads 0.25 – 10MP

Compound and Carriage:

Maximum Compound Slide Travel (in.) 5-1/8
 Maximum Cross Slide Travel (in.) 12
 Carriage Travel (in.) 74

Tailstock:

Tailstock Spindle Travel (in.) 6
 Tailstock Taper MT-5

Steady Rest Capacity (in.) 3/8 to 7-3/4
 Follow Rest Capacity (in.) 1/2 to 3-1/2
 Width of Bed (in.) 13-1/8
 Overall Dimensions (in.)(LxWxH) 130-5/8 x 42-5/16 x 53-5/16
 Motor 10HP, 3PH, 230V/460V (pre-wired 230V)
 Approximate Net Weight (lbs.) 6421

6.0 General Description and Nomenclature

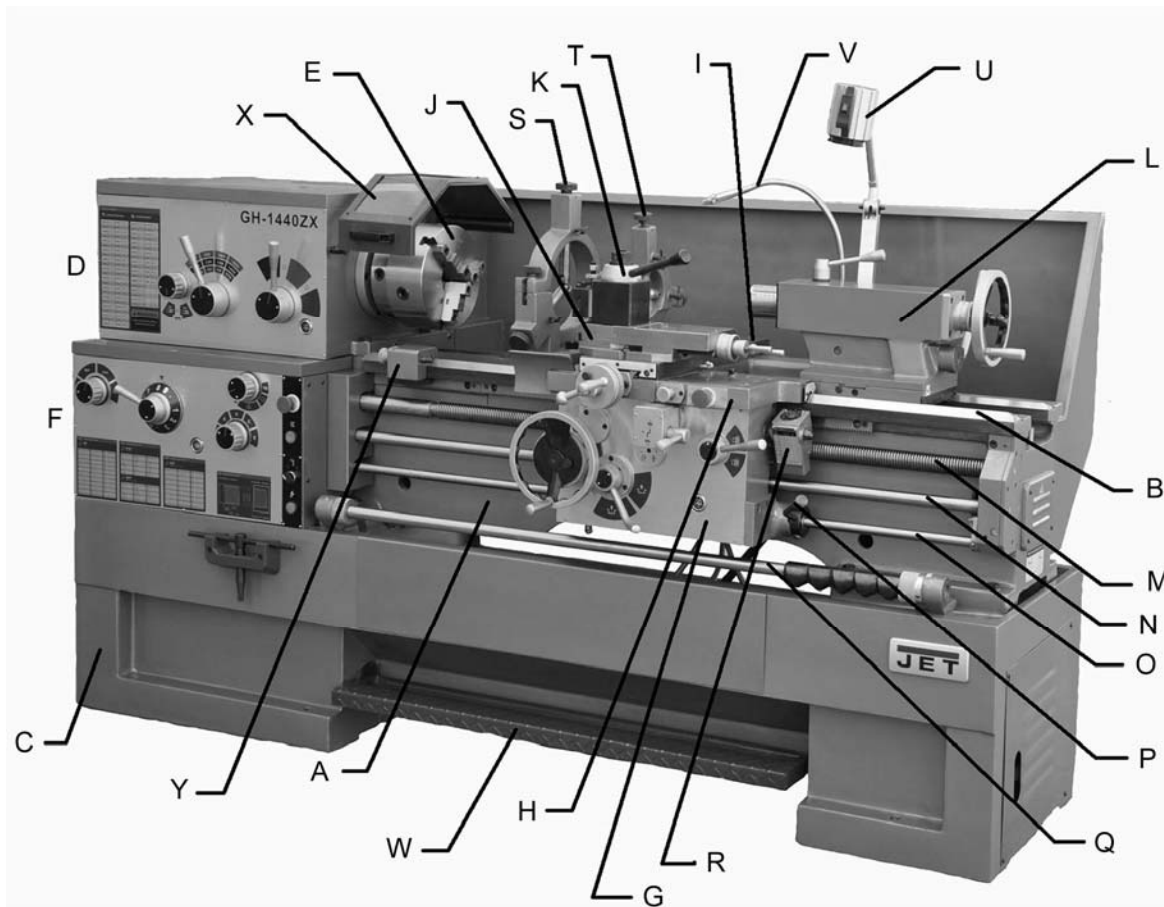


Figure 2 – General Description of ZX Lathes

Bed and stand

The lathe bed (A) is made of cast iron with low vibration and high rigidity. Two precision-ground v-slideways (B), reinforced by supersonic frequency hardening, offer precision guidance for the carriage. The main drive motor is mounted in the stand (C) below the gearbox.

Headstock

The headstock (D) is cast from high grade, low vibration cast iron. In the head, the spindle is mounted in precision taper roller bearings. See section 12.0 for detailed explanation of controls. The electrical box is mounted to the rear of the headstock.

A 3-Jaw scroll chuck (E) is included.

Feed gearbox

The gearbox (F) is made from high quality cast iron and is mounted to the left side of the machine bed.

Carriage

The carriage assembly is composed of the *Apron*, the *Saddle*, the *Cross Slide*, the *Compound Rest*, and the four-way *Tool Post*.

Apron (G). Quick travel of the Apron for positioning is accomplished by means of a bed-mounted rack and pinion, operated manually by the handwheel on the front of the apron, or automatically by the feed direction handle.

Saddle (H). The saddle is made from high quality cast iron and rides along the v-ways.

Cross Slide (I). The cross-slide is mounted on the saddle and used for cross feed operations. It moves on a dovetailed slide which can be adjusted for play by means of the gibs.

Compound Rest (J). The compound rest, which is T-slotted and mounted on the cross slide, can be rotated 360°, allowing tapers to be turned. The compound rest travels on dovetailed ways, with adjustable gibs.

Four-Way Tool Post (K). The tool post is a turret design, mounted to the compound rest. It holds up to four tools simultaneously, and includes an indexing function. *(Always use a minimum of two clamping screws when installing a cutting tool.)*

Tailstock

The tailstock (L) slides on a v-way and can be locked at any location by a clamping lever. The tailstock has a heavy duty quill with a No. 4 Morse Taper or No. 5 Morse Taper (18" and 22" models) and etched graduation scale. The tailstock can be offset for taper cutting.

Leadscrew and feed rod

The leadscrew (M) and feed rod (N) are mounted on the front of the machine bed. They are connected to the gearbox at the left and are supported by bearings on both ends. Both are equipped with shear pins.

Spindle direction control axle (O)

Spindle rotation can be reversed by simply moving the control lever (P) mounted at the right of the carriage. (Allow spindle to come to a stop before reversing.)

Travel setting rod (Q)

The stops can be moved and tightened into position at any point along the rod, to limit travel of the carriage.

Thread chaser (R)

Simplifies the process of setting leadscrew/carriage positions in relation to the workpiece, by indicating the point on the leadscrew where the half nut can be reengaged to continue threading.

Steady rest (S)

The steady rest serves as a support for shafts on the free tailstock end. The steady rest is mounted on the bedway and secured from below with a bolt, nut and locking plate.

Follow rest (T)

The traveling follow rest is mounted to the saddle, and thus follows the movement of the turning tool. Only two fingers are required as the place of the third is taken by the turning tool. The follow rest is used for turning operations on long, slender work pieces. It prevents the work piece from flexing under the pressure of the cutting tool.

Work lamp (U)

Adjustable halogen lamp with independent on/off switch.

Coolant nozzle (V)

Fully adjustable gooseneck; flow is regulated through a valve lever at its base.

Foot brake (W)

Activates a braking strap at the motor for emergency stopping of all lathe functions.

Chuck guard (X)

Hinged, with upper and front windows.

Micro stop (Y)

Used for manual carriage operation.

WARNING Read and understand the entire contents of this manual before attempting set-up or operation! Failure to comply may cause serious injury.

8.0 Installation

1. Finish removing all crate material from around the lathe.
2. Unbolt lathe from shipping pallet.
3. Choose a location for the lathe that is dry and has sufficient illumination (consult OSHA or ANSI standards for recommended lighting levels in workshop environments).
4. Allow enough room to service the lathe on all four sides, and to load and off-load work pieces. In addition, if bar work is to be performed, allow enough space for stock to extend out the headstock end. If used in production operations, leave enough space for stacking unfinished and finished parts.
5. The foundation must be solid to support the weight of the machine and prevent vibration, preferably a solid concrete floor.
6. Sling the lathe as shown in Figure 4; either below the bed at center of gravity area, or around steel rods or pipes of sufficient strength inserted through the holes in the bed casting. **Do not lift lathe by the spindle.** With adequate lifting equipment, slowly raise the lathe off the shipping pallet. Make sure lathe is balanced before moving.

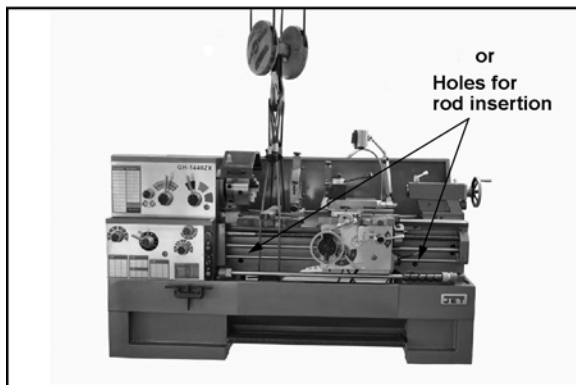


Figure 4: Lifting the lathe

CAUTION Confirm that all suspension equipment is properly rated and in good condition for lifting lathe. Do not allow anyone beneath or near load while lifting.

7. The lathe can be placed upon the cast iron leveling pads under each foot hole, and adjusted using the adjusting bolts with hex nuts. Or, it may be secured to the floor using bolts placed head-down in the concrete, and using shims where needed to level the machine. Refer to Figure 1 for mounting hole dimensions.

8.1 Leveling the lathe

It is imperative that the lathe be on a level plane; that is, where headstock and tailstock center points remain aligned throughout the tailstock travel, with the bed ways absent of twist and thus parallel to the operational center line.

A lathe which is not properly leveled will be inaccurate, producing tapered cuts. Also, the center point of the tailstock will vary as it is positioned along the bed, thus requiring constant readjustment of the set of the tailstock.

8. Use a machinist's precision level on the bed ways both front to back and side to side, as shown in Figure 5. Take the reading in one direction every ten inches. Make sure the ways are clean and free of any debris before placing a level upon them.
9. Deviation over bed length (see Figure 5):
 - a) Maximum 0.02/1000mm
 - b) Maximum 0.04/1000mm

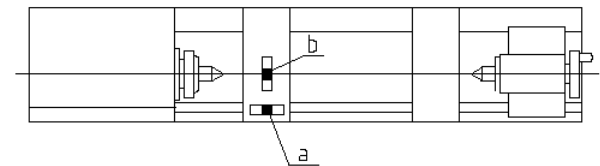


Figure 5: Leveling

10. Tighten foot screw nuts evenly to avoid distortion.
11. Leveling should be inspected occasionally, and especially if the accuracy of the lathe begins to diminish.

8.2 Completing installation

12. Clean all rust protected surfaces using a mild commercial solvent, kerosene or diesel fuel. Do not use paint thinner, gasoline, or lacquer thinner. These will damage painted surfaces. Cover all cleaned surfaces with a light film of 20W machine oil.
13. Open the end gear cover. Clean all components of the end gear assembly and coat all gears with a heavy, non-slinging grease. Close the end gear cover.

8.3 Chuck preparation (three-jaw)

⚠WARNING Read and understand all directions for chuck preparation. Failure to comply may cause serious personal injury and/or damage to the lathe.

The three-jaw scroll chuck is shipped pre-installed on the lathe. It can be used for clamping cylindrical, triangular and hexagonal stock, and has reversible jaws.

Note: An optional 12-inch, 4-jaw chuck is available (part no. ZX-OP-2A). See your dealer to order.

Before removing a chuck, place a flat piece of thick plywood across the bedways under the chuck to prevent damage to the bedways should the chuck fall from your hands. Alternatively, many users make a wood chuck cradle that sits atop the ways and accepts the specific diameter of chuck, for easier installing and removal. Figure 6 shows an example.

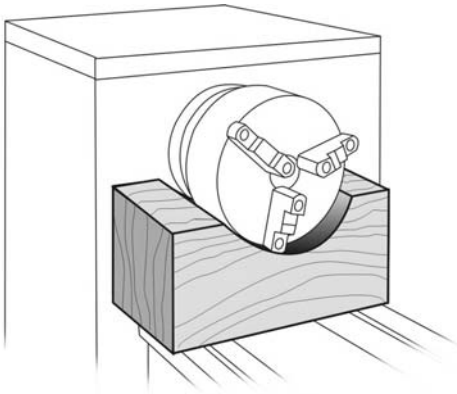


Figure 6: Chuck cradle

To remove the chuck:

1. Support the chuck while turning six camlocks 1/4 turn counterclockwise with the chuck wrench from the tool box.
2. Carefully remove the chuck from the spindle and place on an adequate work surface.
3. Inspect the camlock studs. Make sure they have not become cracked or broken during transit. Clean all parts thoroughly with solvent. Also clean the spindle and camlocks.
4. Cover all chuck jaws and scroll inside the chuck with #2 lithium tube grease. Cover the spindle, camlocks, and chuck body with a light film of 20W oil.
5. Lift the chuck up to the spindle nose and press onto the spindle. Tighten in place by turning the camlocks 1/4 turn clockwise. The index mark (A, Figure 7) on the camlock should be between the two indicator arrows (B) when tight, as shown in Figure 7.

- If the index mark (A) is *not* between the two arrows, i.e. the cam turns beyond the indicator arrows, then remove the chuck and turn the camlock stud IN one full turn.
- If a camlock will not engage, remove the chuck and turn the camlock stud OUT one full turn.

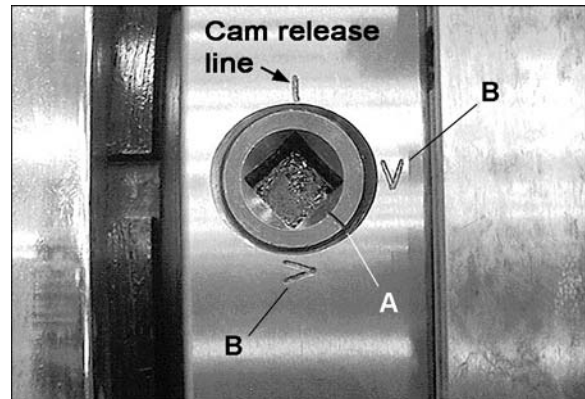


Figure 7: Camlock

6. Make sure chuck is secure on the spindle with the camlocks correctly engaged.

8.4 Break-in period

Do not run the lathe above 560 RPM for the first six hours of operation, to allow gears and bearings to adapt and run smoothly.

9.0 Maintenance/Lubrication

CAUTION Lathe must be serviced at all lubrication points and all reservoirs filled to operating level before the lathe is put into service. Failure to comply may cause serious damage to the lathe.

The ZX series lathe is shipped with oil in the reservoirs. Coolant is not included.

Use clean lubricants and check levels often, including before each working shift. To ensure proper lubrication, oil levels should not be less than the center of the oil sight glass. Try not to overfill, as this may cause leakage.

A chart is supplied in *section 15.0* for quick reference to all lubrication points.

Unless specified otherwise, the lubrication points require a non-detergent, ISO 68, SAE 20W oil. The recommended brand for this lathe is **Mobil DTE® Oil Heavy Medium**.

1. **Headstock** – Oil must be up to indicator mark in oil sight glass (A, Figure 9). Top off with SAE 20W. Fill by removing the plug on top of the headstock. To drain, remove drain plug on the left side of the headstock at the lower rear corner. Drain oil completely and clean out all metal shavings. Refill after the first month of operation. Then change the oil in the headstock every two months.
2. **Gearbox** – Oil must be up to indicator mark in oil sight glass (B, Figure 9). Top off with SAE 20W. To add oil to the gearbox, remove two screws on the top cover and remove cover. To drain, remove drain plug (C, Figure 9) on the left side of the gearbox. Drain oil completely and refill after the first three months of operation. Then change oil in the gearbox every six months.

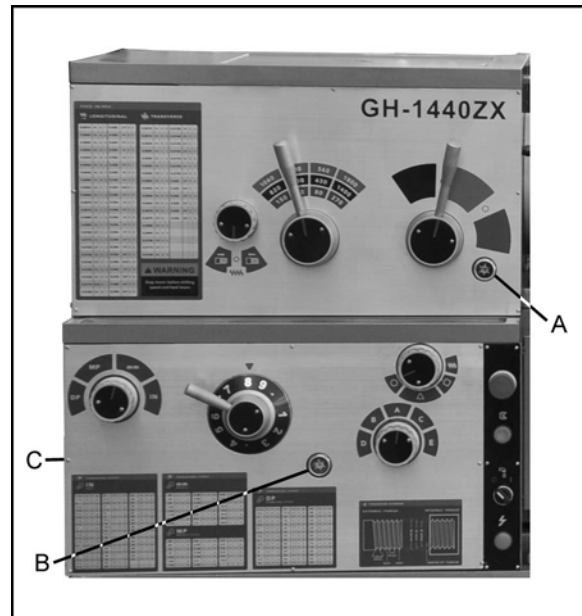


Figure 9

3. **Apron** – Oil must be between indicator marks in the oil sight glass (A, Figure 10). Top off with SAE 20W. Remove oil plug (B, Figure 10) to fill. To drain, remove drain plug on bottom of apron.

Drain oil completely and refill after the first three months of operation. Then, change oil in the apron annually. Pull knob (C, Figure 10) on the one-shot lube system and hold for several seconds to allow oil to fill the pump. When the knob is released, oil will flow through various oil lines to lubricate the ways and cross slide surface. Perform this twice daily or as needed. When the oil level is below the indicator mark, oil must be added.



Figure 10

4. **Leadscrew and Feed Rod** – Daily lubricate two ball oilers on the right side bracket (A, Figure 11) with SAE 20W once or twice per shift.

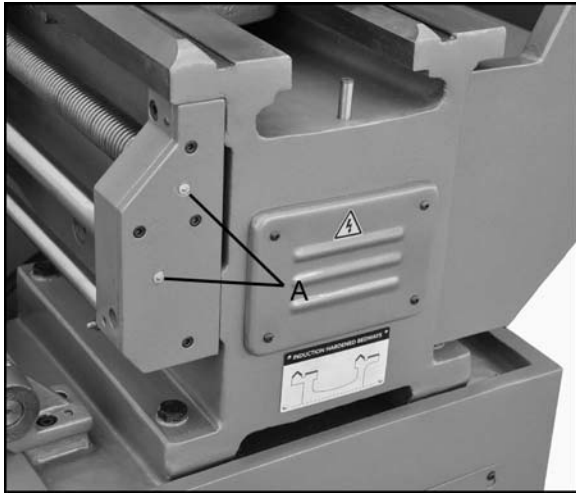


Figure 11

Saddle – Daily lubricate ball oiler (A, Figure 12) on handwheel shaft with SAE 20W.

The anti-dust felt on both ends of the saddle where it contacts the ways should be cleaned weekly with kerosene. If the felt becomes damaged, replace it.

5. **Compound Rest** – Daily lubricate two ball oilers (B, Figure 12) on top of compound rest with SAE 20W.
6. **Cross Slide** – Daily lubricate one ball oiler (C, Figure 12 – opposite side) with SAE 20W.

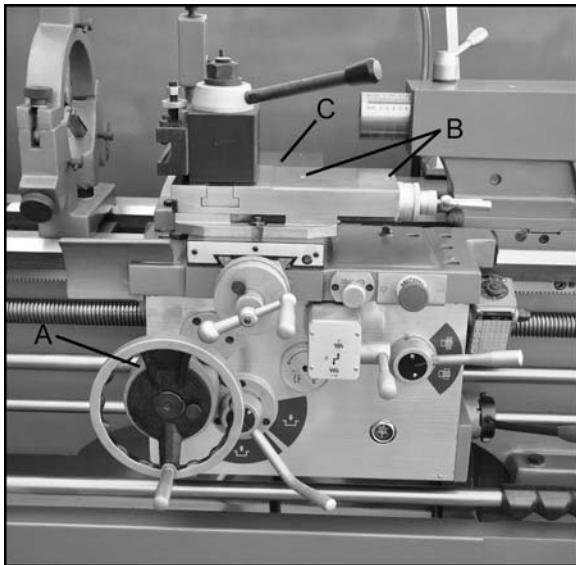


Figure 12

7. **Tailstock** – Daily lubricate one ball oiler (A, Figure 13) on top of tailstock with SAE 20W.

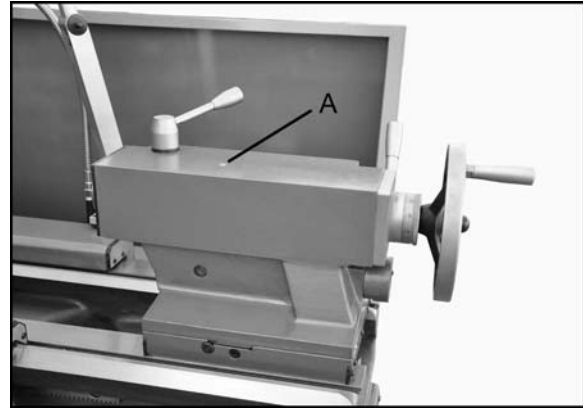


Figure 13

8. **V-Belts** – Regularly check and adjust the tightness of the v-belts to prolong their service life. See section 14.6, *Belt replacement and adjustment*.

10.0 Coolant preparation

CAUTION Follow coolant manufacturer's recommendations for use, care and disposal.

1. Remove access cover on tailstock end at the rear base of the lathe. Make sure coolant pump has not shifted during transport.
2. Pour four gallons (approximate) of coolant mix into the chip pan.
3. After machine has been connected to power, turn on coolant pump and check to see that coolant is cycling properly.
4. Replace access cover.

11.0 Electrical connections

WARNING Electrical connections must be made by a qualified electrician in compliance with all relevant codes. This machine must be properly grounded while in use to help protect the operator from electrical shock and possible fatal injury.

The main motor is rated at 7-1/2 HP (or 10HP for model 2280ZX), 230/460V and comes from the factory prewired at 230V. Confirm that power available at the lathe's location is the same rating as the lathe.

Power is connected properly when rotation of the forward-reverse knob (see E, Figure 15) to the left position causes the spindle to rotate counterclockwise as viewed from the tailstock. If the chuck rotates in the clockwise direction, disconnect the lathe from the power source, switch any two of the three power leads (not the green ground wire), and re-connect the lathe to the power source.

11.1 Conversion to 460 volt operation

⚠WARNING Disconnect machine from power source. Failure to do so may cause serious injury.

Main Motor: Change the wires according to the diagram on the outside of the motor junction box.

Transformer: Open electrical panel on rear of machine on the headstock side. Switch wire from 230V terminal to 460V terminal as outlined on the transformer.

Coolant Pump: Open access panel on the base at the tailstock end. Change wires in coolant pump junction box according to diagram on the outside of the junction box cover.

Main Power Switch (A, Figure 14): Turns power to machine on and off.

Power Source Cable Receiver (B, Figure 14).

Make sure the lathe is properly grounded.

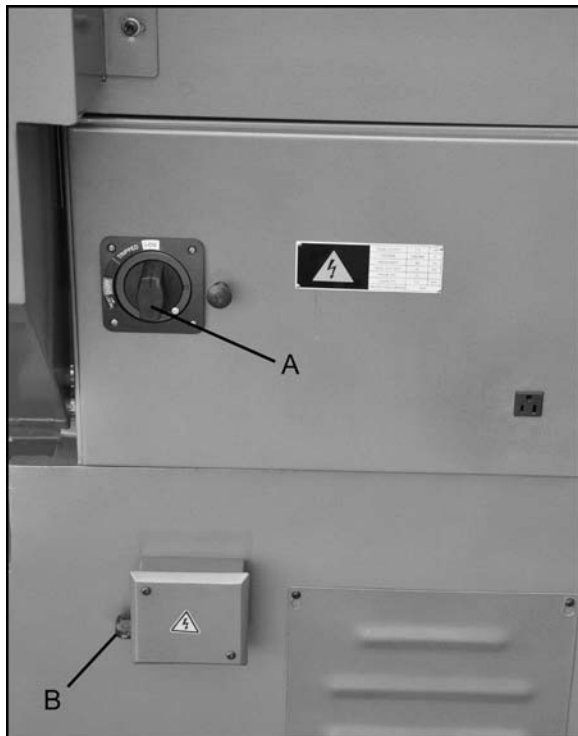


Figure 14: Power input

12.0 Controls

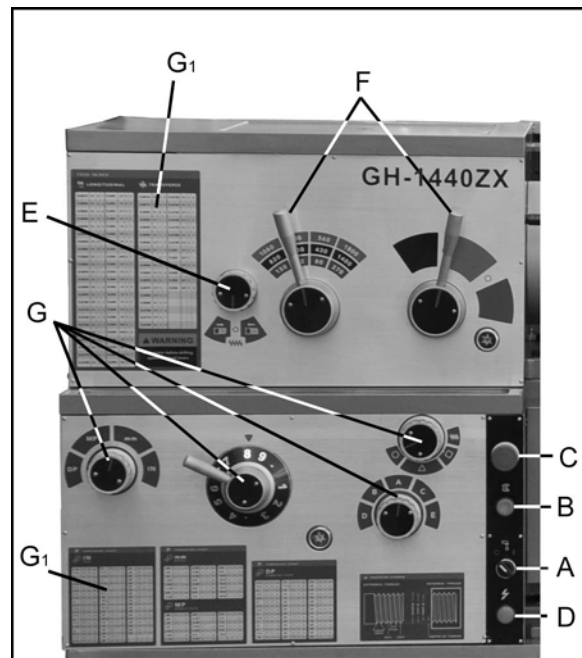


Figure 15 – Headstock controls

1. **Control Panel:** located on front of headstock.
 - **Coolant On-Off Switch (A, Figure 15)** turns coolant pump on and off.
 - **Power Indicator Light (D, Figure 15)** is lit whenever lathe is receiving power.
 - **Emergency Stop Switch (C, Figure 15)** stops all machine functions (**Caution:** Lathe will still have power). Twist clockwise to re-set.
 - **Jog Switch (B, Figure 15).** Quickly press and release to rotate the spindle.
 2. **Headstock Gear Change Levers (F, Figure 15):** Move levers left or right to desired spindle speed, according to accompanying chart.
 3. **Leadscrew/Feed Rod Directional Dial (E, Figure 15):** Changing knob changes direction of feed.
- ⚠CAUTION** Do not move knob (E) while machine is running.
4. **Feed/Lead Selector Levers (G, Figure 15):** Used conjunctively to set up for threading or feeding, according to the accompanying chart (G₁, Figure 15).

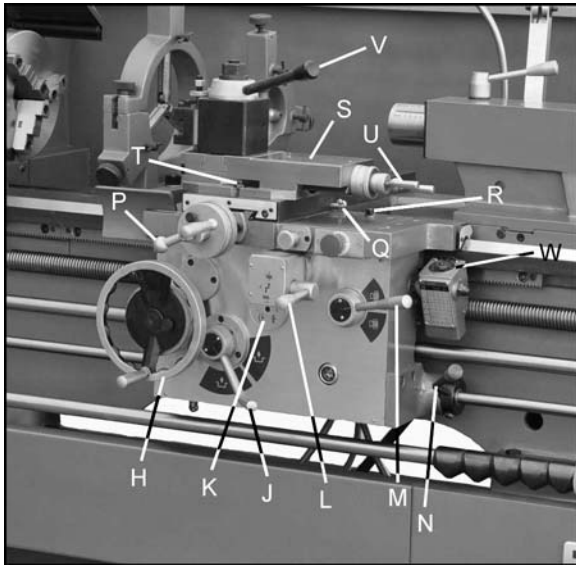


Figure 16 – Carriage controls and settings

5. **Carriage Handwheel (H, Figure 16):** Located on apron assembly. Rotate handwheel clockwise to move carriage toward tailstock (right). Rotate handwheel counterclockwise to move carriage toward headstock (left).
6. **Feed Engagement Lever (J, Figure 16):** Located on front of apron assembly. Pull lever up to engage. Push lever down to disengage.
7. **Adjustable Feed Clutch (K, Figure 16):** When the machine is overloaded, it can slip. Then cutting rate must be reduced. **Note:** This setting has been calibrated at the factory and should not need adjustment. If adjustment ever becomes necessary, follow the diagram on the front of the apron.
8. **Longitudinal/Cross Feed Selector Lever (L, Figure 16):** Can be pushed to upper, middle and lower three positions. Push the lever up, cross feed is effected. Push the lever down, longitudinal feed is effected. When the lever is in the middle position, screws can be cut by engaging the half nut.
9. **Half Nut Lever (M, Figure 16):** Located on front of apron assembly. Used for threading.
10. **Spindle Direction Control Lever (N, Figure 16):** Move lever to the right so that its tab clears the notch, then *downward* for forward spindle rotation, or *upward* for reverse spindle rotation. **Allow spindle to come to a stop before changing directions.** Position lever in neutral position (tab in notch) before shutting off the lathe.
11. **Cross Slide Handwheel (P, Figure 16):** Located above the apron assembly. Clockwise rotation moves cross slide toward rear of machine.

12. **Cross Slide Lock (Q, Figure 16):** Lever located on left side of cross slide. Turn clockwise to lock and counterclockwise to unlock.
13. **Carriage Lock (R, Figure 16):** Located on top right of carriage. Turn clockwise to lock, counterclockwise to unlock.

CAUTION

Carriage lock must be loose before moving carriage or damage to lathe may occur.

14. **Compound Rest (S, Figure 16)** is located on top of cross slide and can be rotated 360°. There are calibrations in degrees (T, Figure 16) below the rest to assist in placement of the compound rest to the desired angle.
15. **Compound Rest Handle (U, Figure 16):** Located on end of compound slide. Rotate clockwise or counterclockwise to position.
16. **Compound Lock (not shown):** Lever located on back of compound rest. Turn clockwise to lock and counterclockwise to unlock.
17. **Tool Post Clamping Lever (V, Figure 16):** Located on top of tool post. Rotate counterclockwise to loosen and clockwise to tighten.
18. **Thread Chaser (W, Figure 16):** Indicates the point on the leadscrew where the half nut can be re-engaged to continue inch threading.
19. **Tailstock Quill Clamping Lever (A, Figure 17):** Located on the tailstock. Rotate clockwise to lock the sleeve. Rotate counterclockwise to unlock.

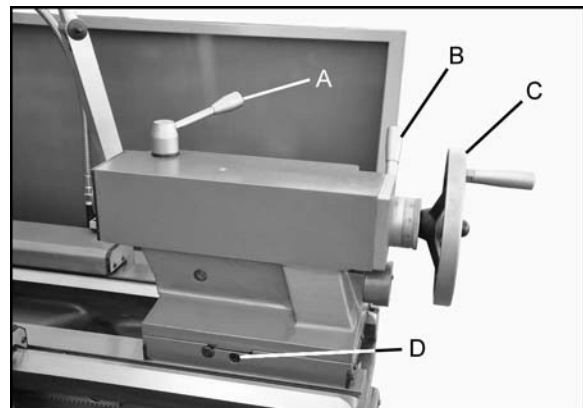


Figure 17 – Tailstock controls

20. **Tailstock Clamping Lever (B, Figure 17):** Lift up to lock. Push down to unlock. If the tailstock has a heavy load, tighten the hexagon head at right side of tailstock for auxiliary locking.
21. **Tailstock Quill Handwheel (C, Figure 17):** Rotate clockwise to advance quill and counterclockwise to retract it.

22. **Tailstock Off-Set Adjustment** (D, Figure 17): Two hex socket cap screws located on the tailstock base are used to off-set the tailstock for cutting tapers. Loosening one screw while tightening the other will off-set the tailstock. Do not clamp the tailstock lock handle when adjusting.

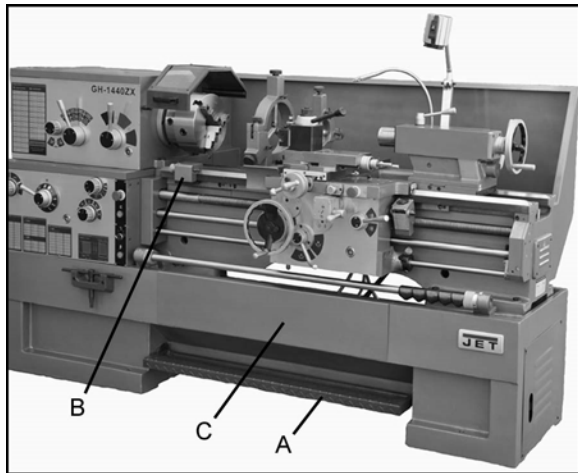


Figure 18 – Other controls

23. **Foot Brake** (A, Figure 18): The connecting rod mechanism is in the bed stand. The braking device is in the pulley of the headstock. Press the pedal to stop all lathe functions. (**Caution:** Lathe still has power.)
24. **Micro Carriage Stop** (B, Figure 18): can be used during manual feed operation. The dial can be turned for fine tuning the position of the stop. The micro carriage stop can be moved along the bed by loosening the two socket head cap screws underneath the stop.
25. **Bed Cover** (C, Figure 18): can be easily removed to clean out the stand.

13.0 Operation

The operator should consult shop manuals such as “Machinery’s Handbook” for cutting speeds and feeds appropriate to specific workpieces. Correct feed depends upon material to be cut, cutting operation, tool type, chucking rigidity, depth of cut, and desired surface quality.

IMPORTANT: Allow a break-in period for the new lathe so that gears and bearings can adapt; do not run the lathe above 560 RPM for the first six hours of operation.

CAUTION

The following points must be observed when operating the lathe:

- Never turn any handles or levers when spindle is at high speed.
- Change spindle speed only after spindle stops.
- Change feed rate only when spindle is at low speed or is stopped.

- Never exceed maximum speed limitation of the work holding device.
- Before starting spindle, check that each handle or lever is at correct position to ensure normal engagement of gears. The spindle direction control lever should be at neutral position.
- If the brake becomes ineffective, turn off machine and adjust brake immediately.
- When operating spindle direction control lever, always turn it to correct position; never use “pre-position” for cutting at a reduced speed.
- Jaw teeth and scroll must be fully engaged, to prevent the jaws from breaking and being thrown from chuck (see Figure 19).

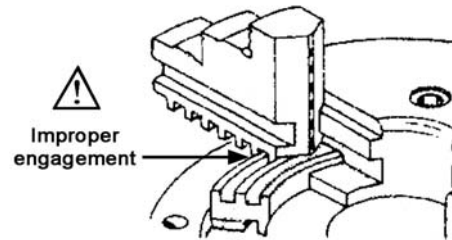


Figure 19 – Insufficient jaw tooth engagement

- Avoid long workpiece extensions, as parts may bend or fly off (see figure 20). Use rests or the tailstock for support.

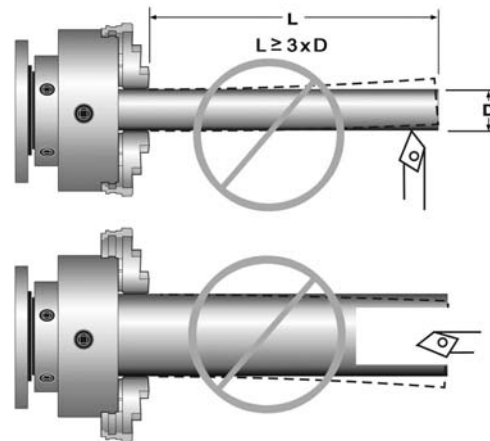


Figure 20 – Improper setups

- Avoid short clamping contact (Figure 21, A) or clamping on a minor part diameter (Figure 21, B). Face-locate the workpiece for added support.

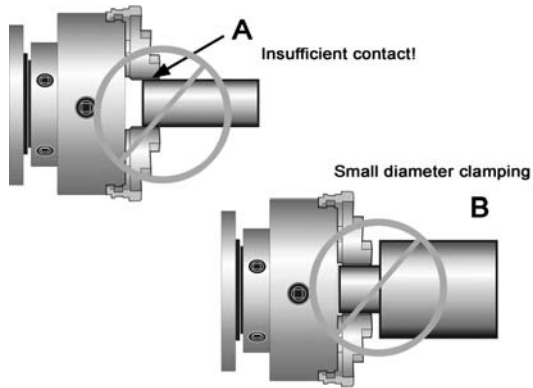


Figure 21 – Improper setups

13.1 Tool setup

The cutting angle is correct when the cutting edge is in line with the center axis of workpiece. Use the point of the tailstock center as a gauge and shims under the tool to obtain correct center height.

Use a minimum of two clamping screws to secure each tool.

13.2 Feed and thread selection

1. Reference the feed and thread chart (A, Figure 22).
2. Move levers and knobs (B/C/D/E, Figure 22) to the appropriate position according to the feed and thread chart.

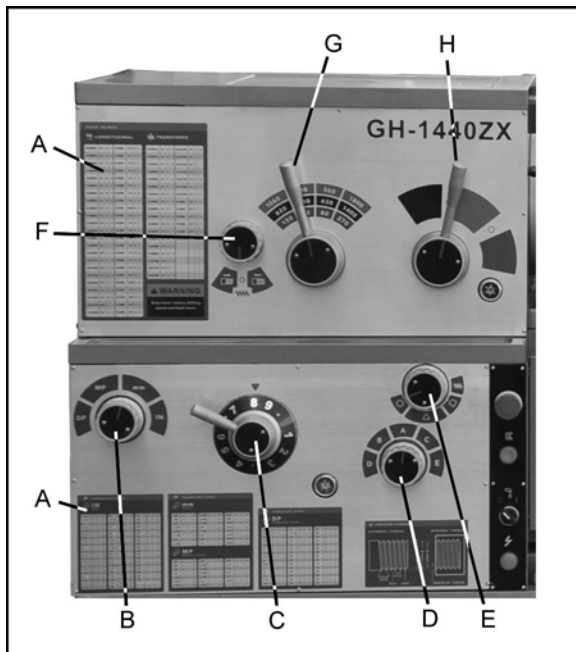


Figure 22

13.3 Thread cutting

1. Set forward/reverse lever (F, Figure 22) to desired direction.
2. Set selector levers (G/H, Figure 22) to desired R.P.M.

3. Select desired thread using levers (B/C/D/E, Figure 22).
4. Set selector lever (A, Figure 23) to correct position (neutral).
5. Engage the half nut lever (B, Figure 23).
6. Make a test cut with scrap material and check results before cutting regular material.

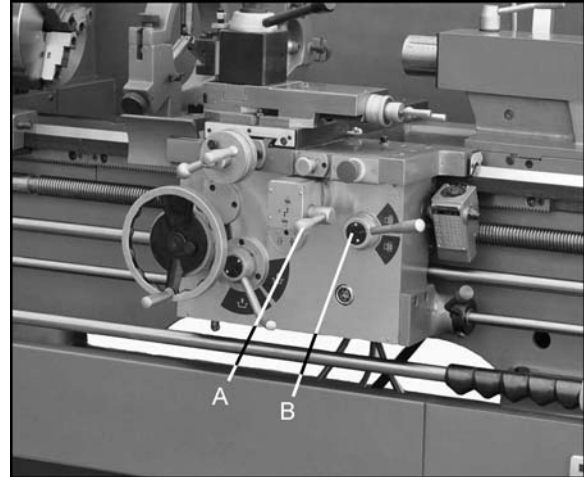


Figure 23

14.0 Adjustments

CAUTION Adjustments to the lathe, especially those involving alignments of bearings, spindle, leadscrew, clutch, etc., should only be performed by qualified personnel, as improper alignments can damage the machine and/or create a safety hazard.

WARNING Turn off main switch and press emergency stop button before making adjustments to lathe.

14.1 Chuck jaw reversal

The three jaws on the scroll chuck are reversible, to hold stock with larger diameters. See Figure 24. Loosen two screws with the provided hex key, remove jaw, and rotate it 180-degrees. Re-install jaw, and tighten each screw in increments until fully tightened.

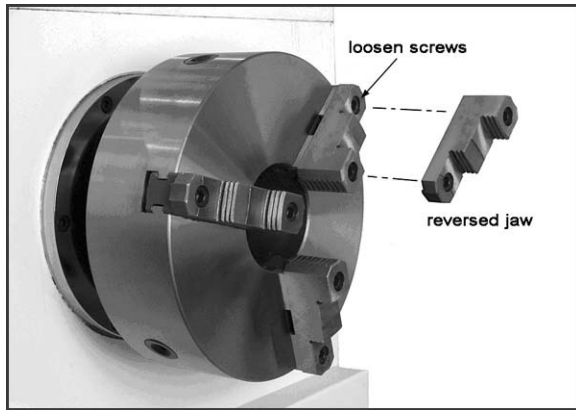


Figure 24 – Chuck jaw reversal

14.2 Gib adjustments

After a period of time, some moving components may need adjustment for play (or “backlash”) due to wear. *Do not overtighten gib screws as this can hasten wear to components.*

14.2.1 Saddle

Turn gib screws on either side of the saddle at the rear to adjust the drag on the saddle.

14.2.2 Cross slide

Gib screws are located at front and rear of slide opposite to one another (A, Figure 25). To adjust drag, loosen rear gib screw one turn, and tighten front gib screw a quarter turn. Rotate handwheel to check play. Repeat as needed until slide moves freely without play. Gently tighten rear gib screw.

14.2.3 Compound rest

Gib screws are located at front and rear of compound rest (B, Figure 25). To adjust, use same method as for Cross Slide.



Figure 25 – Gib adjustments, slide and rest

14.2.4 Half Nut

Gib screws are located on right side of apron (C, Figure 26). Loosen the jam nuts and rotate the screws clockwise until any backlash is corrected. Then re-tighten nuts.

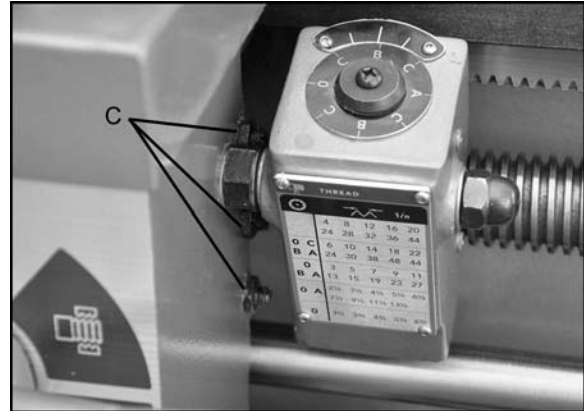


Figure 26 – Half nut gib adjustment

14.3 Tailstock off-set

Follow the procedure below to off-set the tailstock to cut shallow tapers:

1. Loosen tailstock in position by lowering locking handle (B, Figure 27) and loosening hexagon head eccentric shaft at back of tailstock.
2. Alternately loosen and tighten front and rear screws (D, Figure 27). **Note:** Front screw is shown.

The scale on the end of the tailstock base indicates amount of offset, and helps when re-centering.

If clamping force needs to be adjusted, use the hex nut beneath the tailstock body.

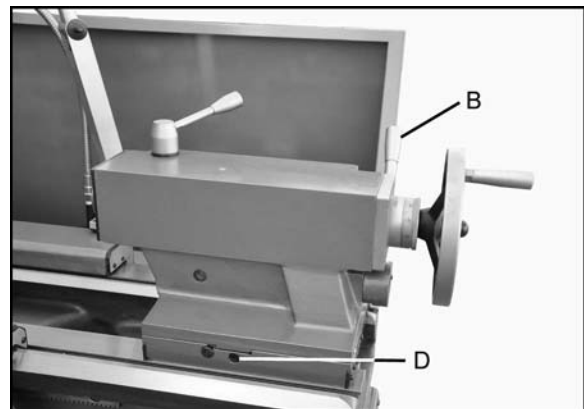


Figure 27 – Tailstock offset

14.4 Removing gap bridge

1. To remove the gap bridge, remove four hex socket cap screws, and two hex cap bolts.
2. Tighten the hex nuts on the tapered alignment pins to loosen the pins. Once loosened, they can be removed.
3. Gap bridge can now be removed.

14.5 Installing gap bridge

1. Clean the bottom and the ends of the gap bridge thoroughly.
2. Set gap bridge in place and align the ends.
3. Loosen the nuts on the locating pins and push down through the gap into the lathe bed.
4. Replace four hex socket cap screws and tighten alternately until all are snug.

14.6 Belt replacement/adjustment

1. Disconnect machine from power source.
2. Open end gear cover, remove lower rear cover and lower side cover. This will expose the motor and v-belts.
3. Loosen upper hex nut (A, Figure 28). Place scrap piece of wood under motor to act as lever. Lift motor up and block temporarily.
4. Remove belts. Install new belts onto pulleys.
5. Lift up on motor and remove temporary blocking.
6. Tension belts by loosening lower nut (B, Figure 28) and tightening upper nut (A, Figure 28) until light finger pressure causes approximately 3/4" deflection on each belt.
7. Install covers and connect lathe to the power source.

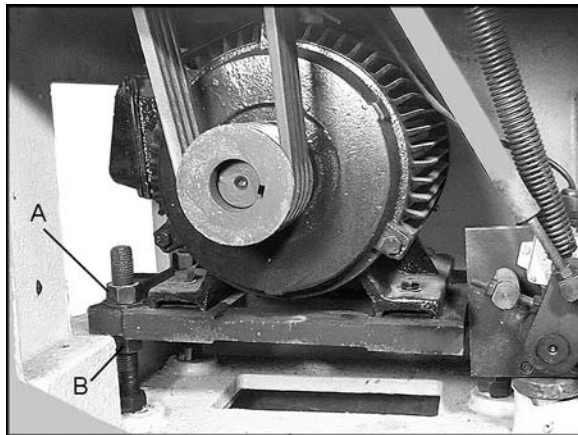


Figure 28 – Belt adjustment

14.7 Aligning tailstock to headstock

1. Fit a 12" ground steel bar between centers of the headstock and tailstock (Figure 29).
2. Fit a dial indicator to the top slide and traverse the center line of the bar.

If adjustment is needed, align the tailstock using the off-set screws (D, Figure 27) until the tailstock is aligned.

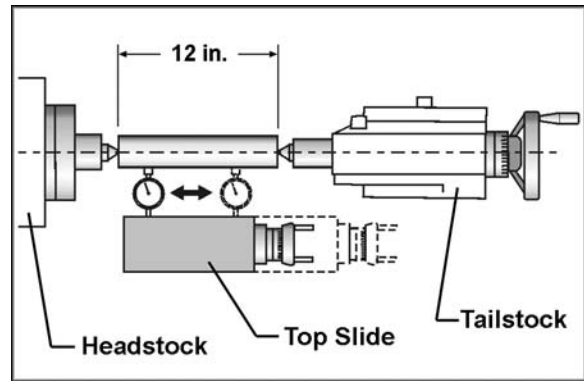


Figure 29 – Tailstock/Headstock alignment

14.8 Cross slide nut adjustment

The cross slide moves via a lead screw which drives a nut. This can be adjusted if backlash develops. Backlash is identified by turning the cross slide handwheel left and right – if there is a delay before any cross slide movement, the nut needs adjusting.

Tighten or loosen the two screws shown in Figure 30 until backlash is adjusted out.

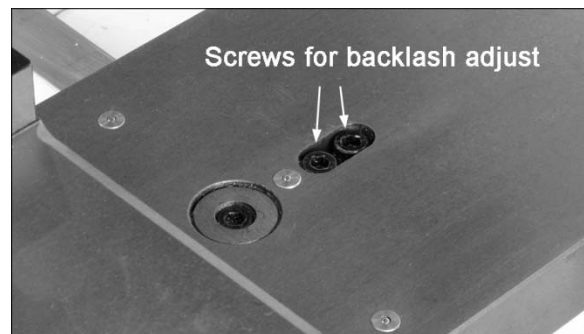


Figure 30 – Cross slide nut adjustment

14.9 Shear pin replacement

The lead screw and feed shaft are equipped with shear pins, which are designed to break in order to protect the drive system against overload. A broken shear pin must be replaced.

Knock out the broken pin; line up the holes and insert new pin.

14.10 Steady rest adjustment

Always lubricate the fingers with grease before using the steady rest. The point at which the fingers contact the workpiece require continuous lubrication to prevent premature wear.

To set the steady rest (see Figure 31):

1. Loosen hex nut (A) to slide steady rest along the ways.
2. Loosen knurled handle (B) until it can be pivoted out of the slot.
3. Loosen three lock knobs (C), and back off the fingers (D) using knurled handles (E).

4. Pivot the collar on its hinge and position steady rest around workpiece.
5. Firmly tighten hex nut (A).
6. Set the fingers snugly to work piece and secure by tightening locking knobs. *Fingers should be snug but not overly tight.*

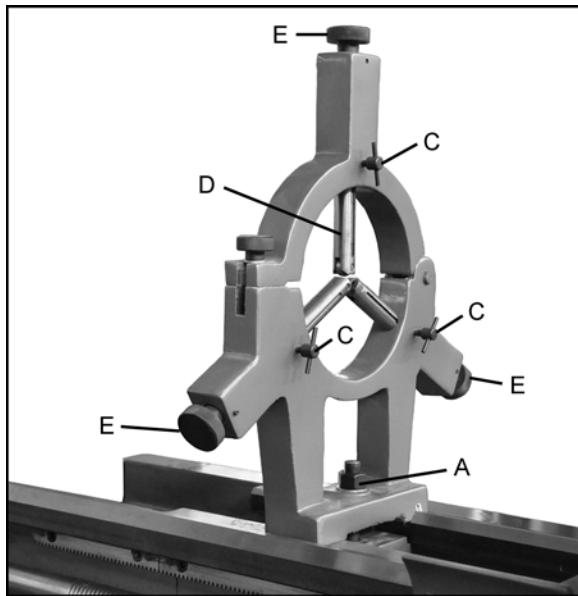


Figure 31 – Steady rest adjustment

14.11 Follow rest adjustment

The follow rest mounts to the saddle with two socket head cap bolts. The follow rest should be mounted so that locking knobs point away from chuck.

The sliding fingers are set similar to those on the steady rest – free of play, but not binding.

Always lubricate the fingers sufficiently with grease before operating.

14.12 Carriage stops

Adjust each stop (Figure 32) by loosening two set screws, and sliding it along the rod. Rotate the stop so that the raised area is upward to contact the carriage. Tighten both set screws securely.

Position the raised area downward when the stop is not being used.

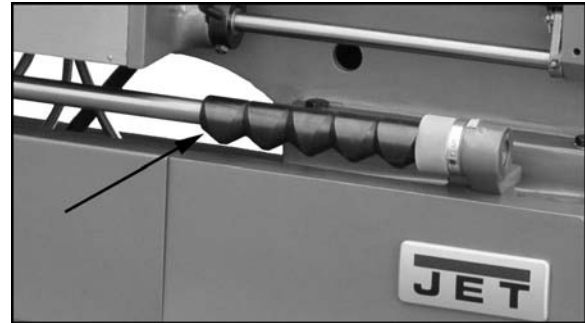


Figure 32

15.0 Lubrication schedule and general maintenance

Regularly scheduled maintenance is crucial to ensure a long service life for your machine. The schedule below shows general cleaning, lubrication points and coolant replacement information for the ZX Series Lathes. **Push stop button and power off before lubricating.** Follow local regulations for disposal of used coolant/lubricants. Minimize direct skin contact with lubricants and coolants, and wear eye protection when pouring coolant in case of splash.

Mobile DTE® Oil Heavy Medium is recommended for the SAE-20W machine oil.

If the brand of oil is ever changed, it is recommended that you flush and clean the reservoir first to prevent any compatibility issues.



Table 1


Section	Element	Action	Lubricant	Frequency
8.3	Chuck	Grease jaws and scroll	#2 lithium tube grease	periodically
8.3	Spindle/cam locks/ chuck body	light coat of oil	SAE-20W machine oil	periodically
	All exposed metal surfaces	light coat of oil	SAE-20W machine oil	frequently
9.0	Headstock	Drain and fill	SAE-20W machine oil	- after 30 days, - every 2 months
9.0	Gearbox	Drain and fill	SAE-20W machine oil	- after first 3 months, - every 6 months
9.0	Apron and Saddle	Drain and fill	SAE-20W machine oil	- after first 3 months, - then annually
9.0	Leadscrew; Feed Rod; Spindle Direction Control Axle	Fill at ball oilers	SAE-20W machine oil	daily (1 or 2 times per shift)
	Travel Setting Rod	Fill at (1) ball oiler	SAE-20W machine oil	as needed
9.0	Cross slide	Fill at (2) ball oilers	SAE-20W machine oil	daily
9.0	Compound rest	Fill at (2) ball oilers	SAE-20W machine oil	daily
9.0	Tailstock	Fill at (1) ball oiler	SAE-20W machine oil	daily
9.0	Anti-dust felt on v-ways	Clean	kerosene	Inspect weekly
10.0	Coolant reservoir	(follow coolant manufacturer's directions)	Coolant of choice, approx. 4 gallons	(follow coolant manufacturer's directions)
14.10	Steady Rest	Lubricate finger shafts and contact points	Lead-based grease	before each use
14.11	Follow Rest	Lubricate finger shafts and contact points	Lead-based grease	before each use
14.6	V-belts	Inspect and tighten if needed		periodically

16.0 Reference tables

16.1 Inch Lead And Feed

Table 2

FEED IN / REV											
 LONGITUDINAL						 TRANSVERSE					
0.0015	IN	A	1	0.020	DP	D	2	0.0010	IN	A	8
0.0020	IN	A	6	0.022	IN	D	9	0.0130	IN	E	6
0.0025	IN	A	8	0.024	DP	D	5	0.0140	IN	E	7
0.0030	IN	B	1	0.025	IN	E	2	0.0150	DP	E	1
0.0035	IN	B	4	0.026	IN	E	3	0.0160	DP	E	2
0.0040	IN	B	6	0.028	DP	D	7	0.0170	IN	E	8
0.0045	IN	B	7	0.030	IN	E	4	0.0180	IN	E	9
0.0050	IN	B	8	0.032	IN	E	6	0.0190	DP	E	5
0.0060	IN	C	1	0.034	MM	E	1	0.020	DP	E	6
0.0065	IN	C	3	0.035	DP	D	9	0.022	MP	E	1
0.0070	IN	C	4	0.036	IN	E	7	0.026	DP	E	8
0.0075	IN	C	5	0.040	DP	E	2	0.028	DP	E	9
0.0080	IN	C	6	0.042	IN	E	8	0.032	MP	E	7
0.0090	IN	C	7	0.045	IN	E	9	0.036	MP	E	8
0.0100	DP	C	2	0.046	DP	E	4	0.0080	DP	D	2
0.0110	IN	C	9	0.048	DP	E	5	0.0090	IN	D	9
0.0120	DP	C	5	0.050	DP	E	6	0.0100	DP	D	6
0.0130	IN	D	3	0.054	MP	E	1	0.0110	DP	D	7
0.0140	DP	C	7	0.058	MM	E	8	0.0120	IN	E	4
0.0150	IN	D	4	0.065	DP	E	8				
0.0160	IN	D	6	0.070	MP	E	6				
0.0170	MM	D	1	0.080	MP	E	7				
0.0180	IN	D	7	0.090	MP	E	8				

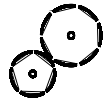


WARNING

Stop motor before shifting speed and feed levers



THREADING CHART



IN INCH

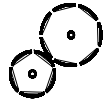
1 5/8	E	9	△
1 3/4	E	8	△
2	E	7	△
2 1/4	E	6	△
2 3/8	E	5	△
2 1/2	E	4	△
2 5/8	E	8	□
2 3/4	E	3	△
2 7/8	E	2	△
3	E	1	△
3 1/4	D	9	△
3 3/8	E	6	□
3 1/2	D	8	△
3 3/4	E	4	□
4	D	7	△
4 1/2	D	6	△
4 3/4	D	5	△
5	D	4	△
5 1/4	D	8	□
5 1/2	D	3	△
5 3/4	D	2	△

6	D	1	△
6 1/2	C	9	△
6 3/4	D	6	□
7	C	8	△
7 1/2	D	4	□
8	C	7	△
9	D	1	□
9 1/2	C	5	△
10	C	4	△
10 1/2	C	8	□
11	C	3	△
11 1/2	C	2	△
12	C	1	△
13	B	9	△
13 1/2	C	6	□
14	B	8	△
15	C	4	□
16	B	7	△
18	C	1	□
19	B	5	△
20	B	4	△

21	B	8	□
22	B	3	△
23	B	2	△
24	B	1	△
26	A	9	△
27	B	6	□
28	A	8	△
30	B	4	□
32	A	7	△
36	B	1	□
38	A	5	△
40	A	4	△
42	A	8	□
44	A	3	△
46	A	2	△
48	A	1	△
54	A	6	□
60	A	4	□
72	A	1	□



THREADING CHART

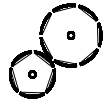


m m METRIC

.50	A	1	□
.75	A	1	△
1.0	A	6	△
1.25	A	8	○
1.50	B	1	△
1.75	B	4	○
2.0	B	6	△
2.25	B	7	△

2.50	B	8	○
3.00	C	1	△
3.50	C	4	○
4.0	C	6	△
4.50	C	7	△
5.0	C	8	○
6.0	D	1	△
7.0	D	4	○

8.0	D	6	△
9.0	D	7	△
10.0	D	8	○
12.0	E	1	△
14.0	E	4	○
16.0	E	6	△
18.0	E	7	△
20.0	E	8	○



M P MODULE PITCH

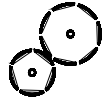
.25	A	1	□
.50	A	6	△
.75	B	1	△
1.0	B	6	△
1.25	B	8	○
1.50	C	1	△
1.75	C	4	○

2.0	C	6	△
2.25	C	7	△
2.50	C	8	○
3.00	D	1	△
3.50	D	4	○
4.0	D	6	△
4.50	D	7	△

5.0	D	8	○
6.0	E	1	△
7.0	E	4	○
8.0	E	6	△
9.0	E	7	△
10.0	E	8	○



THREADING CHART



DP

DIAMETRAL PITCH

3 1/4	E	9	△
3 1/2	E	8	△
4	E	7	△
4 1/2	E	6	△
4 3/4	E	5	△
5	E	4	△
5 1/2	E	3	△
5 3/4	E	2	△
6	E	1	△
6 1/2	D	9	△
7	D	8	△
8	D	7	△
9	D	6	△
9 1/2	D	5	△
10	D	4	△

11	D	3	△
11 1/2	D	2	△
12	D	1	△
13	C	9	△
14	C	8	△
16	C	7	△
18	C	6	△
19	C	5	△
20	C	4	△
22	C	3	△
23	C	2	△
24	C	1	△
26	B	9	△
28	B	8	△
32	B	7	△

36	B	6	△
38	B	5	△
40	B	4	△
44	B	3	△
46	B	2	△
48	B	1	△
52	A	9	△
56	A	8	△
64	A	7	△
72	A	6	△
76	A	5	△
80	A	4	△
88	A	3	△
92	A	2	△
96	A	1	△

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