CINCINNATI LATHE AND TOOL CO.
Hydrashift Lathes
6502-11

17" TOOL ROOM LATHE

LATHE, TOOL ROOM, FLOOR MOUNTED, 17 INCH RATED SWING, GEARED HEAD DRIVE

SCOPE AND CLASSIFICATION

Scope - This specification covers a metal-cutting toolroom lathe, electric motor driven, substantially in accordance with Figure 1, with equipment and accessories as described herein, with or without other equipment at the option of the procuring agency. The lathe is intended for use in toolrooms and machine shops and shall be suitable for rough turning and boring, and fine finish cutting on work requiring accurate dimensions for close fits; and for cutting screw threads, fine and coarse, right or left hand leads.

Classification -

Type - The lathe shall be of the precision geared head type only.

Size - The lathe shall be of one size only, commercially rated a 17 inch diameter swing, and as hereinafter specified.

REQUIREMENTS

Illustrations - The illustration shown herein in Figure 1 is for the convenience of identification, requisitioning, purchasing, and inspection of machines in accordance with the requirements of this specification.

Material and Workmanship - The materials shall be of uniform quality and of sound condition and shall conform in composition, heat-treatment and suitability to those of reputable manufacturers producing equipment of the type called for in this specification. Material shall be free from all defects and imperfections that might affect the serviceability of the finished product. Workmanship shall be in accordance with that of high grade commercial practice covering this type of equipment.

Design - The lathe shall be of the latest improved design and of rugged substantial construction. The design shall be such as to provide convenience and safety of operation. The lathe shall be screw-cutting with quick-change geared headstock to provide required spindle speed ranges. All parts of the machine shall be new and of first-class commercial quality. The parts shall be of such size, material and strength as to properly sustain the maximum allowable load imposed upon them with an adequate factor of safety, maximum working efficiency, and minimum wear.

Maintenance - The machine shall be so designed that the required maintenance can be easily performed, without the use of special tools.

Construction - Construction shall be free from any characteristics or defects which may render the machine unsuitable or inefficient for the purpose intended. The lathe and its equipment shall be complete so that when installed in its intended location and connected to the source of power, it can be used for any operation for which it was designed.

Castings - All castings shall be of uniform quality, free from blow holes, porosity, hard spots, shrinkage defects, cracks, or other injurious defects. Strength and other essential physical properties of the castings shall be adequate throughout for the purpose intended.

Welding, Brazing, and Soldering - These processes shall be performed in accordance with the best commercial practice. In no event shall such processes, including peening or plugging, be used on castings or forgings for reclaiming any part of the machine without authorization of the procuring agency.

Fastening Devices - All screws, pins, bolts and similar parts shall be installed with an adequate means for preventing loss of proper tightness and adjustment. All such parts when subject to removal or adjustment, shall not be swaged, peened, staked, or otherwise permanently deformed.

Electrical Connections - Electrical connections shall be either mechanically secured, soldered, or brazed. Use of soldering acids, acid fluxes, or soldering salts shall be avoided whenever possible. However, if the latter are used, all joints or terminals shall be thoroughly cleaned and all traces of acid removed.

Safety Devices - Each lathe shall be furnished with suitable safety devices of the latest type. Parts which are hazardous to the operator shall be suitably guarded where practicable. Ample protection against electrical shock shall be provided.

Threads - All threaded parts shall be in accordance with the applicable requirements of the National Bureau of Standards Handbook H-28, and 1950 Supplement thereto.

Lubrication - All bearings, revolving shafts, and other working parts shall be provided with ample and suitable means of lubrication. Mechanisms requiring special lubrication shall be in accordance with the requirements hereinafter specified.

Interchangeability - All replaceable parts shall be constructed to definite standards, tolerances, and clearances, in order that any such part, of a particular type or model, may be replaced or adjusted without requiring modification except those parts which are normally scraped and fitted in accordance with best commercial practice of machine tool builders. All such parts, when practicable, shall be permanently and legibly marked with the manufacturer's part number.

Surface Finish - All castings, forgings, molded, or welded parts, shall be thoroughly cleaned and free from sand, dirt, fins, sprues, flux or other harmful or extraneous materials. External surfaces shall be smoothed and all edges shall be rounded or beveled. All bearing surfaces between matching parts shall be finished by machining, grinding, or scraping, to the necessary tolerances to provide the required accuracy. Surface roughness of bearing surfaces shall be such as to not reduce bearing areas to any appreciable extent nor to detract from the appearance of the machine. Other outside surfaces of unpainted parts shall be suitably finished.

The lathe shall conform to the standards of accuracy as set forth in Table II.

Dimensions - The size and capacities of the lathe shall be as shown in Table I. Distance between centers shall be as specified by the procuring agency.

TABLE I

Distance between centers, inches, with tailstock flush

	Distance between centers (Minimum)	30 inches
		42 "
		54 "
Select one of the following:		72 "
		96 "
	(Maximum)	114 "

Swing over bedways, inches, minimum	17-1/8
Swing over cross slide, inches, approximately, minimum	9-1/2
Spindle speed changes, minimum	12
(Select one of the following)	
Spindle speed range, low range, rpm	17-653
standard range, rpm	25-980
high range, rpm	37-1470
super high range, rpm	63-3000
Morse Taper of spindle	4
Diameter of hole through spindle, inches, minimum	1-3/4
Number of threads and feed changes, minimum	48
Low of not more than 1-1/2 threads per inch	
High of not less than 92 threads per inch	
Right hand or left hand	
Low range of feed per revolution of spindle, inches, maximum	.0019
High range of feed per revolution of spindle, inches, minimum	.1215
Diameter of lead screw, inches, minimum	1-3/8
Width of bed, inches, minimum	13-7/8
Distance between "Vees" or "Vee" and center of flat bearing on carriage, inches, minimum	12-3/4
Tailstock spindle, diameter, inches, minimum	2-1/4
Tailstock spindle travel, inches, minimum	5
Tailstock graduation length by 16ths, inches, minimum	5
Steady rest capacity, inches	5/16 to 5
Shank of tool holder, inches	5/8 x 1-3/8
Diameter of small face plate, approximately, inches	9
Diameter of large face plate, approximately, inches	14-1/2
Taper attachment, included angle capacity, degrees	18
Taper attachment, length capacity, inches, minimum	16
Bearing of carriage on ways, inches	22-3/8
Motor, electric, horsepower, minimum -	
Low speed range-1200 RPM	5
Standard speed range-1800 RPM	5
High speed range-1800 RPM	5
Super high speed range-1800 RPM	5
Net weight of lathe, base length, 30" center distance, approximately	3190 pounds
Additional for each 6" of center distance, approximately	50 pounds

Headstock - The headstock shall be totally enclosed and contain all gears for speed ranges as specified in Table I. The intermediate speeds shall be in approximate geometric ratio. The headstock casting shall be reinforced and ribbed to insure strength and rigidity.

Spindle Speed Selection - Spindle speed changes shall be obtained through the use of a hydraulic shifting mechanism. Spindle speeds shall be selected with a direct reading dial located on the front of the headstock. The selected speed shall be engaged by lowering the spindle start-stop lever to the brake position and raising it to start position. The hydraulic shifting mechanism shall permit the selection of the next spindle speed while a cut is being taken.

Headstock Gears and Shafts - All gears shall be made of alloy steel, with teeth hardened and finished accurately to American Gear Manufacturers' Association Standards. Tooth spacing and accuracy of tooth profile shall be in accordance with good commercial practice in order to insure quiet operation and to prevent gear mark transmission onto the work. All headstock shafts shall be steel forgings or heat-treated bar stock, properly heat-treated and ground. All shafts for the spindle drive shall be mounted on anti-friction bearings in the headstock casting.

Headstock Spindle - The spindle shall be machined from an alloy steel forging, properly heat-treated. The spindle nose shall be the standard L-0 taper key drive type to receive and accurately align face plates and chucks.

Headstock Lubrication - Headstock lubrication shall be obtained through the use of an oil pump or splash system which shall provide a full flood of oil over all gears, bearings and moving parts while the lathe is in operation. A filter shall be incorporated to assure clean filtered oil is supplied to bearings. The integral oil reservoir in the headstock shall be furnished with an oil sight gage conveniently located on front face of headstock.

Headstock Spindle Bearings - The spindle shall be mounted on three precision anti-friction bearings. The bearings shall be of such size and construction and assembled to the spindle and the headstock in such a manner as to withstand the loads imposed upon them when the lathe is operated at full capacity. The radial load at 100 rpm of the front bearing shall be not less than 10536 pounds. The thrust load at 100 rpm for the main front bearing shall be not less than 8348 pounds.

Bed - The lathe bed shall be a casting of uniform close grain material and be a structure to provide stability. The bed shall be generously proportioned and designed with ample cross girths to maintain alignment. The width of the body of the bed below the ways shall not be less than 70 per cent of the overall width of the carriage supports. The depth of the bed as measured from

the top of the front flat shall not be less than 10-5/16 inches. The bed shall be supported by a cabinet leg at the headstock end. All legs shall be provided with built-in leveling screws. The legs shall be of adequate construction to properly support the bed and to insure rigidity.

Bedways - The bedways supporting the carriage as well as the tailstock shall be hardened and ground. Bedways shall be of uniform hardness. The hardness shall be at least 60 to 70 Scleroscopie Shore reading. Tops of the Vee ways shall be rounded to resist damage.

Rack & Pinion Gear - The underside of the front V-way shall be fitted with a steel gear rack which will mesh with the apron pinion gear to provide hand and power feeds for the carriage.

Carriage - The carriage shall be of heavy construction securely gibbed to the bed with provision for clamping when the cross feed is being operated. Carriage wings shall be provided with wipers to prevent chips and other foreign matter from working between the carriage and the bedways. The carriage shall be drilled and tapped to permit mounting of the follow rest and taper attachment. A centralized lubrication system shall be provided to force oil to the carriage, cross slide bearings, and bedways.

Apron - The apron shall be of one piece, double-wall construction providing inboard and outboard bearing supports for the gear shafts and studs. The gears shall be made of high grade alloy steel and shall have accurately cut teeth, properly machined and hardened to assure long life and accurate performance. The apron shall be provided with a built-in oil shot plunger lubrication system to force oil to the bedways and cross slide ways and other gears and bearings shall operate in a continuous bath of oil. Apron to include integral oil reservoir with oil sight gage conveniently located in face of apron. Feeds shall be engaged by means of positive quick-disengaging clutches conveniently operated from the front of the apron. Separate controls shall be provided for engagement of cross and longitudinal feeds. An interlock shall be incorporated in the apron to prevent engagement of the feeds and half-nuts at the same time.

Screw Thread Cutting Leads - Leads shall be obtained by means of bronze half-nuts having threads which will engage the lead screw. A lever shall be provided on the front of the apron for opening and closing the half-nuts.

Thread-Chasing Dial Indicator - A thread-chasing dial indicator shall be provided and conveniently located on the apron and shall be properly graduated to indicate correct engagement of the leadscrew and half-nuts when cutting threads.

Carriage Reversing Mechanism - A reversing mechanism shall be furnished affording movement of the carriage in either direction without changing the direction of rotation of the spindle when feeding. The lever controlling this mechanism shall be conveniently located on the quick change box and properly detented for the purpose of holding the lever in the desired position.

Cross Slide - The cross slide shall be fitted to the carriage by dovetail construction with a full length, adjustable, tapered gib to take up wear. The cross slide shall be provided with a guard to prevent the entry of chips or other foreign matter into the cross feed threads. Lubrication to the cross slide ways is to be provided by a built-in oil arrangement in the carriage supplied with oil from a manually operated oil shot system in the apron.

Compound Rest - The compound rest shall consist of a base and top, dovetailed together with an adjustable gib. The compound rest shall be attached to the cross slide by an accurately fitted swivel bearing. Means shall be provided for clamping the compound rest without pitting or deforming the cross slide mechanism. The compound rest shall be graduated from zero (0), as aligned at right angles with the bedways, in increments of 1^{o} up to and including 90^{o} in both directions from zero. The compound rest shall swivel 360^{o} without removal of any parts of the cross slide.

Lead Screw - The screw shall be of good quality steel, properly treated to provide the necessary stability and retention of accuracy in the limits specified herein. The leadscrew shall not be less than 1-3/8 inches in diameter, the threads of which shall be of Acme form and in accordance with commercial Screw-Thread Standards. The lead error shall be in accord with the limitations specified herein.

Feed Screws - The cross feed screw and compound feed screw shall be good quality steel. The screws shall be fitted with direct reading micrometer dials. The cross feed and compound feed screws shall be graduated to indicate one graduation equals 0.001 inch stock removal on the diameter of the work. Provision shall be made to permit positive adjustment of the graduated dials in any position.

Tailstock - The tailstock shall be of heavy construction and shall have bearing surfaces on both sides of the bed for its entire length. A sensitive screw adjustment shall be provided to set over the tailstock for alignment and taper turning. This adjustment shall be a minimum of 1/2 inch from the center, in both directions, and shall be marked on the back end of the tailstock or base in increments of 1/16 inch from zero (0) center in both directions. The tailstock shall be readily removable from the bed to increase carriage travel. The base of the tailstock shall be finished for accurate alignment with the headstock. A heavy single clamp

or locking device shall be provided for holding the tailstock at any position on the lathe bed. This clamp shall be loosened or tightened by means of a single lever. Loosening and tightening the clamp shall not cause misalignment with the headstock center.

Tailstock Spindle - The tailstock spindle shall be of alloy steel accurately ground to fit the housing. It shall be provided with a threaded bronze nut to receive the tailstock spindle screw on one end and accurately ground on the inside of the opposite end to receive the shank end of a No. 4 Morse taper. The tailstock center shall be self-holding and a means shall be provided for ejection of the center by use of the tailstock handwheel. The outside surface of the spindle shall be graduated in increments of 1/16 inch for a distance of 5 inches. A handwheel with ball handle shall be provided for the tailstock screw. A lever lock or spindle binder shall be provided for firmly locking the spindle in any position within its range without shifting the spindle.

Spindle Start & Stop Control - Dual control, operable at the headstock and carriage, shall be provided for starting and stopping spindle rotation.

Quick Change Bear Box and End Gearing - All gearing between spindle and leadscrew shall be suitably enclosed. The selection of feeds and thread pitches for the entire range specified in Table I shall be obtained by shifting gears or levers without the use of pick-off gears. The method of attaching the end gearing quadrant or intermediate segment shall be such as to prevent movement, slippage, or change of gear centers during the normal thread cutting operations. Provision shall be made for the addition or removal of end gearing when special threads are required to be cut. The quick change box shall be totally enclosed and incorporate a built-in oil reservoir and oil shot plunger lubrication system to provide adequate lubrication to all gears and moving parts. A suitable oil sight gage to be located on front of box. Gearing in quick change box shall be alloy steel hardened. To prevent possible damage to the feed transmission, including the quick change box, a shear pin shall be used to transmit power from the quick change box to the lead screw.

Data Plates - Metal plates shall be provided on the front of the gear box and headstock in full view of the operator and shall clearly and legibly indicate the setting for different screw threads, feeds and speeds. The dials for the speed selection shall be direct-reading.

Motor Control and Drive - Motor shall be mounted in an accessible and convenient location outside of the cabinet leg approximately 24 inches from the floor and mounted rigidly to an adjustable tilting plate or other means which provides easy adjustment for belt tension. It shall be connected to the primary drive of the spindle by Vee belts in the proper size and number suitable for the horsepower drive arranged on the machine. The drive mechanism shall be fully enclosed.

Machine shall be equipped with multiple disc clutch and brake in headstock. Motor drive to be controlled by forward, reverse and stop electrical controls which energize suitable magnetic starters from push button station.

All circuits 220 volts and over should include transformer for 110 volt coil which provides low voltage at push button station, a necessary safety feature. The electrical equipment shall incorporate the overload protection of the most modern design. All electrical controls for voltages and current in common use are to be housed in a dust and oil tight enclosure having a metal cover incorporating a built-in disconnect switch so as not to expose a live electrical panel.

Electrical Apparatus and Wiring - All electrical apparatus and wiring shall be in accordance with the National Electrical Manufacturers' Association Standards.

Chip Pan - A heavy gage, formed steel chip pan shall be furnished as a part of the lathe. The chip pan shall slide in and out and provide easy removal of chips.

Standard Equipment - The following standard equipment shall be furnished with the machine:

Hydrashift spindle speed selection
Complete electrical equipment including motor and controls
Compound rest with round toolpost
Chasing dial (U. S. threads only)
Cabinet leg (Headstock end)
Chip Pan
Hardclad (Flame Hardened) bedways
Headstock center bush
Two centers
Necessary wrenches
Large face plate (approximate diameter 14-1/2 inches)
Standard face plate (approximate diameter 9 inches)
Ball type cross feed stop
Steady rest, standard capacity, 1/2 inch to 5 inches
Complete set of built-in leveling jacks
Micrometer carriage stop
Graduated tailstock barrel
Tang slot in tailstock spindle

Additional Items Which May Be Supplied On Request:

Motor driven coolant pump with piping

Taper attachment, telescopic type, graduated in degrees and taper per foot. It shall have dovetail slide with gib for adjustment. It shall provide for maximum taper per foot 4 inches, (or angular setting at 18 degrees, 26 minutes, 5 seconds). Turning 16 inches length at one setting.

Quick change gear box conversion to permit chasing metric leads (and providing feeds in millimeters) with English lead screw. (Shall require only two additional gears in end-gearing train to provide a full series of 48 leads using quick change method and direct-reading index plate).

8 inch 3-jaw Universal chuck, semi-steel body, for direct mounting on spindle nose

10 inch 4-jaw Independent chuck, semi-steel body, for direct mounting on spindle nose

Collet chuck, Jacobs type for direct mounting on spindle nose. 1-3/8 inch round capacity

Collets round (for above) Jacobs Rubberflex set of (11 collets) 1/16" to 1-3/8" capacity

Drill chucks

Steady rest, oversize, 4-1/2 inch to 7-1/2 inch capacity

Follow rest, capacity 1/2 inch to 2-1/2 inch

Single automatic length stop (one direction)

Ball bearing centers

Adjustable light, mounted, complete (reel type)

Four-way turret toolpost

Turret on bed

Toolholder set, Big Ten

Compound and plain connected rear rest

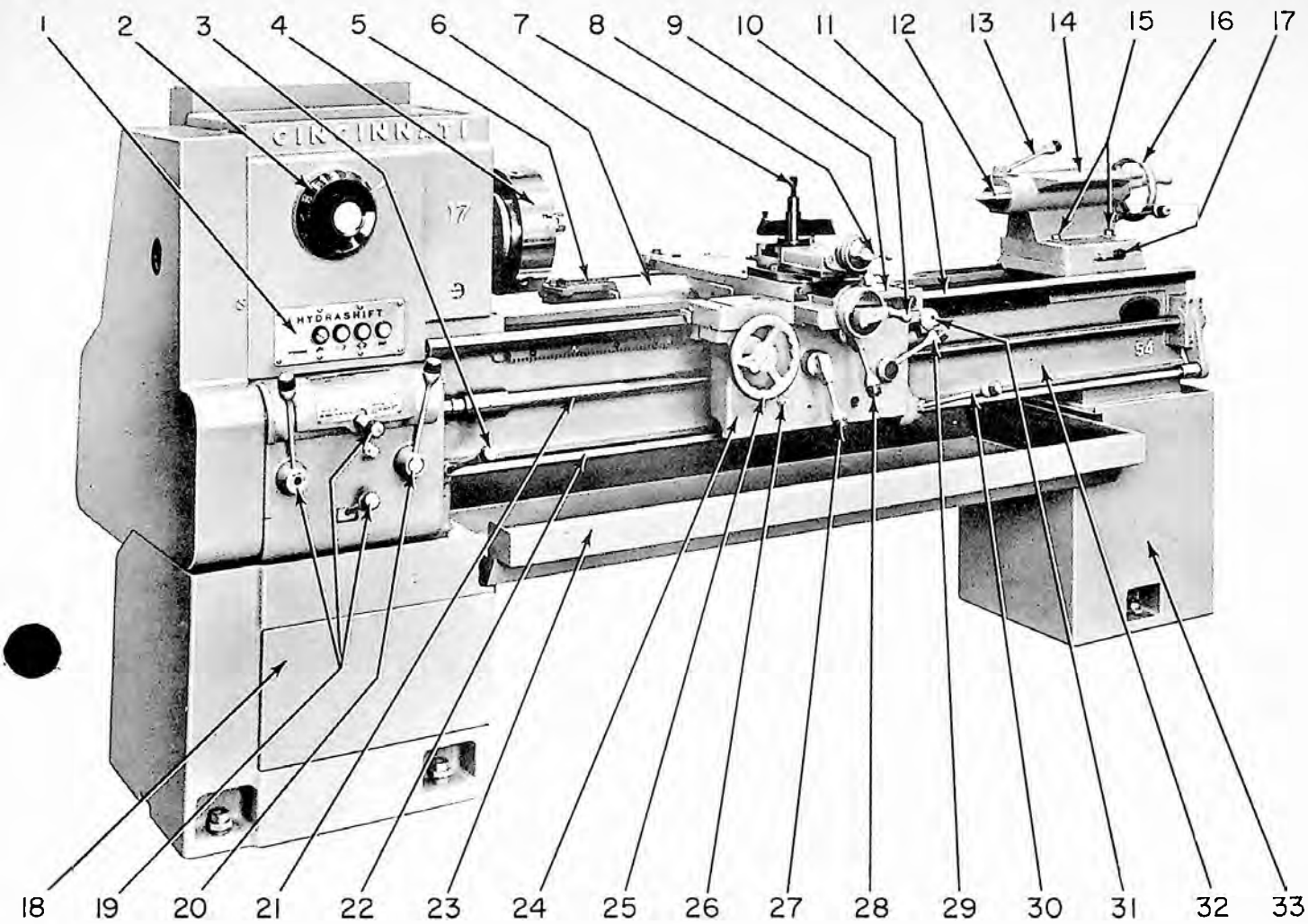

Figure 1.

1. Push Button Panel
2. Spindle Speed Selector Dial
3. Spindle Start-Stop Lever
4. Chuck
5. Taper Attachment
6. Carriage
7. Tool Post
8. Compound Rest Adjusting Crank
9. Carriage Clamp
10. Cross Slide Adjusting Crank
11. Bed Ways
12. Tailstock Spindle
13. Tailstock Spindle Clamp
14. Tailstock
15. Tailstock Clamping Nuts
16. Tailstock Spindle Handwheel
17. Tailstock Set-Over Adjusting Screws
18. Headstock Leg (Storage Compartment)
19. Thread and Feed Selector Levers
20. Leadscrew Reverse Lever
21. Leadscrew
22. Control Rod
23. Chip Pan
24. Apron
25. Carriage Handwheel
26. Carriage Lubrication Hand Pump
27. Longitudinal Power Feed Engaging Lever
28. Cross Slide Power Feed Engaging Lever
29. Half-Nut Engaging Lever
30. Spindle Start-Stop Lever
31. Chasing Dial
32. Bed
33. Tailstock Leg (Coolant Storage Reservoir)

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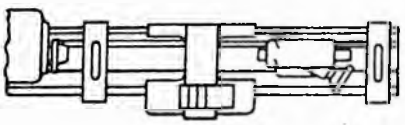
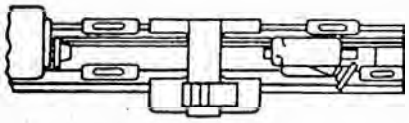
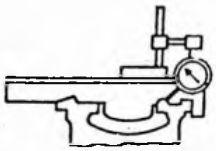
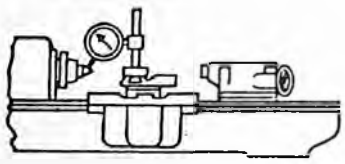
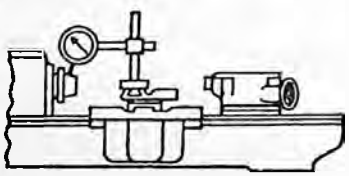
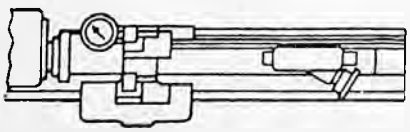
TABLE II — Hydrashift Lathes

STANDARDS OF ACCURACY - TOOLROOM LATHES

TEST	TOLERANCE
1  BED LEVEL — TRANSVERSE DIRECTION	When Using Precision Level All Readings to Be Within 0.0005 in 12 In.
2  BED LEVEL — LONGITUDINAL DIRECTION	When Using Precision Level Along Bed Maximum Reading to Be Within 0.0005 in 12 In.
3  TAILSTOCK WAY ALIGNMENT	Maximum Reading Along Length of Bed 0.0005 in 48 In.
4  SPINDLE CENTER RUNOUT	Total Indicator Reading 0 to 0.0004
5  SPINDLE NOSE RUNOUT	Total Indicator Reading 0 to 0.0003
6  CAM ACTION OF SPINDLE	Total Indicator Reading With Indicator on Rear Side of Test Plate 0 to 0.0003

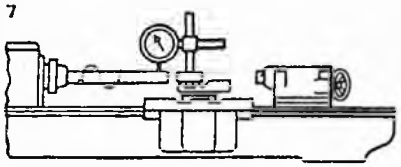
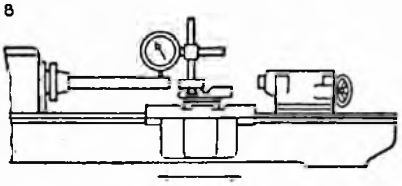
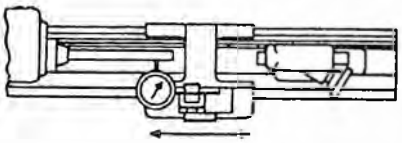
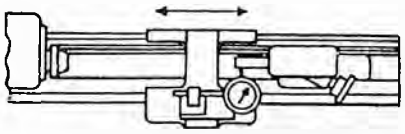
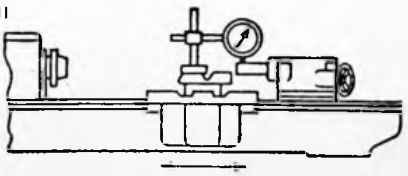
TEST	TOLERANCE
7  SPINDLE TAPER RUNOUT	Total Indicator Reading at End of 12 In. Test Bar 0 to 0.0006 at End of Spindle Nose 0 to 0.0003
8  HEADSTOCK ALIGNMENT — VERTICAL	High at End of 12 In. Test Bar 0 to 0.0005
9  HEADSTOCK ALIGNMENT — HORIZONTAL	At End of 12 In. Test Bar 0 to ±0.0003
10  TAILSTOCK SPINDLE ALIGNMENT — HORIZONTAL	Forward at End of Spindle When Fully Extended 0 to 0.0005
11  TAILSTOCK SPINDLE ALIGNMENT — VERTICAL	High at End of Spindle When Fully Extended 0 to 0.0005

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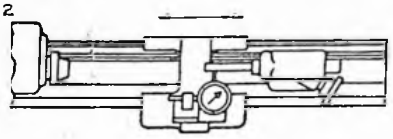
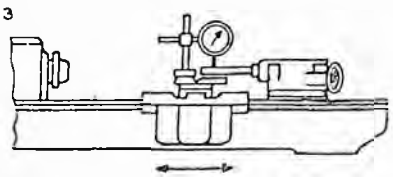
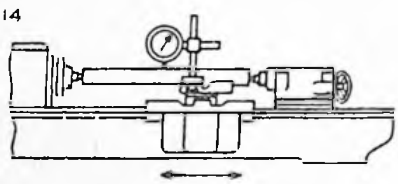
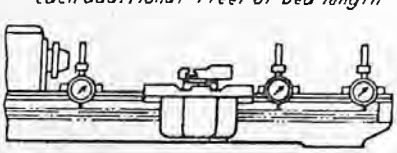
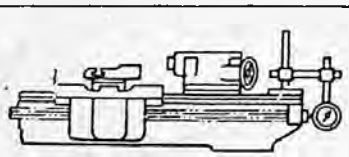
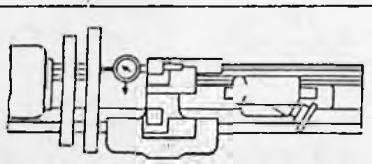
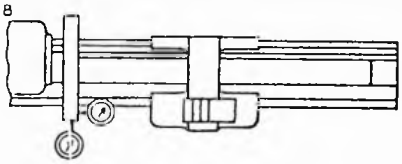
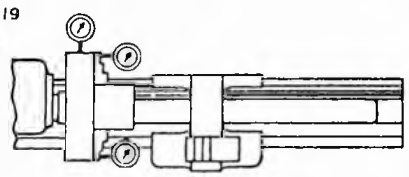
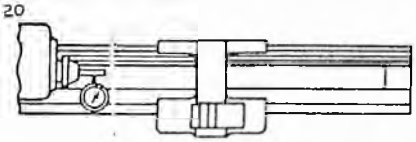
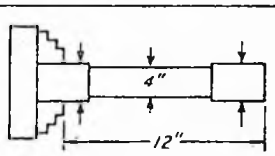
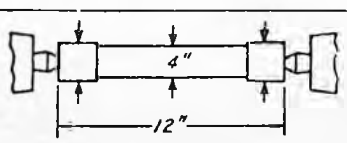
TABLE II

STANDARDS OF ACCURACY - TOOLROOM LATHES

TEST	TOLERANCE
12  TAILSTOCK TAPER ALIGNMENT — HORIZONTAL	End of 12 In. Test Bar 0 to ±0.0005
13  TAILSTOCK TAPER ALIGNMENT — VERTICAL	High at End of 12 In. Test Bar 0 to 0.0005
14  VERTICAL ALIGNMENT OF HEAD AND TAIL CENTERS	High at Tailstock 0 to 0.0008
15 *Readings for base length bed taken with lead screw stationary. Add 0.001 inch for each additional 4 feet of bed length*  LEAD SCREW ALIGNMENT	Parallel With Ways 0 to 0.004 Horizontal 0 to 0.004 Vertical Alignment of Half Nut Horizontal or Vertical 0 to 0.006
16  LEAD SCREW CAM ACTION	Maximum 0.0003
17  CROSS SLIDE ALIGNMENT	To Face Hollow or Concave Only on 12 In. Diameter 0 to 0.0005

TEST	TOLERANCE
18  FACE PLATE RUNOUT	On Diameter 0 to 0.0005 on Face at Nominal Diameter 0 to 0.001
19  CHUCK — RUNOUT	Face and Periphery 0.003 Face of Steps 0.003 Bar Test 3 In. From End of Jaw Bar Diameter Same as Hole 0.003
20  COLLET CHUCK — RUNOUT	1 In. From Collet Chuck 0 to 0.001
21  LATHE MUST TURN ROUND WITH WORK MOUNTED IN CHUCK	0.0003
22  LATHE MUST TURN CYLINDRICAL WITH WORK MOUNTED IN CHUCK	0.0008
23  LATHE MUST TURN CYLINDRICAL WITH WORK MOUNTED BETWEEN CENTERS	0.0004
24 LEAD SCREW — LEAD PER FT. LEAD IN ANY 4"	±0.001 ±0.0004
25 BACK LASH ON CROSS FEEDS SCREW ON COMPOUND REST SCREW	0.004 0.004