Crusader VS Lathe

Operation Manual

Chester UK Ltd
Clwyd Close
Hawarden Industrial Park Hawarden
Chester CH5 3PZ
Tel: 01244 531631
sales@chestermachinetools.com
www.chestermachinetools.com

Contents

1. Safety Rules for Lathes

Safety is a combination of operator common sense and alertness at all times when the lathe is being used. Study these safety rules and general safety rules before operating and retain this manual for future use.

1. Wear eye protection.
2. Never attempt any operation or adjustment if the procedure is not understood.
3. Keep fingers away from rotating parts and cutting tools while in operation.
4. Never force the cutting action.
5. Never perform an abnormal or little used operation without referring to the manual and without the use of adequate blocks, jig stops, fixtures etc.
6. Use of a shop manual such as “machinery’s handbook” or similar is recommended for cutting speeds and operation detail.
7. Do not remove the drive cover while the machine is in operation. Make sure that it is always closed.
8. Always remove the chuck key, even when the machine is not in operation.
9. Do not attempt to adjust or remove tools when in operation.
10. Always keep the cutters sharp.
11. Never use the machine in an explosive atmosphere or where a spark could ignite a fire.
12. Always use identical replacement parts when servicing the machine.

Warning: Do allow familiarity (gained from frequent use of your lathe) to become commonplace. A careless fraction of a second can lead to severe injury.

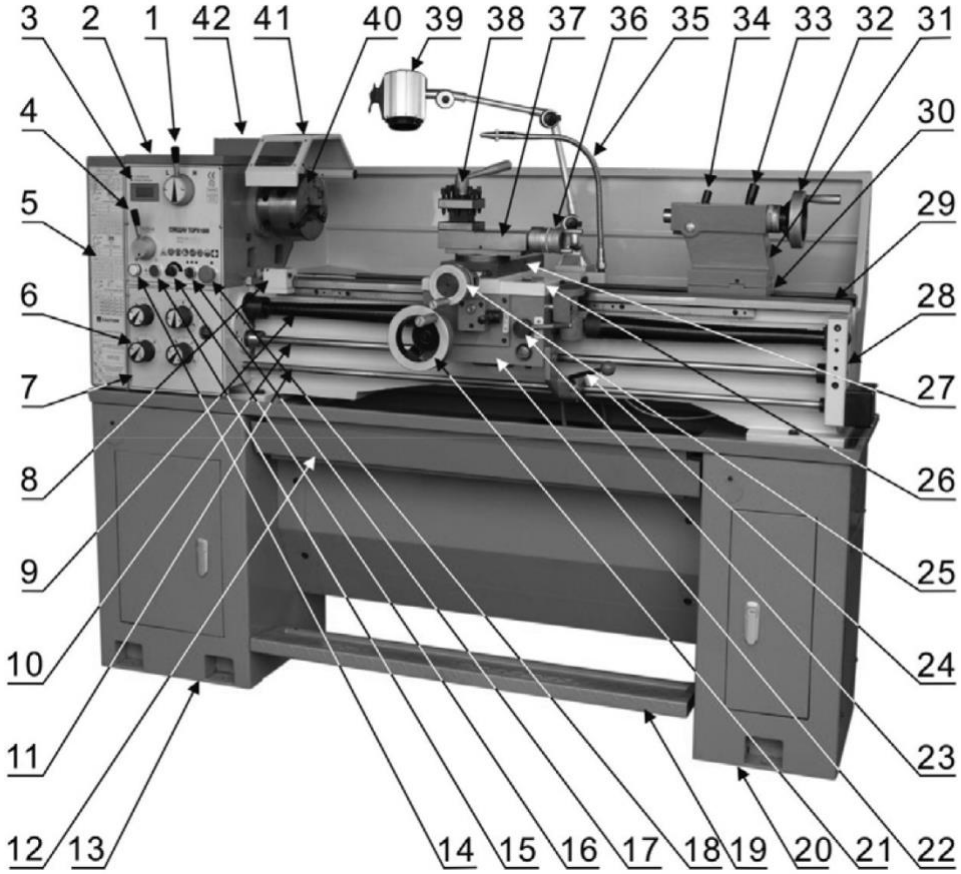
2. Machine Specification

Bench lathes are especially suitable for machining, tool toms and repairing working shops to machine shafts, sleeves and disc workpieces of medium and small sizes. They can also be used to cut metric thread and imperial, with compact construction and reasonable composition, they can cut very well. They are easy and reliable to operate, convenient to repair, high in efficiency and have low noise levels.

Technical Specification

Type	**VS3**	**VS4**
Swing over bed	356mm	356mm
Swing over cross slide	230mm	230mm
Swing over gap	450mm	476mm
Carriage travel	710mm	960mm
Cross slide travel	178mm	
Top slide travel	90mm	
Tailstock quill travel	100mm	
Tailstock taper	MT4	
Bed width	186mm	
Spindle bore	51mm	
Cam lock system	D5	
Spindle speed	70-2000rpm	
Spindle taper	MT6	
Cutting tool (max section)	20 x 20mm	

3. Constructional Indication



No	Name	No	Name
1	Speed selector	22	Apron
2	Headstock	23	Threading cutting engagement lever
3	DRO for spindle speeds	24	Control lever
4	Feed direction selector	25	Cross travel control handwheel
5	Change gear box	26	Saddle
6	Feed box selectors	27	Cross slide
7	Feed gear box	28	Support casting
8	Demarcation frame work	29	Bed way
9	Leadscrew and safety guide	30	Tailstock set-over screw
10	Feed rod	31	Tailstock
11	Control bar	32	Quill travel handwheel
12	Oil Tray	33	Tailstock lock leer
13	Left stand	34	Quill lock lever
14	Indication light	35	Coolant system
15	Inching Button	36	Compound rest handwheel
16	Spindle speeds adjustable knob	37	Compound rest
17	Coolant knob	38	Tool post
18	Emergency stop button	39	Work light
19	Foot brake	40	Spindle and chuck
20	Right stand	41	Safety cover for chucks
21	Longitudinal traverse handwheel	42	Electric box

4. Unpacking and Installation

4.1 Unpacking

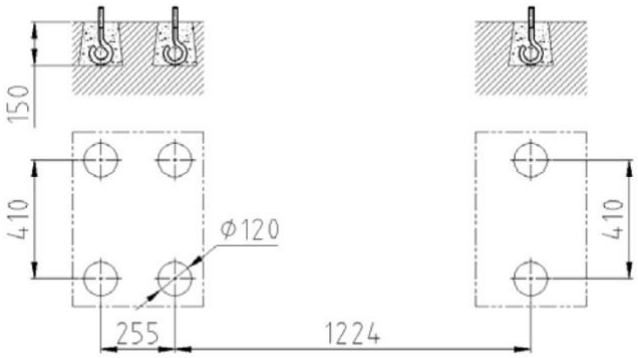
Unload the machine with a tackle, using clamping plates and eyebolts. Keep the machine in balance by moving the tailstock and the bed slide to the right. Avoid using sling chains as they could cause damage to the feed rod and the leadscrew. Lift the lathe carefully and place it softly onto the floor or the workbench.

4.2 Cleaning

Before putting the machine into operation, use kerosene (paraffin) or white spirit to remove the anti-corrosion coating or grease from all the slideways and the gear train. Do not use lacquer thinner or other caustic solvents. Oil all bright machine surfaces immediately after cleaning. Use heavy oil or grease on the change gears.

4.3 Installation

Place the machine on a solid foundation. A concrete floor is the best base for the machine (if necessary, use an under frame operational). Make sure that there is sufficient space around the lathe for easy work and maintenance. Use a precision level on the bed way to make further adjustment for level condition, then tighten the foundation bolts evenly and finally recheck the machines level.



5. Lubrication

Before putting the lathe into operation, make the following lubrication check.

5.1 Headstock

The bearing of the headstock turns in an oil bath. Ensure that the oil level reaches three quarters of the oil gauge glass.

When changing the oil, remove the end cover and the change gears with swing frame. Drain off the oil by removing the drain plug on the bottom of the headstock. To fill, take off the headstock cover. Check the oil level regularly. The first oil change should be made after 3 months, then the oil should be changed annually.

5.2 Gearbox

Remove the end cover to expose the filling plug. Fill the tank with Shell Tellus 32 until the oil level reaches the mark in the oil sight glass. The first oil change should be made after three months then once every year.

5.3 Apron

The oil bath is filled with Shell Tellus 32 through the filling plug on the right side of the apron. Check the oil level in the oil gauge glass on the front of the machine regularly. The fist oil change should be made after three months then once a year. When replacing the oil, drain the oil by removing the oil drain plug from the bottom of the apron.

5.4 Change Gears

Lubricate the change gears with thick machine oil or grease once a month.

5.5 Other parts

There are other lubricating points on the input shaft bracket of the gearbox, the handwheel on the apron, the longitudinal and cross slide, the thread dial indicator, the tailstock and the bracket. Use a grease gun to put a few drops of oil onto the lubricating positions from time to time. Lubricate the apron worm and worm gear, half nut and leadscrew twice a month. Apply a light film of oil to the bed way and all the other bright parts like the tailstock quill, feed rod etc. once a day.

6. Test Running

6.1 Spindle Speed Control

A. Identification before operation

Ensure that lubrication has been carried out as described before.

When the main spindle is rotating, the gearbox and the feed axis of the bed sides are put into operation. The forward/reverse switch (4) should be in the neutral position. The feed axis selector (6) and feed/thread selector handle (6) are in the disengaged position. Under these circumstances, both the longitudinal travel handwheel (21) and the cross travel handle (25) can be operated by hand.

B. Main spindle rotation

The main spindle rotation is selected by the forward/reverse switch.

C. Main spindle speed

The speed of the main spindle is selected by the high/low speed selector (1). For both the high and low speeds, there are two different positions. For the correct speed, refer to the speed chart. Never change the speed before the motor has stopped completely! Adjustment of the speed can be assisted by turning the main spindle by hand.

D. Running In

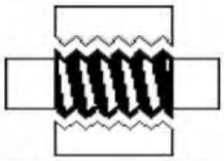
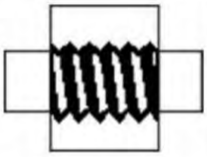
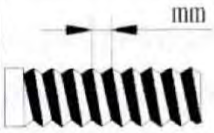
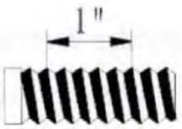
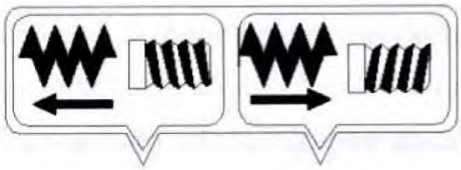
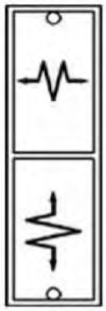
Running in should be done at the lowest possible speed. Let the machine run at the lowest speed for approximately 20 minutes, then check for any irregularities. If everything seems in order, gradually increase the speed.

E. Operation

Only use high peripheral speed type chucks.

The maximum spindle speed for chuck plates with a 250mm should not be more than 1255rpm. When thread cutting or auto feeding are not in use, the feed/thread selector should be in the neutral position so to ensure the disengagement of the leadscrew and the feed rod. To avoid any unnecessary wear, the thread dial indicator should be out of mesh with the leadscrew.

6.2 Operation Symbols

 Red Green	Power Green: on Red: off	 Red Green	Coolant Green: on Red: off
	Half nut opened		Half nut closed
	Metric thread		Imperial thread
		Right-hand thread and longitudinal feed toward the headstock side (left figure)	
		Left-hand thread and longitudinal feed toward the headstock side (right figure)	
	Longitudinal feed engaged (upward). Both Longitudinal feed disengaged (central). Cross feed engaged (downward)		Oil inlet (hole)
			Don't change speed while is running
	Electrical control (Danger)		JOG
	Pilot Lamp		STOP

7. Thread and Feed Selection

7.1 Thread and Feed Selection

All threads and feeds are indicated on the tables fitted on the front of the change gearbox. They are selected with the feed selector handles (6) on the feed gearbox.

A. Manual Operation

The carriage is moved by the handwheel (21), the cross slide handwheel (25) and the compound rest handwheel (36). The slide can be anchored by turning the lock bolts on the top and side of the slide.

B. Feed and Thread Tables

Longitudinal and cross feed table. Metric and imperial thread table.

C. Automatic Feed operation

Engage the 40T change gear at the transmission shaft and the 127T intermediate gear with the feed direction selector (6) then set the feed/thread selector (6) to the left hand position and position one lever at any of the 1-5 hole, the other at the A-E holes. The feed rod will rotate. If the selector is pushed upwards, a longitudinal feed can be obtained. If the selector is pushed down, across feed will be obtained.

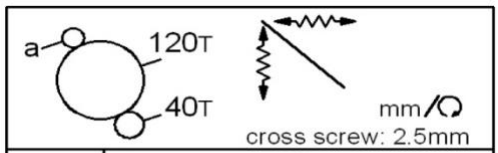
D. Thread Cutting Operation

The direction of thread cutting is controlled by the feed director (6). By operating the feed selector handle and the feed/thread selector handle according to the thread pitch, the leadscrew will rotate. Operate the handle (23) down to engage with the leadscrew to achieve the longitudinal travel of the thread cutting feed.

7.2 Feed and Thread Tables

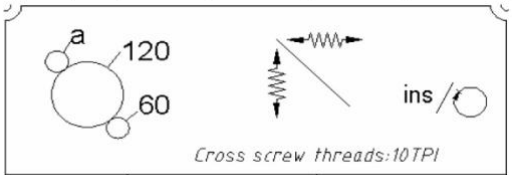
A. Feed Table

Longitudinal and cross feed table for a metric lathe.



a		30T			
LEVER		0T	0S	0R	0U
A	D	1.044 / 0.298	0.975 / 0.278	0.783 / 0.224	0.627 / 0.179
B	D	0.522 / 0.149	0.487 / 0.139	0.392 / 0.112	0.313 / 0.089
A	C	0.261 / 0.075	0.244 / 0.070	0.196 / 0.056	0.157 / 0.045
B	C	0.131 / 0.037	0.122 / 0.035	0.098 / 0.028	0.078 / 0.022

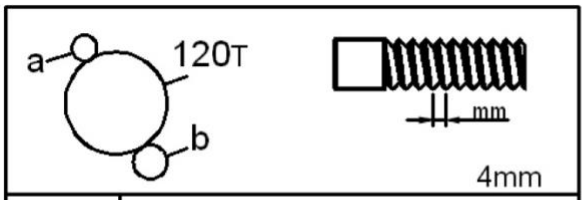
Longitudinal and cross feed for an imperial leadscrew.



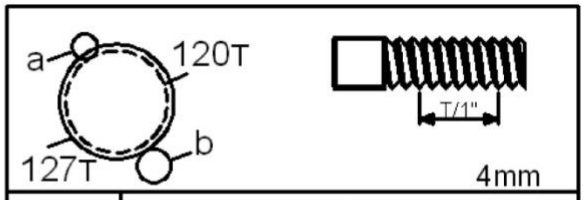
a		60T				30T			
LEVER		T	S	R	U	T	S	R	U
A	D	0.0159 / 0.0098	0.0148 / 0.0092	0.0119 / 0.0074	0.0095 / 0.0059	0.0080 / 0.0049	0.0074 / 0.0046	0.0060 / 0.0037	0.0048 / 0.0030
B	D	0.0080 / 0.0049	0.0074 / 0.0046	0.0060 / 0.0037	0.0048 / 0.0030	0.0040 / 0.0025	0.0037 / 0.0023	0.0030 / 0.0019	0.0024 / 0.0015
A	C	0.0040 / 0.0025	0.0037 / 0.0023	0.0030 / 0.0019	0.0024 / 0.0015	0.0020 / 0.0012	0.0019 / 0.0012	0.0015 / 0.0009	0.0012 / 0.0007
B	C	0.0020 / 0.0012	0.0019 / 0.0012	0.0015 / 0.0009	0.0012 / 0.0007	0.0010 / 0.0006	0.0009 / 0.0006	0.0007 / 0.0004	0.0006 / 0.0003

B. Thread Tables

Thread table for a metric leadscrew

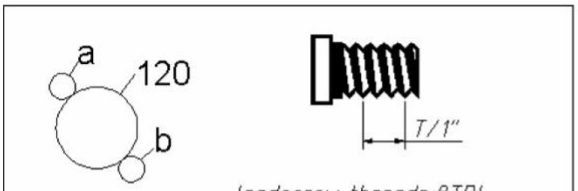


a		30T							
b		40T							
LEVER		4	1	4	2	3	1	3	3
		T	T	R	S	S	U	R	U
A	D	10	8.0	7.5	6.0	5.6	4.8	4.5	3.6
B	D	5.0	4.0	3.75	3.0	2.8	2.4	2.25	1.8
A	C	2.5	2.0	1.875	1.5	1.4	1.2	1.125	0.9
B	C	1.25	1.0	0.9735	0.75	0.7	0.6	0.5625	0.45

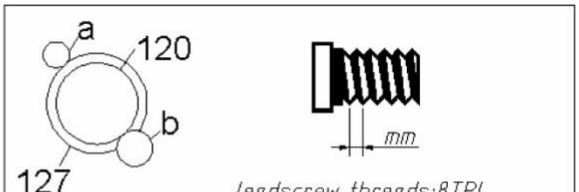


a		40T				
b		40T				
LEVER		1	2	1	3	3
		T	S	U	R	U
A	D	2¼	3	3¾	4	5
B	D	4½	6	7½	8	10
A	C	9	12	15	16	20
B	C	18	24	30	32	40

Thread table for an imperial leadscrew



a		60	60	60	60	40	40	30	40	60
b		60	54	57	60	44	46	60	52	63
LEVER		R	U	U	U	U	U	T	U	U
		1	1	1	1	1	1	1	1	3
A	D	4	4½		5	5½		6	6½	7
B	D	8	9	9½	10	11	11½	12	13	14
A	C	16	18	19	20	22	23	24	26	28
B	C	32	36	38	40	44	46	48	52	56



a		56	60	60	30	60	60	30	60	42
b		60	60	60	60	60	60	60	60	63
LEVER		R	U	S	T	U	R	T	U	U
		4	4	3	4	1	3	1	3	1
A	D	7.0	6.0		5.0		4.5	4.0		
B	D	3.5	3.0		2.5		2.25	2.0	1.8	1.6
A	C	1.75	1.5	1.4	1.25	1.2		1.0	0.9	0.8
B	C		0.75	0.7		0.6		0.5	0.45	0.4

7.3 Thread Cutting Operation

In order to obtain the desired thread, all the correct change gears must be installed in strict accordance with the chart. Failure to do so will give incorrect threads.

Rotate the leadscrew by operating the feed/selector to any position and be sure the feed selector handle is engaged. Operate the thread cutting engagement lever downwards to engage with the leadscrew to obtain the longitudinal travel of the carriage, i.e. the thread cutting feed. Make sure that the feed axis selector is disengaged (at the neutral position) before operating the thread cutting engagement lever as there is an interlock mechanism between the auto feeding and thread cutting engagement. The direction of the thread can be chosen by turning the feed directing

selector at the headstock. There are 31 thread pitches in imperial and 26 metric pitches which can be obtained by turning the feed selector handles.

A. Thread Dial Indicator

The thread dial indicator is installed on the right hand side of the apron. The indicator is used for thread cutting to engage with the leadscrew.

To reduce the amount of wear on the thread dial indicator, the unit should be disengaged by the swinging the pinion out of mesh with the lead screw when not in use.

For these threads it is recommended that the thread dial indicator be used as this allows the half nut of the leadscrew to be engaged at the end of the end of each thread cutting pass, provided that they are re-engaged in accordance with the indicator table mounted in front and down of the change gear box.

In column 1: millimeter pitches to be cut.

27T, 28T, 30T: The number of teeth in “pitch-off gear” arranged to mesh with the leadscrew (this being selected from the stack, stored on the bottom of the dial spindle).

Dial graduation:

The dial numbers at which the half nut may be engaged under numbers of teeth of pick-off gear.

Metric leadscrew machines (Metric thread only), the table shows:

INDICATOR TABLE

27 T	mm	0.45	0.6	1.5	3.0	4.5	6.0
	scale	1 / 5 / 9					
28 T	mm	0.7		3.5		8.0	
	scale	1 / 4 / 7 / 10				1 / 7	
30 T	mm	1.25		2.5		5.0	10
	scale	1 / 3 / 5 / 7 / 9 / 11					
0 T	mm	1.0		2.0		4.0	
	scale						

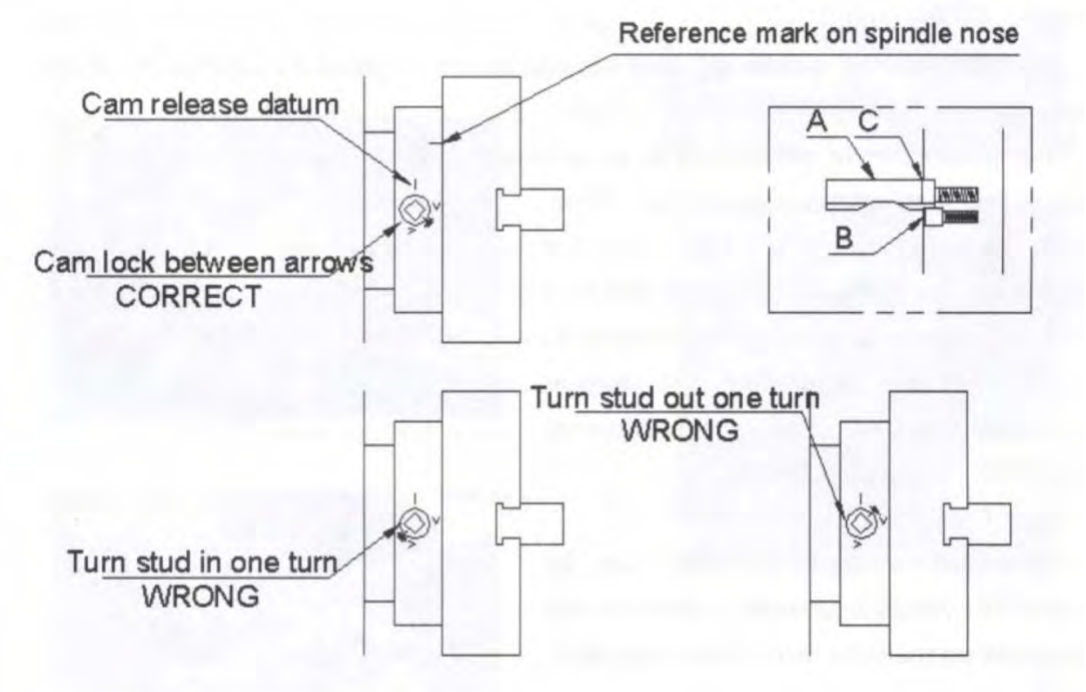
Imperial leadscrew machines (imperial thread only), the table shows:

INDICATOR TABLE

T.P.I	4	4½		5	5½	6	6½	7	8	9	9½	10
SCALE	1-4	1		1	1	1.3	1	1	1-8	1	1	1.3
T.P.I	11	11½	12	13	14	16	18	19	20	22	23	24
SCALE	1	1	1-4	1	1.3	1-8	1.3	1	1-4	1.3	1	1-8
T.P.I	26	28	32	36	38	40	44	46	48	52	56	
SCALE	1.3	1-4	1.3	1-4	1	1-4	1-4	1.3	1-8	1-4	1-8	

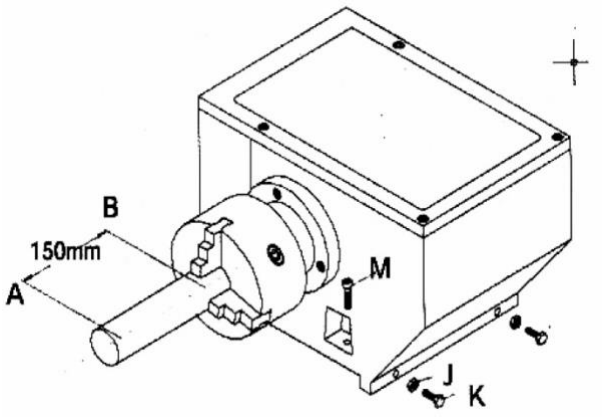
8. Chuck and Faceplate Removal/Installation

When fitting chucks or faceplates, ensure that the spindle and the chuck taper are correct when mounting a new chuck to re-set the cam lock studs (A). Remove the cap head locking screws (B) and set each stud so that the scribed ring (C) is flush with the rear face of the chuck with the slot lining up with the locking screw hole.
Mount the chuck or the faceplate on the spindle nose and tighten the six cams in turn. When fully tightened, the cam lock line on each cam should be between the two V marks of the spindle nose.
If any of the cams do not fully tighten with in these limit marks, remove the chuck or faceplate and re-adjust the stud as indicated in the illustration. Fit and tighten the locking screw (B) at each stud before remounting the chuck for work. A reference mark should be made on each correctly fitted chuck or faceplate to coincide with the reference mark scribed into the spindle nose. This will assist subsequent remounting. Do not interchange chucks or faceplates between lathes without checking for the correct cam locking.



9. Maintenance and Servicing

9.1 Lathe Alignment

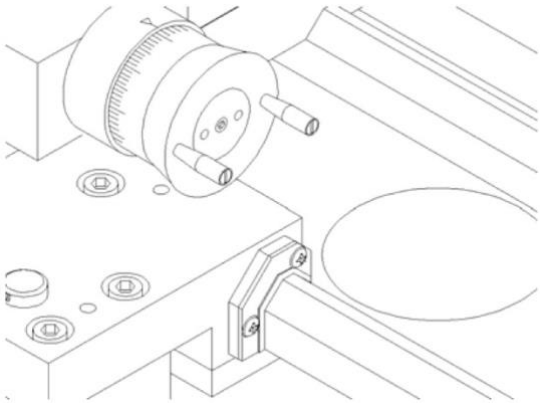


When the lathe is installed and ready for use, it is recommended to check the machines alignment before commencing work. Alignment and levelling should be checked regularly to insure continued accuracy.

Adopt the following procedure:

Take a steel bar with a diameter of approx. 50mm and a length of approx. 200mm. Spin it in the chuck without using the centre and take a cut over a length of 150mm and measure the difference between A and B. To correct any possible difference, loosen the screw (K) clamping the headstock on the bed and adjust the headstock. Repeat this procedure until all the measurements are the same.

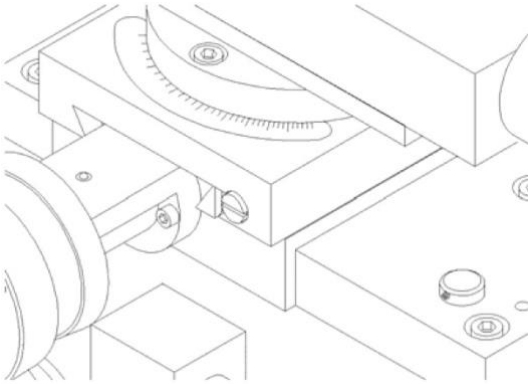
9.2 Saddle Strip



Wear on the rear saddle gib strip may be accommodated by the adjustment of the socket head set screws.

First remove the rear splash guard and release the hexagon nuts, turn the socket head set screws slightly in clockwise and then re-clamp the hexagon nuts. Care should be taken not to over adjust the Gib strip. A 45° turn at the socket head set screw approx. 0.125 (0.005”) take up in the gib.

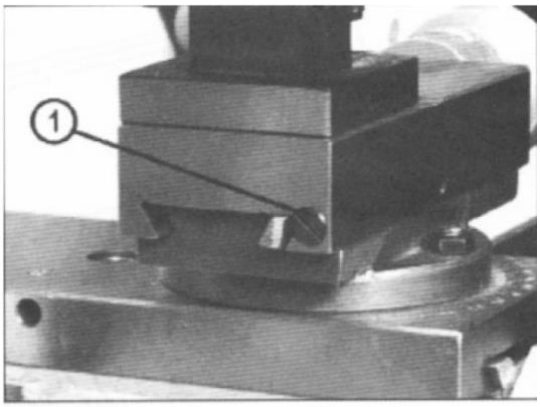
9.3 Cross Slide



Wear the taper gib strip may be adjusted by a clockwise rotation of the slotted head screw on the front face of the cross slide. The procedure is to slacken the similar screw at the rear then retighten this after adjustment to clamp the gib into its new position.

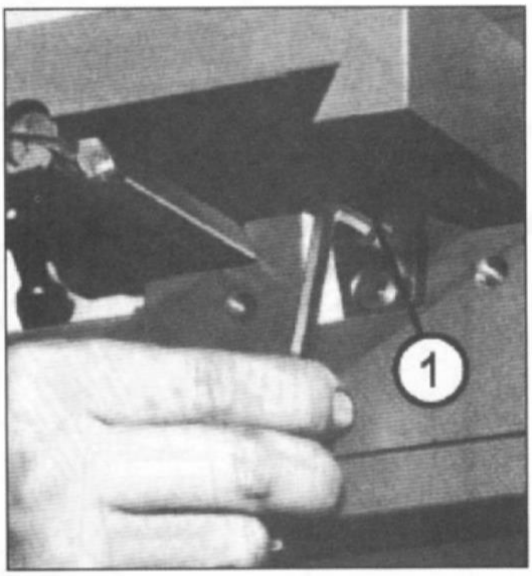
9.4 Compound Rest

It is the same procedure as the cross slide. To take up for the wear on the compound rest taper gib strip can adjust the slotted head screw on the tool post side of the compound rest by a clockwise direction. The procedure is to slacken the similar screw at the rear then retighten this after adjustment to clamp the gib into its new position.



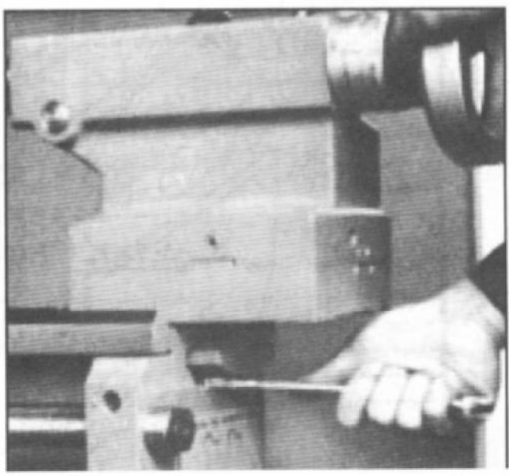
9.5 Cross Slide Nut

A provision is made for the elimination of backlash in the cross slide nut, the procedure for adjustment being as follows: take off the dust plate which is mounted on the rear face of the saddle groove, turn the cross feed nut until it reaches the edge of the feed rod. Turn the socket head cap screw in a clockwise direction as required. Care should be taken to avoid over adjustment, a 45° turn at the socket head cap screw represents approximately 0.125 (0.005”) take up of backlash.

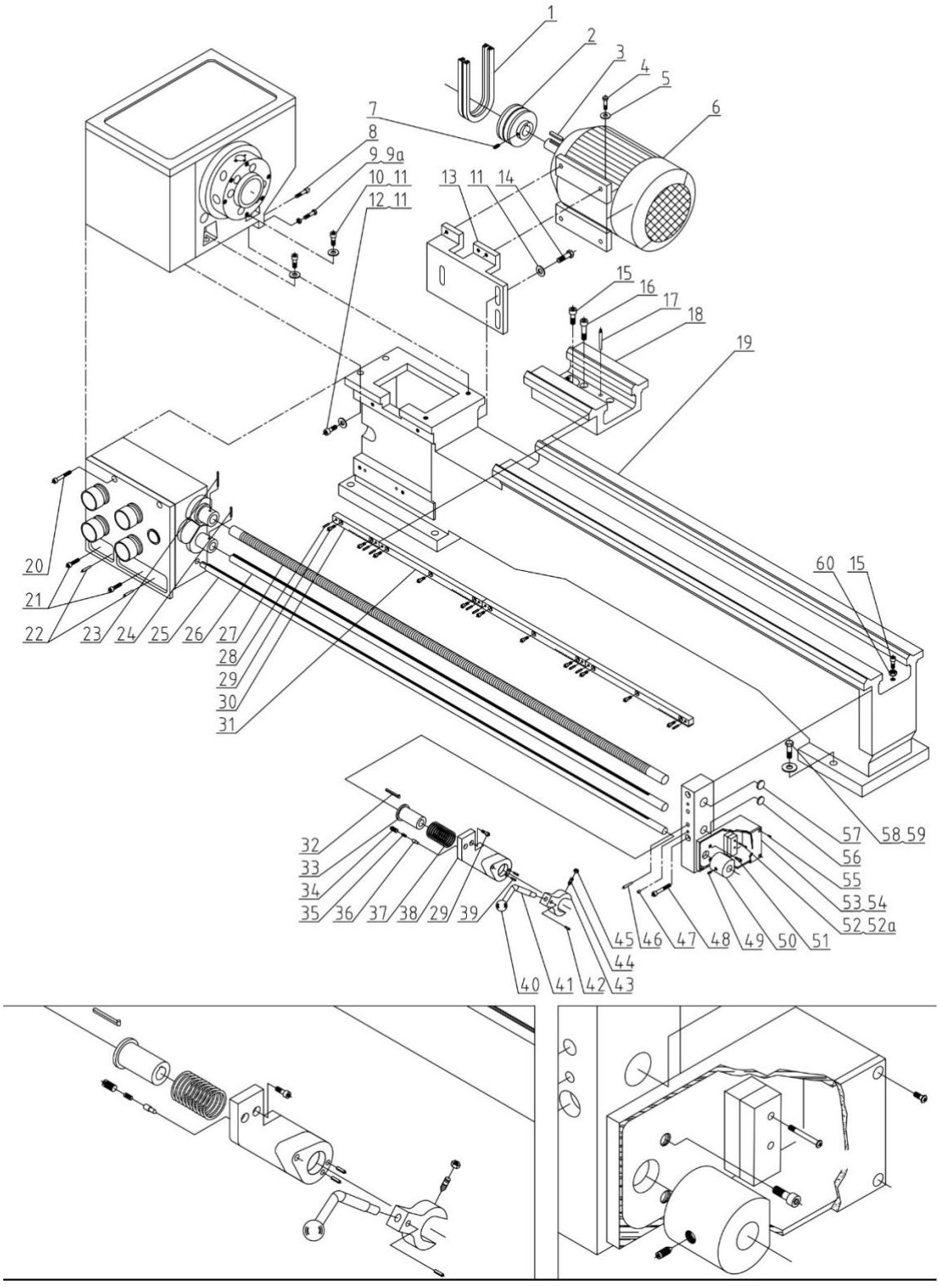


9.6 Tailstock Bed Clamp

The angular lock position of the bed clamp lever is adjusted by means of the self-locking hexagon bolt located on the underside of the tailstock and between the bed ways.



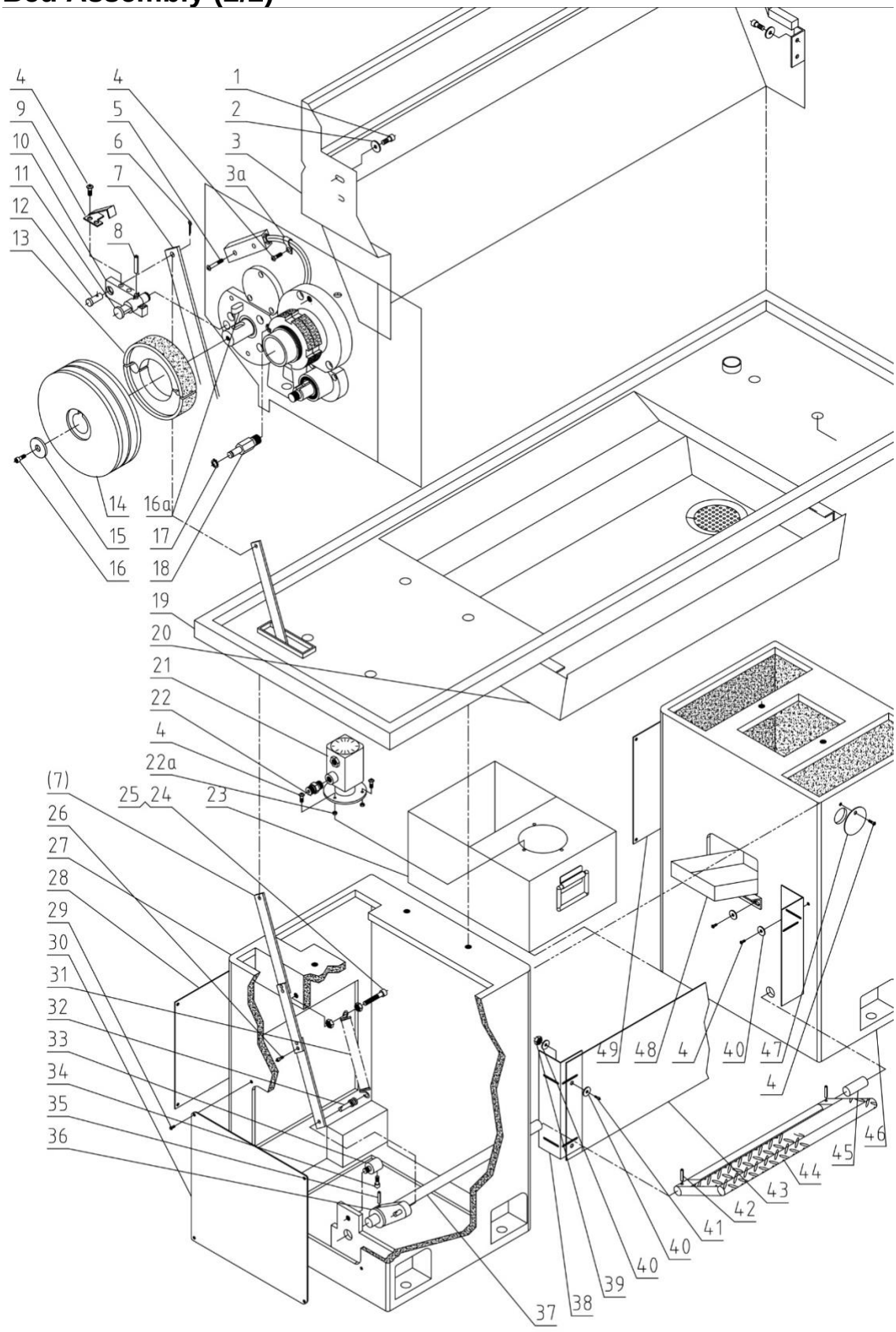
10. Parts List and Diagrams
Bed Assembly (1/2)



No.	Part No.	Name	Specification
1		V-Belt	A838/A850/A864
2	D330A-11106	Pulley	
3	GB1096	Key	8x35
4	GB5781	Hexagonal Head Tap Bolt	M8x25
5	GB97.1	Washer	8x55
6		Motor	415V 50Hz 1.5kW
7	GB78	Screw	M6x8
8	GB70	Socket Head Screw	M8x30
9	GB5781	Hexagonal Head Tap Bolt	M8x40
9a	GB6170	Nut	M8
10	GB70	Socket Head Screw	M12x35
11	GB97.1	Washer	12
12	GB5781	Hexagonal Head Tap Bolt	M12x40
13	D330B-11107G	Bracket	
14	GB5781	Hexagonal Head Tap Bolt	M10x30
15	GB70	Socket Head Screw	M10x35
16	GB70	Socket Head Screw	M12x40
17	GB881	Assembling Pin	8x70
18	D330-11103G	Bridge	
19	D330B-11101G	Bed	
20	GB70	Socket Head Screw	M8x50
21	GB70	Socket Head Screw	M8x30
22	GB118	Taper Pin	6x30
23	GB879	Spring Pin	4x42
24	GB879	Spring Pin	4x32
25	D330B-11203G	Control Rod	
26	D330B-11202G	Feed Rod	
27	D330B-11201G	Leadscrew	Tr22x4-7h
	D330B-11201G-1		Tr22x3.175-7h
28	GB879	Spring Pin	5x20
29	GB70	Socket Head Screw	M6x16
30	D330B-11205G	Short Rack	
31	D330B-11204G	Long Rack	
32	GB1096	Oriented Key	4x50
33	D330B-11217G	Collar	
34	GB77	Screw	M8x8
35		Spring	6x1x15
36	D330B-11105G-1	Assembling Pin	
37		Spring	32x3.6x50
38	D330B-11105G	Bracket	
39	GB879	Spring Pin	5x20
40		Knob	BM10x32
41	D330B-11206G	Lever	
42	GB879	Spring Pin	4x20
43	D330B-11104G	Bracket	

44	GB78	Screw	M6x16
45	GB6170	Nut	M6
46	GB118	Taper Pin	6x45
47	GB7940.4	Oil Cup	6
48	GB70	Socket Head Screw	M8x60
49	GB78	Screw	M8x12
50	D330C-3012C	Plectrum	
51	GB70	Socket Head Screw	M8x16
52	GB818	Screw	M4x42
53a		Switch	
53	D330C-11301C	Box	
54	D330C-11302C	Cover	
55	GB818	Screw	M4x10
56	D330B-11210G-1	Cover	19
57	D330B-11210G-2	Cover	22
58	GB5781	Hexagonal Head Tap Bolt	M12x45
59	GB97.1	Washer	12
60	GB70	Socket Head Screw	M10x35
61	GB6170	Nut	M10

Bed Assembly (2/2)



No.	Part No.	Name	Specification
1	GB70	Socket Head Screw	M6x12
2	GB97.1	Tailor-Made Washer	6
3	D330B-14205	Splash Guard	
4	GB818	Screw	M5x8
6	GB91	Pin	3x16
14	D330A-21105	Pulley	
15	GB97.1	Washer	8
16	GB70	Socket Head Screw	M8x16
16a	GB1096	Key	8x20
19	D330B-14203	Oil Tray	
20	D330B-14204	Oil Tray	
23	D330B-14401	Water Tank	
24	GB70	Socket Head Screw	M10x30
25	GB6170	Hexagon Nut	M10
27	D330B-14201	Left Stand	
28	D330DV-14102	Cover	
29	GB818	Screw	M5x12
30	D330B-14209	Cover	
31	D330A-11237	Drawspring	
32	D330A-11236	Pin	
33	D330A-11242	Shaft	
34	GB70	Socket Head Screw	M6x40
35	GB879	Spring Pin	5x40
36	D330A-11235	Rocker	
37	D330A-11238	Long Shaft	
38	D330B-14206	Angle Iron	
39	GB6170	Hexagon Nut	M6
40	GB97.1	Tailor-Made Washer	6
41	GB70	Socket Head Screw	M6x12
42	GB879	Spring Pin	5x28
43	D330B-14207	Baffle Board	
44	D330B-14212	Brake Pedal	
45	D330A-11241	Short Shaft	
46	D330B-14202	Right Stand	
47	D330B-14208	Cover	
48	D330B-14213	Funnel	
50	D330DV-11211	Washer	
51	D330DV-11210	Cam	
52	GB78	Screw	M6x15
53		Switch	LXW5-11N1
54	GB818	Screw	M4x45
55		Cover	

Headstock Assembly (1/3)