

HIGH SPEED PRECISION LATHE

MODEL: -1640 (12 STEPS)
 -1660 (12 STEPS)

INSTRUCTION AND SPARE PARTS MANUAL

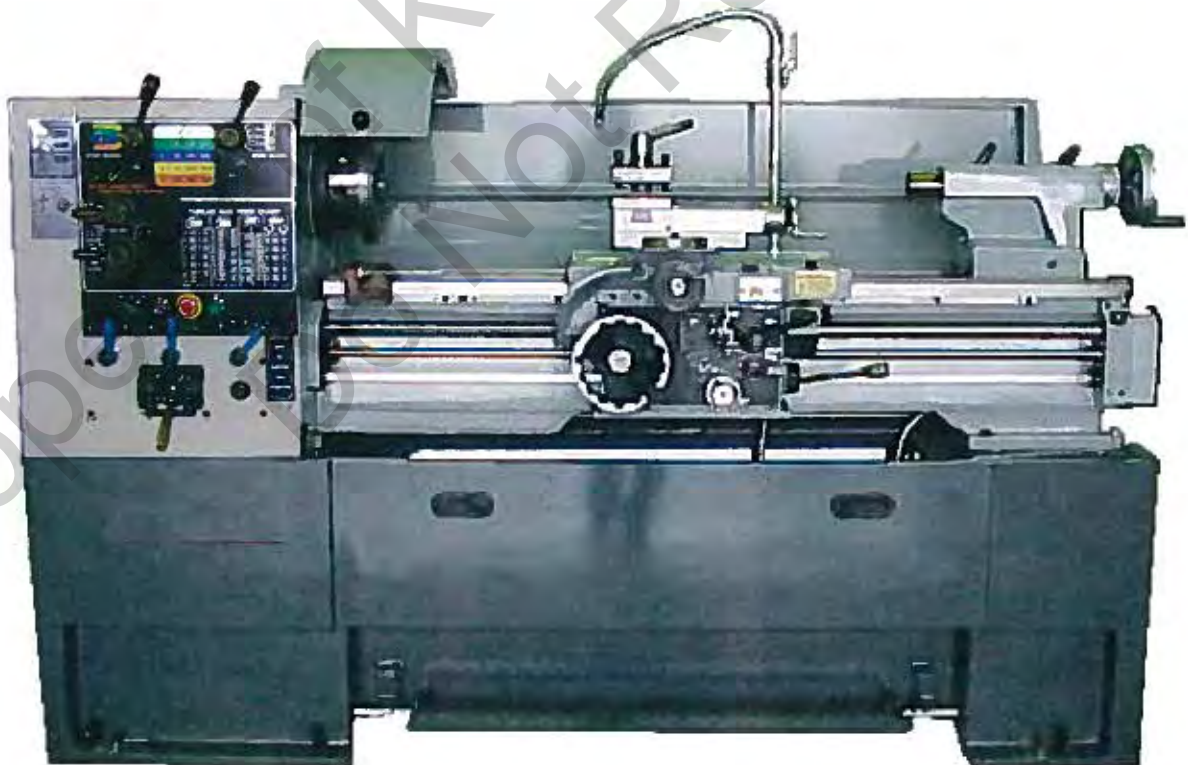


Photo shown model : -1640

SAFETY PRECAUTIONS

1) General Safety Precautions

When operation the machine, think about what you are going to do before you do it. Go over a safety checklist.

1. Do I know how to operate this machine ?
2. What are the potential hazards involved ?
3. Are all guards in place ?
4. Are my procedures safe ?
5. Am I doing something that I probably should not do ?
6. Have I made all the proper adjustments and tightened all locking bolts and clamps ?
7. Is the workpiece secured properly ?
8. Do I have proper safety equipment ?
9. Do I know where the stop switch is ?
10. Do I think about safety in everything I do ?

Clothing, Hair and Jewelry

Wear a short sleeve shirt or roll up long sleeves above the elbow. Keep your shirt tucked in and remove your necktie. It is recommended that you wear a shop apron. A shop coat may be worn as long as you roll up long sleeves. Do not wear fuzzy sweaters.

If you have long hair, keep it secured properly to avoid your hair being entangled in a moving machine.

Remove your wristwatch and rings before operating the machine. These can cause serious injury if they should be caught in a moving part.

Hand Protection

Use a brush to remove chips. Do not use your hands. Resist the temptation to grab chips as they come from a cut. Chips should not be removed with a rag. The metal particles become imbedded in the cloth and they may cut you.

Gloves must not be worn.

If a glove should be caught in a moving part, it will be pulled in along with the hand inside it.

Various cutting oils, coolants, and solvents may affect your skin. The result may be a rash or possible infection. Avoid direct contact with these products as much as possible and wash your hand as soon as possible after contact.

You may be tempted to blow chips from the machine by using compressed air. This is not good practice. The air will propel metal particles at high velocity. They can injure you or someone on the other side of the machine. Do not blow compressed air on your clothing or skin. The air can be dirty and the force can implant dirt and germs into your skin.

Electrical

If you are adjusting the machine or accomplishing maintenance, you should unplug it from the electrical service. If it is permanently wired, the circuit breaker may be switched off and tagged with an appropriate warning.

2) Turning Machine Safety

The machine can be a safe machine only if the machinist is aware of the hazards involved in its operation. Develop safe work habits in the use of setups, chip breakers, guards and other protective devices. Standards for safety have been established as guidelines to help you eliminate unsafe practice. Some of the hazards are as follows:

1. Pinch points due to movement: Keep your hands away from dangerous positions, such as gears, chuck or rotating cutters.
2. Hazards associated with falling components: Heavy chucks workpieces vises, etc. can be dangerous when accidentally dropped. Care must be used when handling them. A chuck wrench left in the chuck can become a missile when the machine is turned on. Always remove the chuck wrench immediately after using it.
3. Hazards resulting from contact with high temperature components: Burns usually result from handling hot chips or a hot workpiece. Gloves may be worn when handling hot workpiece, but never worn when the machine is running.
4. Hazards resulting from contact with sharp edges, corners, and projections: Shields should be used for protection from flying chips and coolant. These shields are usually made of clear plastic. Stringy chips must not be removed with bare hands, wear heavy gloves and use hook tools or pliers but always turn-off the machine before attempting to remove chips. Chips should be broken rather in a stringy mass or long wire. Chip breakers on tools and correct feeds will help to produce safe, easily handled chips. Burred edges must be removed before the workpiece is removed from the machine. Always remove the tool bit when setting up or removing workpieces to avoid cutting yourself.
5. Hazards of workholding devices: When workpieces are clamped, their components often extend beyond the outside diameter of the holding device. Guards, barriers, and warnings such as signs or verbal instructions are all used to make you aware of the hazards. Never run a geared scroll chuck without having something being gripped in the jaws. Centrifugal force on the jaws can cause the scroll to unwind and the jaws to come out of the chuck. Keep tool, files and micrometers off the machine. They may vibrate off into the revolving chuck or workpiece, or cutter.
6. Spindle breaking: The spindle or workpiece should never be slowed or stopped by hand gripping or any other means. Always use the machine controls to stop or slow it.

7. Workpieces extending out of the lathe should be supported by a stock tube:
If a slender workpiece is allowed to extend beyond the headstock spindle a foot or so without support, it can fly outward from centrifugal force. The piece will not only be bent, but it will present a very great danger to anyone standing near.
8. Other safety considerations: Hold one end of abrasive cloth strips in each hand when polishing rotating work. Don't let either hand get closer than a few inches from the work. Keep rags, brushes, and fingers away from rotation work, especially when knurling. Roughing cuts tend to quickly drag in and wrap up rags, clothing, neckties, emery clothes and hair. Move the carriage back out of the way and cover the tool with a cloth when checking boring work. When removing or installing chucks or heavy workpieces, use a board on the ways. To lift a heavy chuck or workpiece (larger than an 8-inch diameter chuck) get help or use a crane. Remove the tool or turn it out of the way during this operation. Do not shift gears or try to take measurements while the lathe is running and the workpiece is in motion. Never use a file without a handle as the file tang can quickly cut your hand or wrist if the file is struck by a spinning chuck jaw or lathe dog. Left-hand filing is considered safest in the lathe, that is, the left hand grips the handle while the right hand holds the tip end of the file.

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CHAPTER 1 ◦ MACHINE SPECIFICATIONS

MODEL			TML-1640	TML-1660														
Capacity	Height of centers		205mm (8.07")															
	Swing over bed		ø410mm (16.14")															
	Swing in gap		ø583mm (22.95")															
	Swing over cross slide		ø264mm (10.39")															
	Distance between centers		1000mm (40")	1500mm (60")														
	Width of bed		260mm (10.236")															
	Gap width in front of faceplate		135mm (5.31")	225mm (8.85")														
Headstock & Main spindle	Spindle nose , Internal taper		D1-6 , MT. No.6															
	Spindle center sleeve		MT. No.6 x MT. No.4															
	Spindle bore		ø52.5mm (2.066")															
	Gear steps Spindle speed : / Range	12 steps / 36 ~ 1800 R.P.M.	<table> <tr> <td>L</td><td>36</td><td>50</td><td>70</td><td>105</td></tr> <tr> <td>M</td><td>130</td><td>180</td><td>250</td><td>380</td></tr> <tr> <td>H</td><td>620</td><td>900</td><td>1200</td><td>1800</td></tr> </table>		L	36	50	70	105	M	130	180	250	380	H	620	900	1200
L	36	50	70	105														
M	130	180	250	380														
H	620	900	1200	1800														
Carriage	Length on bed / Width of carriage		513mm (20.19") / 412mm (16.22")															
	Cross slide travel		220mm (8.6")															
	Top slide travel		140mm (5.5")															
Threads & Feeds	Whitworth threads : Kinds/Range		45 Kinds / 2 ~ 72 T.P.I.															
	Metric threads :		39 Kinds / 0.2 ~ 14 mm															
	Diametral pitch (D.P.) worm gear		21 Kinds / 8 ~ 44 D.P.															
	Module pitch (M.P.) worm gear		18 Kinds / 0.3 ~ 3.5 M.P.															
	Longitudinal feeds		0.05 ~ 1.7 mm (0.002" ~ 0.067")															
	Cross feeds		0.025 ~ 0.85mm (0.001" ~ 0.034")															
Tailstock	Quill diameter		ø52mm (2.047")															
	Quill travel		152mm (6")															
	Taper of center		MT. No.4															
Motor	Main spindle		5 HP															
	Coolant pump		1/8 HP															
Measurement	Weight (Net/Gross) Approx.		1500kgs / 1650kgs	1600kgs / 1750kgs														
	Packing sizes	Length	2270mm (89.4")	2785mm (109.7")														
		Width x Height	Width 1120mm (44.1") X Height 1745mm (68.7")															

**** Specification subject to change without notice ****

◦ STANDARD ACCESSORIES :

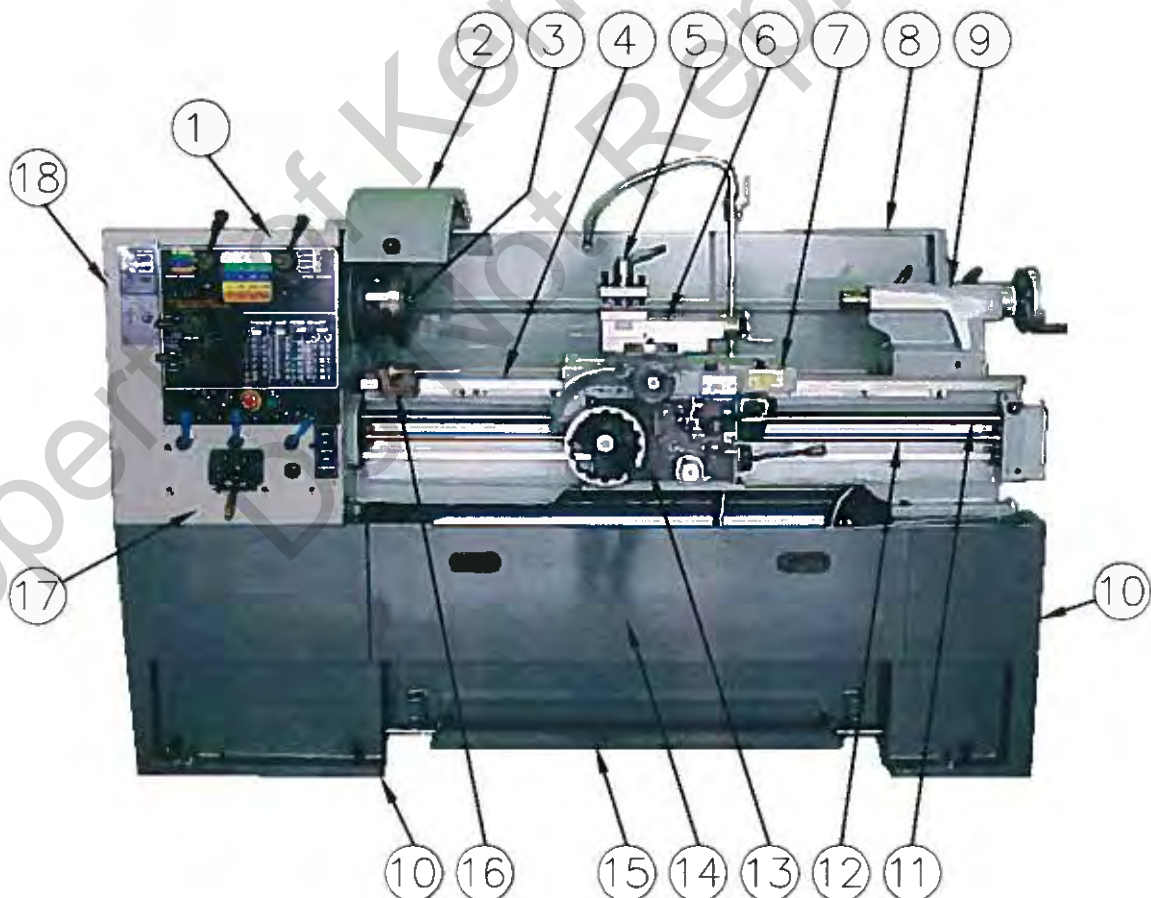
1. Backplate for 9" chuck
2. Dead center MT.4 made of carbon steel
3. Dead center MT.4 with carbide tip
4. Spindle center sleeve MT.6 x MT.4
5. Level pads ----- 6pcs
6. Toolset & Box
7. Operation manual & parts list

◦ OPTIONAL ACCESSORIES :

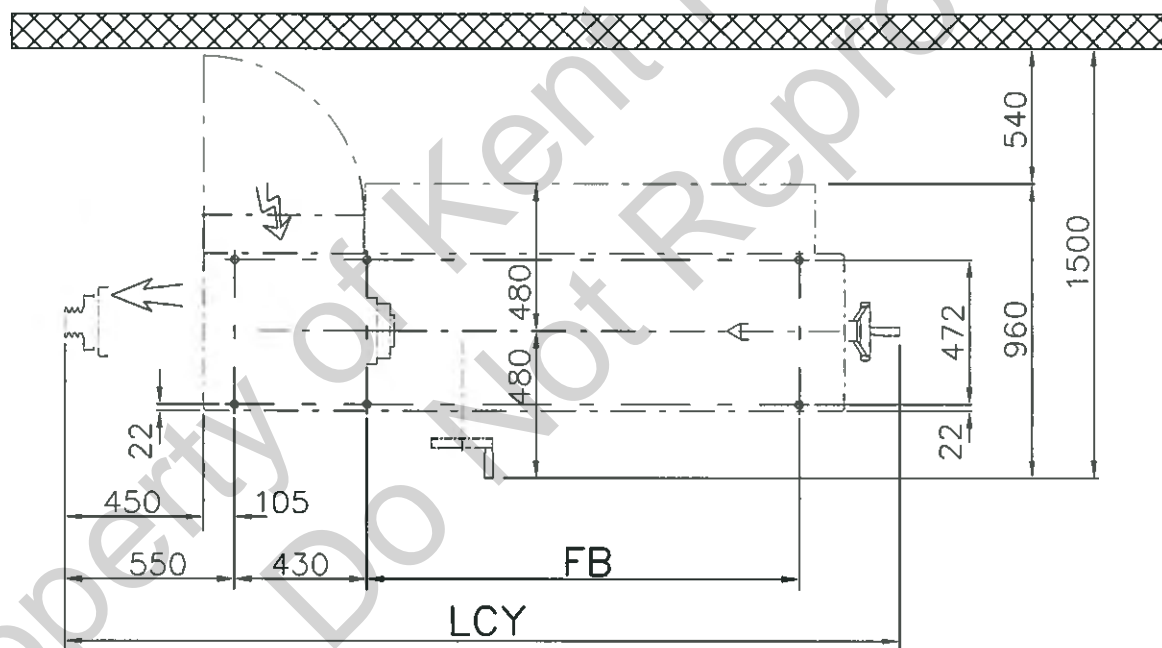
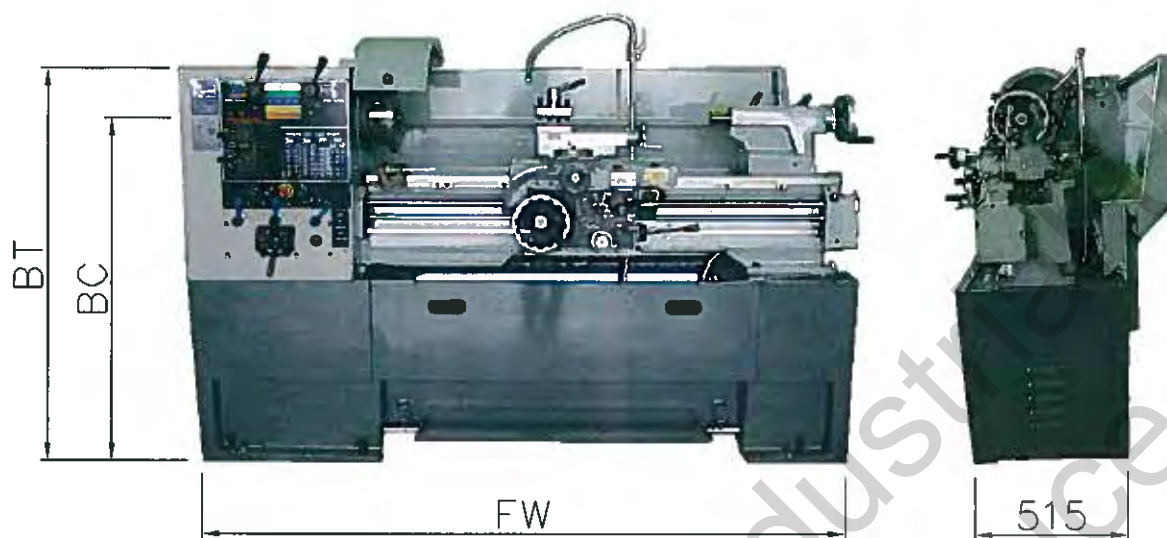
- | | |
|---------------------------------------|---------------------------------|
| 1. 3-Jaws scroll 9" chuck | 12. Steady rest w/ ball bearing |
| 2. 4-Jaws independent 10" chuck | 13. Follow rest w/bronze tip |
| 3. 5C collet closer attachment | 14. Faceplate 12" |
| 4. 5C collets (metric or imperial) | 15. Drill chuck & arbor |
| 5. Driving plate with Dog | 16. Rotating center MT.4 |
| 6. Chuck safety guard | 17. Halogen lamp |
| 7. Hydraulic copying attachment | 18. Quick change tool post |
| 8. Tool post grinder attachment | 19. Carriage micro stop set |
| 9. Taper turning attachment | 20. Digital read out system |
| 10. Electrical system for CE | 21. Full length splash guard |
| 11. Protect cover on leadscrew for CE | |

CHAPTER 1 ◦ GENERAL LAYOUT OF LATHE

1. Headstock
2. Chuck guard (optional)
3. Spindle
4. Bed
5. 4-Way tool post
6. Top slide
7. Saddle and Cross slide
8. Splash guard (optional)
9. Tailstock
10. One piece solid stand
11. Leadscrew
12. Feed shaft
13. Apron
14. Front moveable chip tray (optional model)
15. Footbrake
16. Carriage micro stop set (optional)
17. Gearbox
18. End Cover (Gear Train)



CHAPTER 1 ◦ FOUNDATION PLAN



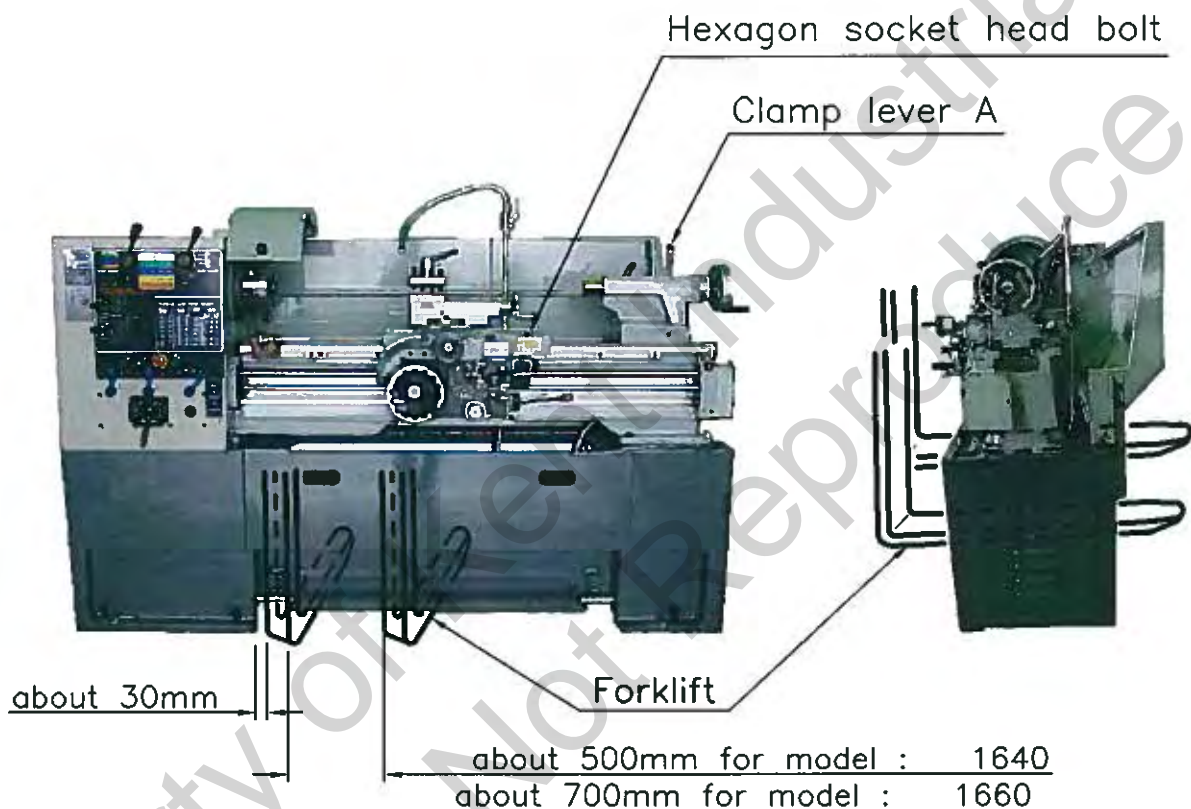
(ONE PIECE SOLID STAND EQUIPPED WITH FRONT MOVEABLE CHIP TRAY OPTIONAL)

Model	LCY	FB	BC	BT	FW
TML - 1640	2620mm	1405mm	1100mm / 1125mm	1500mm/1525mm	2080mm
TML - 1660	3128mm	1913mm	1100mm / 1125mm	1500mm/1525mm	2588mm

CHAPTER 1 ◦ MOVING THE MACHINE WITH A FORKLIFT

* PREPARATION

1. Turn off the power.
2. Position firmly the saddle and tailstock on bedway right side to achieve blance .
3. Locking hexagon socket head bolt by 8mm allen wrench that on the saddle right side.
4. Locking clamp lever A that on tailstock rear side.



- Machine weight model : TML-1640 about 1400 kgs.
TML-1660 about 1500 kgs.

- Make sure that the minimum forklift capacity is more than 2.5 tons for security.
- Forklift work should be cooperatively done by two persons, that is an operator and watchman, not to damage projecting on the machine perimeter.
- To put the fork, use the fork inserting the plinth mid-left.
- Keep the machine's balance of gravity at the center of the forks.

CHAPTER 1 ◦ INSTALLATION OF MACHINE

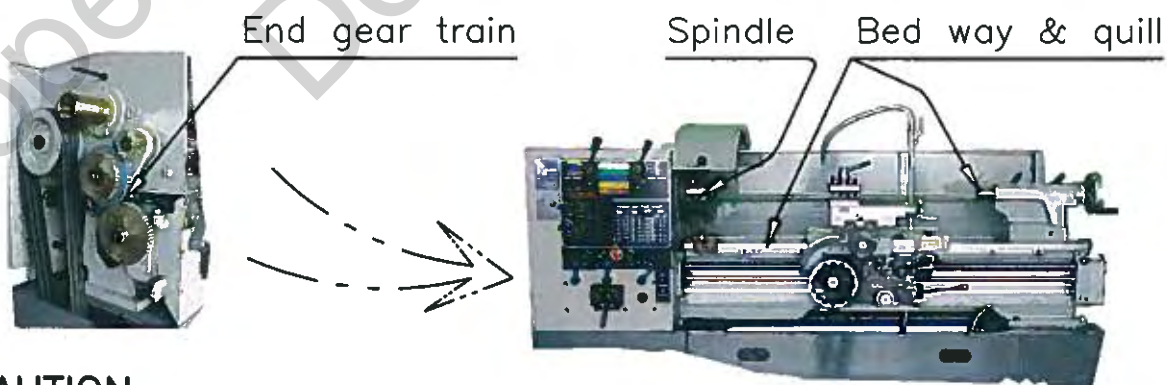
* Notice items:

1. Locate the machine on a solid foundation according to foundation plan as shown in page 4.
2. There must be sufficient power capacity.
3. The machine must not be adjacent to direct sunlight.
4. Don't pile up things on the floor around the machine and must keep floor dry.
5. Must reserve enough space for opening the door of electric box for maintenance and accessing for operation.
6. Position lathe on foundation and adjust each of the six mounting plinth to take equal share of the load.
7. Using an engineers' precision level on the bedways, adjust the plinth to level up machine.
8. Periodically, check bed level to ensure continued lathe accuracy.

◦ CLEANING THE MACHINE

* Notice items:

1. Before operating any controls, remove the anti-rust coating on all slideways and other places.
2. When cleaning. Use spirit or kerosene, instead of cellulose solvents, which may damage the paint finish.
3. Oil all brightly machined surfaces immediately after cleaning. apply machine oil on slideway and heavy oil or grease on the end gears.
4. It is recommended that all slideways, the leadscrew and feed shaft are cleaned (a bristle paint brush is useful for this) and lightly.



CAUTION:

DO NOT USE AIR COMPRESSOR TO CLEANING.

CHAPTER 1 ◦ ELECTRICAL SUPPLY CONNECTION

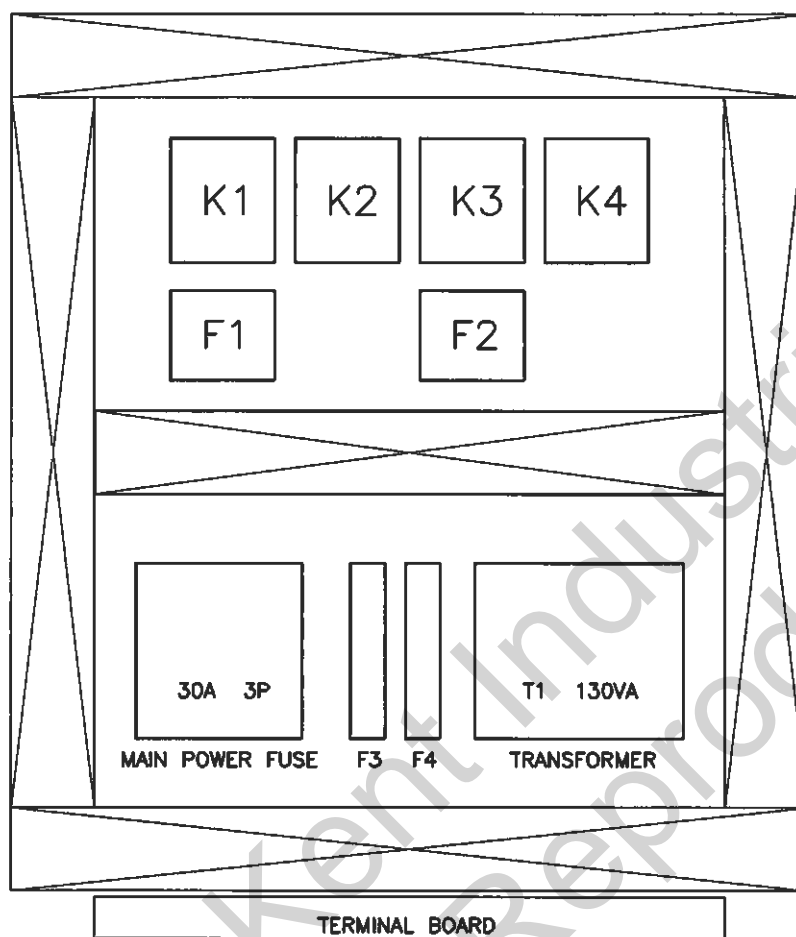
* ELECTRIC BOX INSTRUCTION

- This lathe is wired according to importer's required electric specification. If it happens that the wiring specification need to be rectified, Please refer to wiring diagram shown in this instruction manual.(page 08, 09 ----- for 5HP 4P motor)
- For electrical connection, simply connect R, S, T, E of your supply lines to R, S, T, E of connect terminals on left bottom.



INPUT POWER CABLE 3.5mm²x4C
VOLTAGE : 3-PHASE 220VAC

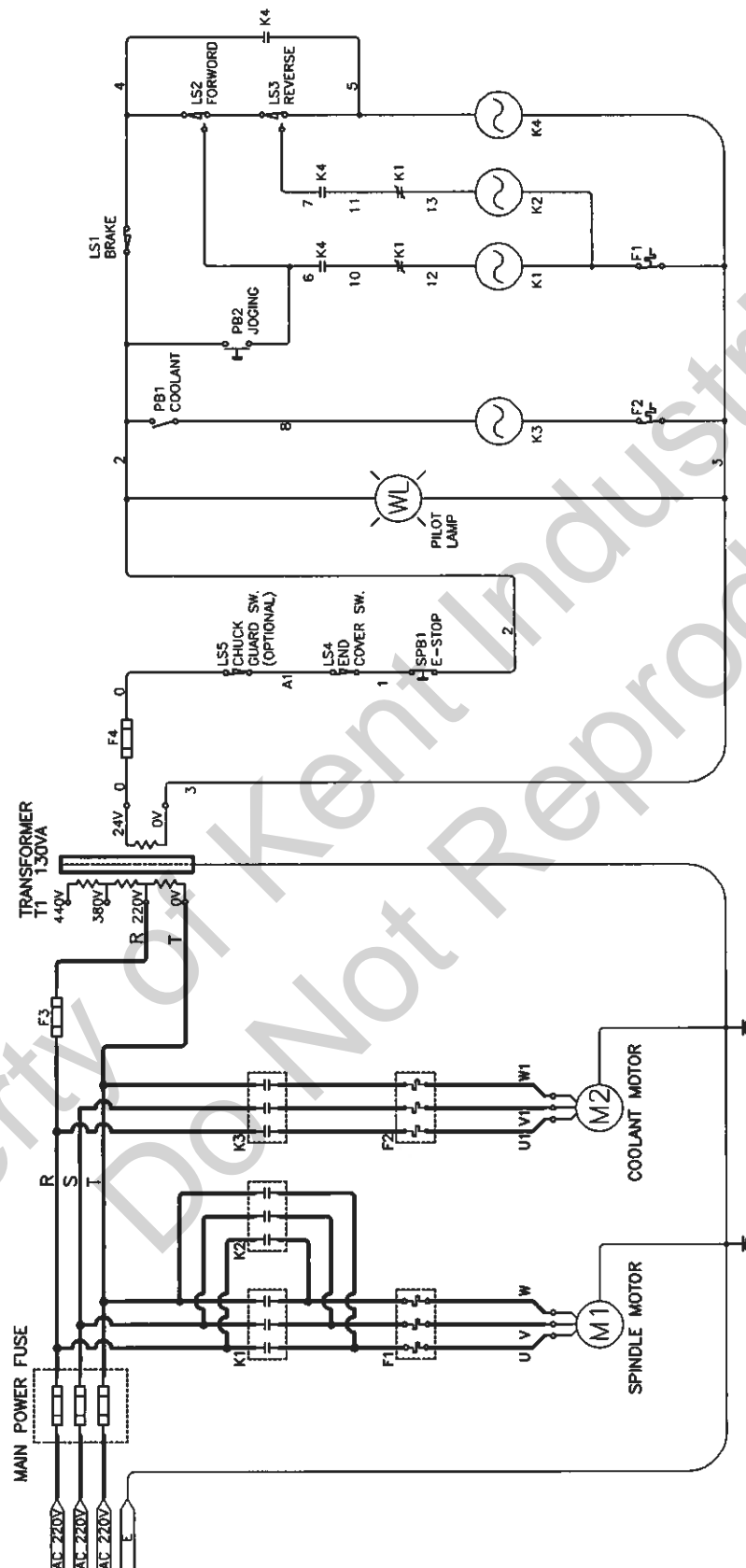
CHAPTER 1 ◦ LAYOUT OF ELECTRICAL BOX



◦ ELECTRICAL COMPONENT LIST

MODEL	DESCRIPTION	SPECIFICATION	Q'TY	SYMBOL
5HP 4P 220V	-1640 AC Magnetic switch	LC1D186B7	2	K1 , k2
	-1660 AC Magnetic switch	LC1D096B7	2	K3 , k4
	Main fuse base	30A 3P	1	MAIN POWER SWITCH
	Fuse base	30mm 2P	1	F3 , F4
	Transformer	130VA	1	T1
	Over relay	LR3D 16A~24A	1	F1
	Over relay	LR3D 0.25A~0.4A	1	F2
	Terminal	25A 12P	1	TB
	Terminal	25A 6P	1	TB
	Emergency-stop	A.P. ALEPB 22 (RED 1b)	1	SPB1
	Joging switch	A.P. APB 22 (GREEN 1a)	1	PB2
	Pilot lamp	A.P. ANPLE 22 (WHITE 24V)	1	WL
	Collant switch	A.P. ASS 22 (GREEN 1a)	1	PB1
	Limit switch	TM1307	1	LS4
	Limits switch	TM1704	3	LS1,LS2,LS3
	Limits switch	AV8112 (OPTIONAL)	1	LS5

CHAPTER 1 ◦ ELECTRICAL CIRCUIT DIAGRAM



CHAPTER 1 ◦ LUBRICATION CHECKS

* HEADSTOCK / GEARBOX / CARRIAGE, APRON / TAILSTOCK

Before operating the machine, make the following important checks:

1. The headstock is filled to level marked on oil sight window with Shell Tellus oil 32 or equivalent. Check oil weekly and change the oil every 6 month.
2. The gearbox is filled to level marked on oil sight window with Shell Tellus oil 68 or equivalent. Check oil weekly and change the oil every year.
3. The carriage apron is filled to level marked on oil sight with Shell Tellus oil 68 or equivalent. Check oil weekly and change the oil every year.

There are two oil ball on the tailstock & a oil cap on the bracket.

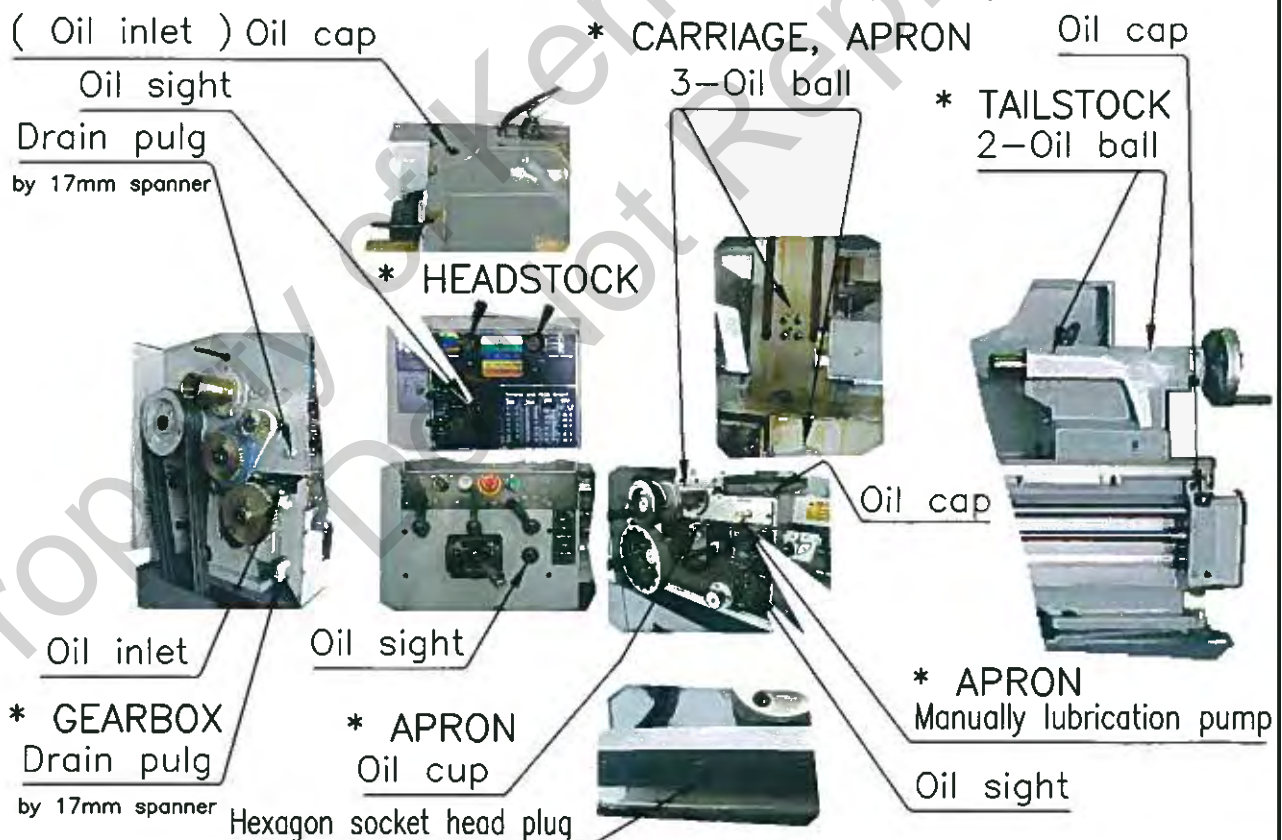
4. Please add No.68 oil 3 c.c. to them respectively every day before operating to ensure the smoothness of ways.

There are three oil ball on the cross slide & top slide.

5. Please add No.68 oil 10 c.c. to them respectively every day before operating to ensure the smoothness of leadscrews.

A manually operated one shoot lubrication pump is incorporated into the apron. Drawing oil from the apron reservoir.

It enables the operator to ensure that the slideways are kept adequately lubricated. The pump should be operated before and occesionally during the work period.



The apron can be unscrewed by 6 mm allen wrench the drain plug in the bottom plate.

CHAPTER 1 ◦ CHUCK AND CHUCK MOUNTING (for D1-6 spindle)

*** WARNING: USE ONLY HIGH-SPEED CHUCKS WITH THESE MACHINES.**

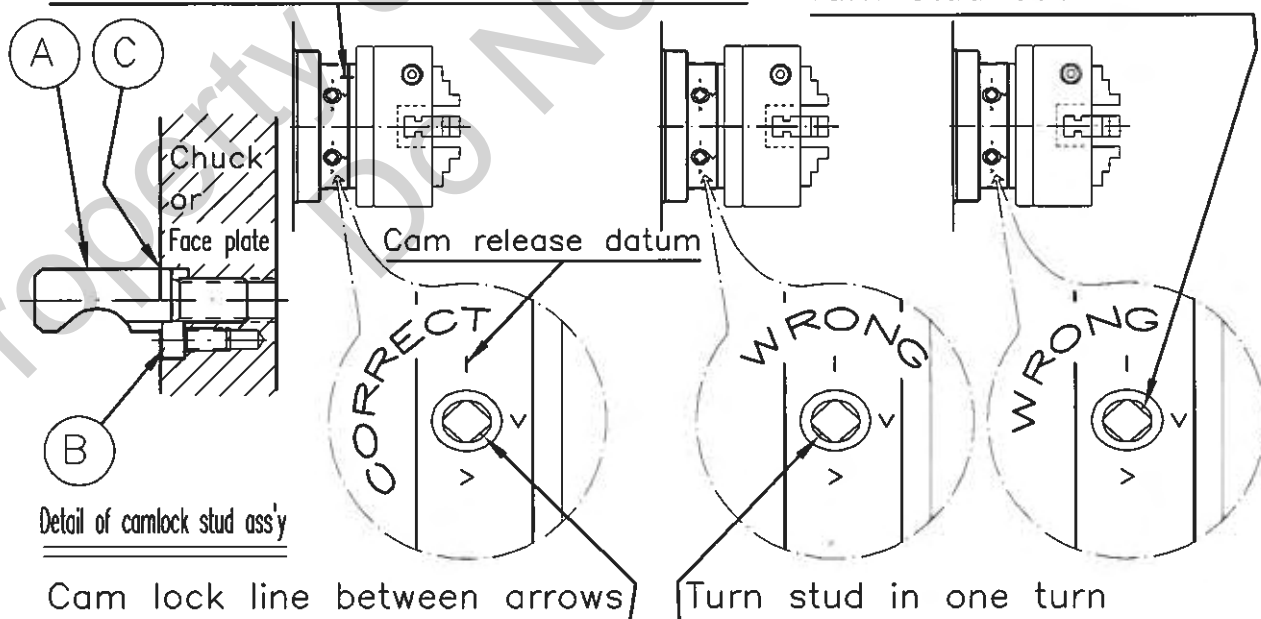
- When fitting chucks or faceplates, ensure that spindle and chuck tapers are scrupulously clean that all cams lock in the correct positions the first.
 - It may be necessary to re-set the camlock studs (A) when mounting a new chuck. To do this, remove the hexagon socket locking screws (B) and set each 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 hold.
 - Now mount the chuck or 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 on the spindle nose. If any of the cams do not tighten fully within 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 scribed on the spindle nose. This will assist subsequent remounting.
- DO NOT INTERCHANGE CHUCKS OR FACE PLATES BETWEEN LATHES WITHOUT CHECKING FOR CORRECT CAM LOCKING.**

IMPORTANT:

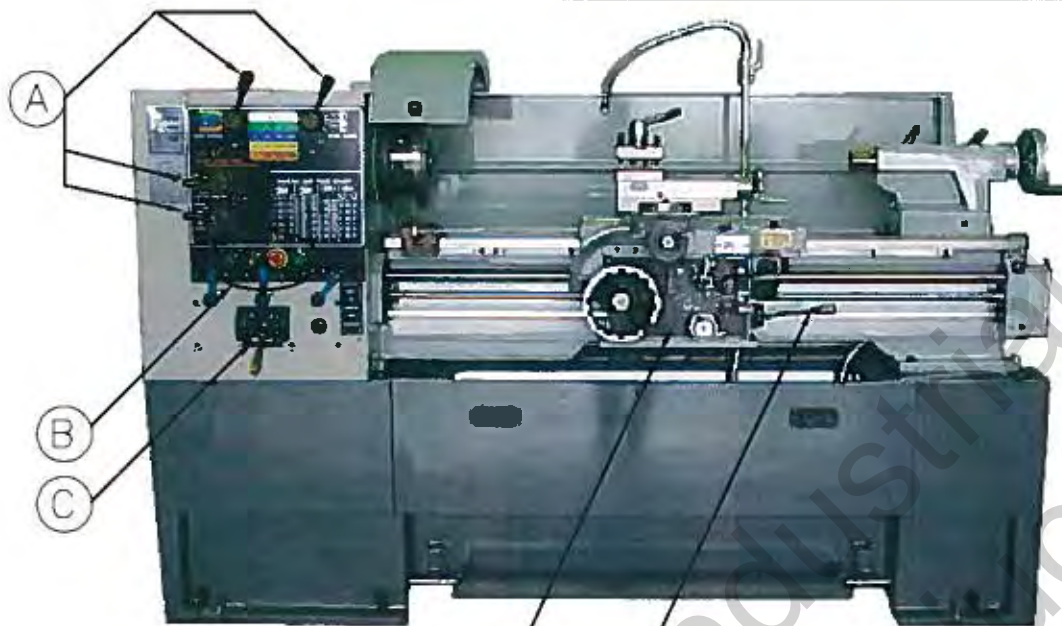
Take careful note of speed limitations when using faceplates; 12 inch faceplates should not be run at speeds higher than 1000 rev/min. and 14 inch faceplates at not higher more than 770 rev/min.

Reference mark on spindle nose and chuck

Turn stud out one turn



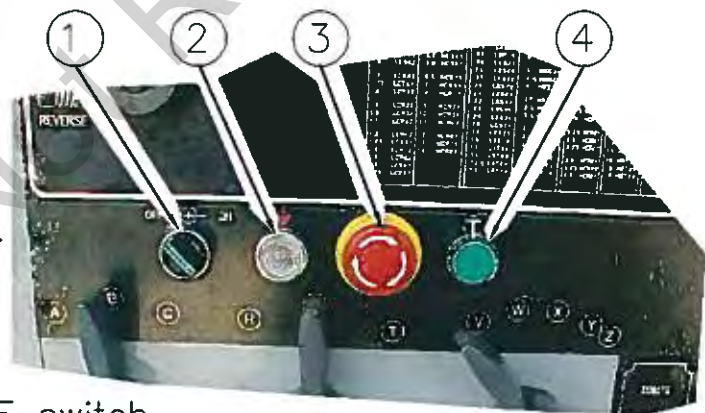
CHAPTER 2 ◦ LATHE CONTROLS



- A. Headstock selector
- B. Electrical control
- C. Gearbox (threads and feeds)
- D. Apron control units, for surfacing, sliding and threading controls.
- E. Spindle rotation, forward, stop and reverse.

◦ ELECTRICAL CONTROL PANEL

With the exception the lathe isolator, all electrical controls are fitted onto the front face of the headstock.



- 1. Coolant pump ON / OFF switch.
- 2. Power ON light. it will glow when the electricity is ON.
- 3. The emergency stop, serving as electricity ON / OFF switch also.
- 4. Inching : Push it to move spindle slightly for checking workpiece is clamped tightly and coaxial in the chuck before cutting!

CAUTION:

DO NOT USE THE INCHING FUNCTION AND SPEED CHANGE MEANWHILE.
AVOID THE GEARS BE DAMAGED TO INTERMITTENT NOISE IN THE HEADSTOCK WHEN SPINDLE RUNNING.

CHAPTER 2 • HEADSTOCK SELECTORS

* (H1) / (H2) Spindle speed selector

1. The upper two selectors (H1)/(H2) on headstock are for spindle speed selection. There are 12 steps spindle speeds, as shown on speed chart, divided into four groups. Each speed is the result of combining the above two selectors,
2. For instance, if 1800 r.p.m. of spindle speed is to be chosen, then move selector(H2) to D, selector(H1) to right side.

* (H3) H–N–L selector for gearbox

1. Following each feed rate or thread pitch on gearbox thread and feed chart, there is a prefix of either H or L, move
2. H–N–L selector to H or L accordingly for feeding or threading. If this lever is positioned at N, the headstock rotation will not be transmitted to gearbox.

*WARNING:

HIGH POSITION DO NOT EXCEED SPINDLE SPEED OF 300 R.P.M.

* (H4) Apron orientation selector

1. This selector may affect the rotation orientation of leadscrew, feed rod and henceforth the movement direction of apron.
2. FORWARD(left-hand arrow) is used for cutting right-hand threads. REVERSE(right-hand arrow) is used for cutting left-hand threads.

* HEADSTOCK SELECTORS

- | | |
|---------------------------------|--------------------------------------|
| (H1) H or L two section speed | (H3) Low–N–High selector for gearbox |
| (H2) A,B,C,D four section speed | (H4) Apron orientation selector |

CORRECT SPEED CHANGE PROCEDURE

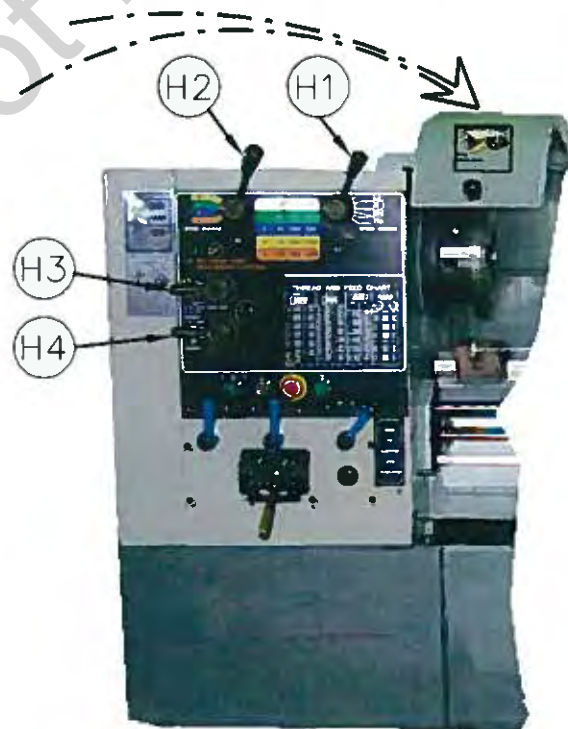


CAUTION:

DO NOT USE INCHING FUNCTION WITH SPEED CHANGE. BECAUSE IT COULD DAMAGE THE GEARS AND CAUSE INTERMITTENT NOISE DURING SPINDLE RUNNING LATER ON.

SPEED CHANGE PROCEDURE :

1. Stop the spindle.
2. Insert a chuck wrench into the chuck square slot and hold it with right hand.
3. Use left hand to hold the headstock selector (as indicated in drawing above).
4. Use right hand to shake the chuck and try to shift selector position with left hand at the same time.
5. Always shift selector into neutral position instead for speed change.
6. Use right hand to shake chuck again while use your left hand to shift selector to engage into desired speed zone slowly.



CHAPTER 2 ◦ GEARBOX SELECTORS

* Gearbox, thread and feed selectors

- All the thread pitches and feeds directly available from the gearbox are shown on the data plate fitted on the front of headstock and the positioning control levers are (G1), (G2), (G3), and (G4).

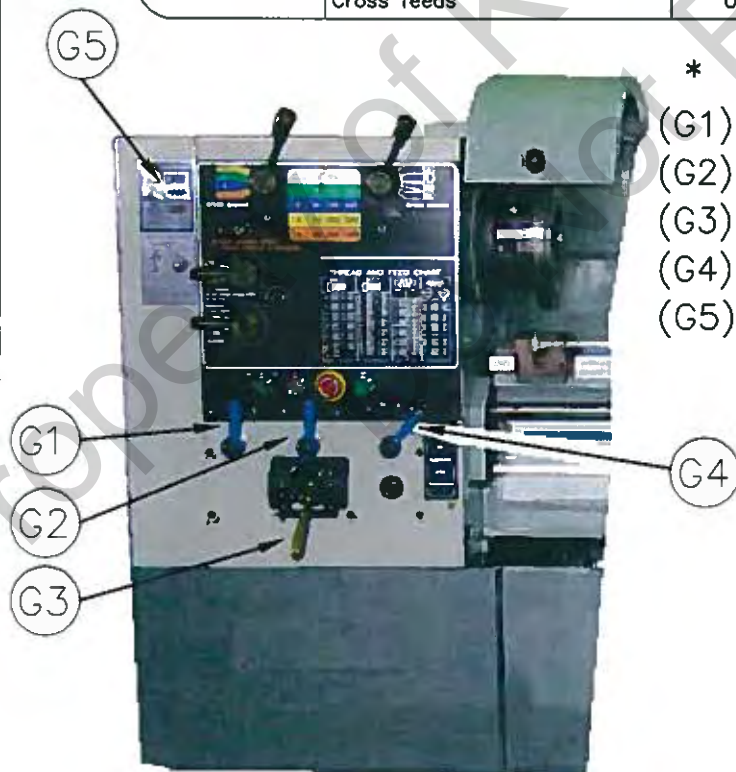
* End gear trains diagram

- The end-gear train should be arranged as in the diagram shown on the dataplate (G5) to meet threading requirements.

* FEEDS:

- Sliding feeds per spindle revolution range from 0.002 to 0.067 inch. (0.05 to 1.7mm)
- Surfacing feeds per spindle revolution range from 0.001 to 0.034 inch. (0.025 to 0.85mm)

Threads & Feeds	Whitworth threads : Kinds/Range	45 Kinds / 2 ~ 72 T.P.I.
	Metric threads :	39 Kinds / 0.2 ~ 14 mm
	Diametral pitch (D.P.) worm gear	21 Kinds / 8 ~ 44 D.P.
	Module pitch (M.P.) worm gear	18 Kinds / 0.3 ~ 3.5 M.P.
	Longitudinal feeds	0.05 ~ 1.7 mm (0.002" ~ 0.067")
	Cross feeds	0.025 ~ 0.85 mm (0.001" ~ 0.034")

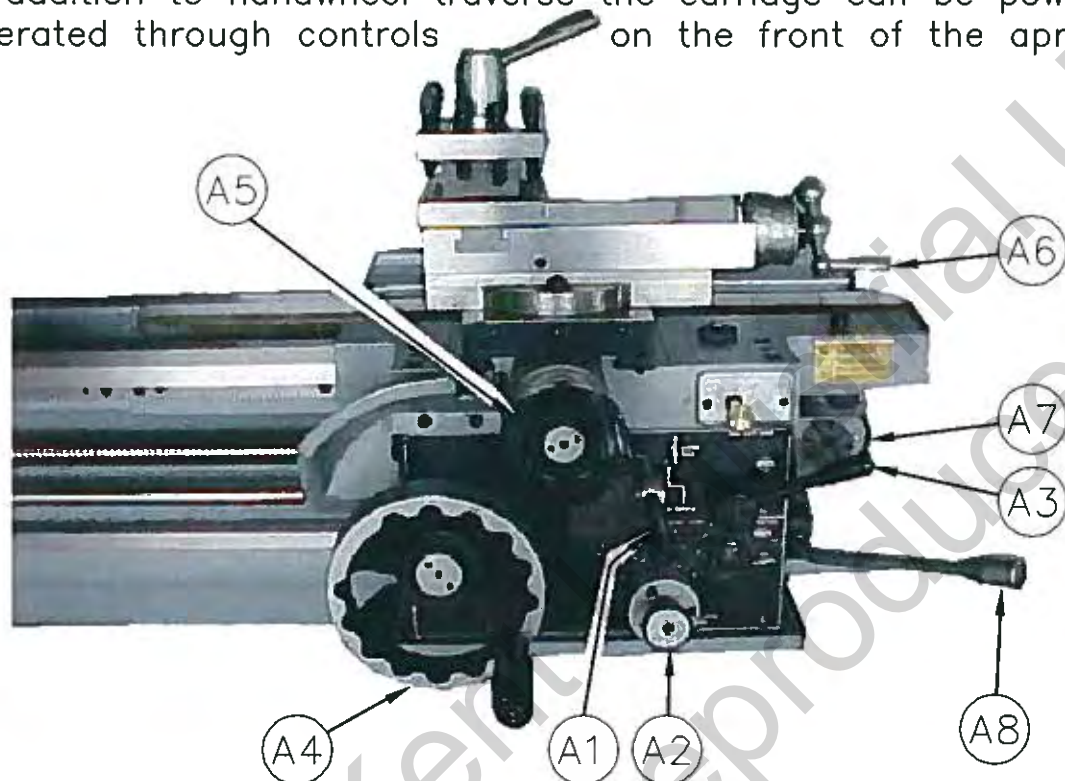


* GEARBOX SELECTORS

- (G1) A,B,C three section selector
- (G2) R,S,T three section selector
- (G3) 1~8 eight section selector
- (G4) V~Z five section selector
- (G5) End gear train diagram

CHAPTER 2 ◦ APRON CONTROLS

- * For surfacing, sliding and thread cutting controls.
In addition to handwheel traverse the carriage can be power-operated through controls on the front of the apron.

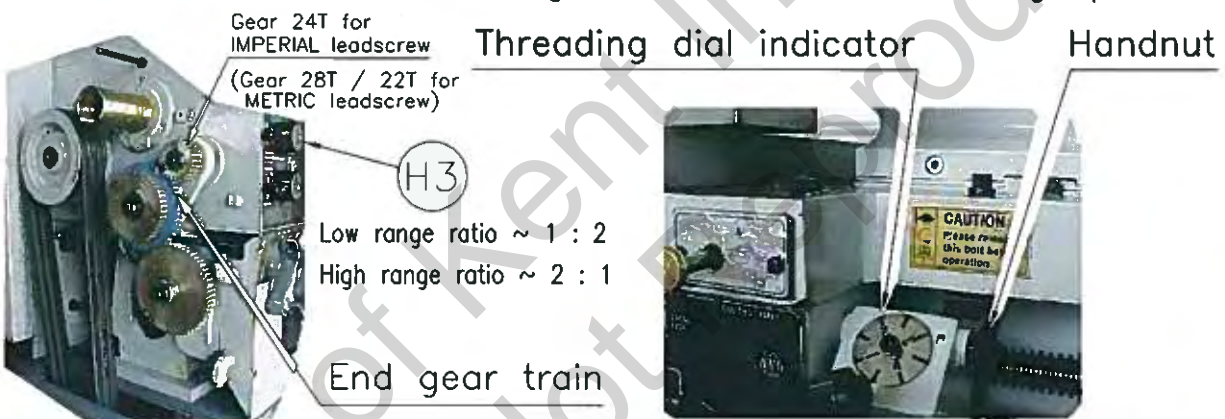


- (A1). Surfacing and sliding selection lever:
When it is in and is moved downward, surfacing is in operation;
When it is pulled out and moved upward, sliding is in operation.
- (A2). Direction selection push button:
Either move this push button inward or outward to change direction of carriage movement or cross-slide. With this push button the operator can ignore the direction of spindle or leadscrew.
- (A3). Half-nut lever:
When it is pressed downward, the half-nut will be engage with leadscrew for thread cutting. To avoid undue wear, release the nut when not thread cutting. An interlock within the apron prevents inadvertent engagement of this lever when in feeding operation.
- (A4). Carriage handwheel.
- (A5). Cross slide handwheel.
- (A6). Compound rest handwheel.
- (A7). Threading dial indicator.
- (A8). Spindle Rotation, Forward, Stop and Reverse:
The forward and reverse rotation of spindle is operated by starting lever at right side of apron and controlled by limit switches right-side the bedway.

CHAPTER 2 • THREADING DIAL INDICATOR

* For threads cutting

- Tighten the handnut to retain indicator in engagement when engaging the indicator with the leadscrew. When not required, release hand-nut and swing indicator out engagement.
- To cut threads of even number per inch, the leadscrew nut can be closed as any line on the dial passes the datum mark.
- To cut threads of odd numbers per inch, close the leadscrew nut at any NUMBERED line.
- Fractional threads of $1/2$ or $1/4$ T.P.I. may be cut by closing the nut at the SAME NUMBERED LINE on each pass of the tool.
- This dial can not be used with an IMPERIAL leadscrew to cut metric threads, D.P., M.P. which are shown on gear box data plate. For the threads being shown, the leadscrew nut must be kept closed. Use apron control lever after each thread cutting when the tool is withdrawn to original start of thread cutting operation.



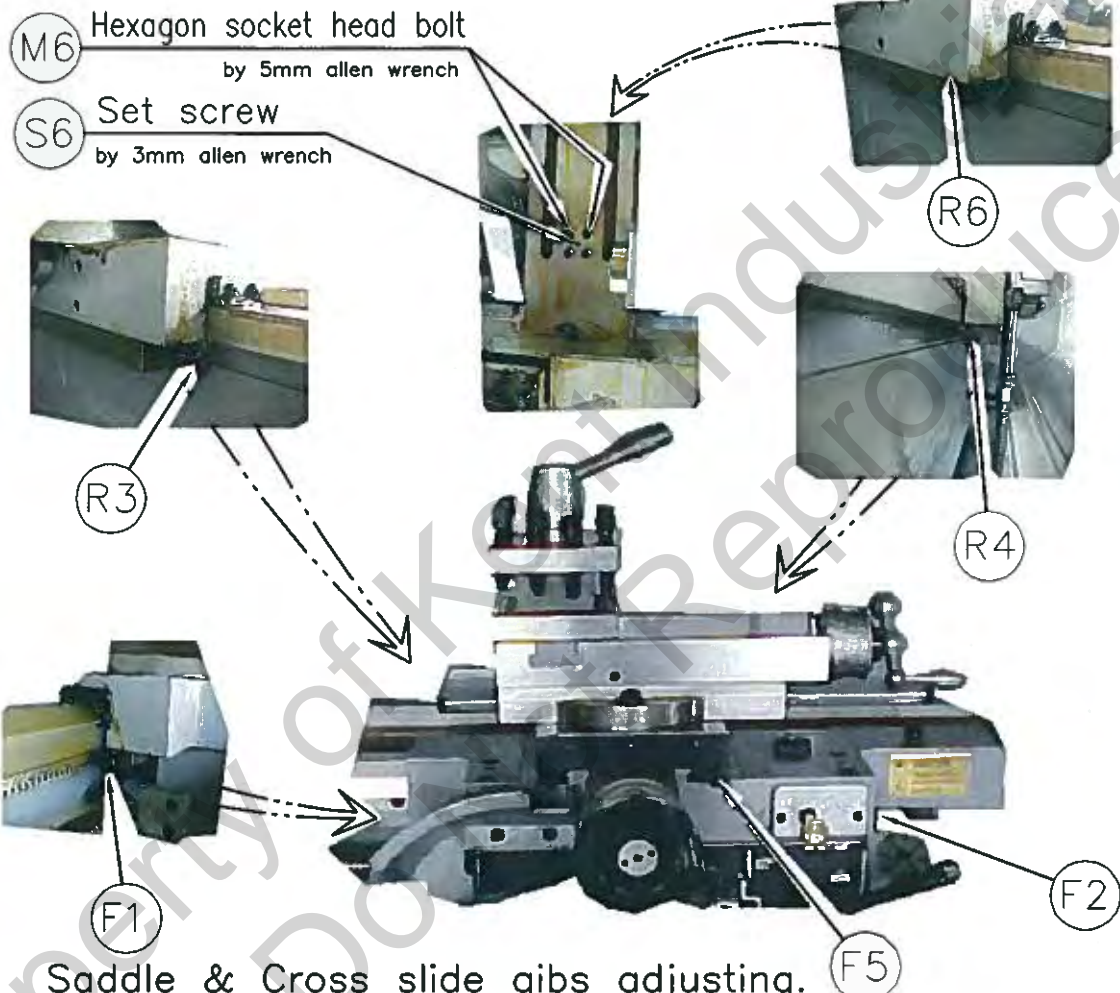
* Multi-start threads can be cut on a lathe in three ways:

1. By repositioning the compound (top) slide one pitch forward for each start. Note that the slide is normally set at 90 deg. to the axis of the machine cross-slide. The accuracy of this method depends upon the skill of the operator.
2. By using an accurately divided driver plate and turning the work-piece one division forward for each start.
3. By advancing the driver gear a calculated number of turns to advance the spindle by one pitch of the thread to be cut. The accuracy of this method is that of the machine.
 - With ALL SERIES lathes, two ratios exist between the spindle and driver gear shift, i.e. the LOW range where the ratio is 1:2 and the HIGH range where the ratio is 2:1.
 - In order to use this method, the number of teeth on the driver gear must be divisible by the number of starts being cut. The driver gear is then advanced by half this number of teeth when in LOW range. and conversely, by twice the number of teeth when in HIGH range.
 - The limitation of this method depends upon whether the number of teeth on the driver gear without a remainder.
 - On the standard end gear train for this machine the driver gear has 24 teeth; so that two, three or four start threads, can readily be cut. For other odd numbers of start a choice must be made of methods 1 or 2.

CHAPTER 2 • CROSS SLIDE

* Cross-slide nut adjusting.

- Reduce backlash by slackening rear hexagon socket head bolt (M6) in top of cross slide, then carefully screw in the center set screw(S6) to adjust a wedge within the split nut.
- Mark only small adjustment at time and retighten two bolts(M6) before operating the cross slide several times by hand to be sure of smooth operation throughout full travel.



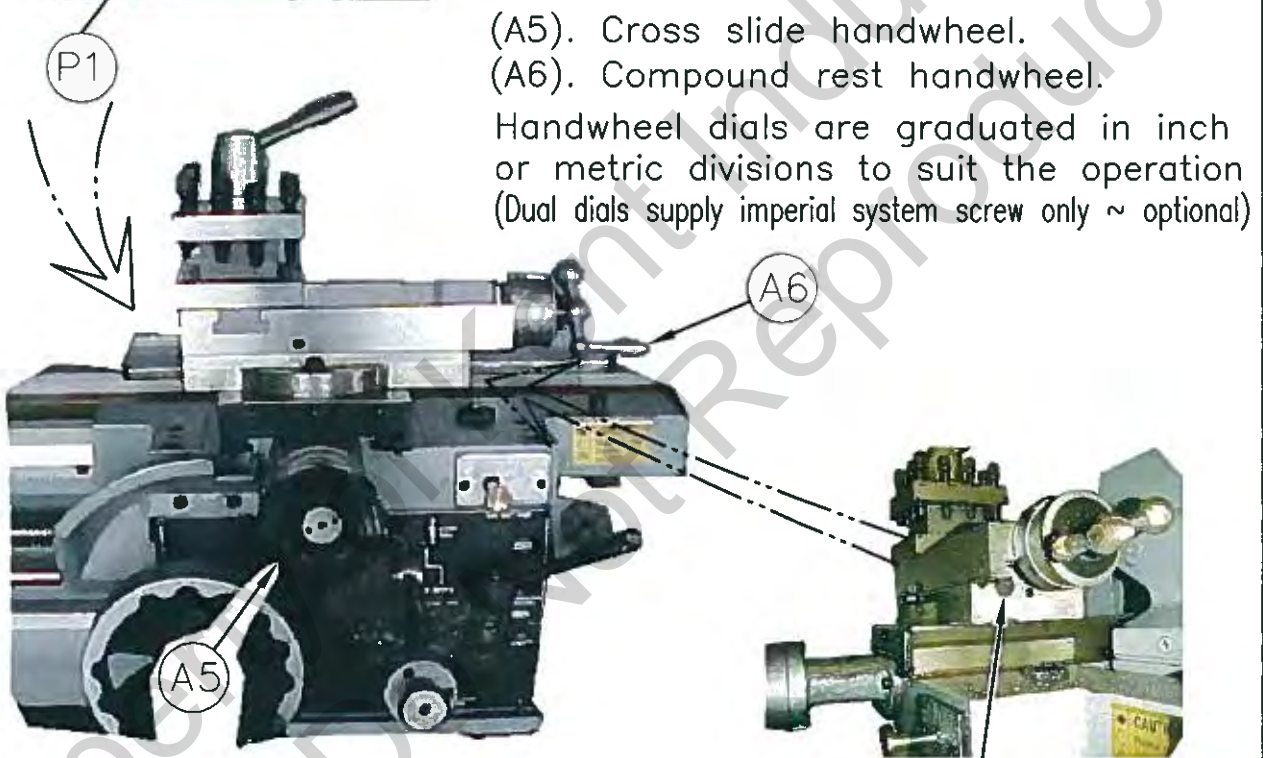
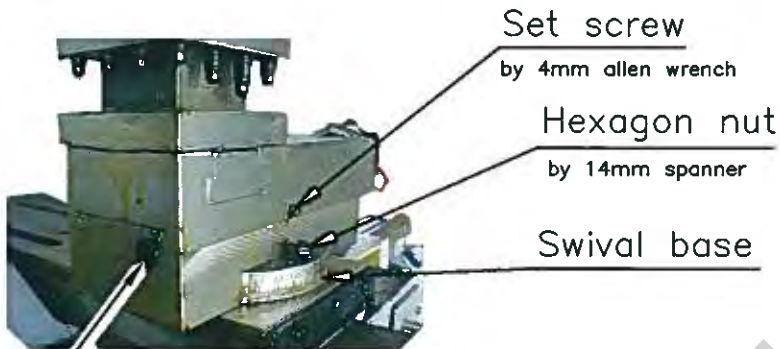
* Saddle & Cross slide gibs adjusting.

- Tapered gib strip are fitted to slideways of saddle cross-slide and top (compound) slides so that any slackness which may develop can be diminished. Check and adjust them every six months.
 - Ensure that slideways are thoroughly cleaned and lubricated before attempting adjustment. According to the following steps :
1. Use flat head screw driver to loosen the adjust screw(F1) & (R4), /(R6) about 1/2 circle CCW.
 2. Appropriately tighten adjust screw(F2) & (R3) /(F5) about 1/2 circle CW.
 3. Move saddle leftward and rightward to satisfied smoothness.
 4. Move cross slide forward and backward to satisfied smoothness.

CHAPTER 2 ◦ TOP SLIDE

* Top slide indexing

- A solid top slide is fitted as standard equipment to the cross-slide mounted on a swivel base which is marked 0–45–0–45 degree. for normal indexing.



* Top slide gibs adjusting.

You should regularly check and adjust them every six months.

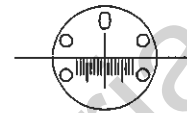
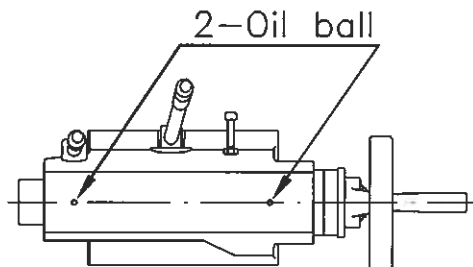
Ensure that slideways are thoroughly cleaned and lubricated before attempting adjustment. According to the following steps :

1. Use flat head screw driver to loosen the adjust screw(P1) , about 1/2 circle CCW.
2. Appropriately tighten adjust screw(P2), about 1/2 circle CW.
3. Move top slide leftward and rightward to a satisfied smoothness.

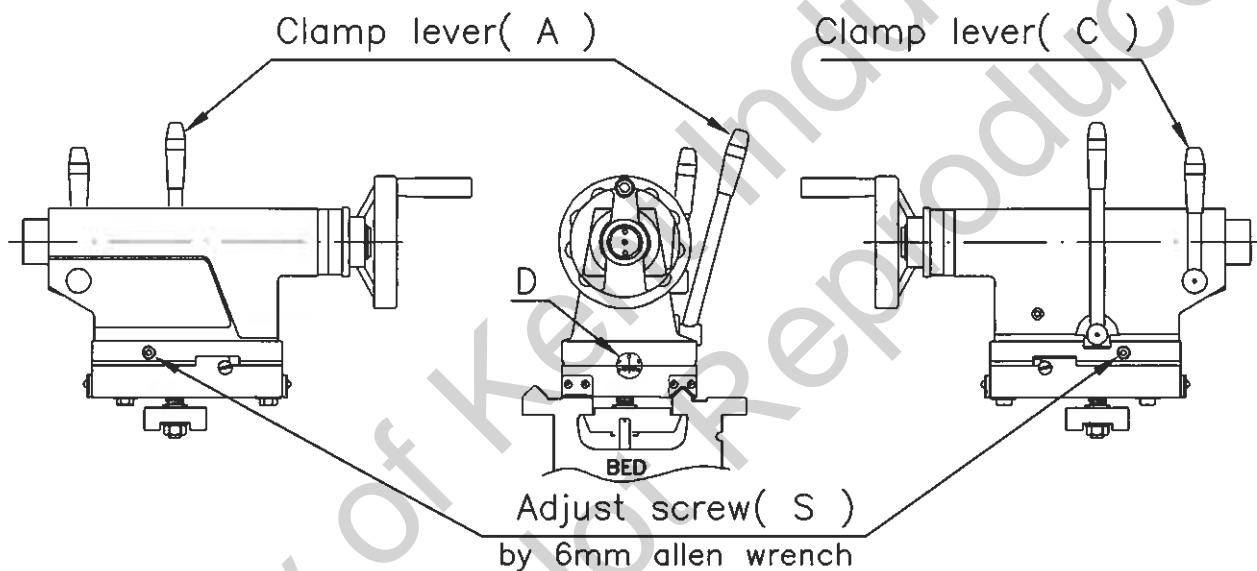
CHAPTER 2 ◦TAILSTOCK

* Quill lubricate

- There are two oil ball on the tailstock.
- Please add No.68 oil 3 c.c. to them respectively every day before operating to ensure the smoothness of ways.



Detail of mark D



* Operation

1. The tailstock can be freed for movement along the bed by unlocking clamping lever(A).
2. Release this clamping lever(A) before attempting to move the tailstock after and on completing of the need, lock it again for extra clamping.
3. The tailstock quill can be locked by clamp lever(C).

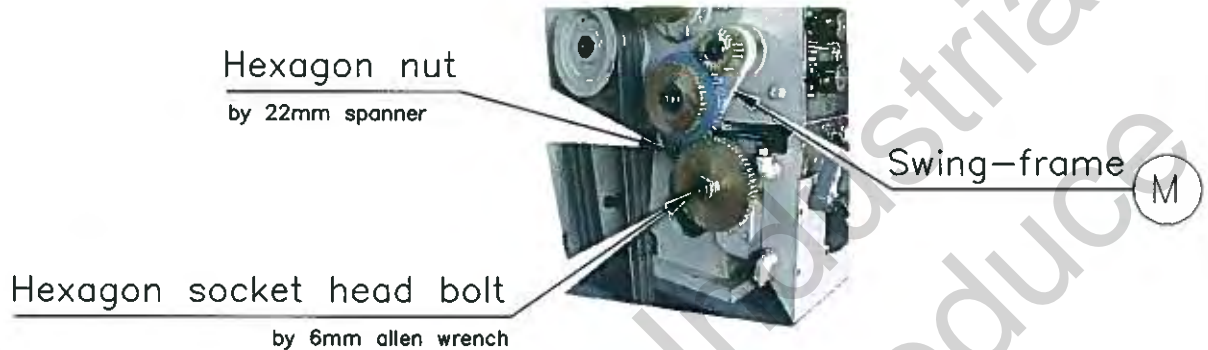
* Adjustment / re-alignment

1. The tailstock also can be set over for turning shallow tapers or for re-alignment.
2. Release the clamping lever(A) and adjust screw(S) at each side of the base to move tailstock laterally across the base.
3. An indication of the set-over is given by the datum mark(D) at the tailstock end face.
4. Tight clamp lever after adjusting set-over.

CHAPTER 2 ◦ END GEAR TRAIN

* Notice items:

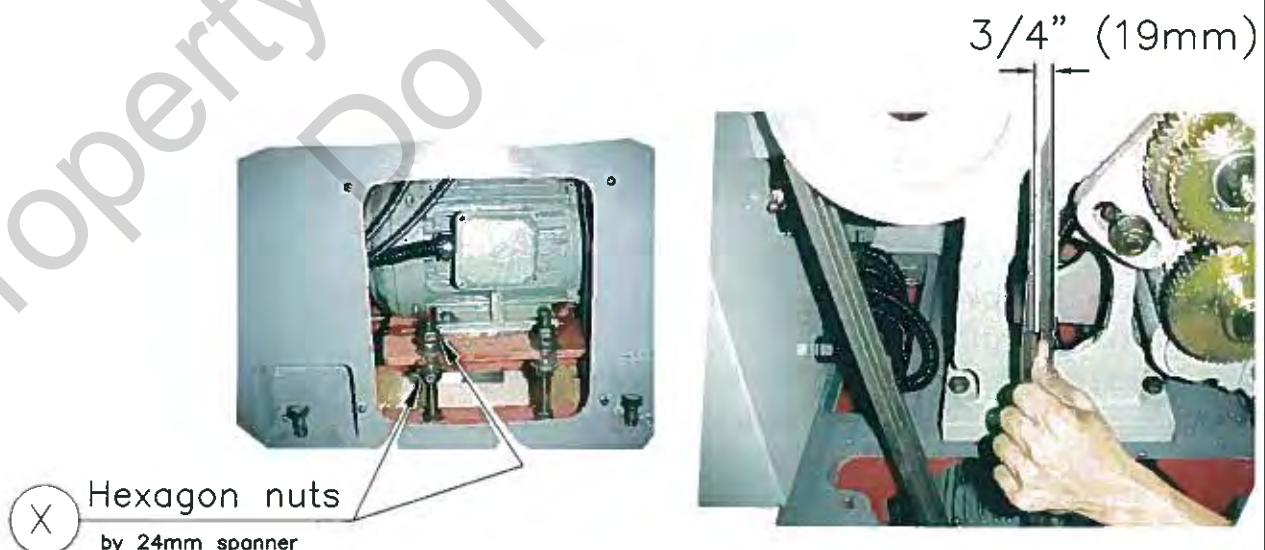
1. Drive from headstock to gear box is transmitted through a enclosed by the headstock end cover. Intermediate gears are carried on an adjustable swing-frame(M).
2. Gears must be thoroughly cleaned before fitting and backlash must be maintained at 0.005"(0.127mm) for correct meshing.
3. Lubricate gear regularly with heavy oil or grease.



◦ DRIVING BELTS

* Notice items:

1. To adjusting belt tension, remove the cover plate on back of the headstock and adjust the hexagon nuts(X) on the hinged motor platform.
2. Ensure that the motor is correctly aligned with the lathe axis.
3. Apply light finger pressure at a point midway between motor and head-stock pulleys, the resulted depression compare to other belt will be about 3/4" (19mm) when under tension.



CHAPTER 2 ◦ LEADSCREW SHEAR PIN

* Safety feature

1. The transmission is protected against severe overload by a shear pin fitted into the leadscrew drive, just beside the right hand of the gearbox.
2. To replace a shear pin:
 - First disengage drive to the leadscrew(63005-*0) by setting the right-hand lever of the gearbox to the position W or X.
 - Move the shroud washer(63008) with snap ring rightward to the spring cover(63006).
 - Then rotate the leadscrew by hand carrying the broken pin to the frontview, on same level to the slot of flanged bearing(30017).
 - By a magnetism screw driver can easily remove the broken pin head from the collar(63009), and other broken pin from gear box housing slot hole.
 - Align the holes in flanged-shaft(30014), collar(63009) and shroud washer (63008) then insert a new pin(63010) and turn the shroud washer half circle to leftward to the collar(63009) with snap ring for retain the new shear pin.

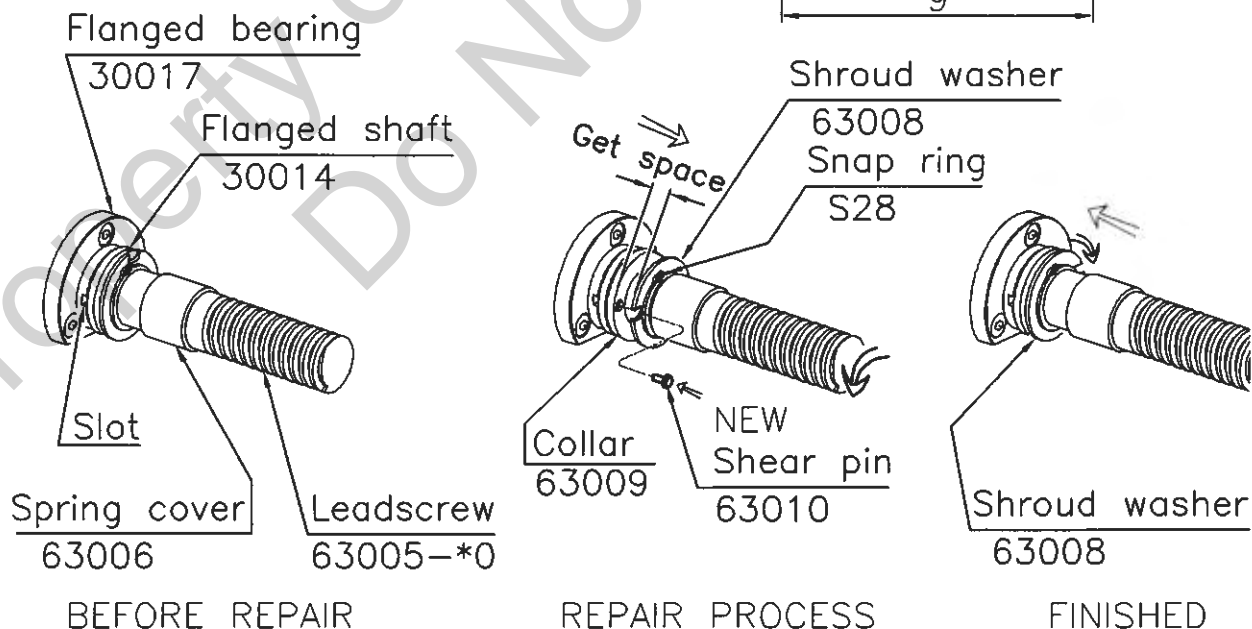
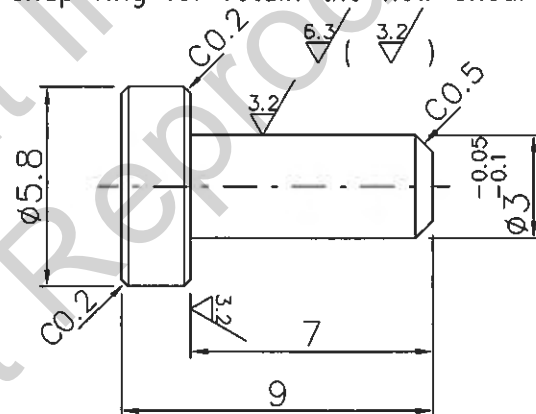
Part name : Shear pin

Drawing no. : 63010

Material : S45C (SAE 1045)

Scale : 5/1

Unit : mm



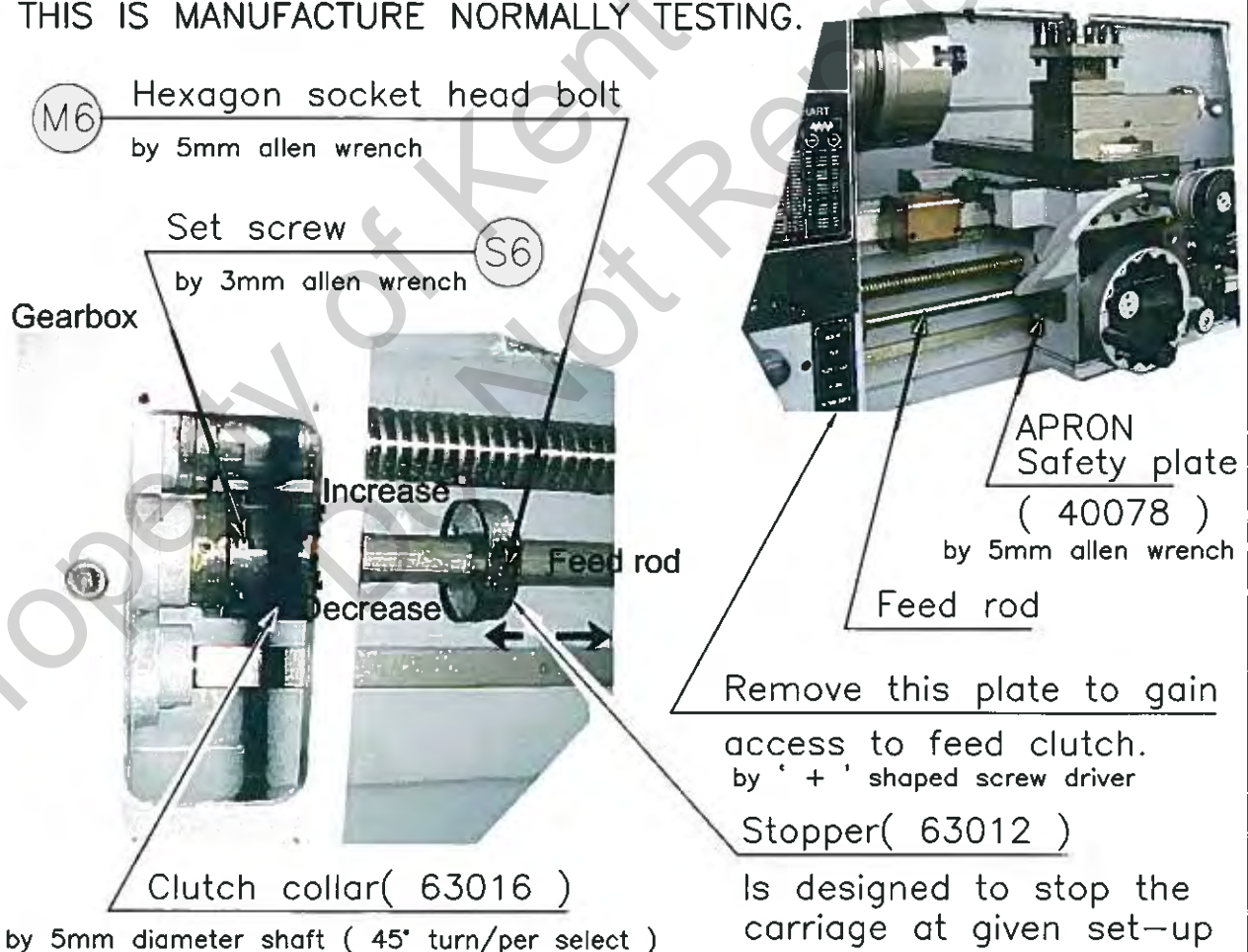
CHAPTER 2 • FEED ROD FRICTION CLUTCH

* Safety feature

1. The friction clutch at left side of feed rod serves as safety device against overload.
2. In case of overload in feeding, the friction clutch will disengage feed rod from transmission and hence the lathe runs freely without any damage.
3. The friction clutch is adjustable to take different cutting loads depending on actual requirement.
4. To increase/decrease cutting load, P/N 63016 clutch collar should be turned reverse/forward. After adjustment, it should be tightened the set screw (S6) into slot again.

IMPORTANT:

WHEN ADJUSTING OVERLOAD FEED CLUTCH FOR SUITABLE FRICTION TO WORKING, MUST BE CHECKING THE CARRIAGE AUTO-FEEDING TOWARD HEADSTOCK, WHEN THE APRON SAFETY PLATE(40078) TOUCHING TO STOPPER(63012) IN THIS MOMENT THE CARRIAGE WILL BE STOP. THIS IS MANUFACTURE NORMALLY TESTING.



CHAPTER 2 ◦ LIMIT SWITCHES

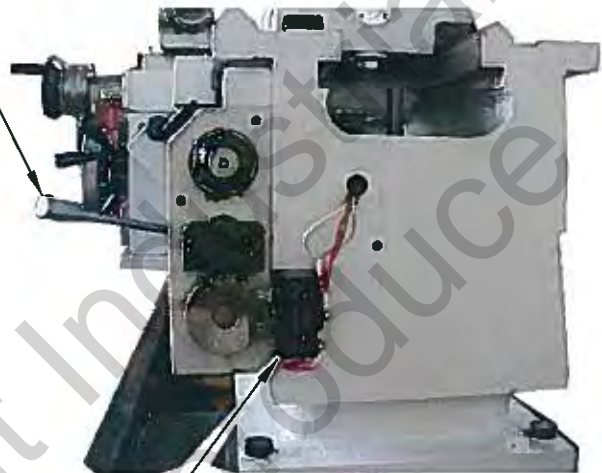
* Foot brake:

1. One limit switch and two limit switches to servo for instant foot brake and spindle forward—reverse rotation respectively.
2. Make sure always the smooth contact of small wheel of limit switch with the cam at end of foot brake and starting lever respectively.

Spindle control lever



Foot brake limit switch



Forward/reverse limit switches

* Safety interlock:

1. IF the end cover is not closed, then the spindle and coolant pump can not rotate and start.
2. IF the chuck guard (optional accessory) is not swivel down, then the spindle and coolant pump can not rotate and start.

Chuck guard



Chuck guard limit switch



End cover limit switch

CHAPTER 2 ◦ LATHE ALIGNMENT

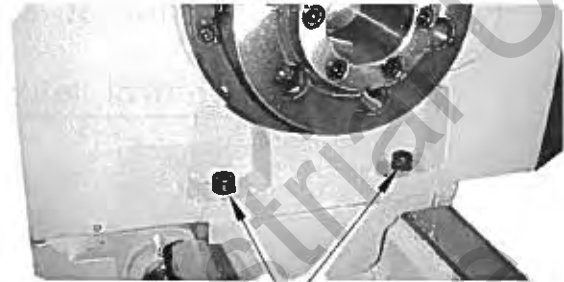
* Lathe alignment :

- With the lathe installed & running we recommend verification on machine alignment before commencing work.
- Check levelling & machine alignment at regular periods to ensure continued lathe accuracy.



(I) 2-Fixing screws

(K) 2-Adjusting screws



(J) 2-Hex. socket head bolts

* Headstock check :

1. Take a light cut with a cutting tool over a 6" (152mm) length of 2" dia ($\phi 50\text{mm}$) steel bar gripped in the chuck but not supported at the free end.
2. Micrometer readings at each end of the turned length (at A & B reference Fig. 24-P1) should be the same.
3. To correct a difference in readings, slacken the four headstock hold-down screws(I) behind headstock and (J) under the headstock, then adjust the set-over adjusting screws(K).
4. After adjustment, tighten screw(I) / (J) first then screw(K).
5. Repeat the test-cut / micrometer-reading sequence until micrometer reading are identical, i.e.

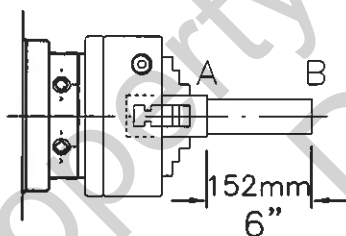


Fig. 24-P1

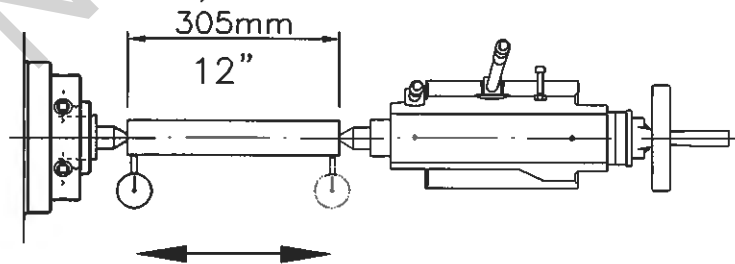


Fig. 24-P2

* Tailstock check : (reference Fig. 24-P2)

1. Using a 12" (305mm) ground steel bar fitted between headstock and tailstock centers, check the alignment by fitting a dial-test indicator to the toolpost and traversing the center line of the bar.
2. To correct error, release the tailstock clamp lever and adjust the set-over screws provided.
3. Continue with checking and correction until alignment is perfect.

CHAPTER 3 ◦ TO ACHIEVE MAXIMUM TURNING EFFICIENCY

In order to make the most economical use of the lathe and to achieve maximum turning efficiency in surface finish and shortest machining time, the cutting conditions of set-up of cutting tool, cutting speed, feed, depth, and application of coolant fluid should be established. In determining the cutting speed, feed and cutting depth, the material and diameter of workpiece and material and shape of cutting tool are the most important factors. In determining the most efficient speed for various kind of material, the operator is advised to refer to machining handbook.

(1) The Cutting Speeds and Feeds for High Speed Steel Cutting Tools are as Follows:

	Low Carbon Steel	High Carbon Steel Annealed	Alloy Steel Normalized	Aluminum Alloys	Cast Iron	Bronze
Roughing speed SFM	90	50	45	200	70	100
Finishing speed SFM	120	65	60	300	80	130
Feed IPR roughing	.010– .020	.010– .020	.010– .020	.015– .030	.010– .020	.010– .020
Feed IPR finishing	.003– .005	.003– .005	.003– .005	.005– .010	.003– .010	.003– .010

Spindle speeds are determined by using—following formula, which is used in turning between centers as well as in facing

$$\text{RPM} = \frac{\text{CS} \times 4}{D}$$

RPM=Spindle speed, revolution per minute
D=Diameter of workpiece
CS=Cutting speed in surface feet per minute(SFM)

EXAMPLE

If the cutting speed is 40 for a certain alloy steel and the workpiece is 2 inches in diameter, find the rpm as follows:

$$\text{RPM} = \frac{40 \times 4}{2} = 80$$

After calculating the PRM, use the nearest or next lower speed on the lathe and set the spindle speed.

CHAPTER 3 • MATERIAL AND SHAPE OF CUTTING TOOLS

(2) Material And Shape of Cutting Tools

the most commonly used material for turning tools is high speed steel, the recommended shape (cutter angle degrees) for high speed steel tools is as follows:

	End Relief	Side Relief	Side Rake	Back Rake
Aluminum	8 to 10	12 to 14	14 to 16	30 to 35
Brass, free cutting	8 to 10	8 to 10	1 to 3	0
Bronze, free cutting	8 to 10	8 to 10	2 to 4	0
Cast iron, gray	6 to 8	8 to 10	10 to 12	3 to 5
Copper	12 to 14	13 to 14	18 to 20	14 to 16
Nickel and monel	12 to 14	14 to 16	12 to 14	8 to 10
Steels, low carbon	8 to 10	8 to 10	10 to 12	10 to 12
Steels, alloy	7 to 9	7 to 9	8 to 10	6 to 8

However, the cutting tool materials such as carbon steels and high speed steel that served the needs of machining in the past years are not suitable in many application today. Tougher and harder tools are required to machine the tough, hard space age metals and new alloys. The knowledge of carbide cutting tools and ability to select them for specific machining tasks will affect productivity directly.

The following steps may be used in selecting the correct carbide tool for a job.

Step 1. Establishing the cutting conditions of speed, feed, and depth of cut to establish metal removal rate.

Step 2. Selecting cemented carbide grade. Its grade classification and comparison table with CCPA "C" numbers and manufacturers designations are briefed as follows:

CHAPTER 3 • MATERIAL AND SHAPE OF CUTTING TOOLS

The Grades Listed Are Those Usually Recommended
by the Manufacturer for the Categories Shown

APPLICATION			Carbide	Ex-cell-o	Firth Sterling	Greenleaf	Kennametal	Metal Carbides	Sandvik	Valenite
Cast irons	Roughing cuts	C-1	CA3	E8	H HB	G10	K1	C89	H20	VC-1
Nonferrous, Nonmetallic, Hi-Temperature alloys	General purpose	C-2	CA4 CA443	E6 XL620	HA HTA	G20 G25	K6 K68	C91	H20	VC-2 VC-28
200&300 series stainless	Light finishing	C-3	CA7	E5	HE HTA	G30	K8 K68	C93	R1P	VC-3
	Precision boring	C-4	CA8	E3	HF	G40	K11	C95	H1P H05	VC-4
	Roughing cuts	C-5	CA721 CA740	10A 945	NTA TXH	G50 G55	K42 K21	S-880	S-6	V-55 VC-125
Carbon steels	General purpose	C-6	CA720	BA 606	T22 T25	G60	K2S K21	S-900 S-901	S-4	VC-6
Alloy steels	Finishing cuts	C-7	CA711	6A XL70 6AX	T25 T31	G70 G74	K45 K5H	S-92 S-900	SM	VC-7 VC-76
400 Series stainless	Precision boring	C-8	CA704	6AX XL88	T31	G80	K7H K165	S-94	F02	XC-8 XC-83
	Hi-velocity	C-80					C06			

CHAPTER 3 ◦ APPLICATION OF COOLANT FLUID

- Step 3. Select nose radius
- Step 4. Select insert shapes
- Step 5. Select insert size
- Step 6. Select insert thickness
- Step 7. Select tool style
- Step 8. Select rake angle
- Step 9. Select shank size

(3) APPLICATION OF COOLANT FLUID

Coolants are used for heavy duty and production turning. Oil–water emulsions and synthetic coolants are the most commonly used, while sulfurized oils usually are not used for turning operations except for threading. Most job work or single piece work is done dry. Many shop lathes do not have a coolant pump and tank, so, if any coolants and cutting oils for various materials are given in following table.

Coolants and Cutting Oils Used for Turning

Material	Dry	Water Soluble Oil	Synthetic Coolants	Kerosene	Sulfurized Oil	Mineral Oil
Aluminum		x	x	x		
Brass	x	x	x			
Bronze	x	x	x			x
Cast iron	x					
Steel						
Low carbon		x	x			
Alloy		x	x		x	
Stainless		x	x		x	

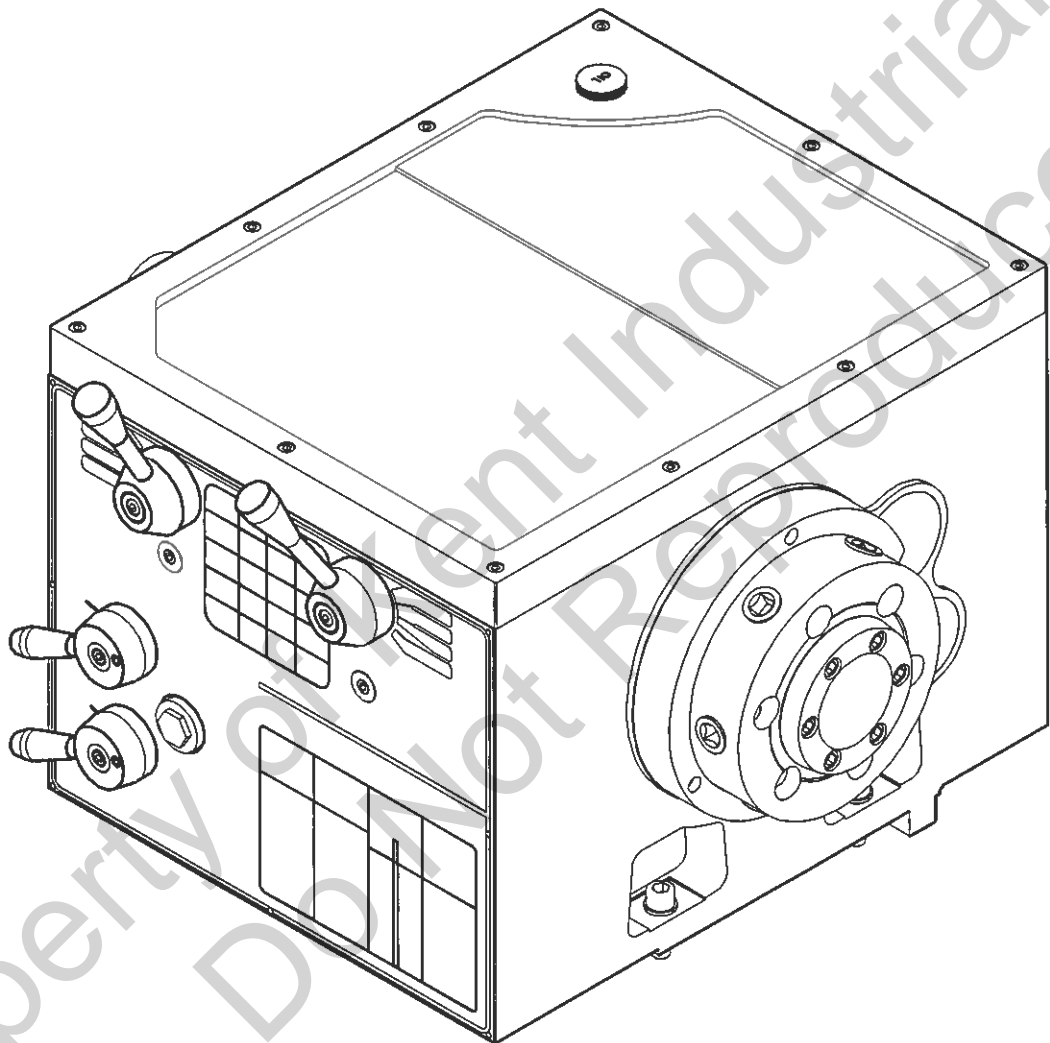
CHAPTER 4 • TROUBLE SHOOTING

	Trouble or Failure	Possible causes	Correction
1	The electricity is on, but the spindle dose not run after the starting lever is moved downwar or upward	1) Fuse is burned 2) Thermal relay is overload	1) Replace fuse 2) Reset thermal relay
2	Outflow of coolant fluid is weak	1) Running orientation of coolant pump is worng 2) The inside of coolant pipe is rusterd or otherwise restricted	1) interchange any two line of 3 phase line 2) Clear the pipe by compressed air or rigid steel rod
3	No coolant fluid comes out of coolant nozzle	The steel ball inside the coolant pipe is stuck to "O" ring	Seperate the steel ball from "O" ring by compressed air
4	Spindle dose not stop instantly even when treadle is fully depressed	The height of treadle is too low	Adjust brake belt to more tight
5	Intermittent noise in headstock	Headstock shift levers are not in position	Stop the machine and re-shift levers to the position where steel ball slips into the concave
6	Headstock and gear train are running and strting lever is moved upward or downward, but the feed rod or leadscrew does not rotate	Gearbox shift levers are not in position	Shift levers to correct positions as specified on data plate
7	When turning long workpiece the right end is smaller than the left end in diameter	Tailstock is not in good alignment to headstock	Offset tailstock until the center line between headstock is parallel to carriage movement
8	Chatter line occurs on turned workpiece	1) Lathe cutter is dull 2) Spindle taper roller bearing is too loose	1) Sharpen the cutting angles of lathe cutter 2) Adjust the tightness of P/N 10011 nut.
9	No Oil comes out of one shot lubrication	Too much air is caught oil groove	Keep on pushing one shot lubrication pump until all air is driven out
10	Sharp, shriek noise in braking action	Brake lining has been worn out	Replace the brake lining
11	Carriage vibrates during heavy cutting	P/N 50053/50056 gip is too loose in fitting	Adjust screw cross slide & tool slide to drive the gib slightly inside
12	Oil leaks at right side of gearbox	The lubricant in gearbox is too light	Replace with slightly denser lubricant in gearbox

CHAPTER 5 SPARE PARTS (ILLUSTRATED)

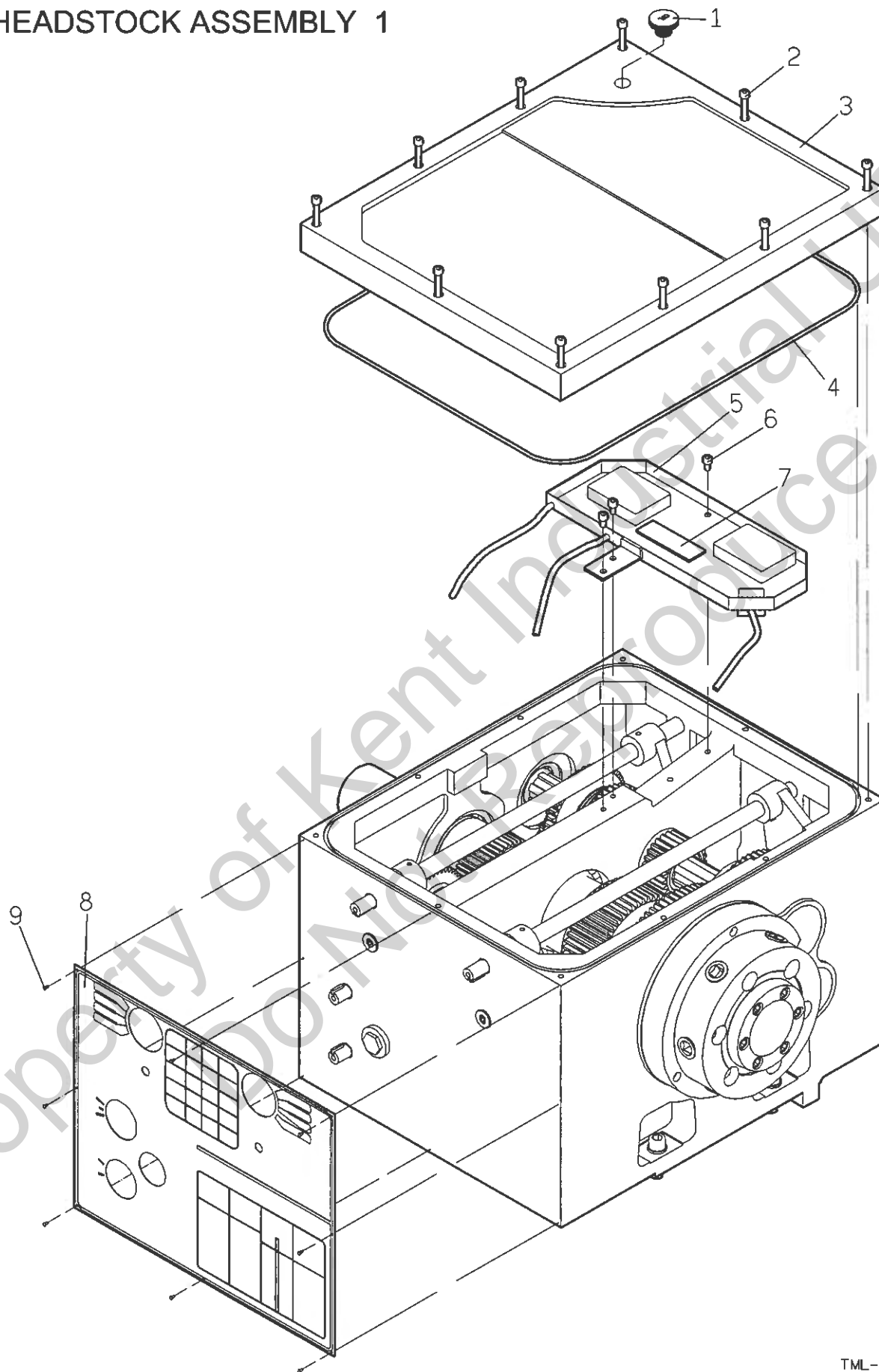
- **HEADSTOCK ASSEMBLY**A01/A02/A03/A04/A05
 PARTS LIST.....A06/A07
- **GEARBOX ASSEMBLY**B01/B02/B03
 PARTS LIST.....B04/B05
- **APRON(L.H) ASSEMBLY**C01/C02
 PARTS LIST.....C03/C04
- **DIAL INDICATOR ASSEMBLY**.....D01
 METRIC (LEADSCREW PITCH 6).....D02
 IMPERIAL (LEADSCREW 4 T.P.I.).....D03
 PARTS LIST.....D04
- **4 WAY TOOL POST**E01/E02
 PARTS LIST.....E03
- **SADDLES ASSEMBLY**F01/F02/F03
 PARTS LIST.....F04
- **BED & SHAFTS ASSEMBLY**.....G01/G02
 PARTS LIST.....G03
- **CONVENTIONAL TAILSTOCK ASSEMBLY**.....H01/H02
 PARTS LIST.....H03
- **END GEAR ASSEMBLY**I01
 METRIC (LEADSCREW PITCH 6) FOR 1640/1660.....I02
 IMPERIAL (LEADSCREW 4 T.P.I.) FOR 1640/1660.....I03
- **MAIN MOTOR ASSEMBLY** (FRONT MOVEABLE CHIP TRAY OPTIONAL).....J01/J02
 PARTS LIST.....J03
- **CABINET AND PANEL** (FRONT MOVEABLE CHIP TRAY OPTIONAL).....K01/K02
 PARTS LIST.....K03

HEADSTOCK ASSEMBLY



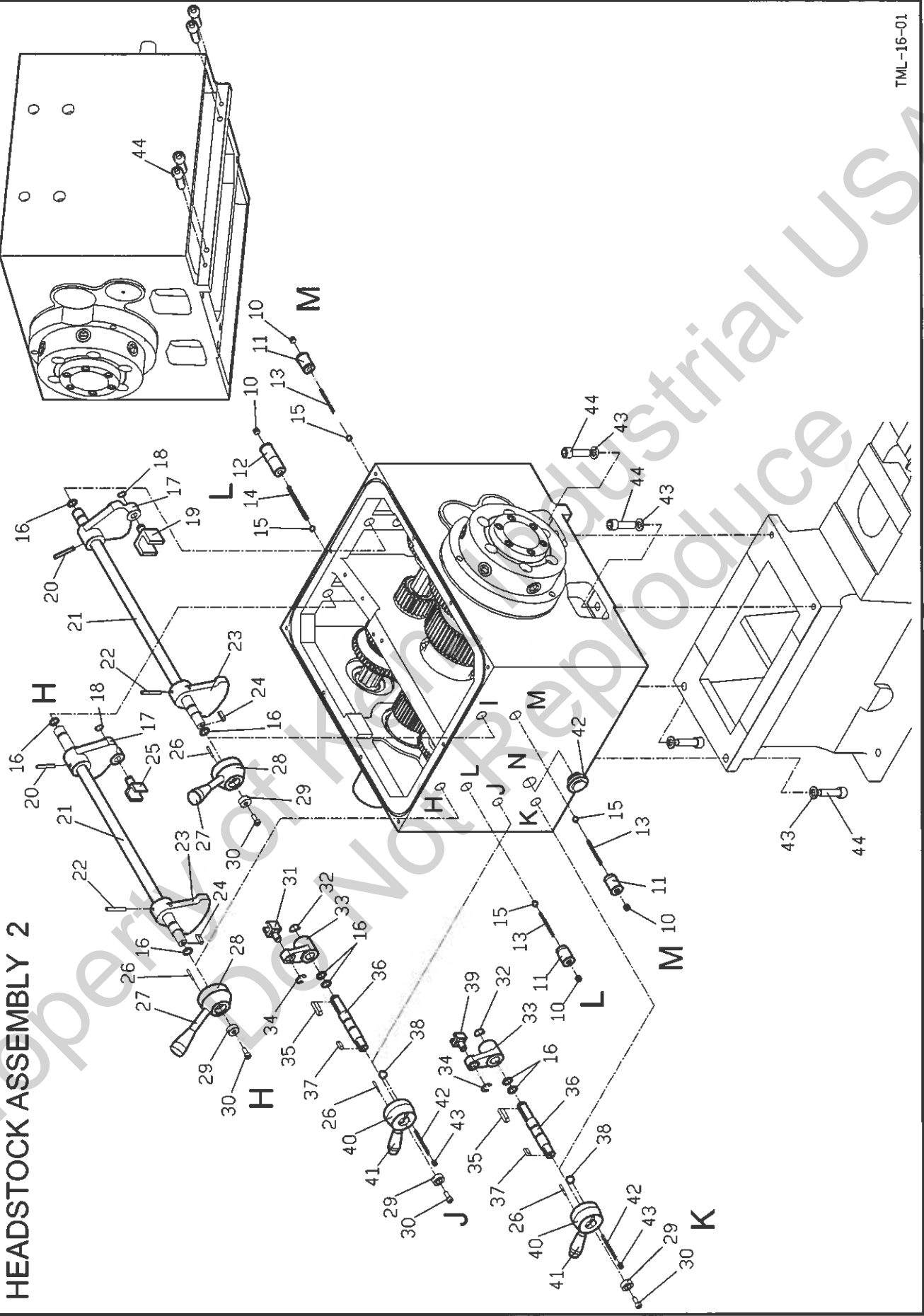
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HEADSTOCK ASSEMBLY 1

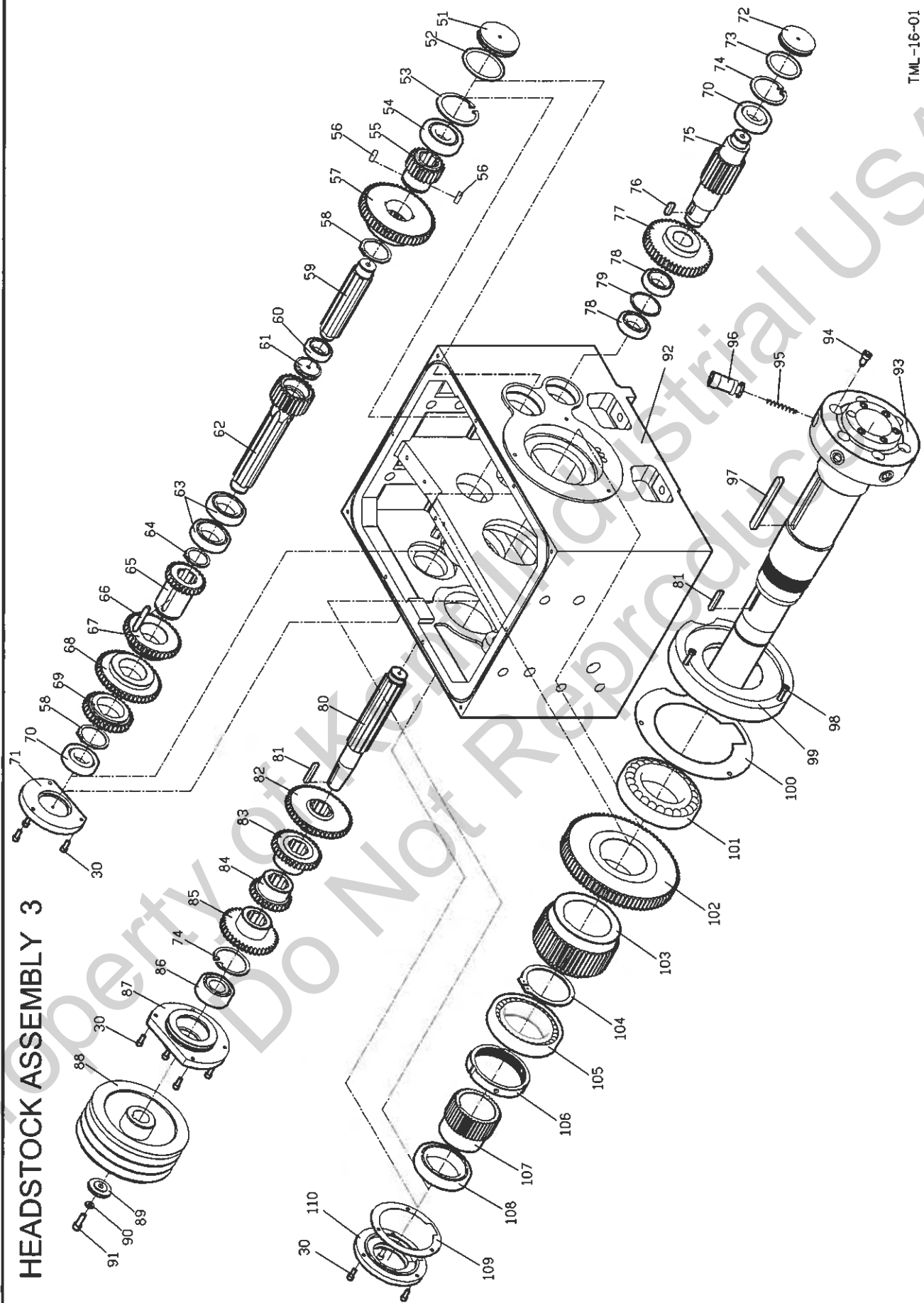


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HEADSTOCK ASSEMBLY 2

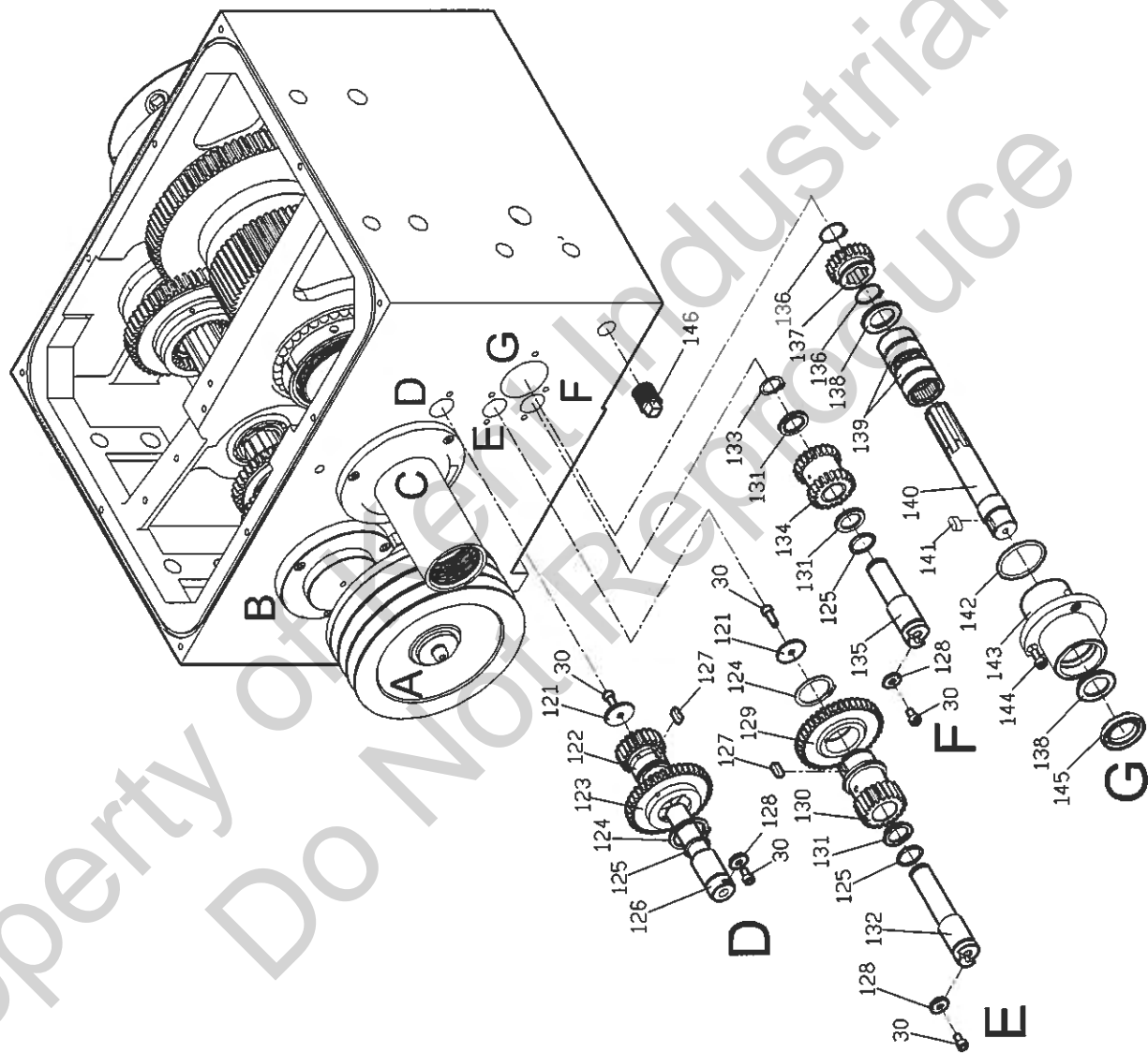


HEADSTOCK ASSEMBLY 3



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HEADSTOCK ASSEMBLY 4



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HEADSTOCK ASSEMBLY

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KEY NO.	PARTS NO.	PARTS NAME	QTY	REMARK	KEY NO.	PARTS NO.	PARTS NAME	QTY	REMARK
1		Oil Cover	1	3/4"	38		Steel ball	2	ϕ 1/4"
2		Hex. socket head bolt	10	M6x40	39	RML-20034	Fork	1	
3	RML-10057A	Head stock cover	1		40	RML-20021	Hub	2	
4		"O" ring	1	ϕ 4x1700	41	RML-20048	Handle	2	
5	61053	Oil tank	1		42	RML-20022	Spring	2	ϕ 6x27.5L
6		Hex. socket head bolt	3	M6x10	43		Set screw	2	M8x8L
7		Magnetic iron plate	1		44		Oil sight	1	3/4"
8	10063	Name plate	1		45		Spring washer	4	M12
9		Rivet	8	ϕ 2	46		Hex. socket head bolt	4	M12x40
10		Set screw	4	M10x10L					
11	10067	Bush	3						
12	10066	Bush	1						
13	10029	Spring	3	ϕ 8x45L					
14	ML-10084	Spring	1	ϕ 8x52.5L	51	ML-10037	Plug	1	
15		Steel ball	4	ϕ 8.5	52		"O" ring	1	G65
16		"O" ring	8	P16	53		Clip	2	R72
17	10050	Lever	2		54		Ball bearing	1	6306
18		Clip	2	S12	55	ML-10017	Gear(23T)	1	Assembly for replacement
19	10052	Fork	1		56		Key(8x7x21L)	2	
20		Spring pin	2	ϕ 6x36	57	ML-10018	Gear(52T)	1	
21	RML-20014	Rod	2		58		Clip(S50)	1	
22		Spring pin	2	ϕ 6x40	59	ML-10016	Shaft	1	
23	ML-10048	Lever	2		60		Ball bearing	1	6005
24		Key	2	5x5x22L	61	10036	Spacer	1	
25	RML-20025	Fork	1		62	10009	Gear	1	25T
26		Spring pin	4	ϕ 3x24	63		Ball bearing	2	6008
27	RML-20004	Handle	2		64		Clip	1	S38
28	RML-20003	Hub	2						
29	RML-20027	Washer	4		58		Clip(S50)	1	Assembly for replacement
30		Hex. socket head bolt	19	M6x16	65	10010	Gear(26T)	1	
31	RML-20044	Fork	1		66		Key(8x7x55L)	1	
32		Clip	2	S15	67	10011	Gear(39T)	1	
33	RML-20032	Lever	2		68	10012	Gear(45T)	1	
34		Clip	2	E8	69	10013	Gear(33T)	1	
35		Key	2	5x5x30L	70		Ball bearing	2	6206
36	RML-20005	Shaft	2		71	10035	Cover	1	
37		Key	2	5x5x17L	72	10039	Plug	1	

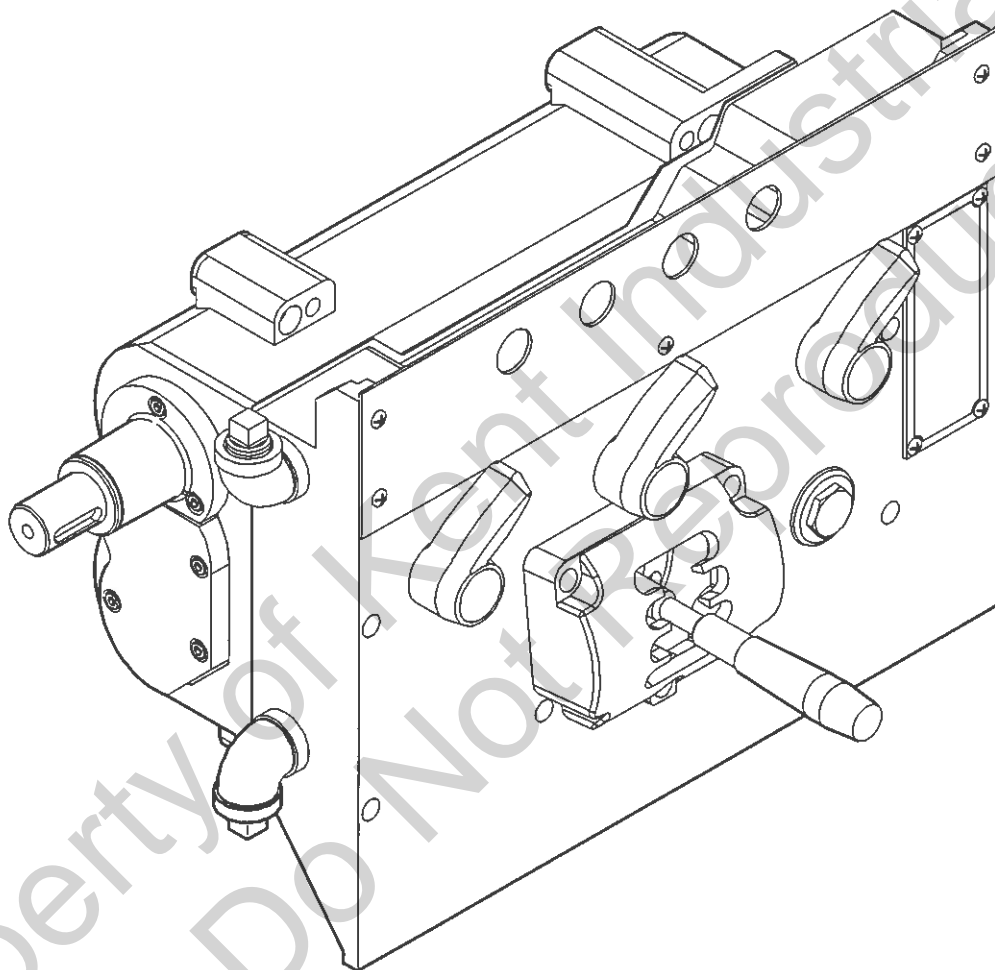
HEADSTOCK ASSEMBLY

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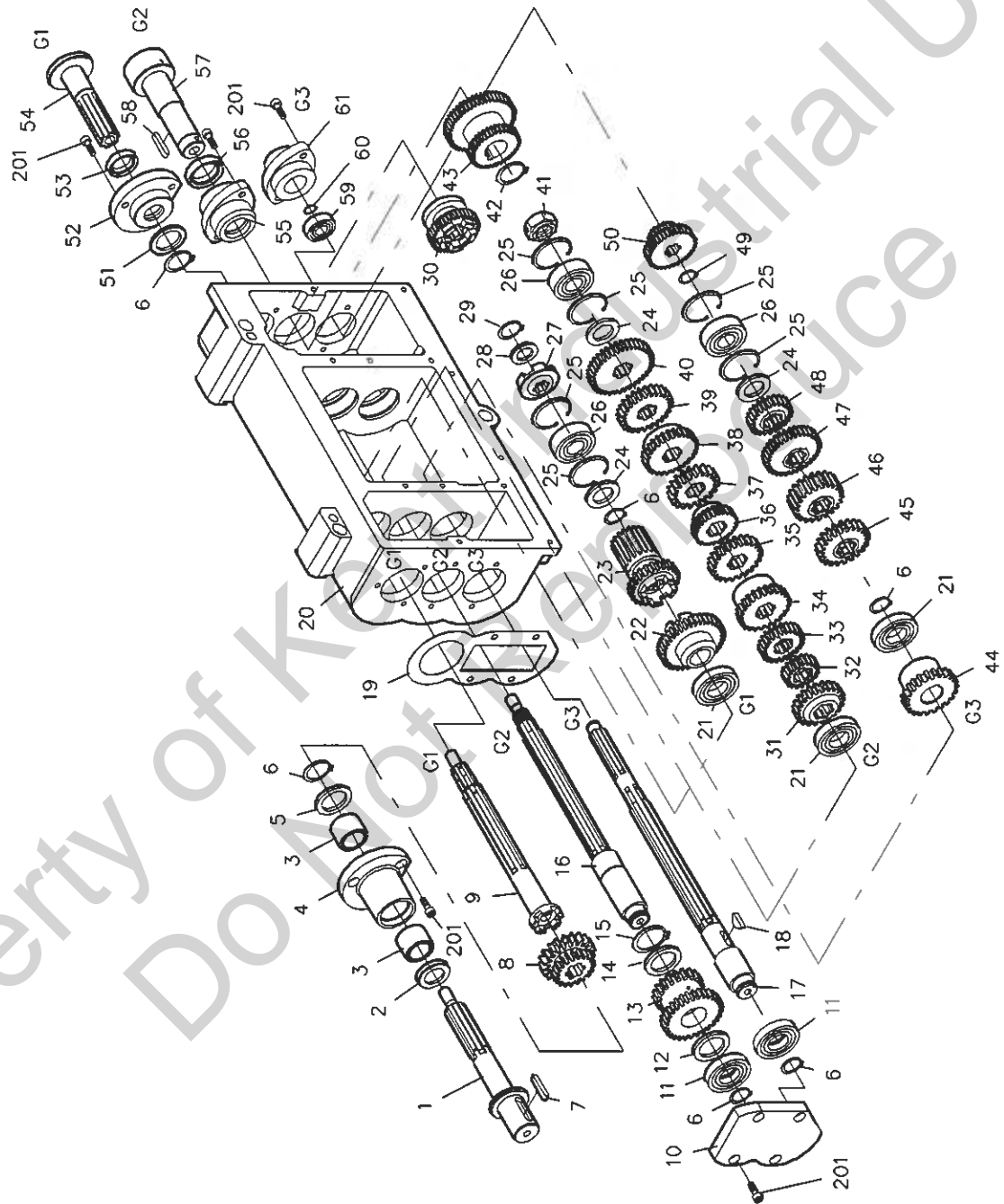
KEY NO.	PARTS NO.	PARTS NAME	QTY	REMARK	KEY NO.	PARTS NO.	PARTS NAME	QTY	REMARK
73		"O" ring	1	G52	110	RML-10012	Outside cover	1	
74		Clip	2	R62					
75	ML-10014	Gear	1	20T					
76		Key	1	8x7x25L	121	RML-10038	Washer	2	
77	ML-10015	Gear	1	47T	122	TRL-10049	Gear(21T)	1	
78		Ball bearing	2	6006	123	TRL-10050	Gear(42T)	1	Assembly for replacement
79	ML-10065	Collar	1		124		Clip(S35)	1	
80	10004	Gear shaft	1		127		Key(6x6x16L)	1	
81		Key	1	7x7x45L					
82	10008	Gear	1	46T	125		"O" ring	3	P21
83	10007	Gear	1	33T	126	TRL-10034	Shaft	1	
84	10006	Gear	1	27T					
85	10005	Gear	1	39T	124		Clip(S35)	1	
86		Ball bearing	1	5206	127		Key(6x6x16L)	1	Assembly for replacement
87	10033	Flanged bearing	1		129	TRL-10048	Gear(42T)	1	
88	RML-10031	Pully	1		130	TRL-10047	Gear(21T)	1	
89	RML-10032	Washer	1						
90		Spring washer	1	M8	128	TRL-10039	Washer	3	
91		Hex. socket head bolt	1	M8x25					
92	10001	Head stock	1		131	RML-10036	Washer	3	
93	10003-D6	Spindle	1		132	TRL-10035	Shaft	1	
94	RML-10003	Bolt	6		133		Clip	2	S20
95	RML-10005	Cam spring	6		134	RML-10046	Gear	1	21T
96	RML-10004	Cams	6		135	TRL-10033	Shaft	1	
97		Key	1	12x8x120L	136		Clip	2	S25
98		Hex. socket head bolt	6	M6x35	137	RML-10051	Gear	1	21T
99	10038-D6	Front bearing cover	1		138	RML-10037	Washer	2	
100	10038-P	Packing F	1		139		Needle bearing	2	RNA-6904
101		Ball bearing	1	32019XU	140	RML-10040	Shaft	1	
102	10019	Gear	1	82T	141		Key	1	7x7x16L
103	10020	Gear	1	53T	142		"O" ring	1	P44
104		Clip	2	S85	143	RML-10041	Flange bearing	1	
105		Ball bearing	1	32017XU	144		Hex. socket head bolt	3	M6x12
106		Nut	1	YSR85	145		Oil seal	1	28x44x07
107	10021	Gear	1	42T	146		Square head plug	1	1/2"
108		Ball bearing	1	6013					
109	RML-10012-P	Packing O	1						

GEARBOX ASSEMBLY (For RML-14/16")

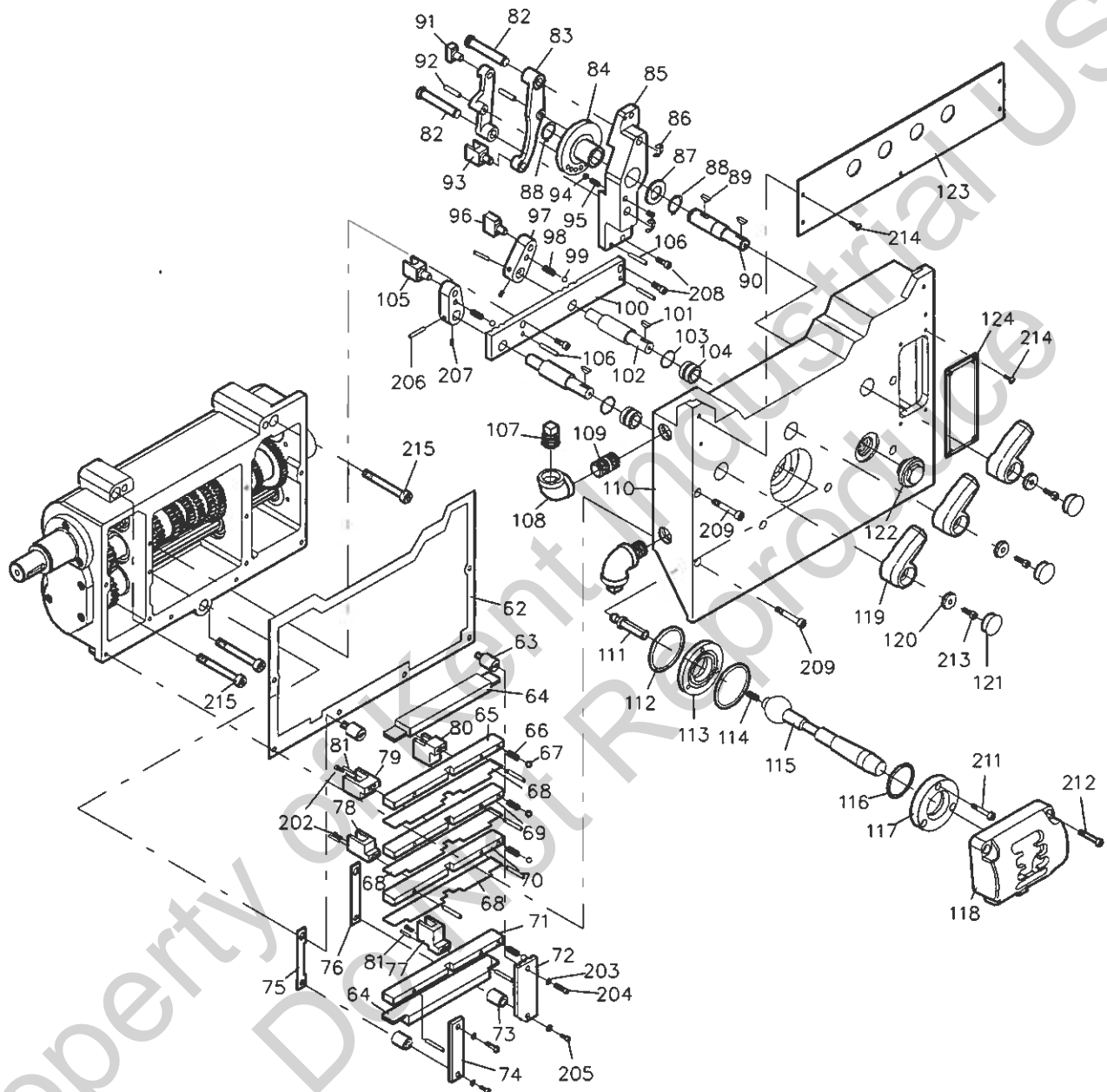


TML-16-02

GEARBOX ASSEMBLY 1



GEARBOX ASSEMBLY 2 (For RML-14/16")



TML-16-02

GEARBOX ASSEMBLY

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KEY NO.	PARTS NO.	PARTS NAME	Q'TY	REMARK	KEY NO.	PARTS NO.	PARTS NAME	Q'TY	REMARK
1	30003	Shaft	1		38	30029	Gear	1	28T
2		Oil seal	1	20x32x05	39	30030	Gear	1	26T
3		Bearing	2	TAF202820	40	30031	Gear	1	38T
4	30005	Flanged bearing	1		41	30032	Nut	1	
5	30016	Washer	1		42		Clip	1	S22
6		Clip	5	S20	43	30034	Gear	1	36T/50T
7		Key	1	7x7x35	44	30037	Gear	1	22T
8	30007	Gear	1	19T/20T	45	30038	Gear	1	22T
9	30008	Shaft	1		46	30039	Gear	1	22T
10	30018	Cover	1		47	30040	Gear	1	33T
11		Bearing	3	16004	48	30041	Gear	1	22T
12	30006	Washer	1		49		Clip	1	S17
13	30020	Gear	1	19T/30T	50	30042	Gear	1	20T/36T
14	30021	Washer	1		51	30016	washer	1	
15		Clip	1	S25	52	30017	Flanged bearing	1	
16	30019	Shaft	1		53		Oil seal	1	20x32x05
17	30036	Shaft	1		54	30014	Shaft	1	
18		Woodruff key	1	5x ϕ 19	55	30035	Flanged bearing	1	
19	30018-P	Oil seal	1		56		Oil seal	1	24x35x08
20	30001	Gearbox body	1		57	30033	Shaft	1	
21		Bearing	3	16004	58		Key	1	5x5x35
22	30009	Gear	1	38T	59		Bearing	1	6001
23	30010	Gear	1	23T/19T	60		Clip	1	S12
24	30011	Washer	1		61	30043	Flanged bearing	1	
25		Clip	6	R40	62	30002-P	Seal	1	
26		Bearing	3	6203	63	30084	Partition nut	2	
27	30012	Clutch	1		64	30077	Upper plate	2	
28	30013	Washer	1		65	30082	Fort support	1	
29		Clip	1	S16	66	30070	Spring	4	ϕ 4x19
30	30015	Gear	1	35T	67		Steel ball	3	1/4"
31	30022	Gear	1	22T	68	30079	Partition	3	
32	30023	Gear	1	19T	69	30080	Fort support	1	
33	30024	Gear	1	20T	70	30078	Fort support	1	
34	30025	Gear	1	24T	71	30081	Fort support	1	
35	30026	Gear	1	23T	72	30087	Reverse-stop	1	
36	30027	Gear	1	27T	73	30085	Spacer	2	
37	30028	Gear	1	24T	74	30086	Shoulder plate	1	

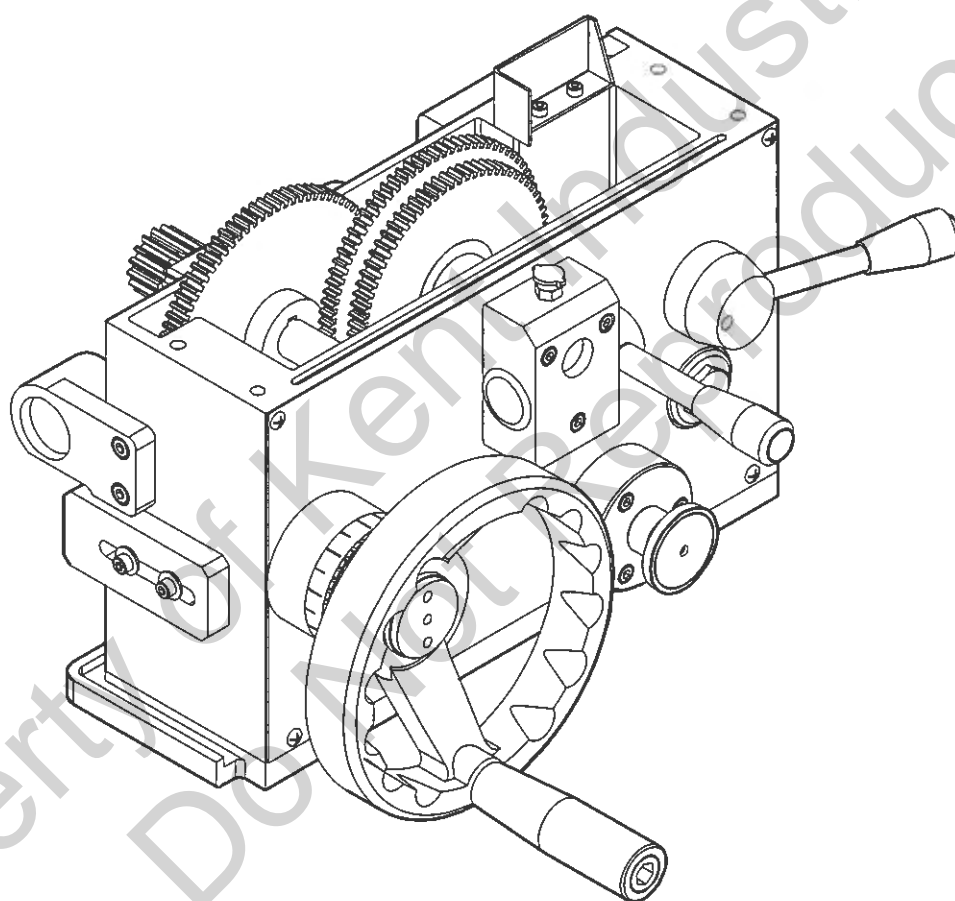
GEARBOX ASSEMBLY

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KEY NO	PARTS NO.	PARTS NAME	QTY	REMARK	KEY NO	PARTS NO.	PARTS NAME	QTY	REMARK
75	30100	Fixed plate A	1		112		O-ring	2	G40
76	30083	Fixed plate B	1		113	30066	Selector lever support	1	
77	30053	Fork	1		114	30069	Spring	1	φ 9x38
78	30055	Fork	1		115	30068	Selector lever	1	
79	30054	Fork	1		116		O-ring	1	G30
80	30053	Fork	1		117	30067	Selector lever cover	1	
81		Spring pin	8	φ 3x16	118	30076	Specifying base	1	
82	30061	Shaft	1		119	30071	Handle	3	
83	30065	Arm	1		120	30072	Washer	3	
84	30060	Cam	1		121	30073	Plug	3	
85	30059	Support seat	1		122		Oil sight	1	
86		Clip	2	E8	123	61022	Switch plate	1	For RL-14"
87	30058	Washer	1		124	30101	Plate	1	For RL-14"
88		Clip	2	S17					
89		Woodruff key	2	4x φ 13					
90	30057	Shaft	1						
91	30047	Pad	1		201		Hex. socket head bolt	14	M6x12L
92	30062	Pin	2	φ 5	202		Hex. socket head bolt	4	M5x20L
93	30063	Fork	1		203		Spring washer	4	M6
94		Steel ball	1	1/4"	204		Hex. socket head bolt	2	M6x12L
95	30049	Spring	1	φ 4x19	205		Hex. socket head bolt	2	M6x35L
96	30046	Pad	1		206		Spring pin	2	φ 4x24
97	30048	Lever	1		207		Set screw	2	M6x8L
98	30099	Spring	2	φ 6x13	208		Hex. socket head bolt	4	M6x20L
99		Steel ball	2	1/4"	209		Hex. socket head bolt	6	M6x70L
100	30052	Selector bar	1						
101		Woodruff key	2	4x φ 13	211		Hex. socket head bolt	3	M5x25L
102	30050	Shaft	2		212		Hex. socket head bolt	3	M6x12L
103		O-ring	2	P18	213		Hex. socket head bolt	3	M5x12L
104	30051	Bush	2		214		Dome cross screw	9	M4x6L
105	30045	Fork	1		215		Hex. socket head bolt	4	M8x65L
106		Spring pin	12	φ 5x16	216		Taper pin	2	#7x3 1/4"L
107		Square head plug	1	1/2"					
108		Elbow	1	1/2"					
109		Nipple	1	1/2"x1"					
110	30002-14	Gearbox cover	1	For RL-14"					
111	30088	Selector lever	1						

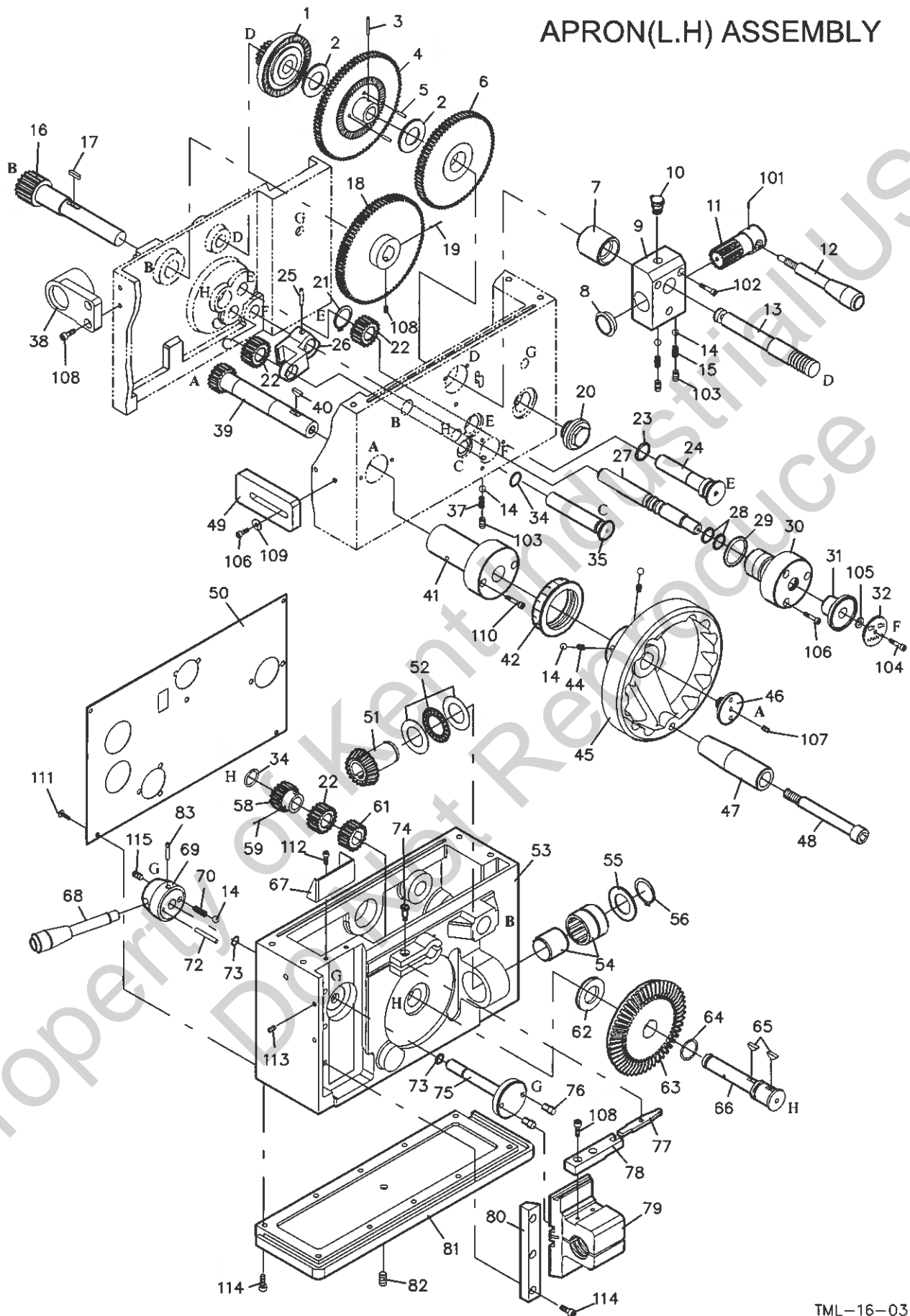
APRON(L.H) ASSEMBLY



TML-16-03

2009.04

APRON(L.H) ASSEMBLY



TML-16-03

2009.04

APPRON(L.H) ASSEMBLY

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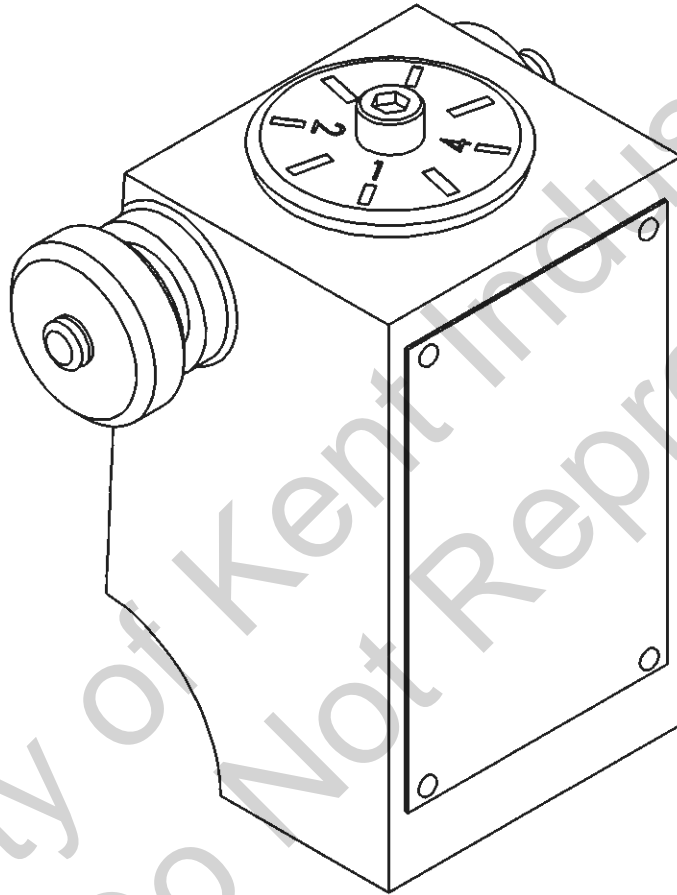
KEY NO.	PARTS NO.	PARTS NAME	QTY	REMARK	KEY NO.	PARTS NO.	PARTS NAME	QTY	REMARK
1	40014	Gear	1	18T/60T	37		Spring	1	φ 4x19
2		Washer	2	AS3047	38	50015	Bracket	1	
3		Spring pin	1	φ 4x22	39	40003	Gear shaft	1	18T
4	40015	Gear	1	81T/60T	40		Woodruff key	1	19x φ 5
5		Pin	3	φ 4x17	41	40004-M	Shaft liner	1	for Metric
6	40017	Gear	1	72T/60T		40004-I			for Imperial
7	40060	Collar	1		42	40005-M	Index ring	1	for Metric
8	40071	Plug	1			40005-I			for Imperial
9	40023	Gear bracket	1						
10		Oil cap	1		44	40016	Spring	3	
11	40019	Cam shaft	1		45	40007	Handle wheel	1	
12	40020	Handle	1		46	40011	Plug	1	
13	40018	Shaft	1		47	40009	Handle	1	
14		Stell ball	7	1/4"	48	40017	Screw	1	
15	40016	Spring	2	φ 6x13	49	40078	Safety plate	1	
16	40013	Gear shaft	1	16T	50	40077	Plate	1	
17		Key	1	5x5x18	51	40034	Bevel gear	1	23T
18	40012-M	Gear	1	82T(for Metric)	52		Thrust bearing	1	NTB/AS-2542
	40012-I			81T(for Imperial)	53	40001-L	Apron(L.H)	1	
19		Spring pin	1	φ 5x36		40001-R	Apron(R.H)		
20		Oil sight	1		54		Bearing	1	NK29/30
21		Clip	1	S16	55	40032	Washer	1	
22	40067	Gear	3	18T	56		Clip	1	S25
23		O-ring	2	P18					
24	40068	Shaft	1		58	40066	Gear	1	18T
25		Spring pin	1	φ 4x24	59		Spring pin	1	φ 5x22
26	40063-L	Fork(L.H)	1						
	40073-R	Fork(R.H)			61	40065	Gear	1	18T
27	40062	Shaft	1		62	40035	Washer	1	
28		O-ring	2	P16	63	40033	Bevel gear	1	64T
29		O-ring	1	P26					
30	40061	Shaft liner	1		65		Woodruff key	2	4x φ 13
31	40076	Knob	1		66	40031	Shaft	1	
32	40025-L	Plate(L.H)	1		67	49001-L	Oil fence	1	
	40024-R	Plate(R.H)			68	40037	Handle	1	
34		O-ring	2	P12	69	40038	Hub	1	
35	40064	Shaft	1		70		Spring	1	φ 6x27

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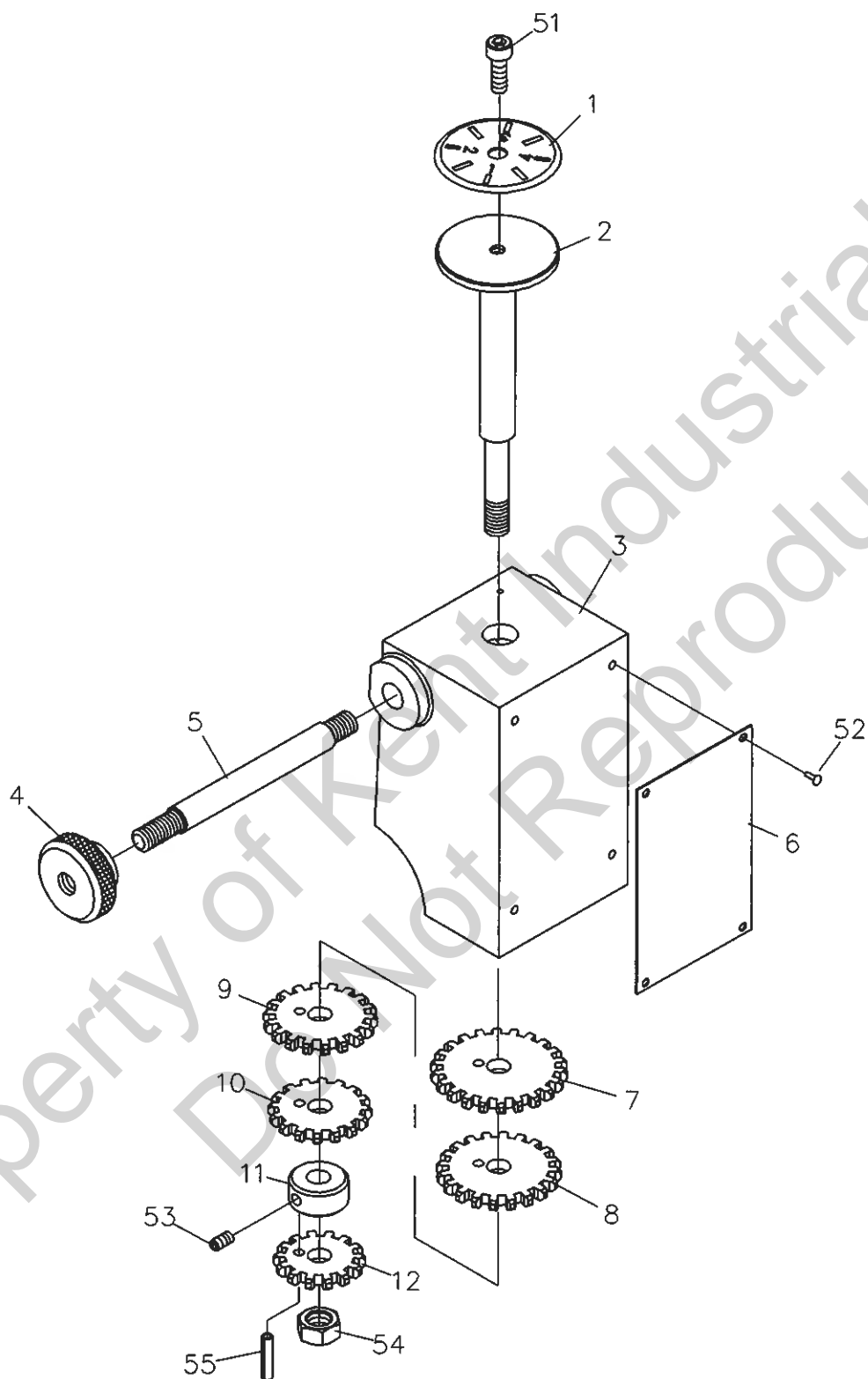
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DIAL INDICATOR ASSEMBLY



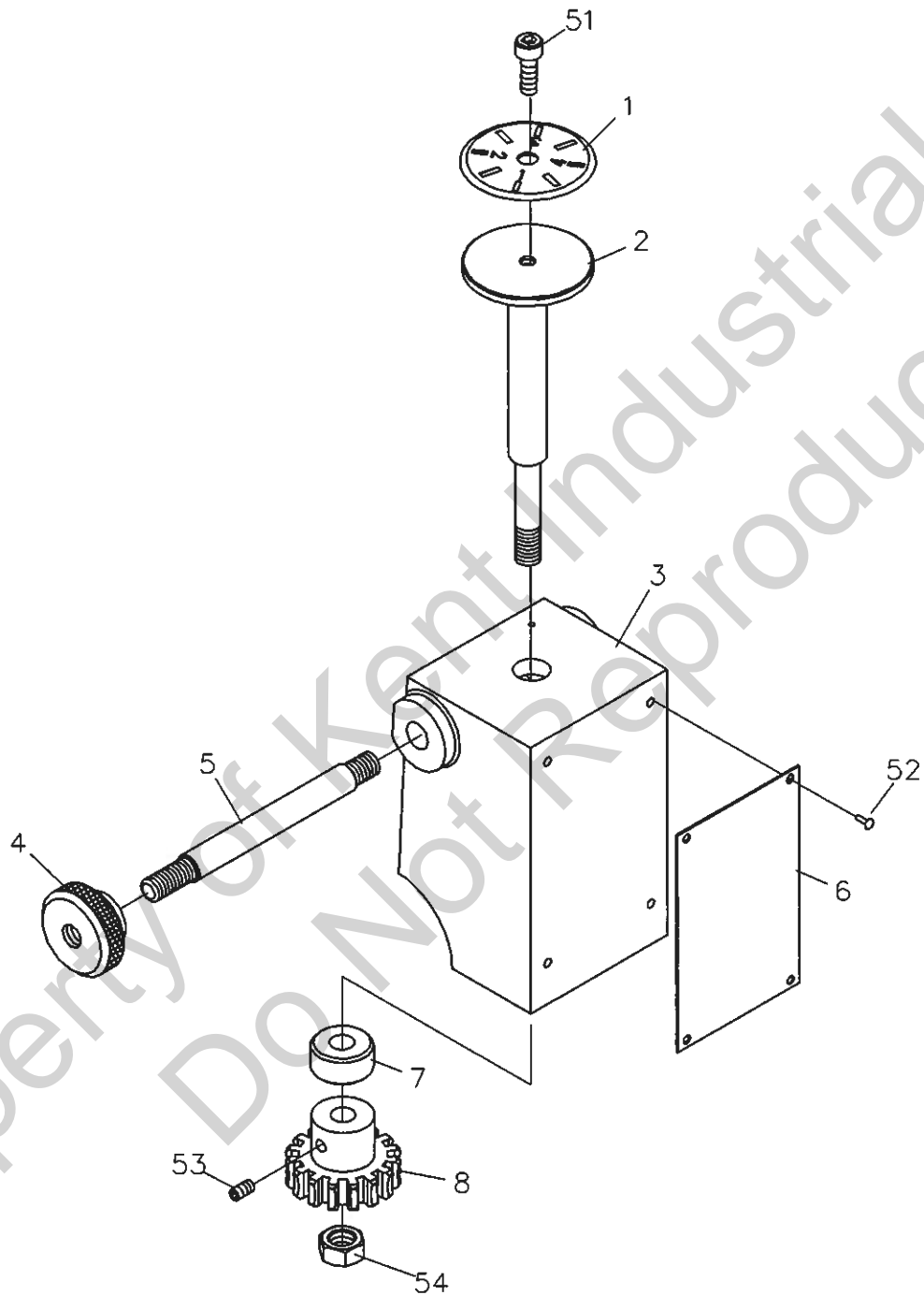
TML-16-04

DIAL INDICATOR ASSEMBLY METRIC (LEADSCREW PITCH 6)



TML-16-04

DIAL INDICATOR ASSEMBLY IMPERIAL (LEADSCREW 4 T.P.I.)



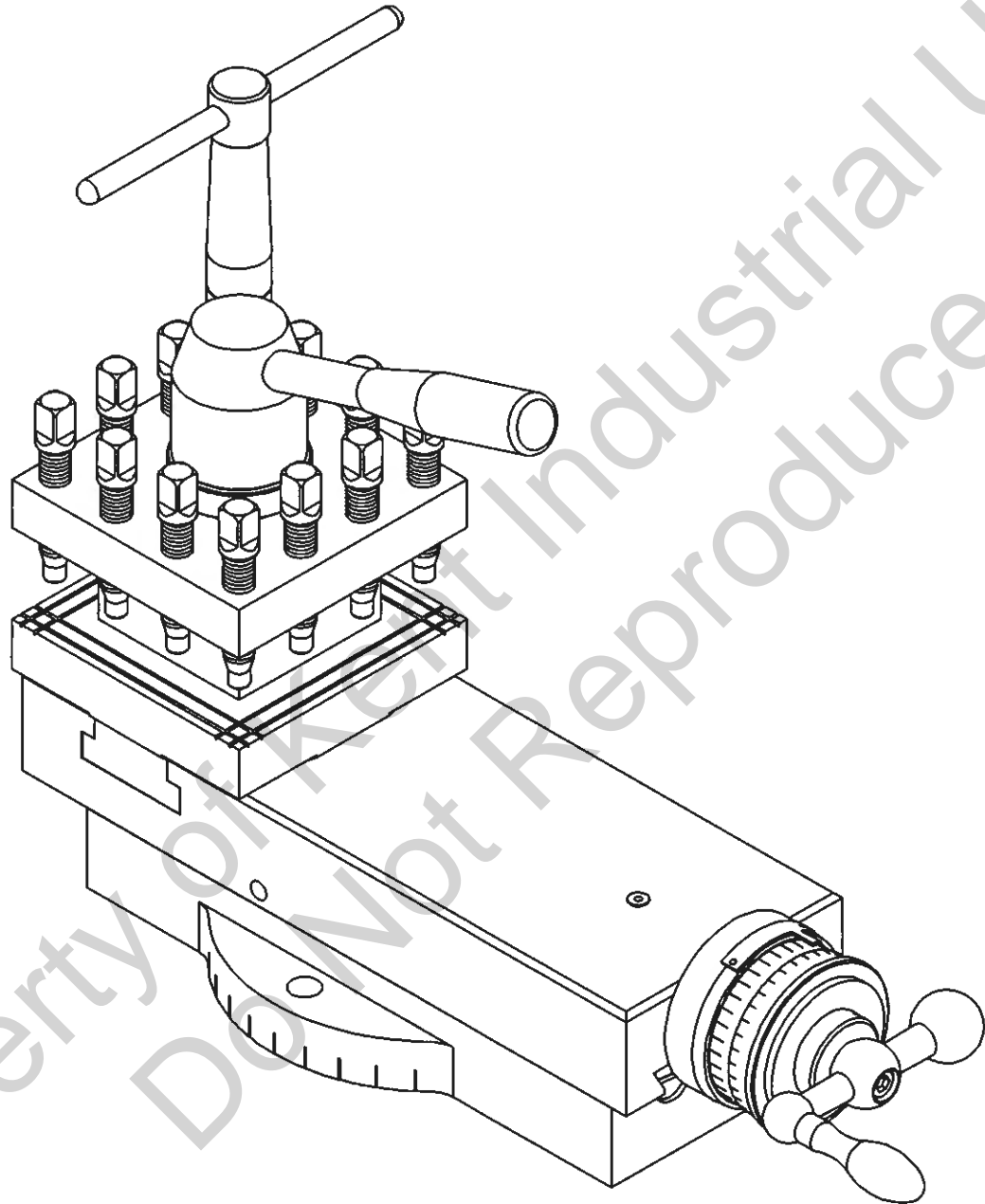
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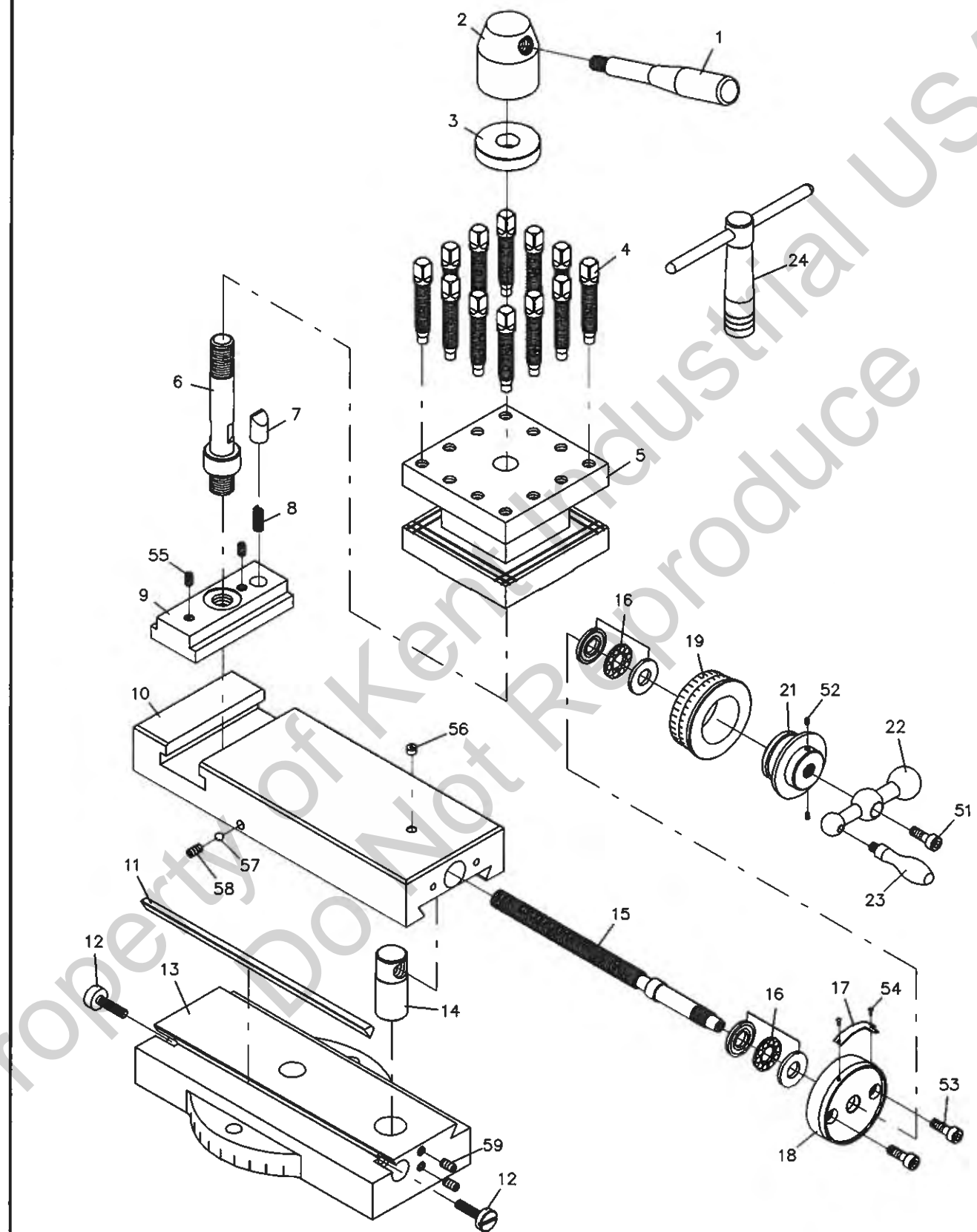
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4 WAY TOOL POST



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4 WAY TOOL POST

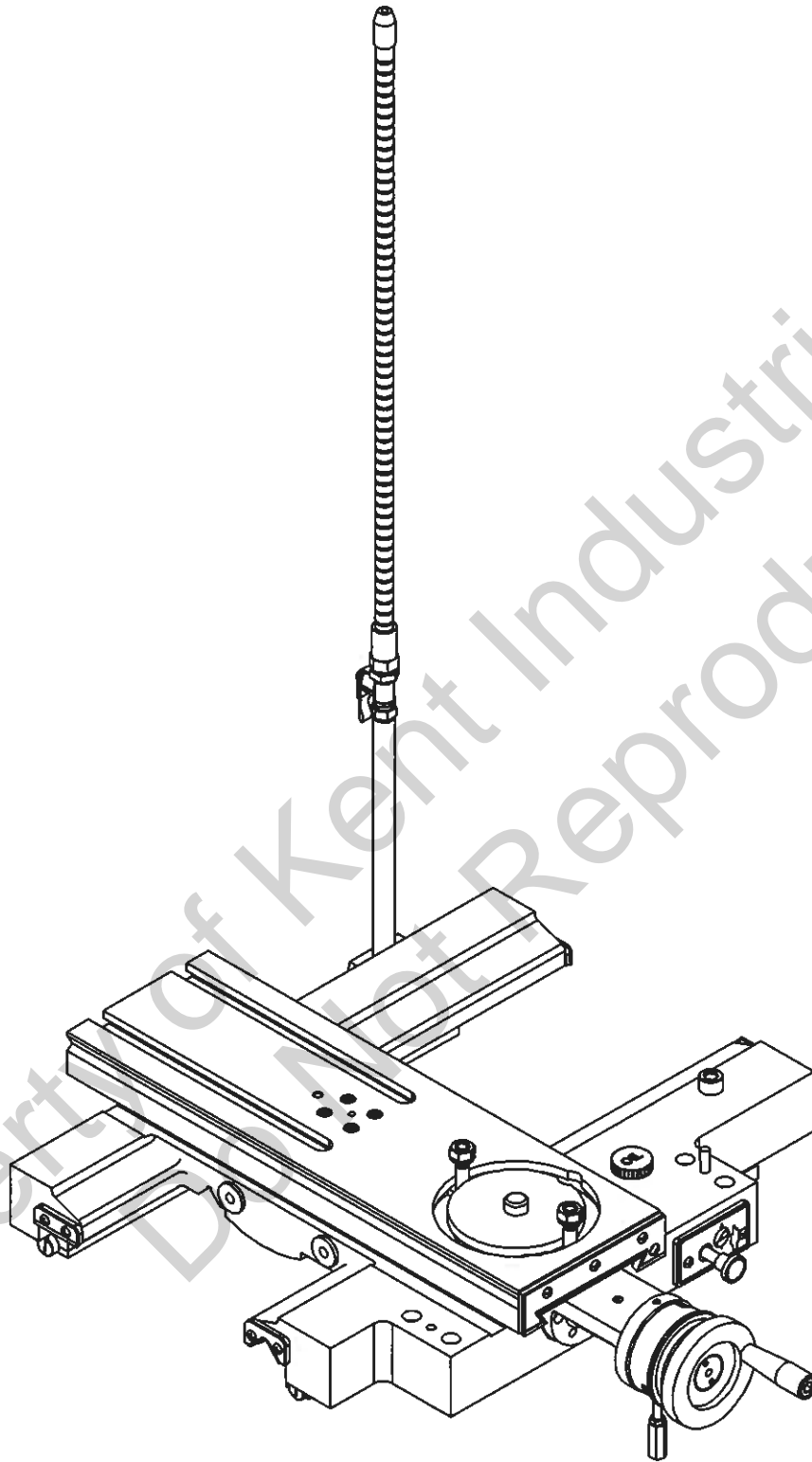


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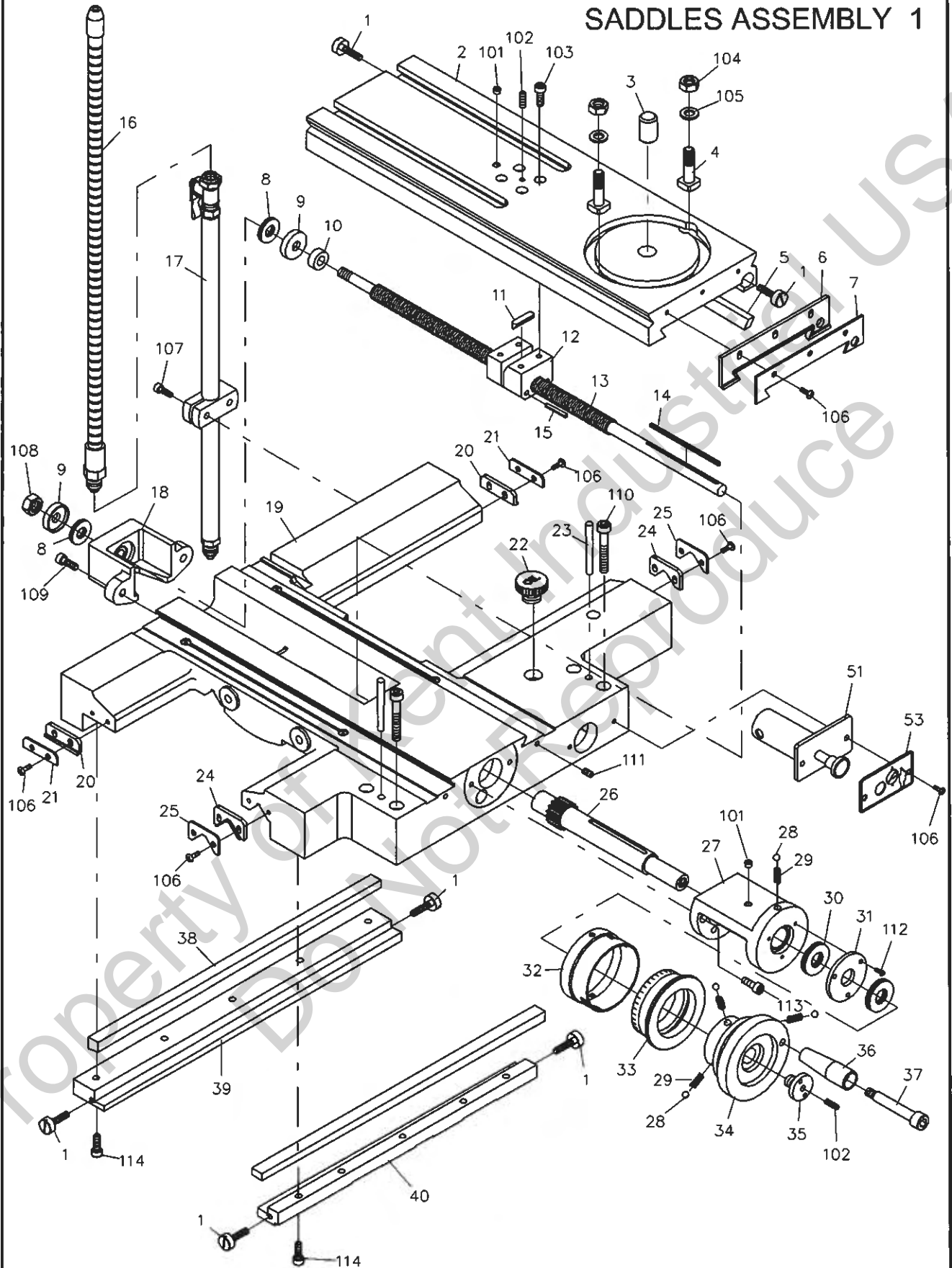
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SADDLES ASSEMBLY



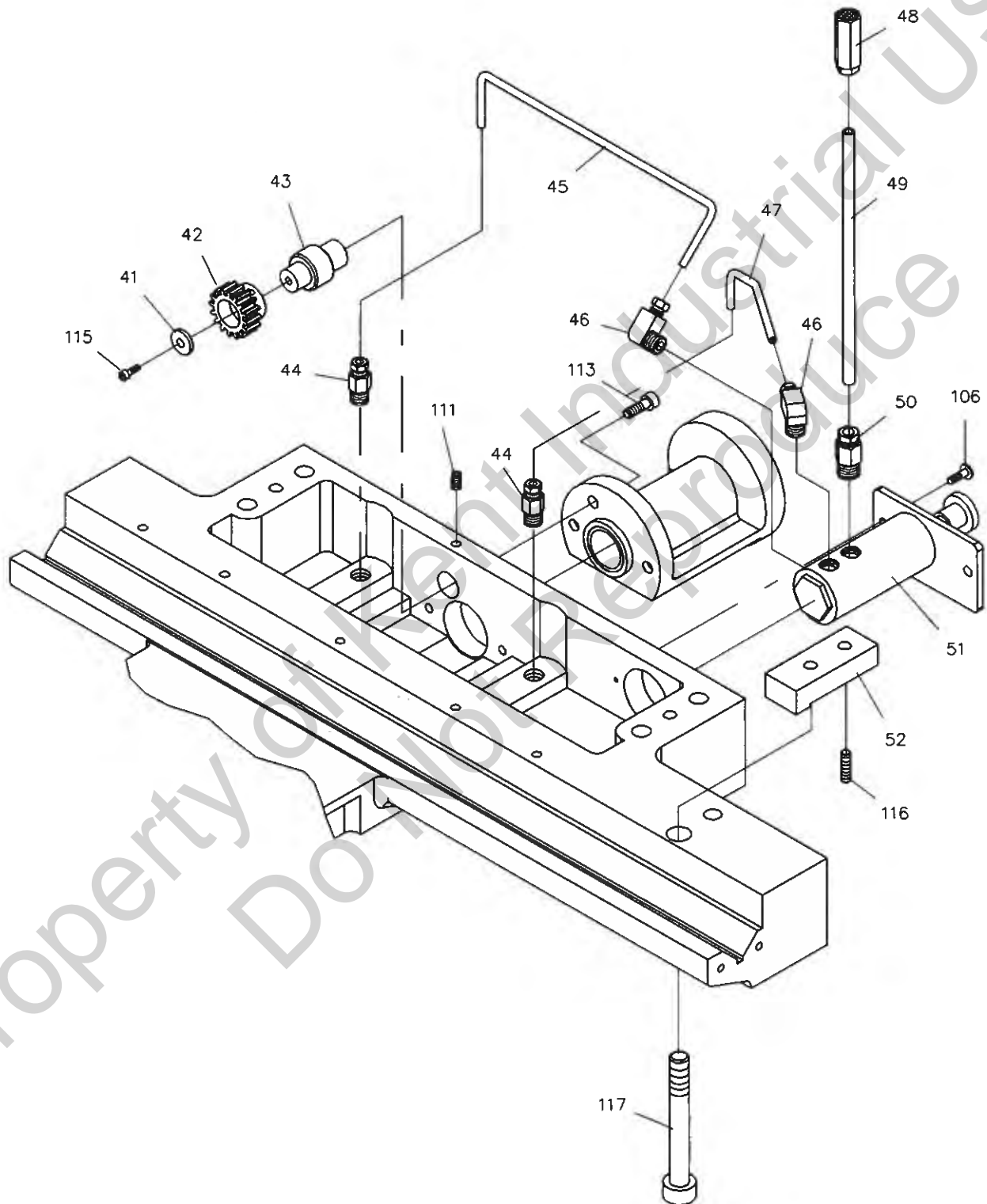
TML-16-06

SADDLES ASSEMBLY 1



TML-16-06

SADDLES ASSEMBLY 2



TML-16-06

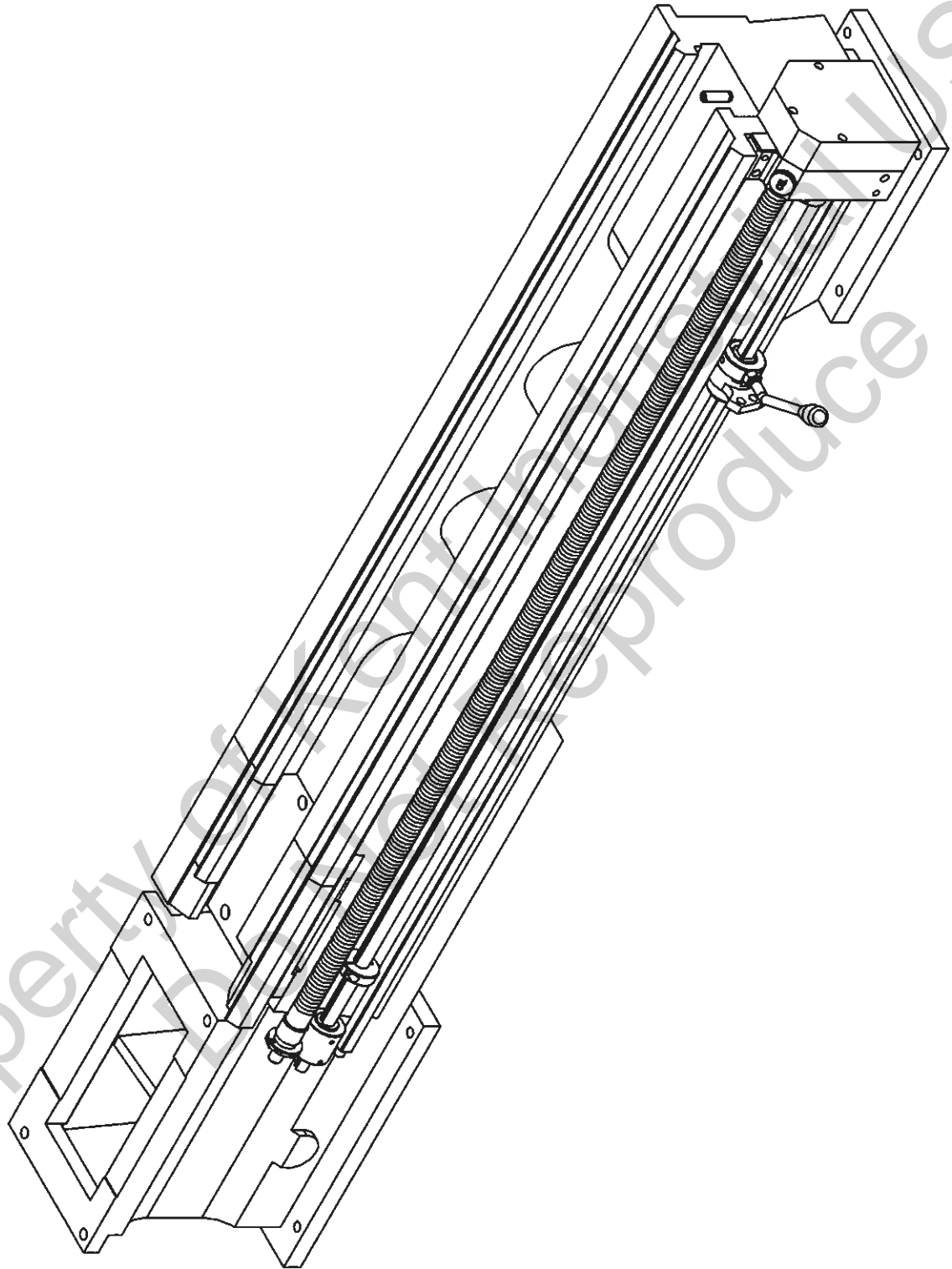
SADDLES ASSEMBLY

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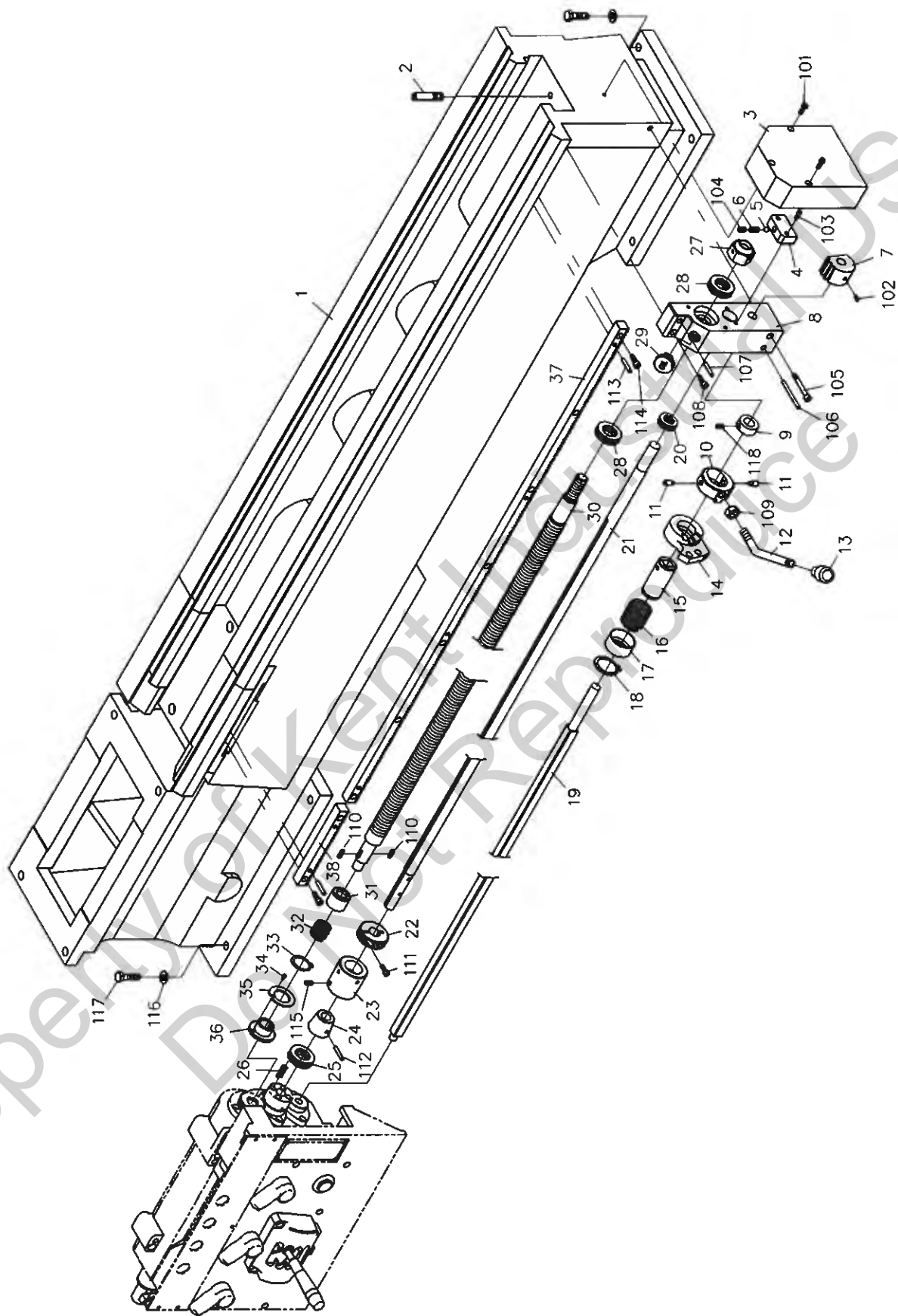
KEY NO.	PARTS NO.	PARTS NAME	Q'TY	REMARK	KEY NO.	PARTS NO.	PARTS NAME	Q'TY	REMARK
1	00AS16M6	Adjust screw	6		34	50029	Hand wheel	1	
2	50003	Cross slide 1416	1		35	50033	Fix screw	1	M12xP1.75
3	50036	Pivot	1	φ 18x28	36	50035	Handle	1	
4	50037	T bolt	2		37	50034	Bolt	1	
5	50023	Gib-X	1		38	50053	Gib-Z	2	
6	50070	Wiper-X	1		39	50052	Front anti-floater	1	
7	50069	Plate -X	1		40	50055	Rear anti-floater	1	
8		Thrust bearing	2	NTB/AS2 1226	41	50013	Washer	1	φ 6.5x φ 15x3
9	50026	Cap collar	2		42	50011	Gear	1	16T
10	50017	Washer	1		43	50012	Short shaft	1	
11	50021	Wedge	1	7x7x30	44		Straight adapter	2	1/8x φ 4
12	50019-M	Nut(for METRIC P=2.5mm)	1	Assembly for replacement	45		AL. tube	1	φ 4x260
13	50016-M	Screw(for METRIC P=2.5mm)	1		46		Elbow adapter	2	1/8x φ 4
12'	50019-I	Nut(for IMPERIAL P=0.1")	1	Assembly for replacement	47		AL. tube	1	φ 4x120
13'	50016-I	Screw(for IMPERIAL P=0.1")	1		48		Oil filter	1	φ 6
14		Key	1	3x3x100	49		AL. tube	1	φ 6x160
15		Spring pin	2	φ 5x40	50		Straight adapter	2	1/8x φ 6
16		Spraying pipe	1	PT3/8 x 24"	51		Lubricator assy.	1	
17		Valve & junction assy.	1	PT3/8	52	50058	Clamp plate	1	
18	50018	Bracket	1		53	50077	Plate	1	
19	50001	Saddle 1416	1		101		Oil ball	2	1/4"
20	50050	Wiper F	2		102		Set screw	2	M6x30L
21	50051	Plate F	2		103		Hex. socket head bolt	4	M6x30L
22		Oil cover	1	NF 3/4"	104		Nut	2	M10
23		Taper Pin	2	#6x2 3/4"L	105		Washer	2	M10
24	50048	Wiper V	2		106		Dome cross screw	13	M5x12L
25	50049	Plate V	2		107		Hex. socket head bolt	2	M6x25
26	50014	Pinion	1	160P 16T	108		Nut	1	M10
27	50015	Keep assy.	1		109		Hex. socket head bolt	2	M6x20L
28		Steel ball	4	1/4"	110		Hex. socket head bolt	4	M8x60L
29	50032	Spring	4	φ 6x15 L	111		Set screw	3	M6x8L
30		Thrust bearing	2	NTB/AS2 2035	112		Hex. socket head bolt	3	M4x10L
31	50030	Washer	1	φ 18x φ 52x4	113		Hex. socket head bolt	3	M6x20L
32	50027-M	Dial ring	1	for METRIC	114		Hex. socket head bolt	10	M6x20L
	50027-I	Dial ring	1	for IMPERIAL	115		Hex. socket head bolt	1	M5x16L
33	50031-M	Dial 250dividing	1	for METRIC	116		Set screw	1	M8x35L
	50030-I	Dual dial 200div/I , 254div/M	1	for IMPERIAL	117		Hex. socket head bolt	1	M12x75L

BED & SHAFTS ASSEMBLY



TML-16-07

BED & SHAFTS ASSEMBLY



TML-16-07

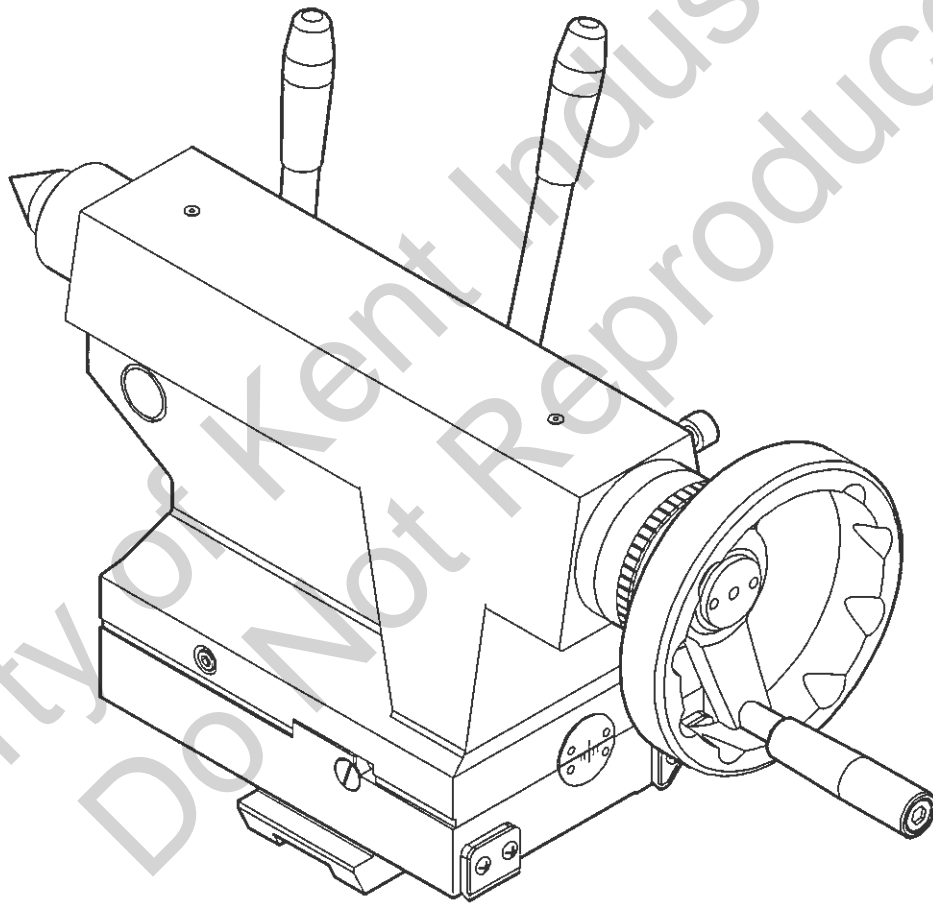
BED & SHAFTS ASSEMBLY

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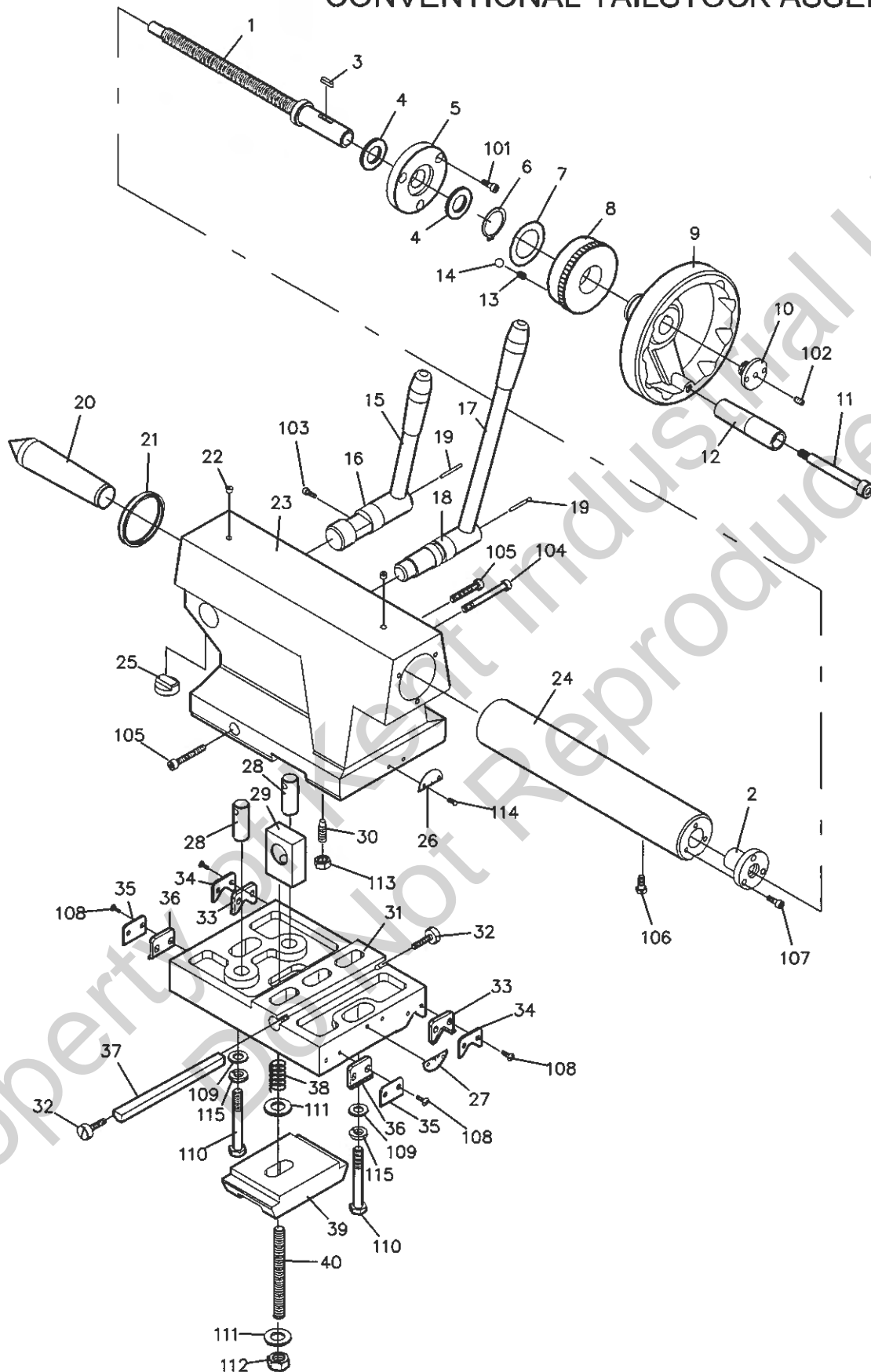
KEY NO	PARTS NO.	PARTS NAME	Q'TY	REMARK	KEY NO	PARTS NO.	PARTS NAME	Q'TY	REMARK
1	63001-40	Bed	1	40"	32	63007	Spring	1	φ 27x55
	63001-60			60"					
2	63038	Bolt	1		34	63010	Shear pin	1	
3	63027	Cover	1		35	63008	Shroud washer	1	
4	63028	Fixed block	1		36	63009	Collar	1	
5		Steel ball	1	5/16"	37	13-63023-40	40" Rack	1	14DP
6	18-40015	Spring	1	φ 8x23		14-63023-60	60" Rack	2	14DP
7	63029	Switch flanged	1		38	13-63024-GL	40" Gap Rack	1	14DP
8	63026	Bracket	1			14-63024-60G	60" Gap Rack	1	14DP
9	63043	Collar	1		101		Hex. socket head bolt	3	M6x55L
10	63020	Lever assy	1		102		Set screw	1	M6x16L
11	63021	Pin	2		103		Hex. socket head bolt	2	M6x25L
12	63022	Handle	1		104		Set screw	1	M10x10L
13	63030	Knob	1		105		Hex. socket head bolt	1	M8x70L
14	63015	Third rod bracket	1		106		Taper pin	1	#7x3 1/4"L
15	63019	Sleeve	1		107		Taper pin	1	#7x2"L
16	63018	Spring	1	φ 38x75	108		Hex. socket head bolt	1	M8x35L
17	63017	Spring cover	1		109		Nut	2	M12xP1.75
18		Snap ring	2	S32	110		Key	2	5x5x15
19	63014A-40	Third rod shaft	1	40"	111		Hex. socket head bolt	1	M6x20L
	63014A-60	Third rod shaft	1	60"	112		Taper pin	1	#4x30L
20		Thrust bearing	1	NTB/AS2 1831	113		Spring pin	6	φ 6x25L
21	63011A-40	Feed rod	1	40"	114		Hex. socket head bolt	9	M6x20L
	63011A-60	Feed rod	1	60"	115		Set screw	1	M6x6L
22	63012	Stopper	1		116		Washer	8	φ 12x φ 20x3t
23	63016	Clutch collar	1		117		Hexagon head bolt	8	M12x45L
24	63013	Bush	1		118		Set screw	3	M6x8L
25		Thrust bearing	1	51203	119	60035	Collar	1	
26	63042	Spring	4	φ 9x32	a	63048-60	Shaft	1	偏心軸
27	63025	Nut	1		b		Hex. socket head bolt	2	CAP 8x30
28		Thrust bearing	2	51105	c	63046-60	Chunk	1	導塊
29		Oil cover	1	油蓋	d		Set screw	1	Set 8x20
30	63005A-40M	40" Leadscrew	1	for METRIC P=6mm	e	63050-60	Pin	3	銅銷
	63005A-40I	40" Leadscrew	1	for IMPERIAL 4T.P.I.	f	63049-60	Chunk	1	鎖緊塊
	63005A-60M	60" Leadscrew	1	for METRIC P=6mm	g		Set screw	2	Set 8x16
	63005A-60I	60" Leadscrew	1	for IMPERIAL 4T.P.I.	h	63047-60	Bracket	1	托架
31	63006	Spring cover	1		i		Set screw	2	Set 8x8

CONVENTIONAL TAILSTOCK ASSEMBLY



TML-16-08

CONVENTIONAL TAILSTOCK ASSEMBLY



TML-16-08

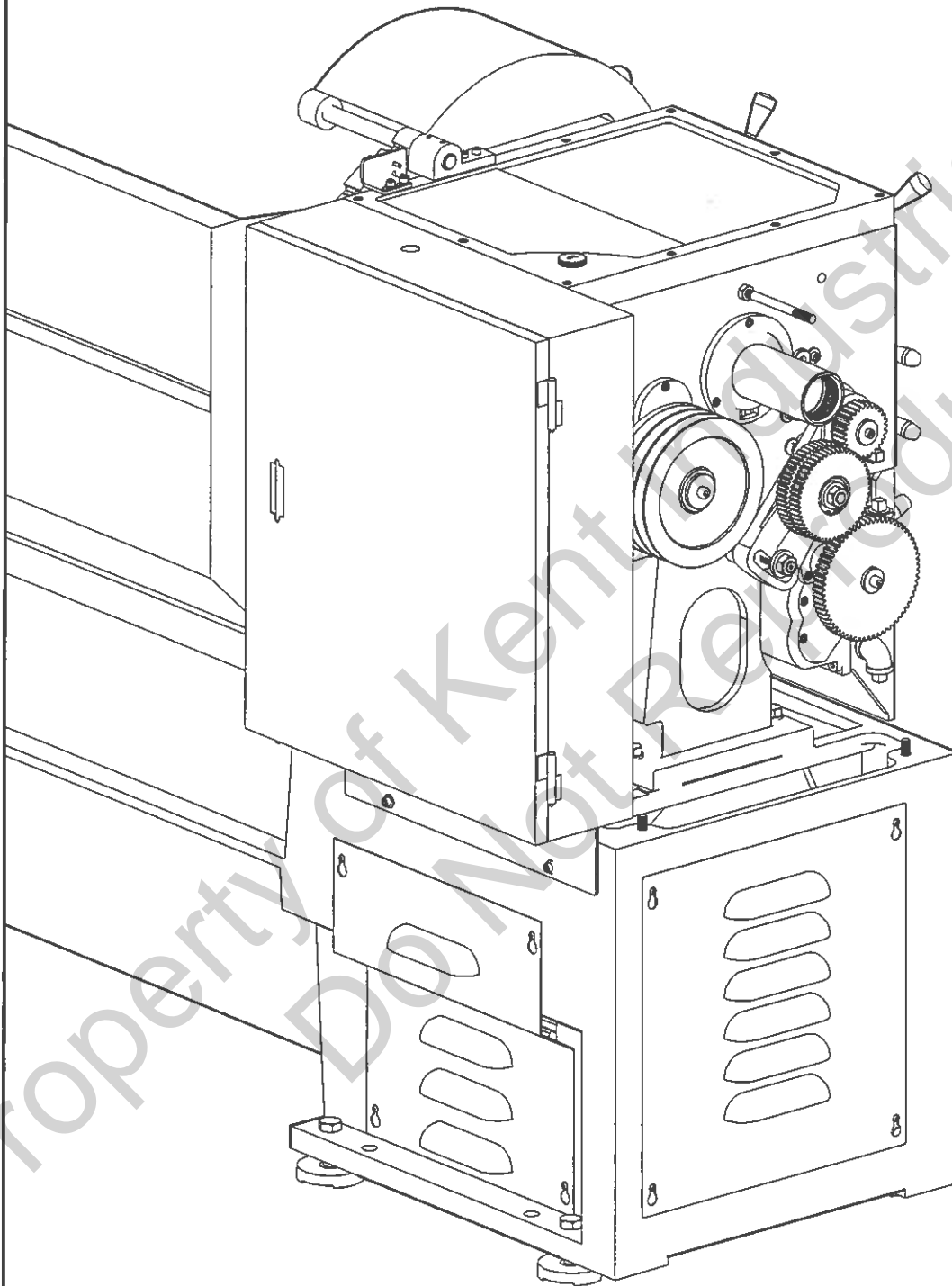
CONVENTIONAL TAILSTOCK ASSEMBLY

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KEY NO.	PARTS NO.	PARTS NAME	QTY	REMARK	KEY NO.	PARTS NO.	PARTS NAME	QTY	REMARK
1	70004-M	Lead screw,P=2.5mm	1	Assembly for replacement	32	00AS16M6	Gib screw	2	M6x ϕ 16
2	70005-M	Nut,P=2.5mm	1		33	70024	Wiper V	2	
1'	70004-I	Lead screw,P=0.1"	1	Assembly for replacement	34	70025	Plate V	2	
2'	70005-I	Nut,P=0.1"	1		35	70027	Plate F	2	
3		key	1	5x5x20L	36	70026	Wiper F	2	
4		Thrust bearing	2	AS2035	37	70018	Gib C	1	
5	70007-M	Flange M	1	for METRIC	38	00SP0250	Spring	1	ϕ 25x45L
	70007-I	Flange I	1	for IMPERIAL	39	70020	Clamp block	1	
6		Snap ring	1	S32	40	70041	Stud	1	M14x110L
7	70006	Washer	1		101		Hex. socket head bolt	3	M6x16L
8	70008-M	Index ring 125 dividing	1	for METRIC	102		Set screw	1	M6x12L
	70008-I	Index ring 100 dividing	1	for IMPERIAL	103		Hex. socket head bolt	1	M6x12L
9	70009	Handwheel	1		104		Hex. socket head bolt	1	M8x70L
10	70010	Fixed screw	1		105		Hex. socket head bolt	2	S-M8x60L
11	70011	Bolt	1	M8x90L	106		Hex. socket head bolt	1	M6x8L
12	70012	Handle	1		107		Hex. socket head bolt	3	M6x16L
13	40016	Spring	3	ϕ 6.2x16L	108		Dome cross screw	8	M5x12L
14		Steel ball	3	1/4"	109		Washer	2	M10
15	70022	Clamp lever L	1		110		Hexagon head bolt	2	M10x60L
16	70013	Cam shaft L	1		111		Washer	3	M14
17	70021	Clamp lever R	1		112		Hexagon nut	1	M14
18	70017	Cam shaft R	1		113		Hexagon nut	1	M8
19		Spring pin	2	ϕ 4x24	114		Rivet	4	ϕ 2
20	70030	Dead center	1	MT4	115		Spring washer	2	M10
21		Oil seal	1	DH53					
22		Oil ball	2	1/4"					
23	70001-14	Tail stock	1	Model 1440,1460					
	70001-16	Tail stock	1	Model 1640,1660					
24	70003	Quill	1						
25	70014	Guide key	1						
26	70032-U	Marked plate U	1	Assembly for replacement					
27	70032-D	Marked plate D	1						
28	70015	Pin nut	2						
29	70016	Pivot block	1						
30	00ST25M8	Set screw	1	Model 1440,1460					
	00ST50M8	Set screw	1	Model 1640,1660					
31	70002	Base	1						

END GEAR ASSEMBLY

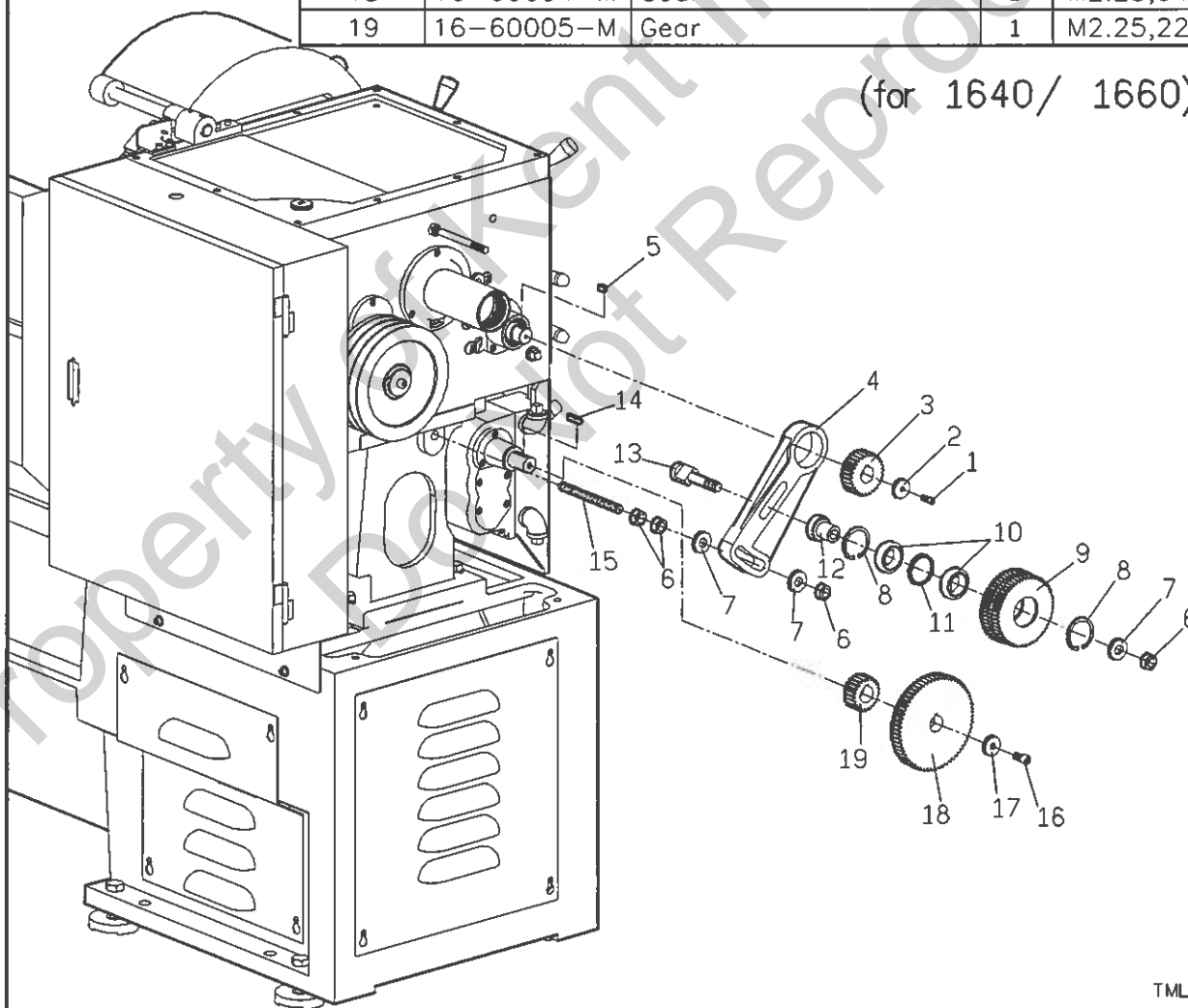


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END GEAR – METRIC (LEADSCREW PITCH 6)

KEY NO.	PARTS No.	PARTS NAME	Q'TY	REMARK
1		Hex. socket head bolt	1	M6x20
2	60022	Washer	1	
3	16-60001-M	Gear	1	M2.25,28T
4	16-60017	Swing frame	1	
5		Key	2	7x7x15L
6		Nut	2	M14xP2.0
7	60023	Washer	3	
8		Clip	2	R47
9	16-60002-M	Gear	1	M2.25,54T/55T
10		Ball bearing	2	6005
11	60020	Washer	1	
12	60013	Shaft collar	1	
13	60015	Gear shaft	1	
14		Key	1	7x7x30L
15	60018	Stud	1	
16		Hex. socket heard bolt	1	M8x20
17	60021	Washer	1	
18	16-60004-M	Gear	1	M2.25,64T
19	16-60005-M	Gear	1	M2.25,22T

(for 1640/ 1660)

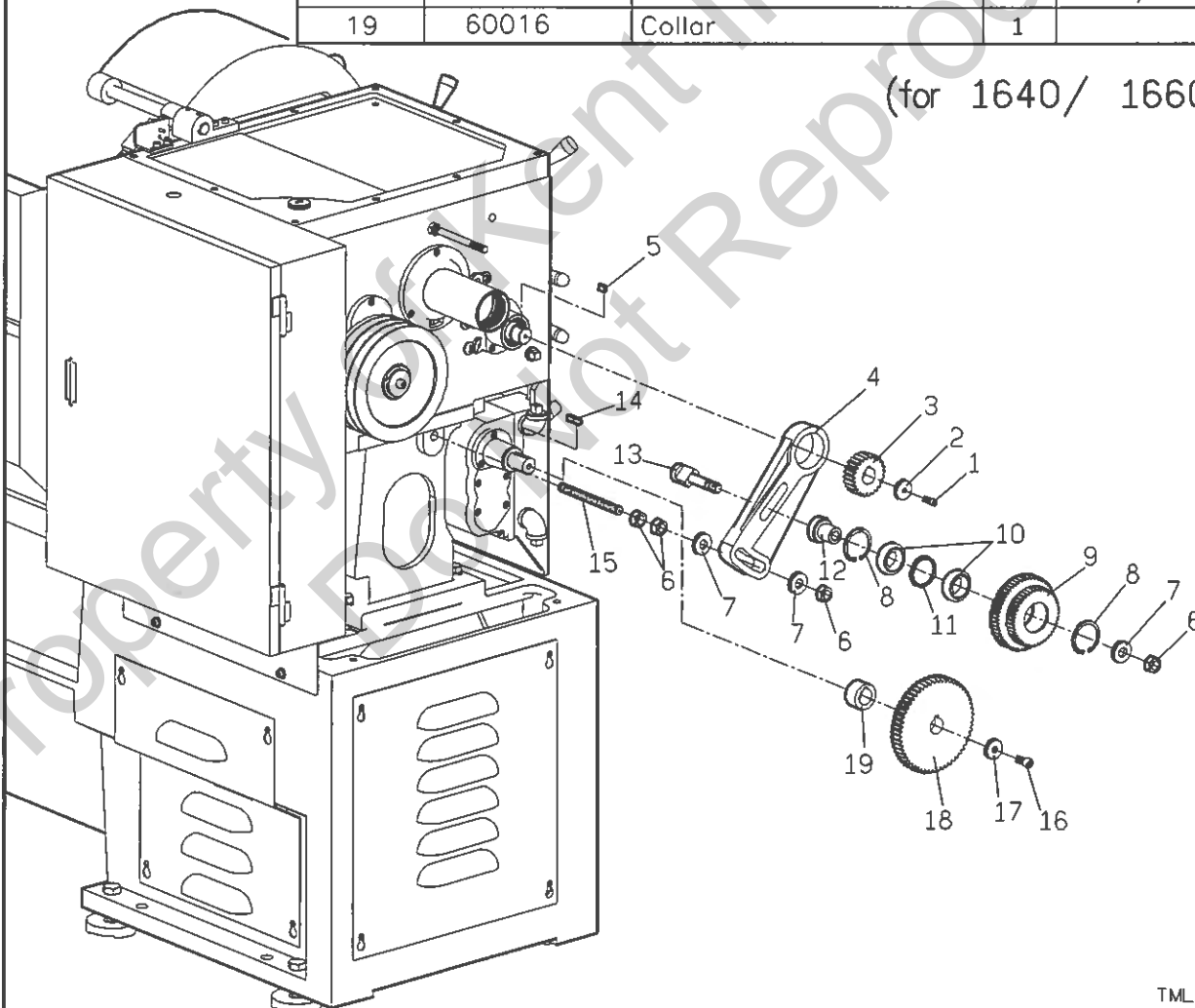


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END GEAR -- IMPERIAL (LEADSCREW 4 T.P.I.)

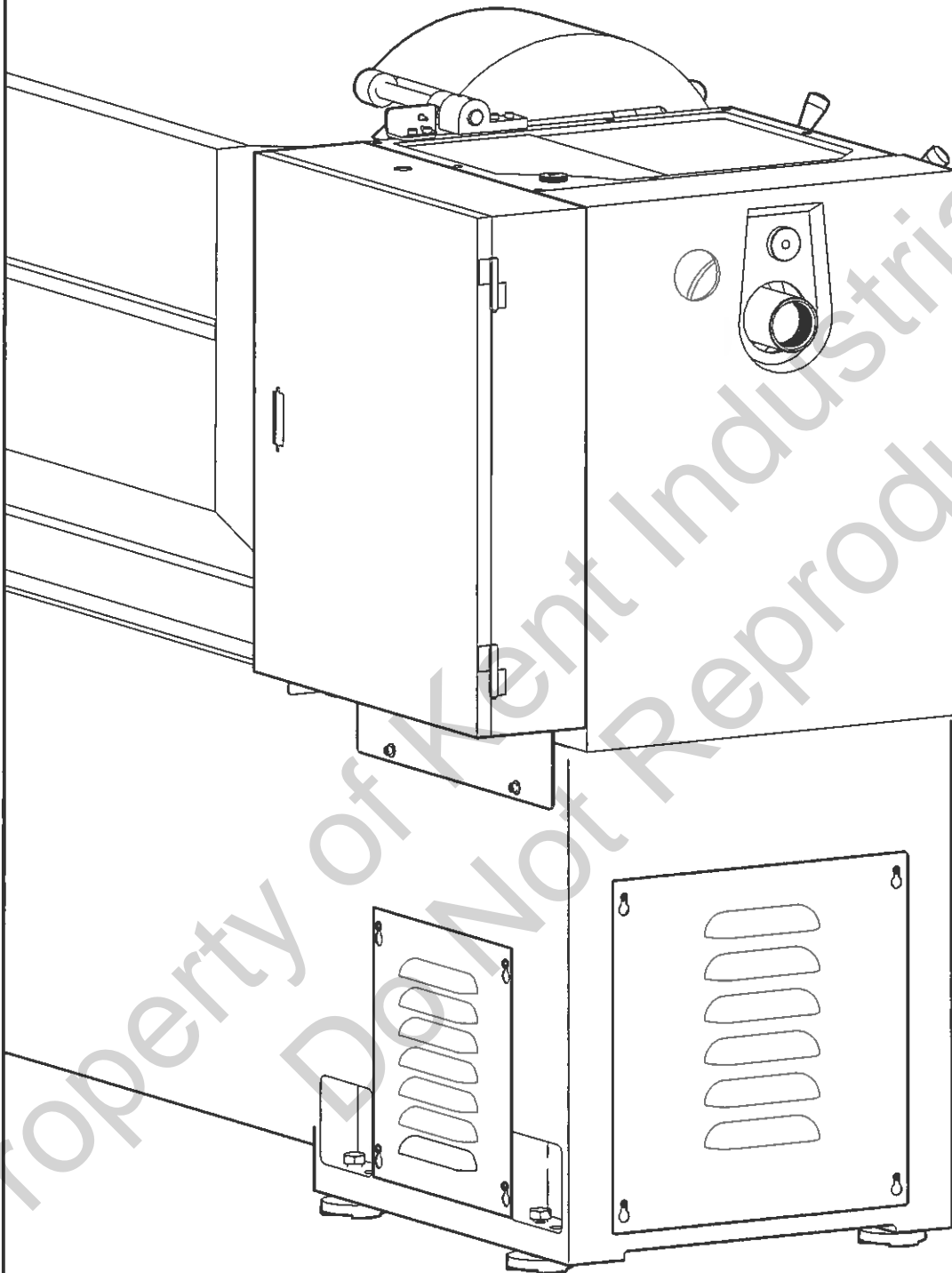
KEY NO.	PARTS No.	PARTS NAME	Q'TY	REMARK
1		Hex. socket head bolt	1	M6x20
2	60022	Washer	1	
3	16-60007-I	Gear	1	M2.5,24T
4	16-60017	Swing frame	1	
5		Key	2	7x7x15L
6		Nut	2	M14xP2.0
7	60023	Washer	3	
8		Clip	2	R47
9	16-60008-I	Gear	1	M2.5,44T/56T
10		Ball bearing	2	6005
11	60020	Washer	1	
12	60013	Shaft collar	1	
13	60015	Gear shaft	1	
14		Key	1	7x7x30L
15	60018	Stud	1	
16		Hex. socket heard bolt	1	M8x20
17	60021	Washer	1	
18	16-60010-I	Gear	1	M2.5,57T
19	60016	Collar	1	

(for 1640/ 1660)



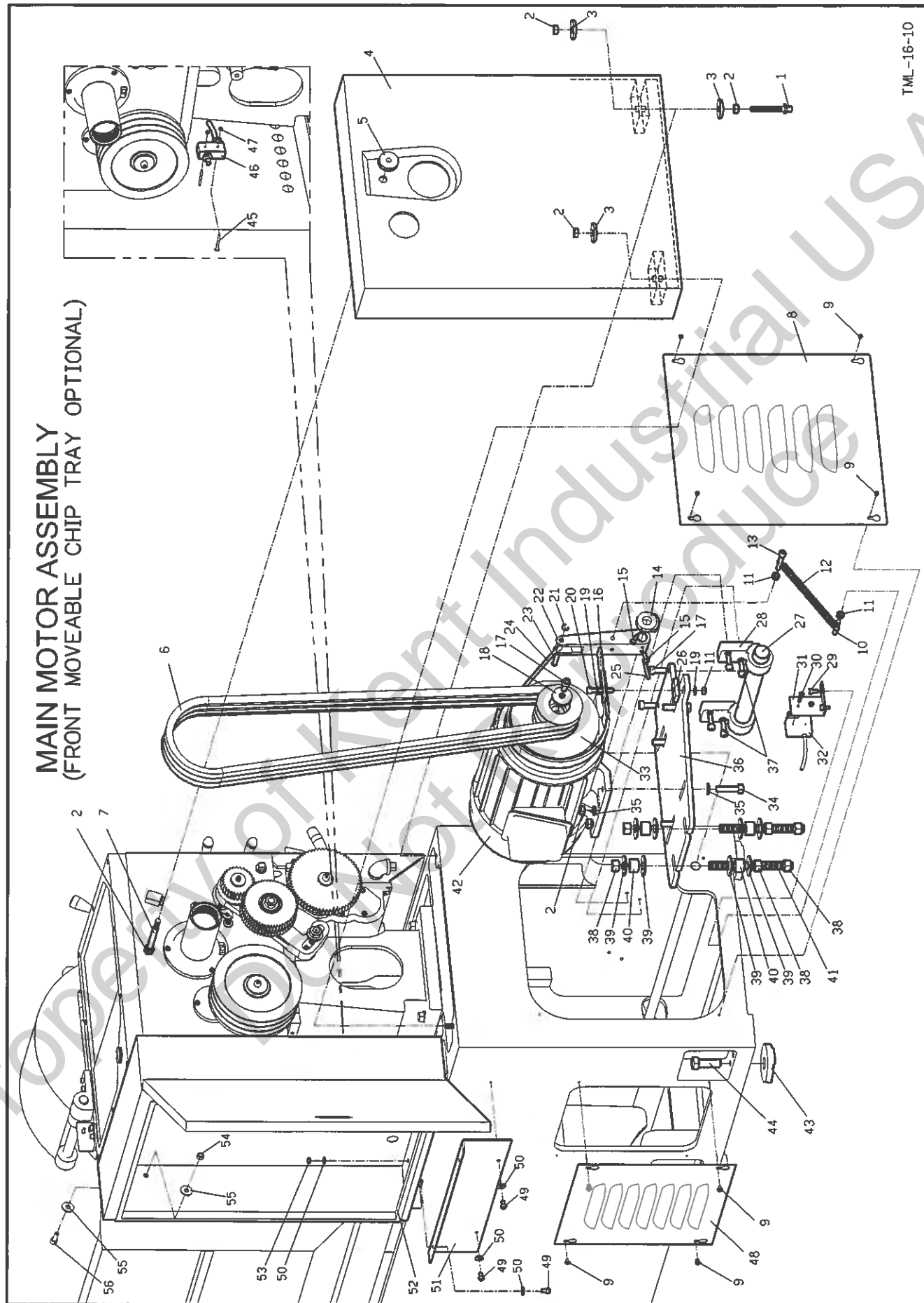
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MAIN MOTOR ASSEMBLY
(FRONT MOVEABLE CHIP TRAY OPTIONAL)



TML-16-10

MAIN MOTOR ASSEMBLY (FRONT MOVEABLE CHIP TRAY OPTIONAL)



TML-16-10

MAIN MOTOR ASSEMBLY

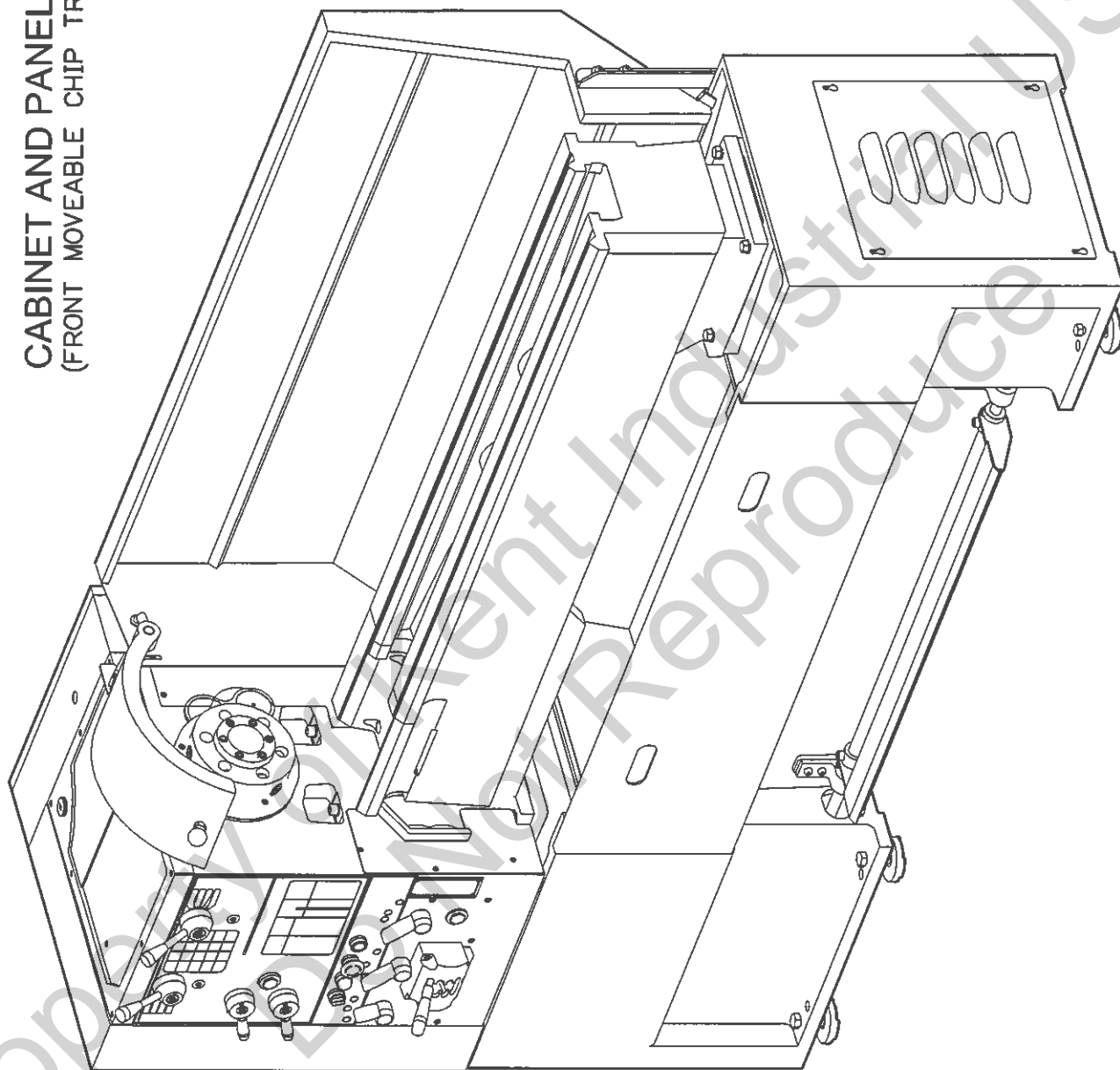
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(FRONT MOVEABLE CHIP TRAY OPTIONAL)

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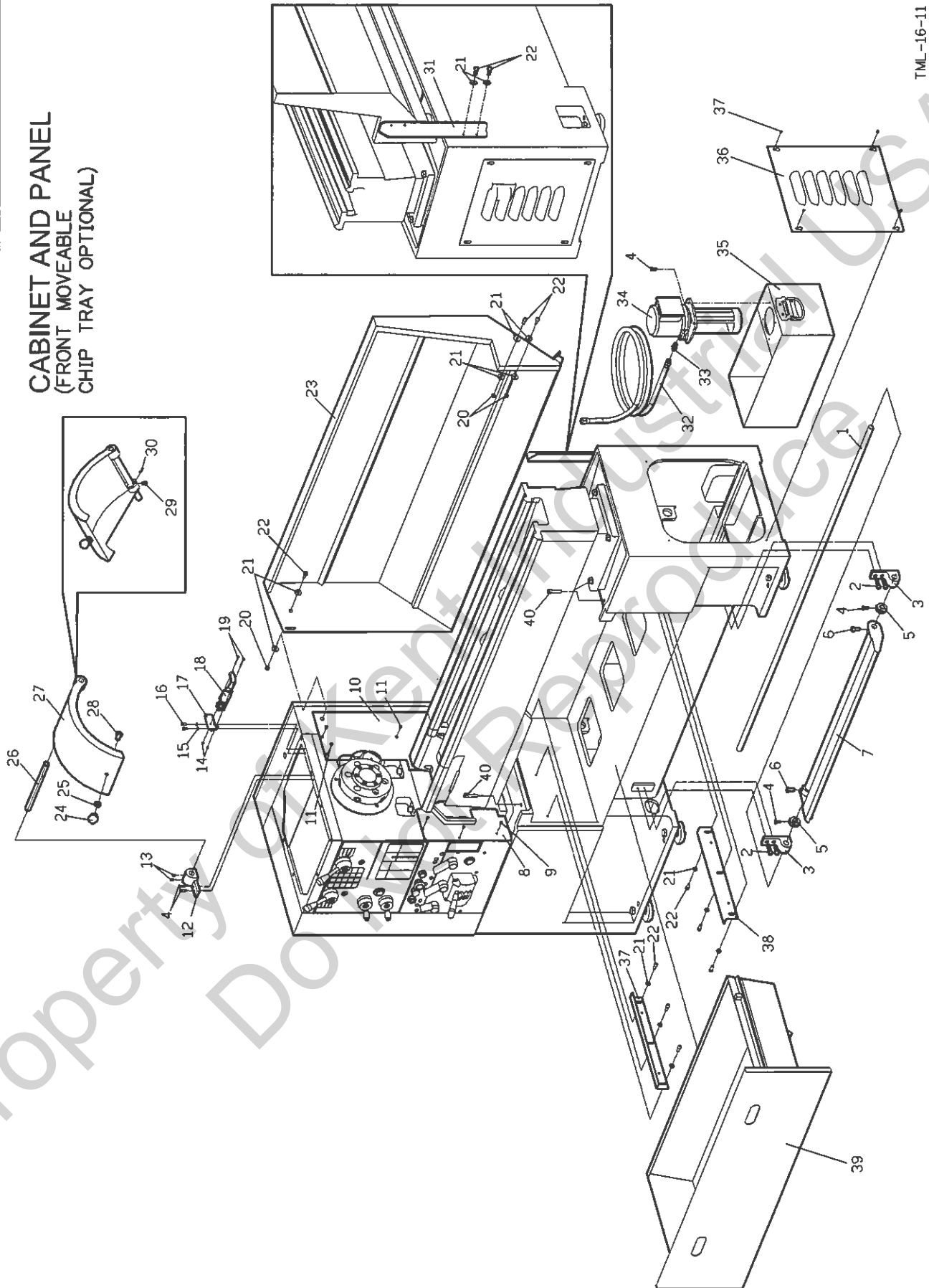
KEY NO.	PARTS NO.	PARTS NAME	QTY	REMARK	KEY NO.	PARTS NO.	PARTS NAME	QTY	REMARK
1	60058	Pin	2		38		Nut	6	M16xP2.0
2		Nut	9	M10xP1.5	39		Washer	8	Ø16.5xØ40
3		Washer	4	M10	40	600048	Rubber ring	4	
4	14-61004	Cover	1		41	60031	Screw	2	M16x170L
5	60056	Nut	1		42		Motor	1	5hp
6		V belt	3	B69	43	63043	Block	4	
7	60055	Bolt	1		44		Hexagon head bolt	4	M16x50L
8	61017	Cover	1		45		Dome cross screw	2	M4x40L
9		Dome cross screw	8	M6x10L	46		Limit switch	1	Tm1307
10	60053	Bolt	1		47		Nut	2	M4xP0.7
11		Nut	3	M8xP1.25	48	13-61018	Cover	1	
12	60046	Spring	1		49		Hex. socket head bolt	4	M6x10L
13		Hex. socket head bolt	1	M8x55L	50		Washer	6	Ø6xØ16
14	13-60033	Cam	1		51	61075	Cover	1	
15		Hex. socket head bolt	2	M6x16L	52	61024A	Cover	1	
16	61061	Fixed plate	1			61025A	Electrical box	1	
17		Hex. socket head bolt	1	M10x25L	53		Nut	2	M6xP1.0
18	60044	Washer	1		54		Nut	1	M8xP1.25
19		Washer	2	M8	55		Washer	2	M8
20		Hex. socket head bolt	1	M8x45L	56		Hex. socket head bolt	1	M8x20L
21		Clip	1	E8					
22	60047	Lever	1						
23	60028	Pin	1						
24	60019	Brake belt	1						
25		Taper pin	1	#4x1 3/4"L					
26	61045RM5	Platform	1						
27	60036	Shaft	1						
28	60061	Support	1						
29		Hex. socket head bolt	2	M6x12L					
30		Dome cross screw	2	M4x30L					
31	61028A	Bracket	1						
32		Limit switch	1	Tm-1704					
33	10043A56	Motor pully	1						
34		Hex. socket head bolt	4	M10x45L					
35		Washer	8	M10					
36	61045TM7	Plate	1						
37		Hex. socket head bolt	4	M8x25L					

CABINET AND PANEL
(FRONT MOVEABLE CHIP TRAY OPTIONAL)



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CABINET AND PANEL
(FRONT MOVEABLE
CHIP TRAY OPTIONAL)



TML-16-11

CABINET AND PANEL

TML-16-11

(FRONT MOVEABLE CHIP TRAY OPTIONAL)

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KEY NO.	PARTS NO.	PARTS NAME	Q'TY	REMARK	KEY NO.	PARTS NO.	PARTS NAME	Q'TY	REMARK
1	60032A	Shsft	1		35	61010-15	Coolant tank	1	
2		Hex. socket head bolt	4	M8x25	36	61017	Cover	1	
3	60029	Pedal bracket	2		37		Dome cross screw	4	M6x10
4		Hex. socket head bolt	6	M6x16	38	61009PB6	Angle steel	2	
5	13-60039	Collar	2		39	61009B4	Chip tray	1	
6		Hex. socket head bolt	2	M10x20	40		Hex. socket head bolt	2	M10x45
7	61043-40	Saddle	1	Model 1440,1640					
	61043-60	Saddle	1	Model 1460,1660					
8	61016	Guard	1						
9		Dome cross screw	3	M5x8					
10	14-61020	Plate	1	Model 1440,1460					
	16-61020	Plate	1	Model 1640,1660					
11		Flat hexagon screw	3	M5x8					
12	10058	Small bracket	1						
13		Set screw	2	M8x12					
14		Nut	2	M4xP0.7					
15		Spring washer	2	M6					
16		Hex. socket head bolt	2	M6x12					
17	61056	Bracket	1						
18		Limit	1	Tz9212					
19		Dome cross screw	2	M4x40					
20		Nut	3	M8xP1.25					
21		Washer	14	M8					
22		Hex. socket head bolt	11	M8x20					
23	61010-40	Splash guard(40")	1	Model 1440,1640					
	61010-60	Splash guard(60")	1	Model 1460,1660					
24		Knob	1						
25		Nut	1	M12xP1.75					
26	13-10102	Piovt	1						
27	14-61053	Chuck safety guard	1						
28		Hex. socket head bolt	1	M12x20					
29		Hex. socket head bolt	1	M6x12					
30		Set screw	1	M5x16					
31	61079	Angle steel	1						
32		Coolant conduit	1	CT801x3/8"x72"					
33		Nipple	1	3/8"PTx3/8"PH					
34		Coolant pump	1	MC6180					