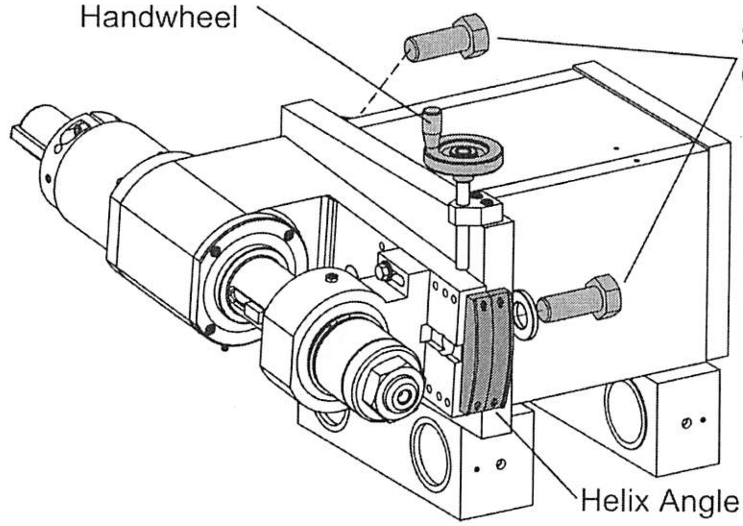
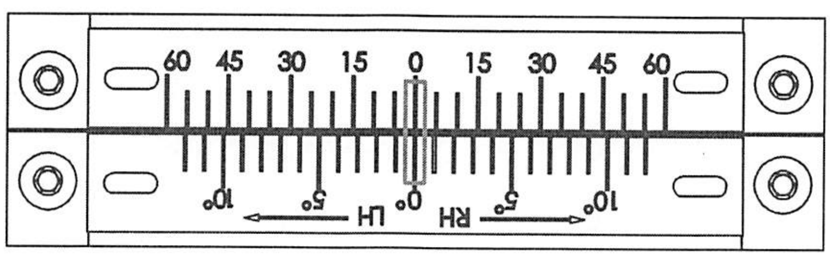
Set helix angle to 0°: First loosen two spindle housing clamp bolts per head as shown in the following diagram:



Tesker spindle helix angles are set using a vernier scale reading in degrees and minutes. Turn the helix adjusting handwheel until the zero's on each scale line up. Further instructions about how to read these scales are given on page 48. Now re-tighten the spindle housing clamp bolts.



Set Initial Spindle RPM (optional): This machine may be equipped with a variable speed drive. Spindle speed can be measured by using the tachometer page (if equipped) in the O.I.T..

Infeed: Infeed rolling usually occurs at 50-100 spindle RPM. If in doubt about job parameters, start at low end of this range.

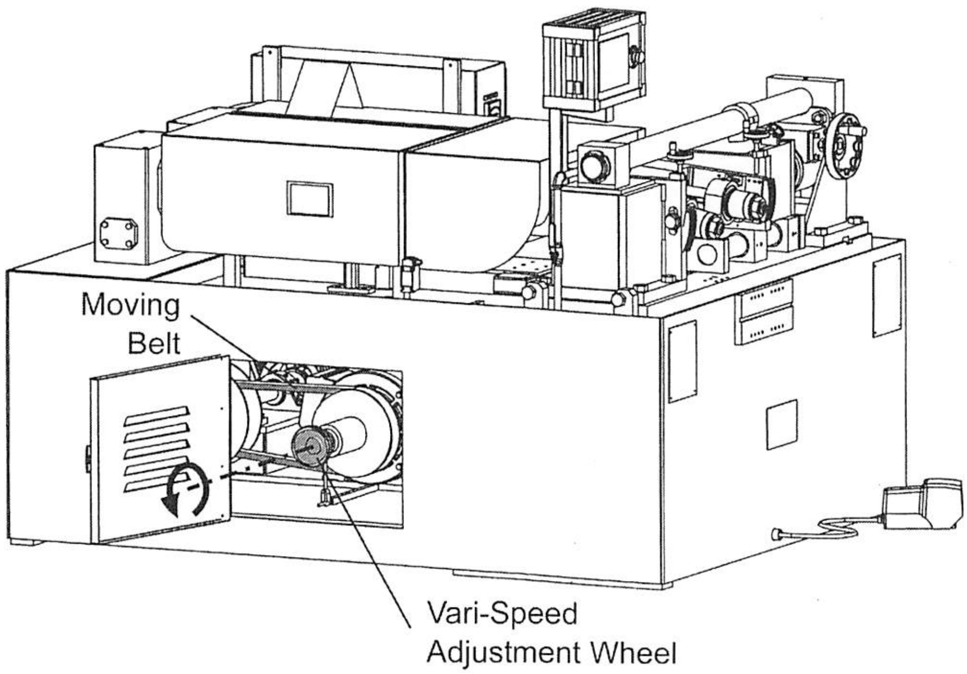
Thrufeed: Thrufeed jobs should start out with a slow spindle speed. Later in the setup process, this speed will be optimized.

Vari-Speed Belt Drive: If equipped, this system provides variable spindle speeds through a belt drive. Speed adjustment is only possible while the drive is turning.

You are about to start the spindles, verify spindle and die area is clear.

Start the spindles and open the base side door. Note the position of the moving belts.

Do not put hands near moving belt!



Turn the handwheel counter-clockwise to slow the spindle speed. Reclose and latch door when finished adjusting speed.

Vector Variable Speed Motor: If equipped this systems controls spindle speed by electronically slowing or speeding the motor. The control for this system is located next to the O.I.T. Refer to the included instruction manual for your specific system.

Set Work Support Height: A work support holds or contains the workpiece between the rotating dies. The most common type is the work support blade, but depending on part geometry, the part may also be rolled between centers, or on an arbor.

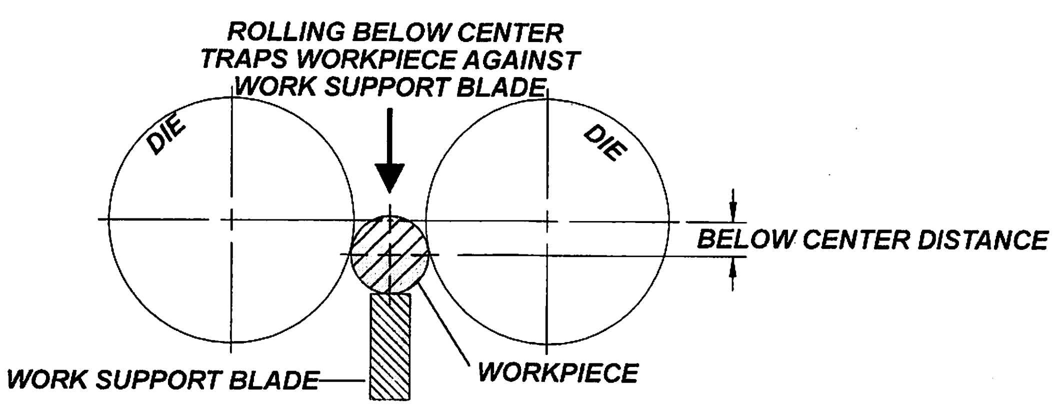
Centers or Arbor: A custom designed fixture is used to roll on centers or over an arbor. The fixture height is exactly inline with the spindle centerlines – also referred to as "On Center" rolling. These fixtures are only applicable to infeed rolling, and making parts like worm shafts, or bushings.

Work Support Blades: Work support blades are used for all thrufeed jobs and most infeed jobs. An interchangeable work support blade is held in an adjustable holder by set screws. The work support assembly must be initially be set to the correct height, but once it is set, job changeover is as simple as switching out blades for different work diameters (work support blades are created with different heights to account for different work diameters). Support blades press on the part O.D. During rolling. Depending on part material and coolant type, thread crest scuffing or welding at the interface might occur.

Production requirements and part material will dictate which blade types are suitable for a particular job:

Carbide: A piece of solid carbide is secured into a steel holder. This is the most common type of blade used. It offers a good balance between toughness and hardness.
Aluminum-Bronze: Constructed from solid silicon-bronze and typically used for rolling high nickle content alloys including stainless steels.
Ceramic: A solid ceramic wear strip is epoxied in a steel holder. This is a long wearing solution typically used on high production runs.
D2: Through-hardened tool steel offers the best toughness of all blade types.
Roller: For special applications, a support blade can be equipped with rolling element bearings, so the sliding action that wears down other blade types is almost eliminated.

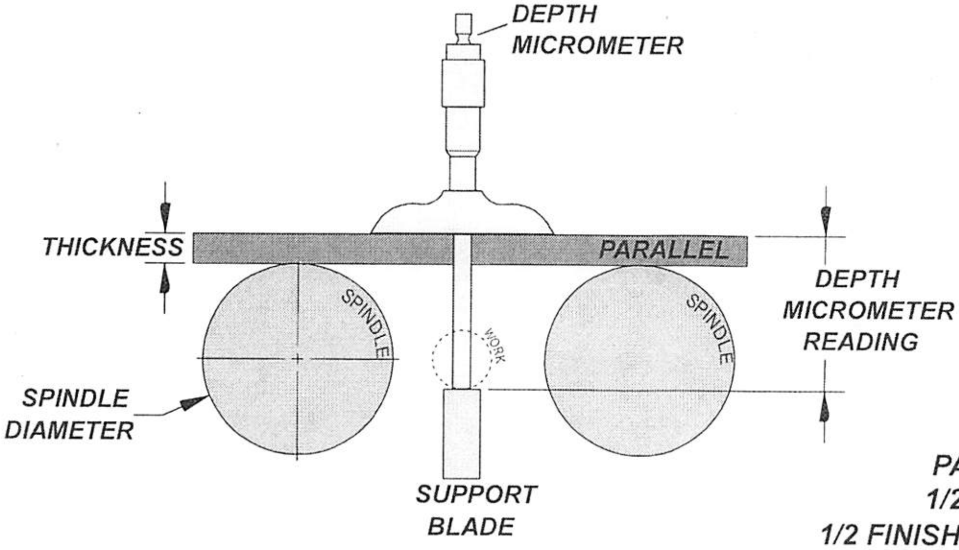
Setting Work Support Height: Jobs are usually rolled "Below Center" to keep the part contained within the dies. The following diagram illustrates this concept:



A precision ground parallel and depth micrometer are needed to set the support blade height. The parallel is laid across the spindles set at zero helix (avoid the spindle keyway), and the depth micrometer measures down to the top of the blade. In nearly all rolling circumstances, the blade should be installed parallel to the zero helix angle plane – that is you should have the same depth reading on the front and back of the blade.

Depth Micrometer

The micrometer's "depth" reading is calculated in the following diagram:

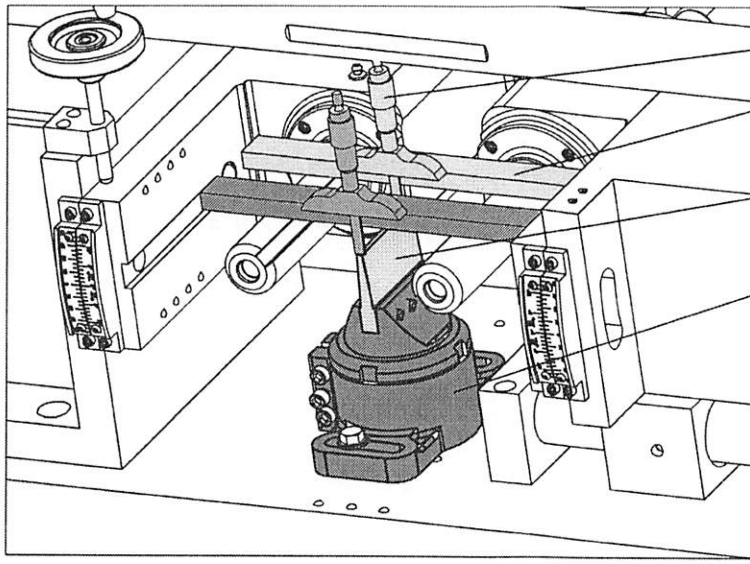


PARALLEL THICKNESS
1/2 SPINDLE DIAMETER
1/2 FINISHED WORK DIAMETER
+ BELOW CENTER DISTANCE

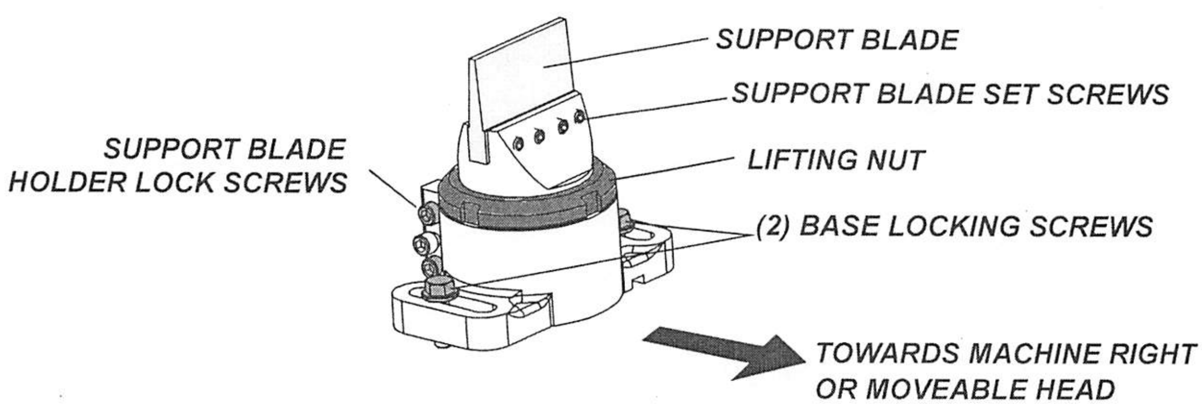
DEPTH MICROMETER READING

Below center distance for most jobs on this machine will be 0.010". Smaller and finer threads tend to be set higher, whereas larger diameter will be set lower. If the work piece is bent, or the work pops up during rolling, lower the work support 0.005" and retry. Setting the support blade lower than necessary will create excessive down force which will wear the blade faster and could deform the thread crests.

This diagram shows the proper parallel and micrometer placement.



Begin the adjustment by cleaning the working area of all scale and flaking – unseated components will affect the measurements. Next, secure the proper size support blade into the blade holder with the blade set screws and lock the assembly down to the base. The holder should be oriented so the set screws are accessible from machine right or moveable head side. Height adjustments are made by loosening the support blade holder lock screws, then turning the lifting nute until the proper height is reached, then re-lock the assembly. The blade should lift level, but front and back blade measurements should still be taken.



Once the work support holder height and level is verified, to changeover jobs, simply replace the support blade (no need to re-adjust the support holder).

Set Support Blade Location: Once the support blade height and level is set, the entire assembly must be positioned under the workpiece. Begin by placing a die on the left spindle all the way against the spindle shoulder. Support blades are available in different lengths and are generally matched to the die width or part width. Make in and out adjustments by loosening the blade locking set screws, and sliding the support blade within the holder.

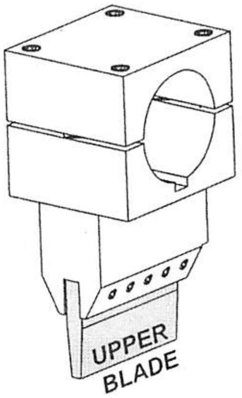
Infeed: The support blade should be under the entire rolled length of the part.

Thrufeed: The back of the support blade should be inset two to three rills from the back of the die for fine pitches, or one to two rills inset for coarse pitches. This will prevent the thread crests from being marked by the support blade after exiting the dies. Now check the front of the support blade, it must extend past the front of the dies.

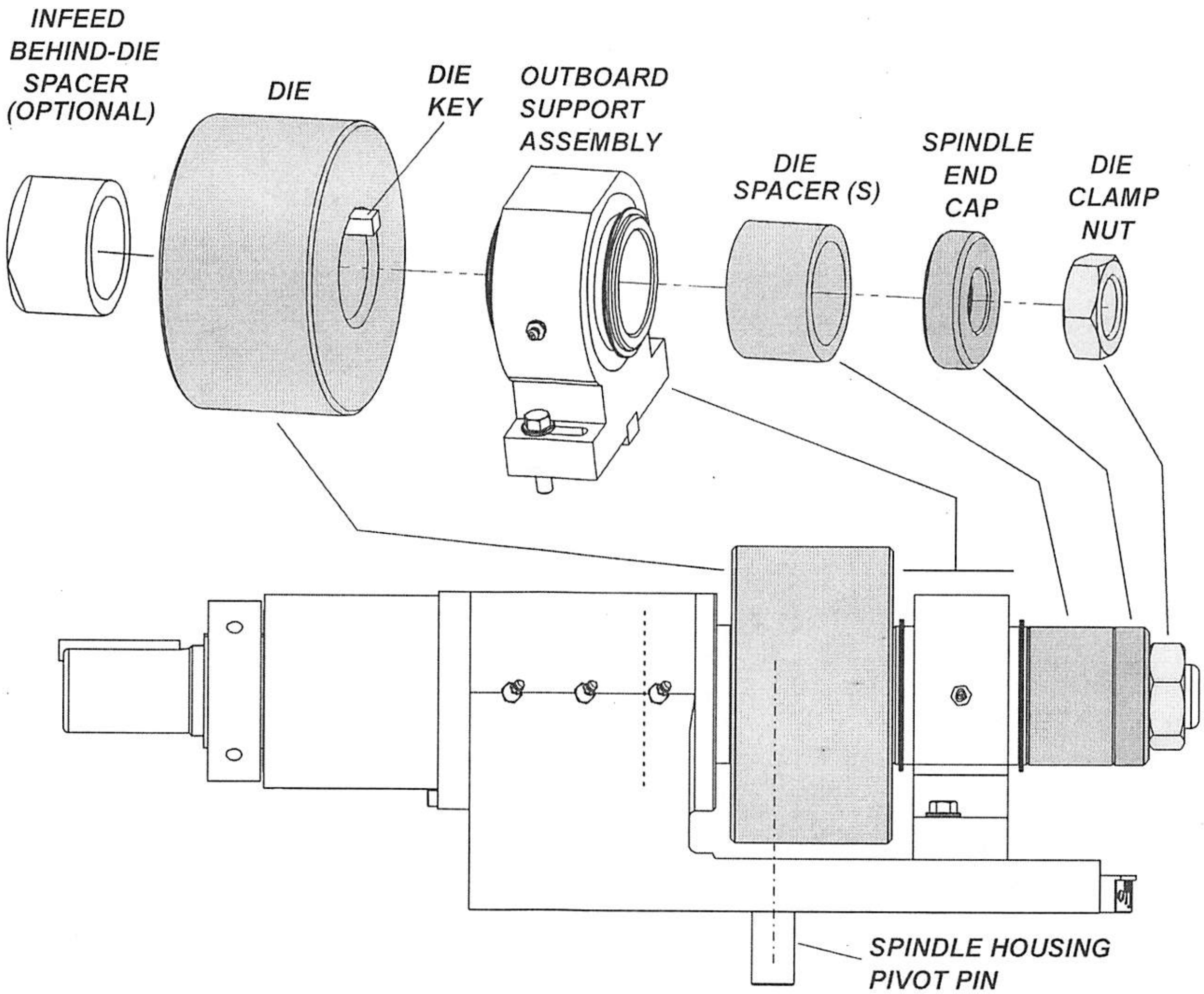
Once the in and out adjustment has been made, loosen the base locking bolts and slide the support holder to the correct left or right position. Rest a part on the support blade and slide the support holder and part into the left die. The correct position will have the part contact both the die and the center of the blade. Tighten the support holder down to the base.

Blade Wear: Some of the softer blade materials will begin to show wear after rolling. The blade must be adjusted up periodically to accommodate this wear. Turn the lift screws evenly to keep the blade level.

Upper Support (optional): In machines equipped with automatic feeders, an upper support blade is added to positively contain the work in the rolling area for high-speed thrufeeding. The upper support holder is bolted to the tie arm, and uses a special height support blade. If using an upper support holder, you should verify clearance of a finished, fully rolled part between the upper and lower blades.



Install dies and spindle supports: Next, assemble the spindle components. The following diagram shows a typical spindle assembly.

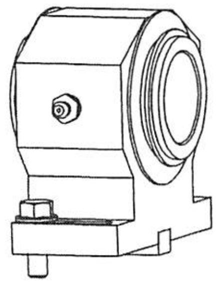


Infeed Behind-Die Spacer (optional): For infeed rolling with narrow dies a spacer is sometimes used to bring the rolling operation forward in the work pocket. If used, this component is installed first, directly against the spindle shoulder.

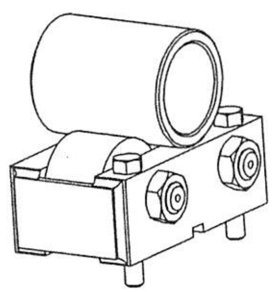
Die: The rolling die is usually installed first (unless behind die spacer is used), directly against the spindle shoulder. Orient the dies so the lead-in taper is facing the operator. Install the die key that matches the width of the die.

> **Note:** In thrufeed rolling, the thread is progressively formed as the work travels thru the dies. The thread should be completely formed 2/3rds of the way through the die width. This area of the die should be located over the spindle housing pivot pin to give the best possible thread form and die life.

Outboard Support Assembly: The outboard support is placed directly in front of the die. An outboard support assembly is keyed and bolted into the spindle housing. Two types of supports are available depending on the application:



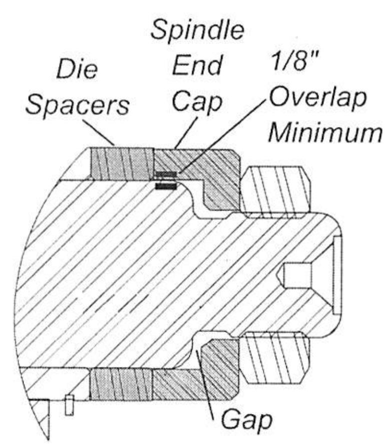
Outboard support block: An outboard support block is typically used because it offers longer bearing life and more rigidity. The outboard support block contains a removeable bushing. When the assembly is installed on the machine, the bushing must be positioned so it's retaining snap rings do not rub on the grease seals.



Outboard roller support: An outboard roller support is used in special circumstances, usually involving infeeding of headed, or shouldered parts. This support gives greater radial part clearance. In this design, the outboard support bushing rides directly on two cam-roller bearings.

Die spacers: The die spacers are located ahead of the outboard support assembly. They are available in lengths to accomodate different die widths.

Spindle end cap: Installed next is the spindle end cap. The inside diameter of this cap must ride on the spindle at least 1/8". Use different combinations of die spacers to adjust this overlap.



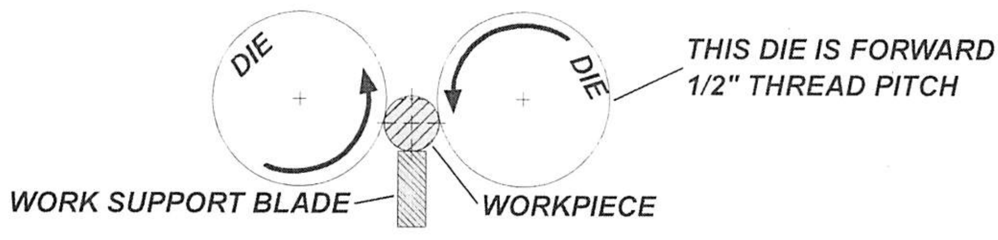
Die clamp nut: The die clamp nut is assembled and torqued using the supplied wrench. Tighten this nut to 50 to 75 ft*lbs torque. This clamp nut holds all of the spindle components in place. Check nut occasionally for tightness.

Finally, tighten the outboard support bolts. Again, make sure the snap rings in the outboard support bushing do not rub on the grease seals.

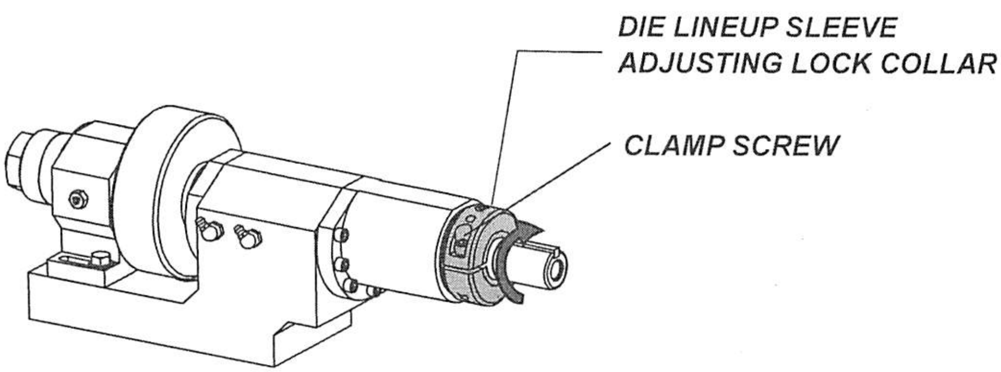
Die Face Alignment: Verify that the front faces of the dies are even in front. Rest a straightedge or parallel on the front face of the right spindle die (Left spindle has a toe-in adjustment that can affect this measurement). Note the right die's alignment with the left die face.

Infeed: For infeed rolling, the die faces should be set even in front at this time.

Thrufeed: For single start threads, the die which turns down on the work (right die for right hand threads) should be set approximately ½ pitch in front of the other die. This will allow the die that comes in contact with the workpiece first to help hold the workpiece down on the support blade. Thrufeed double start threads should be set even in front.



Die lineup is done according to the following diagram. Either spindle can be adjusted. Begin by loosening the allen-head clamp screw on the die lineup adjusting sleeve lock collar. By hand or with a spanner wrench, turn the lock collar to advance the spindle in or out. 1 turn = 0.050" travel. Retighten the allen-head clamp screw.



Set helix angle on spindles: In order to produce a helical thread form on a part, either the machine spindles or the die rills must have an angle on them. For infeed rolling, this required helix angle is ground entirely into the dies, therefore the spindle helix angle is set at zero. In the case of thrufeed rolling, helix angle is required on the machine spindles themselves. It is necessary to lookup the required helix angle setting in the Tesker Thread Chart Book, or calculate it from the equation below. In the case of helical thrufeed dies (speed-up type, or slow-feed type), the machine spindle helix angle setting will be etched into the die set.

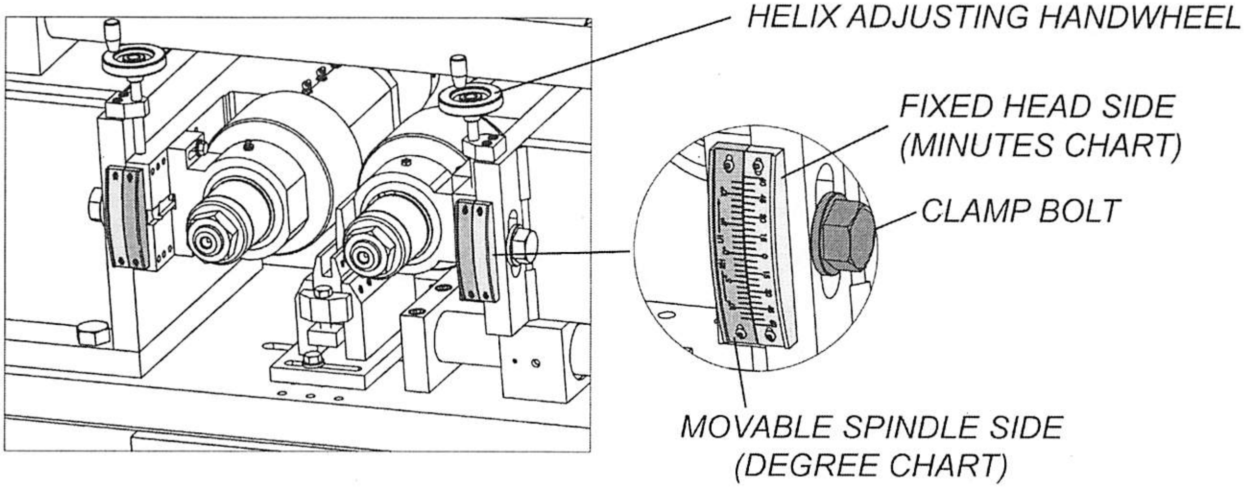
$$\text{Helix Angle} = \arctan\left(\frac{1}{\text{T.P.I.} * 3.1416 * \text{Pitch Dia.}}\right)$$

For multiple start threads, multiply calculated helix angle by number of starts.

Tesker machine spindles and most thread charts are read in degrees and minutes. 3° 24' reads out loud as 3 degrees and 24 minutes. Occasionally, a helix angle will be given in decimal degrees, such as 3.40°. Use the following equation to convert these into degrees and minutes:

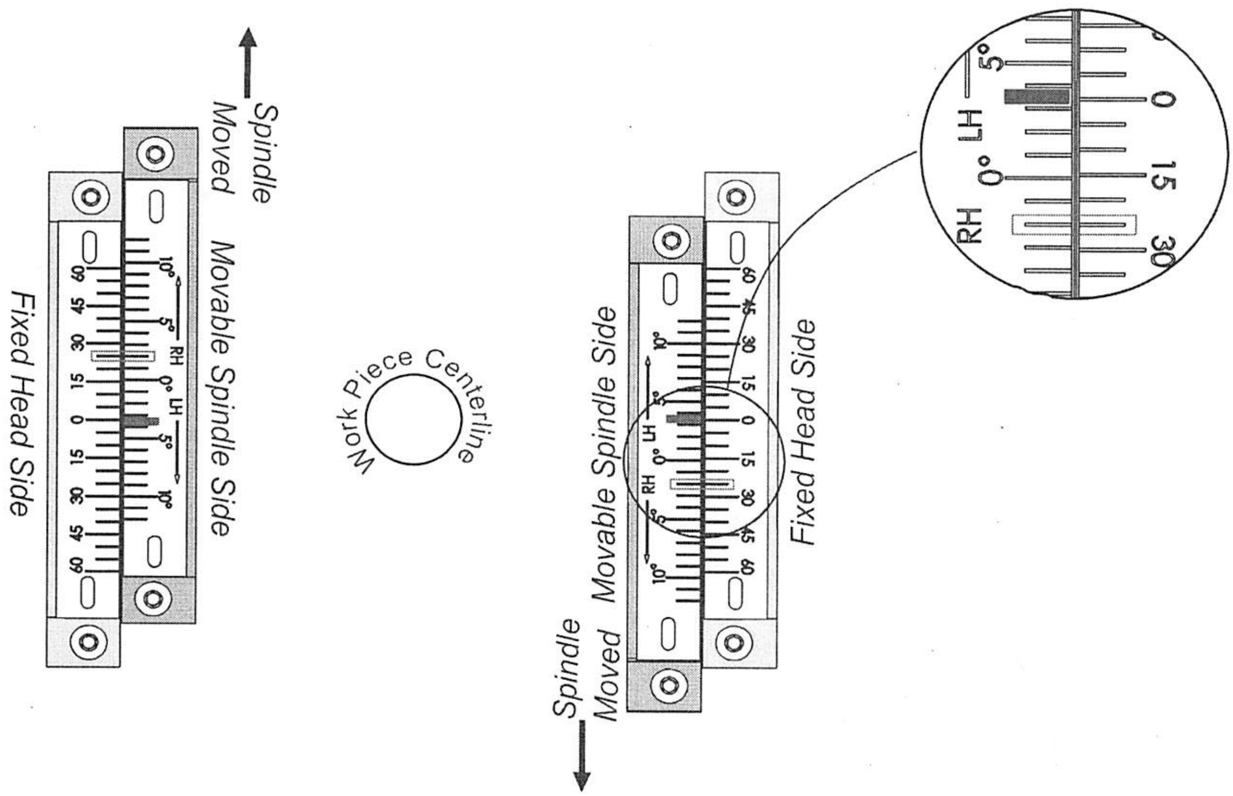
Helix angle given in Degrees to Degrees and Minutes:
Multiply decimal portion of angle by (60)
Example: 3.4° = 3° and (0.40 * 60) minutes = 3° 24'

Machine spindle helix angles are read using a two part vernier scale located on the machine front. Both spindles should always be set to the same helix, with one being up, and one being down. Loosen the spindle housing clamp bolts and use the helix angle adjusting handwheels to make the setting.



Thread Lead Adjustment: For thrufeed rolling, adjusting the machine helix angle will affect the thread lead. More set helix angle will make the lead longer, where as a shallower helix angle will shorten the lead. Adjustments are usually made in 15 minute increments at a time – both spindles should always have the same helix setting.

Reading helix charts: This figure shows a setting of RH 3°25' on a 2-Die machine.



1. Note the way the spindle assembly has moved to give a Right Hand or Left Hand direction. In this example, the spindle housing movement follows the right hand (RH) arrow; therefore, the spindle is set to Right Hand, to roll a right hand thread.

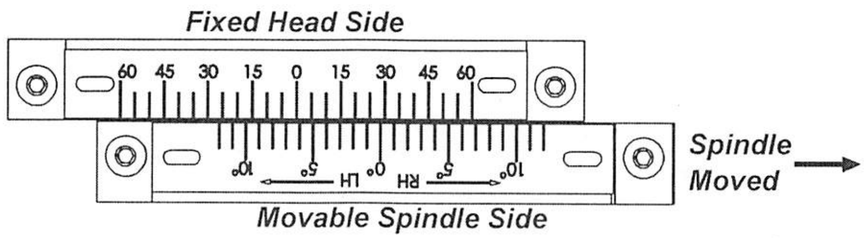
2. Measure whole degrees by noting where the "0" on the "fixed head side" or "minutes scale" points to on the "Movable spindle side" or "degree scale". In this example the fixed scale zero points between 3° and 4° as indicated by the filled box. Therefore, spindle is set to 3 whole degrees and some minutes.

3. Measure minutes by starting at the "0" reading on the minutes scale. Scan along the scale in the direction that the spindle was moved, locate the graduation mark where lines on both scales are directly aligned. The mark on the minute scale where this occurs is the minutes reading. In this example (for the right chart), starting at "0", scan down (direction of spindle movement) until you see that 25' shows an alignment.

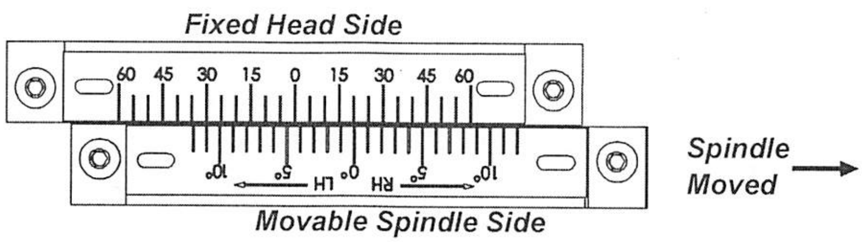
4. Combine readings. This helix chart is set to RH 3°25'. The correct helix angle for a 3/8-16 UNC thread.

Here are a few more example readings of helix charts:

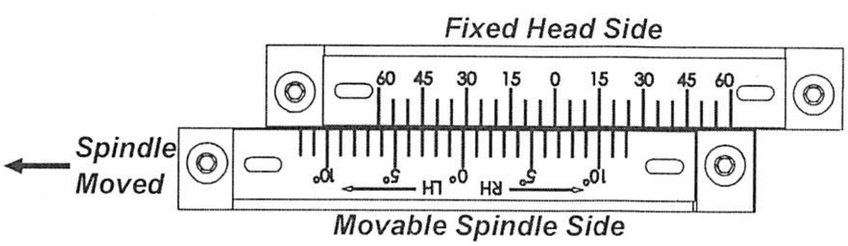
RH 6°11'



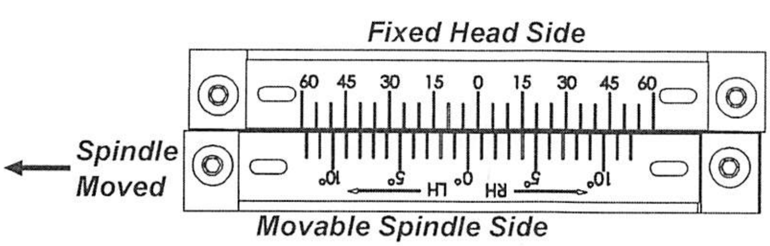
RH 4°23'



LH 6°45'



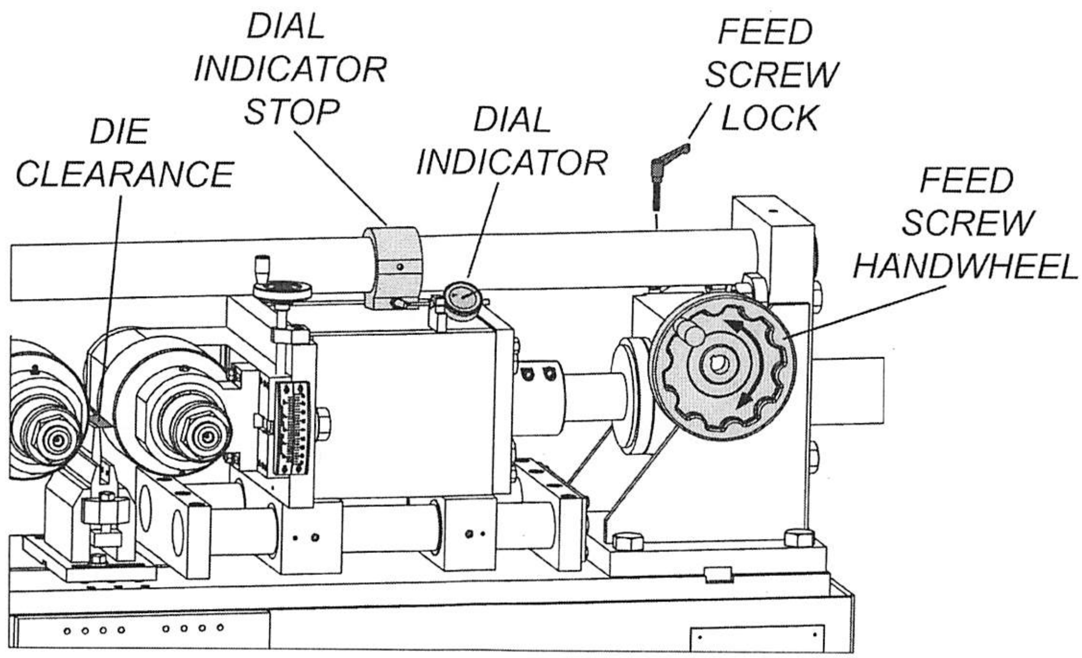
LH 0°41'



Once the helix angles are set, tighten all six spindle housing clamp bolts.

Bring Head In To Contact Part: Head movment on this machine is created by a hydraulic cylinder and a feed screw driven by a handwheel. The use of a hydraulic cylinder lets the head open to load parts and then return to the same positon each cycle. Part size adjustments are made using the feed screw handwheel.

Open the feed screw lock, and open the center head by turning the feedscrew handwheel, so there is at least 2 inches of clearance between the right die and the work support.



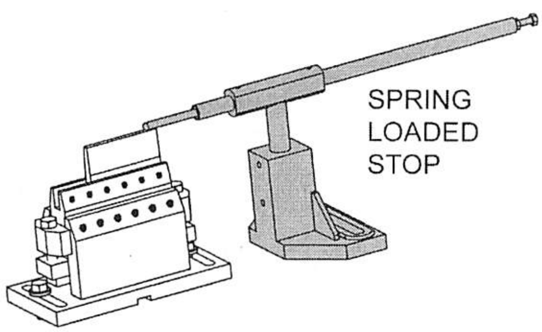
Turn on the hydraulic unit from the OIT. Switch the machine into "Manual 2" mode, and press the floor foot switch to close the center head.

When head closes, make sure nothing is in the way.

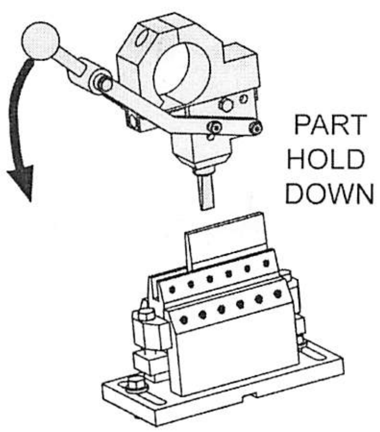
Now place a blank part on the work support. Close the center head using the feedscrew handwheel until the part is clamped securely between the dies. Move the feed dial indicator stop so it contacts the indicator stem. Zero the indicator by rotating the dial bezel.

Fixture Setup: With the blank part clamped in the dies, move or install fixture components into alignment. Essentially every job requires additional fixturing for part quality, but more importantly for safety. All fixturing should hold the part level and inline.

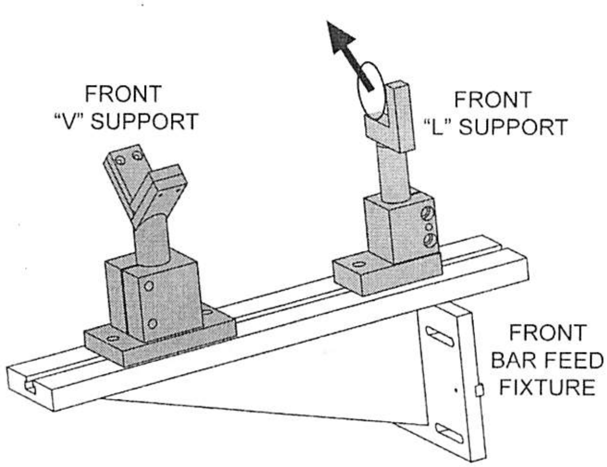
Infeed Fixturing: Infeed fixtures vary widly depending on part geometry. Here are some examples of the most commonly used components:



Spring Loaded Stop: Controls how far a piece is placed between the dies. During rolling, machine inaccuracies may cause an infed part to walk in or out slightly. The stop rod is spring loaded to account for this.



Part Hold Down: Used for short infeed parts. A blank is placed on the work support, and the part hold down handle is lowered to safely hold the part in position. The part is then rolled. A variety of contact tips are availble for different sized parts. The part hold down mounts to the upper tie-arm.



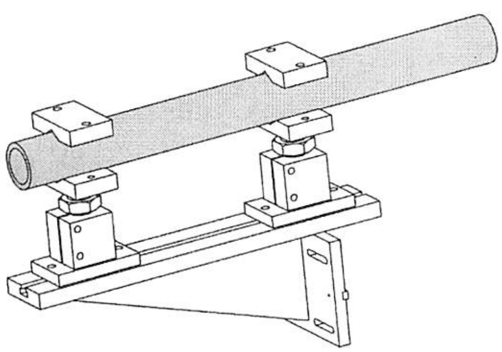
Front Bar Feed Fixture: A platform that extends from the machine base to hold fixturing components. Most often these utilize a t-nut / keyway system to keep the fixturing properly aligned.

Front L Support: An L shaped holder that rests in a stand located on the front bar feed fixture. The L support is always to be installed in the direction shown so as the work rolls into the left die, the work centerline moves away from the "L"

Front V Support: A "V" shaped holder, similar to an "L" support.

Exposed spinning parts can be very dangerous. Follow all aspects of Safety Section. Be especially careful of headed or rough parts.

Thrufeed fixturing: Thrufeed parts are generally fixtured in tubes using tube stands. This effectivly shields spinning parts and precisely locates them.



Feed tubes deliver blank parts on to the support blade and into the dies. These are usually made of steel, where the inside diameter provides around 25% clearance to the diameter of the part blank.

V-troughs are also used to feed parts into the machine. Additional guarding is required over the top of the trough, and parts may not feed as positivly as with a feed tube. However the setup process is easier, because a semi rolled part can be lifted out the top, rather than backing it all the way out of a feed tube.

Exit Tubes carry finished product away. Two center mounted tube stands can support a tube that extends from the back of the dies all the way past the back of the machine. Exit tubes must have a scoop or chamfer on their inside diameter to catch an incoming part. The tube should be advanced as far forward on the machine as clearance with the driveshaft components permit, but not coming closer than ¼" to the back die face. Typically, the inside diameter of the exit tube is 33% larger than the major diameter of the finished part. Parts must not be allowed to jump past each other in the exit tube – large part chamfers may also allow parts to jam. If scuffing on the thread crest is not a concern, steel tubing is most economical. Otherwise, exit tubes are available with plastic liners which protect the finish of threaded parts. Air powered blow-off rings can be added to reclaim some of the coolant that is carried off by the rolled part.

Tesker Manufacturing offers a wide variety of feed and exit fixture options, from 1/8" diameter parts 1" long to 6" diameter bars which are 60 feet long, and in production quantities that are from one to millions.

Die Lineup: Die lineup refers to the process of syncronizing the paths of both dies. That is getting the threads created by one die to align with the threads created by the other die. At this point, the dies faces should be set even in front (See "Die Face Alignment" page 47). Die lineup should be preformed before rolling a full depth thread.

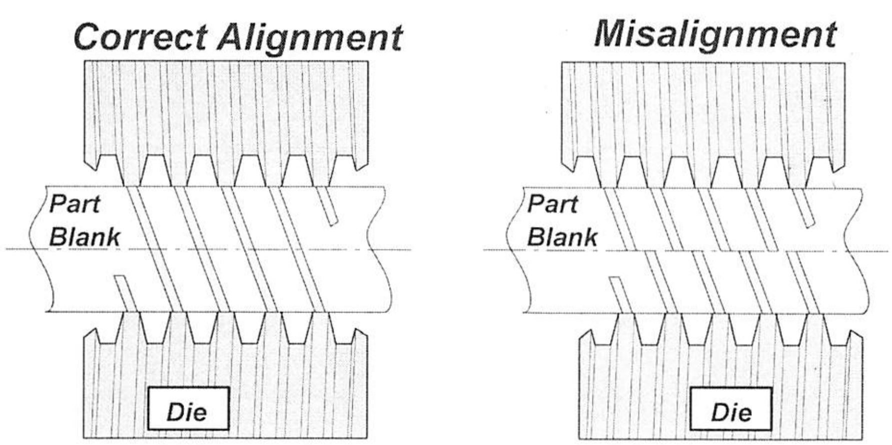
Open the head by pressing the foot switch. Remove the work piece. Now, reclose the head. With the dial indicator zeroed, turn the feed handwheel to advance the head 0.005" past the "light contact" position. Now start the spindles in the correct direction for the work:

Thrufeed: "Right" rotation for a right hand thread will make the work feed through the machine (most common fixturing arangement). "Left" rotation will cause a left hand thread to feed through the machine. Reversing rotation from standard will still create a normal thread, though the work will feed in the oposite direction.

Infeed: Infeed jobs can be rolled with either spindle direction; however, when the heads are open and the part is being removed after rolling, the die rills may contact the threads creating a push or pull on the part. For safety reasons, the rolling direction should be chosen that tends to push a part back towards the operator.

You are beginning to roll. Follow all necessary precautions.

Open the head once again. Place the workpiece between the dies. Close the dies, but reopen them after rolling 180°. Stop the spindles, remove the part and inspect.



The "correct" diagram shows a single track created by both dies. There are two methods to create die lineup on this machine:

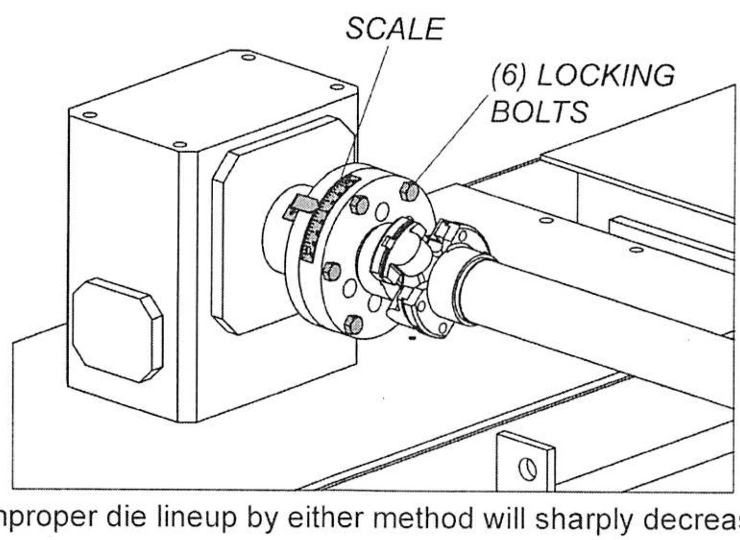
Die Lineup Sleeve: Turning the die lineup sleeve will move the spindle and die assembly axial to create lineup. This is the easiest method. Either spindle can be adjusted, but remember that for thrufeeding, the die that turns "down" on the work should be ahead of the other (see Die Face Alignment, page 47).

Note: While adjusting die lineup, the die shoulder should remain, on average, 3/8" exposed from the spindle housing grease seal. Adjusting the spindle too far in either direction could cause a problem. Also make sure the outboard bushing snap rings are not rubbing on the grease seals.

Radial Linup Coupling (optional): If a job requires infeed rolling tight up to a shoulder, this method is used. Normal adjustment of the Die lineup sleeve produces an offset in the die faces. This offset effectivly limits how close to a shoulder or head you can roll a thread.

The radial lineup coupling is installed on one driveshaft and allows for angular adjustments of the die rotational position. (All infeed dies have helix ground into the rills. Adjusting the angle of one die to the other can create lineup die lineup)

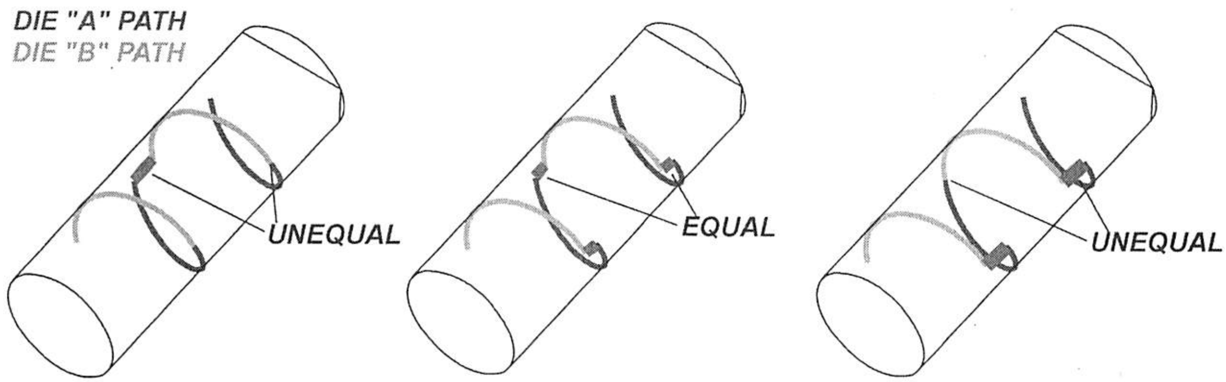
The die lineup sleeves should be adjusted to make the die faces even in front. Note from the test rolled blank which way the die has to be turned to make lineup. Loosen the six locking bolts on the radial lineup coupling. Using the scale as a reference, rotate the driveshaft by hand to the correct location. Re-tighten two bolts across from each other and recheck alignment. If successful, re-tighten all bolts – torque them in a criss-cross pattern to 30 – 34 ft-lbs. In this illustration, guards have been removed for clarity.



Note: Improper die lineup by either method will sharply decrease die life. Spending a few extra minutes ensuring the best possible lineup can extend die life by thousands of parts, and greatly improve thread quality.

Equal Offset Die Lineup: In several circumstances, it is impossible to exactly achieve die lineup, often due to die geometry limitations, deep thread forms, or inaccurate or compensated helix angles. As a consequence of this misalignment, for infeed rolling, the part may actually feed in or out slightly.

All Tesker spindles have axial spring loading that will activate when the machine is rolling a full thread to allow some die floating to make lineup. The following diagram illustrates equal offset lineup. When equal offset lineup is achieved, the spindle's spring loading can best compensate for the inhearant mismatch.



UNEQUAL OFFSET

CORRECT EQUAL OFFSET

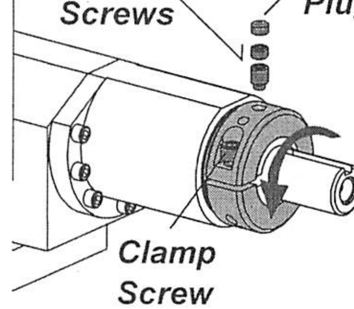
UNEQUAL OFFSET

In the diagram above, the thread is lightly rolled 180° as instructed in the die lineup step. The two die's marks are shown in different colors. The thick red lines show the size of the gaps between each die's marks. In the equal offset condition (center picture) the beginning and end of each 180° trace are equally spaced to the adjacent trace.

Die float adjustment: All Tesker spindles have spring loading which allows the dies to make small axial movements. This feature extends die life and assists with proper die lineup. Spindles are set from the factory with 0.030" die float. This setting is correct for most jobs. Occasionally though, for fine pitch, or tightly controlled lead, this setting will need to be adjusted. The settings should be the same for both spindles.

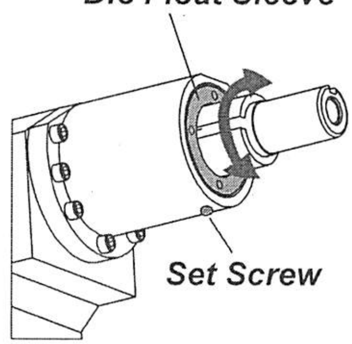
Begin by removing the driveshafts from the machine spindles by loosening the forward setscrews and collapsing them at the spline.

Next, the die lineup sleeve adjusting lock collar must be completely removed. Begin by removing the silicone plug covering set screws. Remove two set screws from this hole. Loosen the clamp screw and thread lock collar off back of spindle.



Now loosen the brass tipped float sleeve set screw from the underside of the rear of the spindle housing.
Finally make the die float adjustment using a face-spanner wrench. Begin by turning the die float sleeve until tight. Now loosen the sleeve until the desired amount of float is reached.

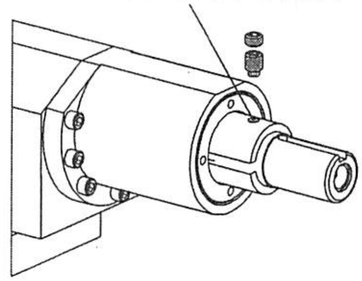
1 turn = 0.050" die float



Tighten the brass tipped float sleeve set screw, and re-thread the lock collar onto the die lineup sleeve.

The set screw tapped hole in the lock collar must align with the pocket in the sleeve. Insert the dog-point set screw into the sleeve pocket, then the jamb set screw. Now replug the hole with RTV silicone, and tighten the lock collar clamp screw.

Finally reattach the driveshafts.



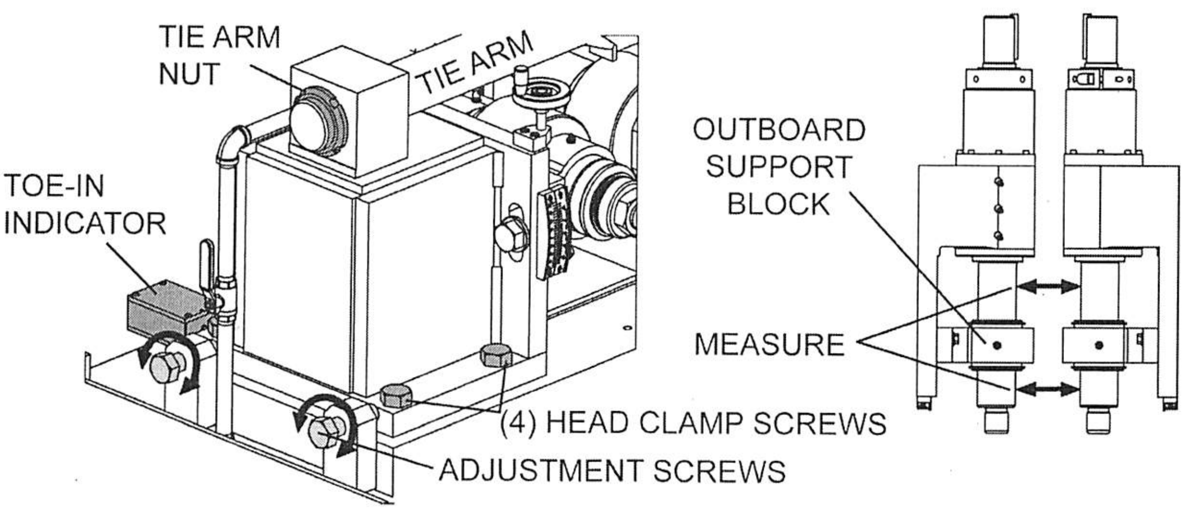
Adjust Toe-In: Toe-in refers to the parallelism of the two machine spindles.

Infeed: Toe-in adjustment for infeed rolling will correct for thread taper. That is, differences in pitch diameter and outside diameter measurements throughout the length of the thread.

Thrufeed: Toe-in adjustments on thrufeed rolling determine at whitch point along the die length the threads will be fully formed. For best die life and best thread form geometry, this should occur over the spindle housing pivot pin (back 1/3rd of die). The test rolled part should show the deepest marks at this point.

Machine Adjustment: The left machine head sits on a pin that allows for angular adjustment of the entire head and left spindle housing. Begin adjustment by loosening the left tiearm nut with a spanner wrench. Now loosen the four head clamp screw. Turn the adjustment screws to change the toe-in.

Toe-In Indicator (optional): The machine may be equiped with a dial indicator that can display relative movement of the head.



Toe-in can also be measured directly from the spindles. With the outboard support blocks installed and the spindle helix angle set to zero, measure the gap between the two spindles, front and back. The toe-in is set from the factory 0.010" narrow at the front. With this setting, under rolling load, machine flexing will usually cause the spindles to run nearly parallel.

Retighten the head clamp screws to 75 ft-lbs. Now snug up both adjusting screws to the head. Finally retorque the tiearm nut. The tiearm nuts should be tightened enough to pre-load the tiearm. This will minimize machine flexing and increase accuracy during rolling.

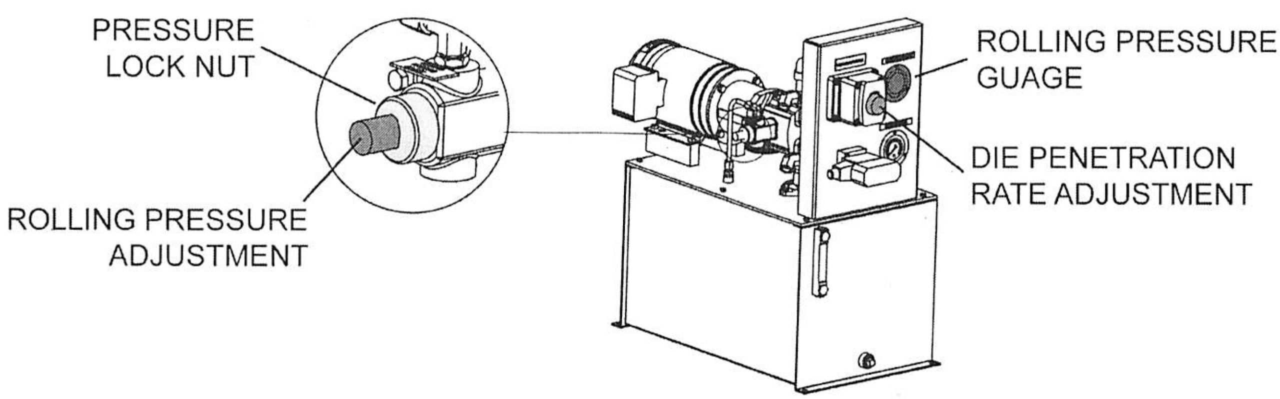
Adjust rolling pressure: Rolling pressure measures the hydrualic force needed to keep the movable head closed while rolling. The hydraulic system acts as a cushion so if a harder spot or oversized region exists on the part blank, the movable head can open slightly to prevent damage to the machine.

Rolling pressure is read from the rolling pressure guage on the hydraulic unit. The pressure is adjusted by turning the pressure adjusting screw on the hydraulic pump. The "Pressure Lock Nut" is set at the factory to the maximum pump pressure. Do not adjust lock nut or overtighten adjustment screw.

Begin by setting the rolling pressure far in excess of required force for rolling setup pieces. This will ensure head stays in closed position.

Once job is running acceptably, decrease pressure until the head begins to float - as indicated by an oversized pitch diameter or undersized outside diameter.

Increase rolling pressure 5000 lbs over this minimum value.



Die penetration rate: Die penetration rate describes how fast the movable head plunges in on the part. The penetration rate is set using the hydraulic flow control on the hydraulic unit.

Thrufeed: Ideally in thrufeed rolling, the parts are fed into the dies with the head closed, and subsequent parts are fed tightly behind. This method keeps the dies "full" and will produce a more consistent thread. As the last part leaves the die, built up flex in the machine may tend to over-roll the tail end of the part or possibly damage the dies. Open the dies when the last part is ½ way through, or use an optional "Tie-Arm Stop" to help with this problem. Penetration rate is typically set near maximum to save time when opening and closing the head.

Infeed Rolling (or plunging in on a blank part for thrufeeding): Die penetration rate for infeed rolling can greatly effect the die and machine bearing life because it controls how quickly the thread is formed. Spreading the work of rolling over a longer time (slower penetration rate) usually means the dies are placed under less stress. Therefore, harder materials will generally be rolled with a slower penetration rate. However, some types of materials, known as "Work Hardening" materials, although hard must be rolled quicker than expected. Experimentation must determine the proper penetration rate for these jobs.

Typical Penetration Rates		
Material	Hardness	Penetration Rate (inches / rev)
Low Carbon	15-34 HRc	.010" - .020"
High Carbon	34 – 48 HRc	0.0015" - .010"
Work Hardening	-	.003"-.006"

The die penetration rate is found by the following formula:

$$\textit{Penetration Rate} = \frac{\textit{Inches}}{\textit{Rotation}} = \frac{\textit{Basic Depth of Thread}}{\textit{DieRotations} * \frac{\textit{DieStarts}}{\textit{PartStarts}}}$$

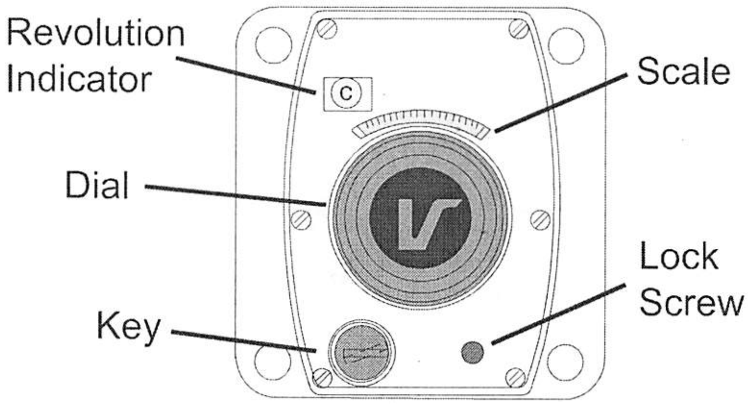
Basic Depth of Threads: A tabular value needed in the "Depth Setting" step.
Die Rotations: Count of rotations from first die/part contact to full penetration depth.
Die Starts: Number of starts on an infeed die.
Part Starts: Number of starts on the part (most commonly one).

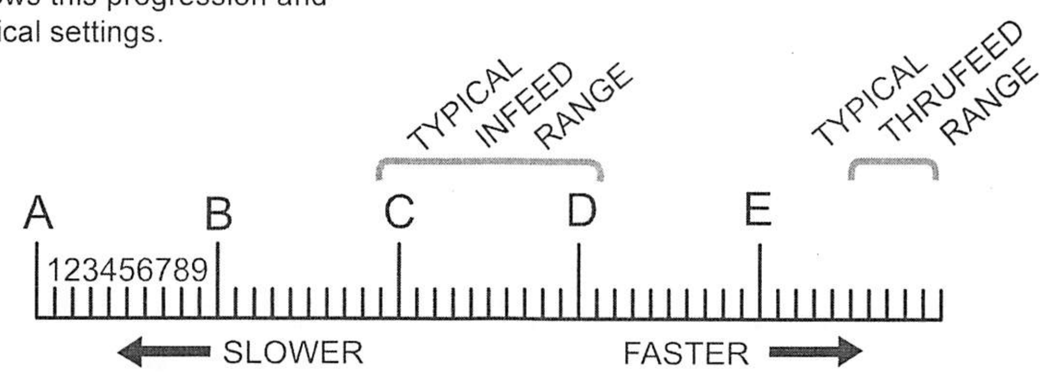
Example: Rolling a single start thread with a 5 start die set. From contact to full depth while rolling is 4 full die rotations. Basic Depth of Thread is 0.080" (from Tesker Thread Chart Book).

$$Penetration\,Rate = \frac{0.080\,inches}{4\,Rotations * \frac{5\,Start}{1\,Start}} = \frac{0.004\,Inches}{Rotation}$$

In other words, in this example, for every rotation the die makes, the part makes 5 turns (because there are 5 starts on the die). The die rotated 4 full revolutions, so the part turned a total of 20 times (4 * 5 = 20). If the head traveled 0.080 inches total, the penetration rate is 0.004 inches per revolution (0.080 ÷ 20 = 0.004).

Flow control adjustment: Penetration rate is increased by turning the dial clockwise. The current speed setting is read by both the scale (0 thru 9) and the revolution indicator (A thru E). Every time the dial completes a revolution, the indicator letter is incremented. A0 is the slowest possible setting, and E9 is the fastest. The following illustration shows this progression and typical settings.





The flow control settings can be locked (to prevent unauthorized adjustment) by first tightening the lock screw, then turning the key to the "locked" position.

Calculate and Set Thread Depth: The head must now be brought in to create a fully formed thread. The required adjustment is equal to the "BASIC DEPTH OF THREAD". Due to machine and spindle flexing, some additional depth will be required.

Basic Depth of Thread can be looked up in the Tesker Thread Chart Book or calculated by using the formula below for a 60° or vee-thread form:

$$\text{Basic Depth of Thread} = \frac{.649}{\text{Threads Per Inch}(T.P.I.)}$$

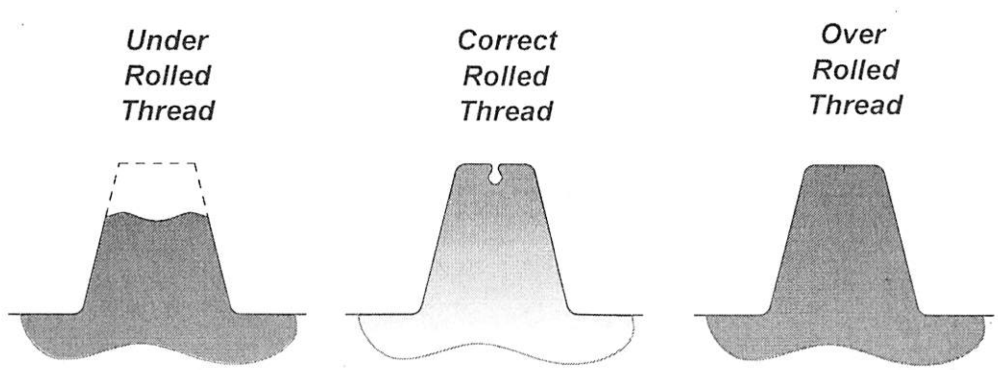
With the head in the open position, turn the feed handwheel and note travel distance on the feed indicator (page 51). Tighten the feed screw lock lever after adjusting head.

Reclose the heads and verify that the work support is equally spaced between the dies. Adjust if necessary.

Test Roll Sample Pieces: Start the machine and test roll several sample pieces (do not re-roll a sample part). While rolling, the current draw, as shown on the ammeter, should stay below the maximum as indicated by the yellow sign above the meter - adjust spindle speed accordingly. Next, verify that the rolling pressure is adequate to keep the movable head closed, if not, increase rolling pressure.

Large or deep threads may need several passes to fully form.

Controlling Part Diameters: Since thread rolling displaces existing material to make the thread crest, the blank part must start with the correct diameter. If the blank is too small, the crest's will not be fully formed. If the blank is too large, the finished thread will be oversized with incorrect lead, and the machine will work harder than necessary, decreasing die and bearing life. Generally speaking, for vee and symmetric acme threads, the starting blank diameter will be close to the final pitch diameter.



Most properly formed threads do show a seam or knit at the center of the crest where the metal fronts come together. This seam is typically shallow and does not effect the strength of the finished thread. A large seam however may create an objectionable appearance to the thread. A very hot part may be an indication of over-rolling. To obtain maximum die life, it is better to start at the minimum blank diameter, and accept a larger seam.

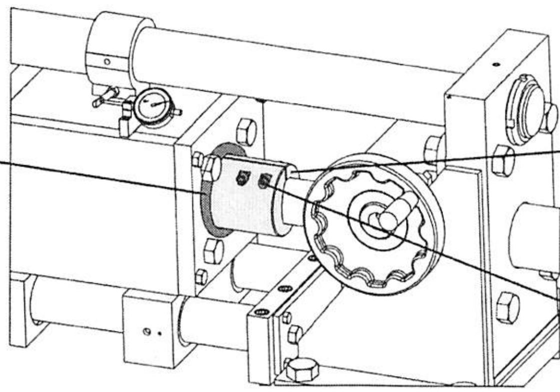
If the thread form is already full, pitch diameter cannot be decreased by bringing in the head more – there is no longer a place for the material to flow. The only option is to start with a smaller diameter blank. Also, as a consequence of the material displacement, a desired decrease in pitch diameter will create a growth of the outside diameter. On a vee thread, a decrease in pitch diameter of 0.001" will grow the outside diameter by 0.003".

Blank sizes on other thread forms (buttress, ball, worm etc...) must be experimentally developed. Start with a blank of a known diameter. Roll with the production set of dies a full depth thread. Now measure the outside diameter of this part. The difference between the final outside diameter and blank diameter is called the "Growth of Thread". This number is unique for each type, pitch and "fullness" of a thread form. Now subtract this growth of thread from the final desired outside diameter of the production part to arrive at a blank diameter.

Within the limits regarding thread fullness described above, gauge a finished part and adjust the head depth accordingly, a few thousandths of an inch at a time, until proper size is met.

As the machine warms up after a period of time, it may be necessary to back off the head a few thousandths of an inch to keep parts within tolerance.

Retract Depth refers to the amount of movement the center head makes when retracting after rolling.



Loosen the stop nut clamp screw and spin the nut on the feed screw. A spreader screw is provided if the nut does not spin freely on the feed screw. The retract distance should be large enough to completely disengage the dies from the part, but not too large as to allow the part to fall along side the work support. A short stroke will speed cycle times by reducing travel distance. Re-tighten the stop nut clamp screw.

CAUTION

Do not allow the stop nut to create a pinch point between the nut and the head. When head is closed, no gap should be visible.

Setting Infeed Timers: Once the final spindle speed, penetration rate and part diameter and retract distance are determined, the timers for infeed rolling can be set. Typically a low-carbon infeed part on this machine will roll for around 1 second.

Re-rolling parts: Setup or damaged parts may need to be re-rolled to bring them to the correct production specifications. Re-rolling at the "once-through" production settings will typically create an over-rolled, undersized part because the strain on the machine has changed. For this reason, re-rolling requires a shallower head setting to produce the desired size.

Infeed Rerolling: The machine mode “REROLL” is used to re-size parts, or correct thread imperfections or nicks. At this start of this cycle, the dies are stopped. A damaged part is placed on the work support and “engaged” into the thread rills on the left die. The cycle starts, the head comes in to contact the part, and the spindles restart. It is important that the “REROLL DIE TO PART CONTACT TIME” is set accurately so the dies do not apply force to the part while the spindles are stopped. See page 27 for more details.

Preform production safety evaluation: Before the job is handed to the production operator, a safety evaluation must be made. Follow the guidelines laid out in the safety section of this manual.

CAUTION

It is the responsibility of the setup person to ensure the safety of each job. Comply with all recommendations in the Setup Safety portion of this manual.

Setup Troubleshooting

Work piece raises off support blade:

POSSIBLE CAUSE	CORRECTIVE ACTION
Support blade above center.	Lower support blade to correct height.
Loss of die match. Workpiece not properly aligned with dies.	Re-align fixturing. Back off hydraulic head and verify die match.
Die penetration rate overly high.	Slow penetration rate down.
Workpiece movement.	Try reversing spindle rotation.
Workpiece blank is oversized or out of round.	Verify blank size and shape.
Excessive die face runout.	Check shoulder on spindle for runout. Check that I.D. of die and face of die run true. Check bearings in spindle housing and in outboard support blocks. Replace if necessary.
One die larger than the other.	Verify the O.D. of each die is the same.

Lead error:

POSSIBLE CAUSE	CORRECTIVE ACTION
Wrong helix set on machine.	Check machine set up.
Starting workpiece several times when thrufeed rolling.	Change die penetration rate and spindle RPM to keep number of starts to a minimum.
Excessive elongation of workpiece material	Adjust helix angle on machine to compensate for lead error.
Wrong helix angle ground into dies or set on machine.	Send dies back to manufacturer for inspection. Recalculate helix angle on machine.
Correction in dies for wrong workpiece diameter.	Send dies back to manufacturer for inspection.
Excessive toe-in or toe-out on left head.	Change toe-in setting on machine. This will affect lead error.

Major diameter or pitch diameter of workpiece is oversized or undersized:

POSSIBLE CAUSE	CORRECTIVE ACTION
Wrong workpiece blank size.	Check workpiece blank size and adjust.
Thread on workpiece not fully formed.	Bring hydraulic head in deeper and see if workpiece size changes.
Gradual erosion of the die crest.	Replace dies.
Workpiece material being shaved off on support blade.	Replace support blade.
Thread form on die not to correct size.	Have die manufacturer check die thread form.

Taper on O.D. and P.D. of thread:

POSSIBLE CAUSE	CORRECTIVE ACTION
Taper in blank of workpiece. This taper will be transferred to thread form.	Workpiece blanks must have as little taper as possible in them.
Toe-in on machine not adjusted for thread size and length.	Re-adjust toe-in.
Excessive taper at tip of workpiece. Very ductile material allows extrusion.	Increase blank diameter. Sometimes incurable.

Scuffed thread crests:

POSSIBLE CAUSE	CORRECTIVE ACTION
Improper support blade height setting.	Check blade height and re-adjust.
Material welded to support blade.	Replace blade with aluminum bronze, ceramic or roller support blade.
Excessive support blade roughness.	Replace blade.
Support blade set too far back for thrufeed rolling	Move blade forward two or three rills in from back of die.
Rear tube or rear feed table not in alignment with workpiece.	Re-adjust rear fixturing.
Rough workpiece blank O.D.	Workpiece blank O.D. should be turned for best finish.
Break-outs of the die thread form.	Replace dies.

Flaking or slivering of thread form:

POSSIBLE CAUSE	CORRECTIVE ACTION
Over-rolling of part.	Back off depth of rolling.
Loss of die match. Workpiece not properly aligned with dies.	Re-align fixturing. Back off hydraulic head and verify die match.
Part making too many revolutions in die.	Increase die penetration rate. Decrease rolling time.
Material welded to support blade. Support blade rough or broken.	Try aluminum bronze, ceramic or roller support blade. Replace with new blade.
Support blade too far below center.	Re-set support height.
Workpiece rubbing on rear tube or feed table.	Re-adjust rear fixturing.
Workpiece material has work-hardening characteristics.	Increase die penetration rate. Decrease rolling time.
Superficial work-hardening of workpiece blank.	Grind blank of workpiece.
Workpiece material has high sulfer or lead content.	Avoid material with sulfur content greater than .13%.

Marked thread flanks:

POSSIBLE CAUSE	CORRECTIVE ACTION
Chips or breaks in dies.	Replace dies.
Deep grooves in support blade.	Replace or re-machine support blade.
Chips or metal shavings in coolant.	Add filtering system to coolant.

Axial line of flakes on part:

POSSIBLE CAUSE	CORRECTIVE ACTION
Seam in stock.	Verify stock quality.

Drunken threads (wavy thread form):

POSSIBLE CAUSE	CORRECTIVE ACTION
Dies out of match.	Re-match dies.
Incorrect helix angle.	Recalculate helix angle and re-match dies.
Front fixturing not holding workpiece square with dies.	Re-adjust work alignment fixturing.
Workpiece O.D. is twice as big as what the thread is long.	Slow die penetration rate and make fixturing to hold workpiece square with dies.
Runout of die face.	Check spindle shoulder for runout. Check for runout between bore and face of die. Check all bearings, replace if necessary.
Die penetration rate too high. Spindles spring load and die match is lost before workpiece can make a complete revolution.	Slow die penetration rate, especially when rolling a fine thread on a large diameter workpiece.

Excessive heat buildup in part:

POSSIBLE CAUSE	CORRECTIVE ACTION
Over-rolling of workpiece.	Back off hydraulic head until seam in crest can be seen on workpiece.
Excessive workpiece hardness or very deep thread form.	In these cases, high heat of the workpiece is normal.
Insufficient coolant supply.	Increase coolant volume.
High speed rolling.	Water will absorb heat twice as much as oil and should be considered as a coolant for high speed rolling.
Improper coolant application.	Apply coolant to workpiece at the point of die contact.

Poor die life:

POSSIBLE CAUSE	CORRECTIVE ACTION
Over-rolling of workpiece.	Back off hydraulic head until seam or void is visible at the crest of the thread.
Die penetration rate too high.	Verify die penetration rate is correct.
Workpiece hardness.	As hardness goes up, die life decreases due to the reduction in the material elongation or ductility. This is normal.
Workpiece material with work-hardening tendencies.	Speed up die penetration rate and reduce workpiece rolling time.
Chamfering of workpiece blank not correct for hardness of material.	Re-chamfer workpiece blanks according to chart.
Material does not have enough elongation.	Minimum elongation is 12%
Material with high sulfur content, resists cold forming.	Find a workpiece material with a sulfur content of less than 0.13%
Material with high lead content, resists cold forming.	Find a workpiece material with a sulfur content of less than 0.10%
Faulty workpiece material.	Investigate the quality of the material used.
Coolant containing active sulfur and/or chlorine has a highly undesirable, erosive effect on dies.	Use coolant with friction-reducing properties and is acceptable for bearing lubrication.

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Machine Maintenance

Tesker thread rolling machines are designed for heavy duty operation, and can last decades if properly maintained. The following section describes recommended maintenance procedures and intervals. Failure to follow these recommendations will shorten machine life and void the warranty. Everyone performing maintenance on this machine should read and understand this entire manual.

Lubrication Requirements

Mobil Polyrex EM – blue bearing grease - resists machine coolant washout
Mobil Vactra #2 – way lubricant used in feed slide lube unit
Mobil Glygoyle 460 P.A.G. - synthetic gearlube used in right-angle gearboxes
Mobil 600 W Super Cylinder – conventional gearlube used in older right-angle gearboxes (See note on page 71)
Mobil DTE 26 – anti-wear hydraulic oil

Maintenance Tasks

The following are descriptions of specific maintenance tasks followed by a table summarizing the maintenance intervals. Intervals listed here are for normal work conditions and eight hour work days. Adjust accordingly for more work hours or unusual work difficulty.

CAUTION

When performing maintenance tasks on this machine, disconnect electrical power and follow lockout/tagout safety procedures.

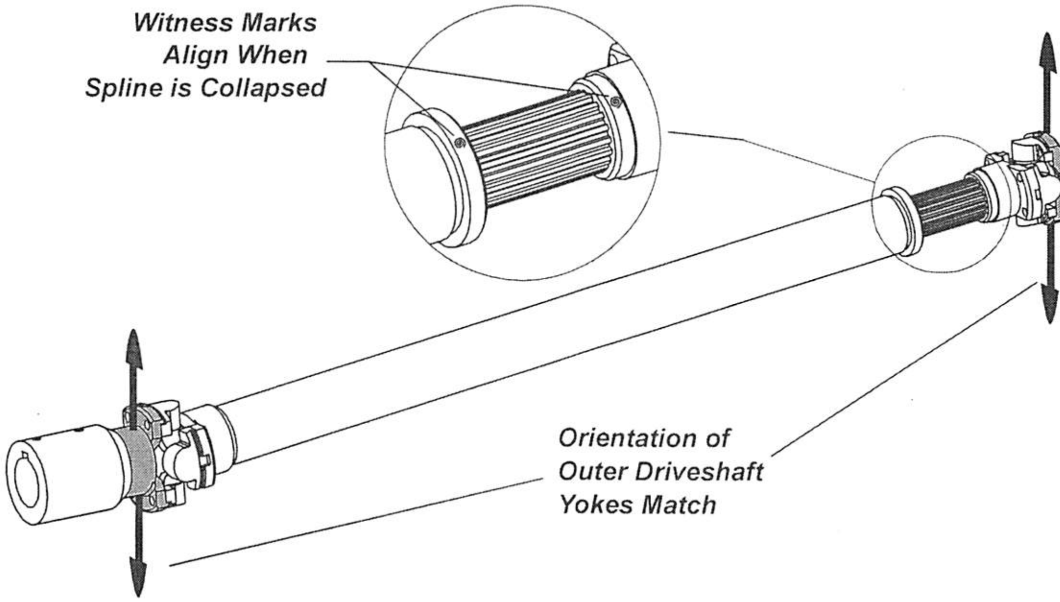
CAUTION

Do not over-grease sealed bearings. Over-greasing of sealed bearings can be just as damaging and under-greasing.

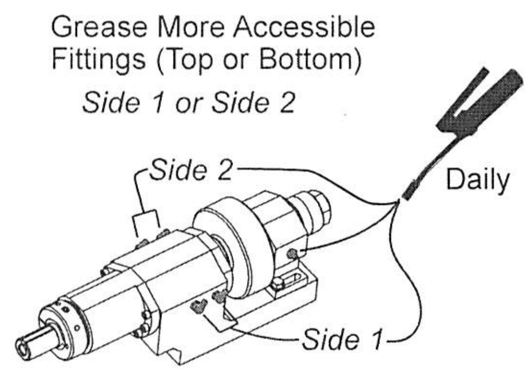
Coolant system: Keep coolant (water-based or oil) clean and at manufacturer recommended concentrations. Shovel or vacuum out swarf when it builds up. Magnetic or membrane filters are available to maintain fluid cleanliness.

Hydraulic Hoses: Check hoses for signs of fatigue, cracks, bulges, etc.... **daily**. If damaged, replace immediately with the same grade and pressure rated hose.

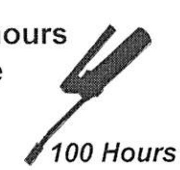
Driveshaft orientation: Attention must be paid to the orientation of the driveshaft u-joints. When a driveshaft is rotated, the u-joints cause slight speed variations. Matching both driveshafts and u-joints will negate this effect. Note a witness stamp indicating the proper spline alignment. The stamps must align when the spline is fully compressed. When assembled correctly, the u-joint orientation should look like the following diagram:



Machine Spindles: Grease fittings on the spindle housings and outboard blocks **daily** for heavy use, or less frequently for lighter use with Polyrex EM or equivalent grease. On the spindle housings, grease only one side of housing. Listen while machine is operating for signs of bearing failure. Spindle must be replaced if spalling occurs under roller bearing surfaces.



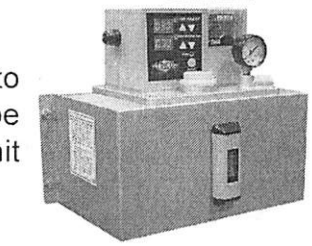
Drive Shafts: Grease universal joints on either end of drive shaft every **100 hours** using Polyrex EM or equivalent grease. Also lubricate spline shaft with grease every **500 hours** – spline must remain clean and operate freely.



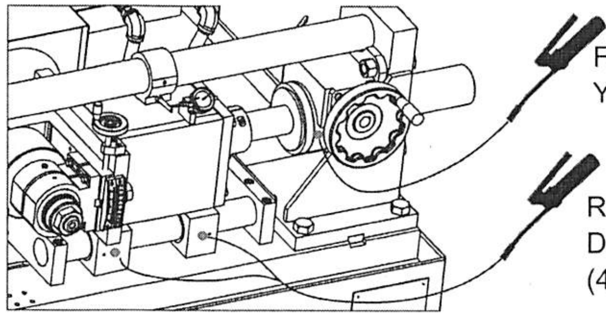
Feed Slide Lube Unit (optional): Use Mobile Vactra #2 in lube unit reservoir. Pump the manual unit **daily**. The automatic unit can be adjusted to lubricate slides depending on machine usage. Typically the unit will be factory set to lube for 15 seconds every 2 hours.

Manual Lube Unit

Auto Lube Unit



Push Rod/Feed Handwheel: Grease feed jack yearly. Operate head though full range of motion occasionally to distribute grease along feed screw and rails. If machine is not equipped with lube unit, grease head/rail fittings daily, 4 fittings total. Use Polyrex EM or equivalent grease.

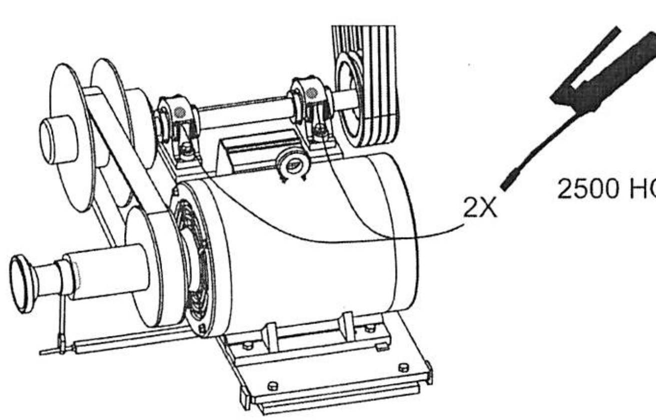


Right Angle Worm Gearbox: New gearboxes are shipped with synthetic lubricant. Check the gearbox nameplate to verify lubricant type. Do not mix lubricant types. Synthetic lubricant offers longer component life and extended service intervals. If switching from conventional to synthetic lubricant, gearbox should be thoroughly flushed before refilling. Gearbox lubricant level can be checked by opening a check plug on the gearbox casing.

Mobil Glygoyle 460 P.A.G. Synthetic: Change oil only when performing maintenance that requires gearbox disassembly.

Mobil 600 W Super Cylinder conventional (or an AGMA Compound #7 equivalent): Change oil in gearbox every 2500 hours or 6-months.

Vari-Speed Belt Drive: Inspect drive belts monthly for loose cords or wear. Replace as necessary. Lubricate the two sealed pillow blocks inside the machine base using Polyrex EM or equivalent grease every 2500 hours of use. Do not over-lubricate sealed bearing units.

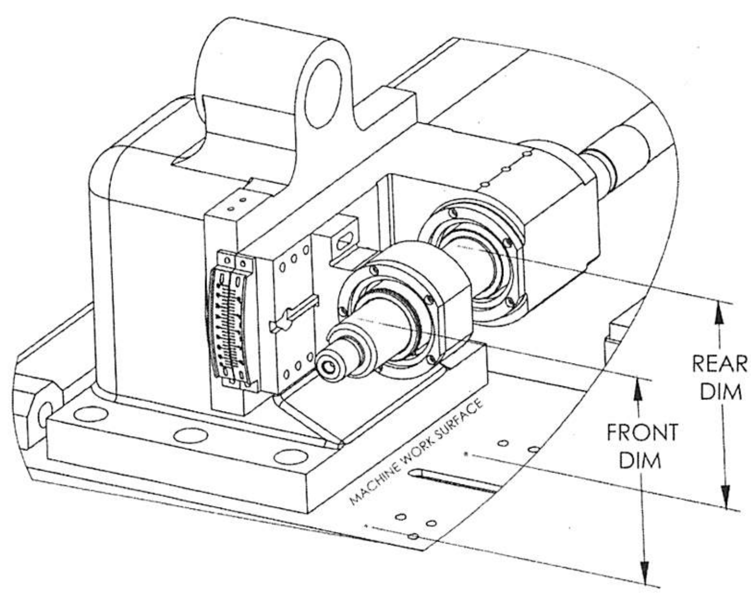


Electric Motors: The spindle motor and hydraulic motor each have two grease fittings located near the end rotor bearings. Grease the motors every **5000 hours** using Polyrex EM or equivalent grease. Do not over-lubricate sealed motor bearings!

Hydraulic Unit: Change the hydraulic system filter **yearly**, or when the filter pressure gauge indicates. Drain and replace the hydraulic oil **yearly** with Mobil DTE 26 hydraulic fluid.

	Daily	100 Hours	500 Hours	2500 Hours or Every 6 Months	5000 Hours or Yearly
Grease Spindles	■				
Grease Head/Rail Fittings	■				
Pump Lube Unit (Manual Unit)	■				
Grease Driveshafts		■			
Grease Handwheel					■
Change Gearbox Oil (conventional)				■	
Inspect Belts			■		
Grease pillow blocks				■	
Grease Electric Motors					■
Change Hydraulic Filter					■
Change Hydraulic Oil					■

Replacing Damaged Helix Charts: If the spindle helix charts need to be replaced, the spindles must be re-indicated to the machine base. Begin by cleaning the machine base and work area around the measurement zones. Now install only the outboard support blocks securely to the center of the spindle length. Using a height guage or dial indicator, adjust the spindles by comparing the "FRONT DIM" to the "REAR DIM". Heights must read within 0.0005" of eachother. Install new charts at zero angle as shown on page 39.



Thread Rolling Procedure

Customer:____________________ Date:________________

Part number:____________________ Procedure by:____________

Part name:____________________ Part revision:____________

Thread form:______________________ Material:____________

Nominal thread size:______________

Thread length:____________________

☐ Right-Hand ☐ Left-Hand

☐ Hot-rolled
☐ Cold-rolled
☐ Turned
☐ Ground

☐ Customer
☐ Warehouse
☐ Mill

Blank Dia:__________ ↑ Limit:________ ↓ Limit:________

Pitch Dia:__________ ↑ Limit:________ ↓ Limit:________

Outside Dia:__________ ↑ Limit:________ ↓ Limit:________

Root Dia:__________ ↑ Limit:________ ↓ Limit:________

Lead/Pitch:__________ ↑ Limit:________ ↓ Limit:________

Measure over wires:__________ ↑ Limit:________ ↓ Limit:________

Wire size:__________

Inspection frequency:__________________________ Pressure angle:__________

Inspection equipment:__________________________ Root radius:__________

Machine / Station No.:__________________________ Die number:______________

Set helix angle:______________ ☐ RH ☐ LH Die Dia:______________

Toe-in setting:______________ Die width:______________

Spindle rotation (standing at front of machine): ☐ CW ☐ CCW

☐ Infeed
☐ Thrufeed
☐ Continuous thrufeed
  ☐ Annular ring
  ☐ Speed-up type
  ☐ Slow-feed type

RPM / Gear:______________

Rolling pressure:______________

Depth of thread:__________________________

Set thread depth from blank contact:______________

Length of stroke:__________________________

Penetration rate:__________________________

Support height:____________

Support width:____________

Below rolling center:__________

Depth mic reading:__________

Rolling time:__________ Load time:____________

Total cycle time:________ Production / Hr:__________

Fixtures:____

____

Guards:____

____

☐ Al-bronze
☐ Carbide
☐ Roller
☐ Upper support
☐ ____________

Thread Rolling Procedure

TMC TESKER

Customer:________________________ Date:____________________

Part number:______________________ Procedure by:____________

Part name:________________________ Part revision:____________

Thread form:__________________________

Nominal thread size:___________________

Thread length:________________________

☐ Right-Hand ☐ Left-Hand

Material:____________

☐ Hot-rolled
☐ Cold-rolled
☐ Turned
☐ Ground

☐ Customer
☐ Warehouse
☐ Mill

Blank Dia:____________ ↑ Limit:_________ ↓ Limit:_________

Pitch Dia:____________ ↑ Limit:_________ ↓ Limit:_________

Outside Dia:__________ ↑ Limit:_________ ↓ Limit:_________

Root Dia:_____________ ↑ Limit:_________ ↓ Limit:_________

Lead/Pitch:___________ ↑ Limit:_________ ↓ Limit:_________

Measure over wires:_________ ↑ Limit:_________ ↓ Limit:_________

Wire size:_______________

Inspection frequency:_____________________________ Pressure angle:____________

Inspection equipment:____________________________ Root radius:_______________

Machine / Station No.:_____________________________ Die number:__________________

Set helix angle:___________________ ☐ RH ☐ LH Die Dia:_____________________

Toe-in setting:____________________ Die width:____________________

Spindle rotation (standing at front of machine): ☐ CW ☐ CCW

RPM / Gear:_____________________

Rolling pressure:_________________

Depth of thread:_________________________________

Set thread depth from blank contact:_________________

Length of stroke:_________________________________

Penetration rate:_________________________________

☐ Infeed
☐ Thrufeed
☐ Continuous thrufeed
  ☐ Annular ring
  ☐ Speed-up type
  ☐ Slow-feed type

Support height:______________

Support width:_______________

Below rolling center:__________

Depth mic reading:___________

☐ Al-bronze
☐ Carbide
☐ Roller
☐ Upper support
☐ ______________

Rolling time:____________ Load time:______________

Total cycle time:_________ Production / Hr:__________

Fixtures:____

____

Guards:____

____