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Die Head / Tangential Chaser Management

BEST thread finish and tool life depends upon proper management of the chasers, die head, and the machine upon which the tool is mounted.

This information gives corrective measures for the morecommon troubles which affect finish and tool life.

Operating problems are defined and corrective measures given strictly on the basis of what can be done to improve threading results. It does not deal with considerations outside those parameters. For example, a given material may be acceptable in all respects except thread finish. In such instances, it will be up to the user to decide whether to accept the finish, or to change to a more expensive, better threading material.

A particular problem can be the source of more than one trouble. Therefore, such problems may, for the sake of quick reference, be covered in more than one section.

Complete and detailed information on how to grind and use chasers, care and operation of die heads can be found in the 17th and earlier editions of the Landis Threading and Forming / Thread Data Handbook. This publication also includes useful information on collapsible taps, thread rolling and eighty-four pages of helix angle and thread data charts on all the major thread forms.

Maximizing Chaser And Threading Performance

To maximize tool life and threading performance, some trial and error adjustments must be made as the threading operation progresses. However, preparations for good results should begin before the spindle makes a revolution.

Where it is possible to do so, select materials that will give good threading results.

Metallurgical quality should be consistent with that established for a given material.

The best possible coolant, correct speed, and other constants should be chosen so that those factors are eliminated as possible trouble sources.

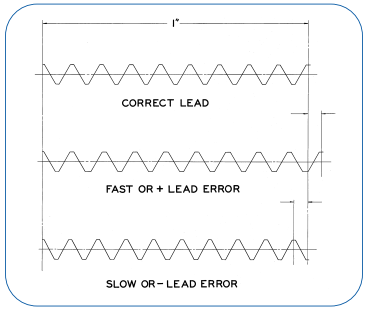
Lead Error

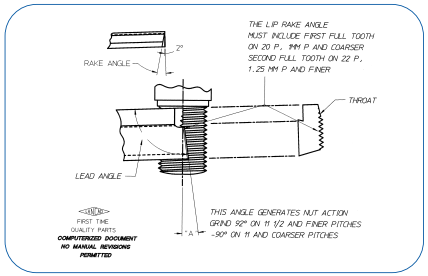
Of a progressive nature, lead error is measured in terms of plus or minus per pitch, accumulated over a given thread length. Because of a number of contributing factors, it can be difficult to trace and correct.

Aside from possible sources of trouble, lead should first be looked at in terms of tolerance demanded and the type of threading means required to produce it.

If tolerances are to be held to .002" per inch or better, a machine with leadscrew or other type of positive feed means will be required. With equipment in good condition, lead error can be held to .0005" per inch with precision positive feed.

While possible to use for coarse pitch, lesser tolerance threads, hydraulic, air, or spring feeds are not recommended for close tolerance work.





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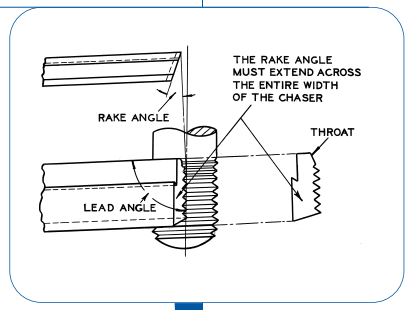
Lead Variation Corrective Measures

Regular chaser holder sets are furnished to produce a range of threads of a given series - UNC, UNF, etc. Each holder set has a mean helix angle which allows it to produce all the standard diameter and pitch combinations within that range - within tolerances for that series.

Special chaser holders having an exact helix angle for a specific diameter and pitch combination are available. Where lead tolerance is very close and cannot be realized with regular holders, special holders should be employed.

For non-leadscrew threading with a Landmatic pull-off type head, or when using a Landex yoke operated type head, chasers require a "lip rake" grind. With this grind the rear threads extend over center to produce a nut-action with the finished thread. This nut engagement is used to pull Landmatic type die heads open.

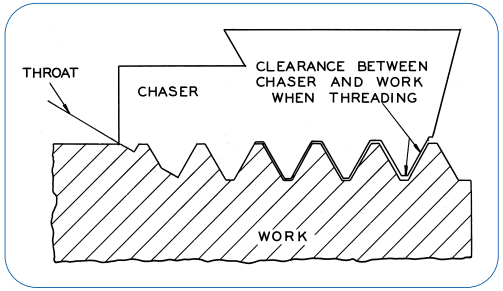


For leadscrew threading with Lanco yoke operated heads, chasers are ground with a straight rake and lead combination grind. The object of this grind is to place the cutting edge exactly on the work centerline so no nut-action is generated that would tend to override the leadscrew feed. This same general type of grind is used to "jam-cut" taper pipe threads like NPT.

With either a lip-rake or straight rake grind, an incorrect grind angle or deviations from the chaser setting position will tend to produce lead error.

For straight threading, chasers are given back clearance to assure that they cut only with the throat and first or second full thread. The first full thread is included on 20 pitch, 1 mm pitch and coarser, the second full thread on 22 pitch, 1.25 mm pitch and finer. The remaining threads extend overcenter and provide nut-action without interfering with the lead being produced.

Any condition that reduces the back clearance between the chaser and finished thread will increase lead. Conversely, an increase in clearance will decrease lead.



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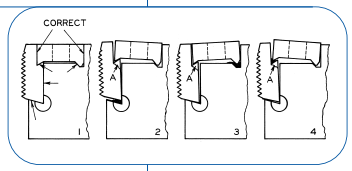
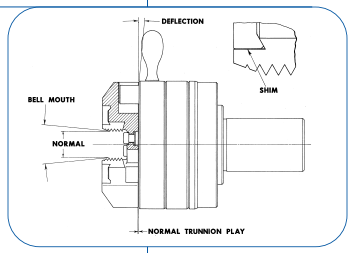
Conditions That Affect Clearance and Lead

A. Improper Chaser Setting



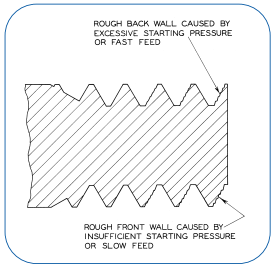
Damaged seating surfaces or dirt can cause improper chaser positioning. Seating surfaces should be cleaned and checked before chasers are installed. Chasers should be cleaned and holder seating surfaces free of dirt. Damaged holder seating surfaces should be honed.

B. Threading Heat Treated Material



Harder materials create increased cutting pressures that force holders to bell-mouth outward which effectively reduces clearance. Several alternatives are possible. Use chasers with longer throats for reduced chip size which spreads the cut over a longer length. Also, make sure the trunnion clearance is correct for the die head being used. Excessive trunnion play allows an even greater degree of bell-mouth, especially when using wider chasers. If this condition is suspected, place shim stock (starting with .003") between the chasers and each clamp as shown by the illustration. If this helps or corrects the problem, the condition is present. Vary the amount of shim until the best results are obtained. It is possible to have future chasers made with extra clearance to offset the degree of bell-mouth.

C. Dull Chasers / Incorrect Starting Pressure



Maintain a sharp cutting edge. Dull chasers increase the resulting pressure which causes bell-mouthing thus reducing clearance.

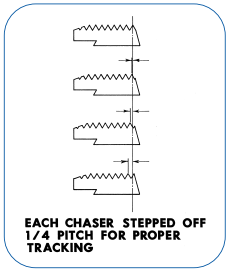
Incorrect starting pressure, especially when the work is being manually fed, can affect lead. Generally of a temporary nature, this problem will disappear as the operator gains experience.

Side Shaved Threads

Improper starting pressure, or any condition which affects proper tracking of the chasers will cause side shaving. Side shaved threads can give an appearance of taper.

Normally found on beginning threads, eventual full engagement of the chasers will correct the condition.

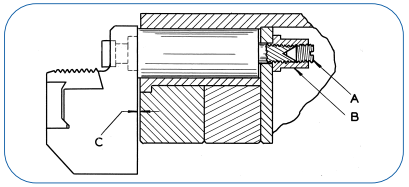
This condition can be confirmed visually. Side shaved threads have a wider root than normal. When hand feeding, new operators need to learn to apply correct starting pressure. When mechanical feed is being employed, the condition causing the problem must be identified and corrected.



Chasers are stepped off for proper tracking. With four chaser heads, the tools are mounted 90° apart, which results in each chaser being stepped off 1/4 lead from other chasers in the set. On a six chaser head, the step is 1/6 lead. The step-off allows the chasers to follow each other in the cut. Any condition that interferes with tracking will produce side shaving for the full length of the thread.

Conditions that affect tracking

A. Improper Trunnion Clearance



A prescribed amount of trunnion clearance or "play" must be maintained between the chaser holders and the face of "Heat Treated" style die heads. Trunnion play serves two purposes. First, it allows head components to move without binding during opening and closing. Secondly, it allows chasers to properly track each other in the cut. Uniform and correct play must be used for all holders or the chasers will not properly track. As shown by the chart, the prescribed amount of clearance varies with size and style of head.

B. Dirt or Chips

Chips and dirt packed between the holders and die head face will eliminate or reduce play and affect tracking. Holders should be periodically removed and cleaned.

C. Worn Equipment

Heads with excessive wear should be rebuilt or replaced.

The die head and machine and the die head and workpiece must be in acceptable angular and concentric alignment.

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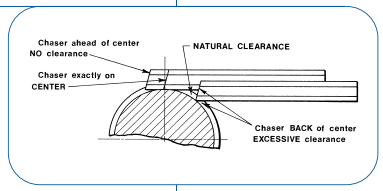
Rough Threads



A common cause of rough threads is improper chaser setting. Chasers work best usually when set slightly back of center where they have natural cutting clearance.

Minor deviations from initial gage setting position are made to accommodate the particular machineability of a specific material. This becomes a matter of trial and error.

However, if chasers are set too far forward, the thread tops will be torn, the chasers will over-heat, and prematurely wear. If set too far back, threads will be chattered and out-of-round. The latter condition can be detected by rotating the thread between thumb and forefinger.

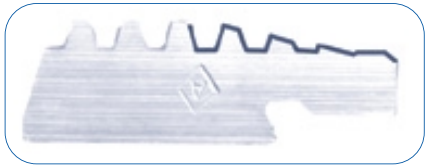
Chips welding to the tool cutting edge can be the cause. Welding occurs when threading gummy materials that do not cut well, or in response to any condition causing excessive heat.

When threading gummy materials, try using a high rake for better shearing action. Start with the recommended angle and increase by degrees until best results are obtained. Finish will never be as good as when threading a harder material that gives better shearing action. The corrective measure used, therefore, improves but doesn't completely cure the condition.

Use the best grade of cutting oil liberally flooding the cutting area. See the section on "Coolant" for more information on this subject.

Grind the cutting end grinds as smooth as possible. A rough finish will not cut as free as a smooth one. Any condition which interferes with cutting efficiency builds heat and heat hinders results.

Use the longest throat possible to spread the chip over the longest length possible. On tougher materials or coarser threads such as Acme, Modified Square, use Roughing and Finishing Form, or Roughing Form Throat chasers. With these, the thread profile of the throat, or the throat and first or second full thread are reduced in thickness. Each modified tooth progressively removes a few thousandths until a full tooth finishes the thread. See the publication on Landis Tangential Chasers for more detailed information on these special features.



Make sure that the chasers are mounted in proper rotation and that all have the same throat angle.

Use the proper speed for the material, diameter and pitch to be threaded.

An improper rake or lip-rake of too little "hook" can be the cause.

The accompanying chart list recommended "starting" rakes. Deviate from the "starting" angle until best results are realized. New "boxed" chasers are ground with a 22° rake suitable for mild steel. If chasers are to be used for other materials, so state on the order and they will factory ground accordingly.

The machineability of some materials is so poor that it will be difficult to obtain good finish regardless of what rake angle or tricks of the trade used.

Lip-rake grinds should be "hooked," as the material may require and on special thread forms like Acme, so the lipped section falls on the centerline, or rough threads can result. To obtain this position, the lip-rake should be hooked back an amount equal to the chaser holder helix angle.

Make certain that the die head, workpiece, and machine are in angular and concentric alignment. Check and indicate to rule out misalignment as a trouble source. The die head should not over extend from the mounting.

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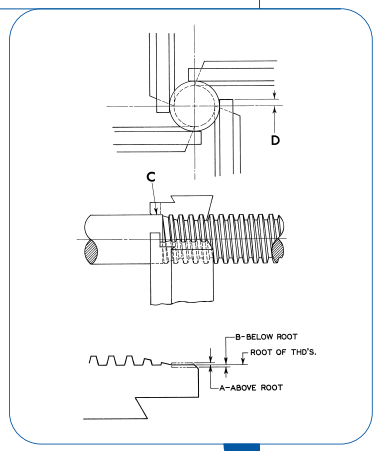


Out-Of-Roundness / Chatter

Out-of-roundness is easily detected and can be readily felt by rotating the thread between thumb and forefinger. Chatter is readily visible on the thread. Both conditions have common causes. Chasers set too far back of center can cause either. This is easily corrected, by advancing each chaser equally, in small increments, until the condition disappears.

Verify that the thread and other diameters of the workpiece are concentric.

The workpiece and die head must be rigid. Lack of workpiece rigidity will tend to be more apparent when coarser pitches and/or long thread lengths are involved. Use of Centering Throat chasers often solves this problem. These chasers employ a pad which precedes the throat to establish a bearing on the workpiece O.D. to steady the part. The O.D. must be held consistently uniform to allow this type chaser to be used.

Never use chipped chasers. Keep the cutting edge sharp. If damaged beyond regrinding, replace.

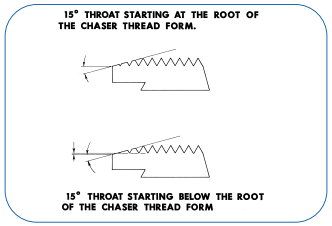
Chasers in the set must all have the same throat angle, for example, and cannot be mixed.

The die head and machine must be in concentric and angular alignment. Indicate the die head and machine components for both conditions to rule out either as a source of trouble.

Use the correct rake or lip rake. Not only must the correct angle be used, but the angle must be uniformly applied to all chasers of the set.

Out-of-roundness occurs on the starting threads of sheared stock. While virtually impossible to completely eliminate the condition, the use of the correct throat can minimize the result.

Use chasers having the throat starting sufficiently below the root of the thread will allow the bell-mouth of the chasers to remove the excess metal.



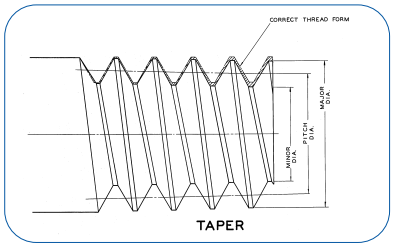
Tapered Threads

Defined as a progressive increase or decrease of major pitch or root diameters over the thread length. Taper is difficult to trace since it is not readily visible.

Small to Large Taper

Stepped flanks from improper starting on pressure can appear to be taper. When checked over wires, the step allows deeper seating of the wires which is falsely interpreted as taper. The condition usually results from improper hand feed. Checking the thread with a comparator will clarify the condition.

Conditions that cause chaser bell-mouthing will reduce chaser clearance and result in taper. This tends to occur more when a straight rake grind is used.



Clearance placed in a chaser at manufacture is based on the material and its specification.

Harder and gummy materials which are more difficult to shear, and abrasive materials which dull or dub the chasers causing the cutting edge to dig in, result in higher cutting pressures with reduced clearance.

Greater back clearance is, or can be, placed in chasers used for such applications.

Worn or defective head parts, such as locking and closing pins and their respective bushings, are a common cause of taper. They wear tapered and the taper produced on the part will be at the end of the thread where the head opens.

The prepared blank must be straight. If the blank is not straight, the thread O.D. will be tapered, but the P.D. and root diameters will be straight.

Large to Small Taper

This condition is usually the result of chasers which are set too far back of center. Advance the chasers equally, in small amounts, until the condition is corrected.

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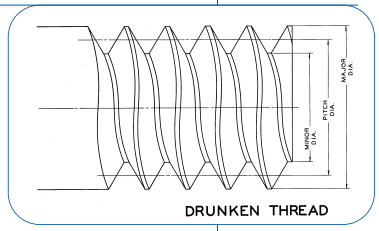
Drunken Threads

This is a "wavy" condition of the thread going plus or minus off true helical lead when measured over the circumference of one thread revolution.

One possible cause is misalignment. Check die head and machine for alignment.



DRUNKEN THREAD

Use of a low lead angle with hand feed can result in drunken threads. For UN, Whitworth, BSF and ISO coarse, and straight pipe threads, the angle should be 90° for 11 pitch and coarser, 92° for 12 pitch and finer.

To establish the lead angle where special chaser holders are used, subtract the helix angle from 90°, then add 3°.
If the holder has a helix angle of 6°, for example, the lead angle would be 90° - 6° + 3° or 87°. For convenience, helix angles of special holders are stamped in the sliding block slot, or on the holder face.

Chipped chasers, chasers set too far back of center, improper feed and worn head parts can cause a drunken thread condition.

Drunken threads are common when cutting over interrupted cuts or when threading hexagon, square, or other unround forms.

Chipped Chasers

There are numerous causes of chipped chasers.

The chasers striking the shoulder before the die head opens and is retracted. An allowance must be added to the throat length to allow for the head's forward movement, which occurs during opening motion at the end of the thread. The allowance is based on thread pitch. Refer to the charts for the appropriate dimensions.

Do not water quench chasers when grinding. Rapidly cooling a hot chaser creates cracks which cause teeth to chip during use.

Higher rake angles weaken the cutting edge. Using a rake lower than recommended generates high cutting pressures with possible chipping.

Rapidly force-starting the head onto the work.

Work not gripped tight enough, especially when positive feed is being used.

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Chip Welding

When good threads are followed by a number of bad threads, followed by more good threads, it is unlikely that a mechanical problem is the cause.

Welding of the cutting edge should be one of the first possibilities investigated.

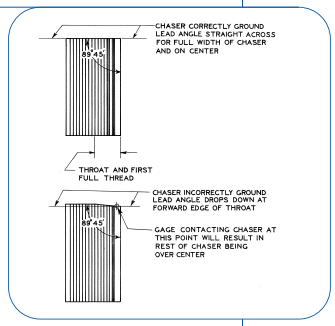
Chasers will start off cutting satisfactory. As the weld builds in size, thread quality becomes worse. The weld will continue to build until it snaps off, then good threads will return.

Welding is caused by excessive heat so the reason for the heat must be located and corrected.

Before spending time chasing possible causes, stop and recollect. Has anything changed? Is the material the same, is a different person doing the end grinding, are chasers with different throats being used?

Some steels weld easier than others and a material change might be required to obtain the desired results.

Use the best grade of threading coolant and flood the cutting operation. When cutting Acme and forms requiring heavy metal removal, such as Acme, use the longest throat possible. Use the highest rake possible for best shearing action and grind the cutting end as smooth as possible for cleaner cutting with less friction.



When grinding chasers there is one fault which is easily overlooked. After regrinding, there should be no rounding or drop-off at the throat end when it is checked with a straight edge. The entire cutting edge of the chaser should contact the straight edge regardless of whether the chaser has been ground with a leadscrew or lip-rake grind.

Lead angles will vary and the 89-1/2° angle used in the illustration is intended as an example and the drop-off has been exaggerated to make a point. The intersection of the throat angle with the end of the chaser forms a compound angle that must be accounted for. Thus, the chaser must be ground to assure a straight edge, especially when manipulated by hand to true out the lip-rake to obtain the straight edge condition.

When setting chasers, the setting gage contacts the cutting edge of the throat. If the cutting edge drops off, the forward throat section will be on center, but the remainder of the chaser will be over-center. Cutting clearance will be reduced in proportion to the drop-off, or eliminated. Rub will increase, heat will be higher, and the tendency to weld greater.

Speeds

Excessive rpm's will affect both thread quality and tool life. Reference to a machineability chart will give some indication of what speed can be tried. Generally, materials with a higher rating can be threaded at faster speeds than ones with lower ratings.

Speeds can be adjusted higher or lower, of course, by trial-and-error until the most acceptable combination of tool life and thread finish is obtained.

Coolant

For best all around results, it is important that the least amount of heat possible be generated and that it be dissipated quickly.

Unless application considerations prevent its use, Landis recommends the use of a better quality sulphur base oil containing 2 to 3% sulphur and 1/2 to 1% chlorine. Sulphur base oil gives better shearing action, reduces material build-up, and gives best tool life.

Water is excellent as far as heat dissipation is concerned. (A ten parts water to one part soluble is generally the best mixture.) However, it lacks the lubricity required to make it a good cutting fluid and will cause rusting of the internal die head parts.

The purpose of placing back clearance in chasers is to lift the heel of the chaser off the work and to restrict cutting to the throat and first full thread. Use of the wrong or inferior coolant dulls the cutting edge which increases pressure and reduces or eliminates clearance. The chasers will rub across the entire width instead of cutting on the throat and first full thread. Tool life will be diminished.

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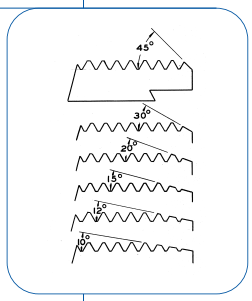
Proper Tool Setting

Setting the chasers with the setting gage will position the cutting edge on the rotational center line of the work.

Understand that the gage position is a starting point. Experience will show that chasers generally work best when set slightly back of center. The amount will vary according to the machineability of the material that is being threaded.

Each chaser is moved the same amount. Start by moving each chaser "one flat" of the chaser abutting screw at a time. Cut a trial thread. Continue to set the chasers as far back as possible without experiencing chattered and/or out-of-round threads. If either of these conditions occur, move the chasers forward until it disappears. This procedure will result in the clearance that gives freest cutting action and best tool life.

Throat Angles



Use the longest possible throat angle.

Chasers used for UN, BSF, Whitworth, and ISO metric are normally supplied with 15°, 20°, 30°, or 45° throats.The latter is sometimes referred to as a "no throat."

A 15° or 20° throat is preferred, while 30° and 45° are to be avoided if possible. They are used where a relief or other restriction prevents using one of the longer throats.

Given a choice, always use a relief width that will allow the use of the longest throat.

The width of relief requirements for UN, Metric, and Acme Threads are given in the charts on pages 92 and 93.

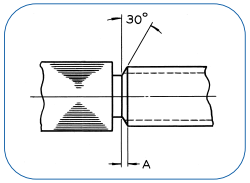
When coarse pitch thread forms are involved, such as Acme, throat angles of 12°, 10°, 9°, or 7° are used.

Throats start "at" or "below" the root of the chaser. When oversize material must be threaded, chasers with throats starting "below root" are used to permit entry of the work-piece and to shave off the excess.

THROAT ANGLE	CHIP THICKNESS	NO. OF THDS. IN THROAT
45°	.0177	0.7
30°	.0125	1.2
20°	.0086	1.9
15°	.0065	2.6

Based on 10 Pitch U.N. Thread Form Chaser

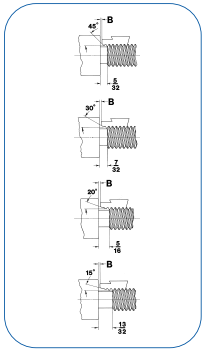
The chart illustrates the distribution of cut for various throats and indicates that the ideal choice is to use the longest throat possible.



With shoulder work, the available width of relief "A" dictates the throat that can be used.

The throat plus the first full thread should enter the relief to completely finish the thread.

The relief dimensions given in the charts represent the throat length plus 1/32" for 32-14P, 3/64" for 13-8P, and 1/16" for 7-4P chasers. These small additions, indicated by "B", are necessary to allow clearance for the forward travel of the die head opening motion to prevent damage from striking the shoulder.



Die Head / Tangential Chaser Management

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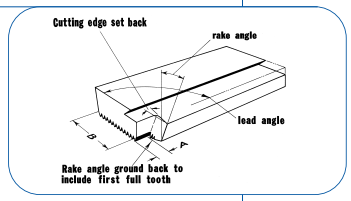
Cutting Short Length, Fine Pitch, Soft Material

When using a pull-off type head, such as an "F" Landmatic, threads of short length, fine pitch, and/or soft materials, do not result in sufficient engagement to effect opening without thread damage. Threads will be side shaved or stripped.

Several "tricks of the trade" can be used to eliminate these conditions.

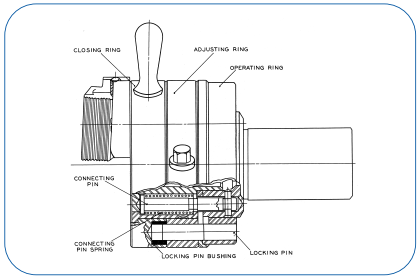
On pull-off type heads, interrupting the forward travel of the carriage or slide affects a separation between the front and rear sections of the die head. As the rear section stops, the front section continues forward due to the nut action formed by the chaser with the completed thread.



When sufficient separation is reached, the locking pins withdraw from the locking pin bushings allowing the closing ring to rotate and withdraw the chasers from the cut. On fine pitch, short length, soft material work, the drag of separation is greater than the contact of engagement and the thread is damaged as a result.

One possible solution is to try using a "keyway" grind on the chasers. As illustrated, grind the lip rake, "A", back more than normal by 1/64" on smaller and 1/16" on larger diameters. Thus, "B" will extend over center to improve the bite and increase the resistance to damage the threads.

Types F, A, and other Heat Treated Style heads have locking pins which engage bushings to keep the head closed. To effect opening, the thread must withstand the force required to compress the connecting pin springs, which then enables the pins to pull from the bushings.



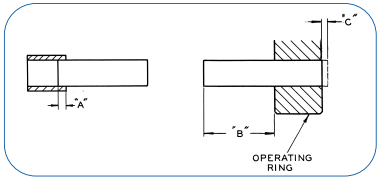
If the "keyway" grind does not solve the problem, an alternative to try is to reduce the amount of locking pin engagement with the bushings. This is done by pressing the pins rearward in the operating ring by the amount listed in the chart. Be sure that all pins are moved exactly the same amount.

Material Hardness and Machineability

Thread cutting is considered impractical when materials are 36 Rockwell C and harder.

Chaser life will be drastically decreased in direct proportion to the hardness increase.

However, the design of the Landis chaser allows a certain amount of latitude in heat treatment and special chaser steels for best performance.



Proper Grinds / Grinding Techniques

The rake and lead angles recommended are starting points. The user can, by trial and error, deviate from these until best results are obtained. This is especially true of rake angles, the varying of which can substantially improve results.

Landis chasers can be hand ground and cutting end grinds are easily varied. Precision grinding is not a requirement.

Use extra care to produce a smooth rake free of rough grinding marks. Rough grinds increase material build-up resulting in higher heat. Excessive heat will affect tool performance.

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How Improper Grinding Affects The Chasers

Often, the extent of damage from improper grinding is not neither readily apparent or understood. Figures 1, 2, and 3 show chasers that have been badly abused during grinding. In Figure 1, they have been magnified three times and appear as they would to the naked eye. Note that a tooth has been chipped off each.

Magnifluxing of the chasers in Figure 2 shows the true extent of the damage. The crack, barely discernible in Figure 1, now shows clearly. Also note the other cracks and grinding burn discoloration. Obviously, chasers damaged to the extent shown cannot give satisfactory performance.

Discoloration indicates excessive heat has been generated. The discoloration on the back of the chaser in Figure 3 obviously follows the cutting end grind.

To prevent damage do not: (1) attempt to remove too much metal per pass, (2) cool by water dipping, (3) use the wrong grinding wheel, (4) use an improperly dressed wheel - improperly dressed wheels load up. Excluding water dipping, the other mentioned no-no's will tend to burnish rather than grind, and that generates high heat. That is further compounded by the chaser being presented and withdrawn from the wheel. The alternating heating and cooling of the surface layer causes surface stresses which will cause cracking. Excessive heat can temper chasers and lower their original hardness. Do not use a hard wheel. Figure 4 illustrates a 64.5 to 65 Rockwell C sample ground on the left with a hard wheel and on the opposite flank with a soft wheel. While the flank ground with the soft wheel does not appreciably differ from the microstructure, the area ground with the hard wheel exhibits a white case. Microhardness in the white area varied from 61.1 to 63.8 in proportion to depth.

Coolant can enhance grinding but will not correct or offset improper grinding techniques. Correctly applied at the wheel and chaser contact point, coolant can limit the depth of surface tempering if excessive heat is developed.

Figure 1

Figure 2

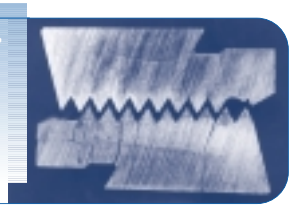


Figure 3

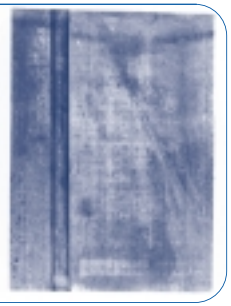
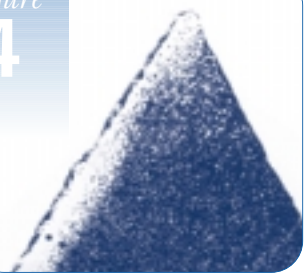


Figure 4



Grinding Do's and Don'ts

1. Do not water quench. The extremely quick drop in temperature rapidly contracts the steel causing cracks.

2. Don't remove too much metal in one pass. That is not to say that the tools should necessarily be "lightly" reground until a sharp edge is restored. Metal removal will vary with the wheel, the chaser, and the operator. Experience is the best teacher.

3. Avoid discoloration. Lack of discoloration indicates a satisfactory removal rate. Watch thread crests for discoloration, being of small cross section, they burn easily.

4. Keep the wheel dressed to prevent load-up and to maintain a clean, abrasive cutting action.

5. Do not subscribe to a "hard wheel" holds up better than a soft one. While soft wheels wear somewhat faster, they produce better results with less tool damage and will be less expensive in overall cost.

6. Grind M-3 (special) high speed steel chasers more carefully than standard ones. M-3 contains higher degrees of Vanadium and carbon which is more difficult to grind.

7. When cracks develop, any attempt to remove by grinding should be done slowly and very carefully. If grinding is hurried, the cracks will extend deeper.

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Chart 1

Threads Per Inch Width of Relief or Undercut – Inches

	UN Thread Form			
Threads Per Inch	45° Throat	30° Throat	20° Throat	15° Throat
32	1/16"	5/64"	3/32"	7/64"
28	1/16"	5/64"	7/64"	1/8"
26	1/16"	5/64"	7/64"	1/8"
24	1/16"	5/64"	7/64"	9/64"
22	1/16"	3/32"	1/8"	5/32"
20	5/64"	3/32"	1/8"	5/32"
18	5/64"	3/32"	9/64"	11/64"
16	5/64"	7/64"	5/32"	3/16"
14	5/64"	1/8"	11/64"	7/32"
13	7/64"	9/64"	3/16"	15/64"
12	7/64"	9/64"	13/64	1/4"
11-1/2	7/64"	5/32"	13/64"	17/64"
11	7/64"	5/32"	7/32"	17/64"
10	1/8"	11/64"	15/64"	19/64"
9	1/8"	11/64"	1/4"	21/64"
8	9/64"	3/16"	9/32"	23/64"
7	5/32"	15/64"	21/64"	27/64"
6	11/64"	1/4"	23/64"	15/32"
5	13/64"	19/64"	27/64"	35/64"
4-1/2"	7/32"	5/16"	15/32"	39/64"
4	15/64"	11/32"	33/64"	43/64"

Note: These figures are based on throat starting at the root of the thread.

Pitch In mm Width of Relief or Undercut – mm

	Metric Threads			
Threads Per mm	45° Throat	30° Throat	20° Throat	15° Throat
.5	1.6	1.6	2.0	2.4
.6	1.6	1.6	2.0	2.4
.7	1.6	2.0	2.4	3.0
.75	1.6	2.0	2.4	3.2
.8	1.6	2.0	2.4	3.2
1	1.6	2.4	3.0	3.6
1.25	2.0	2.4	3.2	4.4
1.5	2.0	3.0	4.0	4.8
1.75	2.4	3.2	4.4	5.6
2	3.0	4.0	5.2	6.8
2.5	3.2	4.4	6.4	8.0
3	3.6	5.2	7.2	9.2
3.5	4.4	6.0	8.8	11.2
4	4.8	6.8	9.6	12.4
4.5	4.8	7.2	10.4	13.5
5	5.2	8.0	11.6	15.1
5.5	5.6	8.4	12.4	16.3
6	6.0	9.2	13.5	17.5

Note:These figures are based on throat starting at the root of the thread

Chart 2

WIDTH OF RELIEF OR UNDERCUT – ACME THREADS

Throat Angle
A -- Starting At The Root
B -- Starting Below The Root

	7°		9°		10°		12°		15°		20°		30°	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Pitch	Width of Relief or Undercut – Inches – Acme Threads													
16	.398"	.480"	.323"	.386"	.297"	.353"	.237"	.304"	.217"	.254"	.176"	.203"	.134"	.151"
14	.443"	.524"	.359"	.422"	.330"	.386"	.286"	.333"	.241"	.278"	.196"	.224"	.150"	.167"
12	.504"	.585"	.409"	.472"	.376"	.433"	.326"	.373"	.276"	.313"	.225"	.252"	.172"	.189"
10	.588"	.670"	.478"	.542"	.440"	.497"	.382"	.429"	.323"	.361"	.264"	.292"	.203"	.221"
9	.645"	.726"	.525"	.588"	.483"	.539"	.419"	.466"	.355"	.393"	.291"	.318"	.224"	.241"
8	.715"	.796"	.582"	.645"	.536"	.592"	.466"	.513"	.395"	.432"	.324"	.351"	.250"	.267"
7	.806"	.887"	.657"	.720"	.604"	.661"	.525"	.573"	.446"	.484"	.366"	.394"	.284"	.301"
6	.926"	1.008"	.756"	.819"	.696"	.752"	.605"	.653"	.515"	.552"	.423"	.450"	.328"	.346"
5	1.095"	1.177"	.894"	.957"	.823"	.880"	.717"	.764"	.610"	.647"	.502"	.529"	.390"	.407"
4	1.349"	1.431"	1.102"	1.165"	1.015"	1.072"	.885"	.932"	.753"	.791"	.620"	.648"	.483"	.501"
3-1/2	1.531"	1.612"	1.251"	1.314"	1.153"	1.209"	1.005"	1.052"	.856"	.893"	.706"	.733"	.550"	.568"
3	1.772"	1.853"	1.448"	1.511"	1.335"	1.391"	1.164"	1.211"	.992"	1.029"	.818"	.846"	.639"	.656"
2-1/2	2.110"	2.191"	1.725"	1.789"	1.590"	1.647"	1.388"	1.435"	1.183"	1.221"	.977"	1.004"	.763"	.781"
2	2.617"	2.698	2.141"	2.204"	1.974"	1.031"	1.723"	1.770"	1.470"	1.507"	1.214"	1.241"	.950"	.967"

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Chart 1

External Threading Problems: Causes And Cures

In addition to this quick reference chart, more complete information on threading problems is contained in "Die Head/Tangential Chaser Management."

PROBLEM CAUSE	SOLUTION
PROBLEM: ROUGH THREADS	
Chasers set too far above or over center	Set to gage position and/or adjust all chasers of the set back equally.
Cutting rake ground too low for the material	Start with rake angle recommended by Landis for the material. Vary if necessary to obtain best results.
Misalignment between die head and workpiece	Check die head and machine components for both angular and concentric agreement.
Improper starting pressure	On hand feedwork, it generally is a matter of an operator's gaining sufficient experience to apply proper pressure. Leadscrew and other mechanical starting means such as cams and spring starts, must be correct for the lead of the thread.
Insufficient hook in the lip rake	Grind lip rake to factory specified angle.
Welding of chips on cutting edge	Increase coolant flow to reduce heat factor, the cause of welding. Use a good grade of sulfur base cutting oil. Use chasers with sufficiently long throats, especially on coarse pitch work. Also, use a higher rake and grind the cutting end as smooth as possible.
Improper chaser seating	Disassemble and clean chaser holders and clamps. Hone away any nicks from clamps and holders that would interfere with proper seating.
Chipped chasers	Regrind.
Mixed chaser throat angles	Make certain all the throats of the chasers have the same angle. If 20°, all should be 20°.
Low machineability rating	Materials with low machineability ratings require that all conditions such as the use of good sulfur base coolant, proper chaser throat, correct cutting end geometry and right speed be met. Using chasers with roughing and finishing throat will often help.
Speed too fast	Use recommended starting speed for the diameter, pitch and material combination. If desired, adjust upward to improve results.

PROBLEM CAUSE	SOLUTION
PROBLEM: CHIPPED CHASERS	
Failing to back off die head when opening under cut	When stopping under cut to check chaser chip distribution, do not open the head until it has been backed off sufficiently to clear the chasers from the cut.
Die head striking shoulder	Add sufficient run-out to include the throat length plus a slight allowance to compensate for the die head's slight forward movement that occurs during opening. When a leadscrew is being used, the leadscrew trip must be set to disengage the screw after the head opens but before the head strikes the shoulder.
Grinding burn	Grind carefully to prevent burn. Also, do not water quench. Alternate rapid heating and cooling with water causes cracks that may break out in service, although not readily visible.
Rake angle too high or too low	A too high rake weakens the edge. Too low rake causes high cutting pressures. Use factory recommended rake.
Misalignment	Check and correct any angular or concentric misalignment between the die head and work.
Abrupt starting	Corrected with experience.
Threading sheared ends	Minimize the effect of the shearing operation as much as possible and use chasers with a throat starting sufficiently below the root of thread to remove excess metal and true out the end.
Work turning in grips	Use more gripping pressure or sharper grips.

Chart 2

External Threading Problems: Causes And Cures

In addition to this quick reference chart, more complete information on threading problems is contained in "Die Head/Tangential Chaser Management."

PROBLEM CAUSE	SOLUTION
PROBLEM: OUT-OF-ROUNDNESS	
Chasers set too far back of center	Advance all chasers of the set gradually and equally until condition disappears.
Lack of rigidity on the part of the workpiece or the die head	Use "centering throat" chasers.
Mixed throats in set	Make sure all chasers of the set are of the same throat angle.
Improper chaser seating	Clean and/or hone defects of chaser holder seating surfaces and clamps.
Chipped chasers	Regrind and/or correct condition causing chipping.
Threading sheared stock	Minimize the effect of the shearing operation as much as possible and use chasers with a throat starting sufficiently below the root of thread to remove excess metal and true out the end.
Using improper rake angle	Use factory recommended rake angle to cut the material.

PROBLEM CAUSE	SOLUTION
PROBLEM: TAPERED THREADS	
Threading hard or abrasive material	When using Heat Treated style heads, hard materials bellmouth the chaser holders destroying chaser clearance to cause cutting across the entire width, thus producing a tapered thread. Use chasers with more heel clearance. Abrasive materials dub the cutting surfaces which also destroys the chaser clearance of Heat Treated heads. Request harder chasers to improve cutting action and obtain longer running time.
Misalignment	Correct any misalignment between die head, machine and work.
Poor starting	Improper hand feed side shaves the flank and can appear to be tapered on the beginning threads. Correct feed rate through experience.
Excessive backlash in head adjusting worm	Take up excess, or, if worm is worn, replace.
Improperly seated chasers.	Clean and/or hone away defects of chaser holder seating surfaces and clamps.
Worn head parts	Return head to factory for inspection and reconditioning or replace obviously defective parts such as sprung chaser holders, worn head body, worn trunnions.

PROBLEM CAUSE	SOLUTION
PROBLEM: LEAD ERROR	
Incorrect helix angle	Use correct chaser holder for the thread series. Where lead is critical, use "special" chaser holder incorporating the correct helix.
Improper chaser setting	Check and reset the chasers.
Improper chaser seating	Clean and/or hone away defects of chaser holder seating surface and clamps.
Improper chaser clearance	Correct any condition affecting clearance, or obtain chasers with different clearance. Reduced clearance increases lead; increased clearance reduces lead.
Improper starting	Correct hand starting technique. Check lead of mechanical feed.
Hand feed being used when leadscrew or positive feed is required	If lead tolerance of .001" per inch or less is required, the use of leadscrew, precision ground thread cam or precision feed gears is required.

NEXT ▶

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Chart 3

External Threading Problems: Causes And Cures

In addition to this quick reference chart, more complete information on threading problems is contained in "Die Head/Tangential Chaser Management."

PROBLEM CAUSE	SOLUTION
PROBLEM: SIDE SHAVE	
Misalignment between die head, machine and workpiece	Check angular and concentric alignment and correct.
Trunnion play or clearance not uniformly set	Reset to factory recommendations.
Improper chaser seating	Clean and/or hone chaser holder seating surfaces and clamps.
Improper hand start	Improve starting technique.
Improper chaser grind	Review recommended grinds and regrind chasers.
Worn head parts	Inspect and replace as required or return for factory inspection and recommendations.
Work turns in grips when using leadscrew feed	Use greater gripping pressure or sharpen grips.

PROBLEM CAUSE	SOLUTION
PROBLEM: DRUNKEN THREADS	
Chasers set too far back of center	Advance all chasers of the set equally until condition disappears.
Misalignment	Correct as required. Drunkenness is most likely caused by an off-square condition, not eccentricity.
Improper feed	Improve hand feed technique. Check lead of mechanical feed.
Improper chaser seating	Inspect, clean and/or hone defects on chaser holders and clamps.
Worn head parts	Replace worn parts or return head to factory for inspection and rebuild.

PROBLEM CAUSE	SOLUTION
PROBLEM: CHATTER	
Chaser set too far back of center	Advance all chasers equally until chatter disappears.
Cutting rake too high	Grind chasers to factory recommended angle for the material being threaded.
Lack of rigidity on the part of the die head or workpiece	Inspect die head and machine components and correct as required.
Too much hook in lip rake	Regrind chasers to recommended rake.
Chipped chasers	Regrind chasers.
Mixed chaser throats	Replace chasers as required.