Lucas Precision

Power Tool Lock & Ejector System Explanation

The Lucas Power Tool Lock & Ejector tool holding system is designed to give maximum tool holding power, minimum tooling 'spring', and allow for rapid changing of the tool Arbor.

The Lucas PTE system is a 'Wedge-Locking' system that delivers much greater 'holding power' than is possible with a simple collet if it is properly used.

The PTE drawstud (the drawback adapter that inserts into the rear of the tooling shanks) is an extremely important part of the overall operation of the Lucas tool holding system. Following, are a few simple rules for how to properly install and adjust the Lucas PTE Drawback Collet Adapter (drawstud) into tooling shanks.

A) PLEASE - do not attempt to use drawstuds from other brands of machines. The design and the dimensions are unique to Lucas. Drawstuds from other machines will NOT properly fit and may damage the PTE mechanism or cause tooling to be improperly retained in the spindle.

B) PLEASE - do not attempt to interchange drawstuds between models of Lucas machines or even between two Lucas machines of the same model. While the overall design of the PTE system is similar among the various models of Lucas machines, there are many slightly different 'versions' of the PTE system that vary with both model number and age of manufacture. NEVER use a drawstud if you are not certain that it is the correct part number drawstud for your specific machine and always adjust it to match the gauge calibrated to that machine. An incorrect drawstud may damage the PTE mechanism or cause tooling to be improperly retained in the spindle.

C) PLEASE - do not attempt to manufacture this item yourself. It is a specially heat-treated, high-precision part with unusual angles and tolerances. A 'homemade' drawstud may cause expensive damage to the PTE mechanism or may cause tooling to be improperly retained in the spindle.

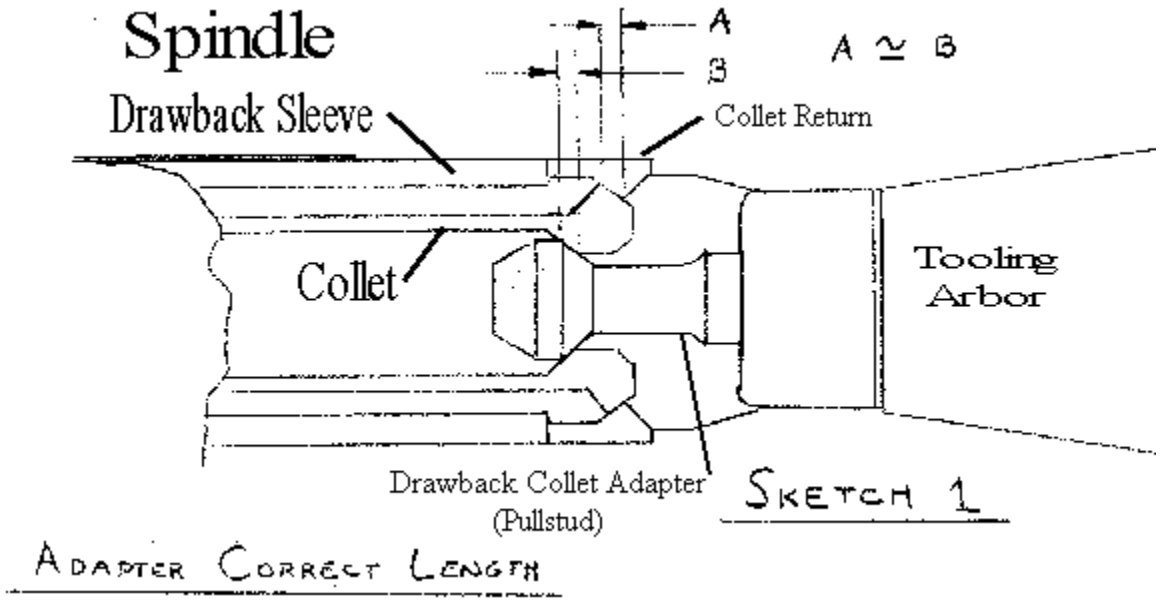
It is extremely important that the drawstud be a TIGHT fit into the threads at the rear end of the tool shank. Most Lucas drawstuds are equipped with a means of expanding the threads to assure a tight thread fit. A loose thread fit will cause the drawstud to 'give' slightly when it is grabbed by the collet. This marginal difference from the properly gauged position may be sufficient to significantly reduce the holding power of the PTE system by allowing the drawstud to move to an incorrect dimension.

When the drawstud is installed into the rear of a tooling adapter, it must be screwed in until the end of the drawstud is flush with the gauging surface of the PTE setting gage. Even a few thousandths of an inch incorrect setting may reduce the holding power of the PTE system.

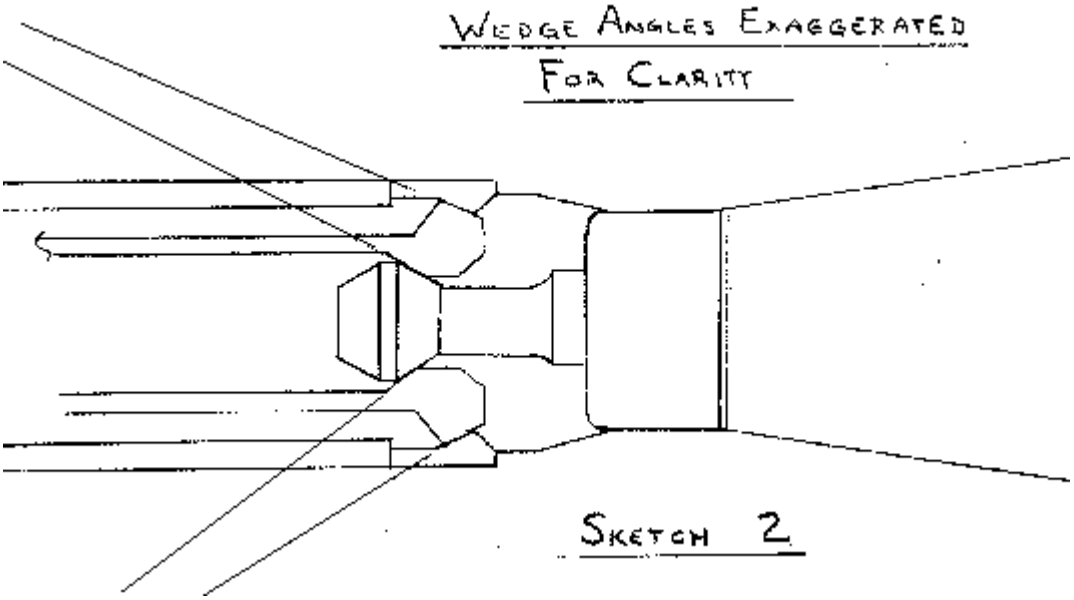
If you find that the flush setting is NOT properly holding the tooling, the setting gage must be recalibrated – see separate documentation for instructions.

We have prepared several sketches to aid in understanding the basic design principles of the Lucas PTE System.

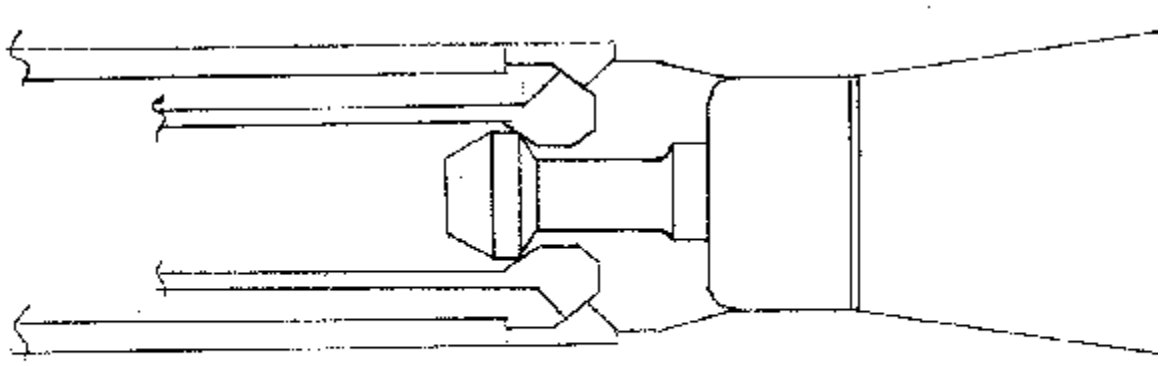
SKETCH 1 shows a correctly adjusted drawstud being retained by the Lucas collet. Notice that the contact width between the collet and the external 'wedged ring' (the 'Collet Return' or 'Collet Retainer') is approximately the same as the contact width between the Collet and the Drawback Collet Adapter (drawstud or pull-stud).



SKETCH 2 shows the 'wedging' angles of the collet. The sketch has been exaggerated for clarity, since the angles are sufficiently small that they cannot be seen by eye alone on the actual parts. The presence of the angles produces a 'chocking' or 'wedging' effect that will hold a tool against substantially any withdrawing force that might be applied to the tool - short of breakage of the parts. The angles also, however, require that the several parts be in correct relationship to each other for proper tool retention.



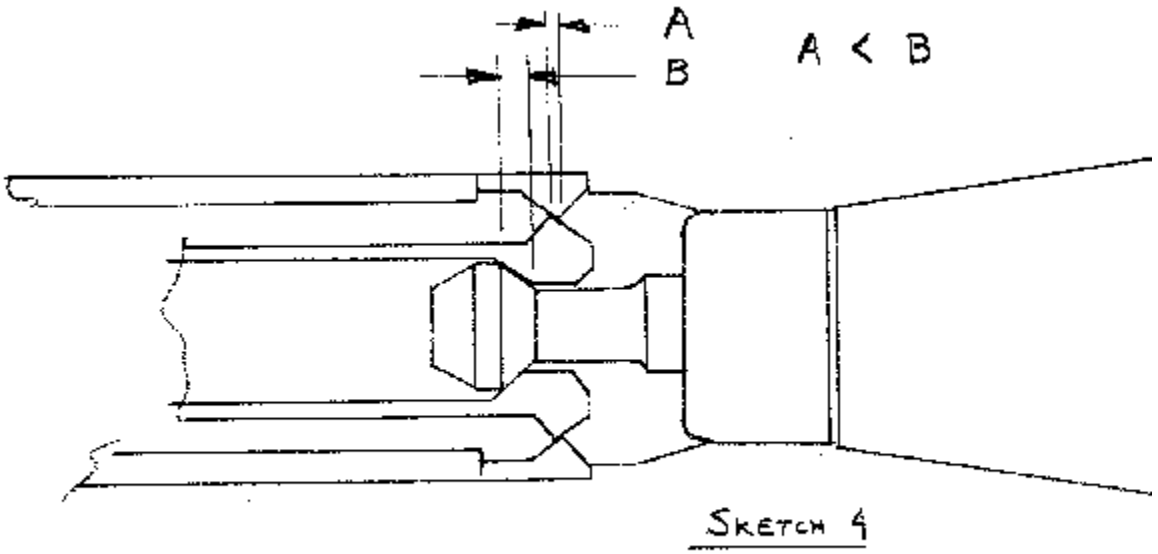
SKETCH 3 shows the contact pattern frequently seen when a non-Lucas adapter with incorrect angles is used in the Lucas system. When an adapter with improper angles is used, at least one of the collet surfaces will be in 'line-contact' (instead of surface area contact) with its mating part. Frequently this results in the sharp corner 'digging' into the surface that it contacts. When this happens, the system may require an extreme amount of pressure being necessary to 'unseat' the collet and to allow the system to eject the tool. Occasionally, it may be necessary to strike the tool arbor sharply (with a hammer) to allow the impact to help unseat the collet. As you can imagine, the wedges twist on the ends of the fingers while trying to align with the incorrect angles. We frequently see collets with the wedges completely broken off from the ends of the collet fingers from the flexing involved. We also see collets with cracked, chipped and completely broken wedges occasioned by the high surface pressures caused by the small areas of contact.



IMPROPER ADAPTER ANGLE
EXAGGERATED FOR CLARITY

SKETCH 3

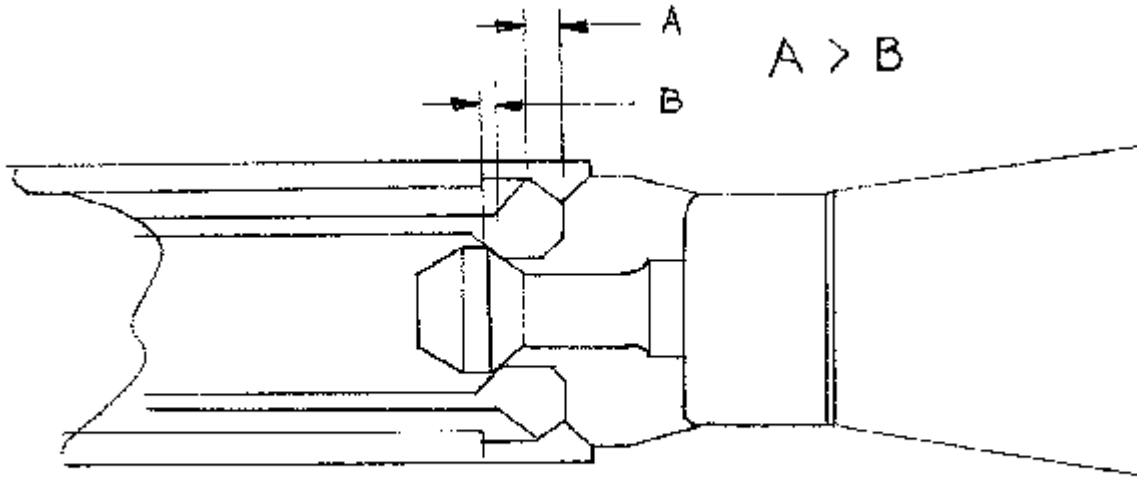
SKETCH 4 shows the effect of a Drawback Collet Adapter that is adjusted 'below' gauge. Observe that the amount of contact on the OD of the collet is considerably LESS than the amount of contact on the ID of the collet. The extremely small angle difference between the OD and ID collet angles causes the collet position to change more rapidly than the position of the Drawback Collet Adapter. In other words, if you shorten the Drawback Collet Adapter position by 0.001 inch - the Collet will shift position by more than 0.001 inch.



SKETCH 4

ADAPTER TOO SHORT

SKETCH 5 shows the effect of a Drawback Collet Adapter that is adjusted 'above' gauge. Observe that the amount of contact on the OD of the collet is considerably MORE than the amount of contact on the ID of the collet.



SKETCH 5

ADAPTER TOO LONG

The precise mechanical position of the several parts is adjusted by the PTE 'Setting Gauge' which must be 'fitted' and calibrated for each machine separately. For this reason, a Drawback Collet Adapter properly adjusted for one machine may not work properly with a different machine of the identical model number.

FLANGED DRAWBACK COLLET ADAPTERS:
We find many customers that make their own Drawback Collet Adapters. That's not a good idea for several reasons. The angles of the Drawback Collet Adapter are critical and must match the angles of the Collet exactly or one of the situations listed above will occur.

In addition to 'rolling their own', many customers attempt to 'improve' on the original design by adding a flange to the threaded area of the adapter to 'seat' against the end of the tooling arbor. Since several other types and brands of drawback collet adapters have flanges, it must be good for a Lucas also - right? WRONG!

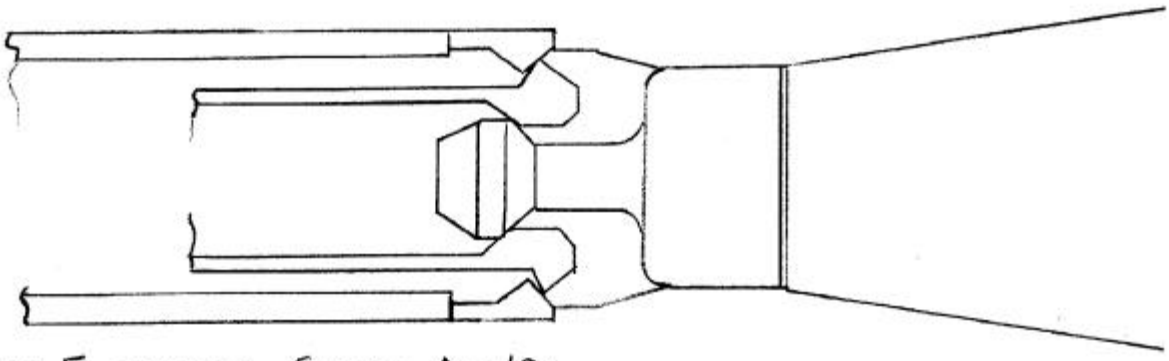
The facts are thus:
Due to the proprietary nature of the Lucas PTE system, it is critical that the Drawback Collet Adapter be a specific distance from the Gage-Line of the tooling. The exact dimension is determined after complete assembly by using the 'pry test' described in Lucas literature. The tolerance 'band' for this dimension is approximately +/- 0.015 for most Lucas PTE systems.

The rear 'face' of a No. 50 NMTBA male arbor (meeting ANSI Standard B5.18A) has a 0.020 tolerance (See Machinery's Handbook). Obviously, if you use this surface to seat an adapter flange, most of the Lucas tolerance is 'used up' - assuming that the 'basic' flange dimension was correct in the first place.

The distance from the No. 50 Gage Line to the end of the shank for ANSI B5.50 tooling is 101.75/101.45 MM or approximately a 0.012 Inch tolerance band. Essentially the same argument applies; the tolerance of the tooling arbor 'uses up' too much of the tolerance allowable by the Lucas PTE system. The result is that some tool Arbors and Drawstuds will function properly while others are not even drawn 'hand tight' into the Spindle. Yet other combinations of Arbors and Drawstuds may 'draw in', but not be retained against cutting pressures.

Of course, ANSI B5.50 tooling with ANSI B5.50 Drawback Collet Adapters function properly in Spindles that are designed for their use on other brands of machinery. They, however, do not use the Lucas proprietary PTE system.

FREQUENTLY SEEN INCORRECT REPAIRS:
We frequently hear of incorrect repairs being made to Lucas PTE systems. The most common are to shorten the drawstud setting in the rear of the tooling by approximately an eighth of an inch to get the PTE to 'grab' the tool as seen in Sketch 6. Of course, what is actually wrong is that the collet is not traveling the proper distance from Eject to Clamp or arriving at the correct position in relation to the Collet Return and the Drawback Collet Adapter. This can happen from incorrect facing of the internal parts of the mechanism; from foreign material trapped between the 'fingers' of the collet; from broken spring washers or several other things. By shortening the drawstud setting, the collet may seize the drawstud, however, the tool is NOT properly held in the Spindle against full machining pressure.



ADAPTER LENGTH EXTREMELY SHORT AND/OR SPACER BEHING COLLET

SKETCH 6

When functioning properly, the collet is drawn into the spindle with approximately 6,000 Lbs of force (for most models), while the tooling is retained against cutting forces in excess of 30,000 Lbs.

If the Collet is not in the correct position - the tooling is only retained against cutting forces of approximately 6,000 Lbs, since only the spring pressure is holding the tool in the Spindle - the wedge locking action is non-functional.

It is only a matter of time until cutting forces actually pull the tool free from the Spindle while performing a cutting operation. In the meantime, you will suffer many symptoms including chatter, out of round bores, a 'swaging' of the Spindle Taper Socket, broken tooling inserts and continually advancing damage to the PTE mechanism.

Needless to say, this is also a possible personnel hazard.

We also see folks attempt to repair the system by placing a spacer behind the Collet. While this may place the Collet in the correct position at Eject, it is NOT in the correct position at Clamp. Shortening the setting of the Drawback Collet Adapter may allow the tooling to be 'grabbed', however, the result is the same - the tooling is not properly held against cutting forces.

Revised 5/2006
Ed Zikursh