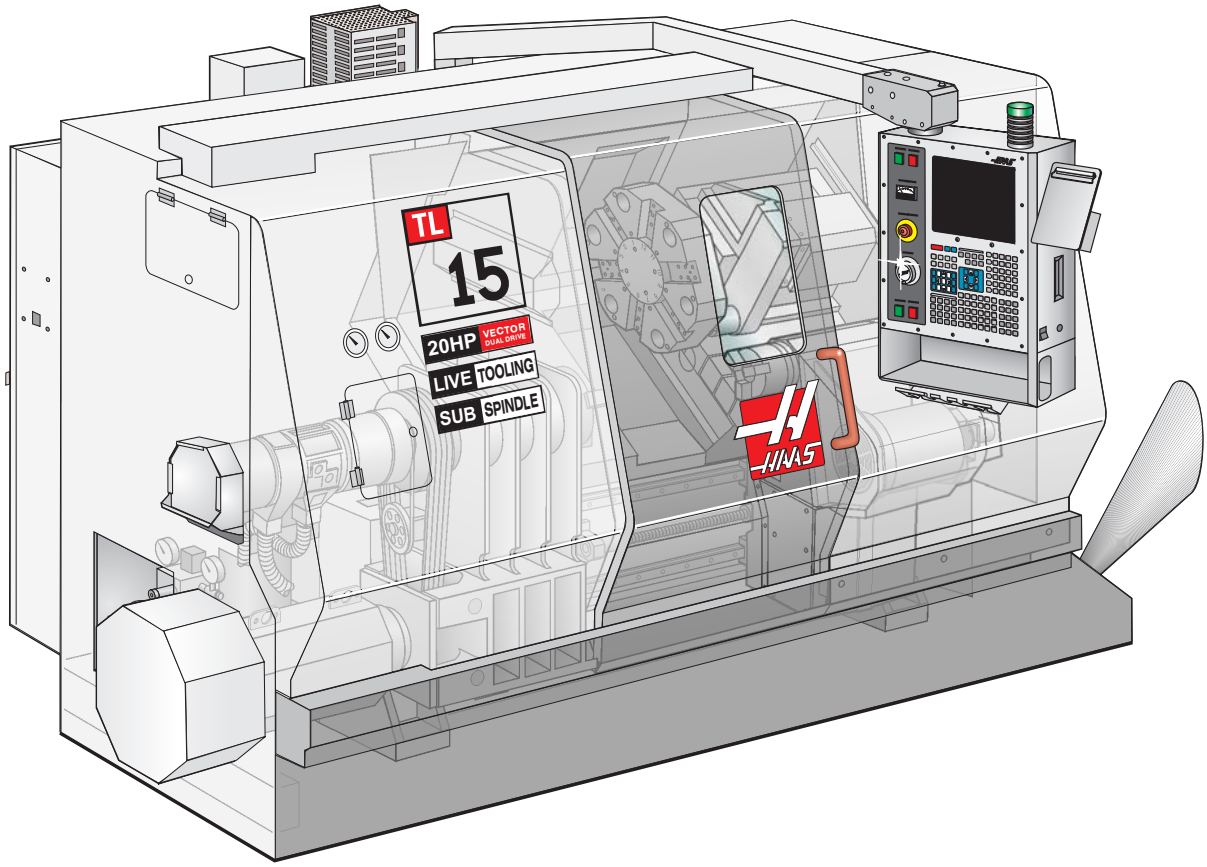
TL-Series Sub-Spindle Operator's Addendum



1. INTRODUCTION

Specific M codes are used in the programming of the sub-spindle operations. The sub-spindle is programmed forward with M143 and reverse with an M144. Use a “P” value to set the sub-spindle speed. To program a stop use M145, without a “P” value the sub-spindle will decelerate to a stop. Note that main spindle M codes can be used as well provided they are prefaced with a G14 “Sub Spindle mode”.

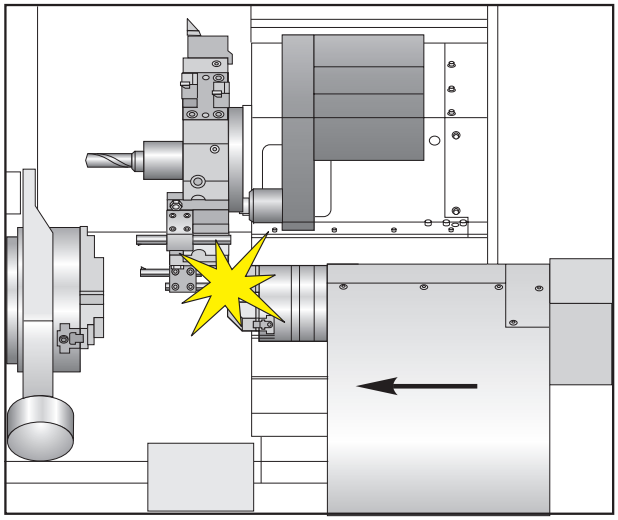
The sub-spindle can be oriented to fixed position with an M119. A “P” or “R” value can be added that will cause it to orient to a particular angle (in degrees). A combination of M19 Pxx or M119 Pxx can be used to transfer irregular workpieces.

Setting 122 is used to set OD or ID clamping of the chuck. The tailstock foot switch can be used to clamp or un-clamp the sub-spindle. It can also be programmed with an M110 to clamp or M111 to unclamp. Additionally the Tailstock feed or rapid buttons on the pendant are used to move the sub-spindle.

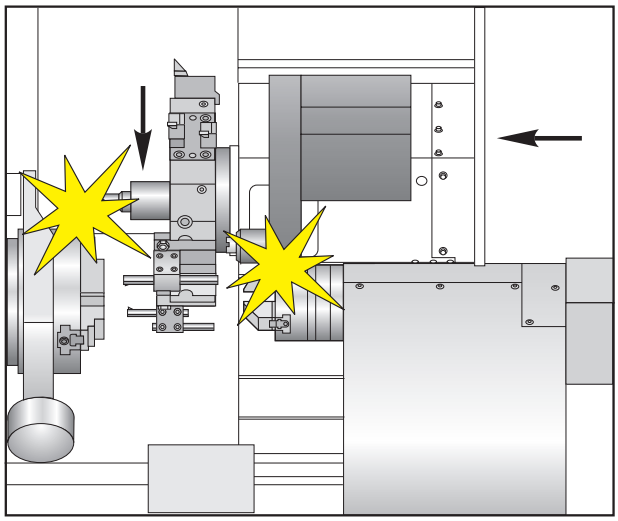
2. CAUTIONS

Sub-Spindle Tools

Be aware of the positions of long sub-spindle tools. If oversized tools are used, they could hit the tool turret mount or way covers.



Long Sub-Spindle Tools



Live Tooling

Live Tooling (optional)

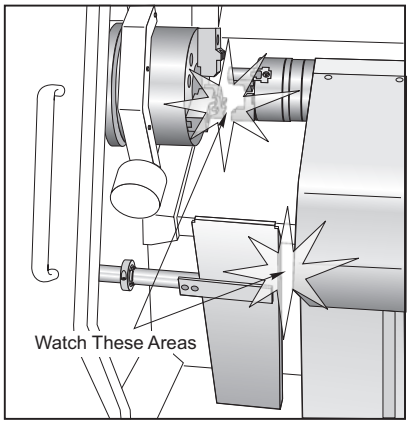
The live tooling drive and subspindle can be a point of interference. Use care during programming to ensure that the live tooling and sub-spindle do not collide.

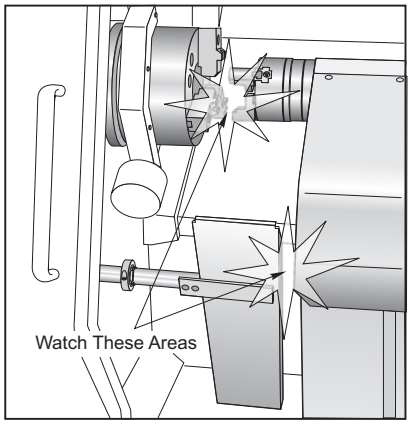
Parts Catcher (optional)

The TL-Series machines have potential interferences between the moving parts. The normal configuration allows the subspindle to be brought forward enough to come in contact and possibly damage the parts catcher. This can be solved by loosening the adjusting collar and sliding the parts catcher towards the main spindle. However once this is done, the parts catcher is now out of position and once activating it will collide with the main spindle. The Operator’s manual gives more information on parts catcher adjustment.

Additionally, once the parts catcher is moved, the spindles could interfere with one another.

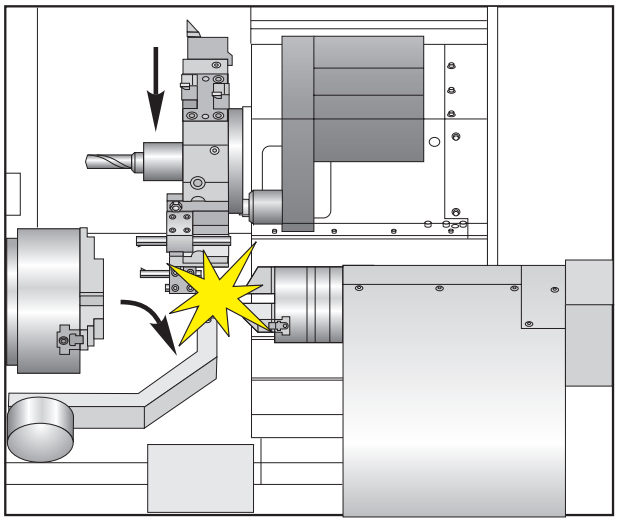
Set-up and operation needs to be well thought out to avoid any damage to the machine.





Tool Presetter (optional)

Extreme care must be used when using the tool presetter and the sub-spindle tools. The Tool Presetter is not recommended for use with the tooling for the sub-spindle. The clearances between a number of parts (Turret, Tools, Sub Spindle) and the Tool Presetter are very tight.



Tool Offsets

A recommendation for setting offsets is to use G54 for the main spindle and G55 for the Sub-spindle. This will help avoid machine crashes should and operator/programmer confuse the offsets. Use the guide on page 22 as an aid to setting up the machine.

Work Envelopes

Sub-spindle travels are governed by tool types and sizes.
The tool envelope chart, in the Technical Reference section, illustrates the types of tools and the restrictions

Speed and Feeds

Sub-spindle can be moved along the B-axis parallel to the main spindle. In addition to two operation machining functions the sub-spindle has the ability to pass a part from one spindle to another without stopping.

Sub-spindle Hydraulic Drawtube Operation

The hydraulic unit provides the pressure necessary to chuck or clamp a part. The hydraulic pump pressure is proportional to the clamping force exerted.

If it is necessary to adjust the clamping force on the part, loosen the locking nut at the base of the adjustment knob. Turn the adjustment knob labeled “Tailstock” until the gauge reads the desired pressure and tighten the lock nut.

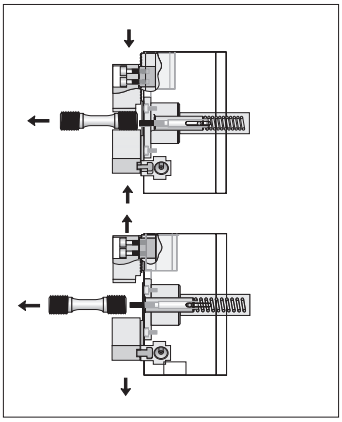
Refer to the chart to adjust the hydraulic pump pressure.

Sub-spindle as a Tailstock

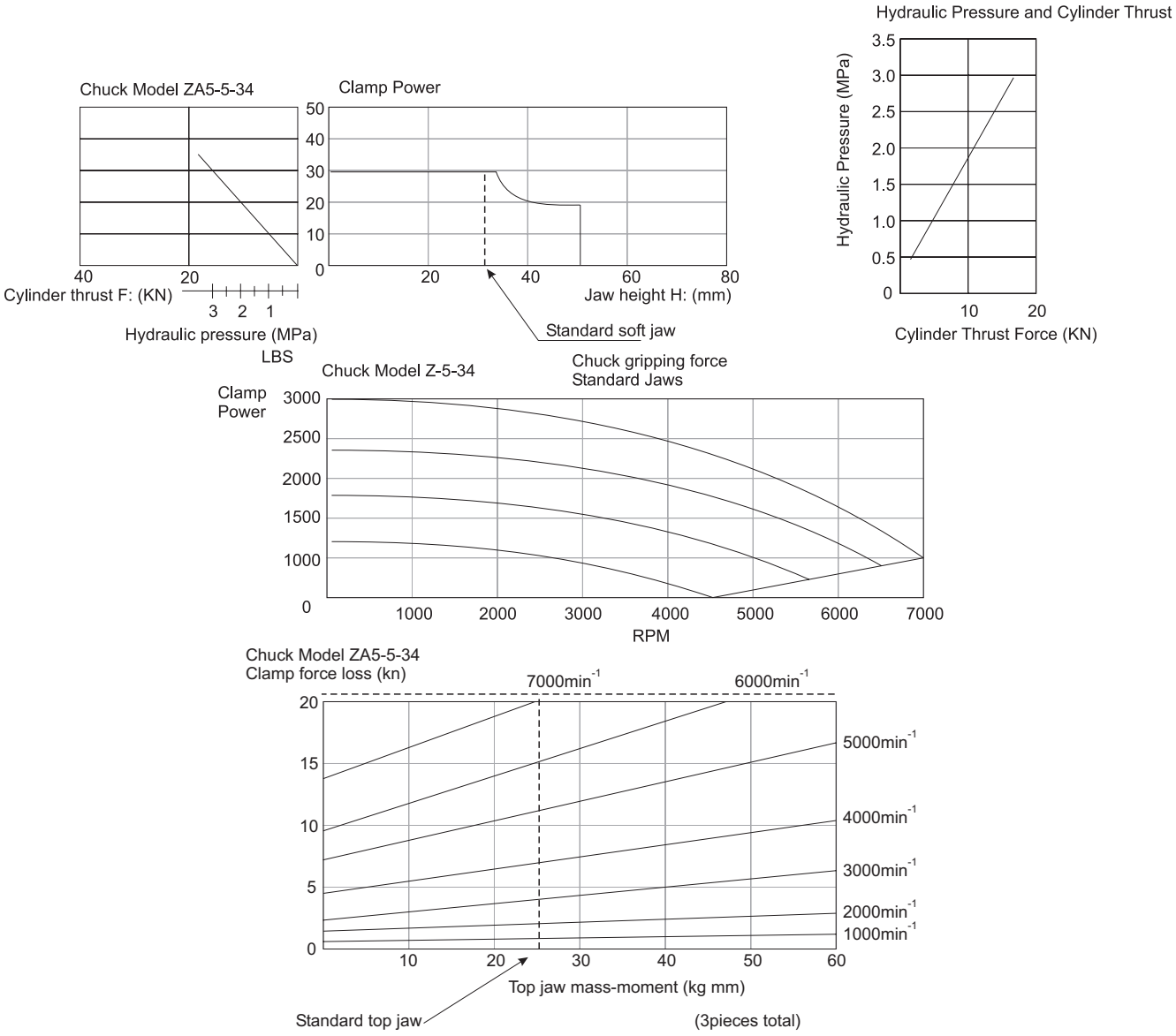
There are cases where the Sub-spindle can be used as a tailstock, however a spring loaded center must be used. Extreme care must be exercised as the additional load may cause servo faults or damage the Sub-spindle. Contact the Haas factory for more information.

Part Ejector

The part ejector is a spring loaded sleeve that fits into the core of the sub-spindle. When the machining operations are completed, the jaws release the part and the part ejector pushes the part on to the parts catcher. The part ejector has a threaded I.D. which allows installation of an adjustable pusher screw or a custom pusher for hollow parts.



Sub-Spindle Chuck Clamping Charts



NOTE: The maximum and minimum hydraulic pressures are 500 psi and 50 psi, respectively.

Main spindle information is in the Operator's Manual and on the side of the machine.

Program Structure

Sub-spindle program structure is the same as the main spindle. However, main spindle M-codes and canned cycles are only supported in the G14 mode. There is no brake on the sub-spindle. Therefore, live tooling machining needs to be done selectively.

G14 Sub-spindle mode is modal therefore it is active until a G15 is encountered, end of program (M30), pressing reset, emergency stop or powering down the machine.

Alphabetical Address Codes

B Linear B-axis motion

The B address character is used to specify absolute motion for the sub-spindle axis. It specifies a position or distance along the B axis. It is either in inches with four fractional positions or millimeters with three fractional positions. It is followed by a signed number between -8380.00 and 8380.00. If no decimal point is entered, the last digit is assumed to be 1/10000 inches or 1/1000 millimeters.

NOTE: There are no incremental or interpolated moves with the B-axis

Sub-Spindle Speed Commands

Spindle speed functions are controlled primarily by the P address code. The P address specifies RPM in integer values from 1 to maximum spindle speed.

Three M codes are used to start and stop the spindle. M143 starts the spindle Forward, M144 starts the spindle Reverse, and M145 stops the spindle.

Features

Sub-Spindle Rigid Tapping

Rigid tapping allows the use of a tap without a floating tap holder. The sub-spindle RPM is synchronized with the Z-axis feed, thereby producing threads accurately. No side forces are generated on the flanks of the threads and tighter thread tolerances are produced. Rigid tapping also eliminates the pullout and distortion of the first thread that occurs on all spring compression/tension devices and tapping heads. While this is not usually a problem on medium to coarse threads, small diameter, fine pitch or soft material tapped holes can have their last thread damaged when the tap pops out of the hole. You can also re-tap a hole without cross-threading provided the tap and **Z** depths have not been changed. Rigid tapping is used in G14 Sub-spindle mode with canned cycle G84 and G184.

It is enabled with the Parameter 57 “Rigid Tap” bit. When enabled, it changes the way G84 and G184 work and floating tap holders are not needed for these **G** codes. In addition, if the “REPT RIG TAP” bit in Parameter 57 is set, every repetition of a tapping operation will control the orientation of the spindle so that the tapping is repeatable.

Rigid tapping will operate from 100 to 2000 RPM and up to 100 inches per minute feed. Thread pitch can be from 5 to 100 TPI

The pitch of a tapped hole is defined by the ratio between the feed rate and spindle speed. When rigid tapping is selected, these two must be set exactly. An encoder mounted with the spindle tracks the position of the spindle and the Z-axis is moved precisely to match the pitch of the thread. If the repeatable option is selected, a position pulse from the encoder is used to synchronize the starting of the **Z** motion with the position of the spindle. For Metric taps, divide the pitch by 25.4

NOTE: You do not need to use M143, M144, or M145 with G84 / G184. These canned cycles start and stop the spindle automatically.

G Codes

G14 Sub-spindle Mode Group 17

This G code selects the sub-spindle, the blocks which follow the G14 command will mirror the moves so they can be used with the sub-spindle. In addition it applies tool nose compensation, if selected. Use G15 to cancel the sub-spindle mode.

It is recommended that tool nose compensation be turned off at the end of the block previous to G14. Once a G14 is commanded then turn the tool nose compensation on within the G14 block.

Group 0,1 and 9 G codes are not allowed on the same line of code as the G14.

Canned cycle G codes are supported, if prefaced by a G14.

G15 Sub-spindle Mode Cancel

The G15 code is used to cancel the Sub-spindle mode. It is modal therefore it affects the following blocks.

G184 Sub-spindle Rigid Tap Cycle Group 09

G184 is programmed the same way as G84 for the main spindle it is not necessary to preface G184 with a G14.

Sub-Spindle M codes

Main spindle M codes can be used to program the sub-spindle while the control is in G14 mode.

M110 Sub-spindle Chuck Clamp
M111 Sub-spindle Chuck Unclamp

These M codes will clamp and unclamp the sub-spindle chuck.
OD / ID clamping is set with Setting 122.

M119 Sub-spindle Orient

Orients the sub-spindle to a fixed position. A P value can be added that will cause the spindle to be oriented to a particular angle (in degrees). For example, M119 P270 will orient the sub-spindle to 270 degrees. An R value will recognize up to four places to the right of the decimal point (i.e. M119 R123.4567). Note: The actual position accuracy of the spindle is further limited by the servo-encoder system resolution.

M143 Spindle Forward

The M143 code will start the spindle moving in a clockwise direction. Use a “P” value to set the sub-spindle speed.

M144 Spindle Reverse

The M144 code will start the spindle moving in a counterclockwise direction.

M145 Spindle Stop

The M145 is used to stop the sub-spindle. With a “P” value of zero (0) entered, the sub-spindle will free wheel, or coast to a stop. With no “P” value the sub-spindle will decelerate to a stop.

Settings

122 SUB-SPINDLE CHUCK CLAMPING Selects OD or ID clamping of the sub-spindle.

5. PROGRAMMING EXAMPLE

Part Pass From Main Spindle to Sub-Spindle

```
N200 (PASS OFF)
(PARAMETER 248 =550) (MAKE SURE THAT PAR 57 “SPINDLE NOWAIT”=1)
G103 P1 (LIMIT BLOCK LOOK AHEAD)
;
;
;
G00 G53 X0 Z-5.
G28 B0
T700
G50 S500
G97 S400 M03
G15 (MAIN SPINDLE PRIMARY)
G54 (FRONT SIDE)
M111 (SS CHUCK OPEN)
M144 P400 (SS M4 AT 400 RPM)
G98
G00 B-15.(FEED TO THE FRONT OF THE PART)
M12 (AIR BLAST ON, IF EQUIPPED)
G01 B-15.8 F50. (FAST FEED ONTO PART)
B-15.855 F5. (FEED ONTO LOCATING POSITION)
M110 (SS CHUCK CLOSE)
G04 P1. (NECCESARY FOR PROPER TIMING)
(INSERT CUT-OFF PROGRAM IF NECESSARY)
M11 ( MAIN CHUCK OPEN )
G04 P1.(NECCESARY FOR PROPER TIMING)
G00 B-2.(RAPID BACK TO MACHINING POSITION)
M10 (MAIN SPINDLE CLOSE)
M13 (AIR BLAST OFF)
G99 (BACK TO IPR)
M01
```

6. MAINTENANCE

The sub-spindle chuck jaws need to be lubricated every 1000 clamp / unclamp cycles or at least once a week. Use the provided grease gun for chuck lubrication.

Lubrication type: Molybdenum Disulfide Grease (20% to 25% moly content)

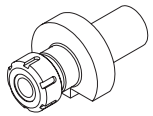
The automatic lubrication system is used to lubricate the sub-spindle bearing and the tailstock ball screw. No additional lubrication is required.

Chuck pressure is set by the valve labeled ‘Tailstock’ on the hydraulic pump.

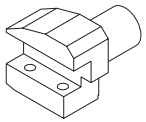
OPTIONAL TOOL HOLDERS

VDI TOOLS

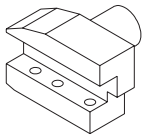
COLLET CHUCK
EXSYS E223.035.220
ER-32



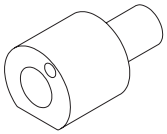
SHORT TURN
EXSYS E213.115.250
1 INCH



LONG TURN
EXSYS E223.115.250
1 INCH

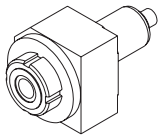


BORING BAR
EXSYS E213.015.246
1-1/4 INCH

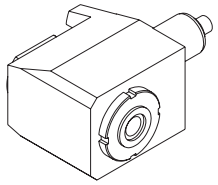


INCLUDED TOOLS WITH LIVE TOOLING OPTION

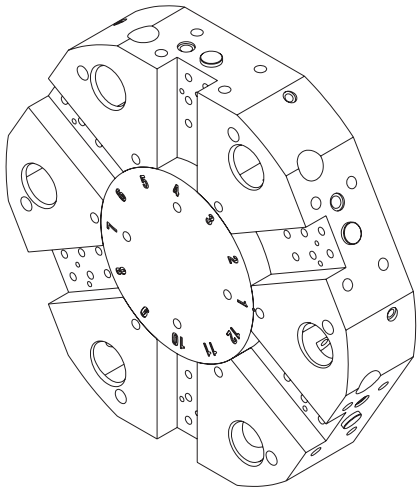
AXIAL MILL/DRILL
HAAS HLT-AHTH
ER-32



RADIAL MILL/DRILL
HAAS HLT-RVTH
ER-32

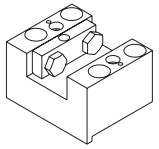


12 STATION TURRET

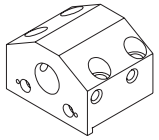


INCLUDED TOOL HOLDERS

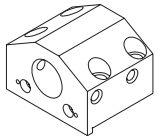
BOLT ON TOOLS



FACE GROOVING
HAAS BOT20F/G
1 INCH

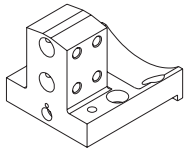


BORING BAR
HAAS BOT20ID-1
1 INCH

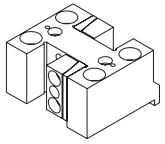


BORING BAR
HAAS BOT20ID-1_1/4
1-1/4 INCH

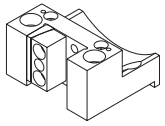
OPTIONAL TOOL HOLDERS



TWIN BORE
HAAS BOT20ID-3/4T
3/4 INCH

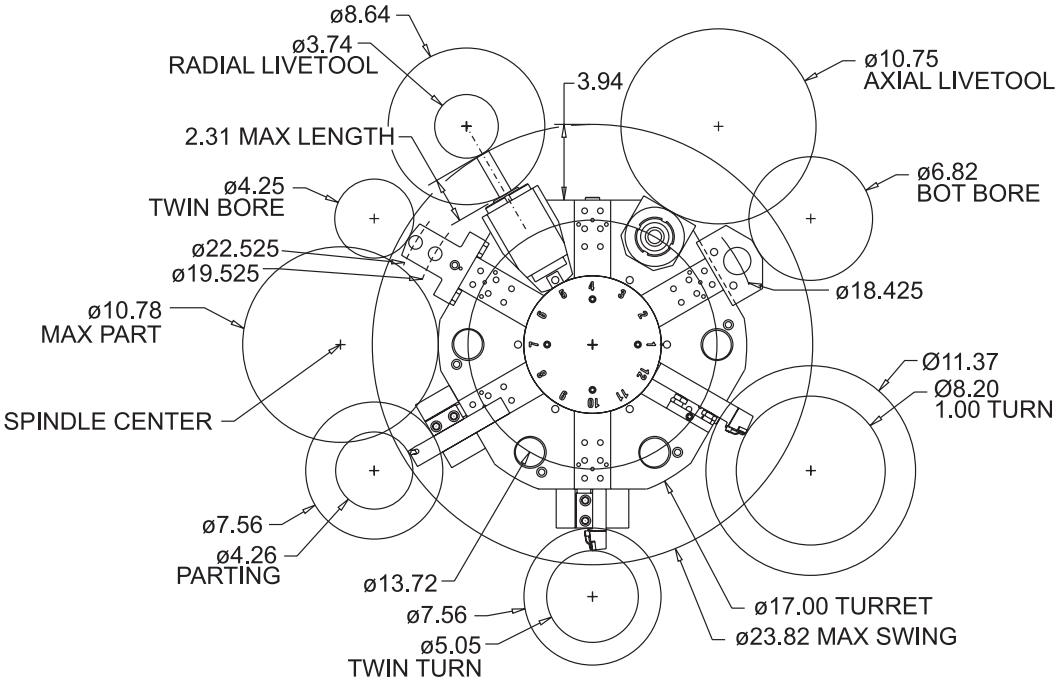


TWIN TURN
HAAS BOT20OD-1T
1 INCH

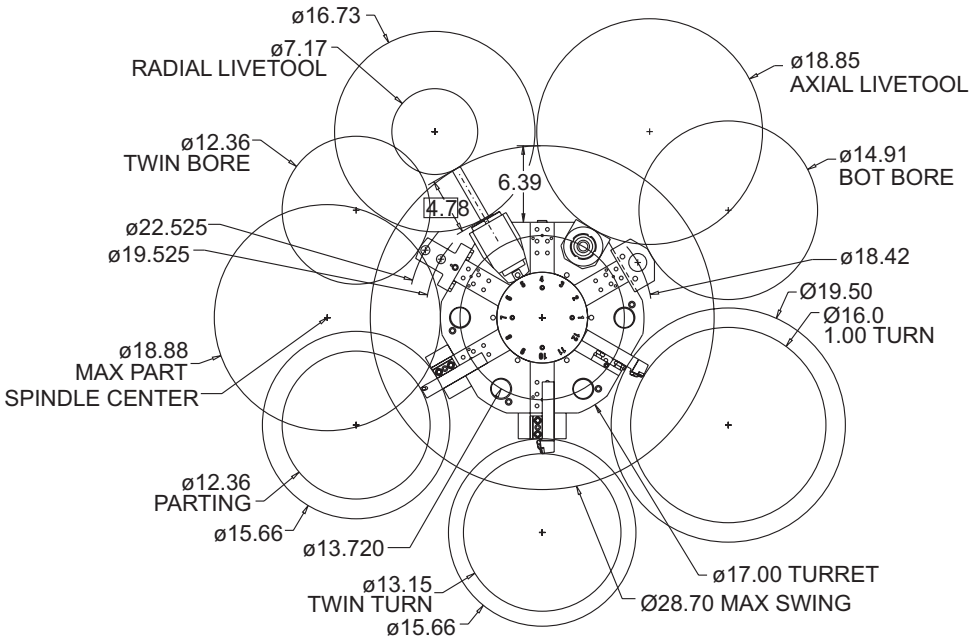


PARTING TOOL
HAAS BOT20OD-1
1 INCH

TL-15 Turret Dimensions

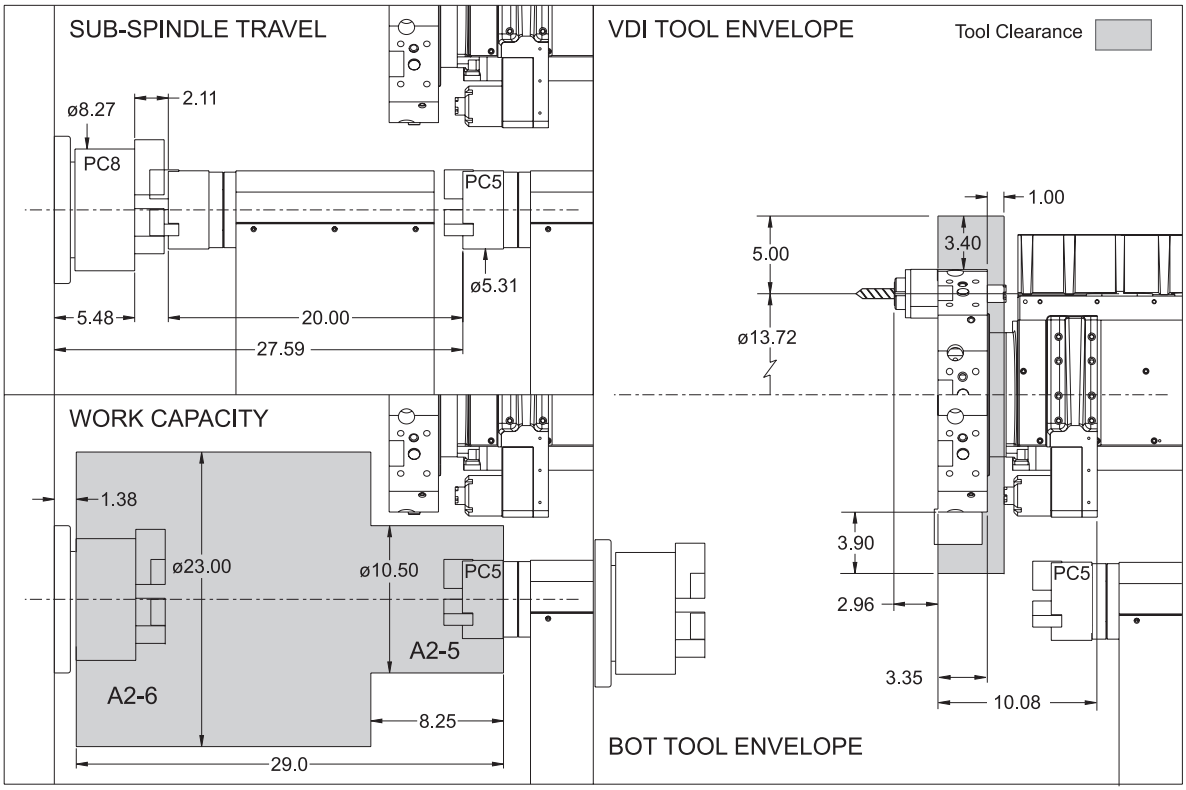


TL-25 Turret Dimensions

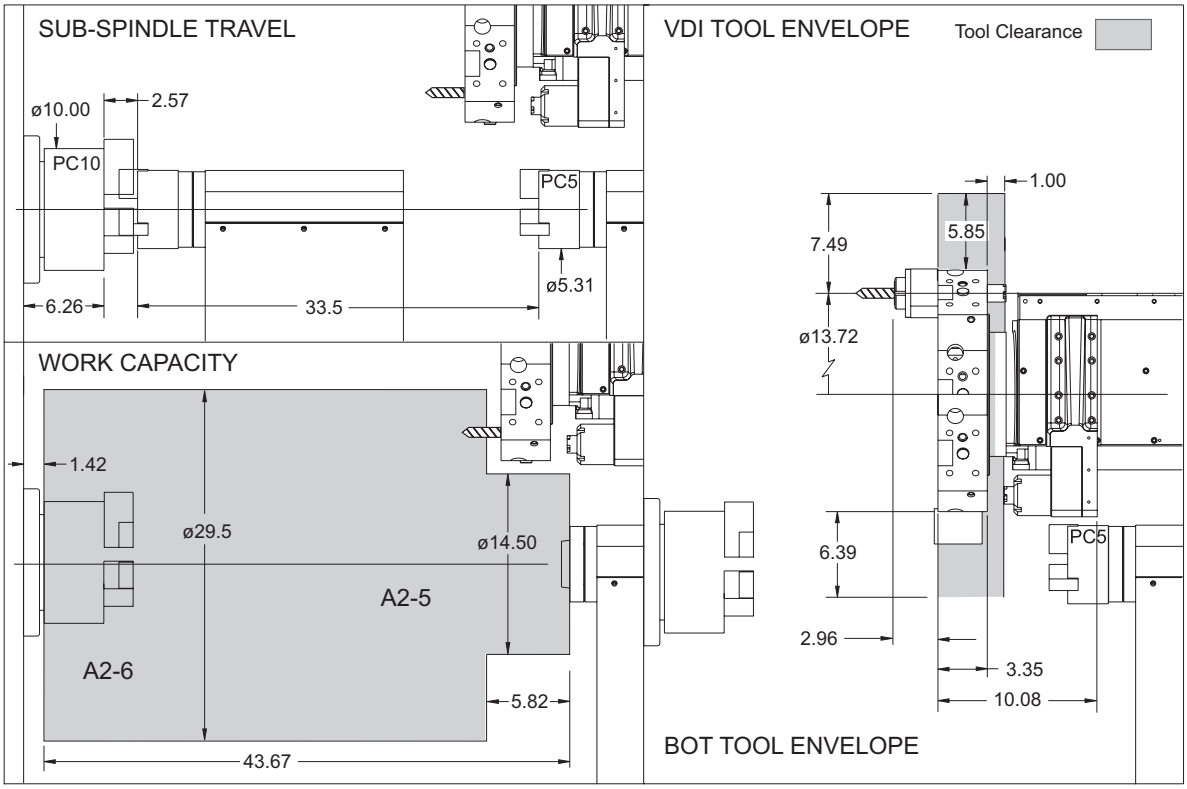


TL-15 Sub-Spindle Reference Diagram

All Dimensions are in inches



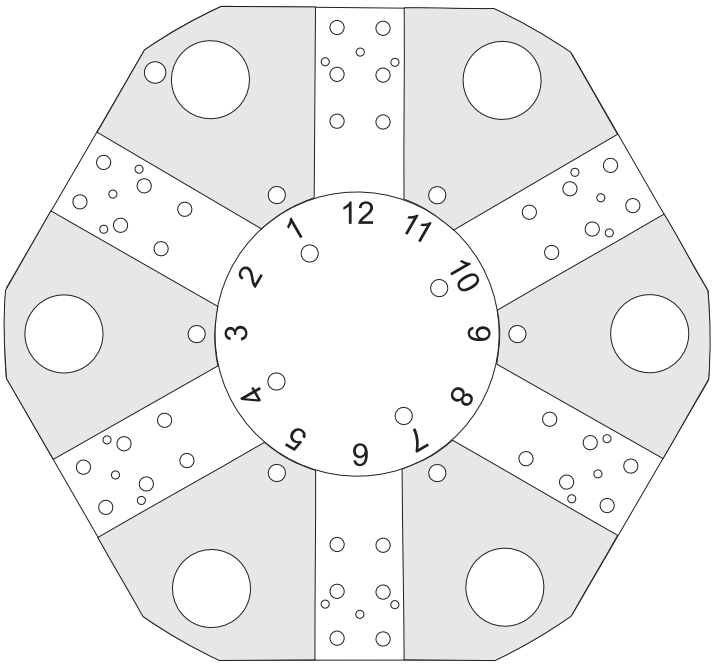
TL-25 Sub-Spindle Reference Diagram



TL-Series Operator's Tool Set-up

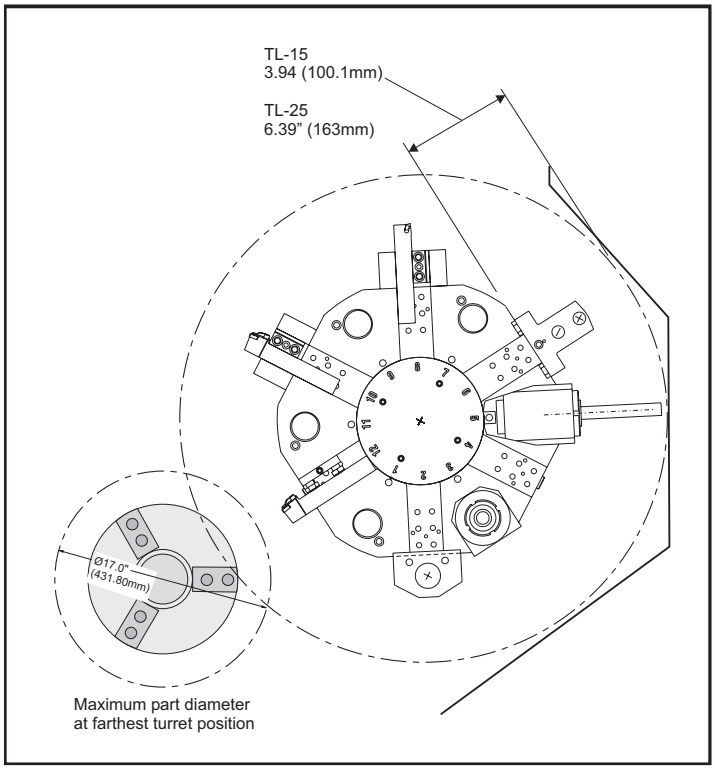
1. (VDI) _____
2. (Turn) _____
   (BOT) A _____
   B _____
3. (VDI) _____
4. (Turn) _____
   (BOT) A _____
   B _____
5. (VDI) _____
6. (Turn) _____
   (BOT) A _____
   B _____
7. (VDI) _____
8. (Turn) _____
   (BOT) A _____
   B _____
9. (VDI) _____
10. (Turn) _____
    (BOT) A _____
    B _____
11. (VDI) _____
12. (Turn) _____
    (BOT) A _____
    B _____

Copy this page for use with future job set-ups



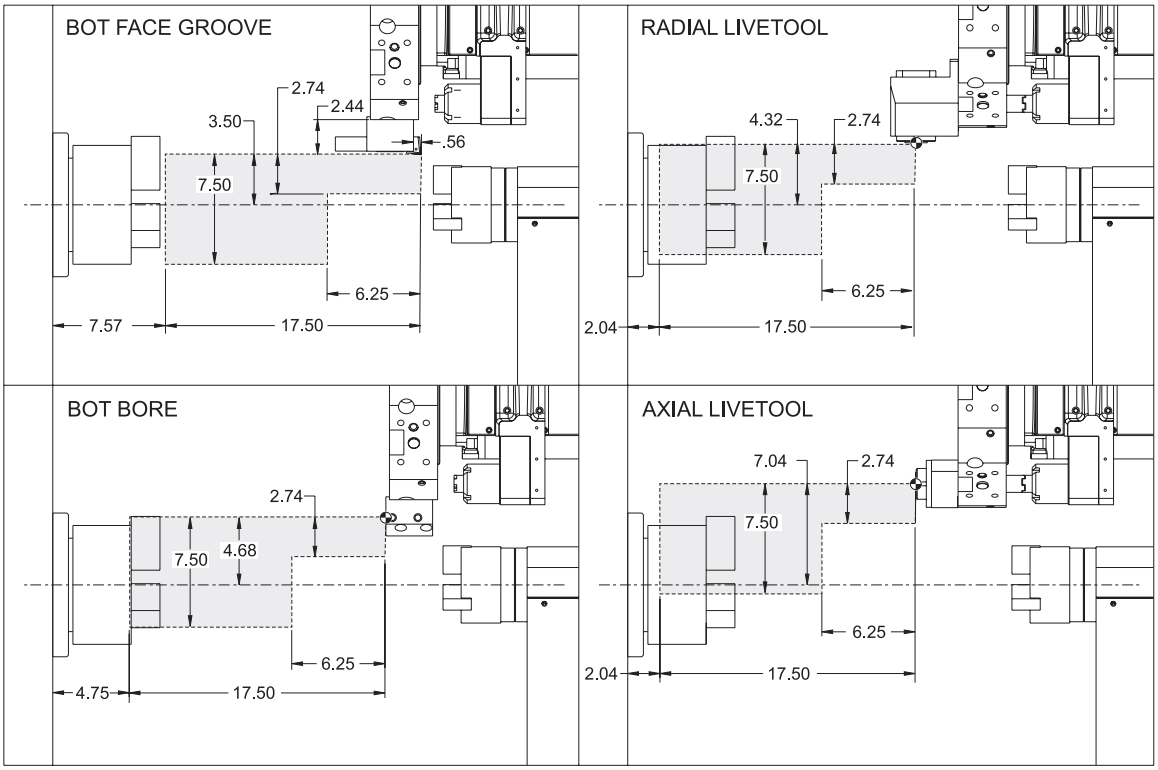
NOTE: Bolt on tools can accommodate two tools. Therefore tool A and B are available in this set-up aid. An example is a main spindle tool would be entered on line "A" and a sub-spindle tool would be entered on line "B".

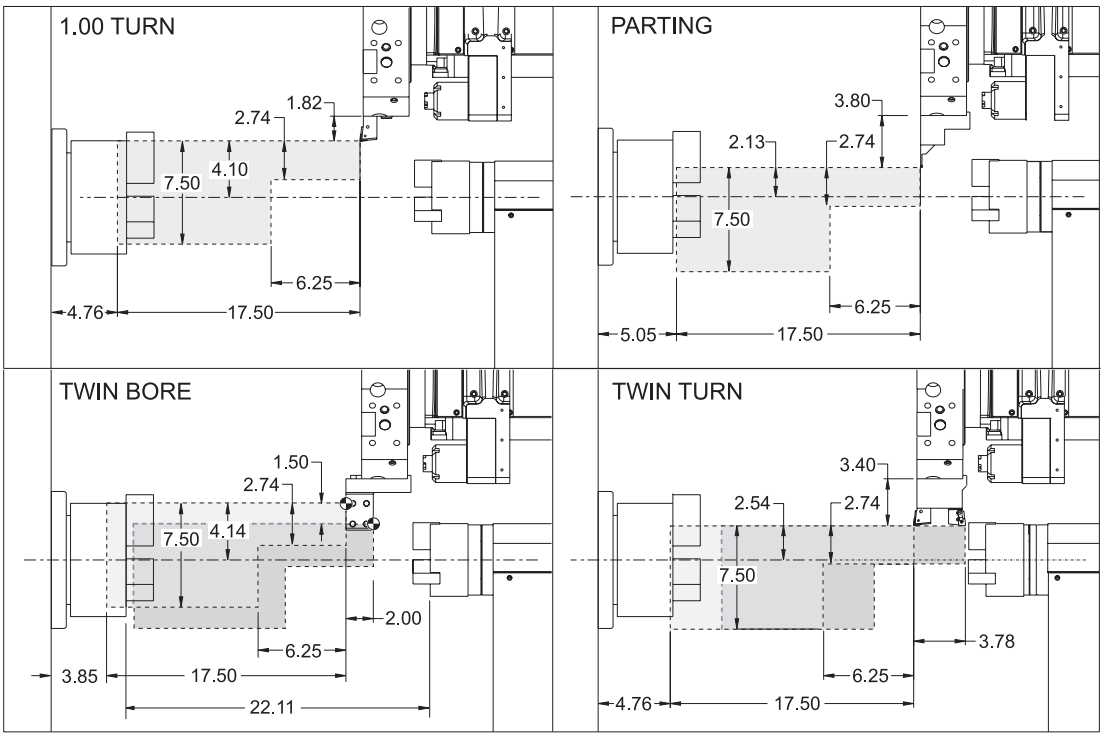
Hyper Turret Tooling Clearance



TL-15 Sub-spindle Tool Travel Range

NOTE: The following diagrams are for machines with the live tooling options.

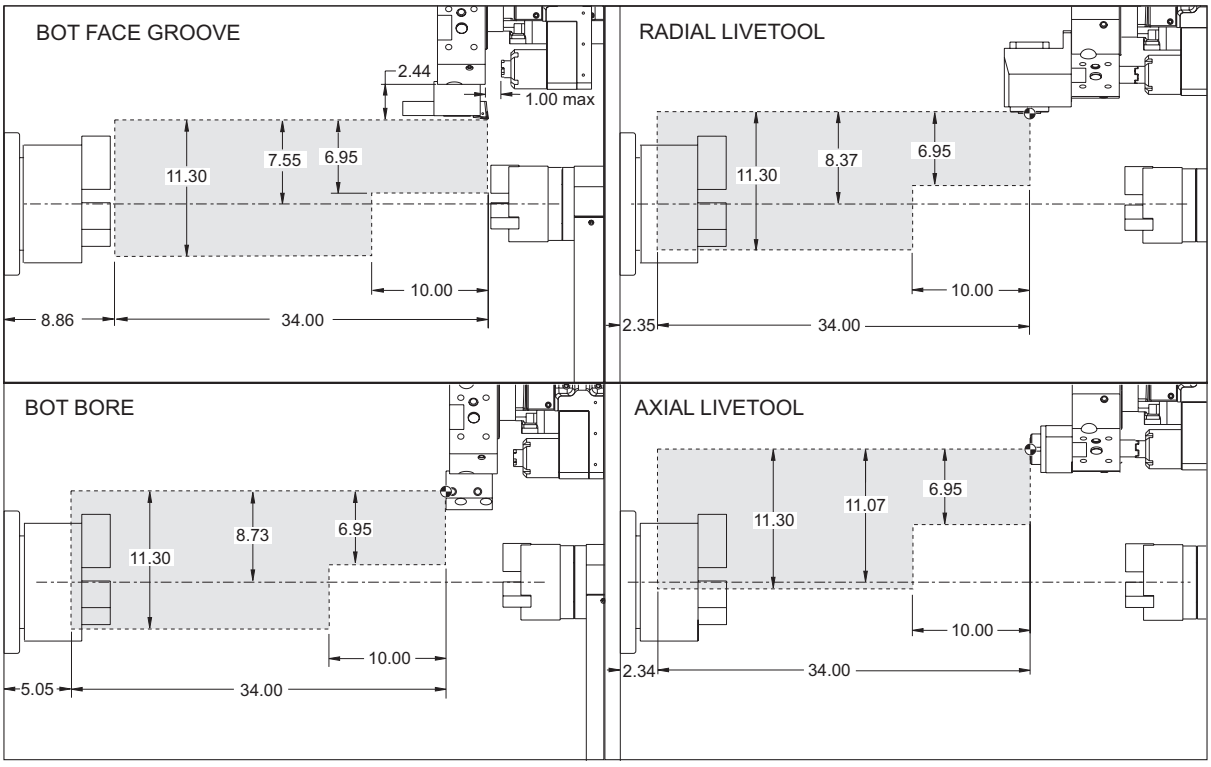


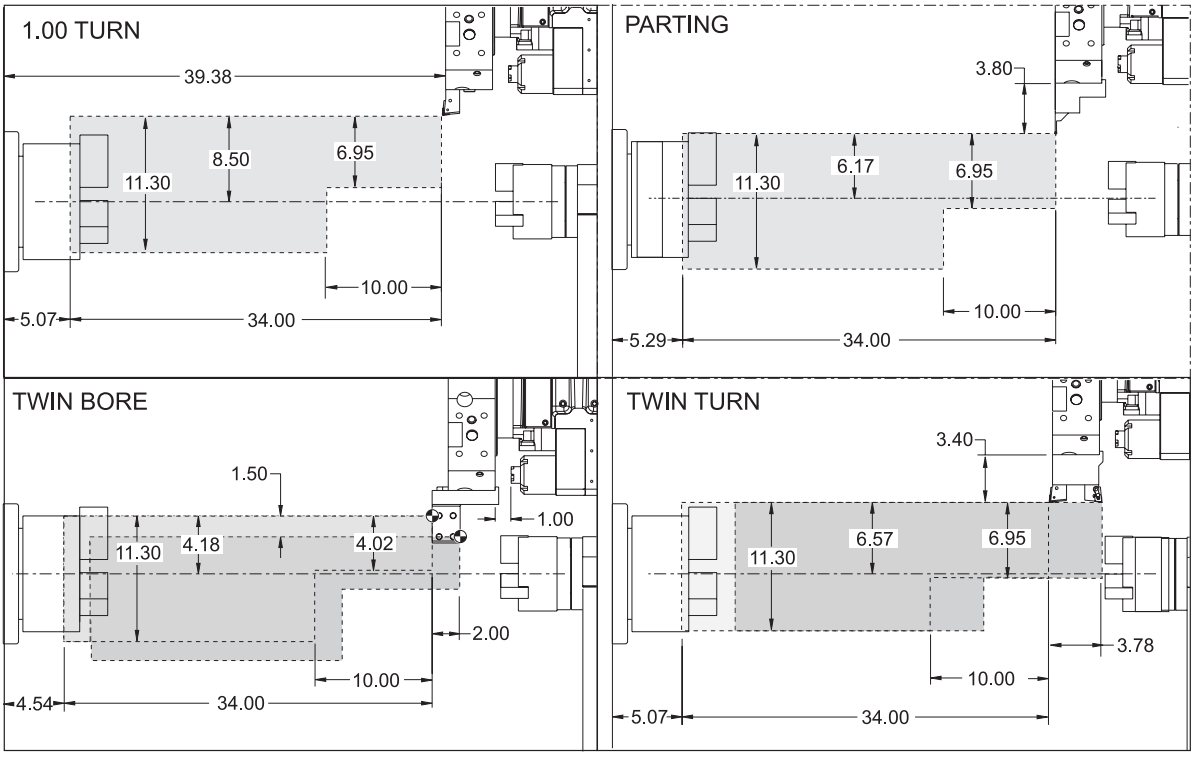


All Dimensions are in inches

TL-25 Sub-spindle Tool Travel Range

NOTE: The following diagrams are for machines with the live tooling options.





All Dimensions are in inches