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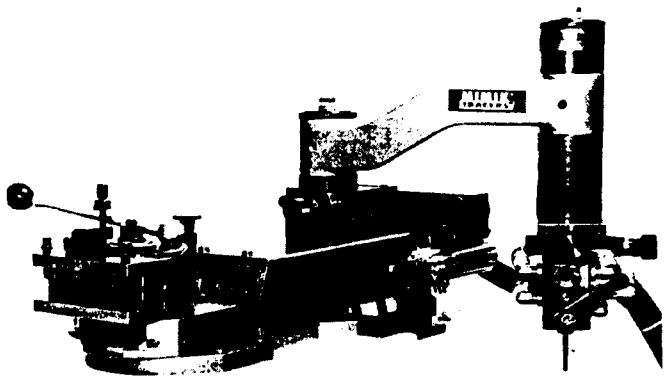

SERIES UT-P UNIVERSAL TRACERS

INSTALLATION & OPERATION MANUAL

MIMIK SERIES UT-P TRACERS

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MIMIK SERIES UT-P TRACERS

INSTALLATION AND OPERATOR INSTRUCTIONS

I. GENERAL DESCRIPTION OF SYSTEM

The MIMIK slide tracer is a single-axis, self contained, hydraulic servo controlled attachment designed to suit engine lathes and other machine tools.

The MIMIK slide tracer is usually mounted to the lathe cross-slide. When front mounted, it is equipped with a swivel adapter which is bolted in place of the swivel compound, allowing the tracer to be positioned to any desired angle.

When rear mounted, as is common on engine lathes with extended cross-slides, custom made swivel adapters are provided.

The MIMIK tracer valve is mounted to an X-Y co-ordinate adjustment slide in turn mounted to a pivoting valve carrier arm supported by a tracer slide mounted finish cut slide assembly (optional). The operator may thus position the tracer valve at any desired angle.

The MIMIK template bracket is either attached to the lathe V-ways, as is common with a front-mounted tracer, or to the back of the bed when the tracer is rear-mounted.

Deflection of the tracer valve stylus as it is fed along the template contour directs hydraulic fluid to either side of the piston. The resulting slide movement, combined with the basic machine feed, moves the cutting tool in a path identical to the template profile.

The main components of this system and their functions are as follows:

TRACER VALVE

The tracer valve controls the amount and direction of oil flowing to the hydraulic cylinder. This is accomplished by deflection of the stylus which bears against the template.

MIMIK tracer valves are equipped with the following controls:

a) Infinitely Variable Infeed Rate Control

To adjust the infeed rate of the slide, rotate the knurled slow feed knob located on the tracer valve.
- Clockwise will decrease infeed rate.
- Counter clockwise will increase infeed rate.

The correct setting should provide an infeed slightly greater than needed to follow the template contour. Most workpieces can be traced at 10 i.p.m.

b) Retract Control Lever

This two position control selects either infeed or retract. Rate of retract is not adjustable.

c) Stylus Pressure Control

Stylus actuating pressure is a function of the spool return spring pressure and frictional resistance. Stylus pressure adjustment on the tracer valve provides a stylus pressure of approximately 4 ounces to 2 pounds. A light stylus pressure provides maximum sensitivity and good surface finish, but must be heavy enough to ensure positive spool return. Recommended stylus pressure is between 4 and 8 ounces. (Dot on adjusting screw about 3/16" counter clockwise from 'L' position)

VALVE ARM ASSEMBLY

This arm supports the tracer valve and valve adjustment slides from the finish cut slide or top of the tracer. It can be pivoted to aid set up.

FINISH CUT SLIDE (optional)

This accurately fitted slide with turcited ways supports the valve arm, adjustment slides and valve. It has a short stroke hydraulic cylinder built into it. The graduated knob allows you to preset the amount of finish cut desired.

The purpose of this slide is to automatically offset the valve back (by the amount indicated on the knob) prior to taking a last pass (finish cut).

This is accomplished by the turret drum actuating a switch set up for the last pass. The finish cut offset can also be accomplished by a selector switch on the remote pendant. Both of these switches operate a solenoid valve controlling the direction of oil flow.

STYLUS

To ensure accurate template-to-part reproduction, the following basic rule must be observed:

Stylus and tool must be ground to a matching radius slightly less than the smallest radius to be traced. Most applications can be traced with the wedge-shaped stylus normally supplied.

As is normal with any tracer valve when a tool is cutting on more than 90° of its configuration, compensation has to be made for "stylus deflection". Stylus radius must be increased approximately .005", depending on the infeed setting, feed rate and tracer slide angle. (These three variables can all affect stylus deflection)

NOTE: When the correct compensation has been determined, the major variables noted above must not be altered.

VALVE ADJUSTMENT SLIDES

These 2-axis slides are mounted at 90° to each other. They are used to accurately position the tracer for cut depth. Graduations are in .001 inch increments on UTP-3.5 and 4.5 MIMIK units, and .0005 inch increments on the UTP-6 MIMIK unit (Metric graduations are available).

TRACER SLIDE

The tracer slide consists of a lower fixed member mounted to the lathe cross-slide and an upper sliding member which carries the cutting tool and the tracer valve.

To ensure accurate and consistent duplication of the template contour, the MIMIK tracer slide is accurately ground and equipped with Turcite "B" Way-Covering.

An adjustable tapered gib provides wear compensation for continued accuracy; automatic lubrication ensures minimum slide friction and wear. Wipers are also provided for the protection of the slide ways.

Fill oiler hole at regular intervals about once a week with Sunoco Way-Lube # 90 to ensure adequate lubrication at all times.

MAIN MANIFOLD & CONTROL VALVE ASSEMBLIES (see drawings 2130-1-5B + 2130-1-4B)

These mount to the cylinder end of the main tracer slide. They house check valves that stop the tracer slide infeed movement upon hitting a turret drum stop.

AUTOMATIC TURRET STOP

Attached to the lower tracer base is a 12-position rotary stop drum carrying adjustable stop buttons which limit the forward, or infeed, stroke of the tracer slide.

Stop buttons are set at appropriate positions to provide the desired stock removal for roughing cuts, and the drum indexes to the next position each time the slide is retracted. When the slide infeeds toward the turret stop, an actuator on the tracer slide rear manifold control valve strikes the appropriate stop button. This holds the slide at a uniform depth of cut until over-ridden by a higher point on the template.

Turret stop drums may be pre-programmed and interchanged for various jobs to reduce set-up times.

TEMPLATE HOLDERS

The most common type of template holder consists of a bracket assembly bolted to a dovetail at the rear of the lathe bed and supporting brackets on which templates are mounted. See page 9 for template making instructions.

HYDRAULIC POWER SUPPLY

Provides oil under pressure to operate the tracer, and consists of a reservoir tank with electric motor-driven pump, oil filter, and pressure gauge.

The model UT-P uses a 1/2 h.p. unit with a fixed displacement gear-type pump operating through a pressure relief valve. Normal maximum supply pressure setting is 300 p.s.i.

For series UTP-3.5, 4.5, & 6:

a) 5 U.S. gallon capacity reservoir.
b) 1.5 U.S. g.p.m. pump.
c) 1/2 h.p., 110 volt, single phase electric motor.
d) Operating pressure 225 - 250 p.s.i.
(220-440-550 volt, three-phase electric motor optional).

All hydraulic power units are equipped with 5 micron filtration.

The oil level should always be visible in the center of the sight glass, located on the side of the hydraulic reservoir.

ELECTRICAL PANEL

An electrical panel mounted to the hydraulic power supply houses a starter for the electric motor (if 3 phase electric motor is used) and circuitry for finish cut, retract and infeed controls.

A remote switch box, which can be mounted handy to the operator or hand held, is wired into this.

TOOLHOLDERS

Standard toolposts, such as Enco, Aloris, KDK, etc., can be used. A threaded bore in the center of the tracer slide tool platform accepts the toolpost stud.

II. INSTALLATION

To obtain correct and lasting operation, read complete instructions before attempting installation.

STEP 1 - Supply Tank

a) Assemble one end of hydraulic hose fittings to tank. Assemble pressure gauge and tighten all Tru-seals.
b) Fill tank to center of sight glass with hydraulic oil (Sunvis 747).
c) With open end of hoses exhausting into tank, start pump. Make sure electric motor is running in proper direction (i.e.: oil flow from pressure line).
NOTE: Do not run pump in reverse rotation.
d) Allow hydraulic supply tank to run with oil discharging to the tank while completing installation to Step 4.

STEP 2A - Front Mounting

a) Remove lathe compound from cross-slide.
b) Check the tracer mounting adapter spigot for fit to the cross-slide. Make sure mounting surface is free of dirt and burrs. If necessary, stone flat.
c) Assemble spigot to bottom face of tracer mounting adapter. Check spigot & adapter mounting screws for proper length. NOTE: Do not bottom screws.
d) Mount the tracer in its place, swivel to desired angle and clamp firmly in place using the existing compound T-bolts.

STEP 2B - Rear Mounting

a) Remove any lathe accessories from rear of cross-slide and make sure surface is clean and flat.
b) Mount adapter plate to cross-slide T-slots, or to dovetailed edges if applicable. If cross-slide is plain type, drill and tap mounting holes and bolt adapter down. If adapter is 2-piece, mount lower plate to lathe and upper plate to tracer slide, first assembling spigot to bottom of tracer slide to project into hole in lower adapter plate.
NOTE: Do not bottom screw into tracer slide.
c) Mount tracer in place, swivel to desired angle, and secure to lower adapter plate.

STEP 3 - Install Tracer Valve - See Maintenance - Section V.

Assemble tracer valve and valve adjustment slide to the pivoting valve arm.

STEP 4

a) Shut off hydraulic supply tank motor.
b) Connect pressure, return and drain hoses to the tracer valve fittings where marked "P", "R" & "D" respectively. Lock all Tru-seals.
c) Connect 2 hoses to finish cut slide.
d) Connect the two short hoses to opposite sides of the tracer valve where marked "A" & "B".

STEP 5 - Toolpost Installation

a) Install toolpost and tighten mounting screws.
b) Note whether tightening of the toolpost affects the smooth movement of the tracer slide at slow infeed rate. If so, toolpost is distorting slide - check mounting surfaces for flatness.

NOTE: Do not over-tighten. Tracer slide may be distorted.

STEP 6 - Set Pump Pressure (See page 3 for correct setting)

a) Pump pressure should be set with tracer slide fully retracted.
b) Cycle unit back and forth through the full stroke ten times to purge air from system.

STEP 7 - Turn knob on finish cut attachment to full open. Open bleed valves on slide slightly, and operate finish cut back and forth (by remote switch) to remove entrapped air. Close bleeds.

STEP 8 - Bleed main manifold assembly (drawing #2130-1-5) by slightly turning set screw # 3 counter clockwise while infeeding and retracting tracer main slide a couple of times by the remote switch. Make sure no turret stops are being contacted. Re-tighten screw # 3 when complete.

STEP 9 - Template Bracket Installation

a) Mount template bracket on lathe bed. Set height of template rail so that tracer valve stylus end is approximately 1/16" above bottom of template rail.

STEP 10 - Re-Check Installation

a) The tracer is now ready to operate.
b) Before attempting to produce parts, familiarize yourself with the operation of the tracer and its controls.

The customer must provide the following items for initial installation:

1. Five gallons of suitable hydraulic oil.
2. Necessary tooling and templates.

If installation is to be done by a MIMIK serviceman, these items should be ready when he arrives.

III. SET-UP FOR CUTTING (Not using drum)

INSTRUCTIONS

a) Position tracer slide to most suitable angle to produce contour.
Wherever possible, slide angle should bisect minimum contained angle of contour.
For straight diameter work with 90° shoulders, slide angle should be 45° or 60°.
b) Clamp tool in toolpost with cutting point exactly on center.
Included angle of tool point must be less than minimum contained angle of part contour.
Tool geometry must suit all part contours. Check tool against template to be certain.
c) Back off cross-slide until tool almost contacts finished workpiece diameter at starting end.
d) Insert stylus in collet on tracer valve.
e) Swing valve arm and set template along rail until stylus contacts template in approximately the same relative position as tool to workpiece. Clamp template in place. Adjust rail and indicate template for parallelism.
Make sure valve adjustment slides are square to lathe bed, (eye alignment adequate) and stylus is contacting template.
f) Adjust tool-to-workpiece and stylus-to-template relationship using valve adjustment slides.
If the tracer slide is set at an angle, some lengthwise adjustment will be necessary to keep the stylus on the desired point.

g) All components are now in position for tracing passes. If stock removal is slight, and fairly uniform over the full contour, one tracing pass may be adequate. For heavier stock removal see notes below re: rough and finish tracing.

When first tracing a new part, watch arrows on tracer slide indicating stroke limits. If limit is reached before covering full contour re-position cross-slide to regain stroke.

Facing operations are performed in the same manner except cross-slide feed is used instead of carriage.

ROUGH AND FINISH CUTTING

Method 1 - Normally used when parts are produced from bar stock and require more than two rough cuts. With tracer slide advanced fully forward, position cross-slide for each rough cut at desired depth. Stylus contact with template will increase on each pass. When it engages full contour, further cross-slide movement will not affect tool position. Re-set tracer adjustment slides to take finish cut. Return both cross-slide and adjustment slides to original position for next part.

Method 2 - More suitable for parts produced from castings or forgings, where stock removal is uniform over contour, as tracer follows full contour on each pass. Set tool position for each pass, including finish cut, using tracer adjustment slides only.

Method 3 - Most practical for high volume parts produced in repeat runs. Use hinged or pinned overlays on finish-size template for rough cuts, and follow final template for finish cut. No operator settings are needed once the correct finish cut position has been established.

Method 4 - Provides uniform tool adjustment where tool is cutting around full nose radius (eg.: cutting a sphere with a button tool). Use removable stylus bushings of different diameters for rough cuts, and basic (round cross-section) stylus for finish cut. No operator settings are needed once correct stylus diameter for finish size is established.

NOTE: Where heavy stock removal causes excessive tool wear, separate tools for roughing and finishing are recommended. The finish tool can be pre-set to eliminate manual adjustment for finish size.

THREADING

A feature often overlooked is the ability to use the MIMIK tracer slide for threading.

With the tracer slide set to the desired angle (normally 29 ½°), infeed to preset depth using a straight template.

When desired length of thread has been cut, the tracer valve stylus contacts a 90° shoulder on the preset template. This causes the cutting tool to retract instantly, clearing shoulders, larger diameters, etc.

Carriage and cutting tool are then repositioned, using the cross-axis adjustment slide for each successive cut.

IV. JOB PROGRAMMING AND SET-UP -Using turret drum - O.D. Tracing Only

The chief reason for using a tracer is to reduce cycle times through automatic control of normally manual operations. However, if job set-ups are not conducted efficiently, some of the tracer's advantages can be lost.

To reduce this potential time loss to a minimum, the user should adopt standard procedures for job planning and set-up. The necessary steps, along with suggested procedures, are explained below.

GUIDELINES FOR EFFICIENT SET-UP

1. Plan a new job thoroughly before starting set-up.
2. Schedule jobs of similar nature consecutively to reduce to a minimum the number of changes needed in a new set-up.
3. Establish as many settings as possible as standard, so they will rarely need re-setting regardless of the job. These can usually include tracer slide angle, stylus type and location, tool type and location, cross-slide position.
4. Establish reference points on the lathe from which variable settings can be measured. Such settings would include cross-slide position and transverse position of the template support rail.
5. Provide the set-up man with a process sheet showing all variable settings. Where certain settings cannot be readily determined, have the set-up man add them to the sheet for future reference..
6. Program the turret drum from pre-calculated data, and use a separate drum for each job that will be repeated.

JOB CYCLE PLANNER

The first step in planning a job cycle is to determine the number of cuts needed and the most suitable tool paths for the various rough and finish cuts. Fig.1 shows a typical job for which the necessary planning steps are outlined in the following page.

PLANNING STEPS FOR A TYPICAL WORKPIECE (See Fig.1)

We will assume this part is being run on a 12 h.p. lathe from 2½" diameter leaded steel bar. At 710 r.p.m., cutting speed on the first pass is 480 fpm and a .220" cut at .010/rev. requires just under 11 h.p. at the spindle. A slightly heavier cut can be taken on smaller diameters for the same power consumption.

We will also assume the workpiece blank is faced to length and centered both ends. A face driving center is being used to permit full length tracing and reduce loading time, and we are tracing from a round master. A run-off is provided at the headstock end of the master to prevent forward slide movement at the end of a cut.

A run-off at the starting end is advisable, although excessive infeed will be prevented by the turret stop button.

It is preferable to program six cuts or less, since a seven or eight cut program would require several dummy passes to use up all twelve index stations. In this example, three rough cuts against turret stops, a final rough cut against the full template, and a finish cut, will complete the part without overloading the lathe. This totals five passes, so one dummy is needed for a program that will divide evenly into the twelve index stations.

Generally, speaking it is best to take only a partial length cut on the first pass when the workpiece is a conventional stepped shaft, since the final rough cut is usually against the full template.

In this case, because of the reduced diameter at the end of the part, cut number 1 should be full length.

Second and third passes are taken against position stops and the tracer should be retracted upon hitting the template.

We now want a full length pass for the final rough cut, and we also need a dummy pass to give a total of six indexes.

To safely program a dummy pass, the position stops should be positioned about 1/2 inch from the end of the drum. Allow the unit to infeed then retract it again to rotate the drum one stop.

Pass number 5 is taken against the full template contour, the cross-hatched areas on the sketch showing material removal on this cut. A stop button is used on this pass, partly to guard against damage if the tracer is fed forward with no template in place, and partly as safe storage for the stop button. It can be set anywhere below the lowest template diameter, but for consistency, it is normally set just below the smallest diameter to be traced.

On the final finish cut pass a stop button is used, as above. The finish cut mechanism is activated to retract the tracer valve by the amount of finish cut setting.

There is also a smaller stop button used on the other side of the turret drum retaining ring to activate the finish cut slide.

A suitable finish cut surface speed of 825 fpm results at 1400 rpm on the above part. This speed requires a feed rate change for a good surface finish. The roughing speed of 710 rpm at .010"/rev requires a primary feed rate of 7.1 ipm. At 1400 rpm the same feed rate requires about .005"/rev. If a spindle speed change for the finish cut is not possible or desirable, then the secondary feed must be set at 3.5 ipm (.005"/rev) for equivalent finish at 710 rpm. This will of course slow down the cycle, and perhaps some other combination of speeds, feeds, & depths of cut would be more suitable.

CALCULATING PROGRAM DRUM STOP BUTTON SETTINGS

The sample job described on the previous page uses a 6-pass cycle, so 2 identical programs must be set on the drum. Each requires a number of stop buttons at specific locations.

While stop button locations can be calculated on the basis of cutting depth times the sine of tracer slide angle to the lathe centerline, the simplest method is to lay out the roughing cuts to scale on an accurate workpiece drawing and extend them to a line representing the drum centerline, drawn at the angle of the tracer slide. This method will usually ensure close enough accuracy, since final workpiece dimensions will be controlled by the template.

Since most tracing jobs have relatively small diameters at the starting end and step up to larger diameters, the tracers radial capacity starting at spindle centerline is usually adequate. The use of spindle centerline for a reference diameter, as shown in figure 1, is therefore recommended for jobs of this category. The sketch also shows graphically the maximum radial tracing capacity, which on a UTP-3.5 is 2.65" (UTP-4.5 is 3.5" and UTP-6 is 4.8")at a 60° slide angle, allowing the necessary 3/8" for turret indexing.

With the tracer slide fully forward and the tool on spindle centerline, the corresponding location of the drum line places its forward end (the steel ring on the drum) 3/8" ahead of centerline.

The various roughing cut depths are extended to the drum line, and measurements noted from slightly below the smallest template diameter to the drum line for the two full template cuts. Stop buttons can now be easily positioned on the drum by measuring from the rear drum face to the edge of each button.

COMPLETING THE PROCESS SHEET

When the program details covered above have been worked out, they should be noted on a process sheet, along with other particulars needed for set-up and production purposes. A suggested process sheet from is used in figure 2.

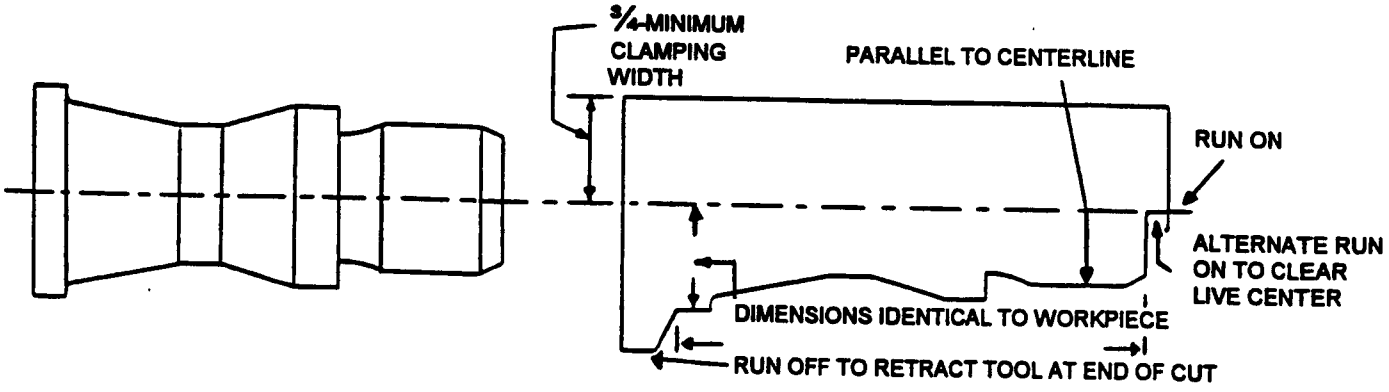
Information provided on the sheet includes details of workpiece, material, cutting tool, speeds and feeds, and programming set-up instructions. Calculated cycle times can also be included.

PREPARING THE TEMPLATE

Flat templates are normally used with Series UTP tracers. The traced contour must be identical to the desired part contour, and should be polished to remove feed lines or file marks. While not always necessary, the addition of a short run-on and run-off past the ends of the contour will usually help avoid interference between the tool and the live center or chuck. With UTP tracers, an angled run-off is recommended to signal the operator to disengage feed.

Flat templates can be made from steel stock of 1/16" to 1/4" thickness and need not be hardened. The most suitable material is 1/8" flat ground stock. A clamping area of at least 3/4" width must be provided behind the lowest traced contour, and this dimension should be held to a standard size on all templates for consistent set-up procedures.

The back face of the template should be parallel to the workpiece centerline and a straight parallel surface should be provided for indicating parallelism during set-up.



COMPLETE SET-UP

Important Note: Ensure that the turret drum indexing actuator rod is set far enough towards the toolpost end of the tracer slide so that the drum mounted buttons clear the control valve plunger.

Set up the program drum from the information on the process sheet. Start at channel 1, locating stop buttons from the end face with a scale or vernier. Now proceed with the tracer lathe settings.

Setting A - Position tracer slide at 60° angle and secure mounting bolts. Swing valve, adjustment slides and valve arm back, out of the way.

Setting B - Rotate toolholder to the position which places it at 90° to the lathe bed. Install the tool with its cutting point projecting 1 5/8" from face of holder.

Setting C - The following setting with tool on center applies to most jobs within the tracer's radial capacity from center. Different tool positions relative to spindle centerline will be needed for large diameter parts.

Set the retract control to 'retract', and the finish cut switch to 'off' and start the supply unit. Install a turret drum with one stop button positioned against the retaining ring. Select 'finish cut' and infeed the tracer against this stop. This positions the slide at the forward end of its stroke. Now position the carriage and cross-slide so the tool point is aligned with the center of the face driving center. Adjust the tool height so the cutting point is exactly on center. Leave the supply unit running during the remainder of set up.

Setting D - With the tracer slide still fully forward and the tool on center, note dimension 'D' from front of cross-slide in this position if possible.

Setting E - Insert stylus in valve. With tracer slide fully forward against turret stop button and in finish cut, swivel valve arm towards template rail bringing stylus against it. (It may also be necessary to move template rail back or forward.)

Note: Dimension E relative to a fixed lathe reference (e.g., rear face of lathe bedway) and set rail parallel to bed by checking dimensions at both ends.

Setting F - The objective is to position the headstock end of templates at a standard location where the final cutting pass will be completed. This location will vary with the type of work-holding device used, and with the length of traced contour relative to overall part length.

To establish the setting for this part and other similar parts, advance the slide to the full-forward turret stop in Finish Cut. Position the carriage to locate the tool tip at the end of a cut (i.e., at the desired minimum tool spacing from face of work-holding device). The tip of the stylus will now be aligned with the corresponding axial position on the master or template.

Allowing for whatever run-off length is provided on the template, the appropriate location can be determined. After clamping in this position, note dimension F from the template to the end of the template support rail. This becomes a basic dimension which can be used as a reference when planning any future jobs.

Setting G - This setting limits the retract position of the slide and is used to save time. With the tracer slide fully forward, set the retract stop nuts to dimension G (between stop nut and plunger) and leave the stop plunger in the up position to allow full retraction.

Now retract fully and install the programmed turret drum.
The drum will fit into place when the spring-loaded ball in the face of the turret mounting block nests in one of the drum slots, and the drum mounting screw aligns with the tapped mounting hole.

Tighten the mounting screw and rotate the drum by hand to check for correct fit. Now set the turret indexing rod to correspond with the retract limit setting as follows:

- Infeed the slide against any of the turret stop buttons.
- Loosen the index rod clamping screw and pull the rod forward to clear the index mechanism.
- Depress the retract stop plunger and retract the slide to the stop limit.
- Push the index rod back in until it bears against the index mechanism, and note the amount of rod extension past the front of the index rod mounting block.
- Infeed the tracer again and push the index rod back in until it projects 3/8" less than in the previous step.
- Tighten the clamping screw.
- Retract and infeed the tracer slide a few times to check for proper drum indexing.
- Make sure the tracer slide retracts far enough so that the drum and stop buttons can index without hitting the side of the control valve.

Setting H - (Depth of Finish Cut) - The finish cut adjustment knob provides a range of zero to .050". Since the resulting movement is along the tracer slide axis, the reduction on workpiece radius will be this amount time the sine of the slide angle. e.g., at a 60° slide angle a .050" finish cut setting will reduce the workpiece radius .043", and will remove .025" from a 90° face.

INSTALL MASTER TEMPLATE

Apart from lathe control settings and tool proving, this is the final step for a UTP tracer.

For flat templates, the rail should be paralleled by adjusting the two screws on the rail mounting brackets. Now clamp the template to the rail, with its back face held firmly against the back of the mounting ledge, and its end face flush with the headstock end of the rail.

The template should now be checked and adjusted for parallelism, using a dial indicator, and feeding the carriage by hand.

Note: Parallelism may be affected by changes in length or position of master or template. Each new set-up should therefore be re-checked with an indicator.

PROGRAMMING PROCEDURE FOR TYPICAL JOB CYCLE - UTP-3.5

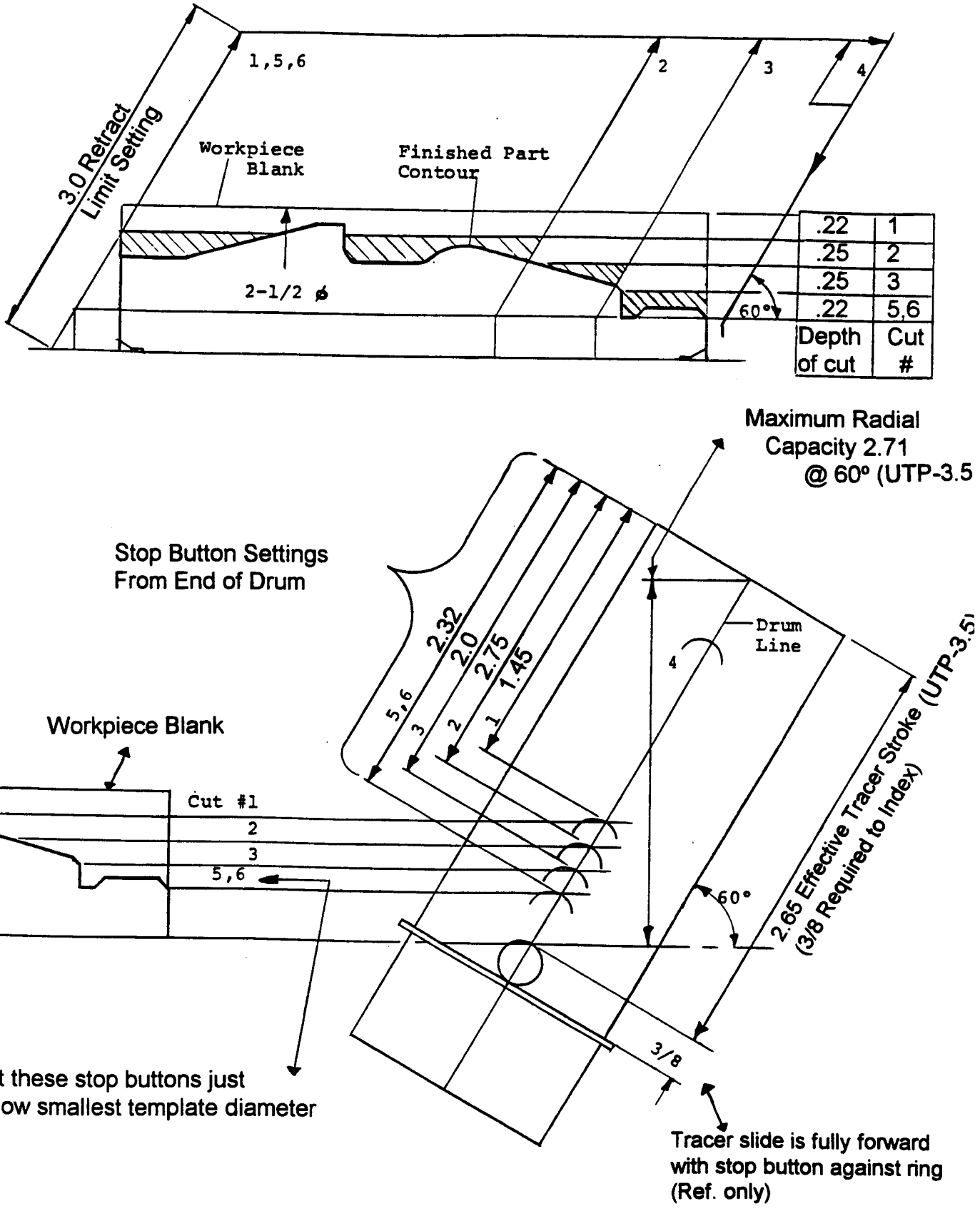


Figure 1