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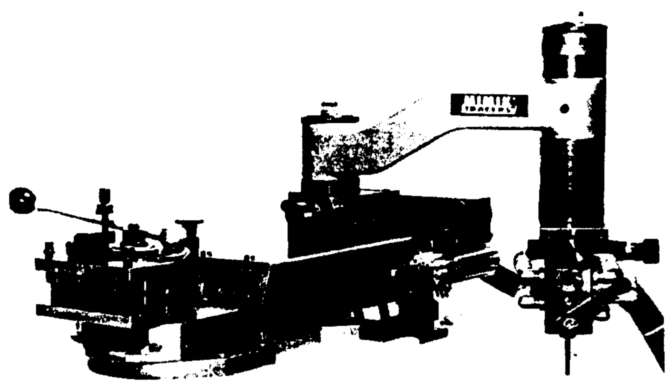

SERIES UT-P UNIVERSAL TRACERS

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.

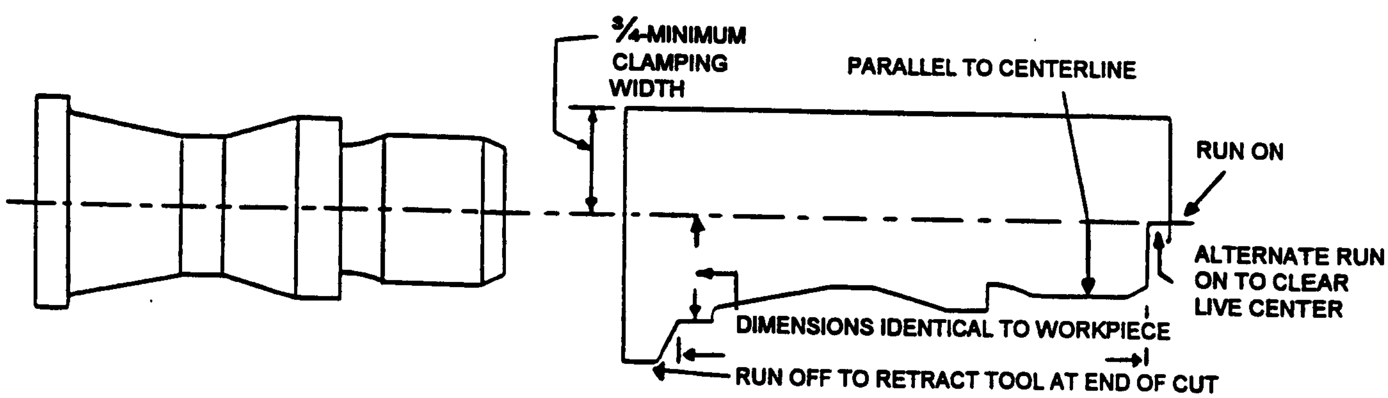
Information provided on the sheet includes details of workpiece, material, cutting tool, speeds and feeds, and programming set-up instructions. Calculated cycle times can also be included.

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

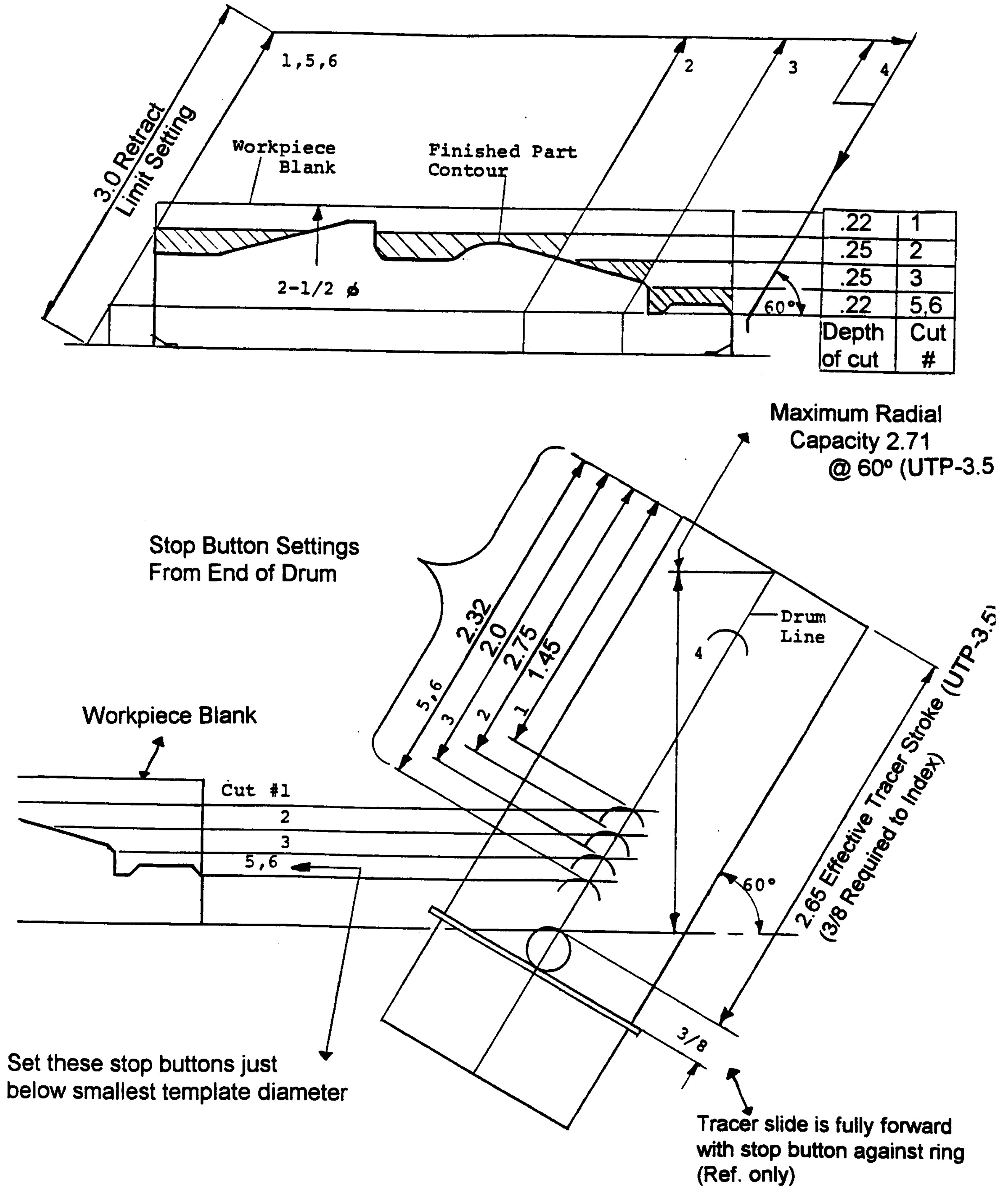


Figure 1

JOB PROCESS SHEET - MIMIK UTP

Part # & Name: ______________________________

Material Size & Spec.: ______________________________

Work-holding Device - Headstock: ______________ Tailstock: ______________

Cutting Tool Specs.: ______________________________

Round Master: ______________ Template: ____________ #: ______________

Cutting Speeds: Rough __________ FPM Finish __________ FPM

Spindle Speeds: Rough __________ RPM Finish __________ RPM

Feed Rates: Rough __________ "/Rev. Finish __________ "/Rev.

Tracer & Lathe Settings

#	Dimen.	Std.	Spec.
A			
B			
C			
D			
E			
F			
G			
H			

H=Finish Cut Depth

Turret Drum Settings

Channel	Stop Location
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	

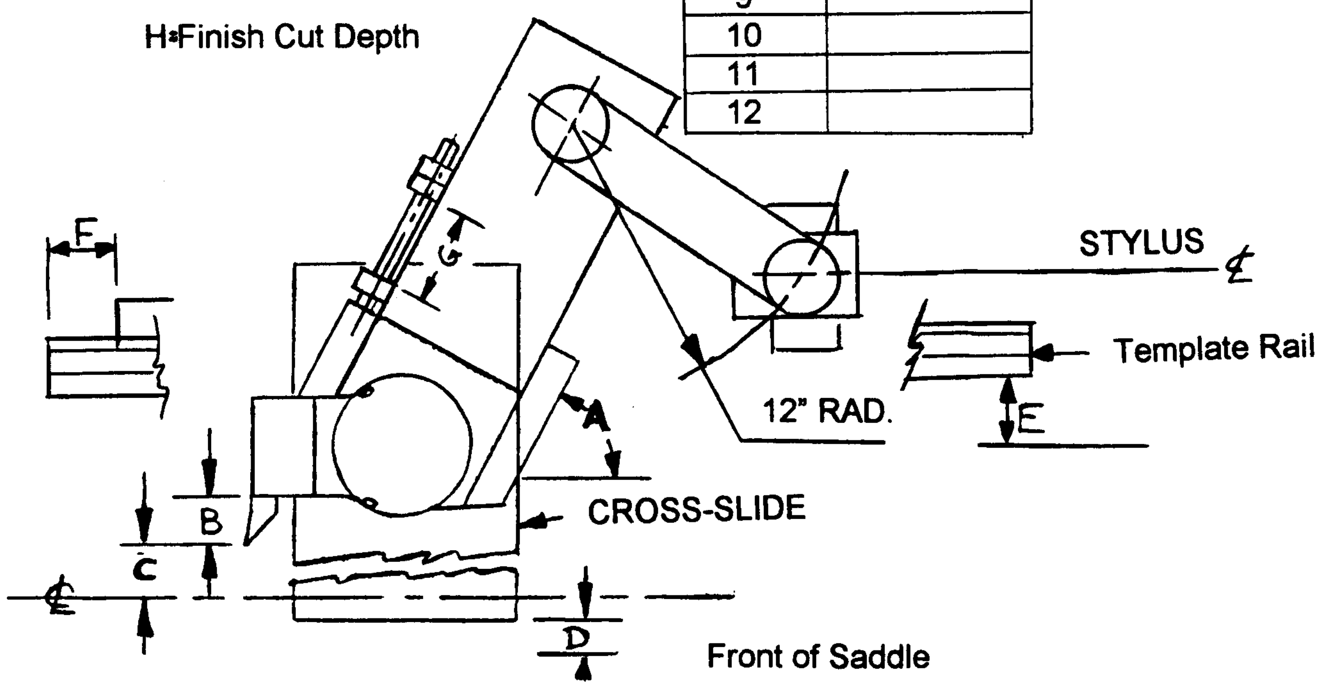


Figure 2

V. MAINTENANCE

CARE AND MAINTENANCE

Unlike other machine slides, the tracer slide must accept the stresses of varying cutting loads while constantly changing its rate and direction of movement. To ensure high accuracy under these conditions, all MIMIK slide ways are fitted to close tolerances and are equipped with special lubrication systems.

The performance of your tracer depends on good maintenance, as outlined below:

a) Keep the tapered gib properly adjusted.
b) Provide an adequate supply of way lubrication. Use Sunoco Way-Lube # 90.
c) Prevent the entry of foreign particles, since they can cause undue wear or scored ways. Make sure the way wipers are installed properly.
d) Avoid uneven mounting of tracer slide and toolholders. Both can cause slide distortion. Do not clamp cutting tool directly to unit, use toolholder or proper mounting base.
e) Keep hydraulic oil clean. Replace hydraulic oil and filter every 6 months (1000 hours).
f) Do not over-tighten fittings. Turn them in finger-tight. Use wrench to lock Tru-seals.
g) Actuate the stylus several times when starting the tracer. Avoid long idle periods which allow oil to gum up inside the valve. This may cause the spool to hang up, in which case the tracer will not feed toward the template or will continue to retract after leaving the template.
h) When starting up tracer system, bleed the finish cut slide, the tracer cylinder, and the single bleed at the top of the main manifold mounted to the end of the cylinder.
i) When not using the MIMIK, fully retract slide and shut off hydraulic supply unit. Also, remove stylus from tracer valve to prevent damage when moving lathe cross-slide or saddle.

KEEP YOUR HYDRAULIC SYSTEM CLEAN!!

Hydraulic Oil (Customer to supply)

Sunvis 747 is the hydraulic oil recommended by MIMIK Industries Inc.

It is a detergent-dispersant type of oil with rust oxidation and anti-wear inhibitors having viscosity of 220 SSU at 100° F.

If not available, other makes having the above characteristic may be used.

For Trouble Shooting, See Page 19.

SPECIAL NOTE RE: TAPERED GIB - Square way tracer slides only (UTP-3.5, 4.5, & 6)

The purpose of the tapered gib on these tracer slides is to facilitate assembly of the unit. Gib tightness is properly set at the factory and should not need adjustment during normal use. The gib is not intended as a means of compensating for wear, since it only provides horizontal adjustment, while slide wear can occur both horizontally and vertically.

If the slide way surfaces become excessively worn after several years of use, they should be re-ground to a precise fit and we recommend that this be done at the factory. The tapered gib should not need adjustment during this period, but if it is re-set for any reason the following procedure should be used:

1. Remove hose fittings from tracer slide (Make sure hydraulic supply is off).
2. Loosen gib adjustment screw at front left of tracer slide.
3. Move slide by hand back and forth over full stroke to remove oil from cylinder. (Use clean receptacle to collect oil)
4. Carefully tighten gib adjustment screw as slide is moved back and forth until resistance due to gib tightness can be felt. Slide should still move freely and smoothly over full stroke but gib must be tight enough to prevent any sideways movement.
5. After re-connecting hoses, run tracer slide full stroke under power several times to remove air from the system.

CAUTION - The above setting in not equivalent to the 50 p.s.i. setting used on dovetail-way slides (UT-2, 9 & 11). A 50 p.s.i. setting would result in an over-tight fit, which could cause galling or slide seizure.

INFEED RATE SETTING ON TRACER VALVE

If the normal range of infeed cannot be obtained through "slow feed knob" rotation, the eccentric tapered pin may be out of position. To reset, proceed exactly as follows:

Before making any adjustments, be sure hoses are connected correctly. Turn on hydraulic supply unit.

a) Turn slow feed knob fully in (clockwise).

b) Loosen retract lever clamping screw and turn slow feed knob further clockwise. Continue turning until tracer slide begins feeding toward template. (It is possible for slide to retract before infeed stroke begins.)

c) With retract lever in trace position, tighten clamping screw. Move retract lever slowly toward retract position until tracer slide just begins to retract.

d) Hold slow feed knob, loosen clamp screw and return retract lever to trace position. Tighten clamping screw.

e) Turn slow feed knob counter clockwise to obtain desired infeed rate.

Proper infeed rate adjustment automatically puts retract - trace mechanism into proper relationship.

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MIMIK #10 AND #15 TRACER VALVES

INSTALLATION INSTRUCTIONS

The MIMIK Tracer Valve is a precision hydraulic valve that controls the amount and direction of oil flow.

The following must be done when installing to ensure proper operation:

1 - Make sure hydraulic oil is clean. Use Sunoco Sunvis 747 or equivalent. Change oil and filter, and flush all hoses prior to installing the tracer valve.

2 - If it is necessary to change or re-position the hose connectors at the valve;

a) Use sealing nuts (with teflon inserts) on the connectors. Do Not use teflon tape on fittings.

b) When installing, put the sealing nut on the connector as far as it will go. Then screw connector into the valve finger tight at least 2½ turns.

c) Tighten only sealing nut against valve body. Do Not over tighten.

3 - Connect hoses to valve connectors. Make sure they are connected as follows;

a) Pressure line from tank to connect to "P" at valve.

b) Return line from tank to connect to "R" at valve.

c) Connect drain line from tank to "D" at valve.

NOTE: There are two "D" (drain) ports on the valve. Connect the drain hose to the lowest "D" port. Make sure the other "D" port in valve has vented brass plug in it.

d) Connect lines from cylinder to "A" and "B" at valve. Turn on hydraulic tank to see if valve moves toward template with retract lever in infeed position. If it moves away, reverse cylinder "A" and "B" lines at valve. If a reversing valve is in the circuit, make sure it is set in the forward position prior to doing this check.

4 - Ensure that return line at tank is not coupled to any other line going to the tracer valve. Return oil must be able to flow directly into tank. If not, oil may leak out stylus end of valve during operation.

5 - If pressure and return lines are reversed (in error) at the valve, or if the return line flow is restricted, oil will leak out the stylus end of the valve during operation.

6 - The drain line from valve to tank cannot be kinked, or looped up above the tracer valve, or oil may leak out stylus end of valve.

Change oil and oil filter at least annually to ensure trouble free operation.

If hoses are removed from valve for any reason, cap the hose ends and the hydraulic connectors on the valve to prevent dirt from entering.

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 the infeed rate.
- Counter-clockwise will increase the 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 ipm.

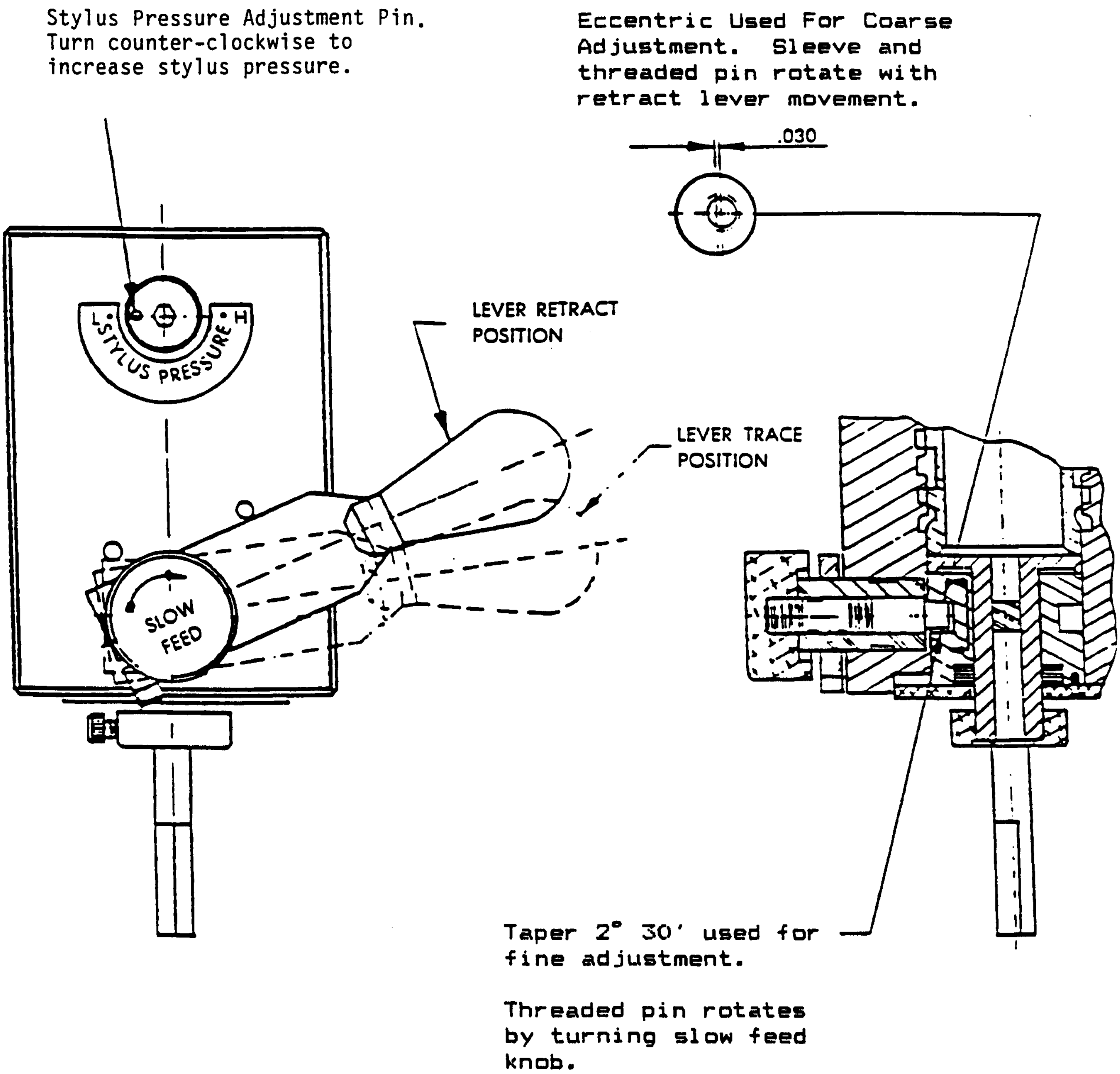
B) Retract Control Lever

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 adjustments 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.)



Scale = 1/1 for #10 Valve

VI. MIMIK TROUBLE SHOOTING CHART

TROUBLE	CAUSE	REMEDIES
1. VIBRATION Occurring When Stylus Feeds Into Template Or Meets Profile Change.	a) Infeed rate too high	Reduce by adjusting infeed rate knob. See Page 15.
	b) Air in hydraulic system	Cycle slide full stroke. Check for leakage at valve & tank fittings. Check for adequate oil in reservoir.
	c) Hydraulic pressure is too high	Reduce for proper setting. See Page 3(d). Check for broken pressure gauge.
	d) Stylus pressure too high or too low	Adjust. See Page 17.
	e) Mechanical looseness	Check mounting bolts, cross-slide, tool-holder, template bracket & tool insert for tightness. Check tracer gib adjustment and piston rod connection.
	f) Lathe vibration	Eliminate by balancing or leveling.
2. SURFACE FINISH PROBLEMS	a) Vibration in tracer system	See Section 1 above.
	b) Template contour not smooth	File, grind or polish.
	c) Valve hang-up	See Page 21.
	d) Air in hydraulic system	See Section 1 (b) above.
	e) Mechanical looseness	See Section 1 (e) above.
	f) Uneven tracer movement	Reduce hydraulic pressure to 50 p.s.i. and check for uniform movement. Check for distortion & lubrication. If tracing small taper, increase slide angle to provide faster tracer slide movement.
	g) Excessive stylus pressure	Reduce.
	h) Incorrect tool geometry	Check for adequate clearance and correct rake & relief angle.
	i) Looseness or vibration in lathe	Check for spindle run out, loose carriage or cross-slide. Take straight cut with tracer in full forward or retract position and inspect for similar marks.

3. PART-TO-PART VARIATIONS	a) Varying cutting load	Provide uniform allowance for finish cut over entire contour.
	b) Excessive tool wear	Use throw-away carbide inserts. Use separate tool for finish cut. Check proper speed and feed.
	c) Operator errors	Use preset tools, turret stop, overlay templates, etc. Eliminate operator settings.
	d) Mechanical looseness	See Section 1 (e) Page 19 + 2 (i) above.
	e) Valve hang-up	See Page 21.
	f) Uneven tracer slide movement	See Section V, Page 14.
	g) Air in hydraulic system	See Section 1 (b), Page 19.
	h) Excessive variation in oil temperature	Let oil warm up before tracing. Cycle slide frequently. Install oil temperature control. Contact MIMIK for details.
4. TEMPLATE-TO-PART VARIATIONS	a) Tool not on center	Adjust cutting point to exact center height.
	b) Template not aligned in horizontal zone	Adjust template using a dial indicator.
	c) Variation in cutting load over length of part	See Section 3 (a) above.
	d) Incorrect tool-stylus relationship	Stylus-tool to have same profile and proper alignment. See Page 2.
	e) Incorrect tool geometry	See Section 2 (h) Page 19.
	f) Incorrect tracer slide angle	Reset slide to ensure full contour coverage.
	g) Excessive stylus deflection	Reduce infeed rate to approximately 10-20 i.p.m.
	h) Mechanical looseness	See Section 1 (e) Page 19.
	i) Valve hang-up	See Page 21.
	j) Uneven tracer slide movement	See Section 2 (f) Page 19.
	k) Excessive machine feed or insufficient tracer slide infeed	Reduce machine feed, increase tracer infeed or change slide angle so stylus will follow contour without floating off template or over-deflecting.

5. <u>SLIDE HANG-UP</u> Slide Will Not Feed Forward With Valve Set To Infeed & Stylus Off Template or Slide Continues to Retract When Stylus Meets A Reduced Slope.	a) Incorrect feed setting	Adjust feed to desired rate.
	b) Slide at end of stroke	Reposition cross-slide to regain stroke.
	c) Hose lines installed incorrectly	Connect hoses properly.
	d) No oil flow from pump	Check for loose motor-to-pump coupling, burnt out motor, broken fittings inside tank, faulty relief valve or plugged filter.
	e) Slide hang-up	See Section 2 (f) Page 19.
	f) Valve hang-up	See Section 8, below.
6. <u>TRACER SLIDE</u> Creeps When On Drum	a) Air trapped in main manifold.	Bleed main manifold by opening set screw at top so that oil just seeps out. Retract and infeed tracer to drum stop a few times. Close bleed.
	b) O-ring on check valves worn in main manifold or control valve manifold.	Replace O-rings.
7. <u>FINISH CUT SLIDE</u> Does Not Move When Activated By Hand Held Switch Or Drum Switch	a) Air in finish cut cylinder.	Open 2 brass bleeds slightly & activate slide to move back and forth a few times for air to escape. Close bleeds when finished.
8. <u>VALVE HANG-UP</u>	a) Insufficient stylus pressure	Increase stylus pressure and actuate stylus by hand. If tracer does not begin to infeed immediately, hang-up may be due to dirt.
	b) Dirt or gummy oil deposits in valve	Drain tank, flush complete system and replace hydraulic oil & filter. Run tank until oil warms up. Actuate stylus by hand until smooth stylus action and positive spool return are obtained.
	c) Distortion from over-tight fittings	Back off Tru-Seals, make sure fittings are just finger tight. Snug up Tru-Seals gently.
	d) Air lock in valve	Cycle tracer slide full stroke several times by activating stylus.
	e) Incorrect hydraulic oil.	Change to Sunvis 747.

If tracer valve continues to hang-up, contact MIMIK Industries Inc.
The tracer valve is factory sealed.
Any attempt to dismantle the tracer valve
can result in damage and will void its guarantee.

FOR SERVICE OR PARTS CONTACT:

ROSEBROOK TRACERS INC
(MANUFACTURER OF MIMIK)

PHONE 719.632.8894
FAX 719.632.8894 (SAME)
rbtracer@rosebrooktracer.com

VII. TIME STUDY PROCEDURE

To obtain maximum value from a time study, an operation should be broken down into elements of sufficient length. The following rules should be adhered to in dividing an operation into elements:

1) Constant elements to be separated from variable elements.
2) Handling elements to be isolated.
3) Machining time elements to be separated.
4) Elements to be as short as practical.

The machining time element, commonly referred to as the "Cutting" time, is a constant regardless of shop efficiency and can easily be calculated using the enclosed format illustrated as "Sample Study #1".

Before proceeding with any calculations, the following questions must be answered:

a) What is the workpiece material?
b) How must stock must be removed?
c) Portion of part to be traced?
d) How is the part fixtured?
e) What feeds and speeds are to be used?
f) What types of cutting tool is to be used?
g) Finish and accuracy requirements?
h) How many pieces?

Based on these answers, you can now proceed to fill in your calculation sheet.

For better illustration, this is further explained in our Sample Study #1.

SAMPLE STUDY #1:

1. CUSTOMER NAME: M.S. Company PART NAME: Axle
2. WORKPIECE DRAWING #: Sample Study #1
3. WORKPIECE MATERIAL: AISI 1045
4. TYPE OF TOOLING: Carbide
5. WORKPIECE DIAMETER: 1.5 INCHES
   Since most tracing jobs involve multiple diameters, a mean diameter must be used in our calculation. In our sample part where the large diameter is 2.375" and the small diameter is .625"; the mean diameter is: $\frac{2.375 + .625}{2} = 1.5"$
6. DEPTH OF CUT: .062 Inches
7. FEED PER REVOLUTION: .010 Inches
8. REQUIRED CUTTING SPEED (SFPM): 450
   SFPM depends on the above items 3, 4, 6 & 7.

SAMPLE STUDY - Continued...

9. SPINDLE RPM: 1150

   The spindle RPM can be calculated as follows:

$$\text{RPM} = \frac{\text{Cutting Speed}}{\text{Circumference of Part (feet)}}$$

10. LENGTH OF CUT: 6.5 Inches

    This is an approximate calculation but close enough for general use.

11. CUTTING TIME: .57 Minutes

    The cutting time can be calculated as follows:

$$\text{Cutting Time} = \frac{\text{Length of Cut}}{\text{RPM x Feed}}$$

REMEMBER: THIS IS <u>NOT</u> FLOOR-TO-FLOOR TIME!

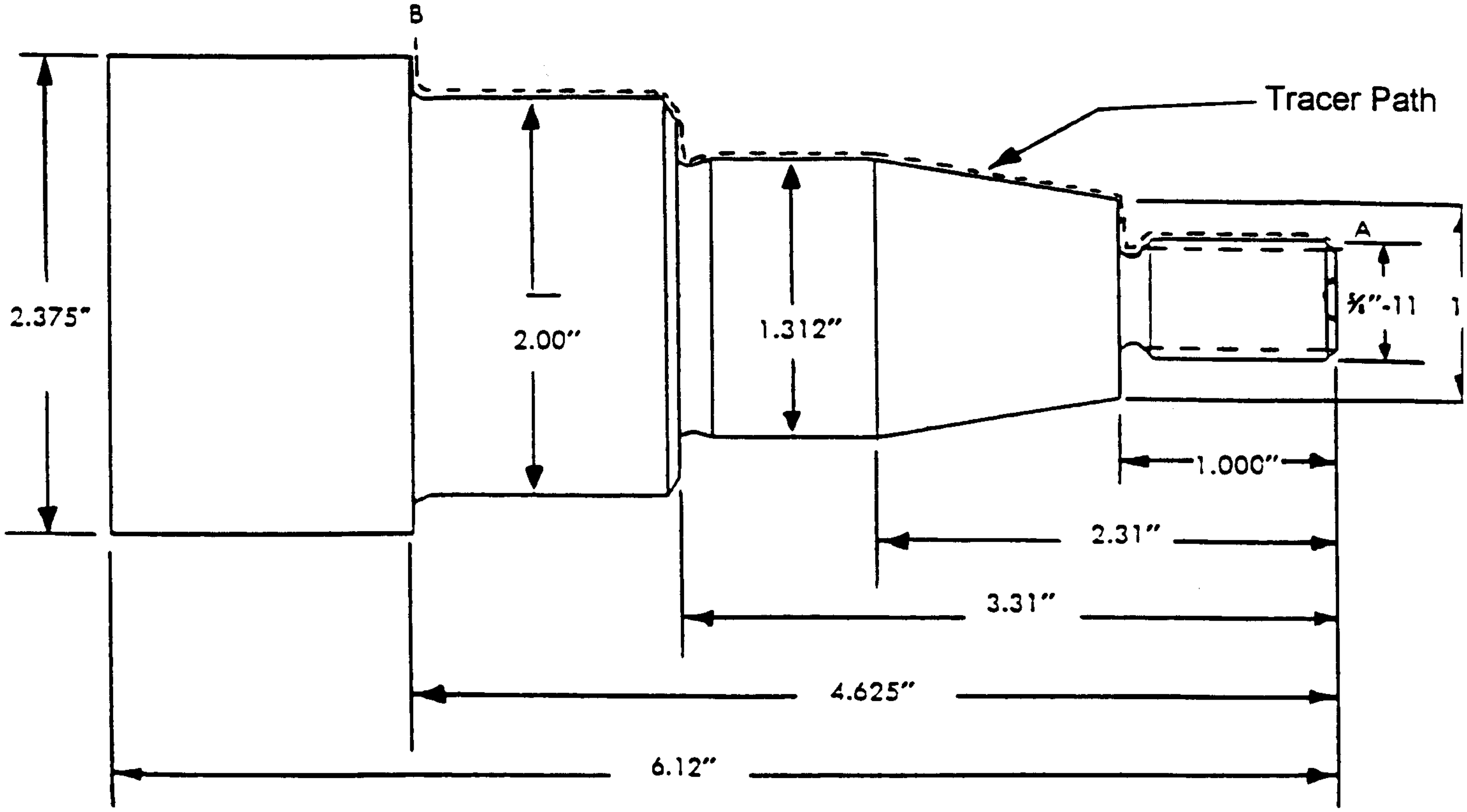
To calculate floor-to floor time add all other elements to the machining time.

<u>NOTE</u>: We have avoided calculating the undercut on this part since it would add very little to the total length and would be a rather involved procedure.

However, on part contours where undercuts, etc. are of major size, the exact length must be determined.

Surface finish is mainly a function of feed and nose radius on the cutting tool and their proper values should be suggested by the customer since he is more familiar with the job and his machine.

SAMPLE STUDY # 1



CUSTOMER: M.S. Company

PART NAME: Axle

PART #: Sample

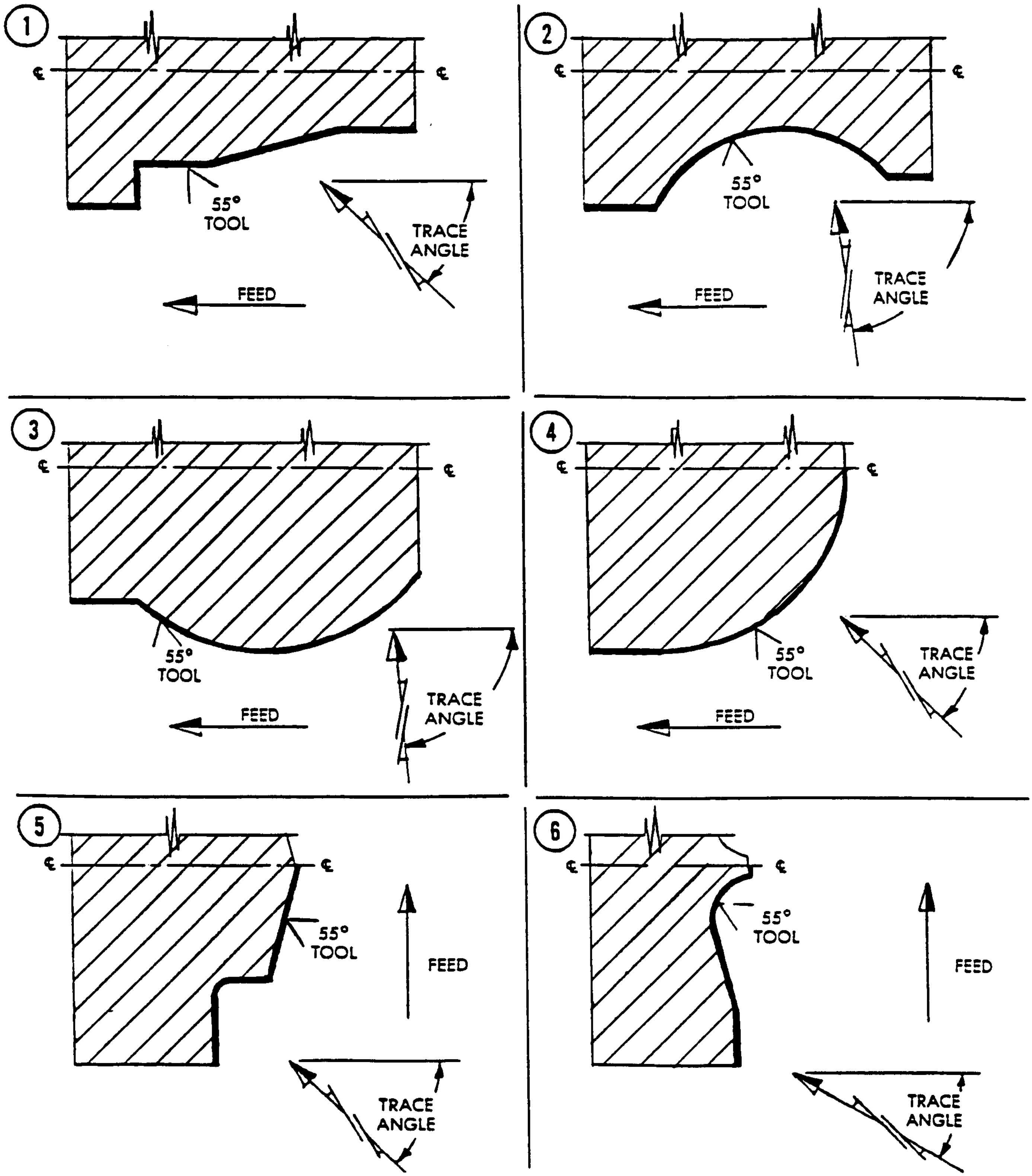
WORKPIECE MATERIAL: 1045 Forging

TYPE of TOOL: Carbide

WORKPIECE DIAMETER: 1.5"

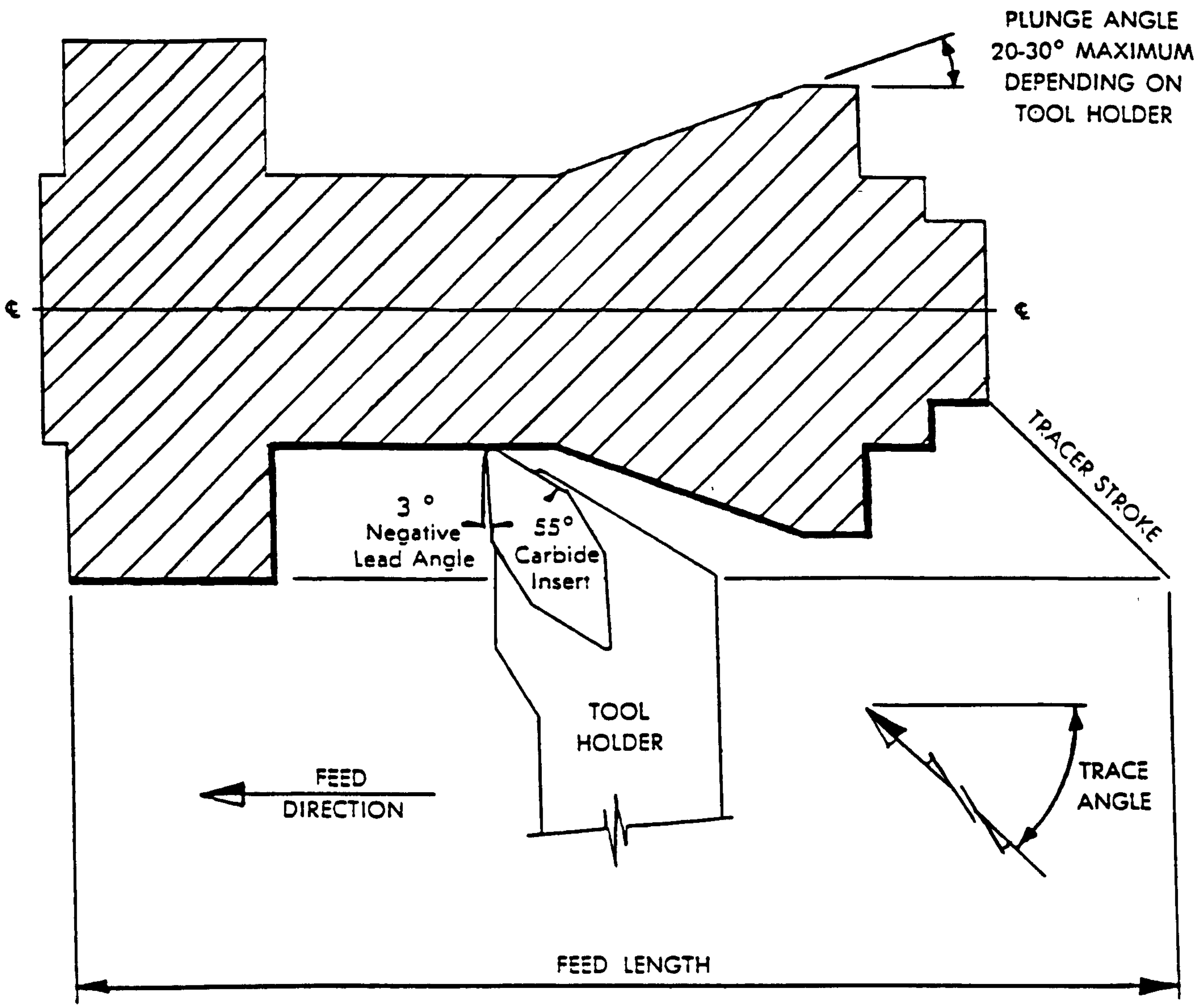
	ROUGH CUT	FINISH CUT
DEPTH OF CUT		.062"
FEED PER REVOLUTION		.010"
REQUIRED CUTTING SPEED		450
SPINDLE RPM		1150
LENGTH OF CUT		6.5"
CUTTING TIME		.57 Minutes

VIII. TRACING TIPS



GENERALLY, <u>THE TRACE ANGLE</u> SHOULD BISECT THE SMALLEST CONTAINED ANGLE IN THE TRACE PATH.

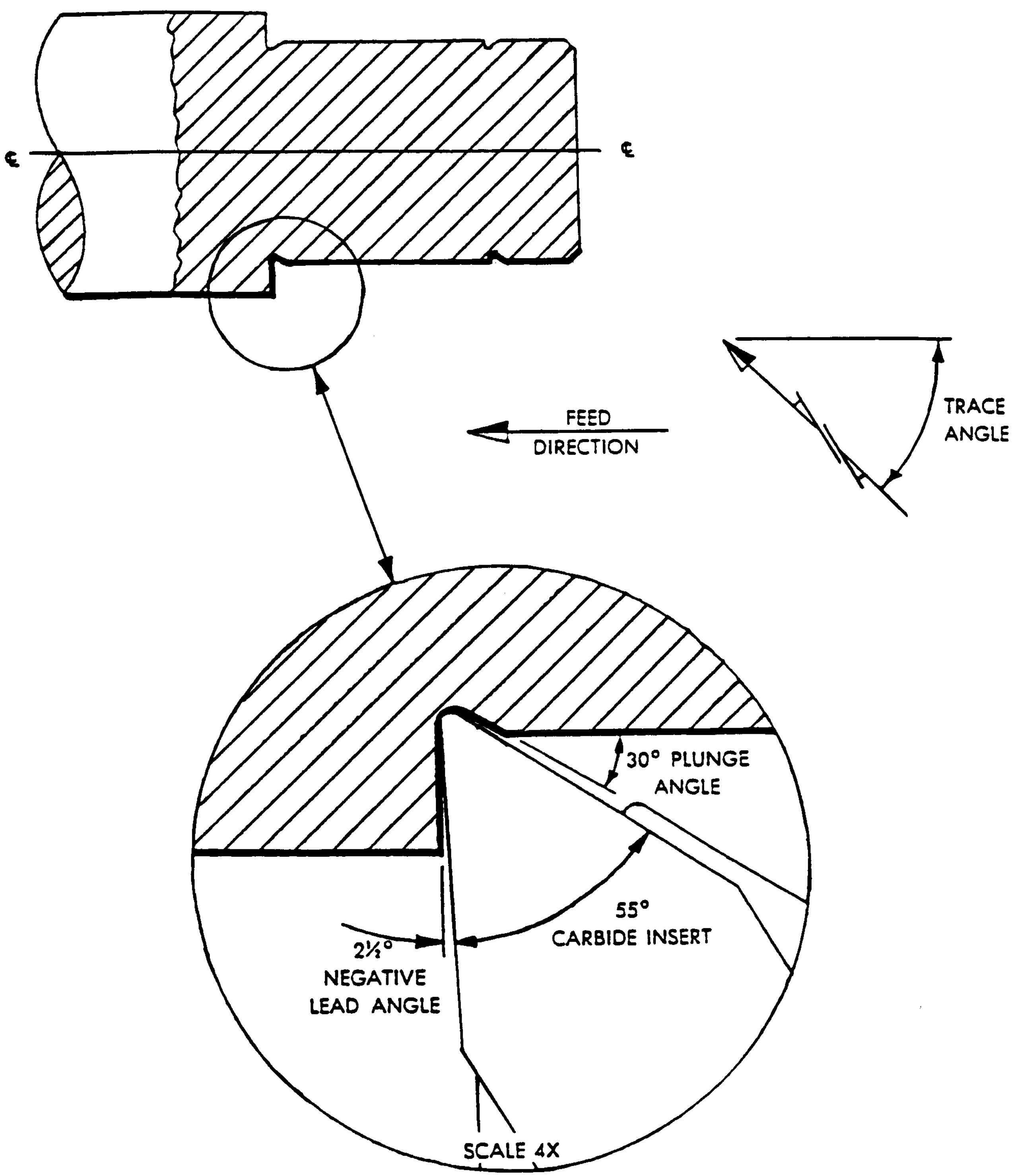
TRACING TIPS - Continued...



POINTS TO CONSIDER

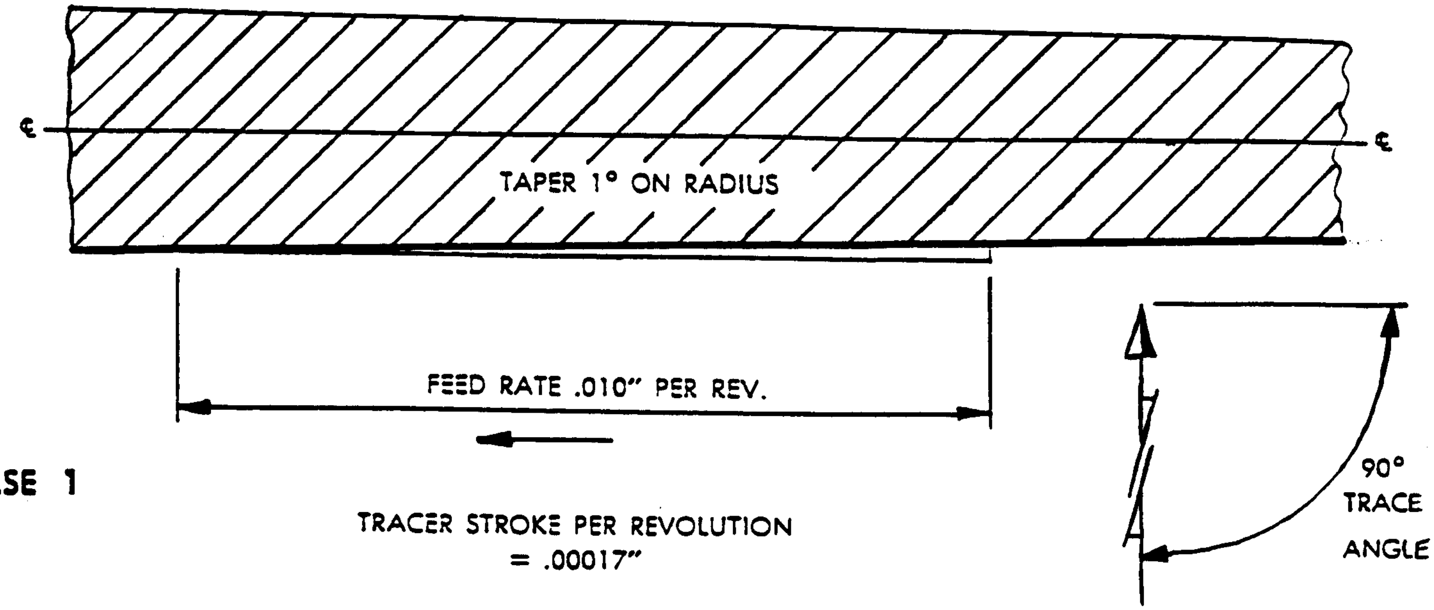
1. Trace angle must be greater than plunge angle.
2. Back edge of tool & toolholder must clear plunge angle.
3. Maximum depth of cut on backfacing is .020 inch with 3° negative lead angle and 1/2" long side cutting edge.
4. Tool nose radius should be less than smallest radius in trace path.

TRACING TIPS - Continued...

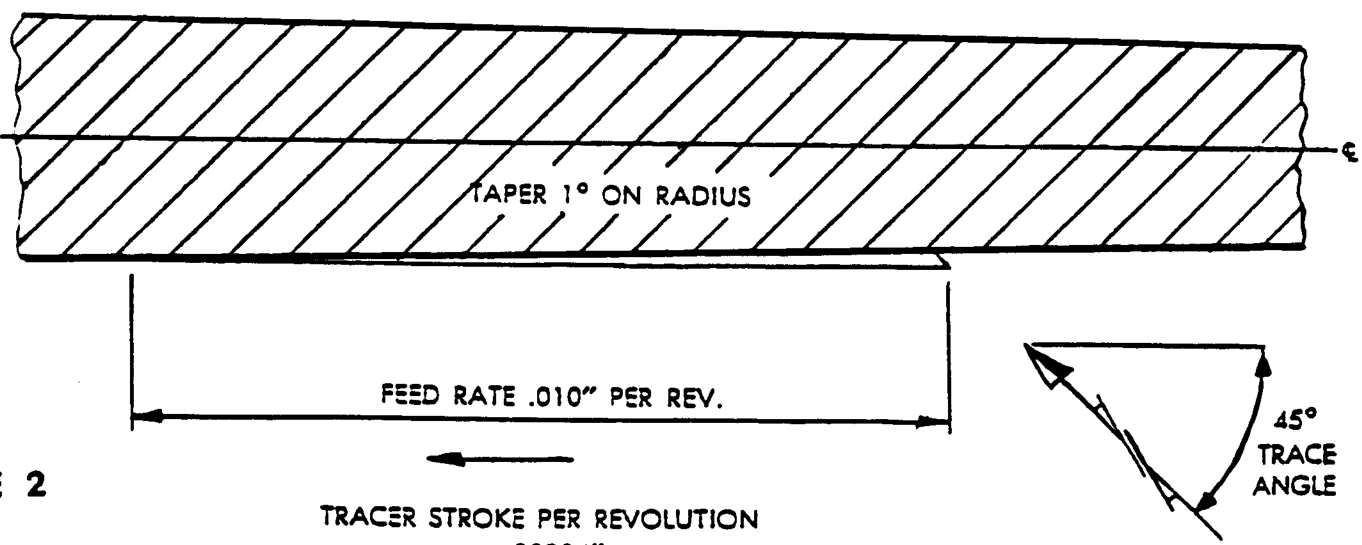


SUGGESTED METHOD FOR TRACING
UNDERCUTS IN SHAFTS

TRACING TIPS - Continued...



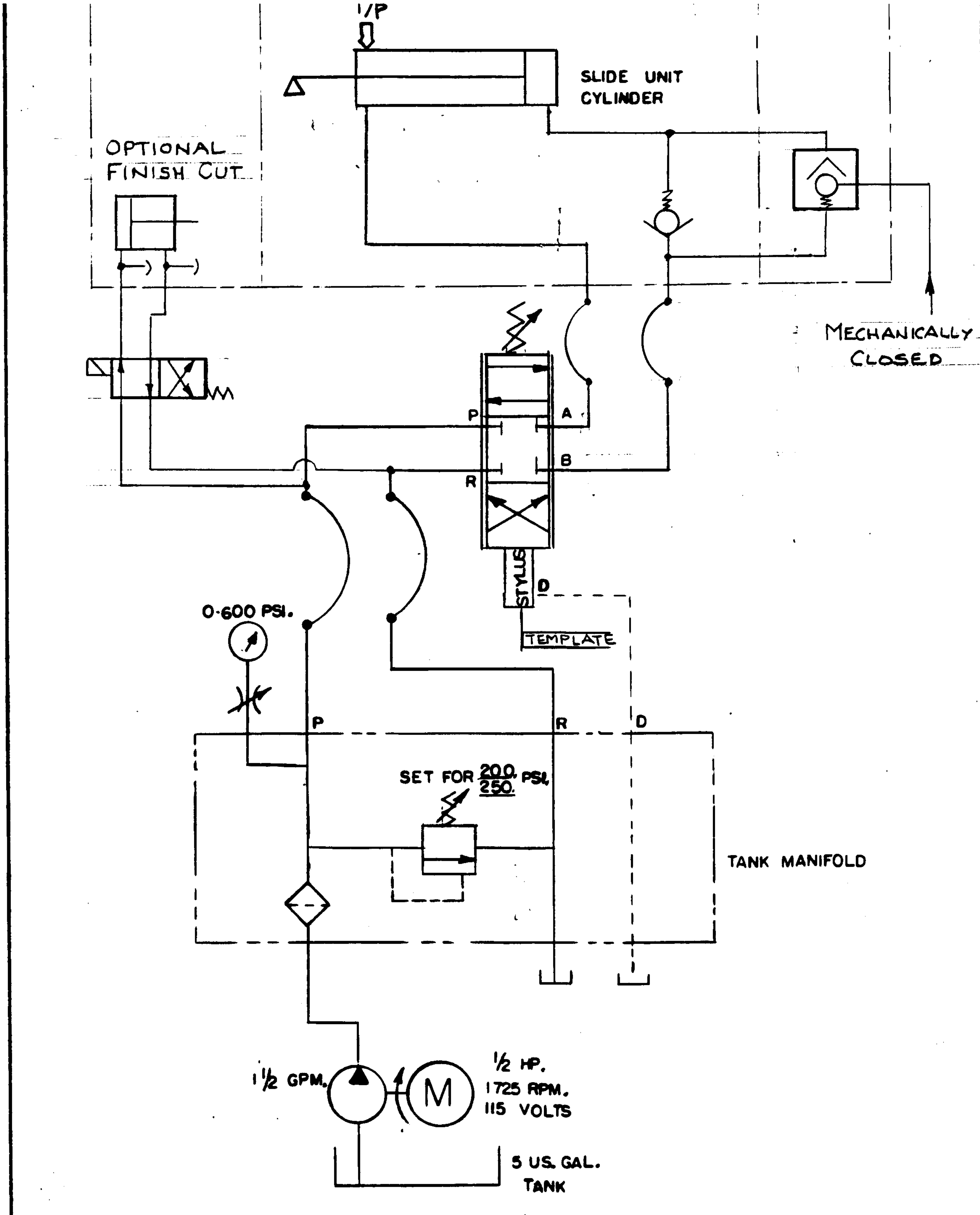
CASE 1



CASE 2

TRACE RATE INCREASED APPROX. 40%

METHOD OF INCREASING TRACE RATE BY ALTERING TRACE ANGLE IN ORDER TO MINIMIZE POSSIBILITY OF STICK-SLIP IN TRACER SLIDE



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