ROSEBROOK

MIMIK MODEL 7000
LATHE TRACER MANUAL

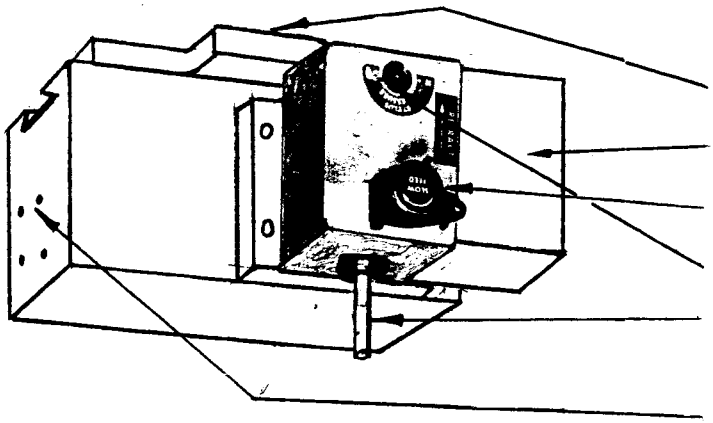
ROSEBROOK TRACERS INC.

3105 N Cascade # 106 Colorado Springs, CO 80907-5165 Phone/Fax (719) 632-8894
www.rosebrooktracer.com

MIMIK 7000 SERIES

CONTENTS

BASIC COMPONENTS OF 7000 TRACER



TRACER SLIDE

Tracer slide base.

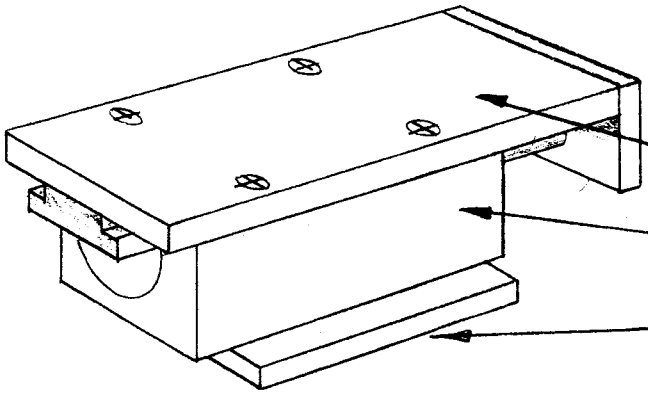
Manifold.

Infeed rate knob and retract lever.

Stylus pressure adjusting screw.

Replaceable stylus - can be shaped and positioned to suit contour.

Toolholder mounting face.



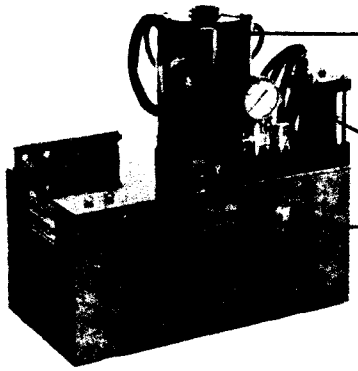
LONGITUDINAL SLIDE

Mounting to machine.

4.5" stroke slide.

Mounting surface for 7000 tracer.

EFFICIENT HYDRAULIC POWER UNIT



Totally enclosed motor and submerged pump designed for continuous operation.

micron filter gives maximum protection. Easily accessible for servicing.

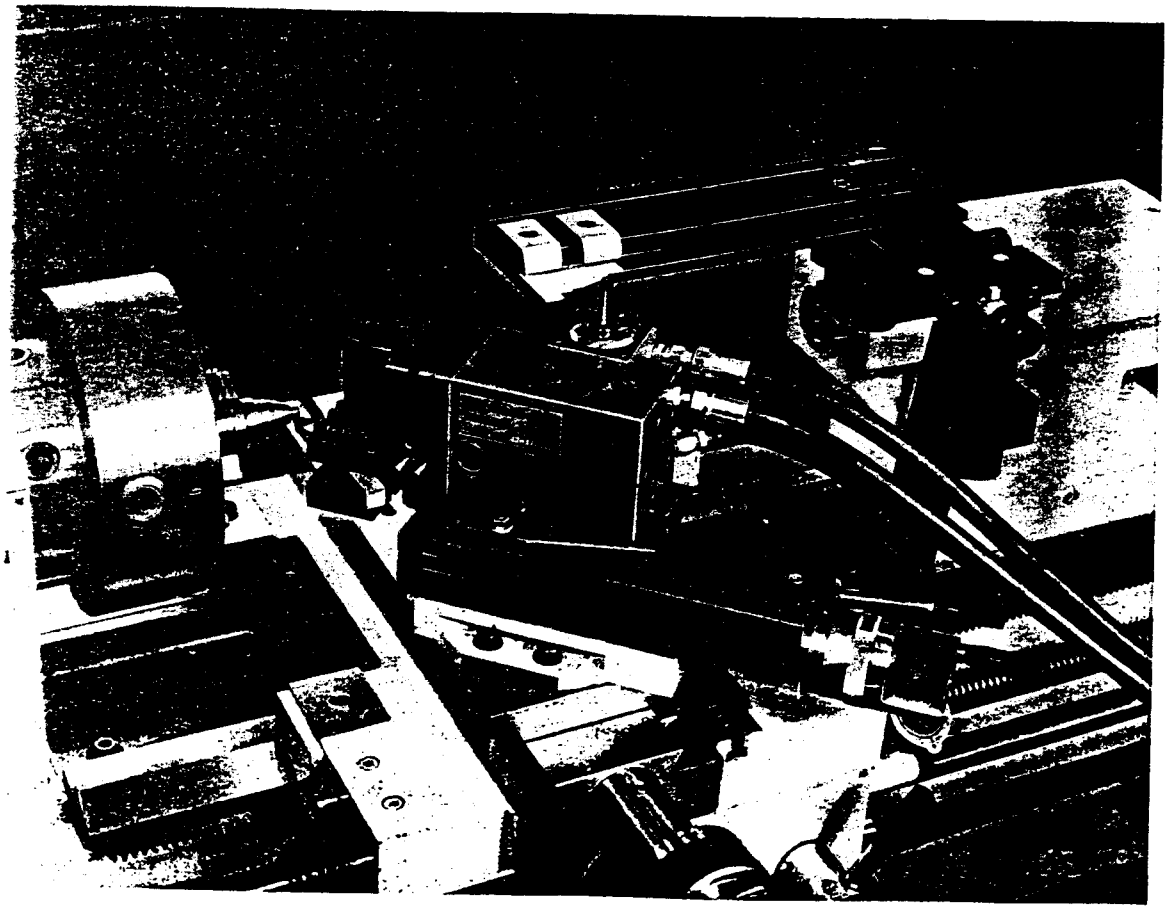
Convenient manifold with pressure gauge and built-in relief valve.

INTRODUCTION

To understand the operation of this tracer, you might compare it to a simple template follower in which a cutting tool and stylus are mounted on a spring-loaded slide. As it is fed along the lathe bed, the spring forces the slide forward until the stylus contacts the template. Within the limits of its stroke, the slide will move further forward when the stylus meets a downward slope on the template, and will retract when it meets an upward slope. The tool thus follows the same path as the contour of the template.

In a hydraulic tracer, the spring is replaced by a servovalve and cylinder which operate in much the same way as a car's power steering, a very light input signal producing an extremely large output force.

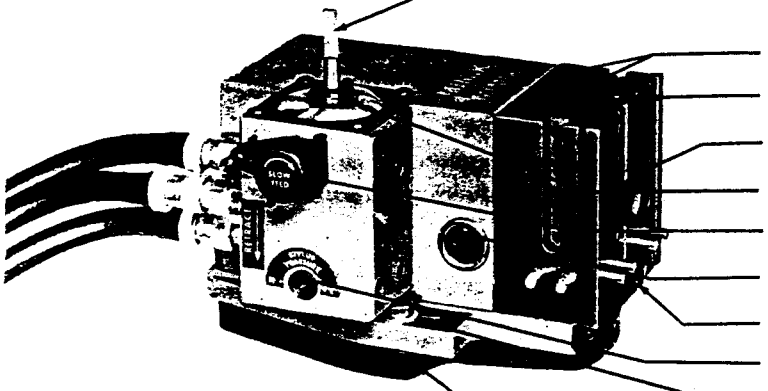
Further refinements such as universal stylus action, automatic way lubrication, and precise manufacture of all components make the 7000 tracer a precision tool which will produce both simple and complex contours with unequalled accuracy.



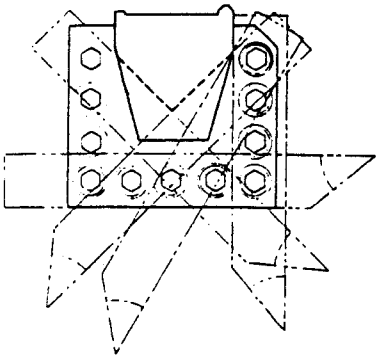
TYPICAL 7000 INSTALLATION ON LATHE COMPOUND

BASIC COMPONENTS OF 7000 TRACER

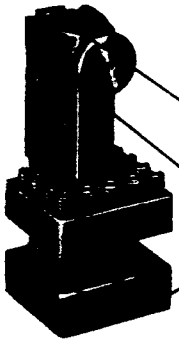
TRACER SLIDE



- Replaceable stylus—can be shaped and positioned to suit contour.
- Way-lubricant filler holes.
- Four toolholder mounting slots.
- Piston rod anchor access hole.
- Protective valve cover.
- Infeed rate knob and retract lever.
- Way-lubricant sight glass.
- Front gib adjusting screw.
- Stylus pressure adjusting screw.
- Mounting stud.
- Mounting plate.



TOOLHOLDER

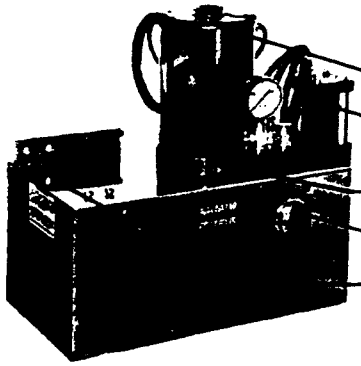


- Vertical adjustment screw access hole.
- Alternate location for locking knob.
- Lower ledge support holes.

TEMPLATE BRACKET

- Template rail with sliding clamps
- X-Y adjustment slides.
- Swivelling support arm.
- Adjustable support tube.
- Clamping block.
- Mounting bar.

HYDRAULIC POWER UNIT



- Totally enclosed motor and submerged pump.
- 5 micron pressure line filter.
- Pressure relief valve adjusting screw.
- Oil level sight glass.
- Tracer slide and template bracket storage.

INSTALLATION INSTRUCTIONS

The 7000 Tracer is normally mounted on the lathe compound in place of the toolpost, although it may be mounted on the cross-slide in special cases, as discussed on page 8.

Initial installation usually involves making a special tee-nut to suit the slot in the compound. This should be done before connecting or operating the tracer. Subsequent removal and installation of the tracer takes only a few minutes, all hoses being left permanently connected. Both the tracer slide and the template bracket can be stored on the supply tank when not in use.

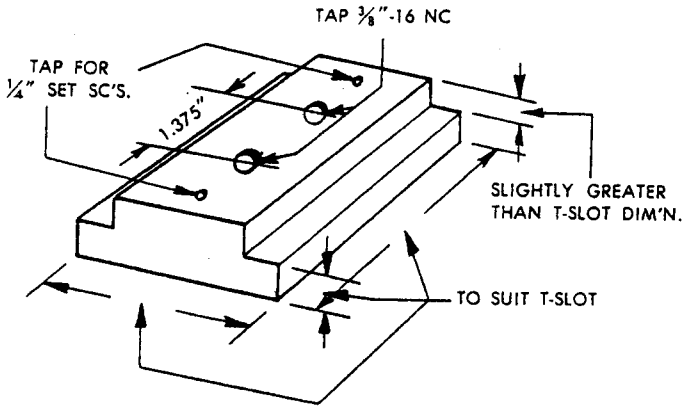
Unlike normal machine slides, the tracer slide must reposition constantly while cutting, and smooth uniform movement is essential. Certain precautions are needed to avoid distortion which can affect this movement. They are outlined in the instructions given below.

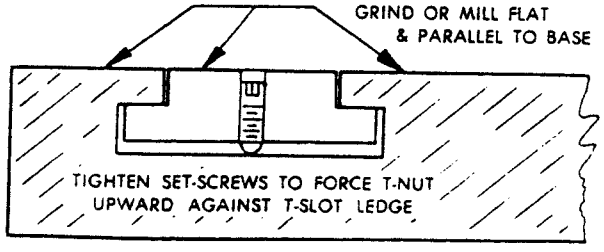
A. NORMAL INSTALLATION ON COMPOUND

1. MAKE A SUITABLE TEE-NUT

If your compound has a tee-slot for toolpost mounting, a special tee-nut should be made for use with the tracer. Tee-nuts are normally recessed below the surface of the compound, and the resulting break in the mounting surface can cause distortion in the tracer slide which may affect its performance.

To avoid this problem, the tee-nut should be perfectly flush with the top of the compound. Details of the recommended tee-nut design and manufacture are illustrated at right.

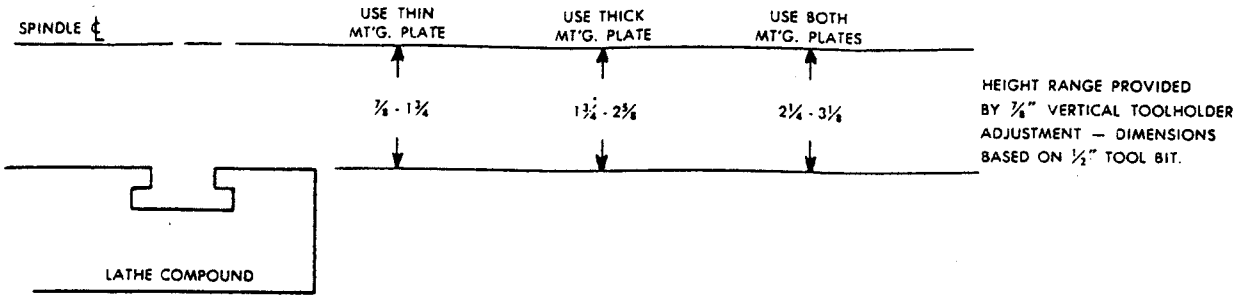




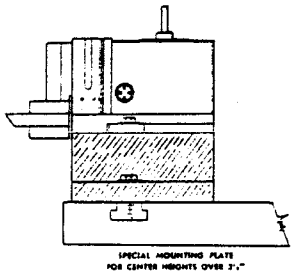
If your compound does not have a tee-slot, it should be drilled and tapped to suit the mounting plate holes. If this is impractical, the compound can be removed and the tracer mounted in its place (See page 8).

2. SELECT THE CORRECT MOUNTING PLATE

Two mounting plates of 1/2" and 1-3/8" thickness are supplied with the tracer to suit a wide range of center heights, as noted below.



For center heights greater than 3-1/8", a special mounting plate can be made to suit, or additional standard plates may be purchased from MIMIK. These plates are designed to stack on top of one another and are dowelled together, and to the tracer slide base, to prevent movement. When a thick and a thin plate are stacked, the thin plate must be at the bottom.



MIMIK mounting plates are carefully checked for flatness and parallelism of both surfaces, and equal care should be taken if you wish to provide your own.

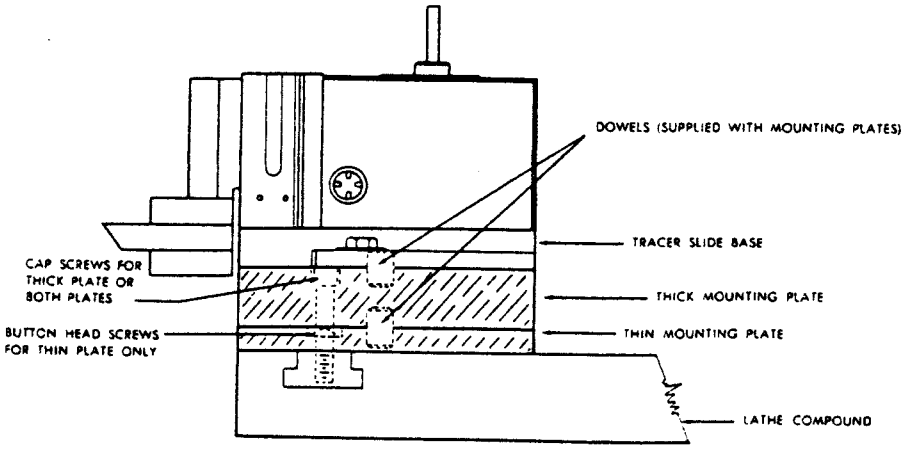
CAUTION: If the 7000 tracer is used on a large or heavy-duty lathe, cutting loads should be limited to those normally encountered on light-duty lathes.

3. INSTALL MOUNTING PLATE AND TRACER SLIDE

Before fastening the mounting plate in place, remove all dirt and burrs from the top surface of the compound and check its full bearing area for flatness. Grind or scrape if necessary to ensure flatness and parallelism. Tighten the lathe compound gib screws to eliminate play.

The thin mounting plate is fastened to the compound tee-nut with two button head screws. Mounting slots are provided to allow lengthwise positioning on the compound, and the plate should be mounted flush with the front edge of the compound to prevent interference from the toolholder.

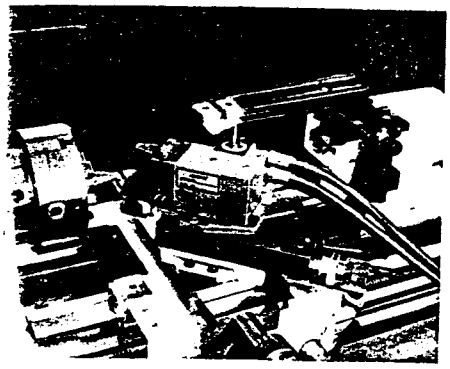
The thick mounting plate is fitted with plain holes to provide only one mounting location. Its thickness prevents toolholder interference, and it need not be flush with the front of the compound.

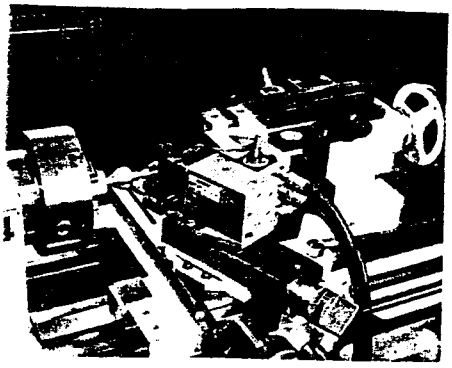


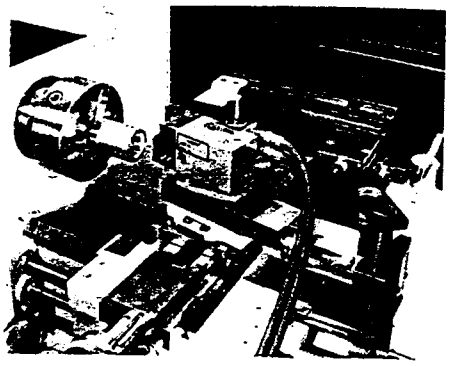
Tighten the mounting plate screws securely (but not excessively), and install the tracer slide assembly parallel to the compound, making sure the mounting plate dowel is in place.

4. INSTALL TEMPLATE BRACKET

Maximum versatility, including full use of tailstock accessories, is ensured by mounting the template bracket on the tailstock base. The photos below show its relation to the tracer slide and its range of adjustments to suit various conditions.

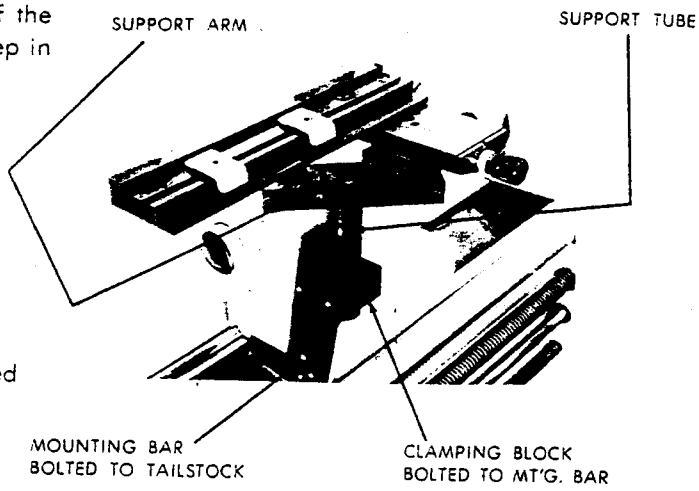






Drill two 3/8" clearance holes near the bottom of the mounting bar and tap 5/16" – 18 holes 3/4" deep in tailstock to suit. These holes must be positioned so the template bracket will clear the tailstock and the tailstock will still nest between the saddle wings.

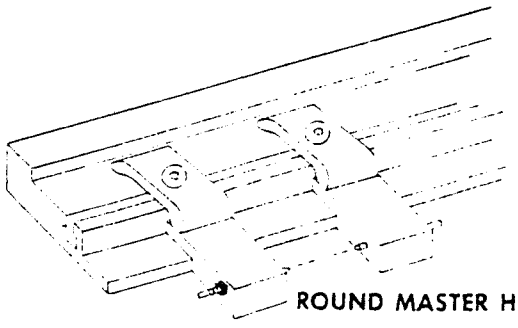
Drill two 17/64" clearance holes in mounting bar to suit tapped holes in clamping block. Locate clamping block and shim mounting bar if necessary so support tube is perfectly plumb. (If preferred, the clamping block may be fastened directly to the tailstock base, omitting the mounting bar).



Fit support tube into clamping block and install remaining components. Adjust height so edge of template will contact stylus near the bottom of its triangular section (See page 18.) Bottom face of template bracket support arm should clear top of tailstock to allow full range of positioning. Support tube should be cut off flush with top of support arm.

Where tailstock mounting is not possible, the template bracket may be adapted to other locations on the lathe, although MIMIK does not provide accessories for this purpose.

Round masters up to 2" diameter may be held between centers using the master holders supplied with the tracer. They can be clamped to the template rail ledge at any desired location.



ROUND MASTER HOLDERS

NOTE: In all tracing applications the template adjustment slides must be parallel to the lathe axes. Visual alignment is usually quite adequate, although a dial indicator may be needed for exact alignment on critical jobs.

5. CONNECT HYDRAULIC POWER UNIT

Fill tank to middle of sight glass with new, clean oil of recommended grade. (Sunoco Sunvis 747 or equivalent.) Approximately 5 U.S. gallons are required.

Provide a 110 v. 60 cycle outlet for the tank motor and anchor the supply cord to prevent accidental disconnection.

The three tank hoses are identified on the manifold by the letters P (pressure) R (return) and D (drain). (Use smaller hose for Drain, larger hoses for Pressure and Return.) Connect the hoses to the tracer valve fittings which are similarly labelled, and check fittings, hose connections, and pressure gauge for tightness. **CAUTION:** Fittings should be turned in finger tight only, and the Tru-seal locknuts then snugged up with a wrench.

Once connected, the hoses should not be removed unless extreme caution is taken to prevent entry of dirt. Fittings must be capped or plugged immediately if disconnected. (Make sure caps and plugs are clean before using).

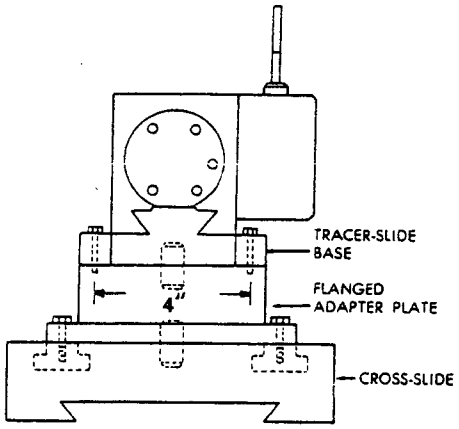
B. SPECIAL INSTALLATIONS ON CROSS-SLIDE

Special mounting arrangements are needed where (a) the compound does not provide a suitably large or clear mounting surface, (b) the lathe is not equipped with a compound, or (c) rear-mounting is preferred. In such cases the tracer may be mounted on the cross-slide.

A flanged adapter plate is needed to locate the tracer slide at the proper height and to allow it to be set at any desired angle. The upper mounting surface of the adapter should be at least 6" diameter if circular, or 4-3/4" x 6-3/8" if rectangular. Flange dimensions should suit the mounting provisions on the cross-slide. Flatness and parallelism of both surfaces must be maintained within close limits to avoid tracer slide distortion.

The tracer slide may be bolted directly to the adapter without using either of the mounting plates. One of the mounting plate dowels may be used to key the tracer slide to the adapter, and the adapter should also be dowelled to the cross-slide at its center of rotation. Under no circumstances should the tracer slide base be drilled or machined, as this could cause distortion.

If full swivelling of the tracer is not desired, the adapter plate can be bolted to the cross-slide at a fixed location. The tracer slide's mounting slots allow 30° swivelling relative to the adapter.



NOTE: UNLESS MOUNTED ON CIRCULAR TEE-SLOT, EITHER ADAPTER FLANGE OR CROSS-SLIDE SHOULD HAVE MOUNTING HOLES SPACED 30° TO ALLOW FULL SWIVELLING.

On small lathes the compound sometimes swivels on a tapered spigot. For cross-slide mounting the same type of spigot can be fitted to the tracer's mounting plate, or to a special adapter plate, if used instead.

REAR MOUNTING

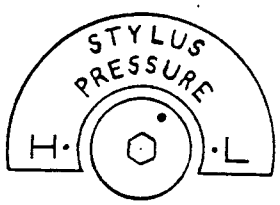
If the tracer is mounted on the rear of the cross-slide, it may be necessary to mount the template bracket on the rear of the lathe bed rather than on the tailstock. Rear mounting allows full normal use of the compound, although it is not usually as convenient for the operator when tracing.

CAUTION: The 7000 tracer is not designed for upward cutting loads, and when rear-mounted, the spindle must be reversed to apply the cutting load downward.

OPERATING PROCEDURE

Before and during operation, the sight glasses on the sides of the tracer slide should be checked to ensure an adequate supply of way lubricant. Refill with SUNOCO WAYLUBE 90 or equivalent.

The stylus pressure adjustment on the tracer valve should be set about halfway between mid-point and L. (A heavy setting reduces sensitivity and affects surface finishes, while too light a setting may cause valve hang-up).



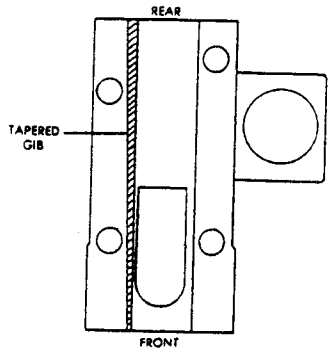
When first starting hydraulic power unit, do not adjust pressure setting until pump has run for at least one minute. Correct operating pressure is 175 psi.

Allow oil to warm up before tracing, and cycle tracer slide full stroke 10 times to distribute way lubricant and remove trapped air.

The tracer slide gib setting should be adjusted on the initial installation to ensure optimum tracer performance. Re-adjustments should be made periodically to compensate for wear in the slide ways. When properly set, slide movement in both directions should be uniform over the full stroke at a pressure setting of 50 psi.

GIB SETTING PROCEDURE

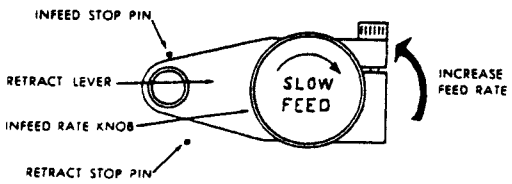
This adjustment is extremely critical and several attempts may be needed to reach the proper setting. Adjustment screws are located at the left dovetail at front and rear of the tracer slide. The front screw is always exposed, but the rear way wiper must be removed to reach the rear screw.



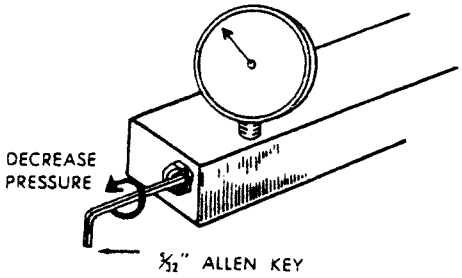
BOTTOM VIEW OF TRACER SLIDE

1. Loosen tracer mounting stud nuts slightly to remove stresses which may result from uneven mounting surface.

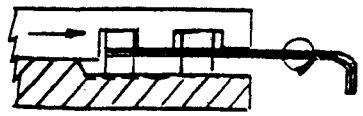
2. Turn infeed rate knob on tracer valve counter-clockwise to maximum infeed, holding lever against infeed stop pin.



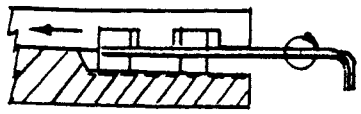
3. Set hydraulic pressure at 50 psi.



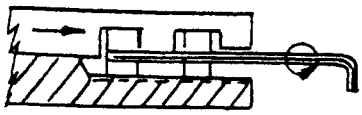
4. (a) **UNLOCK GIB** - Loosen outer screw 1/4 turn, then pass key through to inner screw and rotate both screws c/clockwise to move gib toward rear of tracer slide.



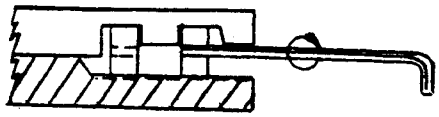
(b) **SET GIB** - Allow tracer slide to feed forward from fully retracted position. Turn screws gently clockwise until slide movement stops.



Turn screws gently c/clockwise until slide just creeps forward.



With slide still feeding forward, lock gib by turning outer screw clockwise till snug. **DO NOT OVERTIGHTEN.**



5. **RE-CHECK** — Feed tracer slide full stroke in both directions and check for uniform movement. Re-adjust gib if necessary. Tighten mounting stud nuts and check again for uniform movement. If tightening affects smoothness of movement, compound and mounting plate surfaces should be re-checked for flatness and freedom from dirt.

6. **RE-SET TRACER FOR NORMAL OPERATION** — Increase pressure to 175 psi. Reduce infeed rate to 15 - 20 in./min., which is adequate for most tracing requirements. A faster rate increases stylus deflection and can cause vibration.

INFEED RATE ADJUSTMENT

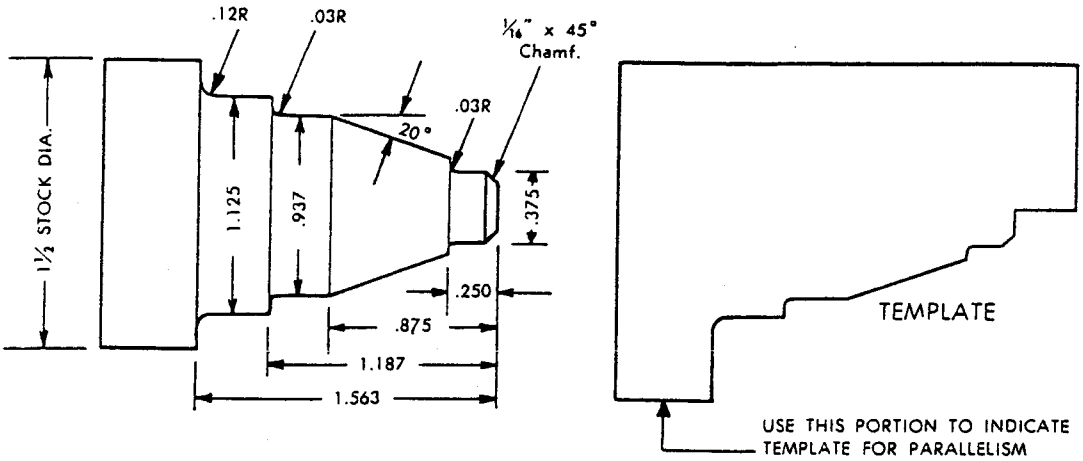
Both the infeed rate knob and the retract lever are pinned to their respective mating parts at the factory to prevent them from slipping out of adjustment. Provision is made for normal wear in the mechanism, and re-adjustment should not be necessary.

The infeed rate knob is factory set to provide a total range of 3-1/2 turns. Maximum infeed rate is provided at the full counter-clockwise position. Approximately two turns clockwise from this position will reduce the infeed rate to zero, and further clockwise rotation will cause the tracer to retract rather than infeed. This portion of the adjustment range (approx. 1-1/2 turns) provides a wear allowance which will gradually decrease with use. The knob should not be set in this position, as the tracer is then inoperative.

SET-UP and OPERATION

SAMPLE PART

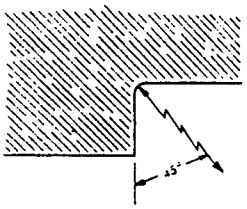
To quickly familiarize you with your tracer, we suggest you follow these detailed steps, using the template, high speed tool, and mild steel workpiece blank provided. Procedures will vary for other job applications, but the fundamentals learned on the sample job will generally apply.



In the method outlined below, initial roughing cuts are taken with the tracer slide fully advanced to the end of its stroke. On the first cut, the stylus only contacts the highest point of the template. Successive depths of cut are taken by advancing the cross-slide, and the stylus contacts more of the template with each cut.

When the lowest point of the template is reached, further advancement of the cross-slide will retract the tracer slide, and will not affect part dimensions. Final size setting for the finish cut is taken with the template adjustment slide.

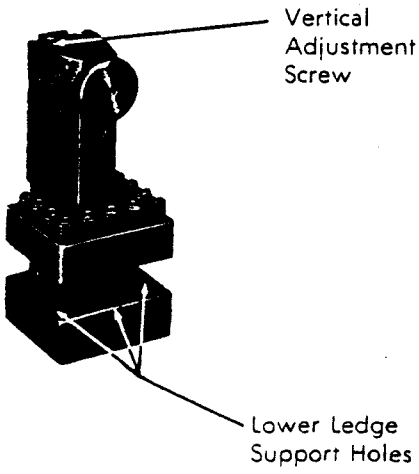
1. The sample workpiece contour ranges between straight diameters and 90° shoulders, so the best tracer slide angle is 45°. This angle should be set with the lathe compound, but if it causes interference, the compound can be set within ± 15° and the tracer slide swivelled the remaining amount on its mounting plate.



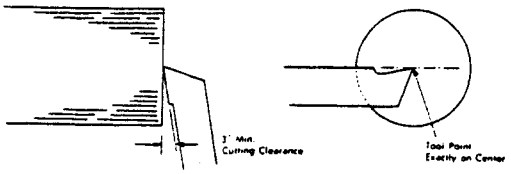
2. With the knurled locking knob in the best location for uniform clamping, install toolholder in left hand slot on front face of tracer slide. Before clamping the tool in place, extend at least two of the set screws into the tapped holes in the lower ledge of the toolholder. This will prevent flexing and ensure maximum rigidity.

   Chuck workpiece blank and clamp tool in left side of holder at suitable angle to provide at least 3° cutting clearance.

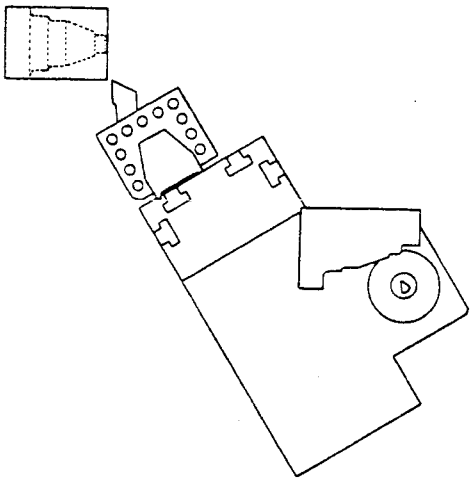
   Rotate stylus in valve collet to same angle as tool and tighten locking screw.



Loosen locking knob and adjust toolholder vertically to set tool point on center. This setting must be exact for maximum tracing accuracy, and can be checked by facing the work blank to center. If the tool point is above or below center, the blank will not be faced completely.



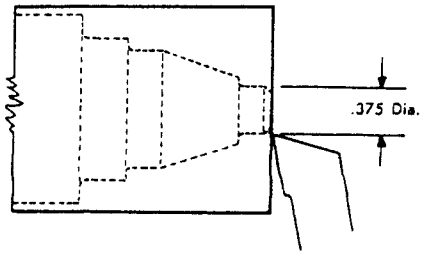
3. Retract cross-slide to provide clearance between tool and work, and feed tracer slide fully forward to the end of its stroke.



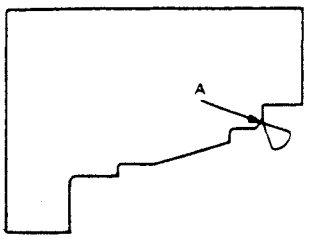
4. Adjust carriage and cross-slide to position tool point near workpiece blank. Leave in this position. Now clamp the template near the left end of the rail and adjust template brackets so template bears approximately the same relation to the stylus (within about 1/4") as workpiece does to tool. (Exact settings will be made later).

5. Check and adjust template for parallelism as follows:
   (a) Move cross-slide back to clear stylus from template.
   (b) Mount dial indicator on any convenient surface fixed to carriage (e.g. top of tracer slide) and set pointer against 1/2" straight section of template (See sketch on page 11).
   (c) Feed carriage and check indicator for parallelism.
   (d) Loosen template rail mounting screws and pivot rail as required. Recheck with indicator after tightening screws.

NOTE: An alternative method, when more familiar with the equipment, is to take a light cut on the workpiece with the stylus on the straight section of the template, and "mike" the cut for parallelism.

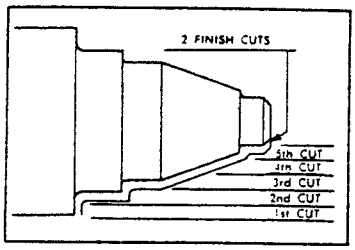


6. Using carriage and cross-slide only, position tool at .375" diameter against end of workpiece blank. Now adjust template slides so point "A" on template bears against edge of stylus. The resulting 1/16" difference between stylus and tool positions will prevent tracing to finish size and allow dimensions to be verified before taking the finish cut.



7. Select suitable lathe speeds and feeds before taking first cut. With high-speed tool cutting mild steel, use .010 - .012 in./rev. feed at about 300 rpm for .100" roughing cuts. Finish cut of .020" to .030" should be taken at .005 - .008 in./rev. feed and about 500 rpm.

8. Leave tracer slide fully forward and position tool with cross-slide to take first roughing cut (approx. .100" deep). Stylus will only contact template on largest diameter, if at all.



Continue taking roughing cuts with cross-slide in .100" increments. Stylus will progressively contact smaller-diameter portions of template with each cut. Stop carriage feed on each cut as soon as tool reaches previous cut.

9. Before full length of taper has been traced, measure one of the large diameters, which should now be about 1/8" above finish size. Adjust template slide if necessary to provide this 1/8" finishing allowance on diameter.

10. Continue roughing cuts until stylus contacts full template contour. Further cross-slide movement now has no effect on workpiece size, since stylus against template causes tracer slide to retract as cross-slide is moved forward. However, cross-slide should be advanced an additional 1/8" (approx.) to prevent bottoming of tracer slide in forward position. **CAUTION:** If advanced too far, remaining tracer retract stroke might not be adequate for largest diameter.

11. Measure one diameter to determine finish cut requirement. Diameter will be about .125" too large, so adjust template slide to remove about half this amount by turning adjustment knob .030" clockwise. Also adjust slides lengthwise to take about .015" finish cuts on shoulders and end face. Change spindle speed and feed and take semi-finish cut to provide a smooth finish for accurate measurement. Measure one diameter and adjust template slide for final cut. Make sure cross-slide setting prevents bottoming of tracer slide.

NOTE: As this template was not made precisely, part dimensions may differ slightly from those noted on page 11.

12. The above steps cover the normal set-up and first piece procedure on a production run. For each subsequent part, the template is turned back about .020" to provide a finish cut allowance, and the cross-slide is retracted to the first rough-cut position. The only critical setting is that made on the template slide for the finish diameter on each part. To eliminate errors due to incorrect settings or tool wear, a pre-set tool can be used for the finish cut in place of the roughing tool. (With proper care the toolholder will reposition within .0001").

TROUBLE SHOOTING CHART

TROUBLE	CAUSE	REMEDY
1. VIBRATION Occurring when stylus feeds into template or meets profile change.	(a) Infeed rate too high.	Reduce by adjusting infeed rate knob.
	(b) Air in hydraulic system.	Cycle slide full stroke. Check for leakage at valve and tank fittings. Check for adequate oil level in tank. Bleed oil filter on tank.
	(c) Hydraulic pressure too high.	Reduce to 175 psi or less. Check for faulty pressure gauge.
	(d) Stylus pressure too high or too low.	Adjust (see Page 9).
	(e) Mechanical looseness.	Check mounting bolts, lathe compound and cross-slide, toolholder and template bracket for tightness. Tighten tracer slide gib if necessary.
	(f) Lathe Vibration.	Eliminate.
2. MARKS ON WORKPIECE	(a) Vibration in tracer system.	See 1.
	(b) Template edge not smooth.	File or Polish.
	(c) Incorrect tool grind.	Check for adequate clearance and correct rake and relief angles.
	(d) Mechanical looseness.	See 1 (e).
	(e) Looseness or vibration in lathe.	Check for spindle runout. Check for loose carriage or cross-slide with dial indicator. Take straight cut with tracer inoperative and check for similar marks.
	(f) Air in hydraulic system.	See 1 (b).
	(g) Sticky tracer valve.	See 5 (f).
	(h) Excessive stylus pressure.	Reduce.
	(i) Uneven tracer slide movement.	Reduce pressure to 50 psi and check for uniform slide movement. Adjust gib if necessary. Check for binding due to dirt or distortion and for adequate lubrication. If tracing fine taper increase slide angle to provide faster tracer slide movement.
	(j) Loose piston rod connection.	Tighten nut (See Page 20).
3. EXCESSIVE VARIATION BETWEEN TEMPLATE AND WORKPIECE	(a) Tool not on center.	Cutting point should be exactly on center.
	(b) Template not aligned with lathe axis.	Check with dial indicator and adjust.
	(c) Variation in cutting load over length of part.	Provide uniform allowance for finish cut over full contour.
	(d) Incorrect tracer slide angle.	Reset to ensure full contour coverage.
	(e) Incorrect tool grind.	See 2 (c).
	(f) Incorrect tool-stylus relationship.	Tool cutting point and stylus contact edge must have same profile and be properly aligned. Slight compensation may be needed to size of stylus radius. (See Page 18).
	(g) Excessive stylus deflection. (Can cause bumps at sharp corners).	Reduce infeed rate to 15-20 ipm. Set stylus pressure near mid-point.

TROUBLE	CAUSE	REMEDY
	(h) Mechanical looseness.	See 1 (e) and 2 (e).
	(i) Sticky tracer valve.	See 5 (f).
	(j) Uneven tracer slide movement.	See 2 (i).
	(k) Excessive machine feed (or insufficient tracer infeed).	Reduce machine feed, increase tracer infeed or change slide angle so stylus will follow contour without floating off template or over-deflecting. (See 3 (g).
4. VARIATION FROM PART-TO-PART.	(a) Variation in cutting load from part-to-part.	See 3 (c).
	(b) Excessive tool wear.	Change or grind tool more frequently. Use separate tool for finish cuts.
	(c) Inaccurate operator settings.	Use pre-set tools, overlay templates, etc., to eliminate operator settings wherever possible.
	(d) Mechanical looseness.	See 1 (e) and 2 (e).
	(h) Sticky tracer valve.	See 5 (f).
	(i) Uneven tracer slide movement.	See 2 (i).
	(j) Excessive variation in oil temperature.	Let oil warm up before tracing. Cycle slide frequently. Install oil cooler if ambient temperature is excessive. (Contact MIMIK for details).
	(k) Air in hydraulic system.	See 1 (b).
5. SLIDE WILL NOT FEED FORWARD WITH VALVE SET TO INFEED and STYLUS OFF TEMPLATE—OR SLIDE CONTINUES TO RETRACT WHEN STYLUS MEETS A REDUCED SLOPE.	(a) Infeed rate knob in retract range.	Turn fully clockwise, then turn clockwise to desired infeed rate (See page 10).
	(b) Slide at end of stroke.	Advance cross-slide to regain stroke.
	(c) Pressure and return lines crossed.	Connect tank hoses correctly.
	(d) No oil flow from pump.	Check for loose motor-pump coupling, burnt out motor, broken lines inside tank, faulty relief valve, plugged filter.
	(e) Slide hang-up.	See 2 (i).
	(f) Valve hang-up.	See below.

CAUSES OF VALVE HANG-UP	CORRECTIVE ACTION
1. Insufficient stylus pressure.	Increase stylus pressure slightly and actuate stylus by hand. If tracer does not begin to infeed immediately, hang-up may be due to dirt. Further increase in stylus pressure could then damage the valve.
2. Distortion from over tight fittings.	Back off Tru-Seals, make sure fittings are just finger-tight, and snug up Tru-Seals gently.
3. Hydraulic lock in valve. (Can cause distinct sluggishness in valve action).	Cycle tracer full stroke several times by actuating stylus.
4. Dirt or gummy oil deposits in valve.	Flush complete system and replace hydraulic oil and filter (See page 19).
5. Wrong hydraulic oil.	Replace with recommended type.
	If valve continues to hang up, contact Mimik for assistance.

GENERAL INFORMATION

TEMPLATE DETAILS

The choice of template material and method of production depends on such things as accuracy required, number of parts to be traced, future repeat runs, size of part, equipment available, etc. Regardless of material or method, all templates should have these common features:

(a) Contour must be an exact duplicate of the desired finished shape within less than half the drawing tolerances on diameters.

(b) Both ends should have a run-off to guide the tool on and off the work.

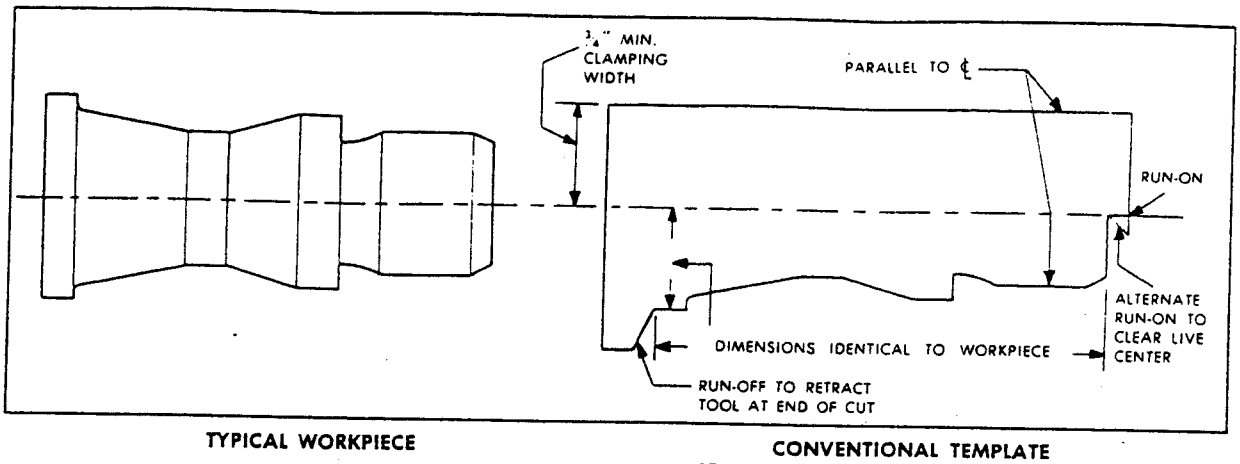
(c) Both the rear edge and a portion of the profiled edge should be parallel or normal to the work-piece center line. These act as a dimensional reference, and provide a means of checking parallelism.

(d) The rear portion of the template should be wide enough to allow rigid clamping.

For small, low-volume parts, steel, brass, or aluminum sheet, plexiglas, masonite, or .003" steel shim-stock sandwiched between two pieces of stiffening material are often suitable. For large parts, high volume runs, or where tolerances are close, 1/8" steel gage stock is preferred. For simple parts templates can often be made by clamping thin sections of flat metal strips to provide shoulders, diameters, tapers, or radii.

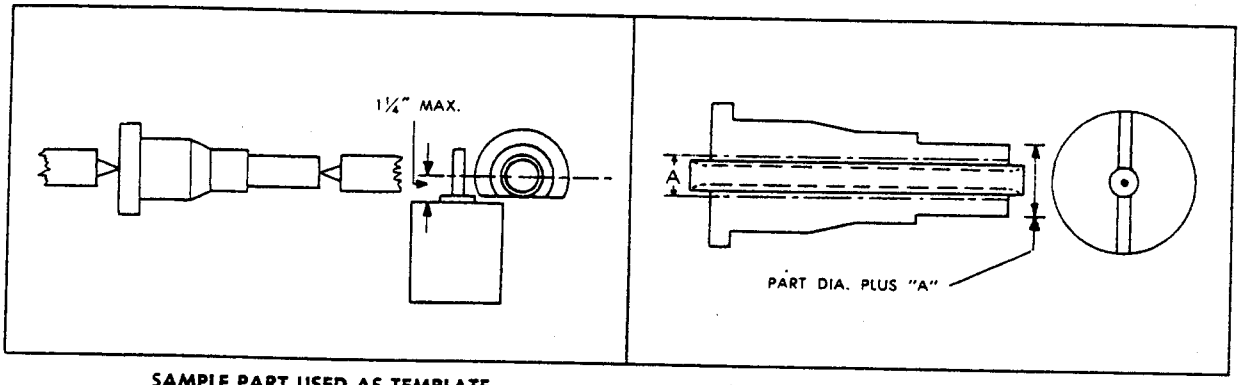
Sawing and filing to layout lines is often acceptable, although milling, grinding or polishing may be needed in some cases. The contoured edge should be square to the surface, and must be free of nicks and burrs. Remember that an error in template dimensions can be doubled when tracing a diameter !

Small turned parts can also be used as tracing masters. If made expressly for this purpose, a run-off should be provided at both ends. Mounting brackets for round masters are described on page 6.



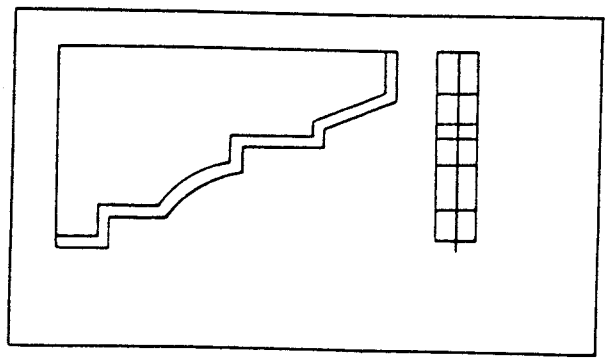
TYPICAL WORKPIECE

CONVENTIONAL TEMPLATE PRODUCED BY SAWING, FILING, MILLING, GRINDING and POLISHING

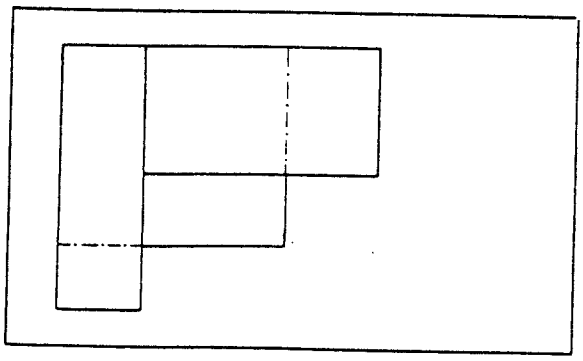


SAMPLE PART USED AS TEMPLATE
(Note radius restriction)

FLAT TEMPLATE TURNED ON MANDREL



SHIM STOCK TEMPLATE SANDWICHED BETWEEN STIFFENERS



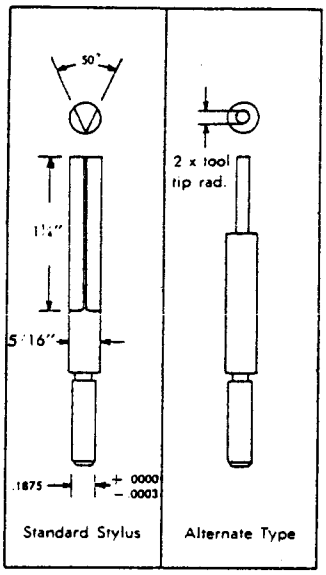
CLAMPED OVERLAY TEMPLATE FOR SIMPLE CONTOURS

CUTTING TOOL REQUIREMENTS

A sharp tool should always be used, and the cutting point should be set exactly on center to avoid errors on changing diameters. Clearance angles of at least 3° should be provided between the edges of the tool and workpiece surfaces. Nose radius should be as small as possible without sacrificing tool life, and must be less than the smallest radius to be traced. Relief and rake angles should be based on cutting conditions as in normal lathe work, although positive rake is recommended when tracing, to minimize cutting loads.

STYLUS REQUIREMENTS

The stylus contact edge should also be ground to a radius less than the smallest one to be traced, and for general use it should be approximately the same as the tool radius. The stylus supplied with the tracer is satisfactory for most applications, although when the smallest included angle on a workpiece is less than 55° a special one may be needed for adequate clearance. Its shank diameter should be held to the tolerance noted on the sketch.



STYLUS COMPENSATION

On some contours where job tolerances require extreme accuracy, a more definite relation may be needed between tool and stylus radii to compensate for slight changes in tool-stylus relationship. These changes occur as the amount and direction of stylus deflection vary over the template contour.

Compensation is usually made by providing a slightly greater radius on the stylus than on the tool. The exact amount depends on such things as template contour, infeed rate setting, machine feed, and tracer slide angle, and cannot be pre-determined. If part inspection shows that dimensions are correct on the two major axes and out of tolerance on intermediate slopes, a change in stylus radius is indicated.

When the correct compensation has been determined, the major variables noted above which affect this type of error should not be changed.

In extreme cases, it may be necessary to make a slight compensation to the template contour. This requirement is quite rare, and even the need for stylus compensation occurs only infrequently.

CARE AND MAINTENANCE

Unlike normal machine slides, a 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 tracer slide ways are fitted to close tolerances and equipped with special lubrication systems.

The performance of your tracer depends on your maintaining this precision fit. You can best assure this by:

1. Keeping the tapered gib properly adjusted.

2. Providing an adequate supply of the proper grade of way lubricant. (Use Sunoco Waylube 90 or equivalent.)
3. Preventing the entry of foreign particles or coolant which can cause undue wear or scored ways.
4. Avoiding excessive cutting loads and uneven mounting surfaces which can cause slide distortion.

Smooth operation of the tracer valve is equally important, and the following rules should be observed:

1. Don't attempt to dismantle or tamper with the valve.
2. When removing hoses from valve or tank, cap or plug fittings and hose couplings immediately.
3. Do not allow coolant to splash valve.
4. Do not tighten valve fittings with a wrench. Turn them in finger-tight only and use a wrench to snug up the Tru-Seal locknuts.
5. Keep hydraulic oil clean. Replace tank oil and filter regularly with approved makes. (See flushing procedure below.)
6. Actuate the stylus several times when starting tracer, and avoid long idle periods which allow oil to gum up inside the valve. This may cause spool hang-up, in which case the tracer will refuse to feed in toward the template or continue to retract after leaving the template. See Page 15 for corrective action.

REGULAR MAINTENANCE PROCEDURES

The following schedules are based on normal machine shop conditions. If dust, dirt, or humidity are severe, maintenance should be more frequent.

EVERY 1000 HOURS (6 months at one shift per day)

Flush complete system and replace hydraulic oil and filter.

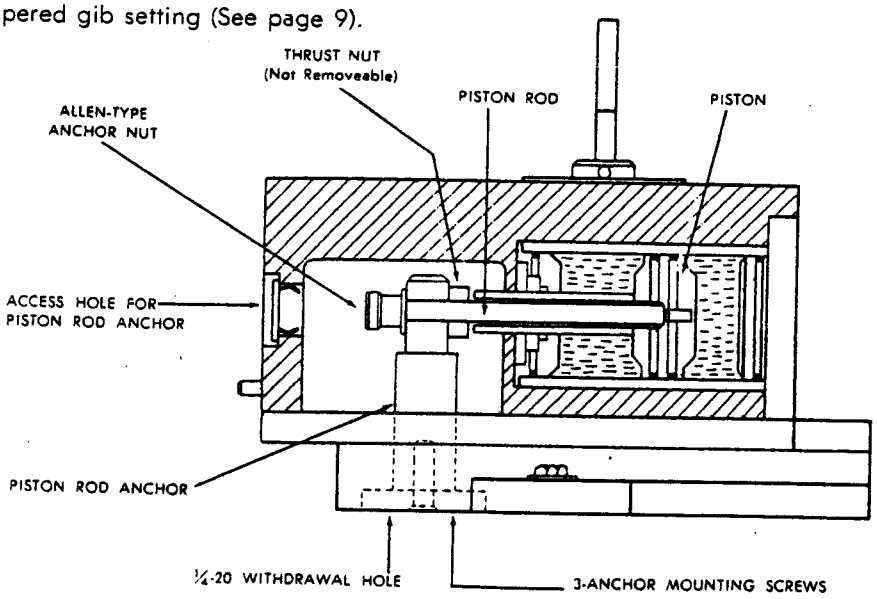
FLUSHING PROCEDURE

1. Before emptying out old hydraulic oil or changing the oil filter cartridge, disconnect the pressure and return hoses from the valve. Insert the loose end of the pressure hose into the oil filler opening of the tank. Start the pump and flush the pressure hose for one minute. Stop pump, remove pressure hose from manifold, and connect return hose to pressure fitting. Flush return hose in the same manner for one minute.
2. Empty oil out of tank. Remove oil filter cartridge. Wash out supply tank and filter housing with Varsol and wipe clean.
3. Insert new filter cartridge (See Replacement Parts List on page 25), and fill supply tank to the proper level with Sunoco Sunvis 747 or equivalent.
4. Re-flush return hose with clean oil as described under '1'. Connect return hose to return fitting, and pressure hose to pressure fitting. Re-flush pressure hose as described under '1'.
5. Connect pressure and return hoses to valve. Start pump, bleed filter housing, and stroke unit for 5 minutes by actuating stylus.

B. EVERY 2000 HOURS (12 months at one shift per day)

Remove tracer slide from tracer slide base and replace felts in way lubrication holes. (Felts are available from your MIMIK dealer).

1. Remove tracer slide and base from mounting plate, and loosen tapered gib. Leave all hoses connected.
2. Remove plug from access hole on front face of tracer slide.
3. Hold tracer slide fully retracted under hydraulic pressure to prevent piston rod rotation, and remove piston rod anchor nut, using 1/4" allen key inserted through access hole.
4. Feed tracer slide forward to clear piston rod. Remove anchor mounting screws and withdraw anchor from bottom of slide, using a 1/4"-20 screw as a puller.
5. Replace felts in lubrication holes on bottom face of tracer slide (2 per side) and re-assemble with extreme care, making sure all way surfaces are free of dirt.
6. Re-adjust tapered gib setting (See page 9).



Guarantee and Repair Service

All components of the MIMIK 7000 are guaranteed for one year from date of purchase against faulty materials and workmanship. Both tracer valve and cylinder are factory-sealed, and any attempt to dismantle them can result in damage and will void the guarantee on these items. If a claim is made against the guarantee, the faulty component must be returned to MIMIK for assessment.

Should your tracer become damaged or inoperative at any time, it can be repaired or replaced by MIMIK at reasonable cost. An estimate can be obtained by contacting MIMIK directly (see page 25) and advising date of purchase, serial number, and full particulars of the tracer's condition.

OPERATING LIMITATIONS

While an extremely versatile piece of equipment, the 7000 tracer does have some limitations. We will discuss them briefly and point out some ways to overcome them:

1. LATHE SIZE

The 7000 is designed primarily for light-duty lathes, which are usually in the 1 to 5 H.P. range, where the tracer will handle normal cutting loads without difficulty. It may also be used on larger or more powerful lathes, but its use should always be restricted to light-duty work.

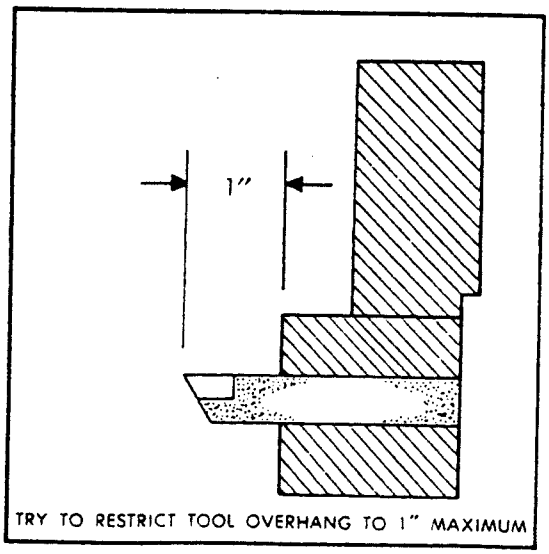
2. CUTTING LOADS

Excessive cutting forces can cause binding in the tracer slide ways which may affect accuracy and could even cause serious damage to the tracer. If good machining practice is used, there is little danger on small lathes, since the lathe spindle will likely stall or the tool will break before the tracer is damaged. On large lathes the chance of damage is much higher, and care must be taken at all times. If the cutting load exceeds the maximum tool force the tracer can apply, the stylus will back off from the template and the tool will cut oversize. This may or may not occur before the slide ways bind or become damaged, so overloading should be avoided.

A more common problem can result from variations (rather than excesses) in cutting load variables during a production run. If cutting forces are allowed to change from one part to another or while a single part is being traced, the amount of spool groove opening will also change a slight amount. Since spool movement is accompanied by a change in stylus deflection, the relation between stylus and tool will vary, and dimensional errors may result.

Cutting load variations can result from the tool becoming dull, changes in the amount of material being removed, hard spots in the workpiece, or changes in speeds and feeds. The tool should be kept sharp at all times, and a uniform cut allowance should be provided over the full contour before taking the finish tracing pass. If tool wear occurs during roughing cuts, a separate tool should be used for finish tracing.

Since tool bits used with the 7000 tracer are small, tool overhang must be kept to a minimum to avoid deflection or breakage. Doubling the overhang increases deflection 8 times). Where excessive overhang cannot be avoided, cutting speeds and machine feeds should be reduced. For small precise boring jobs, a solid carbide boring bar will reduce deflection to about 40% of that of a steel-shanked bar.

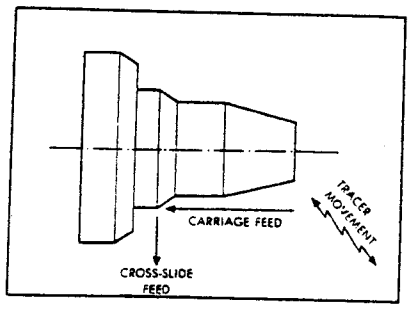


TRY TO RESTRICT TOOL OVERHANG TO 1" MAXIMUM

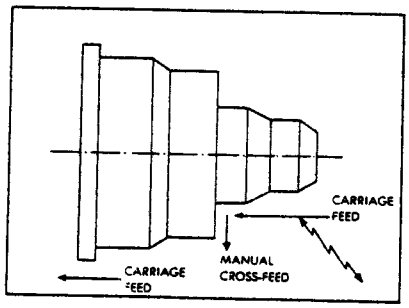
3. TRACING STROKE

Full stroke of the tracer slide is 1-1/2", but the maximum traceable contour variation is often less than this because the tracer slide is set at an angle. (e.g. max. variation at 45° slide setting is .707 x 1-1/2" = 1-1/16"). Where a contour requires more than the available stroke, these methods may be used:

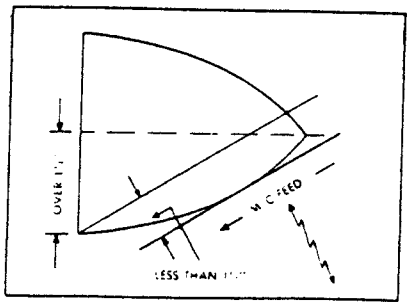
(a) Interchange machine feeds between carriage and cross-slide, preferably at shoulders.



(b) Move the unengaged machine slide away from the work manually to regain lost tracer stroke (Preferably at a shoulder or after stopping the other feed).



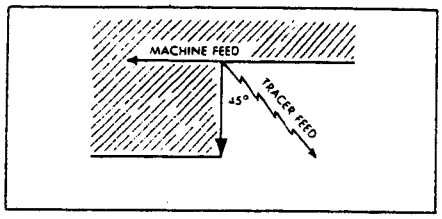
(c) Use the lathe's taper attachment to provide an angular machine feed.



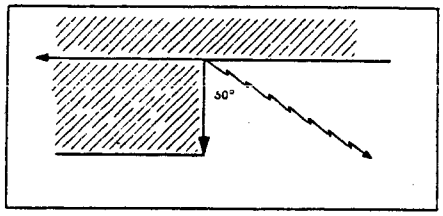
4. CONTOUR LIMITATIONS

Because of the tracer valve's swash plate design it responds smoothly to all contour angles. However, there are some combinations of contour slopes which cannot be traced at one setting. This is not due to any limitation of the tracer, but to the fact that the tool path is the resultant of machine feed and tracer slide movement. Since the direction and rate of machine feed must normally stay constant during a cut, the resultant tool path must remain within certain angular limits as defined by the tracer slide angle.

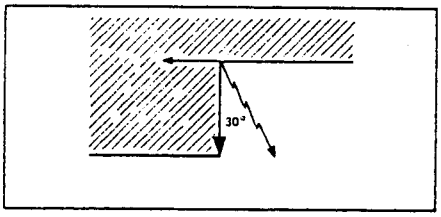
In this example, the tracer slide must be set at an angle to produce the L.H. shoulder. Tool feed along the shoulder is the resultant of machine feed and tracer feed, and with a 45° tracer angle it is equal in rate to the machine feed.



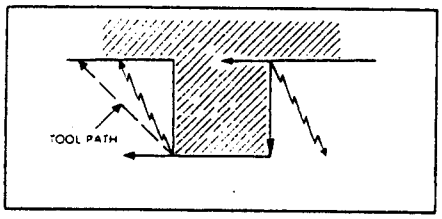
If the tracer slide angle is increased, tool feed rate along the shoulder becomes less than machine feed rate.



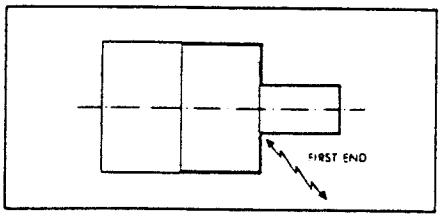
If decreased, tool feed rate becomes greater than machine feed rate. It would be excessive if the slide angle were too close to zero.

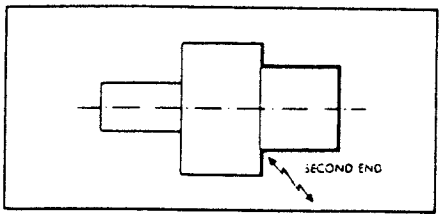


If an opposing R.H. shoulder were added to the template, the stylus would not touch it, since the resultant of machine and tracer feeds would be an angular path.

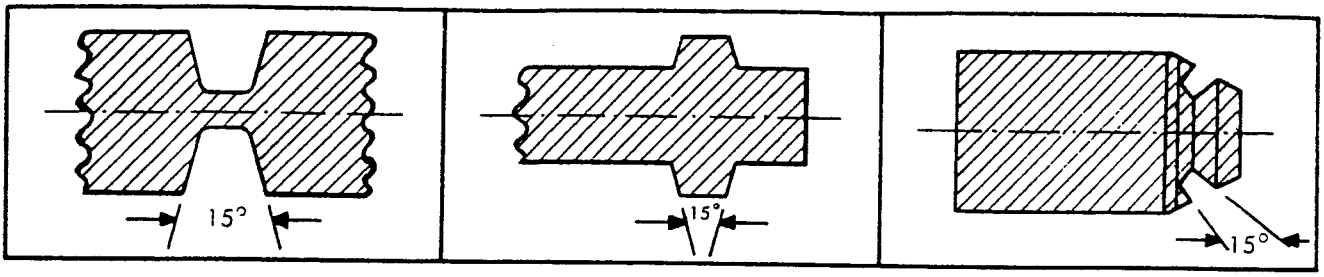


This contour could only be traced at one setting if the tracer slide were set at 90° to the feed direction, and the machine feed were stopped and started at exactly the right time. Such control over machine feeds is impractical, however, without specialized equipment such as MIMIK Dynatrace or Automatic 360° control systems. The best method to produce this contour with a slide tracer is to trace one shoulder with the tracer slide at an angle and re-chuck the part to trace the opposing shoulder at the same slide angle.



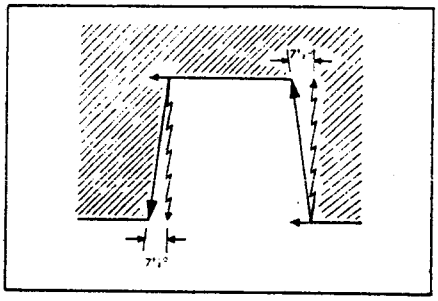


Where opposing contour slopes are not parallel, the practical limit to their minimum included angle is about 15°.



With the tracer set to bisect a 15° angle, rate of tool feed along the two slopes is 7.6 times the machine feed. A low feed rate would be needed to ensure an acceptable surface finish, avoid tool breakage, and stay within the limits of tracer slide movement (about 50 ipm max.)

Where tool feed is excessive over part of a contour, it can sometimes be reduced by changing to the other machine feed at the critical portion. This will also increase the required tracer stroke, and may require careful planning.



WHEN TO TRACE

All machining jobs can be broken down into two sets of time elements—"cutting time", in which the tool is removing metal and the operator may be idle, and "handling time", in which the tool is not cutting and the operator is positioning the machine slides for each change in contour, checking the part, changing tools, loading and unloading, etc.

A tracer has little effect on cutting time and none on loading and unloading time. It can, however, have a tremendous effect on the remaining elements of handling time, since the tool need only be positioned once for each tracing path, regardless of complexity. Furthermore, inspection is reduced to a single dimension on each part (after full inspection of the first part) and tool changes are often not needed at all.

On a tracer-equipped lathe, the only justification for conventional turning is when the cost of the template exceeds the potential saving in handling time. Even for simple parts or short runs, it is often better to leave the tracer in position than to replace it with a toolpost. For straight cuts it should either be fully retracted or operated against a straight edge which acts as a template.

The following conditions generally justify using the tracer:

1. Jobs which would normally take several hours to run, regardless of run quantity. Where the template is simple or already on hand, the break-even point may be as low as 2 or 3 hours.
2. Parts which involve 2 or more contour changes in one plane.
3. Jobs in which manual elements (handling time) comprise more than one-third of the total job time.

REMEMBER: Extensive studies have shown that on the average, manual machining involves 75% handling time and only 25% cutting time, while controlled machining (tracer or NC) reverses these figures.

ROSEBROOK TRACERS INC
3105 North Cascade #106
Colorado Springs, CO 80907
USA

TOLL FREE 800.265.3564
FAX 719.632.8894
rbtracer@rosebrooktracer.com

HYDRAULIC OIL

MIMIK recommends the use of detergent-dispersant hydraulic oil for use in all our tracing systems. The oil should also contain rust and oxidation inhibitors as well as anti-wear foam depressant additives. The viscosity index should be around 100 or higher. The viscosity of the oil at 100°F should be between 190 and 225 SSU for best performance. Using a lower viscosity oil may cause the tracing unit to vibrate upon infeeding into the template and cause more leakage in the pump and valves. If the above factors are taken into account, the oils of as low as 125 SSU at 100°F can be used.

The detergent oil is recommended to reduce the possibility of a film deposit building up on critically fitted components which in turn could cause malfunction of the valve. Normally the disadvantage of using a dispersant type of oil is that it allows water to mix with the oil but, in industrial tracer applications, this has not been found to be a problem.

Too much detergent in the oil (as in modern engine oils) can cause clogging of filters prematurely and is not recommended for that reason. We require an oil that meets U.S. military specifications MIL-L-2104B. The oil should not exceed the detergent level specified there.

Preferred Hydraulic Oils

1. Exxon - Fleet HDX 10W
2. Gulf - Gulf Lube Motor Oil #10
3. Sunoco - Sunvis 747

In general low detergent motor oils meeting MIL-L-2104B of SAE #10 grade.

Alternate Hydraulic Oils

These oils are of the non-detergent type.

1. Atlantic Richfield – DURO AW S-215
2. Castrol Hyspin AWS 46
3. Exxon Nuto H48
4. Gulf Harmony 48 AW
5. Mobil DTE 32
6. Shell Tellus 32
7. Texaco Rando oils HD 215