

**TROUBLE SHOOTING CHART  
FOR MODEL B-360-3D HYDRAULIC TRACING CONTROLS**

Checklist of Outside Difficulties. An analysis of service calls reveals that a large majority of all tracing difficulties arise from conditions which are extraneous to the Tracer itself. It is suggested, therefore, that the factors listed below be checked as possible causes of malfunctioning **before assuming** that the difficulty lies with the Tracer itself.

- |   |   |
|---|---|
| <ul style="list-style-type: none"> <li>a. Inadequate training of operator</li> <li>b. Tracer Brackets loose</li> <li>c. Ways not properly lubricated</li> <li>d. Hydraulic Lines undersized</li> <li>e. Machine practice substandard</li> <li>f. Improper hookup of hydraulic circuit</li> <li>g. Tracer Spindle bent</li> <li>h. Oil leakage in system</li> <li>i. Rod or cylinder brackets loose</li> <li>j. Cutter Spindle eccentric</li> <li>k. Cutter Spindle repair needed</li> <li>l. Machine not repeating (Fish tail)</li> <li>m. Cutter running out</li> <li>n. Loose rail on planer</li> </ul> | <ul style="list-style-type: none"> <li>o. Contaminated oil</li> <li>p. Spindle drive motor loose</li> <li>q. Gibs too tight on machine</li> <li>r. Gibs too loose on machine</li> <li>s. Fixture bowed</li> <li>t. Bad tooling</li> <li>u. Cylinders leaking (Blow-by)</li> <li>v. Machine not level</li> <li>w. Tracer stylus eccentric</li> <li>x. Insecure foundation</li> <li>y. Improper set-up (relationships of part to template and stylus to cutter.)</li> <li>z. Cutter and stylus not 1:1 ratio on finish cut</li> </ul> |
|---|---|

Trouble	Probable Cause	Item No.	Probable Remedy
<p>A. Chatter (Hydraulic pulsation) or rough finish on work piece (Be sure to use good cutting practice.)</p>	<ul style="list-style-type: none"> <li>a. Improper gib adjustment (too loose or too tight)</li> <li>b. Loose linkage between tracer and cutter</li> <li>c. Inadequate stress provision in cylinder mounting brackets or at cylinder mounting location on machine tool</li> <li>d. Under-size piston working area for hydraulic power requirement</li> </ul>	<ul style="list-style-type: none"> <li>1. Tighten gibs until a slight bind occurs; then back off slightly. Gibs should be snug but not binding.</li> <li>2. Check linkage at each point between tracer and cutter for wear, looseness or other factors contributing to lost motion. Eliminate all lost motion between tracer and cutter.</li> <li>3. Use well-stressed cylinder mounting brackets and mount cylinder securely to rigid surface.</li> <li>4. Use cylinder and piston rod combination which provides adequate working area on each side of piston. When working area of cylinder piston is inadequate to afford a positive control of the tracer-controlled member, the moving tracer-controlled mass is sluggish in response to stylus deflection changes and can cause over-deflection, which can result in chatter or pulsation. It is generally recommended that the cross-section area (working area) of the rod end of the piston be large enough to provide from three to four times the force (at operating pressure) required to keep tracer-controlled sliding member in motion, after overcoming inertia of rest and static friction.</li> </ul>	

Trouble	Probable Cause	Item No. Probable Remedy
A. Chatter (Hydraulic pulsation) or rough finish on work piece (Be sure to use good cutting practice.)	e. Hydraulic pressure too high	5. Hydraulic pressure on different installations varies from 125 PSI to 500 PSI, depending upon various inherent elements in each installation. 250 PSI is found to be average.
	f. Inadequate lubrication	6. Use Socony Mobil Vactra No. 4 for heavy machines or No. 2 for light machines or Sunoco Way Lube SAE 80. These lubricants have been found to effectively reduce friction in ways, and consequently help to attain a smooth, free-tracing operation with a minimum of power. Ways should be lubricated at least every four hours of operation. Keep ways clean at all times.
	g. Excessive friction between cylinder wall and piston	7. Cylinder wall must be honed to a 20 Micro finish. Piston and piston rod seals must be as friction-free as possible, without allowing any blow-by of hydraulic oil.
	h. Faulty or improper hydraulic power supply	8. Use True-Trace hydraulic power supply unit or equivalent. Be sure all components are functioning properly.
	i. Air in hydraulic circuit	9. Bleed hydraulic circuit of all trapped air. Be certain that there is sufficient oil in system and that vacuum unit (if used) does not aerate oil in reservoir.
	j. Piston rod flex or spring	10. Piston rod must be able to function under full load without flexing. Be sure piston rod is sufficiently stiff.
	k. Torque or flex between tracer and cutter	11. The tendency for torque or flexing between tracer and cutter increases as the distance between the two increases. Make tracer mounting bracket extremely rigid and firmly secured to machine tool. Keep distance between tracer and cutter to a minimum. Be sure that tracer is firmly locked on tracer mounting bracket when tracing.
	l. Vibration in machine tool	12. Machine tool vibration can induce a secondary vibration into the tracer Spindle, thereby causing tracer spool to oscillate inside tracer, causing rapid changes in direction of flow of hydraulic oil. The use of lightweight tracing finger will minimize the tendency for a secondary vibration, and subsequent chatter. Eliminate vibration in machine tool.
	m. Loose tracing finger in Spindle of tracer	13. Be sure stem of tracing finger is seated firmly and tight inside tracer Spindle.
	n. Misalignment of cylinder	14. If longitudinal axis of cylinder is not parallel with the line of motion of tracer-controlled member, unnecessary and detrimental friction can be created between cylinder wall and piston. In time, excessive wear can result.

Trouble	Probable Cause	Item No.	Probable Remedy
A. Chatter (Hydraulic pulsation) or rough finish on work piece (Be sure to use good cutting practice.)	o. Improper flexible lines	15.	Use $\frac{3}{8}$ " diameter steel braid; must be Neoprene, oil resistant interior.
	p. Pivot bearing loose	16.	Refer to pivot bearing adjustment Figure No. 10.
	q. Slide block or Spindle worn	17.	Replace with new parts.
B. Tracing too slowly	a. Collapsed flexible lines or dented stationary lines	18.	Replace all collapsed or dented lines.
	b. Tracer out of adjustment	19.	Readjust tracer. (See manual for adjustment instructions.)
	c. Hydraulic lines or fittings too small	20.	Replace with proper sized components.
	d. Piston working area too large	21.	A large diameter cylinder requires more oil to move the tracer-controlled member at a given rate than a small cylinder. Use of a smaller cylinder will normally increase feed rate of tracer-controlled member. Caution—Do not under-power (Ref. Item 4).
	e. Inadequate hydraulic pressure or volume	22.	Use higher volume pump if present pump output is less than capacity of tracer. Increase hydraulic pressure, being careful not to induce chatter by excessive pressure. (Ref. Item 5).
	f. Inefficient hydraulic power supply unit	23.	Replace inefficient components of hydraulic power supply unit.
	g. Foreign matter in hydraulic system	24.	Foreign matter in hydraulic oil is one of the greatest contributors to tracing trouble!! Impurities in oil can cause excessive friction at various points in the hydraulic system. It can also clog strainer and severely reduce the amount of oil available to the pump. This condition can cause, in addition to slow tracing, a noisy pump, and in time, permanent damage to pump. <b>KEEP OIL CLEAN AT ALL TIMES!!!</b>
	h. External control metering (needle) valve restricting flow of oil	25.	Open external control metering valves. Be sure that they are functioning properly.
	i. Improper gib adjustment	26.	Reference Item 1.
	j. Inadequate way lubrication	27.	Reference Item 6.
	k. Excessive friction between cylinder wall and piston	28.	Reference Item 7.

Trouble	Probable Cause	Item No. Probable Remedy
B. Tracing too slowly	1. Improper hydraulic oil	29. True-Trace recommends only Mobil Velocite "S" oil, a product of Socony Mobil. This oil has been tested and used in actual job shop production for several years and has proven to be very stable through all operating heat ranges. It requires only a short warm-up time, and does not tend to thin out and get "mushy" in operation at maximum specified heat. There are cases on record of three years and better without the necessity of changing the oil in the reservoir. Time has proven that no trouble has been caused by this oil. Since all True-Trace valve spool ports are ground and flow-tested with this oil used in the flow test bench, we cannot guarantee the operation of our tracing instruments with any other oil. Accept no substitute — not even from Socony Mobil.
C. Variations between template and machined part	<p>a. Eccentric tracing finger</p> <p>b. Bent tracer Spindle or tracing finger</p> <p>c. Loose linkage between tracer and cutter</p> <p>d. Cutter-spring</p> <p>e. Template or work-piece not securely held on holding surface</p> <p>f. Improper gib adjustment</p> <p>g. Inaccuracies in machine tool</p> <p>h. Method of tracing cavities</p>	<p>30. The spindle of the tracer is free to rotate, and any eccentricity in tracing finger will be duplicated in the finished part, accordingly. Use only concentric tracing fingers.</p> <p>31. A bent spindle, free to rotate within the tracer, will induce the effect of eccentricity into the tracing finger. (Ref. Item .30). Straighten or replace bent spindle and/or tracing finger.</p> <p>32. Your True-Trace tracer does not compensate for lost motion in the machine tool (Ref. Item 2).</p> <p>33. This is generally recognized by oversize or tapered cut, and can be eliminated only by better cutting practice.</p> <p>34. Hold template and work-piece securely.</p> <p>35. Reference Item 1.</p> <p>36. Inaccuracies in the machine tool, such as play in machine spindle, fish-tail of tracer-controlled member, etc., are not overcome by your True-Trace tracer. Precision duplicating can be accomplished only if your machine tool is accurate.</p> <p>37. When tracing cavities where extremely close precision is required, it is generally recommended that the tracer climb up a cavity wall, rather than to trace down a cavity wall.</p>

Trouble	Probable Cause	Item No.	Probable Remedy
D. Excessive leakage of tracer	a. Clogged vacuum unit, or check valve in vacuum line	38.	Be certain that the vacuum unit is free-flowing to reservoir, and ball in check valve is seating.
	b. Hydraulic line obstructions	39.	Reference Item 18.
	c. Loose line connections at valve	40.	Tighten loose fittings.
E. Valve fails to return to template	a. Hydraulic bind	41.	The condition under which the tracer spool is forced against the side of the tracer sleeve, causing excessive internal friction within the tracer, is termed hydraulic bind. Hydraulic bind can be caused when pressure and exhaust lines are reversed, in which case the remedy is to make the proper circuit changes. (See Hydraulic Circuit Diagram). Hydraulic bind can also be caused by excessive friction of piston and/or piston rod seals (Ref. Item 7, 14), improper gib adjustment (Ref. Item 1), excessive hydraulic pressure (Ref. Item 5), or underpowered piston working area (Ref. Item 4).
	b. Contaminated hydraulic oil	42.	Clean entire system and replace oil. Be sure hydraulic system is free from all foreign matter (Ref. Item 24). Do not try to filter the oil.
	c. Air in hydraulic circuit	43.	Reference Item 9.
	d. Control valve closed.	44.	Open control valves.
	e. Horizontal spool out of adjustment	45.	See vertical spool adjustment in adjustment of B-360-3D.
F. Valve fails to induce any motion when hydraulic power unit is functioning	a. Piston at end of stroke	46.	Tracer-controlled travel is limited to length of piston stroke.
	b. Same causes as "Tracing too slowly" (B)	47.	Reference Items 18 through 25.
	c. Valve spool out of adjustment	48.	Refer to Figures No. 14 and 15.
G. "Sticky" tracer spool (Spindle action sluggish)	a. Hydraulic bind	49.	Reference Item 41.
	b. Improper hydraulic oil	50.	Reference Item 29.
	c. Hydraulic oil too cold	51.	Oil should be at 90°-120° for optimum tracing. In cold weather, especially, allow hydraulic power unit to run for approximately an hour prior to tracing operation.
	d. Contaminated hydraulic oil	52.	Reference Items 42, 73.

Trouble	Probable Cause	Item No. Probable Remedy
H. Excessive noise in hydraulic power unit	<ul style="list-style-type: none"> <li>a. Cavitation — inadequate supply of oil in pump</li> <li>b. Worn, faulty or dirty relief valve</li> <li>c. Worn or faulty pump components</li> <li>d. Loose pipes on intake side of pump</li> </ul>	<ul style="list-style-type: none"> <li>53. Be sure that there is sufficient hydraulic oil in the reservoir to allow full volume intake at pump at all times. Be sure filter is clean.</li> <li>54. Be certain that relief valves are clean and functioning properly.</li> <li>55. Check pump vanes, bearings and ring for wear or dirt. Repair or replace.</li> <li>56. Tighten pipes on intake side of pump.</li> </ul>
I. No oil pressure when hydraulic power unit is in operation	<ul style="list-style-type: none"> <li>a. Pressure line pinched or collapsed</li> <li>b. Faulty pump</li> <li>c. Sheared coupling between motor and pump</li> <li>d. Worn, faulty or dirty relief valve</li> </ul>	<ul style="list-style-type: none"> <li>57. Replace faulty pressure line.</li> <li>58. Correct the adjustment of pump or replace.</li> <li>59. Replace coupling.</li> <li>60. Ref. Item 54. Be sure that no foreign matter is lodged under relief valve seat.</li> </ul>
J. Electric motor on hydraulic power unit stalls	<ul style="list-style-type: none"> <li>a. Defective motor</li> <li>b. Pump frozen</li> <li>c. Faulty adjustment of pump end plates</li> <li>d. Under-capacity electric motor</li> <li>e. Excessive hydraulic pressure</li> </ul>	<ul style="list-style-type: none"> <li>61. Replace defective motor.</li> <li>62. Repair or replace defective components of pump.</li> <li>63. Reference Item 58.</li> <li>64. Use greater capacity motor, or use lower volume pump.</li> <li>65. Reduce hydraulic pressure, or use greater capacity motor if high pressure is required.</li> </ul>
K. Oil becomes too hot	<ul style="list-style-type: none"> <li>a. Inadequate reservoir</li> <li>b. Too much oil blown over relief valve</li> <li>c. Inadequate oil cooling system</li> </ul>	<ul style="list-style-type: none"> <li>66. Increase size of reservoir and quantity of hydraulic oil in system.</li> <li>67. Reduce volume of pump. Reduce hydraulic pressure.</li> <li>68. If volume, pressure, etc., cannot be reduced, install an oil cooler in the circuit, on the exhaust side of the pressure relief valve.</li> </ul>
L. Valve moves from template when stylus is deflected toward template	<ul style="list-style-type: none"> <li>a. Pressure and exhaust lines are reversed</li> <li>b. Cylinder lines are reversed</li> </ul>	<ul style="list-style-type: none"> <li>69. Correct circuit hook-up (Ref. Hydraulic Circuit Diagram).</li> <li>70. Correct circuit hook-up (Ref. Hydraulic Circuit Diagram).</li> </ul>
M. Excessive pressure required to deflect stylus and actuate tracer	<ul style="list-style-type: none"> <li>a. Hydraulic bind</li> <li>b. Excessive hydraulic pressure</li> <li>c. Foreign matter in hydraulic system</li> <li>d. Improper hydraulic oil</li> <li>e. Hydraulic oil is too cold</li> </ul>	<ul style="list-style-type: none"> <li>71. Reference Item 41.</li> <li>72. Reference Item 5.</li> <li>73. Ref. Item 24. Be sure no foreign matter is lodged between sleeve and spool of Tracer.</li> <li>74. Use proper hydraulic oil (Ref. Item 29).</li> <li>75. Allow hydraulic oil to attain operating recommended temperature (90°-120°F.)</li> </ul>