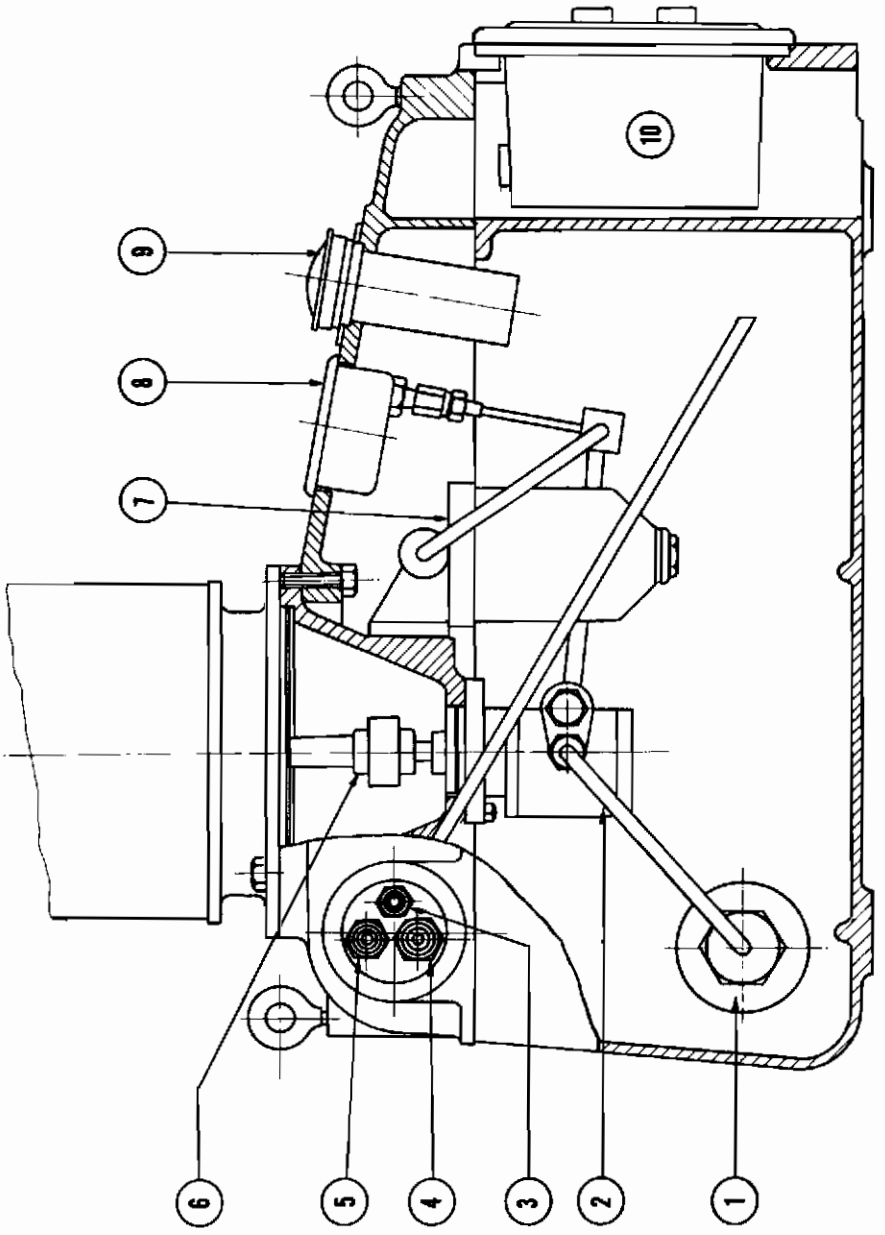
14.62 SPARE PARTS LIST FOR H.I.C. OIL PUMP AND TANK

1. Purolator plain filter.
2. Gear pump.
3. Leak connection.
4. Pressure connection.
5. Exhaust connection.
6. Pump driving coupling.
7. Purolator micronic filter.
8. Pressure gauge.
9. Oil filter.
10. Starter unit.



PLEASE STATE MACHINE SERIAL NUMBER, SHEET NUMBER & ITEM NUMBER.

14.7 HYDRAULIC COPYING UNIT FAULT FINDING & CORRECTION

AIR IN UNIT.

Air trapped in the hydraulic system will rise to the highest point which is the copy slide cylinder. This will result in erratic movement of the copy slide and inaccurate work.

Common causes of air entering the system are:-

Non use of the copying unit for protracted periods.
Removal of pipe connections and valve.
Damage to sealing washers by over tightening, particularly those under bleeder screws.

TO BLEED SYSTEM.

Advance unit to balance on any copy template. Adjust cross slide and saddle until copy slide is approximately 1/2" short of maximum forward position. Release front bleeder screw in top of cylinder and allow oil to flow until free of air bubbles. Lock bleeder screw with minimum force required to seal. Adjust cross slide and saddle until copy slide is approximately 1/2" short of maximum rear position. Release rear bleeder screw in top of cylinder and allow air to flow as previously. Do not bleed the system with the slide in the retracted position.

TIGHT COPYING SLIDE OR MALALIGNMENT OF UNIT.

This is one of the major causes of copying inaccuracy and can be due to:-

TIGHT SLIP, INGRESS OF DIRT, BADLY ADJUSTED WIPERS, BADLY ALIGNED PISTON.

Remove wipers and thoroughly oil slide before making adjustment.
Re-adjust slip (check force to move slide).
Check wiper fitting.
Disconnect unit from top slide to expose piston rod. Check alignment with dial gauge carried on top slide, and reading on piston rod. Error should not exceed .0005" in either plane. Re-scrape bracket for piston if necessary.
Finally if tightness is still present remove top slide and check for scoring and embedded swarf. Re-scrape if necessary.

The speed of the copy slide will also indicate tightness, the following being minimum speed with valve fully retracted or advanced.

Advance and retraction 100" per min.

INACCURATE STYLUS ARM.

Tightness or excessive clearance will cause copying errors.

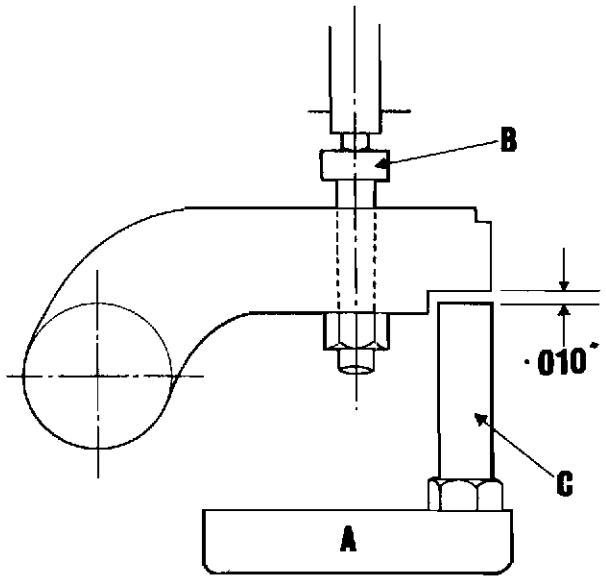
If the stylus arm is correctly fitted it should fall under its own weight when inclined 15° either direction from vertical. This cannot be done on machine.

A frequent cause of arm defect is the distortion or damage resulting from a "run in" of stylus and copy. This usually occurs when the operator has failed to start the pump set motor.

Check arm for fracture and squareness to beam.

VALVE STIFFNESS & INCORRECT SETTING.

A tight valve will cause the unit to float away from master or fail to advance to template. An incorrect setting of tappet screws on stylus lever and retraction lug will prevent correct movement of valve. Check this before removing valve.



STICKING VALVE

To set tappet screws take unit to rear of machine and balance stylus on flat bar held in template bracket. Remove cover A, set screw B to adjust position of lever if necessary. Adjust screw C to give .010" approx. clearance on lever (Note: If clearance of screw C is limited, maximum advance speed is reduced).

If valve is sticking this should be removed by removing plug at rear of cartridge assembly and thoroughly cleaned with a soft cloth. DO NOT USE ABRASIVES OF ANY KIND, TAKE CARE NOT TO DAMAGE CORNER OF VALVE. Check filter in tank and replace if necessary. Dirt can collect in valves from drilling and tapping operations and affect accuracy. BLEED AFTER REPLACING VALVE.

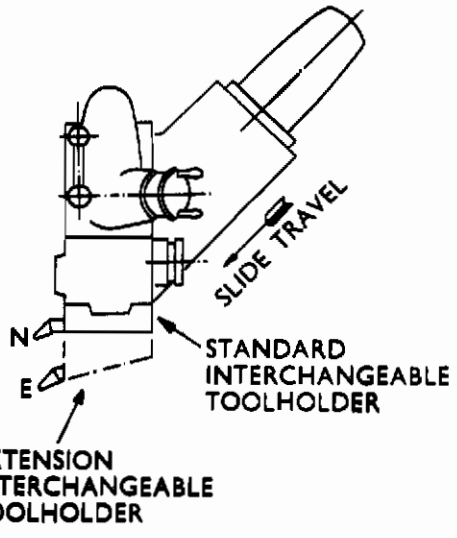
14.72 HYDRAULIC COPYING UNIT GUIDE TO FAULT FINDING

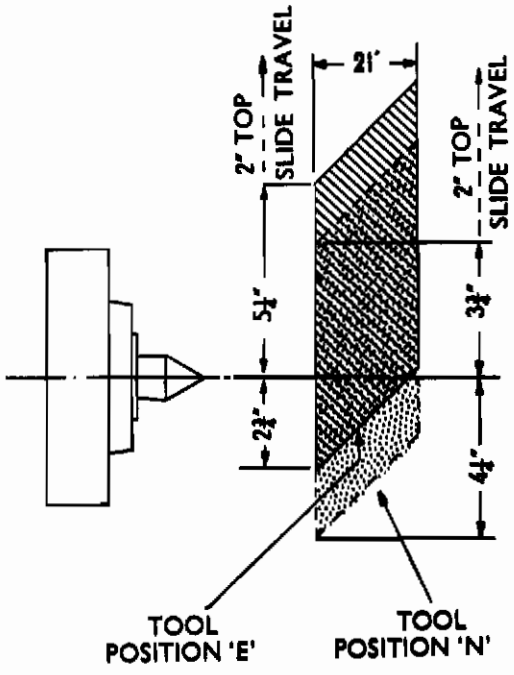
FAULT.	CAUSE.	REMEDY.
TAPERED WORK AND INCORRECT DIAMETER INCREASES.	1. Mololignment of copy with oxis of Lathe.	1. Clean oll mating surfoces, centres and centre holes. Check alignment with dial gauge carried on saddle if necessary.
	2. Bent or eccentric copy.	2. Check for eccentricity using dial gauge and rotating copy between centres. Check for straightness with dial gauge carried on saddle.
	3. Loose stylus.	3. Tighten stylus.
	4. Copy tool set at incorrect height.	4. Set tool correct on centre of Lathe.
	5. Lathe cross slide loose.	5. Adjust strip.
	6. Worn stylus.	6. Regrind stylus.
INCORRECT SHOULDER LENGTHS.	7. Stylus out of square.	7. Check fit in stylus arm and regrind stylus square to copy beam if necessary.
INCORRECT CONTOUR OR RADII REPRODUCTION.	8. Stylus and tool radii not identical.	8. Correct tool or stylus radius.
INCORRECT CONTOUR OR RADII REPRODUCTION.	9. Stylus out of square.	9. As 7.
	10. Loose stylus.	10. Tighten stylus.
BAD SURFACE FINISH ON WORK PIECE.	11. Chatter of copy tool or boring bar.	11. Reduce cut, adjust speed or feed, increase stiffness of tool or bar.
	12. Bad surface finish on copy.	12. Correct copy.
UNIT FAILS TO CLIMB.	13. Overlood due to excessive depth of cut or excessive tool rake.	13. Reduce depth of cut or feed. Limit back to front rake to 3° and apply top rake os side rake.
	14. Stylus loose.	14. Tighten stylus.
	15. Stylus too long.	15. Shorten stylus.
	16. Excessive feed rate.	16. Reduce feed.
UNIT FAILS TO MOVE INTO WORK.	17. Incorrect adjustment of retraction contral or stop screw for stylus arm.	17. Adjust retraction cable or screw situated in cover in front of stylus arm, with unit balanced on copy.
SLOW OR SLUGGISH UNIT.	18. Cold oil.	18. Run pump to raise temperature to approx. 100° F min.
	19. Tight slide.	19. Lubricate copy slide and adjust slip if necessary. Remove wiper.
UNIT OSCILLATES.	20. Copy slide too free.	20. Adjust slide strip.
	21. Stylus loose.	21. Tighten stylus.
	22. Stylus lever loose.	22. Tighten grub screws on lever.
	23. Air in hydraulic system.	23. Bleed system.
UNIT FLOATS AWAY FROM COPY.	24. Sticking valve.	24. Remove valve spool, clean and carefully replace.
	25. Dirty oil.	25. Replace oil and filter cartridge.
	26. Sticking lever.	26. Check lever fulcrum and bearings.

14.8 HYDRAULIC COPYING UNIT
45° CAPACITY CHART

Capacities	13/1 × 30	13/1 × 30	13/1 × 42	13/1 × 42
Maximum swing over saddle for copying	6½"	165 mm.	6½"	165 mm.
Maximum diameter of cylindrical copy	5¼"	133 mm.	5¼"	133 mm.
Maximum length of cylindrical copy	2' 6"	762 mm.	3' 6"	1016 mm.
Maximum length of workpiece (3 jaw chuck)	2' 1"	635 mm.	3' 1"	940 mm.
Maximum length of workpiece (Pratt Driver)	2' 1"	635 mm.	3' 1"	940 mm.
Copy slide radial movement	2¾"	76 mm.	2¾"	76 mm.
Tool infeed adjustment	2⅛"	54 mm.	2⅛"	54 mm.
Tool side adjustment	1"	25 mm.	1"	25 mm.
Copy tool shank Width	¾"	19 mm.	¾"	19 mm.
Depth	1"	25 mm.	1"	25 mm.
Length	5½"	140 mm.	6½"	140 mm.
Stroke of copy slide cylinder	4"	101 mm.	4"	101 mm.
Diameter of copy slide cylinder	2⅜"	60.3 mm.	2⅜"	60.3 mm.
Stalled effort of copy slide	620 lb.	281 kg.	620 lb.	281 kg.
Operating pressure of hydraulic system	280 p.s.i.	19.6 kg./sq.cm.	280 p.s.i.	19.6 kg./sq.cm.
H.P. of hydraulic pump set motor	1 H.P.		1 H.P.	
Maximum copy slide velocity (advance and retraction)	100in./min.	2540 mm./min.	100 in./min.	2540 mm./min.
Stylus pressure	1 lb.	0.45 kg.	1 lb.	0.45 kg.

FACE COPYING CAPACITIES





Cutting area. At one setting with tool in position 'N'.

Cutting area. At one setting with tool in position 'E'.

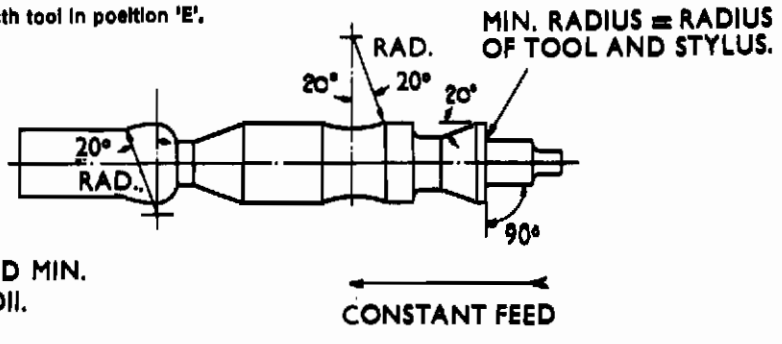
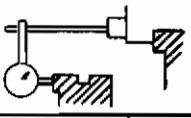
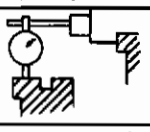
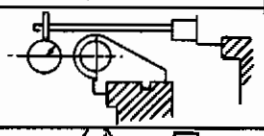
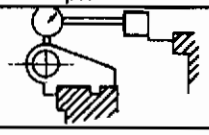
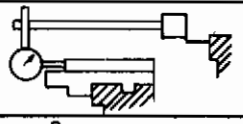
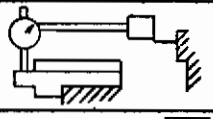
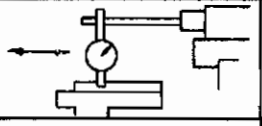
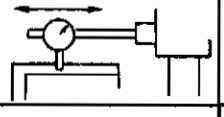
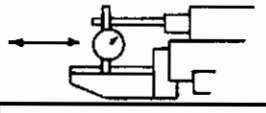
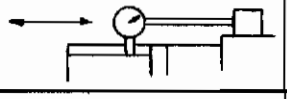
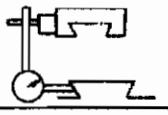
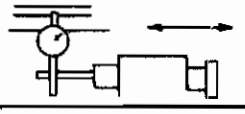
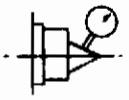
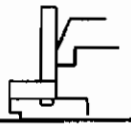


DIAGRAM SHOWING MAX. AND MIN. PERMISSIBLE ANGLES AND RADII.

14.9 HYDRAULIC COPYING UNIT ALIGNMENT TESTS

ALIGNMENT TEST	SET - UP	LIMIT ALLOWED
SIDE OF COPY BEAM PARALLEL TO BED		+ 0.00025" - PER FOOT
TOP OF COPY BEAM PARALLEL TO BED		0.002" IN FULL LENGTH
AXIS OF CYLINDRICAL COPY BRACKETS PARALLEL TO BED IN VERTICAL PLANE		+ 0.00025" - PER FOOT
AXIS OF CYLINDRICAL COPY BRACKETS PARALLEL TO BED IN HORIZONTAL PLANE		0.003" IN FULL LENGTH
ALIGNMENT OF FLAT COPY BRACKETS TO BED IN VERTICAL PLANE		0.001"
ALIGNMENT OF FLAT COPY BRACKETS TO BED IN HORIZONTAL PLANE		0.003"
ALIGNMENT OF FLAT COPY BRACKETS TO SADDLE IN HORIZONTAL PLANE		0.001"
ALIGNMENT OF FLAT COPY BRACKETS TO SADDLE IN VERTICAL PLANE		0.001"
ALIGNMENT OF FACE COPY BRACKET TO SADDLE IN HORIZONTAL PLANE		0.001"
ALIGNMENT OF FACE COPY BRACKET TO SADDLE IN VERTICAL PLANE		0.001"
INFEED SLIDE PARALLEL TO SADDLE IN VERTICAL PLANE		0.003"
SIDE ADJUSTMENT SLIDE PARALLEL TO BED IN VERTICAL PLANE		0.001"
RUN OUT OF SPRING LOADED CENTRE		0.0007" TOTAL INDICATOR READING
STYLUS EDGE SQUARE TO COPY BEAM IN ANY VERTICAL PLANE		0.001"