SECTION II

MACHINE AND CONTROL SPECIFICATIONS

2.1 AXIS TRAVEL RANGES (Figure 2-1)

Axis	Travel	Increments
Table X	30"	.0005"
Saddle Y	15"	.0005"
Knee Z	12" (Auto) 16" (Manual)	.00025"

X-AXIS. The X-axis is horizontal motion of the table on the saddle, perpendicular to the spindle axis. Total X axis travel is 30", 15" to the left of the spindle center line, 15" to the right of the spindle center line.

Y-AXIS. The Y-axis is horizontal motion of the saddle on the knee, perpendicular to the spindle axis. Total Y axis travel is 15". The spindle can be mounted on a movable ram that slides horizontally on the column perpendicular to the X axis with a total travel of 14.75". The minimum throat distance (spindle to column) is 11.25", the maximum throat distance is 26.0".

Z-AXIS. The Z axis is vertical travel of the knee on the column, parallel to the spindle axis. Total Z axis travel is 12", (16" for manual knee machines). The minimum distance from the table to the collet with the quill up is 1.0".

QUILL. The spindle is mounted in a quill with 5.0" vertical travel, parallel to the Z axis. If the quill is fitted with a tape-controlled quill drive unit and turret depth stop equipment, the quill travel is reduced to 4.0".

2.2 ACCURACY

Absolute individual machine slide positioning accuracy measured with a calibrated high accuracy scale:

X Axis $\pm$ .001" in 24" travel
Y Axis $\pm$ .001" full travel
Z Axis $\pm$ .002" full travel

Figure 2-2 shows an example Accuracy Cutting Test

The stepmotors step in increments of 0.000500", the control system input resolution is 0.000100" and the control system interpolator calculates to

0.000050". The accuracy of arithmetic interpolation within the control is better than 0.0001". Logic in the control rounds off in such a manner that a control accuracy of ± 0.00025" is maintained at the stepmotor drive shaft. The chart below indicates when the round-off hardware outputs pulses to the stepmotor drive and exposes the resultant error at the stepmotor shaft:

Manual Input = .000" Increment	XY Step	Total XY Move @ .0005" Per Step	Accumulated XY Error	Z Step	Total Z Move @ .00025" Per Step	Accumulated Z Error
1	0	.0000	-.0001	0	.00000	-.00010
2	0	.0000	-.0002	1	.00025	+.00005
3	1	.0005	+.0002	0	.00025	-.00005
4	0	.0005	+.0001	1	.00050	+.00010
5	0	.0005	.0000	0	.00050	.00000
6	0	.0005	-.0001	0	.00050	-.00010
7	0	.0005	-.0002	1	.00075	+.00005
8	1	.0010	+.0002	0	.00075	-.00005
9	0	.0010	+.0001	1	.00100	+.00010
10	0	.0010	.0000	0	.00100	.00000
11	0	.0010	-.0001	0	.00100	-.00010
12	0	.0010	-.0002	1	.00125	+.00005
13	1	.0015	+.0002	0	.00125	-.00005
14	0	.0015	+.0001	1	.00150	+.00010
15	0	.0015	.0000	0	.00150	.00000
16	0	.0015	-.0001	0	.00150	-.00010
17	0	.0015	-.0002	1	.00175	+.00005
18	1	.0020	.0000	0	.00175	-.00005
19	0	.0020	+.0001	1	.00200	+.00010
20	0	.0020	+.0002	0	.00200	.00000

NOTE: The round-off hardware accumulates the error between input control pulses and output stepmotor pulses. If the sum of all the moves in any axis zero, the accumulated round-off error will be equal to zero. The round-off accumulator is initialized to zero error. If the ERASE pushbutton is operated in the middle of a program, the round-off accumulated error will be lost.

2.3 SPINDLE

Drive: Full 4-hp totally enclosed, fan-cooled motor with patented air evacuation system which precludes need to run motor up to operating temperature to avoid thermal expansion.

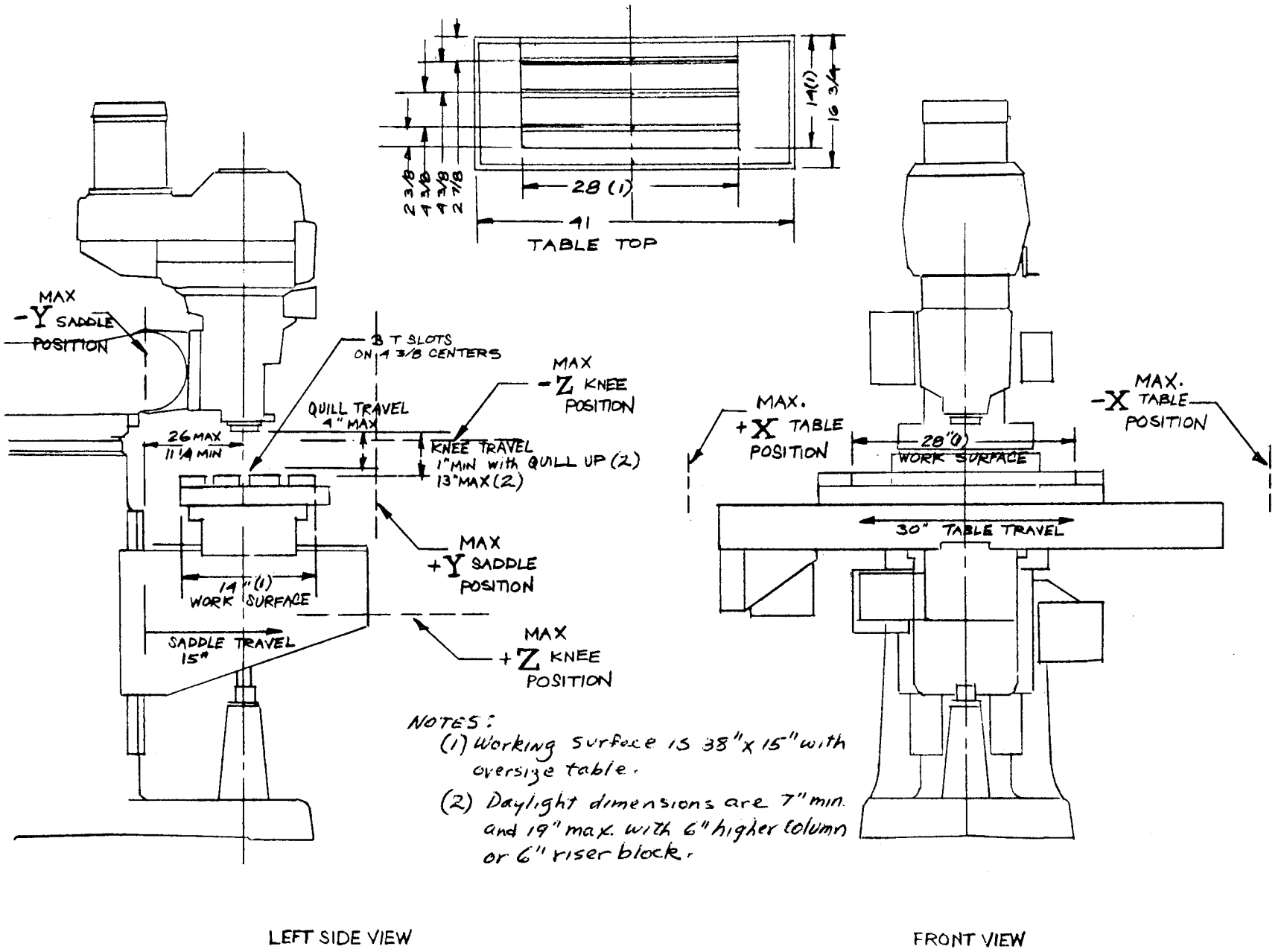
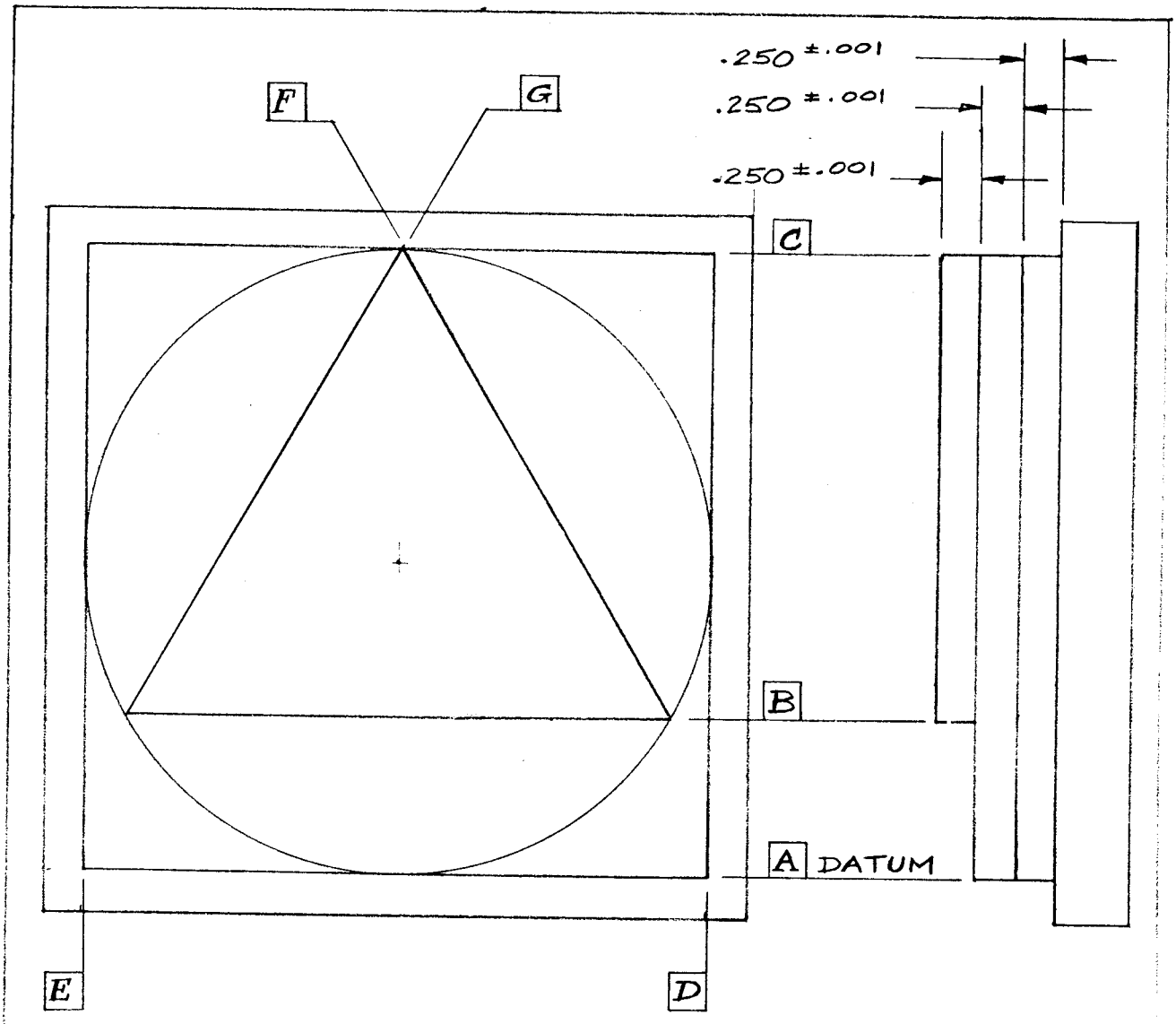


Figure 2-1. Axis Travel Ranges



	TOLERANCE	ACTUAL
4.000 x 4.000 SQUARE	± .001	
4.000 DIA. CIRCLE	± .001	
A PARALLEL TO **B**	.0015 TIR	
A PARALLEL TO **C**	.0015 TIR	
A SQUARE TO **D**	.0015 TIR	
A SQUARE TO **E**	.0015 TIR	
F 60° TO **A**	.002 TIR	
G 60° TO **A**	.002 TIR	
CIRCLE ROUNDNESS (DIA)	.002 TIR	
SURFACE FINISH	63√	

Figure 2-2. Accuracy Cutting Test

Type: 2-1/8" diameter, class 7 bearings, with Bridgeport Quick-Change #40 taper. (Also available, Universal #300).

Speed and Horsepower: Horsepower varies with spindle speed through two ranges. (See Fig. 2-3). Range selection is through a manually operated gear change lever. Spindle speed is manually adjustable in infinitely small steps through the following speeds:

Low Range.....50 to 400 RPM
Hi Range .....450 to 3500 RPM

2.4 FEED RANGE

	Range	Steps
XY Axes	1 to 39 ipm	1 ipm
Z Axis	1 to 20 ipm	1 ipm

Rapid traverse is 80 ipm. XY axes, 24 ipm -Z, 40 ipm +Z.

Programmed feedrate may be adjusted ±50% by means of an infinitely variable feedrate override dial on the operator's console. Maximum coded feedrate plus override shall not be more than 40 ipm in XY and 20 ipm in Z.

The system maintains constant velocity in the feed ranges regardless of the slope of cut for both 3 axis linear and 2 axis circular interpolation.

2.5 WEIGHT

Maximum allowable weight of workpiece and tooling is 1,000 lbs.

2.6 AXIAL FORCE AT SPINDLE

The Bridgeport Series II N/C system positions by using stepping drive motors connected to anti-backlash ball lead screws through nonslip timing belts. A patented axis drive control system maintains constant output torque at the drive motor shaft throughout the low-feed cutting range. Figure 2-4 shows the table force developed by each axis drive. If the cut required more force than the axis drive can supply, mispositioning will occur.

As the tool dulls, the force necessary to drive the tool into the work increases. If the machine feed and speed is pushed to the maximum, the tool may be dull enough by the second or third cut to cause mispositioning.

CAUTION: Plunging into an extremely deep cut at a high feed may instantaneously exceed the force developed by the axis drive. Care should be exercised to avoid this.

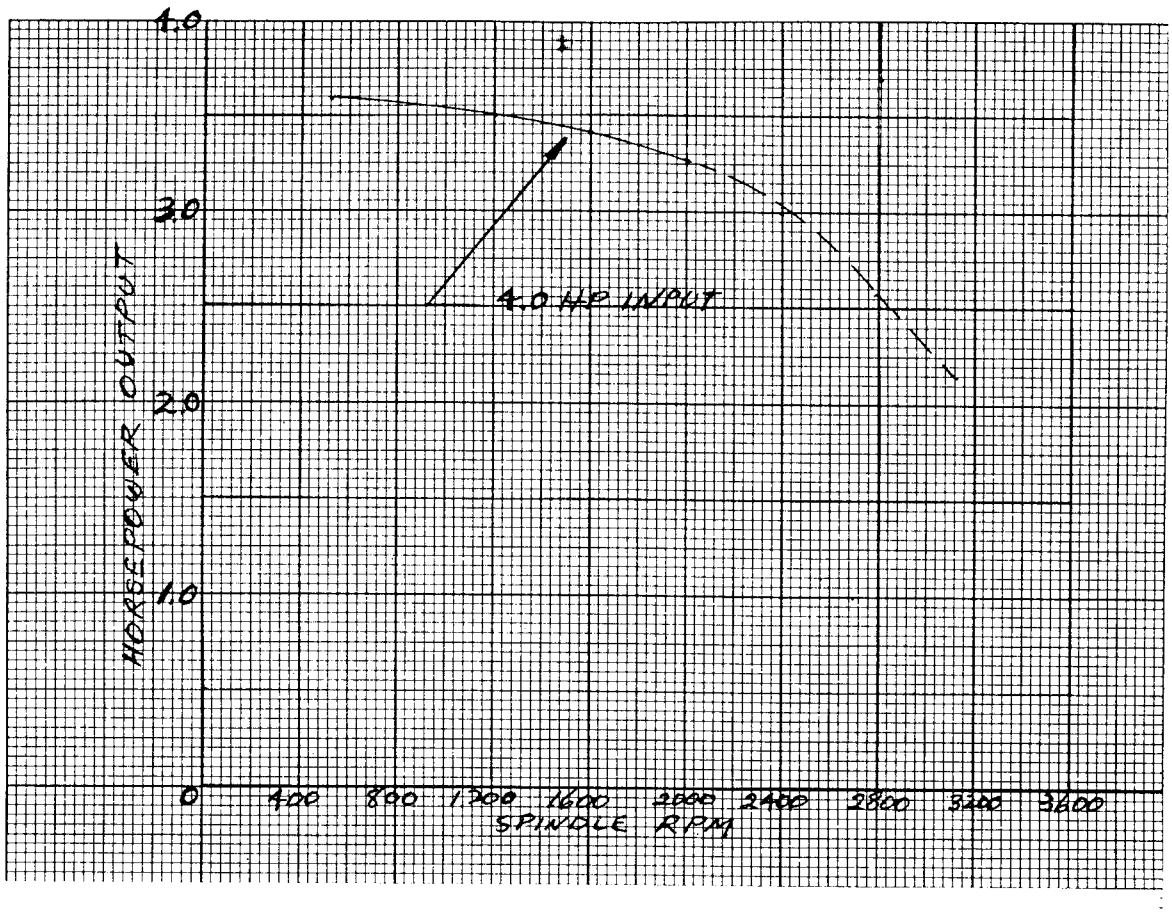


Figure 2-3. Horsepower vs. Spindle Speed

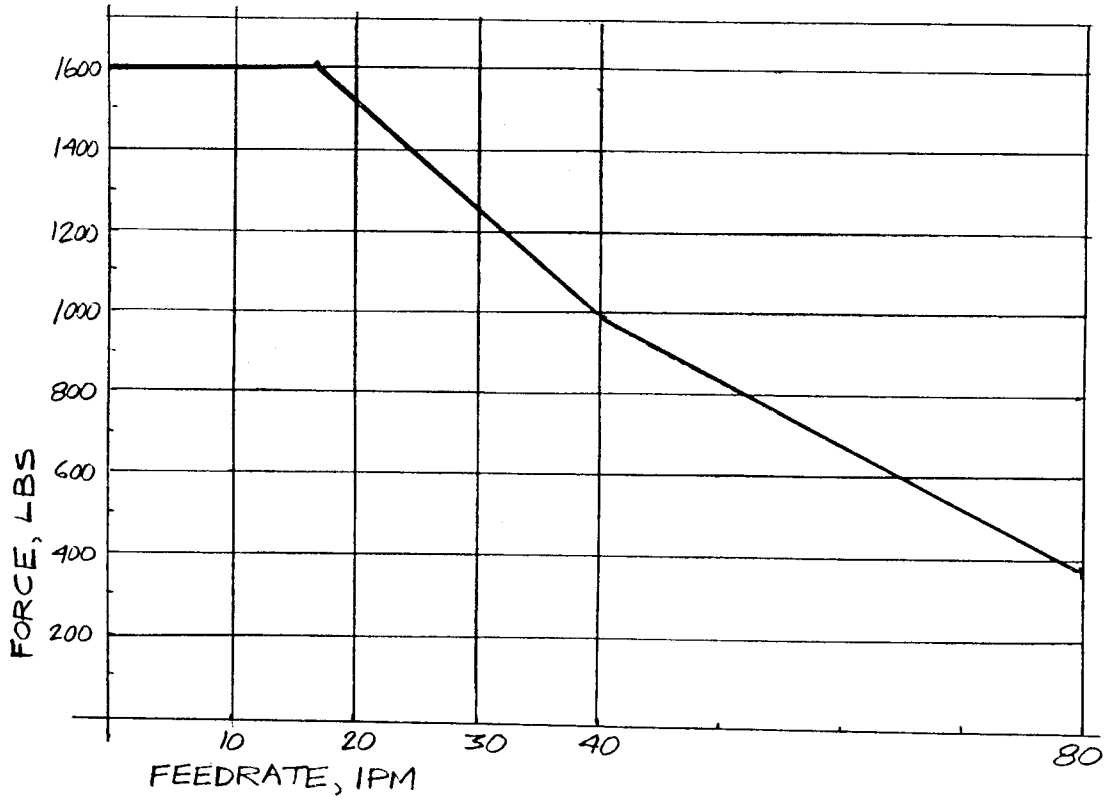


Figure 2-4. Axial Force at Spindle