Product and Process Information

Product Specifications:

Equipment:
KLR-200 Series 2-Axis CNC Lathe
CNMG 321-PM 4325 Tool Insert

Product Specifications:
Cylindrical steel shaft with keyrings slots and varying diameters to fit several bearing types.

Process Specifications:
Turning and grooving with CNC lathe that is operate through G-Code.

Variables for Transformation Equations:

N [rev/min] = Rotational speed of workpiece
f [in/rev] = Feed
v [in/min] = Feed rate
V [in/min] = Surface speed of workpiece
L [in] = Length of cut
D_o [in] = Original diameter of workpiece
D_f [in] = Final diameter of workpiece
D_{avg} [in] = Average diameter of workpiece
d [in] = Depth of cut
A_s [in^2] = Area of shear plane
S [psi] = Shear strength
F_c [N] = Cutting force
α [°] = Rake angle
β [°] = Clearance angle
ϕ [°] = Shear plane angle
t [min] = Cutting time
MRR [in^3/min] = Material removal rate
T [lb-ft] = Torque
P [hp] = Power
n [] = Taylor's tool life exponent
C [in/min] = Taylor constant
TL [min] = Tool life

Transformation Equations

Feed Rate: $v = fN$
Avg. Diameter of Workpiece: $D_{avg} = (D_o + D_f)/2$
Maximum Surface Speed: $V = \pi D_o N$
Average Surface Speed: $Vavg = \pi D_{avg} N$
Depth of Cut: $d = (D_o - D_f)/2$
Cutting Time: $t = L/fN$
Material Removal Rate: $MRR = \pi D_{avg} Nfd$
Shear Plane Angle: $\phi = 45 + \alpha/2 - \beta/2$
Area of Shear Plane: $A_s = fd/\sin\phi$
Shear Force: $F_s = SA_s$
Cutting Force: $F_c = F_s\cos(\beta - \alpha) / \cos(\phi + \beta - \alpha)$
Torque: $T = F_c D_{avg}/2$
Power: $P = F_c V/33{,}000$
Tool Life: $T_L = (C/V)^{1/n}$

m

Input

Electrical Energy: 20 hph
Material: Steel

Output

Completed Shaft
Material Removed: 31.1837 in^3

Resources

Equipment: KLR-200 Series 2-Axis CNC Lathe
Tools: Turning tool with CNMG 321-PM 4325 Tool Insert
Software: CNC with G-Code