HIGH VOLTAGE CONNECTOR

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INTRODUCTION

The originally designed high voltage connectors were to be made of brass. However, if treated like a Bellevile spring with the initially given dimensions, the stresses of the connector when crimped were calculated to be much higher than the yield stress of brass. Since the flange and outer diameters of the connector are to remain small, it was necessary to alter the other dimensions and choice of material in order to bring down the stresses applied to the connector.

STRESS CALCULATIONS

One reason that brass was originally chosen was because of its low modulus of elasticity. But, even by greatly adjusting the dimensions of the connector to produce stresses less than that of yield, the deflection allowed due to crimping would have to be .001" of less. A deflection of at least .002" was desired so two other materials with low moduli and higher yield stresses, beryllium copper and phosphorous bronze, were also investigated.

The formulas used to calculate the stresses in the connector (Belleville spring) were:

$$Q_A=-((E*\partial)/((1-v^2)*M*a^2))*((C_1*(h-\partial/2))+(C_2*t))$$

$$Q_B=-((E*\partial)/((1-v^2)*M*a^2))*((C_1*(h-\partial/2))-(C_2*t))$$

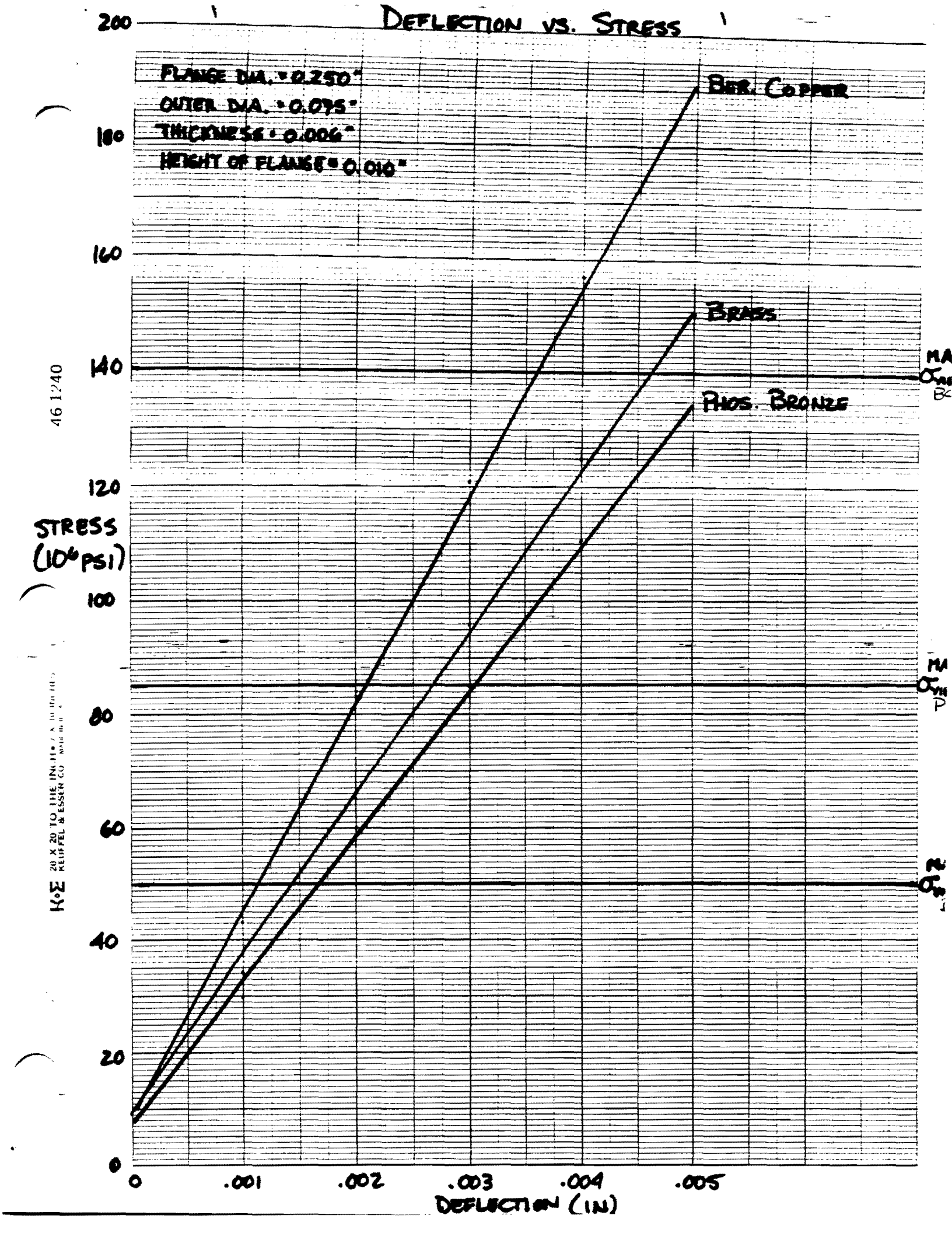
E=modulus of elasticity
∂=deflection
h=cone height of either inner or outer surface
t=thickness
v=Poisson's ratio
a=outer radius of middle surface
b=inner radius of middle surface
M, C_1, C_2 are constants whose values are functions of a/b

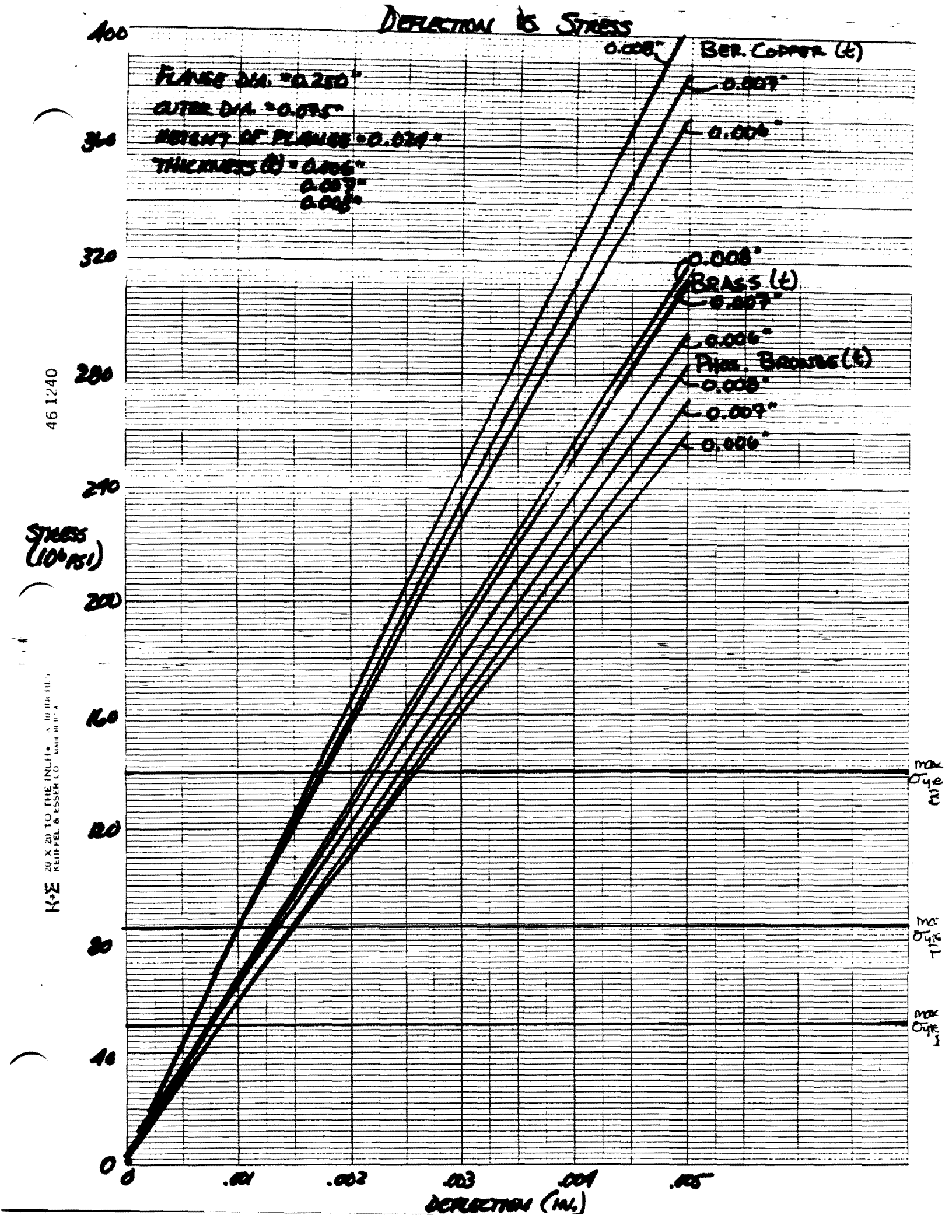
The stresses of brass, beryllium copper, and phosphorous bronze were calculated for various deflections under seven different cone height and thickness conditions at point A, where the higher stress occurs, and the results graphed. (See attached graphs.)

CONCLUSION

From the results of the graphs, it was decided that berylium copper would be used with a given cone height and thickness of .010" and .006", respectively. With these dimensions, the stress occuring for a deflection of .002" is 83,677 PSI, or 60% of the yield stress, a safety factor of 1.67. The numbers of the drawings for the design of the connector and its corresponding lug are DWG. 3740.222-MB-223799 and DWG. 3740.222-MB-223800 A.

DEFLECTION VS. STRESS




DEFLECTION VS STRESS
FLANGE DIA. = 0.250"
OUTER DIA. = 0.375"
HEIGHT OF FLANGE = 0.024"
THICKNESS (t) = 0.006"
0.007"
0.008"
0.008" BER. COPPER (t)
0.007"
0.006"
0.008" BRASS (t)
0.007"
0.006"
PHOS. BRONZE (t)
0.008"
0.007"
0.006"
STRESS (10³ PSI)
400
360
320
280
240
200
160
120
80
40
0
0
.001
.002
.003
.004
.005
DEFLECTION (IN.)
max σ ye
max σ ty
max σ ty
46 1240
K&E 20 X 20 TO THE INCH
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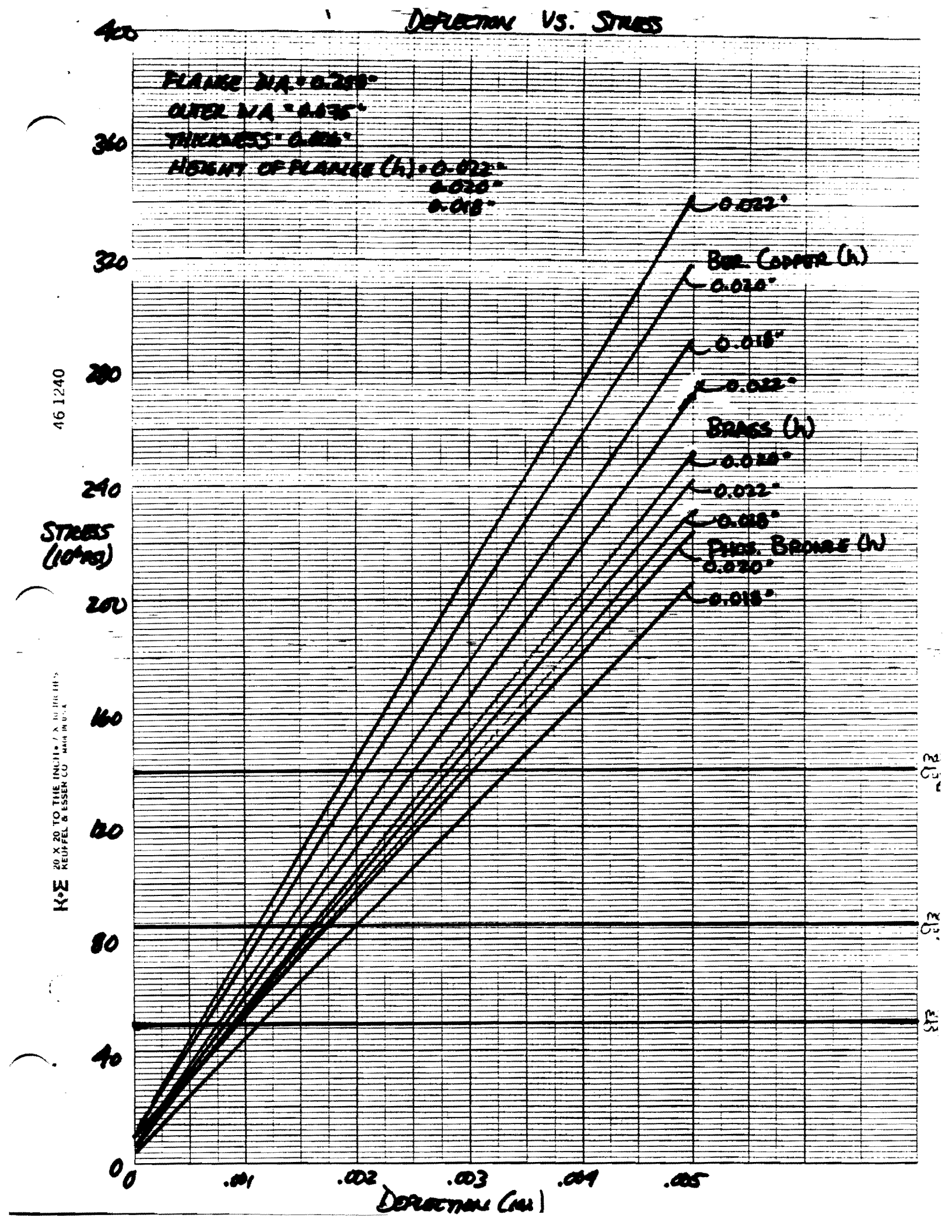
DEFLECTION VS. STRESS
PLANKE W.A. = 0.250"
OUTER W.A. = 0.135"
THICKNESS = 0.016"
HEIGHT OF PLANKE (h) = 0.022"
0.020"
0.018"
BER. COPPER (h)
0.022"
0.020"
0.018"
BRASS (h)
0.022"
0.020"
0.018"
PHOS. BRONZE (h)
0.022"
0.020"
0.018"
STRESS (10^3 psi)
DEFLECTION (in.)
400
360
320
280
240
200
160
120
80
40
0
.001
.002
.003
.004
.005
46 1240
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