Example 6
PLATE IN FLEXURE
Illustrating Section F.2

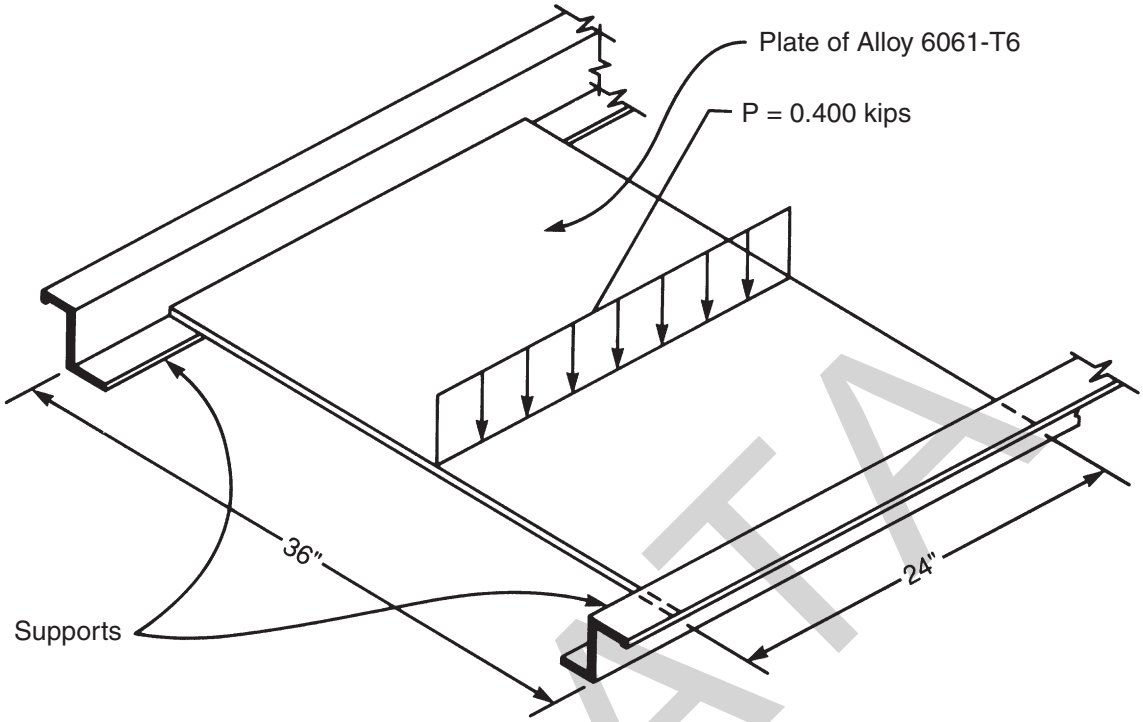

Figure 6

GIVEN:

1. Load 0.400 k, along a line at the center of a plate.
2. Plate: 24 in. wide, spanning 36 in.
3. Alloy: 6061-T6
4. Structure type: building

REQUIRED:

Minimum standard thickness to support the load safely without deflectingmorethan3/8in.

SOLUTION:

From Part VI, Beam Formulas Case 1, simply supported beam, concentrated load P at center

$M = PL/4 = (0.4)(36)/4 = 3.60$ in-k

For building-type structures, Section F.1 gives a safety factor of 1.95 for the rupture limit state and 1.65 for all other limit states.

The allowable yield moment M_{np}/Ω given in Section F.2 is the lesser of $1.5SF_{ty}/\Omega$ and ZF_{ty}/Ω; using F_{ty} = 35 ksi (see Table A.3.3), Ω = 1.65, and setting the allowable yield moment equal to the required moment:

$ZF_{ty}/\Omega = Z(35\ \text{k/in}^2)/1.65 = 3.60$ in-k

gives $Z = 0.170$ in^3.

and

$1.5SF_{ty}/\Omega = 1.5S(35\ \text{k/in}^2)/1.65 = 3.60$ in-k

gives $S = 0.113$ in^3.

The allowable moment for the limit state of rupture given in Section F.2 is $M_{nu}/\Omega = ZF_{tu}/k_t/\Omega$; using F_{tu} = 38 ksi and k_t = 1.0 (see Table A.3.3), Ω = 1.95, and setting the allowable moment equal to the required moment:

$ZF_{tu}/k_t/\Omega = Z(38\ \text{k/in}^2)/1.0/1.95 = 3.60$ in-k

gives $Z = 0.185$ in^3.