

Assumptions–Caution Flags in Design

Assumptions are used as a last resort when necessary information is not accessible or does not exist. Because assumptions are uncertain, they qualify the acceptability of your design especially since they are the basis for your solution. Care must be taken when listing them. Choose precise language to avoid confusion and vagueness. Guidelines in the tables below will help to identify proper statements. Next to each assumption, the implication of the assumption is stated.

Do not include material properties or factors of safety as assumptions. Do include statements about the material and nature of loading which help to define the factor of safety or material load limits.

Assumption	Implication
The working normal stress σ_w is approximated as 50% of the ultimate normal stress, σ_{ult} .	Since a yield strength was not available, a working normal stress of $0.5 \sigma_{ult}$ is used. The factor of safety is applied to the working normal stress, σ_w .
The yield shear stress τ_y is approximated as 60% of the yield normal stress σ_y . (This is based on comparison of τ_y to σ_y for similar metals.)	Since the shear strength at yield was not available, but the normal yield stress is, a yield shear stress is assumed to be $0.6\sigma_y$.
The composite material is isotropic and homogeneous.	Material properties are independent of direction. Include only if materials are not obviously isotropic and homogeneous and actual properties are unavailable.
The load on the lamp is assumed to be the weight of a three-year-old child.	The load on a lamp is neither obvious nor intended but a plausible load is necessary for design.

Do not treat the list of assumptions as a laundry list of specifications. Do identify conditions which are not explicit in the problem statement but will allow you to use certain theories or properties.

Assumption	Implication
All beam deflections are small and plane sections remain plane during loading.	Bernoulli-Euler beam theory is used even though deformation may be large.
The slot is treated as a circular hole for the purpose of applying stress concentration factors. (Value could not be found for slot.)	Treat the circular end of the slot as a single circular hole to determine the stress concentration that develops as a result of axial loads.
Material response is linearized in the nonlinear elastic region of the stress-strain curve.	The modulus of elasticity can be used to relate stress to strain. No deformations are permanent.

Exercise 4. Below is a list of assumptions which are incorrect, i.e., improper or poorly stated. Consider why each is inappropriate and correct the wording of those that have merit as assumptions. The first one is done for you.

Assumption	Correction
The welds are sufficiently strong.	Eliminate the statement from the ASSUMPTIONS section of the report. If you do not intend to design the weld, provide a statement to that effect in the WARNINGS section.
The weight of snow is assumed to be 20 lbs per square foot.	
The bar does not lose a significant amount of strength when bent.	
The factor of safety for impact is 2.	
Working shear stress is 20.5 ksi.	
Each bolt that secures plate A to B carries the same load.	
The plate is treated as a cantilever beam.	