

Safety Factors

ANSI A92.2 dictates that for a non-ductile material (fiberglass, with about 3% elongation) must have a design stress of less than 20% of the minimum ultimate strength of the material. This translates (inverts) to a safety factor of 5:1 of the rated load. The specification further requires that the analysis consider the effects of stress concentration and dynamic loading (and loading on a 5 degree slope). Most designs we have seen and the calculations we have used referenced the old Canadian Standard CSA-225 (I think was the number, it has been a number of years). The CSA defined dynamic loading as no less than 1.25 and stress concentration as no less than 1.1. If you perform an actual test to failure on the boom, you don't have to consider stress concentration.

Therefore we have seen a lot of designs with 5 x 1.25 or 6.25:1 safety factors. Since we take the booms to failure, but may not completely simulate the stress concentration using our test fixtures, we typically have quoted the minimum safety factor as 7:1 when we have quoted a boom. This would be 5 x 1.25 x 1.1 or 6.875:1, which we rounded up to 7:1. The CSA has now been harmonized with A92.2, so it no longer exists, but many of the other A92 specifications for different types of lifts are using the same loading factors. Where the customer does not specifically require the dynamic loading to be calculated in the analysis, most designers default to the 1.25 factor.

By Bob Simon

