

Transverse Strength

Three 6x8 ID thin wall booms were tested to destruction and resulted in an ultimate strength (outside facing stress) of 42,000 psi average. The booms were sectioned and sent to independent labs for coupon tests and tensile, compressive and flexural strength were all performed on these booms. One lab also performed some transverse tests. In lab terminology, a coupon cut parallel to the axis of the boom would be a longitudinal coupon, and a specimen cut 90 degree to the longitudinal direction would be called a transverse coupon. Since the strongest booms will have a predominance of fibers running in the direction of the load and this boom in particular had very little fibers running in the transverse direction, WBCL would expect that the longitudinal coupons would be stronger than the transverse coupons.

Typically coupon tests do not completely mimic the actual destruction of a boom because boom failure, especially on a thin wall part like this, can be attributed to more than just the outside fibers breaking in tension or compression. The failure is a combination of flexing and buckling in all directions and typically a compressive failure in the bottom face. This is why WBCL designs with the destructive test rather than rely on coupon tests for ultimate strength. Another observation in non-ductile (low elongation at failure) materials such as the fiberglass/epoxy used in the WBCL parts is the ultimate and yield strengths are almost the same. To explain this better, a part can be taken up to a load that is close to failure and then taken back down to a no load state many times with little impact on the final destructive load.

The three labs reported tensile strengths averaging about 47,000 psi on the coupons, compressive strength of about 38,000 psi and flexural strength of 60,000 psi. One lab also tested the transverse direction and in flexural, the transverse properties were approximately 85% of the longitudinal coupons. Compressive strength was also checked by this lab in both directions with similar results. Since tensile strength was not tested by this particular lab, WBCL doesn't have actual numbers to report, but WBCL can deduce that like flexural and compressive strength, WBCL would expect that the tensile strength would drop by a similar amount. Therefore, if the boom is averaging about 48,000 psi in tension in the longitudinal direction, WBCL would expect that the transverse direction would average around 41,000 psi.

By Bob Simon