We have carried out the first systematic survey of the sub-millimeter properties of broad absorption line (BAL) quasars. 30 BAL quasars drawn from a homogeneously selected sample from the Sloan Digital Sky Survey at redshifts 2 < z < 2.6 were observed with the SCUBA array at the JCMT to a typical rms sensitivity of 2.5 mJy. Eight quasars were detected at > 2σ significance, four of which are at > 3σ significance. The far-infrared luminosities of these quasars are > 10^{13} L. There is no correlation of sub-millimeter flux with either the strength of the broad absorption feature or with absolute magnitude in our sample. We compare the sub-millimeter flux distribution of the BAL quasar sample with that of a sample of quasars which do not show BAL features in their optical spectra and find that the two are indistinguishable. BAL quasars do not have higher sub-millimeter luminosities than non-BAL quasars. These findings are consistent with the hypothesis that all quasars would contain a BAL if viewed along a certain line-of-sight. The data are inconsistent with a model in which the BAL phenomenon indicates a special evolutionary stage which co-incides with a large dust mass in the host galaxy and a high sub-millimeter luminosity. Our work provides constraints on alternative evolutionary explanations of BAL quasars.