Abstract: In models with Universal Extra Dimensions (UED), the mass spectrum of Kaluza-Klein partners of the Standard Model particles depends on the size of the extra dimension as well as on bulk and boundary localized higher dimensional operators. We show that bounds from flavor physics and electroweak precision tests strongly constrain these operators. This in turn implies characteristic patterns of degeneracies and splittings in the Kaluza-Klein partner mass spectrum which can be searched for at the LHC.