In this paper we propose a way to weakly prescribe Dirichlet boundary conditions in embedded finite element meshes. The key feature of the method is that the algorithmic parameter of the formulation which allows to ensure stability is independent of the numerical approximation, is relatively small and can be fixed a priori. Moreover, the formulation is symmetric for symmetric problems. An additional element-discontinuous stress field is used to enforce the boundary conditions in the Poisson problem. Additional terms are required in order to guarantee stability in the convection-diffusion equation and the Stokes problem. The proposed method is then easily extended to the transient Navier-Stokes equations.