Hollow black body

Black body radiation can be approximated by employing a hollow body of homogeneous temperature with a small opening.

Task: A hollow copper sphere of a homogeneous temperature T_S is $d_\mathrm{S} = 20\,\mathrm{cm}$ in diameter. Its internal surfaces are grey and emit diffuse radiation; the emissivity is $\epsilon_\mathrm{S} = 0.55$. Determine the diameter of a circular opening d_O necessary to emit radiation of the temperature T_S, equivalent to the sphere's temperature, which differs from the amount of radiation emitted by a black body by exactly 1 %. Consequently the surface area of the opening has an emissivity of $\varepsilon_\mathrm{O} = 0.99$.

Assumptions: Interactions of radiation between the sphere or opening and its surroundings can be disregarded ($\epsilon_\mathrm{A} = 1$, $T_\mathrm{A} = 0\,\mathrm{S}$).