Collison-induced absorption coefficients for the 1.27 μm band of O₂ have been measured at a resolution of 0.5 cm⁻¹ and an optical pathlength of L = 84 m using a Fourier-transform spectrometer and 2-m long White-type multipass absorption cell. Spectra were recorded for sample densities, p, from 1 to 10 times that of an ideal gas under standard conditions (T = 273.15 K and P = 101.325 kPa), i.e., 1 to 10 amagats, at temperatures of 253 K, 273 K, and 296 K, for pure O₂ and O₂/N₂ mixtures. After removing the contributions from the sharp lines of the v = 0 ← 0 component of the O₂ a¹Δg ← X³Σg⁻ band, which overlaps the continuum band, the integrated band strength per unit pathlength, S = S_{O₂→-O₂}ρ_{O₂}² + S_{O₂→-N₂}ρ_{N₂}ρ_{O₂}, has been determined for several values of the densities, ρ_{O₂} and ρ_{N₂}, to give values for S_{O₂→-O₂} and S_{O₂→-N₂}. At 296 K we find S_{O₂→-O₂} = 4.847(22) × 10⁻¹⁸ cm⁻² (molecule/cm³)⁻² [3.400(16) × 10⁻¹⁹ cm⁻² amagat⁻²] and S_{O₂→-N₂} = 0.941(50) × 10⁻¹⁸ cm⁻² (molecule/cm³)⁻² [0.679(36) × 10⁻¹⁹ cm⁻² amagat⁻²]. Here and elsewhere, Type A expanded uncertainties are given with a coverage factor k = 2. The S_{O₂→-O₂} coefficient is in reasonable agreement with the previous measurements of Cho et al. [C.W. Cho, E.J. Allin, and H.L. Welsh, Can. J. Phys. 41, 1991-2002 (1963)], however our value of S_{O₂→-N₂} is a factor of 2.6 times greater than their results. The derived air coefficient, S_{O₂→air}, is 37 % greater than the value determined by Mlawer et al. [E.J. Mlawer, S.A. Clough, P.D. Brown, T.M. Stephen, J.C. Landry, A. Goldman, and F.J. Mucciay, J. Geophys. Res. 103, 3859-3863 (1998)] from an atmospheric measurement, which has been corrected for the most recent value for the absorption coefficients for the overlapping O₂ a¹Δg ← X³Σg⁻ band. The binary collision coefficients are available as a function of frequency for use in atmospheric modeling.