Air-velocity along a pipe-wall

From air-velocity-measurements in an airflow in a pipe, a table is made in which the wall-velocity is given in relation to the mean velocity and as a function of the Reynolds-number of the flow.

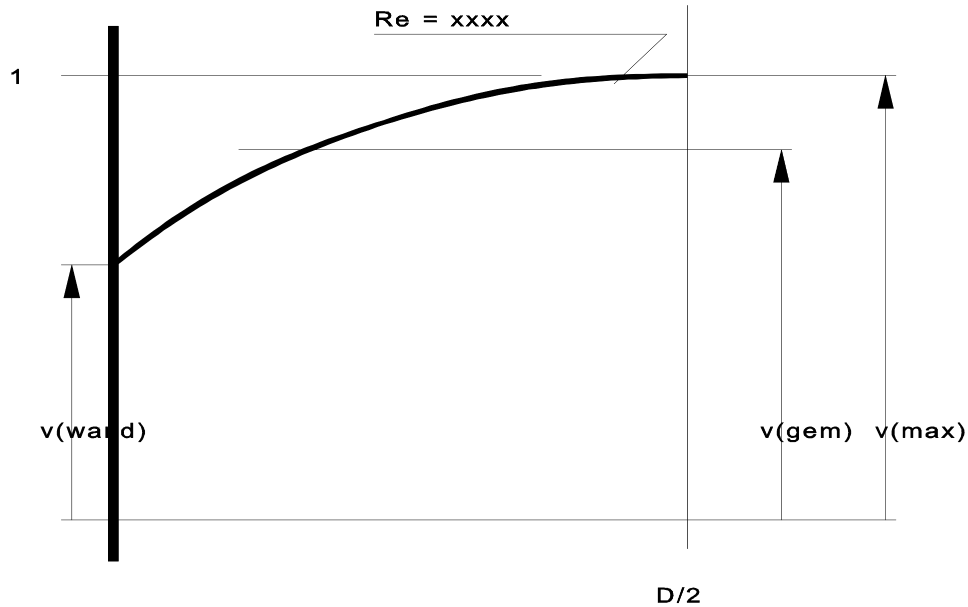

FIG.40

Table : v(wall) = factor * v(mean)

factor	Re-number
0,2983	4,0 * 10^3
0,3547	2,3 * 10^4
0,3935	1,1 * 10^5
0,5009	1,1 * 10^6
0,5244	2,0 * 10^6
0,5385	3,2 * 10^6

This factor can be represented by a logarithmic regression-line as a function of the Re-number as follows :

$$\text{factor} = -0{,}0165 + 0{,}0369 * \ln(Re)$$

Substituted :

$$v(\text{wall}) = (-0{,}0165 + 0{,}0369 * \ln(Re)) * v(\text{mean})$$

in which :

$$Re = \frac{1.293 * 273/(273+t_{ambient}) * 1/p_{ambient} * Vol_p}{\pi/4 * D * \eta(0) * \sqrt{\dfrac{T * (1 + C/T(0))}{T(0) * (1 + C/T)}}}$$

The condition for a flow ,whereby no fall back or depositing against the wall occurs is given by :

v(wall) => constant * local suspension velocity (vz)

Normally :

Vertical : v(wall) = 2 * vz(locally)

Horizontal : v(wall) = 2,5 * vz(locally)

Generally :

$$v(\text{wall}) = \sqrt{2^2 \sin^2(\alpha) + 2{,}5^2 \cos^2(\alpha)} * vz(\text{loc})$$

From : v(wall) = (-0,0165 + 0,0369*ln(Re)) * v(mean)
and : v(wall) = constant * vz(locally)
follows :

$$v(\text{mean}) = \frac{\text{constant} * vz(\text{locally})}{(-0{,}0165 + 0{,}0369 * \ln(Re))}$$