Air Vision,

Pressure loss due to a stationary fan

Often we are requested to know what will be the pressure loss caused by a fan stopping to operate, after an electrical or mechanical breakdown, in order to size sufficiently another fan far further on the same circuit, which will compensate momently the loss of pressure, without to affect the stable flow.
The information below is extracted from test but with only one type of fan. This is then empiric values which are able to change according the fan geometry. However, they allow us to fix some realistic data for this problem.

As every quadratic drop pressure, it will looks like the following expression:

$$\Delta p = K\, v^2.\rho/2.g \text{ , expressed in mmwk},$$

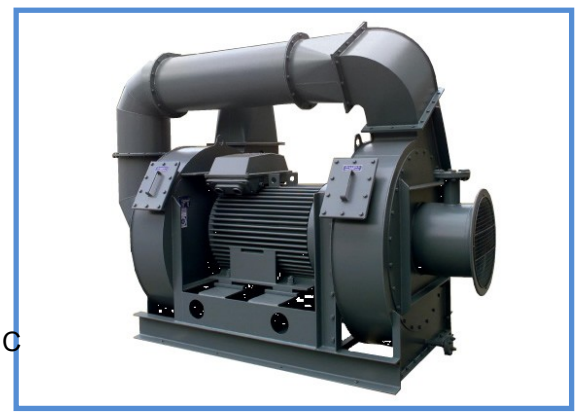
with :
K= pressure drop coefficient, without unit
V= air speed at the obstacle point causing the pressure drop, in m/s
ρ=density of the gas at the obstacle point, in kg/m³
g=9.81 m/s² = gravity acceleration

It is then the value K which allows to calculate the pressure drop of the stationary fan.

Case 1: Out of order fan with flowing gas in the proper flow direction of the fan

We take as value v, the speed resulting from the flow at the section of the inlet cone fan.

C



-If the impeller is blocked, for example with a brake or a backstop,
K = 2.3 à 2.6

-if the impeller rotates freely thank to the flow animating it,

K will be close to 1

Case 2 : Out of order fan with flowing gas in the opposite way of the proper flow direction of the fan

We use the value v corresponding to the flow in the outlet section fan.

-if the impeller is blocked thanks to a brake or backstop, K= 25 à 30

-if the impeller rotates freely under the natural air flow, we do not have empiric data, because depending of the dynamic speeds vectors triangle, relative and absolute of the air at the impeller tip. Vectors, which are changing according the blades shape and the tip speed of the impeller.