**Calculation of gas costs for Leak rates**

Taking a Pressure drop rate for one gap as the max accepted limit of 1mm WC over 10 mins. For any gap.

Gives 0.2mbar/10mins

Assume here for a bottom gap of 2m2 = 4000cm3 = 4litres.

dP/dt = 0.2mbar/10mins = 3.3 E -04 [mbar/s]

for a bottom gap of 4litres

Leak Rate = 3.3 E -04 x 4 = 1.32 E -03 [mbar.l/s]

This at std of 1bar atmospheric is equivalent to 1.32E -03 [cm3/s]

One year operation of say 300days = 26 E 06 [s]

Lose of gas in one year for 1 gap = 26E 06 x 1.32E -03 [cm3]

= 34.3E 03 cm3 = 34 litres

In the RE1,2,3 & 4 we will have effectively 2 bottom gaps per chamber and 576 chambers

= 1152 gaps x 34 litres

= 40klitres per year

A bottle of Freon costs 5770chf/466kg in CERN stores ( as used in the experiments?) = 12.4chf/kg

R134a gas density = 4.25kg/m3 = 4.25kg/1000litres = 4.25E -03 [kg/litres] = 0.0527 [chf/litres]

Therefore 40k litres/year costs 2kchf.

One hour at 700litres/hr costs 40chf/hr and 265kchf/year

Lose per hour

= 1152 gaps at a leak rate of 1.32E -03 [cm3/s]

1152 x 1.32E-03 x 3600 [cm3/hr] = 5474/1000 [litres/hr] = 5.5[litres/hr]

These values will become worse as we go through the chamber, super-module, sector and P2 stages. To measured.

We know the CMS RPCs use 500 or 700 [litres/hr], so clearly the total leak rate is coming from somewhere else, the RE uses <100litres/hr and so we have a base value for gap testing that should be respected BUT with very flexible margins.

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24 Jan 2013

Ref;

http://encyclopedia.airliquide.com/Encyclopedia.asp?GasID=141