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INFLUENCE OF LEAKAGE WHEN MEASURING AIR EXCHANGE EFFICIENCY

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SUMMARY

Air exchange efficiency is measured using a transient change in tracer gas concentration. This can be made using clean supply air and tracer gas in the room air or tracer gas in the supply air and clean room air. Air leaking into the test room disturbs the measurements. This is discussed and measurements indicating no leakage are given.

INTRODUCTION

When measuring the air exchange efficiency it is customary to use a step-change in the concentration of tracer gas in supply air. All other flow characteristics should be kept constant as it is essential that the state of flow is steady during the experiment. The step change can be made in two different ways:

- o Room air at zero concentration. Step change of tracer gas concentration in the supply air from 0 to 100%.
- o Room air and supply air at 100% tracer gas concentration. Step change of tracer gas concentration in the supply air from 100 to 0%.

If the test is made so that it does not change the air flow in any way and if the room has no other air exchange than the controled ventilation, then the two different ways should give exactly the same result. However, this is seldom the case.

LEAKAGE

An obvious reason for differences between the two methods, is leakage of air. The air leaking into the test room has no tracer gas and will be taken as original room air in the first method and as supply air in the second. When using the first method, with tracer gas in the supply air, leakage air makes it impossible to achieve even concentration in the test room in steady state, unless mixing in the room is god. The second method, with even concentration of tracer gas in the test room when starting the experiment, is disturbed by leakage air, too. Artificial mixing of the room air up to the moment the experiment starts, that is tracer gas in the supply air is stopped, is not possible as the room air flow then changes during the experiment. With leakage air it is then impossible to have perfectly even concentration in the room when the experiment starts.

During the experiment leakage will cause differences between the two methods. This is of course due to the fact that the leakage air is taken as ventilation air in one method but not in the other. When representing graphically the results from the concentration measurements those often are normalized by dividing with the total step change from the starting concentration to the final steady state concentration. Also when doing this differences normally occur between measurements made according to the two methods, if air mixing in the room not is very good.

MEASUREMENTS

Measurements have been made in a model, see fig. 1. Examples of results from two of the tests are given in fig. 2 and fig. 3. Supply air was heated in order to create stagnation. Tracer gas was N_2O and the instrument used Miran 104A equipped with a specially made small cuvette in order to decrease the necessary flow rate for the concentration measurement.

The results shown in the graphs indicate the closest agreement achieved between the two test methods, in our tests. The results indicate a very small leakage.

CONCLUSION

Measurements of tracer gas concentrations in different places in a test model have been made. The results indicate good agreement between two different methods of measuring air exchange efficiency in a room: clean room air and tracer gas in the supply air and tracer gas in the room air and clean supply air. This is probably caused by absence of leakage air.

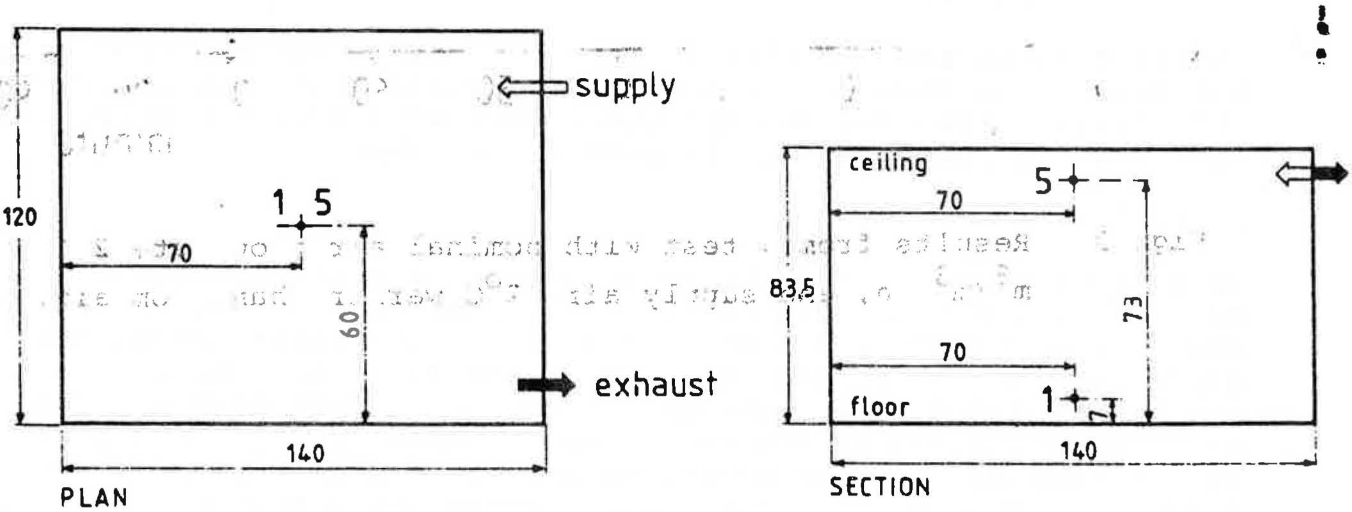

Fig. 1 Dimensions of test model.

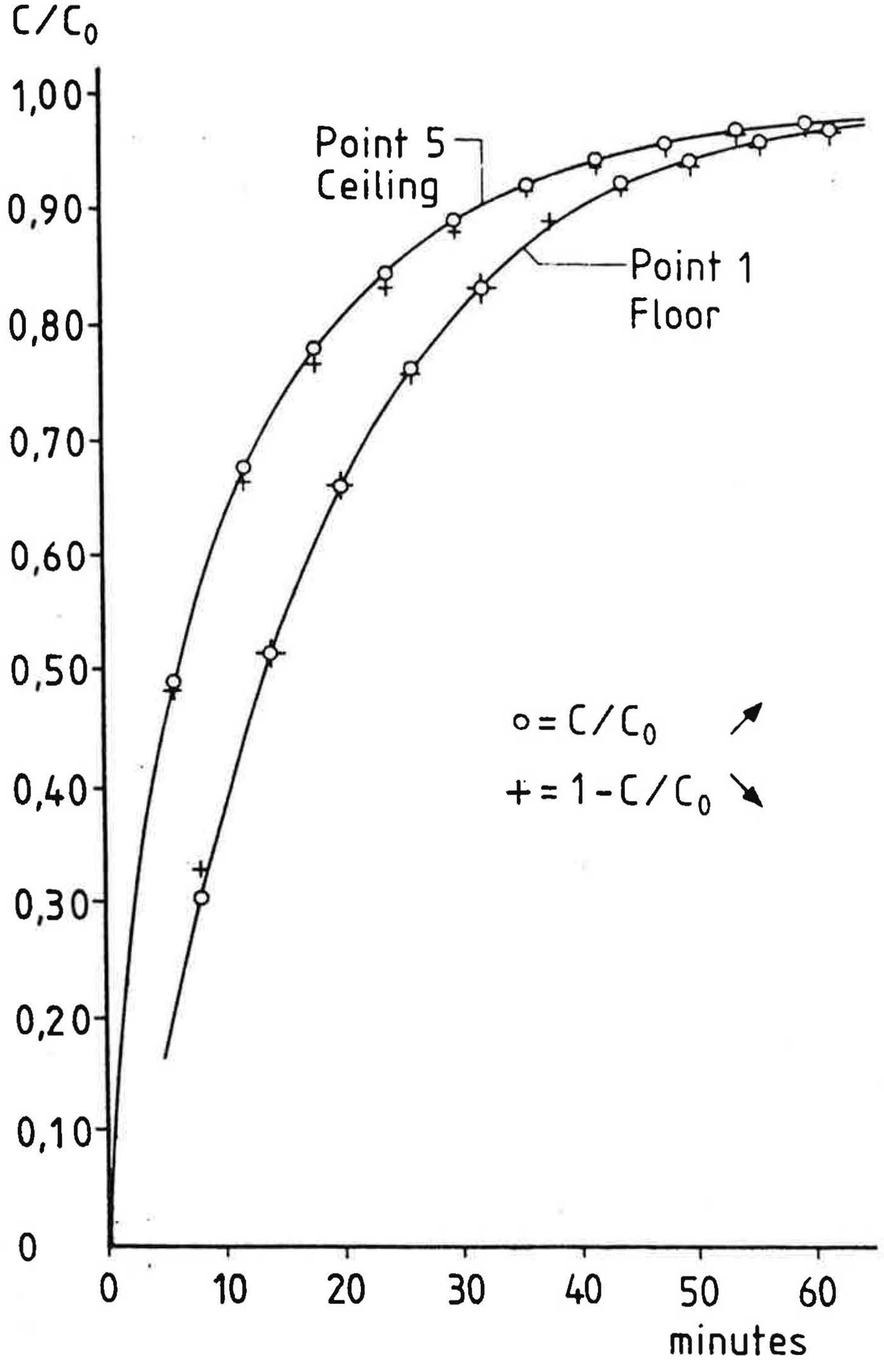

Fig. 2 Results from a test with nominal air flow rate 4,2 m^3/m^3,h, and supply air 45°C warmer than room air.

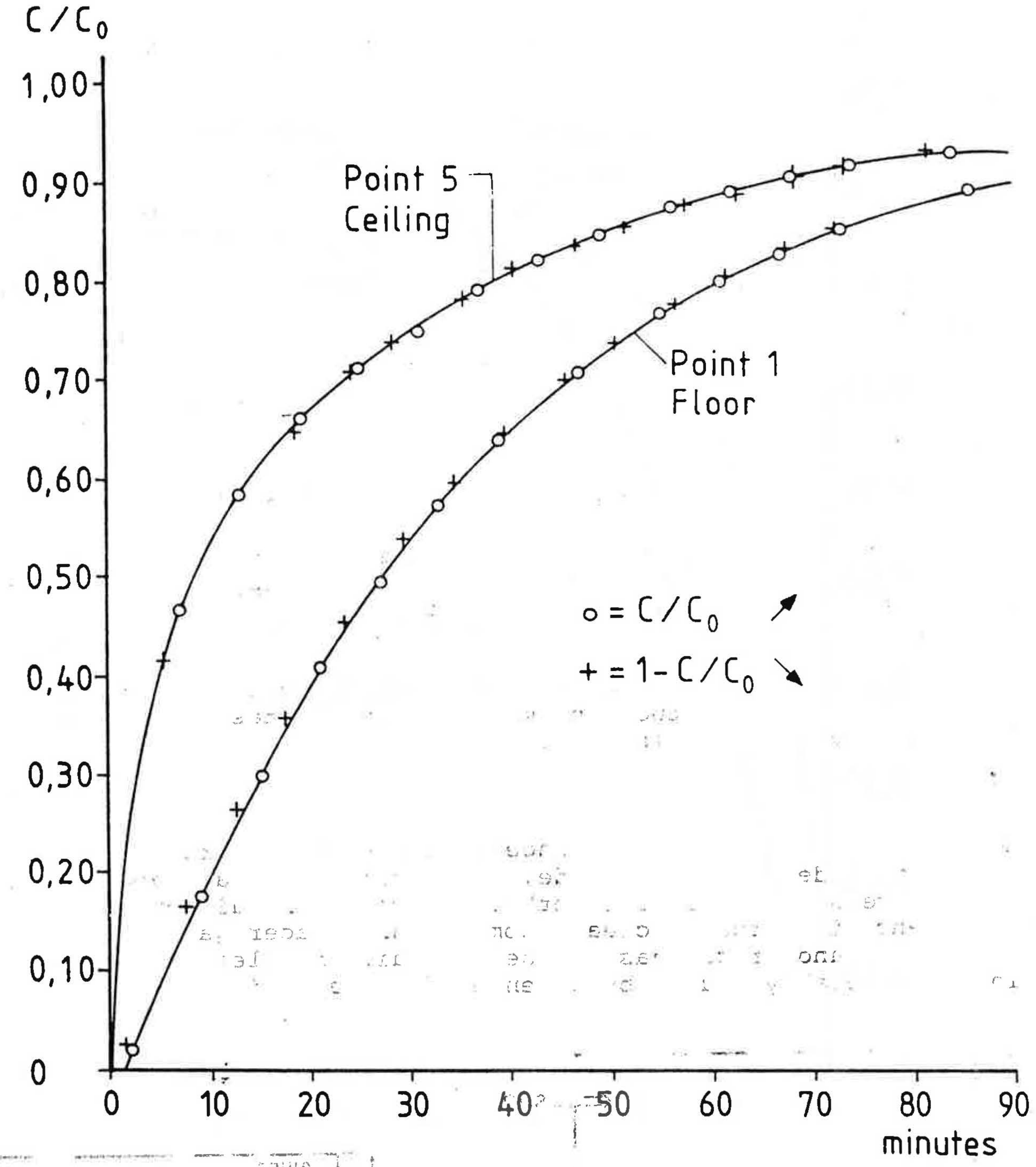

Fig. 3 Results from a test with nominal air flow rate 2,1 m^3/m^3, h, and supply air 52°C warmer than room air.