The industries vision and activities for better buildings in the future.

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ABSTRACT

The industry is now focusing in system solutions and the goal is to be able to deliver complete reliable, energy efficient solutions that is understandable and easy to maintain by the normal service personal.
In order to do this the basic products have to perform exactly as they are described in the technical documentation. The documentation have to help the designer and the installer to actually build the system in the correct way without compromises from other stakeholders.
The system integration must also be simple and with a plug and play vision in order to have the correct function including demand controlled ventilation, the function in a fire situation and be able to maintain the system by a smart diagnostic tool, helping the service personal and enlighten the building owner with usable graphs and information to be able to follow up on the performance.
All these issues is one by one not technically not very difficult but when it comes to reality it often fails due to the complexity of a building and the responsibility chain that is used in our business.
We can today see that many systems is performing poorly and the end user have no chance of communicating the problem to the right responsible stakeholder. The solution is that the suppliers have to take a bigger responsibility and actually see and provide guaranteed functions instead of the cheapest product just like the car industry.
One real technically difficult issue that will be highlighted in this presentation is to be able to measure the airflow very accurate in a world were space is not available and the flows are going to very low levels and that we are not allowed to create extra pressure drop. The modern way of measuring airflow will probably be with ultrasonic sound which allows very low flows and no pressure drop and high accuracy. This smart and accurate devices can also be the basis for a diagnostic tool that can provide indication of the:
Controlling and monitoring of the system
Status of the system
Where to look for failure
Costs follow-up
Accurate payment of IAQ to the tenants

KEYWORDS

Better IAQ, Accurate flow measurement, Better performing ventilation systems.

1 INTRODUCTION

Flow measurements has always been difficult to do in lab environment and even worse in a real building so the result is often bad and perhaps not constant over time due to contaminations in the ducts. At the handing over process the designed flows should be measured and documented and then verified by the inspector. If the flows mismatches the system have to be re-commissioned and verified again. This procedure seldom works and the customer receives a system balanced the best possible way but perhaps not the most effective way according to energy and IAQ. Lindab has developed a new flow measuring device based

on ultrasonic sensors that is very accurate in the whole flow range and is easy to use both for persons and superior control system. With this it will be easy to see and regulate the design values until they are accomplished and the design is thoroughly tested.

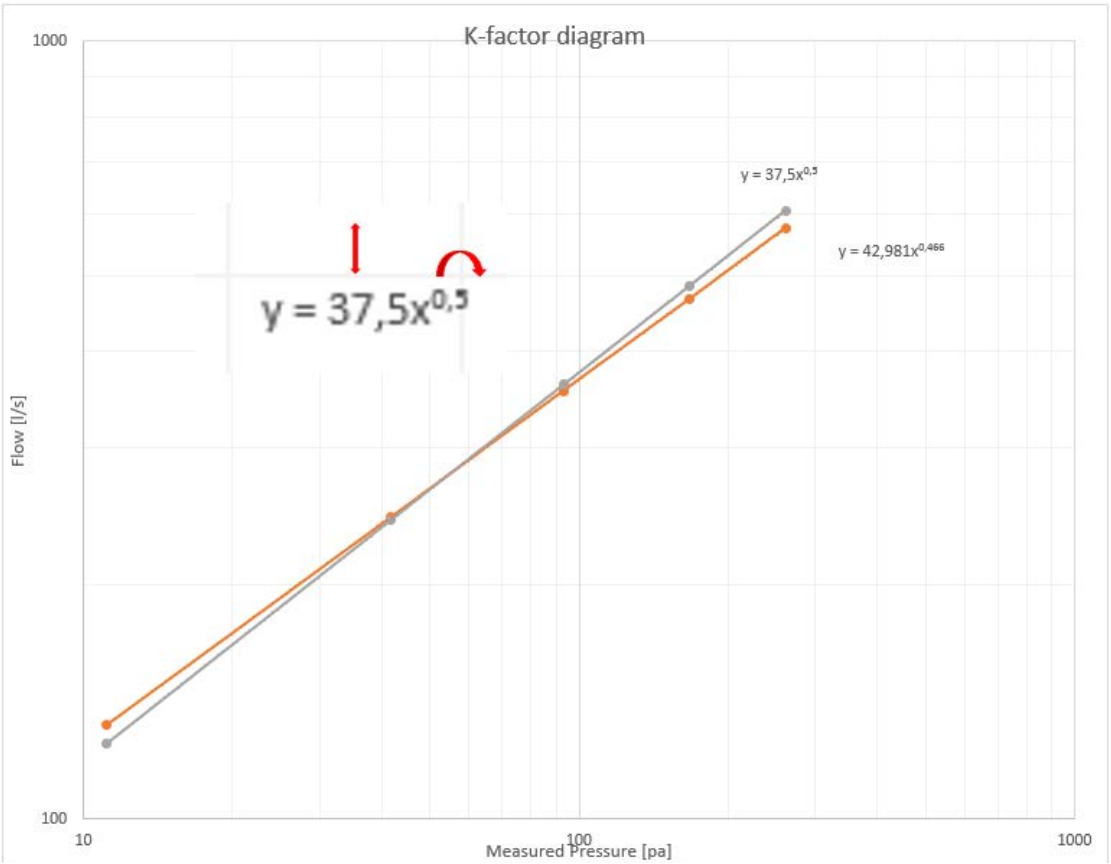
2 FLOW MEASURMENT IN DUCTS

2.1 The K factor principle

The flow can be measured using some kind of obstacle to create an predefined pressure drop and then measure the pressure difference over the obstacle.

This procedure is called k-factor measurements because the equation follows a straight line in a log-log diagram with the direction of 0,5.
$Q=K*P_m^{0,5}$.

Q is the flow in the duct.
K is a factor found in measurements
Pm is the measurement pressure over the predefined obstacle.
0,5 is the direction of the line.



- To make it easy to use there is an approximation using the direction 0,5 which is the same as square root that everybody know and can use even though the real result with better accuracy can be 0,48.
- The small holes to measure the pressure can easily be filled with dirt and change over time.
- The producers chose the highest pressure difference in order to measure it as correctly as possible. However to measure a pressure lower than 5-10 Pa is often very difficult and this ends up with a bad accuracy lower than 3 m/s.
- The K factor measurements are quite good in a defined steady state obstacle but to measure over some moving parts like a damper is very difficult and the K factors differs from individual to individual and also moving from closed to open or open to close due to hysteresis.

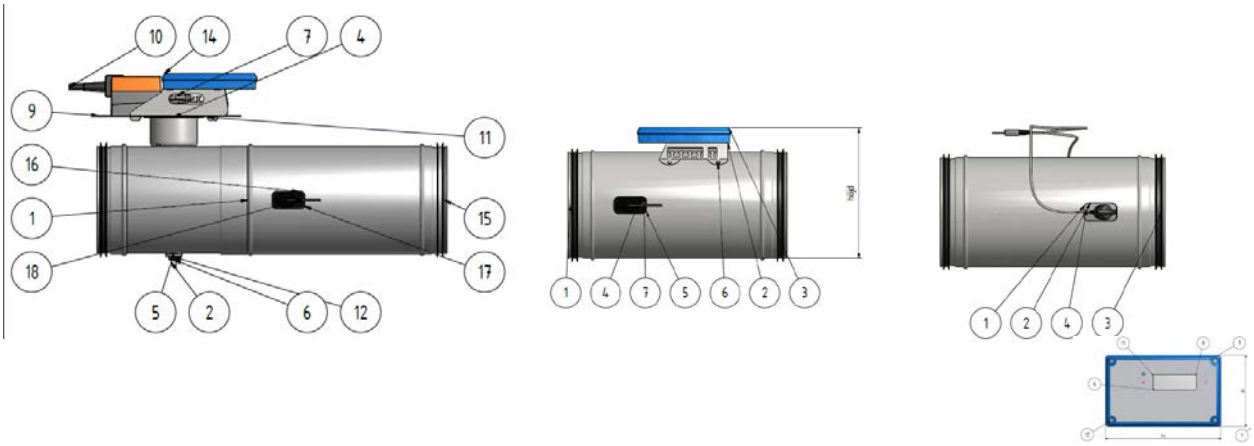
- The error is depending on the flow profile and is only correct with a non-disturbed. The flow profile and the measure pressure is very difficult to align.

2.2 The ultra-sonic principle

To measure with ultrasonic sound is in principal very easy. Only to use the time difference between upstream and downstream time for the ultrasonic sound. However to do it in a correct way there is a lot of traps to fall down in that we didn't know when we started. Millions of measurement wiser we know how to interpret the result and present it as the ultimate truth. The ultra-sonic sound is following the technique in a very straight forward manner and can be used to an accurate result. However all other old technology have problems and when we now see the result of the ultrasound it is easy to be misled and involve all this old errors into the new technology. The ultrasound is influenced mostly on the temperature but also a little bit by pressure, humidity and the shape of the flow profile.
The flow shape can be to one side, which is the easiest part, swirled and divided to several corposants. This errors will be in the result and has to be dealt with to present the right value.

2.3 The solution

Controller	Monitor	Sensor/display
FTCU	FTMU	FTSU/FTD



The Lindab solution is a ultrasonic measuring device with three features depending on usage. The simplest is the sensor which only contains the transmitter and receiver and have to be read by a display that is like a handheld measuring device via a USB or radio. This is mostly to be used at a commissioning and service phase.
The second is the monitor that continuously monitors the flow and temperature and can communicate the result to a superior computer using a the RS485 with Modbus. This product is very usable to advanced systems to measure the flow and the superior system can control the flow with the fan and dampers.
The third and most advanced product have its own damper and can be used as a standalone regulator controlling its own flow via analogue or digital inputs/outputs.

2.4 The accuracy

The accuracy is very good and very reliable all the way down to 0,5 m/s up to 15 m/s. The biggest problem today is that there are several measuring units with the same bad performance which does not add up to the correct decisions. With the UltraLink and its high accuracy and high reliability it is very easy to make the correct decision and it can also be a base for a diagnose tool for the whole system.

3 CONCLUSIONS

Lindab thinks we have a technology that is way better than common flow measuring and will in the future lift the ventilation business to a higher level being able to maintain a good IAQ and save energy by not over dimension and by being able to control the flows all the way down to 0,5 m/s when no one is in the room. Also being able to diagnose the system and guide the owner, service personnel and tenants to smart usage and operation.

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