TROX® TECHNIK

The art of handling air

CAV VAV

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Rendez-vous ATIC bijeenkomst

Luchthoeveelheidsregeling Constant en Variabel
Régulation de débit Constant et Variable

Programma

- Meting en regeling
- Evoluties
- Toepassingen:
- Ruimteregeling
- Drukregeling
- Speciale oplossingen
- Atex
- Labcontrol
- Selectie

Program

- Mésurer et régler
- Evolutions
- Applications
- Régulation d‘une pièce
- Régulation de pression
- Solutions spéciales
- Atex
- Labcontrol
- Selection

Luchtbehandelingsinstallaties moeten ervoor zorgen dat de luchtkwaliteit, thermische behaaglijkheid en luchtvochtigheid in de ruimte aan de vooraf gestelde eisen voldoen (DIN EN 13779).

Bepalend hierbij is het klimaat in de ruimte. Om de gewenste luchtkwaliteit te behouden en gelijktijdig een energiezuinige werking van de installatie te krijgen, moeten alle luchtstromen in de installatie gecontroleerd en geregeld worden. De componenten die voor de luchtzijdige regeling zorgen spelen daarbij een belangrijke rol.

Les systèmes de ventilation et de climatisation sont sollicités pour adapter la qualité de l'air intérieur et les conditions de confort entre chauffage et humidité dans une pièce tout en respectant la réglementation en vigueur (EN 13779).

Une des premières exigences de ce processus est le confort de la pièce. Afin de maintenir une qualité de l'air nécessaire et permettre un fonctionnement rentable du système, tous les débits d'air d'un système doivent être contrôlés et régulés. Les équipements pour le traitement d'air jouent alors un rôle majeur.

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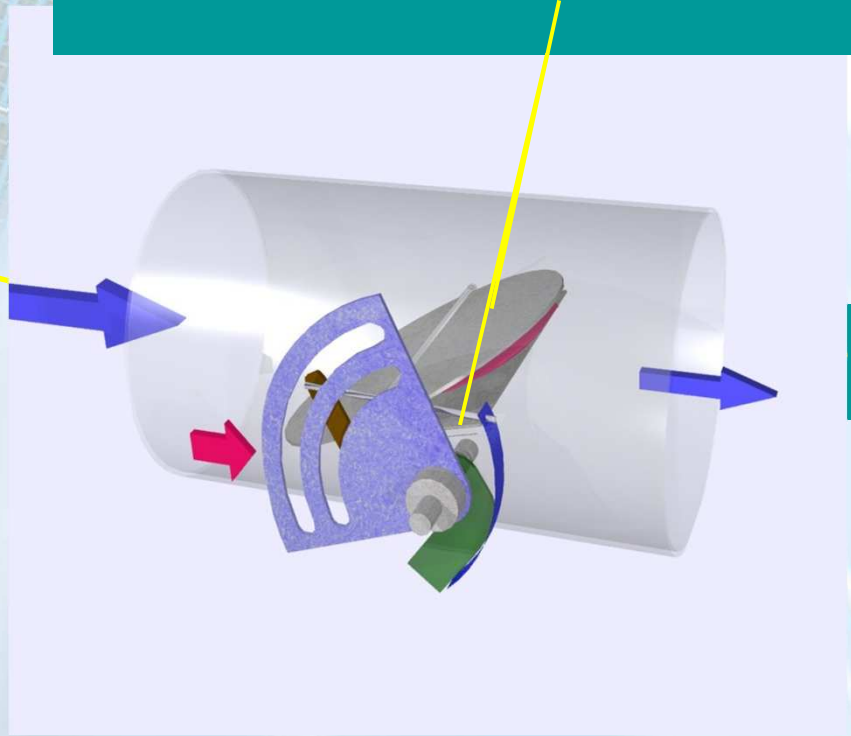
CAV Controller

RN / EN function

leaf spring increased t

bellow inflating damper closing



volume flow changed

volume flow regulated

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Mechanical system-powered

VFL

VFC

RN

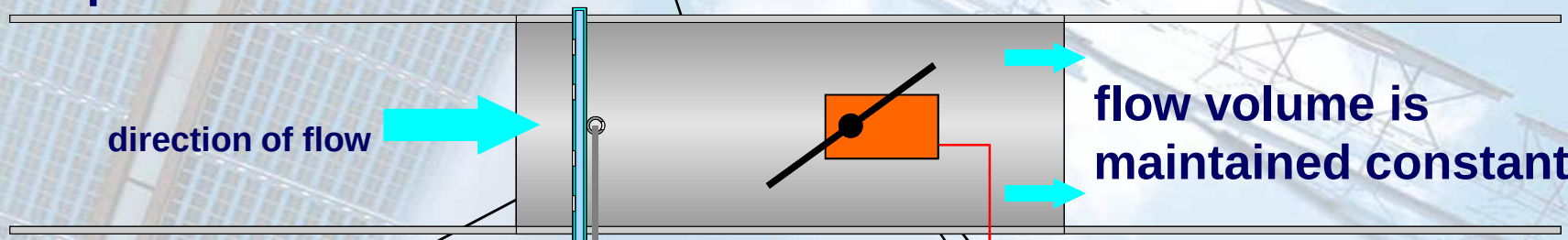
EN

VAV Controller Basic function

volume flow control device

damper is moved

duct pressure increases



flow volume is maintained constant

effective pressure increases

effective pressure sensor

damper actuator

damper

differential pressure transducer

volume flow controller

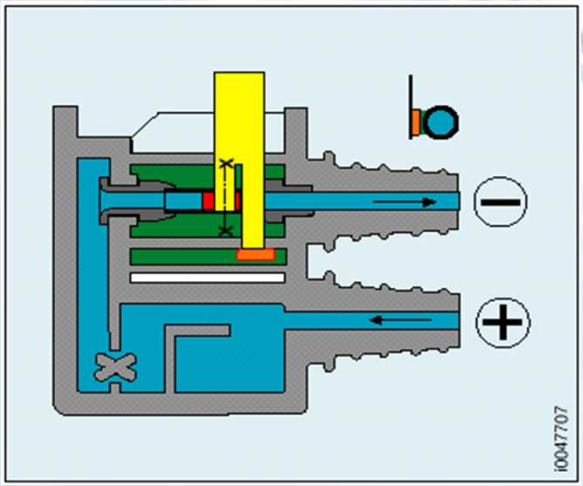
command signal from room temperature controller

$$q_V = C * \sqrt{\Delta p_w}$$

VAV Controller

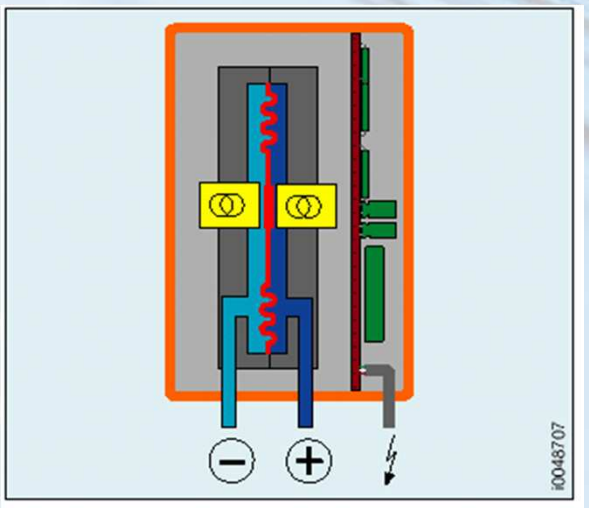
Measuring methods

air velocity



effective pressure
dynamic

effective pressure
static

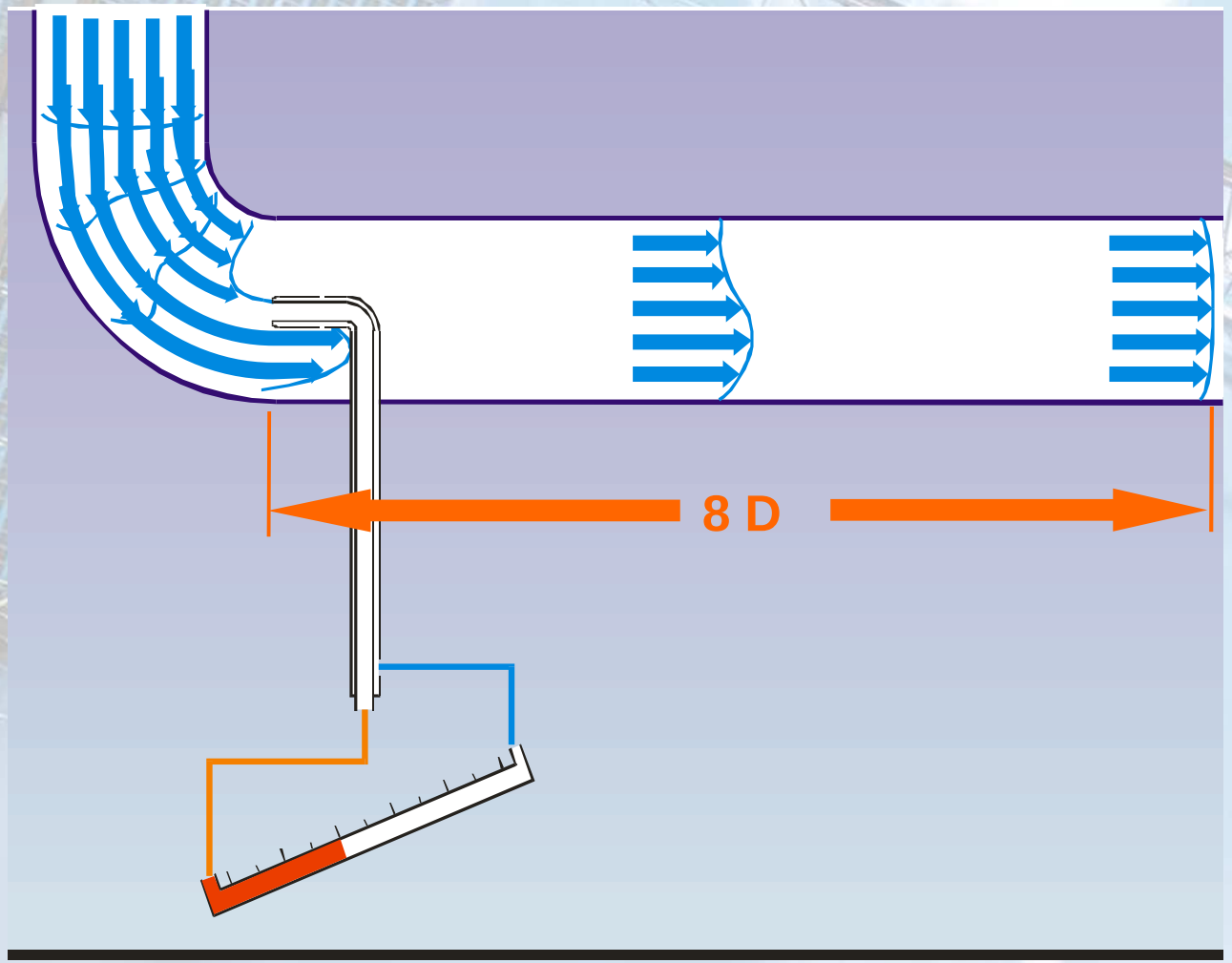


VAV Controller

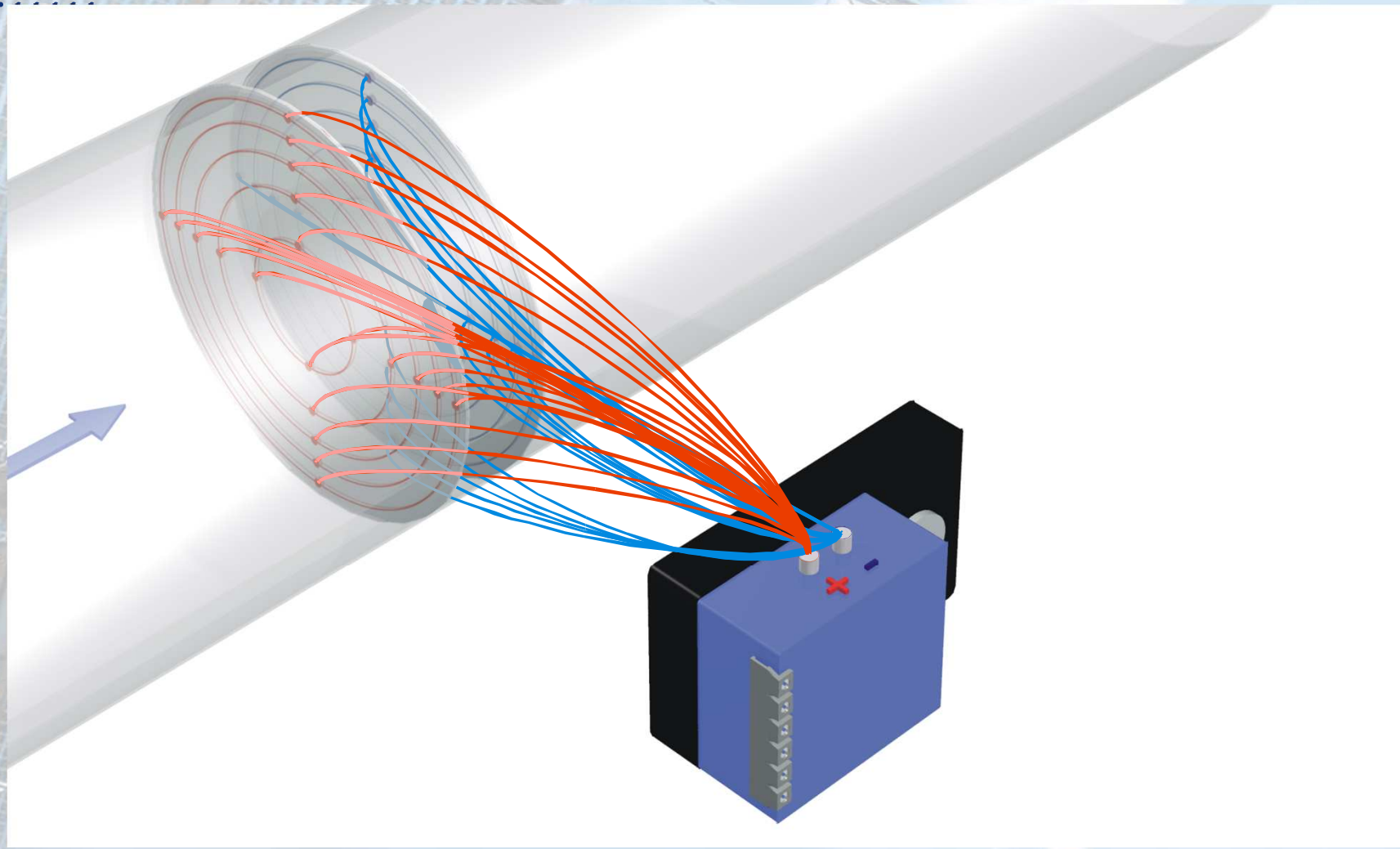
Comparison of methods

Feature	dynamic	static
range of airflow	10 to 100%	app. 17% (20%) to 100%
costs	100%	app. 250%
critical	dusty air contaminated air length of tubing	gravity dependency drift
commissioning	parallel measuring not possible	parallel measuring possible
maintenance	none	once a year recommended

Streaming profile after elbow



Dynamic sensor / optimized



VAV Controller Test rig in our factory in Anholt

Manufacturing and adjusting volume flow terminal units

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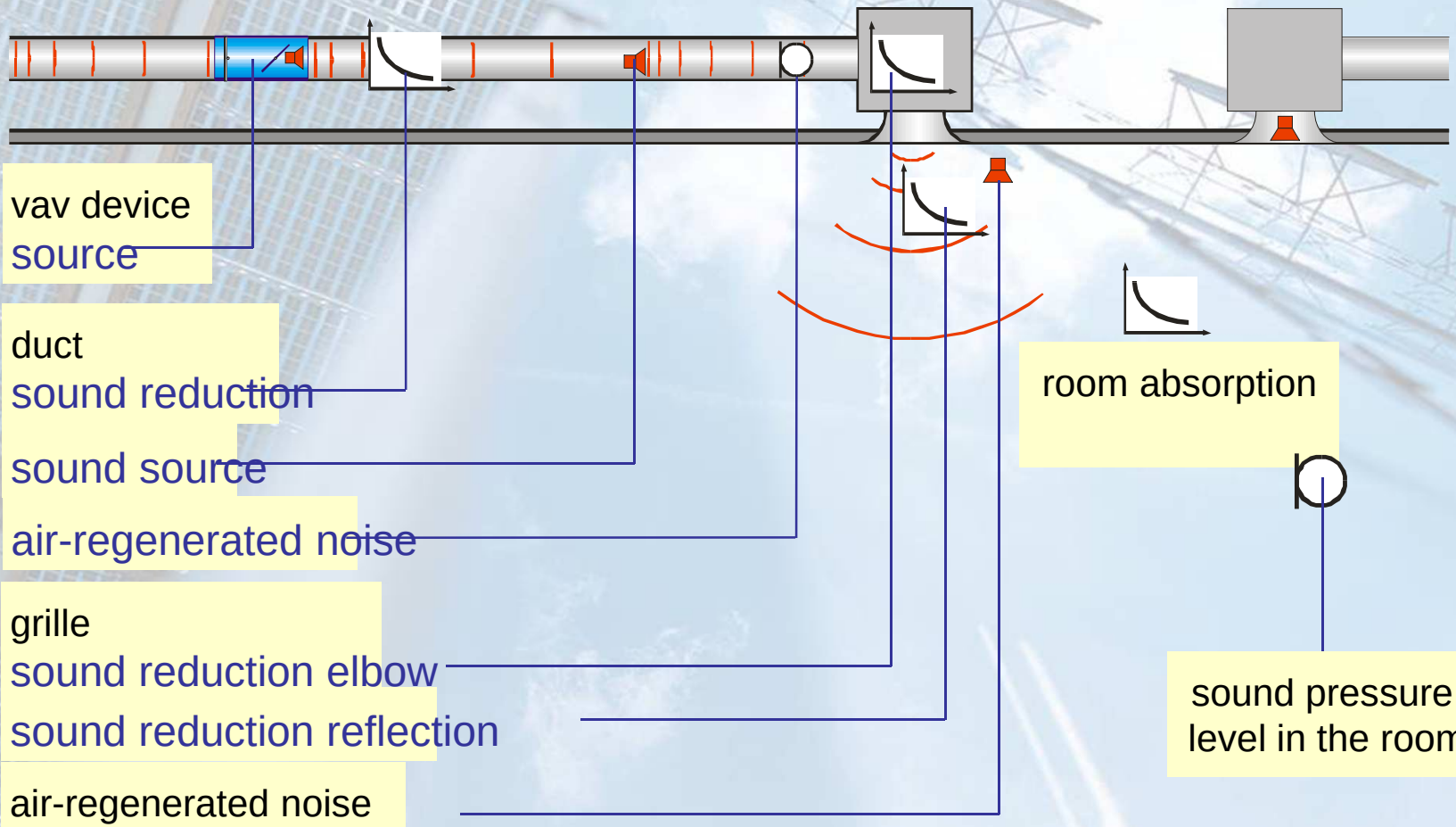
VAV Controller

Acoustic designing



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VAV Controller

Acoustic desining

Log 10

Linear

Katalog - Tabelle 6 : Air-regenerated noise without attenuator

DN	V l/s	V m³/h	ΔPst = 100 Pa LW in dB fm in Hz 63	125	250	500	1000	2000	4000	8000	L in dB(A)	NC	ΔPst = 250 Pa LW in dB fm in Hz 63	125	250	500	1000	2000	4000	8000	L in dB(A)	NC	ΔPst = 500 Pa LW in dB fm in Hz 63	125	250	500	1000	2000	4000	8000	L in dB(A)	NC
100	10	36	55	42	40	37	28	17	<	<	23	17	55	47	47	45	42	36	27	22	35	30	54	48	50	49	46	44	43	35	42	37
	30	108	64	59	52	45	38	31	26	21	33	27	64	62	59	53	49	42	37	34	43	37	66	63	63	58	55	51	46	43	49	43
	60	216	67	67	61	51	45	42	37	<	41	34	71	74	70	59	53	48	45	42	49	42	71	74	74	65	60	56	51	50	55	49
	95	342	62	61	62	56	52	50	43	37	47	42	75	76	75	64	58	54	50	46	54	48	77	79	80	70	62	58	54	53	59	53
125	15	54	43	39	40	39	31	20	<	<	26	20	53	43	45	46	44	39	29	24	38	33	58	48	48	49	47	47	45	37	44	39
	60	216	61	60	53	47	41	35	30	23	37	30	65	67	62	56	50	45	41	37	46	40	68	68	67	62	58	56	51	47	54	48
	105	378	61	64	57	50	49	43	39	30	43	39	72	74	67	59	54	49	49	44	50	44	72	75	74	66	61	57	54	52	57	50
	150	540	64	58	58	54	54	48	43	38	47	43	73	74	70	62	59	54	53	48	54	49	76	79	79	68	63	59	58	56	60	55
160	25	91	46	44	45	45	39	34	22	<	35	29	50	48	47	50	47	44	34	27	42	37	55	55	52	54	54	52	49	42	50	45
	80	288	62	60	55	48	44	43	32	<	40	35	67	66	63	57	54	54	46	40	51	46	68	68	67	63	61	63	56	51	59	55
	145	522	65	63	57	50	48	45	37	<	44	38	74	73	67	60	56	55	50	45	53	47	75	77	74	68	63	64	58	54	61	56
	250	900	65	65	62	57	57	51	46	40	51	46	78	77	73	65	62	59	56	51	58	52	82	82	79	71	66	66	61	59	64	58

TROX 2011

- New Control Components
- Volume flow controllers

- LVC-Low Velocity
- TZ-Silenzio / TA-Silenzio

Megatrend Green Buildings

- Energy saving is of most importance

- To show how innovative a product is, the sustainability is of most interest

Actual demands

Decree for the Energy Law (Basel 2001)

Bei der Dimensionierung des Luftkanalnetzes und der Auswahl der . Apparate muss auf **geringe Druckverluste** geachtet werden.
Die maximalen Strömungsgeschwindigkeiten in den Luftaufbereitungsgeräten darf bezogen auf die Nettoquerschnittsfläche des Gehäuses 1,5 m/s, bezogen auf die Nettoquerschnittfläche der Apparate 2,0 m/s betragen. In den für den Druckverlust maßgebenden Strängen des Kanalnetzes **dürfen fo lgende Geschwindigkeiten nicht überschritten werden:**

bis	1.000 m³/h	3 m/s
bis	2.000 m³/h	4 m/s
bis	4.000 m³/h	5 m/s
bis	10.000 m³/h	6 m/s
über	10.000 m³/h	7 m/s

Grössere Luftgeschwindigkeiten werden toleriert, wenn:
a) weniger als 1000 Betriebsstunden pro Jahr erreicht werden;
b) sie wegen einzelner räumlicher Hindernisse nicht vermeidbar sind;
c) mit einer fachgerechten Energiebedarfsrechnung nachgewiesen wird, dass kein erhöhter Energieverbrauch auftritt-
.Für bestehende Klima- und lüftungstechnische Anlagen können….

Specific Fan Power => SFP

Sie definiert in der Klimatechnik das Verhältnis von verbrauchter elektrischer Ventilatorleistung zum geförderten Luftvolumenstrom und wird „specific fan power“ genannt.
Die spezifische Ventilatorleistung dient zur Kennzeichnung des elektrischen Energieverbrauchs und kennzeichnet den Leistungsgrad einer Ventilatoranlage, inkl. Riementrieb, Getriebe und Frequenzumrichter.

$$SFP = \frac{P}{q}$$

P = used Power [W]
q = $\dot{V}$ = Transported Volume flow [m³/s]

Important: The SFP says nothing about the total energy consumption!

(In comparison with DID a cooling with air could have a better SFP!)

SFP-Classes

EN 13779

Today:

Big HVAC systems SFP-3 ... SFP-4 and small ones between SFP-5 ... SFP-7

Kategorie	spezifische Ventilatorleistung [Ws/m3]
SFP-1	<500
SFP-2	500-700
SFP-3	750 - 1250
SFP-4	1250 -2000
SFP-5	2000 - 3000
SFP-6	3000 - 4500
SFP-7	>4500

According to the energy saving decree (ENEV-2007)
new HVAC systems with more then 4000m³/h are allowed to work with max. SFP-4

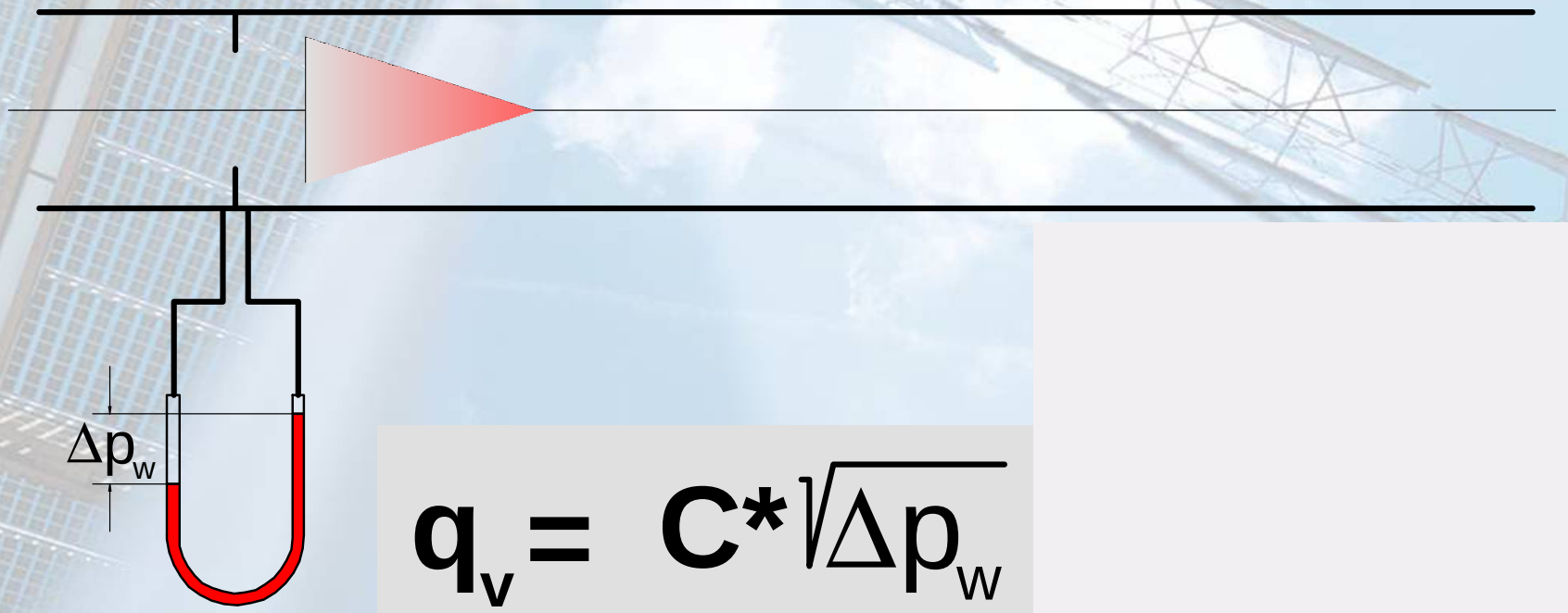
What does that mean for us … ?

- **Less duct-pressure**
- **Less velocities in the ductwork**

The border of todays measuring principles

- Air velocities in between ca. 2-12 m/s
- Less dynamic pressure during Vmin control
  (for dynamic transducers about 2Pa and less then 2 m/s)

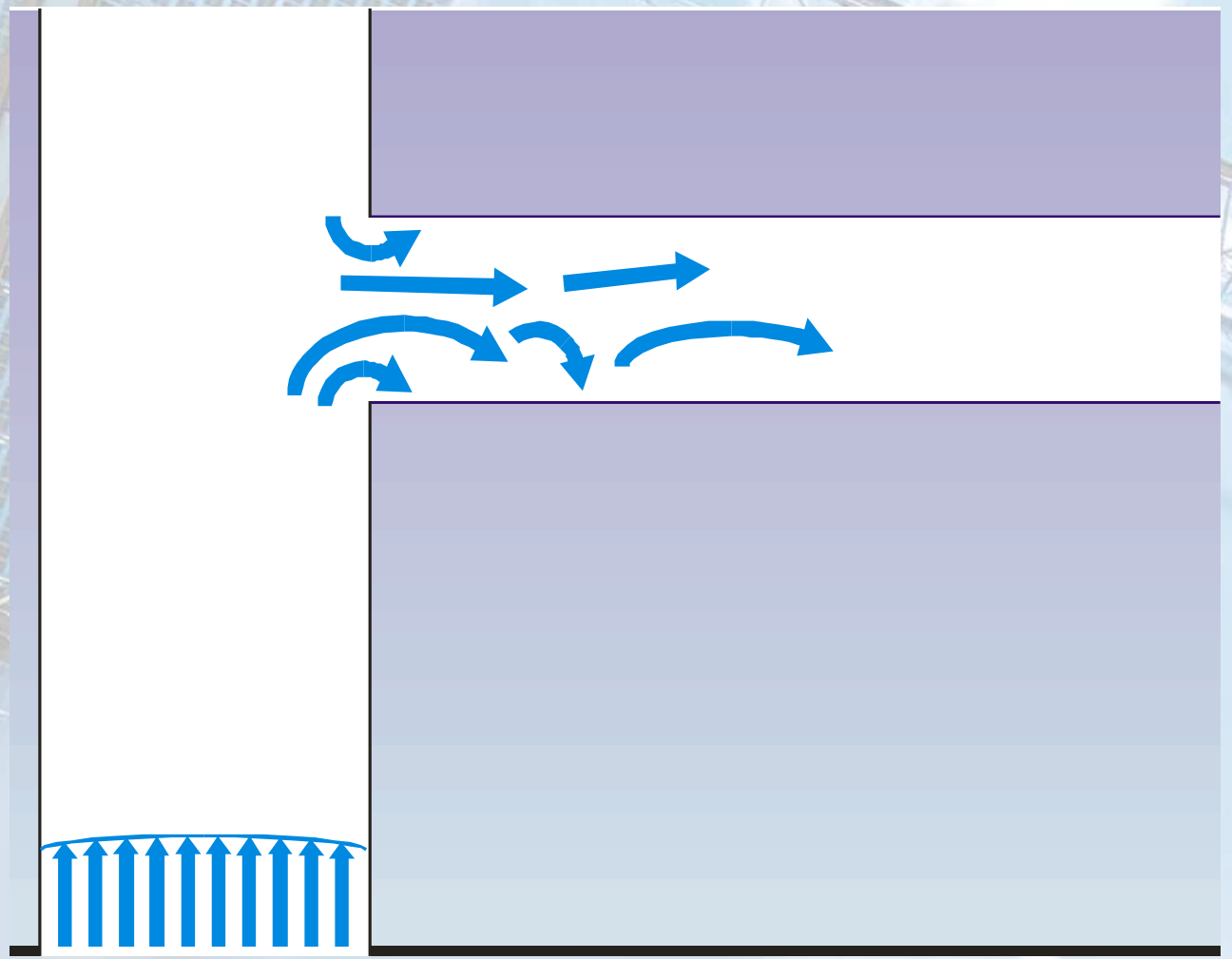
Volume flow measurement



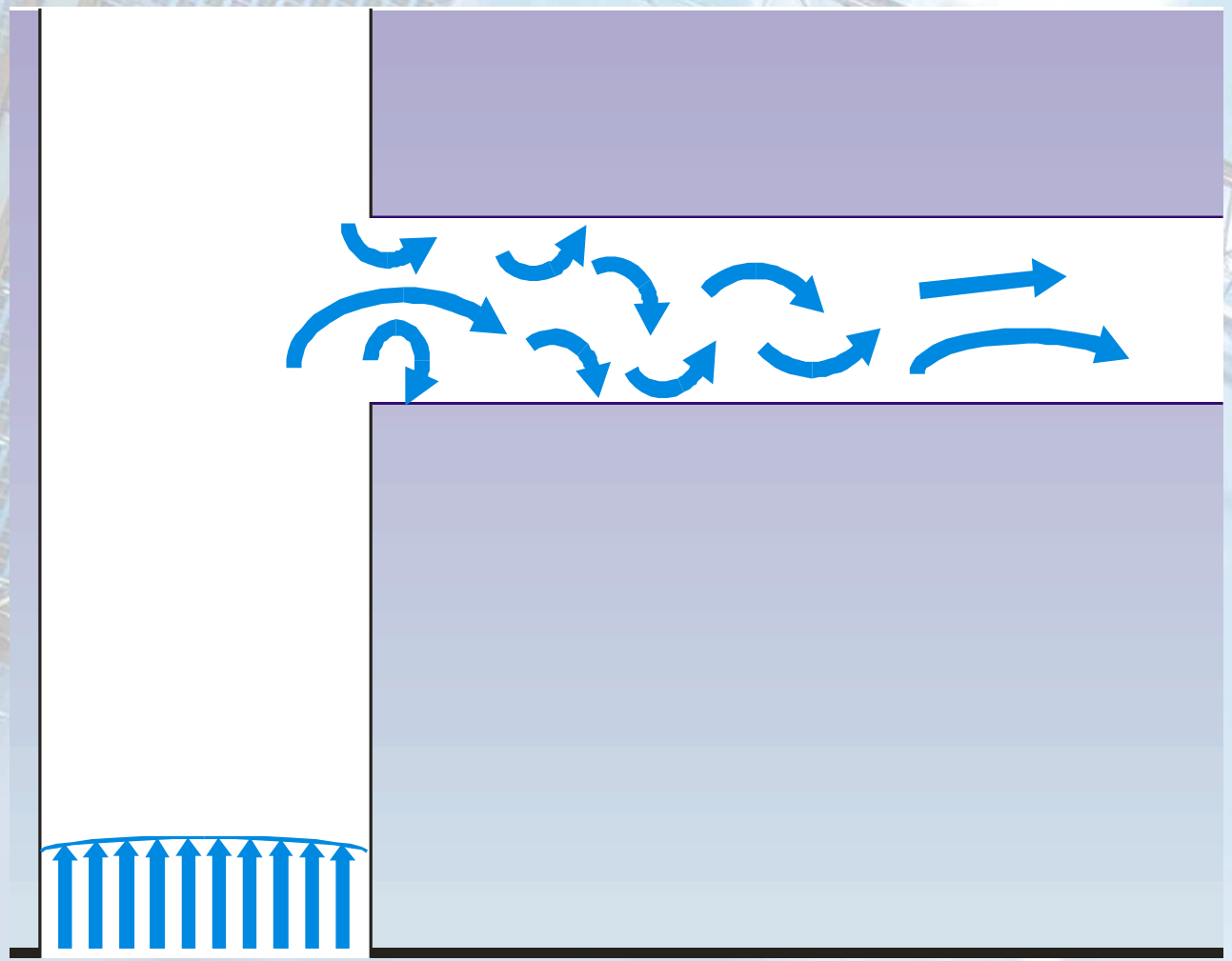
$$q_v = C^* \sqrt{\Delta p_w}$$

This method is not possible with LVC-LowVelocity!

Low velocity in main duct

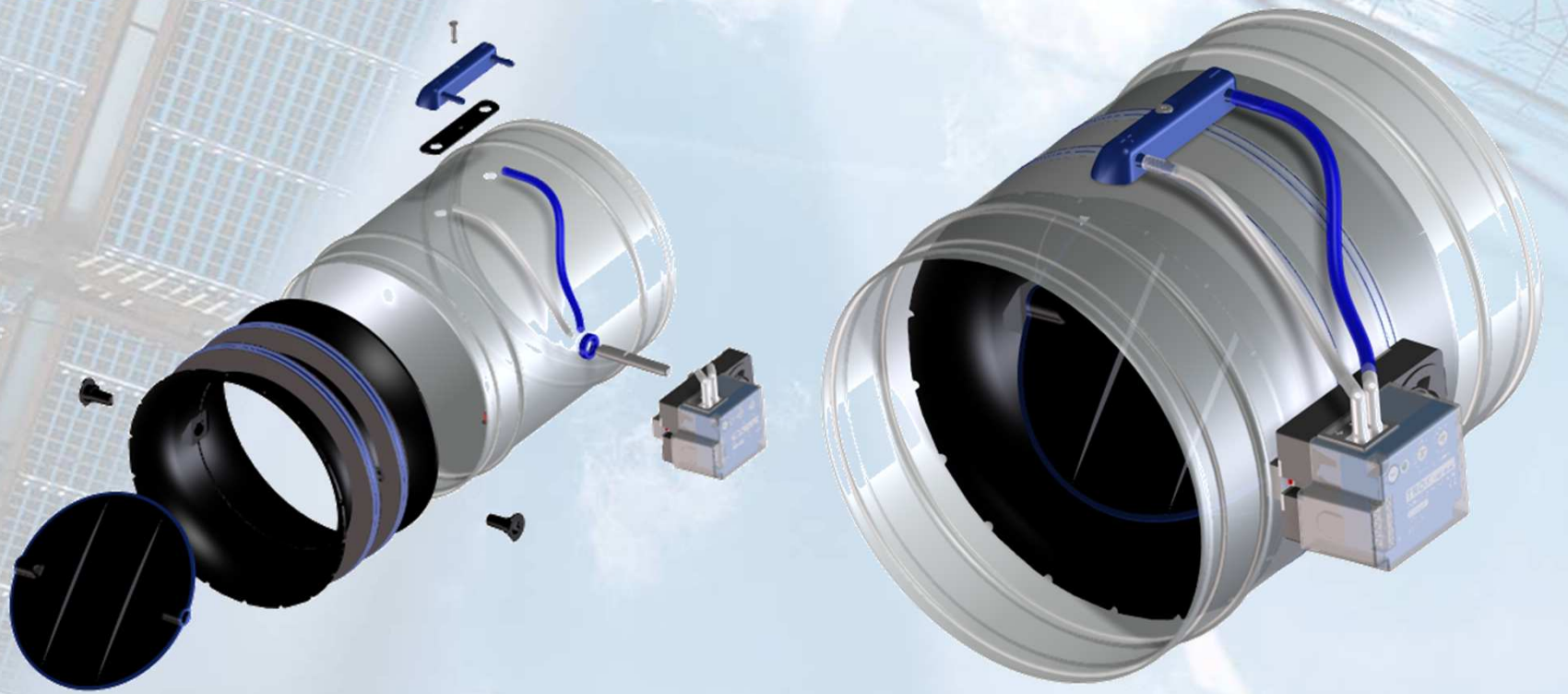


High velocity in main duct



TROX – LVC-LowVelocity Controller

- Very low air velocity in the duct
- High effective pressures on the plastic nozzle (variable C-value / Deposit of a C-value curve)

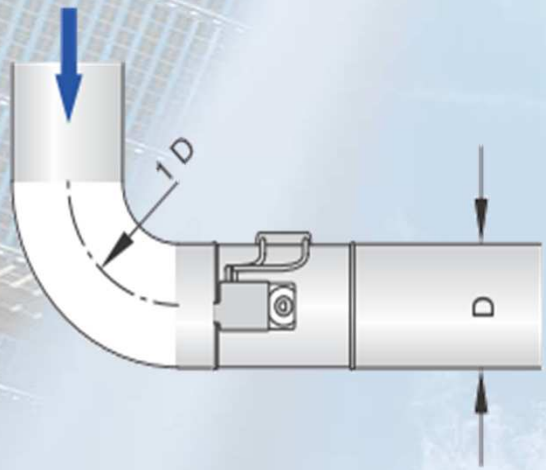


New: TROX – LVC-LowVelocity Sizes 125 – 250

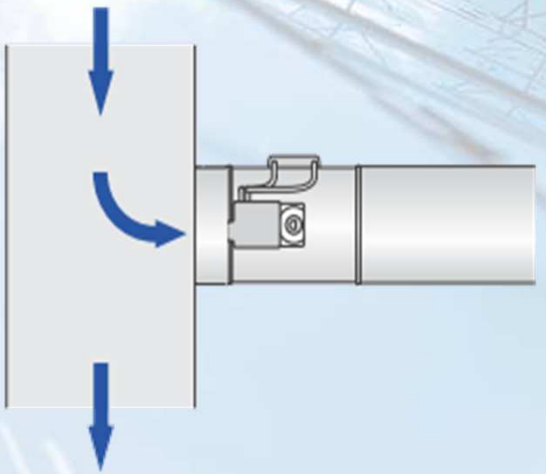
- Optimised for low air velocities from 0,6 - 6m/s
- Optimised for low duct pressure from 30Pa - 300Pa
- Direct connection to main duct possible, no straight lenght required
- Available in four sizes
- Compact construction, 310 mm long
- TROX specific controller

LVC-LowVelocity / optimized installation options

Upstream flow conditions
Upstream bend



Branch off the main duct



LVC-LowVelocity / acoustic data

Different pressure area!

Strömungsgeräusch

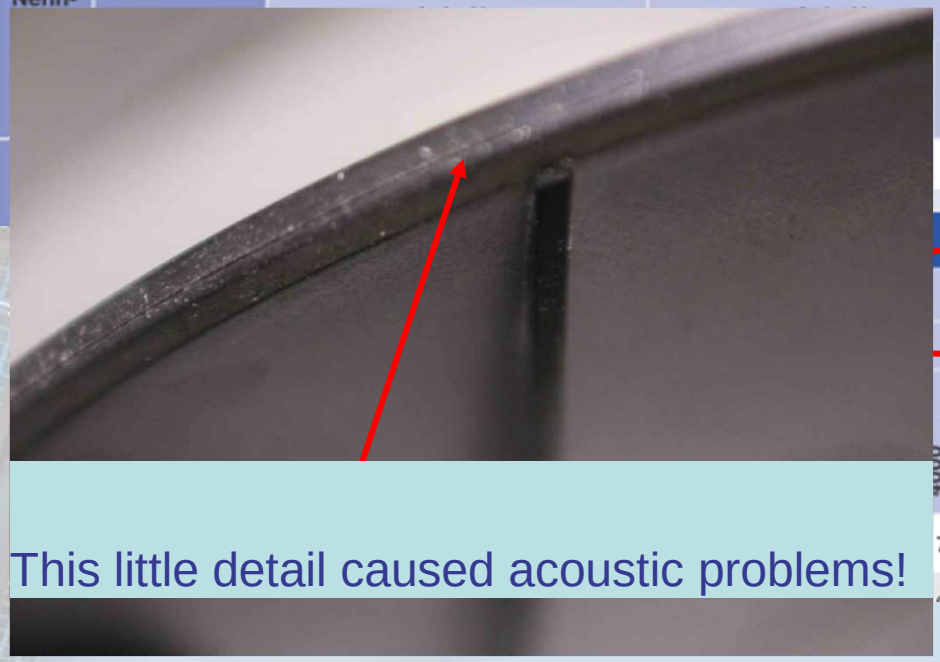
Nenn-	$\dot{V}$	Δp_{st} = 50 Pa	Δp_{st} = 150 Pa	Δp_{st} = 300 Pa
		L_W in dB	L_W in dB	L_W in dB
				f_m in Hz

4000	8000	63	125	250	500	1000	2000	4000	8000
17	22	45	41	45	50	47	41	26	31

Abstrahlgeräusch

	Δp_{st} = 150 Pa	Δp_{st} = 300 Pa
	L_{W2} in dB	L_{W2} in dB
	f_m in Hz	f_m in Hz

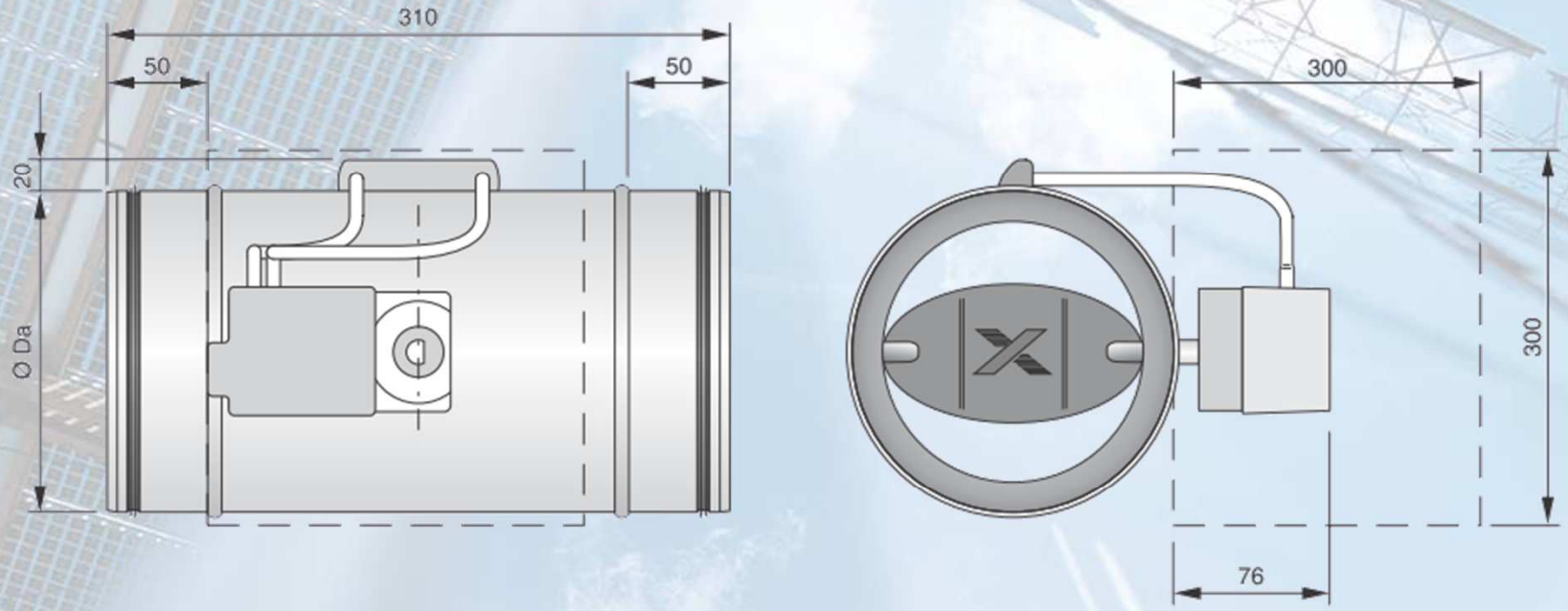
8000	63	125	250	500	1000	2000	4000	8000	63	125	250	500	1000	2000	4000	8000
13	26	14	16	20	24	18	21	28	27	18	21	26	30	26	29	38



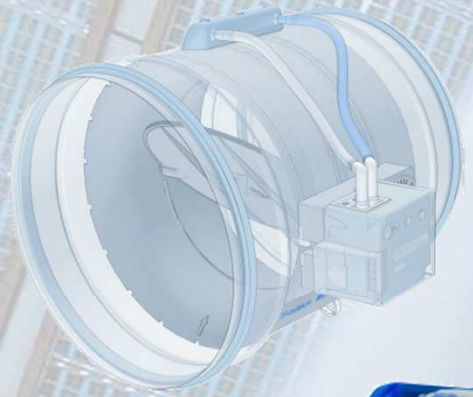
This little detail caused acoustic problems!

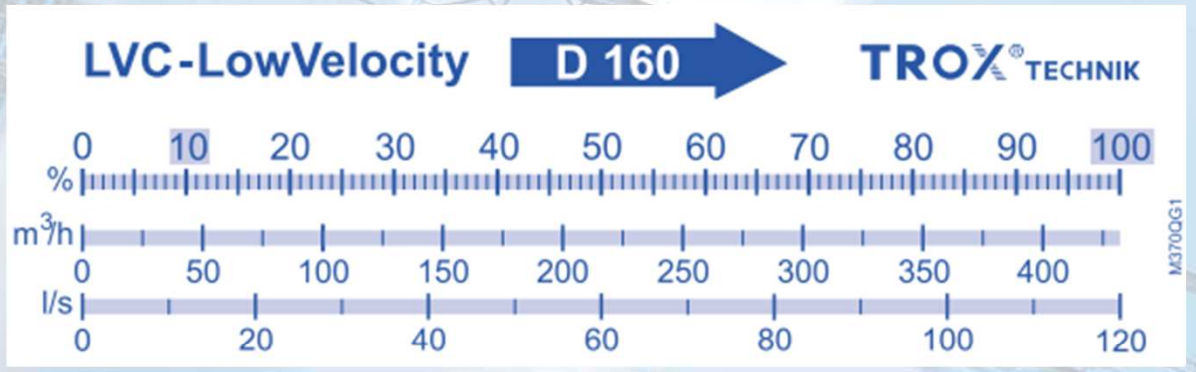
LVC-LowVelocity / short installation dimensions

Dimensions



New: LVC-LowVelocity





Order code

LVC-LowVelocity	/	160
[1]		[2]

[1] Type

[2] Nominal size
125
160
200
250

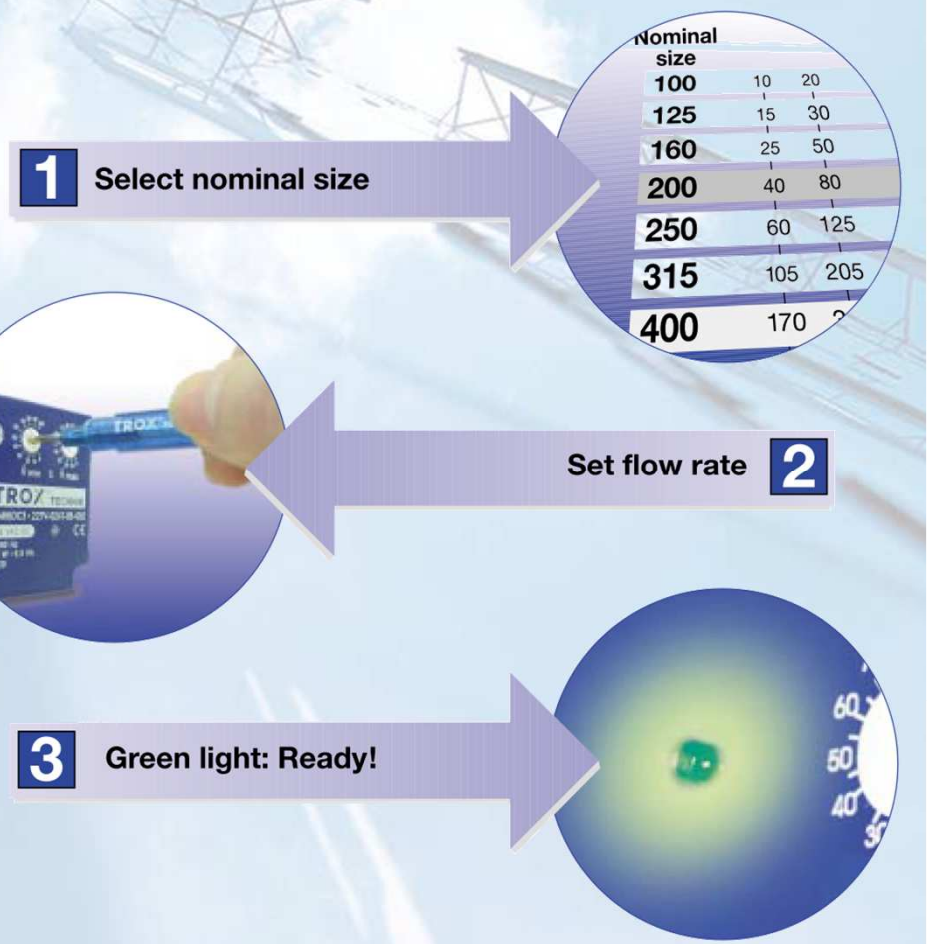
TVR-Easy Philosophy also for the LVC

EASY Selection according to nominal size of the duct system

EASY Flow rate adjustment without adjustment tool

EASY Functional testing with service button

EASY Functional check by indicator light



Flow rate tolerance Size 250

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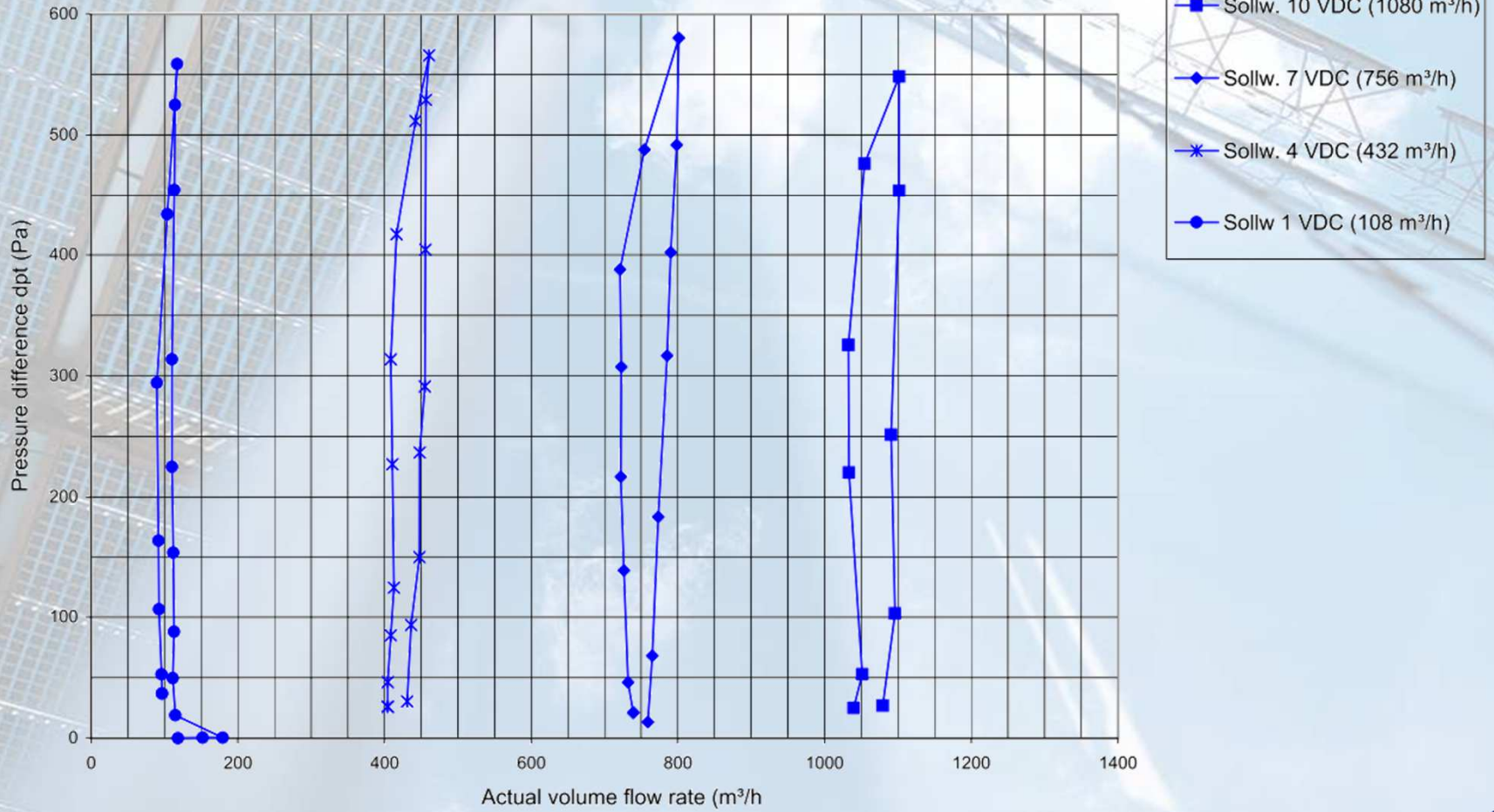
Test: 06.031 (LVC)
Size 250

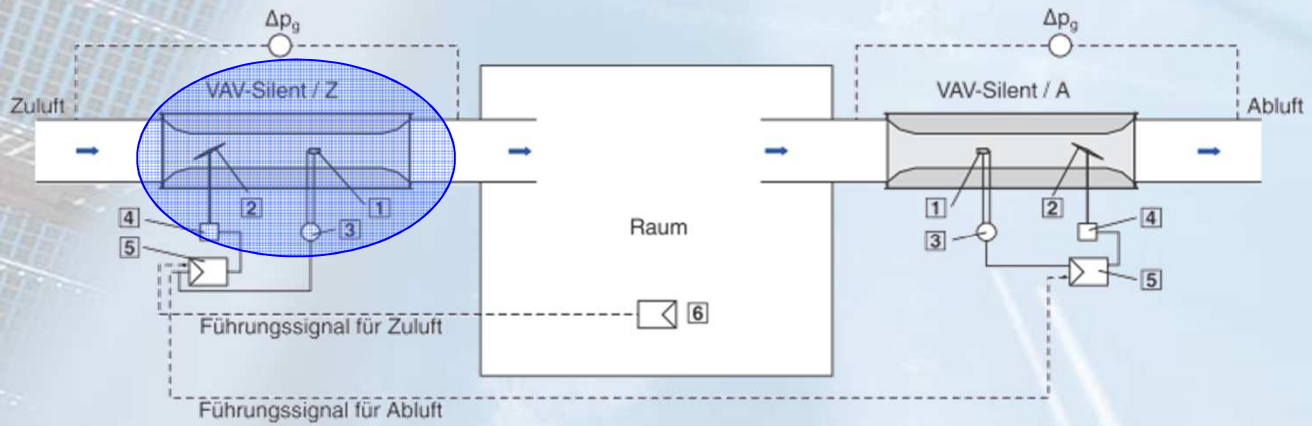


New: VAV-Silenzio type TZ- or TA Silenzio with rectangular sides

Nenngröße	B	H	L
1	300	236	1035
2	410	236	1035
3	560	281	1250
4	700	311	1250
5	900	361	1250

VAV-Silent / Z

VAV-Silent / A



1 Differenzdruck-Sensor
2 Stellklappe
3 Drucktransmitter
4 Stellantrieb
5 Volumenstromregler
6 Raumtemperaturregler (kundenseitig)

TROX Volume Flow Control Devices

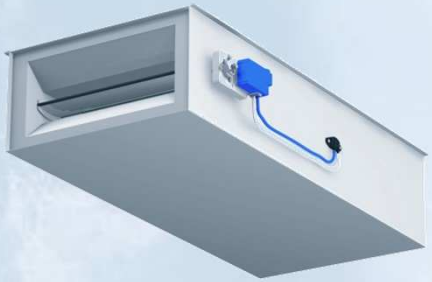
VAV units with auxiliary power

TVR (Easy)

LVC-LowVelocity

TVJ/TVT (Easy)

TVZ/TVA (Easy)



TZ(A)-Silenzio

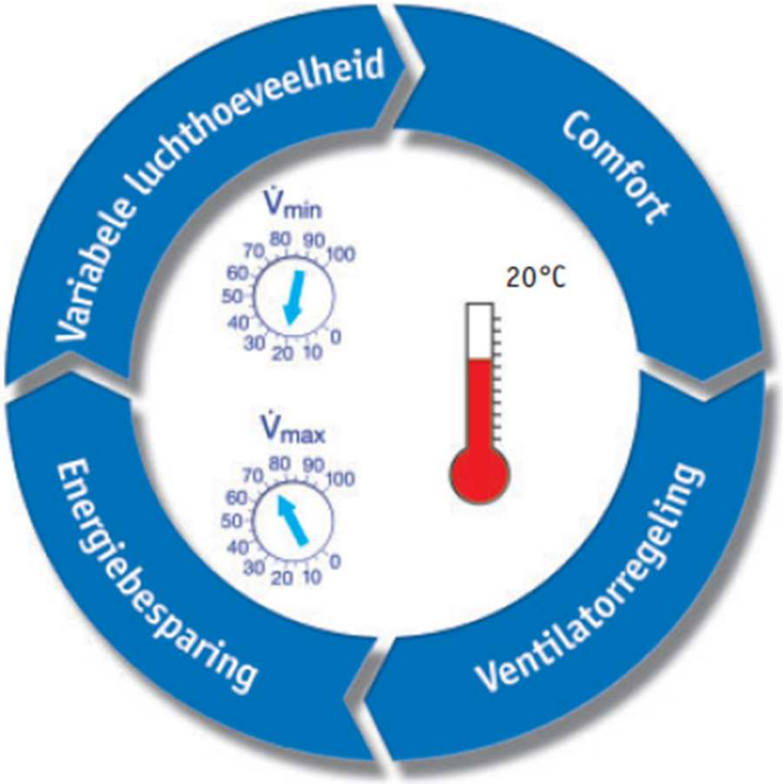
TVM

Toepassingen

Applications

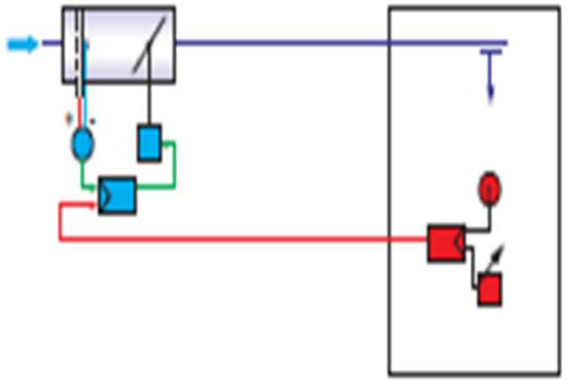
Variabel volume installaties

In geklimatiseerde gebouwen is de kwaliteit van de ruimtelucht belangrijk, waarbij ook rekening moet worden gehouden met het energieverbruik van de installatie. Aan deze vraag kan voldaan worden met variabel volumesystemen. Elke ruimte, respectievelijk elke zone krijgt exact de luchthoeveelheid, die nodig is om te blijven voldoen aan de gestelde eisen.

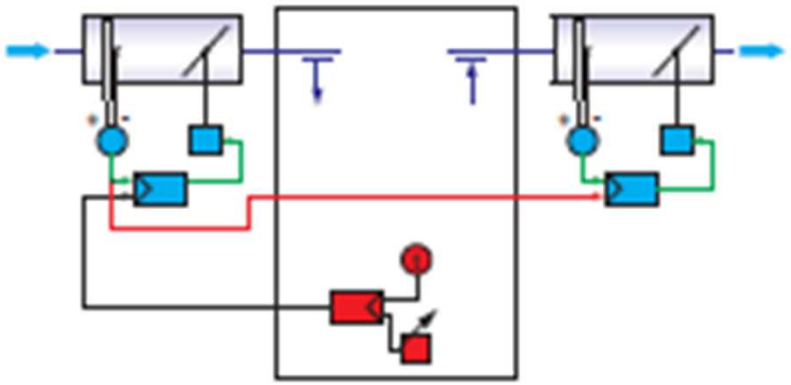


- Individuele regeling in elke zone
- Volledige afsluiting en andere dwangsturingen mogelijk
- Traploos geregelde luchthoeveelheid tussen $\dot{V}_{min}$ en $\dot{V}_{max}$ of omschakeling tussen bedrijfsstanden
- Geen negatieve beïnvloeding van de regelkringen onderling
- Verandering gewenste waarde altijd mogelijk
- Decentrale regeling
  Integreerbaar in het gebouw beheerssysteem

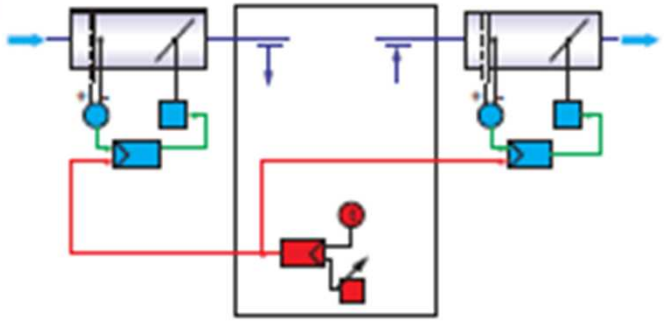
Régulation de la température de la pièce



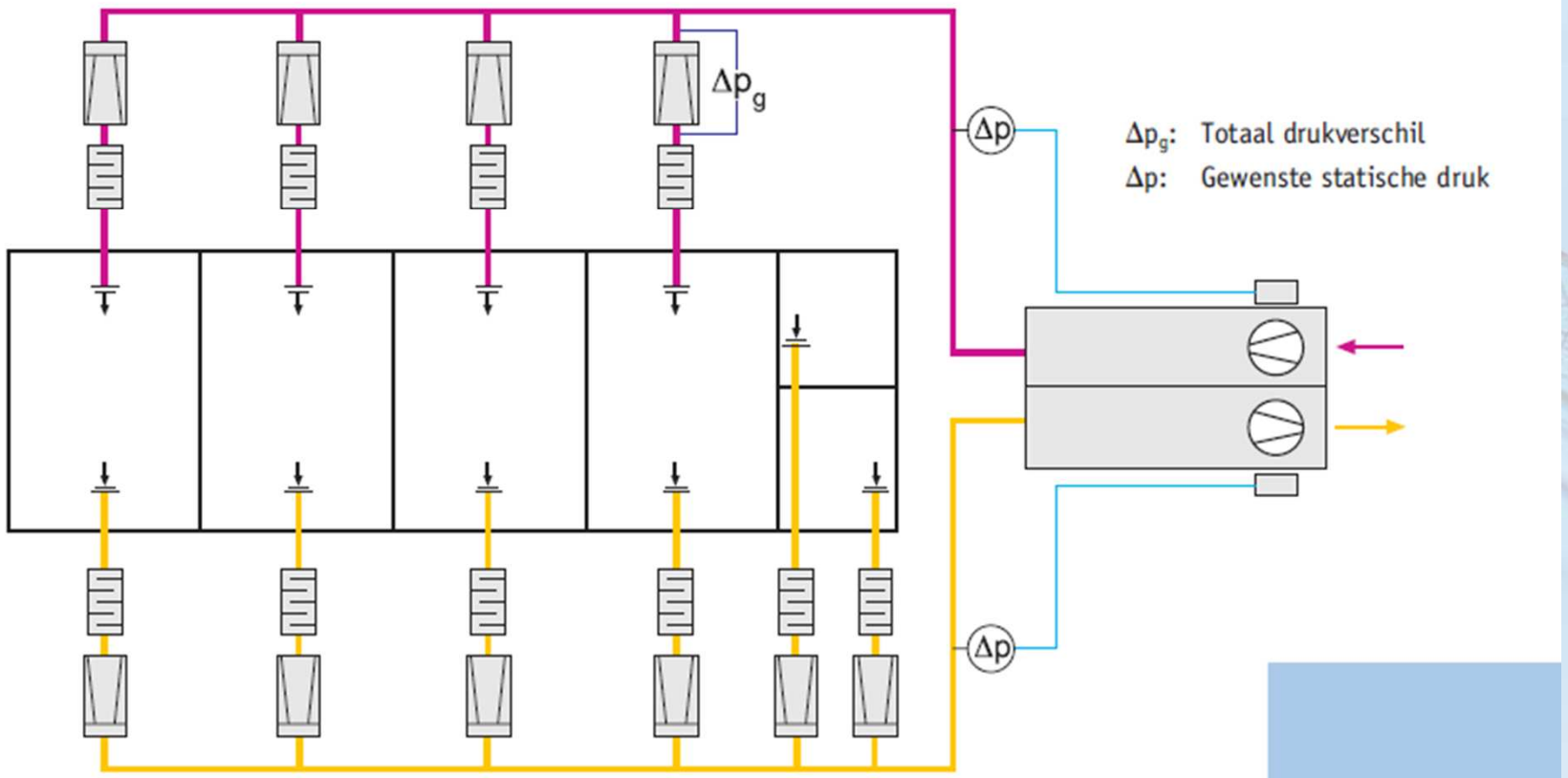
Régulation en soufflage et reprise



Régulation en parallèle



Ventilatorregeling

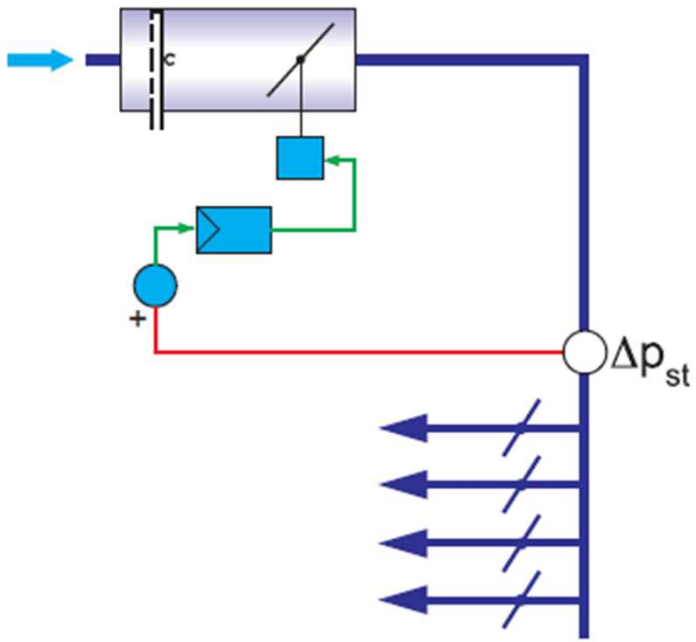


Statische drukregeling

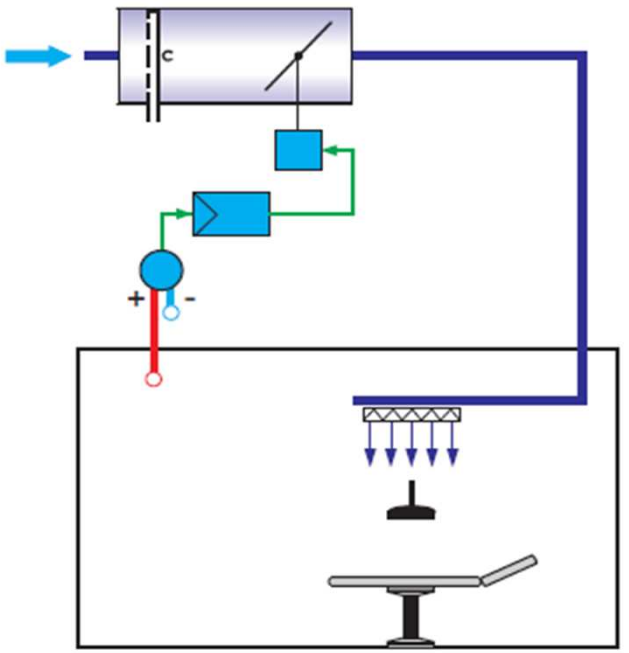
Klepstandregeling

Drukregeling

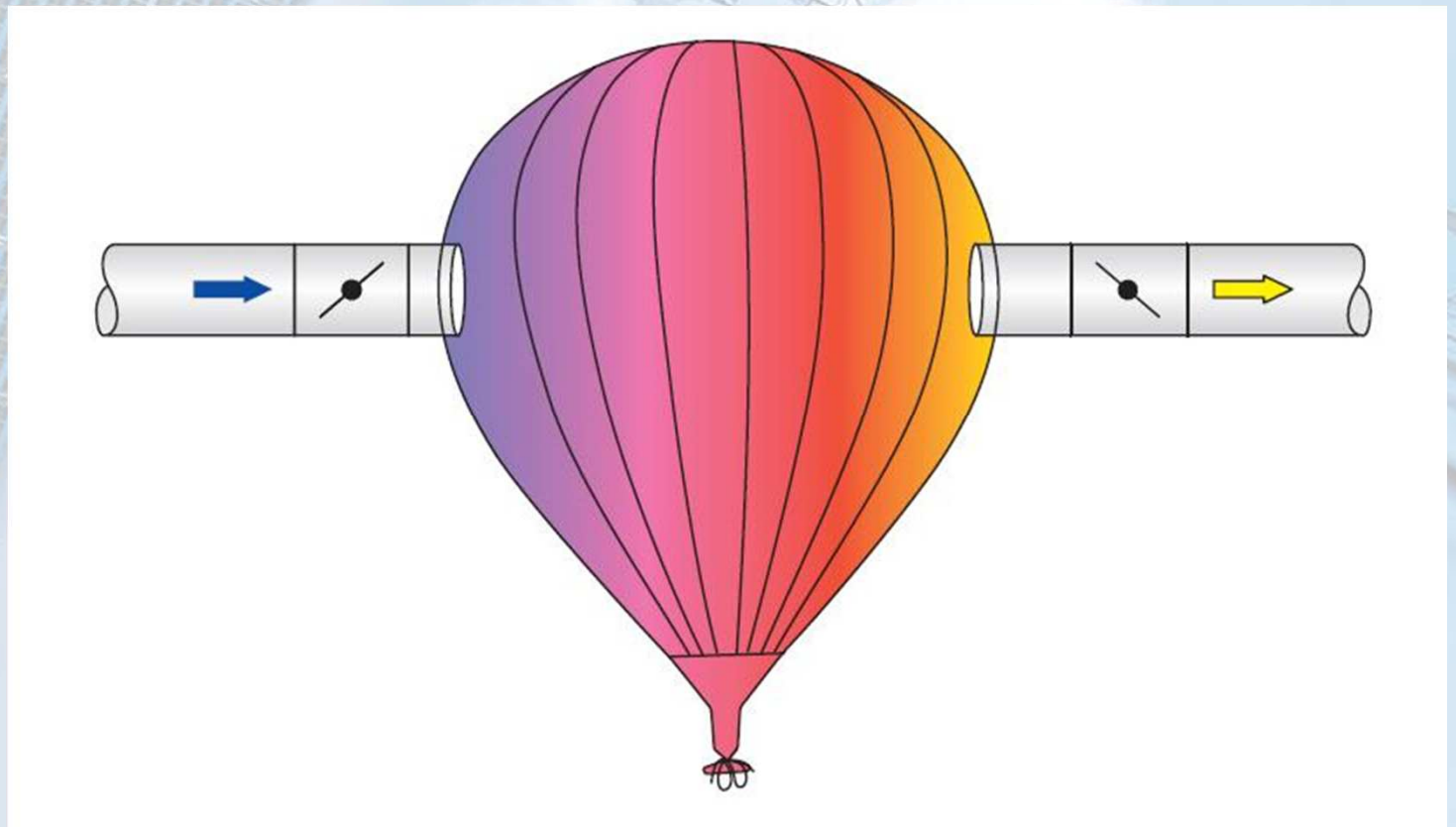
Kanaaldrukregeling



Ruimtedrukregeling



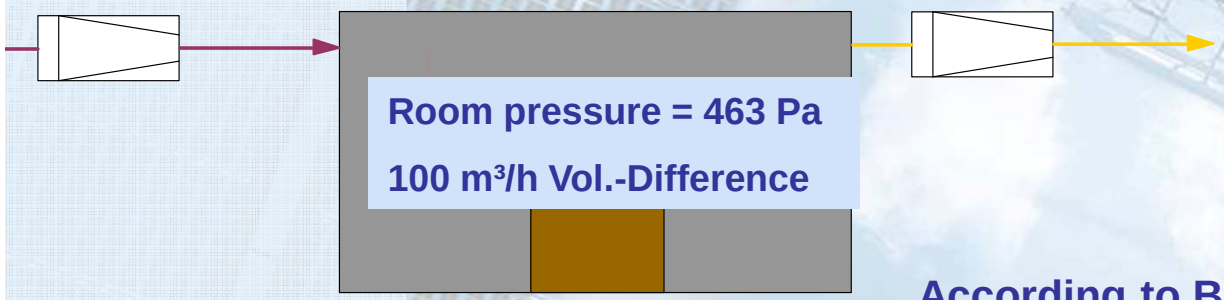
Not so easy to keep him on the same size



Physical Backround

Roomleakage: 0,001 m²

About 1 mm gap below the door



According to Bernoulli:

‡ = Volume flow difference

A = Roomleakage

ρ density of air 1,2 kg/m³

$$\Delta p = \frac{\rho}{2} * \left(\frac{\dot{V}}{A}\right)^2$$

If the area is nearly zero this part of the formular is nearly unlimited!

Then little canges in the volume flow have extreme effects

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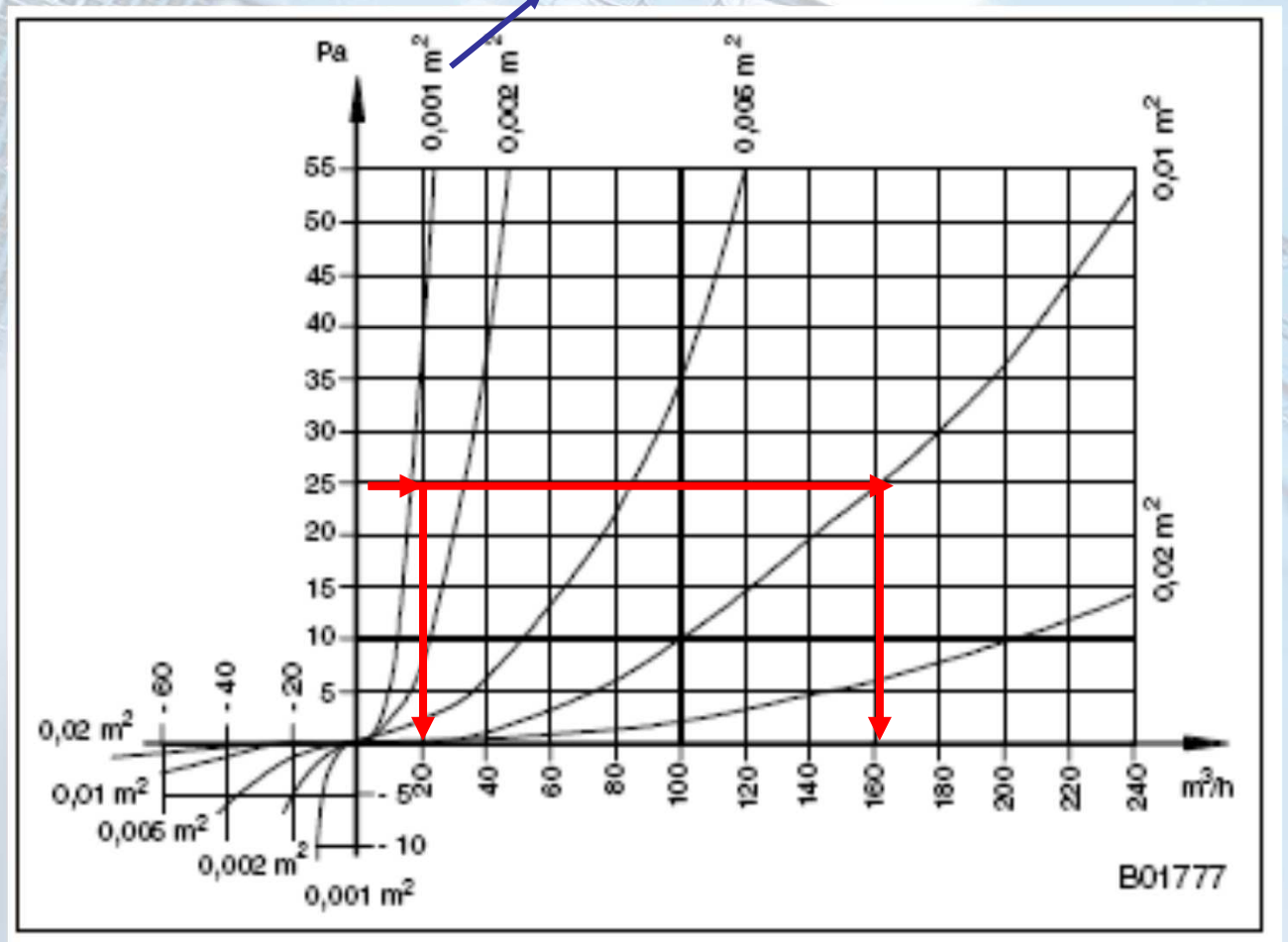
The art of handling air

The volume flow difference is independet of the room size!

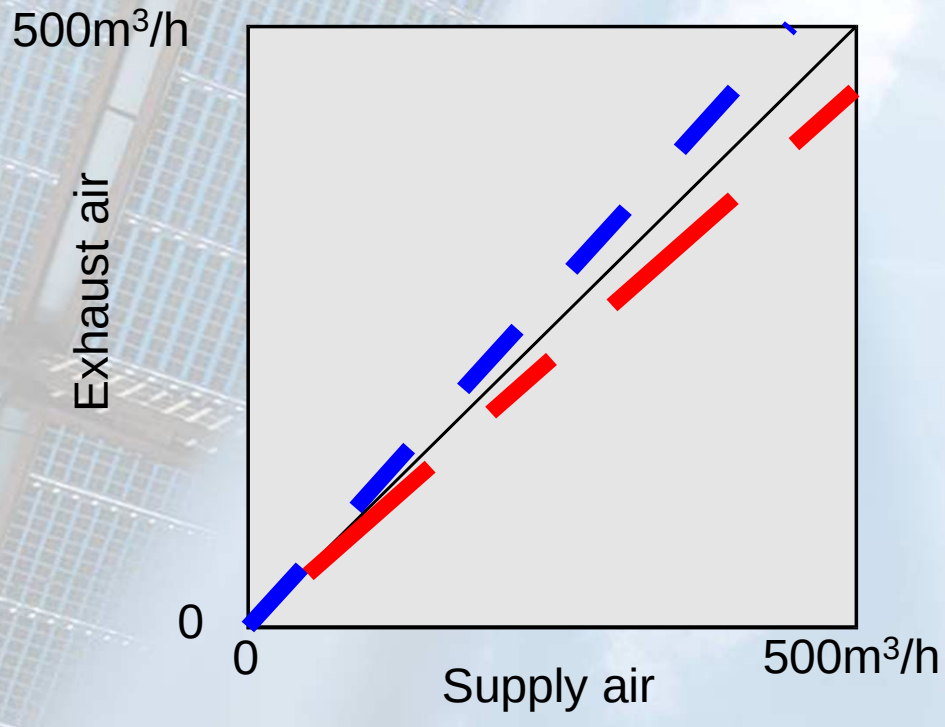
$$\Delta p = \frac{\rho}{2} * \left(\frac{\dot{V}}{A * \mu} \right)^2$$

about 1mm gap



%-control

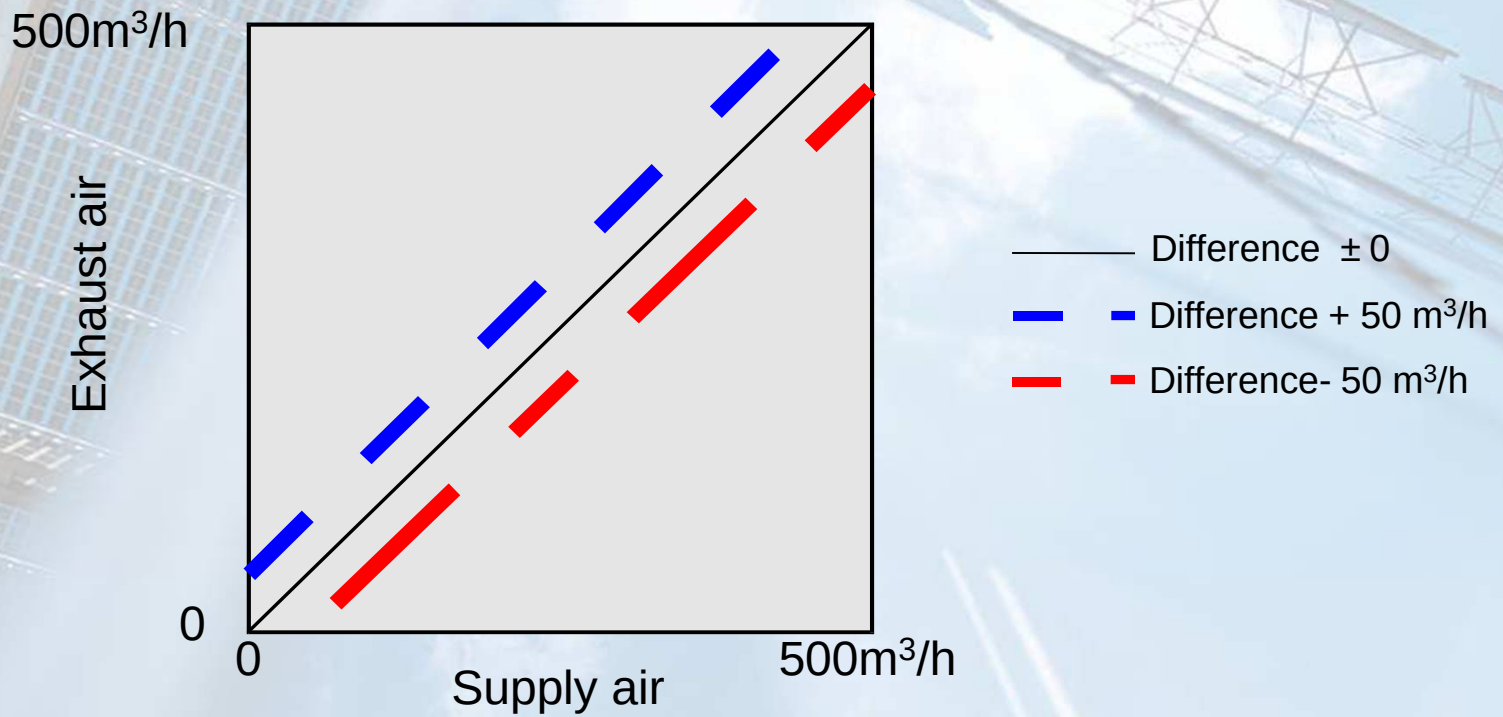
‡supply set = ‡exhaust act. ……%



100% means 1,0
+10% means 1,1
-10% means 0.9

Constant difference-Control

$\ddagger_{supply\ set} = \ddagger_{exhaust\ act.}$ **+ Difference**



EASYLAB – Basics of pressure control

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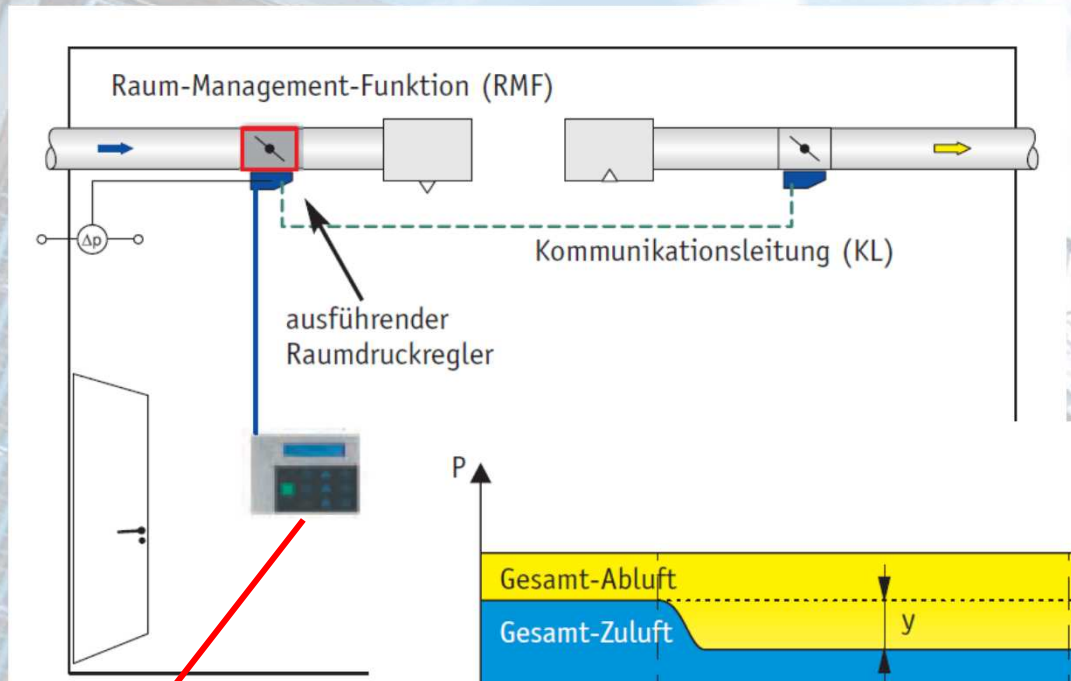
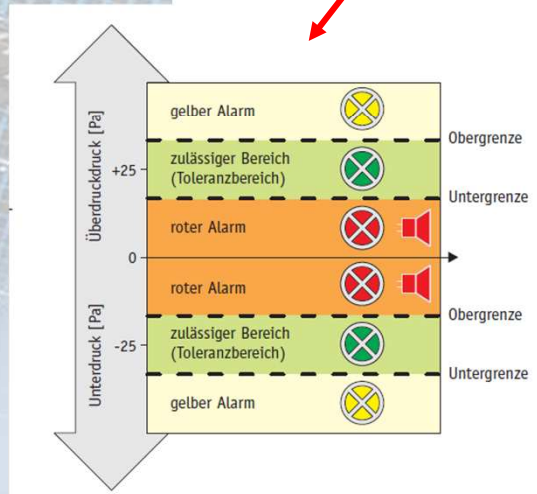
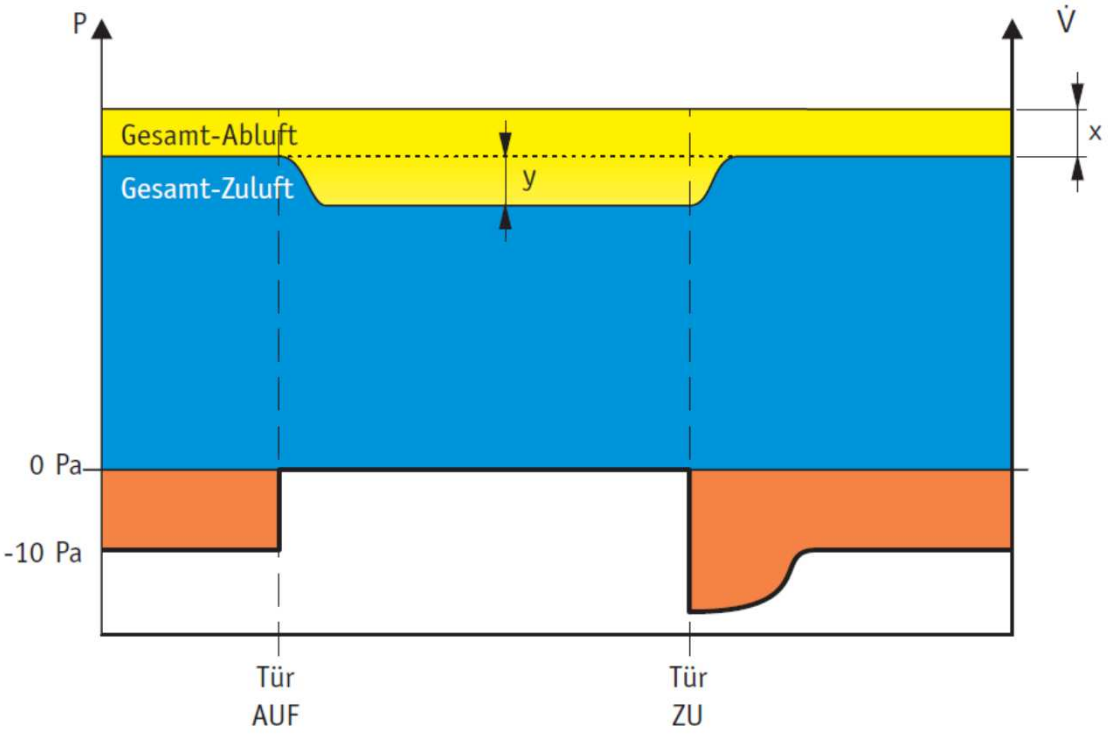
The art of handling air





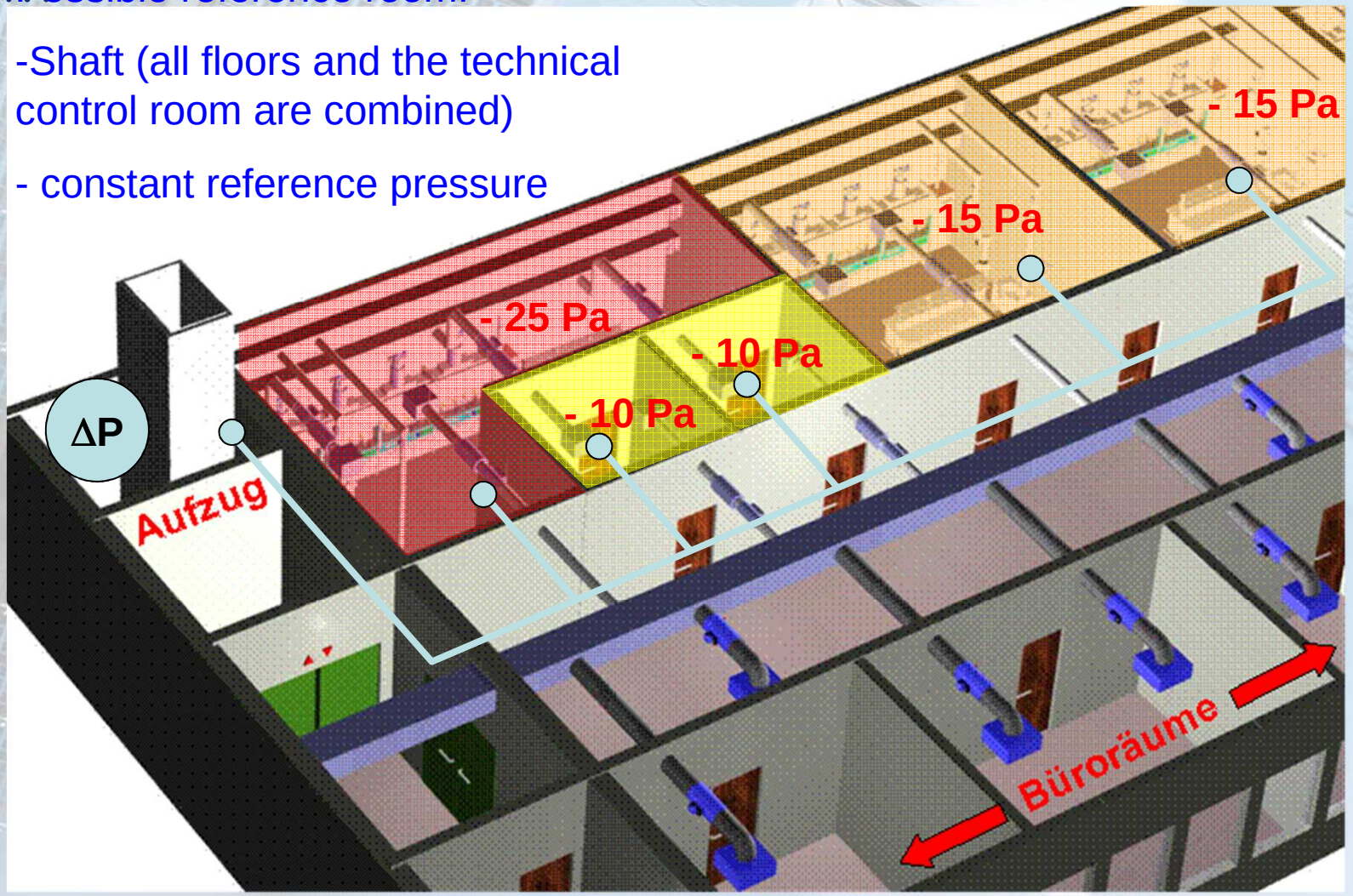


Room pressure control

. . . . . Possible reference room:

-Shaft (all floors and the technical control room are combined)

- constant reference pressure



Applications spéciales

Speciale toepassingen

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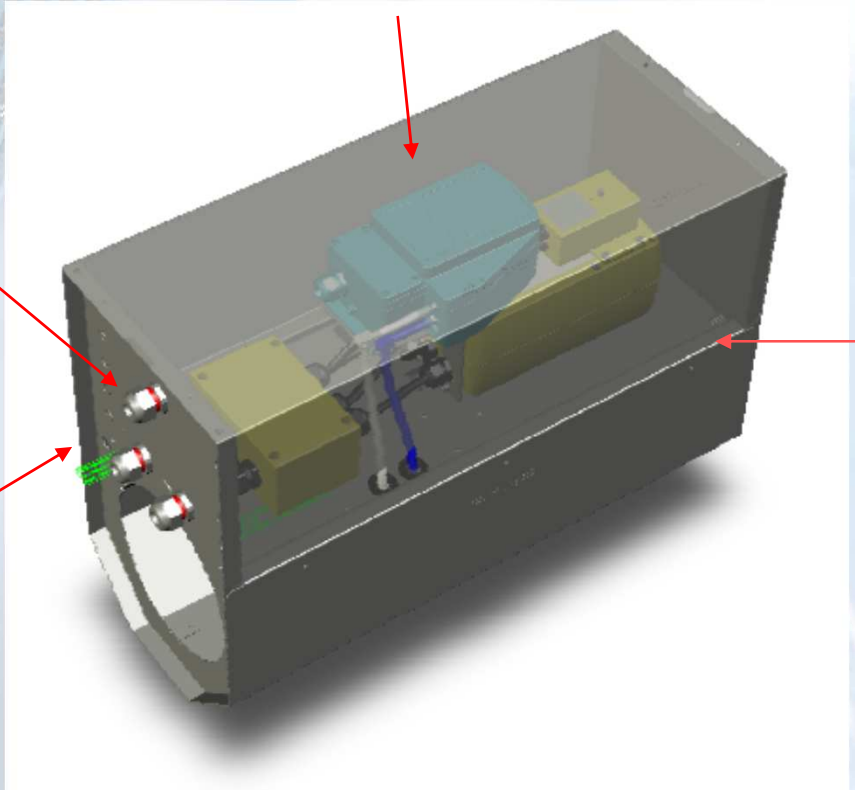
ATEX
Trox solution TVR-Ex electronic

Ex-plugs for all connection wires

Ex-Connection box, Ex- actuator and Ex-transducer under cover blade



Material:

Sheet metal,

Stainless steel,

Powder coated

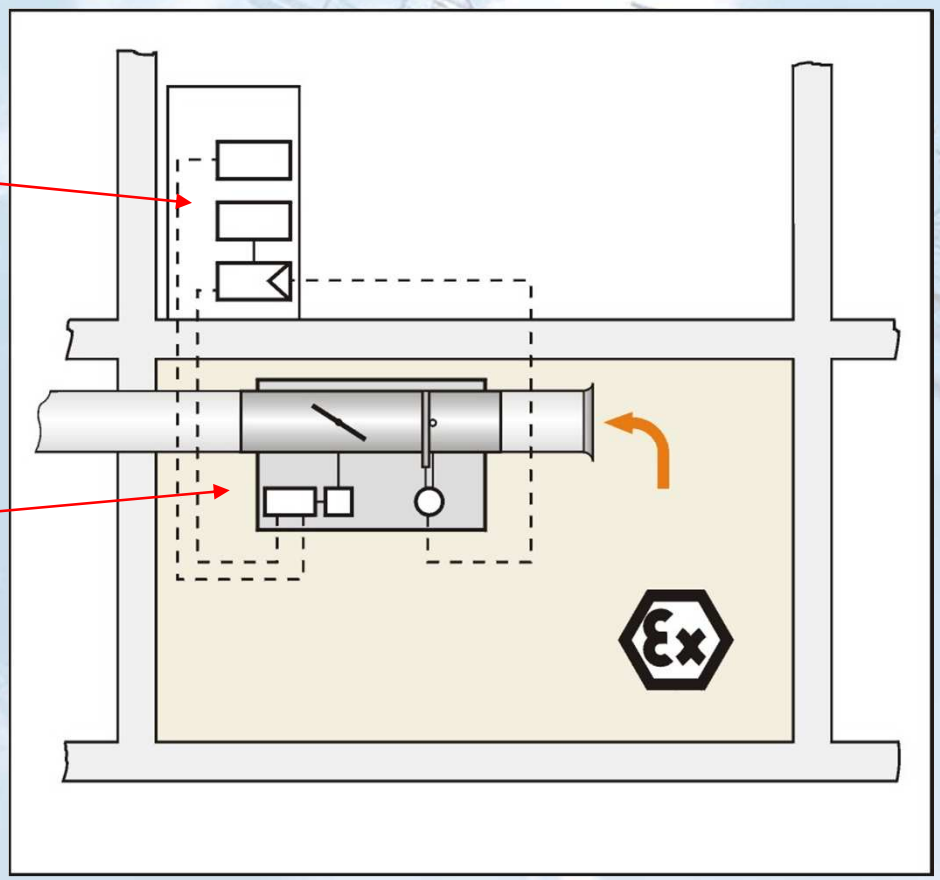
Ground wire

Principle of the TVR-EX

Electronic controller TCU II

TVR-EX with all electronic components

Power supply 230 / 24 VAC



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RN-Ex, EN-Ex

ATEX Certificate

RN-Ex

EN-Ex

TVR-Ex

TÜV CERT TÜV TÜV Rheinland Group

(1) **Baumusterprüfbescheinigung**

(2) Geräte und Schutzsysteme zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen - Richtlinie 94/9/EG

(3) Baumusterprüfbescheinigungsnummer:

TÜV 05 ATEX 7159 X

(4) **Gerät:** **Konstantvolumenstromregler RN und EN**

(5) **Hersteller:** **Gebrüder Trox GmbH**

(6) **Anschrift:** **47504 Neukirchen- Vluyn**
Heinrich- Trox- Platz

(7) Die Bauart dieses Gerätes sowie die verschiedenen zulässigen Ausführungen sind in der Anlage zu dieser Baumusterprüfbescheinigung festgelegt.

(8) Die TÜV CERT-Zertifizierungsstelle für Ex-Schutz-Produkte der TÜV Industrie Service GmbH, TÜV Rheinland Group, bescheinigt die Erfüllung der grundlegenden Sicherheits- und Gesundheitsanforderungen für die Konzeption und den Bau von Geräten und Schutzsystemen zur bestimmungsgemäßen Verwendung in explosionsgefährdeten Bereichen gemäß Anhang II der Richtlinie 94/9/EG.

Die Ergebnisse der Prüfung sind in dem vertraulichen Prüfbericht Nr.:194 /Ex 159 00 / 05 festgelegt.

(9) Die grundlegenden Sicherheits- und Gesundheitsanforderungen werden erfüllt durch Übereinstimmung mit

EN 1127-1:1997 **EN 13463-1: 2001**
EN 13463-5: 2003

(10) Falls das Zeichen „X" hinter der Bescheinigungsnummer steht, wird auf besondere Bedingungen für die sichere Anwendung des Gerätes in der Anlage zu dieser Bescheinigung hingewiesen.

(11) Diese Baumusterprüfbescheinigung bezieht sich nur auf Konzeption und Prüfung des festgelegten Gerätes gemäß Richtlinie 94/9/EG. Weitere Anforderungen dieser Richtlinie gelte für die Herstellung und das Inverkehrbringen dieses Gerätes. Diese Anforderungen werden durch diese Bescheinigung nicht abgedeckt.

(12) Die Kennzeichnung des Gerätes muss die folgenden Angaben enthalten:

Ex II 2 G D **c 80°C (T6)**

TÜV CERT-Zertifizierungsstelle für Explosionsschutz
Am Grauen Stein 1
D-51101 Köln

Dipl.-Ing. Klaus Wettingfeld Köln, 20.06.05

Diese Baumusterprüfbescheinigung hat ohne Unterschrift und Stempel keine Gültigkeit
Diese Baumusterprüfbescheinigung darf nur unverändert verbreitet werden. Auszüge und Änderungen bedürfen der Genehmigung der TÜV Cert-Zertifizierungsstelle für Ex-Schutz-Produkte
TÜV Industrie Service GmbH TÜV Rheinland Group Am Grauen Stein 51105 Köln
Tel. +49 (0) 221 806-0 Fax. + 49 (0) 221 806 114

Everything started with the fume hood …

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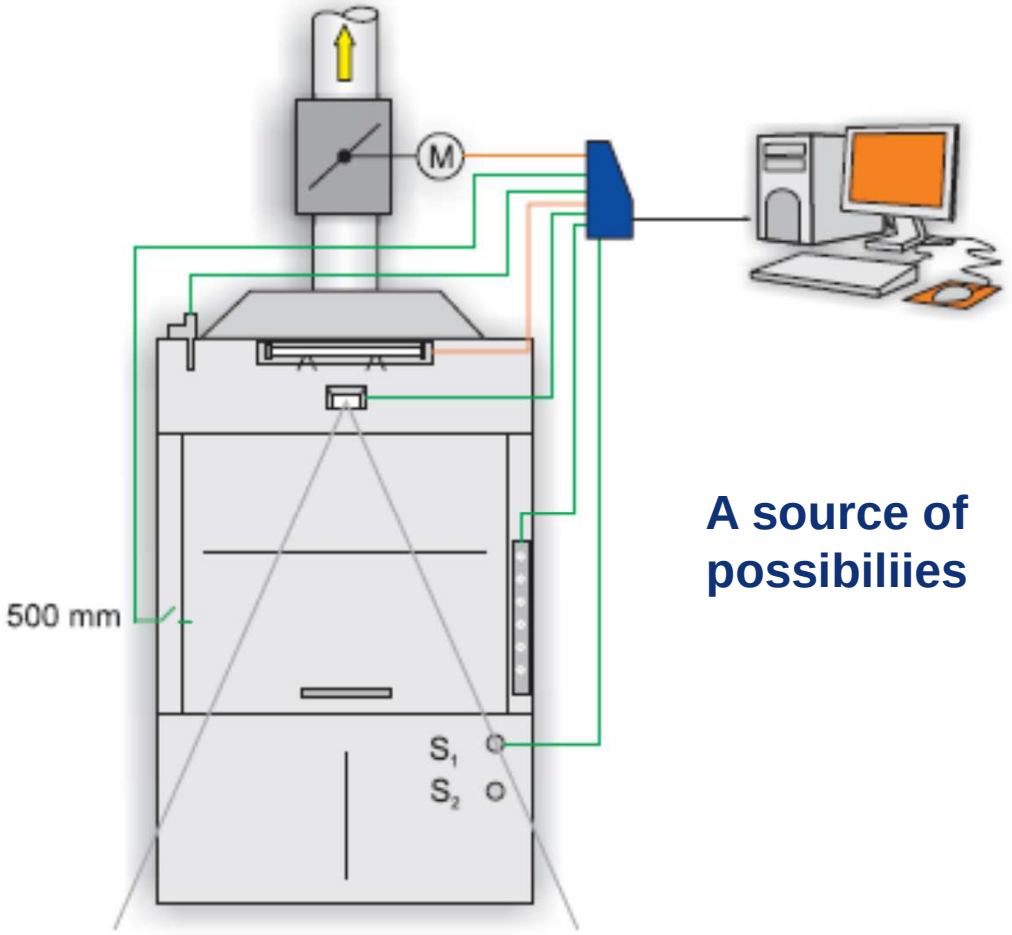

A source of possibiliies

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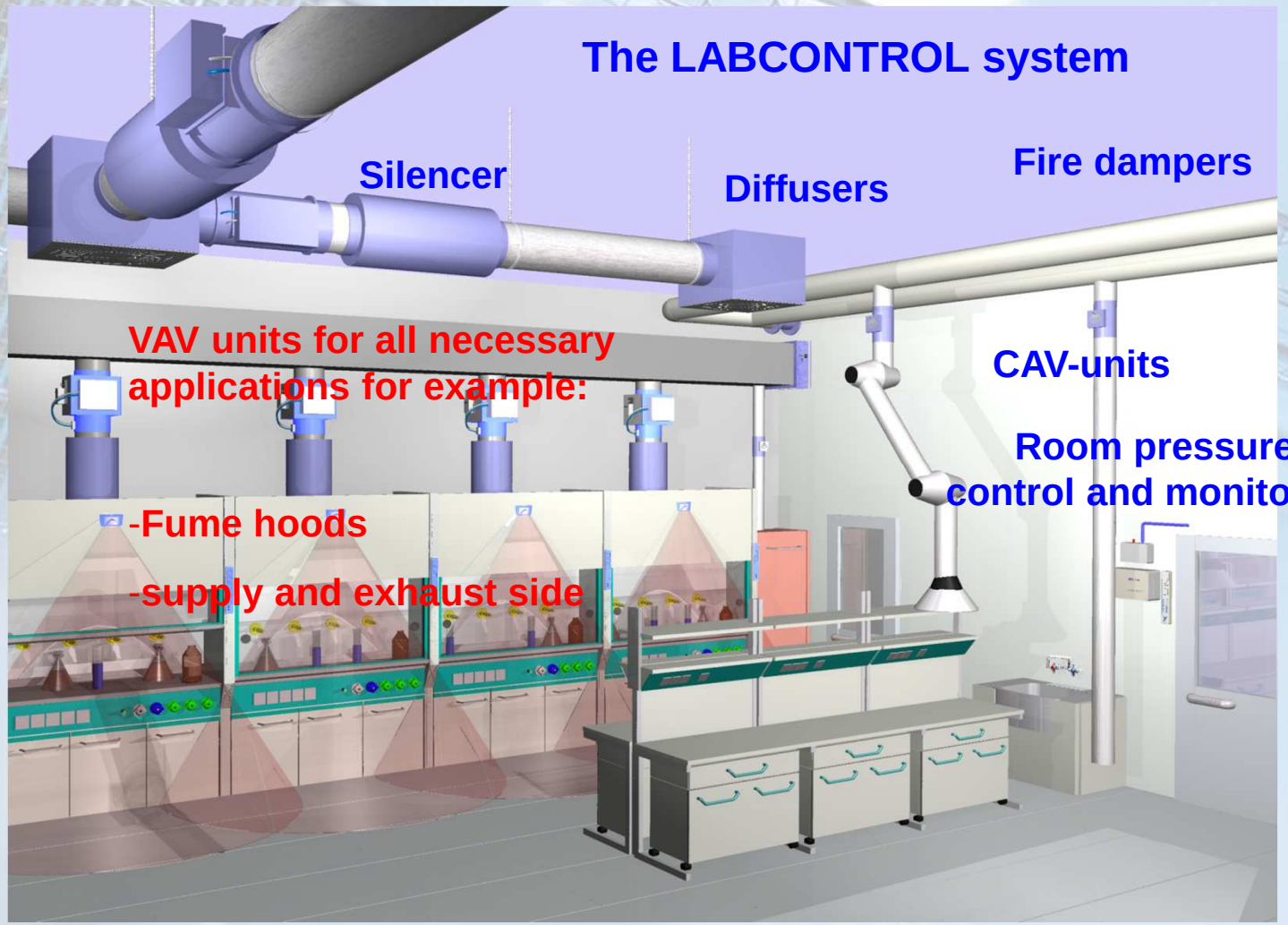
All necessary components from single source



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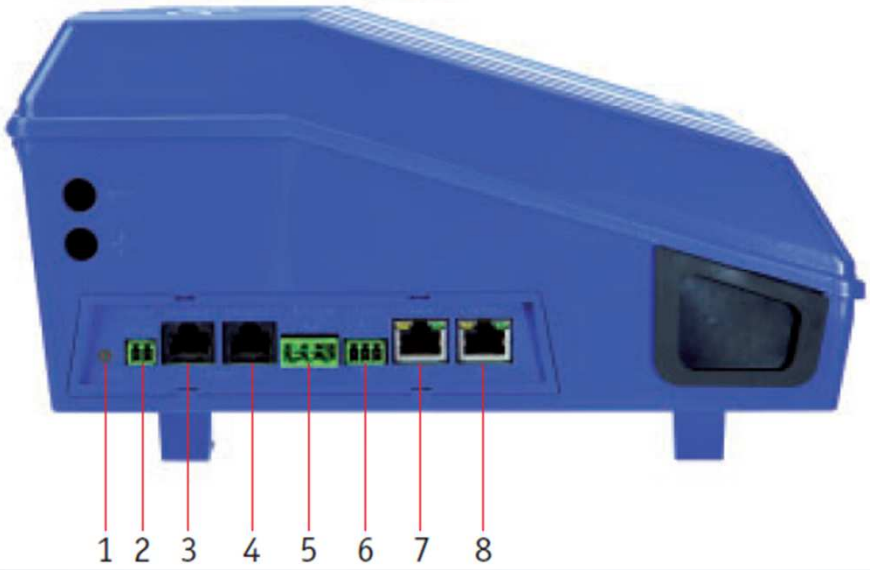
EASY to install

Easy Wiring:

- **Connections integrated in the casing**
- **Easy Patch Wire technology**



1 LED for failure indication (on both sides)
2 Connection for the 500mm switch (EN 14175)
3 Connection user terminal 1
4 Connection user terminal 2
5 Connection actuator
6 Connection VS-TRD (face velocity sensor)
7 Connection KL (Communication Patch-Wire)
8 Connection KL (Communication Patch-Wire)

That is fast!!

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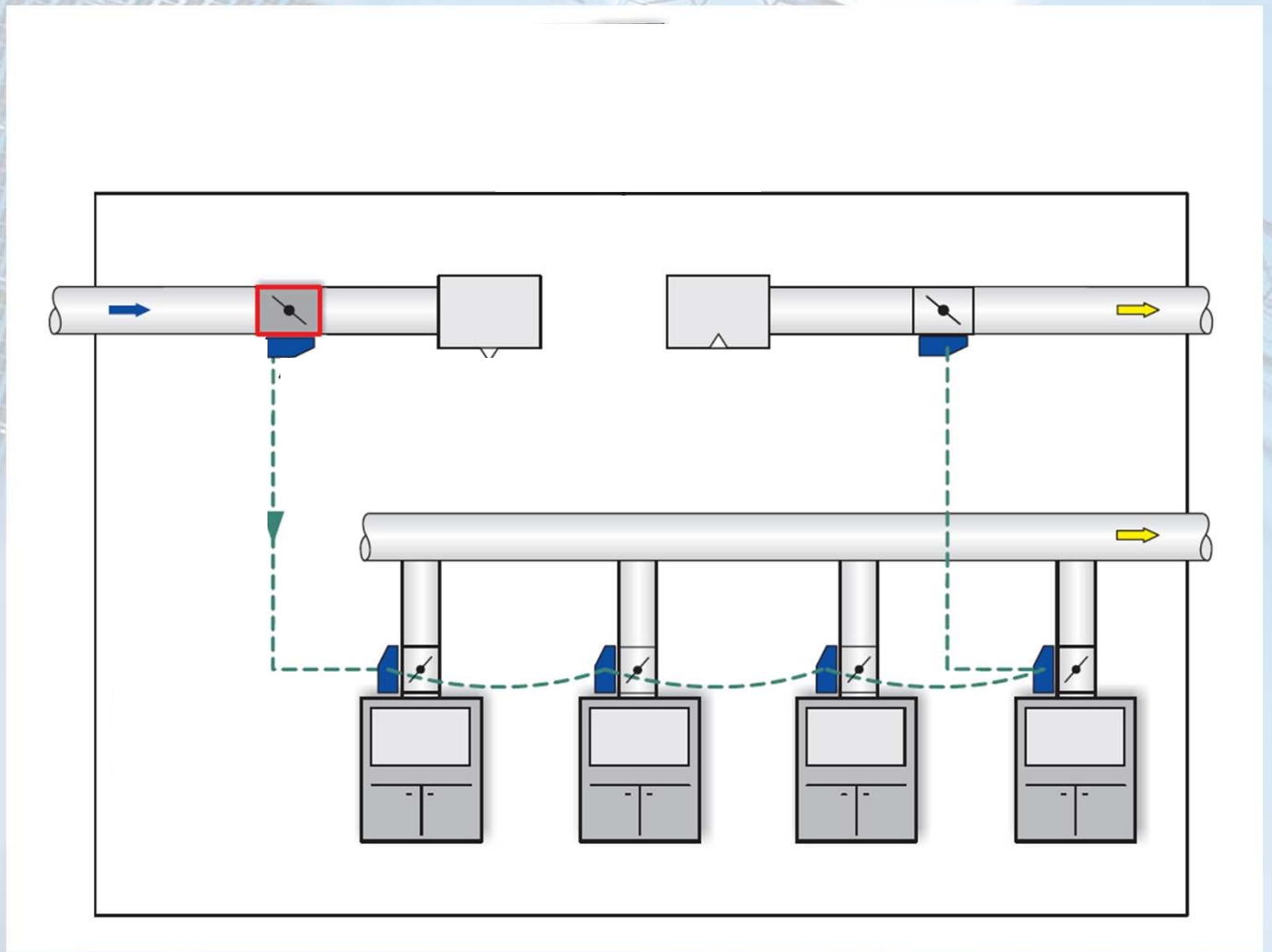
The wiring can be done within minutes!



Selectie en voorbeelden

Selection et exemples

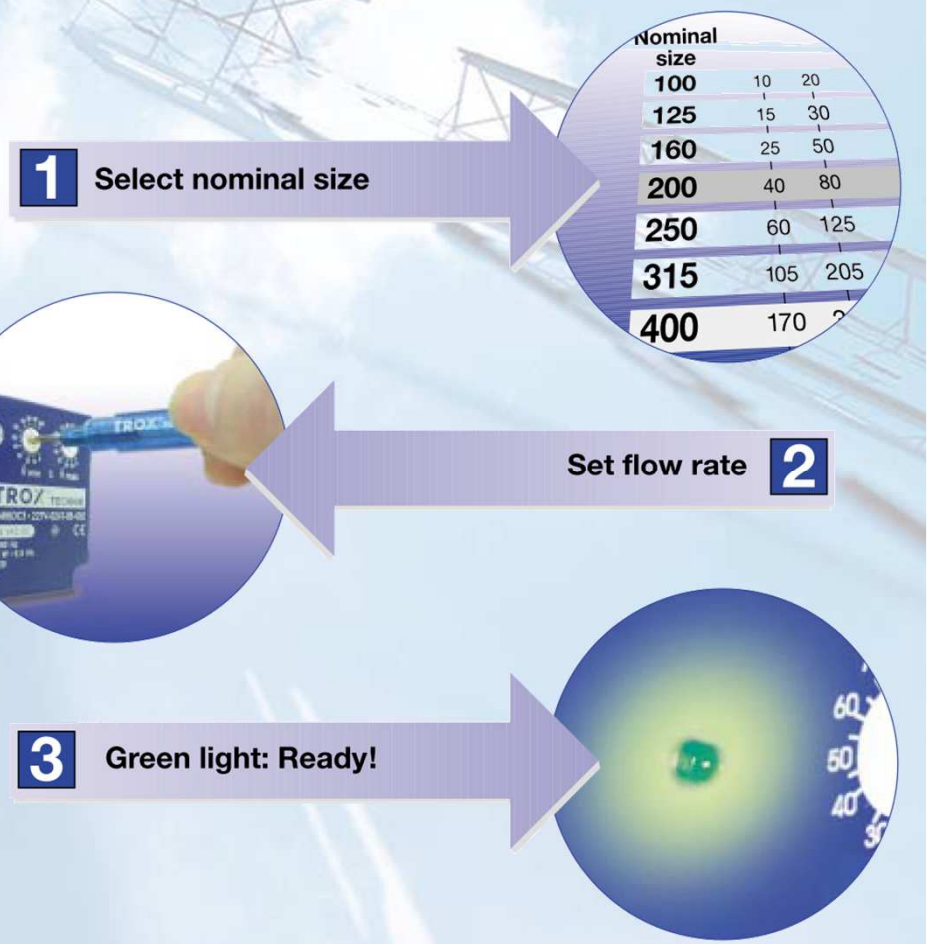
The Easy Philosophy

EASY Selection according to nominal size of the duct system

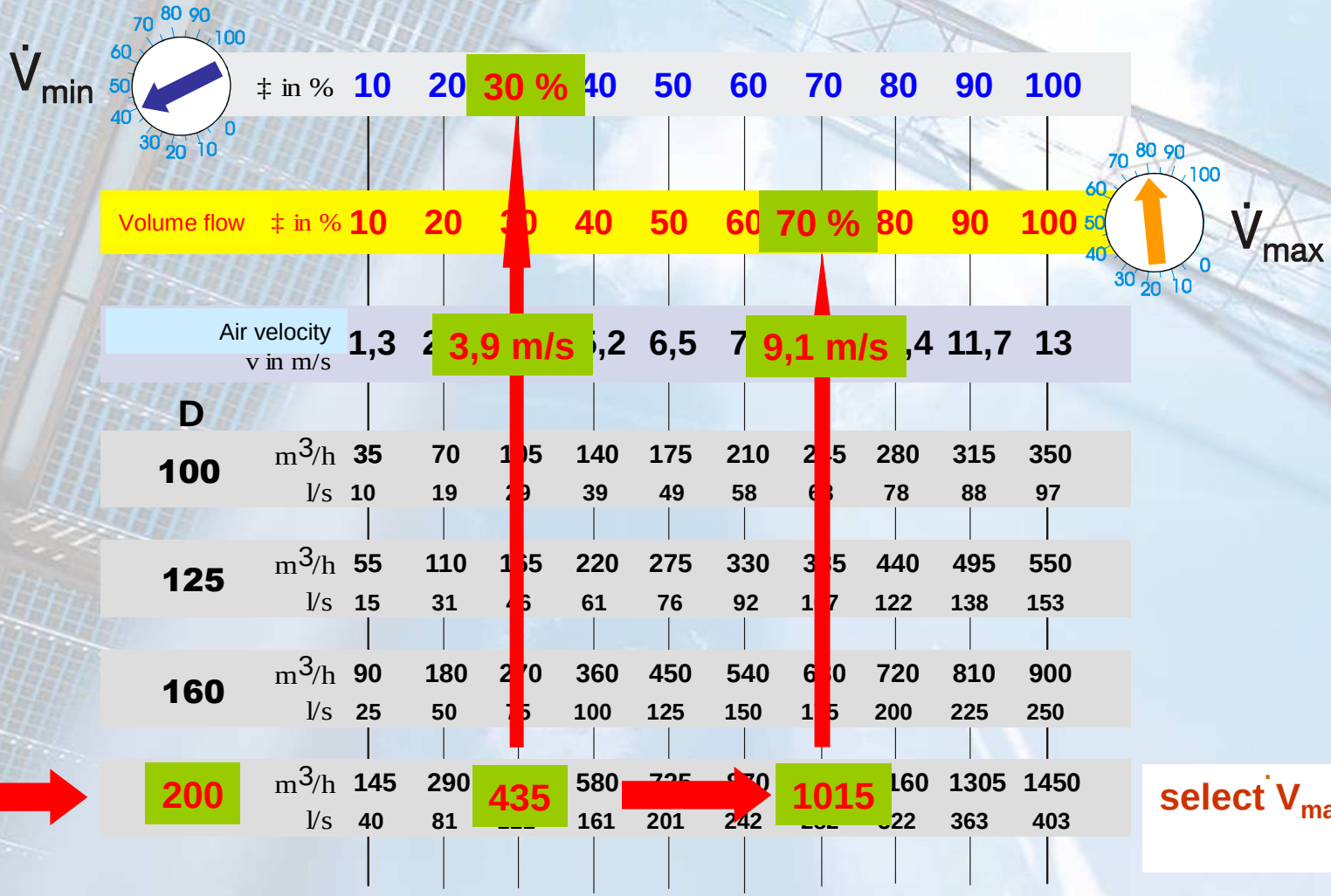
EASY Flow rate adjustment without adjustment tool

EASY Functional testing with service button

EASY Functional check by indicator light

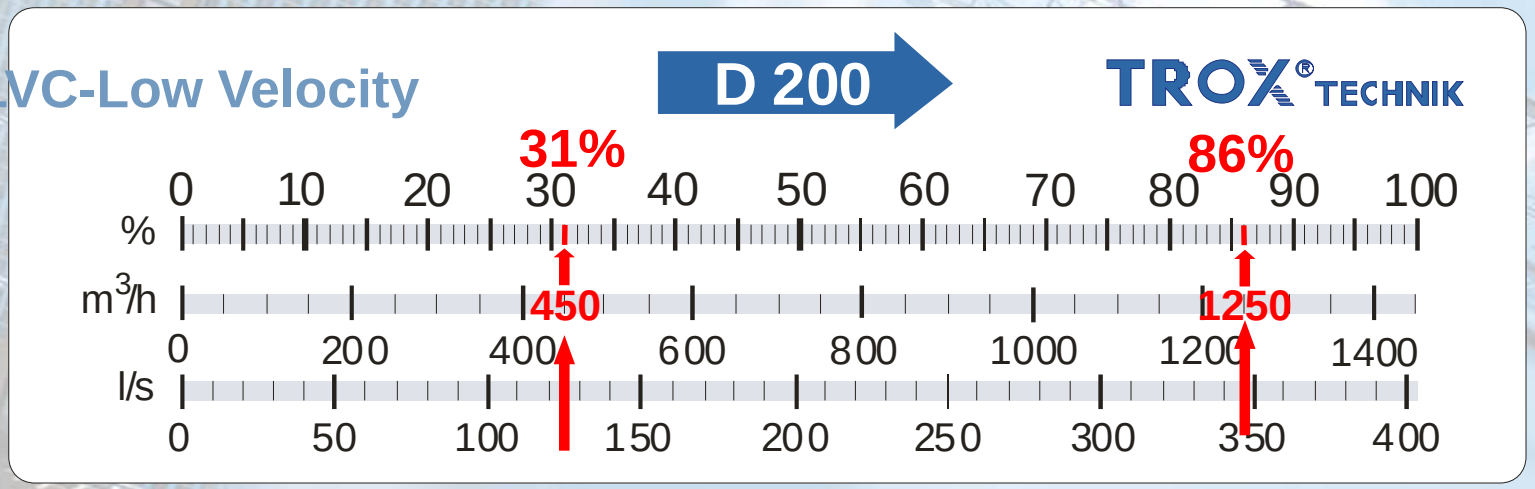


Size selection, Determination of percentages



select $\dot{V}_{max}$

Determination and adjustment of percentages on site



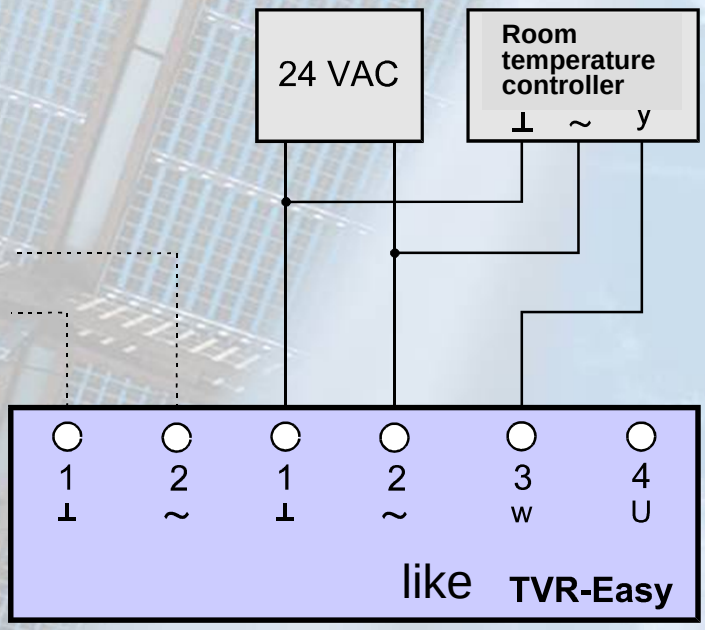
Example:

$\dot{V}_{min}$ **Set = 450 m3/h**

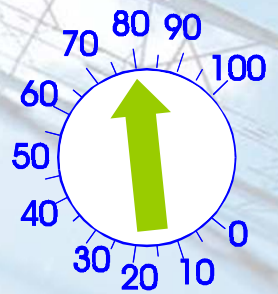
$\dot{V}_{max}$ **Set = 1250 m3/h**

Connection examples

Variable flow rate control



$\dot{V}_{min}$



$\dot{V}_{max}$

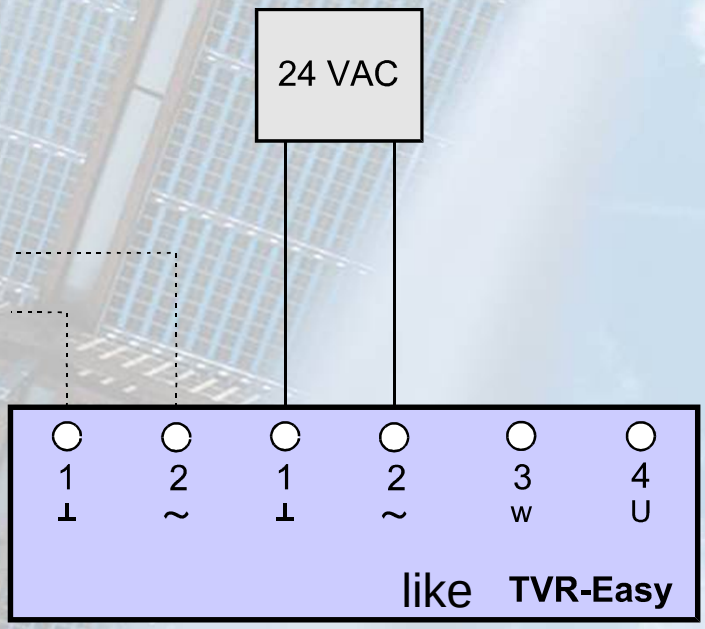
If $\dot{V}_{min}$ is set higher than $\dot{V}_{max}$, then $\dot{V}_{min}$ min is provided as a constant flow rate.

If $\dot{V}_{min}$ is set on 0 %, then control is between shut-off and $\dot{V}_{max}$.

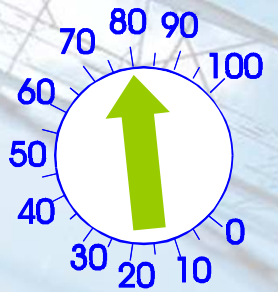
If the control signal falls below 0.1 VDC, the control damper closes (leakage flow only).

Connection examples

Constant volume flow rate control



$\dot{V}_{min}$

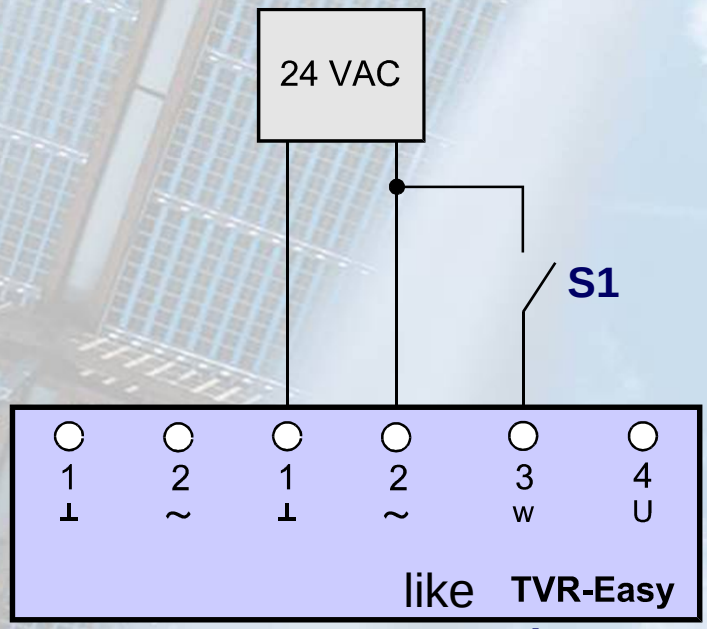


$\dot{V}_{max}$

The constant flow rate can be set with the $\dot{V}_{min}$ potentiometer.
The setting of the V_{max}-potentiometer is unimportant.

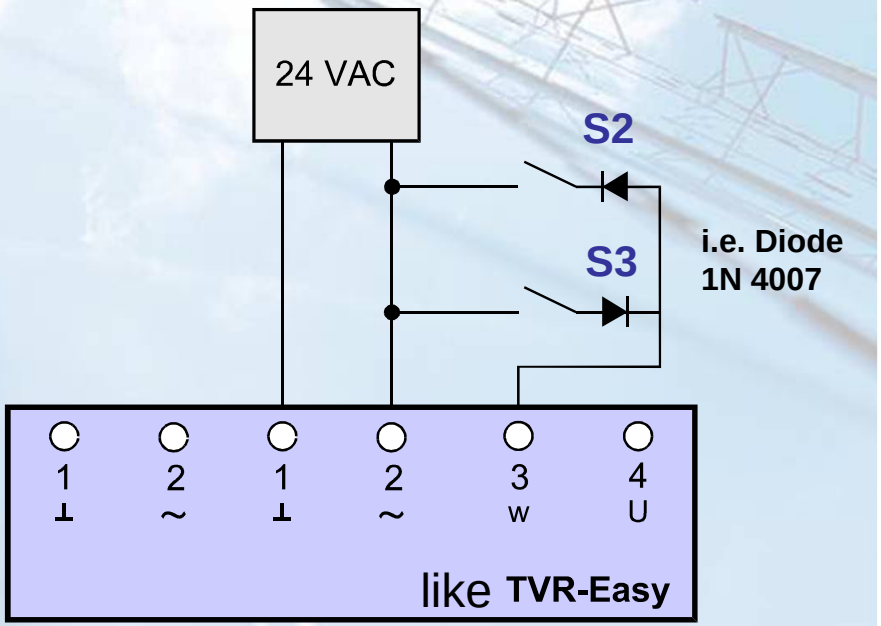
Connection examples

$\dot{V}_{min}$ / $\dot{V}_{max}$ changeover

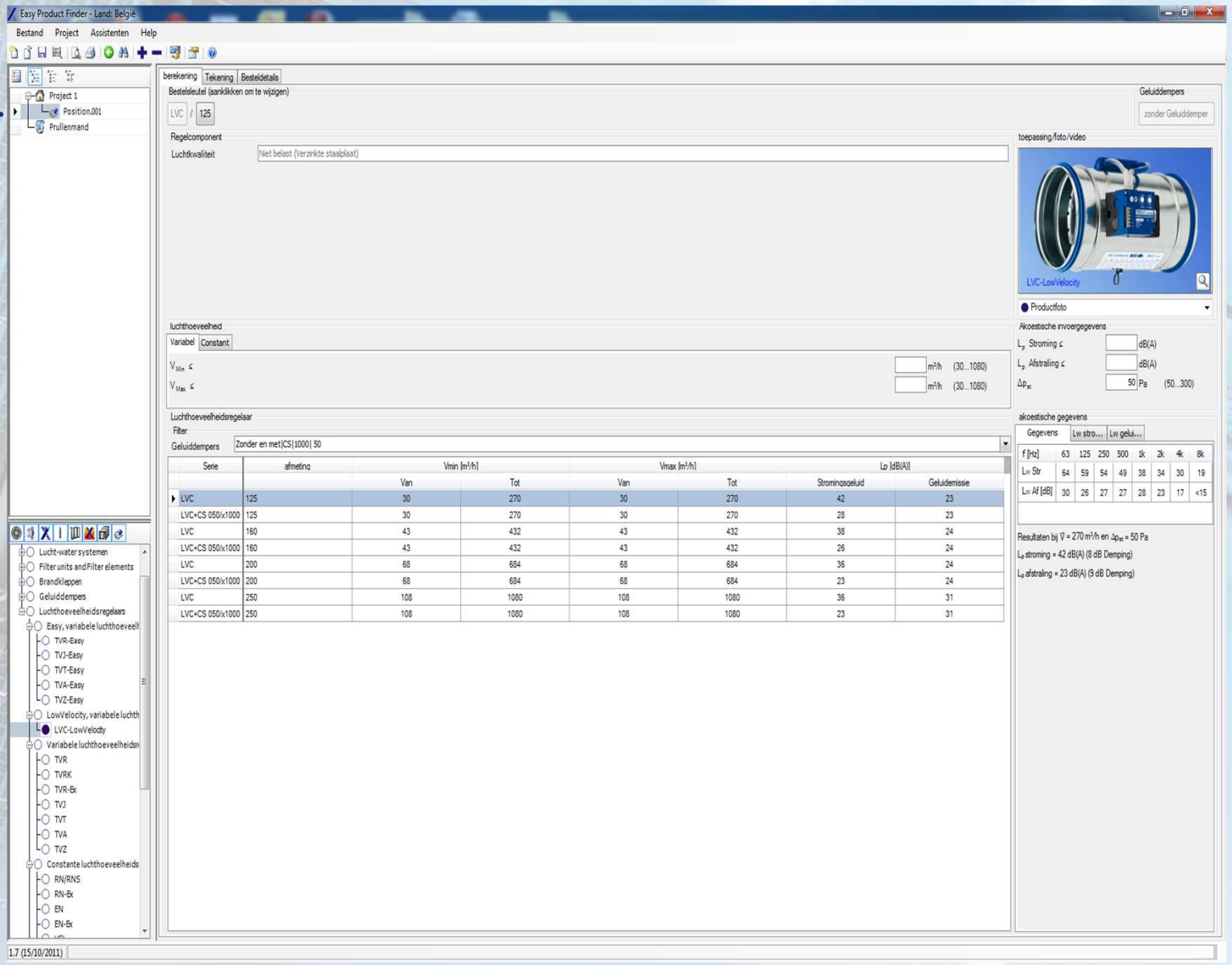


S1 open: $\dot{V}_{min}$ S1 closed: $\dot{V}_{max}$

Override controls OPEN / CLOSED



S2 closed: Damper blade CLOSED
S3 closed: Damper blade OPEN


Easy Product Finder - Land: België
Bestand Project Assistenten Help
Project 1
Position.001
Prullenmand
berekening Tekening Besteldetails
Bestelsleutel (aanklikken om te wijzigen)
LVC / 125
Geluiddempers
zonder Geluiddemper
Regelcomponent
Luchtkwaliteit
Niet belast (Verzinkte staalplaat)
toepassing/foto/video
LVC-LowVelocity
Productfoto
luchthoeveelheid
Variabel Constant
Akoestische invoergegevens
Stroming ≤ dB(A)
Afstraling ≤ dB(A)
50 Pa (50...300)
Luchthoeveelheidsregelaar
Filter
Geluiddempers Zonder en met|CS|1000| 50
akoestische gegevens
Gegevens Lw stro... Lw gelui...
Serie afmeting Vmin [m³/h] Vmax [m³/h] Lp [dB(A)]
Van Tot Van Tot Stromingsgeluid Geluidemissie
LVC 125 30 270 30 270 42 23
LVC+CS 050/x1000 125 30 270 30 270 28 23
LVC 160 43 432 43 432 38 24
LVC+CS 050/x1000 160 43 432 43 432 26 24
LVC 200 68 684 68 684 36 24
LVC+CS 050/x1000 200 68 684 68 684 23 24
LVC 250 108 1080 108 1080 36 31
LVC+CS 050/x1000 250 108 1080 108 1080 23 31
f [Hz] 63 125 250 500 1k 2k 4k 8k
Lw Str 64 59 54 49 38 34 30 19
Lw Af [dB] 30 26 27 27 28 23 17 <15
Resultaten bij V̇ = 270 m³/h en Δpst = 50 Pa
Lp stroming = 42 dB(A) (8 dB Demping)
Lp afstraling = 23 dB(A) (9 dB Demping)
Lucht-water systemen
Filter units and Filter elements
Brandkleppen
Geluiddempers
Luchthoeveelheidsregelaars
Easy, variabele luchthoeveelh
TVR-Easy
TVJ-Easy
TVT-Easy
TVA-Easy
TVZ-Easy
LowVelocity, variabele luchth
LVC-LowVelocity
Variabele luchthoeveelheidsr
TVR
TVRK
TVR-Ex
TVJ
TVT
TVA
TVZ
Constante luchthoeveelheids
RN/RNS
RN-Ex
EN
EN-Ex
1.7 (15/10/2011)

Thanks for your interest!