VAV BOX

Electric, PTC & Hot Water Reheat Types

STARDUCT

MADE IN VIETNAM

RE-HEAT AND FAN POWERED VARIABLE AIR VOLUME TERMINAL UNIT

S-VSV-SW/SE
S-VAV-PF/SF

STARDUCT

WE

SALE

SUPEIORITY

Index	Page

STARDUCT
CERTIFIED MANUFACTURER

With nearly 20 years of experience in manufacturing supplement and supporting systems for M.E.P and HVAC, Star Asia Jsc. has been supplying many major heavy industrial, commercial and residential projects with its Starduct products and service.

Starduct VAV terminal units of Star Asia are results of carefully researching, testing and manufacturing in a long period of time. With complex requirements in terms of technical standards and accuracy in operation, these products require a close combination of professional design engineers, technical staff and experienced workers. . Therefore, VAV boxes are not only products but also the pride of our company.

PRODUCTION SYSTEM AND PROCESS OF STAR ASIA

In order to meet the high technical requirements of products, Star Asia has focused on long-term investment in research and development (R&D), design engineers are directly involved in manufacturing product, quality inspection and testing.

Towards the international market, our VAV terminal units are processed, manufactured, assembled and quality controlled on the most modern machine tools and testing equipment

To ensure reliability and accuracy according to specifications, all batches of VAV products are tested prior to shipment.

APPLICABLE STANDARDS

Meeting technical requirements of national and international standards is a direction throughout Star Asia's activities. In designing, manufacturing and testing, Star Asia references and bases on the highest standards in the industry as a basis such as AMCA, ASTM, ASHRAE, ISO, AHRI, TCVN...

Star Asia Jsc. is the member of AMCA (Air Movement and Control Association), ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers), AHRI (Air-Conditioning, Heating, and Refrigeration Institute), so we are usually receiving relevant updates from these organizations, so that it can be professonally applied to our products.

Star Asia is international member of AMCA

DAS CERTIFICATION

DAS CERTIFICATION

Quality Management System

Certificate of Approval

This is to certify that the QMS of

STARDUCT MECHANICAL FACTORY

(belongs to STAR ASIA TECHNOLOGICAL INVESTMENT JOINT STOCK COMPANY)

Phung Town industrial park, Dan Phuong district, Hanoi City, Vietnam

Has been assessed and found to meet the requirements of

ISO 9001:2015

This certificate is valid for the following scope of operations:

Manufacture and supply of air grilles, air dampers, air ducts, cable tray, cable trunking, cable ladder and HVAC accessories, solar battery brackets

Authorised by:

S.Đ.K.K.D: 0101505053 - C.T.T.N.H.H - CÔNG TY TRÁCH NHIỆM HỮU HẠN CHỨNG NHẬN D.A.S VIỆT NAM - Q. THANH XUÂN - TP. HÀ NỘI

Nguyen Huong Giang
Director

Date of Certificate Issue: 1st February 2024
Certificate Valid Until: 31st January 2027

EA code: 25.99. Recertification audit before 1st November 2026. Certified since 1st February 2018.
This certificate is the property of DAS Vietnam Certification Co.,Ltd and remains valid subject to satisfactory annual Surveillance audits.

DAS Vietnam Certification Co.,Ltd

6th Floor, 34JSC office building,
lane 164 Khuat Duy Tien street,
Thanh Xuan district, Hanoi City, Vietnam.
Tel: +(84) 024.37763177 – 024.35539135
Email: dasinfo@dasvietnam.com
Web: www.das.com.vn

Certificate Number: NVQV 17299

MEMBER OF MULTILATERAL RECOGNITION ARRANGEMENT IAF
ISO 9001
BUREAU OF ACCREDITATION VIETNAM
VICAS-009 QMS

Certificate of Product Ratings

AHRI CERTIFIED®
www.ahridirectory.org

Certificate of Product Ratings

AHRI Certified Reference Number : 213355065 Date : 08-27-2025 Model Status : Active

Old AHRI Reference Number :

Brand Name : Starduct

Model Number : SVAV-S-10

Product Type : Single Duct Terminal Unit (Supply)

Country Of Origin : Vietnam

Rated as follows in accordance with the latest edition of ANSI/AHRI 880 (I-P) with Addendum 1: Performance Rating of Air Terminals and subject to rating accuracy by AHRI-sponsored, independent, third party testing:

Rated Duct Width x Height, in : 14.00x12.00
Primary Air Flow Rate, CFM : 1100
Minimum Operating Pressure, in H2O : 0.04 WAS 0.01

Radiated Sound Power Level @ 1.5 in H2O Differential Static Pressure and 100% Rated Airflow, db
125 Hz : 85 WAS 60
250 Hz : 82 WAS 55
500 Hz : 77 WAS 47
1000 Hz : 76 WAS 38
2000 Hz : 75 WAS 33
4000 Hz : 60 WAS 28

Discharge Sound Power Level @ 1.5 in H2O Differential Static Pressure and 100% Rated Airflow, db
125 Hz : 127 WAS 77
250 Hz : 101 WAS 73
500 Hz : 85 WAS 70
1000 Hz : 86 WAS 67
2000 Hz : 86 WAS 59
4000 Hz : 89 WAS 51

†"Active" Model Status are those that an AHRI Certification Program Participant is currently producing AND selling or offering for sale; OR new models that are being marketed but are not yet being produced."Production Stopped" Model Status are those that an AHRI Certification Program Participant is no longer producing BUT is still selling or offering for sale.
Ratings that are accompanied by WAS indicate an involuntary re-rate. The new published rating is shown along with the previous (i.e. WAS) rating.

DISCLAIMER
AHRI does not endorse the product(s) listed on this Certificate and makes no representations, warranties or guarantees as to, and assumes no responsibility for, the product(s) listed on this Certificate. AHRI expressly disclaims all liability for damages of any kind arising out of the use or performance of the product(s), or the unauthorized alteration of data listed on this Certificate. Certified ratings are valid only for models and configurations listed in the directory at www.ahridirectory.org.

TERMS AND CONDITIONS
This Certificate and its contents are proprietary products of AHRI. This Certificate shall only be used for individual, personal and confidential reference purposes. The contents of this Certificate may not, in whole or in part, be reproduced; copied; disseminated; entered into a computer database; or otherwise utilized, in any form or manner or by any means, except for the user's individual, personal and confidential reference.

CERTIFICATE VERIFICATION
The information for the model cited on this certificate can be verified at www.ahridirectory.org, click on "Verify Certificate" link and enter the AHRI Certified Reference Number and the date on which the certificate was issued, which is listed above, and the Certificate No., which is listed at bottom right.

AHRI AIR-CONDITIONING, HEATING, & REFRIGERATION INSTITUTE
we make life better™

©2025 Air-Conditioning, Heating, and Refrigeration Institute

CERTIFICATE NO.: 13400750138055976 9

Check all our Certificate of product ratings @ Universal Search (ahridirectory.org)

Relevant Technical Standards

The design and operation of fan-powered VAV (Variable Air Volume) boxes must comply with various international standards concerning performance, safety, and indoor air quality:

- **ASHRAE Standards**
  - **ASHRAE 62.1 – Ventilation for Acceptable Indoor Air Quality** – Specifies minimum outdoor air requirements for each zone. For VAV systems, it mandates that minimum airflow must not fall below the necessary ventilation rate. Additionally, it adjusts outdoor air requirements when supplying heated air from the ceiling: if supply air temperature exceeds room temperature by more than 15°F (8°C), additional outdoor air must be introduced to counteract stratification effects that reduce air distribution efficiency.
  - **ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential** – Limits inefficient reheat practices. For reheating VAV systems, it typically requires minimum airflow to be capped (e.g., ≤30% of maximum flow) when using electric resistance heating to avoid simultaneous strong cooling and reheating. It also encourages the use of high-efficiency fan motors (ECM) and smart controls. Many designs compliant with 90.1 use fan-powered boxes in perimeter zones to recover waste heat, reduce boiler load, and require ECM motors for continuously operating series fan boxes to reduce power consumption.
  - **ASHRAE 55 – Thermal Environmental Conditions for Human Occupancy** – Addresses thermal comfort. Though not directly regulating VAV systems, it influences temperature and airflow control to prevent cold drafts during low airflow and excessive heating that causes discomfort.tránh thổi khí quá nóng gây mất thoải mái.
- **AHRI/ANSI Standards**
  - **AHRI 880 – Performance Rating of Air Terminals** – Defines testing and performance reporting methods for VAV boxes. Manufacturers must disclose airflow-pressure characteristics and sound levels using standardized procedures. Most commercial VAV boxes are AHRI 880 certified and bear the AHRI label.
  - **AHRI 885 – Procedure for Estimating Occupied Space Sound Levels** – Guides engineers in predicting room noise levels caused by VAV boxes using sound power data from AHRI 880 and attenuation factors through ceilings, ducts, etc. For fan-powered boxes, catalogs typically provide two sets of sound data: with fan on and fan off (airflow-only noise).
  - **ANSI/UL 1995 / UL 60335-2-40 – HVAC Equipment Safety Standards***:* Covers integrated electric heaters, requiring compliance with electrical connections, overheat protection, insulation clearance, non-combustible materials, etc. Products are usually certified by international labs (ETL, UL) and labeled accordingly.
  - **ANSI/ASHRAE 130 – Method of Testing Air Terminal Unit Performance***:* Specifies lab testing procedures for pressure loss, airflow verification, and other performance metrics to ensure manufacturer data accuracy.
- **AMCA Standards (Air Movement and Control Association)**
  - **AMCA 210 / ANSI 51 – Laboratory Methods of Testing Fans for Aerodynamic Performance***:* Applies to small centrifugal fans in VAV boxes. Ensures objective measurement of airflow/pressure curves and fan efficiency. Many VAV fans follow this standard for accurate performance curves.
  - **AMCA 300 – Reverberant Room Method for Sound Testing of Fans***:* Used to independently assess fan noise. Results can be combined with AHRI 880 data to calculate total noise levels of fan-powered VAV boxes.
  - **AMCA 208 – Fan Energy Index (FEI) Classification Standard:** Classifies fan energy performance. ECM motors in VAV boxes typically achieve high ratings (FEI A or B), helping systems meet building code efficiency requirements
- **SummaryFan-powered VAV box design must meet multiple criteria:Indoor air quality: ASHRAE 62.1Energy efficiency: ASHRAE 90.1, ECM motorsAcceptable noise levels: AHRI 885, ASHRAE 55Fan performance: AMCA/ISO standardsElectrical safety: UL standardsEngineers should consult these standards during equipment selection and system design to ensure compliance and optimal performance.**

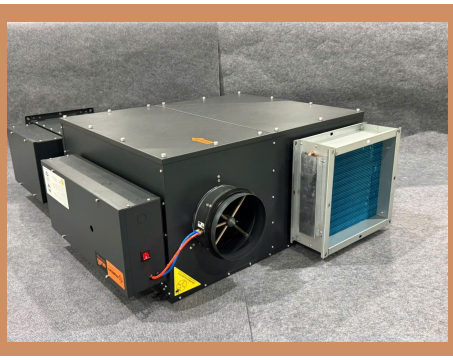
Product Line Overview

Model	Description	Heating Option	Control
S-VAV-SW-T100	Single Duct Re-heat by hot water coil	Water Coil	Belimo/Other
S-VAV-PFW-T200	Parallel fan powered with Hot water coil	Water Coil	Belimo/Other
S-VAV-SE-T100	Single duct Re-heat by Electric heater	Electric Heater	Belimo/Other
S-VAV-SP-T100	Single Duct Re-Heat bt PTC heater	PTC Heater	Belimo/Other
S-VAV-PF	Parallel Fan Poeered VAV Box	No	Belimo/Other
S-VAV-SF	Series Fan Powered VAV Box	No	Belimo/Other
S-VAV-SFE-T200	Parallel fan powered with Electric heater	Electric Heater	Belimo/Other
S-VAV-SFP-T200	Parallel fan powered with PTC heater	PTC Heater	Belimo/Other
S-VAV-L	Single duct vav long box	No	Belimo/Other
S-VAV-LE	Single duct vav long box + Electric Heater	Electric Heater	Belimo/Other
S-VAV-LP	Single duct vav long box + PTC Heater	PTC Heater	Belimo/Other
S-VAV-LW	Single duct vav long box + Hot water Coil	Water Coil	Belimo/Other
S-MV	Compact VAV Box	No	Belimo/Other

RE-HEAT

COMFORTABLE

SERIES FAN



LOW ENERGY

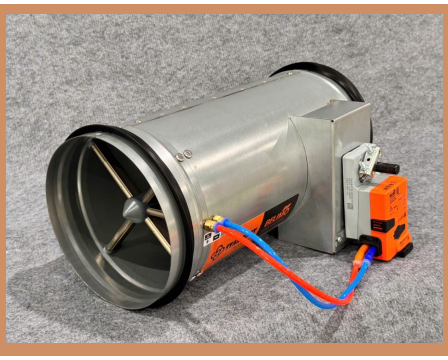
LONG BOX

LOW NOISE

PARALLEL FAN

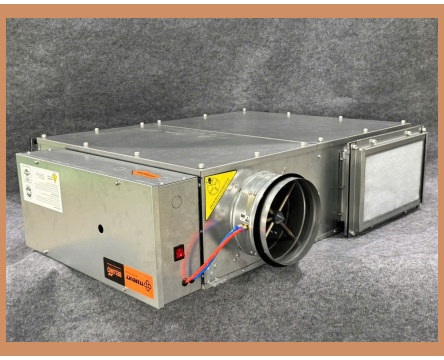
MORE DURABILITY

COMPACT



AIR TIGHT

SLIM TYPE



SAVE SPACE

Features and Advantages

- Quiet operation (sound-insulated plenum)
- EC motor for energy efficiency
- AHRI-certified performance
- Multiple heater options (Electric, PTC, Hot Water Coil)
- Modular control with Belimo ZoneEase™ BACnet
- Easy maintenance and installation.

Selection Software - Build BOQ 24/7

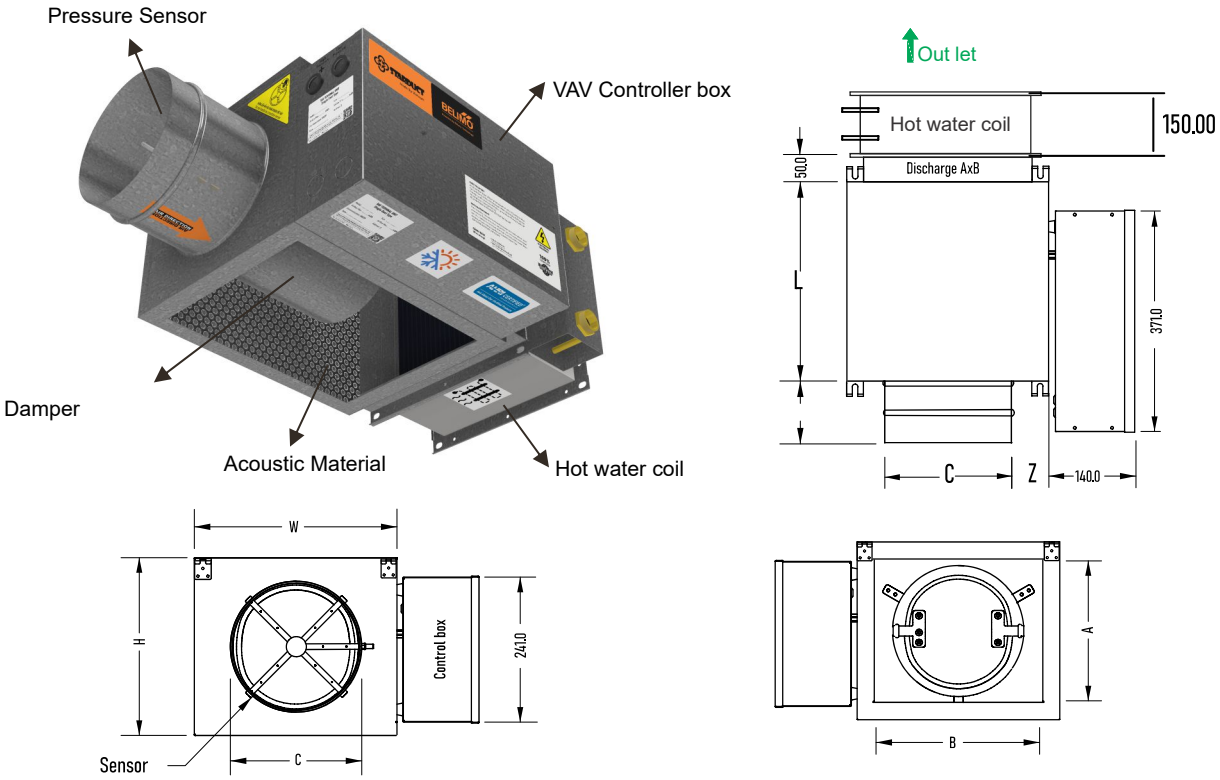
- Introduction to Starduct Selection Software (online 24/7)
- Integration with AHRI performance database

High Class Materials

- **Casing: 0.8mm thick 3-componet plated iron sheet, Zinmag (Z.A.M, 270g/m^2 - imported from Vietnam.**
- **Case material optional : Aluminum. Stainless steel**
- **Damper blade: 0.8mm thick, Stiffness stamping of Zinmag (Z.A.M), sealed with EPDM rubber seal for heat resistance.**
- **Insulation: Closed Cell Foarm, Egg crate type, ASTM 2856**
- **Bushing: ABS plastic**
- **Shaft: CT45 Hexagonal steel bar, Black coating**
- **Pressure sensor: Multi-Quadrant Averaging Signal Sensor by A6061 Aluminum tube**
- **Control system: Belimo BACnet/Modbus**

HIGH QUALITY MATERIALS AND CONTROLLER

SINGLE DUCT TYPE WITH HOT WATER COIL
Model: S-VAV-SW-T100



DIMENSIONAL DETAIL (IP)

TYPE	Valve	Inlet Dia (C) in.	L in.	H in.	W in.	Z in.	Discharge Dim		Weight lb
							Height (A) in.	Width (B) in.	
SVAV-SW-T100-04	4	4	11,5	11	13	3,5	8	10	21
SVAV-SW-T100-05	5	5	11,5	11	13	3,5	8	10	21
SVAV-SW-T100-06	6	6	11,5	11	13	3,5	8	10	21
SVAV-SW--T100-07	7	7	12	13	14	3,5	10	11	22
SVAV-SW--T100-08	8	8	12	13	14	3,5	10	11	22
SVAV-SW--T100-09	9	9	12	15	17	3,5	12	14	30
SVAV-SW--T100-10	10	10	12	15	17	3,5	12	14	30
SVAV-SW--T100-12	12	12	13	17	20	3,5	14	17	38
SVAV-SW--T100-14	14	14	14	21	22	3,5	18	19	46
SVAV-SW--T100-16	16	16	15	21	26	3,5	18	23	51

DIMENSIONAL DETAIL (SI)

TYPE	Valve	Inlet Dia (C) mm	L mm	H mm	W mm	Z mm	Discharge Dim		Weight kg
							Height (A) mm	Width (B) mm	
SVAV-SW-T100-04	4	102	292	279	330	89	203	254	9,5
SVAV-SW-T100-05	5	127	292	279	330	89	203	254	9,5
SVAV-SW-T100-06	6	152	292	279	330	89	203	254	9,5
SVAV-SW--T100-07	7	178	305	330	356	89	254	279	10
SVAV-SW--T100-08	8	203	305	330	356	89	254	279	10
SVAV-SW--T100-09	9	229	305	381	432	89	305	356	13,5
SVAV-SW--T100-10	10	254	305	381	432	89	305	356	13,5
SVAV-SW--T100-12	12	305	330	432	508	89	356	432	17,5
SVAV-SW--T100-14	14	356	356	533	559	89	457	483	21
SVAV-SW--T100-16	16	406	381	533	660	89	457	584	23

NC LEVEL SELECTION TABLE

Inlet Size	Air Flow		Basic Unit		With Atten		Min. △ptbose Unit		Discharge NC Assembly △ps, Across Unit			Discharge NC Assembly 914mm △ps, Across Unit			Radiated NC Basic Assembly △ps, Across Unit		
									0.5"W.G	1.5"W.G	3"W.G	0.5"W.G	1.5"W.G	3"W.G	0.5"W.G	1.5"W.G	3"W.G
in	CMH	CFM	*W.G	Pa	*W.G	Pa	*W.G	Pa	125Pa	375Pa	750Pa	125Pa	375Pa	750Pa	125Pa	375Pa	750Pa
05	102	60	0.01	2	0.01	2	0.06	15	-	-	-	-	-	-	-	-	-
	230	140	0.01	2	0.01	2	0.14	35	-	-	-	-	-	-	-	-	21
	425	250	0.01	2	0.01	2	0.25	62	-	-	24	-	-	-	20	24	27
	612	360	0.01	2	0.01	2	0.39	97	-	22	26	-	-	22	25	28	31
06	153	90	0.02	5	0.02	5	0.05	12	-	-	-	-	-	-	-	-	-
	381	225	0.05	11	0.05	11	0.12	30	-	-	21	-	-	-	-	-	21
	511	300	0.08	20	0.08	20	0.21	52	-	-	24	-	-	-	-	20	25
	637	375	0.13	31	0.13	31	0.33	82	-	21	27	-	-	22	-	23	27
	880	517	0.18	45	0.18	45	0.46	114	-	24	30	-	-	25	-	25	29
07	204	120	0.03	7	0.03	7	0.12	30	-	-	26	-	-	-	-	-	23
	561	330	0.05	12	0.05	12	0.20	50	-	23	29	-	-	21	-	22	26
	935	550	0.07	18	0.07	18	0.29	22	-	25	32	-	-	24	-	24	28
	1190	700	0.10	26	0.1	26	0.41	102	-	27	34	-	22	27	22	27	29
08	272	160	0.01	2	0.01	2	0.07	17	-	-	25	-	-	-	-	21	25
	849	500	0.01	2	0.01	2	0.10	25	-	20	28	-	-	-	-	23	28
	1018	600	0.01	2	0.01	2	0.15	37	-	23	30	-	-	22	-	26	30
	1188	700	0.01	2	0.01	2	0.20	50	-	24	32	-	-	24	20	27	32
	1560	920	0.01	2	0.01	2	0.25	62	-	25	32	-	-	24	22	29	33
09	374	220	0.01	2	0.01	2	0.06	15	-	22	31	-	-	22	-	-	25
	935	550	0.01	2	0.01	2	0.12	30	-	25	34	-	-	25	-	-	28
	1530	900	0.01	2	0.01	2	0.2	50	-	25	35	-	-	26	-	22	31
	1972	16	0.01	2	0.01	2	0.3	75	-	27	36	-	21	27	-	24	37
10	425	250	0.01	2	0.01	2	0.06	15	-	-	27	-	-	21	-	-	25
	1274	750	0.01	2	0.01	2	0.10	25	-	20	28/	-	-	22	-	-	27
	1612	950	0.01	2	0.01	2	0.15	37	-	22	30	-	-	24	-	22	29
	2430	1429	0.01	2	0.01	2	0.29	72	-	25	33	-	20	27	-	25	32
12	612	360	0.01	2	0.01	2	0.07	17	-	23	31	-	-	23	-	21	28
	2037	1200	0.01	2	0.01	2	0.11	27	-	25	32	-	-	26	-	23	30
	2548	1500	0.01	2	0.01	2	0.17	42	-	26	37	-	21	28	-	25	31
	3060	1800	0.01	2	0.01	2	0.24	60	-	27	35	-	23	30	-	26	363
	3500	2060	0.01	2	0.01	2	0.33	82	-	28	35	-	25	31	-	28	34
14	816	480	0.01	2	0.01	2	0.05	12	-	22	31	-	21	29	-	21	28
	2548	1500	0.01	2	0.01	2	0.10	25	-	25	34	-	23	31	-	26	32
	3398	2000	0.01	2	0.01	2	0.18	45	-	27	36	-	24	32	21	29	35
	4248	2500	0.01	2	0.01	2	0.27	67	-	29	38	-	25	34	24	32	37
	4760	2800	0.01	2	0.01	2	0.38	95	-	30	39	-	26	35	27	35	40
16	1071	630	0.01	2	0.01	2	0.06	15	-	22	30	-	20	28	-	23	30
	3398	2000	0.01	2	0.01	2	0.10	25	-	25	33	-	22	30	-	26	33
	4248	2500	0.01	2	0.01	2	0.16	40	-	27	35	-	24	32	22	30	35
	5097	3000	0.01	2	0.01	2	0.22	55	-	29	37	-	26	34	25	33	38
	5947	3500	0.01	2	0.01	2	0.30	75	-	31	40	-	27	35	28	36	41
	6232	3660	0.01	2	0.01	2	0.39	97	20	33	41	20	28	36	31	39	44

Rediated sound is based on a 16mm mineral fiber tile ceiling per ARI 855-998 typical cottenuation values. Discharged sound is based on enviornmetal effect, end reflection, flex duct effect, space effect, soumd Power, division and lined duct effect.

Âm thanh phát xạ dựa trên trần bằng tấm sợi khoáng 16mm theo các giá trị giảm âm điển hình của ARI 855-998. Âm thanh phát ra phụ thuộc vào ảnh hưởng môi trường, phản xạ cuối, hiệu ứng ống dẫn mềm, ảnh hưởng không gian, công suất âm thanh, sự phân chia và hiệu ứng ống dẫn có tiêu âm.

Total Deduction	Octave Band mid Frequency, Hz					
	125	250	500	1000	2000	4000
All size	18	19	20	26	31	36

Total Deduction	Octave Band mid Frequency, Hz					
	125	250	500	1000	2000	4000
<300CFM	24	28	39	53	59	40
300CFM-700CFM	27	29	40	51	53	39
>700CFM	29	30	41	51	52	39

1. Sound Power levels Lw dB re 10^{-12} watts
2. NC-Based on ARI 855-98
3. Dashes (-) indicate NC's less than 20
4. CFM-Cubic feet / minute
5. CMH-Cubic meter / hour
6. pa-Pressnre given in Pascals
7. "W.G.-inches of Water Gauge

HOT WATER COIL SELECTION TABLE (KW)

Type	Rows	Coil	HD Loss	Airflow(CMH)					
		L/s	KPa	212	299	338	425	594	680
S-VAV-SW-T100-04" S-VAV-SW-T100-05" S-VAV-SW-T100-06"	1	0.03	0.39	1.64	1.90	1.99	2.17	2.43	2.52
		0.06	1.46	1.82	2.17	2.29	2.52	2.90	3.05
		0.13	5.56	1.96	2.34	2.49	2.78	3.22	3.40
		0.19	12.22	1.99	2.40	2.58	2.87	3.34	3.55
		Through the Coil, △ ps		4.98	7.47	9.95	12.44	24.88	29.86
	2	0.06	0.36	2.72	3.28	3.52	3.93	4.54	4.78
		0.13	1.40	2.99	3.66	3.99	4.48	5.33	5.69
		0.25	5.35	3.14	3.93	4.25	4.86	5.86	6.30
		0.38	11.72	3.19	4.02	4.37	5.01	6.10	6.54
		Through the Coil, △ ps		9.95	17.42	19.91	29.86	52.26	64.70

Type	Rows	Coil	HD Loss	Airflow(CMH)					
		L/s	KPa	338	511	680	1019	1188	1361
S-VAV-SW-T100-07" S-VAV-SW-T100-08"	1	0.03	0.51	2.29	2.67	2.93	3.28	3.43	3.55
		0.06	1.97	2.61	3.14	3.55	4.10	4.31	4.48
		0.13	7.47	2.84	3.46	3.96	4.69	4.95	5.22
		0.19	16.38	2.93	3.60	4.13	4.92	5.25	5.51
		Through the Coil, △ ps		4.98	9.95	17.42	37.33	47.28	59.72
	2	0.06	0.51	3.93	4.78	5.42	6.30	6.62	0.92
		0.13	1.91	4.40	5.54	6.42	7.74	8.62	8.70
		0.25	7.26	4.69	6.04	7.12	8.76	9.44	10.02
		0.38	15.90	4.81	6.21	7.39	9.17	9.94	10.58
		Through the Coil, △ ps		12.44	24.88	39.81	79.63	102.02	126.91

Type	Rows	Coil	HD Loss	Airflow(CMH)					
		L/s	KPa	511	850	1188	1530	1699	1868
S-VAV-SW-T100-09" S-VAV-SW-T100-10"	1	0.06	0.33	3.49	4.28	4.78	5.16	5.30	5.45
		0.13	1.26	3.96	4.98	5.71	6.24	6.48	6.68
		0.25	4.81	4.25	5.45	6.33	7.03	7.33	7.59
		0.38	10.52	4.37	5.66	6.59	7.36	7.68	7.97
		Through the Coil, △ ps		4.98	14.93	24.88	37.33	47.28	54.74
	2	0.06	0.69	5.48	6.89	7.80	8.44	8.70	8.94
		0.13	2.63	6.33	8.32	9.73	10.81	11.25	11.66
		0.25	9.98	6.86	9.29	11.14	12.57	13.19	13.77
		0.38	21.82	7.06	9.70	1.89	13.31	14.01	14.65
		Through the Coil, △ ps		12.44	29.96	54.74	82.12	97.05	114.47

Type	Rows	Coil	HD Loss	Airflow(CMH)					
		L/s	KPa	680	1018	1300	2037	2379	2718
S-VAV-SW-T100-12"	1	0.06	0.45	4.57	5.33	5.86	6.59	6.86	7.09
		0.13	1.67	5.25	6.30	7.06	8.18	8.62	9.00
		0.25	6.34	5.89	6.95	7.91	8.35	9.94	10.43
		0.38	13.84	5.86	7.21	8.24	9.85	10.46	11.02
		Through the Coil, △ ps		4.98	9.95	17.43	37.33	47.28	59.72
	2	0.06	0.93	6.95	8.26	9.14	10.32	10.73	11.08
		0.13	3.47	8.24	10.20	11.66	13.75	14.54	15.21
		0.25	13.06	9.06	11.55	13.48	16.44	17.58	18.58
		0.38	28.48	9.48	12.07	14.24	17.55	18.90	20.08
		Through the Coil, △ ps		12.44	24.88	39.81	79.63	102.02	126.91

HOT WATER COIL SELECTION TABLE (KW)

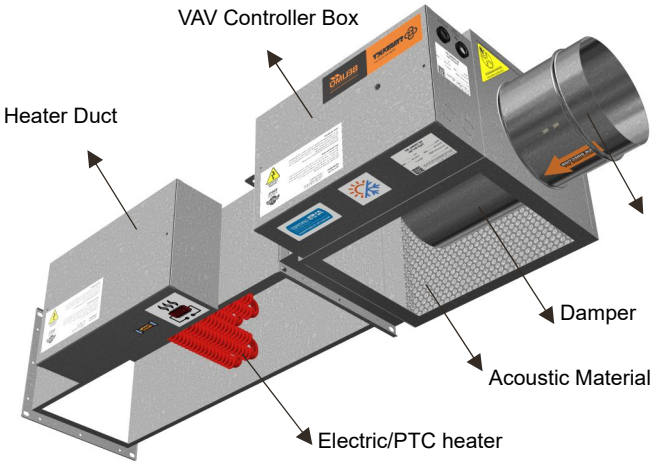
Type	Rows	Coil	HD Loss	Airflow(CMH)					
		L/s	KPa	1018	1090	2379	3080	3398	3736
S-VAV-SW-T100-14"	1	0.06	0.60	6.30	7.47	8.24	8.76	8.97	9.14
		0.13	2.27	7.47	9.26	10.46	11.37	11.72	12.07
		0.25	8.58	8.24	10.46	12.10	13.36	13.89	14.36
		0.38	18.71	8.56	11.02	12.78	14.18	14.80	15.36
		Through the Coil, △ ps		4.98	14.93	24.88	37.33	47.28	54.74
	2	0.09	0.99	10.35	12.78	14.27	15.33	15.74	16.12
		0.19	3.80	12.25	15.94	18.49	20.40	21.19	21.89
		0.38	14.50	13.48	18.17	21.63	24.35	25.53	26.58
		0.57	31.83	13.95	19.08	22.95	26.02	27.37	28.60
		Through the Coil, △ ps		12.44	29.86	54.74	82.12	97.05	114.47

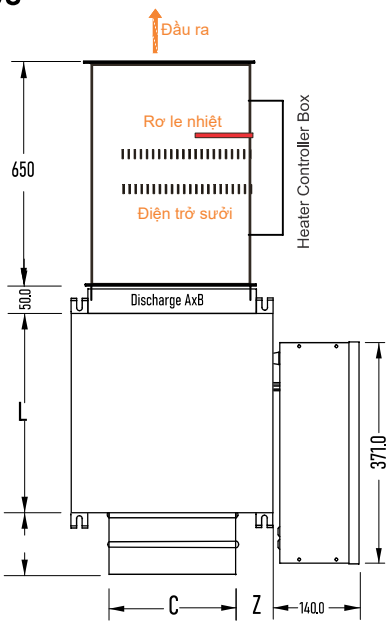
Type	Rows	Coil	HD Loss	Airflow(CMH)					
		L/s	KPa	1360	2037	2718	3398	4078	4755
S-VAV-SW-T100-16" S-VAV-SW-T100-20X16	1	0.06	0.69	7.50	8.53	9.20	9.70	10.11	10.40
		0.13	2.57	9.17	10.79	11.93	12.84	13.54	14.16
		0.25	9.71	10.29	12.40	13.98	15.27	16.29	17.20
		0.38	21.16	10.73	13.07	14.86	16.29	17.50	18.52
		Through the Coil, △ ps		7.47	14.93	22.40	34.84	47.28	58.72
	2	0.09	1.11	12.40	14.45	15.80	16.76	17.53	18.08
		0.19	4.18	15.15	18.49	20.93	22.77	24.27	25.50
		0.38	15.99	17.00	21.42	24.79	27.56	29.81	31.74
		0.57	35.12	17.73	22.60	26.44	29.57	32.24	34.55
		Through the Coil, △ ps		14.93	29.86	49.77	72.16	97.05	126.91

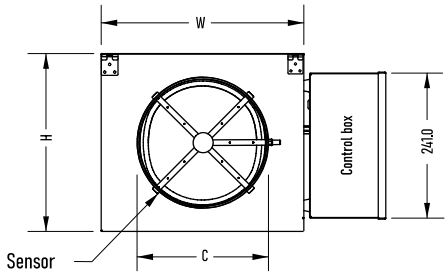
Correction Factors – Hot Water Coils

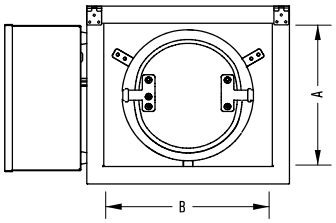
		Entering water temperature, ℃							
		49	54	60	66	71	77	82	88
Entering Air Temp℃	10	0.54	0.62	0.71	0.79	0.87	0.96	1.04	1.12
	13	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08
	16	0.47	0.55	0.63	0.71	0.79	0.88	0.96	1.04
	18	0.43	0.51	0.59	0.67	0.75	0.84	0.92	1.00

SINGLE DUCT TYPE + ELECTRIC/PTC HEATER DUCT
Model: S-VAV-SE/SP-T100









DIMENSIONAL DETAIL (IP)

TYPE	Valve	Inlet Dia (C) in.	L in.	H in.	W in.	Z in.	Discharge Dim		Weight lb
							Height (A) in.	Width (B) in.	
SVAV-SE-T100-04	4	4	11,5	11	13	3,5	8	10	21
SVAV-SE-T100-05	5	5	11,5	11	13	3,5	8	10	21
SVAV-SE-T100-06	6	6	11,5	11	13	3,5	8	10	21
SVAV-SE-T100-07	7	7	12	13	14	3,5	10	11	22
SVAV-SE-T100-08	8	8	12	13	14	3,5	10	11	22
SVAV-SE-T100-09	9	9	12	15	17	3,5	12	14	30
SVAV-SE-T100-10	10	10	12	15	17	3,5	12	14	30
SVAV-SE-T100-12	12	12	13	17	20	3,5	14	17	38
SVAV-SE-T100-14	14	14	14	21	22	3,5	18	19	46
SVAV-SE-T100-16	16	16	15	21	26	3,5	18	23	51

DIMENSIONAL DETAIL (SI)

TYPE	Valve	Inlet Dia (C) mm	L mm	H mm	W mm	Z mm	Discharge Dim		Weight kg
							Height (A) mm	Width (B) mm	
SVAV-SE-T100-04	4	102	292	279	330	89	203	254	9,5
SVAV-SE-T100-05	5	127	292	279	330	89	203	254	9,5
SVAV-SE-T100-06	6	152	292	279	330	89	203	254	9,5
SVAV-SE-T100-07	7	178	305	330	356	89	254	279	10
SVAV-SE-T100-08	8	203	305	330	356	89	254	279	10
SVAV-SE-T100-09	9	229	305	381	432	89	305	356	13,5
SVAV-SE-T100-10	10	254	305	381	432	89	305	356	13,5
SVAV-SE-T100-12	12	305	330	432	508	89	356	432	17,5
SVAV-SE-T100-14	14	356	356	533	559	89	457	483	21
SVAV-SE-T100-16	16	406	381	533	660	89	457	584	23

HOT WATER COIL SELECTION TABLE (KW)

Inlet Size	Air Flow		Basic Unit		With Atten		Min. △ptbose Unit		Discharge NC Assembly △ps, Across Unit			Discharge NC Assembly 914mm △ps, Across Unit			Radiated NC Basic Assembly △ps, Across Unit		
									0.5"W.G	1.5"W.G	3"W.G	0.5"W.G	1.5"W.G	3"W.G	0.5"W.G	1.5"W.G	3"W.G
in	CMH	CFM	*W.G	Pa	*W.G	Pa	*W.G	Pa	125Pa	375Pa	750Pa	125Pa	375Pa	750Pa	125Pa	375Pa	750Pa
05	102	60	0.01	2	0.01	2	0.06	15	-	-	-	-	-	-	-	-	-
	230	140	0.01	2	0.01	2	0.14	35	-	-	-	-	-	-	-	-	21
	425	250	0.01	2	0.01	2	0.25	62	-	-	24	-	-	-	20	24	27
	612	360	0.01	2	0.01	2	0.39	97	-	22	26	-	-	22	25	28	31
06	153	90	0.02	5	0.02	5	0.05	12	-	-	-	-	-	-	-	-	-
	381	225	0.05	11	0.05	11	0.12	30	-	-	21	-	-	-	-	-	21
	511	300	0.08	20	0.08	20	0.21	52	-	-	24	-	-	-	-	20	25
	637	375	0.13	31	0.13	31	0.33	82	-	21	27	-	-	22	-	23	27
	880	517	0.18	45	0.18	45	0.46	114	-	24	30	-	-	25	-	25	29
07	204	120	0.03	7	0.03	7	0.12	30	-	-	26	-	-	-	-	-	23
	561	330	0.05	12	0.05	12	0.20	50	-	23	29	-	-	21	-	22	26
	935	550	0.07	18	0.07	18	0.29	22	-	25	32	-	-	24	-	24	28
	1190	700	0.10	26	0.1	26	0.41	102	-	27	34	-	22	27	22	27	29
08	272	160	0.01	2	0.01	2	0.07	17	-	-	25	-	-	-	-	21	25
	849	500	0.01	2	0.01	2	0.10	25	-	20	28	-	-	-	-	23	28
	1018	600	0.01	2	0.01	2	0.15	37	-	23	30	-	-	22	-	26	30
	1188	700	0.01	2	0.01	2	0.20	50	-	24	32	-	-	24	20	27	32
	1560	920	0.01	2	0.01	2	0.25	62	-	25	32	-	-	24	22	29	33
09	374	220	0.01	2	0.01	2	0.06	15	-	22	31	-	-	22	-	-	25
	935	550	0.01	2	0.01	2	0.12	30	-	25	34	-	-	25	-	-	28
	1530	900	0.01	2	0.01	2	0.2	50	-	25	35	-	-	26	-	22	31
	1972	16	0.01	2	0.01	2	0.3	75	-	27	36	-	21	27	-	24	37
10	425	250	0.01	2	0.01	2	0.06	15	-	-	27	-	-	21	-	-	25
	1274	750	0.01	2	0.01	2	0.10	25	-	20	28/	-	-	22	-	-	27
	1612	950	0.01	2	0.01	2	0.15	37	-	22	30	-	-	24	-	22	29
	2430	1429	0.01	2	0.01	2	0.29	72	-	25	33	-	20	27	-	25	32
12	612	360	0.01	2	0.01	2	0.07	17	-	23	31	-	-	23	-	21	28
	2037	1200	0.01	2	0.01	2	0.11	27	-	25	32	-	-	26	-	23	30
	2548	1500	0.01	2	0.01	2	0.17	42	-	26	37	-	21	28	-	25	31
	3060	1800	0.01	2	0.01	2	0.24	60	-	27	35	-	23	30	-	26	363
	3500	2060	0.01	2	0.01	2	0.33	82	-	28	35	-	25	31	-	28	34
14	816	480	0.01	2	0.01	2	0.05	12	-	22	31	-	21	29	-	21	28
	2548	1500	0.01	2	0.01	2	0.10	25	-	25	34	-	23	31	-	26	32
	3398	2000	0.01	2	0.01	2	0.18	45	-	27	36	-	24	32	21	29	35
	4248	2500	0.01	2	0.01	2	0.27	67	-	29	38	-	25	34	24	32	37
	4760	2800	0.01	2	0.01	2	0.38	95	-	30	39	-	26	35	27	35	40
16	1071	630	0.01	2	0.01	2	0.06	15	-	22	30	-	20	28	-	23	30
	3398	2000	0.01	2	0.01	2	0.10	25	-	25	33	-	22	30	-	26	33
	4248	2500	0.01	2	0.01	2	0.16	40	-	27	35	-	24	32	22	30	35
	5097	3000	0.01	2	0.01	2	0.22	55	-	29	37	-	26	34	25	33	38
	5947	3500	0.01	2	0.01	2	0.30	75	-	31	40	-	27	35	28	36	41
	6232	3660	0.01	2	0.01	2	0.39	97	20	33	41	20	28	36	31	39	44

Rediated sound is based on a 16mm mineral fiber tile ceiling per ARI 855-998 typical cottenuation values. Discharged sound is based on enviornmetal effect, end reflection, flex duct effect, space effect, soumd Power, division and lined duct effect.

Âm thanh phát xạ dựa trên trần bằng tấm sợi khoáng 16mm theo các giá trị giảm âm điển hình của ARI 855-998. Âm thanh phát ra phụ thuộc vào ảnh hưởng môi trường, phản xạ cuối, hiệu ứng ống dẫn mềm, ảnh hưởng không gian, công suất âm thanh, sự phân chia và hiệu ứng ống dẫn có tiêu âm.

Total Deduction	Octave Band mid Frequency, Hz					
	125	250	500	1000	2000	4000
All size	18	19	20	26	31	36

Total Deduction	Octave Band mid Frequency, Hz					
	125	250	500	1000	2000	4000
<300CFM	24	28	39	53	59	40
300CFM-700CFM	27	29	40	51	53	39
>700CFM	29	30	41	51	52	39

1. Sound Power levels Lw dB re 10^{-12} watts
2. NC-Based on ARI 855-98
3. Dashes (-) indicate NC's less than 20
4. CFM-Cubic feet / minute
5. CMH-Cubic meter / hour
6. pa-Pressnre given in Pascals
7. "W.G.-inches of Water Gauge

ELECTRIC/PTC HEATER SELECTION (KW)

Principles for Calculating Electric Heater Capacity in Single-Duct VAV Boxes:

- When integrating electric heaters directly into single-duct VAV boxes for heating purposes, it is essential to define the minimum and maximum airflow rates during heating mode—distinct from cooling mode—to ensure that the heat generated by the electric heater is fully delivered to the space. This prevents energy waste and overheating, which could pose fire hazards.
- Airflow DeterminationMinimum Heating Airflow (Q_heating_min): Set at 50% of the nominal maximum airflow (Q_max) of the selected VAV box.Maximum Heating Airflow (Q_heating_max): Recommended to be no more than 80% of Q_max to avoid excessive airflow that may reduce heating effectiveness or cause control instability.
- Electric Heater Capacity CalculationTo calculate the required electric heating power (P), use the following formula:

$$P(kW)=\frac{1.206 \times V(cmh) \times \Delta T\ (°C)}{3600}$$

Where:

P(KW) = Electric heating power (kW); V(cmh) = Airflow rate (CMH);
ΔT (°C) = Assumed heating temperature is 32°C – Temperature difference (32°C − 13°C = 19°C)

Model Number	Cooling Capacity (Qc)		Heating Capacity (Qh)	
	Qc min (CMH)	Qc max (CMH)	Qh min (CMH)	Qh max (CMH)
S-VAV-SE-T100-05	102	612	306	490
S-VAV-SE-T100-06	153	880	440	704
S-VAV-SE-T100-07	204	1.190	595	952
S-VAV-SE-T100-08	272	1.560	780	1.248
S-VAV-SE-T100-09	374	1.972	986	1.578
S-VAV-SE-T100-10	425	2.430	1.215	1.944
S-VAV-SE-T100-12	612	3.500	1.750	2.800

Control and Safety for Single-Duct VAV Boxes with Reheat

Temperature Control: "Shut-off with Reheat" Sequence:

- **Cooling Mode:** The VAV damper modulates from minimum (Vmin) to maximum (Vmax) airflow based on demand (typically PID control based on temperature deviation). The heating coil is off.
- **Deadband (Comfort Range)**: The VAV damper maintains Vmin. The heating coil remains off.
- **Heating Mode:** The VAV damper stays at Vmin (or a fixed heating maximum, typically equal to Vmin in shut-off mode). The heating coil is activated.
  - For electric heaters: controlled via SSR (solid-state relay) modulation or multi-stage on/off.
  - For hot water coils: the control valve opens. The coil modulates to raise room temperature to the setpoint.Dynamic Minimum (Advanced DDC Control): Some DDC systems allow the VAV damper to increase slightly above Vmin if the coil is at 100% output and the room is still underheated after a certain time. This introduces more warm air (from the AHU if central heating is available) or at least adds thermal energy, even if cooler. According to ASHRAE 62.1, if supply air temperature exceeds 32°C (90°F), the system must increase airflow to prevent stratification. This logic is complex, so many designs simplify by limiting coil output to not exceed 32°C from the start.

Multi-Stage Electric Heater Control:

Example: 6 kW heater split into 2 stages:

- Room temperature < setpoint −1°C → turn on 1 stage (~3 kW)
- Room temperature < setpoint −2°C → turn on 2 stages (6 kW)
- As temperature approaches setpoint, stages are turned off sequentially.More refined control: SSR modulation allows partial power (e.g., 30%) by rapid switching, resulting in more stable temperature control.

Safety Measures:

- Airflow Dependency: Since all airflow passes through the coil via the VAV damper, ensure the damper never fully closes when the coil is active. Many controllers enforce a minimum damper position of ~5–10% even when demand is zero.
- Airflow Sensor: Electric heater circuits include a duct airflow sensor. If pressure drop is <0.05" H_2O (indicating insufficient airflow), the heater is shut off.
- Overheat Protection: A high-limit thermostat mounted downstream of the heater cuts power if temperature exceeds ~60°C.
- Hot Water Coils: Typically lack airflow sensors. However, 3-way mixing valves or modulating valves close when there's no heating demand.

BMS Integration:

Reheat VAV boxes are often networked with a Building Management System (BMS), enabling:

- Monitoring of current airflow, damper position, and heating status.
- Optimization strategies like AHU supply air temperature reset.
- Zone coordination to avoid conflicting heating demands

Maintenance:

- This type of box is the simplest—no fan, fewer failure points.
- Electric heaters: require periodic cleaning (dust buildup may cause burning smell).
- Hot water coils: need air purging and scale prevention.

Operating Mode

4 Cooling with 1-Stage Electrical Reheat

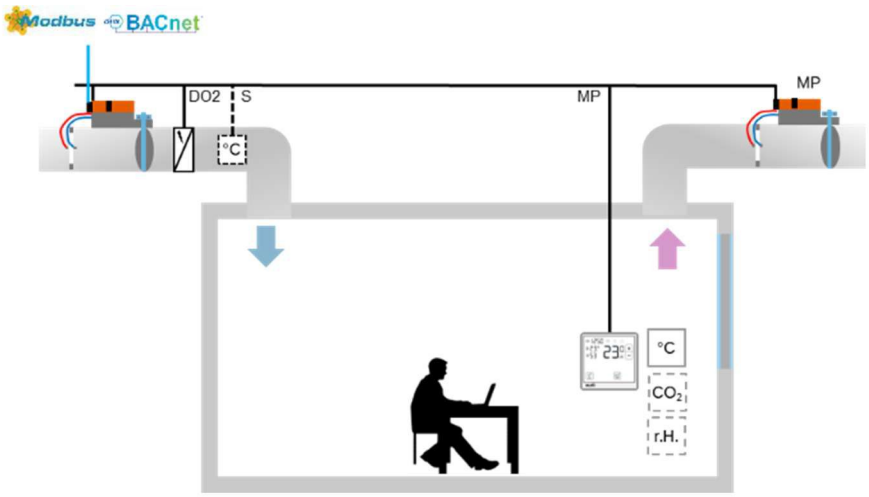
Application description

- Cooling with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool primary air.
- Reheating with 1-stage electric reheater at digital output DO2.

Required components:

- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. room operating unit

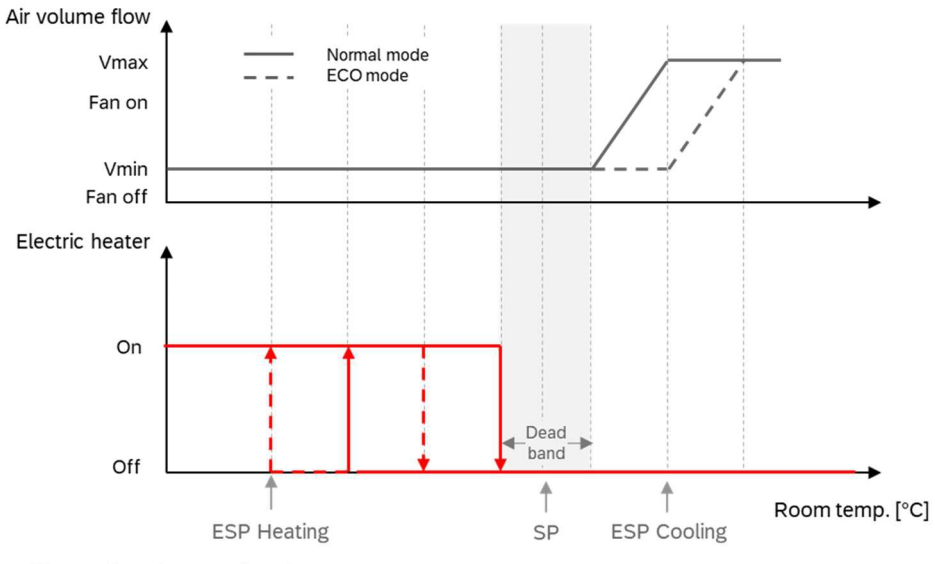
Application diagram



Application 4
LMV-BAC-002 / NMV-BAC-002

RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
	D-	
	⊥	
AC 24 V	⊥	Power supply for ZoneEase VAV actuator
	~	
Room unit	⊥	Room unit power supply / MP-Bus
	~	
	MP	
Analog IN / MP	S	[Duct temp. sensor 0..160°C]
	⊥	
	~	
	MP	2nd VAV controller
Digital OUT	1	- not used -
	2	Electric heater stage 1
	3	- not used -
	COM	Fan / heater GND

Sequence diagram



SP: Setpoint, normal mode
ESP: Setpoint, ECO mode

Operating Mode

5 Cooling with 2-Stage Electric Reheat

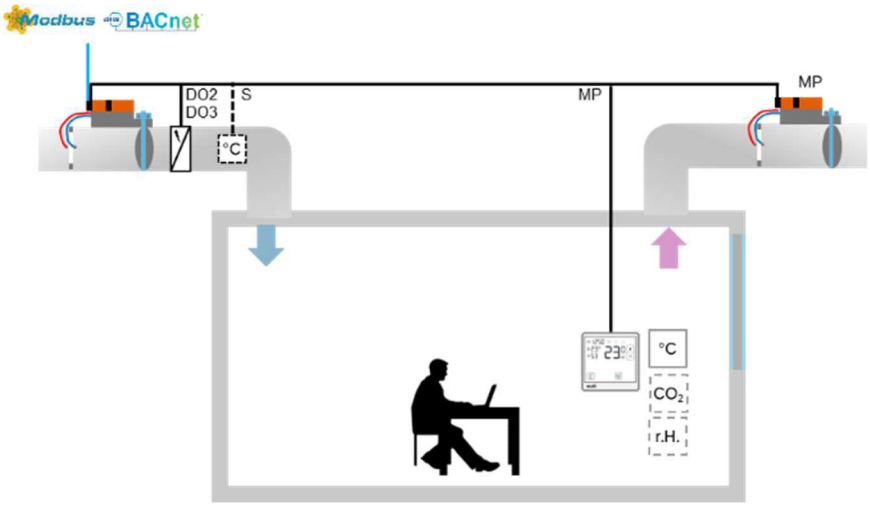
Application description

- Cooling with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool primary air.
- Reheating with 2-stage electric reheater at DO2 + DO3

Required components:

- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. room unit

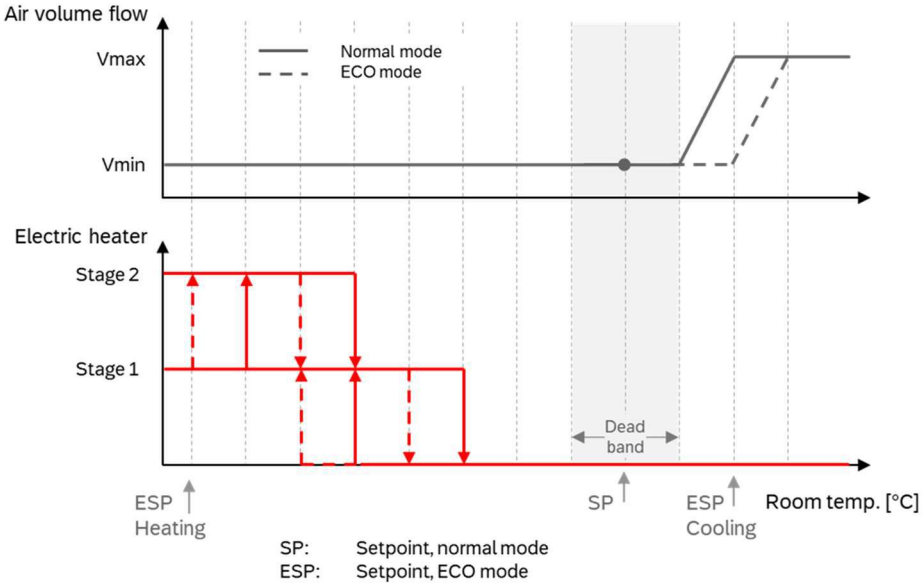
Application diagram



Application 5
LMV-BAC-002 / NMV-BAC-002

RS-485	D+	⊥	BMS (BACnet MS/TP or Modbus RTU)
	D-		
AC 24 V	⊥	~	Power supply for ZoneEase VAV actuator
	~		
Room unit	⊥	MP	Room unit power supply / MP-Bus
	~		
	MP		
Analog IN / MP	S	⊥	[Duct temp. sensor 0..160°C]
	⊥	~	
	~	MP	2nd VAV controller
Digital OUT	1	2	- not used - / Electric heater stage 1
	2	3	Electric heater stage 1 / Electric heater stage 2
	3	COM	Electric heater stage 2 / Fan / heater GND
	COM		Fan / heater GND

Sequence diagram



Operating Mode

6 Cooling with On-Off Hydronic Reheat

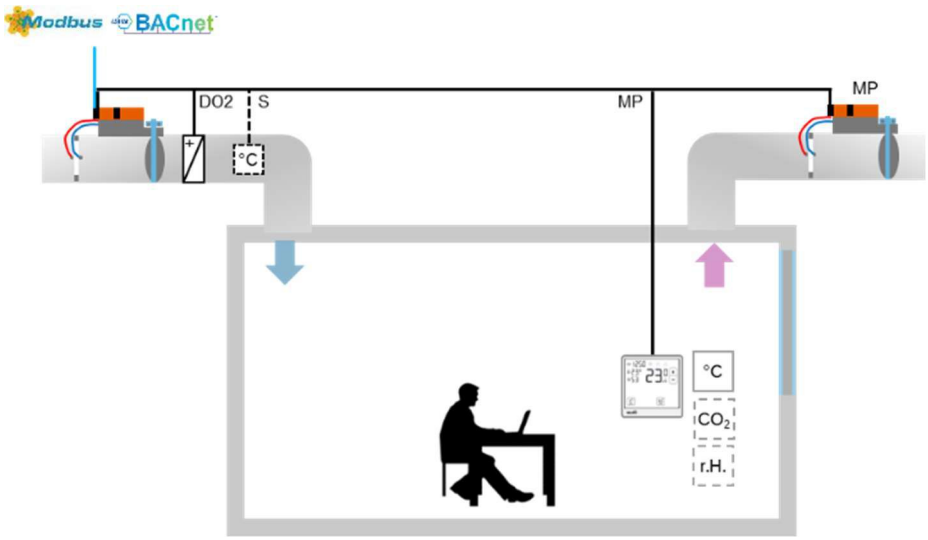
Application description

- Cooling with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool primary air.
- Reheating with on/off reheat valve at DO2.

Required components:

- L/NMV-BAC-002 ZoneEase VAV actuator
- P-22RT-1T.. room operating unit
- CQ24A On/Off reheat valve actuator

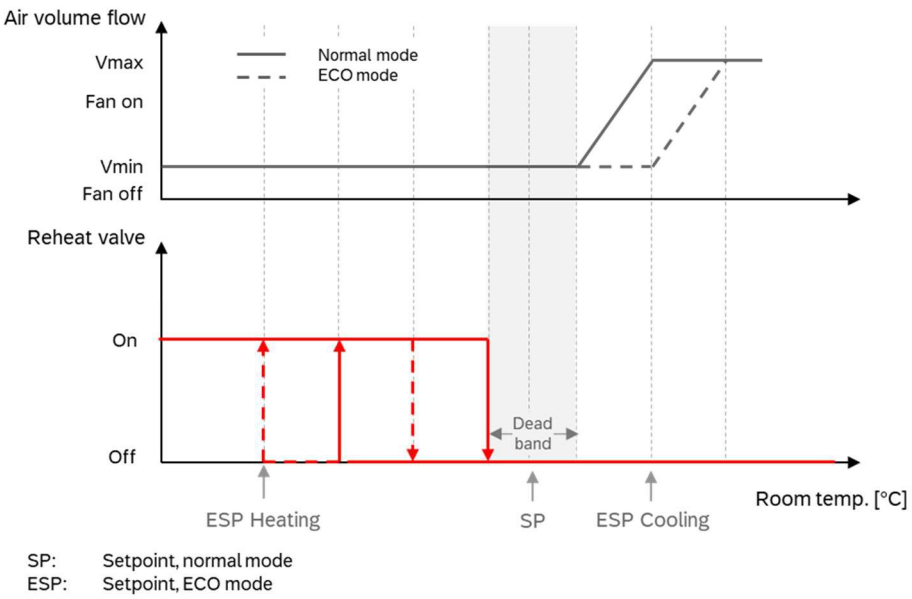
Application diagram



Application 6
LMV-BAC-002 / NMV-BAC-002

RS-485	D+	BMS (BACnet MS/TP or Modbus RTU)
	D-	
	⊥	
AC 24 V	⊥	Power supply for ZoneEase VAV actuator
	~	
Room unit	⊥	Room unit power supply / MP-Bus
	~	
	MP	
Analog IN / MP	S	[Duct temp. sensor 0..160°C]
	⊥	
	~	
	MP	2nd VAV controller
Digital OUT	1	- not used -
	2	On/Off reheat valve actuator
	3	- not used -
	COM	Fan / heater GND

Sequence diagram



SP: Setpoint, normal mode
ESP: Setpoint, ECO mode

Operating Mode

7 Cooling with Modulating Hydronic Reheat

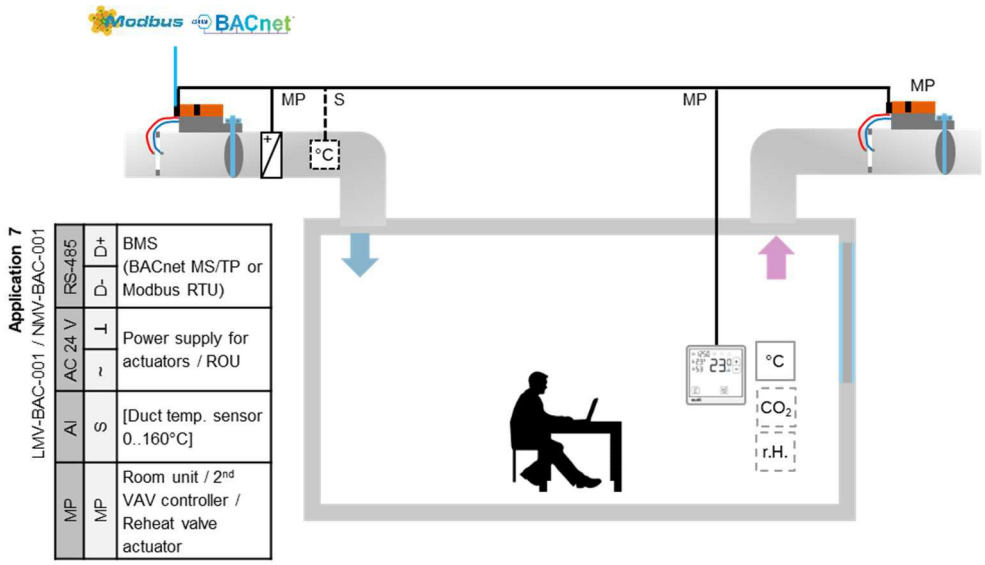
Application description

- Cooling with supply air by modulating the air damper (based on the temperature setpoint).
- Central AHU / RTU must provide cool primary air.
- Reheat with modulating reheat valve.

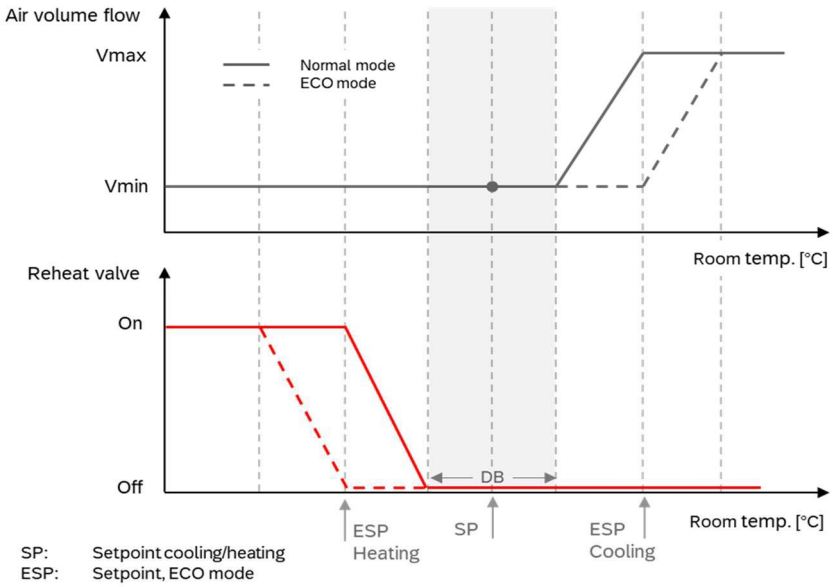
Required components:

- L/NMV-BAC-001 ZoneEase VAV actuator
- P-22RT-1T.. Room operating unit
- CQ24A-MPL-A8 Modulating valve actuator

Application diagram



Sequence diagram



Controller

Belimo product type	Function	Remark
Controllers / Actuators		
LMV-BAC-001	VAV Zone Controller, integrated 5 Nm damper actuator	
NMV-BAC-001	VAV Zone Controller, integrated 10 Nm damper actuator	
Room units / room sensors		
22RT-A001	Room unit with display, white housing. MP-Bus, NFC, one digital input	
22RT-A0011	Room unit with display, black housing. MP-Bus, NFC, one digital input	
22RT-A002	Room sensor, no display, white housing. MP-Bus, NFC	
22RT-A003	Room sensor, no display, white housing. MP-Bus, NFC, one digital input	
Duct sensors		
22DT-12L	Duct temperature sensor, 0...5 V / 0...10 V, -50...160°C	Optional, for Auto-C/O
22DC-11	Duct CO_2 sensor, 0...5 V / 0...10 V, 0...2000 ppm	Optional

Terminal assignment

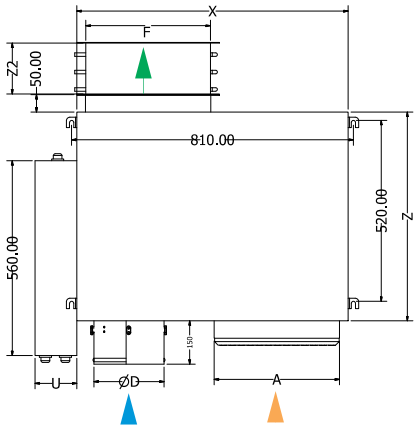
LMV-BAC-001 / NMV-BAC-001

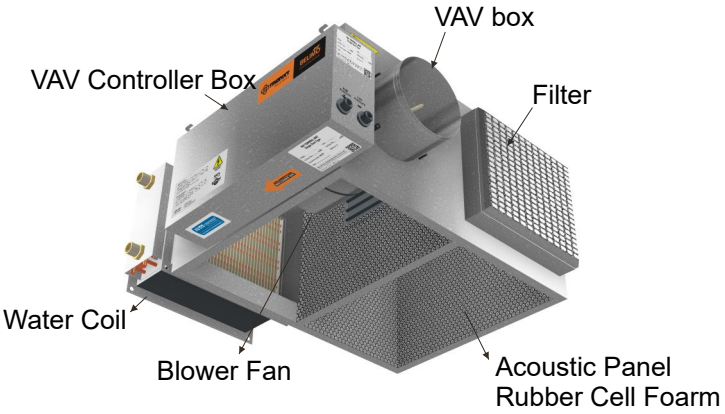
BACnet		AC 24 V		AI	MP
D+	D-	⊥	~	S	MP
BMS		ZoneEase actuator / sensor / room unit power supply		*Room CO_2 sensor or duct temp. sensor*	Room unit 22RT-A001(1) / -A002 / -A003

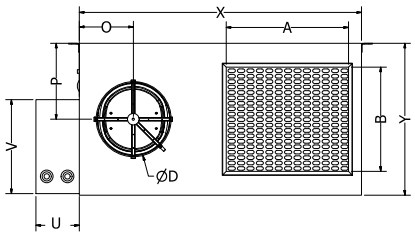
Good to know

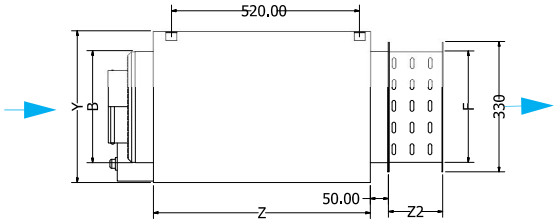
- In bypass control, setpoint and actual values are effective as damper position setpoint / actual value.
- The room sensor 22RT-A002 doesn't support the connection of a window switch / occupancy detector.

PARALLEL FAN POWERED VAV BOX WS HOT WAETR COIL









CONTRUCTION: Model: S-VAV-PF-W-T200

1. Pressure Sensor
2. Damper
3. Casing
4. Outlet TDC Connection
5. Power switch
6. VAV Controller
7. Controller Box
8. Damper Blade
9. Blower Fan
10. Hot water coil
11. Damper Shaft, D12.7
12. Presuure connector P_t/P_s
13. Power Transformer 24v DC
14. Electric parts, fuse 2A

DIMENSION AND AIRFLOW

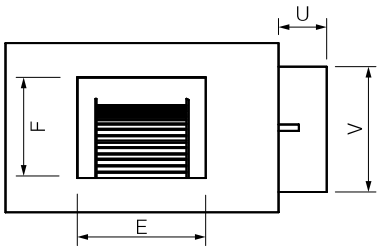
Unit: mm

BOX DIMENSION															COIL				MULTIPE OUTLET				Cont.er Box		
Model	Airflow		Inlet	Cont. Box			Outlet		O	P	Filter		Fan vCap.	Fan Airflow	Cont. Box			Heating Cap.	Model	Dimension			Dimension		
	Min m^3/h	Max m^3/h	(D)	Z	X	Y	E	F			A	B	(W)	m^3/h	Z2	A	B			Z1	X1	Y1	T	U	V
T200 -06	176	880	150	600	780	420	320	280	120	210	360	310	200	730	150	360	310	20/25	TB–MOA	600	370	330	580	120	255
T200 -08	312	1560	200	600	780	420	320	280	145	210	360	310	200	1150	150	360	310	20/25	TB–MOA	600	370	330	580	120	255
T200 -10	486	2430	250	600	780	470	320	280	170	235	360	310	200	1800	150	360	310	20/25	TB–MOA	600	370	330	580	120	255

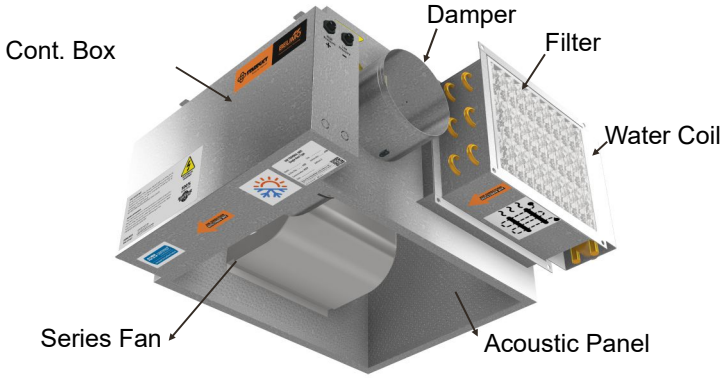
Note: The manufacturer, Starduct, reserves the right to modify certain structural details or product dimensions without prior notice.

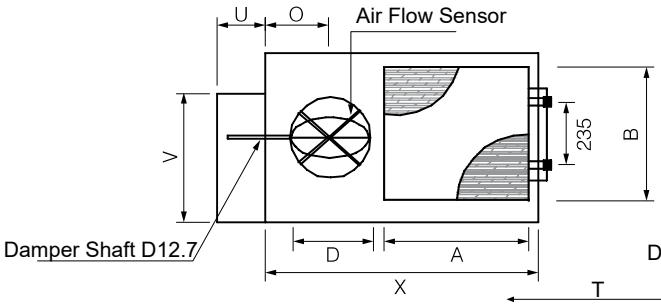
SERIES FAN POWERED VAV BOX WS HOT WAETR COIL

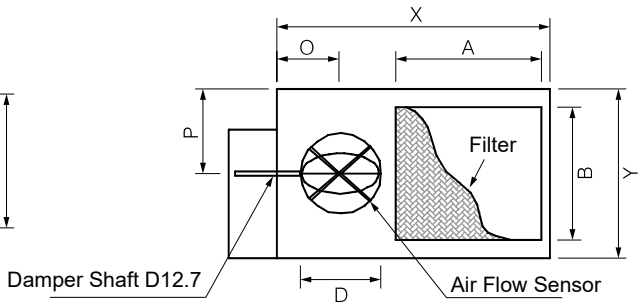
Model: S-VAV-SF-T200

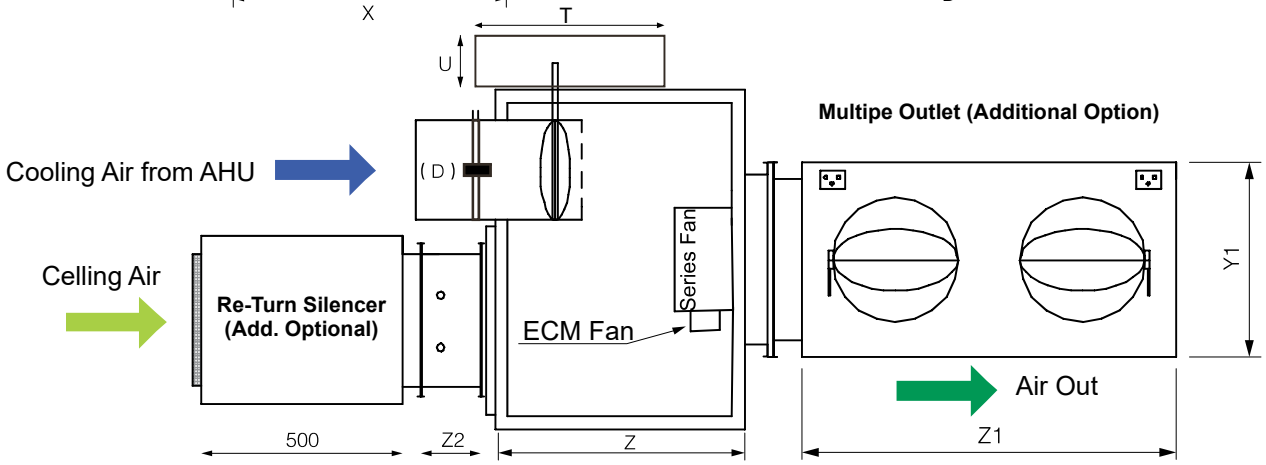


Back View









DIMENSION AND AIRFLOW

Unit: mm

BOX DIMENSION															COIL				MULTIPE OUTLET				Cont.er Box		
Model	Airflow		Inlet	Cont. Box			Outlet		O	P	Filter		Fan vCap.	Fan Airflow	Cont. Box			Heating Cap.	Model	Dimension			Dimension		
	Min m^3/h	Max m^3/h	(D)	Z	X	Y	E	F			A	B	(W)	m^3/h	Z2	A	B			Z1	X1	Y1	T	U	V
T200 -06	176	880	150	600	780	420	320	280	120	210	360	310	200	730	150	360	310	20/25	TB–MOA	600	370	330	580	120	255
T200 -08	312	1560	200	600	780	420	320	280	145	210	360	310	200	1150	150	360	310	20/25	TB–MOA	600	370	330	580	120	255
T200 -10	486	2430	250	600	780	470	320	280	170	235	360	310	200	1800	150	360	310	20/25	TB–MOA	600	370	330	580	120	255

Note: The manufacturer, Starduct, reserves the right to modify certain structural details or product dimensions without prior notice.

NC Level Slection Table

TERMINAL UNIT SELECTION DATA SHEET

Size (Inch/mm)	Airflow	P. Drop ▲ps		Discharge NC (△ ps)			Radial NC (△ ps)		
				0.5"W.G.	1"W.G.	1.5"W.G.	0.5"W.G.	1"W.G.	1.5"W.G.
	CMH	Pa	"W.G	125Pa	250Pa	375Pa	125Pa	250Pa	375Pa
06 (Ø150)	425	24	0	–	–	–	–	24	26
	511	34	0	–	–	–	22	26	28
	594	46	0	–	–	–	23	27	30
	880	60	0	–	–	–	25	29	31
08 (Ø200)	680	12	0	–	–	–	27	29	30
	850	18	0	–	–	–	29	30	31
	1019	25	0	–	20	21	30	32	33
	1188	34	0	23	23	24	31	33	35
08 (Ø200)	936	25	0	–	–	–	25	29	31
	1019	29	0	–	–	–	26	30	32
	1105	34	0	–	–	–	26	31	33
	1188	39	0	–	–	–	27	31	34
	1560	44	0	–	–	–	28	32	34
10 (Ø250)	1361	12	0	–	–	–	27	29	31
	1530	15	0	–	20	21	27	30	32
	1699	19	0	22	23	23	28	31	33
	1868	22	0	25	25	26	29	31	34
	2038	26	0	27	27	28	29	32	34
10 (Ø250)	1361	15	0	–	–	–	28	30	32
	1613	21	0	–	–	21	29	31	33
	1868	27	0	20	22	23	30	33	35
	2430	35	0	22	24	25	30	34	36

ceiling per typical Discharged
effect, end reflection, flex duct effect, space effect, soumd Power, division and lined duct effect.

Âm thanh bức xạ được đo dựa trên trần gạch sợi khoáng 16mm theo giá trị suy giảm âm tiêu chuẩn của ARI 855-998. Âm thanh thoát ra được xác định dựa trên các yếu tố môi trường, phản xạ đầu cuối, ảnh hưởng của ống mềm, ảnh hưởng của không gian, công suất âm thanh, trong vùng và ảnh hưởng của ống có cách âm.

Total Deduction	Octave Band mid Frequency, Hz					
	125	250	500	1000	2000	4000
All size	18	19	20	26	31	36

Total Deduction	Octave Band mid Frequency, Hz					
	125	250	500	1000	2000	4000
<300CFM	24	28	39	53	59	40
300CFM–700CFM	27	29	40	51	53	39
>700CFM	29	30	41	51	52	39

1. Sound Power levels Lw dB re 10^{-12} watts
2. NC–Based on ARI 855–98
3. Dashes (–) indicate NC's less than 20
4. CFM–Cubic feet / minute
5. CMH–Cubic meter / hour
6. pa–Pressnre given in Pascals
7. "W.G.–inches of Water Gauge

HOT WATER COIL SELECTION TABLE (KW)

Type	Rows	Coil	HD Loss	Airflow(CMH)					
		L/s	KPa	212	299	338	425	594	680
S-VAV-SW-T100-04" S-VAV-SW-T100-05" S-VAV-SW-T100-06"	1	0.03	0.39	1.64	1.90	1.99	2.17	2.43	2.52
		0.06	1.46	1.82	2.17	2.29	2.52	2.90	3.05
		0.13	5.56	1.96	2.34	2.49	2.78	3.22	3.40
		0.19	12.22	1.99	2.40	2.58	2.87	3.34	3.55
		Through the Coil, △ ps		4.98	7.47	9.95	12.44	24.88	29.86
	2	0.06	0.36	2.72	3.28	3.52	3.93	4.54	4.78
		0.13	1.40	2.99	3.66	3.99	4.48	5.33	5.69
		0.25	5.35	3.14	3.93	4.25	4.86	5.86	6.30
		0.38	11.72	3.19	4.02	4.37	5.01	6.10	6.54
		Through the Coil, △ ps		9.95	17.42	19.91	29.86	52.26	64.70

Type	Rows	Coil	HD Loss	Airflow(CMH)					
		L/s	KPa	338	511	680	1019	1188	1361
S-VAV-SW-T100-07" S-VAV-SW-T100-08"	1	0.03	0.51	2.29	2.67	2.93	3.28	3.43	3.55
		0.06	1.97	2.61	3.14	3.55	4.10	4.31	4.48
		0.13	7.47	2.84	3.46	3.96	4.69	4.95	5.22
		0.19	16.38	2.93	3.60	4.13	4.92	5.25	5.51
		Through the Coil, △ ps		4.98	9.95	17.42	37.33	47.28	59.72
	2	0.06	0.51	3.93	4.78	5.42	6.30	6.62	0.92
		0.13	1.91	4.40	5.54	6.42	7.74	8.62	8.70
		0.25	7.26	4.69	6.04	7.12	8.76	9.44	10.02
		0.38	15.90	4.81	6.21	7.39	9.17	9.94	10.58
		Through the Coil, △ ps		12.44	24.88	39.81	79.63	102.02	126.91

Type	Rows	Coil	HD Loss	Airflow(CMH)					
		L/s	KPa	511	850	1188	1530	1699	1868
S-VAV-SW-T100-09" S-VAV-SW-T100-10"	1	0.06	0.33	3.49	4.28	4.78	5.16	5.30	5.45
		0.13	1.26	3.96	4.98	5.71	6.24	6.48	6.68
		0.25	4.81	4.25	5.45	6.33	7.03	7.33	7.59
		0.38	10.52	4.37	5.66	6.59	7.36	7.68	7.97
		Through the Coil, △ ps		4.98	14.93	24.88	37.33	47.28	54.74
	2	0.06	0.69	5.48	6.89	7.80	8.44	8.70	8.94
		0.13	2.63	6.33	8.32	9.73	10.81	11.25	11.66
		0.25	9.98	6.86	9.29	11.14	12.57	13.19	13.77
		0.38	21.82	7.06	9.70	1.89	13.31	14.01	14.65
		Through the Coil, △ ps		12.44	29.96	54.74	82.12	97.05	114.47

Type	Rows	Coil	HD Loss	Airflow(CMH)					
		L/s	KPa	680	1018	1300	2037	2379	2718
S-VAV-SW-T100-12"	1	0.06	0.45	4.57	5.33	5.86	6.59	6.86	7.09
		0.13	1.67	5.25	6.30	7.06	8.18	8.62	9.00
		0.25	6.34	5.89	6.95	7.91	8.35	9.94	10.43
		0.38	13.84	5.86	7.21	8.24	9.85	10.46	11.02
		Through the Coil, △ ps		4.98	9.95	17.43	37.33	47.28	59.72
	2	0.06	0.93	6.95	8.26	9.14	10.32	10.73	11.08
		0.13	3.47	8.24	10.20	11.66	13.75	14.54	15.21
		0.25	13.06	9.06	11.55	13.48	16.44	17.58	18.58
		0.38	28.48	9.48	12.07	14.24	17.55	18.90	20.08
		Through the Coil, △ ps		12.44	24.88	39.81	79.63	102.02	126.91

HOT WATER COIL SELECTION TABLE (KW)

Type	Rows	Coil	HD Loss	Airflow(CMH)					
		L/s	KPa	1018	1090	2379	3080	3398	3736
S-VAV-SW-T100-14"	1	0.06	0.60	6.30	7.47	8.24	8.76	8.97	9.14
		0.13	2.27	7.47	9.26	10.46	11.37	11.72	12.07
		0.25	8.58	8.24	10.46	12.10	13.36	13.89	14.36
		0.38	18.71	8.56	11.02	12.78	14.18	14.80	15.36
		Through the Coil, △ ps		4.98	14.93	24.88	37.33	47.28	54.74
	2	0.09	0.99	10.35	12.78	14.27	15.33	15.74	16.12
		0.19	3.80	12.25	15.94	18.49	20.40	21.19	21.89
		0.38	14.50	13.48	18.17	21.63	24.35	25.53	26.58
		0.57	31.83	13.95	19.08	22.95	26.02	27.37	28.60
		Through the Coil, △ ps		12.44	29.86	54.74	82.12	97.05	114.47

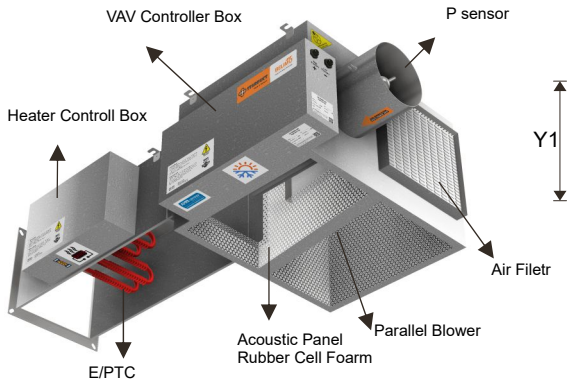
Type	Rows	Coil	HD Loss	Airflow(CMH)					
		L/s	KPa	1360	2037	2718	3398	4078	4755
S-VAV-SW-T100-16" S-VAV-SW-T100-20X16	1	0.06	0.69	7.50	8.53	9.20	9.70	10.11	10.40
		0.13	2.57	9.17	10.79	11.93	12.84	13.54	14.16
		0.25	9.71	10.29	12.40	13.98	15.27	16.29	17.20
		0.38	21.16	10.73	13.07	14.86	16.29	17.50	18.52
		Through the Coil, △ ps		7.47	14.93	22.40	34.84	47.28	58.72
	2	0.09	1.11	12.40	14.45	15.80	16.76	17.53	18.08
		0.19	4.18	15.15	18.49	20.93	22.77	24.27	25.50
		0.38	15.99	17.00	21.42	24.79	27.56	29.81	31.74
		0.57	35.12	17.73	22.60	26.44	29.57	32.24	34.55
		Through the Coil, △ ps		14.93	29.86	49.77	72.16	97.05	126.91

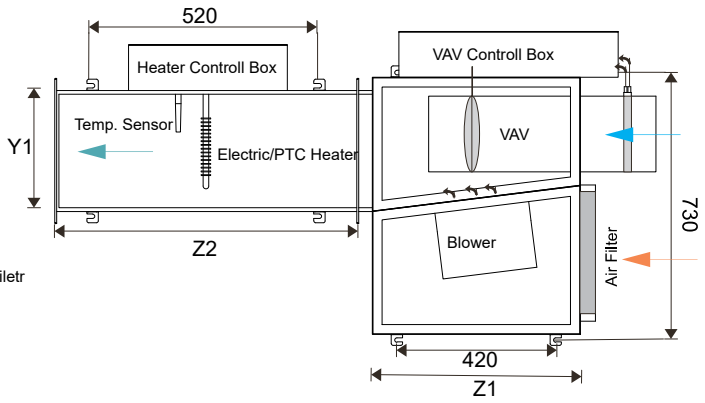
Correction Factors – Hot Water Coils

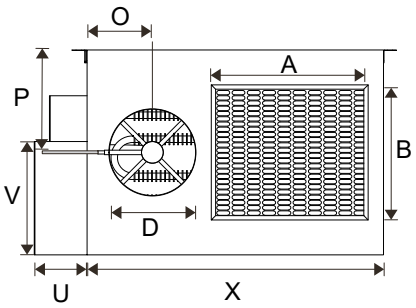
		Entering water temperature, ℃							
		49	54	60	66	71	77	82	88
Entering Air Temp℃	10	0.54	0.62	0.71	0.79	0.87	0.96	1.04	1.12
	13	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08
	16	0.47	0.55	0.63	0.71	0.79	0.88	0.96	1.04
	18	0.43	0.51	0.59	0.67	0.75	0.84	0.92	1.00

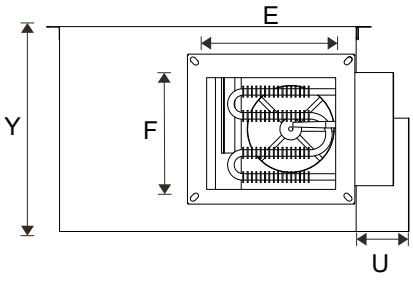
PARALLEL FAN POWERED VAV BOX WS ELECTRIC/PTC HEATER

Model: S-VAV-SFE/SFP-T200









CONTRUCTION: Model: S-VAV-SFE/SFP-T200

1. Pressure Sensor
2. Damper
3. Casing
4. Outlet TDC Connection
5. Power switch
6. VAV Controller
7. Controller Box
8. Damper Blade
9. Blower Fan
10. Hot water coil
11. Damper Shaft, D12.7
12. Presuure connector P_t/P_s
13. Power Transformer 24v DC
14. Electric parts, fuse 2A

DIMENSION AND AIRFLOW

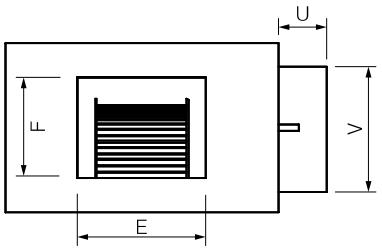
Unit: mm

BOX DIMENSION															COIL				MULTIPE OUTLET				Cont.er Box			
Model	Airflow		Inlet	Cont. Box			Outlet		O	P	Filter		Fan vCap.	Fan Airflow	Cont. Box			Heating Cap.	Model	Dimension			Dimension			
	Min m^3/h	Max m^3/h	(D)	Z	X	Y	E	F			A	B	(W)	m^3/h	Z2	A	B			Z1	X1	Y1	T	U	V
T200 -06	176	880	150	600	780	420	320	280	120	210	360	310	200	730	150	360	310	20/25	TB–MOA	600	370	330	580	120	255
T200 -08	312	1560	200	600	780	420	320	280	145	210	360	310	200	1150	150	360	310	20/25	TB–MOA	600	370	330	580	120	255
T200 -10	486	2430	250	600	780	470	320	280	170	235	360	310	200	1800	150	360	310	20/25	TB–MOA	600	370	330	580	120	255

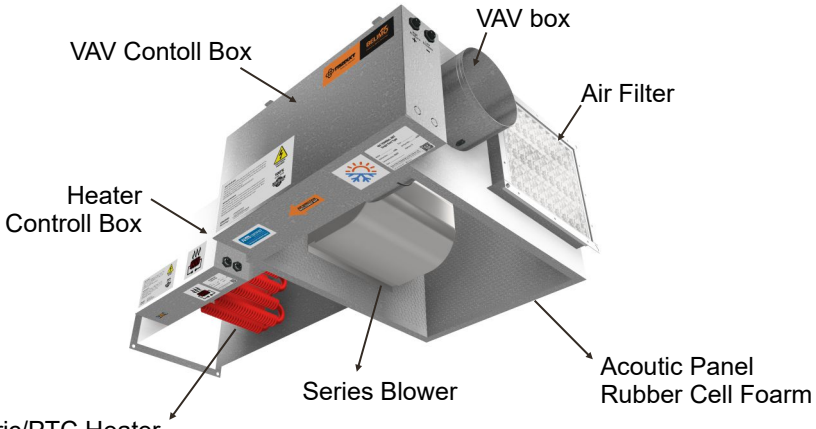
Note: The manufacturer, Starduct, reserves the right to modify certain structural details or product dimensions without prior notice.

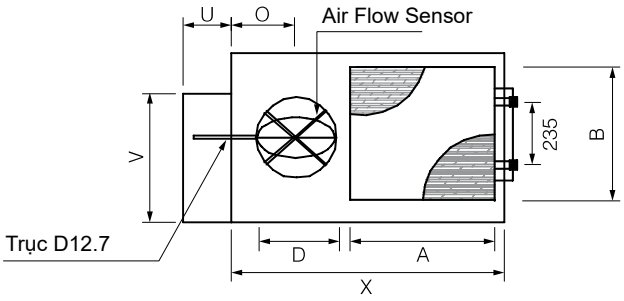
SERIES FAN POWERED VAV BOX WS ELECTRIC/PTC HEATER

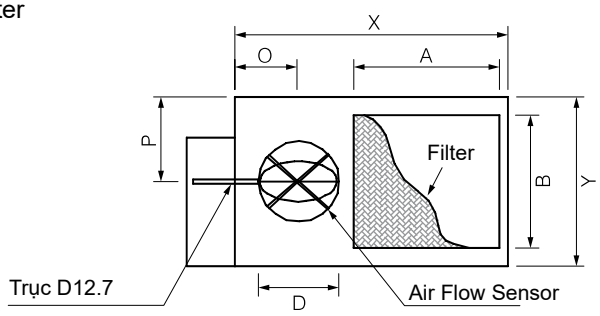
Model: S-VAV-SF-E/P-T200

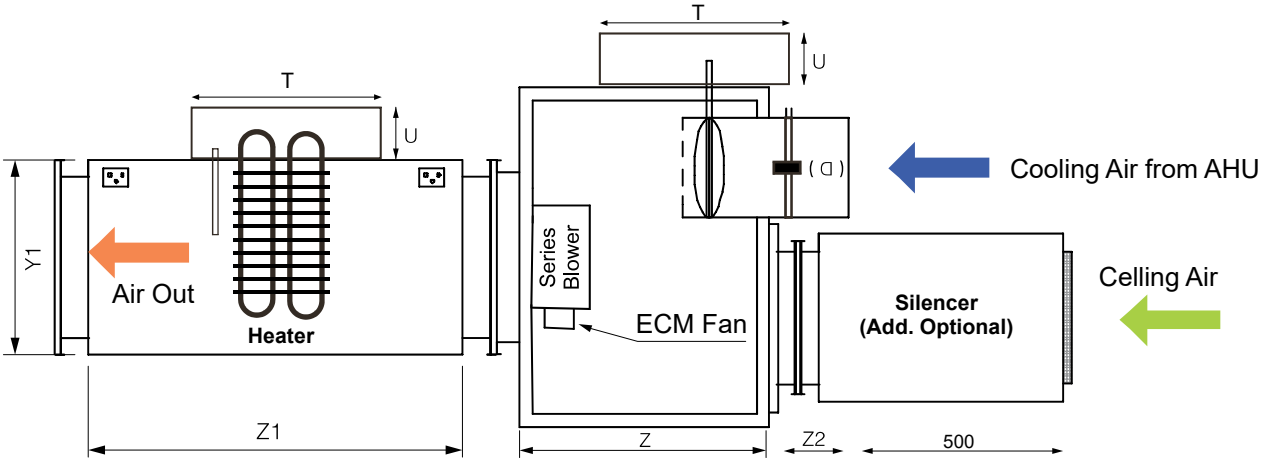


Back View









DIMENSION AND AIRFLOW

Unit: mm

BOX DIMENSION															COIL				MULTIPE OUTLET				Cont.er Box		
Model	Airflow		Inlet	Cont. Box			Outlet		O	P	Filter		Fan vCap.	Fan Airflow	Cont. Box			Heating Cap.	Model	Dimension			Dimension		
	Min m^3/h	Max m^3/h	(D)	Z	X	Y	E	F			A	B	(W)	m^3/h	Z2	A	B			Z1	X1	Y1	T	U	V
T200 -06	176	880	150	600	780	420	320	280	120	210	360	310	200	730	150	360	310	20/25	TB–MOA	600	370	330	580	120	255
T200 -08	312	1560	200	600	780	420	320	280	145	210	360	310	200	1150	150	360	310	20/25	TB–MOA	600	370	330	580	120	255
T200 -10	486	2430	250	600	780	470	320	280	170	235	360	310	200	1800	150	360	310	20/25	TB–MOA	600	370	330	580	120	255

Note: The manufacturer, Starduct, reserves the right to modify certain structural details or product dimensions without prior notice.

Operating Mode

Cooling with Parallel or Series Fan-Powered VAV Boxes

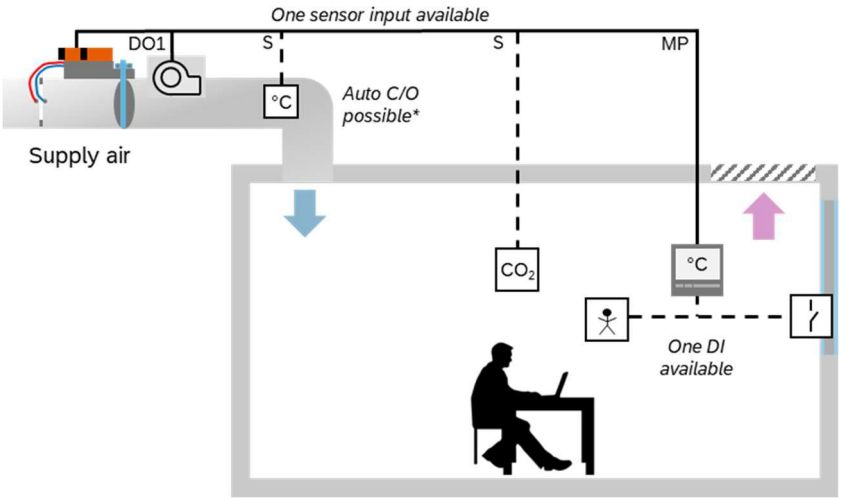
Application Description

- Cooling is achieved by modulating the air damper based on the set temperature.
- The central AHU (Air Handling Unit) or RTU (Rooftop Unit) must supply primary chilled air.
- Heating is provided via a single-stage electric heater connected to digital output Do1.

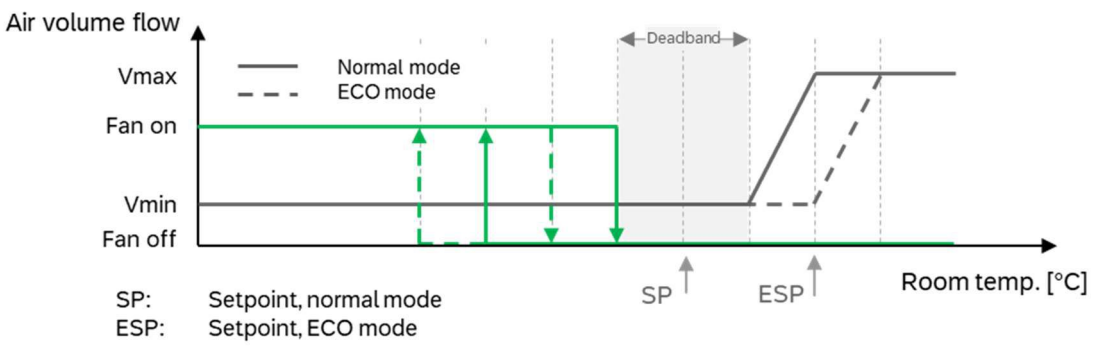
Optional Features:

- Automatic switching between heating and cooling modes if a duct temperature sensor 22DT-12L is installed (*).
- Co_2 sensor for monitoring indoor air quality.
- Window switch or occupancy sensor (only one can be selected) connected via MP-Bus room device.
- Bypass control (position-based) without reheat if D3 sensor is disabled.

Application Diagram:



Sequence diagram



Operating Mode

ZoneEase VAV Applications

Cooling with Parallel or Series Fan + Single-Stage Electric Heater

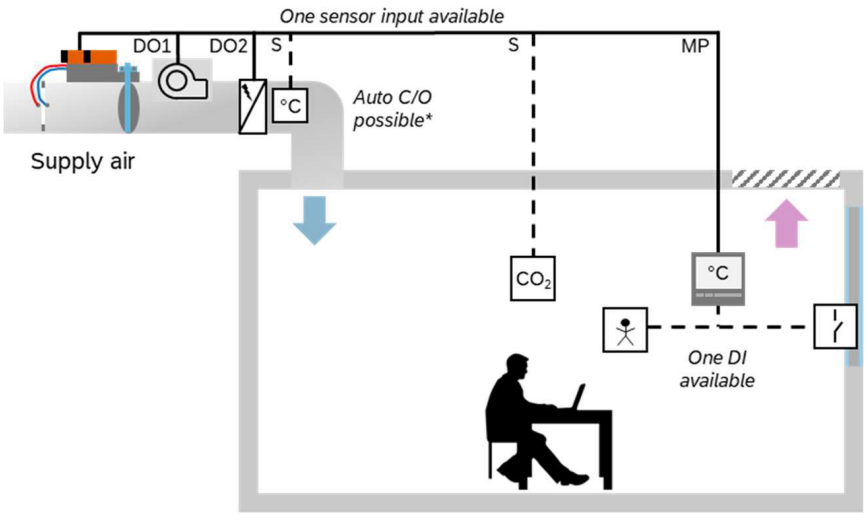
Application Description:

- Cooling is achieved by modulating the air damper based on the set temperature.
- The central AHU (Air Handling Unit) or RTU (Rooftop Unit) must supply primary chilled air.
- First heating stage: recirculates return air through the parallel fan, activated via digital output Do1.
- Second heating stage: uses a single-stage electric heater, activated via digital output Do2.

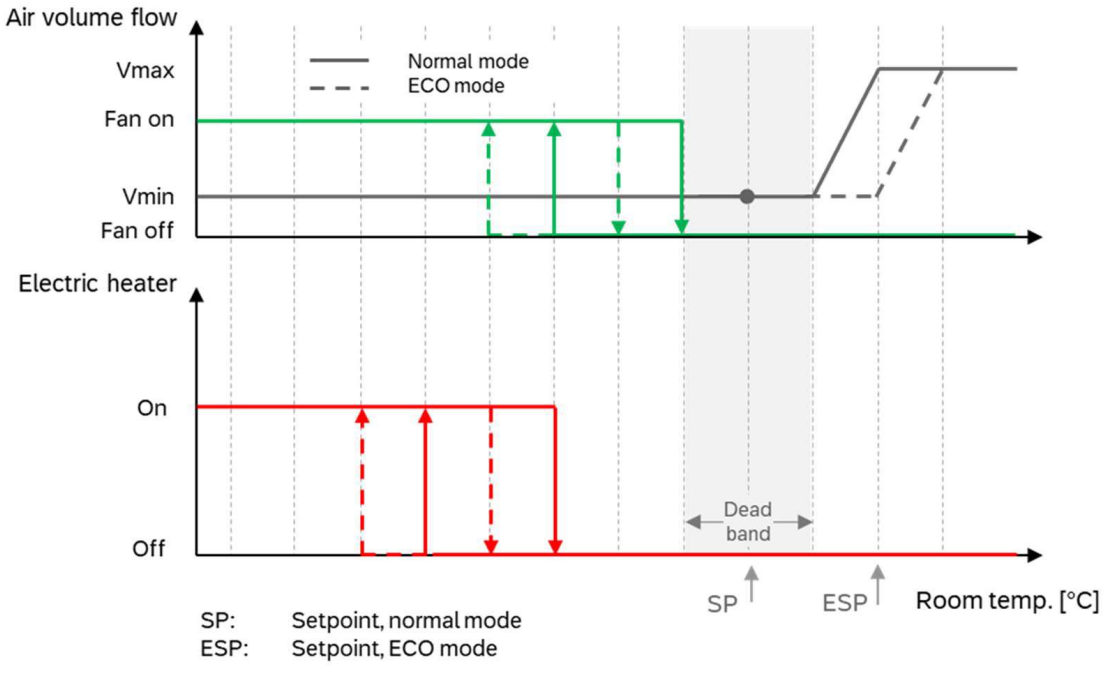
Optional Features:

- Automatic switching between heating and cooling modes if a duct temperature sensor 22DT-12L is installed (*).
- Co_2 sensor for monitoring indoor air quality.
- Window switch or occupancy sensor (only one can be selected) connected via MP-Bus room device.

Application Diagram:



Sequence diagram



Operating Mode

ZoneEase VAV Applications

Cooling with Parallel Fan + Two-Stage Heating

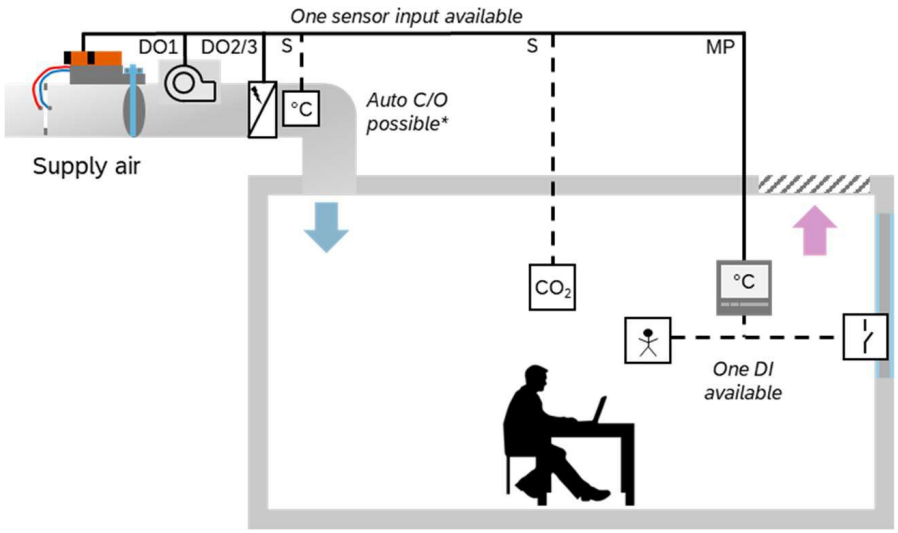
Application Description

- Cooling is achieved by modulating the air damper based on the setpoint temperature.
- The central AHU (Air Handling Unit) or RTU (Rooftop Unit) must supply the primary chilled air.
- First heating stage: Recirculates return air through the parallel fan, activated via digital output Do1.
- Second heating stage: Uses a single-stage electric heater, activated via digital outputs Do2 and Do3.

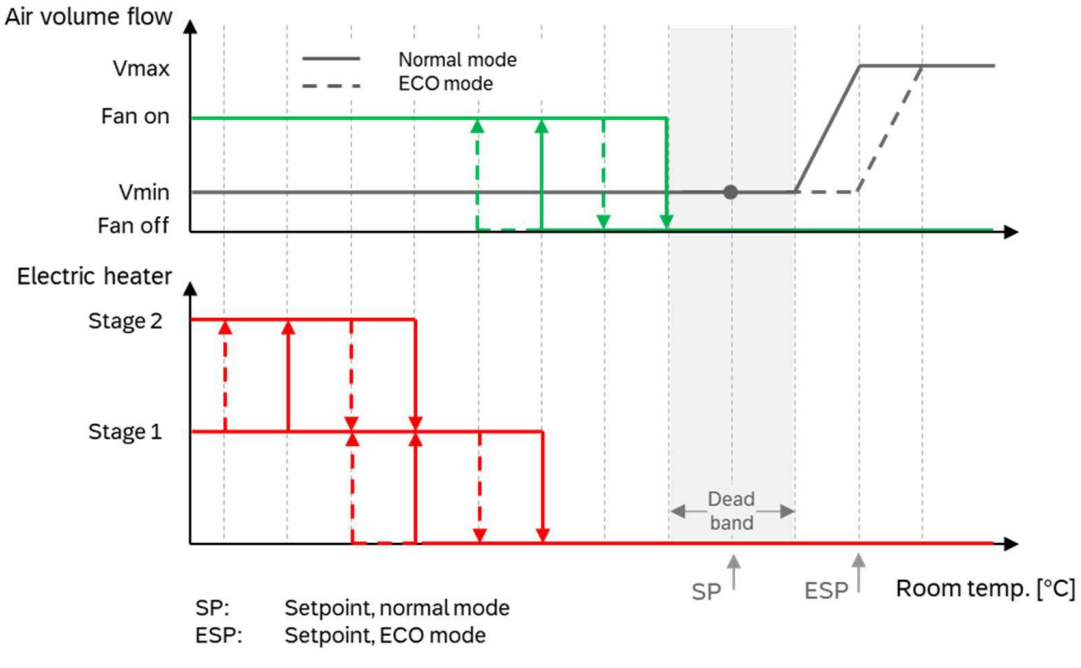
Optional Features:

- Automatic switching between heating and cooling modes if a duct temperature sensor 22DT-12L is installed (*).
- Co_2 sensor for monitoring indoor air quality.
- Window switch or occupancy sensor (only one can be selected) connected via MP-Bus room device.

Application Diagram:



Sequence diagram



Controller

Belimo product type	Function	Remark
Controllers / Actuators		
LMV-BAC-001	VAV Zone Controller, integrated 5 Nm damper actuator	
NMV-BAC-001	VAV Zone Controller, integrated 10 Nm damper actuator	
Room units / room sensors		
22RT-A001	Room unit with display, white housing. MP-Bus, NFC, one digital input	
22RT-A0011	Room unit with display, black housing. MP-Bus, NFC, one digital input	
22RT-A002	Room sensor, no display, white housing. MP-Bus, NFC	
22RT-A003	Room sensor, no display, white housing. MP-Bus, NFC, one digital input	
Duct sensors		
22DT-12L	Duct temperature sensor, 0...5 V / 0...10 V, -50...160°C	Optional, for Auto-C/O
22DC-11	Duct CO_2 sensor, 0...5 V / 0...10 V, 0...2000 ppm	Optional

Terminal assignment

Cooling with Parallel or Series Fan-Powered VAV Boxes

LMV-BAC-002 / NMV-BAC-002

BACnet			AC 24 V		Room unit			Analog IN / MP				Digital OUT			
D+	D-	⊥	⊥	~	⊥	~	MP	S	⊥	~	MP	1	2	3	COM
BMS			ZoneEase actuator power supply		Room unit 22RT-A001(1) / -A002 / -A003			*Room CO_2 sensor OR duct temp. sensor*	Ext. sensor / actuator power supply		- not used -	Parallel fan	- not used -		Fan GND

Good to know

- The room sensor 22RT-A002 doesn't support the connection of a window switch / occupancy detector.

Cooling with Parallel or Series Fan + Single-Stage Electric Heater

LMV-BAC-002 / NMV-BAC-002

BACnet			AC 24 V		Room unit			Analog IN / MP				Digital OUT			
D+	D-	⊥	⊥	~	⊥	~	MP	S	⊥	~	MP	1	2	3	COM
BMS			ZoneEase actuator power supply		Room unit 22RT-A001(1) / -A002 / -A003			*Room CO_2 sensor OR duct temp. sensor*	Ext. sensor / actuator power supply		- not used -	Parallel fan	Electric heater stage 1	- not used -	Fan / heater GND

Good to know

- Reheat aggregates can' t be turned on if the actual air volume flow is < 10% of Vmax.
- The room sensor 22RT-A002 doesn't support the connection of a window switch / occupancy detector.

Cooling with Parallel Fan + Two-Stage Heating

LMV-BAC-002 / NMV-BAC-002

BACnet			AC 24 V		Room unit			Analog IN / MP				Digital OUT			
D+	D-	⊥	⊥	~	⊥	~	MP	S	⊥	~	MP	1	2	3	COM
BMS			ZoneEase actuator power supply		Room unit 22RT-A001(1) / -A002 / -A003			*Room CO_2 sensor OR duct temp. sensor*	Ext. sensor / actuator power supply		- not used -	Parallel fan	Electric heater stage 1	Electric heater stage 2	Fan / heater GND

Good to know

- Reheat aggregates can' t be turned on if the actual air volume flow is < 10% of Vmax.
- The room sensor 22RT-A002 doesn't support the connection of a window switch / occupancy detector.

NC Level Slection Table

TERMINAL UNIT SELECTION DATA SHEET

Size (Inch/mm)	Airflow	P. Drop ▲ps		Discharge NC (△ ps)			Radial NC (△ ps)		
				0.5"W.G.	1"W.G.	1.5"W.G.	0.5"W.G.	1"W.G.	1.5"W.G.
	CMH	Pa	"W.G	125Pa	250Pa	375Pa	125Pa	250Pa	375Pa
06 (Ø150)	425	24	0	–	–	–	–	24	26
	511	34	0	–	–	–	22	26	28
	594	46	0	–	–	–	23	27	30
	880	60	0	–	–	–	25	29	31
08 (Ø200)	680	12	0	–	–	–	27	29	30
	850	18	0	–	–	–	29	30	31
	1019	25	0	–	20	21	30	32	33
	1188	34	0	23	23	24	31	33	35
08 (Ø200)	936	25	0	–	–	–	25	29	31
	1019	29	0	–	–	–	26	30	32
	1105	34	0	–	–	–	26	31	33
	1188	39	0	–	–	–	27	31	34
	1560	44	0	–	–	–	28	32	34
10 (Ø250)	1361	12	0	–	–	–	27	29	31
	1530	15	0	–	20	21	27	30	32
	1699	19	0	22	23	23	28	31	33
	1868	22	0	25	25	26	29	31	34
	2038	26	0	27	27	28	29	32	34
10 (Ø250)	1361	15	0	–	–	–	28	30	32
	1613	21	0	–	–	21	29	31	33
	1868	27	0	20	22	23	30	33	35
	2430	35	0	22	24	25	30	34	36

ceiling per typical Discharged
effect, end reflection, flex duct effect, space effect, soumd Power, division and lined duct effect.

Âm thanh bức xạ được đo dựa trên trần gạch sợi khoáng 16mm theo giá trị suy giảm âm tiêu chuẩn của ARI 855-998. Âm thanh thoát ra được xác định dựa trên các yếu tố môi trường, phản xạ đầu cuối, ảnh hưởng của ống mềm, ảnh hưởng của không gian, công suất âm thanh, trong vùng và ảnh hưởng của ống có cách âm.

Total Deduction	Octave Band mid Frequency, Hz					
	125	250	500	1000	2000	4000
All size	18	19	20	26	31	36

Total Deduction	Octave Band mid Frequency, Hz					
	125	250	500	1000	2000	4000
<300CFM	24	28	39	53	59	40
300CFM–700CFM	27	29	40	51	53	39
>700CFM	29	30	41	51	52	39

1. Sound Power levels Lw dB re 10^{-12} watts
2. NC–Based on ARI 855–98
3. Dashes (–) indicate NC's less than 20
4. CFM–Cubic feet / minute
5. CMH–Cubic meter / hour
6. pa–Pressnre given in Pascals
7. "W.G.–inches of Water Gauge

Fan Capacity and Heater Capacity Calculation

1. Determine Required Airflow (Q)

- Based on room size, occupancy, heat-generating equipment, and ventilation standards (e.g., ASHRAE 62.1).
- Example:Office space of 30 m², 3 occupants, 10 L/s per person → Q = 30 L/s = 108 m³/h

2. Estimate System Pressure Loss (ΔP)

- Includes ductwork, damper, filter, heating coil, and VAV box resistance.
- Example: Total pressure loss = 250 Pa

3. Calculate Fan Power:

$$\mathbf{P(fan)} = \frac{Q \times \Delta p\ (pa)}{\eta \times 3600}$$

. Where:

Q: airflow in m³/h; Δp: pressure loss in Pa; η: fan efficiency (typically 0.5–0.7)

Example:

$$\mathbf{P(fan)} = \frac{108 \times 250(pa)}{0.6 \times 3600} = \mathbf{12.5\ W}$$

Actual fan power should be slightly higher to ensure reliability and reserve capacity.

Heating Capacity Calculation (Electric Heater or Hot Water Coil)

1. Determine Heating Airflow (V m/s)

- **Typically:**
  - Vmin=30% of VAV box max airflow
  - Vmax=80% of VAV box max airflow

2. Determine Temperature Rise (ΔT)

Example: Desired supply air temperature = 32°C, incoming air = 13°C → ΔT = 19°C

3. Calculate Heating Power (P_heat)

Formula (SI units):

$$\mathbf{P\_heat = 0.33} \times V \times \mathbf{\Delta T}$$

Where:

P_heat: heating power in kW; V: airflow in L/s; ΔT: temperature rise in °C

Example: V=100 L/s, ΔT=19°C

$$\mathbf{P\text{-}heat = 0.33} \times \mathbf{100 \times 19 = 627\ W \approx 0.63\ kW}$$

For multi-stage electric heaters, divide total power into steps (e.g., 30%, 60%, 100%) for better control.

Equipment Selection Tips

Component	Selection Criteria
Fan	ECM motor, high efficiency, AMCA 210 compliant
Electric Heater	Overheat protection, staged or SSR control
Hot Water Coil	Modulating valve, flow control
VAV Box	AHRI 880 certified, BMS integration

Structure, Function, and Application

1. Overview of Parallel Fan-Powered VAV Box with Reheat

This type of VAV box is commonly used in HVAC systems to regulate supply airflow and maintain desired room temperature. It operates by modulating airflow based on thermal load demand and can provide supplemental heating via electric resistance or hot water coils.

2. Main Components

- Variable Air Volume (VAV) Box: Modulates supply airflow from the central system into the conditioned space.
- Parallel Fan: Operates independently from the main airflow and typically activates when additional return air or supplemental airflow is needed.
- Reheat Coil (Electric or Hot Water): Heats the air when temperature needs to be increased.
- Temperature Sensor & Controller: Monitors and controls the damper, fan, and heating coil operation.

3. Operating Mechanism

State 1: Low Thermal Load (Cooling Mode)

- Damper opens partially or fully to deliver cool air.
- Parallel fan remains off.
- Reheat coil is off since heating is not required.

State 2: Moderate Thermal Load (Intermediate Mode)

- If central cooling airflow is insufficient, the damper opens further to increase supply.
- If thermal load decreases, the damper closes slightly to reduce airflow.

State 3: Heating Required (Heating Mode)

- If supply air lacks sufficient heat, the parallel fan activates to draw return air from the ceiling plenum or return space and push it into the occupied zone.
- Reheat coil turns on to warm the air delivered by the fan, maintaining the desired room temperature.
- Damper adjusts to optimize airflow.

State 4: High Heating Demand (Full Heating Mode)

- Parallel fan runs continuously to provide supplemental airflow.
- Reheat coil operates at full capacity to ensure room temperature is maintained.
- Damper may close partially to limit cold air from the central system.

4. Advantages of Parallel Fan-Powered VAV Box with Reheat

- Enhanced Temperature Control: Parallel fan ensures airflow even when central system reduces supply.
- Improved Heating Efficiency: Reheat coil quickly raises room temperature when needed.
- Energy Savings: Fan operates only when necessary, optimizing energy use.
- Occupant Comfort: Maintains stable temperature under varying load conditions.

5. Practical Applications

- Offices, hotels, and hospitals with fluctuating cooling loads.
- Spaces requiring precise temperature control and rapid heating response.
- Commercial buildings with multiple zones and diverse thermal demands.

The interrelationship between factors in the selection process

The Relationship Between VAV Box Nominal Airflow, Fan Airflow, and Heating Capacity

In a VAV (Variable Air Volume) system with parallel or series fan-powered boxes and electric heating elements, there is a close relationship between three key factors:

- Nominal airflow of the VAV box – The maximum airflow the VAV box is designed to handle.
- Fan airflow – The actual airflow supplied by the parallel or series fan.
- Heating capacity – The required heating power to raise the air temperature to the desired level.

Below is how the nominal airflow of the VAV box influences fan selection and heating capacity.

1. Relationship Between VAV Nominal Airflow and Fan Airflow

- The nominal airflow of the VAV box (Q_nom) is the maximum airflow the box can regulate from the AHU/PAU.
- Parallel or series fans must be designed to operate within the airflow range of the VAV box.
- Fan airflow must be adjusted according to the operating condition of the VAV box:
  - If the damper is wide open, the fan may not need to operate much (especially in parallel fan systems).
  - If the damper is partially closed, the fan must compensate for the reduced airflow to maintain the minimum required airflow to the space.

Fan airflow selection based on VAV box airflow:

- In parallel fan systems, fan airflow is typically less than or equal to the nominal airflow of the VAV box, as the fan only runs when additional airflow is needed.
- In series fan systems, fan airflow is usually equal to or greater than the nominal airflow of the VAV box, since the fan runs continuously to maintain system airflow.

General relationship formula:

$$Q_{fan} \approx Q_{VAVmin} \leq Q_{fan} \leq Q_{VAVmax}$$

Where:

$Q_{VAV,min}$ = Minimum airflow of the VAV box (when the damper is mostly closed)

$Q_{VAV,max}$ = Nominal (maximum) airflow of the VAV box

Q_{Fan} = Required fan airflow

2. Relationship Between VAV Nominal Airflow and Heating Capacity

- The heating capacity (P_heater) must be sufficient to heat the volume of air supplied by the fan.
- When the VAV box has a high nominal airflow, the electric heater must have a higher capacity to ensure adequate heat transfer to the air stream.

Heating capacity formula:

$$P_{heater}=Q_{fan}\times\Delta_T\times C_p\times\rho$$

Where:

Q_{fan} ≈ Q_{VAV} for series fans

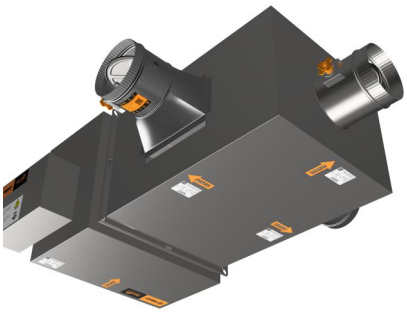
Q_{fan} ≤ Q_{VAV} for parallel fans

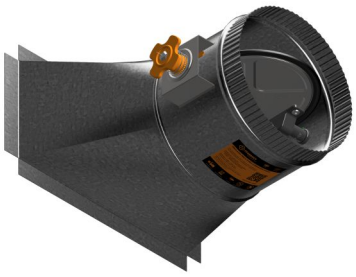
Δt = Desired temperature rise

Cp =1.005 kJ/kg·°

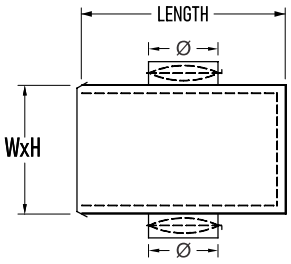
ρ (specific heat of air) ρ=1.2 kg/m3 (air density)

AIR TERMINAL WITH MULTIPLE OUTLET PLENUM ARRANGEMENT

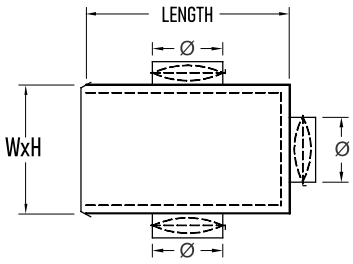




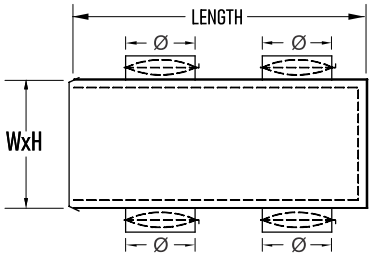
Spigot details



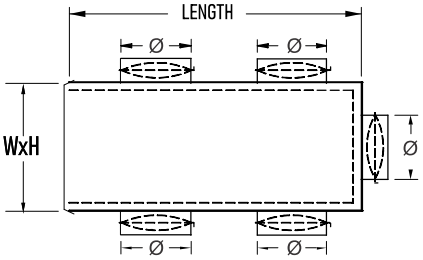
ARRANGEMENT - A



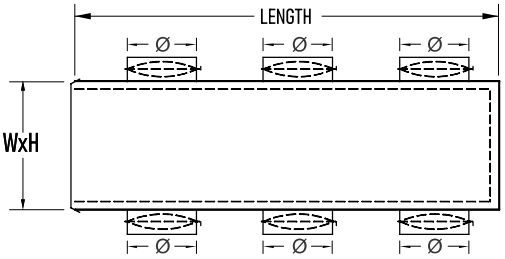
ARRANGEMENT - B



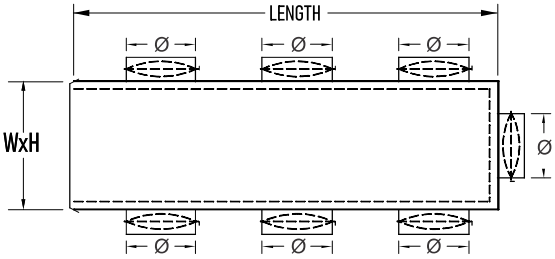
ARRANGEMENT - C



ARRANGEMENT - D



ARRANGEMENT - E



ARRANGEMENT - F

NOTE:
Multiple outlet plenums can be supplied in the upon arrangement and the dimensions will be as per customer's requirement

CONTROLLER

The ZoneEase VAV System Solution

Belimo ZoneEase VAV is a VAV-based zone control solution with 19 selectable and configurable applications. The solution encompasses a cloud-based engineering and commissioning workflow with offline capabilities to support a seamless and error-free workflow.

VAV actuators with or without I/O module contain decentralized control logic and allow for standalone zone / room automation as well as systems with building management system integration over BACnet MS/TP or Modbus RTU. Applications can be realized with an optional 2nd VAV flow controller for supply/extract air or dual supply air control. Room temperature control applications can be combined with IAQ (indoor air quality) control.

Core Components

- VAV zone control actuators with 5 or 10 Nm nominal torque, with or without I/O module.
- VAV compact controllers with 5 or 10 Nm nominal torque for extract air or dual supply air control.
- Room operating units with e-paper display for room temperature, room temp. + rel. humidity, or for room temp., rel. humidity, and CO2 measurement.
- Room operating units without e-paper display (with virtual display) for room temperature, room temp. + RH, or for room temp., RH, and CO2 measurement.
- Room operating units (with / without display) can be used in combination with the Belimo Display app.

VAV zone control actuators 5 / 10 Nm
LMV/NMV-BAC-001 and LMV/NMV-BAC-002

Room Operating Units and Belimo Display App
P22RT..-1T00D1 and P22RT..-1T-1

Optional / supplementary components

- On/off or MP-Bus zone valve actuator for hydronic reheating coils.
- Duct CO_2 sensors 0-10V for installation in the extract air duct. Can be used for IAQ control or for monitoring purposes.
- Duct temperature sensors 0-10V / 0-160°C to support automatic heating / cooling changeover based on the supply air temperature, or for reheater monitoring.
- An occupancy sensor can be connected to the digital input (DI) of the Room operating unit.

2nd VAV controller 5 / 10 Nm
LMV/NMV-D3-MP-A7

Duct sensor CO_2 or temperature
22DC11 and 22DT-12L

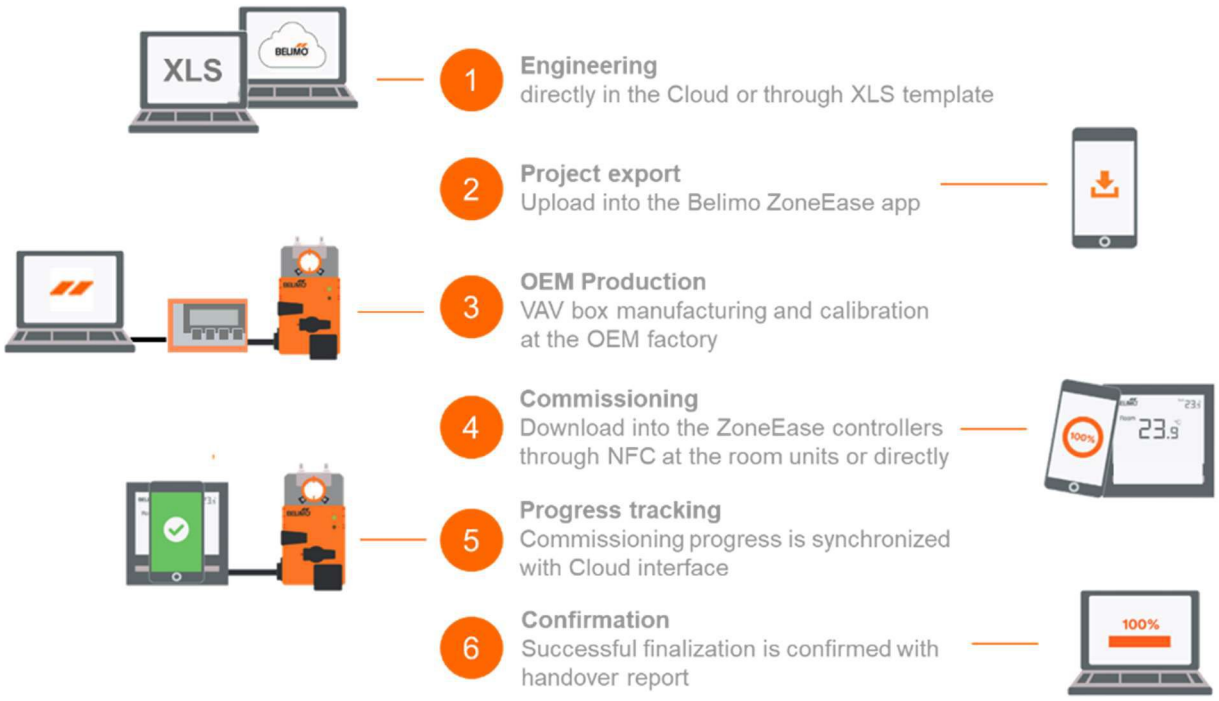
Reheat valve actuator
CQ24A-MPL-A8

Tooling environment

- Cloud-based project setup and management with commissioning and progress report.
- Offline project setup with an XLS template that can be uploaded to the cloud interface. Download at https://www.belimo.com/zoneease-excel
- Smartphone access (Android smartphones only) to VAV ZoneEase directly via NFC or Bluetooth (with ZIP-BT-NFC interface converter) or through the room units with NFC.
- OEM PC-Tool with ZTH EU interface converter and VAV ZoneEase configuration module.
- For more information, please visit https://zoneease.cloud.belimo.com

General workflow

1. The Project Engineer or System integrator enters and uploads the configuration data (excl. protected OEM parameters) at their office to the cloud system.
2. The project is published and released to the connected smartphones running the ZoneEase VAV app. When the installer logs in, configuration data are synchronized to his smartphone on site.
3. OEM calibration data is forwarded to the contracted OEM who manufactures and calibrates the project's VAV boxes at the OEM factory. The calibration parameters are protected against unauthorized modification with a customer-specific release code.
4. All components are installed in the building. Once done, the installer holds his smartphone to the room unit or actuator. This works while the actuators are powered or unpowered.
5. The commissioning progress is synchronized with the Cloud project through the smartphone app, where the progress can be tracked. Changes made on site are synchronized back to the initial project data.
6. After completion of the commissioning process, a final report can be generated in the Cloud interface.



General Operating Principles

Reference to the BACnet / Modbus interface specification

The BACnet objects and Modbus registers are listed in detail in the BACnet PICS and the Modbus register list which can be downloaded at the Belimo website. For details regarding datapoints mentioned below, please refer to these documents.

Operating modes

ZoneEase VAV works with four basic operating / system modes. The availability of certain functions depends on the application, e.g., whether reheating aggregates or certain sensors are connected and configured.

The operating mode is either set by the system, which could be based on the input status of the presence sensor connected to the room operating unit or other criteria, or it can be set through the datapoint MV[1] / Reg. 150 *System Mode* with the enumeration [1:Off, 2:Active, 3:Eco, 4:Boost].

BACnet	Modbus	Designation	Description
MV[1]	150	System Mode [1:Off, 2:Active, 3:Eco, 4:Boost]	Setting the system mode over the bus

Off mode / frost protection

The Off mode is used for energy saving or when the room is unoccupied, e.g., during holidays. When active, an air flow of Vmin is delivered to the zone and all supplementary in- and outputs are deactivated. The Off mode includes a frost protection function that can't be turned off. This function maintains a predefined minimum room temperature (default 4°C) with a non-modifiable hysteresis of 4K. This function is turned off when the room temperature rises above the frost protection setpoint under consideration of the hysteresis.

The following actions are taken by the system while the frost protection function is active (depending on the availability of the external aggregate):

- Reheat1/Reheat2/On/Off Valve (if available) is switched on.
- Parallel Fan (if available) is switched on.
- Heating Valve (if available) is fully opened.
- Damper is controlled to Vmin.

Active mode

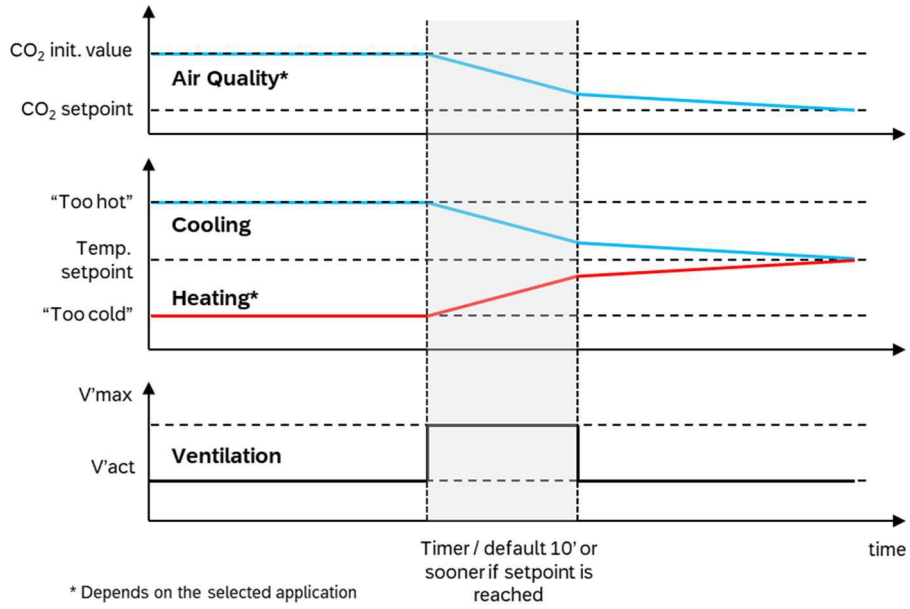
The active mode is the standard operating mode. In active mode, ZoneEase VAV controls the air flow and reheating aggregates to achieve the target temperature or indoor air quality. Both control targets can be active at the same, see "*Combined room temperature / air quality control*" below.

Eco mode

The Eco mode is an energy saving mode. When the room is temporarily unoccupied, e.g., at night times or during the weekend, the cooling or heating setpoint is overwritten with the Eco mode setpoint. The Eco mode can also be enabled by turning it on at the room unit.

Boost mode

The Boost mode is used to quickly reach the target room temperature, resp. for application no. 8, the target air quality. When this mode is enabled, the air volume flow is set to Vmax for a maximum of 10 minutes (default setting, adjustable) or automatically disabled if the target value is reached sooner than in 10 minutes.



This mode can be set by the room user or via the Building Management System by trigger or by a time scheduler event. The following conditions must be met to enable the boost mode:

- The room temperature is above the setpoint if there is a cooling demand or below the setpoint if there is a heating demand.
- The room temperature (based on the active mode temperature setpoint) is not within the dead band. If the room temperature is within the dead band, the boost mode can`t be enabled.

Application Overview

Applications are grouped into basic applications (indoor air quality and air volume flow control) and room temperature control applications. Room temperature control applications are available with or without parallel / series fan.

All room temperature control applications can be used with combined room temperature / indoor air quality control if a CO_2 sensor is available. A CO_2 sensor can either be integrated in the room unit / room sensor P-22RTM-1T.. or connected to the sensor input at the L/NMV-BAC-..

All applications can be configured with a secondary VAV controller L/NMV-D3-MP as extract air or as second supply air controller. This L/NMV-D3-MP needs to be set at MP-Bus address 7 and needs to have the same Vmin / Vmax values as the L/NMV-BAC-.. controller which is supervising it.

Application name	Application ID	L/NMV-BAC-001	L/NMV-BAC-002	L/NMV-D3-MP-A7	P-22RT-1T..	P-22RTH-1T..	P-22RTM-1T..	22DC-11	22DT-12L	CQ24A-MPL-A8
Basic applications										
Indoor air quality control	8	■	□	□	□	□	■	■(*)	□	
Air volume flow control	9	■	□	□	■	□	□		□	
Room temperature control										
Cooling only	2	■	□	□	■	□	□	□	□	
Cooling or heating (changeover)	3	■	□	□	■	□	□		■	
Cooling + 1-stage electric reheat	4		■	□	■	□	□	□	□	
Cooling + 2-stage electric reheat	5		■	□	■	□	□	□	□	
Cooling + on/off hydronic reheat	6		■	□	■	□	□	□	□	
Cooling + modulating hydronic reheat	7	■	□	□	■	□	□	□	□	■
Parallel fan + room temperature control										
Cooling only	10		■	□	■	□	□	□	□	
Cooling + 1-stage electric reheat	11		■	□	■	□	□	□	□	
Cooling + 2-stage electric reheat	12		■	□	■	□	□	□	□	
Cooling + on/off hydronic reheat	13		■	□	■	□	□	□	□	
Cooling + modulating hydronic reheat	14		■	□	■	□	□	□	□	■
Series fan + room temperature control										
Cooling only	15		■	□	■	□	□	□	□	
Cooling or heating (changeover)	16		■	□	■	□	□	□	□	
Cooling + 1-stage electric reheat	17		■	□	■	□	□	□	□	
Cooling + 2-stage electric reheat	18		■	□	■	□	□	□	□	
Cooling + on/off hydronic reheat	19		■	□	■	□	□	□	□	
Cooling + modulating hydronic reheat	20		■	□	■	□	□	□	□	■

(*) CO_2 sensor in the room op. unit **or** as analogue sensor

HOT WATER COIL DIMENSION AND TECHNICAL DATA

4-5-6 INCH

COIL SIZE	Unit	Value
W	mm	254
H	mm	203
L	mm	150
Tube size	mm	9.52
Row		**1**
Q_Coil	**KW**	**7.21**
LAT	°C	37.44
LWT	°C	71.21
HD Loss	**Kpa**	**29.05**
Δ_P_air	**Pa**	**38.67**
Q_Pump	KW	0.01
Water Velocity in Tubes	m/s	1.31
Air Velocity	m/s	4.56
Row		**2**
Q_Coil	**KW**	**8.48**
LAT	°C	41.91
LWT	°C	75.66
HD Loss	**Kpa**	**34.30**
Δ_P_air	**Pa**	**77.34**
Q_Pump	KW	0.02
Water Velocity in Tubes	m/s	2.62
Air Velocity	m/s	4.56

7-8 INCH

COIL SIZE	Unit	Value
W	mm	279
H	mm	254
L	mm	150
Tube size	mm	12.7
Row		**1**
Q_Coil	**KW**	**13.44**
LAT	°C	38.35
LWT	°C	71.95
HD Loss	**Kpa**	**29.78**
Δ_P_air	**Pa**	**72.02**
Q_Pump	KW	0.02
Water Velocity in Tubes	m/s	1.42
Air Velocity	m/s	5.97
Row		**2**
Q_Coil	**KW**	**22.33**
LAT	°C	55.78
LWT	°C	74.97
HD Loss	**Kpa**	**34.34**
Δ_P_air	**Pa**	**144.04**
Q_Pump	KW	0.05
Water Velocity in Tubes	m/s	1.68
Air Velocity	m/s	5.97

HOT WATER COIL DIMENSION AND TECHNICAL DATA

9-10 INCH

COIL SIZE	Unit	Value
W	mm	356
H	mm	305
L	mm	150
Tube size	mm	12.7
Row		**1**
Q_Coil	**KW**	**18.31**
LAT	°C	35.07
LWT	°C	70.47
HD Loss	**Kpa**	**30.44**
Δ_P_air	**Pa**	**74.23**
Q_Pump	KW	0.02
Water Velocity in Tubes	m/s	1.68
Air Velocity	m/s	6.06
Row		**2**
Q_Coil	**KW**	**21.68**
LAT	°C	39.32
LWT	°C	75.17
HD Loss	**Kpa**	**50.22**
Δ_P_air	**Pa**	**148.47**
Q_Pump	KW	0.08
Water Velocity in Tubes	m/s	3.36
Air Velocity	m/s	6.06

12 INCH

COIL SIZE	Unit	Value
W	mm	432
H	mm	365
L	mm	150
Tube size	mm	12.7
Row		**1**
Q_Coil	**KW**	**24.13**
LAT	°C	33.28
LWT	°C	70.45
HD Loss	**Kpa**	**38.01**
Δ_P_air	**Pa**	**71.84**
Q_Pump	KW	0.04
Water Velocity in Tubes	m/s	1.47
Air Velocity	m/s	5.96
Row		**2**
Q_Coil	**KW**	**48.93**
LAT	°C	55.16
LWT	°C	71.05
HD Loss	**Kpa**	**43.35**
Δ_P_air	**Pa**	**143.68**
Q_Pump	KW	0.09
Water Velocity in Tubes	m/s	1.58
Air Velocity	m/s	5.96

HOT WATER COIL DIMENSION AND TECHNICAL DATA

14 INCH

COIL SIZE	Unit	Value
W	mm	483
H	mm	457
L	mm	150
Tube size	mm	15.88
Row		**1**
Q_Coil	**KW**	**35.01**
LAT	°C	32.59
LWT	°C	70.83
HD Loss	**Kpa**	**38.15**
Δ_P_air	**Pa**	**57.88**
Q_Pump	KW	0.06
Water Velocity in Tubes	m/s	2.07
Air Velocity	m/s	6.39
Row		**2**
Q_Coil	**KW**	**58.94**
LAT	°C	46.66
LWT	°C	72.27
HD Loss	**Kpa**	**45.43**
Δ_P_air	**Pa**	**115.77**
Q_Pump	KW	0.13
Water Velocity in Tubes	m/s	2.00
Air Velocity	m/s	6.39

16 INCH

COIL SIZE	Unit	Value
W	mm	584
H	mm	457
L	mm	150
Tube size	mm	15.88
Row		**1**
Q_Coil	**KW**	**36.19**
LAT	°C	27.96
LWT	°C	70.45
HD Loss	**Kpa**	**40.32**
Δ_P_air	**Pa**	**70.39**
Q_Pump	KW	0.06
Water Velocity in Tubes	m/s	2.07
Air Velocity	m/s	7.04
Row		**2**
Q_Coil	**KW**	**69.96**
LAT	°C	42.86
LWT	°C	70.45
HD Loss	**Kpa**	**49.56**
Δ_P_air	**Pa**	**140.78**
Q_Pump	KW	0.14
Water Velocity in Tubes	m/s	2.00
Air Velocity	m/s	7.04

HOT WATER COIL DIMENSION AND TECHNICAL DATA

24 X 16 INCH

COIL SIZE	Unit	Value
W	mm	609.6
H	mm	406.4
L	mm	150
Tube size	mm	15.88
Row		**1**
Q_Coil	**KW**	**36.19**
LAT	°C	24.77
LWT	°C	70.45
HD Loss	**Kpa**	**40.87**
Δ_P_air	**Pa**	**127.64**
Q_Pump	KW	0.06
Water Velocity in Tubes	m/s	2.07
Air Velocity	m/s	9.49
Row		**2**
Q_Coil	**KW**	**69.96**
LAT	°C	36.69
LWT	°C	70.45
HD Loss	**Kpa**	**50.59**
Δ_P_air	**Pa**	**255.28**
Q_Pump	KW	0.15
Water Velocity in Tubes	m/s	2.00
Air Velocity	m/s	9.49

COIL PERFORMANCE AND FACTOR

Coil Performance (KW)									
		T_water in							
		40.00	54.00	60.00	66.00	71.00	77.00	82.00	88.00
T_Air in	10.00	0.54	0.62	0.71	0.79	0.87	0.96	1.04	1.12
	13.00	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.08
	16.00	0.47	0.55	0.60	0.71	0.79	0.88	0.96	1.02
	18.00	0.43	0.51	0.59	0.67	0.75	0.84	0.92	1.00

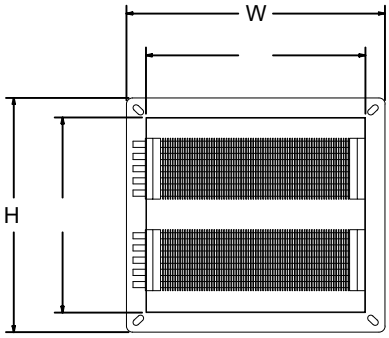
ELECTRIC AND PTC HEATING

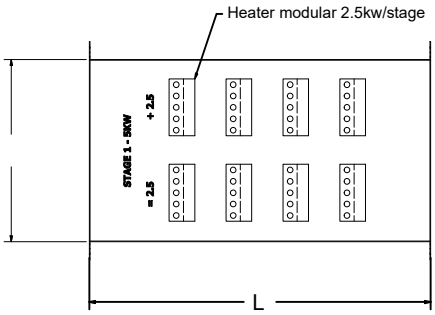
Electric Heater Section

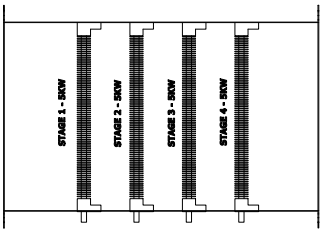
- Heater sizing method: required airflow, kW demand, coil configuration.
- Selection table for 220V/380V – 50Hz / 60Hz.
- Safety devices: thermal cut-off, airflow switch, contactor wiring.

PTC Heater Section

- Auto-regulating ceramic heating element
- Efficiency curve vs temperature
- Selection table by airflow & CFM.







Safety Protection Mechanism of Electric Heater

The electric heater integrated in the VAV Box is equipped with a multi-layered safety control system to ensure reliable operation and prevent overheating or fire hazards. The protection mechanism includes the following components and logic:

1. Fan Interlock ControlThe Belimo LMV BAC-002 controller provides an interlock function that allows heater activation only after the fan start signal is confirmed and a minimum airflow is detected.This prevents the heater from operating without sufficient air circulation, thereby avoiding overheating of the heating elements.

2. Outlet Temperature SensorA temperature sensor installed at the discharge outlet continuously monitors the air temperature downstream of the heater.If the outlet temperature exceeds the preset safety limit (typically 60–80°C), the controller immediately cuts off the heater power signal.Once the temperature drops to a safe level, the system automatically resets and resumes normal operation.

Safety Protection Mechanism of PTC Heater

The PTC (Positive Temperature Coefficient) Heater integrated in the Fan Powered VAV Box is designed with an intrinsic self-regulating thermal protection mechanism combined with electronic and mechanical safety controls. This system ensures maximum operational safety, energy efficiency, and long service life.

1. Self-Regulating Heating Principle (Intrinsic Protection)The PTC heater uses ceramic semiconductor elements with a positive temperature coefficient of resistance.As the temperature of the heating element increases, its electrical resistance rises exponentially, which automatically reduces the current flow and thus limits further temperature rise.This self-regulating behavior eliminates the risk of overheating, as the PTC element naturally stabilizes at its design temperature (typically 200–250°C surface temperature).No risk of “thermal runaway” exists, even in the event of airflow loss or blocked ducts.

2. Fan Interlock ControlSimilar to electric coil heaters, the controller (Belimo LMV BAC-002) ensures that the PTC heater is energized only after the fan has started and minimum airflow is confirmed.This interlock guarantees that the heater operates only under safe airflow conditions, maintaining stable heat transfer and avoiding local hot spots.

Heater Capacity Calculation

1. Overview

Heater capacity determines the total energy required to raise the air temperature from the entering (mixed) temperature to the desired supply temperature. This section applies to all heater types used in Fan Powered VAV Boxes: **Electric, PTC, and Hot Water Coil Reheat**.

2. Key Formula

For air-side heating load:

$$P_{heater}(kW) = 1.206 \times V(m^3/s) \times \Delta T(^\circ C)$$

If airflow is in m³/h:

$$P_{heater}(kW) = 0.000335 \times V(m^3/h) \times \Delta T(^\circ C)$$

Where: - **V** = Heating airflow rate - **ΔT** = Supply temperature rise (T_{sup} – T_{in})

3. Hot Water Coil Load

For coil-based reheating:

$$\dot{m}_w(kg/s) = \frac{P_{heater}}{4.186 \times \Delta T_w}$$

$$Q = 1.206 \times V \times \Delta T$$

Typical design ΔT_w = 10°C to 12°C.

4. Nomograph (Quick Reference)

Heater Power (kW) ≈ 0.000335 × Airflow (m³/h) × Temperature Rise (°C)

Airflow (m³/h)	ΔT = 5°C	ΔT = 10°C	ΔT = 15°C	ΔT = 20°C
300	0.5	1.0	1.5	2.0
500	0.8	1.7	2.5	3.4
1000	1.7	3.4	5.0	6.7
2000	3.4	6.7	10.1	13.4

Use this table to approximate required heater power before final selection.

Heater Capacity Calculation

5. Example Calculation

Given: - Airflow (V) = 400 m^3/h
- Entering air temperature = 22°C
- Desired supply temperature = 32°C

Then:
ΔT = 32 – 22 = 10°C
P = 0.000335 × 400 × 10 = **1.34 kW**

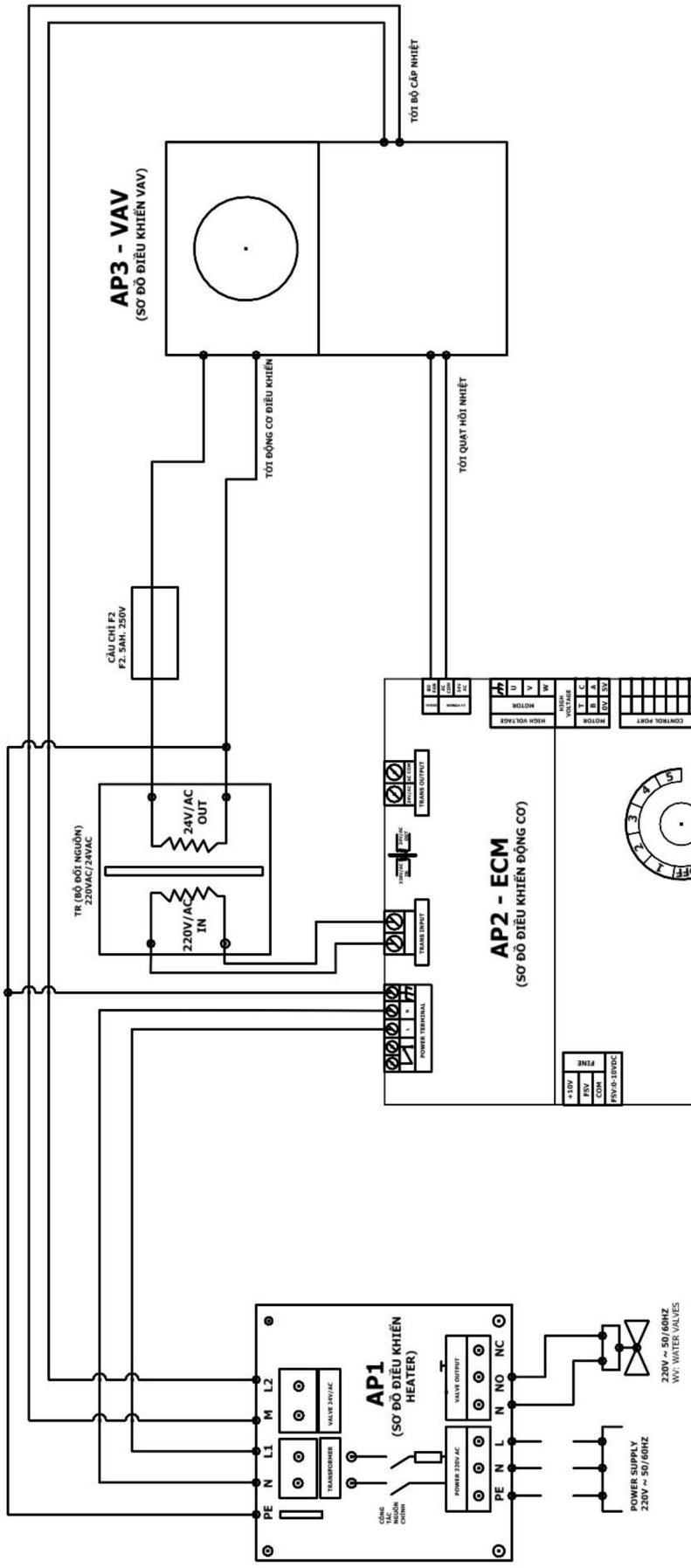
Hot Water Coil Equivalent:
ΔT_w = 10°C →
$\dot{m}_w = \frac{1.34}{4.186 \times 10} = 0.032\ \text{kg/s} \approx 0.032 L/s (1.9 L/min)$

6. Design Notes

- **Heating airflow** should be defined separately from cooling airflow (V_{maxH} < V_{cool}).
- **Electric/PTC heater** stages must comply with control logic and circuit ratings.
- **Water coil** selection depends on desired air ΔT, water ΔT_w, and flow rate.
- Verify acoustic impact and ΔP in the selection tables.

This heater sizing guideline ensures optimal comfort, safety, and performance in all Starduct Fan Powered VAV configurations.

Electrical Wiring Layout for VAV Box with Fan and Heating Element



SYSTEM OPERATION AND MAINTENANCE (O&M)

The key components

The key components of a pressure-independent VAV (Variable Air Volume) terminal box and its connections are crucial for the efficient operation of HVAC systems. Here's an overview of these components:

- Supply Ducting System: Connects each VAV terminal box to the air handling unit (AHU), which includes:
- Air Filters: Clean the air before it enters the system.
- Cooling Coils: Cool the air as needed.
- Supply Fans: Usually equipped with a Variable Frequency Drive (VFD) to adjust the fan speed based on demand.
- Duct Pressure Sensor: Measures the static pressure in the supply duct to control the VFD fan output, optimizing energy use.
- VAV Terminal Box: Contains several components that work together to control airflow and temperature:
- Airflow Sensor: Measures the airflow at the inlet and adjusts the damper position to maintain desired flow rates.
- Damper: Modulates airflow based on the airflow sensor's readings and zone temperature requirements.
- Fan: Some VAV boxes include fans to either supplement airflow (series fans) or assist with heating needs (parallel fans).
- Filter: Included in fan-powered boxes to clean the air drawn from the plenum or return-air source.
- Reheat Coil: An optional component that heats the air leaving the box; can be electric or hydronic.
- System Controls: Can be pneumatic, electronic, or direct digital, depending on the system's age. They use airflow and zone temperature inputs to control the damper and heating.
- Zone Temperature Control: The main control point for the VAV system, which uses a sensor or thermostat to provide a signal to the VAV controller.

Each of these components plays a vital role in ensuring that the VAV system delivers the right amount of conditioned air to each zone efficiently and effectively. Regular maintenance and monitoring of these components are essential for the system's longevity and performance

Safety Issues:

- Always power down the system to a safe state before performing any maintenance or diagnostics.
- Enable VAV system functions for testing and verification as needed, following the manufacturer's and electrical safety recommendations.
- Adhere to standard electrical and mechanical safety practices.

Maintenance of Technology:

- Conduct preventive maintenance to minimize operational and maintenance (O&M) requirements, enhance system performance, and protect the asset.
- Follow the equipment manufacturer's maintenance manuals for specific guidelines.

MAINTENANCE CHECKLIST

Maintaining a Variable Air Volume (VAV) system is essential for its longevity and efficiency. Here's a general maintenance checklist to guide you:

General Maintenance Checklist for VAV Systems:

- Inspection: Regularly inspect all components for signs of wear and damage.
- Cleaning: Clean all parts, including sensors, filters, and ducts, to ensure unobstructed airflow.
- Lubrication: Lubricate moving parts as necessary to prevent friction and wear.
- Calibration: Calibrate controls and sensors to ensure accurate operation.
- Testing: Test the operation of dampers, fans, and reheat coils to verify they are functioning correctly.
- Air Filters: Replace or clean air filters according to the manufacturer's schedule.
- Belts: Check and adjust or replace drive belts as needed.
- Motors: Inspect motors and bearings, replacing or servicing them if there are signs of overheating or excessive noise.
- Dampers: Ensure that dampers are free to move and are not obstructed.
- Reheat Coils: Clean and inspect reheat coils for any signs of corrosion or leaks.

Frequency of Maintenance Actions:

- Daily: Monitor system operation for any abnormal noises or performance issues.
- Weekly: Check for any error messages on the BAS and verify zone temperature accuracy.
- Monthly: Inspect and clean filters, check belt tension, and lubricate bearings.
- Quarterly: Calibrate sensors and controls, test damper and fan operation.
- Annually: Perform a comprehensive inspection and maintenance of the entire system.

Remember, this checklist is a general guide and should be tailored to the specific recommendations provided by the VAV system manufacturer. Always ensure that maintenance is performed by qualified personnel to maintain system integrity and safety.

Performance Monitoring

Monitoring the performance of a Variable Air Volume (VAV) system is crucial for maintaining optimal operation and energy efficiency. Here's a summary of the key points you should monitor using a Building Automation System (BAS):

- Static Pressure: Monitor the static pressure in the supply duct and the control point for the system's Variable Frequency Drive (VFD) fan to ensure it modulates with changing VAV box flow rates.
- Damper Position: Check the VAV box damper position in relation to the zone temperature and reheat status to ensure the damper is at the minimum setting before reheat is applied.
- Reheat Valve Position: Observe the reheat valve position in comparison to the call for heat to ensure proper functioning.
- Airflow Rate: Ensure the VAV box airflow rate is commensurate with the damper position and within the system's minimum and maximum settings.
- Delivered Air Temperature: The temperature of the air delivered by the VAV box should be appropriate for the zone conditions.
- Reheat Call: The VAV box's call for reheat should be appropriate for the conditions and correspond with the chiller's operating point and reset status.
- Zone Temperature: Regularly monitor the temperature of the zone to ensure comfort and efficiency.
- Zone Occupancy Status: Keep track of the occupancy status of the zone to adjust the VAV settings accordingly for energy savings and comfort.

By closely monitoring these aspects, you can ensure that the VAV system operates efficiently, providing comfort while minimizing energy consumption

LIMITED PRODUCT WARRANTY POLICY

1 Warranty Period:

The VAV box STARDUCT-BELIMO product manufactured by NSCA is warranted to be free from material and workmanship defects for a period of 365 days from the initial delivery date of NSCA.

2 Warranty Conditions:

This warranty will be void if the product's label and identification card are removed or erased to the extent that the name, signature code, and manufacturing date of the device cannot be determined.

3 NSCA's Responsibilities:

NSCA guarantees to provide replacement materials or repair the defective product, or provide a similar product for replacement (if the defective product cannot be repaired) during the warranty period. NSCA also reserves the right to refund the value paid by the buyer for the defective goods as a way to fully meet its warranty obligations.

4 Limitation of Liability:

NSCA is not responsible for warranty coverage of damages due to incorrect technical installation, unauthorized repairs or misuse, unauthorized structural changes, and damages due to environmental conditions or events beyond NSCA's control. NSCA also does not warrant any commitments or authorizations for any third party that commits warranty conditions beyond the contents stated in this document.

5 Exclusion of Liability:

NSCA is not responsible for the costs of dismantling, inspecting, reinstalling, or replacing the allegedly defective equipment at the site, special, incidental, or consequential damages, or any damages exceeding the value of the product sold. This includes errors that fall within the warranty scope of NSCA.

6 Exclusivity of Warranty:

This warranty is exclusive and supersedes all other warranties. The buyer's acceptance of the purchase of the product will confirm that the buyer agrees to be bound by this warranty.

7 Scope of Warranty:

NSCA only warrants defects in materials and/or workmanship that are identified as occurring during the manufacturing process from the factory where the product is produced.

8 Warranty Method:

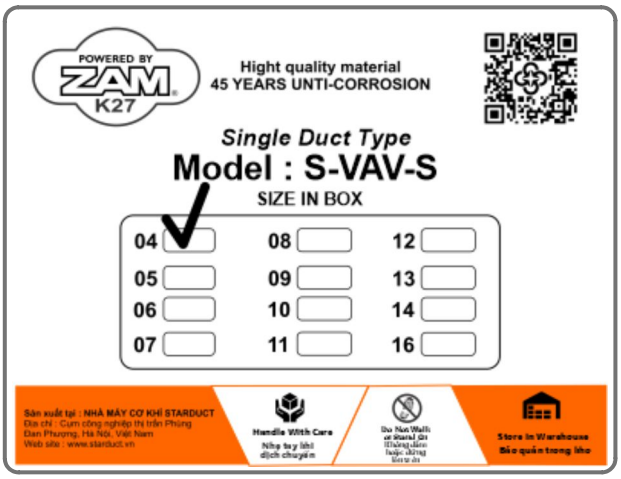
NSCA will provide replacement parts, materials along with authorization for the contractor to perform the replacement at the site, and/or receive the equipment sent by the customer to the factory for repair, replacement, and return to the customer. If the faults are confirmed to be due to NSCA, then NSCA will pay all shipping costs to and from incurred during the warranty process.

9 NSCA's Rights:

NSCA does not assume, nor authorize anyone else to assume on its behalf, any other responsibilities related to the warranty of its products.

10 Validity of Warranty:

If any term or provision of this warranty is illegal, invalid, or unenforceable, the remainder of this warranty shall not be affected.



Size in box

Standard pakaging

STARDUCT

STAR ASIA JSC.
Starduct Mechanical Factory
Dan Phuong 2 Industrial Zone, Dan Phuong dist., Hanoi, Vietnam
Phone: +84 24 3514 7999 - Email: nsca@nsca.vn - Website: https://starduct.vn