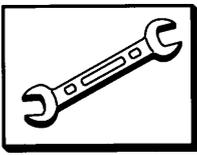


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**Before installing the VAV terminal units, read and observe these installation instructions!**

## Proper Application

The VAV terminal units are suitable for use in ventilation and air conditioning systems. Particular conditions can restrict the functioning capacity and must be taken into account during the design stage:

- If the air is very dusty or contains fluff or sticky particles, e.g. extract air, units with membrane pressure transducers must be used. Access to the units for maintenance must be allowed.
- For aggressive air, only volume flow control units made of plastic materials should be used after extensive tests for suitability.
- Galvanised sheet steel units must not be installed in contaminated environments (e.g. acetic acid).
- For hazardous areas, only use units with explosion-proof electrical components.
- For protected exterior areas, only use units with membrane pressure transducers. Larger volume flow tolerances occur due to the wider temperature range.

## Safety Instructions

- Installation and wiring should only be carried out by specialists.
- During installation, wiring and commissioning, the normal rules of site working, in particular the safety and accident prevention regulations, must be observed.
- Because of the risk of injury from edges and burrs, carry and install units only while wearing gloves.
- Mount devices properly and secure fixings with locking nuts. Suspension points must only carry the weight of the unit. Adjacent components and connecting ducts must be supported separately.

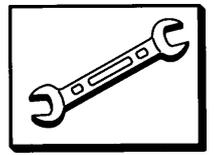
## Wiring the Control Components

- The electrical connection must be made by an electrical engineer with observation of all safety measures.
- Safety transformers must be used (EN 60742).
- The following regulations and conditions must be observed:
  - National IEE regulations
  - Health and Safety directives
  - Wiring instructions and circuit diagrams from the manufacturer of the control components.

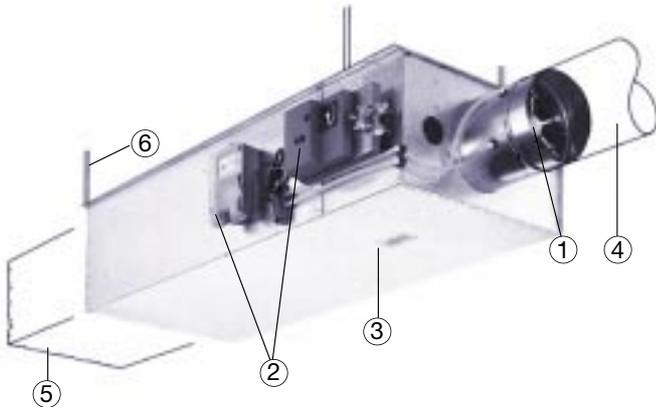
## Residual Risks

- Under extremely rare and unfavourable conditions, despite observation of the regulations listed, faults can occur in the controller due to electromagnetic fields. These can usually be remedied by screening or relocating the controller.
- Foreseeable damage which could occur due to the failure of control components must be prevented in critical cases by corresponding measures (e.g. pressure relief openings in sealed rooms).

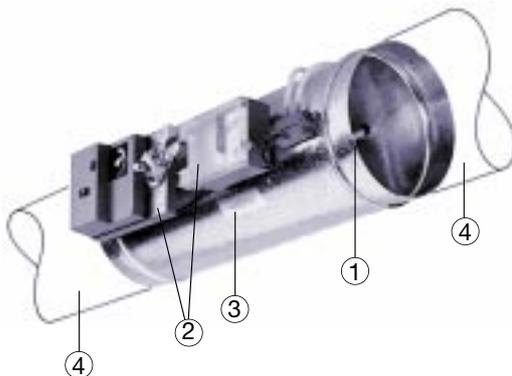
# Installation



## TVZ · TVA



## TVR



- ① Trox differential pressure sensor
- ② Control components with actuator
- ③ Label with arrow showing air flow direction
- ④ Circular connection duct
- ⑤ Rectangular connection duct
- ⑥ Suspension rods (supplied by customer)

## Delivery and Storage

Several devices are supplied on each pallet, held by bands against sliding. TVR's are packed in non-returnable containers.

- Immediately after delivery, check units for completeness and transport damage. If delivery is incomplete or if transport damage has occurred, inform the carriers and Trox immediately.
- Do not expose the units (even when packed) to the direct effect of weather. Protect from water, direct sunlight and dirt.
- Do not store in temperatures above 50 °C.

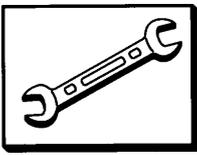
## Transport on Site

Units should not be carried by the control components but only by the terminal unit edges.

- The differential pressure sensor in the spigot connection is a measuring instrument which is extremely important for correct functioning, and must be handled with particular care. Do not therefore pull on the aluminium tubes of the sensors.

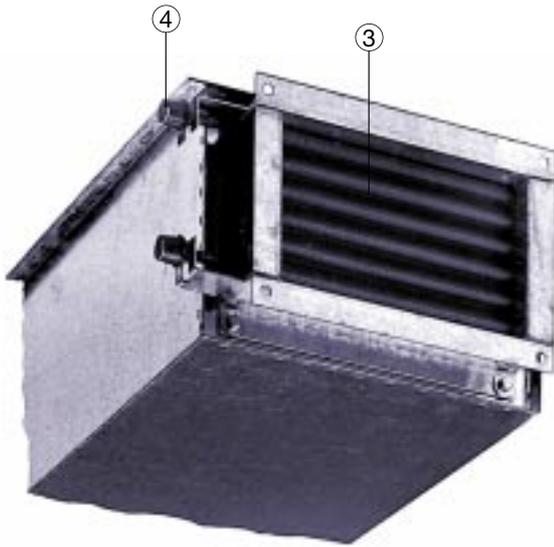
## Installation Point

- Select the installation point such that the control components and maintenance openings remain accessible.
- Do not confuse supply and extract air units. Note the air flow direction arrow on the unit label.
- Do not confuse the units for master and slave control units (e.g. supply and extract air).
- Units with membrane pressure transducers should be mounted in the position shown by the label. Consult Trox before fitting in other positions or moving the pressure transducer.
- For installation before and after bends, dampers or other flow distortion elements, note that an increase in flow tolerance and noise level can result.

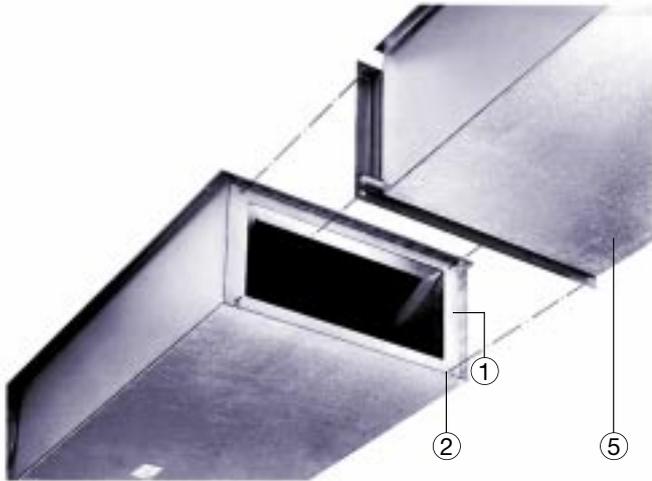


# Installation

## Reheat Coil Connections



## Secondary Silencer Connections



- ① Rectangular end wall of terminal box
- ② Inset nut M8
- ③ Reheat coil
- ④ Water flow and return
- ⑤ Additional secondary silencer TS

## Fixing

TVZ/TVS/TVA/TVM boxes have 10.5 mm dia. mounting holes on the top edge to take threaded drop rods up to 10 mm in diameter. The circular spigots on all boxes fit into circular ducts to DIN 24145 and 24146. The rectangular end wall on the boxes has 4 M 8 inserts with centres that match 30 mm (TVS 20 mm) slide on frames or suitably prepared angle flanges. The protective cardboard can be used as a drilling template for duct flanges. TVJ/TVT has 4 corner flange holes 13 mm dia. on both mounting flanges.

## Duct Connections

- Before connecting the ducts, check the inside of the unit for damage and any loose parts, and check the connecting ducts for contamination.
- Seal the duct connections well with conventional sealing materials.
- Because of the plastic components in the immediate vicinity of the connector, heat shrink tape should be used with care.

## Wiring and Tubing Connections

Control components mounted on the unit are connected together by cables and tubing in the factory. Each unit is calibrated individually on an air flow test rig. The complete function and direction of rotation of the actuators/controller is tested.

- Customer connections should be carried out carefully and tested, taking into account the technical literature issued and the project specification.

## Reheat Coils

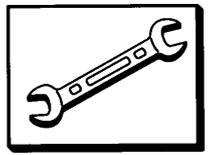
Units with reheat coils are supplied fully mounted. The reheat coil fins are covered by a protective steel plate. Remove the protective plate before connecting to the duct. The customer must connect the flow and return pipe connections (for 1, 2 and 4 row coils, 1 off each). Air venting and water draining/isolation facilities must be provided.

## Secondary Silencer TS

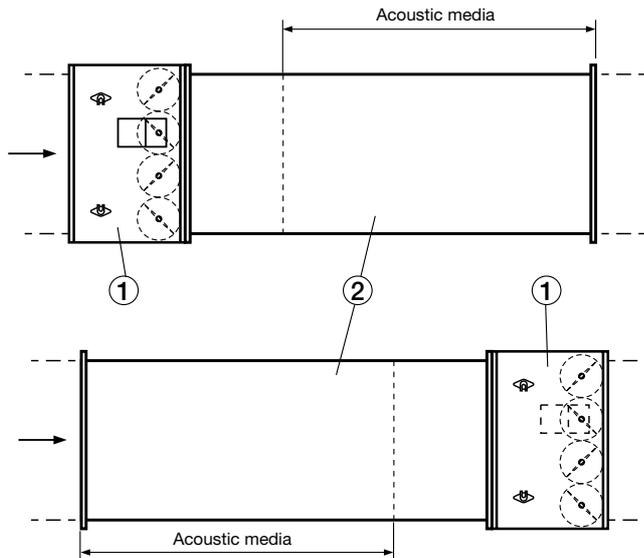
The secondary silencers are supplied separately and must be mounted at the point of installation directly onto the unit or reheat coil.

- Fix secondary silencer to the terminal unit end wall or reheat coil using 4 x M 8 bolts.

# Installation



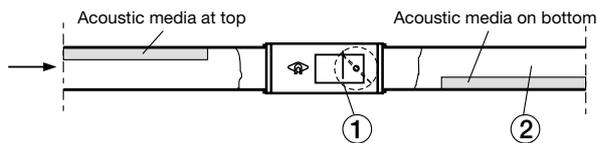
## TVJ with TX



## TVJ/TVT with Silencer TX

For aerodynamic and acoustic reasons, direct connection of TVJ control units and TX silencers is not recommended. To achieve the technical data as specified, a duct section must be installed between the damper and the silencer. The units are supplied separately and must be mounted by the customer as shown. TX and the duct section both have 4 corner flange holes for bolting to the TVJ/TVT.

## TVJ/TVJD, H = 100<sup>1)</sup> mm, with TX



- ① TVJ/TVT
- ② Silencer TX

## Unit with 100<sup>1)</sup> mm Height

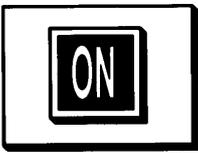
For this height, to achieve the aerodynamic data given in the sales leaflet, the TX must be installed as shown. Note the unit labels relating to the installation position.

1) Also valid for the former height 107 mm

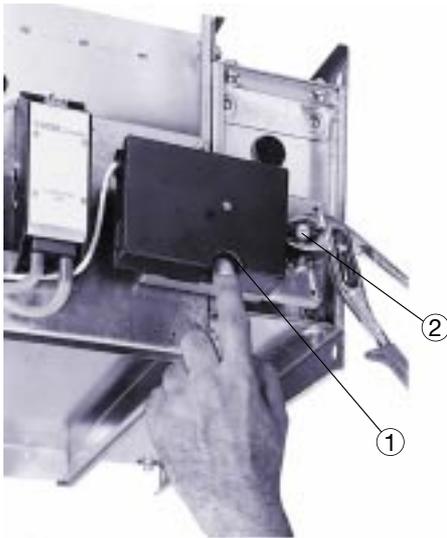


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## Disengaging the Drive



- ① Button for disengaging the drive
- ② Control damper shaft with position indicator

## Control Damper Actuator

Most electric actuators can be adjusted by hand. The drive is disengaged via a button so that the blade shaft can be turned. For larger sizes and greater pressure differentials, high torque loadings occur.

- To avoid injury, only move the damper shaft using pliers.

A slot in the damper shaft indicates the position of the blade. The direction of rotation can be reversed with most electric actuators. However, the rotation is correctly set in the Trox works. If the actuator runs in one direction only, changing the direction of rotation will show whether there is a fault with the actuator. If, after changing direction, the drive rotates in the other direction, there is a wiring fault or the controller is faulty.

Dampers which are permanently open or closed may have the following faults in addition to wiring faults:

### Open

- Static differential pressure too low
- No air flow (fan stopped, fire damper closed)

### Closed

- Override position control in action (e.g. window switch/shut off)

## Function Test

### Safety notes

- Commissioning should only be carried out by specialists.
- To ensure complete functioning, check the customer connections carefully before commissioning.
- The control damper blade may only be manually adjusted using pliers when the actuator drive has been disconnected.

The function of the volume flow control has been tested in the Trox works. If all customer connections have been correctly made, the system is ready for operation.

For function testing and commissioning:

- All control components must be wired and the wiring/tubing connections tested.
- The duct system to the VAV terminal unit must be complete.
- The fans must be running.
- The supply voltage or compressed air must be connected.

The basic procedure for function testing during commissioning is described below. Further details are given in the VARYCONTROL Product Information under the heading "Control Components" and the documentation from the control component manufacturer.

## Volume Flow Controllers and Transducers

The volume flow controllers can only be site tested in conjunction with transducers and actuators. It must be checked that the supply voltage or operating pressure is present at the terminal unit.

The controller/transducer function unit is tested by adjusting the actuator position by hand or through the controller. The transducer signal must change position in accordance with the setting.

To test the actuator, ensure that the controller opens and closes the damper blade. Further details are given in the information for the controller type concerned. External control functions are tested as specified by the controller manufacturer.



# Commissioning

## C-Values TVZ, TVS, TVR, TVM and TVA

Size	TVZ/TVR/TVS	TVM-cold	TVM-tot.	TVA
10	6.1 <sup>1)</sup>			
12	9.7	9.7	16.8	9.0
16	15.9	15.9	29.1	15.2
20	25.5	25.5	44	24.2
25	39	39	61	38
31	65			63
40	106			103

1) TVR only

## C-Values TVJ/TVT

B x H mm	C	B x H mm	C	B x H mm	C
200 x 100	14.8	400 x 400	146	700 x 700	415
300 x 100	21.2	500 x 400	183	800 x 700	469
400 x 100	28.8	600 x 400	212	900 x 700	535
500 x 100	35	700 x 400	239	1000 x 700	597
600 x 100	44	800 x 400	281	800 x 800	543
200 x 200	30	900 x 400	320	900 x 800	636
300 x 200	45	1000 x 400	359	1000 x 800	681
400 x 200	60	500 x 500	207	900 x 900	720
500 x 200	75	600 x 500	234	1000 x 900	786
600 x 200	90	700 x 500	284	1000 x 1000	904
700 x 200	107	800 x 500	318		
800 x 200	120	900 x 500	361		
300 x 300	75	1000 x 500	409		
400 x 300	100	600 x 600	297		
500 x 300	137	700 x 600	344		
600 x 300	147	800 x 600	396		
700 x 300	174	900 x 600	461		
800 x 300	207	1000 x 600	508		
900 x 300	228				
1000 x 300	254				

## Measuring the Effectiv Pressure $\Delta p_e$



- ① Remove test point cap and replace after measurement
- ② Manometer

## Transducer Curve

The transducers are calibrated in the Trox works such that the transducer output signal shown on the curve agrees with the actual volume flows. This setting is sealed. If the transducers are tested, the differential pressure must be measured at the differential pressure sensor. If the measuring lines contain T-pieces, a manometer can be connected. If the transducer has no T-piece at the effectiv pressure sensor, parallel measurement is not possible. In this case, the actuator must be locked in position (release wiring, program manual operation etc). After measuring the transducer output voltage, the tubes are carefully removed from the transducer connections and the effectiv pressure measured. The volume flow is calculated according to the formula below.

$$\dot{V}_{l/s} = C \cdot \sqrt{\Delta p_e} \quad \text{in l/s}$$

$$\dot{V}_{m^3/h} = C \cdot \sqrt{\Delta p_e} \cdot 3.6 \quad \text{in m}^3/\text{h}$$

$\dot{V}$  : volume flow

$\Delta p_e$  : measured effectiv pressure in Pa

C : constant for air density  $\rho = 1.2 \text{ kg/m}^3$

The accuracy for the measurement is  $\pm 7 \%$  (for  $TVM_{total} \pm 12 \%$ ).

If the minimum requirements given in the leaflets for the flow conditions are not observed, this tolerance will be greater.

## Volume Flow Adjustment

The volume flow limit value can be changed, depending on controller type, by adjusting setting knobs with percentage scales, manual operation devices or by computer. For analogue controllers, the adjustment accuracy can be increased if the transducer signal is measured and the volume flow set according to the voltage curve. Ensure that the controller will actually control at  $\dot{V}_{min}$  or  $\dot{V}_{max}$  and that the system pressure is adequate. The DDC controller parameters are reprogrammed using a laptop P.C. or through the network via the central computer.



## TVRK



## Volume Flow Controller and Transducer

The TVRK plastic controllers have been developed for the use in air-conditioning systems, where the air contains aggressive media. For this reason only membrane pressure transducers are used.

Membrane pressure transducers are depending on position (installation position to be indicated when ordering). The intended installation position will be considered at adjustment in the factory and is marked with an arrow. Should another installation position be requested at site, the zero point adjustment of the membrane pressure transducer as per individual product information has again to be carried out by the customer.

## Transducer Curve

The differential (effective) pressure can be measured direct at the differential pressure sensor in order to check the membrane pressure transducer. For this purpose a pressure gauge (manometer) is connected to the measuring lines. The pressure gauge (manometer) can also be connected parallelly to the membrane pressure transducer. The volume flow is calculated according to the following formulae:

$$\dot{V} = C \cdot \sqrt{\Delta p_e} \quad \text{in l/s}$$

$$\dot{V} = C \cdot \sqrt{\Delta p_e} \cdot 3.6 \quad \text{in m}^3/\text{h}$$

$\dot{V}$  : Volume flow

$\Delta p_e$  : Measured effective pressure in Pa

C : Constant for air density  $\rho = 1.2 \text{ kg/m}^3$

The accuracy for the measurement is  $\pm 7\%$ .

If the minimum requirements given in the leaflets for the flow conditions are not observed, this tolerance will be greater.

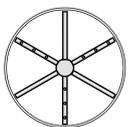
## C-Values TVRK

Size	C-Value	
	Star shaped grid	Flow grid
110	6.5	
125	9.7	8.6
160	15.8	15.1
200	27	24.3
250	41	38
315	73	62
400	116	103 <sup>1)</sup>

<sup>1)</sup> From January 1997 no longer included in the delivery programme

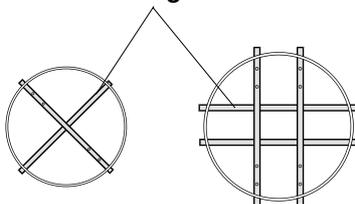
## Effective Pressure Sensors

### Star shaped grid

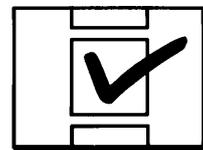


Delivered until end of 1995, approx.

### Flow grid

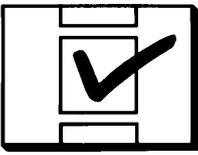


Delivered from beginning of 1996, approx.

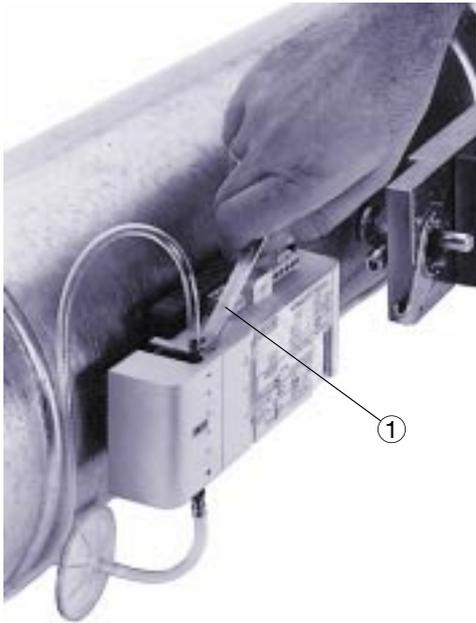


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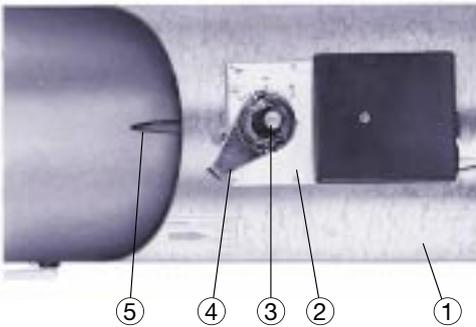


## Removing tubes



① Special tool for removing tubing

## Blade Position Indicator



① VAV terminal unit                      ④ Rotation angle limiter  
 ② Actuator                                      ⑤ Control damper blade  
 ③ Shaft with position indicator

## Maintenance

### Safety Note

- Maintenance should only be carried out by specialists! The control damper mechanism on the VAV terminal unit is maintenance-free. To ensure perfect functioning of the entire system, function tests should be carried out as part of the regular system maintenance.

The following criteria should be used:

1. Does the room temperature controller function?
2. Does the volume flow controller function?
3. Does the actuator turn in both directions?
4. Does the transducer output signal vary according to the actuator movements?
5. Do the override controls such as shut off function?
6. Are the tubing connections airtight?

Further details on fault diagnosis are given in the information on each controller type.

### Replacement of Control Components

If faulty control components have to be replaced, the following principles must be observed:

- Spare parts must comply with the technical requirements of the manufacturer. Only use original spare parts.
- Disconnect supply voltage 24 volts or operating pressure.
- Mark wiring/tubing connections before releasing.
- Carefully remove pneumatic tubing without pulling.
- Replace component and all connections.

When replacing controllers and transducers, they must be adjusted to suit the unit size. Therefore electronic and pneumatic components are preset in the Trox works. Digital controllers can be set up by the customer.

When changing actuators, note the following:

- Mechanical rotation angle limiters on the new actuator should be set as the existing unit. A slot in the control damper shaft shows the position of the blade.
- Direction of rotation should be set as before (switch or plug setting).

## Measuring Equipment Required:

### Electronic control

- Digital voltmeter
- Manometer, 0 to 1000 Pa
- Service unit

### Pneumatic control

- Pressure gauge, 0 to 1.5 bar
- Manometer, 0 to 1000 Pa

### DDC control

- Service computer
- Digital voltmeter
- Manometer, 0 to 1000 Pa