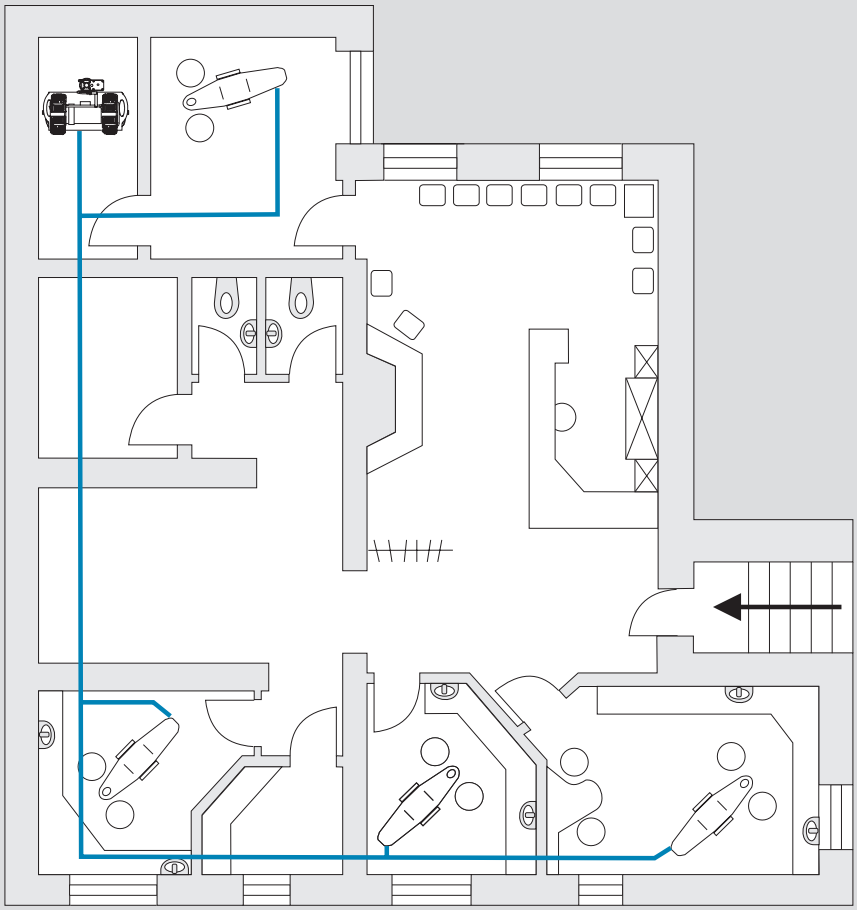
Planning Information Compressed Air



EN

COMPRESSED AIR
SUCTION
IMAGING
DENTAL CARE
HYGIENE

9000-617-09/02

DÜRR DENTAL

2013/12

Content

Important information

1. Notes 4

Useful information

2. Dental air quality 4

Compressor and Power Tower Silence PTS

3. Membrane-drying units 5
4. Comparison with drying systems 6
5. Product range oil-free compressors 7
6. Technical Data 10
7. Compressor selection according to Technical Data * 11
8. Dental air consumption examples 12
9. Relative and absolute air humidity 14
10. Relative humidity in tank 15
11. Functional layout of compressor 16
Compressor with membrane-drying unit 16
Compressor without membrane-drying unit 16
12. Functional description 17
13. Pressure dew point of membrane-drying unit ... 18
14. Composition of sterile filter 19
14.1 Filter size of sterile and fine filters 20

Important planning information

15. Set-up and ambient conditions 21
16. Operating conditions 22
17. Supplementary ventilation in room for set-up ... 22
18. Supplementary ventilation in room for set-up ... 23
19. Noise reduction using compressor cabinet 24
20. Compressor connections 25
20.1 Electrical connection 25
20.2 Circuit protection 25
20.3 Compressed air connection and power supply 25
21.4 Plumbing materials 25
21. Dimensions of pipe lines for Dürr Dental compressors 26
22. Planning examples of pipe lengths and diameters 27

Power Tower Silence PTS

23. Power Tower Silence PTS 30
23.1. Planning examples of PTS pipe lengths and diameters 31

Important information

1. Notes

This Planning Information is a recommendation and is designed to inform you of the correct application, installation and start-up of Dürr Dental appliances as well as providing notes on the correct handling of these devices.
Only install components in variant arrangements after checking with DÜRR DENTAL or with your dental supplier.

It is extremely important
- to read and fully understand the contents of this Planning Information documentation.
- to observe all safety instructions or any other instructions and to pass them on to the technician responsible for installation on site.

1.1 Validity

- Tornado 1 / 2, Primo, Duo, Trio, Quattro, Duo Tandem and Quattro Tandem
- Power Tower Silence PTS 105, PTS 120, PTS 200

1.2 Copyright DÜRR DENTAL AG

1.3 Warnings and Symbols

Warning notes

The warning notes in this document highlight potential dangers to people and equipment.

They are marked with the following warning symbols:

SIGNAL WORD
Description of type and source of potential danger
Here you will find the possible consequences of ignoring the warning
- Measures to be taken to avoid any possible danger.

DANGER	Immediate danger of severe injury or death
WARNING	Possible danger of severe injury or death
NOTICE	Danger of considerable equipment damage

Further symbols

Notes, e.g. special instructions concerning optimum use of the appliance.

Useful information

2. Dental air quality

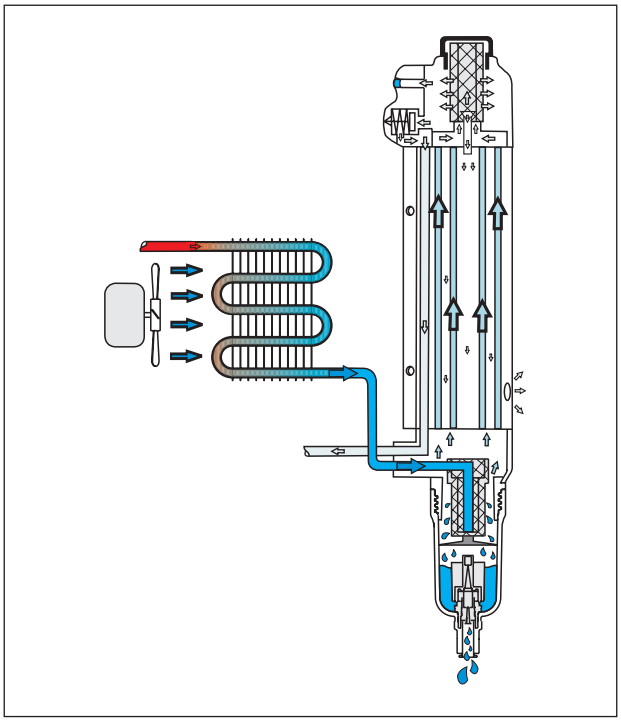
Oil-free, dry and hygienic

Dental air must meet special requirements.
Good air quality is a prerequisite for the continuing good health of persons, and never more so than when treatment is undergone in the dental surgery or clinic. That is because so-called dental air as used in dental surgeries must be of a particularly high quality: dry, oil-free and hygienic. If not, there may be dramatic consequences for patient and dentist if, for example, a severe infection develops in an open wound. For this and other reasons, the compressor plays a central role in providing a medically safe and sure treatment: It is the "Heart of the surgery".

Installation within medical treatment facilities:
during development and during manufacture of the compressor, any and all requirements for medical products have been taken into consideration whenever possible. As a result, this compressor is suitable for **installation within medical treatment facilities**. Where these compressors are installed within medical treatment facilities, then during installation and assembly any and all requirements concerning medical gas supply units and all relevant standards and legislation, especially regarding the Pharmaceuticals Act (e.g. Germany) must be rigorously observed.
Any use of this appliance/these appliances above and beyond that laid down in the Installation and Operating Instructions is deemed to be incorrect usage. The manufacturer cannot be held liable for any damage resulting from incorrect usage. The operator / user bears all risks.

WARNING
Risk of explosion caused by ignition of combustible materials
- Do not use the unit in rooms in which there are combustible mixtures present, e.g. in operating theatres.

  Do not use the compressed air for respiration equipment or similar, for example for equipment that may be used in operating areas.



3. Membrane-drying units

The design and the development of the membrane-drying unit has been carried out with reference to the English standard „HTM 2022“ and the American standard ANSI/ ADA specification No 94-1996 which both concern the quality of the dental air.

Layout of the membrane-drying unit under the following conditions:

- Ambient temperature 40 °C
- Relative humidity >60%
- Continuous operation 7 bar

= means a pressure dew point of +5 °C (approx. -20 °C atmospheric)

Function

- Efficient cooling of the compressed air (cooling element with ventilation fan) causes the temperature of the air mix + water content to cool to approx. 1.5 °C - 8 °C above room temperature (depending on unit employed).
- Condensation is caused as a result of the saturation of the steam.
- Drops of condensate and air are then spun through a sinter filter and the condensated water can be collected in a condensate beaker.
- All particles arising from, for example, friction between piston rings, sealing ring and cylinder >35 µm will be collected in the sinter filter.
- The majority of those particles smaller than 35 µm will be extracted together with the condensated water via the condensate valve and so into the atmosphere.
- Final filtering takes place via the 2 µm paper filter.

Special characteristics of the drying units

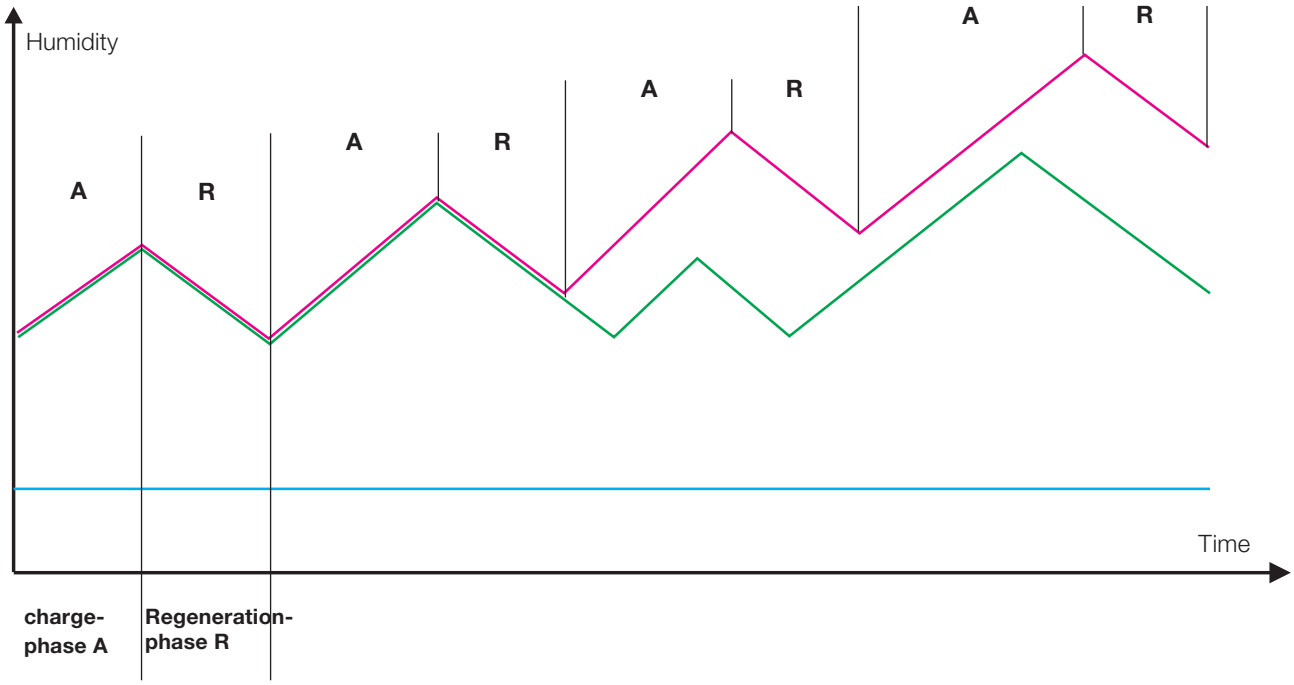
- 100 % Duty cycle for the compressor set (the operator can work continuously).
- Regeneration takes place while the compressor is generating compressed air.
- The compressed air reaches a maximum pressure dew point of +5 °C at 7 bar.
- No condensed water buildup in the airlines is possible.
- The life cycle of the dry air unit is greater than 300 000 cycles.
- Filtering of the compressed air takes place with both a 35 µm sinter filter and a 2 µm paper filter.
- When required the paper filter can be replaced with a sterile filter of 0.01 µm.
- Simple and light design with hardly any extraneous movement of components.

4. Comparison with drying systems

with purge volume

Adsorption drying with hygrostat

Membrane-drying units



Absorption drying uses a granular material which takes up the humidity and then expels the humidity during a regeneration phase. The period of time needed for the regeneration phase depends on the purge volume (A) or on the set humidity at the hygrostat.
Where the compressor is subject to longer running periods with absorption drying the humidity in the tank will rise!

Under the purge system the length of the regeneration phase is dependent on the size of the purge volume (A). Where the compressor is subject to longer running periods a rise in the humidity in the tank as the fall in the humidity (Delta) always stays the same.

Absorption drying using a hygrostat causes drying to the level of humidity in the tank that the hygrostat is set at. The fall in the humidity (Delta) will vary according to the humidity in the tank.

Membrane drying means that there is a continuous drying of the compressed air during compressor operation and, therefore, a constant low humidity in the tank. An idling time for the compressor during the regeneration cycle is not necessary.

5. Product range oil-free compressors

Tornado 1

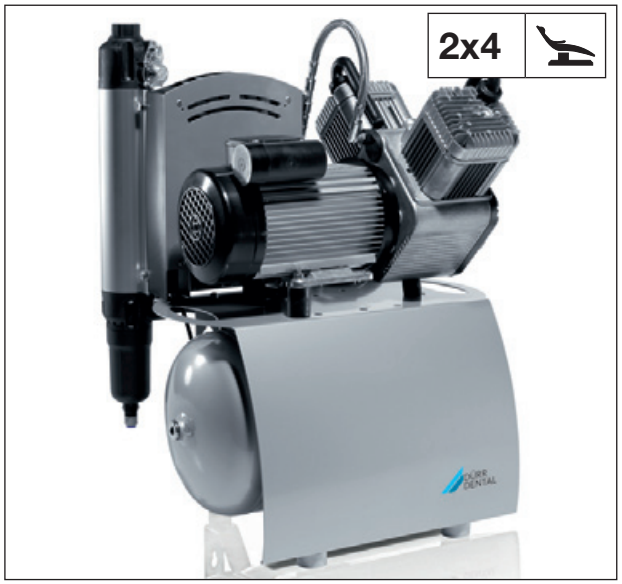
Model 5182-01

230 V, 50/60 Hz
with membrane-drying unit
20-l-Tank
Performance approx. 60/67 l/min.
at 5 bar

Tornado 2

Model 5282-01

230 V, 50/60 Hz
with membrane-drying unit
20-l-Tank
Performance 110/125 l/min.
at 5 bar



Duo

Model 5252-01

230 V, 50/60 Hz

Model 5252-51

400 V, 50/60 Hz

with membrane-drying unit
20-l-Tank
Performance approx. 105 l/min.
at 5 bar

Trio

Model 5352-01

230 V, 50 Hz
with membrane-drying unit
50-l-Tank
Performance approx. 160 l/min.
at 5 bar

Quattro

Model 5452-51

400 V, 50/60 Hz
with membrane-drying unit
50-l-Tank
Performance approx. 215 l/min.
at 5 bar

Duo Tandem

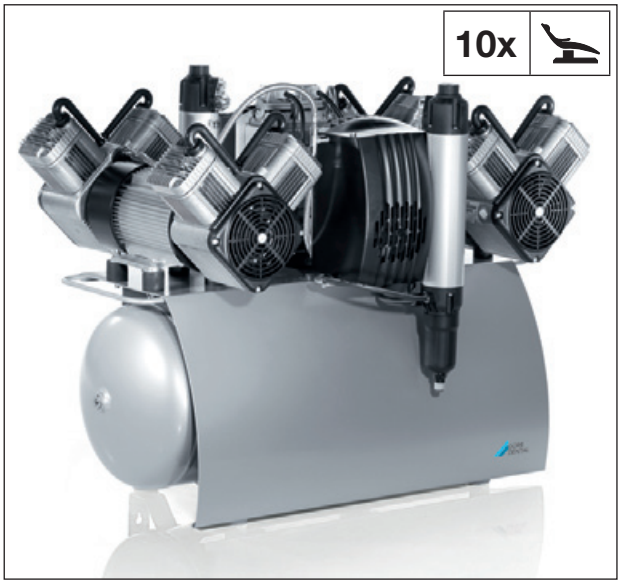
Model 4252-01

230 V, 50/60 Hz

Model 4252-51

400 V, 50/60 Hz

with membrane-drying unit
50-l-Tank
Performance approx. 210 l/min.
at 5 bar



Quattro Tandem

Model 4682-51

400 V, 50/60 Hz
with 2 generators
and
with 2x membrane-drying units
90-l-Tank
Performance approx. 430 l/min.
at 5 bar

6. Technical Data

Model	Weight kg	Electr. output (50-60Hz) kW	Current consumption (50-60Hz) A (8 bar)	Frequency Hz	Voltage V	Performance at 5 bar (50-60Hz) l/min	Tank volume l	Max. tank pressure bar	Pressure setting ON - OFF bar	Dimensions H x W x D cm	Noise levels dB(A)*	Duty cycle %
5252-01 Duo	47	1,3 - 1,6	6,3 – 7,0	50 – 60	230	105 – 120	20	10	6 – 7,8	69 x 49 x 46	66 – 69	100
5252-51 Duo	47	1,4	3,1 – 2,5	50 – 60	400	105 – 120	20	10	6 – 7,8	69 x 49 x 46	66 – 69	100
5352-01 Trio	70	1,9	8,6	50	230	160	50	10	6 – 7,8	76 x 74 x 52	69	100
5452-51 Quattro	82	2,2 - 2,95	4,4 – 4,8	50 – 60	400	215 – 240	50	10	6 – 7,8	76 x 74 x 52	70 – 75	100
4152-01 Duo Tandem	64	1,3 - 1,6	6,3 – 7,0	50 – 60	230	105 – 120	50	10	6 – 7,8	76 x 75 x 52	68 – 70	100
4152-51 Duo Tandem with 1 generator	64	1,4	3,1 – 2,5	50 – 60	400	105 – 120	50	10	6 – 7,8	76 x 75 x 52	68 – 70	100
4252-01 Duo Tandem	90	2,7 - 3,3	12,2 – 14,3	50 – 60	230	210 – 240	50	10	6 – 7,8	76 x 79 x 52	69 – 74	100
4252-51 Duo Tandem	90	2,8 - 2,84	6,2 – 5,0	50 – 60	400	210 – 240	50	10	6 – 7,8	76 x 79 x 52	69 – 74	100
4642-51 Quattro Tandem with 1 generator	98	2,2 - 2,95	4,4 – 4,8	50 – 60	400	215 – 240	90	10	6,5 – 8,5	76 x 102x62	70 – 73	100
4682-51 Quattro Tandem	143	4,4 - 5,9	8,8 – 9,6	50 – 60	400	430 – 480	90	10	6,5 – 8,5	76 x 102x62	74 – 77	100
4682-52 Quattro Tandem	134	4,4 - 5,9	8,8 – 9,6	50 – 60	400	470 – 540	90	10	6,5 – 8,5	76 x 102x62	74 – 77	100
5182-01 Tornado 1	38	0,9 - 1,09	3,7 – 4,4	50 – 60	230	60	20	10	6 – 7,8	66 x 49 x 43	64	100
5282-01 Tornado 2	44	1,45 - 1,70	7,3 - 6,7	50 - 60	230	110	20	10	6 – 7,8	64 x 49 x 43	68	100

7. Compressor selection according to Technical Data *

Model	Discharge flow l/min at 5 bar	Number treatment stations	Weight kg	Voltage V	Dimensions Dimensions H x W x D cm
Tornado 1 5182 	60	1	38	230	66 x 49 x 43
Tornado 2 5282 	110	2	44	230	64 x 49 x 43
Duo 5252 	105	2	47	230 / 400	69 x 49 x 46
Trio 5352 	160	3	70	230	76 x 74 x 52
Quattro 5452 	215	4	82	400	76 x 74 x 52
Duo Tandem 4252 	210	4	90	230 / 400	76 x 79 x 52
Quattro Tandem 4682 	430	10	143	230 / 400	76 x 102 x 62

* The compressor selection is based on a value of 50 l/min at 5 bar per treatment station.

8. Dental air consumption examples

Dental unit	Model	bar	l/min
A-dec	A-dec 500	5,2 - 7	70
Bien Air	Air motor Aquilon 830	3	50 - 70
	Micromotor (MC3 SR, IR, LK, MC2, Isolite)	2,6	10 - 20
	Turbine (Bora, Prestige, Gyro Long-life, Black Pearl ECO)	2,3	35 - 45
EMS	Air-flow air abrasion unit	4,5 - 7	18 - 21
	Air-flow handy 2 air abrasion unit	3,5 - 4,5	13 - 15
	Hygiene Master T2 cleaning unit	4 - 8	50
Fargo	Delta Turbine	2,2	34 - 40
	S 405 Turbine	2	30-33
KaVo	Lifetime care unit	4 - 10	60
	Air motor, e.g Intraflex	3,5	60 - 65
	Turbine GENTLEforce 7000	3,5	50-55
	Turbine SUPERtorque	2,8	50 - 55
Micro Mega	Air Motor MM 324	3	45
	Turbocid care unit (pre-1997)	5	67-75
	Turbocid care unit (later)	5	25 - 30
Sirona	Hygiene Center	5 - 8	50
	Air / Water injection	2,7	14
	Air motor	2,7	30 - 38
	Turbine	2,7	45 - 53
W & H	Assistina cleaning unit	4 - 10	60
	Air motor LT 25 / A25 INCO / EXCO	3	42 - 50

Laboratory appliances	Model	bar	l/min
Bego	Aquablast SL	5-6	250
	Aquamat	5-6	160
	Korostar Pplus (blasting unit)	4-6	120
	Duostar Z2	4-6	100
	Top Star Plus	3-6	40
Bien - Air	Turbine S 791	3,5	35
Fino	Compressed air plaster cutter	4-6	120-140
	Finostar 1 blaster	5	40-50
Harnisch+Rieth	Hand blast unit D-H 22	6	250
	Compact blaster M-S 355	6	150
	Sandblast unit D-Gn14	5	120
	Mini single cabin blaster M-S 350	5	100
	Spot blaster P-G 400 /2/3/4	7	80
Heraeus	CL - FSG 1 / FSG 2	4	65
	CL - FSG 3	4	130
	CL - SSG	4	150
KaVo	EWL 5420/23/33	6	100
	Soldering unit 650-5601	6	40
	Hand air jet 650-5601	6	40
	Everest		100 - 120
Leleux	Combiblaster Korund	4,5	90-120
	Strahlboy M	4,5	90-120
3M Espe	Rocatector delta (blaster)	6	125
	Rocatector (blaster)	2,5	100
NSK	Presto Aqua Laborturbine	2,8 - 3,2	402
	Presto Laborturbine	2 - 2,5	38
Renfert	Compressed air saw Nr.5030	5-6	240
	Basic quattro (blaster)	1-6	120
	Keramo Basic	max. 10	60-80
Schuler	S-U-Prolamat	6	150
	S-U-Unomat	5	100
	S-U-Aura-Blaster	4-6	80

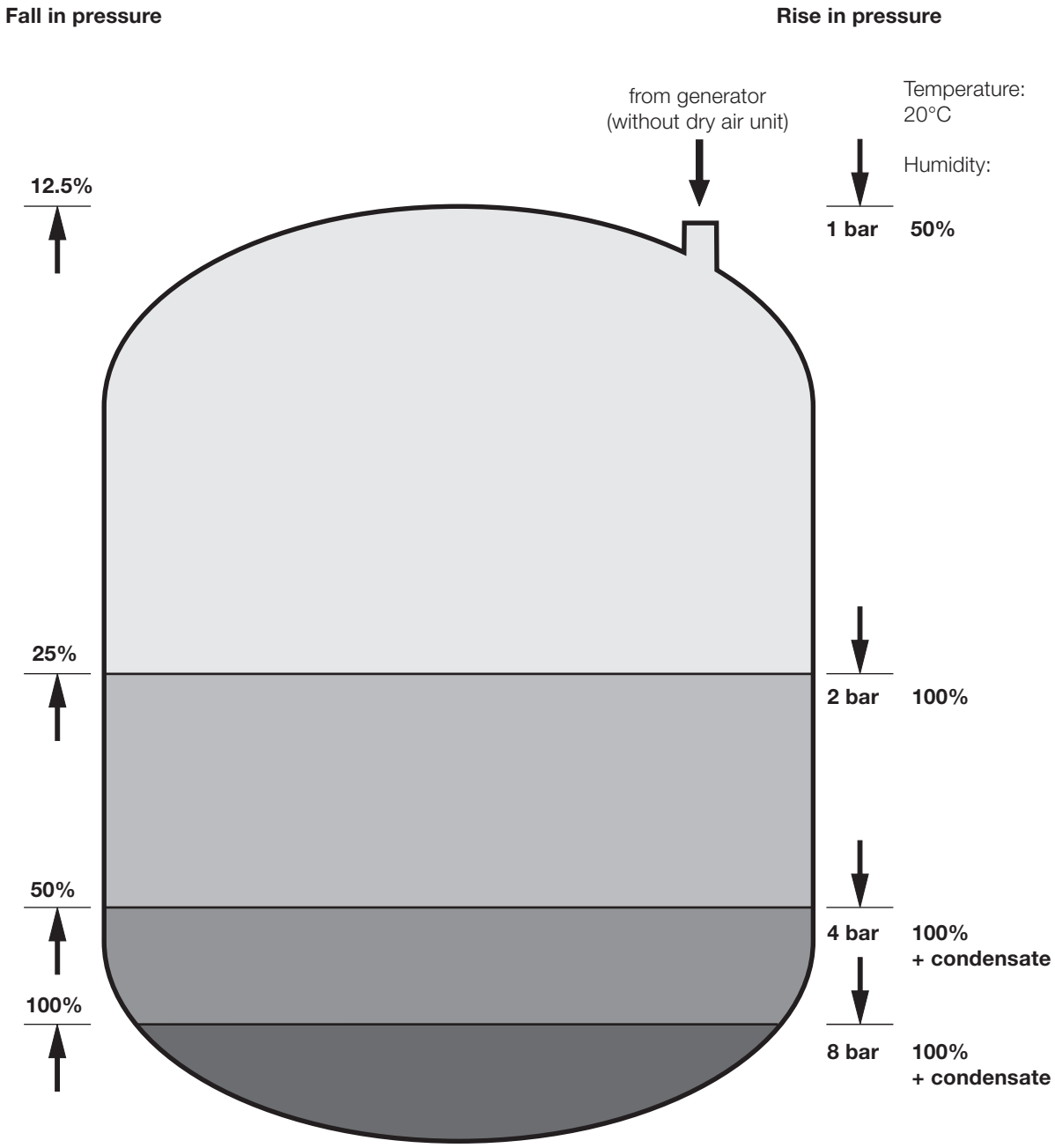
9. Relative and absolute air humidity

Temperature °C	Relative humidity in %								
	20	30	40	50	60	70	80	90	100
	Absolute humidity in g/m³								
0	1,0	1,5	1,9	2,4	2,9	3,4	3,9	4,3	4,8
2	1,1	1,7	2,2	2,8	3,3	3,9	4,4	5,0	5,6
4	1,3	1,9	2,5	3,2	3,8	4,5	5,1	5,7	6,4
6	1,5	2,2	2,9	3,6	4,4	5,1	5,8	6,5	7,3
8	1,7	2,5	3,3	4,1	5,0	5,8	6,6	7,4	8,3
10	1,9	2,9	3,8	4,7	5,6	6,5	7,5	8,5	9,4
12	2,1	3,2	4,3	5,3	6,4	7,4	8,5	9,6	10,7
14	2,4	3,6	4,8	6,0	7,3	8,5	9,7	10,9	12,1
16	2,7	4,1	5,5	6,8	8,2	9,5	10,9	12,3	13,6
18	3,1	4,6	6,2	7,7	9,2	10,7	12,3	13,8	15,4
20	3,5	5,2	6,9	8,6	10,4	12,1	13,8	15,6	17,3
22	3,9	5,9	7,8	9,7	11,7	13,6	15,5	17,5	19,4
24	4,4	6,5	8,7	10,9	13,1	15,3	17,4	19,6	21,8
26	4,9	7,4	9,8	12,2	14,6	17,1	19,6	22,0	24,4
28	5,5	8,2	10,9	13,6	16,3	19,1	21,8	24,5	27,3
30	6,1	9,2	12,1	15,2	18,2	21,3	24,3	27,4	30,4
32	6,7	10,1	13,5	16,9	20,3	23,7	27,1	30,5	33,8
34	7,5	11,3	15	18,8	22,6	26,3	30,1	33,9	37,7
36	8,3	12,5	16,7	20,9	25,0	29,2	33,4	37,6	41,7
38	9,2	13,9	18,6	23,2	27,8	32,4	37,0	41,6	46,2
40	10,2	15,3	20,4	25,6	30,7	35,8	40,9	46,0	51,1

From the table the absolute humidity can be read off in g/m³ for set temperatures and given relative humidity.

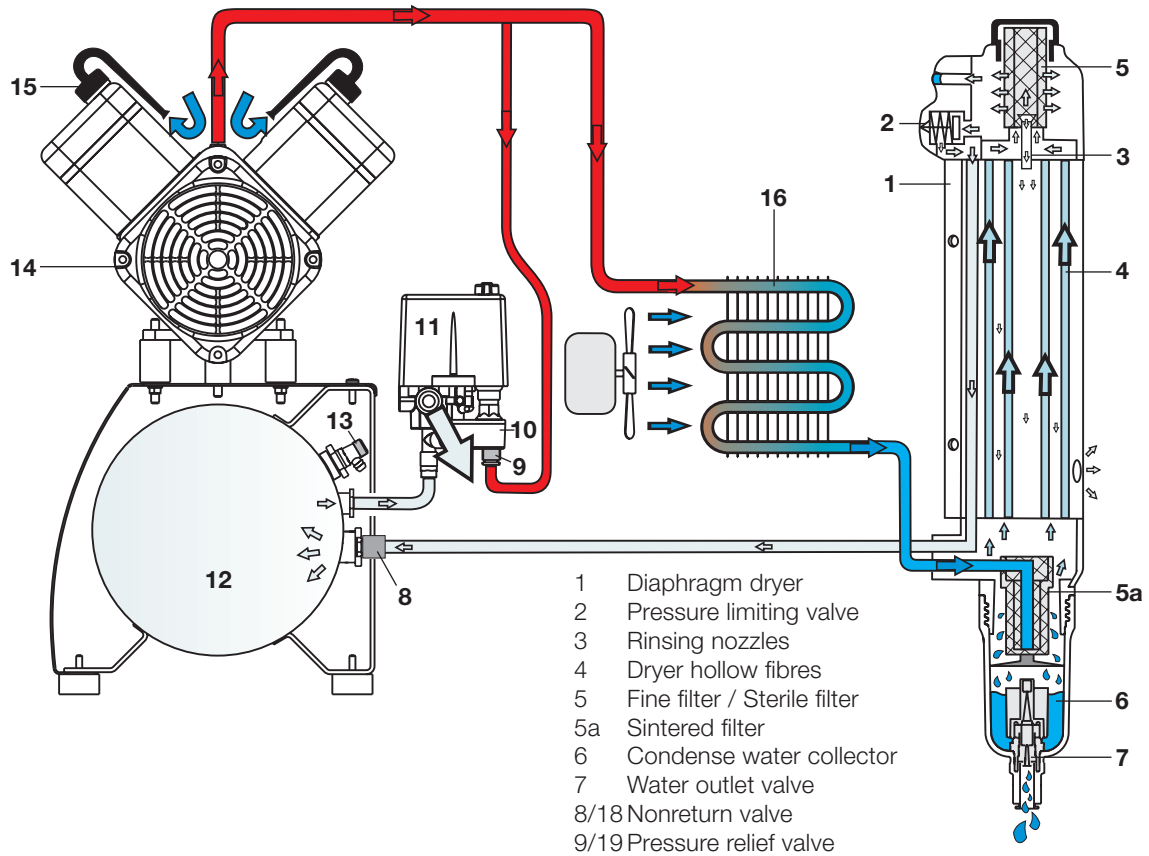
10. Relative humidity in tank

When the pressure rises the relative humidity rises in a linear relationship.



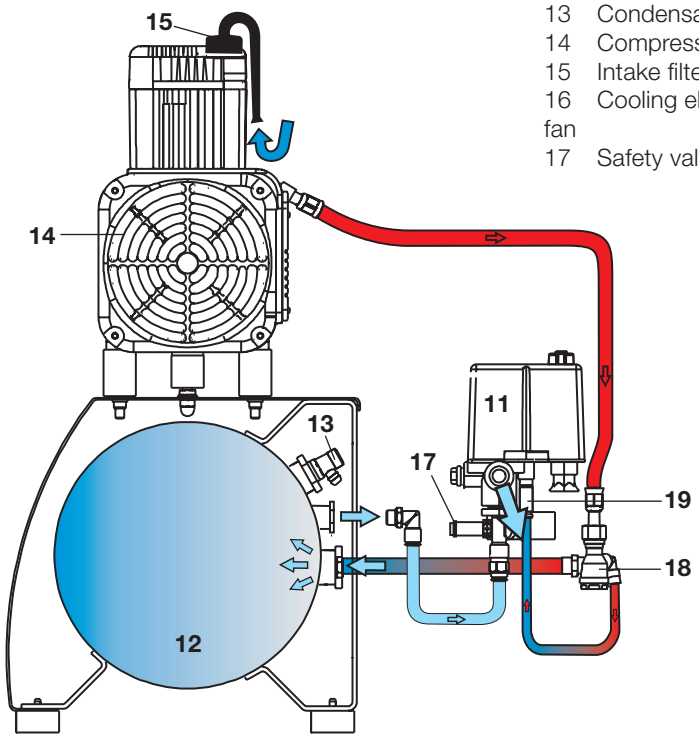
11. Functional layout of compressor

Compressor with membrane-drying unit



1 Diaphragm dryer
2 Pressure limiting valve
3 Rinsing nozzles
4 Dryer hollow fibres
5 Fine filter / Sterile filter
5a Sintered filter
6 Condense water collector
7 Water outlet valve
8/18 Nonreturn valve
9/19 Pressure relief valve
10 Pressure gauge
11 Pressure switch
12 Pressure tank
13 Condensate drainage valve
14 Compressor generator
15 Intake filter
16 Cooling element with ventilation fan
17 Safety valve

Compressor without membrane-drying unit



12. Functional description

Compressor with membrane-drying unit

Brief functional description:

The compressor generator (14) draws in atmospheric air and compresses it. It then transports this oil-free compressed air to the drying unit. The cooling element (16) and the membrane dryer (1) extract any moisture from the compressed air. The oil-free, clean and dry air is then made available to the operator (e. g. turbine) in the pressure tank (12).

Detailed Functional Description:

- **compressor generator**

Air is drawn in from the surrounding atmosphere through the intake filter (15). The plunger of the compressor generator (14) then compresses this air. The intake and outlet valves serve to block the flow in one direction at a time so that the compressed air is fed either to the cooling element or to the diaphragm dryer (1).

- **Cooling element and membrane dryer**

The hot and moisture-containing compressed air which is produced by the compressor generator flows to the cooling element (16). Once inside the cooling element the compressed air is cooled to a temperature just above room temperature and the water condenses. 100% Saturated compressed air and condensated water exit the cooler and flow to the water separator. The cyclone effect and coalescence effect at the sintered filter (5a) cause the condensated water present in the air to be discharged and it collects in the water collector vessel (6). The automatic water outlet valve (7) vents the water as set. Finally the air is fed to the membrane element. The air flows through the membrane fibres (4), thereby diffusing the water molecules present in the air through the membrane wall and they collect on the outer side of the membrane fibres. Meanwhile the dried air flows through a fine filter / sterile filter (5), pressure valve (2) and the nonreturn valve (8) to the pressure tank (12).

In order to regenerate the membrane dryer a small part of the dry air stream is fed via the rinsing nozzles (3) to the outside of the membrane fibers. This stream of air serves to absorb the moisture which diffused through the membrane wall and transports it to the outside environment. This regeneration process is carried out continuously during operation. There is no need for operation during a period of idle mode. The integrated pressure relief valve (2) present in the upper part of the membrane ensures that the membrane dryer reaches its rated operating pressure in the shortest possible time and provides that under all operating conditions the optimum drying performance is obtained. A humidity indicator has been integrated into this upper section of the membrane element which is clearly visible through the transparent upper section. In the case of a possible malfunction of the dryer and the accompanying insufficient air drying the colour of the indicator changes from blue to pink.

- **Pressure switch fittings**

When a user (e. g. turbine) is extracting compressed air the pressure within the compressed air tank falls. If the minimum possible tank pressure allowed is registered at the pressure switch (11) then the compressor generator will be switched on. If the maximum possible tank pressure allowed (circa 7.8 bar) is registered at the pressure switch (11) then the compressor generator will be switched off. The absolute maximum permitted tank pressure of 10 bar is clearly marked on the pressure gauge (10) in red. The safety valve (17) prevents the maximum permissible tank pressure (10 bar) from being exceeded. The condensate outlet tap (13) can be used in order to drain the condensated water from the pressure tank by opening the valve.

Compressor without membrane-drying unit

- **compressor generator**

The compressor generator (14) draws air from the surrounding environment through an intake filter (15) and compresses this air oil-free.
The inlet and outlet valves ensure that flow in only one direction is possible, i.e. so that the compressed air is forced through the non-return valve (18) into the pressure tank (12).

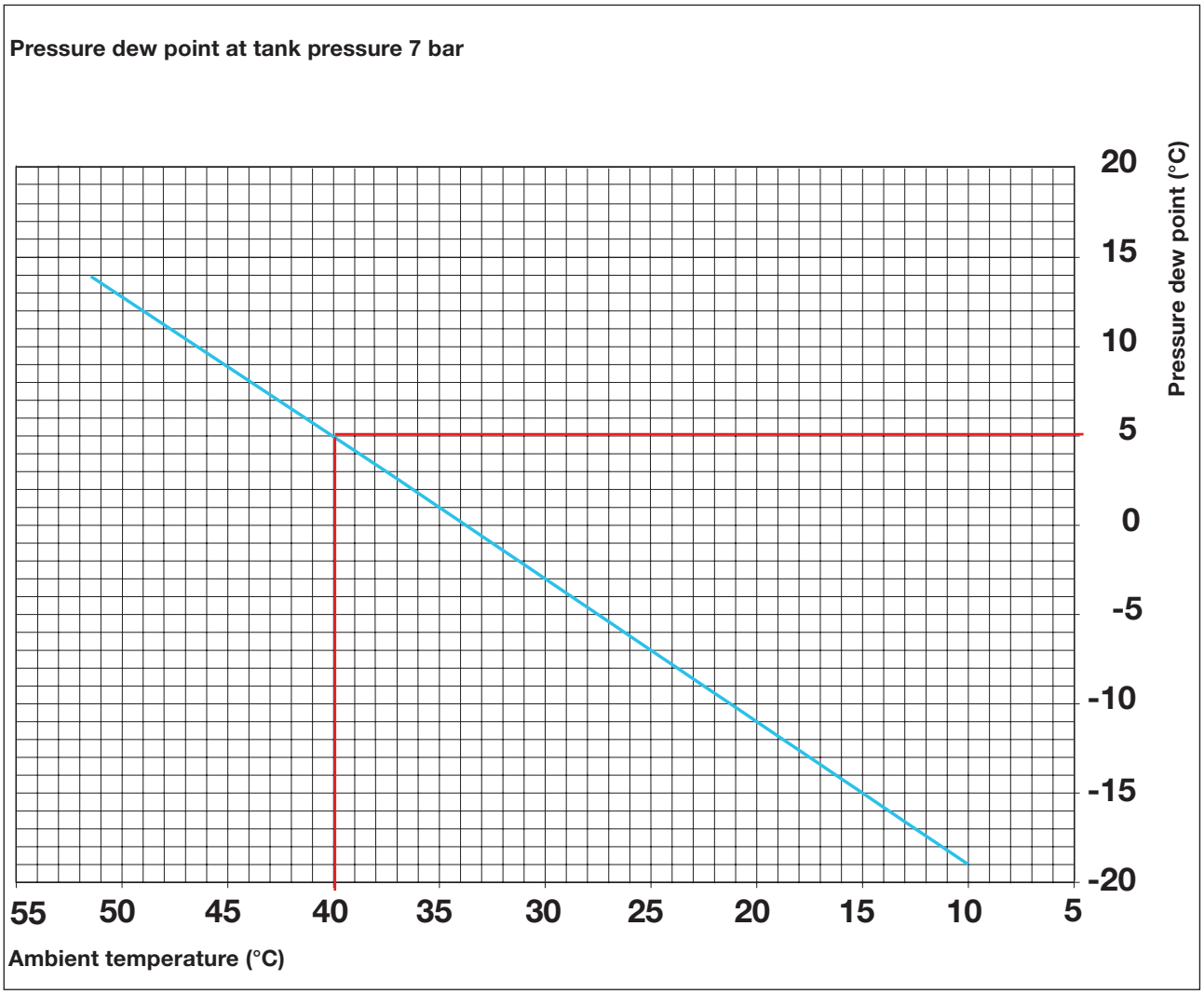
- **pressure switch**

The compressor generator (14) continuously supplies compressed air until such time as the pressure switch (11) setting registers the maximum permitted pressure within the tank (12) and then the compressor generator is switched off.
After switching off the compressor generator the pressure hoses are vented using the exhaust air vent (19).

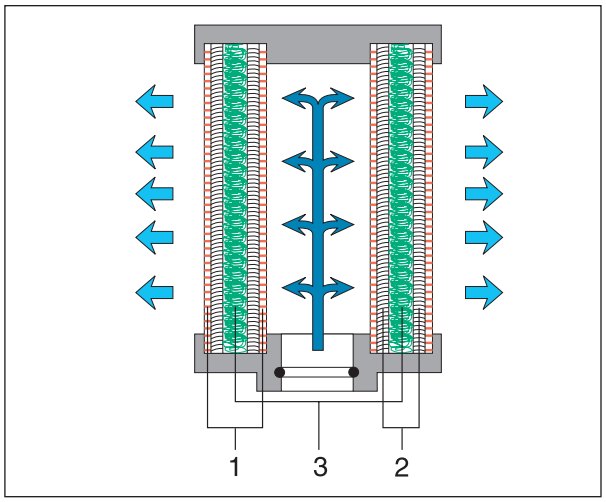
- **Pressure switch fittings**

see previous section, "Detailed Functional Description.

13. Pressure dew point of membrane-drying unit

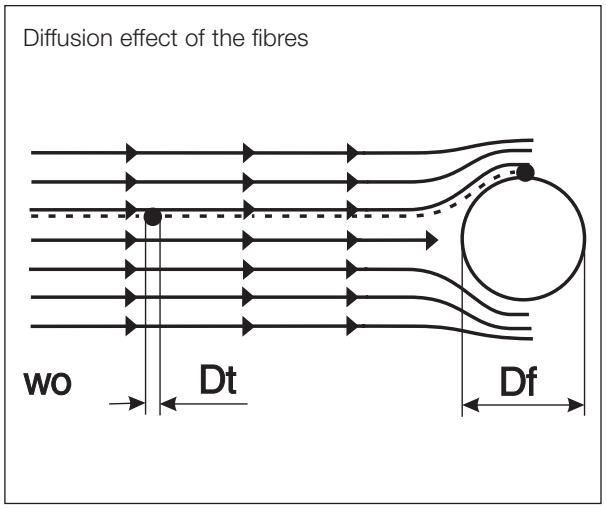


14. Composition of sterile filter

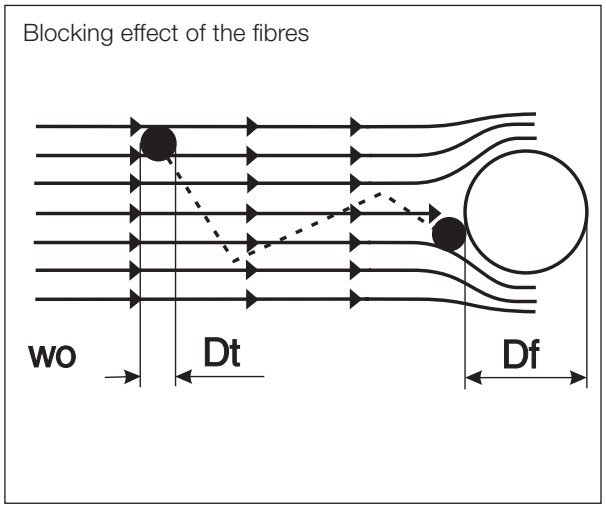


1 . Stainless steel fitting
2 . Pre-filter
3 . Deep filter of microfibre cloth

Diffusion effect of the fibres



Blocking effect of the fibres



Functionality

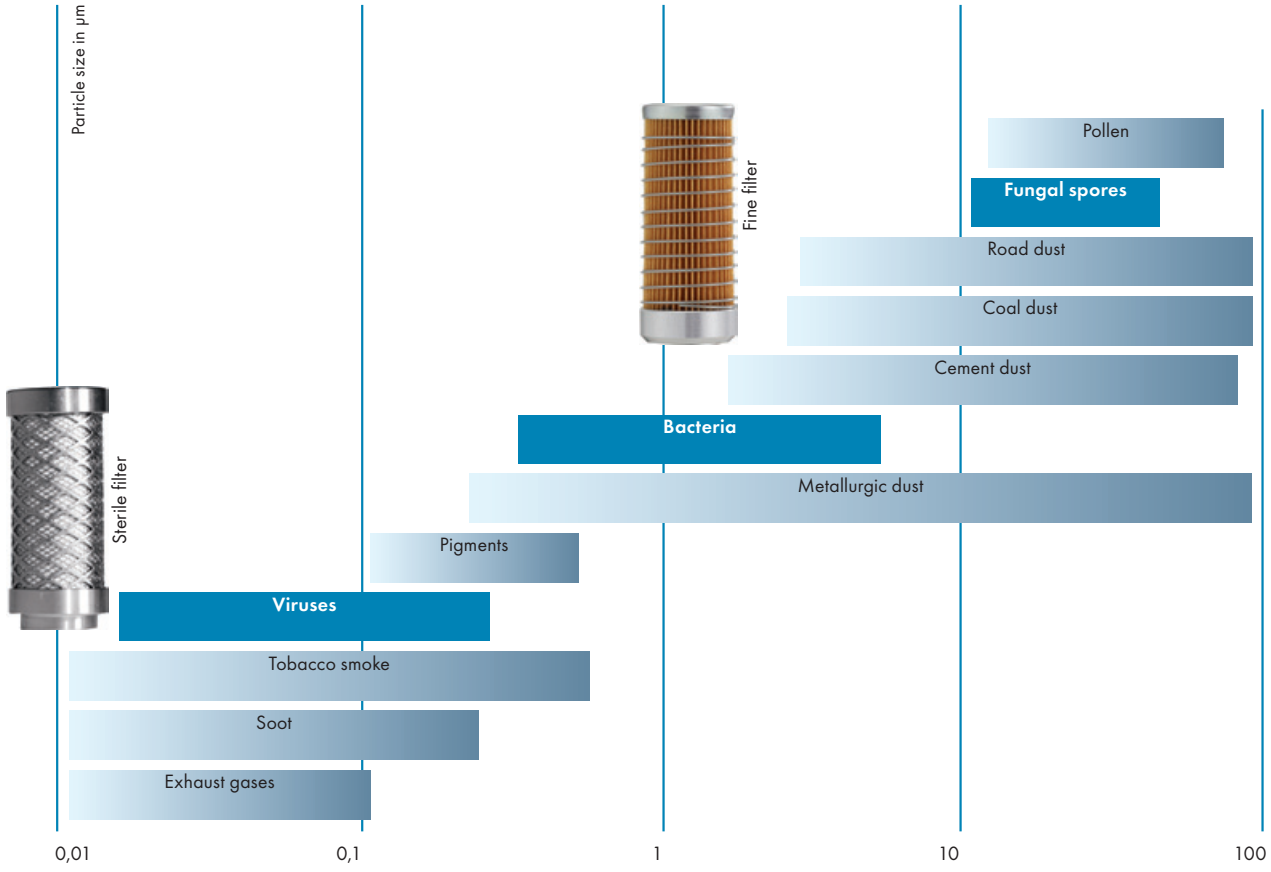
The filter consists of a two-step approach whereby the first stage is a pre-filtering followed by a second stage based on the principle of Brownian molecular movement and has an electrostatic effect.
The compressor generator generates a stream of incoming air which on its way to the tank passes through the membrane dryer in which a sterile filter is integrated. The air passes through the pre-filter 2, and this has a sieve-like effect and executes the first filtering stage. Subsequently the pre-filtered air now passes through the deep filter of micro-fibre where all particles to a size of 0.01 µm are collected. This means that bacteria, spores, virus, pollen, tobacco smoke, exhaust gases, soot and atmospheric dust are kept back. The Brownian molecular movement theory means that the resulting warming movements of the smallest medium molecules influence the foreign body particles present. The smaller these foreign body particles are then the greater the effect of the molecular movement on these particles through oscillating air molecules. In effect this means that the smaller these particles are then the greater is the probability that they will collide with the filter fibre elements and therefore be filtered out.

wo = Flow speed
Dt = Particle diameter
Df = Fibre diameter

The electrostatic effect is based on the fact that the gas stream (i.e. flow of air) through the fibre network causes a permanent redirection of the flow of gas. This continuous friction of the fluids on the barrier layer of the fibre surface creates an electric charge. Even the smallest particles down to 0,01 µm can thereby be expelled.

14.1 Filter size of sterile and fine filters

Sterile and fine filters are used in dry air units and must be replaced annually.
The sterile filter is autoclavable and is used for reducing the bacteria.



15. Set-up and ambient conditions

WARNING
Risk of explosion caused by ignition of combustible materials

- Do not use the unit in rooms in which there are combustible mixtures present, e.g. in operating theatres.
- Do not use the compressed air for respiration equipment or similar, for example for equipment that may be used in operating areas.

General notes on set-up

The set-up alternatives for the compressors vary according to particular model and / or on-site building situation. Installation in a purpose-built room, e.g. in boiler room, must be approved before-hand (i.e. observe local building regulations).
It is recommended that the compressors be set up in an adjoining room or machine room wherever possible due to the noise emissions generated.

- The appliance must be set up in a dust-free, cool and dry room.
- The room temperature in winter must not fall below +10 °C and in summer must not exceed +40 °C.
- Where the room temperature exceeds +35 °C then additional ventilation must be provided in the room for set-up, e.g. a fan, see section „Ventilation“.
- When fitting the unit into a cabinet sufficient air circulation must be provided for. Check that ventilation slots have been provided for in the cupboard unit.
  For the correct ventilation of cabinets and rooms see section „Ventilation“.

Ca. 70 % of the electrical energy taken up by the compressor generator is transformed into heat and given off to the environment.

- The maximum relative humidity during operation should not exceed 70 % (non-condensating).
- The compressor must be set up in accordance with any relevant pressure tank regulations so that the model identification plate is easily accessible and legible.

Vibration:

The compressor stands on rubber pads to reduce the level of vibration and resulting operating noise.

Noise levels:

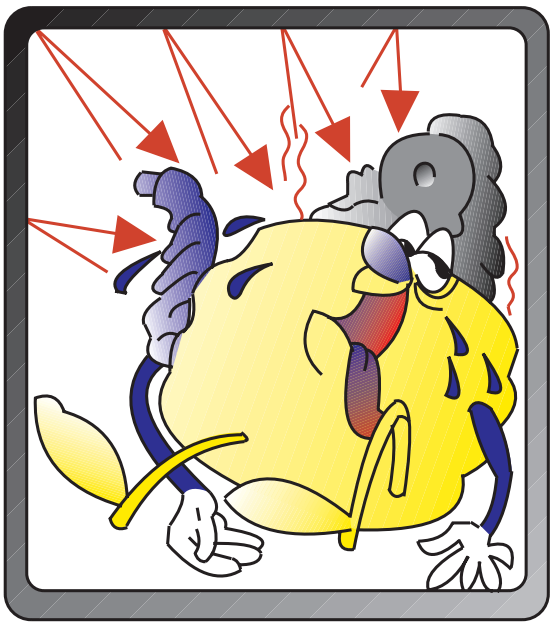
The noise levels were measured under soundproof conditions according to EN ISO 1680. The levels are average values with a tolerance of +/-1.5 dB(A). Higher values will be achieved in reverberant rooms (e.g. with tiled walls).

Ventilation

- In order to ensure adequate air circulation it is important to provide ventilation slots when the compressor is set up in a cabinet. Alternatively, an appropriate ventilator should be fitted suitable for the particular compressor.
- The ventilation slots for the room air circulation must be so positioned that the appliance is directly in the path of the forced air circulation.

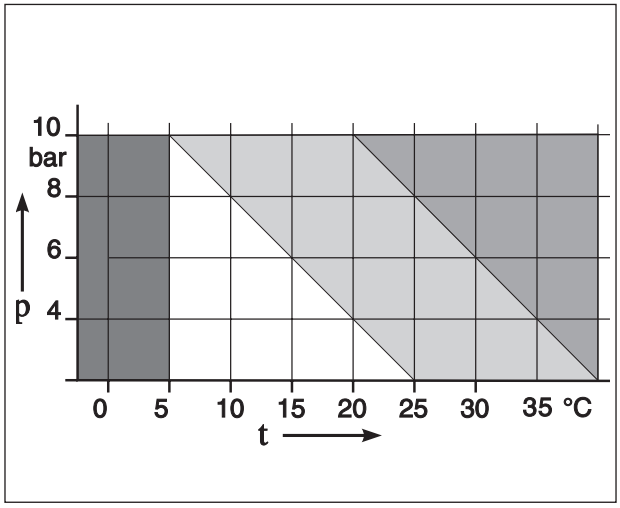
With air ventilation

Without ventilation



16. Operating conditions

The actual delivery rate of the compressor with a membrane drying unit depends on the ambient temperature and the relative humidity at set-up location.
The chart below gives an overview of the operating conditions:



Example:
Where flow pressure is 6 bar

- Very good operating conditions ambient temperature 5 - 15 °C
- Normal operating conditions 15 - 30 °C
- Poor operating conditions 30 - 40 °C
- Very poor operating conditions <5°C or >40 °C

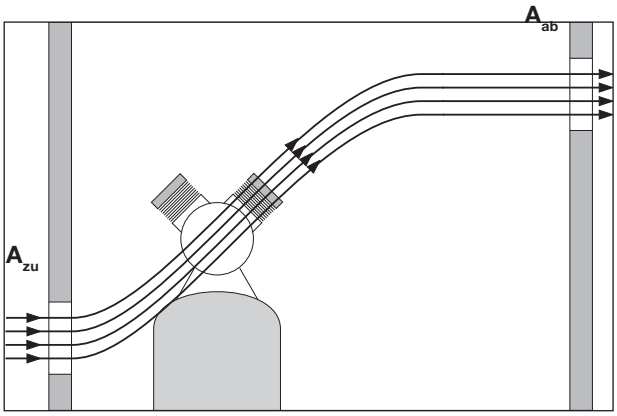
The following basic considerations should be taken into account when setting up the compressor:

- The higher the flow pressure in the hose lines, the lower the room temperature needs to be.
- Good ventilation at set-up location provides an even room temperature and even economic efficiency.

17. Supplementary ventilation in room for set-up

In principle the openings for both intake air and air extraction should be the same size. The stream of cool air must flow through both openings. Taking the installation of blinds, grilles etc. into consideration then the intake air slots should be approx. 20 % larger than the exhaust air slots.

NOTICE
Risk of overheating

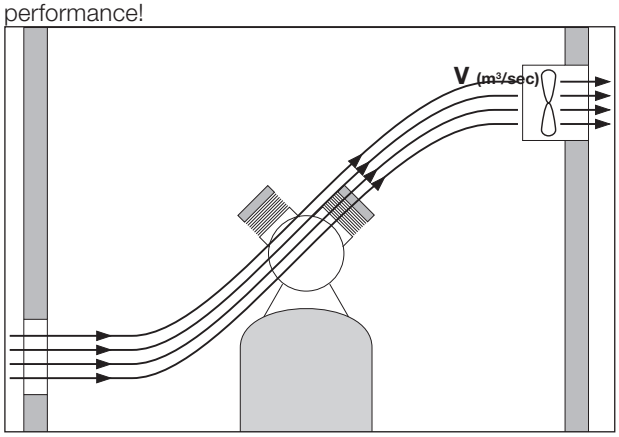


Required air openings assuming natural in and out air flows VDMA 4363	
Drive power KW	**Ventilation openings A_{ab} =A_{zu} m^2**
2,0	0,16
3,0	0,20
4,0	0,25
5,5	0,30
7,5	0,40
11	0,50

18. Supplementary ventilation in room for set-up

In some circumstances the natural ventilation may be insufficient in the set up room. The particular building features of the room itself and / or the higher performance of the compressor and suction unit installed may mean that insufficient cooling air is available. In this case the warm air must be extracted.

Artificial ventilation increases the flow speed of the cool air in the set up room and guarantees the flow of cooling air necessary. This also allows for some reserve, e.g. when the outside temperatures are higher in summer.
The intake openings must be proportional to the ventilator performance!



Example:
- Normal temperature in set up room 20 °C
- Highest temperature of 35 °C should not be exceeded
- VS 900 S with 2 KW
- Duo Tandem with 2.8 KW

P_{ges} = 2 KW + 2.8 KW = 4.8 KW
Efficiency level 70 % (heat development)
Heat performance Q

$$Q_{ges} = P_{ges} \bullet 70\ \% = 4.8\ KW \bullet 70\ \% = 3.36\ KW$$
$$+ 10\ \%\ safety = 3.7\ KW$$

$$Q = m \bullet c \bullet \Delta T$$

$$m = \frac{Q}{C \bullet \Delta T} = \frac{3.7\ KW}{0{,}285\ \frac{Wh}{kg \bullet K} \bullet 15\ K} = 866\ kg / h$$

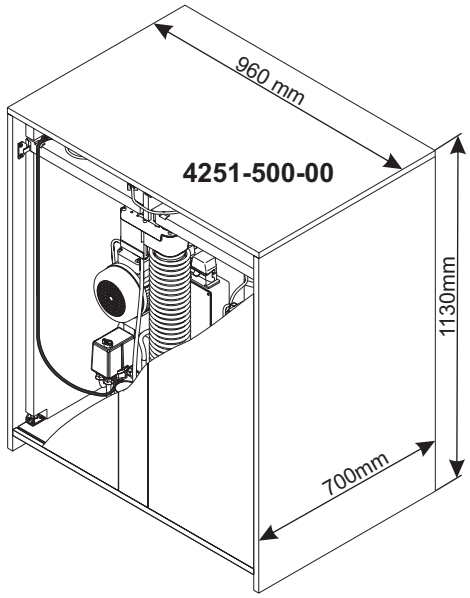
$$V = \frac{m}{P_L} = \frac{866\ kg / h}{1.29\ kg / m^3} = 672\ m^3 / h = \mathbf{0.19\ m^3 / sec}$$

P_{ges} = Total output (KW)
Q_{ges} = Total heat output (KW)
c = Specific heat capacity (air = 0.285 Wh / kg • K)
m = Mass (kg)
ΔT = Temperature difference (35 °C - 20 °C = 15 K)
P_L = Air density (1.29 kg / m^3)
V = Required volume of air flow for ventilator (m^3 / sec)

Size of ventilator necessary using artificial ventilation (ΔT = 15 °C)	
Drive power KW	**Ventilator performance V = m^3 / sec**
2,0	0,08
2,5	0,10
3,0	0,12
3,5	0,14
4,0	0,16
4,5	0,18
5,0	0,20
5,5	0,22
6,0	0,24
6,5	0,26

In order to establish generally valid values for the flow of cooling air V, the following general conditions have been applied which can affect the size of the required cool air flow V.
- max.room temperature 35 °C
- temperature differenceΔ T = 15 K
- wall thickness 25 cm,
(homogeneous brick wall without windows and doors)
- height of room under 3 m
- room size less than 50 m^2

19. Noise reduction using compressor cabinet

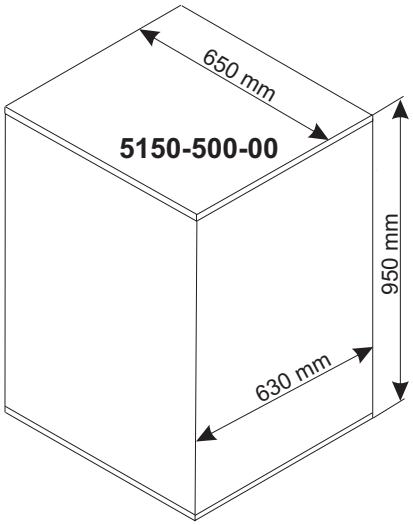


85 kg

10-40 °C

56 dB(A)

Duo Tandem 415., 425.
Trio 535.
Quattro 545.

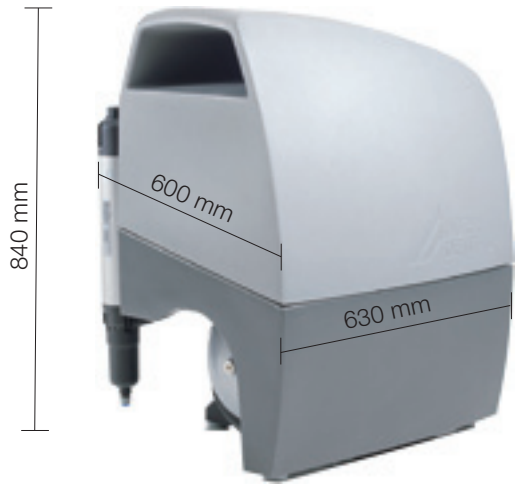


45 kg

10-40 °C

60 dB(A)

Duo 525.



57 kg

10-40 °C

56 dB(A)

Tornado 1, 518.
Tornado 2, 528.
Complete with housing
Exhaust air system for housing

20. Compressor connections

20.1 Electrical connection

Depending on particular model of compressor

- 400 V-model type with CEE-connector
- 230 V-model type with earthed safety plug
- Where the appliance is connected to the mains power supply using a socket then this must be easily accessible so that the unit can be switched off and disconnected from the mains easily and quickly.
- Fixed connection to mains power supply, requires that in the vicinity of the appliance some form of circuit breaker with at least 3 mm contact opening width must be installed (e.g. power switch).

20.2 Circuit protection

- The appropriate circuit must be fitted with an LS-switch of 10 A (characteristic B, C or D) fusing on the building side.
  (Models 4252-01, 4252-51 and 4682-52 require LS 20 A.)

WARNING
Danger of injury or damage.

- All and any rules and regulations laid down by the local power supply provider must be observed.
- Power supply voltage and frequency must agree with the instructions given on the model identification plate.

20.3 Compressed air connection and power supply

WARNING
Electric shock

- Do not use a pressure hose which contains any electrically conductive reinforcement material.

NOTICE
Vibration and noises

- A flexible pressure hose between the fixed plumbing line (ø 10 x 3 x 16) and the compressor prevents the transmission of vibrations and thereby reduces the noise arising.

Recommendation: Use a quick release coupling and lock-off valve on the fixed compressed air pipe, see section„ 22. Planning examples“.

21.4 Plumbing materials

The compressed air pipes are laid parallel to the suction system using copper (Cu).

21. Dimensions of pipe lines for Dürr Dental compressors

Interior pipe diameter ø [mm]		Rate of flow in the connection													
		5 bar							7 bar						
		6	8	10	12	15	18	22	6	8	10	12	15	18	22
Delivery rate	500l	-	4	11	28	80	200	550	-	5	16	38	120	290	800
	360l	-	7	20	50	150	380	1000	-	9	28	70	210	530	1500
	250l	3	13	38	100	300	750	2000	4	18	55	140	420	1000	2500
	180l	6	24	70	180	550	1350	3500	8	33	100	250	750	1900	>
	120l	12	50	150	380	1100	2800	>	17	70	210	500	1650	>	>

Table 1 L [m] Max. connection line length for total pressure loss of Δp = 0.5 bar

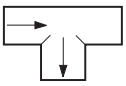
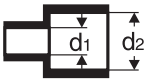
	Interior pipe diameter ø [mm]						
	6	8	10	12	15	18	22
 Elbow piece r=2 x d	0,08	0,10	0,12	0,15	0,18	0,21	0,25
 Elbow piece r = d	0,17	0,20	0,25	0,30	0,35	0,40	0,45
 T-piece	0,4	0,5	0,7	0,8	1,1	1,5	1,8
ø d2 - d1 [mm]	2	4	6	8	10	12	14
 reducer part	0,06	0,14	0,20	0,23	0,25	0,27	0,29

Table 2 Flow resistance calculated by pipe length [m] operating pressure 7 bar

When planning new compressed air systems care should be taken to ensure the line diameter dimensions are chosen corresponding to the size of the compressor and the line pressure (rate of flow pressure).
Tables 1 and 2 can help when choosing the necessary pipe diameters for Dürr Dental compressors.

Example:
Compressor model Quattro Tandem (~430l)
Length of straight pipe line connection L = 15m,
rate of flow p = 7 bar
13 Elbow pieces
required: internal pipe dimension Ø (d_i)
According to Table 1:

For L = 15m and p = 7 bar then d_i = 10mm

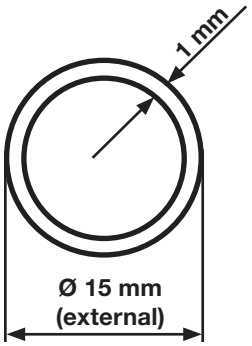
According to Table 2:
d_i = 10 mm and 13 elbow pieces (r = d)
Pipe length 0.25 x 13 = 3.25 m
Total length is L = 15 + 3.25 = 18.25m

According to Table 1:
For L = 18.25m -
chosen value in table = 38m
t**hen d_i = 12mm**

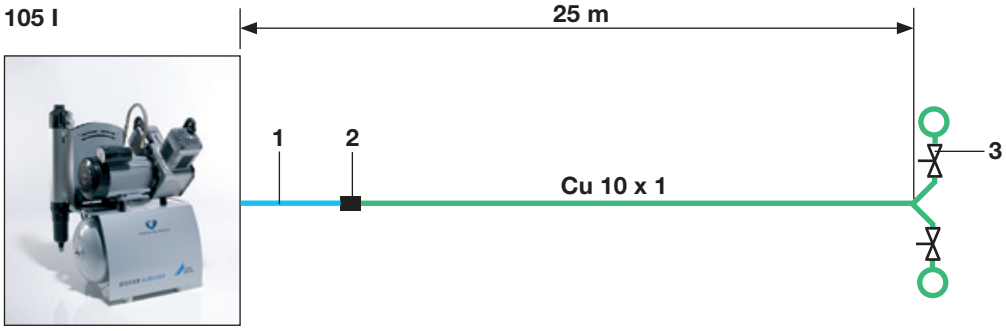
22. Planning examples of pipe lengths and diameters

calculated according to section 22. Dimensions of pipe lines

For the following planning examples the elbow pieces, reducer parts, taps and fittings and lock-off valves have been provided with a safety factor of 1.5.
Required rate of flow 5 bar.

Copper piping (Cu), conventional sizing		
6 x 1		**e.g.** **Cu 15 x 1** **Ø$_i$ 13 mm**
8 x 1		
10 x 1		
12 x 1		
15 x 1		
16 x 1		
18 x 1		
22 x 1		
28 x 1		
28 x 1.5		

Duo
105 l



Duo calculation		
Main connection line		25 m
Safety factor 1.5	25 x 1.5	37.5 m
From Table 22. Dimensions of pipe line	5 bar rate of flow up to 120 l up to 50 m	Ø$_i$ = **8 mm**
Copper piping selected		**Cu 10 x 1**

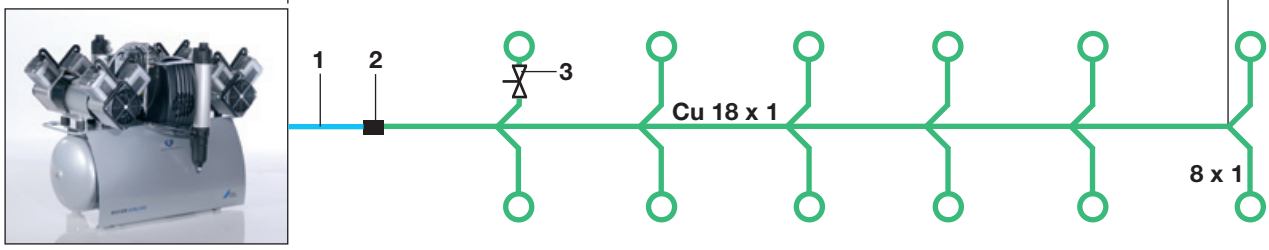
1 Flexible compressed air hose Ø 10 mm x 3 mm (16 mm) x 3 m (supplied)

2 Quick release coupling (mount on-site)

3 Lock-off valve (mount on-site)

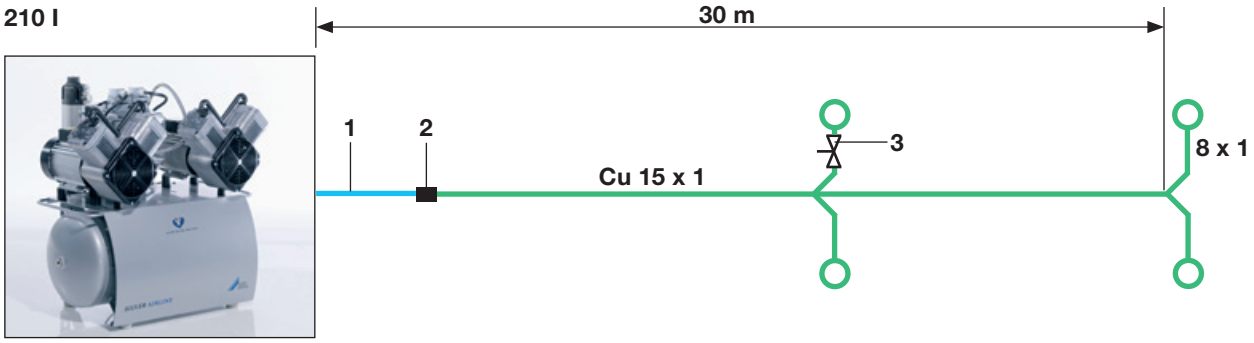
Required rate of flow 5 bar

Quattro Tandem
430 l



Calculation for Quattro Tandem		
Main connection line		50 m
Safety factor 1.5	50 x 1.5	75 m
From Table 22. Dimensions of pipe line	5 bar rate of flow up to 500 l up to 80 m	$Ø_i$ = **15 mm**
Copper piping selected		**Cu 18 x 1**

Duo Tandem
210 l

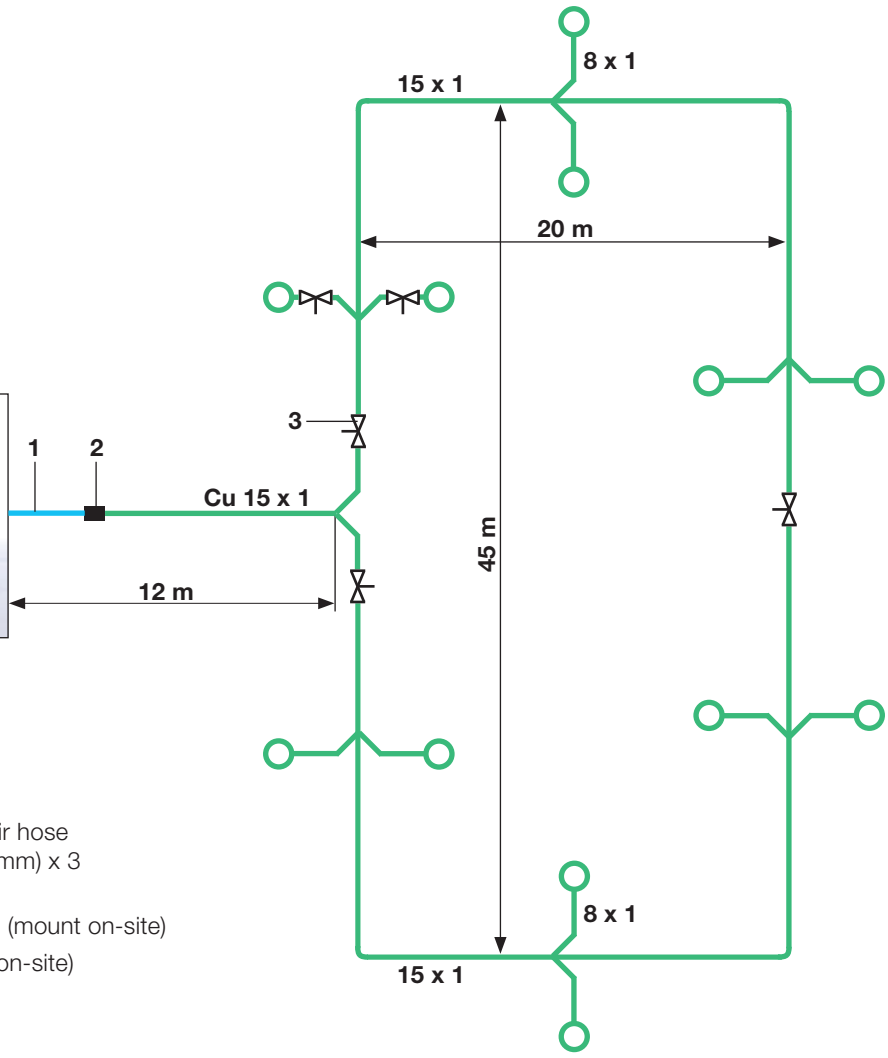


Duo Tandem calculation		
Main connection line		30 m
Safety factor 1.5	30 x 1.5	45 m
From Table 22. Dimensions of pipe line	5 bar rate of flow up to 250 l up to 100 m	$Ø_i$ **12 mm**
Copper piping selected		**Cu 15 x 1**

1 Flexible compressed air hose Ø 10 mm x 3 mm (16 mm) x 3 m (supplied)
2 Quick release coupling (mount on-site)
3 Lock-off valve (mount on-site)

Advantages of using a ring line system!
Providing compressed air requirements using a ring connection supply means that the compressed air actually has a shorter travel distance than with conventional direct supplies. This means a lower pressure drop Δp. Calculating the dimensions required for the ring connection means that
- half the total pipe length is required for flow-related reasons
and
- half the rate of volume flow can be calculated, which in turn leads to a smaller line diameter being required.

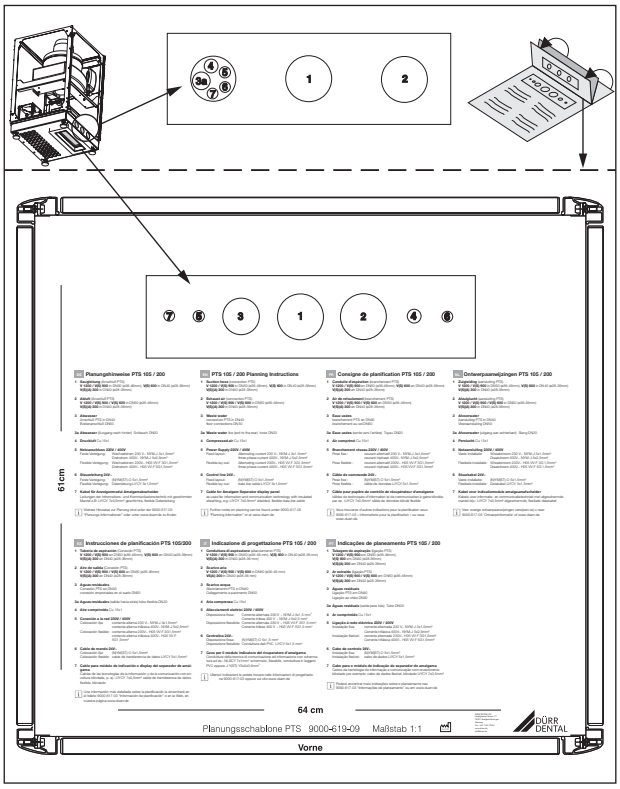
Quattro Tandem
430 l



1 Flexible compressed air hose Ø 10 mm x 3 mm (16 mm) x 3 m (supplied)
2 Quick release coupling (mount on-site)
3 Lock-off valve (mount on-site)

Calculation for Quattro Tandem		
Main connection line		12 m
Safety factor 1.5	12 x 1.5 =	18 m
From Table 22. Dimensions of pipe line	5 bar rate of flow up to 500 l up to 28 m	$Ø_i$ = **12 mm** **Main connection line**
Ring line	(2 x 45 + 2 x 20) : 2 =	65 m
Safety factor 1.5	65 x 1.5 =	97,5
Half rate of flow	500 l : 2	250l
From Table 22. Dimensions of pipe line	5 bar rate of flow up to 250 l up to 100 m	$Ø_i$ = **12 mm** **Ring line**
Copper piping selected		**Cu 15 x 1**

Planning example PTS 200



23. Power Tower Silence PTS

The PTS is the ideal combination of compressed air and suction system in compact form.
Information on suction can be found in our brochure Planning Information (9000-617-03/xx) or the Planning Example sheet (9000-619-09).
PTS , 120 and 200 are supplied with different compressor generators.
When installing compressed air units the same instructions as for individual compressor set up must be applied, see the following table:

Model	Compressor generator
PTS 120	Tornado 1
PTS 200/01 /11 /21/ /22	1x Duo
PTS 200/02 /12 /13	2x Duo

- Where the PTS is integrated into a wall cupboard or cabinet in such a way that there can be no air circulation to the sides then it is important that the ventilation slots to the front are never blocked or obstructed in any way.

Provide adequate room ventilation, otherwise there is the risk of overheating.

Set up for Power Tower Silence PTS

- On same floor as surgery, e.g. in adjacent room.
- Set-up, e.g. one floor lower.
- The PTS must be set up on a stable and horizontal floor. A certain amount of unevenness can be compensated for using the universally adjustable feet of the PTS.
- The Power Tower can be set up in any part of a room or can be installed into a cupboard.
  A distance of at least 2 cm must be provided between the sides of the PTS and the cabinet walls.

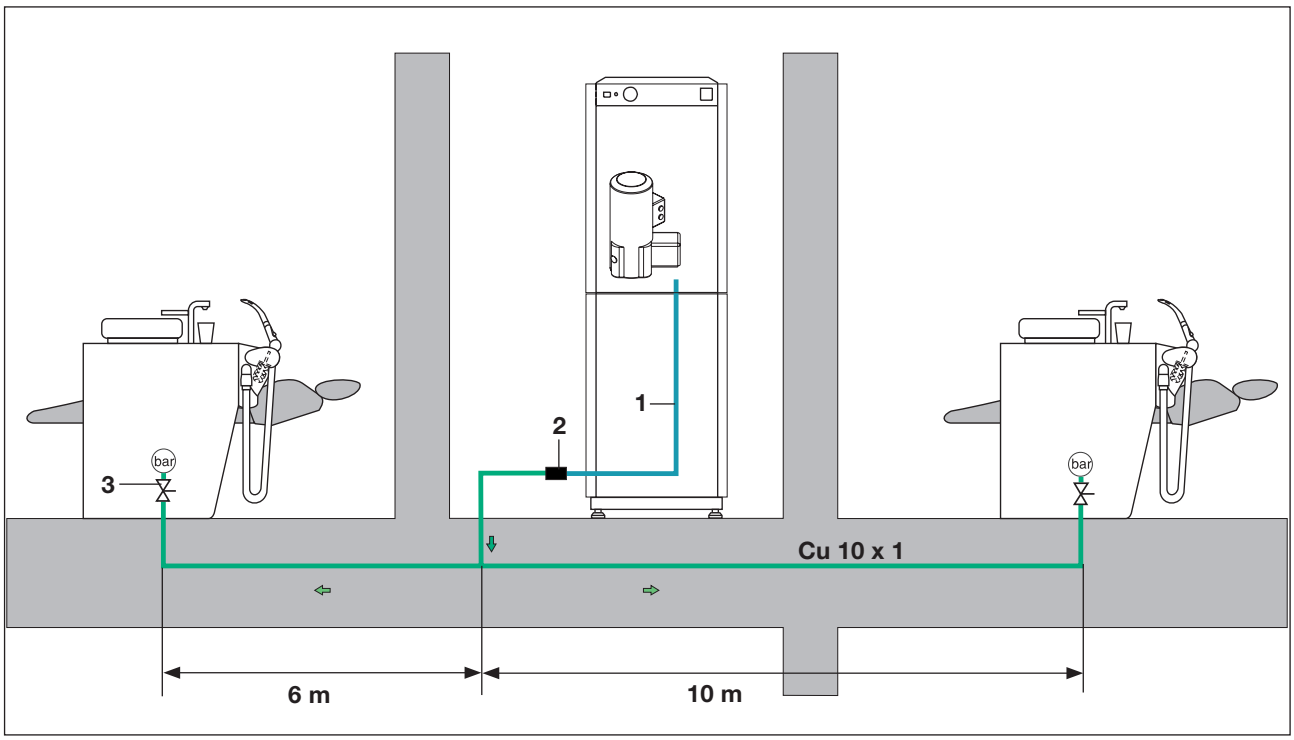
Where the distance is too small, there is the danger of vibration effects

23.1. Planning examples of PTS pipe lengths and diameters

calculated according to section 22. Dimensions of pipe lines

For the following planning examples the elbow pieces, reducer parts, taps and fittings and lock-off valves have been provided with a safety factor of 1.5.
Required rate of flow 5 bar.

PTS 200 with one Duo generator
105 l



Calculation for PTS 200 with one Duo generator		
Max. stub line		10 m
Safety factor 1.5	10 x 1.5	15 m
From Table 22. Dimensions of pipe line	5 bar rate of flow up to 50 m	$Ø_i$ = **8 mm**
Copper piping selected		**Cu 10 x 1**

1 Flexible compressed air hose Ø 10 mm x 3 mm (16 mm) x 3 m (supplied)

2 Quick release coupling (mount on-site)

3 Lock-off valve (mount on-site)

DÜRR DENTAL AG
Höpfigheimer Straße 17 • 74321 Bietigheim-Bissingen, Germany
Tel: +49 7142 705-0 • Fax: +49 7142 705-500
info@duerr.de • www.duerr.de

DÜRR DENTAL