12. Condensate Drains

12. General

Newly compressed air is 100% saturated with water vapour which begins to precipitate out as soon as the air cools in the after-cooler, separator, air receiver, etc,. This precipitant of water and other pollutants carried in the air ingested by the compressor, is known as condensate and its proper removal from the system is vital for the protection of the machinery itself and the quality of compressed air delivered to the consume.
Various methods of draining off condensate are available:

Time-controlled
A timer-controlled solenoid valve opens at set intervals of between 1.5 and 30 minutes, for periods which can be adjusted between 0.4 and 10 seconds, to allow the accumulated condensate to be blown out.

Advantage: automatic drainage
Disadvantage: air loss; the valve can open at times when there is no condensate to drain; tendency to emulsify the condensate as it is blown out at high speed.

Level-controlled
a) Floating level sensor
As the name indicates, a float moves upward with the level of accumulating condensate until reaching a set point at which a mechanical linkage attached to the float, opens a port to allow the condensate to escape.

Advantages: automatic drainage; drainage only when condensate has accumulated; no air loss
Disadvantages: highly susceptible to failure due to dirt in the condensate; no external indication that the device is working or not.

b) Electronic level sensor ECO-Drain
A capacitive sensor registers the condensate level and opens and closes the drain port accordingly.

Advantages: automatic drainage; drainage only when condensate has accumulated; no air loss
self-monitoring; volt-free contact for further signalling (except ECO-Drain 10)
Disadvantages: none

12.1 Time-controlled drains

12.1.1 Function

Condensate collecting in air receivers, centrifugal separators or filters is released at regular, pre-set intervals by the opening of a solenoid valve. The intervals can be set at 1.5 - 30 minutes and time for which the valve remains open from 0.4 to 10 seconds depending on the volume of condensate expected.

The solenoid valve is equipped with a sieve and dirt trap which must be cleaned regularly to ensure proper functioning of the valve.

12.1.2 Technical Specification

Adjustable timer for intervals between opening and opening duration.

Ambient temperature range +1°C to +60°C

Electrical connection 230V, 1-phase, 50 Hz

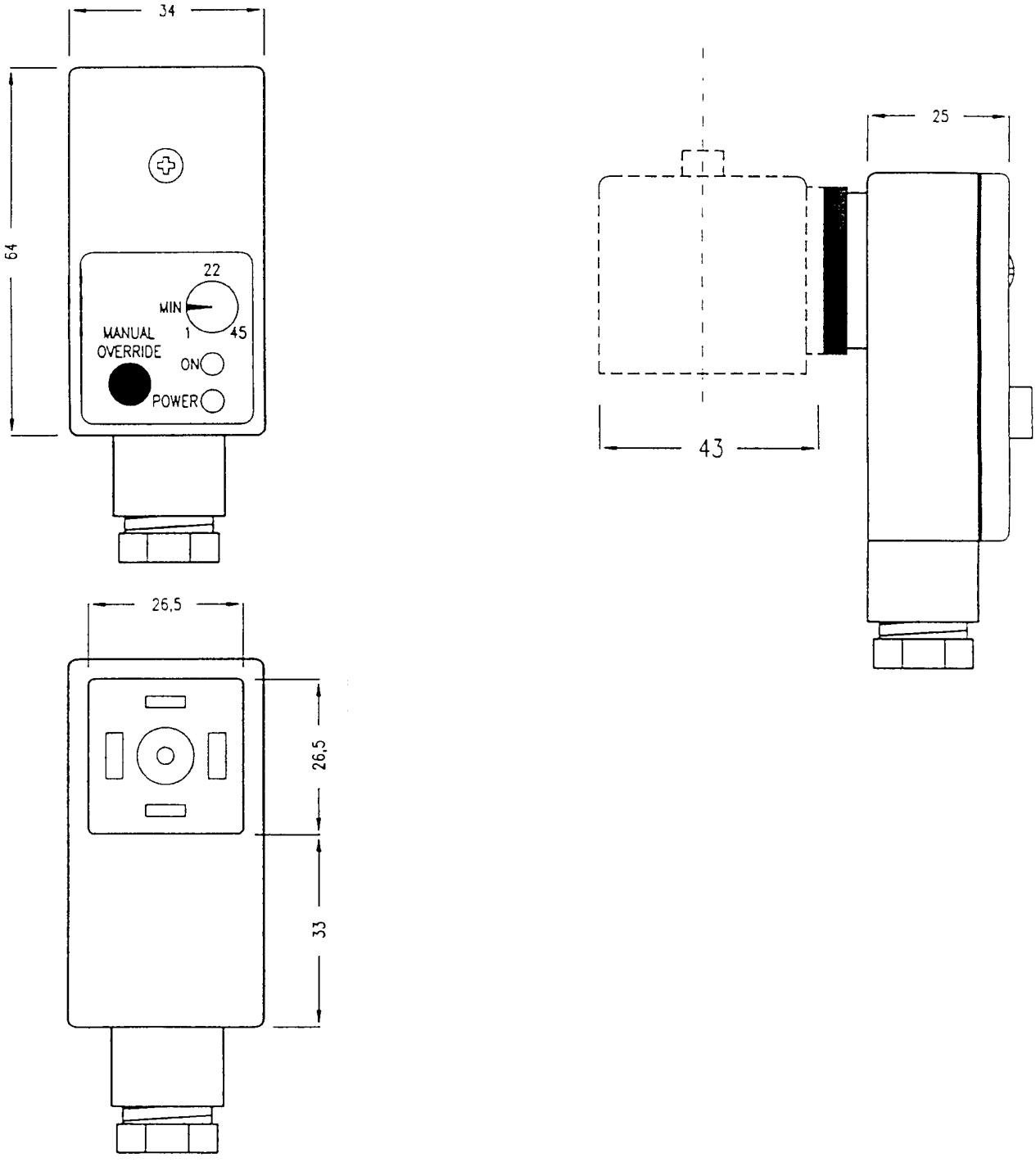
Interval setting range 1.5 to 30 min

Opening duration range 0.4 to 10 seconds

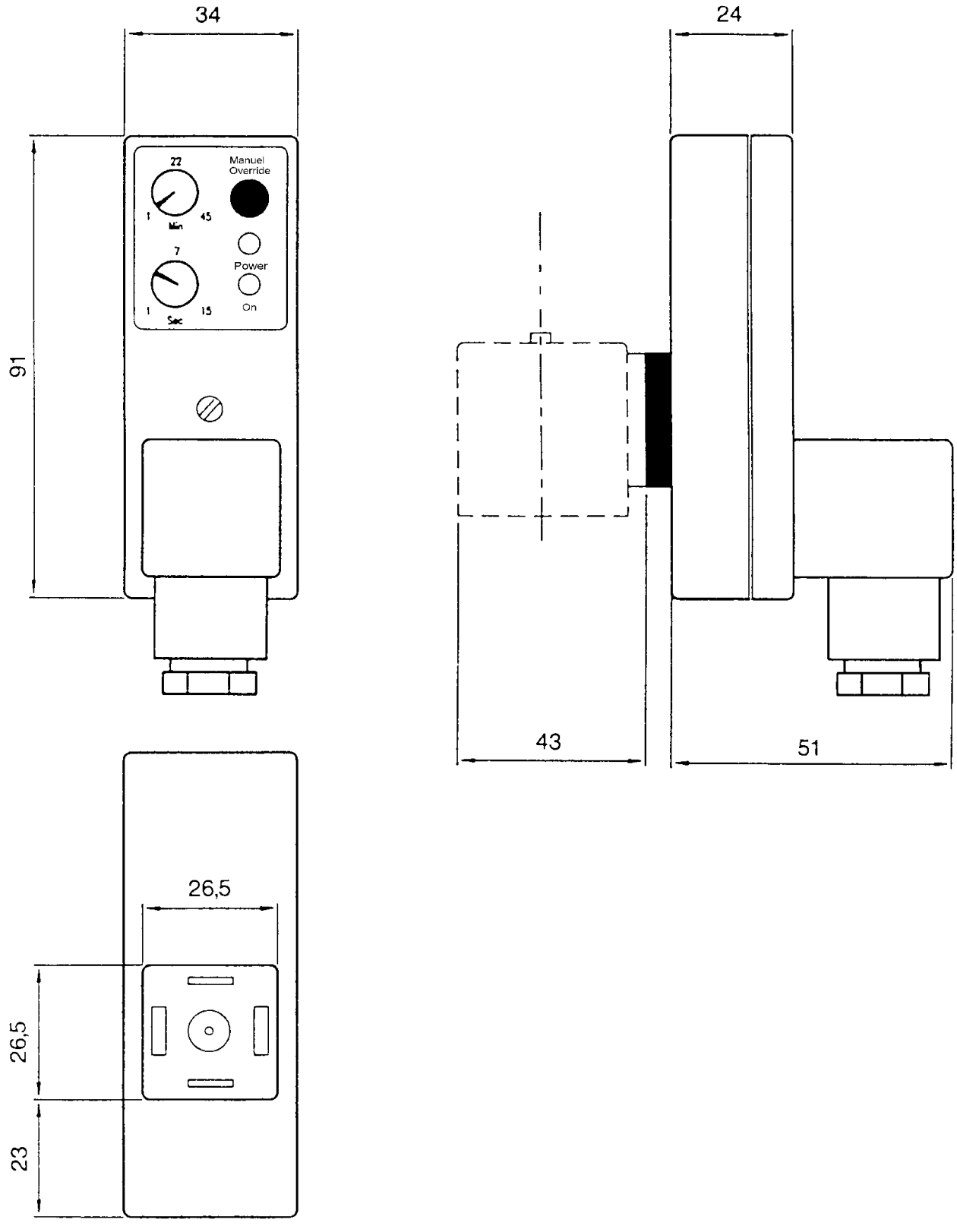
	Pressure bar(g)	Connection G
Time drain	16	¾"
Solenoid valve with timer	16	¾"
	16	½"
	16	3/8"
	35	¾"
Separate solenoid valve	16	¾"
	16	½"

12.1.3 Dimensions

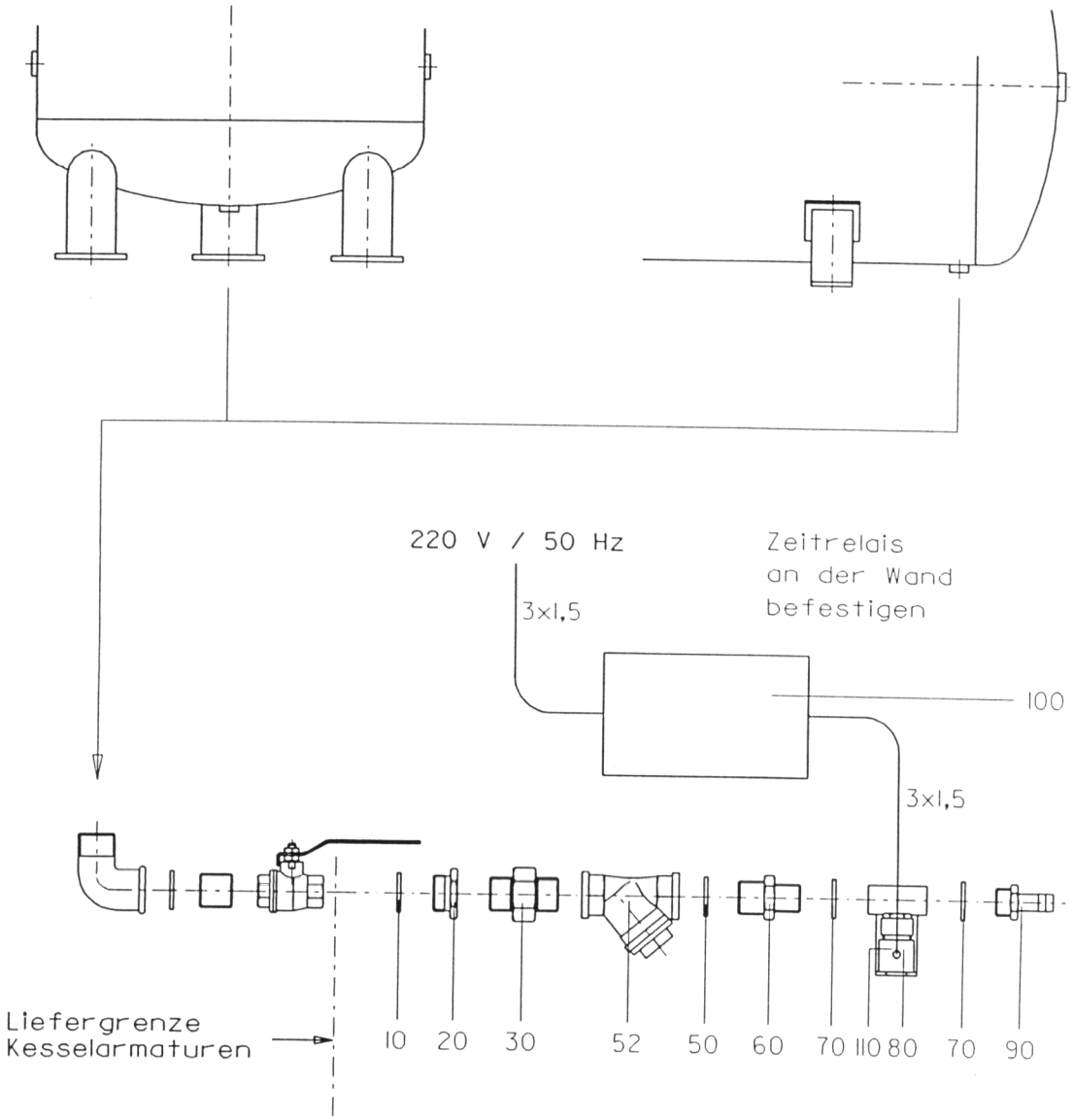
12.1.3.1 Time Drain 10



12.1.3.2 Time Drain 20



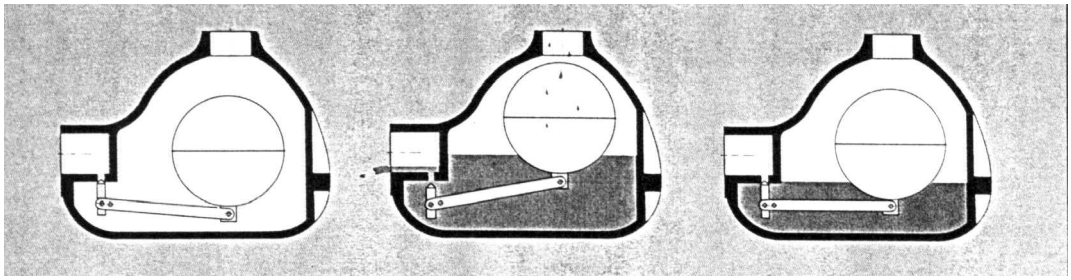
12.1.4 Installation instructions



010	Aluminium gasket	070	Aluminium gasket
020	Reducer	080	Solenoid valve
030	Fitting	090	Male hose fitting
050	Aluminium gasket	100	Timer
052	Dirt trap	110	Solenoid valve plug
060	Double nipple		

12.2 Level-controlled Drains with Floating Level Sensor

12.2.1 Function



Condensate flows into the collecting chamber of the drain lifting a float which is mechanically linked to a valve. When the level lifts the float to a certain point, the valve opens allowing condensate to be forced out by the pressure of compressed air behind it. When the float sinks, the valve closes before the level of condensate reaches that of the valve aperture ensuring that no compressed air is lost. This process is repeated so long as condensate flows into the drain collecting chamber. The valve seat is so arranged that dirt in the condensate does not lodge in it, but sinks to the bottom of the chamber.

12.3 Level-controlled Drains with Electronic Level Sensing (ECO-Drain)

12.3.1 Function

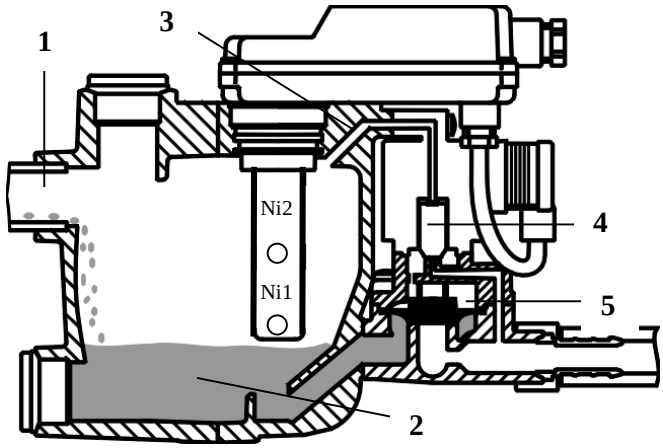


Fig 1
Condensate enters the port (1) and collects in the chamber (2). The diaphragm valve (5) is closed because the pressure balance line (3) and the solenoid valve (4) ensure pressure compensation above the valve diaphragm. The large area above the diaphragm results in a high closing force ensuring a leak-proof seal.

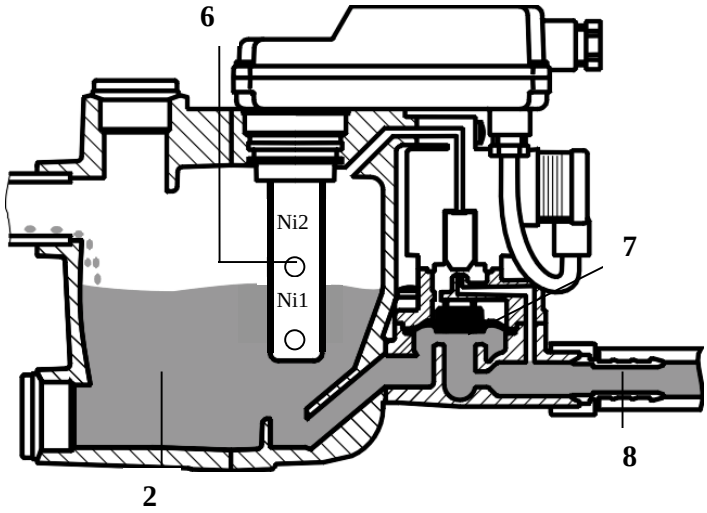
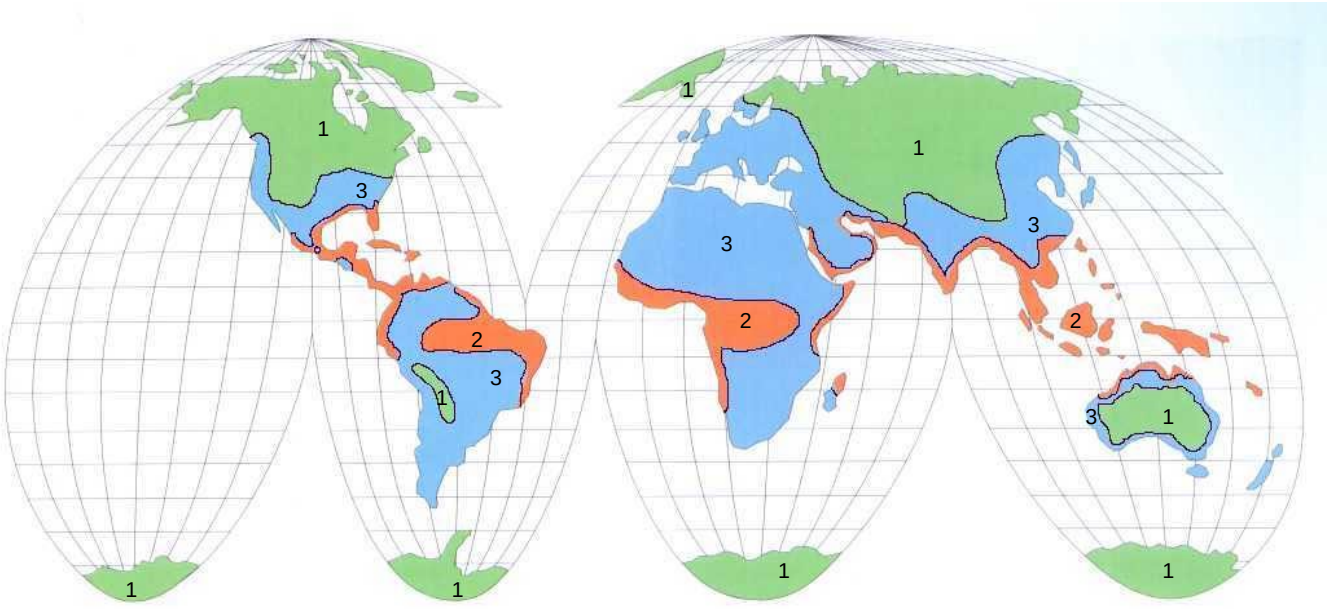


Fig 2
When the collection chamber is filled with condensate the level sensor (6) signals maximum level. The solenoid valve is energised, the pressure balance line is closed and the space above the valve diaphragm vents. The diaphragm lifts off the valve seat (7) and the condensate is forced into the discharge pipe (8) by the pressure in the chamber. The integrated electronics determine the rate of discharge (which is dependant on the pressure in the chamber) and from this calculate the remaining opening time to discharge the condensate completely. Before any compressed air can escape, the valve is closed again. If a fault occurs to prevent discharge, an alarm is sounded after 60 seconds. A red LED flashes and a volt-free contact closes to signal a remote alarm. The drain then switches to timed mode and the solenoid valve is energised for 7.5 seconds every four minutes. This ensures that a drain filled in a non-pressurised state automatically clears the alarm under pressure.



Klimakarte.jpg

The consideration of world-wide climatic zones effects a correction of the respective data of the device.

Green (1) - dry and cold climate (e.g. Northern Europe, Canada, Northern USA, Central Asia)
blue (2) - temperate climate (e.g. Central- and South Europe, Central America)
red (3) - humid tropical climate (e.g. South East Asia Coastline, Amazon and Congo Region)

	Working Pressure min / max. bar	Weight kg	Temperature * min. / max. °C	Application **	Climatic Zone	Max. Compressor FAD m³/min	Max. Dryer Flow Rate m³/min	Max. Filter Flow Rate m³/min
Eco-Drain 21 Plus	0,8/16	0,7	+1/60	a, b a, b	**green** **blue** **red**	5,0 4,0 2,5	10,0 8,0 5,0	50,0 40,0 25,0
Eco-Drain 12 **Eco-Drain 12 CO** **Eco-Drain 12 CO PN 63**	0,8/16 1,2/16 1,2/63	0,8 0,8 0,9	+1/60	a a, b a, b	**green** **blue** **red**	8,0 6,5 4,0	16,0 13,0 8,0	80,0 65,0 40,0
Eco-Drain 13 **Eco-Drain 13 CO** **Eco-Drain 13 CO PN 25**	0,8/16 1,2/16 1,2/25	2,0 2,0 2,2	+1/60	a a, b a, b	**green** **blue** **red**	35,0 30,0 20,0	70,0 60,0 40,0	350,0 300,0 200,0
Eco-Drain 14 **Eco-Drain 14 CO**	0,8/16 1,2/16	2,9	+1/60	a a, b	**green** **blue** **red**	150,0 130,0 90,0	300,0 260,0 180,0	1500,0 1300,0 900,0
Eco-Drain 16 CO	1,2/16	5,9	+1/60	a, b	**green** **blue** **red**	1700,0 1400,0 1000,0	3400,0 2800,0 2000,0	

*) with heating device and professional installed insulation usable down to –25°C
**) a = condensate from an oil-cooled compressor
b = condensate from an oil-free compressing system (aggressive)

Alarm indication / test function

Volt-free contact

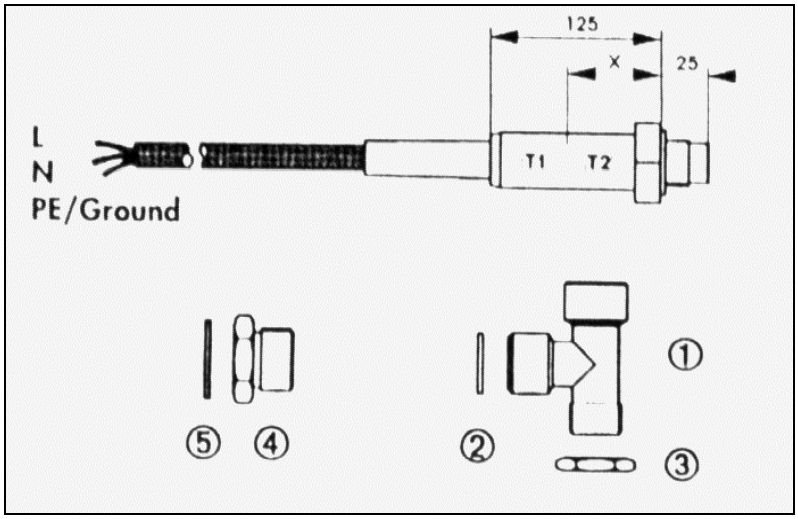
Loading limits for volt-free contact :

Udc/Idc (min.) : > 12 V / > 50 mA
Udc/Idc (max.) : < 30 V / < 500 mA
Uac/Iac (max.) : < 250 V / < 0,5 A

(No lower loading limit necessary with AC current)

12.3.3 ECO-Drain Heating

A heating cartridge with integrated thermostat is available for all ECO-Drain models, except for ECO-Drain 10 and specials. The cartridge, with adapter set, is screwed into the ECO-Drain supply line or into the unit housing. Power is independent of the ECO-Drain.



Heater cartridge
Adapter set comprising:

- **(1)** T-piece
- **(2)** Gasket 22 x 27
- **(3)** Pipe nut G ½
- **(4)** Reducer
- **(5)** Gasket 26 x 33

The metallic fittings of the cartridge transfer the heat evenly to the ECO-Drain housing.
Permissible heat insulating area X: max 30 mm!

Working thermostat T1

- registers the ambient temperature
- switches the heater on when the temperature falls below +6°C and off again when it rises above +15°C

Safety thermostat T2

- switches the heater off at +75°C

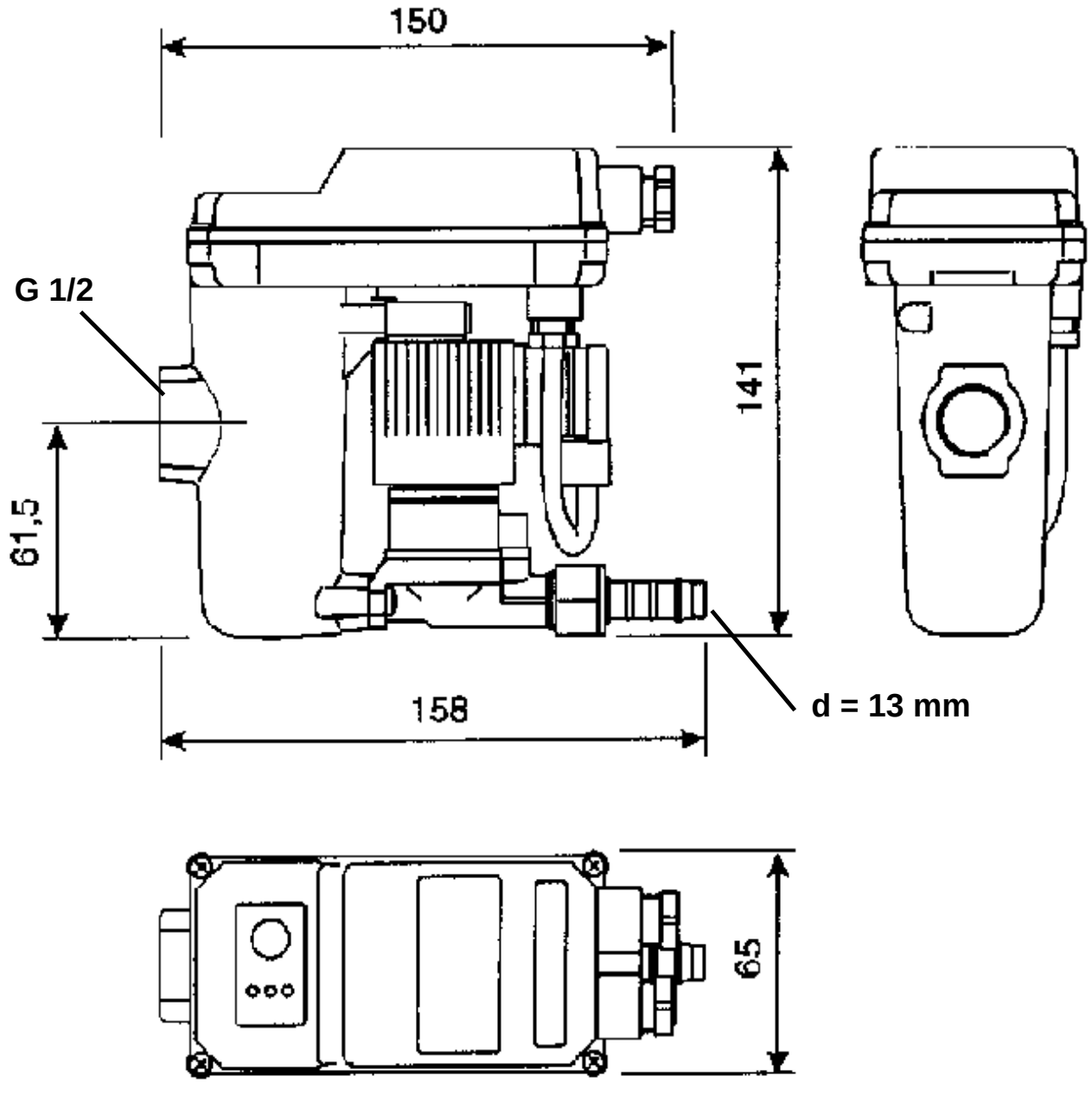
Technical Specifications

Working temperature:	down to -25 °C (with special insulation)
Protection:	IP 65
Weight:	0.45 kg
Connection:	G ½“ (standard), NPT (option)
Materials:	Cartridge: stainless steel
	Adapter: brass
	Gaskets: polyamide
	Power cable: PVC and halogen-free
Cartridge max. pressure:	63 bar
Adapter set max. pressure:	25 bar
Switching temperatures:	“ON“ below +6 °C, “OFF“ above +15 °C
Safety thermostat:	“OFF“ above +75 °C
Cable length:	2 m
Cable section:	3 x 0.75 mm²
Connection (standard):	230 V, AC (±10%), 50 – 60 Hz
Power consumption:	< 125 W

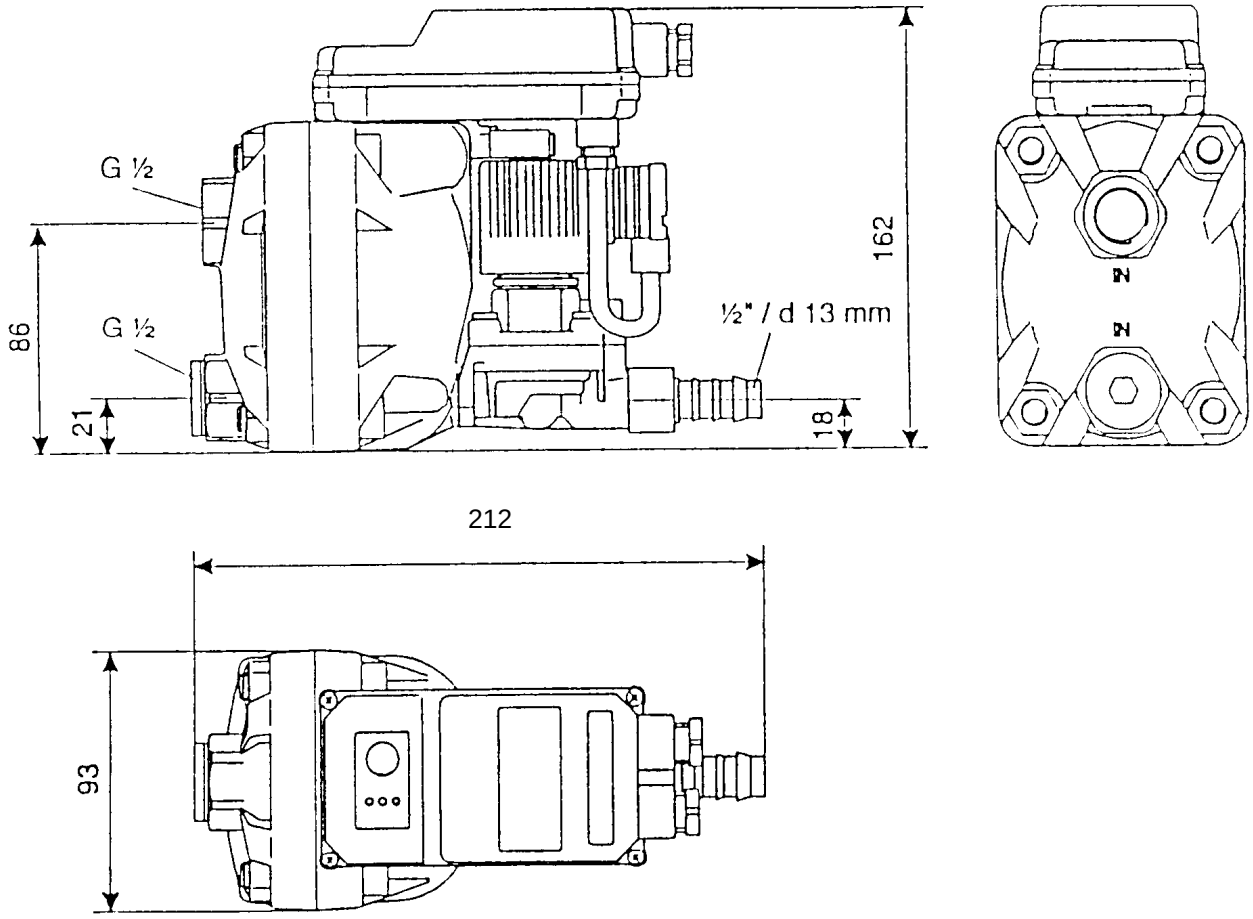
Use appropriate fusing

Voltage	**Power**
230 V, AC ± 10 %	125 W (standard)
110 V, AC ± 10 %	125 W
24 V, AC/DC ± 10 %	50 W

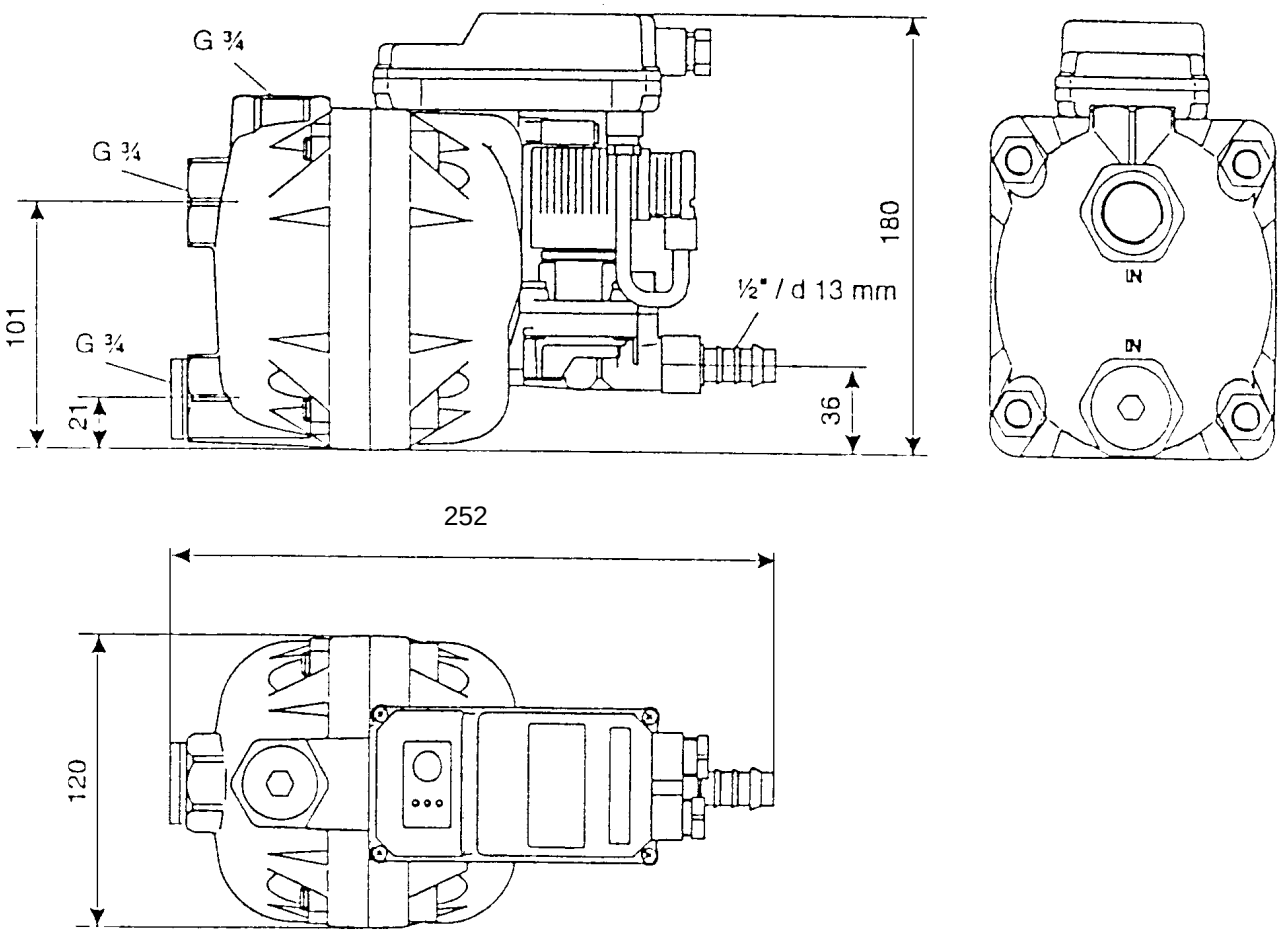
12.3.4.2 ECO-Drain 12



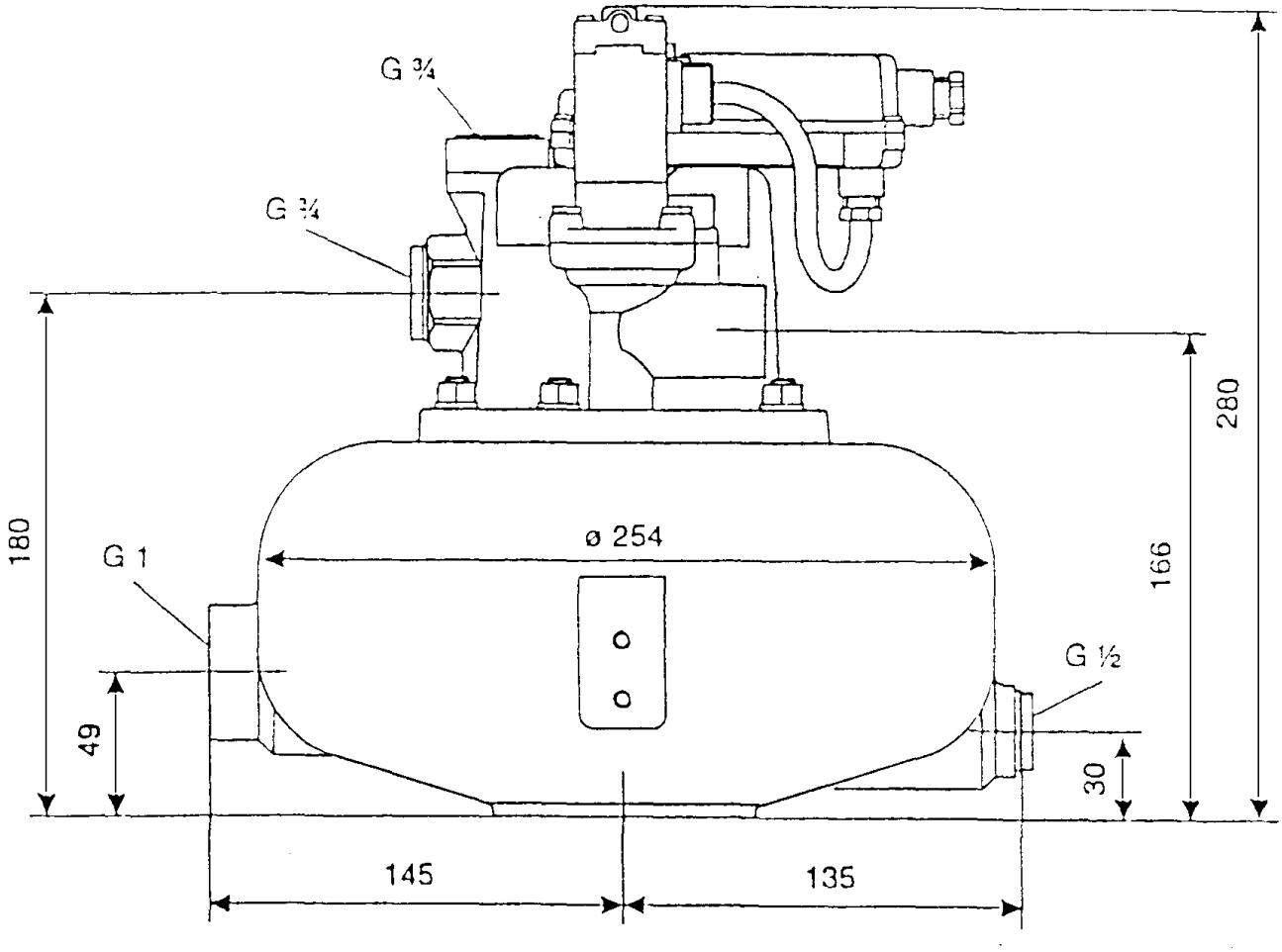
12.3.4.3 ECO-Drain 13



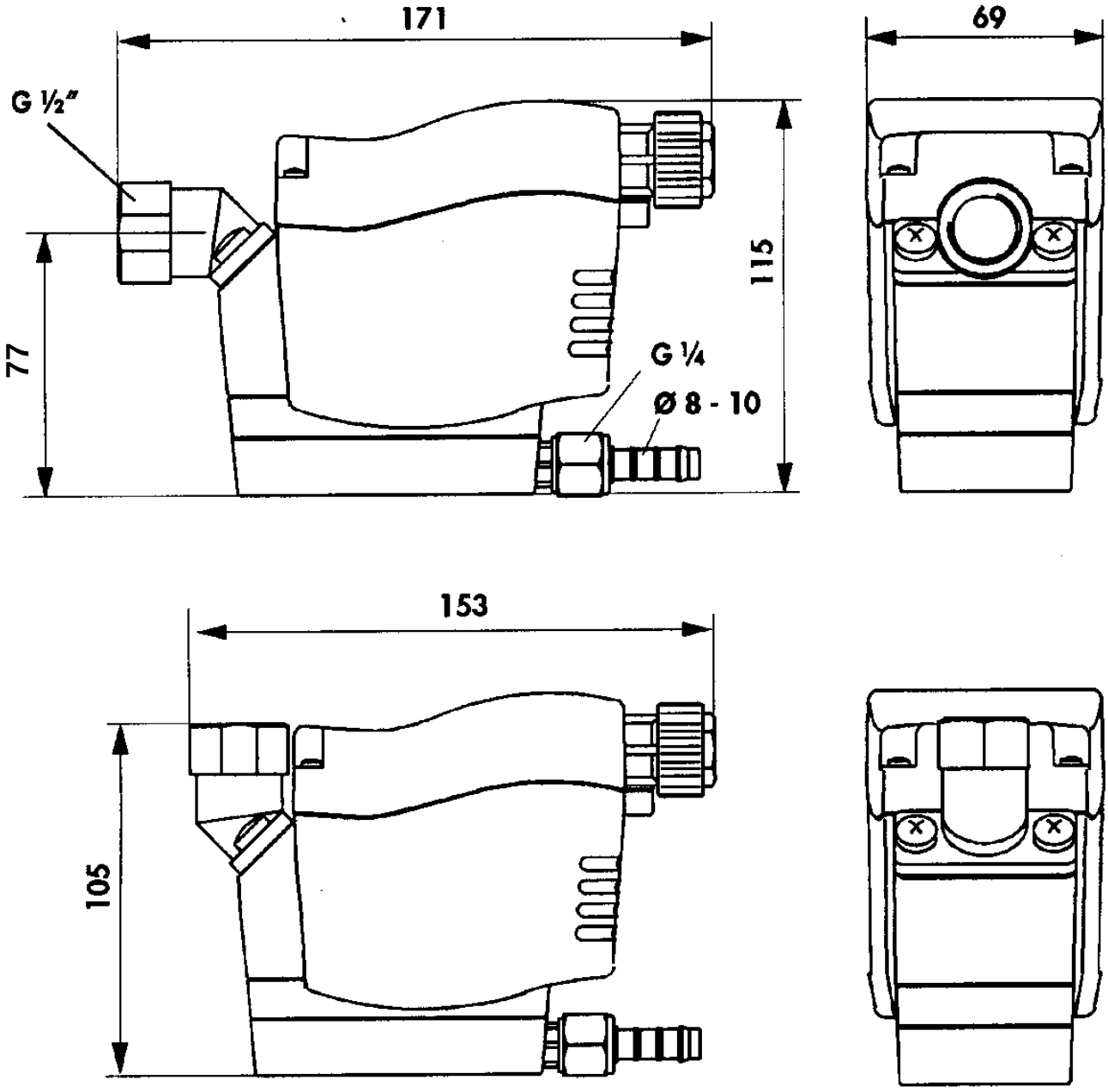
12.3.4.4 ECO-Drain 14



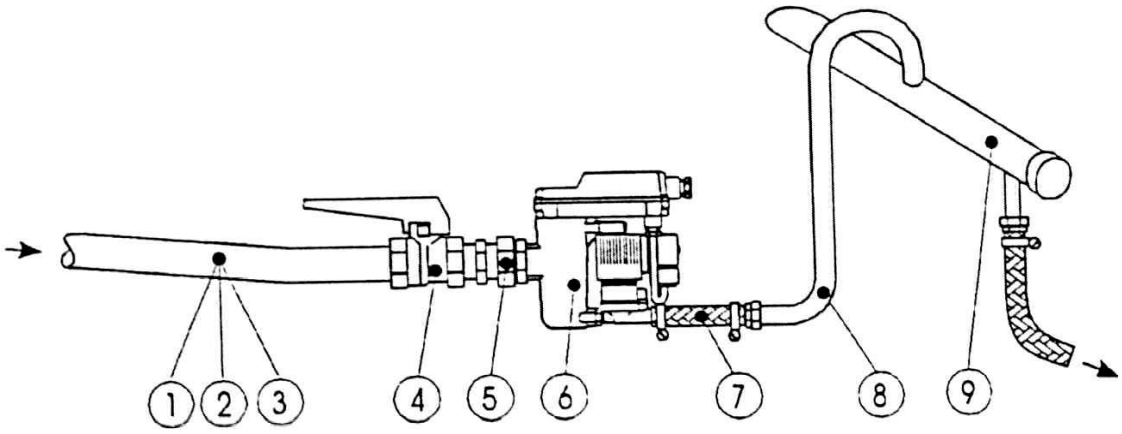
12.3.4.5 ECO-Drain 16



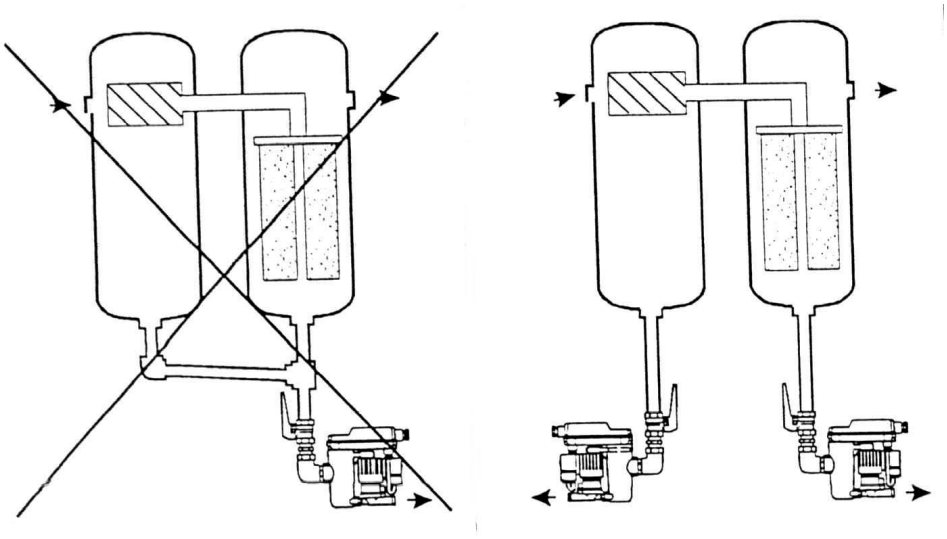
12.3.4.6 ECO-Drain 21 (Plus)



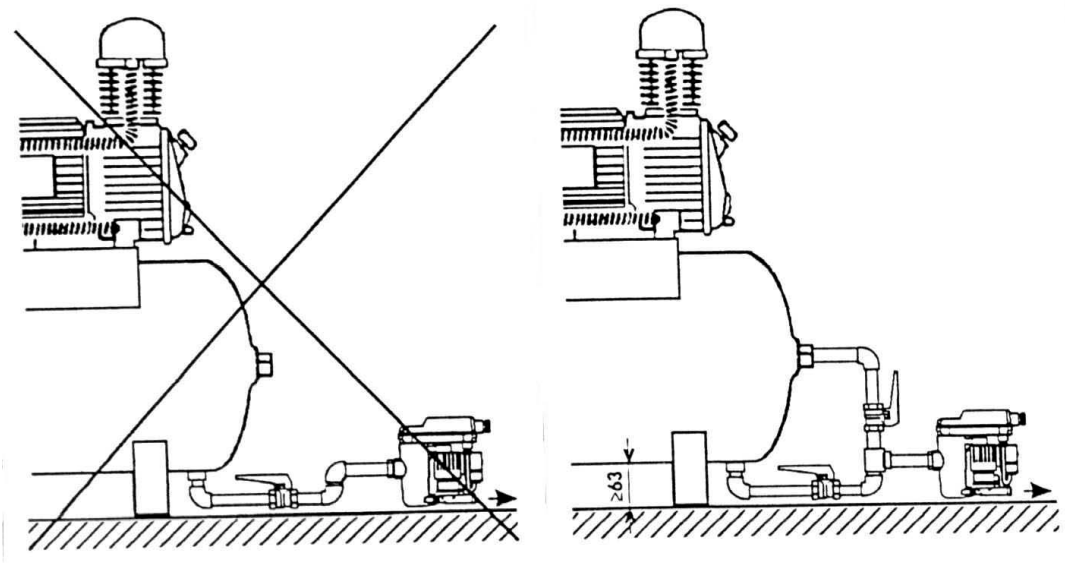
12.3.5 Installation Instructions



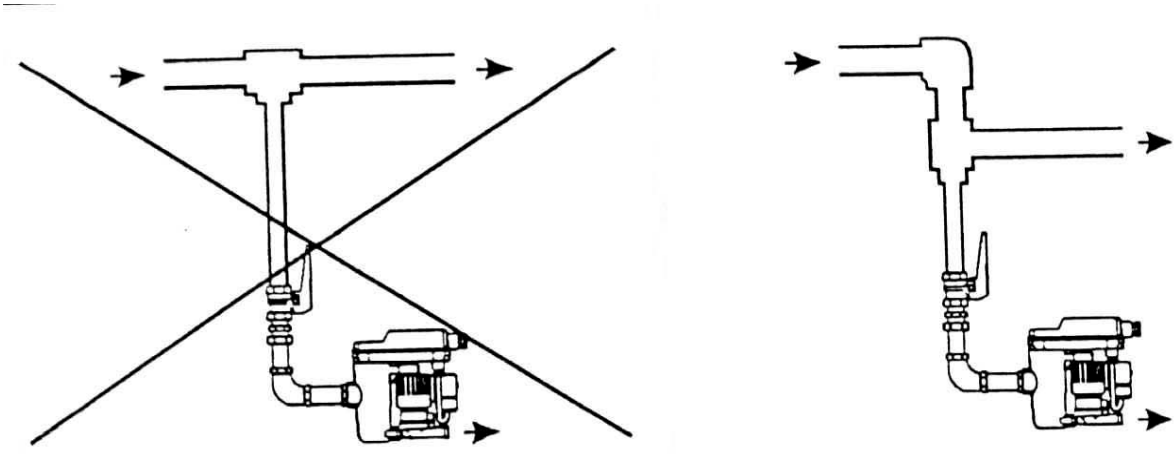
1. Condensate inlet pipe
2. No filter in inlet pipe
3. Downward inclination (fall)> 1%
4. Use ball valve only
5. Use only cylindrical fittings
6. Minimum pressure 0.8 or 1.2 bar (see drain identity label)
7. Short pressure hose
8. The minimum pressure rises by 0.1 bar for each meter rise in the discharge line. Max. rise 5 m.
9. Lay discharge pipe with at least 1% fall



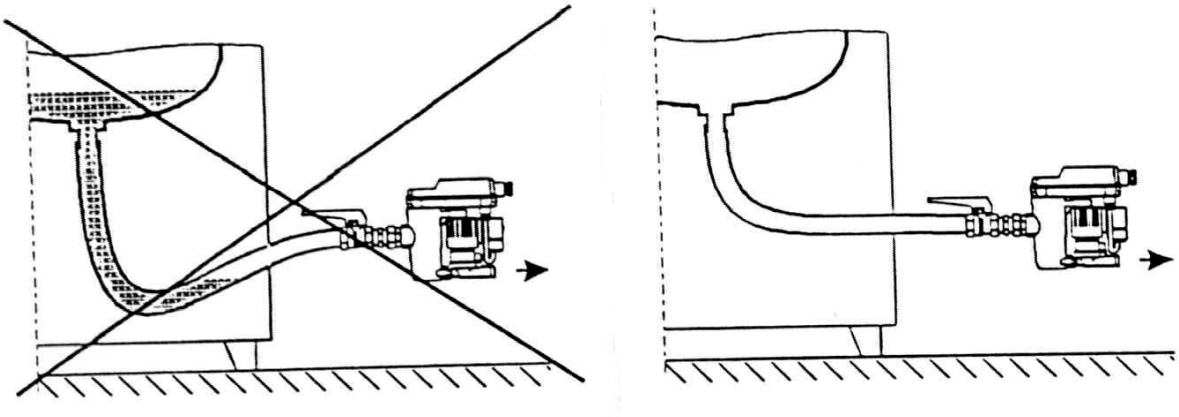
Note: Pressure differential!
Each condensate collector must have its own drain.



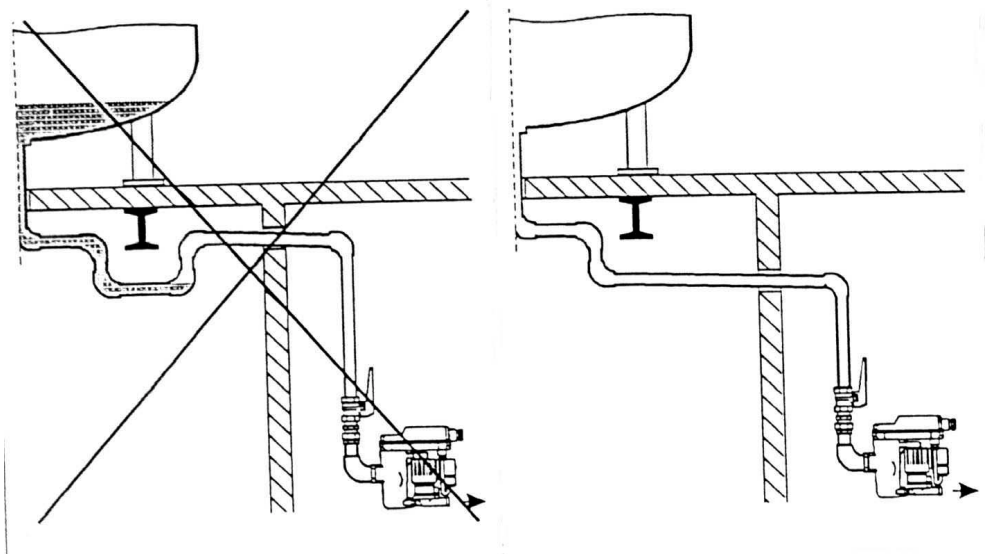
Note: venting!
If there is insufficient fall in the inlet line, a venting line must be installed.



Note: Deflection!
A deflection is useful when draining a line directly



Note: Continuous fall
Avoid water traps when using a hose inlet line.



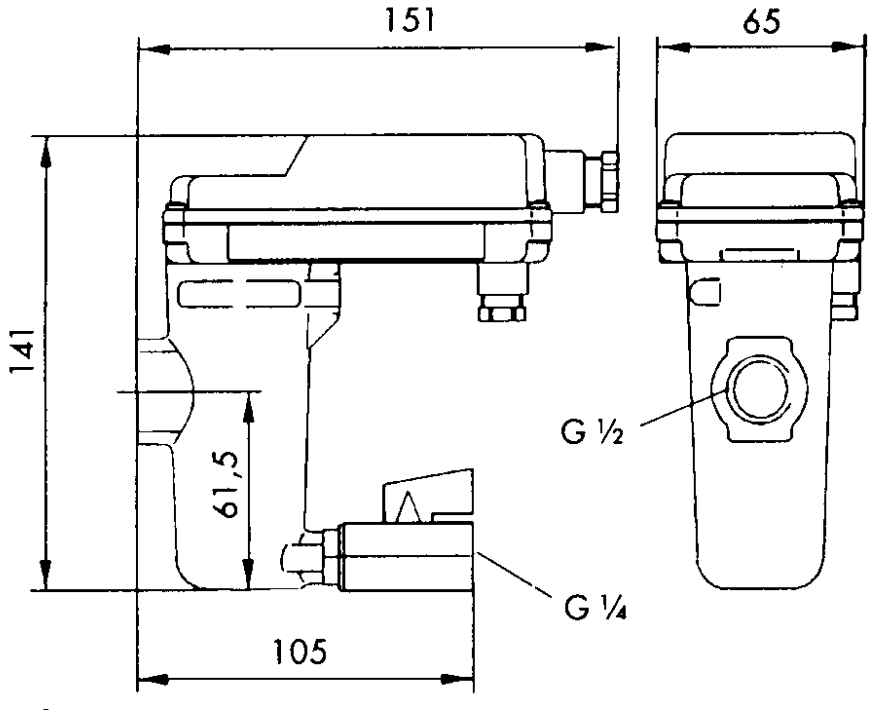
Note: Continuous fall!
Avoid water traps also with piped inlet lines

12.4 Special Units
12.4.1 Condensate Detector

The reliability of the compressed air system is of top priority for quality of air and the processes which it serves.
Installation of a condensate detector gives added security if 100% drainage cannot be guaranteed at all times by the installed drains.
The condensate detector is installed in dry sections of the compressed air system.
An optical and acoustic alarm signal is given as soon as condensate enters the detector.
The alarm is stopped by opening the ball valve to empty the accumulated condensate.
The device is maintenance-free.

Specification

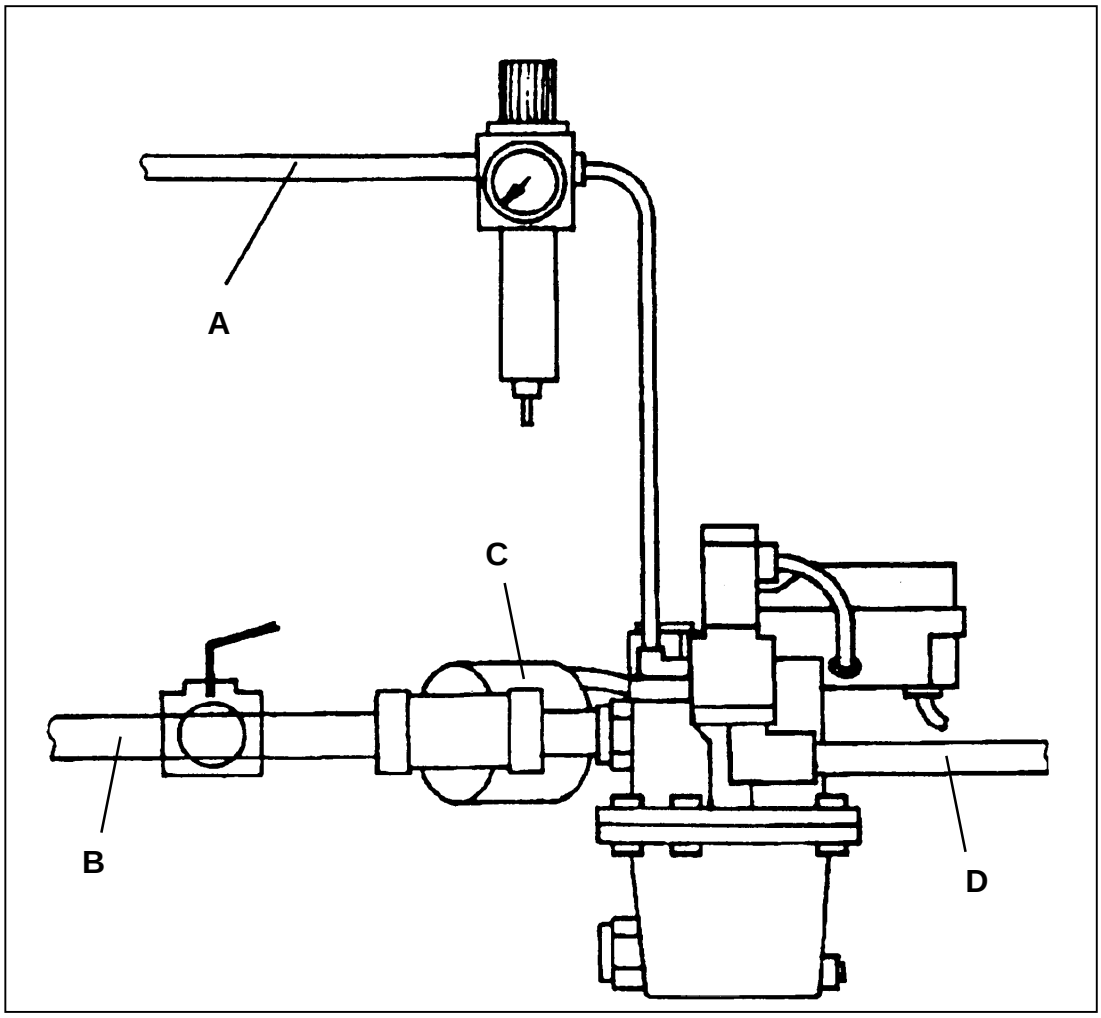
Max. working pressure	16 bar (g)
Condensate temp. range	+1 to +60 °C
Weight	0.70 kg
Power supply	230V, 50-60 Hz
1 relay contact	



12.4.2 Vacuum Version

Function

A capacitive measuring sensor registers the condensate level in the collector. If the switching point is achieved, the pre-control valve opens the control air inlet. The control pressure closes the slanting seat valve so that the condensate inlet pipe is shut off. The pressure in the container rises. The pressure rise in the ECO-DRAIN V causes the membrane valve to open and the condensate is blown out. When the lower switching point on the measuring sensor is reached, the remaining time to empty the collector is calculated and when this has elapsed the pre-control valve closes the control air inlet, purges the slanting seat valve in the condensate inlet pipe and allows condensate to flow once more into the ECO-DRAIN V. A time or pressure setting on the device is not necessary



A – Control air inlet
B – Connection to the vacuum network (receiver etc.)
C – Slanting seat valve
D – Condensate outlet

Technical Data

Size ECO-DRAIN 3V

ECO-DRAIN 6V

Pressure range 100 mbar(a) to 1800 mbar(a)

Control air 4 – 8 bar (g)

Electrical supply 230 V, 1 ph, 50/60 Hz

Installation

A control air supply of 4 – 8 bar (g) (6 bar is optimal) must be provided to serve the ECO-DRAIN and the air must be clean. Connection of the control air is made on the diaphragm cover by a 4/6 plug-in connector (id 4mm, od 6mm, material recommended PA). The control line must be equipped with a pressure reducing valve and pressure must be kept within the set limits. Pressure must not fall below 4 bar or condensate ejection will not take place and if the pressure exceeds 8 bar the diaphragm will be continuously open and the shutoff valve to the vacuum system continuously closed. Otherwise, the same installation instructions apply as in the case of the ECO-DRAIN basic type with regard to piping layout, pipe cross-section and the collecting pipe layout.

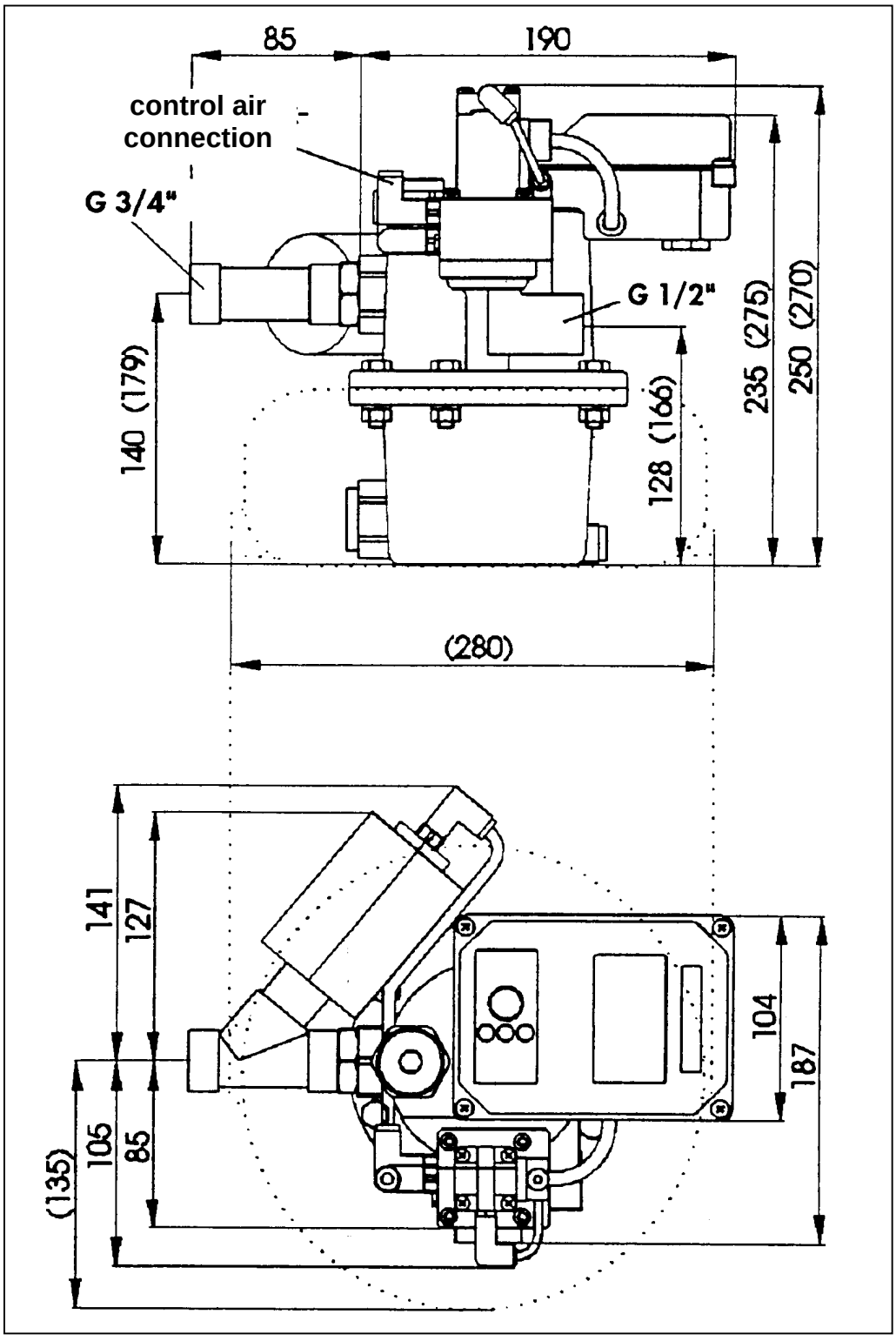
Some control air leaks into the vacuum system while switching.

(ECO-DRAIN 3V at 6bar = approx.2-3 liter normal volume)
(ECO-DRAIN 6V at 6bar = approx.15 liter normal volume)

The ECO-DRAIN V may only be used in systems in which no technical, procedural or safety problems would arise from these amounts of control air (e.g. formation of explosive gas mixtures).

Dimensional diagram

Dimensions in brackets and dotted lines belong to the ECO-DRAIN 6V variant.



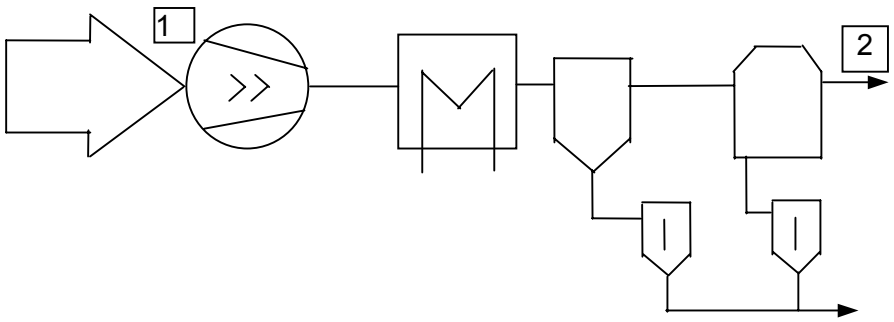
12.5 Condensate Calculations

The volume of condensate to be encountered is calculated by subtracting the permissible water content of the working air from the water content on the air ingested by the compressor.

$$K = \frac{60 \times V_L}{1000} \times \left(\frac{X_1 \times f_{r1}}{p_1} - \frac{X_2 \times f_{r2}}{p_2} \right)$$

K	Condensate volume	Litre/hour
V_L	Compressor FAD	m³/min
f_r	Relative humidity	%
p	Pressure	bar $_{(a)}$
X	Water content at saturation (depending on temperature, value found from table)	g/m³

Index 1 Inlet air condition
Index 2 Working air condition, (after treatment, refrigeration dryer, etc.)



Example:

Compressor FAD	10,0 m³/min
Working pressure	11.5 bar $_{(g)}$
Inlet pressure	1.0 bar $_{(a)}$
Ambient temperature	45°C
Humidity	45%

	Inlet filter	After after-cooler, centrifugal separator, refrigeration dryer	Units
Temperature or pressure dewpoint	45	3	°C
f_r	45	100	%
X	64.848	5.953	g/m³
p	1.0	12.5	bar $_{(a)}$

Calculation

$$K = \frac{60 \times 10}{1000} \times \left(\frac{64.848 \times 0.45}{1.0} - \frac{5.953 \times 1.00}{12.5} \right)$$

K = 17.22 Litre/hour

Water content of air at various temperatures

Dewpoint °C	g/m³	Dewpoint °C	g/m³	Dewpoint °C	g/m³	Dewpoint °C	g/m³
+ 100	588.208	+ 58	118.199	16	13.531	- 25	0.55
99	569.071	57	113.130	15	12.739	- 26	0.51
98	550.375	56	108.200	14	11.987	- 27	0.46
97	532.125	55	103.453	13	11.276	- 28	0.41
96	514.401	54	98.883	12	10.600	- 29	0.37
95	497.209	53	94.483	11	9.961	- 30	0.33
94	480.394	52	90.247	10	9.356	- 31	0.301
93	464.119	51	86.173	9	8.784	- 32	0.271
92	448.308	50	82.257	8	8.243	- 33	0.244
91	432.885	49	78.491	7	7.732	- 34	0.220
90	417.935	48	74.871	6	7.246	- 35	0.198
89	403.380	47	71.395	5	6.790	- 36	0.178
88	389.225	46	68.056	4	6.359	- 37	0.160
87	375.471	45	64.848	3	5.953	- 38	0.144
86	362.124	44	61.772	2	5.570	- 39	0.130
85	340.186	43	58.820	1	5.209	- 40	0.117
84	336.660	42	55.989	0	4.868	- 41	0.104
83	324.469	41	53.274			- 42	0.0093
82	311.616	40	50.672	- 1	4.487	- 43	0.083
81	301.186	39	48.181	- 2	4.135	- 44	0.075
80	290.017	38	45.593	- 3	3.889	- 45	0.067
79	279.278	37	43.508	- 4	3.513	- 46	0.060
78	268.806	36	41.322	- 5	3.238	- 47	0.054
77	258.827	35	39.286	- 6	2.984	- 48	0.048
76	248.840	34	37.229	- 7	2.571	- 49	0.043
75	239.351	33	35.317	- 8	2.537	- 50	0.038
74	230.142	32	33.400	- 9	2.339	- 51	0.034
73	221.212	31	31.744	- 10	2.156	- 52	0.030
72	212.648	30	30.078	- 11	1.96	- 53	0.027
71	204.286	29	24.488	- 12	1.80	- 54	0.024
70	196.213	28	26.970	- 13	1.65	- 55	0.021
69	188.429	27	25.524	- 14	1.51	- 56	0.019
68	180.855	26	24.143	- 15	1.38	- 57	0.017
67	173.575	25	22.830	- 16	1.27	- 58	0.015
66	166.507	24	21.578	- 17	1.15	- 59	0.013
65	159.654	23	20.386	- 18	1.05	- 60	0.011
64	153.103	22	19.252	- 19	0.96	- 65	0.0064
63	146.771	21	18.191	- 20	0.88	- 70	0.0033
62	140.659	20	17.148	- 21	0.80	- 75	0.0013
61	134.684	19	16.172	- 22	0.73	- 80	0.0006
60	129.020	18	15.246	- 23	0.66	- 85	0.00025
59	123.495	17	14.367	- 24	0.60	- 90	0.0001

Example:
Air at +25°C, 100% saturated with water vapour (equivalent to a dewpoint of +25°C) contains 22.830 grams of water per cubic meter.

Required humidity 0.117 g/m³ (equivalent to a dewpoint of - 40°C),
water to be removed by dryer Δ x = 22,713 g/m³.