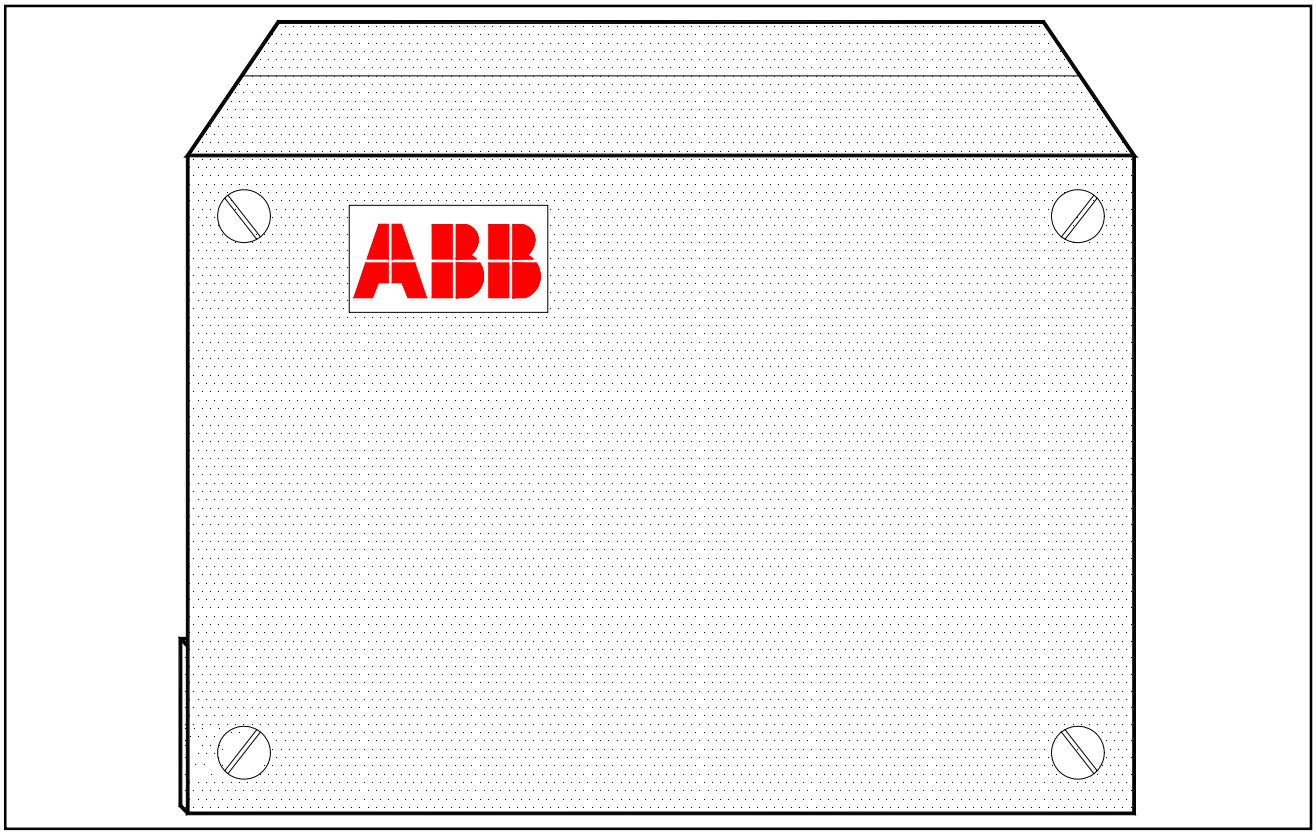
ABB Analytical Limited

MEMBRANE PUMP 3N



Instruction Manual
IM-GAA-002
July 2000

Contents Page

Subject to technical change.

TECHNICAL DESCRIPTION

1. Application

This Diaphragm Pump Model 3N is used to pump a stream of sample gas from the gas sampling point to the gas analyzer through any gas conditioning equipment. It is used whenever the pressure of the process gas at the sampling point is inadequate.

2. Technical data

2.1 Equipment data

Designation	:	Diaphragm Pump Model 3N
Catalogue No. (B-Nr.)	:	23132-0-(plus 7-digit version number)
Case	:	Sheet Steel (CRCA), colour siemens grey (equivalent to RAL 7032)
Degree of protection of case	:	IP 20 per DIN 40 050 (IS-2147)
Case of dimensions (Approx.)	:	Width :205mm Height : 152mm (without gas connections and cable connector) Depth : 120mm
Type of mounting	:	Wall mounting, pump motor shaft horizontal
Weight	:	Approx. 3.5kg
Material of gas conducting parts	:	Valve plate and diaphragm: EPDM (ethylene - propylene) Pump body PP (polypropylene) Hose: FPM (Viton) Hose Nozzle: ETFE Gas port: Stainless steel 316
Gas connection	:	Gas connection with G1/4 female thread IS - 2643 (DIN ISO 228-1), For male fittings, pipe or hose fittings, with G1/4 A threaded connections (ETFE hose nozzles with 6 mm OD for hoses with 4 mm ID or stainless steel for to PTFE 6 mm OD x 4 mm ID & 6 mm OD Metal tube can be used).
Electrical connection	:	Rubber Grommet suitable for 7 to 12 mm OD cable for power supply lead 3 terminals for power supply (L1,N) and grounding conductor (E), for solid conductors up to $4mm^2$ and for stranded conductors up to $2.5mm^2$
Grounding	:	To ground conductor terminal
Power Supply (mains)	:	220V AC + 10%... - 12%, 48...52 Hz approx. 46W The diaphragm pump is also available for the supply voltage 110V + 10%...-12%,50 Hz
Environment capabilities		
Degree of protection	:	IP 20
Climate group	:	3Z
(Correspondence to DIN 40040)	:	(LWR)
Transportation & storage Temp.	:	-25 to + 65ºC

Relative Humidity : <=90% annual average
Condensate permissible

Mechanical capabilities
Mechanical test class : 2F/2sF
Impact : 30g, 11ms
Vibration : 2g, 4…7hz
(g = acceleration due to gravity = 9.81 m/s^2)

2.2 Measurement data

Pumping capacity : Approx. 250l/h at atmospheric pressure; see pumping Capacity graph (Fig. 1) for other pressures

A Pressure at pump inlet: below atmospheric pressure
Pressure at pump outlet : atmospheric pressure

B Pressure at pump inlet: atmospheric pressure
Pressure at pump outlet: above atmospheric pressure

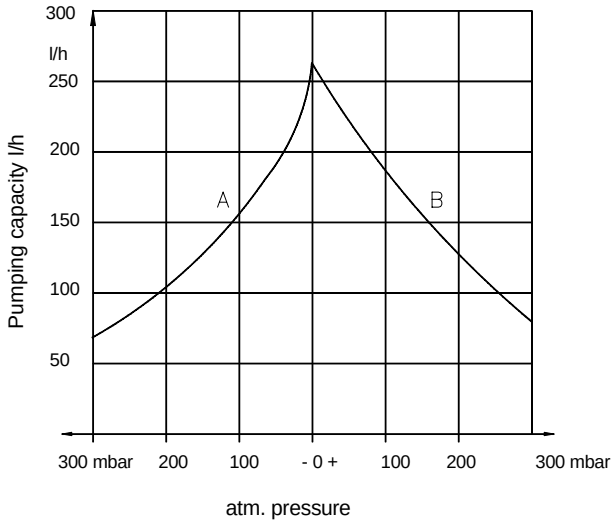


Fig. 1 Diaphragm Pump Model 3N
Pumping capacity graph

Time response :

Output in l/h	30	60	120
Dead Time T_t in s	0.5	0.25	0.2
90%-time T_{90} in s	0.85	0.4	0.35

Effect of external variables

Effect of temperature : ≤ 0.35% change in flow rate per 10ºC
Within the permissible temperature range

Effect of power supply : ≤ ±2.5% change in flow rate per ±10%
Change in mains voltage
≤ 3.2% change in flow rate per 1 Hz change in frequency

Effect of mounting position : The mounting position has no effect on the flow rate (pumping & capacity), however the bearings in the Diaphragm Pump Model 3N are least stressed when the Pump is mounted horizontally.

Smoothness of operation : Normally, mounting on vibration-absorbing elements is not required.

3. Construction of the diaphragm Pump Model 3N

The Diaphragm Pump Model 3N is supplied as a surface-mounting instrument in a metal case (32)*) protected to IP 20 (see Figs. 2 and 6) IS-2147 (DIN 40 050). Once the 4 slotted screws have been removed, the square case cover can be taken off. For wall mounting, the Diaphragm Pump Model -3N has mounting holes (22) of 4.5 mm diameter recessed into each of the 4 corners on the back of the case (see Fig.2). The ventilation holes (26) are located on the left**) and right hand side of the case.

The pump motor (27) and pump body (28) are fastened to a mounting plate (23) inside the case (32). To maintain tightness, the gas connections inserted and glued into the ribbed cover (18) of the pump **body must not be twisted.** The connecting hoses (31) between the gas connections in the case and those in the ribbed cover (18) of the pump body (28) are made of Viton.

On the left hand side of the pump motor shaft (27) there is a fan wheel (29) for air circulation purposes.

The 3 terminals (24) for power supply and grounding and their holder (25) are located on the right hand side next to the pump body.

A step-up transformer 110/220 (35) is mounted in the model which operates on 110V AC supply.

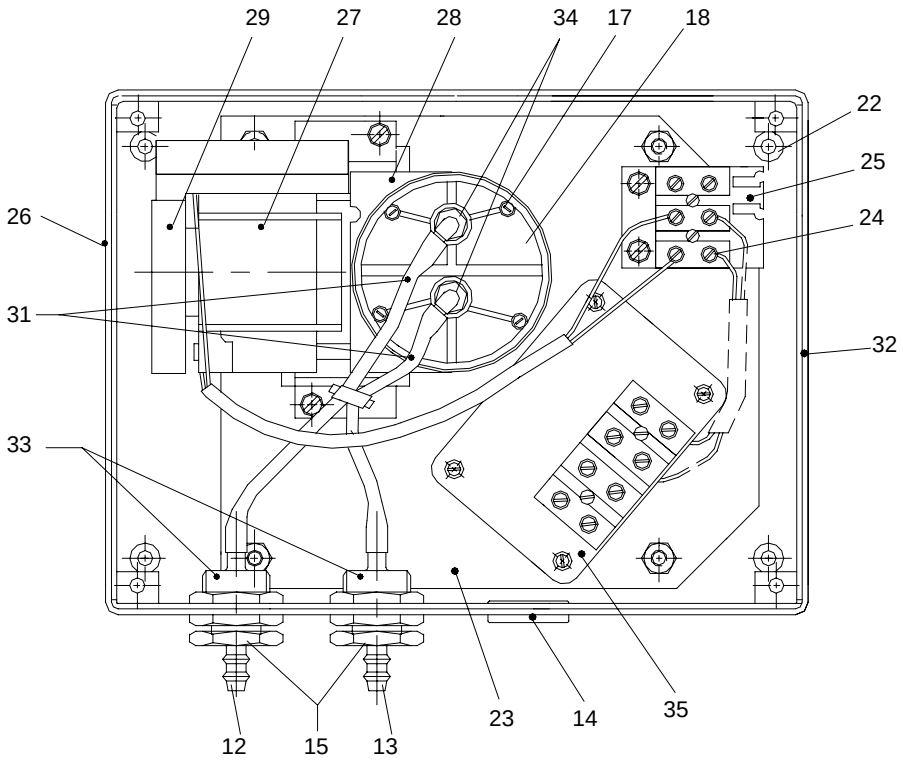


Fig. 2 Diaphragm Pump Model 3N; with cover removed

12.Sample gas inlet
13.Sample gas outlet
14.Gromet connecting cable for power supply lead
17.Flat head screw
18.Ribbed cover
22.Fastening hole for wall mounting (4.5mm diameter)
23.Mounting Plate
24.Terminals for the power supply
25. Terminal holder
26.Ventilation holes
27.Pump motor
28.Pump Body
29.Pump wheel
30.Electrical drive (hidden)
31.Connecting hoses for gas connections “case”–gas connection “pump body”
32.Case
33.Gas connection case
34.Gas connection pump body
35.Step up transformer (optional)

*) The numerals in ( ) are identical to the reference data in the figures of this Operating Manual
**)The description "left", "right" etc. are always to be taken from the point of view of an observer regarding the instrument from the front.

OPERATING INSTRUCTION

4 Mounting and connecting instructions

4.1 Location of the diaphragm Pump Model 3N in the overall measuring setup

In the gas analysis setup, which must always be carefully matched to the particular operating conditions, the Diaphragm Pump Model 3N should be located downstream of any condensate removal - condensation section with condensate trap (e.g. electric sample gas cooler). Since a certain amount of pump wear can never be completely excluded, a filter (e.g. membrane filter) should be placed downstream of the Diaphragm Pump Model 3N. One example of the arrangement of individual components in a sampling system for gas analysis is shown in Fig.3.

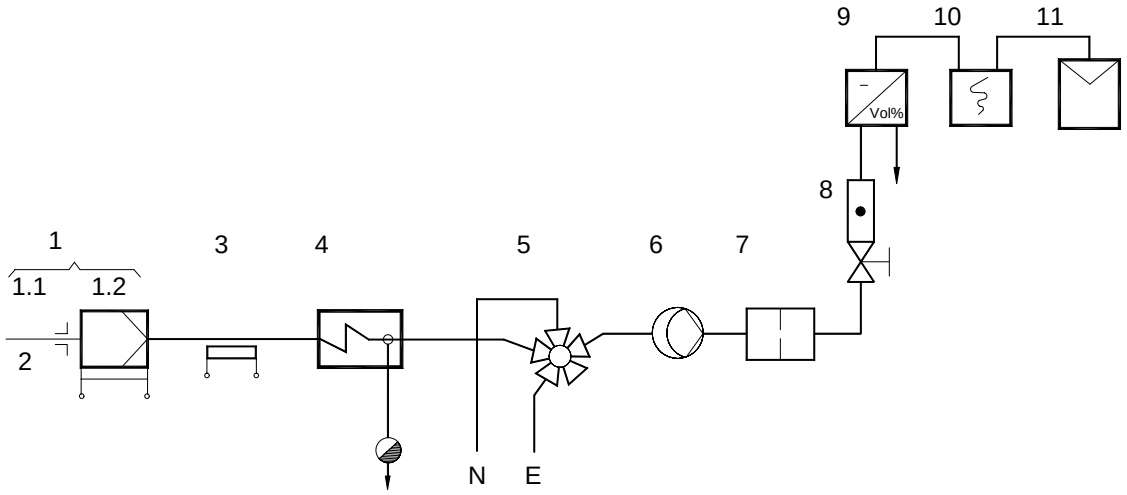


Fig. 3 Example of a complete gas analysis setup for flue gas monitoring

1	Gas sampling probe with external filter
1.1	Sampling probe (max. 900ºC)
1.2	Heating device for case with external filter
2	Feed pipe with flange Bushing tube (to be provided by the customer)
3	Heating device line to prevent freezing
4	Electric sample gas cooler
5	Five-way valve
6	Diaphragm Pump Model 3N
7	Membrane filter
8	Flowmeter with adjustable needle valve
9	Gas analyzer in surface-mounting case (field unit)
10	Recorder
11	Controller
N	Zero gas
E	Span gas

4.2 Mounting the unit

After removing the case cover, the Diaphragm Pump Model 3N is screwed to a wall, mounting plate, control panel etc. using the 4 mounting holes (22) of M4 diameter (see Figs. 2 & 6). Normally, mounting on vibration - absorbing elements is not required. The preferred connection or operating position is as follows:

- Gas connection for
  Sample gas inlet (12) - left, symbol ⌞ **O**
  Sample gas outlet (13) - right symbol **O** ⌟
  And
- Grommet for cable (14) for power supply lead facing downwards.
- Pump motor shaft horizontal (this result in minimum bearing load.)

4.3 Sample gas connection

This sample gas connections on the Diaphragm Pump Model 3N have been designed such that the sample gas lines to be connected may be either

Flexible Hose with 4mm ID and or 6mm OD

Metal tubing with 6mm OD or PTFE tube 4mm Idx6mm OD

For flexible hose connections, the ETFE hose nozzles - 5 mm OD - for hoses with 4 mm ID are to be screwed into the female fittings. The O-rings provided - 13 mm ID, 17 mm OD-must be inserted first to provide a proper seal. In addition, a hose connection can be made by means of hose fittings with G1/4 A IS-2643 (DIN ISO 228/1) threaded connections.

If metal tubing is used for the gas connections, appropriate tubing fittings or the like with G1/4 A IS-2643 (DIN ISO 228/1) Threaded connections (e.g. ferrule fittings) for tubing with 6mm OD and 4mm ID are required.

If PTFE tubing is used for the gas connecting tube fitting with G1/4 A IS-2643 (DIN ISO 228/1) threaded connection 6mm OD ferrule suitable to PTFE tube are required.

4.4 Power Connection

The power connection is always to be made last and with the power switched off (see Fig-4).
The Diaphragm Pump Model 3N is connected to the power supply (mains) via terminals L1 and N in accordance with Fig. 4.The unit should be grounded in accordance with local codes. The ground terminal located next to the power connection terminals is provided for this purpose.

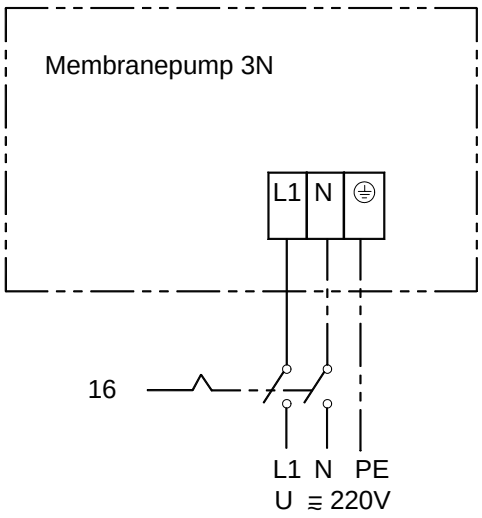


Fig.4 Electrical connection diagram for the Diaphragm Pump Model 3N

(16) External 2-pole switch

For maintenance of the entire gas analysis setup as well as for safety reasons, it is necessary that the Diaphragm Pump Model 3N be installed such that it may be disconnected from the supply voltage with an external 2 - pole switch (16) or by means of a grounding connector. (This external switch or grounding connector is not supplied with this unit). This facilitates maintenance work such as changing the filter or removing condensate.

The power line is introduced via Rubber Grommet (14) on the underside of the pump case (see Figs. 2&6)

Before any other connection is made the protective around terminal shall be connected to a protective conductor

The mains plug shall only be inserted in a socket outlet provided with a protective ground contact. The protective action must not be negated by the use of an extension cord without a proper protective conductor.

In selecting the line material as well as when laying and connecting the power supply, the requirements of VDE 0100 "Specifications for the installation of power system with rated voltages up to 1000 V" or equivalent local codes are to be observed.

5 Initial operation

Before switching on the apparatus, make sure that it is connected to correct power supply.

The Diaphragm Pump Model 3N will start operating upon switching on the mains voltage (=supply voltage)

6 Maintenance

Except for occasional replacement of the diaphragm (9) and the valve plate (37), the Diaphragm Pump Model 3N is completely maintenance-free. The replacement intervals depend on the particular local operating conditions to which the gas analysis setup is exposed.

Changing the Diaphragm and the valve plate (see Fig. 5)

Since this requires opening the case of the Diaphragm Pump Model 3N and exposing live parts (e.g. power supply connections, motor connections), the following warning in accordance with DIN 57 411 Part 1 a/VDE 0411 Part I a/2.80" "Safety measures for electronic measuring apparatus", should always be observed for safety reasons :

The apparatus has to be disconnected from all voltage sources before it is opened for any adjustment, replacement, maintenance or repair.

Disassembly

- Unscrew case cover and remove
- Make a mark (M) on head plate (3), intermediate plate (2), and housing (1) with a pen/marker. This help to avoid wrong assembly.
- Unscrew the four CSK head screws (4) in the head plate and lift the head plate with the intermediate plates of the pumps housing.

Changing the diaphragm

- Turn the fan to bring structural diaphragm (9) to top dead-center.
- Lift the edge of the diaphragm and, gripping it on opposite sides, unscrew it by turning it anticlockwise. Please take care that disc. spring (7) and diaphragm spacer (6) on the threaded portion do not fall into the housing while opening.
- Check all the parts are free from dirt and clean them if necessary.
- Put the diaphragm support (5), disc spring (7) and diaphragm spacer (6), in that order on the thread of new diaphragm.
- The concave side of disc spring should be towards the diaphragm.
- Turn the fan until the connecting rod (8) at top dead center.
- Screw the diaphragm, complete with diaphragm support, diaphragm spacer and disc spring into the connecting rod clockwise and tighten it by hand.

When replacing the diaphragm, Care should be taken that no oil gets on the diaphragm and valves.

Changing the valve plates

- Separate the head plate (3) from intermediate plate (2)
- Remove the valve plates (37) and spring (38) from intermediate plate (3)
- Check the valve seats in the head plate and intermediate plate are clean. If scratches, distortion, or corrosion are evident on these parts, they should be replaced.

- Lay new valve discs in the recesses in the intermediate plate. The valve plates for suction and pressure Sides are identical; as are upper and lower side of the plates.
- Check that the valve plates are not deformed by moving them gently "side ways in their recesses"
- Lay the sealing ring on the intermediate plate.

Refitting the pump head

- Turn the fan to bring the diaphragm at top centre
- Place the intermediate plate (2) with valve plates (37) and sealing spring (38), and head plate (3) on the housing in the position by the marking (M).
- Check that the head plate is centered by moving it gently sideways
- Gently tighten the screws (4) evently and diagonally
- Turn the fan to check that the pump rotate freely
- Turn the fan to bring the diaphragm to top dead center
- Now tighten screw (4) firmly

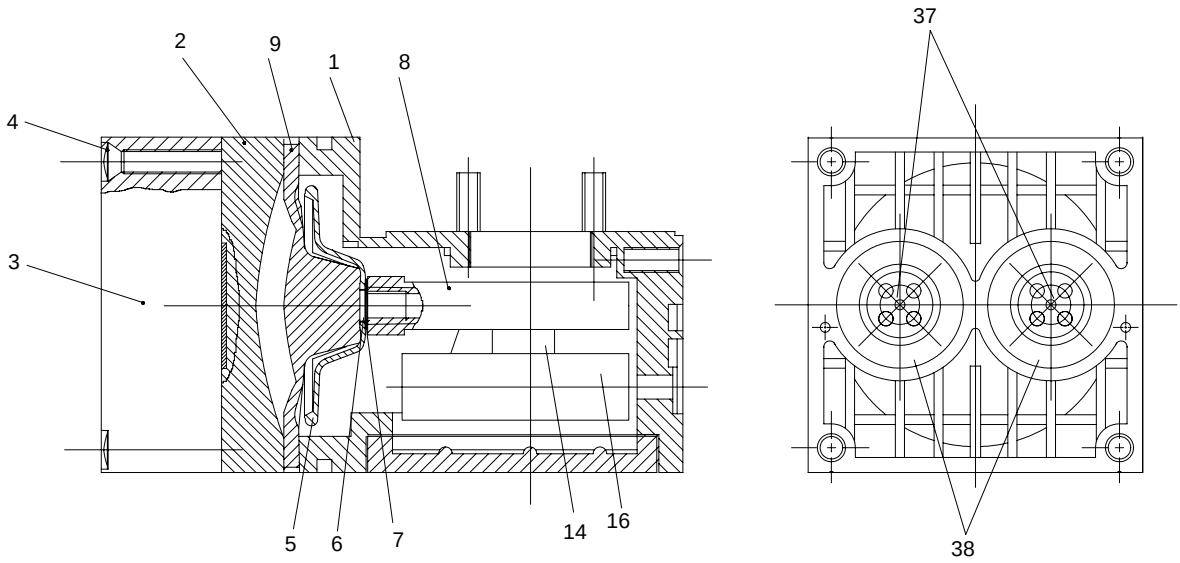


Fig 5 Pump body, pump motor and fan wheel of the diaphragm Pump Model 3N

1. Pump Body
2. Intermediate plate
3. Head Plate
4. CSK Head Screw
5. Diaphragm support
6. Diaphragm spacer
7. Disk Spring
8. Connecting Rod
9. Diaphragm
14. Eccentric
16. Counter weight
37. Valve plate
38. Sealing rings

7 Accessories

A bag of replacement parts (B-Nr. 0801928) with the following contents is provided with the original unit:

1. Diaphragm made of EPDM (9)
1. Valve plate made of EPDM (37)
2. O-ring made of EPDM (38)
4. CSK-head screws (4)

8 Packing

Before removing and shipping the Diaphragm Pump Model 3N, the sample gas inlet, sample gas outlet should be well sealed with protective caps.

If the original packing is no longer available, the Diaphragm Pump Model 3N must be wrapped in paper and placed in a sufficiently large crate lined with shock-absorbing material (excelsior, spun rubber on the like). If excelsior is used the packed layer should be at least 10 cm thick on all sides.

For overseas shipment, the Diaphragm Pump 3N must be additionally sealed in 0.2 mm thick polyethylene with a desiccant (e.g. silica gel). Furthermore for this type of shipment the transport container should be lined with a layer of bituminous paper.

These packing prescriptions also apply when returning the unit to the manufacturer (e.g. for repair)

9 Spare Part List

Whenever replacement parts are needed, the bag of replacement parts mentioned in Section 7 should be ordered from the manufacturer by specifying the designation and catalogue number (B-Nr.). Furthermore when ordering spare parts or making complaints of any kind, the serial number on the Diaphragm Pump Model 3N should always be given.

Description	Catalogue No. (B-Nr.)
Bag of replacement parts (see section 7 for contents) It is not possible to order partial contents of the bag.	0801928
Special nozzle PTFE suitable for flexible Hose 4mm ID	0402180
`O' Ring for PTFE nozzle : 12OD x 3	0651885
Tube connector G1/4 x 6mm OD Metal tube	9622091
Tube connector G1/4 x 6mm OD PTFE tube	9622042

Note

All spare part sales are handled by means of EDP. Thus, the catalogue designation (Catalogue No.) on the order confirmation, shipping papers and invoice are subject to the laws of automatic data processing.

The Catalogue No. (B-Nr.) is the sole criterion!

10 Dimensional Drawing

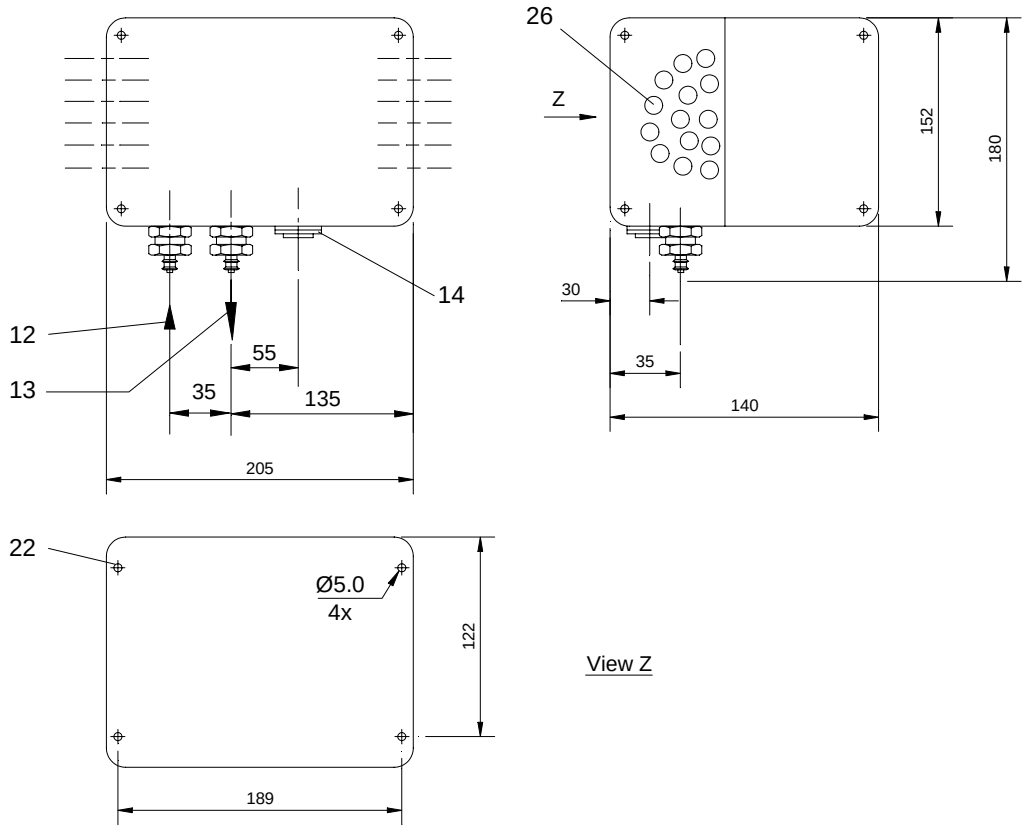


Fig. 6 Dimensional drawing of the Diaphragm Pump, degree of protection of case IP 20 (dimensions in mm)

12	Sample gas inlet	Gas connection with G1/4 female thread IS-2643 (DIN ISO 228/1 for male fitting, tubing or hose fittings, with threaded connection G1/4 A IS-2643 (DIN ISO 228/1)
14	Grommet	for connecting cable for power supply lead
22	Fixing holes for wall mounting (Ø5mm)	
26	Ventilation holes	

ABB Analytical Limited
14, Mathura Road, Faridabad-121 003, Haryana (INDIA)
Ph.: 0129-5279627, 5279628, 5279739, 5279740 Fax : 0129-5279692
E-mail : ineba@nda.vsnl.net.in
Regional Offices: - Mumbai • Chennai • Vadodara