Supplementary

Operating instructions

for

SF6 Volume Percentage Measuring Device

Type-no: 3-027-R002

To reduce the risk of operator error, please read this supplementary manual, as well as original version prior to using the 3-027-R002. Non-observance of specific operating instructions may result in damage to equipment and/or personnel, release of DILO Company, Inc. liability, and termination of warranty.

This supplement to the 3-027-R002 operating manual is offered by DILO Company, Inc. as a customer service to augment the instructions given in the original version. Where conflict exists between what is contained herein and the original, the latter shall take precedence.

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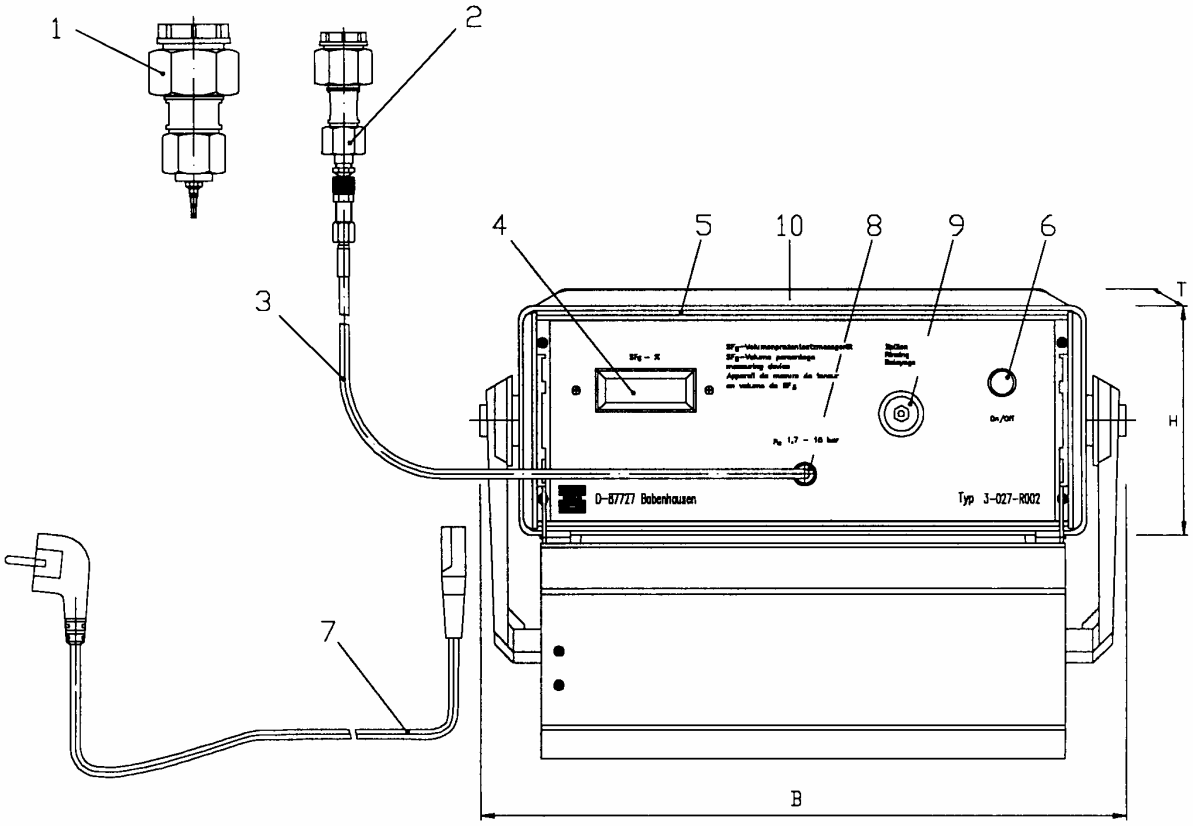


Descriptions of components:

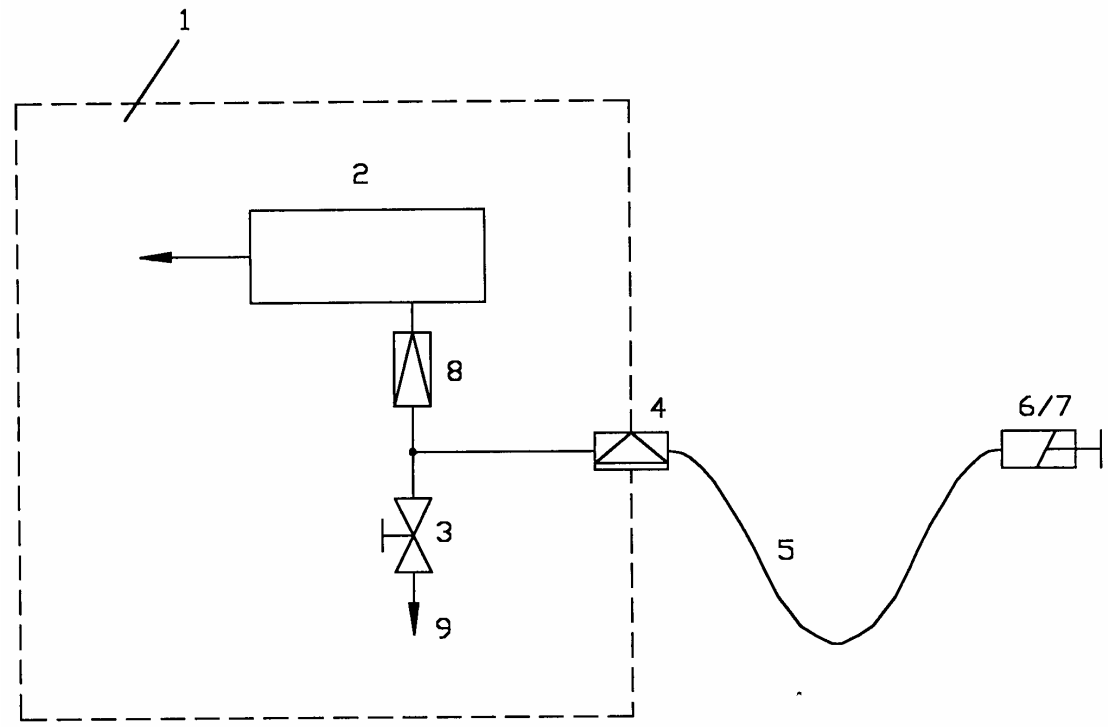
1	DILO – coupling DN20
2	DILO – coupling DN8
3	Connecting hose (6 foot)
4	Digital display
5	Main housing
6	Power button
7	Power cable (8 foot)
8	SF6 Inlet
9	Purging valve
10	Exhaust port (on rear of unit)
11	Transport case (not illustrated)

Technical data

Dimensions of the devices (with handle):

Width:	16.3 inches
Height:	6.1 inches
Depth	17.7 inches
Weight:	25.3 lbs.
Measuring media:	SF6/N2 o SF6 air mixtures
Measuring range:	0-100% SF6 by volume
Operating pressure:	Unit input pressure should be between 25 and 145 psig. A pressure regulator must be used in series with the unit if pressures are greater than 145 psig. If inlet pressures drop below 20 psig, the device will still be accurate, but the time required to get a valid reading will increase.
Response time:	Approx. 1 minute when using a purged hose
Measuring pressure:	The pressure at the sensor is at atmospheric pressure (0 psig)
Measuring accuracy:	+/- 1% SF6 by volume.
Flow rate:	1.2 grams per minute using 100%, and inlet pressures of 130 psig.
Power supply:	See nameplate on device
Operating temperatures:	-4°F – 104°F ambient
Main fuse:	630 mA/mT

Gas Flow Diagram



Pos	Description
1	Main housing
2	Sensor
3	Purging valve
4	SF6 inlet
5	Connecting hose (6 foot)
6	DILO DN8 coupling
7	DILO DN10 coupling
8	Internal pressure regulator (max. inlet pressure 145 psig)
9	Exhaust

Functional Description:

The SF6 percentage analyzer comes equipped with a connecting hose, power plug, and two DILO self-sealing couplings (DN8 and DN20). The unit has been designed to measure percentages of SF6, quickly, and accurately. It is most accurate with SF6/air or SF6/nitrogen mixtures, however, it can be used in other gas mixtures (see page 9)

The device is easy to use, and is completely independent of breaker pressure or temperature. The 3-027-R002 sensor calculates the speed of sound through the gas being tested. The test readings are compared against known values for pure SF6. The result is displayed on the digital read-out as a SF6 volume percentage. The resolution on digital display is 0.1%.

Any gas traveling through the sensor chamber is reduced to atmospheric pressure (0 psig) via an internal regulator. This makes the unit inlet pressure independent. The device will function properly if the inlet pressures remain between 20 and 150 psig.

Because the flow rate through the sensor is very slow (1.5 grams per minute), a purging valve is located between the inlet and the sensor. By briefly opening this valve, the operator can significantly reduce the time needed to obtain an accurate reading. This allows the gas sample to reach the sample faster.

WARNING:
The gas outlet, or exhaust port, must not be closed or blocked off. The resulting back-pressure will destroy the measuring sensor and chamber.

Typical use for the 3-027-R002

- Testing new gas when received from supplier.
- Testing for dropping percentages when suctioning gas from equipment (due to air leaks).
- Routine gas testing on gas insulated equipment.

How to use the device:

a) Place the device as close to the filling port on the gas insulated equipment (GIE), and connect power.
b) Turn on the device. As soon as the digital display stops blinking, and numbers are displayed, it is ready to take a reading.
c) Using the supplied connecting hose, connect the device to the GIE. The male pin on the hose must connect to the inlet of the device. The female end must be used to connect to the DILO adapters (DN20 or DN8).

Wrong adapters?
If the GIE in question does not match the DN20 or DN8 couplings supplied with the device, the male pin may be removed from either of the fittings. The other end of the male pin is a male 1/8" parallel thread. This can be used to connect to a female 1/8" NPT. Using commercially available fittings will allow for easy adaptation to various common fittings (i.e. ¼" JIC, 3/8" JIC, etc.). If you are unable to make an appropriate adapter, please call DILO Company, Inc. at the numbers below.

d) As soon as the gas begins to flow, the digital display begins to indicate change. The reading displayed is considered accurate once it ceases to fluctuate.
The response time can be shortened significantly by opening the purging valve (labeled Scavange on the device) for approximately 2 seconds for every 3 feet of hose. This allows the gas to reach the sensor faster.

Trouble shooting:

All components within the 3-027-R002 are non-user serviceable. Do not open the device, unless authorized by a factory representative. Any unauthorized tampering will void warranty.

Error codes:

Internal faults, and extreme temperature conditions may cause the unit to display error codes. These codes are designed to help the operator diagnose problems. Possible codes are as follows:

E-32:	Fault in RAM of microprocessor. This requires factory servicing
E-40:	Operating temperatures are too cold (below -4°F). Warming the gas above this temperature will resolve the problem.
E-41:	Operating temperatures are too hot (above 104°F). Cooling the gas below this temperature will resolve the problem.
E-00 to E-30:	Other fault codes. This requires factory servicing

If neither the power switch or display illuminate when turned on, check the main fuse. The unit is supplied with an over-voltage protection circuit. If this circuit fails, it will continually blow the fuse. If this happens, return the unit to the factory for servicing.

Measuring SF6/CF4 gas mixtures:

The 3-027-R002 can be used to determine the SF6 percentage by volume in an SF6/CF4 mixture. However, the reading displayed must first be cross referenced with the table on the following page (page 10). Accuracy of the device drops to +/- 4% by volume when working with SF6/CF4 mixtures.

For example:

A gas mixture consisting of SF6 and CF4 are tested. No other gases (such as air) are present. After displaying a reading of 79%, we must use the table on the following page to determine ACTUAL SF6 content.

Cross referencing the 79% on the value, we see that the actual SF6 content is only 58.3%.

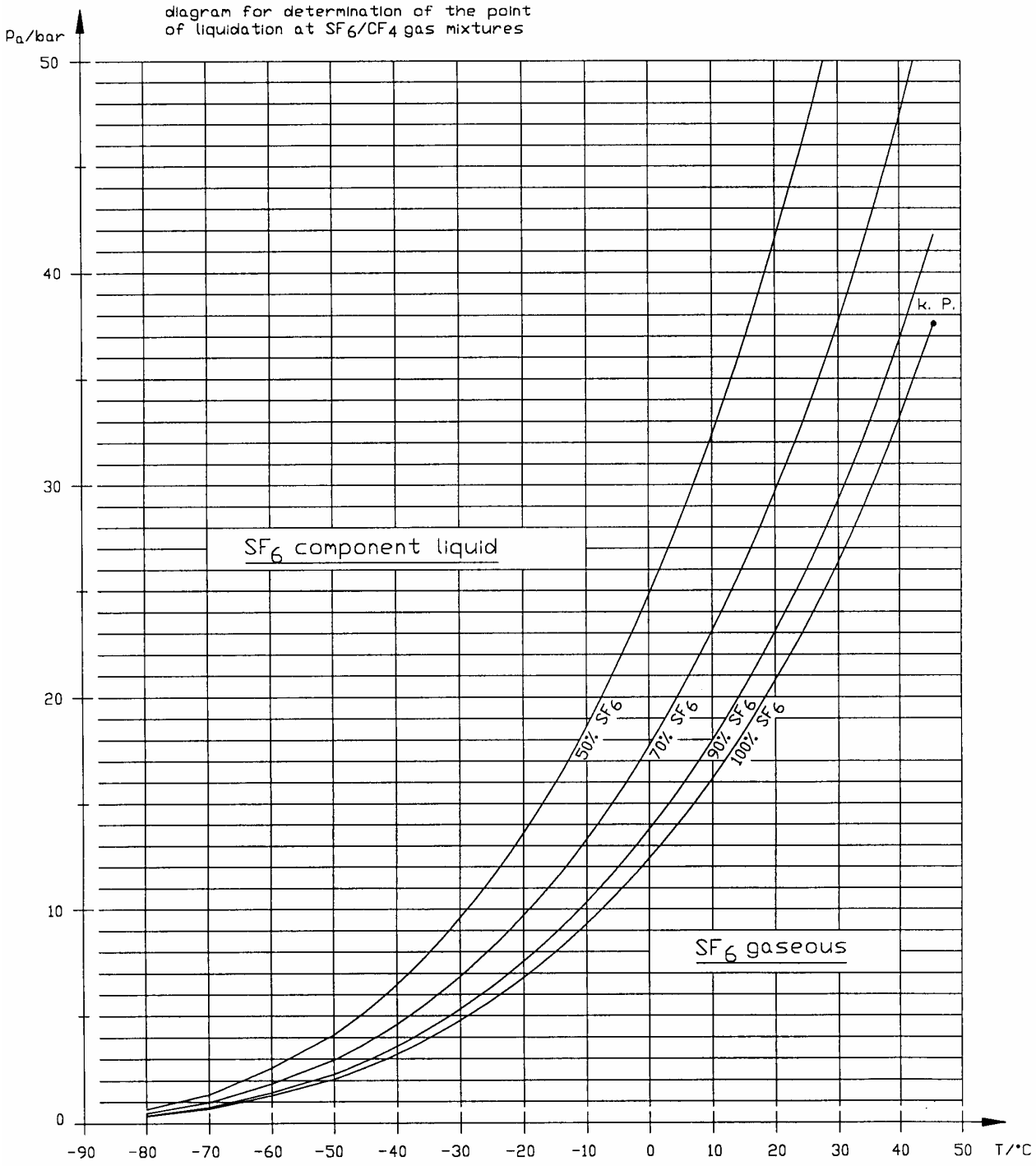
Reading	Actual SF6 content
49.6	0.0
50.0	0.8
51.0	2.8
52.0	4.8
53.0	6.7
54.0	8.7
55.0	10.7
56.0	12.7
57.0	14.7
58.0	16.7
59.0	18.7
60.0	20.6
61.0	22.6
62.0	24.6
63.0	26.6
64.0	28.6
65.0	30.6
66.0	32.6
67.0	34.5
68.0	36.5
69.0	38.5
70.0	40.5
71.0	42.5
72.0	44.4
73.0	46.4
74.0	48.4

Reading	Actual SF6 content
75.0	50.4
76.0	52.4
77.0	54.4
78.0	56.3
79.0	58.3
80.0	60.3
81.0	62.3
82.0	64.3
83.0	66.3
84.0	68.3
85.0	70.2
86.0	72.2
87.0	74.2
88.0	76.2
89.0	78.2
90.0	80.2
91.0	82.1
92.0	84.1
93.0	86.1
94.0	88.1
95.0	90.1
96.0	92.1
97.0	94.0
98.0	96.0
99.0	98.0
100.0	100.0

A gas mixture of 49.6% SF6, 50.4% air has the same velocity of sound as 100% pure CF4.

Note: If liquid SF6 is in the sample gas, it will be impossible to determine the correct concentration of gas. In such a case, the reading will always indicate a value less than actual concentrations.

The following diagram shows at which pressures/temperatures SF6 is in gaseous or liquid state.



For example:

An SF6/CF4 mixture of 70% vol SF6 gas, at a pressure of 290 psig (20 bar) can be at temperatures as low as 4°C before liquefaction begins. Pure SF6, on the other hand, would begin to liquefy at higher temperatures (18°C).

Measuring decomposed gas

Minor amounts of decomposition by products have no effect on the sensor. However, stronger concentrations can damage the sensor after prolonged exposure. It is recommended that the unit be purged with dry air or nitrogen following all testing. This will prevent the decomposition by-products from forming acids on the sensor, and damaging it.