氟利昂气体传感器NAP－11AF使用手册

(Revised; August 12, 1996)

USER'S MANUAL

NEMOTO FREON GAS SENSOR NAP-11AF

1. General

NEMOTO's semiconductor type gas sensor NAP-11AF is designed to detect freon gases which create serious problems in the maintenance of the global environment. Being sensitive also to Freon 22 or 134 which do not damage the ozone layer but are still costly, this sensor is useful for detecting leakage of such substitution gases that are mainly used as refrigerants.

1) Features

* Excellent response characteristics
* Very stable to the ambient temperature & humidity
* Remarkable gas selectivity

2) Applications

* Freon gas leak monitoring devises

3) Specifications

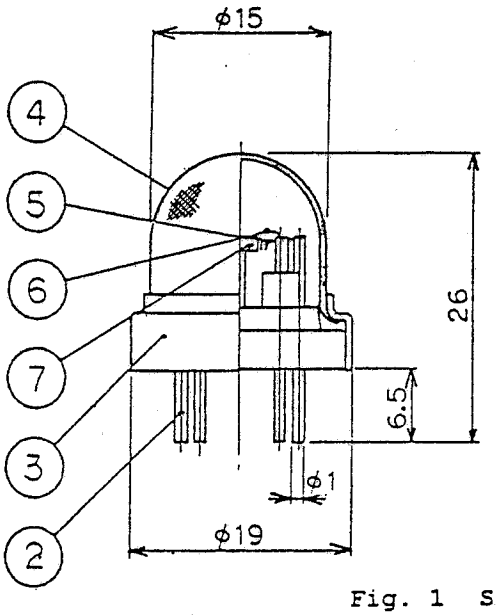
* Heater voltage	A.C. 5.0V ± 0.25V (r.m.s. 50-60Hz) D.C. 5.0V ± 0.25V
* Heater current (When 5.0V supplied)	A.C. 150 ~ 170 mA (r.m.s. 50-60Hz) D.C. 150 ~ 170 mA
* Circuit voltage	A.C. less than 15V (r.m.s. 50-60Hz) D.C. less than 15V

* Ambient temperature & Humidity

During normal operation	Temperature	0 ~ +50°C
	Humidity	Less than 95 %RH
During storage	Temperature	-20 ~ +60°C
	Humidity	Less than 95 %RH

2. Structure

The following illustrates the structure of NAP-11AF



No.	Parts	Material	Remarks
1	Base plate	Phenol resin	Flame proof
2	Pins	Pure nickel	φ 1 mm
3	Skirt	SUS304	
4	Metal mesh	SUS316	100 mesh
5	Heater	Fe•Cr alloy	φ 60 μm
6	Lead wire	Pt alloy	φ 80 μm
7	Sensing element		NAP-11AF

Fig. 1 Structure of NAP-11AF

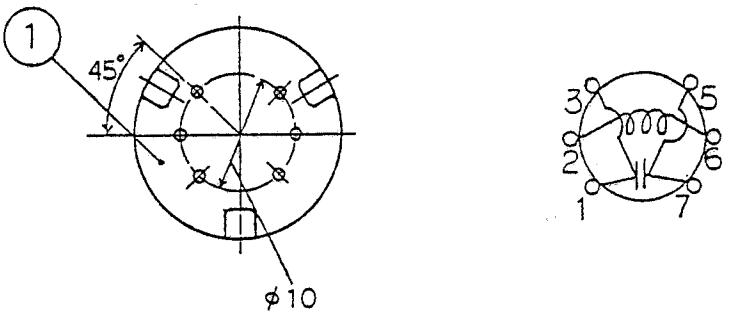


Fig. 2 Location of pins

The body of the sensor in Fig. 1 is a ceramic tube housing that contain a pair of electrodes, with a base layer consisting of semiconductor material consisting of mainly indium oxide and a second layer of a special catalyst material. The ceramic housing contains a heating coil and two pairs (a total of 4) of precious metal wires to transmit the changes in the electric resistance of the semiconductor element. The positioning of these pins is shown in Fig. 2. The sensor is protected with stainless steel explosion proof double layered wire-mesh (SUS316 - JIS, mesh size - 100). The supporting base material is made of a flame-resistant thermosetting resin, and the pins are made of pure nickel.

3. Freon gases

The conventional so-called freon gases have been mainly used as refrigerants and washing agents for electronic components and devices. However, it has been determined that these react with ultraviolet light and destroy the ozone layer, thus the use of freon gases is greatly restricted. Recently, substitution gases or ammonia is used since these are harmless to the ozone layer, however substitution gases are still expensive. The following list shows the kinds and applications of various gases.

Name	Chem. formula	Applications	Ozone layer
Freon 113	$CCLF_2CCL_2F$	Washing solvent	×
Freon AK225	$CF_3CF_2CCL_2H$	"	○
Freon 12	CCL_2F_2	Refrigerant	×
Freon 22	$CHCLF_2$	"	○
Freon 134	CF_3CFH_2	"	○

4. Basic characteristics of NAP-11AF

1) Sensitivity characteristics

Fig. 3 shows the sensitivity characteristics to various freon gases.

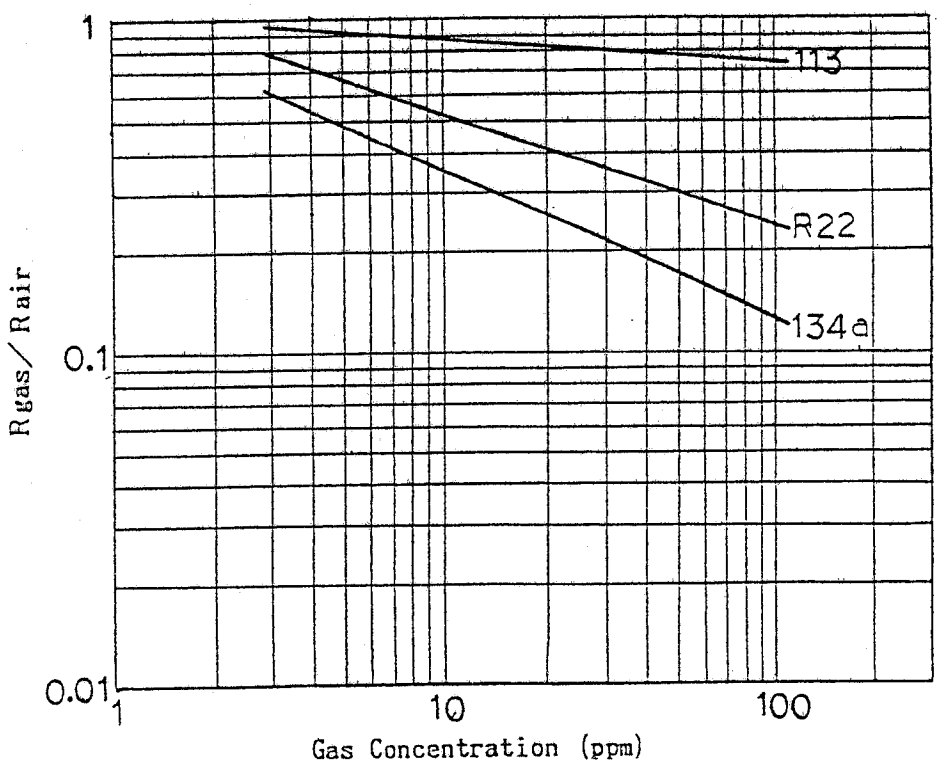


Fig. 3 Gas sensitivity of NAP-11AF

2) Temperature characteristics

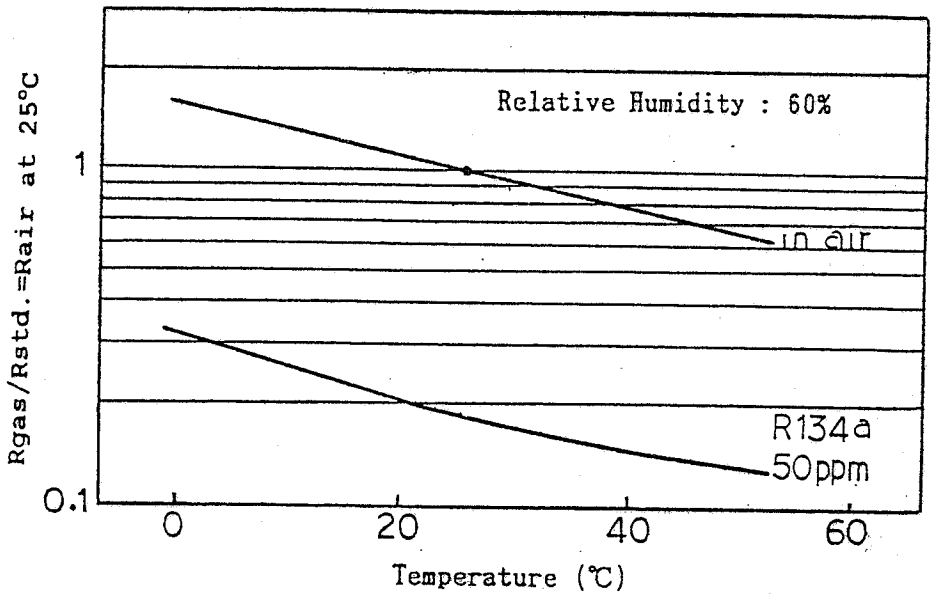


Fig. 4 Temperature characteristics of NAP-11AF

3) Humidity characteristics

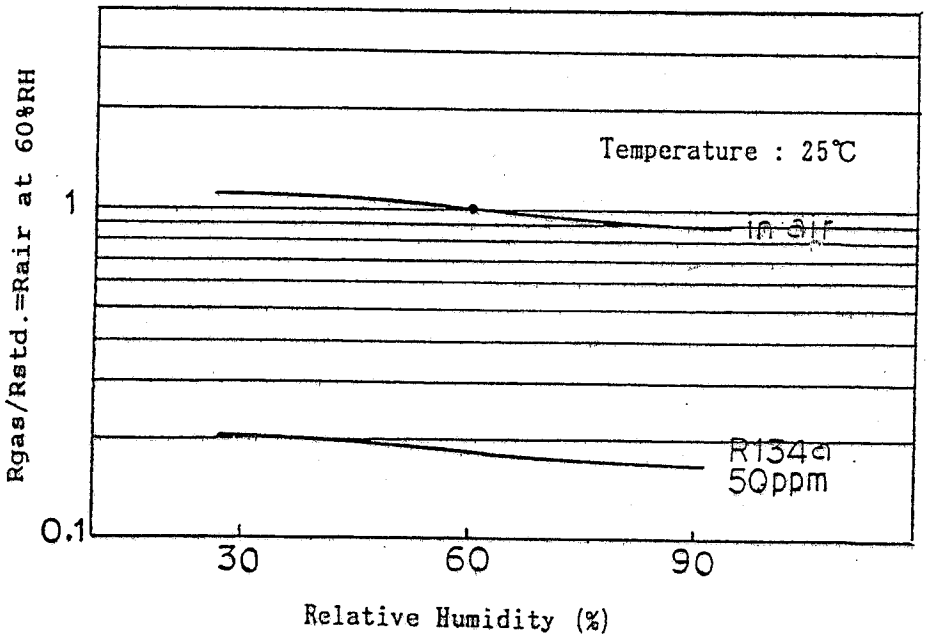


Fig. 5 Humidity characteristics of NAP-11AF

3) Response characteristics

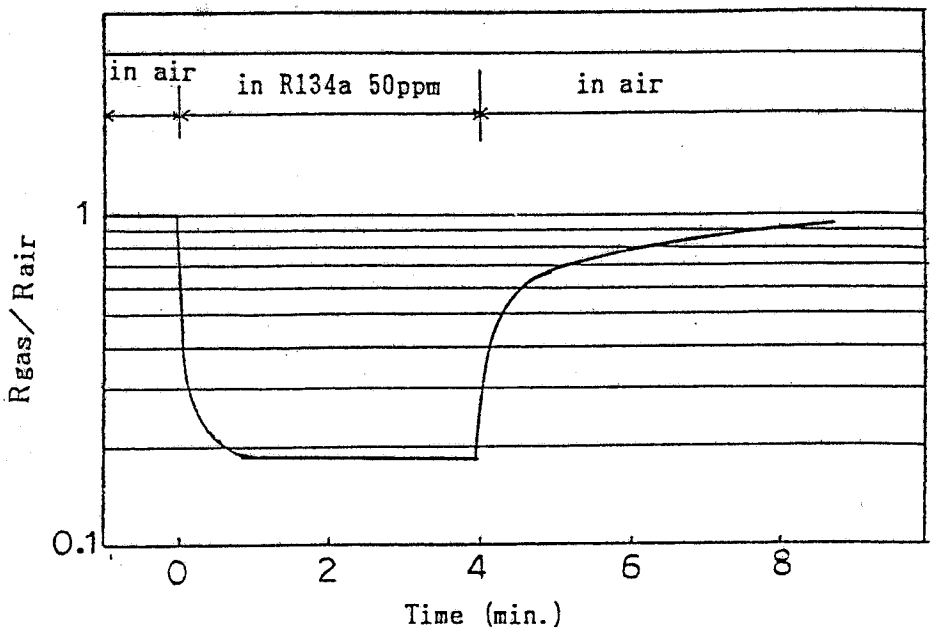


Fig. 6 Response characteristics of NAP-11AF

4) Initial stabilization characteristics

Fig. 7 shows the initial stabilization test data on NAP-11AF sensors stored for a long period without electricity.

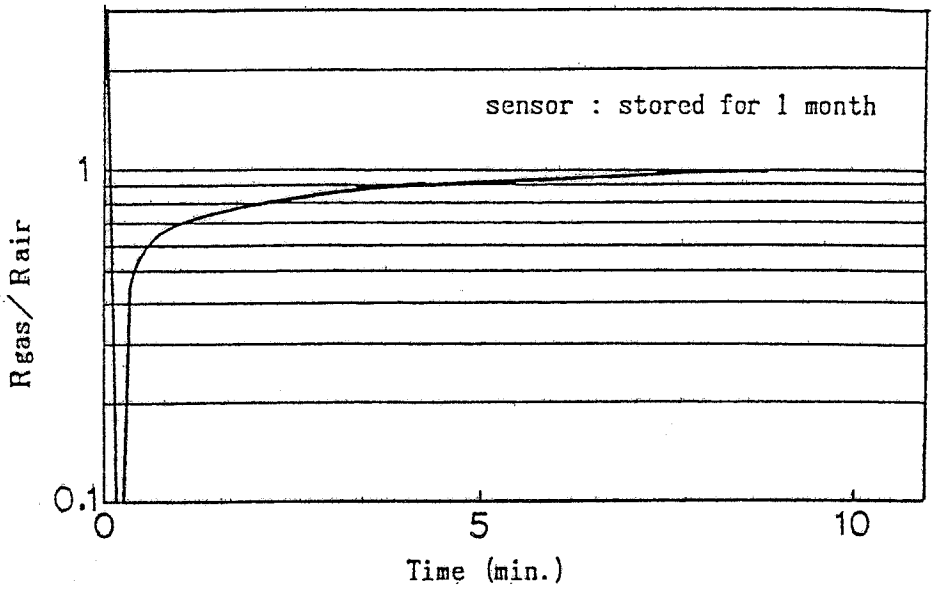


Fig. 7 Initial stabilization characteristics of NAP-11AF

6) Long-term stability characteristics

Fig. 8 shows the long term stability test data under normal ambient conditions.

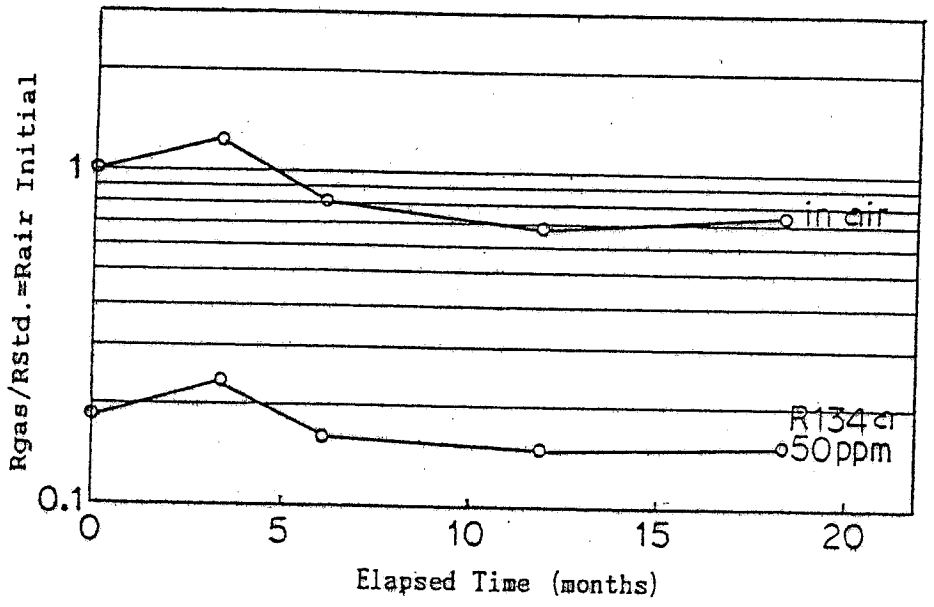
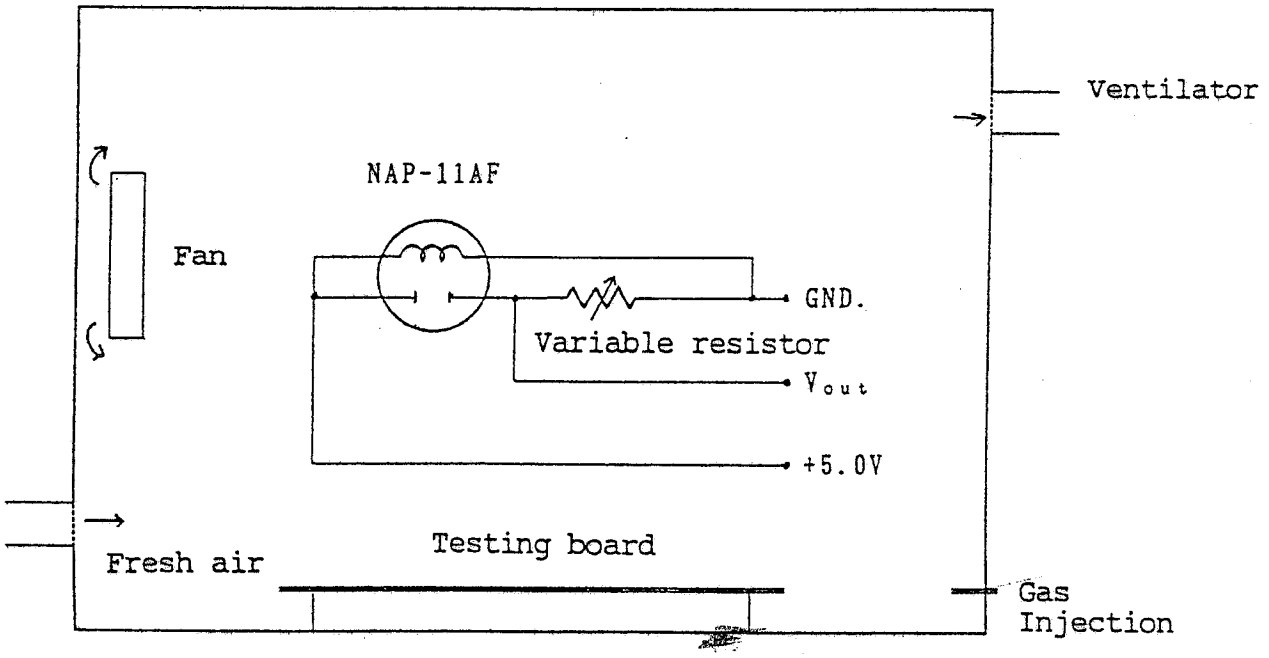


Fig. 9 Long-term stability of NAP-11AF

5. Evaluation of NAP-11AF

1) Testing equipment: The following is an outline of the test system.



Remarks:

a) Test chamber; Metal or glass which does not generate or absorb gases is desirable as test chamber material. The volume of the chamber should be larger than 1 liter / sensor.

b) Power supply: Sensors can be operated using either D.C. or A.C., but for optimal measurement accuracy, use of a D. C. voltage stabilizer is recommended.

c) Voltmeter; A voltmeter with approximately 20 MOhm impedance is sufficient for measuring sensor output voltage.

d) Ventilation; The test chamber should be ventilated directly outdoors so as to avoid contamination of the air inside the test room.

(2) Adjustment of gas concentration

Gas concentration in a test chamber is to be adjusted by a volumetric method. Use of a substitution freon gas for testing is preferable, but it may be difficult to obtain on the market.

(3) Measurement

a) Preparatory aging; Before measurement of gas sensitivity, an ageing period of more than 1 day with the specified voltage should be given to test samples.
The appropriate aging time depends on the length of the storage period, but longer aging periods are preferable.

b) Measurement;

* Test samples on the testing board are put into the test chamber.

* Va (output voltage in clean air) is measured.

* Using a syringe freon gas is injected into the test chamber.

* Wait until the test gas is dispersed in the chamber, and Vg (output in gas) is measured.

* Ventilation output should be directed outdoors.

c) Re-measurement

In case of a re-measurement of the same sensor, a 6.0 V power supply (specified voltage x 1.2) is recommended to remove contamination of the sensor surface. This removes decomposed or partly oxide substances that may form when freon gases is adsorbed in the sensor element. Same effect is obtained when the specified voltage is supplied to the sensor for 10 - 30 min., but the aging time can be shortened with 6.0 V.

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