



Novec™

Brand

3M™ Novec™ 4710 Insulating Gas

Introduction

3M™ Novec™ 4710 Insulating Gas is a sustainable alternative to sulfur hexafluoride (SF₆) for electrical equipment insulation and arc quenching applications. It offers excellent dielectric properties, a wide range of operating temperatures and significant reductions in environmental impact compared to SF₆. Novec 4710 gas is non-flammable and has a wide safety margin for workers when used as designed in intended applications. The intended applications are as a dielectric medium for medium voltage and high voltage power generation and distribution equipment which includes gas insulated switchgear, gas insulated lines and circuit breakers. Novec 4710 gas is mixed with inert gases for use in the intended applications.

As shown in the Environmental Properties table, gas mixtures containing Novec 4710 gas enables a significant and meaningful reduction in greenhouse gas (GHG) emissions from gas-insulated equipment compared to using SF₆. Novec 4710 gas has the following advantages:

- Potential to reduce GHG emissions by more than 99% in gas mixtures.
- Dielectric breakdown voltage approximately 2 times that of SF₆ at a given pressure (in pure form)
- Wide margin of safety for workers when used as designed for intended applications
- Non-flammable
- Compatibility with a wide range of equipment components

Product Description

Not for specification purposes. All values @ 25°C/77°F unless otherwise specified.

Novec 4710 gas (C₃F₇CN) consists of iso-C₃F₇CN (CAS No. 42532-60-5).

3M™ Novec™ 4710 Insulating Gas

Typical Physical Properties

Not for specification purposes. All values @ 25°C/77°F unless otherwise specified. Final product specifications and testing methods will be outlined in the product's Certificate of Analysis (COA) that is shipped with the product.

Property	SI Units	Imperial Units
Molecular Weight	195 g/mol	195 lb/lb mol
Flammability in air	non-flammable	non-flammable
Boiling Point	-4.7°C	23.5°F
Freezing Point	-118°C	-180°F
Critical Temperature	122.8°C	235°F
Critical Pressure	2.50 MPa	363 psia
Ideal Gas Density at 1 bar	7.9 kg/m ³ (at 1 bar)	0.49 lb/ft ³ (at 14.5 psia)
Vapor Pressure	297 kPa	43.1 psia
Dielectric Breakdown Voltage (kV, parallel disk electrodes)	27.5 at 1 bar over 2.5 mm gap	27.5 at 14.5 psia over 0.1-inch gap

Environmental Properties	3M™ Novec™ 4710 Insulating Gas	SF ₆
Atmospheric Lifetime (years)	30	3,200
Global Warming Potential (100-yr ITH, IPCC 2013 method)	2,100	23,500
Global Warming Potential (100-yr ITH, IPCC 2021 method) *	2,240	25,200
Ozone Depletion Potential (CFC-11 = 1)	0	0

* The value reported in IPCC 2021 (Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change) for Novec 4710 gas is incorrectly reported as 2,750. The corrected value is reported in 3M Technical Brief: Review of Atmospheric Lifetime and Global Warming Potential for Novec 4710 gas relative to the IPCC Sixth Assessment Report.

As the Novec insulating gases are mixed with an inert gas (or gases) the reduction in GHG emissions is significant compared to installations using SF₆.

Gas formulation	Novec 4710 Gas (3.5 mole %) in CO ₂	100% SF ₆
Gas pressure (bar)	6	4
Gas density at 25°C (kg/m ³)	11.9	23.6
Composite GWP of gas mixture	292 **	23,500
GWP reduction compared to SF ₆	98.8%	-
GHG emissions (MT CO ₂ e/m ³)	3.5	554
GHG emissions reduction (i.e. CO ₂ e reduction) ***	99.4% ****	-

** $GWP_{mixture} = \sum_i X_i GWP_i$

*** GHG emission reduction considers GWP and reduced density of the gas mixtures

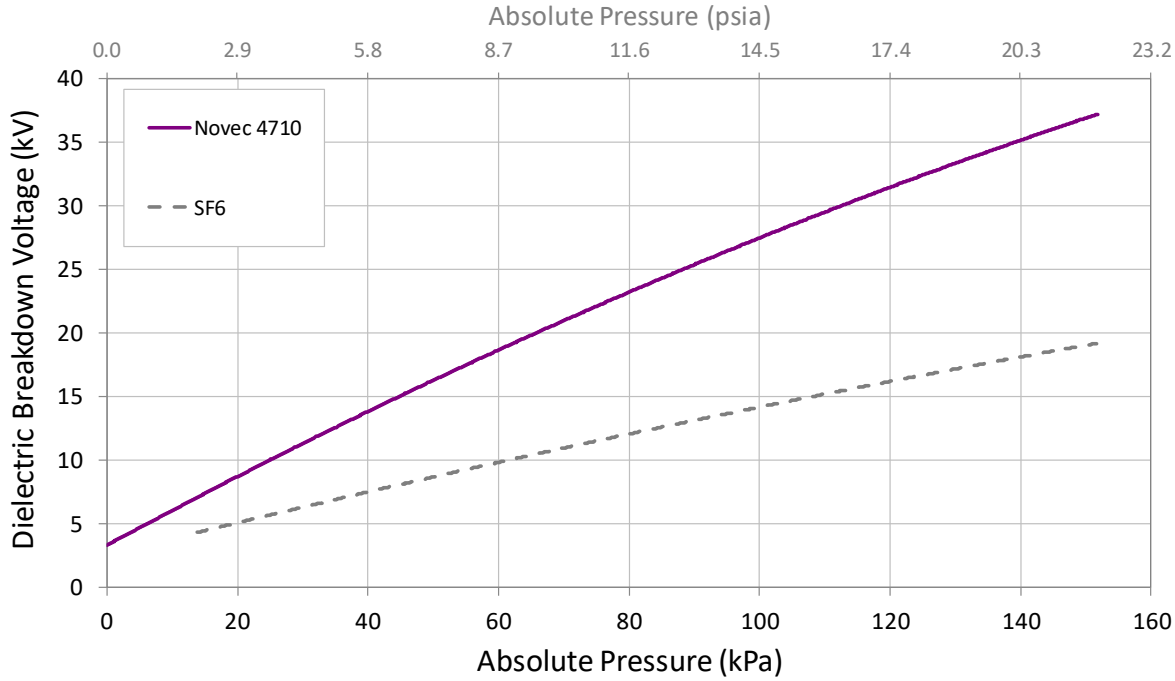
**** Since GHG emissions reduction in CO₂e uses the commonly accepted GWP calculated over a 100-year integration time horizon, it discounts the longer-term effects of SF₆, which continue far beyond 100 years. As a result, the CO₂e emissions reductions calculated over longer time frames are > 99.9%.

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Dielectric Breakdown Voltage of 3M™ Novec™ 4710 Insulating Gas compared to SF₆

(Uniform field using parallel disk electrodes with 2.5 mm/0.1 inch gap)

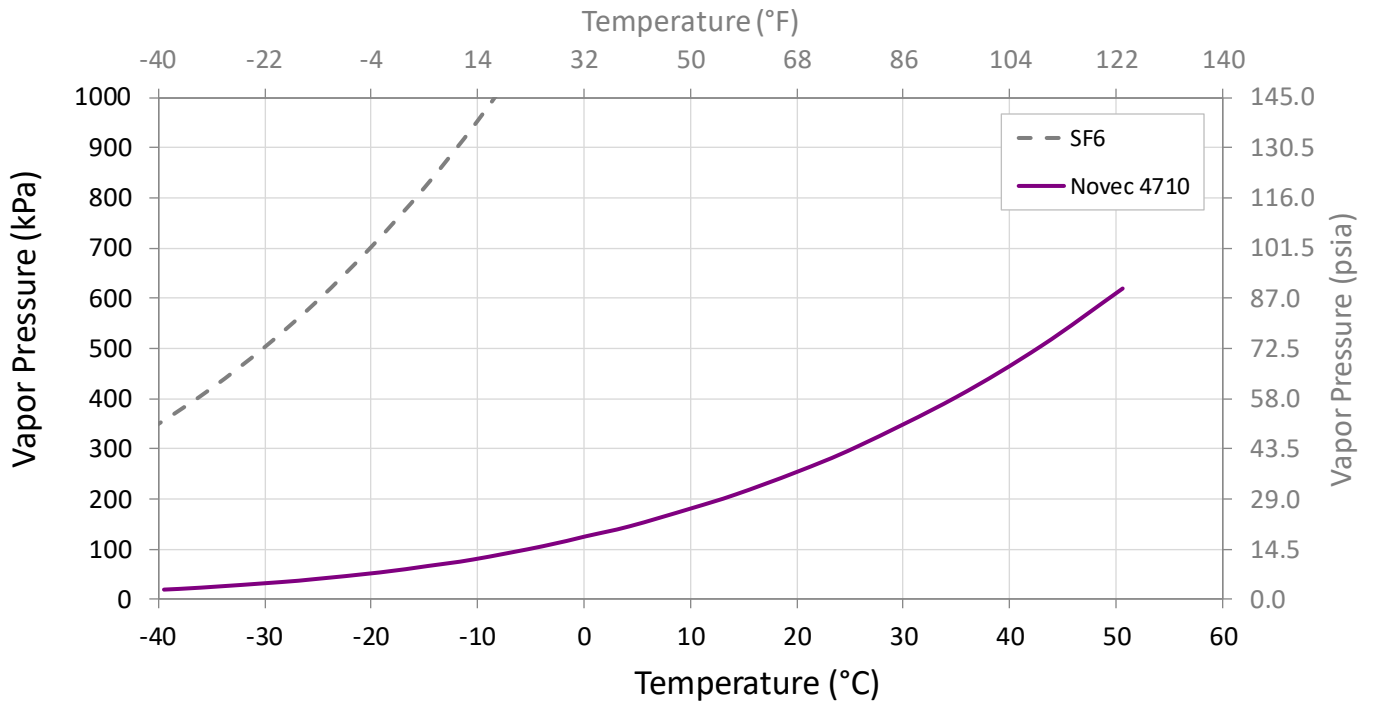
Not for specification purposes. All values @ 25°C/77°F unless otherwise specified



Vapor Pressure of Novec 4710 gas compared to SF₆

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3M™ Novec™ 4710 Insulating Gas

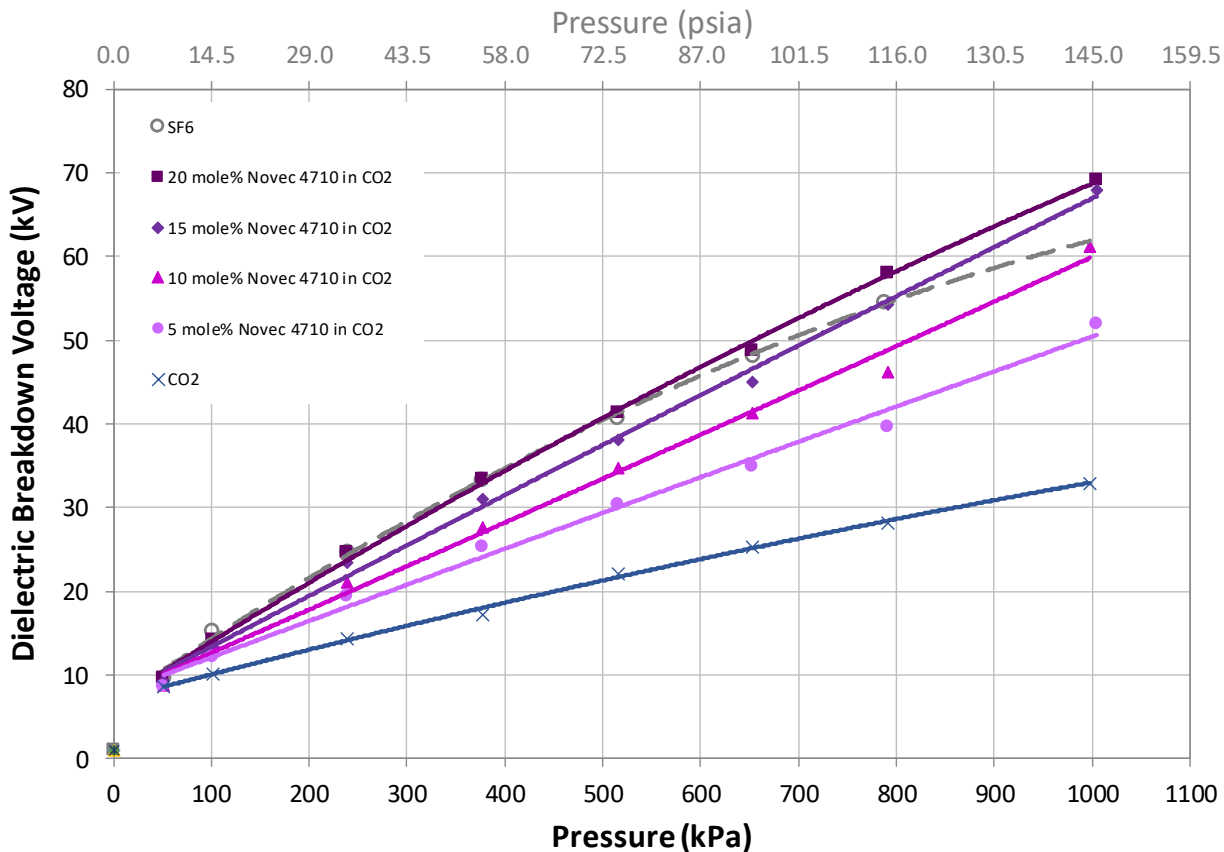


Dielectric Breakdown Voltage: Mixtures of 3M™ Novec™ 4710 Insulating Gas in CO₂

(Uniform field using parallel disk electrodes with 2.5 mm/0.1 inch gap)

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Materials Compatibility

In practice, 3M™ Novec™ 4710 Insulating Gas differs somewhat in materials compatibility compared to SF₆. While the product is compatible with most common metals, it can be affected by some of the components found in lubricating greases and the elastomers used in gaskets and O-rings.

Many materials have been found to be compatible with the product. However, material compatibility is best evaluated using the specific materials of construction being considered for contact with the Novec 4710 gas, and the end user will need to determine whether this gas is suitable for their intended application.

3M research scientists are available to provide guidance for running materials compatibility evaluations. Contact your local 3M sales representative for additional information.

Regulatory Status

The component(s) of Novec 4710 gas are in compliance with the chemical notification/registration requirements of the United States, Europe, Canada, Korea, China (R&D), Taiwan, and Japan. Additional notification/registration activities are in progress in these and other countries or regions. Certain restrictions may apply, including required import of this product through a local 3M subsidiary, import volume limitations, and/or use limitations. Contact your local 3M sales representative for additional information. A current safety data sheet (SDS) and regulatory data sheet for this product is available at 3m.com/sds.

Storage and Shelf Life

The shelf life of 3M™ Novec™ 4710 Insulating Gas is 24 months from the date of manufacture when stored in the original packaging materials and stored at 21°C (70°F) and 50% relative humidity. Please read and follow the precautions and directions for use contained in the product label and Safety Data Sheet before using this product.

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Certificate of Analysis (COA)

The 3M Certificate of Analysis (COA) for this product is established when the product is manufactured and is deemed commercially available from 3M. The COA contains the 3M specifications, test methods and test results for the product's performance attributes that the product will be supplied against. Contact your local 3M representative for this product's COA.

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Safety Data Sheet: Consult Safety Data Sheet before use. https://www.3m.com/3M/en_US/company-us/SDS-search/

Regulatory: For regulatory information about this product, contact your 3M representative.
https://www.3m.com/3M/en_US/company-us/SDS-search/

Technical Information: The technical information, recommendations and other statements contained in this document are based upon tests or experience that 3M believes are reliable, but the accuracy or completeness of such information is not guaranteed.

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