

**3M****Novec™****Engineered Fluids  
for LOX/GOX Cleaning**

**It's time to bring**  
**LOX/GOX**  
**cleaning...**

**T**he cleaning of liquid oxygen and gaseous oxygen (LOX/GOX) lines can be a hazardous undertaking. Any contaminant that comes into contact with pure oxygen has the potential to react violently. This makes compatibility with the cleaning solvent very important.

In the past, chlorofluorocarbons (CFCs) and hydrochlorofluorocarbons (HCFCs) have been used to clean these sensitive systems. Although they did an excellent job of cleaning, their emissions contributed to ozone depletion.

**...up to**  
**speed**

Now, after years of investigative testing, a new solvent family is poised to take LOX/GOX cleaning into a new era. 3M™ Novec™ Engineered Fluids HFE-7100 and HFE-71DE, hydrofluoroethers, have proven to be suitable replacements for CFCs and HCFCs in many critical LOX/GOX cleaning applications.

Unlike some products that are due to be phased-out by regulations, Novec fluids are long-term, sustainable solutions. With zero ozone depletion potential, low global warming potential, low toxicity and nonflammability, they offer a balance of performance, environmental and safety properties to help address the growing demands for chemical technologies that are compatible with the “human environment.”

# balancing performance and safety

**M**aintaining a clean environment for oxygen lines and systems is critical. Contamination can affect system performance and increase maintenance costs. In the worst case scenario, contaminants can even cause fires hot enough to ignite the metals used in the oxygen system.

To minimize these hazards, 3M offers 3M™ Novec™ Engineered Fluids HFE-7100 and HFE-71DE for LOX/GOX cleaning.

**Novec fluid HFE-7100** has been tested and found compatible with liquid and gaseous oxygen and the materials typically utilized in these systems. It has been qualified by government and military as well as commercial organizations for use in LOX/GOX cleaning. These qualifications include tube flushing, vapor degreasing, wipe cleaning, and cleaning of gauges and regulators. It is also used as a cleanliness verification fluid for these cleaning operations.

When increased solvency is required, **Novec fluid HFE-71DE** is generally part of a two-step process. In this process, Novec fluid HFE-71DE has cleaning performance comparable to previously used solvents such as CFC-113, 1,1,1-TCA, or HCFC-141b. Novec fluid HFE-71DE did not pass some of the critical compatibility tests required by NASA and other LOX/GOX users; therefore, Novec fluid HFE-7100 may be used to thoroughly flush or rinse the system once cleaning with Novec fluid HFE-71DE is complete.

A verification test should be employed to confirm that the trans-1, 2-dichloroethylene has been completely removed. Novec fluid HFE-71DE may be used as the sole cleaner in applications where complete evaporation/removal can be verified. Regardless of the method, verification of any oxygen component cleaning system should be established using procedures that have been reviewed and certified by qualified individuals or organizations.

Unlike some products that are due to be phased-out by regulations, Novec fluids are a long-term sustainable solution. The U.S. Environmental Protection Agency (EPA) has approved all components of Novec fluids HFE-7100 and HFE-71DE as acceptable (without restrictions) under the Significant New Alternatives Policy (SNAP) program.

# An accepted solution



## **NASA**

3M™ Novec™ Engineered Fluid HFE-7100 is approved for cleaning and cleanliness verification of oxygen lines and systems at the NASA facilities responsible for the space shuttle under NASA specification SE-S-0073.



## **Versar, Inc.**

Versar, Inc., an international public services firm, has developed a new, portable oxygen line cleaning system that has been approved by the U.S. Air Force to clean oxygen lines without removing them from the aircraft. This new system was engineered to eliminate the costly disassembly and cleaning procedure that is currently employed, and uses Novec fluid HFE-7100 because it provides the safest threshold for use in human breathing systems. The system effectively cleans the oxygen lines and valves by pumping the solvent through the oxygen system. A sophisticated detection system is used to determine when the lines are clean. The entire cleaning process now takes about four hours and costs approximately \$2500 per aircraft. The old method could cost \$1 million and took up to six months for the B1 bomber.

# Going

the extra mile...

## 3M style

When you choose 3M™ Novec™ Engineered Fluids for LOX/GOX cleaning, you get more than great products—you get the technical and customer support of a global supplier and world leader in fluorochemicals.

### Consultants

Due to the extremely hazardous nature of LOX/GOX cleaning, 3M recommends that you contact a LOX/GOX cleaning consultant prior to changing solvents or implementing a new process. A qualified consultant will be able to evaluate the fluid and the process to ensure that there will be no problems.

### Used Fluid Return Program

In the U.S. and Puerto Rico, 3M offers a free Used Fluid Return Program to those companies and agencies with a qualifying amount of used 3M fluid. Contact your local 3M sales representative for additional information.

### Committed to the future

While it's difficult to forecast the exact nature of legislation, it's a good bet that it will continue to evolve in favor of environmental stewardship. With 3M's Product Stewardship Program, Novec fluids are well positioned to meet regulations today and into the future.

What's more, 3M is committed to improving our technologies, with continuous new product research and development.

### Contact us

If you have any questions about Novec fluids for use in LOX/GOX cleaning, please contact your local 3M representative, or call 3M Specialty Materials, 800-810-8513.

For information on additional 3M cleaning fluids, metalworking fluids and coatings for the aerospace industry, visit our web site at: [www.3m.com/specialtymaterials](http://www.3m.com/specialtymaterials)

Because 3M™ Novec™ Engineered Fluids are low in toxicity and have zero ozone depletion potential, there may be lower costs associated with handling and regulatory compliance.

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## 3M

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