

## TMC-649

TMC-649 PERFLUORO(2-METHYL-3-PENTANONE) has an excellent environmental profile. It doesn't have damage to the ozone layer, and the ODP is 0, the GWP is 1, the ALT is 0.014 year. Although the ODP of fluoroalkane halon substitute products is 0, its GWP is larger, which has a negative effect to global warming and climate change. PERFLUORO(2-METHYL-3-PENTANONE) can solve the two problems very well, that is the GWP and the ODP very small, which is better than that of the halon fire extinguishing agent and other types of fluoroalkane halon alternatives (HFC-227ea, HFC-236fa) at this point.

### Features

- EXCELLENT ENVIRONMENTAL PROFILE
- LOW TOXICITY
- EFFICIENT FIRE EXTINGUISHANT
- NONCORROSIVE
- IMMERSION COOLING

### Packaging Information

*Sold in:*

- 1 gal. Bottle - 12 lbs (5.4 kg)
- 5 gal. Pail - 44 lbs. (20 kg)
- 55 gal. Drum - 550 lbs. (250 kg)

**Product name:** TMC-649 (Perfluoro(2-methyl-3-pentanone))

**Synonyms:** Dodecafluoro-2-methylpentan-3-one; Fluorinated ketone;  
Heptafluoroisopropyl pentafluoroethyl ketone ; FK-5-1-12

### Properties

Property	Unit	Value
Molecular weight	–	316.04
Boiling point at 1013bar	°C	49.2
Freezing point	°C	-108.0
Critical temperature	°C	168.7
Critical pressure	bar	18.65
Critical density	g/m <sup>3</sup>	639.1
Heat of vaporization at boiling point	kJ/kg	88.0
Liquid Viscosity @25°C	cp	0.524
Solubility of water in NY5112 @21°C	wt%	<0.001
Specific heat, liquid@25°C	kJ/kg °C	1.013
Liquid density	g/ml	1.60
Vapor density	g /ml	0.0136
Vapor pressure (25°C)	bar	0.404
Dielectric strength		~60kv
Purity		99.9% min
Relative Density (Water = 1)		1.6
Odor		Low odor
Appearance		Colorless transparent liquid

# Applications

## Fire Suppression

<b>Chemical Identity</b>	TMC-649 is described as a chemically identical replacement for Novec™ 649. This suggests that it has a similar chemical composition, which is effective at suppressing fires.
<b>Clean Agent Fire Protection</b>	Like Novec™ 649, TMC-649 is touted as a clean agent fire protection system. Clean agents are designed to extinguish fires without leaving behind harmful residues, making them suitable for protecting sensitive environments like data centers, museums, or places with valuable electronic equipment and documents.
<b>Rapid Fire Suppression</b>	TMC-649 is claimed to extinguish fires in seconds, which is significantly faster than traditional water-based fire suppression systems. Rapid fire suppression can help minimize damage and prevent the spread of fires more effectively.
<b>Waterless Solution</b>	TMC-649 is categorized as a waterless fire suppression solution. This means it doesn't rely on water to extinguish fires, avoiding potential water damage to sensitive equipment or materials.
<b>Residue-Free</b>	One of the advantages of clean agent fire suppression systems is that they leave no residue after extinguishing a fire. This is crucial for protecting irreplaceable items like paper documents and electronics, as there is no cleanup or damage caused by residues.

- Stored as a liquid and discharged as a gas
- Appropriate for Class A, B and C fire hazards
- Provides the highest margin of safety for human occupancy of any clean agent solution under the NFPA 2001 standard

## Immersion Cooling - Heat Transfer Applications

TMC-649 is a chemically identical replacement for Novec™ 649 with specific properties suitable for heat transfer applications where non-flammability and environmental concerns are important.

### Application Examples

- Electronics Cooling (Single or Dual Phase)
- Computer/Data Center Cooling
- Power Electronics such as IGBTs or inverters
- Geothermal Applications
- Transformers and other equipment (SF6 replacement)
- Organic Rankine Cycle
- Diesel Engines
- Generators
- Solar Applications

### Properties of TMC-649 vs. 3M™ Novec™ 1230, 649, FK-5-1-12

Property	3M™ Novec™ 1230, 649	TMC-649
CAS #	756-13-8	756-13-8
Boiling Point	120 F° / 49°C	120°F / 49°C
Pour Point	-162°F / -108°C	-162°F / -108°C
Specific Gravity	1.60 g/mL @ 25°C	1.60 g/mL @ 25°C
Vapor Pressure	41kPa / 308 mmHg @ 25°C	41kPa / 308 mmHg @ 25°C
Critical Temperature	336°F / 169°C	336°F / 169°C
Critical Pressure	1.88mPA	1.88mPA
Pour Point	-164°F / -108°C	-164°F / -108°C
Viscosity	0.64cPs @ 25°C	0.64cPs @ 25°C
Specific Heat	1103 J/kg-K@ 25°C	1103 J/kg-K@ 25°C
Latent Heat of Vaporization @ Boil Point	88-kJ/kg	88-kJ/kg
Dielectric Constant	1.8 @ 1kHz	1.8 @ 1kHz
Dielectric Strength	48kV	48kV
Flash Point	None	None

## Materials Compatibility

Experiments show that TMC-649 PERFLUORO(2-METHYL-3-PENTANONE) with other materials, such as rubber, metal, has good compatibility, and little impact on a variety of materials used. Though PERFLUORO(2-METHYL-3-PENTANONE) with metal contact 10 days under 48 °C, no fade or damage trace is found.

## Environmental Properties

Compare to the Environmental condition of Perfluoro(2-methyl-3-pentanone) and Halon and part of the other products.

	Perfluoro(2-methyl-3-pentanone)	Halon 1301	Halon 1211	HFC-227ea	HFC-236fa
Chemical Formulas	C3F5(O)CF(CF3)2	CF3Br	CF2ClBr	CF3CHFCF3	CF3CH2CF3
ALT (Year)	0.014	65	11	33	220
GWP	1	6900	1300	3500	9400
ODP	0	10	4	0	0

## Fire Extinguishing Concentration

PERFLUORO(2-METHYL-3-PENTANONE) has excellent fire performance, and its fire extinguishing concentration for class A is only 3.5%, its fire extinguishing concentration for class B is only 4.5% which is the closest to the halon, and it is far less than other fluoroalkane halon substitute. It can save A, B, C fires, non-conductive, immediate gasification after the injection, no residue.

The extinguishing concentration of PERFLUORO(2-METHYL-3-PENTANONE) and halon 1301 and part of fluorine alkane halon substitute.

	TMC-649	Halon 1301	HFC-227ea	CO2
Extinguishing Concentration (%)	4-6	5	7.5-8.7	30-75

## Health & Safety

The toxicity of PERFLUORO(2-METHYL-3-PENTANONE) is very low, and the extinguishing concentration of PERFLUORO(2-METHYL-3-PENTANONE) is much lower than its NOAEL, so the PERFLUORO(2-METHYL-3-PENTANONE) has a high safety. The fire extinguishing agent has been registered by the USE.P.A.T.S.C.A.

The extinguishing concentration of PERFLUORO(2-METHYL-3-PENTANONE) and Halon and part of fluoroalkane halon substitute

	Perfluoro(2-methyl-3-pentanone)	Halon 1301	HFC-227ea	HFC-236fa
Extinguishing Concentration (%)	4	5	7	15
NOAEL (%)	10	5	9	10

Note: the NOAEL: invisible harm concentration

It's shown in the table that the NOEL PERFLUORO(2-METHYL-3-PENTANONE) approximately twice the extinguishing concentration, the safety margin is bigger; And slightly above its NOEL of HFC-227ea fire extinguishing concentration, the safety margin is small; Halon 1301 NOEL and extinguishing concentration is very close, no safety margin; HFC-36fa NOEL is less than its extinguishing concentration, there is a danger to people. Therefore, PERFLUORO(2-METHYL-3-PENTANONE) extinguishing agent in extinguishing efficiency at the same time, more suitable for the place of someone.

Based on Pensky-Martens Closed Cup (ASTM D93) or Tag Closed Cup (ASTM D56) methods, TMC-649 exhibits no flash point and is not classified as flammable by OSHA or DOT. As with almost all halogenated solvents, flammability limits exist in the presence of a high ignition energy source.



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