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Applied to Life.™

3M™ Novec™ 1230 Fire Protection Fluid

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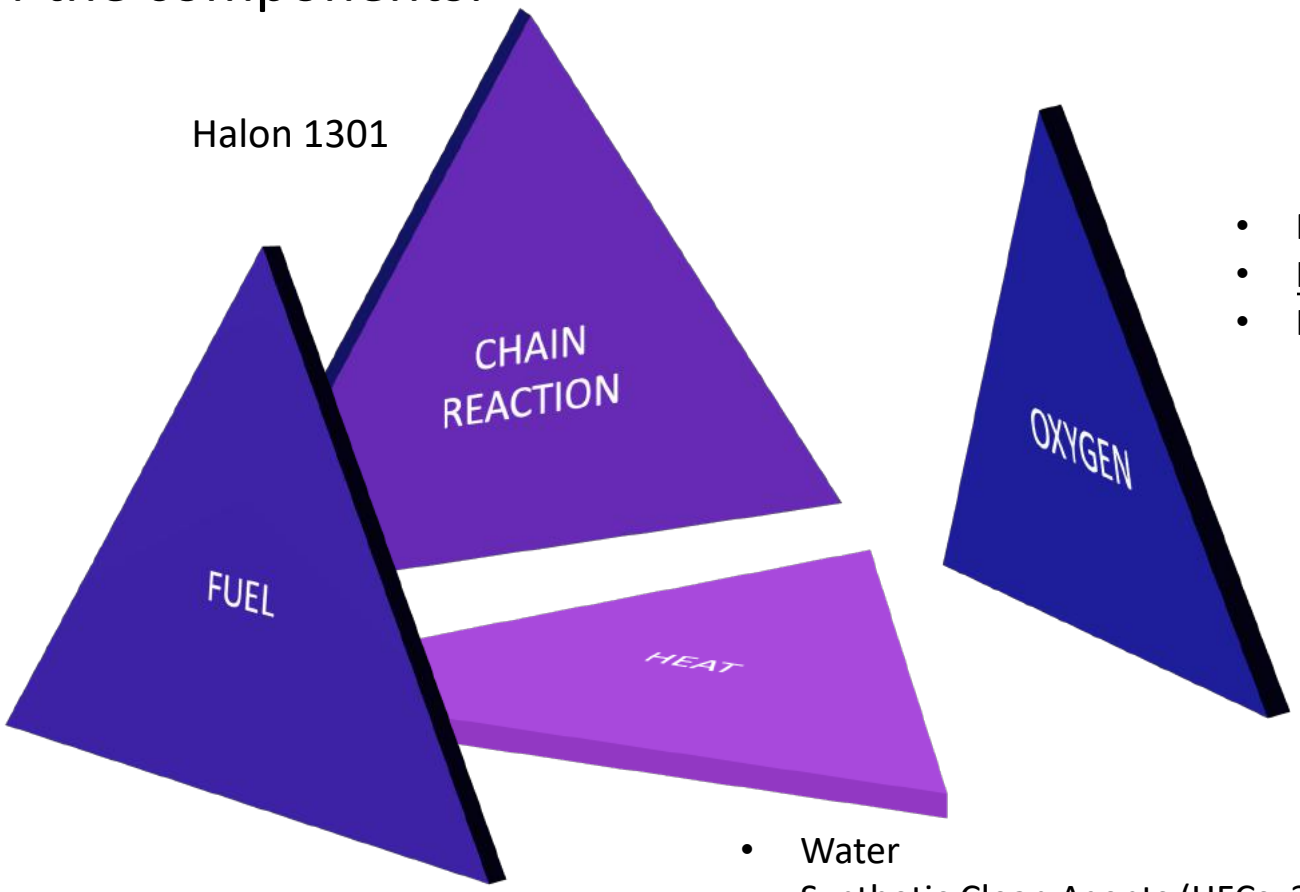
Extinguishing fires: The fire tetrahedron

Fundamental of Fire Control

Based on the Fire Tetrahedron, fire can be extinguished by simply removing any of the components:

Halon 1301



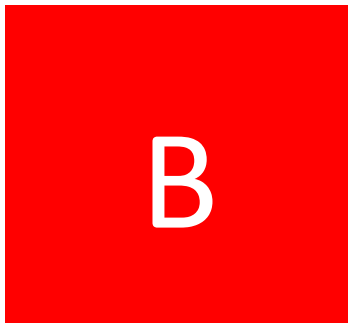
- Foam
- Inert gases
- Hypoxic

- Water
- Synthetic Clean Agents (HFCs, 3M™ Novec™ 1230 Fire Protection Fluid)

Types of fire hazards

NFPA 2001/EN15004 - Standard on Clean Agent Fire Extinguishing Systems

Class A - General Hazards



Class B - Combustible/Flammable liquids

Class C - Energized Electrical Hazards or Higher Class A (EN15004)

Clean agent fire extinguishing systems

5 key properties of clean agents:

- Agent will extinguish Class A, B & C fires
- Leaves no residue behind
- Electrically non-conductive
- No observed adverse effect limits (NOAELs) are defined
- No ozone depletion potential (ODP)

- *Ref*: (NFPA 2001, Sec. 3.3.6)

Clean fire extinguishing agents

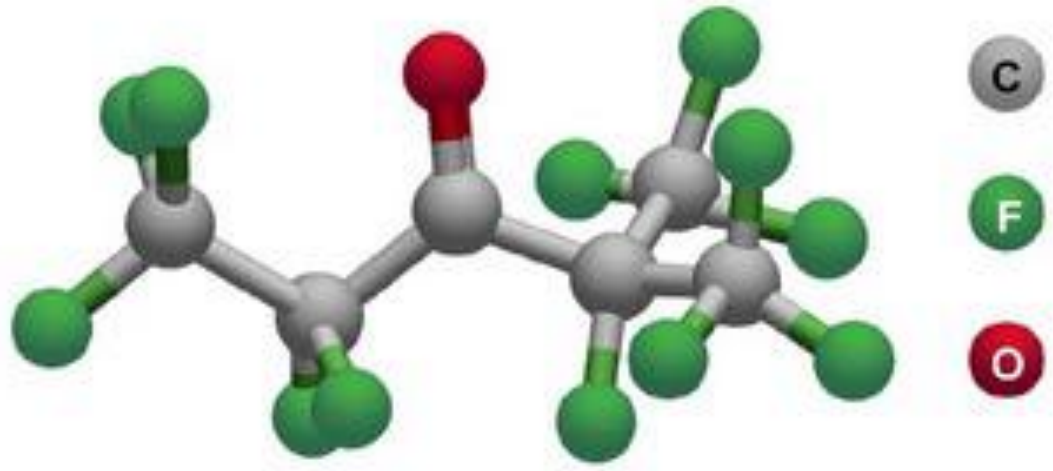
Clean agents are governed by EN15004 and local guidelines: Standard on Clean Agent Fire Extinguishing Systems.

Inert Gases

- IG-541 (Inergen®)
- IG-55 (Argonite®)
- IG-100 (Nitrogen)

Chemical Agents

- HFC-227ea (Chemours™ FM-200®)
- HFC- 125 (Chemours™ ECARO-25™)
- 3M™ Novec™ 1230 Fire Protection Fluid



When to use Clean Agents

"For fire protection of special hazards and valuable assets"

- Protecting high value assets without causing damage
  - Energized electrical areas
  - Artifacts and archived data
- Continuous operations must be maintained
- Life safety is a concern
  - Emergency communications
  - Occupied or may be occupied (with the exception to CO_2)
- Must be a clean agent
  - No residue

Common extinguishing agents

Halon is an effective fire suppressant but was banned some years ago under the Montreal Protocol due to its environmental profile

HFC systems emerged as a popular alternative to halon when it was phased out. Their high global warming potential (GWP) means they are themselves subject to phase down under several regulations including the European F-Gas Regulations

Inert gas systems are generally mixtures of argon and nitrogen and work by removing oxygen from the protected area. They require significant pressure to operate, plus significant storage

Novec 1230 fire protection fluid is a truly 'clean' extinguishing agent exempt from all international regulations

Carbon Dioxide is widely used in fixed fire suppression systems, but CO2 systems have been linked to several deaths due to causing suffocation at low (5%) concentrations

Gaseous Clean Agents

- Halon
- HFCs
- Inert gas
- 3M™ Novec ™ 1230 Fire Protection Fluid

Gaseous (other)

- Carbon Dioxide

Not in-kind protection

- Aerosols
- Sprinkler
- Foam
- Water Mist
- Oxygen Reduction

Aerosols are a suspension of fine solid particles in a gaseous medium, mostly effective on Class B fires

Sprinkler systems are designed to control, not necessarily extinguish a fire. Release of water onto electronics or valuable assets can cause more damage than the fire itself

Extinguishes fire by covering it with a film of foam that starves it of oxygen. A 'wet' technique that can damage assets and dry goods

Water mist systems discharge very fine spray to reduce heat and displace oxygen. Good for large fires but less effective for hidden or obstructed fires.

Extinguishes fire by permanent reduction of oxygen concentration . Not suitable for occupied spaces

Environmental Regulations and Sustainable Solutions

Discover how to specify clean agent systems to meet environmental protocols, standards, regulations and codes such as NFPA 2001, EPA SNAP, the Montreal Protocol and more.

From 2009 to 2012, the average HFCs (all applications) quantity which was sold in the EU was 183 million tons of CO_2 equivalents per year.
This CO_2 equivalent quantity is the basis for the reduction plan.

Year	% of Base Quantitiy
2015	100
2016 and 17	
2018, 2019, 2020	
2021, 2022, 2023	45
2024, 20	31
	24
	21

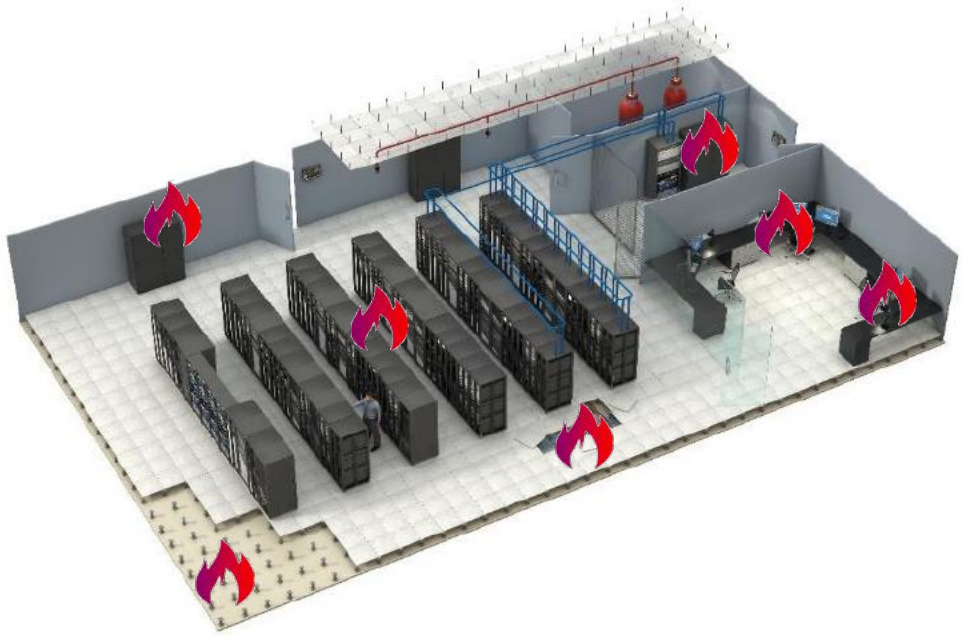
Applicable for all HFCs and PFCs but NOT for Novec 1230

Conclusions

- Know the environmental impact of the agents specifie
- Select a system that complies with current regulations your area
- Specify an environmental warranty to ensure protectio against future changes and phase downs

Common data center fire hazards

- **Server Rooms**
  - Class A, B & C
  - Electrical, Rack KW, Plastic, Batt
- **Network Rooms**
  - Class A, C
  - Electrical, Plastics
- **Under Floor**
  - Class C
  - Old standard, low protection
- **Plenum**
  - Class A & C
  - Increased wiring
- **Power & Generation**
  - Class C & B
  - Electrical, Lubricants



- **Battery Rooms**
  - Class A, B & C
- **CRAC and HVAC**
  - Class B & C
  - Electrical, Oils
- **Documents**
  - Class A
  - Paper, Artifacts
- **Security Rooms**
  - Class C & B
  - Electrical, Lubricants
- **Malicious**
  - Class A & B
  - Intentional

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Value Proposition

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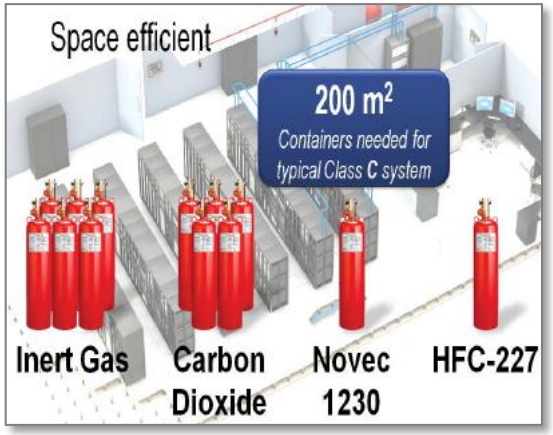
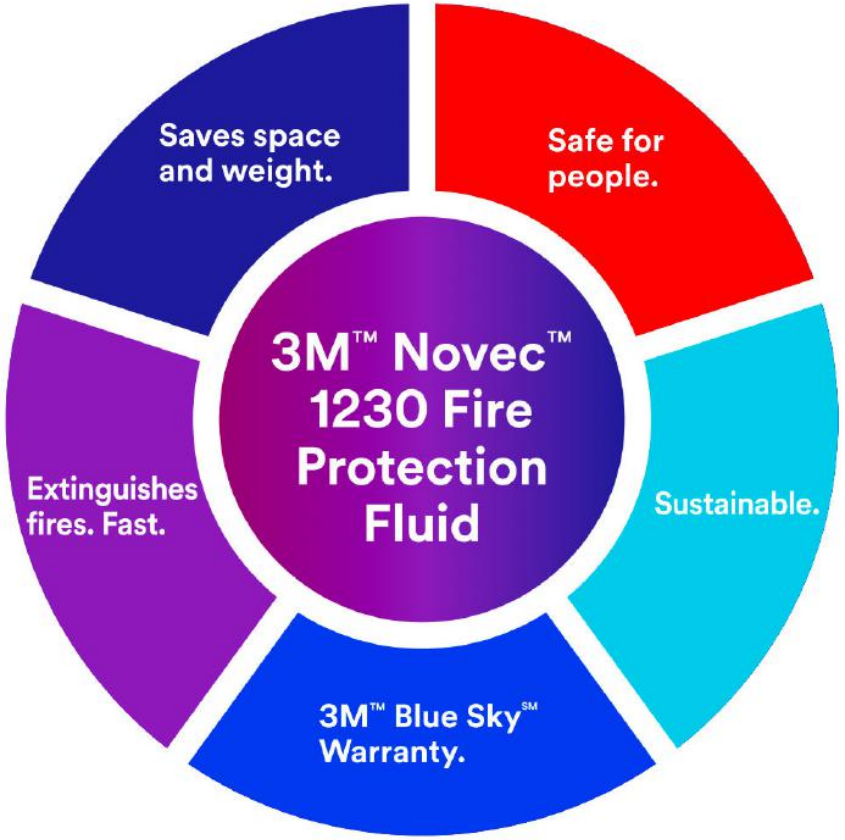
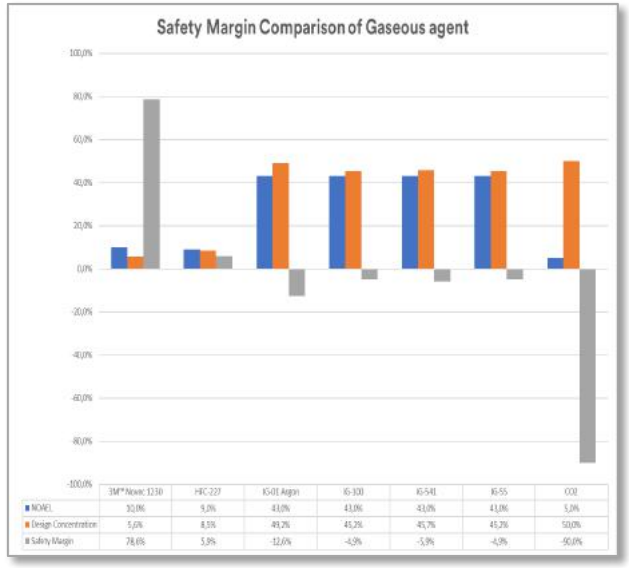
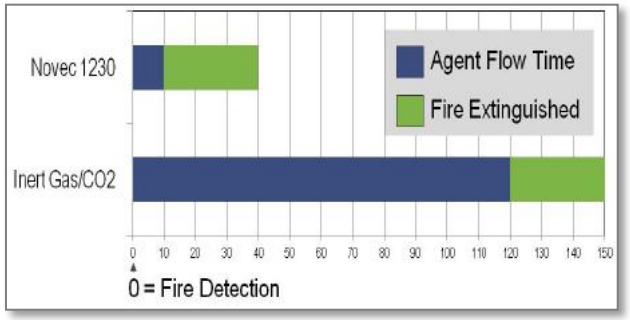
Clean Extinguishing agent to protect high value assets where life safety is paramount

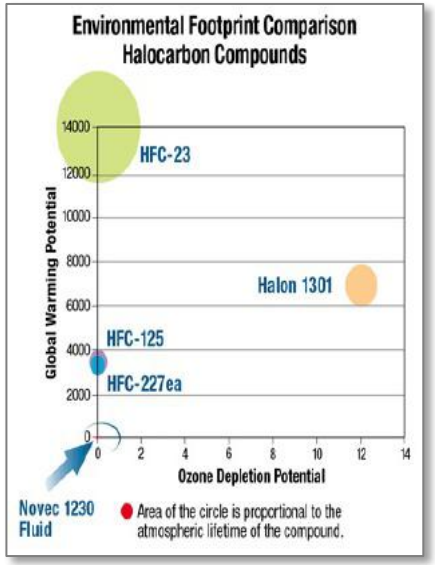




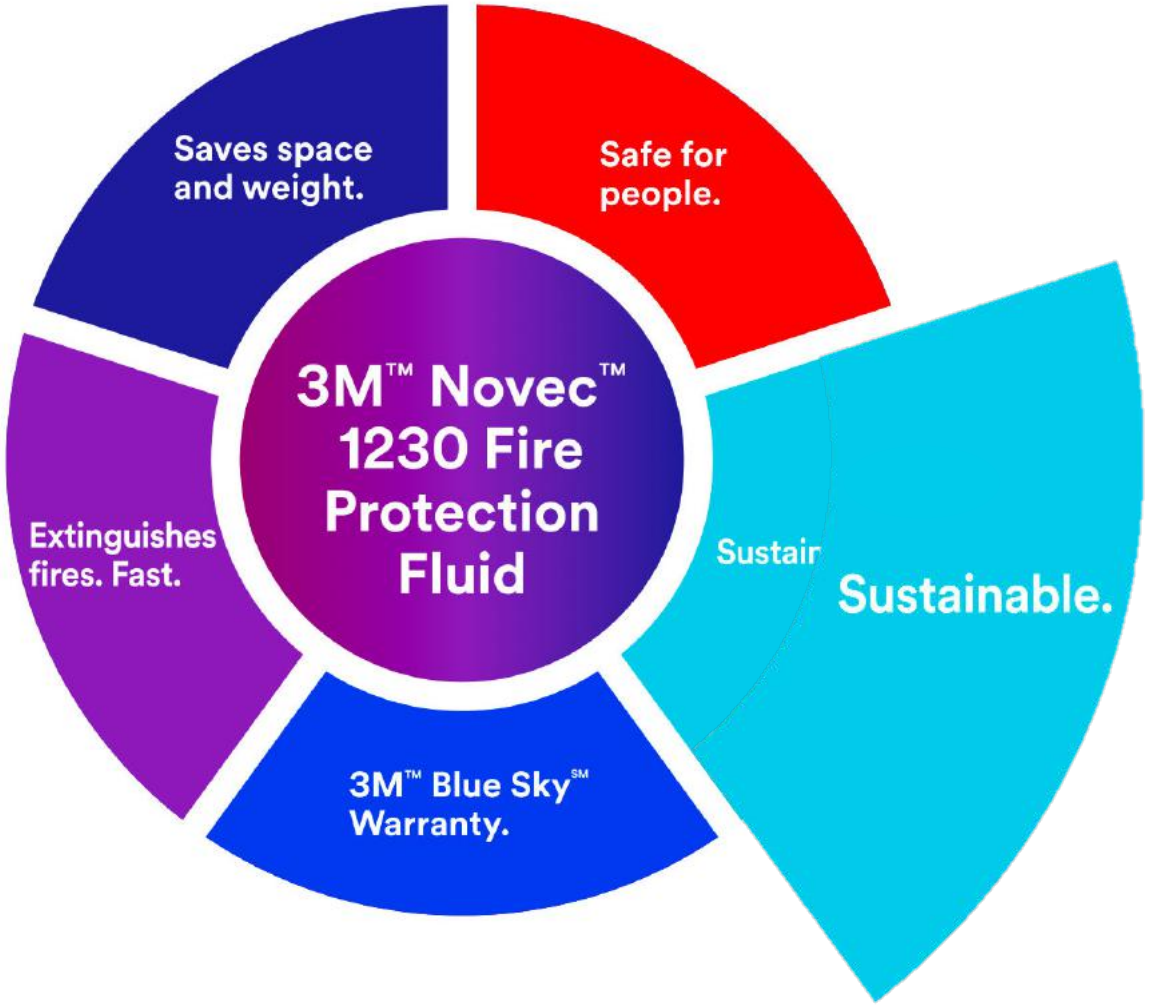


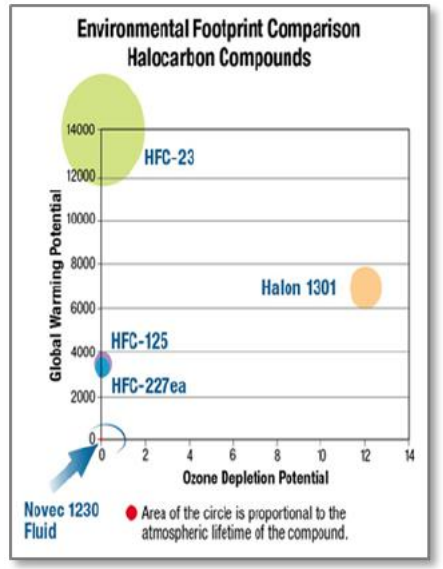
Extinguishing Speed



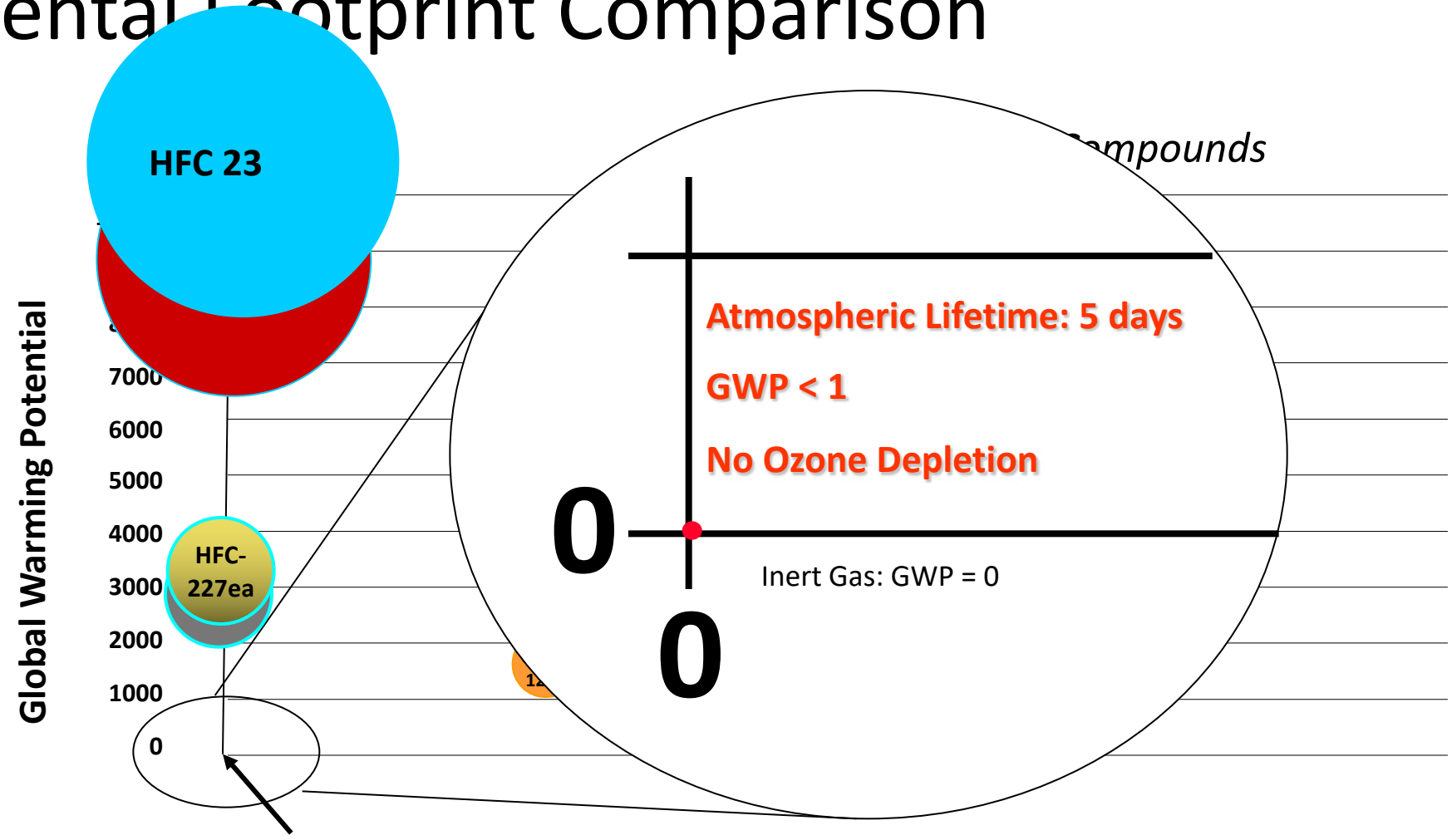


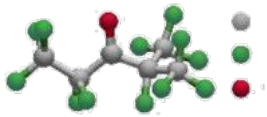
Value Proposition for Clean Agent Fire Suppression Systems





Environmental Footprint Comparison





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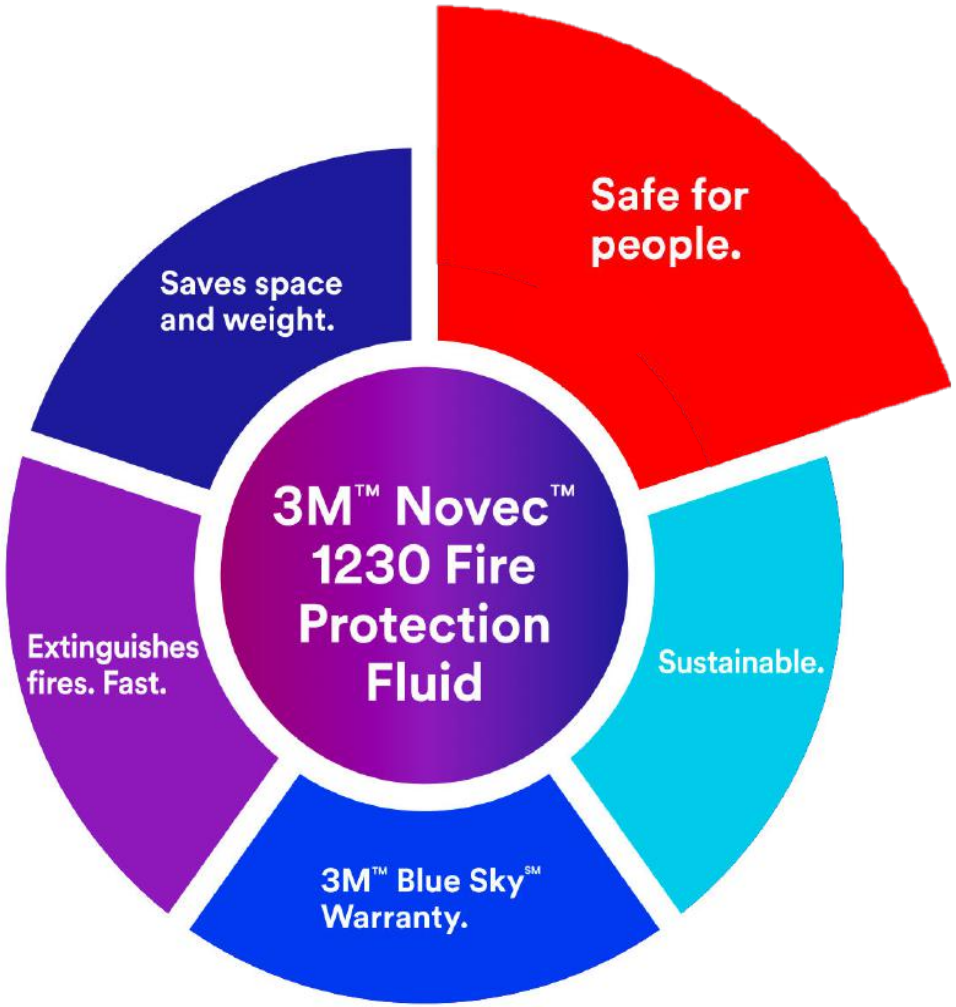
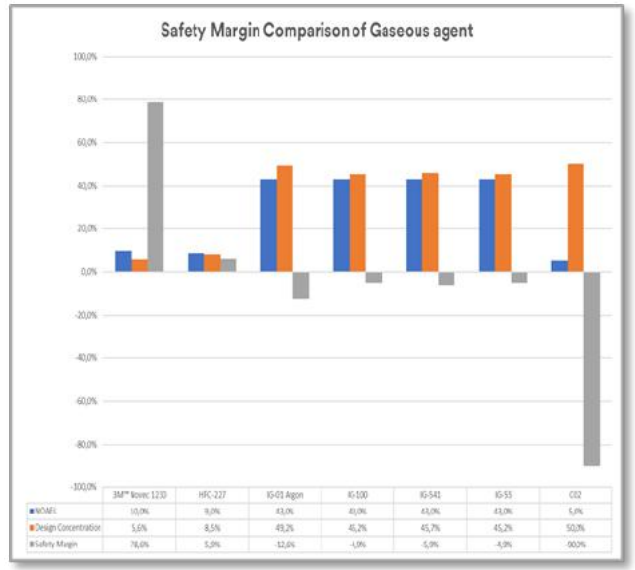
Area of the circle is proportional to the atmospheric lifetime of the compound.

Value Proposition for Clean Agent Fire Suppression Systems





Fire smoke is a deadly mixture of CO_2, CO, solid and liquid particulates and potentially a wide range of highly toxic gases. The contents of smoke vary widely depending on the chemical composition of the fuel and the availability of oxygen but can include toxic chemicals such as:

Hydrogen Cyanide, Halogen Acids, Dioxins, Sulphur compounds and hydrocarbon compounds

By extinguishing the fire we can eliminate the threat from these chemicals.

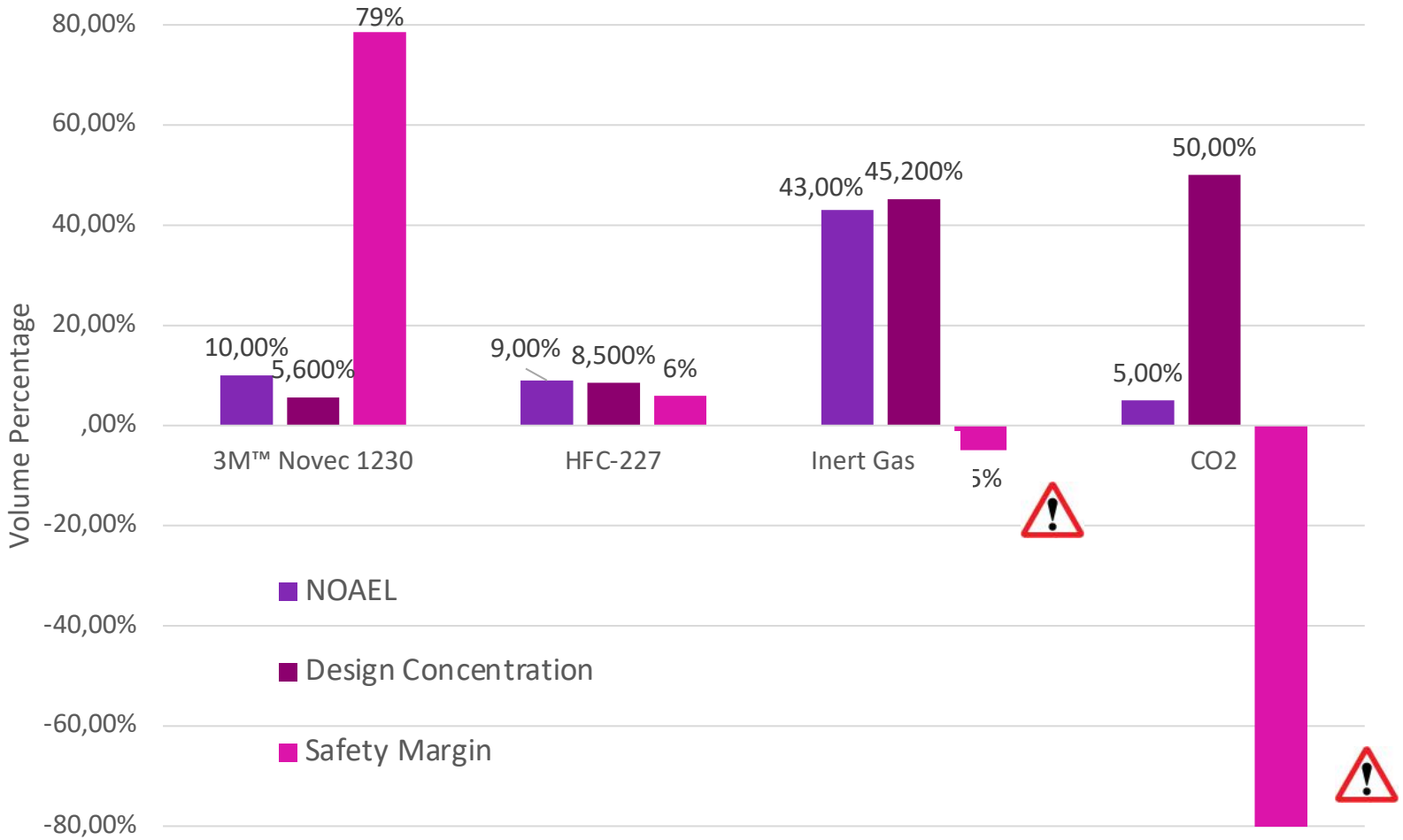
Pro-active interference with a developing incident can prevent fire and therefore, fuel breakdown components

But how do we determine that the extinguishing agents are safe and what precautions are required?

Designing Safe systems

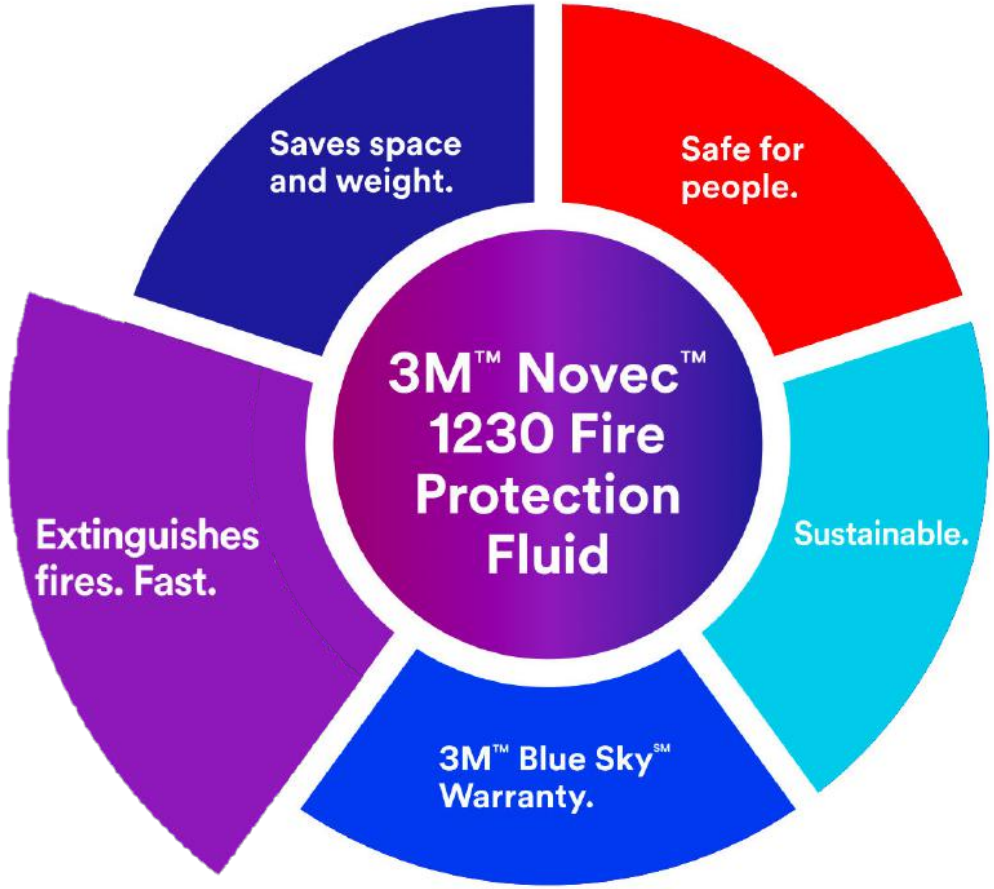
$$\text{Safety Margin} = \frac{\text{NOAEL} - \text{Design Conc}}{\text{Design Conc}}$$

Example for a Higher Hazard Class A installation

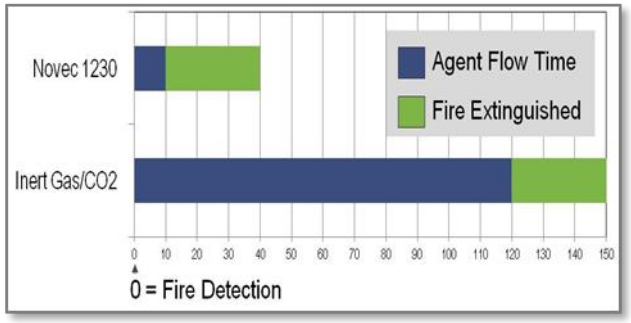


Ref: Higher Hazard Class A, EN15004

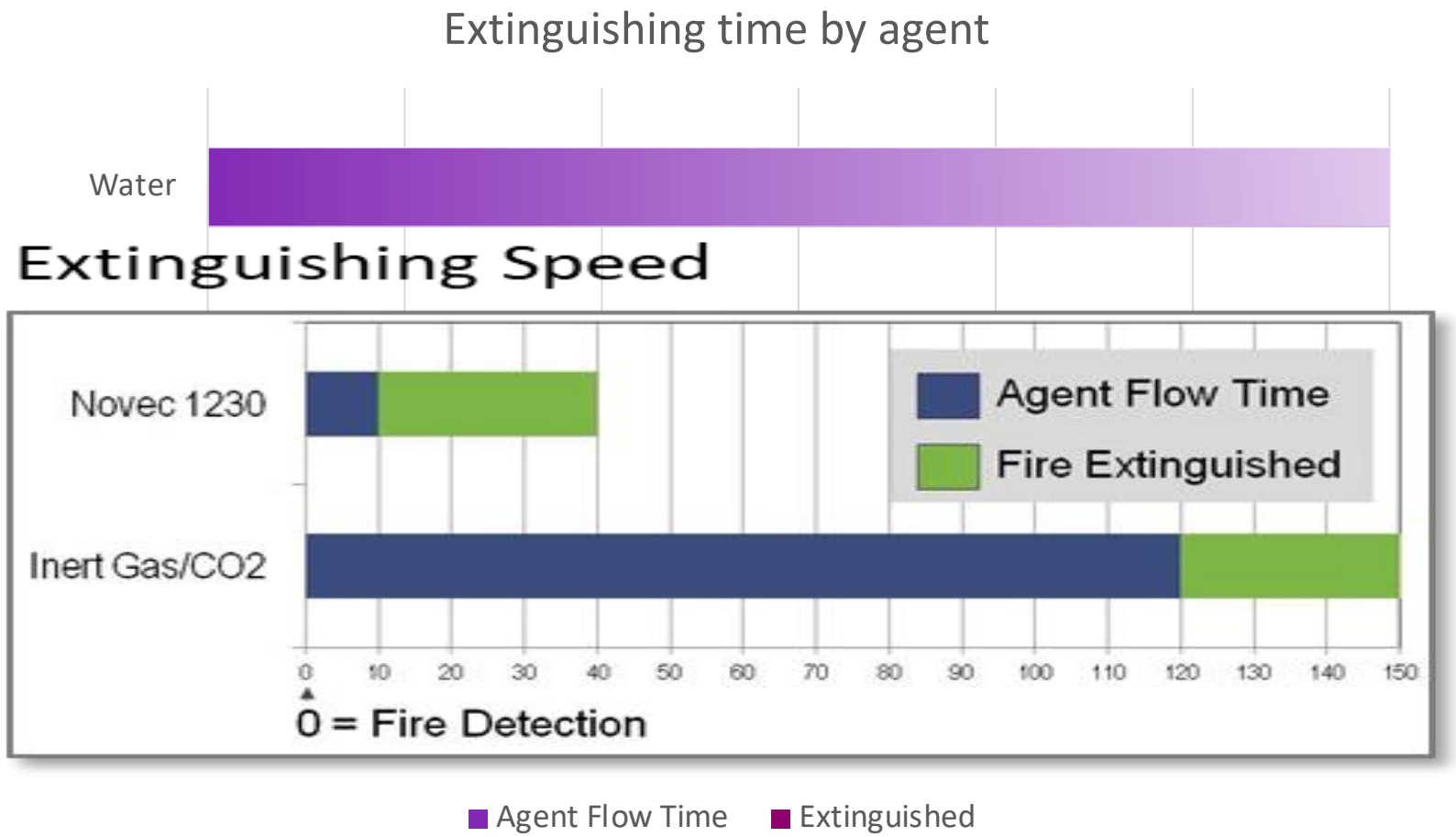
Value Proposition for Clean Agent Fire Suppression Systems



Extinguishing Speed

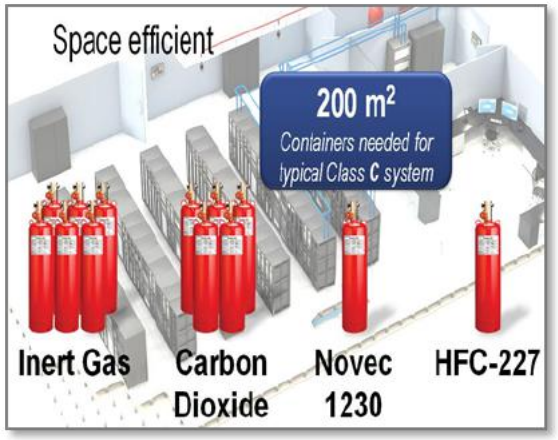


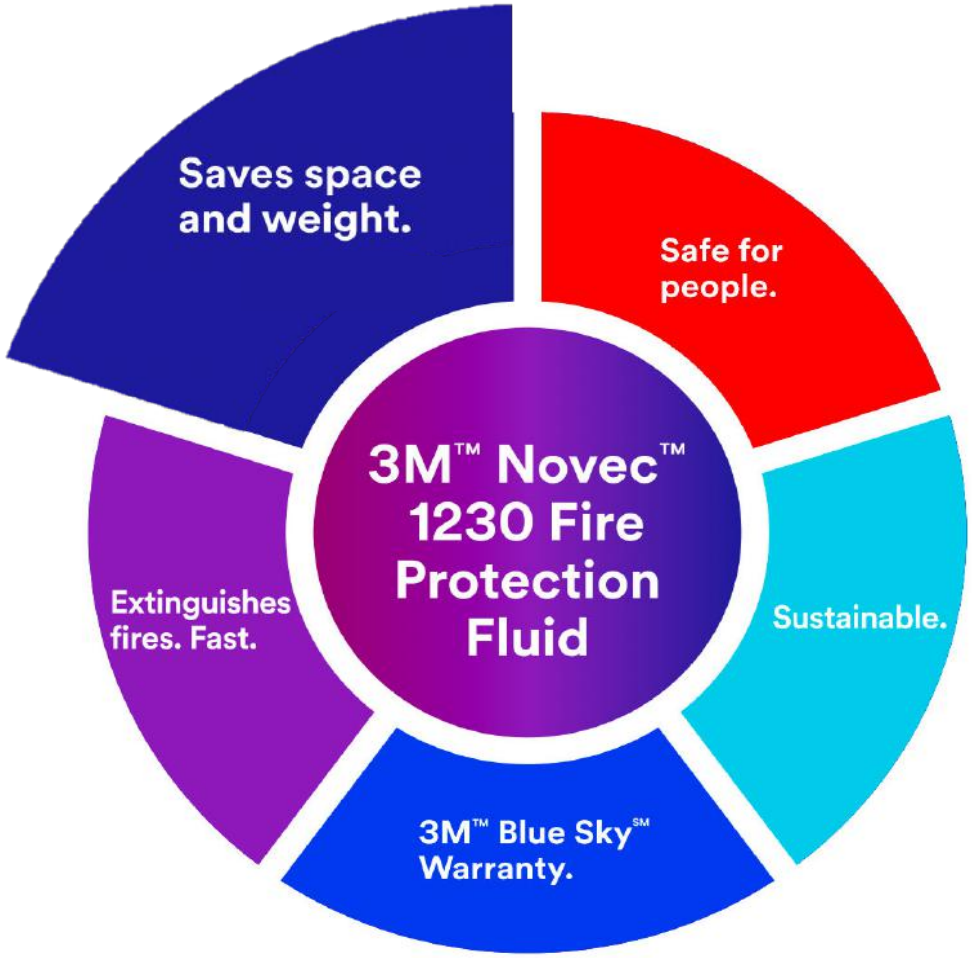
Speed of Suppression



Ref: ISO14520, EN15004

Value Proposition for Clean Agent Fire Suppression Systems

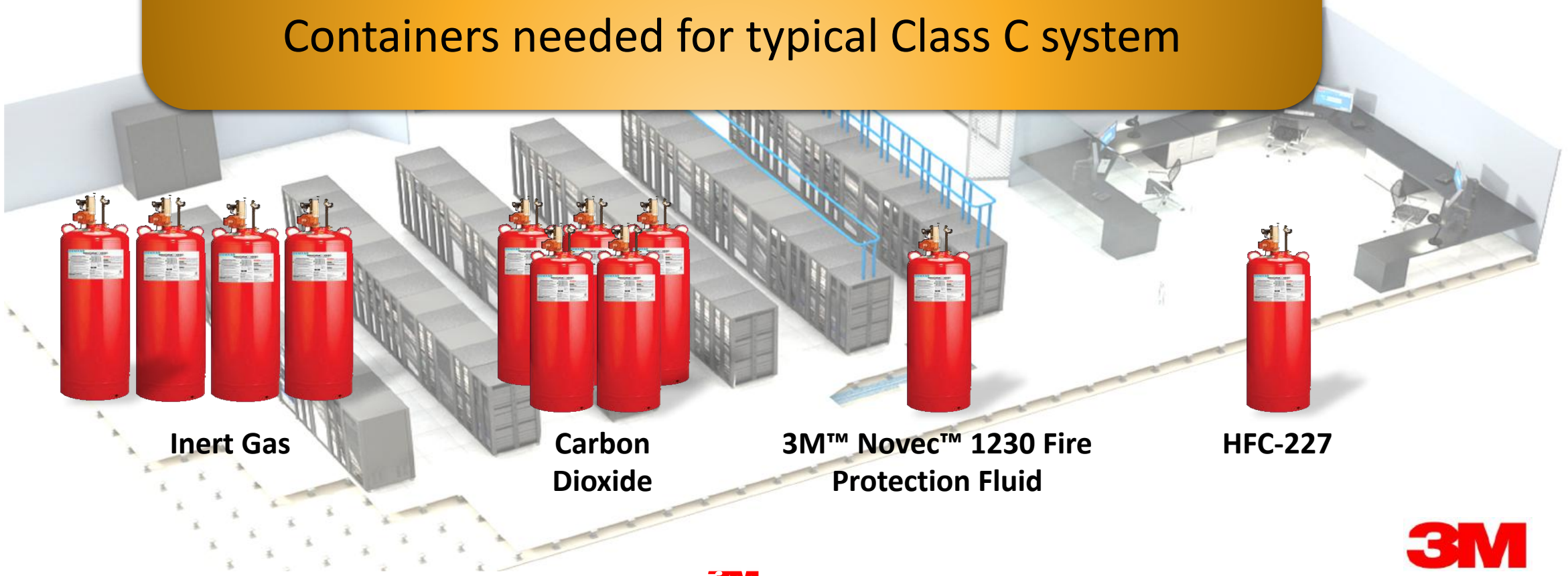




Saves space.

200m³

Containers needed for typical Class C system



Standards, Approvals and Listings for Engineered Systems using 3M™ Novec™ 1230 Fire Protection Fluid

VdS Approved

FM Approved

Certification

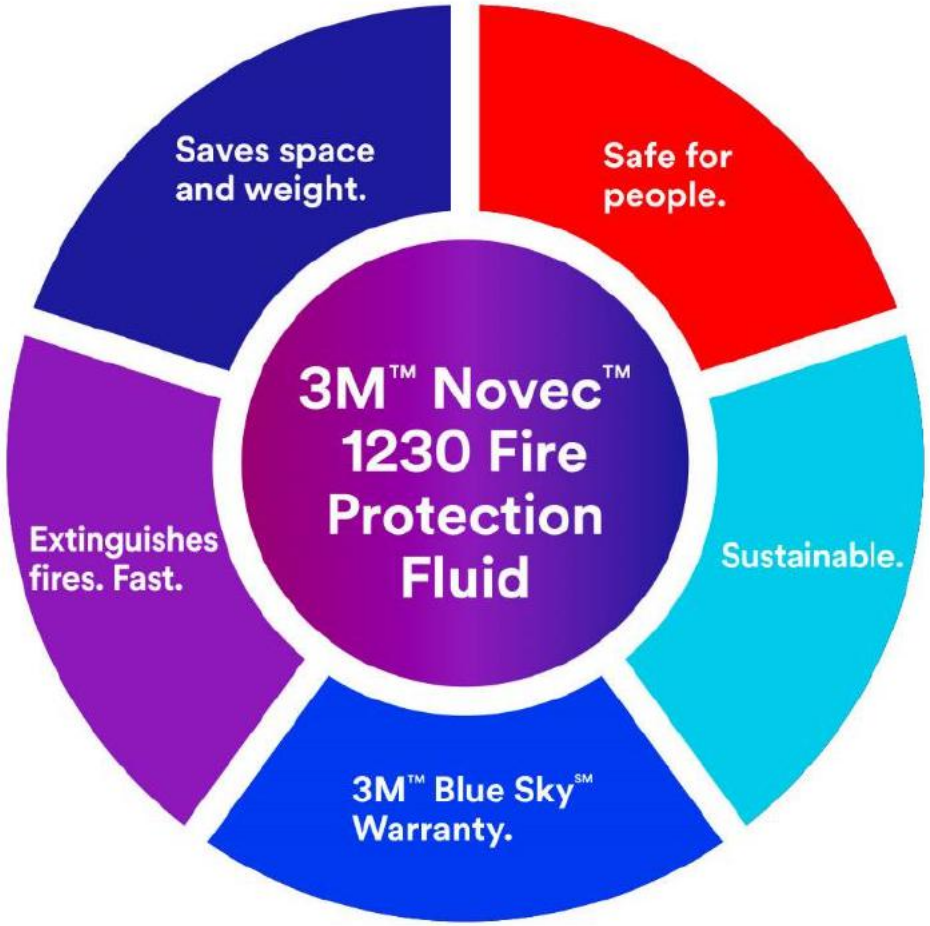
LPCB Approved

ISO 14520 Standard on
Gaseous Media Fire Extinguishing Systems

UL Listed

NFPA 2001 Standard on
Clean Agent Fire Protection Systems

Key considerations



- Systems Capabilities
  - Single or multi zone
- Engineering specifications
  - Standards
  - 3rd party testing
  - System approval
- Extinguishing Performance
  - Risk and hazard
  - Refilling stations
  - Maintenance
  - Total cost of ownership