

THERMASOLV™

DIELECTRIC COOLING FLUIDS

for electronic & electric devices

**INVENTEC**
PERFORMANCE CHEMICALS



HIGH
PERFORMANCE



EXCELLENT
COMPATIBILITY



OPTIMAL
PROCESS



ENVIRONMENTAL
FRIENDLY

INVENTEC, A DEHON GROUP COMPANY

A family company created in **1874**, first specialized in the filling and distribution of refrigerants.



Dehon group companies:

SMB AUTO

Car care solutions
& services

climalife®

Refrigeration, air
conditioning & heating

matelex

connected refrigeration
Leak detection for
refrigeration

SODEREC
INTERNATIONAL

High-risk chemicals

INVENTEC
PERFORMANCE CHEMICALS

Soldering, Cleaning, Coating
& Cooling solutions

PUS
Pure
Ultrasonic
Systems

Metal powders
powder atomizers & sieving

crealis

blending, filling & packing
of chemicals

750 collaborators worldwide: 16 subsidiaries in 3 continents

INVENTEC PERFORMANCE CHEMICALS

GLOBAL PROVIDER OF SOLDERING, CLEANING, COATING & COOLING SOLUTIONS FOR ELECTRONIC, SEMICONDUCTOR AND INDUSTRIAL APPLICATIONS

For nearly **60 years** we have shown leadership in innovation by putting High Reliability applications and minimizing **environmental & health impact** at the core of our product development. **10% of our turnover is invested in R&D.**

With **ISO 9001 & 14001 production sites** in France, Switzerland, USA, Mexico, Malaysia and China we can guarantee a smooth and cost-effective supply chain.

With more than **1500 satisfied customers** & more than **300 products**, we are armed to find the right solution based on your requirements, process and sustainability targets.



OUR GUIDELINES

PROXIMITY

A worldwide presence to support our customers

PERFORMANCE

Specialized teams and effective technical solutions to serve our customers

PROTECTION

Friendly solutions for health & environment

A COOLING SOLUTION FOR NEW & FUTURE INNOVATIONS



INNOVATION IS TURNING THE HEAT UP

Many innovations to improve performance of electronic & electrical devices result in a higher power consumption and hence generate more heat.

- The number of cores within a CPU is constantly increasing
- More use of overclocking to improve compute performance
- Increasing use of high power GPU's
- Lower latency requirements demands components to be put closer together
- Miniaturization and weight reduction of devices
- Faster EV charging
- Fast acceleration or more powerful electric engines
- Batteries perform best when maintained cooled and need security from fire

GLOBAL WARMING IS DEMANDING A MORE SUSTAINABLE APPROACH

The high energy use for air-cooled datacenters is a big concern and putting legislation in place to limit the PUE of new datacenters build. Besides, there is the restriction of excessive water use and concerns towards health & safety issues with some current available solutions.



WHEN YOU REACHED THE LIMITS
WITH CONVENTIONAL COOLING...

RELY ON THERMASOLV™

THERMASOLV™

PRODUCTS MADE FOR HIGH RELIABILITY



Electronic or electrical devices in use, create heat and **need to be cooled to avoid malfunction**. Based on our 60 years of experience in solvent based cleaning fluids and processes, Inventec has developed a cooling fluid range **to cater today's and future technical requirements**.

Key parameters taken into account:

- Heat transfer effectiveness
- Electrical Insulating Properties
- Safety & environmental consideration
- Compatibility with materials

PERFORMANCE

- Outstanding thermodynamic properties
- Dielectric fluid
- Low viscosity
- Low surface tension
- High thermal stability

SAFE

- Non-flammable & no flash point
- No CMR or hazardous compounds
- Fire extinguishing properties
(Depending on product)

SUSTAINABLE

- Recyclable
- Non-corrosive
- Compatible with most materials
- Mild odor
- Medium low to No GWP
(Except Thermasolv CF1)
- No ODP



COOLING FLUIDS

APPLICATION FIELDS



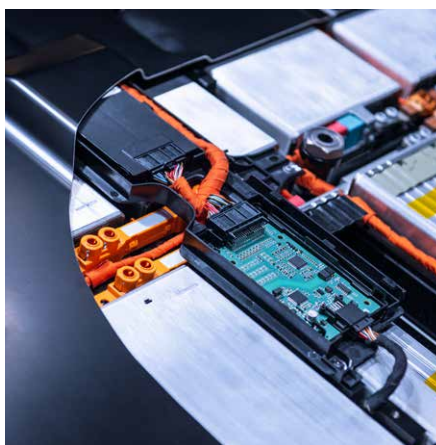
COMPUTING

- DATACENTERS
- CRYPTO & BLOCKCHAIN
- SUPERCOMPUTERS
- STOCK EXCHANGE SYSTEMS



INDUSTRIAL PROCESSES

- DIELECTRIC TESTING
- FREEZE-DRYING
- SEMICON ETCHING



MOBILITY

- CHARGING STATIONS
- BATTERY SYSTEMS
- ELECTRIC MOTORS
- CONTROLLERS
- BRAKING SYSTEMS



HIGH POWER MANAGEMENT

- CONVERTERS & INVERTERS
- LASERS & POWER LEDS
- MEDICAL SCANNERS
- MILITARY INSTALLATIONS





RECOMMENDED PRODUCTS

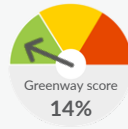
Each product has specific parameters in order to suit best your application and process. Our team is ready to help you to select the right product.

All our Thermasolv products have no Ozon Depleting Potential (ODP), no flashpoint and non-flammable. Besides are all product recyclable.

THERMASOLV™ IM2

Dielectric heat transfer fluid

GREENWAY

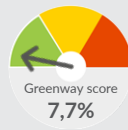


- Dedicated for 2-phase systems (BP: 49°C / 120°F)
- Ultra-low GWP
- Well balanced performance

THERMASOLV™ IM6

Dielectric heat transfer fluid

GREENWAY NEW

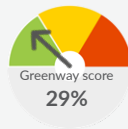


- Dedicated for 2-phase systems (BP: 47°C / 117°F)
- Ultra-low GWP
- Suitable for high humid environments

THERMASOLV™ CF3

Dielectric heat transfer fluid

GREENWAY NEW



- Dedicated for 1-phase systems (BP: 120°C / 248°F)
- Low GWP
- Non-flammable & no flashpoint

Non-exhaustive list of products. INVENTEC assists you to select the best product adapted to your need.

3 MAIN PROCESSES

1

IMMERSION COOLING (1-PHASE / 2-PHASE)

Electronic boards, components or devices are immersed in a dielectric fluid where heat from the components is transferred to the fluid. Pumps are used to flow the heated fluid to a heat exchanger.

In 2-Phase immersion cooling, fluid is boiled and condensed, increasing substantially heat transfer efficiency.

2

DIRECT COOLING

The fluid is pumped through cold plates attached to electronic components or through cooling tubes to take away the heat. The electronics are never in contact with the fluids. The heated fluid can be cooled in a 1 or 2-phase system.

3

DIELECTRIC TESTING & MANUFACTURING

The cooling fluid is used for dielectric testing or to cool critical manufacturing processes in the semicon and pharma industry.

Dielectric cooling fluids

OVERVIEW TABLE



APPLICATIONS	THERMASOLV IM1	THERMASOLV IM2	THERMASOLV IM6	THERMASOLV IM7	THERMASOLV CF2	THERMASOLV CF3
ODP	0	0	0	0	0	0
GWP	320	<10	20	55	<120	<108
Flash Point	No	No	No	No	No	No
Boiling Point (°C/°F)	61 / 142	49 / 120	47 / 117	76 / 169	110 / 230	120 / 248
Pour Point (°C/°F)	-135 / -211	-108 / -162	-117 / -179	-138 / -216	-110 / -166	-82 / - 116
Critical Temperature (°C/°F)	195 / 387	169 / 336	170 / 337	210 / 410	285 / 545	285 /545
Critical Pressure (Mpa)	2,23	1,88	2,21	2,01	5	n.a.
Vapor Pressure (kPa)	27	40	35	16	1,9	1,5
Heat of vaporization (KJ/Kg @BP)	112	88	93	119	88	82,8
Liquid density (Kg/m ³)	1520	1600	1600	1430	1815	1836
Kinematic viscosity (cSt)	0,38	0,4	0,36	0,43	1,35	1,27
Specific Heat (J/Kg-K @25°C)	1138	1103	1144	1220	1087	1034
Surface tension (dynes/cm ²)	13,6	10,8	11,4	13,6	15	13
Dielectric strenght (KV)	28	>40	79	>25	39	>35,7
Dielectric constant @ 1 kHz	7,4	1,84	1,88	7,3	1,79	2,09
Resistivity (Ohm-cm)	1,00E+09	1,00E+13	1,00E+15	1,00E+08	2,50E+14	1,00E+15
Thermal conductivity (W/m-K)	0,069	0,059	0,110	0,069	0,115	0,112
Water content spec (ppm)	50	10	10	100	15	15
Water solubility (ppm)	95	10	<10	92	<10	<10

Non-exhaustive list of products. INVENTEC assists you to select the best product adapted to your need.

Greenway™

THE WAY WE THINK, THE WAY WE ACT



In 2012, Inventec launched Greenway™ in order to steer new development to more green products.

10 years later, Greenway™ evolved to **classify each product related to their HSE impact.**

GREENWAY™ SCORE

GUIDES YOU
TOWARDS THE MOST
SUSTAINABLE SOLUTION

To evaluate the impact, the following product indicators are taken into account:

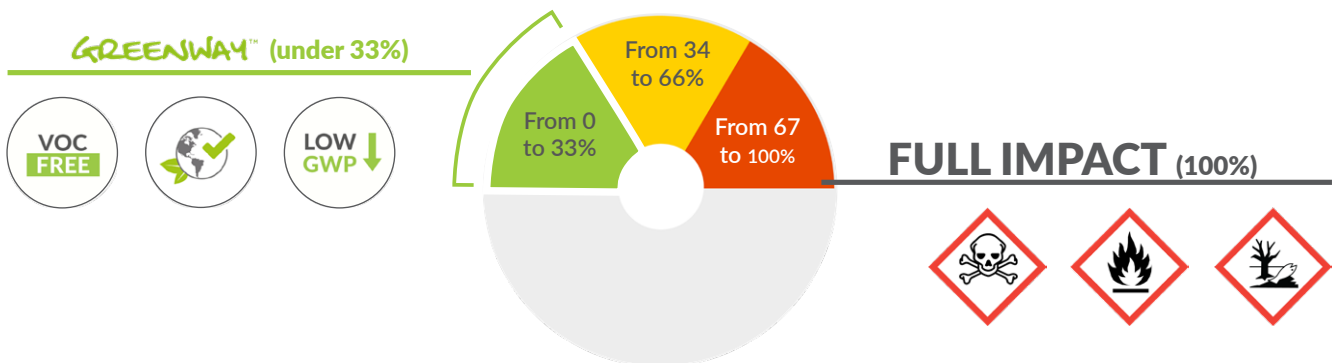
INDICATORS ON HUMAN HEALTH

- flammability
- toxicity
- corrosivity
- risks of raw materials

INDICATORS ON ENVIRONMENT PROTECTION & RESSOURCES MANAGEMENT

- water consumption
- energy consumption
- source / origin of raw materials
- waste management
- emissions reduction (VOC, GWP)
- recyclability of the product & packaging
- circular economy possibilities: with the **ECOPROGRAM**
- consumption of other consumables
- comparison of processes

Indicators are translated in percentage with crossed reference data. The data taken into account to calculate the impact score are based on the product MSDS, industrial expertise & European legislations.



A GREENWAY™ PRODUCT HAS LESS THAN 33% OF IMPACT

Ecoprogram™

RECYCLING OF COOLING FLUIDS



ECOPROGRAM

Service for SOLVENT RECYCLING, SOLVENT REGENERATION & ECO-CONSULTANCY

Benefits:

- to reduce the amount of waste in the environment
- to avoid cost & administration for the destruction
- to buy recycled but still high-quality product at lower cost
- to improve your company's environmental image

Most Thermasolv cooling fluids don't end up as waste when you don't need them anymore.

You may also want to purify the fluid over time to avoid the risk of any build up impurities in your system.

REDUCE

- ENVIRONMENTAL IMPACT
- COST



Our ECOPROGRAM service availability may differ from one to another country as recycling and waste-treatment is strictly regulated.



OUR COOLING FLUIDS
DON'T END UP AS
WASTE

Application focus

DATACENTERS



Innovation pushes the performance of a single server unit to new heights but this comes also with a higher power output and hence increase of generated heat. Cooling with air is at its technical limits.







Energy consumption for cooling is a major cost for datacenters and from a global warming perspective, some countries already put regulation in place to cap the PUE of newly to build facilities.

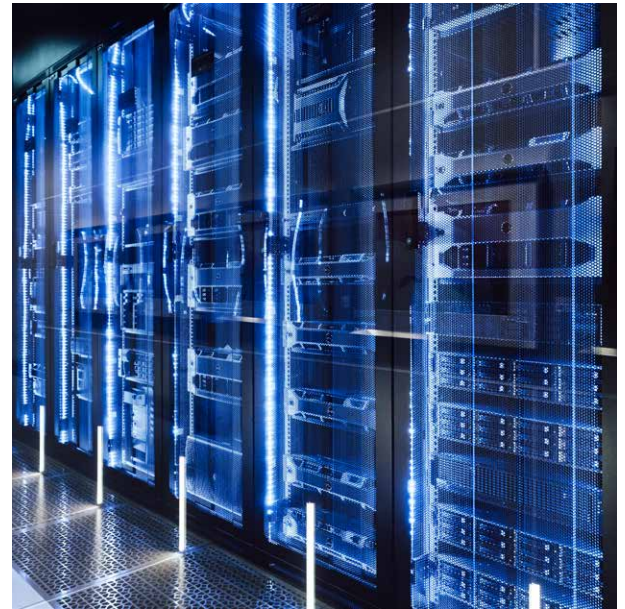
Power density per rack is limited to around 40 kW for air cooled datacenters. With current server specification, a lot more physical space is needed to meet up with demand.



RE-THINK
COOLING
FROM THE GROUND UP

ADVANTAGES OF IMMERSION COOLING

-  95% reduction in energy consumption
-  Increase power density to > 250kW per rack
-  Greater & uniform thermal efficiency
-  Reduce physical space to 100 kW/m²
-  Less design complexity, more design freedom
-  Reduce water consumption



ADDITIONAL BENEFITS

- Some Thermasolv™ fluids have fire extinguishing properties providing an extra fail-safe in case of fire.
- In case of a leakage, the clean-up is not as messy compared with oil-based cooling fluids.
- The very low surface tension allows the fluid to penetrate under low stand-off components.
- Easy extraction and recovery of heat for further use.
- Higher hardware reliability as moving parts, like fans, are not needed and electronics are shielded from dust and humidity.
- Less depending on geographical conditions.
- Some of our fluids evaporate quickly, making it easy to perform maintenance.
- Reduction in noise level.

Application focus

ELECTRICAL VEHICLE BATTERIES & CHARGING STATIONS



ELECTRICAL VEHICLE BATTERIES

KEY ISSUES

Keeping EV batteries cool is critical for the performance and to optimize driving range and battery lifetime. Besides, there is the need for shorter charging times and the safety issue of run-away fires with lithium battery technology.

Direct cooling by liquid cooling of cold plates or tubes does provide better results as air cooling but does not provide a uniform cooling. Cells positioned farther from the inlet of cooled fluid receive less cooling, leaving so called hot spots.

CHARGING STATIONS

KEY ISSUES

While 150 kW DC fast charging is becoming the standard for public charging facilities, solutions of up to 350 kW are entering the market. Profound heat management becomes critical with these solutions.

These charging stations also need to be able to operate in environments as low as -35 and up to 50 degrees Celcius.

ADVANTAGES USING THERMASOLV™

- Uniform temperature across the whole battery pack
- Possible to increase the battery density
- Less weight
- Higher charging & discharging possible
- Eliminate the risk of short circuits
- Prevention of run-away fires

ADVANTAGES USING THERMASOLV™

- Non-flammable
- Outstanding thermodynamic properties compared to glycol & oils
- Space & weight saving compared to air cooling
- Easy & ergonomic integration
- Non-corrosive

INVENTEC WORLDWIDE

6
PRODUCTION SITES

10
SUBSIDIARIES

WORLDWIDE
DISTRIBUTOR
NETWORK



EUROPE

INVENTEC Performance Chemicals

Head Quarter, Sales office and production facility

26 rue des Coulons – BP 27

94363 Bry-sur-Marne cedex / France

Tel: +33 (0)1 43 98 75 00

Email: info_france@inventec.dehon.com

INVENTEC Switzerland

Production site & Sales office

Z.I. Petits Champs 15

1400 Yverdon-les-Bains

Tel: +41 (0)24 424 80 90

Email: info.ch@inventec.dehon.com

INVENTEC Germany

Sales office

Robert-Bosch-Strasse 14

D-40668 Meerbusch

Tel: +33 (0)6 11 95 98 86

Email: info_germany@inventec.dehon.com

INVENTEC Spain

Sales office

Polígono Industrial Sepes, C/ Kepler 10,
E-46520 Puerto de Sagunto, Valencia

Tel: +34 (0)96 353 51 93

Email: infospain@inventec.dehon.com

INVENTEC Hungary

Sales office

Gábor Dénes körút 580. (BITEP Ipari Park)

H-2040 Budaörs

Tel: +36 (0)23 431 660 / 661

Email: inventec.hu@inventec.dehon.com

ASIA

INVENTEC China

Production site & Sales office

1/2 F Building 6, No. 185 yuanke Rd.

Xinzhuan Industry Park 201108 Shanghai

Tel: +86 (0)21 6442 3962/82

Email: infochina@inventec.dehon.com

INVENTEC South East Asia

Production site & Sales office

No. 3, Jalan Industri Kidamai 2/1,

43000 Kajang, Selangor, Malaysia

Tel: +60 (0)3 8741 8925

Email: infosea@inventec.dehon.com

INVENTEC Japan

Sales office

Nippon TV Yotsuya Building

1F 5-3-23 Kojimachi, Chiyoda-ku, Tokyo

Tel: +81 (0)80 9567 1063

Email: infojapan@inventec.dehon.com

AMERICA

INVENTEC USA

Production site & Sales office

500 Main Street, Suite 18, PO Box 989

Deep River, CT 06417 USA

Tel: +1 (0)860 526 8300

Email: info_northamerica@inventec.dehon.com

INVENTEC Mexico

Production site & Sales office

Rio Conchos 1757, Fraccionamiento Industrial El Rosario

Guadalajara, Jalisco C.P. 44890, Mexico

Tel: +52 (0)33 3838 8866

info_southamerica@inventec.dehon.com

INVENTEC
PERFORMANCE CHEMICALS
INSPIRING INNOVATION

www.inventec.dehon.com • contact@inventec.dehon.com

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