

Helping to sustain the world's resources

Heat transfer fluids for alternative energy and technologies



In a world of finite resources, such as energy and drinkable fresh water, innovation is required to meet the demands of a growing population. Eastman Therminol® heat transfer fluids are helping meet those demands. Whether it is harnessing the power of the sun to convert water into steam for generating electricity or distilling fresh water from sea water, needed to irrigate desert crops, Therminol fluids are at the forefront of providing solutions to meet tomorrow's needs.

Following are some applications where Therminol heat transfer fluids are used.

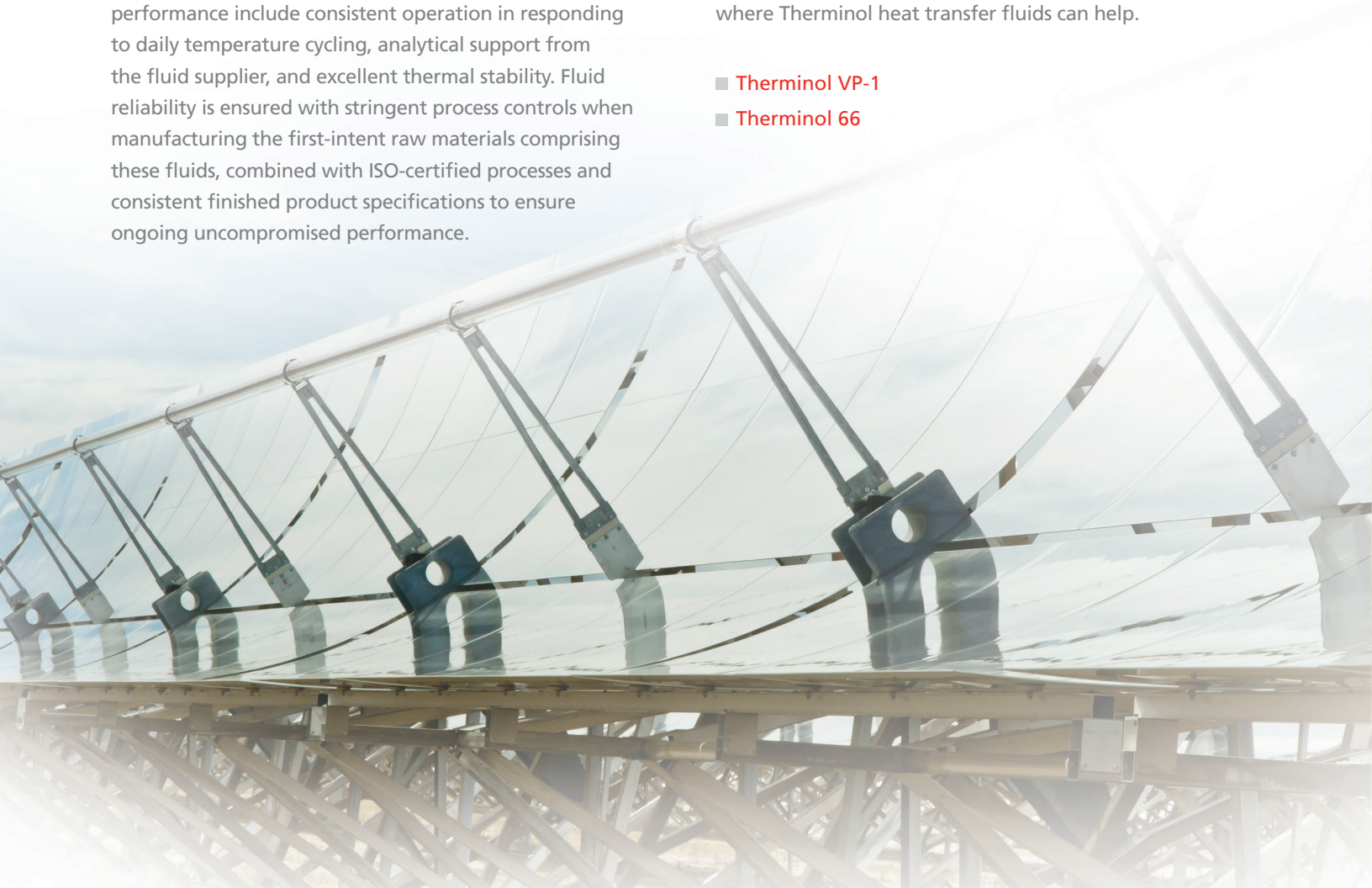
CSP (concentrated solar power)

Therminol heat transfer fluids for long life and thermal stability at the highest temperatures

Therminol® heat transfer fluids have been utilized in concentrating solar plants since the mid-1980s, some of which continue to operate on their maintained charge of original fluid today! Keys to such long life and reliable performance include consistent operation in responding to daily temperature cycling, analytical support from the fluid supplier, and excellent thermal stability. Fluid reliability is ensured with stringent process controls when manufacturing the first-intent raw materials comprising these fluids, combined with ISO-certified processes and consistent finished product specifications to ensure ongoing uncompromised performance.

CSP hybrid applications, combining CSP and ORC (organic rankine cycle) to generate electricity, as well as CSP and seawater desalination, are just two of several new developments in alternative energy and technologies where Therminol heat transfer fluids can help.

- Therminol VP-1
- Therminol 66





ORC (organic rankine cycle)

Therminol heat transfer fluids for safe waste heat recovery and excellent transfer of thermal energy

The production of electrical energy by capturing the heat from biomass-fired systems, geothermal sources, or waste heat and gases from any other process is the goal of ORC systems. This is accomplished by using Therminol® heat transfer fluids in heat exchange with gas streams 450°C (842°F) or higher. In the past, this thermal energy would often have been exhausted without capture. However, the expanding ORC technologies are helping to reduce our energy footprint, recover the thermal energy from stack gases, and transform it into electrical power by vaporizing a motive fluid that runs special ORC turbines. The producing sites are also taking advantage of the cost benefits made possible by putting this electrical power onto the grid.

All of this is supported by the world's leading high-temperature heat transfer fluids due to their excellent thermal stability and heat transfer coefficients. ORC hybrid applications, combining CSP and ORC, are also finding Therminol products to be excellent heat transfer media.

- Therminol 66
- Therminol 55
- Therminol SP
- Therminol 59
- Therminol 62



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Biofuel manufacturing

THERMINOL heat transfer fluids for stable, precise temperature control

The most common types of biofuels are ethanol, biodiesel, and fuels produced by gasification of biomass and the synthesis of liquid fuels from this synthesis gas. This process is called biomass-to-liquids (BTL). Other BTL technologies are producing renewable fuels by a special vegetable oil refining process. Also, nearly every step of biodiesel production requires efficient heating or cooling of product, from below 25°C (77°F) to 200°C (392°F) or more in some processes.

Other biofuel technologies require even higher temperatures up to 380°C (716°F) to achieve the desired high quality fuel based on renewable sources.

- **Therminol VP-1**
- **Therminol 72**
- **Therminol 66**
- **Therminol 55**
- **Therminol SP**
- **Therminol 59**
- **Therminol XP**
- **Therminol 62**





Desalination

THERMINOL heat transfer fluids for safe, reliable, long life that resists fouling

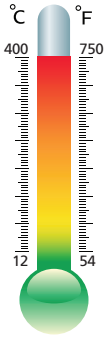
The global demand for fresh water production is increasingly critical for developing countries bordering the world's oceans. Several technologies exist, with some utilizing heat transfer fluid for assistance in the distillation step, which can occur with vacuum for increased boil-up rates. Therminol® heat transfer fluids are available to support these process needs whether the energy source is from concentrating solar or fuel-fired heaters.

Therminol fluid thermal stability ensures long life for the fluid, resistance to fouling, and excellent fluid-side heat transfer coefficients for consistent and reliable service.

- Therminol 66
- Therminol 55
- Therminol SP
- Therminol 59
- Therminol XP



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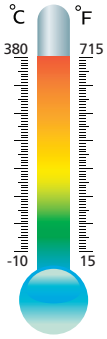
Therminol VP-1 *For ultra-high temperature, liquid or vapor phase operations*

Optimum temperature use range: 12° to 400°C (54° to 750°F)

SUGGESTED APPLICATIONS: • CSP (concentrated solar power) • Biofuel

BENEFIT	FEATURE
Superb heat transfer properties	Combines exceptional thermal stability and low viscosity for efficient, dependable, uniform performance in a wide optimum use range
Excellent vapor phase performance	A eutectic mixture of diphenyl oxide (DPO) and biphenyl. It can be used as a liquid heat transfer fluid or as a boiling-condensing heat transfer medium up to its maximum use temperature.



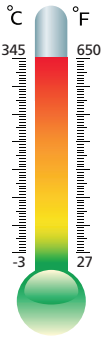


Therminol 72 *For ultra-high temperature, medium-pressure applications*

Optimum temperature use range: -10° to 380°C (15° to 715°F)

SUGGESTED APPLICATIONS: • Biofuel

BENEFIT	FEATURE
High-temperature stability	Ideally suited for high-temperature heat recovery applications that also require low-temperature fluidity
Reduced maintenance, lower operating and capital costs	May result in a significant reduction in capital investment, due to reduced freeze-protection requirements and lower-pumping energy costs at low temperatures as compared to other very high-temperature alternatives

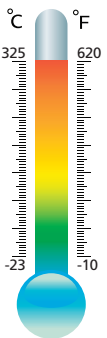


Therminol 66 *For high-temperature, low-pressure applications*

Optimum temperature use range: -3° to 345°C (27° to 650°F)

SUGGESTED APPLICATIONS: • CSP • Biofuel • ORC • Desalination

BENEFIT	FEATURE
Experience	Proven across many applications, many environments
Resistant to fouling	Specifically engineered to resist solids formation and system fouling, providing more reliable operation and potential cost savings



Therminol 62 *For medium-temperature, low-pressure applications*

Optimum temperature use range: -23° to 325°C (-10° to 620°F)

SUGGESTED APPLICATIONS: • ORC • Biofuel

BENEFIT	FEATURE
High value to cost	Users can expect many years of reliable, trouble-free operation, even when operating continuously at the recommended maximum temperature.

Low-end optimum use temperatures for most Therminol fluids are listed at 2000 cSt pump values. For 300 cSt pump values, see the specific product page on our website, www.therminol.com.

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Heat Transfer Fluids by Eastman



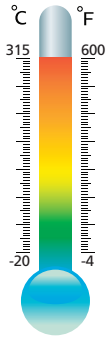
Therminol 59 *For applications requiring wide temperature range operations*

Optimum temperature use range: -49° to 315°C (-56° to 600°F)

SUGGESTED APPLICATIONS: • ORC • Desalination • Biofuel

BENEFIT	FEATURE
Superb low-temperature pumpability	Low viscosity at exceptionally cold temperatures makes this an ideal fluid for year round use in colder climates.
Long life means low cost	Fewer fluid refills, means low operating costs, which is critical for alternative technologies in today's highly competitive business environment. Users can expect many years of reliable, trouble-free operation, even when operating continuously at the recommended upper temperature limit of 315°C (600°F).
Nonfouling	Specifically engineered to resist solids formation and system fouling; like-new fluid-side heat transfer coefficients can be maintained.



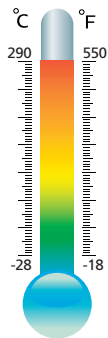


Therminol XP *For medium-temperature applications*

Optimum temperature use range: -20° to 315°C (-4° to 600°F)

SUGGESTED APPLICATIONS: • Biofuel • Desalination

BENEFIT	FEATURE
Excellent performance without additives	Additives can break down rapidly at high temperatures to form sludge/solids. Therminol XP has outstanding performance up to its rated maximum temperature without the need of stabilizing additives thereby reducing the risk of system fouling.
Low toxicity	Meets the U.S. Food & Drug Administration requirements defined in 21 CFR 172.878 as an indicator of its low toxicity and excellent purity. Meets requirements of U.S. National Formulary (NF) and is registered with the NSF (HT-1).

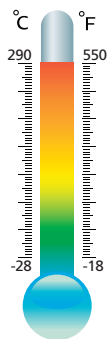


Therminol 55 *For medium-temperature applications*

Optimum temperature use range: -28° to 290°C (-18° to 550°F)

SUGGESTED APPLICATIONS: • ORC • Desalination • Biofuel

BENEFIT	FEATURE
Excellent low-temperature pumpability	Your heat transfer fluid system can start up quickly and easily; Therminol 55 is pumpable at -28°C (-18°F), compared to some mineral oils that will not pump at temperatures below -7°C (20°F).
Long life, high value to cost	Years of reliable, cost-effective performance, even when operating your system continuously at 290°C (550°F). This means you do not have to overspecify your fluid.



Therminol SP* *For medium-temperature applications*

Optimum temperature use range: -28° to 290°C (-18° to 550°F)

SUGGESTED APPLICATIONS: • ORC • Desalination • Biofuel

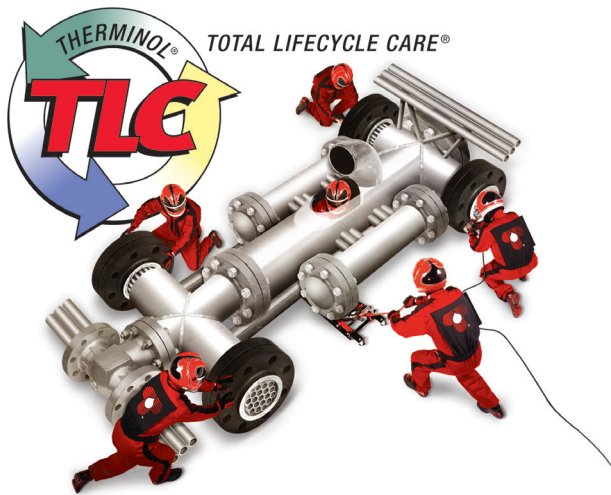
BENEFIT	FEATURE
Excellent low-temperature pumpability	Your heat transfer fluid system can start up quickly and easily; Therminol SP is pumpable at -28°C (-18°F), compared to some mineral oils that will not pump at temperatures below -7°C (20°F).
Long life, high value to cost	Years of reliable, cost-effective performance, even when operating your system continuously at 290°C (550°F). This means you do not have to overspecify your fluid.

*Therminol SP is available in Europe, Africa, Middle East, and CIS.

The maximum extended use temperature for both Therminol 55 and Therminol SP is 315°C (600°F).

Low-end optimum use temperatures for most Therminol fluids are listed at 2000 cSt pump values. For 300 cSt pump values, see the specific product page on our website, www.therminol.com.

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Heat Transfer Fluids by Eastman



Eastman's TLC Total Lifecycle Care® Program is designed to support Therminol customers throughout their systems' lifecycle.

This comprehensive program includes system design support, start-up assistance, training, sample analysis, flush and refill fluids, and our fluid trade-in program. In North America, call our hotline 1-800-433-6997 or contact your local sales or technical representative.

In-service heat transfer fluid sample analysis

When Therminol heat transfer fluids are used within suggested temperature limits, they may provide years of trouble-free service. To help users get maximum life, Eastman offers testing of in-service heat transfer fluids to detect contamination, moisture, thermal degradation, and other conditions that may impact system performance. This comprehensive analysis includes acid number, kinematic viscosity, insoluble solids, low boilers, high boilers, and moisture content. Additional special analyses are available on request. Sample analysis includes sample collection kits that are easy to use. Most systems should be sampled annually. Users should also sample any time a fluid-related problem is suspected.

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Results of the test are presented in a detailed report that provides suggestions for corrective action. Test results are stored in a database for future reference. Customers can access their specific test information via my.therminol.com.

Technical service hotline

Experienced technical service specialists can help answer your questions regarding heat transfer fluid selection, system start-ups, system design, and operational issues.

System design support

Eastman regularly assists some of the world's largest engineering, chemical, and equipment manufacturing companies on the design and operation of heat transfer systems. Our liquid phase and vapor phase design guide information and system design data have been field tested in numerous installations. Eastman also conducts engineering seminars for customers, engineering firms, and equipment manufacturers to cover a wide range of heat transfer fluid system design and operation issues. Customers can request a technical service visit to audit heat transfer systems for fluid loss and leak prevention opportunities.



Operational training

Eastman believes that by sharing our experience with customers we can help improve system design, promote safety, and reduce overall cost. Customers can take advantage of Eastman's heat transfer system operation and product training programs. These programs are customized to suit the varied needs of front line technicians, operations supervisors, and maintenance technicians to design engineers. Customers can also receive training assistance for dealing with important topics like fluid safety and handling.

Safety awareness training

At Eastman, we're "All in for Safety." We provide our customers safety awareness training that focuses on the design, start-up, operation, and maintenance of heat transfer fluid systems.

Start-Up assistance

Eastman provides start-up assistance by reviewing procedures and offering suggestions to reduce typical problems. Customers can also receive help via our toll-free technical service hotline or through on-site assistance.

Flush fluid and fluid refill

Liquid phase heat transfer systems can be cleaned with Therminol® FF Flush Fluid. After the system is flushed, the appropriate liquid phase Therminol heat transfer fluid can be added.

Fluid trade-in program*

As part of our commitment to sustainability and the environment, Eastman offers a trade-in program for used Therminol and competitive heat transfer fluids.

Depending on the fluid and its condition, it may be turned in for potential credit towards the purchase of new Therminol heat transfer fluid.



** Available in North America. Contact your local sales representative for more information.*



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