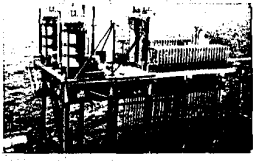




therminol.

applications unlimited





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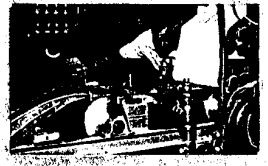



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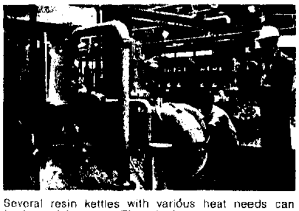
Why Therminol?

Does your process require indirect heating — that is, high working temperatures delivered to remote "user" locations without flame? Perhaps your process requires indirect heating and cooling within the same system. Or, maybe you'd like to get more out of your process heat by using it in a nearby space heating application, as well.

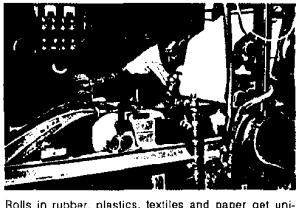
There are a number of ways to get these jobs done. A common one involves the use of a pressurized heating system — water (or other liquids) heated to the vapor phase and transferred under high pressures to the user. But there are drawbacks to this type of indirect heating. Costly, often complex equipment, for one. The need for licensed boiler operators for another. Then, too, high operating pressures pose some very real safety problems.



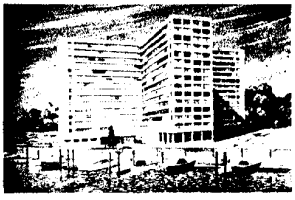
This Dutch tanker uses a Therminol system to heat living quarters as well as cargo.



Several resin kettles with various heat needs can be heated from one Therminol system.



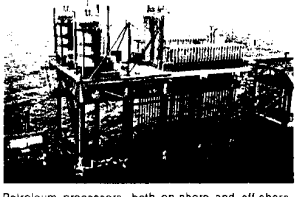
Rolls in rubber, plastics, textiles and paper get uniform heat with Therminol.



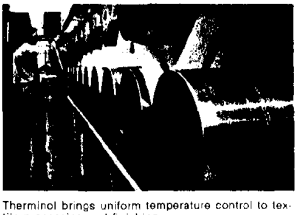
Apartment buildings, offices, hospitals—buildings of all kinds find Therminol an economical alternative to steam.

That's Why There's Therminol® Heat Transfer Fluids

With Therminol fluids, you discover the best of all indirect heating worlds—high and low heat ranges, thermal stability, and efficient heat transfer *without* high pressure, *without* the need for costly equipment, and without the need for continuous observation. Therminol fluid heat systems offer you the most dependable, most efficient indirect heating and cooling your process dollars can buy—and this booklet tells you why.



Petroleum processors, both on-shore and off-shore, enjoy increased heat transfer safety with Therminol.



Therminol brings uniform temperature control to textile processing and finishing.

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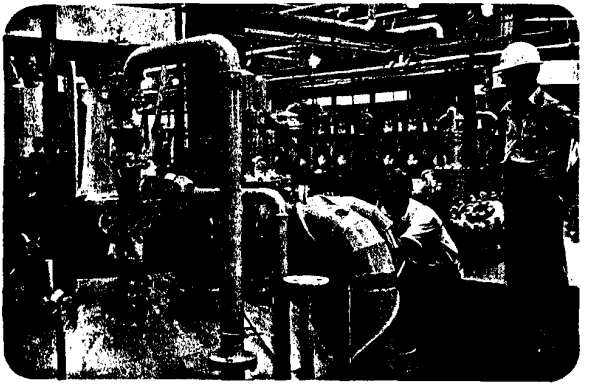
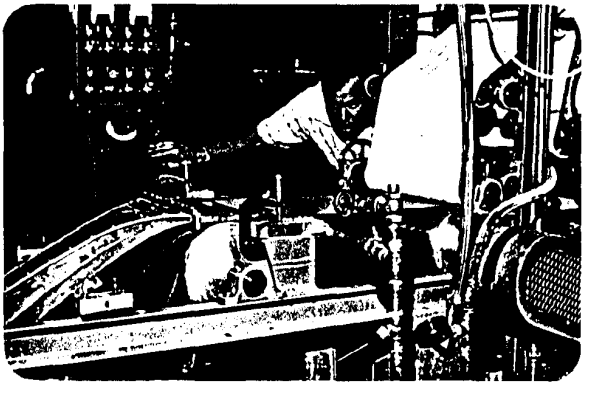


The big plus you get with Therminol in chemical processing, like this resin kettle, is heating and cooling from the same system.

What makes Therminol right for your application? Hundreds of customers who have specified Therminol for new installations and conversions of existing systems will give you these answers.

LOWER CAPITAL COSTS | Without pressure you can save 25% to 50%. That's because you don't need heavy piping, relief valves or other high pressure devices.

LOWER OPERATING COSTS | Fluid make-up is generally not required. Heat losses are reduced over vapor phase systems because condensate subcooling is not present. Routine maintenance is minimized and these non-pressured systems require only minimum attention by non-licensed personnel.



Since Therminol remains liquid throughout its temperature range, rapid circulation through your rolls helps achieve uniform heat. This has resulted in greater throughput and fewer rejects for Therminol customers producing rubber, plastics and paper.

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Textile processing and finishing—where close temperature control is a must—is a "natural" for Therminol with no need for venting, high operating pressures and continuous observation.

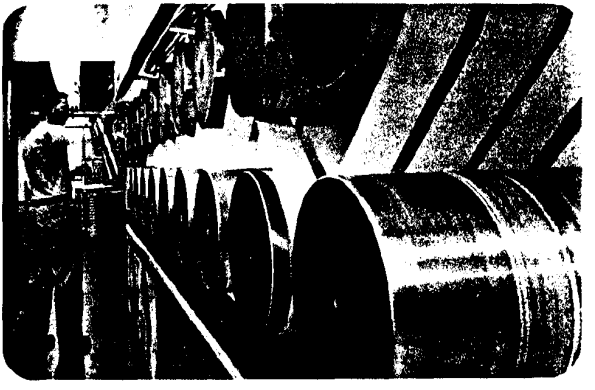
You'll be surprised at how easy it is to work with a Therminol heat transfer system. The middle diagram at the right shows typical Therminol liquid heating and cooling systems used together to maintain very close temperature control at the user. Note that the term "heater" is used rather than "boiler" since we do not boil Therminol in the primary heat source.

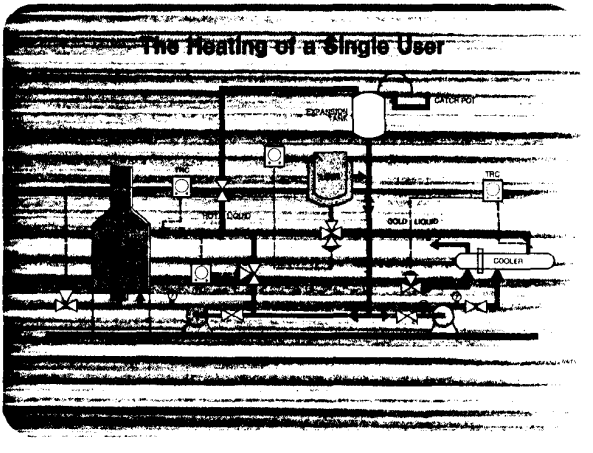
Benefits of a Liquid Heating System

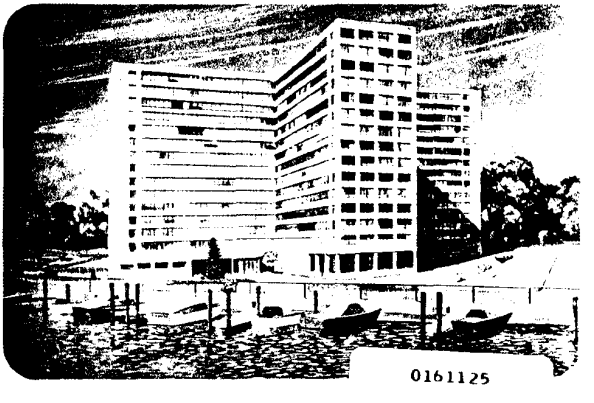
You gain a wide spectrum of benefits with a Therminol liquid heating system.

- In many locations, codes favor Therminol systems, thus minimizing the need for expensive operating personnel.
- Positive circulation through your users ends venting problems; the system remains sealed and flooded.
- Liquid systems respond more rapidly to your system's load changes.
- Install your users at any level in relation to the heater; there's no condensate removal problem.
- You realize a substantial cost savings with smaller pipe. Also, smaller valves control temperature more accurately—down to ± 2°F.
- No temperature loss due to pressure drop in the piping; with vapor, any line friction loss results in a lower vapor condensing temperature at the users.
- You can meet different temperature demands in the same user if required by certain processes by adjusting the circulation rate.
- A liquid heating medium, like Therminol, will usually give you higher heat transfer rates in certain types of users, such as shell and tube heat exchangers.
- Cooling can be handled in the same system. Heating systems for Therminol are sold around the world on a competitive basis. Contact your nearest Monsanto office, (listed on the inside back cover) for information and recommendations on the heating equipment that will fit your particular need.

The conversion of the Detroit River House Cooperative from steam boilers to Therminol heating saves $36,000 annually by providing non-pressurized unattended operation and through documented fuel savings.




The Heating of a Single User



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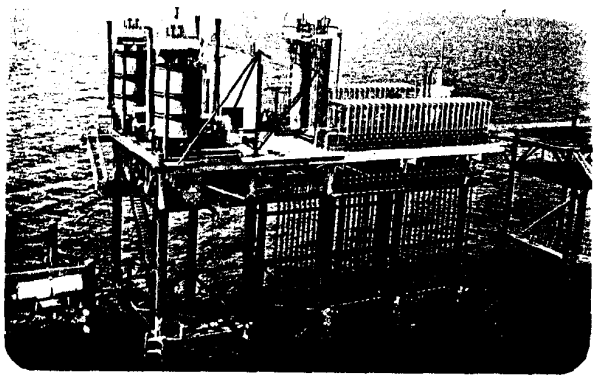


On this offshore processing platform, a Therminol system provides efficient, dependable heat to multiple users — controllable over a wide temperature range.

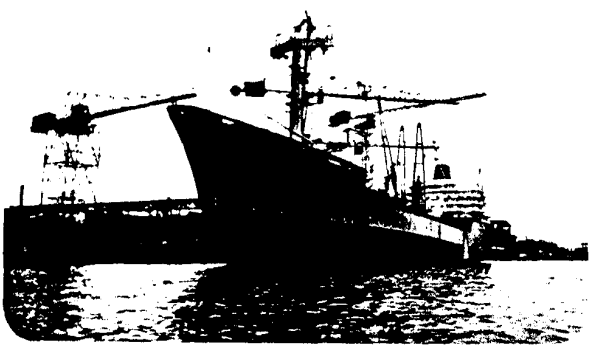
The Therminol Family

You find more design and engineering flexibility with Therminol than with any other heat transfer media because of the wide range of fluids in the Therminol family.

The Therminol series of heat transfer fluids offer an operating range of 0° to 800°F.

Important for the future, as your processes change, you can pick a new Therminol fluid to match your new needs. Most Therminol fluids are interchangeable in your liquid heating system.

The charts on the next two pages detail the broad characteristics of the Therminol family of fluids.



On both ships and barges Therminol preempts the high costs of pressurized indirect heating. Therminol's ability to recover waste heat adds to the savings.

Low temperature pumpability allows convenient cold weather start up, so viscous liquid cargoes are ready for unloading where the vessel reaches port.

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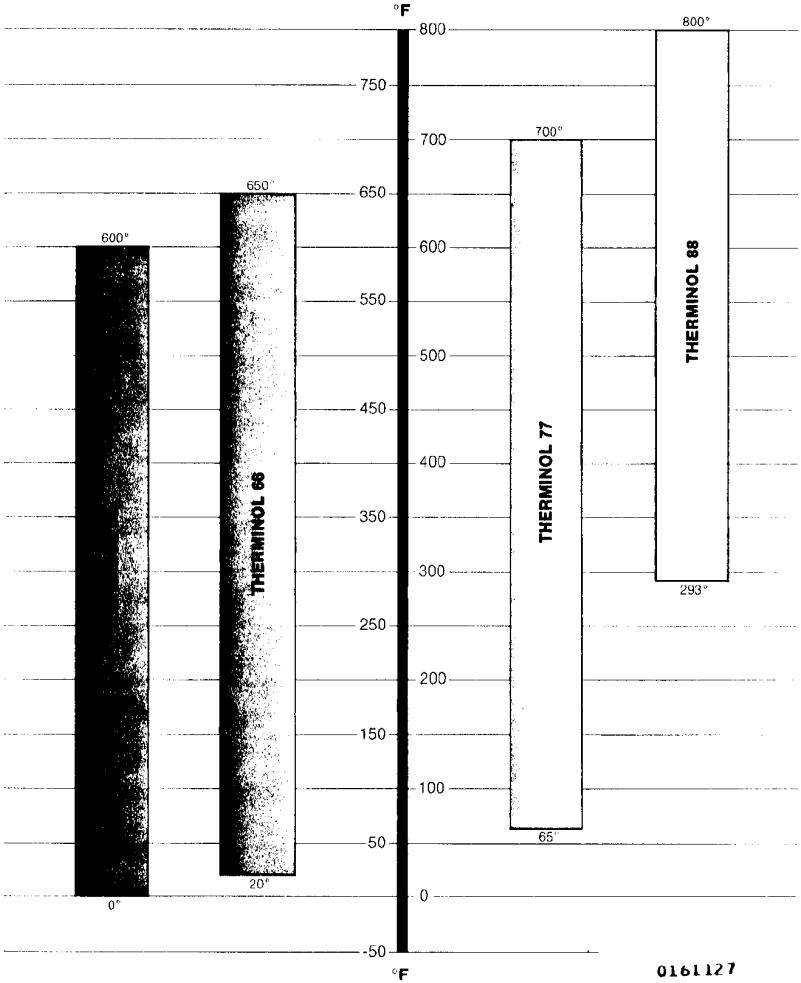
Temperature Use Ranges For Therminol® Heat Transfer Fluids



Therminol heat transfer fluids offer a wide range of operating temperature capability. As this bar chart indicates, there is a Therminol fluid for virtually any special temperature situation your process may encounter — from 0° to 800°F. Each Therminol fluid is carefully formulated to bring the best heat transfer properties to a given temperature situation. This page and the following will help you select the right Therminol fluid for your application.

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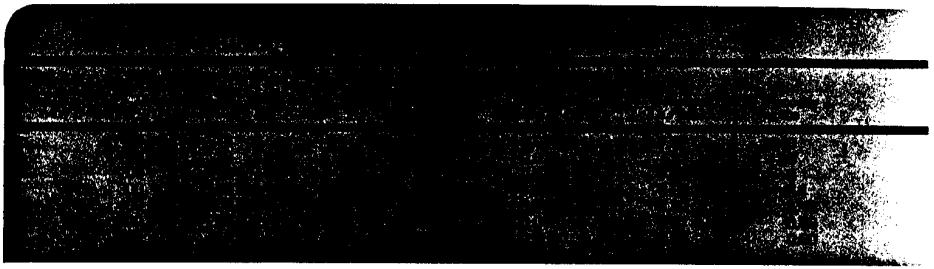

THERMINOL 66

Temperature °F	Temperature °C	Vapor Pressure mm Hg. Absolute	Specific Heat BTU./Lb. °F	Thermal Conductivity BTU/Hr. ft² °F/ft.	Density Lb./Gal.	Viscosity Cs
0	—	—	0.320	0.0720	8.67	50000
50	10	—	0.350	0.0711	8.51	250
100	38	—	0.380	0.0703	8.34	28.0
150	66	—	0.410	0.0695	8.14	10.0
200	93	0.1	0.440	0.0687	7.91	4.40
250	121	—	0.466	0.0678	7.77	2.60
300	149	0.4	0.495	0.0670	7.59	1.70
350	177	—	0.505	0.0662	7.39	1.20
400	204	20.6	0.530	0.0653	7.17	0.90
450	232	20.0	0.555	0.0645	7.04	0.69
500	260	120.0	0.580	0.0637	6.76	0.55
550	288	200.0	0.605	0.0628	6.62	0.46
600	316	350.0	0.630	0.0620	6.42	0.40
650	343	740.0	0.655	0.0612	6.24	0.36
700	371	1200	0.680	0.0603	6.00	0.31

THERMINOL 77

Temperature °F	Temperature °C	Vapor Pressure mm Hg. Absolute	Specific Heat BTU./Lb. °F	Thermal Conductivity BTU/Hr. ft² °F/ft.	Density Lb./Gal.	Viscosity Cs
50	10	—	0.330	0.0793	9.8	—
100	38	—	0.360	0.0781	9.6	181
200	93	—	0.415	0.0790	9.25	7.78
300	149	0.27	0.470	0.0739	8.94	2.65
400	204	1.08	0.495	0.0712	8.58	1.50
500	260	32	0.520	0.0685	8.16	0.96
600	316	44	0.550	0.0670	7.78	0.66
700	371	155	0.575	0.0660	7.88	0.46
800	426	430	0.600	0.0640	7.05	0.34

THERMINOL 88

Temperature °F	Temperature °C	Vapor Pressure mm Hg.	Specific Heat BTU/# °F	Thermal Conductivity BTU/hr-ft²-°F/ft.	Density Lb./Gal.	Viscosity cs
300	149	1.2	0.467	0.0738	8.41	1.57
400	204	11	0.497	0.0712	8.00	0.87
500	260	65	0.525	0.0686	7.66	0.55
600	316	260	0.554	0.0660	7.33	0.38
700	371	800	0.584	0.0634	6.91	0.29
800	426	1500	0.613	0.0608	6.58	0.23
900	482	3000	0.642	0.0581	6.16	0.19

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therminol®

Applications Unlimited

The pictures on the preceding pages have given you a glimpse of a few typical Therminol applications. On land and sea. In plants and apartment buildings.

But the applications for Therminol are actually **unlimited.** As unlimited as your needs for safe, uniform, efficient heat delivery.

Here are a few more areas where Therminol has met those needs:

CHEMICAL PROCESSING . . . especially where flammable materials are handled. Therminol has proved particularly successful for exchangers, distillation columns, reboilers, mixers, dryers, etc.

RESIN PROCESSING . . . where a single "circuit" with multiple users and varying temperatures is desirable.

PLASTICS, RUBBER MOLDING AND PAPER . . . where uniform heating, rapid temperature flux and pin-point control is essential such as heating corrugating and drying rolls, crimping presses, calendars, platens and molds.

TEXTILE PROCESSING . . . for controlled temperatures in processing and finishing of synthetic fibers.

PETROLEUM AND CHEMICAL . . . offers control over a wide temperature range and the ability to accommodate sudden fluctuations in processing loads automated with complete safety.

SHIPS AND BARGES . . . preempts the cost of pressurized indirect heating systems with efficient, dependable heating while underway.

SPACE HEATING . . . ideal for hospitals, hotels, apartment houses and office buildings where the goal is safety, low maintenance and reduced operating costs.

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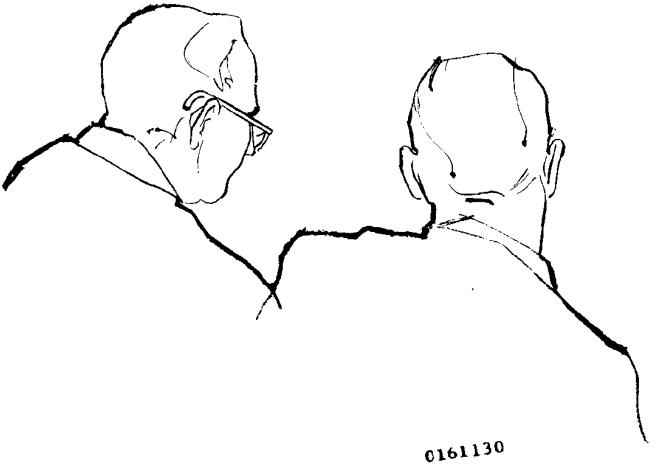
You Don't Have To Be An Expert

We'll loan you ours.

Talk to the Monsanto heat transfer experts. They've provided consultation for hundreds of Therminol fluid systems—in both new installations and in conversions of existing systems. They can point out the benefits of a Therminol system, and offer detailed assistance to you now — no matter what stage your project is in, what application you have in mind. From design and engineering to start up operations, you'll be surprised at how easy it is to work with a Therminol heat transfer system.



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