in heating system design

O/FF-20

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a NEW concept in heating

Therminol high temperature liquid phase heating offers new answers to questions you may be facing in heating system design. Questions like:

- **How do you lower the capital investment for heating/cooling equipment?**
- **How do you cut operating costs — particularly rising labor expenses?**
- **How do you save valuable floor space?**
- **How can your system meet rapid changes in heat demand?**
- **How can heating system safety be maximized?**

A liquid phase system designed around Therminol heat transfer fluid — in a new building or in the modernization of an old one — may be your answer to many or all of these questions.

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THERMINOL FOR DRAMATIC SAVINGS

When the need to modernize a heating system arises, you will find that Therminol liquid phase heating offers:

- *Superior operating efficiency.*
- *Elimination of licensed boiler operators in many cities.*
- *Maintenance reduced by up to 80 percent.*
- *Easy conversion and installation.*

Operating Savings

The use of high temperature Therminol eliminates the need for system pressurization. A high temperature primary loop (see diagram below) is vented to atmosphere, and thus the heaters usually are not classified as pressure vessels. This in turn eliminates the need for a crew of licensed low pressure boiler operators, a major factor in the cost of many old systems.

Cut Maintenance Costs

Operation of the new plant is entirely automatic except for preventive and operational maintenance and system shutdown and startup. These operations can be performed by the regular building maintenance staff.

Easy Conversion and Installation

Installation basically involves replacing steam boilers with fluid heaters. A steam generator can furnish hot water during the conversion to minimize inconvenience to your building's occupants.
Each of the fluid heaters are connected to heat exchangers. These converters generate hot water for building heating and domestic hot water heating and steam for kitchen equipment, garage heating systems and the building ventilation. Two pumps recirculate the fluid between heaters and converters.

Space No Problem

All system changes can be confined to the previous boiler room area. Existing piping and equipment for the secondary services, including building heating service pumps, domestic hot water pumps, and condensate receivers remain in place. Thus, your building's services can continue to utilize water and steam as before.

River House Cooperative Apartments — Detroit

This system, which has been in operation for more than five years, provides an annual savings of $36,000 compared to the old steam systems; $25,000 through the elimination of licensed boiler operators and $11,000 through reduced fuel costs. The latter saving results from an increase in over-all efficiency from 60 percent with the old system to 83 percent with the new, and from switching to gas firing.

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TOTAL THERMINOL SYSTEMS IN BUILDINGS

From open flame, to steam, to liquid phase fluids. Unhappy with early direct-fired heating, engineers centralized the fire and used steam to bridge the gap. Now you can bridge that gap more efficiently with new, high temperature liquid phase heating. Some examples of the ways others have designed Therminol into their heating systems are detailed on this page.

Therminol Versus Steam in an Eleven Story Hospital

Kaiser Engineers sought the most economical heating system for the Tower addition to an Oakland, Calif. Hospital. Consequently, they made a detailed analysis of steam versus Therminol for their 243,000 square foot expansion. Their findings:

- Therminol's initial installation cost is *$21,850 less than steam.*

The reduction in capital costs was due to the elimination of low and high pressure steam boilers, deaerator feed water heaters, condensate drainage system for absorption chillers, steam piping, related equipment and mechanical equipment floor space.

- Therminol's operating cost is *$8,000 less than steam;* a 22 percent annual savings.

The reduction in annual operating costs were due primarily to the anticipated added thermal efficiency of the Therminol System and the reduction in preventative maintenance and repair. It was projected that if licensed boiler operators had been required, as is generally the case, an additional operating savings of approximately $25,000 per year would have been realized by utilizing the Therminol System approach.

In addition to these outstanding cost savings, the study found Therminol:

1. Provided excellent response to building load changes.
2. *Created no venting problems.*
3. Offered increased safety because of the non-pressure characteristics of the system.

On this basis, a number of hospitals have used Therminol in their heating systems or incorporated it into their designs.

Diagrams detailing the design of these two systems are on the next page.

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Holy Cross Hospital — Detroit

The conversion of this 250-bed hospital addition to Therminol liquid phase heating yielded an annual savings of $40,000 in operating costs. This saving was estimated to pay for the cost of conversion in three years. Moreover, the improved efficiency of the system added additional savings through lower fuel costs. J. P. Noble, Detroit consulting engineer, received the first honor award for mechanical engineering in the 1968 awards competition of the Consulting Engineers Council of Michigan for his design of this system.

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This Monsanto office and laboratory building in Akron, Ohio, was the first to use a high temperature, non-pressurized, fire-resistant fluid system for all direct heat needs. These include refrigeration, pre-heat, re-heat, baseboard, steam generation and hot water. The completely automatic and unattended system utilizes conventional off-the-shelf heating and air conditioning hardware. Installation costs were $10.50, per square foot, or 13 percent of the total building cost.

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THERMINOL FOR HEATING AND COOLING IN BUILDINGS

In addition to high-rise structures, Therminol heating systems offer considerable savings for campus-type buildings. Ferris & Hamig, Inc., St. Louis consulting engineers, prepared a feasibility study comparing a conventional system with high pressure steam distribution to four varieties of Therminol systems.
The Monsanto office complex in Creve Coeur, Missouri, was used as a basis for comparison. This complex comprises a powerhouse and five office buildings totalling 425,000 square feet and including a cafeteria and kitchen.
Here's a summary of the five systems and their comparative costs:

The report's conclusion: for this campus, application, a Therminol heating system costs less than a conventional system using high pressure steam. And, in addition to eliminating an operating engineer on each shift, the Therminol system would offer; no trap maintenance, no water treatment and lower liability insurance rates.

System	*Description*	*Initial and Operating Cost**
1.	High pressure steam distribution to the five office buildings; with steam pressure reduced in each building to 10 lbs. pressure. Low pressure steam was distributed to heating coils in the air conditioning units. A central electric motor driven centrifugal water chilling system with condensing water pumps and cooling tower would be installed in the powerhouse. Chilled water mains would be run parallel to the steam mains in the tunnels with braches to the air conditioning units in each building.	$86,997
2.	Varies from No. 1 in that Therminol heaters replace pressure boilers. Therminol supply and return piping are used in the tunnel with branches to each building. At each building a booster pump with a three-way valve would be installed to reduce the temperature of Therminol from 550° to about 275°. The Therminol would then be pumped to heating coils in the air conditioning units. The water chilling system would be the same as in No. 1.	$82,555
3.	This system is the same as No. 2 except that centrifugal water chillers would be replaced by absorption units in the powerhouse; the cooling tower and condensing water pumps would be increased to reject the additional heat from the absorption units.	$83,514
4.	This system varies from No. 3 in that individual absorption units will be installed in each building. Condensing water from a central cooling tower and condensing water pumps at the powerhouse will supply condensing water through the tunnel to these units.	$94,806
5.	This system varies from No. 4 in that individual cooling towers and condensing water pumps would be installed in each building.	$77,476

*These costs *do not* include savings in labor.

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The Monsanto Therminol heat transfer fluids have been used for a number of years in a variety of heat transfer applications; from rubber rolling to food processing. Therminol FR-1 represents the best fluid for space heating systems. Therminol FR-1 is unique. It permits installation of a non-pressurized system operating with a liquid which has no fire point and will not support combustion. Therminol FR-1 is so fire-resistant, it has been listed with Underwriters' Laboratory.

Still another unique property of Therminol FR-1 is its unusual chemical inertness. It is among the most oxidation-resistant compounds known. This inertness prevents the formation of oxidation sludges if the hot fluid comes in contact with air. This extends the useful service life of the fluid; occasionally allows economies in design. However, Therminol FR-1 is not intended for use in open vessels but in properly vented, closed systems.

Chemically, Therminol FR-1 is resistant to strong acids, mild alkalies and dilute solutions of strong alkalies.

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THERMINOL FR SAFETY OF HANDLING

On the basis of animal toxicity studies, THERMINOL FR may be considered only slightly toxic from the standpoint of accidental massive skin exposure or accidental ingestion. Similarly, single exposures to high concentrations of vapors (when heated sufficiently to volatilize) or high concentrations of decomposition products (if the fluid is accidentally discharged into the fire chamber) are not serious hazards because the irritating character of such concentrations preclude voluntary exposure.

Repeated or prolonged skin exposure should be avoided since THERMINOL FR acts as a solvent for fats and oils of the skin. Removal of these natural, protective barriers can lead to drying and chapping such as occurs with exposures to paint thinners. More important, THERMINOL FR may be absorbed if it is allowed to remain on the unbroken skin. For these reasons, we recommend that the skin be washed with soap and water if there is contact. A skin burn resulting from accidental contact with hot fluid should be treated in the normal manner for any thermal burn due to hot oils.

Because of its low vapor pressure, there is no significant vapor inhalation hazard when THERMINOL FR is at room temperature. For example, there is no vapor exposure problem while transferring the fluid from its shipping container to the heat transfer system. On the other hand, the vapors emitted by THERMINOL FR heated to elevated temperatures are injurious on prolonged exposure. It is indicated that the "threshold limit value" or atmospheric vapor concentration which cannot be safely exceeded (on a daily basis) is 0.5 – 1.0 milligrams of THERMINOL FR vapor per cubic meter of air in the workroom. In heat transfer installations, the fluid must be used in a closed system free from leaks with the expansion tank vented to the out-doors. Accordingly, there should be little or no opportunity for workers to come in contact with vapors.

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