COPY

DATE December 8, 1971

JOB THERMINOL CONVERSION BULLETIN

INTRODUCTION

Therminol FR® fire-resistant heat transfer fluids have long provided safe, dependable, ~~economical~~ performance for hundreds of users in dozens of applications. The presence of poly-chlorinated biphenyl (PCB) in the Therminol FR formulation provided fire-resistance, giving Therminol FR an added margin of safety which was especially desirable in hazardous applications.

Most recently, PCB has been identified as a potential hazard to the environment. Monsanto has accordingly elected to discontinue the manufacture and sale of Therminol FR fluids for heat transfer applications, and has undertaken the rather substantial task of converting Therminol FR users over to the non-PCB-containing formulations, Therminol 55 and Therminol 66.

These products offer most of the excellent heat transfer characteristics of Therminol FR fluids, and even a few additional advantages, such as a lower ~~bulk~~ specific gravity ~~density~~ for improved pumpability requiring less horsepower. But in fact, Therminol 55 and 66 are not fire-resistant to the extent the Therminol FR fluids were, and due consideration must be given this fact in converting to these ~~newer~~ alternate Therminol fluids.

Conversion from a Therminol FR ~~system~~ fluid to a Therminol 55/66 ~~system~~ fluid will be a relatively simple, low-cost procedure in the ~~vast~~ majority of cases. Incorporation of proper fire protection equipment will be the only consideration

0592578

Monsanto

TOWOLDMON0037259
WATER_PCB-00021728

of any major consequence in most cases. But even this modification becomes academic, for with the discontinuation of Therminol FR fluids, fire protection equipment becomes necessary for any and all low pressure heat transfer media available today, since the Therminol FR fluids were unique in their fire-resistance.

This bulletin is to assist you in making the conversion to Therminol 55 or 66 as quickly, efficiently and economically as possible. Should questions arise, or if you run into difficulty, Monsanto's Specialty Products Group invites you to call upon its staff of qualified systems engineers for consultation at any time. Call...

(314) 694-1000

collect, and ask for a Monsanto Heat Transfer specialist.

Thank you.

0592579

TOWOLDMON0037260
WATER_PCB-00021729

Therminol 55 ~~/66~~ and 66 and Your Heat Transfer System

Table I. shows the typical physical, chemical and thermal properties of Therminol FR-1, ~~and~~ Therminol 55 and Therminol 66. As you will note, the ~~two~~ three products are quite similar except with regard to AIT, Fire Point and Weight per Gallon. The substantially lower weight per gallon of Therminol 55 and 66 means that pumps used in a Therminol FR-1 system ~~will~~ should be ~~more than~~ adequate for a Therminol 55 and 66 system. ~~In fact,~~ In most cases, pumping rates will be increased with a resultant saving in horsepower requirements.

Therminol 55 and 66 has ~~outstanding~~ excellent heat transfer properties, so ~~nothing will be~~ heating and cooling performance will not be sacrificed ~~from that standpoint~~ in a change from Therminol FR-1. The specific heat and thermal conductivity of Therminol 55 and 66 are shown, along with other physical properties, in Tables ~~IV~~ 2, 3 & 4. The lower pour points of Therminol 55 and 66 ~~(-15°F.)~~ ~~means it will be~~ will provide easier cold startup of ~~to bring~~ the system, ~~to temperature for cold startups~~.

Generally speaking, then, a well designed system currently operating on Therminol FR-1 can be converted to Therminol 55 or 66 with few, if any, basic changes in design -- and without sacrifice to heat transfer efficiency. With the similarity of the heat transfer properties of the ~~two~~ three fluids thus established, let us turn to the important differences between Therminol FR-1 and Therminol 55 and 66: namely, fire-resistance and oxidation-resistance.

Fire-Resistance

As stated in the Introduction to this bulletin, the Therminol FR fluids were unique in their inherent fire-resistance. No other commonly used heat transfer medium could be so classified. Even so, the Therminol FR fluids could be made to burn under certain conditions, as indicated by their AIT of something around 1200°F. and fire points within their boiling ranges.



0592580

TOWOLDMON0037261
WATER_PCB-00021730

TABLE 2

THERMINOL FR-1

VARIATION OF PROPERTIES WITH TEMPERATURE

| Temperature | | Density | | Specific Heat | | Thermal Conductivity | | Viscosity | | Vapor Pressure | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| °F | °C | lb/gal | Kg/m$^3$ | BTU/lb °F | Kcal/Kg °C | BTU/ft hr °F | Kcal/m hr °C | Cp | Cs | mmHg absolute | Kg/cm$^2$ |
| 50 | 10 | 11.68 | 1399.6 | 0.272 | 0.272 | 0.06098 | 0.0907 | 308 | 220 | - | - |
| 100 | 38 | 11.46 | 1372.7 | 0.282 | 0.282 | 0.06050 | 0.0902 | 23.2 | 16.9 | - | - |
| 150 | 66 | 11.22 | 1343.7 | 0.291 | 0.291 | 0.06021 | 0.0896 | 6.6 | 4.9 | - | - |
| 200 | 93 | 10.99 | 1316.7 | 0.3047 | 0.3047 | 0.05976 | 0.0889 | 3.4 | 2.6 | - | - |
| 250 | 121 | 10.76 | 1289.1 | 0.3151 | 0.3151 | 0.05927 | 0.0882 | 2.3 | 1.8 | - | - |
| 300 | 149 | 10.53 | 1261.3 | 0.3255 | 0.3255 | 0.05875 | 0.0874 | 1.4 | 1.1 | - | - |
| 350 | 177 | 10.30 | 1233.5 | 0.3359 | 0.3359 | 0.05819 | 0.0866 | 1.0 | 0.8 | 10 | 0.0136 |
| 400 | 204 | 10.07 | 1205.8 | 0.3464 | 0.3464 | 0.05760 | 0.0857 | 0.8 | 0.7 | 27 | 0.0367 |
| 450 | 232 | 9.83 | 1178.0 | 0.3568 | 0.3568 | 0.05697 | 0.0848 | 0.6 | 0.5 | 65 | 0.0884 |
| 500 | 260 | 9.60 | 1150.2 | 0.3672 | 0.3672 | 0.05630 | 0.0838 | 0.5 | 0.4 | 143 | 0.1945 |
| 550 | 288 | 9.37 | 1122.5 | 0.3776 | 0.3776 | 0.05550 | 0.0827 | 0.4 | 0.4 | 291 | 0.3958 |
| 600 | 316 | 9.14 | 1094.7 | 0.3880 | 0.3880 | 0.05487 | 0.0817 | 0.4 | 0.3 | 550 | 0.7480 |
| 650 | 343 | 8.91 | 1066.9 | 0.3985 | 0.3985 | 0.05409 | 0.0805 | 0.3 | 0.3 | 18.8psia | 1.3218 |
| 700 | 371 | 8.68 | 1039.3 | 0.4089 | 0.4089 | 0.05329 | 0.0793 | 0.3 | 0.3 | 31.9psia | 2.2429 |

0596861

TOWOLDMON0037262
WATER_PCB-00021731

TABLE 3

THERMINOL 55

VARIATIONS OF PROPERTIES WITH TEMPERATURE

| Temperature | | Density | | Specific Heat | | Thermal Conductivity | | Viscosity | | Vapor Pressure | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| °F | °C | lb/gal | Kg/m$^3$ | BTU/lb °F | Kcal/Kg °C | BTU/ft hr °F | Kcal/m hr °C | Cp | Cs | mmHg absolute | Kg/cm$^2$ |
| 0 | -18 | 7.62 | 915 | 0.420 | 0.420 | 0.0813 | 0.1210 | 1472 | 1610 | - | - |
| 100 | 38 | 7.31 | 878 | 0.472 | 0.472 | 0.0784 | 0.1167 | 25.4 | 30.1 | 0.5 | 0.001 |
| 200 | 93 | 7.00 | 840 | 0.522 | 0.522 | 0.0753 | 0.1121 | 4.20 | 5.0 | 3.0 | 0.004 |
| 300 | 149 | 6.69 | 803 | 0.572 | 0.572 | 0.0724 | 0.1077 | 1.69 | 2.10 | 10 | 0.014 |
| 400 | 204 | 6.39 | 766 | 0.620 | 0.620 | 0.0692 | 0.1030 | 0.904 | 1.18 | 40 | 0.054 |
| 500 | 260 | 6.07 | 729 | 0.670 | 0.670 | 0.0661 | 0.0984 | 0.583 | 0.80 | 100 | 0.136 |
| 600 | 316 | 5.76 | 691 | 0.718 | 0.718 | 0.0630 | 0.0938 | 0.415 | 0.60 | 250 | 0.330 |

0592582

TOWOLDMON0037263
WATER_PCB-00021732

TABLE 2

THERMINOL 55

VARIATION OF PROPERTIES WITH TEMPERATURE

| Temperature | | Density | | Specific Heat | | Thermal Conductivity | | Viscosity | | Vapor Pressure | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| °F | °C | lb/gal | Kg/m$^3$ | BTU/lb °F | Kcal/Kg °C | BTU/ft hr °F | Kcal/m hr °C | Cp | Cs | mmHg absolute | Kg/cm$^2$ |
| 0 | | 8.67 | 1040 | 0.320 | 0.320 | 0.0720 | 0.1072 | 62000 | 50000 | | |
| 50 | 10 | 8.51 | 1020 | 0.350 | 0.350 | 0.0711 | 0.1058 | 255 | 250 | | |
| 100 | 38 | 8.34 | 1000 | 0.380 | 0.380 | 0.0703 | 0.1046 | 28.0 | 28.0 | | |
| 150 | 66 | 8.14 | 975 | 0.405 | 0.405 | 0.0695 | 0.1034 | 9.75 | 10.0 | | |
| 200 | 93 | 7.91 | 950 | 0.430 | 0.430 | 0.0687 | 0.1022 | 4.18 | 4.40 | 0.1 | |
| 250 | 121 | 7.77 | 930 | 0.455 | 0.455 | 0.0678 | 0.1008 | 2.42 | 2.60 | | |
| 300 | 149 | 7.59 | 910 | 0.480 | 0.480 | 0.0670 | 0.0997 | 1.55 | 1.70 | 2.0 | 0.003 |
| 350 | 177 | 7.39 | 885 | 0.505 | 0.505 | 0.0662 | 0.0985 | 1.06 | 1.20 | | |
| 400 | 204 | 7.17 | 860 | 0.530 | 0.530 | 0.0653 | 0.0972 | 0.77 | 0.90 | 20.0 | 0.027 |
| 450 | 232 | 7.04 | 840 | 0.555 | 0.555 | 0.0645 | 0.0959 | 0.58 | 0.69 | 50.0 | 0.068 |
| 500 | 260 | 6.75 | 810 | 0.580 | 0.580 | 0.0637 | 0.0948 | 0.45 | 0.55 | 100.0 | 0.136 |
| 550 | 288 | 6.62 | 793 | 0.605 | 0.605 | 0.0628 | 0.0935 | 0.36 | 0.46 | 200.0 | 0.272 |
| 600 | 316 | 6.42 | 770 | 0.630 | 0.630 | 0.0620 | 0.0923 | 0.34 | 0.44 | 350.0 | 0.476 |
| 650 | 343 | 6.24 | 750 | 0.655 | 0.655 | 0.0613 | 0.0912 | 0.27 | 0.36 | 760.0 | 1.034 |
| 700 | 371 | 6.09 | 730 | 0.680 | 0.680 | 0.0605 | 0.0900 | 0.20 | 0.28 | 1000 | 1.360 |

0592583

TOWOLDMON0037264
WATER_PCB-00021733

These points are made to emphasize that, although Therminol 55 and 66 are certainly less fire-resistant than Therminol FR-1, blends they should be viewed in that perspective; Combustible but not highly flammable". On a scale of fire-resistance where water would be rated as "0" and ether as "100"; Therminol FR-1 would be rated "3", and Therminol 55 and 66 would fall somewhere between "15" and "20". It is important to realize that Therminol 55 and 66 are less fire-resistant than Therminol FR-1, and to modify the heat transfer system accordingly: it is equally important to understand that Therminol 55 and 66 are not a volatile, highly flammable fluids of itself, but rather combustible fluids as defined by FM and NFPA.

Protecting the System

There are two major fire protection considerations in changing to Therminol 55 or 66 -- system leakage and possible tube rupture (in the heater). The former is actually part of the larger subject of good system maintenance, and should be considered regardless of the heat transfer medium employed. A tight, well-maintained system is usually a good, safe system! Following are some specific recommendations to prevent leakage when you convert to Therminol 55 or 66.

First, if your system has rotary mechanical seals, you should enclose them, or at least provide a drip pan with a drain to a collection sump. Canned and sealless pumps offer excellent protection against leakage.

The best way to prevent piping leakage is to weld all connections. Where you must have access, use raised-face flanges with appropriate gasketing and high-temperature bolting. Controlling of piping leaks is especially important, since fluid-soaked insulation poses a more serious hazard than the leaking fluid, itself.



0592584

TOWOLDMON0037265
WATER_PCB-00021734

Organic compounds such as Therminol 55 and 66 ~~appear to create~~ exhibit a slow ~~exothermal~~ oxidation reaction with the air trapped inside the voids of the insulating material when system temperatures reach about 500°F. Saturated insulation offers a large fuel surface in the face of poor heat dissipation conditions, and this, along with possible catalysis from the insulating material (magnesia, silicate-bonded asbestos or calcium silicate) can cause a temperature build-up in the mass. This temperature build-up can ~~far exceed the autoignition temperature~~ result in ignition of the fluid ~~and~~ when the space between the piping and the saturated insulation is exposed to air (i.e., should the insulation be broken for repair, etc.). ~~fire can result.~~

This phenomenon is not fully understood, but appears to occur less with closed cell insulation than with the insulating materials mentioned above. Closed cell materials, then, are preferred, especially where leakage is a possibility despite all precautions.

The principle problems areas are near ~~thermocouple~~ instrument connections, valve packing glands, flanges, and ~~wherever insulation contacts horizontal flat surfaces, such as floor plates.~~ where cracks develop in relatively impermeable insulation cement adjacent to oil soaked insulation.

To obviate this problem, eliminate any source of leakage promptly. Replace leaky gaskets, ~~use flange back-up rings,~~ oil soaked insulation and re-pack valve stems. Cover insulation where leaks might occur with a hydraulic-setting, oil-resistant cement. Install valves, where possible, with the stems in a horizontal position so that leaks will drip away from the insulation. And again, use closed cell insulating materials on suspect piping areas.



0592585

TOWOLDMON0037266
WATER_PCB-00021735

Tube Rupture In Fired Heaters

Generally speaking, where fire protection is concerned, it is best to consult your insurance underwriter for guidance and counsel. Likewise, you will want to discuss your fire safety equipment requirements with ~~top-notch~~ qualified suppliers ~~in that field.~~ of fire protection equipment Selection and sizing of fire protection equipment ~~are critical.~~ is important to safeguard the installation.

In the case of tube rupture in fired heaters, we recommend ~~the~~ piping ~~of~~ either steam or $CO_2$ as a snuffer into the combustion chamber of the heater. A minimum one-inch line with a remote manual valve for activation ~~should a fire erupt internally~~ is the preferred arrangement. This snuffer system can be automated by the use of an exhaust stack temperature switch. This switch would energize a solenoid valve and alarm upon excessive temperature rise, to automatically flood~~ing~~ the chamber with ~~the~~ a fire extinguishing agent ~~or merely alarm for manual activation of extinguishing equipment~~ ~~inert snuffer automatically.~~

It is advisable to set the temperature switch about 100°F. over the normal exhaust temperature to prevent nuisance shutdowns. If a steam snuffer system is used, it is a good idea to employ a steam trap to avoid slugging the combustion chamber with water when the system activates, or is activated manually.

You can obtain a basic guideline in the selection of $CO_2$ protection equipment (again, it is best to consult your insurance underwriter) from the National Fire Protection Assn.,

0592586

TOWOLDMON0037267
WATER_PCB-00021736

Booklet Number 12, dated 1968. In this publication, it is stated that a minimum $CO_2$ concentration of 46% in the combustion chamber will extinguish a Therminol 55 or 66 fire. The following table will be useful in determining the volume of $CO_2$ required:

| Volume of Combustion Chamber - Cubic Feet | Calculated Quantity* $CO_2$ Pounds | Temp. Corrected** $CO_2$ Pounds |
|---|---|---|
| 0 - 140 | 15 | 30 |
| 141 - 500 | 15 | 30 |
| 501 - 1600 | 53 | 106 |
| 1601 - 4500 | 150 | 300 |

* Calculated quantity of $CO_2$ required to maintain 46% concentration by volume at temperatures of 200°F. or less.

** Temperature corrected quantity of $CO_2$ required to maintain 46% concentration by volume at temperatures of 700°F. (Rule of thumb: increase volume of $CO_2$ by 1% for every additional 5°F. over 200°F.)

$CO_2$ cylinders are available from Cardox Division of Chemetron, Chicago, Illinois. Standard sizes available and approximate costs are as follows:

| $CO_2$ Pounds Cylinder Size | Single Automatic | Double Automatic |
|---|---|---|
| 50 | $410 | $610 |
| 75 | $460 | $710 |
| 100 | $650 | $980 |

These units and prices include drawings of the units, fully-



TOWOLDMON0037268
WATER_PCB-00021737

charged cylinders, flexible piping connectors, spray nozzle, pressure switch, alarm and automatic control, provided $CO_2$ release signal is supplied by customer device. Piping, wiring and installation labor is provided by the customer. Recharging of cylinders is available at a cost of $15.00 to $25.00 from a variety of "Fire & Safety Equipment Suppliers" listed in the Yellow Pages of your phone book.

In the normal installation a single cylinder would be released to extinguish the fire, with a second unit available as standby. The second cylinder could actually be used for extended discharge to maintain maximum concentrations, since some $CO_2$ will obviously be lost by leakage from the combustion chamber. This arrangement could prevent re-ignition while the heater is cooling.

The Halon® Fire Suppression System is a possible alternative to a $CO_2$ arrangement, and can be used in closed spaces with personnel in the area. Far less concentration is required than with the $CO_2$ system, but the Halon® system is more costly to recharge, facilities to do so are not as readily available, and the latter system is a "fire suppression" arrangement as opposed to a "fire extinguishing" system.

Again, we strongly recommend that the advice of fire protection companies be solicited in either case to insure proper equipment selection and installation.

~~Table~~ FIGURE 1 shows the amounts of snuffing steam required in the combustion chamber for control, if steam is to be used rather than the other alternatives suggested above.

0592586

TOWOLDMON0037269
WATER_PCB-00021738

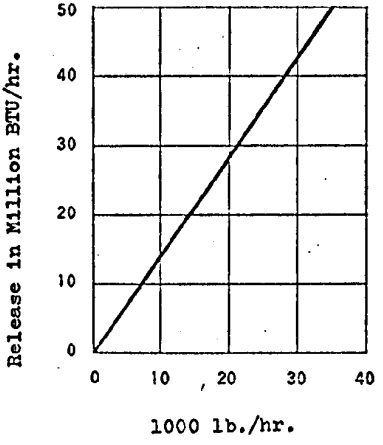



Figure 1 -- Rate of Steam Introduction in 1000 lb./hr.

0592589

TOWOLDMON0037270
WATER_PCB-00021739

Oxidation-Resistance

With a Therminol 55 or 66 system, some provision should be made to prevent oxidation caused by air contact at fluid temperatures exceeding 200°F. This was not the case with Therminol FR fluids, but must be observed for the newer-generation fluids. Oxidation can result in sludge formation, eventually leading to ~~loose~~ carbonaceous deposits on heat transfer surfaces and mechanical seal faces. Oxidation of fluid can develop by air contact in an open, vented expansion tank. ~~and we~~ Therefore, we recommend that the expansion tank be blanketed with an inert gas, such as Nitrogen, as shown in FIGURE 2. If this is not possible, air contact can be minimized by ~~use~~ a cold seal arrangement as shown in ~~Table~~ FIGURE 3. An inert gas pressure of one to two psi ~~should be~~ is adequate, as Therminol 55 and 66 ~~do~~ not require presurization.

You can design the cold seal arrangement quite simply by piping the expansion tank vent to a second tank where the vent line projects subsurface and can be flooded with additional Therminol 55 or 66 to ~~prevent~~ minimize air ingress ~~contact in~~ to the expansion tank vapor space.

In converting from Therminol FR to Therminol 55 or 66, it is important to remember that many Therminol FR systems were designed with a hot bleed line into the expansion tank to eliminate moisture accumulation. This bleed line should be ~~eliminated in a~~ valved off during operation of the Therminol 55 or 66 system.

Carbonaceous deposits can also occur at the pump seal face due to leakage at high temperatures. The use of a ~~seal~~guard flush system or a double mechanical seal is helpful in preventing ~~this~~ excessive seal wear.

0592590

TOWOLDMON0037271

WATER_PCB-00021740

~~INERT GAS BLANKETED LAYOUT~~

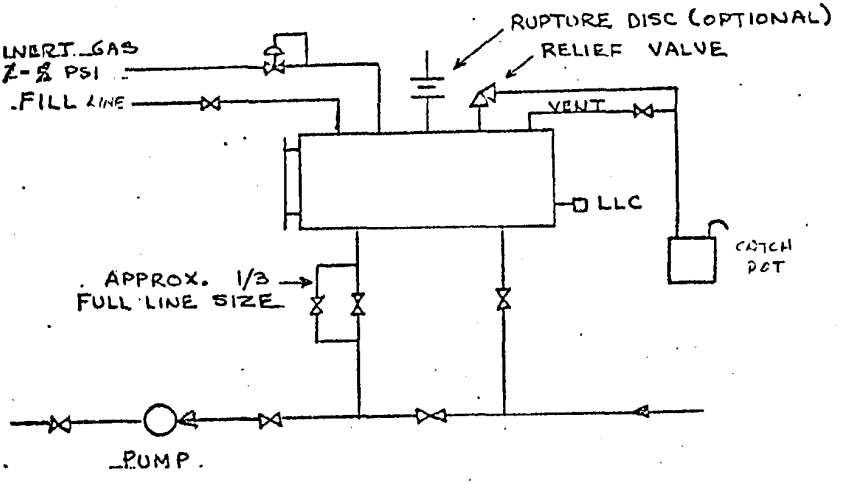



FIGURE 2

SUGGESTED INERT GAS ARRANGEMENT FOR EXPANSION TANKS



TOWOLDMON0037272
WATER_PCB-00021741

~~SUGGESTED~~

~~EXPANSION TANK LAYOUT~~

~~COLD SEAL LAYOUT~~

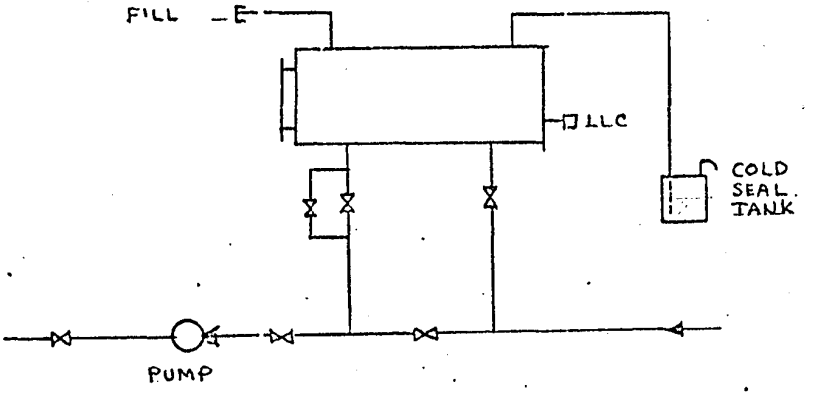



FIGURE 3

SUGGESTED COLD SEAL TRAP ARRANGEMENT

FOR EXPANSION TANKS

0592592

TOWOLDMON0037273
WATER_PCB-00021742

CONVERTING TO THERMINOL 55 or 66

With fire-protection and oxidation-resistance procedures well in mind, let us turn to the matter of preparing the Therminol FR system ~~to accept~~ for Therminol 55 or 66.

The most expedient procedure would be to simply drain and change the system to Therminol 55 or 66. However, expedience is not always the best alternative, and certainly not in this case.

Debris, accumulated over the years in the system, could cause serious problems, especially to mechanical seals, rotary joints, etc. ~~(see Suggested Expansion Tank Layout, Table _____)~~. All heat transfer systems should be ~~drained and~~ cleaned from time to time as a part of normal preventive maintenance. Since a fluid change is necessary at this time, it would seem ~~logical~~ practical to use the downtime to thoroughly clean ~~up~~ the system ~~and~~ from to start up on a fresh charge of fluid. We ~~would~~ strongly advise you not to simply drain and change, but to take this opportunity to clean your system. Many potential problems will be preempted by so doing.

~~The other~~ Another reason for cleaning your system at this time is to assure ~~that the system should be completely purged of PCBs, and~~ complete removal of the Therminol FR fluid — a system cleanout is the only sure way to do so. How to go about the cleanout is a matter of choice, but here are some alternatives for your consideration:

A. CHEMICAL CLEANING

This method is particularly effective in cleaning heavily-fouled heating surfaces.

0592593

TOWOLDMON0037274
WATER_PCB-00021743

Cleaning service may be purchased from Dow Industrial Service Company or Halliburton...or, it may be done in-house using Oakite cleaning products or caustic soda and soda ash. Consult the Yellow Pages of your phone book for the above services and suppliers.

Chemical cleaning procedure with caustic soda and soda ash follows: contact Oakite for detailed information on their procedure.

Chemical Cleaning - Caustic Soda and Soda Ash

1. Fill empty system with cleaning solution containing 5 lb. caustic soda and 5 lb. soda ash per 120 gallons of water.
2. Initiate circulation* and heat liquid to 180°F.
3. Circulate 24 hours, periodically drain fluid from a low point and replace with clean water. Do this until fluid in system is clear (about 24 hours).
4. When fluid in system is clear, raise temperature to 215°-225°F, stop pump and heater.
5. Quickly drain system, open all vents, and allow residual heat to dry system.
6. Assure system is dry.
7. Fill with Therminol ~~Fluid selected.~~ 55 or 66.

*May be desirable to pack pump with Teflon filled asbestos packing to prevent damage to mechanical seal faces.

0592594

TOWOLDMON0037275
WATER_PCB-00021744

B. FLUID FLUSH CLEANING

This ~~system~~ method is probably the fastest and most effective where heating surfaces are not heavily fouled. It also offers the advantage of not having to introduce foreign chemicals into the system.

With this method, the system is drained of Therminol FR, re-filled with Therminol 55 or 66, ~~(Therminol 55 may also be used)~~, operated for a reasonable period of time, drained once again, and finally, re-charged with fresh Therminol 55 or 66.

Both the drained Therminol FR and the Therminol 55/66 used to flush the system may then be returned to Monsanto for disposal at no cost to you, assuring you of a PCB-free system, and a fresh start.

C. SOLVENT CLEANING

This method is satisfactory for cleaning a slightly soiled system, but chlorinated solvents must be avoided. Typical solvents used are acetone, benzene, kerosene and xylol. Do not use trichlorobenzene or perchloroehtylene. (CAUTION: ALL SOLVENTS SHOULD BE COMPLETELY REMOVED FROM THE SYSTEM PRIOR TO CHARGING WITH THERMINOL 55 or 66).

0592595

TOWOLDMON0037276
WATER_PCB-00021745

Fluid Disposal

All drained Therminol FR and Therminol 55/66 flushing fluid should be returned to Monsanto for incineration. This service is provided at no cost to you, and assures proper elimination of PCBs from the environment.

All such material should be shipped to:

Monsanto Company
W. G. Krummrich Plant
Sauget, Illinois
ATTN: Supervisor, Dept. 246

Please make certain that shipped materials are properly sealed and identified.

As stated earlier, Monsanto maintains a staff of qualified engineers who will be available for consultation should you have questions or run into difficulties. The number to call, again, is (314)694-1000: ask for a Monsanto Heat Transfer Specialist.

Thank you.

0592596

TOWOLDMON0037277
WATER_PCB-00021746

THERMINOL 55 and 66

SAFETY OF HANDLING

Therminol 55 and 66 are virtually non-toxic and non-irritating, posing no special handling problems. ~~It is~~ They are not absorbed through the unbroken skin in significant quantities, ~~is~~ are non-irritating to the skin and only mildly irritating if eye contact occurs. Immediate flushing of the eye with copious amounts of water will avoid irritation or after-effects. It is suggested that Therminol 55 and 66 be washed off the skin with soap and water as soon as possible after contact, but no serious irritation should ~~be observed~~ result. Handled like any other industrial chemical, Therminol 55 and 66 ~~is~~ are quite safe to store and use.

Vapors from Therminol 55 and 66 ~~vapors~~ are not ~~dangerously~~ toxic, but may cause discomfort if coming off of heated fluid. There is no vapor exposure problem when transferring the fluid from its shipping container to the heat transfer system. On the other hand, vapors emitted by Therminol 55 and 66 heated to elevated temperatures may be mildly irritating upon prolonged exposure. In heat transfer installations, the fluid is used in a closed, unpressurized system free from leaks and with the expansion tank vent trapped so as to condense any vapors. Consequently, there should be little or no opportunity for workers to come in ~~extensive~~ contact with vapors. ~~A sight maintenance program is the best answer to employee~~

0592597

TOWOLDMON0037278
WATER_PCB-00021747

While Therminol 55 and 66 pose no serious problems with respect to the environment, as a concerned supplier to industry, Monsanto urges the user to maintain a tight system, to correct leakage promptly, and to exercise care in the handling and disposal of this and all other such products. A tight maintenance program not only protects the environment, but keeps employes comfortable, the working area clean, and the system running smoothly.

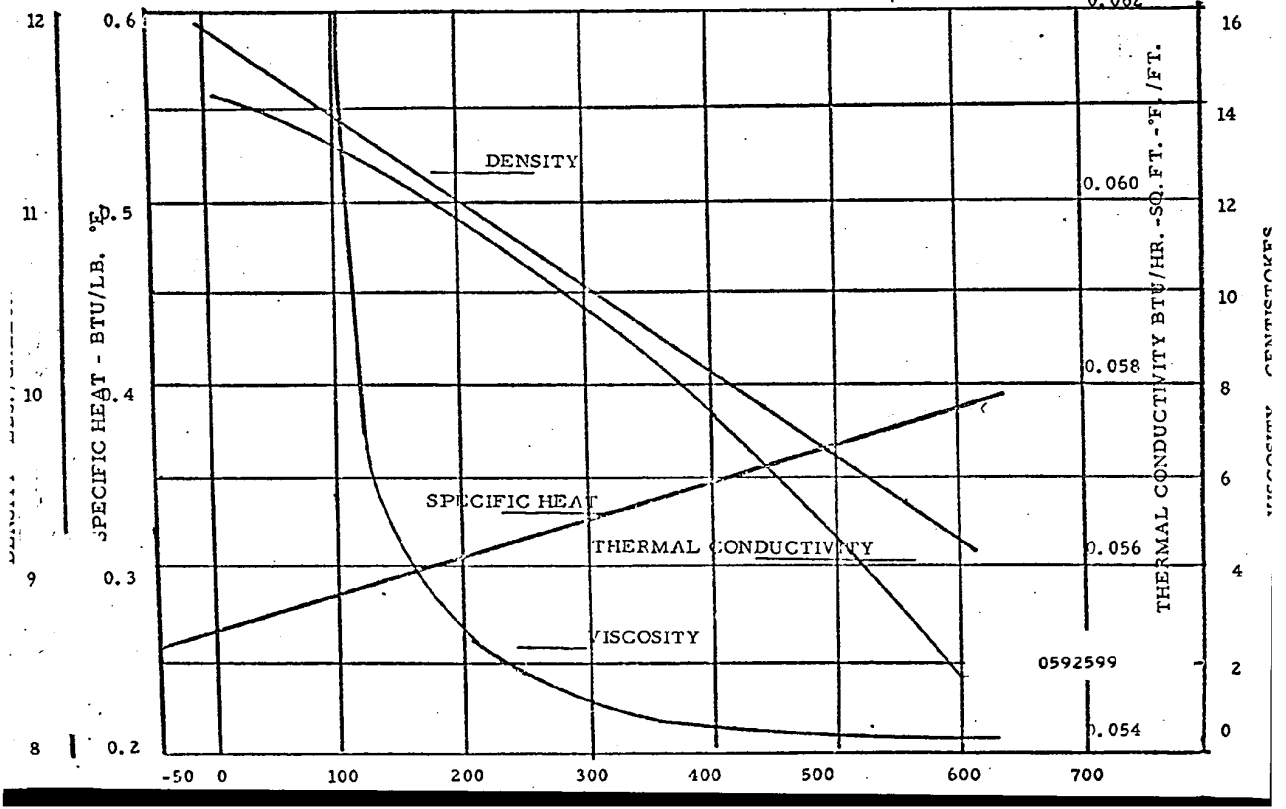
0592598

TOWOLDMON0037279
WATER_PCB-00021748

FIGURE I

THERMINOL® FR-1

PHYSICAL PROPERTIES

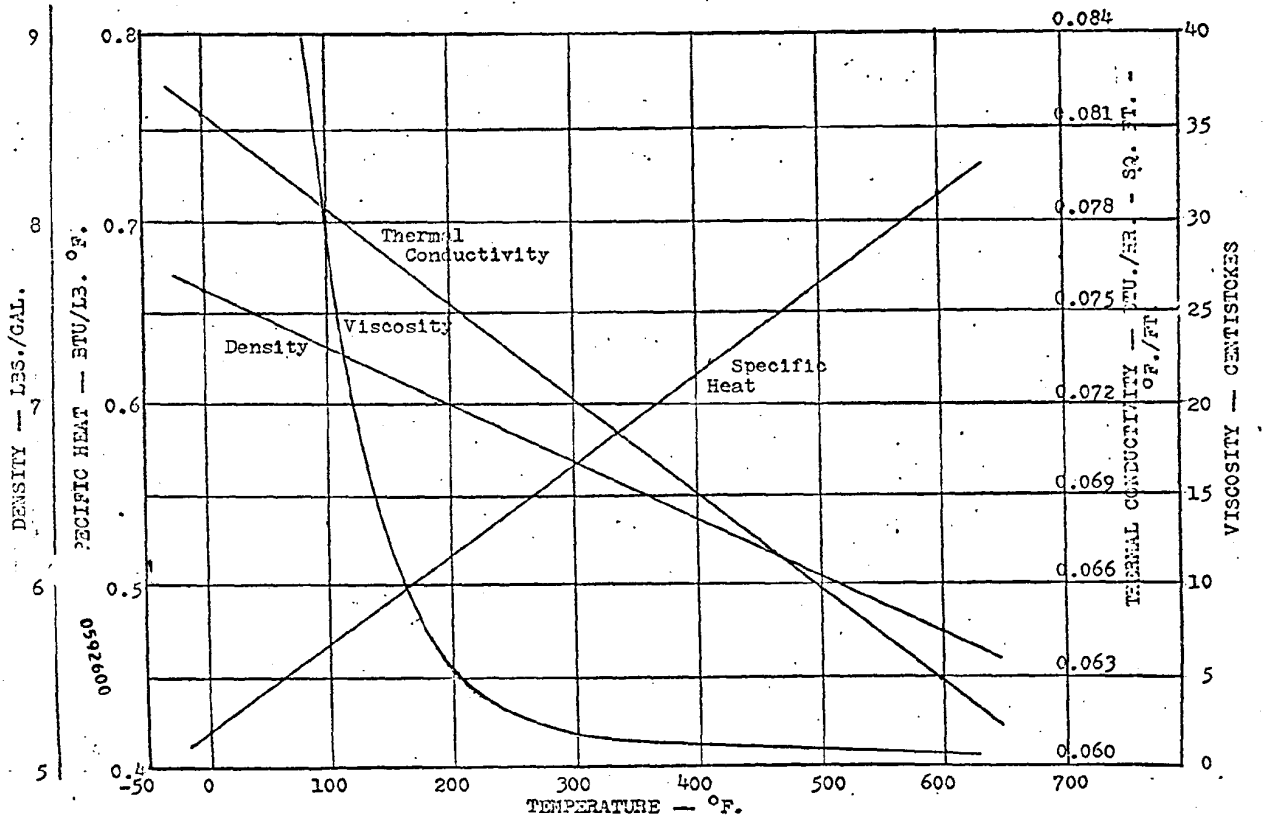



TOWOLDMON0037280
WATER_PCB-00021749

FIGURE 11

THERMINOL® 55

PHYSICAL PROPERTIES



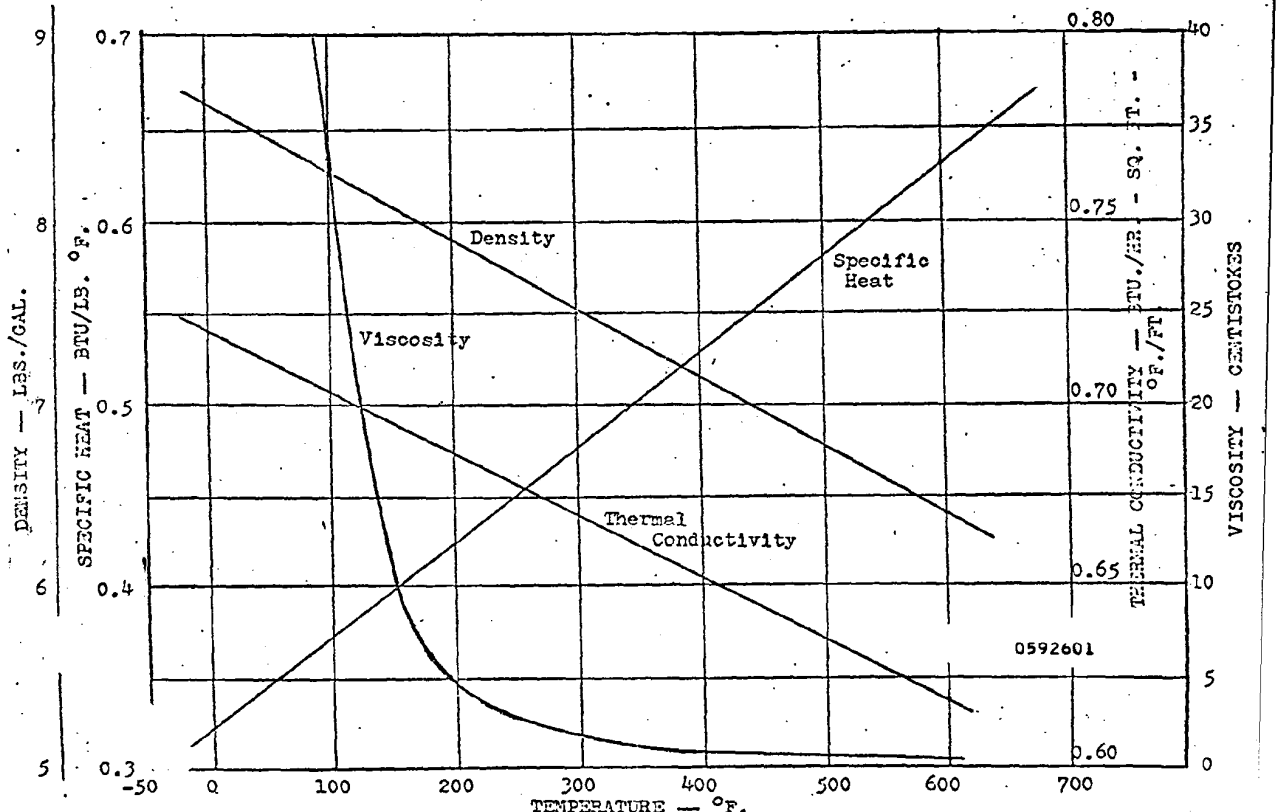

0092600

TOWOLDMON0037281
WATER_PCB-00021750

FIGURE

# THERMINOL® 66

## PHYSICAL PROPERTIES




TOWOLDMON0037282
WATER_PCB-00021751