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Why Therminol?



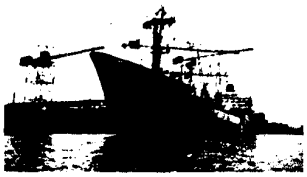
Apartment buildings, offices, hospitals—buildings of all kinds find Therminol an economical alternative to steam.

Does your process need an indirect heating system like steam? Or the high temperatures of a synthetic heat transfer fluid or oil? Perhaps you need to heat and cool with the same system.

But pressurized heating systems need costly equipment. And licensed boiler operators in many areas. Safety isn't the long suit of many fluids and oils, either.

That's why there's Therminol®.

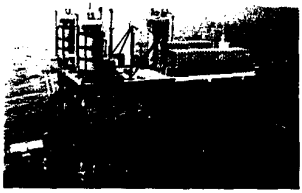
You discover the best of all worlds in Therminol: high and low heat ranges, thermal stability and efficient liquid heat transfer *without* expensive equipment. In short, the safest, most efficient heat transfer systems for your application.



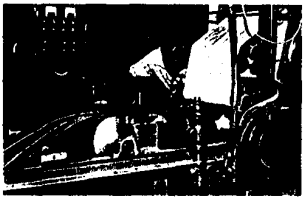
This Dutch tanker uses a Therminol system to heat living quarters as well as cargo.



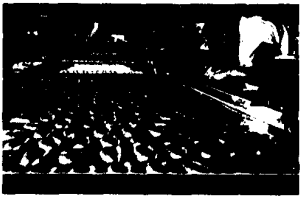
Several resin kettles with various heat needs can be heated from one Therminol system.



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



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



Any food application that can use uniform temperature control can use Therminol.

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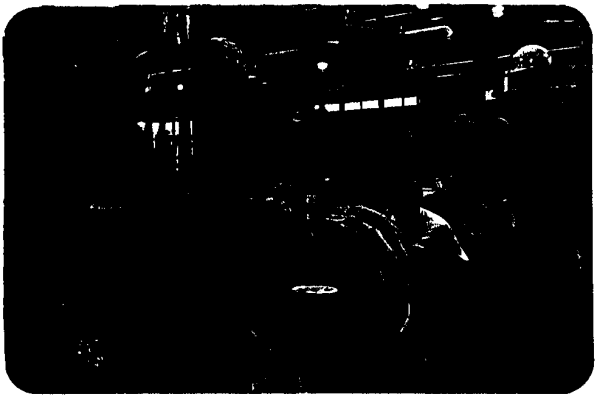

The big plus you get with Therminol in chemical processing, like this resin kettle, is heating and cooling from the same system. This flexibility added to Therminol's fire safety gives you a completely unique heating system.

What makes Therminol right for your application? The more than 2500 customers who have specified Therminol for new installations and conversions of existing systems will give you these answers.

SAFETY! Insurance underwriters such as FIA and FM approve the fire resistant Therminols—the *only* heat transfer fluids listed with Underwriters' Laboratory, Inc. And Therminol systems are vented to the atmosphere since they're entirely liquid. Fire safety plus

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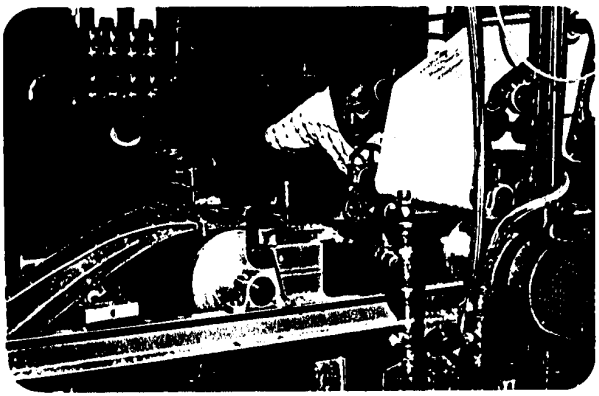

Since Therminol remains liquid throughout its temperature range, rapid circulation through your rolls helps achieve uniform heat. This has resulted in greater throughput and fewer rejects for Therminol customers producing rubber, plastics, paper and textiles.

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Accurate temperature control [illegible] without hot spots makes for less decomposition of cooking oil. The results are improved throughput and a product that looks and tastes better.

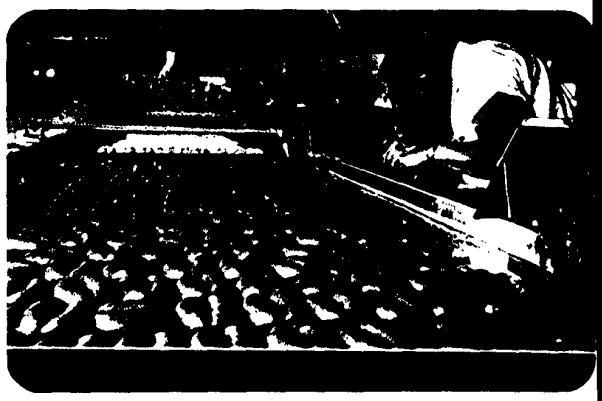
You'll be surprised at how easy it is to work with a Therminol heat transfer system. The middle diagram at the right shows typical Therminol liquid heating and cooling systems used together to maintain very close temperature control at the user. Note that the term "heater" is used rather than "boiler"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

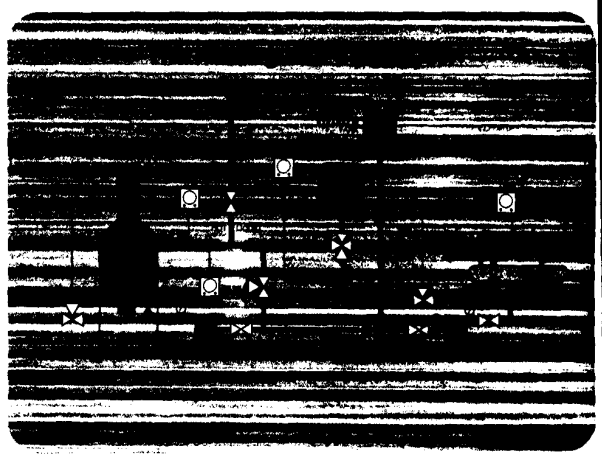
Benefits of a Liquid Heating System

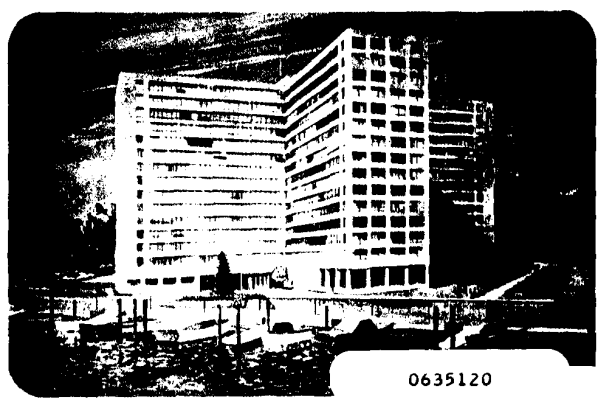
You gain a wide spectrum of benefits with a Therminol liquid heating system.

- In many locations, codes favor Therminol systems, thus eliminating 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 conver[illegible] ative from [illegible] 336 000 [illegible] boiler operat[illegible] ings







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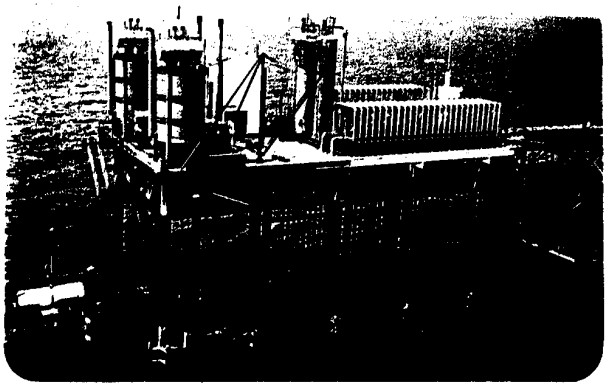


Safety through fire resistance is the keynote on this offshore platform. Its maintenance-free Therminol system offers safety plus heat that's controllable over a wide temperature range. And there's no longer any need to isolate the heating equipment from the processing platform.

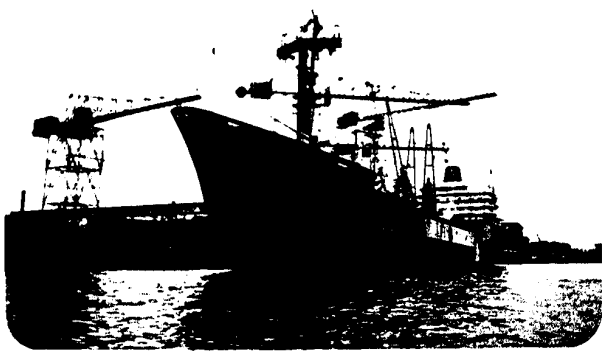
The Therminol Family

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 -40°F. to 800°F. Five are fire resistant . . . they're the only heat transfer fluids listed by Underwriters' Laboratories and approved by FIA and FMA.

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 eight members of the Therminol family of fluids.



On both ships and barges Therminol eliminates licensed boiler operators because it's a non-pressurized system. Therminol's ability to recover waste heat adds to the savings it offers. More important, Therminol is a safe system—fire resistant and non-pressurized, it offers extra protection for both personnel and property.

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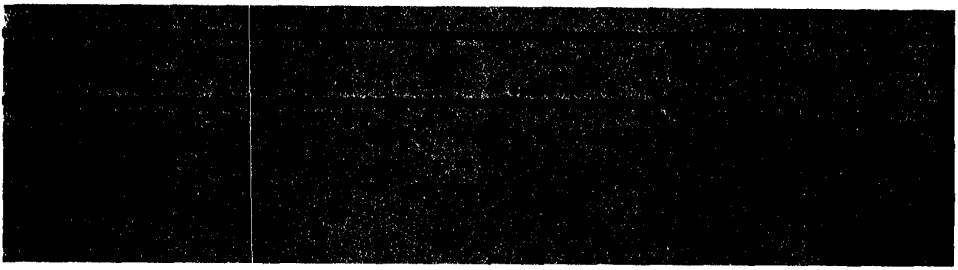

THERMINOL FR-1

Temperature °F	°C	Vapor Pressure mm Hg. Absolute	Specific Heat BTU./Lb. °F	Thermal Conductivity BTU/Hr. ft² °F/ft.	Density Lb./Gal.	Viscosity Cs
[illegible]	10	—	0.272	0.06098	[illegible]	[illegible]
[illegible]	38	—	0.283	0.06060	[illegible]	[illegible]
[illegible]	66	—	0.291	0.06021	11.22	[illegible]
[illegible]	93	—	0.3044	0.05978	[illegible]	[illegible]
[illegible]	[illegible]	—	0.3151	0.05927	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	0.3288	0.05878	10.53	[illegible]
[illegible]	[illegible]	[illegible]	0.3359	0.05815	10.30	[illegible]
[illegible]	[illegible]	[illegible]	0.3464	0.05760	10.07	[illegible]
[illegible]	232	[illegible]	0.3566	0.05697	9.83	[illegible]
[illegible]	260	[illegible]	0.3672	0.05630	9.60	[illegible]
[illegible]	288	[illegible]	0.3776	0.05560	9.37	[illegible]
[illegible]	[illegible]	[illegible]	0.3880	0.05487	9.14	[illegible]
[illegible]	[illegible]	[illegible]	0.3985	0.05409	8.91	[illegible]
[illegible]	[illegible]	[illegible]	0.4090	0.05329	8.68	[illegible]

THERMINOL FR-2

Temperature °F	°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	—	0.257	0.05881	12.23	1999
100	38	—	0.265	0.05852	12.00	43.4
150	66	—	0.274	0.05801	11.75	8.2
200	93	—	0.2840	0.05788	11.53	3.6
250	121	—	0.2922	0.05748	11.29	2.1
300	149	—	0.3003	0.05703	11.06	1.4
350	177	6	0.3084	0.05655	10.83	1.0
400	204	15	0.3166	0.05603	10.60	0.8
450	232	37	0.3247	0.05548	10.37	0.6
500	260	84	0.3328	0.05488	10.14	0.5
550	288	173	0.3410	0.05424	9.90	0.4
600	316	340	0.3491	0.05357	9.67	0.4
650	343	615	0.3573	0.05286	9.44	0.4
700	371	20.3 psia	0.3654	0.05211	9.21	0.4

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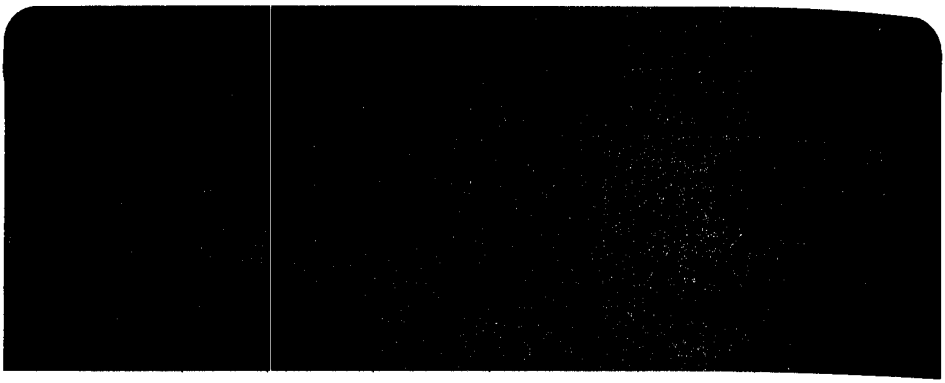

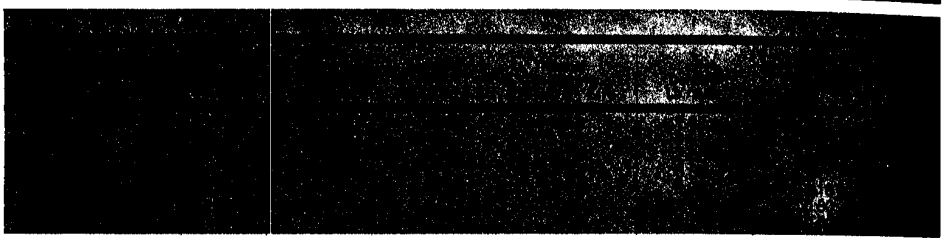

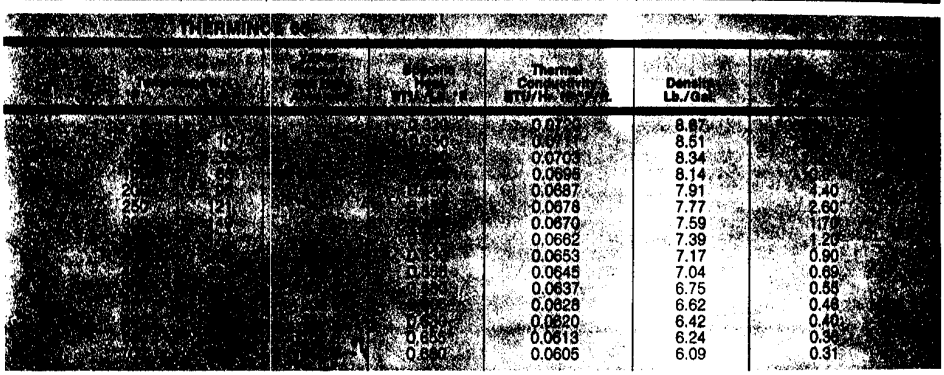

Temperature °F	Temperature °C	Vapor Pressure mm Hg. Absolute	Thermal Conductivity BTU/Hr.	Density Lb./Gal.	Viscosity Cs
			0.07	8.67	
			0.07	8.51	
			0.0703	8.34	
			0.0695	8.14	
20			0.0687	7.91	4.40
25			0.0678	7.77	2.60
			0.0670	7.59	1.70
			0.0662	7.39	1.20
			0.0653	7.17	0.90
			0.0645	7.04	0.69
			0.0637	6.75	0.55
			0.0628	6.62	0.46
			0.0620	6.42	0.40
			0.0613	6.24	0.36
			0.0605	6.09	0.31

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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	—	0.350	0.0781	9.6	181
200	93	—	0.375	0.0760	9.26	7.78
300	149	0.27	0.420	0.0739	8.94	2.65
400	204	1.03	0.455	0.0719	8.58	1.50
500	260	9.2	0.495	0.0698	8.16	0.96
600	316	44	0.530	0.0678	7.76	0.66
700	371	168	0.565	0.0660	7.38	0.46
800	426	530	0.600	0.0640	7.05	0.34

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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 heating reactors, autoclaves, heat exchangers, distillation columns, reboilers, mixers, dryers, etc.

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

PLASTICS AND RUBBER MOLDING; PAPER AND TEXTILES . . . 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.

FOOD PROCESSING . . . for controlled, quality "cooking" of potato chips, precooked/frozen products, other foodstuffs.

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

SHIPS AND BARGES . . . eliminates expensive boiler operators with a system that can heat both cargo and living quarters.

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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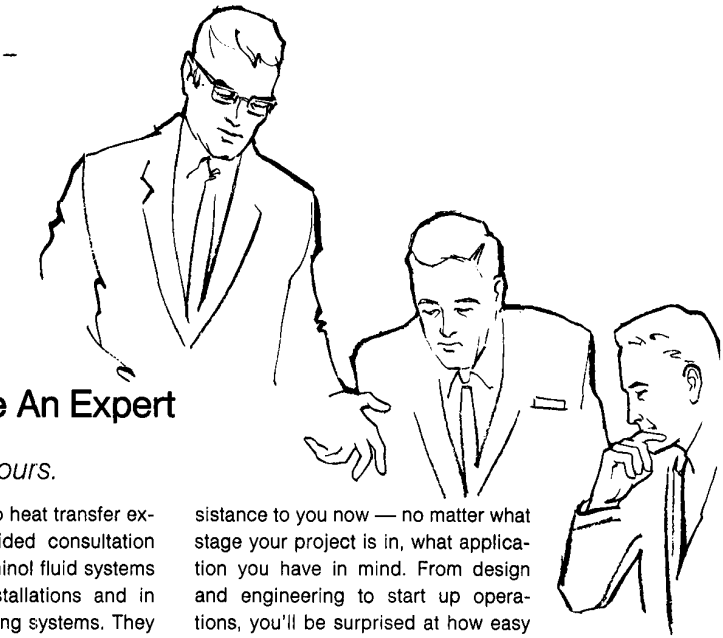

You Don't Have To Be An Expert

We'll loan you ours.

Talk to the Monsanto heat transfer experts. They've provided consultation for over 2,500 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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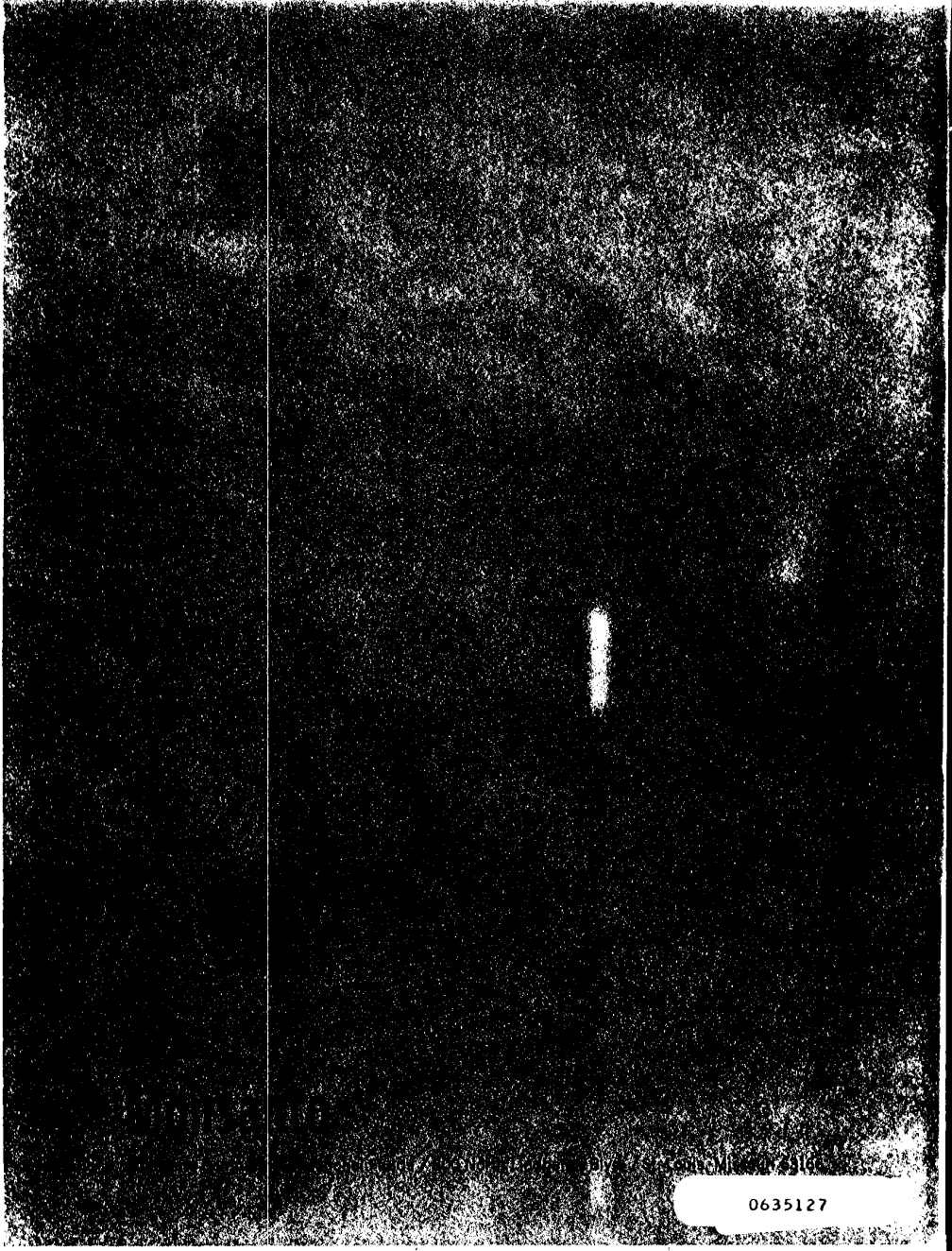
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