TURPENTINE RECOVERY IN PULP AND PAPER MILLS

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1.0 SCOPE

This data sheet covers turpentine recovery systems in pulp and paper mills. It does not cover noncondensable gas systems or the combustion of turpentine or methanol in equipment such as incinerators, kilns or boilers.

1.1 Changes

April 2025. Interim revision. This data sheet was reaffirmed to be tecHnically correct. Figure C.1-1, Turpentine recovery system, was updated.

2.0 LOSS PREVENTION RECOMMENDATIONS

2.1 Introduction

2.1.1 Turpentine storage tanks should be located, arranged, and protected in accord with the guidelines in Data Sheet 7-88, *Storage Tanks for Flammable and Combustible Liquids*. FM Approved (see Appendix A for definition) sight glasses or other liquid-level indicator means should be provided, and the tank contents should be checked periodically to determine turpentine level.

2.2 Construction and Location

2.2.1 A safe outdoor location is preferred for the turpentine recovery system. For indoor locations, the digester condenser and turpentine decanter should be located in an area of noncombustible construction enclosed by walls having a one-hour fire rating. The area should be provided with good drainage, including curbs or ramps at door openings, all arranged in accord with Data Sheet 7-83, *Drainage Systems for Ignitable Liquids*.

2.3 Occupancy

2.3.1 Grouped electrical cables for control of important pulp and paper mill processes should not be routed through areas containing turpentine recovery system equipment.

2.3.2 Provide automatically operated safety/emergency shutoff valves in gravity lines from turpentine recovery system condensers and decanters in accordance with Data Sheet 7-32, *Ignitable Liquid Operations*. Remote, manually actuated-only safety/emergency shutoff valves may be provided in lieu of automatically operated shutoff valves.

2.3.3 Overflow piping from turpentine recovery system equipment should be arranged to discharge to a remote safe location when the piping is used for disposal purposes.

2.3.4 Provide vents to outdoors on turpentine decanters with a flash arrester or conservation vent at the end of the vent line. Size the vent in accordance with Data Sheet 7-88, *Ignitable Liquid Storage Tanks*.

2.3.5 Turpentine recovery system areas should be provided with emergency drainage to an acceptable location. For guidance refer to Data Sheet 7-83, *Drainage Systems for Ignitable Liquids*.

2.4 Protection

2.4.1 Provide automatic sprinkler protection for turpentine recovery systems located indoors in accordance with Table 2.4.1. Where the turpentine decanter and condenser are located within a curbed and drained area, sprinkler protection may be provided over the curbed area only.

2.4.2 Turpentine recovery systems located outdoors should be protected in accordance with the guidelines of Data Sheet 7-88, *Ignitable Liquid Storage Tanks* (i.e., turpentine storage tank(s) requirements sufficient).

Table 2.4.1. Sprinkler Protection Requirements for Indoor Turpentine Recovery Systems

Arrangement	*Reference*	*Type of Sprinkler System*	*Sprinkler Temperature Rating °F (°C)*	*Density gpm/ft² (mm/min)*	*Area of Demand ft² (m²)*
Multilevel	Data Sheet 7-14			0.30 (12) for first level, solid intermediate levels, and roof. 0.15 (6) for grated intermediate levels.	per level
		Wet	286 (141)		3000 (279)
		Wet	165 (74)		4000 (372)
		Dry	286 (141)		5000 (464)
		Dry	165 (74)		6000 (557)
Single Level		Wet	286 (141)	0.25 (10)	3000 (279)
		Wet	165 (74)	0.25 (10)	4000 (372)
		Dry	286 (141)	0.25 (10)	5000 (464)
		Dry	165 (74)	0.25 (10)	6000 (557)

2.5 Equipment and Processes

2.5.1 Provide a low waterflow alarm for turpentine recovery system condensers or a high temperature alarm on the condensate line to minimize the probability of introducing steam into the decanter.

2.6 Human Element

2.6.1 Use a permit system for cutting and welding operations in turpentine recovery system areas.

2.7 Ignition Source Control

2.7.1 Electrical equipment within turpentine recovery system areas should be suitable for Class 1, Group D locations in accordance with Data Sheet 5-1, *Electrical Equipment in Hazardous (Classified) Locations*.

3.0 SUPPORT FOR RECOMMENDATIONS

3.1 General

Turpentine, a hydrocarbon mixture, is an ignitable liquid with a reported closed-cup flash point of 95°F (35°C).

FM Global Research has determined a closed-cup flash point of 80°F (27°C) for a crude turpentine sample taken from a turpentine recovery system. Turpentine is primarily handled as a heated ignitable liquid, approximately 100° to 150°F (38° to 66°C), in the recovery process.

Although an equipment explosion hazard could be present, the primary hazard of turpentine recovery systems is the fire hazard associated with the accidental release of turpentine or other related ignitable liquids. Turpentine recovery systems, except for the turpentine storage tank, are frequently located in open grated multilevel buildings using gravity flow. This can present a three-dimensional spill fire hazard.

4.0 REFERENCES

4.1 FM

Data Sheet 5-1, *Electrical Equipment in Hazardous (Classified) Locations*.

Data Sheet 7-14, *Fire and Explosion Protection for Ignitable Liquid, Flammable Gas, and Liquefied Flammable Gas Processing Equipment and Supporting Structures*.

Data Sheet 7-32, *Ignitable Liquid Operations*.

Data Sheet 7-83, *Drainage Systems for Ignitable Liquids*.

Data Sheet 7-88, *Ignitable Liquid Storage Tanks*.

APPENDIX A GLOSSARY OF TERMS

FM Approved: References to ″FM Approved″ in this data sheet mean a product or service has satisfied the criteria for FM Approval. Refer to the Approval Guide, an online resource of FM Approvals, for a complete listing of products and services that are FM Approved.

Ignitable Liquid: Any liquid or liquid mixture that is capable of fueling a fire, including flammable liquids, combustible liquids, inflammable liquids, or any other reference to a liquid that will burn. An ignitable liquid must have a fire point.

Turpentine: volatile hydrocarbon (ignitable liquid) of the oleoresinous material that is contained within and flows from coniferous trees, primarily pine trees.

APPENDIX B DOCUMENT REVISION HISTORY

April 2025. Interim revision. This data sheet was reaffirmed to be technically correct. Figure C.1-1, Turpentine recovery system, was updated.

January 2012. Terminology related to ignitable liquids has been revised to provide increased clarity and consistency with regard to FM Global's loss prevention recommendations for ignitable liquid hazards.

May 2000. This revision of the document has been reorganized to provide a consistent format.

May 1984. First issued.

APPENDIX C SUPPLEMENTARY INFORMATION

Many pulp and paper mills using the sulfate process for cooking or digesting wood chips (i.e., to produce sulfate or kraft pulp) have turpentine recovery systems as part of their air pollution control systems. Turpentine is the volatile hydrocarbon portion of the oleoresinous material that is contained within and flows from coniferous trees, primarily pine trees.

C.1 Process Description

In the typical kraft or sulfate pulp mill, the relief gases and escaped steam are passed to a condenser from the digesters. The noncondensable gases are usually passed to an incinerator, kiln or boiler where they are burned. The condensate, usually less than 100 gal/min (378 dm^3/min) containing approximately 1% by weight turpentine, flows to a decanter where crude turpentine separates as an upper layer (overflow). Turpentine decanters range in size from approximately 1000 to over 10,000 gallons (3.8 to 38 m^3) total capacity (mostly water). Turpentine storage tanks range in size from approximately 10,000 to 20,000 gallons (38 to 76 m^3). The underflow, mainly water and approximately 1% by weight methanol and a limited amount of turpentine, is piped to a condensate storage tank (or underflow tank). From there it may be pumped to a steam stripping column or disposal area. In the stripping column, methanol is separated as a vapor and passed to an incinerator, kiln or boiler for burning. Further recovery of the residual turpentine through decanting may be attempted. In some cases, there may be a bypass at the decanter, which will allow the condensate containing turpentine to enter the condensate storage tank (underflow tank) directly, due to inadequate turpentine levels. Turpentine recovery system arrangements and controls may vary considerably. One arrangement as described above is shown in Figure C.1-1.

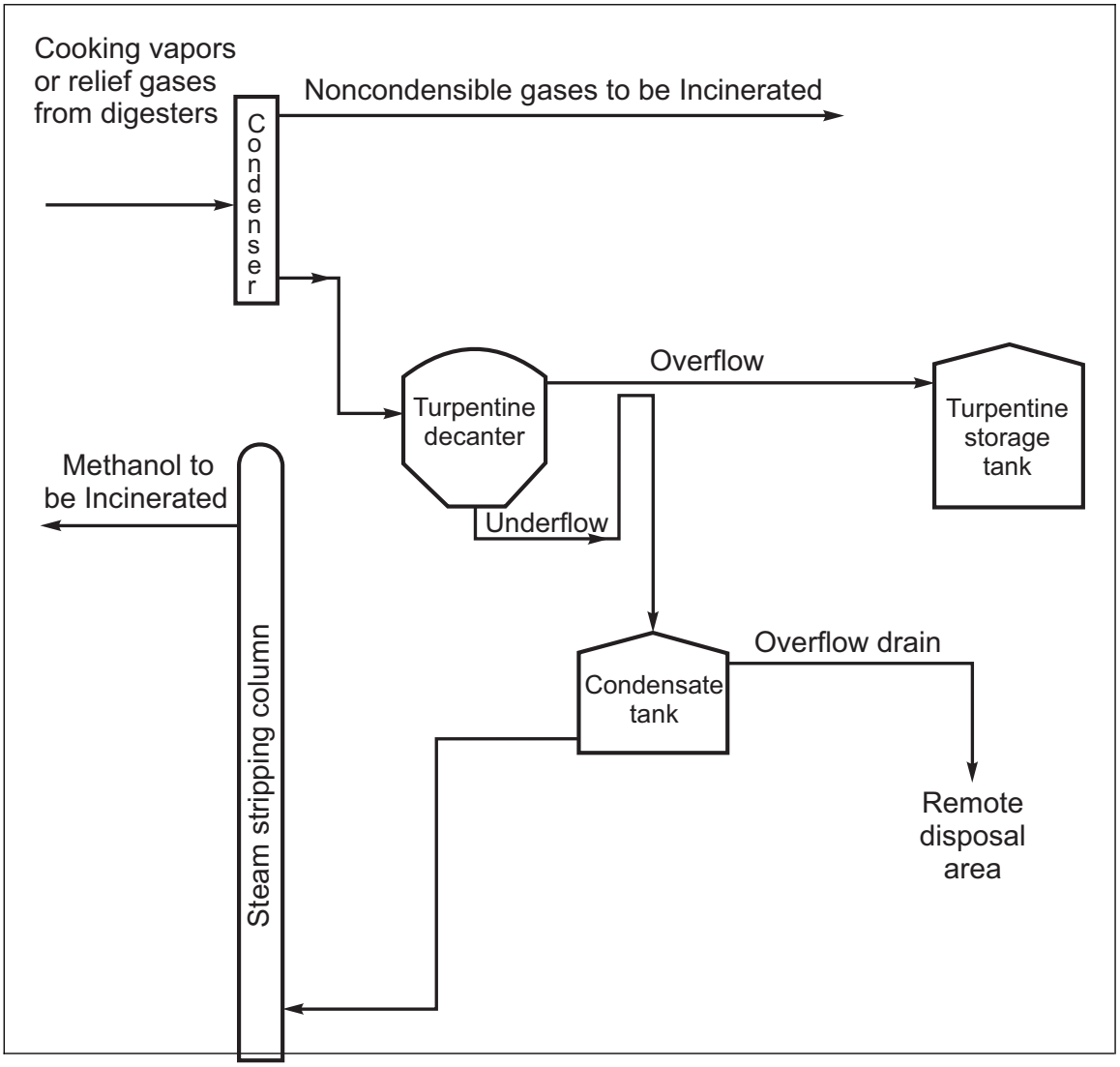

Fig. C.1-1. Turpentine recovery system.