EMBANKMENT-SUPPORTED FABRIC TANKS

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1.0 SCOPE

This document provides guidelines for the design, installation and maintenance of embankment-supported fabric tanks used for fire protection water storage. For lined earth fire protection reservoirs, see Data Sheet 3-6, *Lined Earth Reservoirs for Fire Protection*. For other types of fire protection water storage tanks, see Data Sheet 3-2, *Water Tanks for Fire Protection*.

1.1 Changes

July 2022. Interim revision. The new FM Global Worldwide Freeze Map has been developed and is available online at https://www.fmglobal.com. The map incorporates recent worldwide temperature data, but the key change is that the weather-related freeze hazard is now determined based on 100-year return period daily minimum temperature (100-year DMT) zones. The 100-year DMT differs from the temperature measure previously used (i.e., the lowest one-day mean temperature [LODMT]) to identify areas having a significant freeze hazard.

This data sheet is revised in parallel with Data Sheet 3-2, *Water Tanks for Fire Protection*, to adjust guidance as appropriate for use with the new 100-year DMT zones. Some editorial changes are made as well. Revisions include:

A. Revised Recommendation 2.1.4

B. Revised Table 1

2.0 LOSS PREVENTION RECOMMENDATIONS

2.1 Construction and Location

2.1.1 Ensure embankment-supported fabric tanks (ESFT) are Approved by FM Approvals (see Appendix A for definition).

2.1.2 Consult a soils engineer if there is any question about the suitability of the on-site soil for the dike or tank.

2.1.3 If the property is not protected by suitable fences or barriers, enclose the tank area (see Appendix A).

2.1.4 Where the 100-year return period daily minimum temperature (100-year DMT) zone is 20°F (-6.7°C) or colder, protect tanks and exposed suction piping against freezing using the requirements in Data Sheet 3-2, Water Tanks for Fire Protection, Section 2.2.6. 100-year DMT zones are shown in the FM Worldwide Freeze Map, available online at https://www.fmglobal.com. An overview of the worldwide map is shown in Data Sheet 3-2. Where tank heating is indicated, provide as recommended in Table 1.

Table 1. Thousands of British Thermal Units Lost Per Hour From Embankment-Supported Fabritank® Containers Based on Minimum Water Temperature of 42°F (6°C) and Wind Velocity of 12 mph

100-year DMT Zone °F	Heat (BTU) Loss per Ft^2 Tank Radiating Surface	Tank Capacities—Thousands U.S. Gallons							
		100	200	300	400	500	600	800	1,000
		Ft^2 of Tank Surface*							
		2746	4409	6037	7604	9139	10,630	13,572	16,435
		BTU Lost per Hour, Thousands							
30	22.2	61	68	134	168	202	235	300	363
25	28.5	78	126	173	217	261	304	389	470
20	35.1	96	155	212	266	320	372	476	576
15	41.5	114	183	251	315	379	441	564	682
10	48.0	132	212	290	364	438	510	652	789
5	54.5	149	241	329	413	497	579	740	896
0	61.0	167	269	369	463	557	648	828	1003
-5	67.5	185	298	408	512	616	717	916	1109
-10	73.9	203	326	447	561	675	786	1004	1216
-15	80.4	220	355	486	610	734	855	1092	1322
-20	86.8	238	384	525	659	793	924	1180	1429
-25	93.3	256	412	564	708	852	992	1268	1536
-30	99.9	273	441	604	758	912	1061	1356	1642
-35	106.2	291	469	643	807	971	1130	1444	1749
-45	119.3	327	526	721	905	1089	1268	1620	1692
-55	131.9	362	584	799	1003	1207	1406	1796	2175
-65	145.1	397	641	878	1102	1326	1544	1972	2389

*These numbers are square feet of radiating surface used for each capacity to compute the tabulated heat loss values.

To determine capacity of heater needed, find the 100-year return period daily minimum temperature (100-year DMT) zone from the FM Worldwide Freeze Map at https://www.fmglobal.com. (see Data Sheet 3-2, *Water Tanks for Fire Protection*, for an overview of the map) and note the corresponding heat loss above.

2.1.5 Ensure the discharge fitting is either a goose neck or a vertical pipe with a horizontal plate mounted above the pipe to support the fabric. When a goose neck is used, provide a minimum ⅛ in. hole in the top of the neck to bleed air into the pocket.

2.2 Operation and Maintenance

2.2.1 Follow the inspection, testing and maintenance (ITM) guidance in Data Sheet 2-81, *Fire Protection System Inspection, Testing and Maintenance*. Some key items specific to embankment-supported fabric tanks include:

- Inspect the interior of the tank for deterioration at intervals not exceeding 5 years. These inspections are especially critical and must be made more frequently as the tank approaches the end of its reliable life.
- Protect the exterior surfaces of the dike against erosion by plantings, black-top or other means. In addition, the dike must be checked frequently (i.e., monthly) and partial erosion refilled and replanted.
- Paint the exposed surface of the tank, and inspect the coating at least every 2 years and repaint as necessary, to protect it from weathering. Ensure all painting is in accordance with the manufacturer's recommendations.

3.0 SUPPORT FOR RECOMMENDATIONS

3.1 General Information

3.1.1 History of Development

Traditionally, pump suction tanks for private fire protection have been of steel, wood, and occasionally concrete. Earth-dike reservoirs, sometimes lined with an impermeable membrane, also have been used. World War II saw the introduction of coated-fabric bladders for fuel storage. This idea was later extended to fire-protection reservoirs, but it was recognized as impractical to achieve a self-supporting bladder for the quantity of water it would have to hold.

At first a chain-link fence enclosure was considered, but such an arrangement would have been extremely vulnerable to damage. This idea was discarded in favor of a substantial earth dike with an impermeable liner and a floating cover (Figure 1). Suitable accessories were later developed.

Fig. 1. View of a filled 200,000-gal embankment-supported fabric tank

The main objection to using such a reservoir for a suction supply was that the fabric might be drawn into the suction outlet. To overcome that objection, a manufacturer conducted a test witnessed by representatives of fire protection interests. A 200,000 gal reservoir was pumped down to the end of usable water supply in less than four hours. Toward the end of the test, the pumping rate was in excess of 2000 gpm. The fabric displayed no tendency toward being drawn into the suction discharge.

If a more flexible fabric, or if different details, are used, the possibility remains that the fabric might be drawn into the suction outlet. Therefore, tanks produced by various manufacturers must be evaluated on an individual basis.

3.1.2 Description

The dike that constitutes the supporting system is provided by the purchaser, using drawings submitted by the tank manufacturer. The purchaser is responsible for stability of the dike. Construction is especially critical in areas of heavy rain or strong earthquake forces.

The dike may be constructed of on-site materials if they are suitable. Such material should be clean wellgraded gravel, substantially free from organic matter. Clay and silt are not satisfactory. The ground surfaces in contact with the fabric should be sandy and free from large angular objects. Exterior surfaces should be loam or other similar material.

The bladder is prefabricated of a neoprene-coated nylon fabric. It comes in roll form and is installed by the purchaser or his contractor. Field supervision of installation should be by the manufacturer whose representative also will witness one filling and drawdown.

Accessories should include an access manhole fitting, a vent-pipe pressure-release cap, a bottom filler and discharge fitting with sump extension, and a sump drain fitting (Figure 2). A clear plastic pipe used as a liquid level indicator should be located within view of the pump house. In cold climates the preferred location for the indicator is in the pump house.

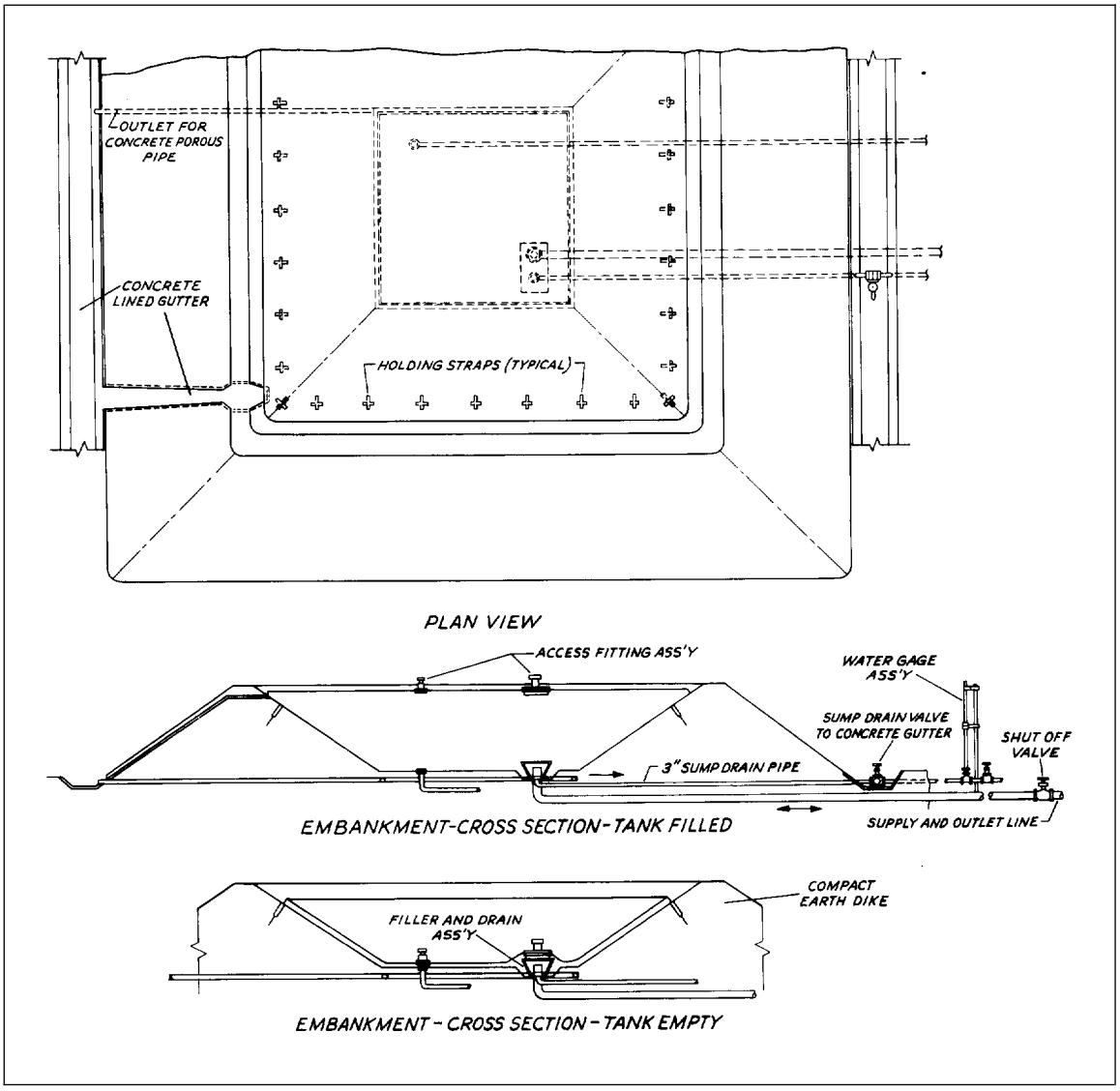

Fig. 2. Installation details of a fabric tank, including recommended fittings

Where greater water supply reliability is desired, two tanks can be installed side by side sharing a common subdividing dike.

3.1.3 Maintenance

The top surface of the fabric must be repainted periodically; the frequency is dependent on the climate and materials used. Patch kits are available to repair punctures of the top surface. Access to the interior of the tank for inspection can be achieved by draining the water and inflating the tank as if it were an air-supported structure.

4.0 REFERENCES

4.1 FM

Data Sheet 3-2, *Water Tanks for Fire Protection*.
Data Sheet 3-6, *Lined Earth Reservoirs for Fire Protection*.

4.2 NFPA Standards

NFPA 22, *Water Tanks for Private Fire Protection*, 1998.

APPENDIX A GLOSSARY OF TERMS

Approved/Approval: references to ‘‘Approved/Approval’’ in this data sheet means the product and services have satisfied the criteria for FM Approvals. Refer to the *Approval Guide*, a publication of FM Approvals, for a complete listing of products and services that are FM Approved.

Embankment-Supported Fabric Tank: a water storage structure which is totally enclosed, constructed of a flexible coated fabric which rests on grade and is usually laterally supported by an earthen dike.

Fences or Barriers: fences should be flush with the ground and a minimum of 7 ft (2 m) in height, with barbed wire at the top tilted toward the outside of the protected area. Barrier systems such as walls or concertina (coiled, barbed wire) should provide the same degree of protection.

APPENDIX B DOCUMENT REVISION HISTORY

The purpose of this appendix is to capture the changes that were made to this document each time it was published. Please note that section numbers refer specifically to those in the version published on the date shown (i.e., the section numbers are not always the same from version to version).

July 2022. Interim revision. The new FM Global Worldwide Freeze Map has been developed and is available online at https://www.fmglobal.com. The map incorporates recent worldwide temperature data, but the key change is that the weather-related freeze hazard is now determined based on 100-year return period daily minimum temperature (100-year DMT) zones. The 100-year DMT differs from the temperature measure previously used (i.e., the lowest one-day mean temperature [LODMT]) to identify areas having a significant freeze hazard.

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A. Revised Recommendation 2.1.4

B. Revised Table 1

October 2021. Interim revision. Revised operation and maintenance recommendations in Section 2.2 to align them with the July 2021 revision of Data Sheet 2-81, *Fire Protection System Inspection, Testing and Maintenance*.

September 2004. Minor editorial changes were done for this revision.

May 2000. This document was reformatted and editorial changes were made.

This document was first published in April, 1971.

In the May, 1998 version the following was added:

1. Table 1, which contains heating criteria,