



Bladder Tank Model VFT & FT
Installation, Operation And Maintenance Manual
(Foam Concentrate Inside The Bladder)

March 14, 2016

F_032216 16.1 | TM1.3.1.1/14032016/en



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

NOTICE

THIS DOCUMENT PROVIDES IMPORTANT SAFETY INSTRUCTIONS

The user is strongly recommended to read and to follow carefully the instructions contained in this manual to prevent damage to people and objects.

This document must be kept in a safe place together with all the technical documentation relevant to the materials purchased (certificates, test report, etc...)

All the information contained in this manual is relevant to the description and operation of the whole equipment. For more details regarding the sub-components, please make reference to the relevant manufacturer's documentation.

DISCLAIMER

Viking declines any responsibility due to non-observance of these instructions, improper use of the equipment or use outside its design limitation.

The compliance, partial or full, with the prescriptions and the information contained in this manual does not relieve anyone who is in charge to install, to operate or to maintain in full efficiency the bladder tank from the responsibility due to improper actions or inexperience.

Viking is not responsible for the damage and any other consequence caused by a lack of skill of the personnel involved with the with bladder tank's operation.

It is the sole purpose of this document to provide operating personnel with a basic understanding of the equipment and of its components. In order to maintain the bladder tank and its accessories at a high level of efficiency, all operators and maintenance crew are urged to carefully read this instruction manual and keep it readily available for future reference.

This manual does not provide instructions on the procedures for installation, operation and maintenance that are specifically in place at the installation site. In addition, this manual does not provide instructions on the procedures, installation, operation and maintenance of the fire protection system the bladder tank is part of.

The user must be informed on the local regulations and laws and get in contact with the local authorities to obtain all required permissions and approvals for operation within the installation plant.

In case any of the instructions provided in this manual are not completely understood by anybody involved in the installation, operation and maintenance of the bladder tank manufactured by Viking, this must be reported to Viking before making any further actions.



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
 Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
 VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

GENERAL INDEX

SECTION 1 – SAFETY PRECAUTIONS.....	5
1.1 Safety and warning notices.....	5
1.2 General notes for operator safety.....	5
1.3 Safety during maintenance.....	5
SECTION 2 – SCOPE OF THE MANUAL.....	6
2.1 Purpose of the manual.....	6
2.2 Precautions to extend the equipment lifetime.....	6
2.3 Environment.....	6
SECTION 3 – EQUIPMENT DESCRIPTION.....	7
3.1 Bladder tank description and principle of operation.....	7
3.2 Bladder tank design data.....	7
3.3 Bladder layout.....	9
3.4 The safety thermal relief valve.....	10
SECTION 4 – MATERIAL TRANSPORTATION, RECEPTION AND STORAGE.....	11
4.1 Checks on the bladder tank at the reception.....	11
4.2 Storage recommendation before installation.....	11
SECTION 5 – BEFORE THE INSTALLATION.....	12
5.1 Installation place requirements.....	12
SECTION 6 – INSTALLATION REQUIREMENTS.....	13
6.1 General prescriptions.....	13
6.2 System (primary) relief valve.....	14
6.3 Installation of the bladder tank.....	14
SECTION 7 – BLADDER TANK FIRST FILLING.....	15
7.1 Separation bladder.....	15
7.2 Before the first filling.....	16
7.3 Bladder tank first filling.....	17
7.4 Level indicator setup.....	23
SECTION 8 – BLADDER TANK COMMISSIONING AND START-UP.....	24
SECTION 9 – FOAM CONCENTRATE LEVEL MEASUREMENT.....	25
SECTION 10 – PERIODIC MAINTENANCE.....	27
10.1 Periodic maintenance frequency.....	27
10.2 General requirements.....	27
10.3 Maintenance Schedule.....	28
10.4 Bladder connections - bolts tightening torque adjustment.....	29
10.5 Check of bladder integrity.....	30
10.6 Bladder replacement.....	31
10.7 Extraordinary maintenance.....	35



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL


SECTION 1 – SAFETY PRECAUTIONS


1.1 Safety and Warning Notices

Throughout this publication, **DANGER**, **WARNING** and **CAUTION** signs may be used to alert the installer/user to special instructions concerning a particular service or operation that may be hazardous if performed incorrectly or carelessly. **OBSERVE THEM CAREFULLY.**


Safety notices are introduced by signal words which indicate the degree of danger.


These “Safety Notices” cannot eliminate by themselves the hazards that they signal. Strict compliance to these special instructions plus “common sense” operations are major accident prevention measures.

 **DANGER** Indicates an imminently hazardous situation. If not avoided, death or serious injury will result.

 **WARNING** Indicates a potentially hazardous situation. If not avoided, death or serious injury could result.

 **CAUTION** Indicates a potentially hazardous situation. If not avoided, slight or minor injuries could result.

 **NOTICE** Indicates a potentially harmful situation. If not avoided, the system or something in its surroundings may be damaged.

 **INFORMATION** This symbol emphasizes useful tips and recommendations as well as information for efficient and trouble-free operation.

1.2 General notes for operator safety

 **CAUTION**

The bladder tanks manufactured by Viking are designed to work under pressure and to handle fire fighting foam concentrates. Both these two conditions represent a potential risk for people and property.

For the appropriate operation when the tank is under pressure, please refer to the instructions that follow in this manual. For safe foam concentrate handling and first aid measures, please refer to the applicable parts of the concentrate’s MSDS.

1.3 Safety during maintenance

 **WARNING**

Maintenance staff **MUST** carry out a risk assessment prior to performing any activity on the bladder tank. Particular care must be paid to those actions where the lowering or removal of safety measures may be required (e.g. temporary removal of the thermal relief valve, etc...).

The personnel in charge of the maintenance must be equipped with all the individual protection equipment to act safely and in accordance with all the applicable laws and rules. In particular:

1. Safety clothes must be worn
2. The work tools must be according to the law and in good condition



The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

SECTION 2 – SCOPE OF THE MANUAL

2.1 Purpose of the manual

The scope of this manual is to provide adequate information and instruction to bladder tank users, maintenance staff and any other qualified personnel who is involved with and authorized to operate and maintain the unit. Attention is focused on the potential for the risk of damage, injury or death that may occur due to the lack of compliance with the instructions given in this document. This manual details filling and the initial start-up operation of the bladder tank plus recommended periodic maintenance activities

2.2 Precautions to extend the equipment lifetime

NOTICE

All installation, commissioning, operation and maintenance activities must be carried out by personnel who are qualified and authorized by the system's owner or manager. The personnel responsible for these activities must proceed only after reading and fully understanding this manual.

As the bladder tanks manufactured by Viking have been designed, tested and approved by third party organizations including the durability and performance of the original accessories installed - only original spare parts and consumables must be used when replacements are required. The use of non-original spare parts may result in an unsafe or poor performance of the bladder tank and decrease its overall lifetime usage. Use of non-original spare parts automatically expires the warranty clause of the supplied equipment. This prescription applies, in particular, to the separation bladder between water and foam concentrate and to the foam concentrate itself

2.3 Environment

NOTICE

The bladder tank user is responsible for the appropriate disposal of all parts that have to be replaced, during the routine and special maintenance, according to local applicable laws and rules. In particular the foam concentrate contained in the tank and the replacement seals and separation bladder.

Care must be taken when flow and mixing tests are carried out at the installation site, in such a way not to threaten the environment. Please always refer to the foam concentrate's MSDS indications concerning the environmental considerations prior to the handling of foam concentrate and water-foam solution



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

SECTION 3 – EQUIPMENT DESCRIPTION

3.1 Bladder tank description and principle of operation

The Viking bladder tank stores foam concentrate inside the bladder. When used in conjunction with the Viking Ratio Controller it proportions the foam concentrate accurately into the water stream. The outer shell of the bladder tank is pressurized by the system water supply then during extinguishing system operation; foam concentrate is squeezed out to the ratio controller. Simultaneously, as water flows through the venturi area of the ratio controller, a metered pressure drop also draws foam concentrate into the system water creating a foam solution mixed to the appropriate ratios. This solution then flows through the system pipework and out of the open sprinklers, nozzles or other discharge devices.

The pressure tank is manufactured either according to **ASME Sec. VIII Div. 1** or **EN13445** design codes. Please check the equipment nameplate for the code relevant to your bladder tank.

3.2 Bladder tank design data

As a pressure vessel, the bladder tank supplied by Viking can be manufactured according to different design codes - see previous section - as indicated in the identification nameplate placed on the tank's shell.

Depending on the requirements of the project, the tank design can additionally be validated as compliant with the European Pressure Equipment Directive 97/23/EC. This requirement shall be specified at the Ordering stage. When the Viking bladder tank is manufactured according to the standard EN-13445 "Unfired pressure vessels", this is also compliant to the Directive 97/23/EC. The following design data applies to standard bladder tanks of volume ranging from 1,000 to 20,000 liters:

Internal volume	See nameplate (from 1,000 litres to 20,000 litres)	
Design pressure Ps	12.1 barg (175 psig) or 16 barg (232 psig)	
Minimum/maximum metal design temperature Ts	-10 °C, +50 °C	
Hydraulic test pressure	ASME VIII Div.1: ASME VIII Div.1 + PED: EN 13445:	1.3 x Ps 1.43 x Ps 1.43 x Ps (c*)=0,85) or 2.20 x Ps (c*)=0,70)
Corrosion thickness	0,0 mm	
Fluid / physical state	Water-foam concentrate / Liquids	
Fluid group (Art. 9 of 97/23/EC, if applicable)	Gr. 2	
Category (Annex II of 97/23/EC, if applicable)	I	
Evaluation form (Annex III of 97/23/EC, if applicable)	A	

(*) C is defined as *Welding Joint Efficiency coefficient as reflected by the design calculation*

When validated as compliant to Directive 97/23/EC, all the above bladder tanks are CE marked.



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
 Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

For standard bladder tanks with volume from 25 to 775 liters, the following data table applies:

Table 3.2.2: Design data	
Internal volume	See nameplate (from 25 litres to 775 litres)
Design pressure Ps	12.1 barg (175 psig) or 16 barg (232 psig)
Minimum/maximum metal design temperature Ts	-10 °C, +50 °C
Hydraulic test pressure	ASME VIII Div.1: 1.3 x Ps ASME VIII Div.1 + PED: 1.43 x Ps EN 13445: 1.43 x Ps (c [*] =0,85) or 2.20 x Ps (c [*] =0,70)
Corrosion thickness	0,0 mm
Fluid / physical state	Water-foam concentrate / Liquids
Fluid group (Art. 9 of 97/23/EC, if applicable)	Gr. 2
Category (Annex II of 97/23/EC, if applicable)	N/A (Art. 3, Par. 3)
Evaluation form (Annex III of 97/23/EC, if applicable)	N/A (Art. 3, Par. 3)

(*) C is defined as *Welding Joint Efficiency coefficient as reflected by the design calculation*

All tanks verified in compliance with Directive 97/23/EC are CE marked with the following exceptions (Art. 3, Para. 3 of the aforementioned Directive):

- Tanks rated 12.1 bar with volumes equal or lower than 800 liters
- Tanks rated 16.0 bar with volumes equal or lower than 600 liters

The bladder tanks manufactured by Viking are designed taking into account the following:

1. maximum expected pressure at the design condition and at the hydraulic test condition
2. maximum temperature at the design condition and at the hydraulic test condition
3. static pressure of the fluid (due to the bladder tank height)
4. stress due to handling (lifting lugs verification)
5. stress on the supporting legs

The design of the bladder tank supplied by Viking does not normally take in consideration, if not otherwise requested on the Purchaser Order:

6. unstable fluid decomposition (not expected with water and foam concentrate)
7. external fire
8. corrosion allowance
9. stress due to the wind (the bladder tank shall be placed in a protected area unless it is calculated according to the actual wind site conditions)
10. seismic stresses (the bladder tank shall be placed in a non-seismic area unless it is calculated according to the actual site conditions)
11. stresses due to loads on the bladder tank's nozzles (there are to be avoided, see below)



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

3.3 Bladder tank layout

The layout and the position of the accessories of the bladder tank are shown in **figure 3.3.1**.

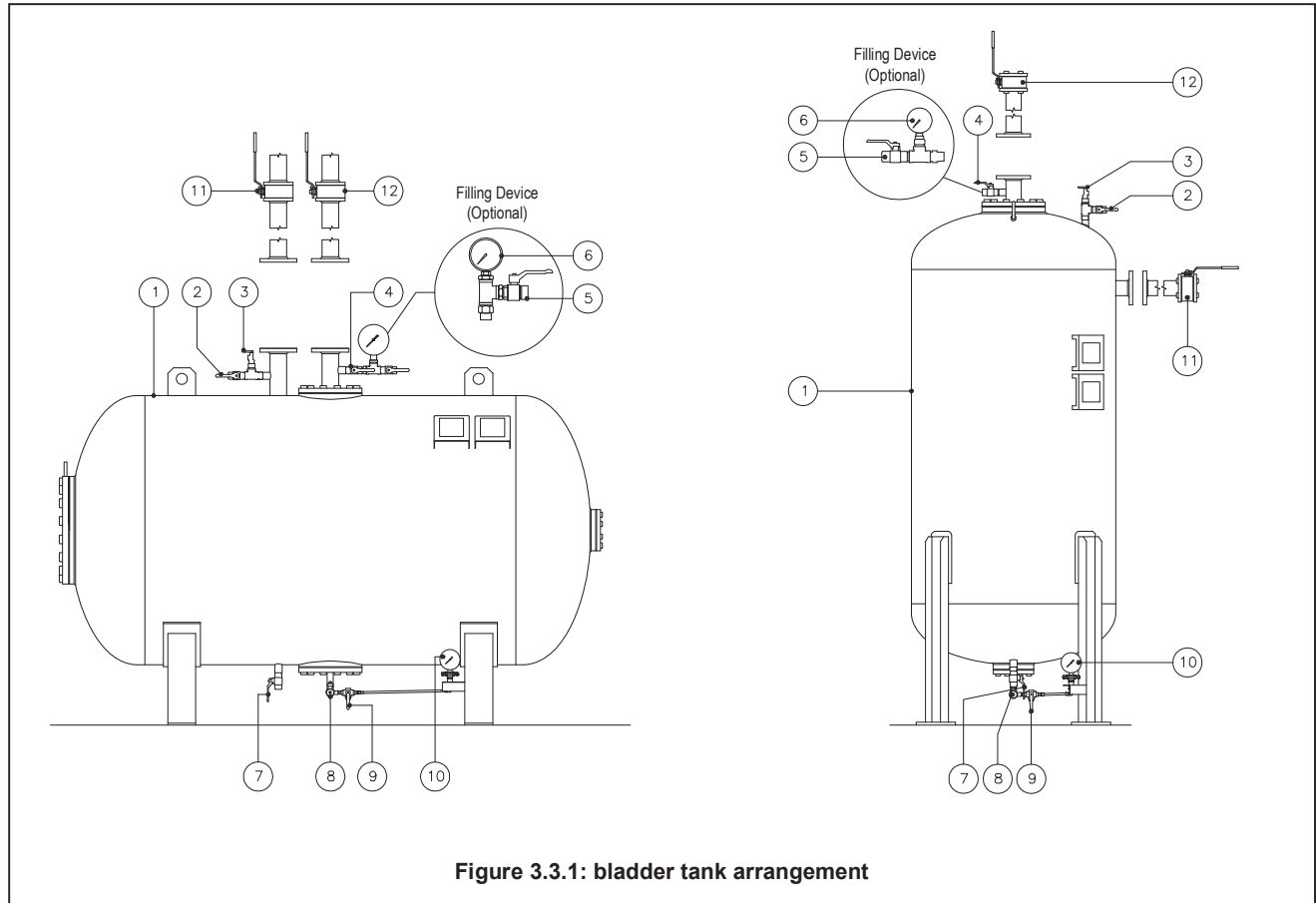


Figure 3.3.1: bladder tank arrangement

Table 3.3.2: Normal Operating Valve Positions

Item	Description	Normal Valve Operating Position	
		Automatic System	Manual System
1	Bladder Tank	N/A	N/A
2	Water Vent Valve	Normally Closed	Normally Closed
3	Safety Thermal Relief Valve	Automatic – Tamper Proof	Automatic – Tamper Proof
4	Foam Concentrate Vent Valve	Normally Closed	Normally Closed
5	Filling Vent Valve (Optional)	Maintenance Only	Maintenance Only
6	Filling Pressure Gauge 1-10 kpa (Optional)	Maintenance Only	Maintenance Only
7	Water Filling/Drain Valve	Normally Closed	Normally Closed
8	Foam Concentrate Filling/Drain Valve	Normally Closed	Normally Closed
9	Concentrate Level Indicator Drain Valve	Normally Closed	Normally Closed
10	Concentrate Level Indicator	Normally Closed	Normally Closed
11	Water Shut Off Valve	Normally Open	Normally Closed
12	Foam Concentrate Shut Off Valve	Normally Open	Normally Closed



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

3.4 The safety thermal relief valve

The standard design pressure - and maximum working pressure - of Viking bladder tanks is 175 psig (12.1 barg) unless otherwise stated. Please always refer to the bladder tank nameplate placed on the shell to determine the design pressure. It is the responsibility of the end user to provide a **primary pressure regulating / relief valve**, of suitable set-point and capacity, resulting from a specific calculation, to protect the tank from rapid over-pressurization. Details of the entire fire protection systems design must be known, such as water pressure and flow capacity, to size this primary pressure regulating/relief valve.

Thermal expansion of foam concentrate and water inside the tank can also generate a pressure exceeding the rated capacity. This slow but steady pressure increase could result in problems ranging from leaks at threaded or flanged connections to a serious physical damage of the bladder or pressure tank. For this reason a safety valve, called the thermal relief valve, is installed on all Viking bladder tanks (see **item no. 3** in **figure 3.3.1.**). **This valve is not intended to protect the tank from an overpressure generated by the fire fighting network system**, as the latter depends on the pump(s) flowrate, total pump(s) head and on the static (geodetic) pressure arising from the bladder tank elevation. This data is normally unknown to Viking and therefore outside Viking's scope of work.

The thermal relief valve's only function is to prevent an over-pressurization which the isolated and self-standing bladder tank may experience due to the volume change of its content. The thermal relief valve is provided with a locking seal that prevents pressure-setting modification after the equipment has been despatched from the Viking factory. For any technical detail on the thermal relief valves, please refer to the data sheet and certificates supplied by Viking.

To prevent or minimise the effect of thermal expansion, which may result in water discharge from the thermal relief valve, it is recommended to:

1. Avoid filling the tank with cold concentrate. If possible, allow the concentrate to warm-up to room temperature and, in any case, do **not fill the bladder tank above its nominal volume if temperature increases are envisaged** (the bladder tank has an effective volume higher than the nominal. This allowance permits the foam concentrate expansion to be relieved by the thermal relief valve placed on the water side).
2. Install a sun canopy to protect tanks installed outdoors.
3. Avoid tank exposure to high temperatures.

To prevent unwanted water discharge on the surface of the bladder tank, which may result, after a period, in a painting damage, the thermal relief valve should be preferably piped to a drain. If piped, make sure that the piping does not limit the discharge capacity of the thermal relief valve and consider the use of a drain cup or sight glass to give a visual indication of any thermal relief valve activation



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

SECTION 4 – MATERIAL TRANSPORTATION, RECEPTION AND STORAGE

4.1 Checks on the bladder tank at the reception



Bladder tanks manufactured by Viking are supplied on non stackable pallets suitable for inland (truck) transportation, if not otherwise requested on the purchase order. This type of packaging is suitable to avoid damage to the equipment if handled correctly during transit. Other types of packing can be provided on request (e.g. sea freight or for other expected severe handling conditions).

When received at the destination the bladder tank must be checked for signs of damage that may have occurred during transportation and unloading operations. Damage to the pressure portion of the bladder tank, the tank's shell, proportioning device and interconnecting piping (if fitted) - may result in liquid leaks, liquid spray jets or even structural failures. **Such damage has to be reported to Viking immediately for risk assessment.**

Any other damage that, based on the judgment of the installer/end user, is supposed to potentially result in a failure or that may affect the performance of the bladder tank **must be promptly highlighted to Viking and rectified before the start-up according to the manufacturer's indications.**

Viking is not responsible for damage due to equipment mishandling during the transportation, unloading and positioning stages (Viking is responsible only when in charge for the transportation). Bladder tanks must be handled by skilled and authorized personnel only who are competent in the planning and execution of such operations using appropriate lifting machinery. All applicable Viking equipment is supplied with eyebolts which shall be used for lifting operations.

4.2 Storage recommendations before installation



The bladder tanks produced by Viking shall preferably be stored in a sheltered or indoor area before installation. The storage temperature should not be outside the range of +5 °C; +30 °C for a prolonged period of time. This prescription is aimed to preserve the bladder from an excessive thermal stress before the tank is filled with water and foam concentrate.

In case the storage temperature is **above + 30 °C**, either permanently or for a prolonged period of time (this may happen when the bladder tank is stored outdoor under direct sun exposure or because of the ambient air temperature itself); the tank must be filled with a suitable quantity of water to thermally insulate the bladder. This amount equals to 20% of the tank capacity inside the bladder and 80% of the tank capacity outside of the bladder. This operation must be done to avoid overheating of the bladder at the regions where contact with the tank's metallic shell occurs as the circumstance may lead to bladder damage. In no scenario should the temperature of the bladder be permanently above 30 °C.

To avoid bladder ruptures whilst filling the tank with water, **always ensure that the net unbalanced pressure of the bladder does not exceed 1 kPa** (refer to **section 7.** for details). In case the storage temperature is **below +5 °C but higher than -30 °C**, either permanently or for a prolonged period of time, the user has to ensure that the atmosphere in contact with the bladder is dry to avoid icing - that may result in bladder damage.

For storage temperature below -30 °C, please contact Viking



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
 Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
 VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

SECTION 5 – BEFORE INSTALLATION

5.1 Installation place requirements



The bladder tank shall not be installed in areas:

1. Too close to other equipments/objects that may prevent a safe access for equipment's operation and periodic inspections.
2. Where it is subject to heat sources that may affect its safety, performance or durability.
3. Close to flammable materials or chemicals that can generate a fire concern to the tank.
4. Not protected against collision or tampering.
5. Where vibrations can generate loads on the legs/saddles, tank's nozzles and interconnecting piping (in case of vibration, suitable damping method shall be put in place).
6. Where a potentially explosive area is present, unless supplied in the ATEX version.
7. Where wind loads exceed the calculated limits.
8. Where seismic loads exceed the calculated limits.
9. Where the corrosion due to the atmosphere is more severe than that the painting cycle is designated to withstand (e.g. where aggressive acids like H₂S are present);
10. Where the temperature is outside the range (-10 °C; +50 °C) referring to the metal shell and (+5°C-+30 °C) referring to the water/foam concentrate;

In case of temperature below +5 °C:

- a. the foam concentrate must be of a suitable freezing point rating.
- b. the compensation water between the bladder and the tank shell must be mixed with acceptable anti-freeze compounds at a suitable mixing ratio whilst ensuring the tank contains the anti-freeze solution permanently. Please contact Viking for details on the anti-freeze compounds compatible with the bladder material and to be instructed on the appropriate mixing ratio.



Most of the anti-freeze solution are flammable and can cause irritation by contact on eye and skin. Please always refer to the relevant MSDS



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

SECTION 6 – INSTALLATION REQUIREMENTS

6.1 General Guidance



The installer and the user of the equipment supplied by Viking have the responsibility to ensure that the following points are fulfilled:

1. The installation must be carried out by qualified and authorized personnel according to the applicable local regulations and laws. Refer to appropriate Installation Standards (i.e. NFPA, VdS, LPCB, etc.) and / or FM Global Property Loss Prevention Data Sheet 4-12, Foam-Water Sprinkler Systems.
2. Any safety measure to prevent accidents must be taken according to the applicable legislation.
3. The bladder tank and accessories have to be connected to the piping system in such a way that the connections are not subject to stresses beyond the design limit.
4. The supplied equipment installed in systems where the maximum working pressure does not exceed the bladder tank's design pressure (ratio controller and accessories included).
5. The bladder tank must be connected to the system with approved methods (threads, flanges, grooved fittings, etc...) whose pressure rating is not lower than the system's one;
6. The installation works must be accomplished avoiding damage to the equipment supplied by Viking. In case damage occurs, a thorough investigation must be made in order to assess the potential consequences for the safety and the fire protection operation. Viking must be contacted.
7. Do not remove, alter, exchange or tamper with the original thermal relief valve supplied by Viking.
8. Stop valves, or any other device limiting the flowrate capacity, shall not be placed between the tank and the pressure relief devices (unless calculated in the system design).
9. Drains and vents must be positioned in such a way not to create threats or hazard to personnel. If the safety thermal relief valve drain is piped, care must be taken to prevent that the capacity is not reduced.
10. All foam concentrate and foam solution pipe shall be designed and installed in accordance with the piping section of NFPA 11 and/or FM Global Property Loss Prevention Data Sheet 4-12, Foam-Water Sprinkler Systems.
11. Once the installation is completed, a final inspection must be carried out to ensure that the installation drawings have been properly fulfilled and that the quality of work is satisfactory. Non-conformities must be recorded and rectified prior to commencing with the commissioning and start-up stages.



The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
 Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

6.2 System (primary) relief valve



The installer/owner has to ensure that the maximum working pressure of the system the bladder tank is connected to - as determined at the equipment's installation position - does not exceed the design pressure of the bladder tank. In case the maximum working pressure exceeds, under any condition (including failure) the Viking bladder tank's nameplate design value, a **primary safety valve** or equivalent device to control the overpressure **must be installed by the installer/owner/end user**. This valve or device must be sized so that its capacity is larger than the maximum fluid overflow responsible for the overpressure of the bladder tank. **The bladder tank safety valve shall not be considered in this calculation.**

The pressure setting of the primary relief valve or equivalent pressure control device must be not higher than the design pressure of the bladder tank. The valve(s) shall be of such design and construction so that the *temporary* peak overpressure at the bladder tank is limited to a maximum 10% under any condition including system failure.

The installation position of the primary relief valve or equivalent pressure control device shall be determined based on the applicable technical standards and good engineering practice. This should be upstream of the complete bladder tank arrangement and not on the tank water connection pipework only. The operation of these devices shall not cause hazards to people and property. If the drain port is piped, care must be taken that the safety device capacity is not lowered. Pressure indicators in addition to those provided by Viking (that are factory installed on the bladder tank), must be placed throughout the system to adequately monitor the pressure value.

The selection and installation of the primary relief valve or of an equivalent pressure control device is normally part of the final approval of the system and coded by the applicable legislation on this matter (e.g. for European installation, the Directive 97/23/EC "Pressure Equipment Directive").

6.3 Installation of the bladder tank



The following precautions must be observed:

1. During the system installation it is **essential to keep valves 11 & 12 closed (figure 3.3.1)**.
2. This will avoid that debris or test water/air can enter the tank before the pipework is flushed and tank filling / commissioning procedures are due to commence.
3. Bladder tank positioning to the designated installation place must be made using the tank's lifting lugs.
4. The installer/end user must securely fix the tank to the ground with appropriate anchor bolts/rods designed to withstand the loads determined by site conditions (wind, seismic, etc...).
5. The discharge port of the thermal relief valve (3), water drain valve (7), level indicator drain (9) and foam filling/drain connection (8) could be piped to a suitable place as defined by the end user/installer.
6. In order to preserve the bladder tank over a long operation period and to avoid migration of the water-foam solution back to the fire water network, a stop valve, a Y-strainer and a check valve (in this order from the pump side to the bladder tank side) are recommended to be installed upstream the proportioning device (if present).



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

SECTION 7 – BLADDER TANK FIRST FILLING



The bladder tank foam filling is a simple operation to perform if the instructions contained in this manual are carefully followed. The filling process is a fundamental task determining the proper bladder tank performance when required to operate. Incorrect filling may compromise the bladder's lifetime or cause an immediate rupture. It is **highly recommended** that the installer/user contacts Viking in case of doubts on the instructions shown in this manual. Viking is not responsible for any damage to the bladder if the filling operation is not made by Viking.

7.1 Separation bladder

- Viking certifies and guarantees, with release of a test certificate, that all the separation bladders have been subjected to a pneumatic pressure test for integrity assessment.
- Viking guarantees the bladder integrity for one year starting from the delivery date;
- Viking guarantees the bladder against tearing or bursting only and exclusively if the filling operation is performed by Viking's employees or by Viking authorized personnel. The operator performing the filling will validate this activity and activate the warranty covering the bladder by sending back to Viking the certificate of warranty duly undersigned.
- To avoid bladder damages the installation of a strainer upstream of the tank is recommended;
- **To avoid damaging the bladder, DO NOT perform welding on the tank body.**



TECHNICAL MANUAL

**BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL**
(foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

7.2 Before the first filling

Before the filling operations can take place the installer/end user has to make sure that:

1. The installation of the bladder tank and the assembling to the owner's system have been accomplished according to the design documents, applicable standards and good engineering practice.
2. All the threads, flanges and grooved fittings are tightened to the recommended values.
3. The safety devices have been properly selected and installed to preserve the bladder tank from overpressure.
4. The Concentrate Control Valve (if present) and relevant trim is properly connected. Please make reference to the CCV manual for the connection of the trim to the system.
5. All the connecting piping has been thoroughly flushed to avoid debris getting into the bladder tank, proportioning device and CCV trim (if present).
6. Instrumentation, such as the pressure gauges and the level indicator (10), are not damaged.
7. The safety valve seal is unimpaired.
8. The bladder tank is securely fixed to the ground.
9. The bolts at the top and bottom flanges holding the bladder are tightened at the design torque value (see Paragraph 10.4)

NOTICE

The bladder tank filling relies on a procedure which requires the use of some **SPECIAL TOOLS**. The following devices **MUST BE** procured by the installer/user before the filling operation:

- a) the filling device (**figure 3.3.1**, supplied as an optional by Viking) or an equivalent assembly with a 0-6 kPa range pressure gauge;
- b) Qty 1 x 25mm non-collapsible pick-up hose to fit the filling pump. Length to cover the distance from the foam concentrate containers. (The hose is supplied optionally by Viking with the manual filling pump).
- c) Qty 1 x 25mm BSP male thread connection non-collapsible delivery hose to fit the filling pump Length to cover the distance to the bladder tank fill valve. (The hose is supplied optional by Viking with the manual filling pump).
- d) Qty 1 water/concentrate filling pump (manual or electrical type). In case of an electrical pump the maximum recommended flowrate, to avoid excessive stress to the bladder, is 100 l/min. These pumps are supplied by Viking as an option.
- e) Air compressor if a compressed air service is not available. In both cases the maximum recommended air flowrate is 100 l/min and a suitable regulating device must be installed to prevent overpressure



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT INSTALLATION, OPERATION AND MAINTENANCE MANUAL (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

7.3 Bladder tank first filling

The status of the Viking bladder tank's relevant valves before the first filling, making reference to **figure 3.3.1**, must be as described table 7.3.1. Valve 5 and Gauge 6 are part of the temporary filling device previously described.

Table 7.3.1: valves condition before the bladder tank filling

Item	Valve Name	Status
2	Water vent valve	Open
7	Water filling/drain valve	Open
8	Concentrate filling/drain valve	Closed
9	Concentrate level indicator drain valve	Liquid Indicator Isolated from Tank (fig. 7.3.3)
11	Water cut-off valve	Closed
12	Concentrate cut-off valve	Closed
-	Concentrate Control Valve (CCV, if any)	Open (priming trim depressurized)

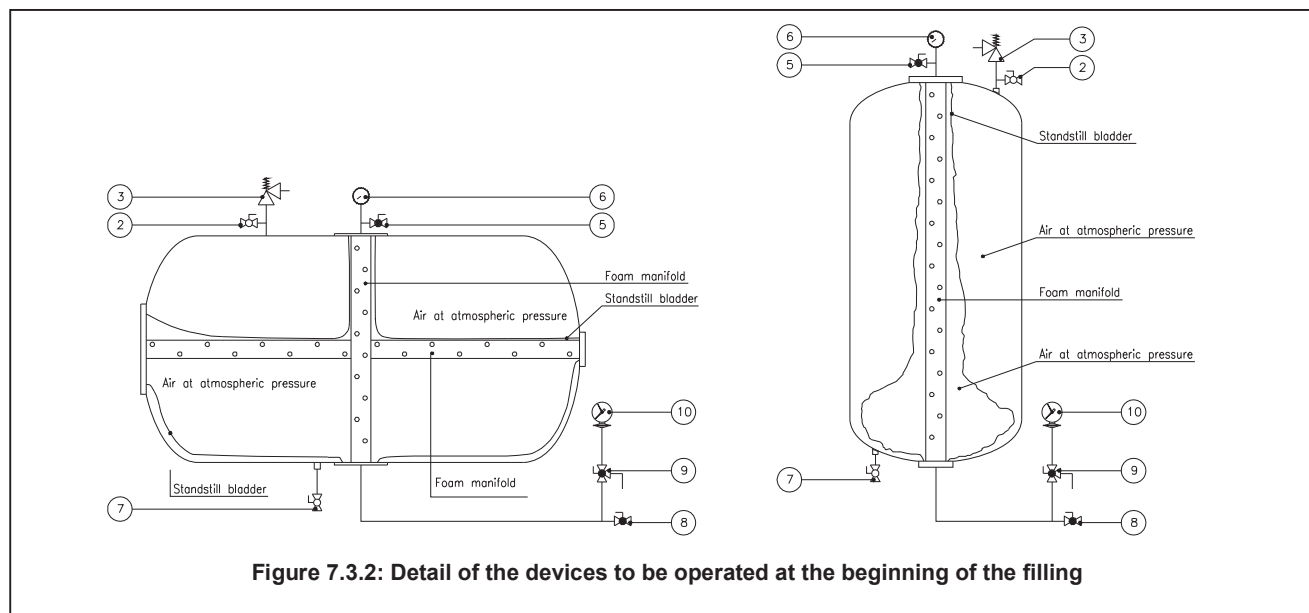


Figure 7.3.2: Detail of the devices to be operated at the beginning of the filling

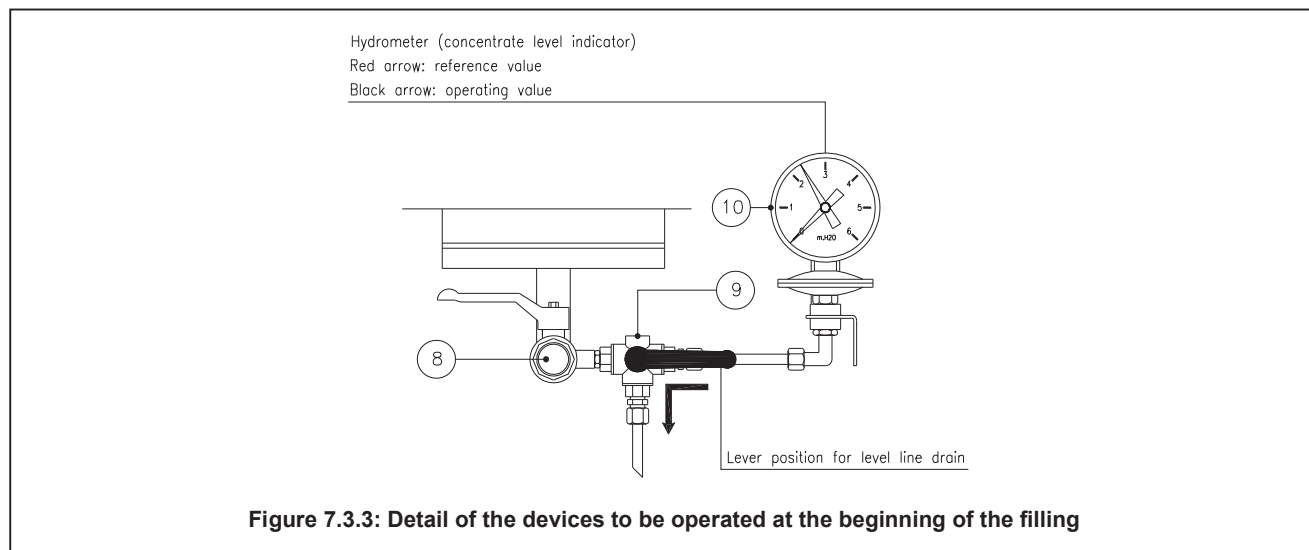


Figure 7.3.3: Detail of the devices to be operated at the beginning of the filling

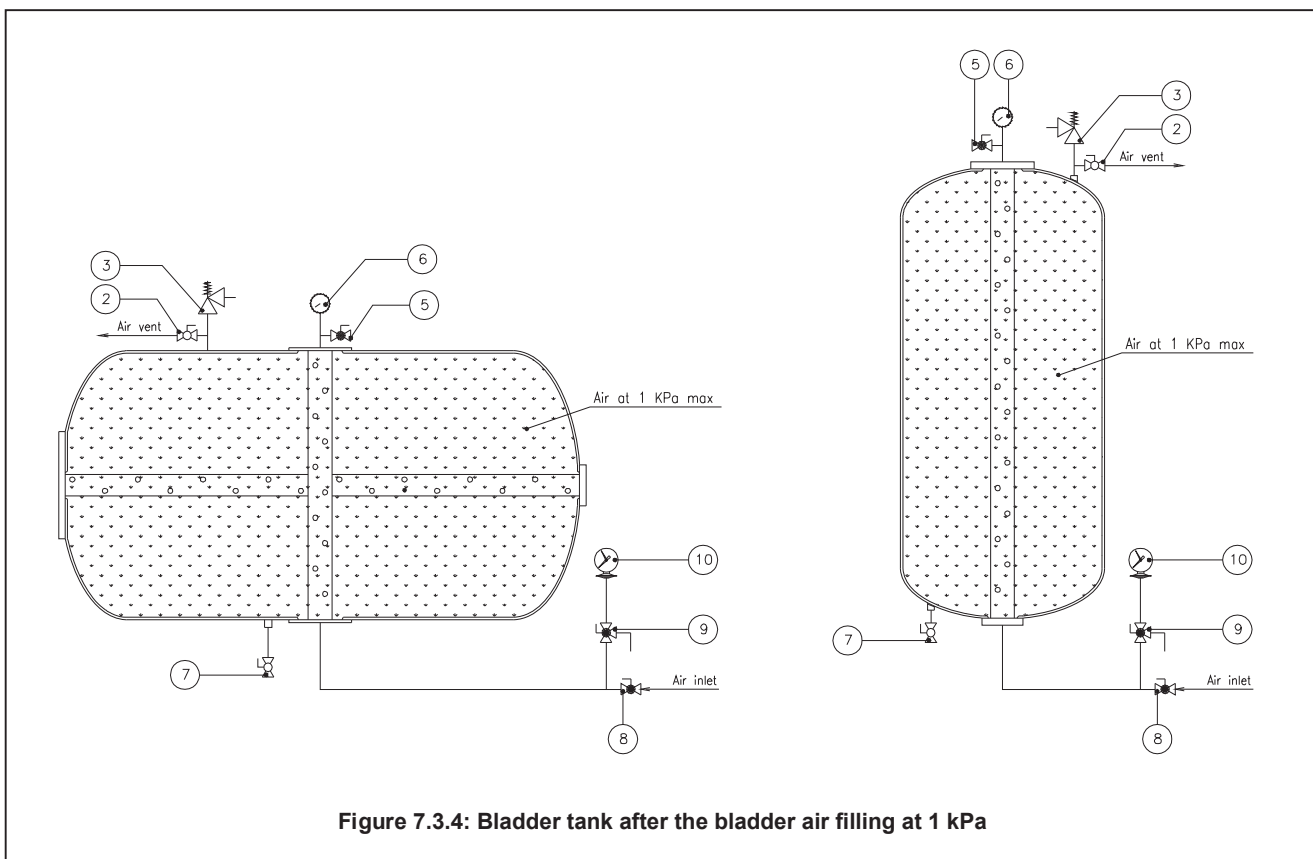
The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

With reference to Figure 3.3.1, the bladder tank filling is made following the steps below:

1. Make sure that the three way valve (9) is set to put in communication the liquid indicator and the drain, so as to isolate the instrument from the bladder tank (see **figure 7.3.3**). (Pressure in excess of 0.6 bar applied to the level indicator may damage it).
2. Keep valves (11) and (12) closed and open the valves (2) and (7). Some water drainage from valve (7) is normal as all Viking bladder tanks are hydrotested during the manufacturing process. The bladder tank's condition at this stage is represented in **figure 7.3.2**.
3. Remove the foam vent valve (4) and assemble the filling device in place of it (**figure 3.3.1**).
4. The air vent valve on the filling device (5) must be closed;
5. Connect a compressed air source having the features described in 7.2(e) to the foam fill/drain valve (8) (The Viking bladder tank standard connection is 25mm BSP female thread).
6. Close the water drain valve (7) and open the foam filling/drain valve (8).
7. Start the air compressor or open the installation's air network valve to inflate the bladder taking care to operate these devices and/or the foam filling/drain valve (8) to achieve a maximum air pressure of 1 kPa as shown by the filling device pressure gauge (6).
8. Once the bladder is pressurized at **1 kPa** pressure, close the concentrate filling/drain valve (8) to stop the air flow. Turn off the air compressor or disconnect the air network. The bladder tank condition after this operation is described in **figure 7.3.4**;



The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

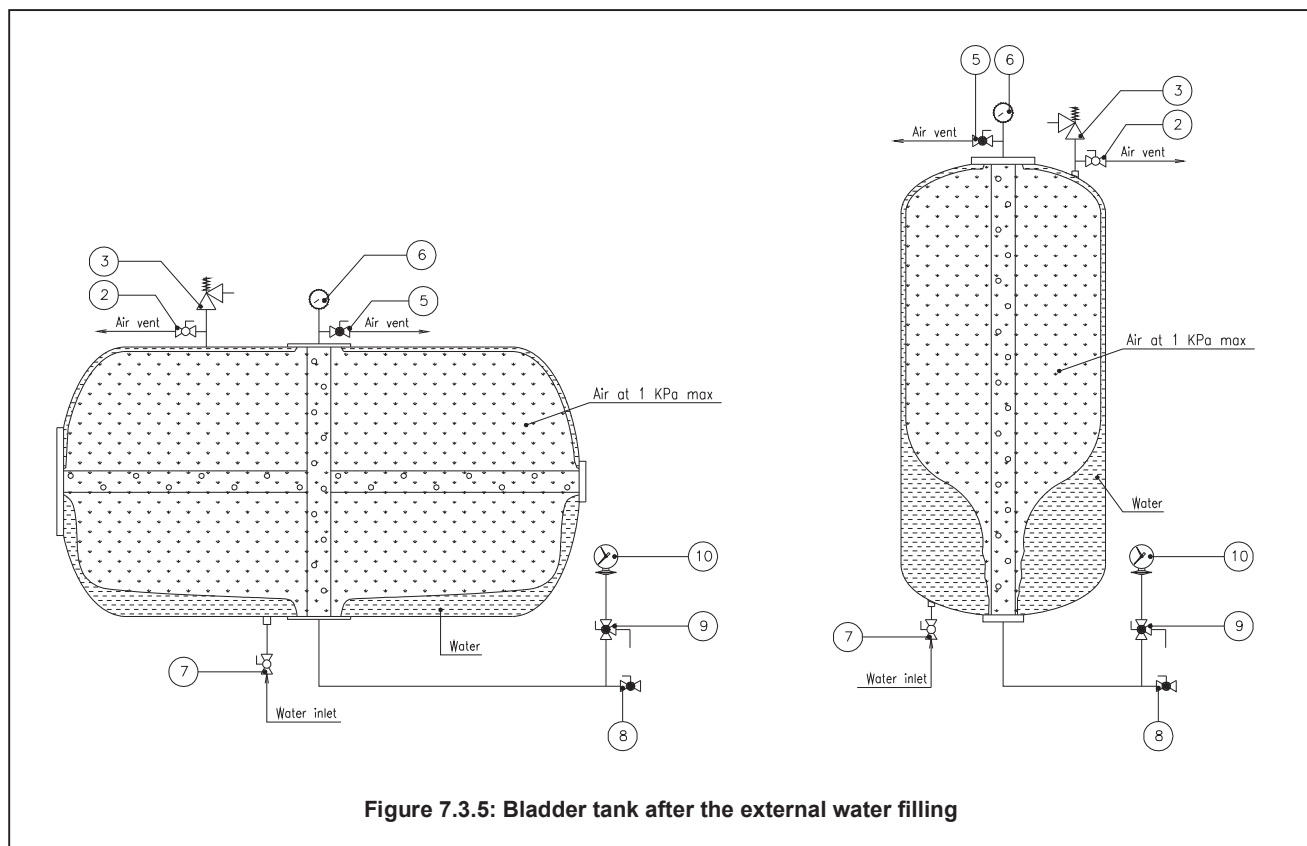
VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

9. Water shall be added outside the bladder in order to prepare it for foam filling. To do that, connect a water hose (for example from a hydrant or hose connection) to the water drain valve (7).

The water drain valve standard connection is 25mm BSP female thread. Pressurize the hose line and open **partially and slowly** the water drain valve (7), whilst operating the air vent valve (5) in such a way that the incoming water volume equals exactly the vented air and the bladder air pressure remains, **steadily, at 1 kPa**.

Stop the water filling by closing the valve (7) when approximately **10%** of the bladder tank nominal capacity has been filled with water. Close the valve (5) if it has been previously opened.

The condition of the bladder tank after this operation is described in **figure 7.3.5**;



10. Disconnect the water hose from valve (7) and connect the delivery hose of the foam filling pump, having the features described in 7.1(d), to the foam filling/drain valve (8);
11. Place the foam filling pump suction tube inside the foam concentrate container.



TECHNICAL MANUAL

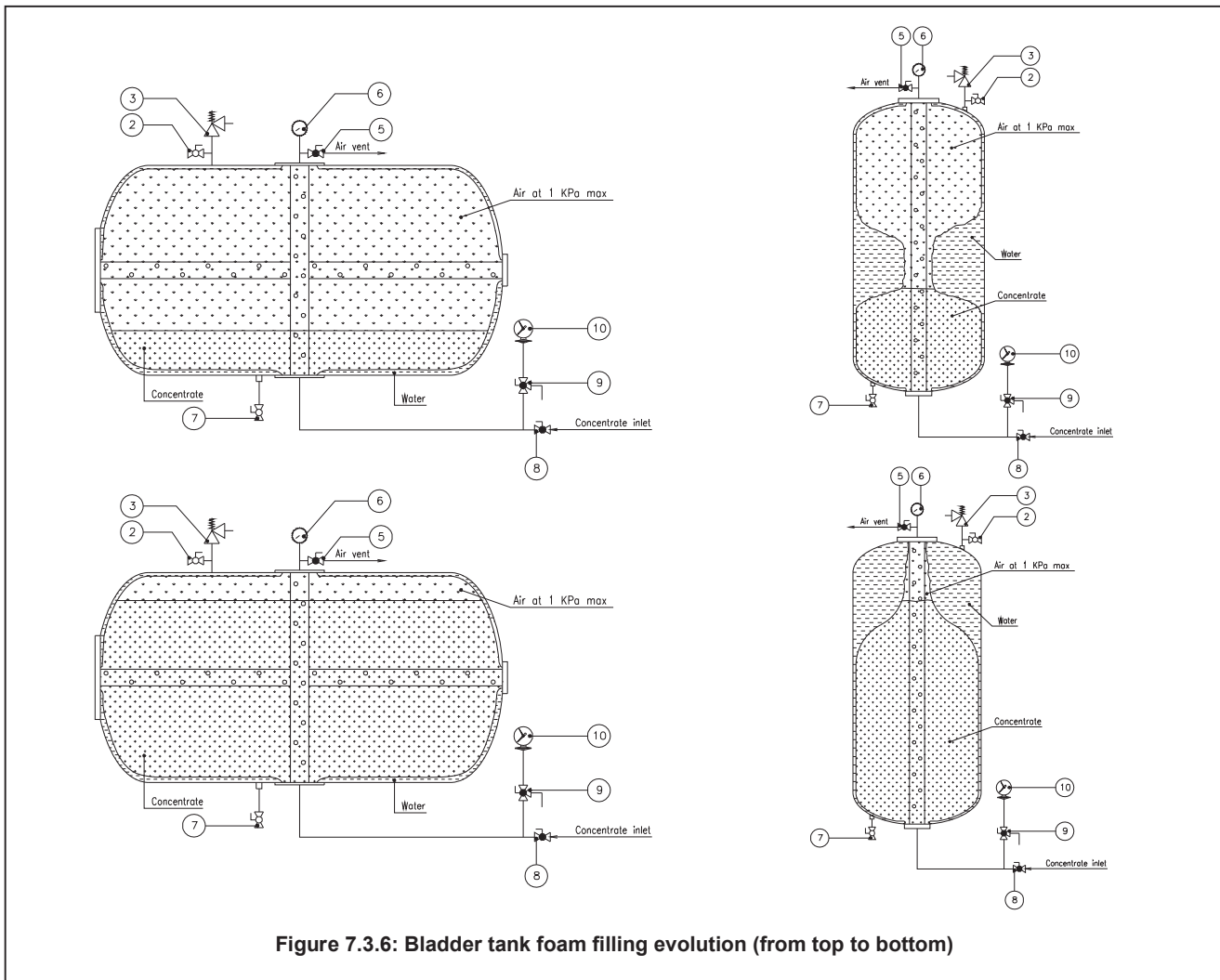
BLADDER TANK MODEL VFT & FT INSTALLATION, OPERATION AND MAINTENANCE MANUAL (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

12. Open the foam filling/drain valve (8) and activate the foam pump to fill the bladder. During this operation open partially the vent valve (5) to equalize the incoming foam volume with the vented air from the bladder, in such a way to **maintain constantly a maximum pressure of 1 kPa** as indicated by the pressure gauge (6). The bladder tank condition evolves as indicated in **figure 7.3.6**



13. Keep pumping the foam into the bladder tank, always making sure that the **maximum pressure of 1 kPa is not exceeded**. In case the bladder tank is to be filled to its *total nominal capacity* or *less than its total nominal capacity (partial filling)*, pumping of foam must continue until the available foam reservoir is emptied.

Viking bladder tanks have a real capacity higher than the nominal to allow for foam concentrate thermal expansion under the worst expected temperature conditions within the design limits. As a consequence, water is normally vented through valve (2) in case of filling to nominal capacity or less while the foam amount is not enough to be made it discharged through (5). A water cushion remains outside the bladder. At this stage the pump can be stopped and the valves (5) and (8) can be closed



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

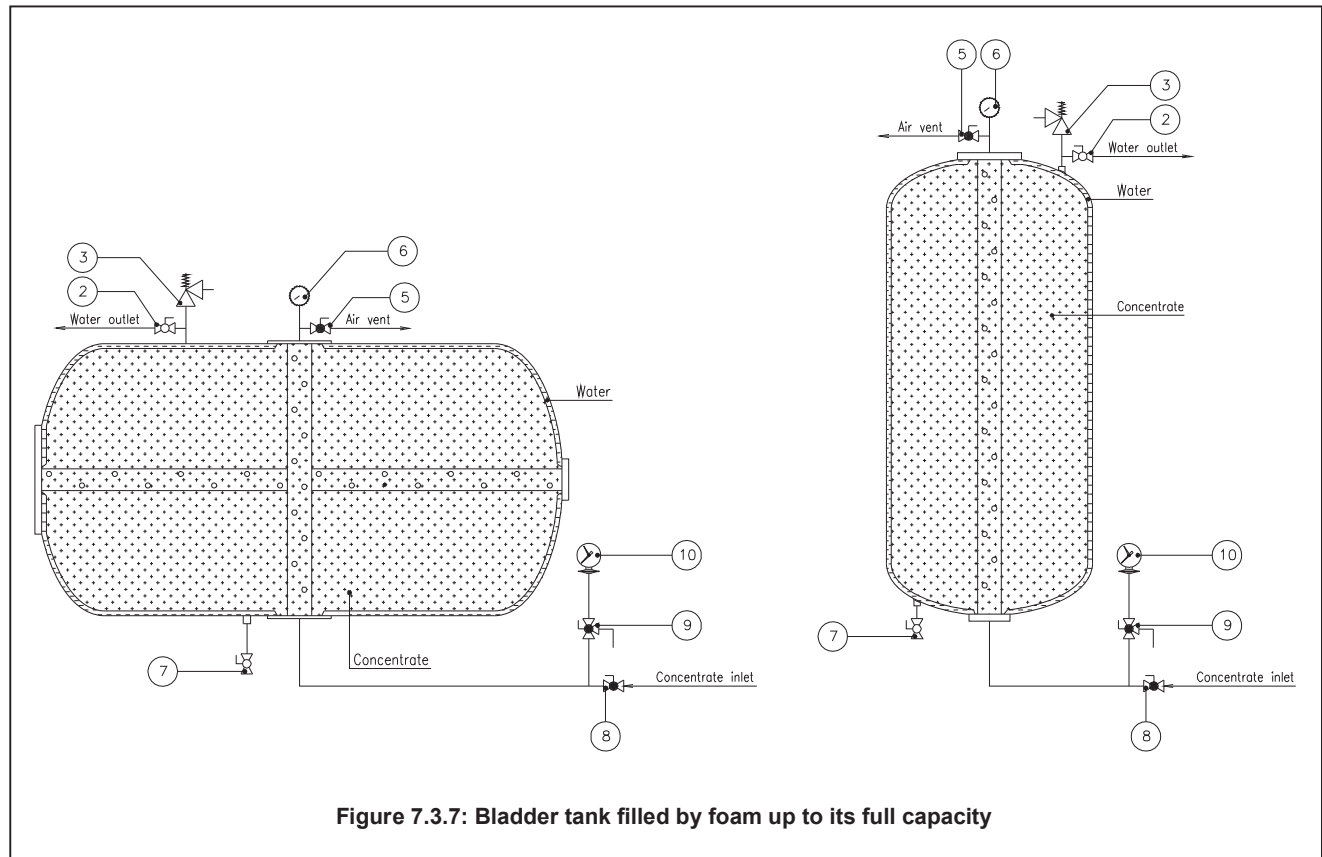
13a. (Alternative): foam filling up to the total capacity



Even if not normally recommended, and limited to situation where the bladder tank is subject to constant temperature, there may be some situations where filling the bladder *up to the total capacity* is necessary.

In this case the installer/end user must make sure that the temperature of the foam concentrate from the atmospheric container is not lower than the (constant) room temperature. If it does not happens the tank may be subject to overpressure due to concentrate expansion that cannot be compensated by the thermal relief valve on the water side.

If such a circumstance is envisaged, the installer/end user must require at the order the installation of an **additional safety valve on the foam side**. In this case foam pumping must continue until water is vented through valve (2) and foam is discharged through valve (5). In this circumstance the process skips **step 13**. and jumps directly to **step 14**. The situation is described in **figure 7.3.7**;





TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

14. Once partial filling or filling to nominal capacity is complete, a water supply hose should be connected to the water fill/drain valve (7). Water must then be transferred into the tank, by slowly opening valve (7) and venting air through valves (2) and (5) **always ensuring the pressure is less than 1 kPa** at pressure gauge (6).

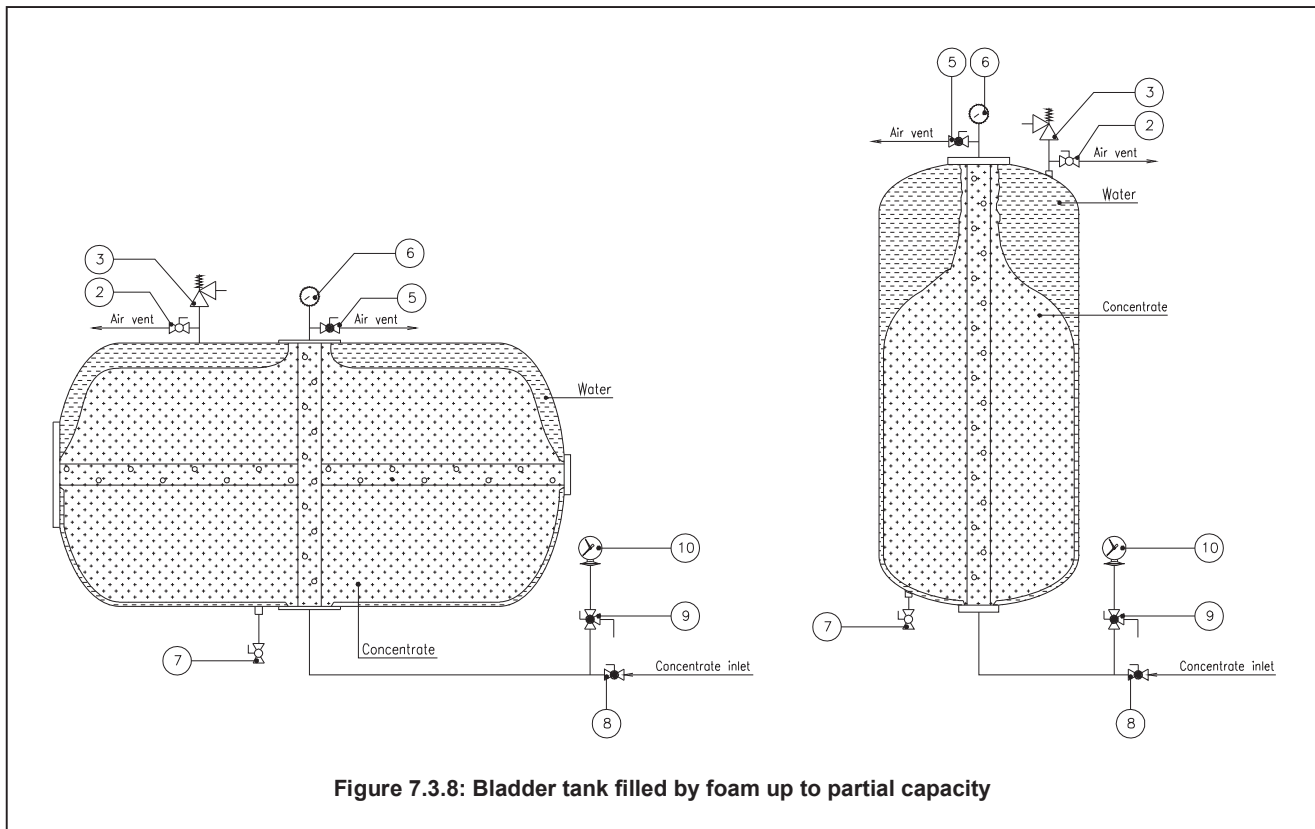
Water filling must continue until water, free of air bubbles, is drained through valve (2) and until foam concentrate, after some seconds, is drained through the valve (5).

Close the valves (7), (2) then (5). The bladder tank condition is described in **figure 7.3.8**;

15. Disconnect the foam pump hose from the tank and clean foam pump and hoses
16. Disassemble the filling device (6)/(5) and restore the concentrate vent valve (4) as shown in **figure 3.3.1**.
The filling process is now finished.

This section also applies to any foam filling after the first one. When re-filling because the tank is empty to 75% full of foam concentrate, please ensure that the initial relevant conditions are as those described from the beginning of **paragraph 7.3**. Note that in cases where the tank is not completely emptied, the air supply described in **figure 7.3.5** should be connected to the filling device valve (5).

If the bladder tank needs to be re-filled and is more than 75% full as illustrated in **figure 7.3.8**, the filling activity shall follow all the relevant steps described in this section until the end of the process. Water should be drained from the tank to allow room for new concentrate to be poured in manually through the top bladder vent valve or pumped in through foam concentrate fill valve (8).



To check the foam level inside the bladder tank, please refer to the instruction in **Section 9**.

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

7.4 Level indicator setup (where fitted)

Since the Viking bladder tanks, due to tolerances, have a capacity that differs slightly among tanks of the same size, the level indicator showing the max capacity must be adjusted in the field after a full foam loading.

This adjustment is optional, since it does not affect the operation of the bladder tank. It is only to have an easier visualization of the foam concentrate level height. After the complete foam filling, follow the standard procedure for level check described in **Section 9**.

NOTICE

This procedure must be done only with a complete filling of the tank. If a partial loading is performed, the level shown with the black needle will not be representative of the foam concentrate level due to the water that is also in the tank and therefore cannot be used to set the red needle.

After following the procedure in **Section 9** the foam quantity is shown on level indicator by the black needle:

1. Remove the glass cover of indicator by rotating the bezel counter-clockwise, exposing the needles.
2. Move manually with finger(s) the red needle to let it match the black needle, which is showing the actual measurement.
3. Replace the glass cover securing it by rotating clockwise on the corresponding stops

See also **Figure 7.4.1** for a visual explanation about how to adjust the indicator

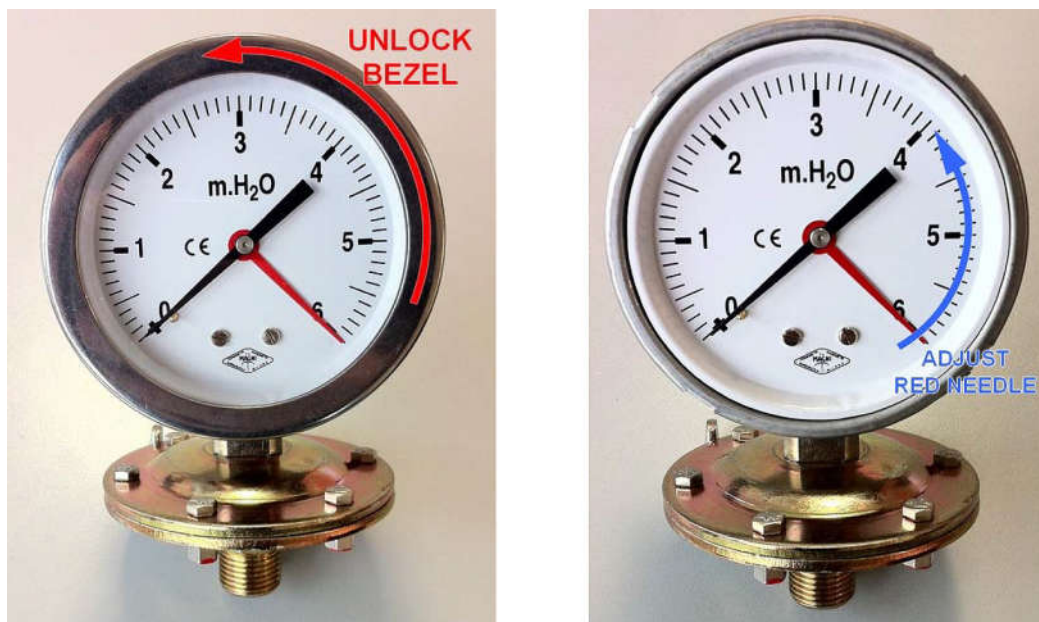


Figure 7.4.1: Detail of the needle adjustment procedure for level indicator



The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

SECTION 8 – BLADDER TANK COMMISSIONING AND START-UP

Once the bladder tank is filled with foam it can be put in service for fire protection purposes. In order to carry-out this step the installer/end user must always perform the following actions:

 **WARNING**

1. The foam quantity inside the bladder tank must be measured/verified and be in accordance with the system design requirements. For measurement instructions, please refer to **Section 9**;
2. The Concentrate Control Valve (if any) must be reset to the closed position. Please refer to the CCV manual for resetting operations. If a functional test of the CCV is required, it should be made at this stage before pressurizing the bladder tank.
3. The pressure and flowrate of the water supply line must be compared to the system's pressure safety devices. The available pressure at all flow rates should exceed the capacity of the system's safety devices!!
4. The concentrate **(12)** and water **(11)** cut-off valves (shown in **figure 3.3.1**), that are currently in the closed position after the filling operations must now be opened if the bladder tank is designated to operate automatically (i.e. without human operation at the tank's position).

Please ensure the valves are opened slowly. In order to avoid water or foam concentrate migration outside the bladder tank due to siphoning, it is highly recommended that the connecting these valves to the system are constantly under pressure

5. The bladder tank is now ready to operate according to two designated scheme:
 - a. Automatic: the valves **(12)** and **(11)** are normally open, a CCV may be present, water flow through the mixer starts when a master valve, either wet type, deluge, pre-action or manual, is opened. The CCV, activated by the master valve, opens automatically and the foam concentrate flow starts;
 - b. Manual: the valves **(12)** and **(11)** are normally closed, a CCV is not present, water flow through the mixer starts when a master valve, either wet type, deluge, pre-action or manual, is opened. The foam concentrate flow starts only when both the valves **(12)** and **(11)** are opened.
6. Proportioning discharge tests should be made in accordance with the appropriate Installation Standards (i.e. NFPA, VdS, LPCB, etc.) and / or FM Global Property Loss Prevention Data Sheet 4-12, Foam-Water Sprinkler Systems.



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

SECTION 9 – FOAM CONCENTRATE LEVEL MEASUREMENT

NOTICE

Level checking of bladder tanks cannot be performed under normal standby/operational conditions. Isolation of the bladder tank from the system and shell water drain down is always required.

The Viking bladder tanks are equipped with a foam concentrate level indicator (*hydrometer*) at its bottom (**10**) in **figure 3.3.1**). From the level measurement the foam volume of the tank can be easily calculated.

The lever indicator bases its measurements on the column weight generated by the foam concentrate. As a consequence, the range of pressure this device is designated to measure is within few (typically 6) meters of liquid column.

To check the foam concentrate level the following operations must be performed:

1. Close the water (**11**) and foam concentrate (**12**) cut-off valves;
2. Completely drain the water from the region outside the bladder by first opening the water drain valve (**7**). Once the water pressure has been reduced, carefully open water vent valve (**2**) and foam vent valve (**4**) to allow the pressure inside the tank to equalize. Depending on the system configuration, the presence of foam from valve (**7**) could be caused by migration back through the water supply piping. In the event of bladder failure, a solution of water and foam may consistently flow through valve (**7**), all the necessary measures to avoid environmental contamination must be taken. Further details regarding a Bladder Integrity Check can be found in **section 10.5**.
3. Once the water pressure and water column weight have been eliminated (**steps 1. & 2.**), move the handle of the 3-way valve (**9**) from its normal position shown on the right hand side of **figure 9.1.1** (i.e. when the bladder tank is in operation) to the measurement position shown on the left hand side of **figure 9.1.1**.
4. Take the reading of the level indicator. The number indicated on the scale equates to the height, in metres, of the foam concentrate above the hydrometer's lower diaphragm section. As most of the foam concentrates have a specific gravity equal to that of water within few %, the reading will indicate the foam level above the hydrometer position (expressed in meters). Should the foam density ρ_{foam} differ significantly from that of the water ρ_{water} , the foam level position above the hydrometer $h(\text{m})$ can be calculated by the formula:

$$h(\text{m}) = \rho_{\text{water}} / \rho_{\text{foam}} \times h_{\text{reading}} (\text{m})$$

5. Move the handle of the 3-way valve (**9**) from the measurement position to the normal position. This operation will avoid that the bladder tank pressure is transmitted to the hydrometer and will drain the foam concentrate from the hydrometer line.
6. **To place the bladder tank back in service (using filling device).**
 A water supply hose should be connected to the water fill/drain valve (**7**). Water must then be transferred into the tank, by slowly opening valve (**7**) and venting air through valves (**2**) and (**5**) always ensuring the pressure is less than 1 kPa at pressure gauge (**6**).
 Water filling must continue until water, free of air bubbles, is drained through valve (**2**) and until foam concentrate, after some seconds, is drained through the valve (**5**).
 Close the valves (**7**), (**2**) and (**5**). The bladder tank condition is described in **figure 7.3.8**;



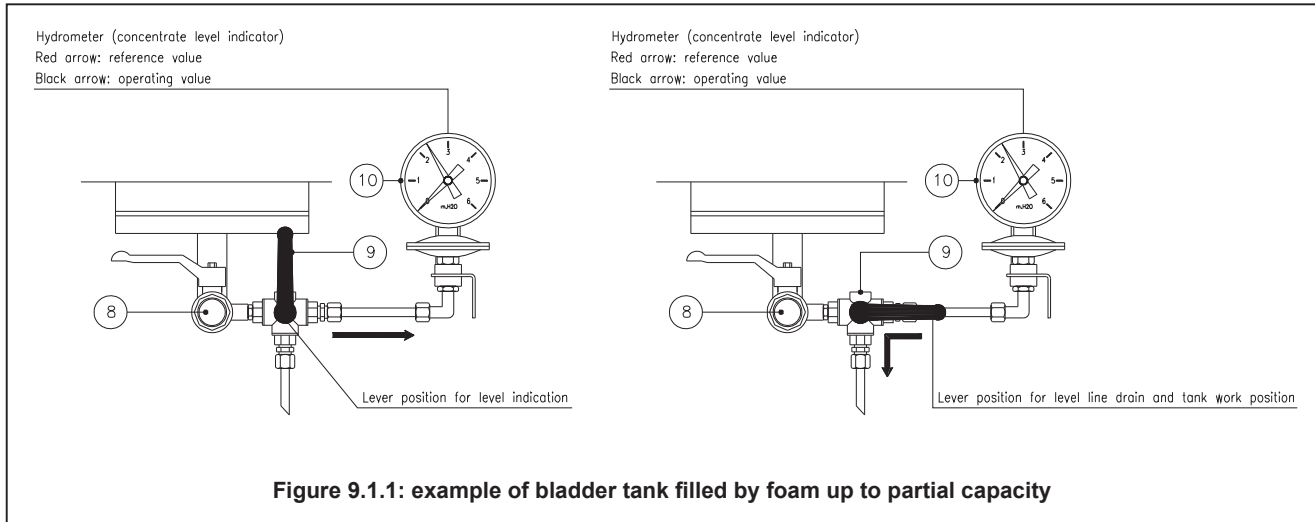
TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

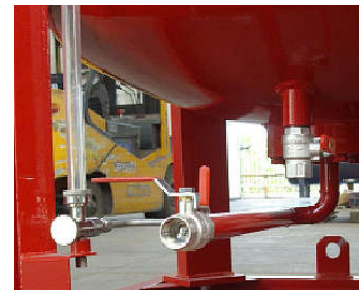
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL



- At the end of the operation, restore all the bladder tank valves to their original configuration. The concentrate (12) and water (11) cut-off valves, that are currently in the closed position after the filling operations must now be opened if the bladder tank is designated to operate automatically (i.e. without human operation at the tank's position). Please ensure the valves are opened slowly. In order to avoid water or foam concentrate migration outside the bladder tank due to siphoning, it is highly recommended that the connecting these valves to the system are constantly under pressure.

Note: If optional sight tube (shown right) is used instead of the hydrometer, **Steps 1-7** must still be followed. In **Step 4** the volume level will be shown directly in the sight tube after rotating the valve at the entrance to the tube.



WARNING

The level indicator is **not designed to withstand the bladder tank design pressure**. Any pressure in excess to 0.6 bar will result in a hydrometer failure. **Before commutating the 3-way valve (9) from its normal position to the measurement position, please always make sure that the bladder tank is not subject to any pressure other than water or foam concentrate static head.**

The foam concentrate level measurement must be made as a minimum after any operation of the bladder tank and according to the schedule of **table 10.3.1**.



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

SECTION 10 – PERIODIC MAINTENANCE

The bladder tank by itself, requires a limited level of maintenance throughout its lifetime.

However, some essential operations must be regularly carried out to ensure appropriate performance and durability of the bladder tank components.

This section covers the periodic (i.e. “ordinary”) maintenance. The ordinary maintenance does not include special repairing of the bladder tank, except the bladder substitution. For repair operations, always contact Viking

10.1 Periodic maintenance frequency

It is the responsibility of the end user to keep informed and updated of the local regulations concerning frequency and extent of maintenance activities.

Viking indicates in this manual the minimum recommended maintenance to control and to preserve in full efficiency the equipment supplied. The extent and the frequency of the maintenance shall also be linked to the environmental and usage conditions. Any additional request as a result of norms, laws and regulation, must be added to the recommendations made by Viking.

10.2 General requirements



CAUTION

- a. The maintenance must be carried out by qualified and authorized personnel according to applicable local regulations and laws.
- b. Responsible site personnel must be informed about the planned maintenance of the bladder tank and its accessories ensuring alternative fire safety measures are in place.
- c. Any safety measure to prevent accidents must be taken according to the applicable legislation.
- d. Maintenance personnel must operate with caution and use all required individual safety equipment (safety shoes, gloves, glasses, etc...).
- e. Do not act on the bladder tank before isolating from the fire system and relieving the pressure.
- f. Do not perform welding on the tank body as damage to the bladder will occur.
- g. For maintenance operations on bladder tank accessories (such as thermal relief valve or CCV) always make reference to their dedicated documentation and manuals.
- h. When removing tank components during maintenance, care should be taken to avoid damage to the connections and piping these components are installed in.
- i. In case of a malfunctioning safety device (thermal relief valve, system relief valve, etc...) depressurize the bladder tank immediately .
- j. In case of bladder tank, component parts or consumables are to be disposed of, do so accordance with local regulations and in full respect for the environment. Ensure authorized disposal companies are used.

The maintenance recommendations given in this manual are relevant to the Viking bladder tank and accessories only. Inspection and maintenance of the entire foam system, where materials supplied by Viking are included, are not within the scope of this manual or the following recommendations. It is recommended that the instructions given in applicable standards or regulations are adhered to (e.g. NFPA 11/16/25 codes, EN standards, etc...).



TECHNICAL MANUAL

**BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL**
(foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

10.3 Maintenance schedule

Viking recommend, as a minimum, to implement a maintenance program as indicated in the table below:

Table 10.3.1: Recommended maintenance schedule

No.	Activity	Start Up	Monthly	6 Monthly	Annually	5 Yearly	Procedure
1	Check of foam concentrate level	✓	✓				Section 9
2	Check of bladder integrity	✓		✓			Section 10.5
3	Visual check of paint work Check of external surface(s) Visual check of welding (external)	✓		✓			
4	Check of flanged connections bolts tightening torque	✓		✓			
5	Check of bladder top and bottom flanges: bolts tightening torque	✓		✓			Section 10.4
6	CCV (if any) "white test" (opening without foam discharge to the system)	✓		✓			Refer to CCV manual
7	Manual valves opening/closing	✓		✓			
8	Foam concentrate sampling & analysis				✓		
9	Thermal relief valve operation (valve removed from tank and tested)				✓		
10	Flow test of the bladder tank system				✓		As per local regulation
11	Valves: greasing of moving parts				✓		
12	Visual check of internal tank shell					✓	

Local regulations may require activities exceeding those stipulated in **table 10.3.1** (for instance, mandatory periodic qualification of the pressure vessel). It is full responsibility of the end user to be informed of these requirements and to put in place all the necessary activities.



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
 Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

10.4 Bladder connections - bolts tightening torque adjustment

The separation bladders used in Viking bladder tanks are made by synthetic materials whose consistency is similar to that of the rubber. In particular, the top and bottom caps are made of synthetic rubber. These two caps provide the fixing of the bladder to the rest of the tank. They are installed in a wafer configuration between the tank ingots and the top and bottom closure flanges.

Environmental changes, such as temperature and humidity, vibration and periodic fluctuation of the bladder working pressure may result in small leaks of water or concentrate if a periodic adjustment of the tightening torque at the top and bottom bladder flange bolt's is not made.

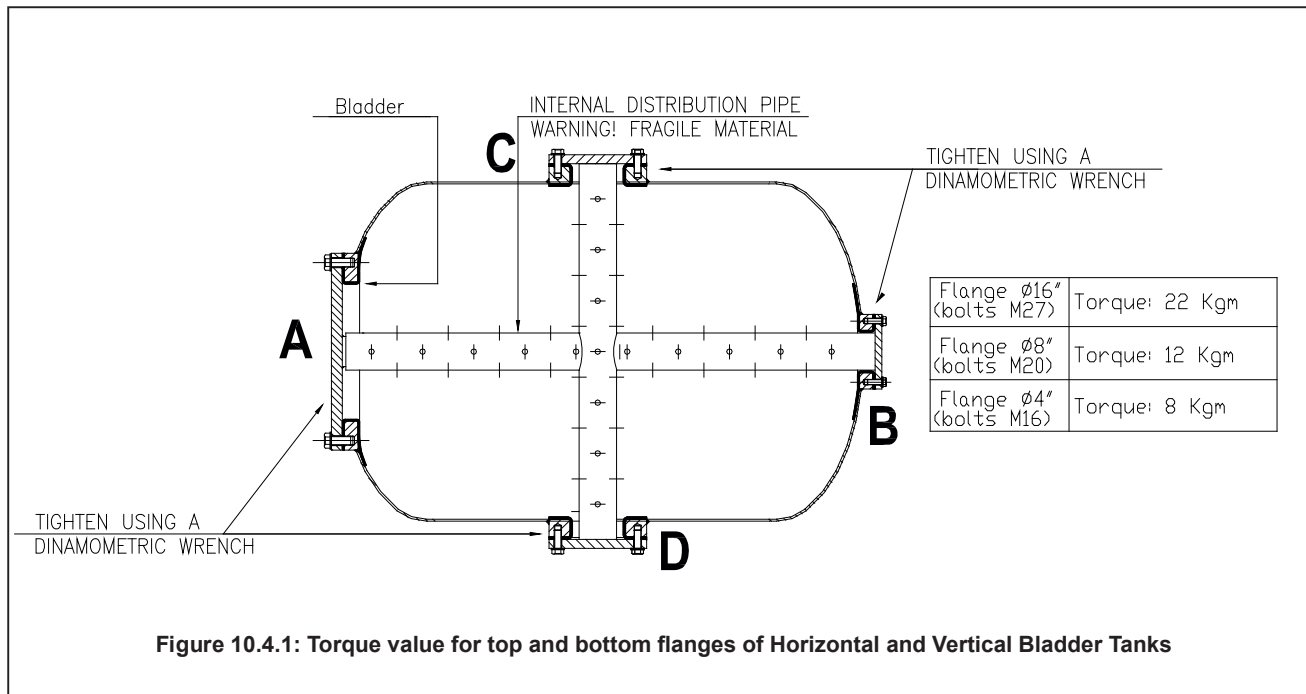


Leaks of foam concentrate from the top flange may damage the tank painting if not readily eliminated

The bolt tightening operation is made for the first time in the factory as part of the manufacturing process and **must be repeated by the installer/end user at the start-up and according to the frequency stated in table 10.3.1.**

The procedure to tighten the bolts requires the use of a dynamometric (torque) wrench and is described as follows:

1. Starting from the top flange and using a dynamometric wrench, tighten each diagonally opposite bolts in sequence. Torque value is indicated in **figure 10.4.1** based on different flange/bolt sizes.
2. Perform the same activity on the bottom flange





TECHNICAL MANUAL

**BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL**
(foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

10.5 Check of bladder integrity

During the normal operation, if the instructions given in this manual are correctly followed, the bladder is always subject to a virtually null net pressure as the pressure in the internal area equals that in the external region. This is achieved because the filling and the normal use procedures described so far avoid the formation of air bubbles inside or outside the bladder. Under this condition it is extremely unlikely that a bladder rupture will occur.

A periodical check is however recommended to ensure that water and foam concentrate do not contaminate each other, decreasing, yet not zeroing even in case of bladder rupture, the fire fighting performance of the system where the bladder is installed.

The bladder integrity check can be done following these steps and referring to **Figure 3.3.1**:

1. Close the water (11) and foam concentrate (12) cut-off valves;
2. Completely drain the water from the region outside the bladder by first opening the water drain valve (7). Once the water pressure has been reduced, carefully open water vent valve (2) and foam vent valve (4) to allow the pressure inside the tank to equalize.
In the event of bladder failure, a solution of water and foam may consistently flow through valve (7); all the necessary measures to avoid environmental contamination must be taken.
3. In the event that a water foam solution is persistently discharged through water drain valve (7), possibly becoming richer with foam concentrate as the discharge continues and resulting almost in a pure foam concentrate discharge at the end, then the bladder integrity is likely to be compromised and further investigation is required (**step no. 4**).
If only water or a lean foam solution is discharged, not resulting in a pure foam concentrate flow and ending in water flow only then the bladder is probably unimpaired. In this case please jump to **step 6** in **Section 9** or make the additional check detailed in **step 4**.

Note: An initial discharge of water and foam solution, made particularly evident by the foaming properties of the foam concentrate is normal if a CCV is not installed and the bladder tank operates in automatic mode (see **Section 8**). This is because pressure fluctuations such as those caused by jockey pumps, combined with small leaks through the system piping network, may cause some water flow through the ratio controller. This flow sucks some foam concentrate and generates water foam solution through the ratio controller. This solution may pass to the water side of the bladder tank through valve no. (11).

4. If the water drain valve (7) discharges foam concentrate or sufficient doubt still exists regarding bladder integrity, then the bladder needs to be pressurized with air to assess its status;
Remove the foam vent valve (4) and assemble the filling device in place of it (**figure 3.3.1**).
Connect a compressed air source having the features described in **7.2(e)** to the filling device valve (5)
Close the water drain valve (7) and open the water vent valve (2).
Start the air compressor or open the installation's air network valve to inflate the bladder to 1kPa.
5. Scenario 1 - The time taken to achieve 1 kPa is variable depending on size and foam concentrate volume of the bladder. If it is not possible to achieve 1 kPa on gauge (6) then a bladder rupture has occurred and the bladder must be replaced. For bladder tank replacement operations refer to **Paragraph 10.6**.
Scenario 2 - Once 1 kPa air pressure inside the bladder is achieved on gauge (6), record the time and the temperature at the tank shell. After 60 minutes record the air pressure inside the bladder and the temperature of the tank shell. Should the drop of pressure exceed 0.3 kPa temperature adjusted (i.e pressure inside the bladder less than 0.7 kPa, **temperature adjusted**), the bladder has a leak and must be replaced. For bladder tank replacement operations refer to Paragraph 10.6;
Scenario 3 - If the 1 kPa air pressure inside the bladder is retained over 60 minutes then the bladder is undamaged and the tank can be put back into service. Restore water outside the bladder conditions following **steps 6 & 7** from **Section. 9**.

Note: It is vital that the individual carrying out the bladder integrity check fully understands the working concept of the bladder tank and the steps given in 10.5. This is because any deviation in the checking process could give a false conclusion leading to unnecessary remedial work or placing a damaged bladder back in service.



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
(foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

10.6 Bladder replacement

In the unlikely event of a rupture, the bladder must be replaced immediately.

NOTICE

Since the lack of a bladder or its damages determines a decrease of performance of the foam fire fighting system served by the bladder tank, it is **highly recommended that the end user always keeps a spare bladder readily available for replacement within 24 hours.**

Replacement bladders should be original manufactured by Viking to fit properly the tank's shape and to secure the design performance of the equipment. **Viking is not responsible for the overall performance of the supplied bladder tank if non original spare parts are installed. The warranty on the equipments provided by Viking, in such case, expires automatically and immediately.**



CAUTION

The replacement of used bladders is likely to put the operator in contact with foam. Only skilled and experienced personnel must carry out this task. The foam concentrate Material Safety Data Sheet must be consulted prior to make any activity. The personnel must be equipped with individual protection equipments (gloves, glasses, protective clothing).



WARNING

The surfaces in contact with foam (bladder and tank shell) easily become slippery. Attention must be paid to avoid accidents.



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

The bladder replacement operation is split into two parts: removal of the existing bladder and installation of a new one. Referring to Figure 3.3.1 and 10.4.1

This bladder replacement operation requires at least 2 personnel.

Additional tools and accessories such as a torch, rope/string, and strong adhesive tape will also be required

BLADDER REMOVAL – VERTICAL & HORIZONTAL TANKS

1. Close the foam concentrate (12) and water (11) cut-off valves;
2. Completely drain the water from the region outside the bladder by opening water drain valve (7) and the water vent valve (2). In the event of bladder failure, a solution of water and foam may flow through valve (7) so all necessary measures to avoid environmental concerns must be taken.
3. Drain the foam inside the bladder by opening the valve (8). For large volumes the filling pump could also be used. Adopt suitable safety measures to collect all the foam in such a way to avoid environmental concerns.
4. Disconnect and remove the relevant foam discharge piping from the top of the bladder tank connecting the tank to the ratio controller.
Disconnect the foam level indicator trim from the foam outlet welded to the tank's bottom flange.
5. Remove all bolts and then the top, bottom and side flanges (horizontal tank only).
6. Withdraw the drilled tube out of the top opening for vertical tanks. For horizontal tanks, remove the horizontal tube from the large inspection flange on the side (A) of the tank and then the vertical running tube out of the top opening (C) (figure 10.4.1).
7. **Vertical Tanks:** - Extract the bladder from the top opening taking care to fold the bottom cap in such a way it can pass through the bottom opening. For larger bladders this operation may require the use of a fork-lift or other lifting equipment operated by an authorized operator.

Horizontal Tanks: - Extract the bladder from the side inspection flange (A) taking care to fold the bottom, top and side caps in such a way they can pass through their respective openings.

TIP: - After folding in the flange caps but before removing the bladder, it is advisable to replace the bottom flange (D) which includes the drain connection. As it is very difficult to fully drain the tank and bladder contents in steps 2 and 3, this will facilitate a controlled draining of the bladder contents as it is withdrawn from the tank.

8. Thoroughly clean the internal walls of the bladder tank with a hose and inspect the inside of the tank for any debris that could have been responsible for the bladder rupture.



TECHNICAL MANUAL

BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL
 (foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

BLADDER INSTALLATION - VERTICAL TANK ONLY

1. Replacement bladders are normally supplied with drilled caps to fit the fixing flanges. In case they are not, drill the top and bottom caps according to the flange holes. This operation must be made by marking a reference position with a pen/marker on both the caps (for instance, that of the longitudinal welding of the tank). Drill holes on both caps must be made to copy the actual holes position on the tank ingots. Take a record of the new bladder serial number and associate it to the bladder tank serial number in the maintenance book for future reference.
2. Clean the surfaces of the bladder ingots and flanges (top and bottom). The absence of any impurity or debris is essential for proper bladder sealing at the top and bottom flanges.
3. Keep the bottom cap folded tight using, for instance, an adhesive tape to make sure it will pass through the bottom opening. String or rope can be carefully threaded through the rubber flange holes and secured – this will aid maneuvering of the bladder into position later.
4. Lower the bladder with care from the top tank opening, making sure that the top and bottom caps are not rotated around the bladder axis (use the marks made with the pen/marker). For larger bladders this operation may require a fork-lift or other lifting equipment operated by an authorized operator.
5. From the bottom of the tank, reach inside and guide the bladder cap through the opening taking care not to rotate out of alignment with the top flange. The rope and adhesive tape can now be removed and the rubber neck and flange will open out and can be secured into position. The upper rubber neck and flange can now be secured into position.

NOTICE

Cap rotation will result in unbalanced strains on the bladder during the filling & operation phase which are likely to produce bladder ruptures!!

6. Insert the drilled tube from the top opening taking care to center it with respect to the lower opening and bladder flange. Centering is automatic as the bottom ingot opening is just slightly larger than the pick-up tube. To make this operation easier, the operator should reach into the tank and guide into place.
7. Reassemble the bottom bladder flange by screwing the bolts at the tightening torque value stated in **figure 10.4.1** using a dynamometric wrench. Tighten each couple of opposite bolts at a time at a progressively increasing torque and repeat the operation iteratively until the nominal value is achieved;
8. Reassemble the top flange taking care to center the drilled tube in the opening. Again, centering is automatic as the top flange is provided with a centering coupling whose diameter is larger than that of the drilled tube. Tighten the bolts at the torque value stated in **figure 10.4.1** using a dynamometric wrench. Tighten each couple of opposite bolts at a time at a progressively increasing torque and repeat iteratively until the nominal value is achieved;
9. Reassemble the foam discharge piping to the top flange, replacing the old gaskets with new ones, and the foam level indicator trim to the welded pipe at the bottom flange;
10. Perform the bladder tank filling according to **Section 7.**;



TECHNICAL MANUAL

**BLADDER TANK MODEL VFT & FT
INSTALLATION, OPERATION AND
MAINTENANCE MANUAL**
(foam concentrate inside the bladder)

The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058

Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com

VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

BLADDER INSTALLATION - HORIZONTAL TANK ONLY

1. Replacement bladders are normally supplied with drilled caps to fit the fixing flanges. In case they are not, drill the top and bottom caps according to the flanges holes. This operation must be made by marking a reference position with a pen/marker on both the caps (for instance, that of the longitudinal welding of the tank). Drills on both the caps must be made to copy the actual holes position on the tank ingots. Take record of the new bladder serial number and associate it to the bladder tank serial number in the maintenance book for future reference;
2. Clean the surfaces of the bladder ingots and flanges (top and bottom). The absence of any impurity or debris is essential for proper bladder sealing at the top and bottom flanges;
3. Keep the top, bottom and small cap folded tight using, for instance, an adhesive tape to make sure it will pass through the bottom, top and side openings. String or rope can be carefully threaded through the rubber flange holes and secured – this will aid maneuvering of the bladder into position later.
4. Insert the bladder with care from the inspection flange side opening (A) and drawer into the tank from the opposite side using the pre-secured rope making sure that the top, side and bottom caps are not rotated around the bladder axis (use the marks made with the pen/marker).
5. From the bottom of the tank, reach inside and guide the bladder cap through the opening taking care not to rotate out of alignment with the top flange. Reach into the tank from the top opening and raise the bladder using the pre-installed rope. Repeat the process for the small side flange.
TIP:- Subject to local regulations and permits, it is also possible for the operator to enter inside the tank to maneuver the bladder into position.
6. The rope and adhesive tape can now be removed and the rubber neck(s) and flange(s) will open out and can be secured into position. The large side rubber neck and flange can now be secured into position.

NOTICE

Cap rotation will result in unbalanced strains on the bladder during the filling & operation phase which are likely to produce bladder ruptures!!

7. Insert the drilled tube from the top opening taking care to center it with respect to the lower opening and bladder flange. Centering is automatic as the bottom ingot opening is just slightly larger than the pick-up tube. To make this operation easier, the operator should reach into the tank and guide into place. Next, insert the horizontal drilled tube through the vertical tube taking care to center it with respect to the side opening and bladder flange.
8. Reassemble the bottom and side bladder flanges by screwing the bolts at the tightening torque value stated in **figure 10.4.1** using a dynamometric wrench. Tighten each couple of opposite bolts at a time at a progressively increasing torque and repeat the operation iteratively until the nominal value is achieved
9. Reassemble the top flange taking care to center the drilled tube in the opening. Again, centering is automatic as the top flange is provided with a centering coupling whose diameter is larger than that of the drilled tube. Tighten the bolts at the torque value stated in **figure 10.4.1** using a dynamometric wrench. Tighten each couple of opposite bolts at a time at a progressively increasing torque and repeat iteratively until the nominal value is achieved.
10. Reassemble the foam discharge piping to the top flange, replacing the old gaskets with new ones, and the foam level indicator trim to the welded pipe at the bottom flange.
11. Perform the bladder tank filling according to **Section 7**.



The Viking Corporation, 210 N Industrial Park Drive, Hastings MI 49058
Telephone: 269-945-9501 Technical Services: 877-384-5464 Fax: 269-818-1680 Email: techsvcs@vikingcorp.com
VISIT THE VIKING WEBSITE FOR THE LATEST EDITION OF THIS TECHNICAL MANUAL

10.7 Extraordinary maintenance

The ordinary maintenance operations described in Section 10 are normally enough to ensure an appropriate service regime during the Viking bladder tank lifetime. In case of special intervention on the tanks, due for instance to environmental conditions or wrong handling/operation of the bladder tank, **always contact Viking**.

Any extraordinary maintenance activity not carried out by Viking will automatically and immediately determine the warranty terms expiration.