



# **CONCENTRATE CONTROL SYSTEM**

**OPERATING, MAINTENANCE,  
AND FILLING MANUAL**

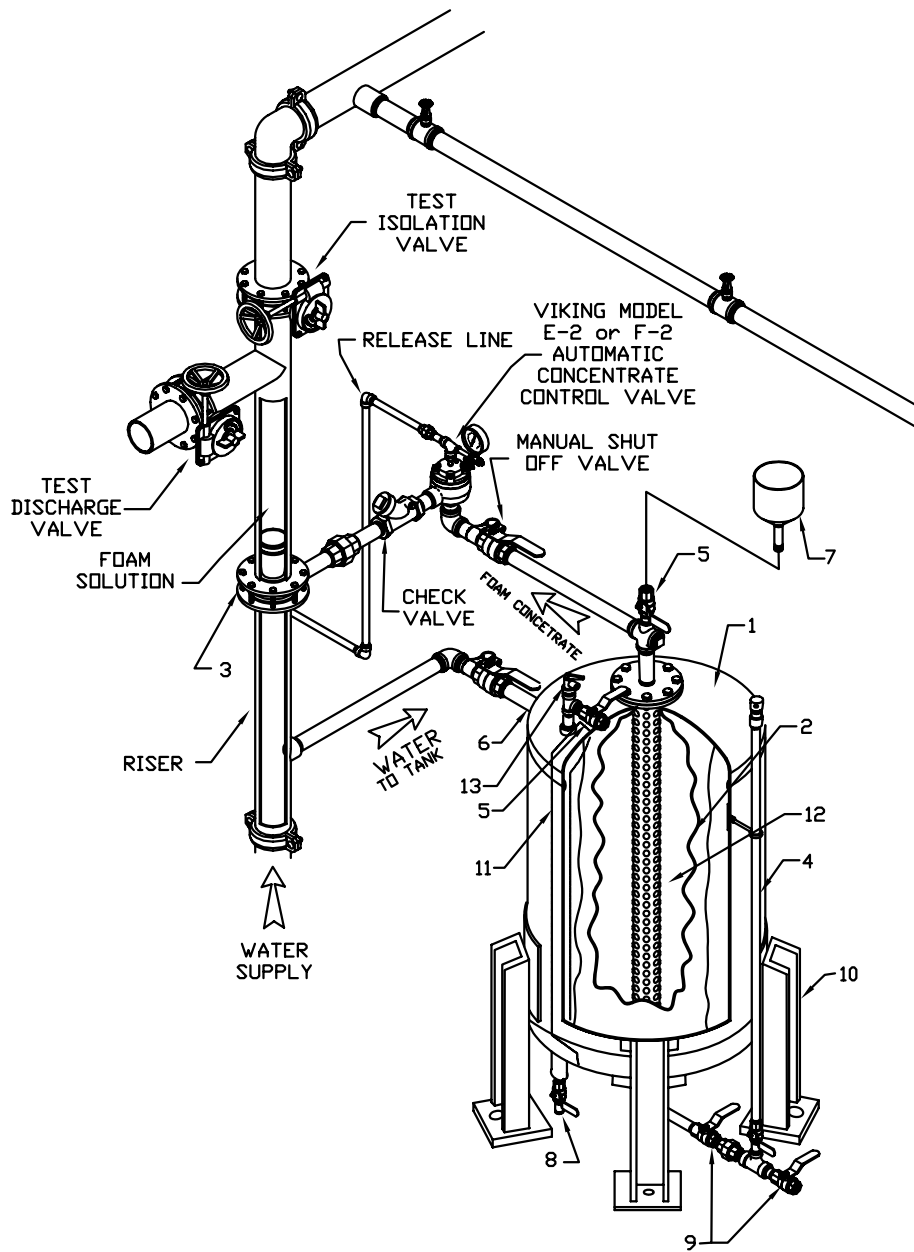
**VERTICAL AND HORIZONTAL  
BLADDER TANKS**

**October, 2006**

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## CCS Cut-Away Drawing



1. ASME Bladder Tank
2. Nylon reinforced elastomeric concentrate bladder
3. Concentrate Controller (sold separately)
4. Sight Gauge
5. Vent Valves
6. Water Inlet
7. Fill Cup
8. Water drain/fill valve
9. Concentrate filling/drain valve
10. Bladder tank support mounts
11. Channel inlet/drain
12. Total discharge pipe
13. Thermal relief valve

## 1.0 BALANCED PRESSURE PROPORTIONER (CCS) ENVIRONMENT

There are numerous ways in which the fire protection engineer can design a system using a Viking Concentrate Control System (CCS). The method he chooses must take into consideration the CCS specifications.

The outer tank is ASME constructed at a design or working pressure of 175 PSI, and is hydrostatically tested at 263 PSI.

The inner tank (bladder) is fabricated of a flexible fabric, Buna-N® over nylon, Mullen burst 800 pounds (relative to area and pressure), tensile (grab) 400 pounds X 450 pounds.

Forces such as waterhammer - expansion/contraction of the contents in the CCS - valve arrangement, pressure relief valves, concentrate specifications, etc., could affect the operation of the system.

Any design or manipulation of valves that will cause a significant pressure differential across the bladder should be compensated for or avoided.

It is the responsibility of the design engineer to accommodate the CCS in an environment compatible with its specifications.

## 2.0 CONTROLLER INSTALLATION & OPERATION

**IMPORTANT: DO NOT ALTER INTEGRAL PIPING WITHOUT CONSULTING WITH A SYSTEM DESIGN REPRESENTATIVE. PIPING ALTERATION CAN INFLUENCE SYSTEM PERFORMANCE. BEFORE INSTALLING A "CONCENTRATE CONTROLLER," CHECK YOUR SYSTEM DESIGN DRAWING TO ENSURE THE LOCATION DOES NOT ADVERSELY AFFECT THE PROPORTIONING DUE TO EXCESSIVE LOSS OR FRICTION LOSS.**

**CHECK THE PERCENT STAMPING ON THE CONTROLLER TO ASSURE THAT YOU HAVE THE CORRECT CONTROLLER FOR THE SYSTEM.**

It is recommended that a length of straight pipe, equal to 4-6 pipe diameters, be installed immediately before and after the "Concentrate Controller". This will help eliminate the possibility of turbulence affecting the proportioning accuracy. Install the controller with the Viking pointing in the direction of the water flow.

The ideal location of the controller is level with the top discharge, and within a couple feet of the tank. Actual field conditions, however, will not always allow for this design. The controller will still proportion as intended in a wide variety of locations, providing the design is made with the operating characteristics of the controller in mind.

Mounting above the discharge level or long distances from the CCS will affect the low flow performance of the controller by raising its low flow minimum. Mounting the controller below the discharge lowers its minimum flow requirement; however, SPECIAL PRECAUTIONS ARE REQUIRED TO PREVENT CONCENTRATE MIGRATION INTO THE WATER SUPPLY.\*

The concentrate controller is a modified venturi device. As water flows through the venturi, it creates an area of lower pressure, referred to as the metering pressure drop. The faster the water flows through the venturi, the higher the metering pressure drop. This allows more concentrate to enter through the orifice to mix with the increasing water flow. A decrease in water has the opposite effect on the metering pressure drop, thereby reducing the amount of concentrate passing through the orifice.

Moving the concentrate out of the tank to the controller incurs some friction loss. The low flow rating of the controller is that point where the metering pressure loss created by the flow of water across the venturi is now greater than the total friction loss incurred by the concentrate moving to the controller.

This figure is obtained by calculating the friction loss of the interconnection piping. This includes the water supply piping to the tank and the concentrate discharge pipe to the controller. This figure is then added of the pressure loss incurred within the bladder itself - approximately 1 PSI.

A metering pressure drop chart is found elsewhere in this manual. As an example, a flow rate of 100 GPM through a 4" controller results in a MPD of .55 PSI. This is not high enough to overcome even the pressure loss within the tank, so the controller will proportion on the light side.

However at 150 GPM, the MPD is now 1.2 PSI, which is high enough to overcome the friction loss, assuming the controller is located in its ideal location, as noted previously. One can now see how moving the controller will create subtle changes in friction loss, which will require a somewhat higher water flow rate to generate a higher MPD. A smaller controller will generate a higher pressure drop at the same flow rate as that of the larger controller.

The interconnecting piping should be sized to generate as little friction loss as possible. Avoid tees and elbows wherever possible, and use full port valves. Swing check valves are recommended to prevent water backflow into the bladder. Strainers, while called for by NFPA, are, in our opinion, not necessary when used with AFFF/AR products. Consult the foam manufacturer or Viking for compatibility of foam concentrates with various pipe and valving materials.

Residual water pressure, flow requirements, and locations are main factors in sizing a controller for installation. A permanent pressure loss chart and a proportioning curve with recommended flow rates are located elsewhere in this manual.

There are numerous ways to design and install an Viking Concentrate Control System for effective operation. Your Viking representative will be happy to assist in whatever way possible.

Viking does not warrant or represent that this system is adequate for your fire protection needs. You should determine whether this system is adequate for its intended use, as you assume all risk and liability in connection therewith.

See the Warranty located in the back of this manual.

### **3.0 CONCENTRATE PIPING CCS**

In order to prevent the inversion of the concentrate stored in the CCS bladder to the water system, it is recommended that the concentrate controller be located level with the top discharge of the CCS tank. In addition, a concentrate isolation valve should be installed in the concentrate pipe between the CCS and the concentrate controller for either manual or automatic systems.

This method of installation prevents the heavier-than-water (AFFF/AR) concentrate from draining or siphoning from the tank into the water supply piping. The concentrate isolation valve serves as a positive means of separating the concentrate from the water supply source, which is required by law in some states.

When the concentrate is not isolated from the water supply, there have been cases where the concentrate has siphoned out of the bladder and was replaced by supply water, giving the erroneous indication that the bladder has ruptured.

This is very probable when the controller is positioned lower than the top flange of the CCS.

Piping between the CCS and the controller is not normally furnished by Viking, and is the responsibility of the system design engineer for the type system wanted - manual, automatic electrical, automatic pneumatic, fail-safe, dry, wet, etc.

### **4.0 PRIMARY AND THERMAL RELIEF VALVES**

The design pressure and maximum working pressure for the Viking bladder tank is 175 PSI. It is the responsibility of the owner or design engineer to provide a primary relief valve to protect the tank from a rapid over-pressurization. Details of the fire protection systems design must be known, such as water pressure and flow capacity, to size this relief valve.

Thermal expansion of the foam concentrate within the tank can also create pressures exceeding the rated capacity of the bladder tank. This slow but steady pressure increase could result in problems ranging from leaks at threaded or flanged connections to physical damage of the bladder or pressure tank.

To prevent or lessen the effect of thermal expansion, we recommend the following:

- A. Avoid filling the tank with cold concentrate. Allow the concentrate to warm to room temperature, if possible.
- B. Do not fill beyond the tank's rated capacity. All Viking bladder tanks have 5-10% extra capacity for expansion.
- C. Install a sun canopy over tanks installed outdoors.
- D. Install a thermal relief valve.

Viking recommends that only tanks installed "normally un-pressurized" have these relief valves. This type of installation, while completely acceptable, is most likely to experience the effects of thermal expansion should the tank be filled to capacity with foam concentrate.

We do not recommend using thermal relief valves on bladder tanks installed "normally pressurized", such as in wet pipe systems. These installations frequently have fire pumps that cycle on and off, creating pressure spikes which can result in frequent discharges of foam concentrate through the relief valve. It is the responsibility of the owner or design engineer to determine:

- E. If these pressure spikes can occur; and
- F. If a device or method is required to protect the tank and/or water piping and valves from over-pressurization.

Experience has shown that the water surrounding the bladder in a pressurized installation creates its own cushion against thermal expansion of the foam concentrate, eliminating the need for the thermal relief valve.

Viking can provide a thermal relief valve that is compatible for this service. Refer to our schematic diagram for its recommended locations. Please specify when ordering whether the tank will be installed pressurized or not.

## 5.0 AFFF SCHEMATIC

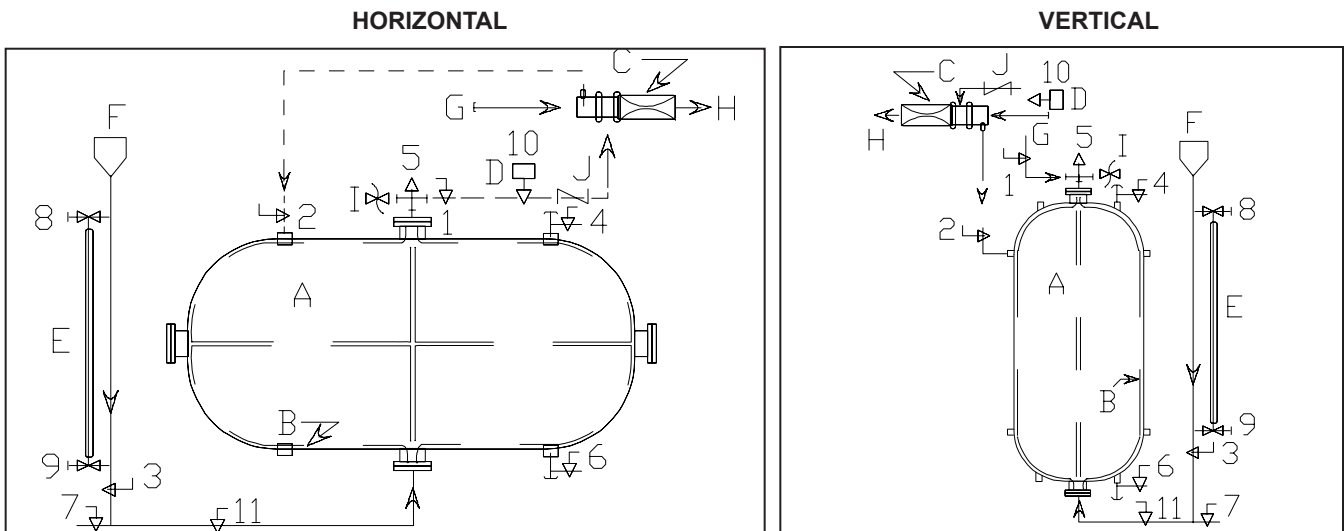
### IMPORTANT FOR OPERATION:

Piping between the concentrate vessel and concentrate controller is not furnished by the Concentrate Control System manufacturer. The concentrate piping to the controller must meet certain criteria to prevent loss of concentrate into the water supply piping. This piping (dotted lines on the schematic below) is to be included by the design engineer for the type of system wanted - manual, electrical, pneumatic, fail-safe, etc. Viking does not accept responsibility for concentrate piping to the controller or water piping to the concentrate vessel.

**NOTE: (Per schematic below) Manual System - Valve No.'s 1 and 2 must be opened manually.  
Automatic System - Valve 10 must be opened with an alarm signal  
(if necessary, use manual override).**

### TYPICAL SCHEMATIC DIAGRAMS:

Consult the system design for actual piping requirements. Before filling system, consult manufacturers filling procedure. Improper filling can result in damage to the concentrate bladder.



#### COMPONENT DESCRIPTION

A - Storage Tank

B - Bladder

C - Concentrate Controller

D - Automatic Valve (optional)  
(See instructions above)

E - Sight Gauge

F - Fill Cup

G - Water Supply Piping (See instructions above)

H - Solution Delivery Piping (See instructions above)

I - Thermal Relief Valve (Optional)

J - Swing Check Valve

VALVE NUMBER	DESCRIPTION	*NORMAL VALVE POSITION	
		Automatic System	Manual System
1	Manual concentrate shut-off - by others	N.O.	N.C.
2	Water pressure shut-off - by others	N.O.	N.C.
3	Fill cup shut-off	N.C.	N.C.
4	Tank water vent	N.C.	N.C.
5	Diaphragm concentrate vent	N.C.	N.C.
6	Water drain/fill	N.C.	N.C.
7	Concentrate drain/fill	N.C.	N.C.
8	Upper sight gauge \ Open only when	N.C.	N.C.
9	Lower sign gauge / system is depressurized.	N.C.	N.C.
10	Automatic concentrate isolation (Optional) by others	N.C.	-
11	Fill line master shut-off	N.C.	N.C.

\* N.O. - Normally Open      N.C. - Normally Closed

## 6.0 ARC SCHEMATIC

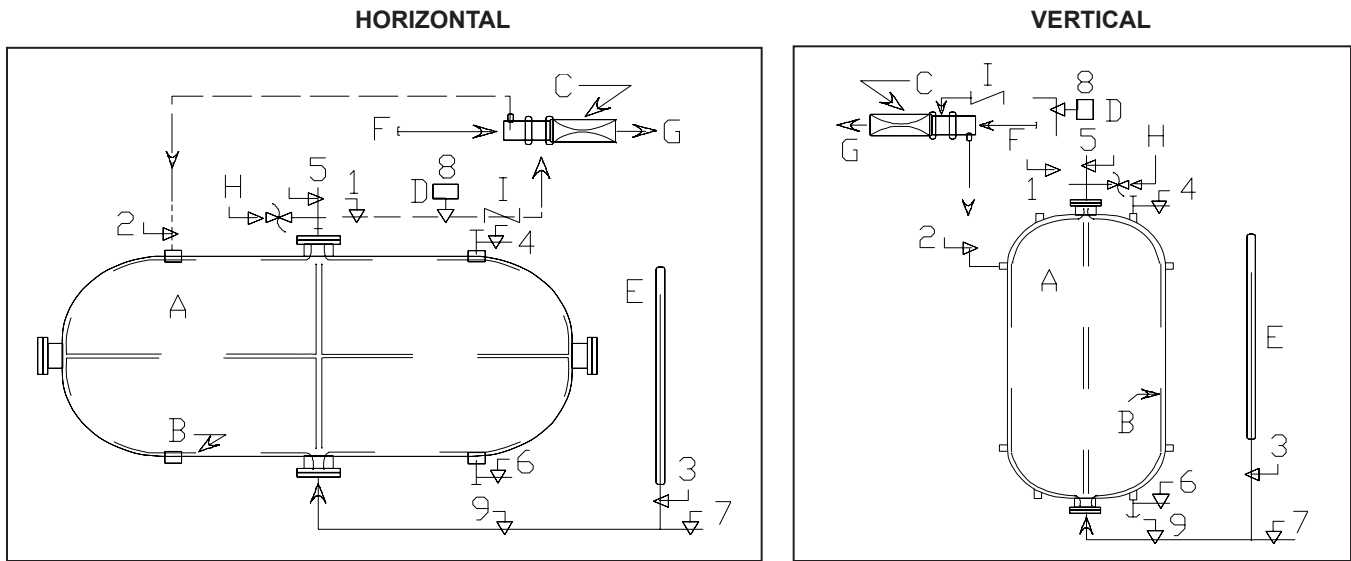
### IMPORTANT FOR OPERATION:

Piping between the concentrate vessel and concentrate controller is not furnished by the Concentrate Control system manufacturer. The concentrate piping to the controller must meet certain criteria to prevent loss of concentrate into the water supply piping. This piping (dotted lines on the schematic below) is to be included by the design engineer for the type system wanted - manual, electric, pneumatic, fail-safe, etc. Viking does not accept responsibility for concentrate piping to the controller or water piping to the concentrate vessel.

**NOTE: (Per schematic below) Manual System - Valve No.'s 1 and 2 must be opened manually.  
Automatic System - Valve No. 8 must be opened with an alarm signal  
(if necessary, use manual override).**

### TYPICAL SCHEMATIC DIAGRAMS:

Consult the system design for actual piping requirements. Before filling system, consult manufactures filling procedure. Improper filling can result in damage to the concentrate bladder.



### COMPONENT DESCRIPTION

- A - Storage Tank
- B - Bladder
- C - Concentrate Controller
- D - Automatic Valve (optional)  
(See instructions above)
- E - Sight Gauge
- F - Water Supply Piping (See instructions above)
- G - Solution Delivery Piping (See instructions above)
- H - Thermal Relief Valve (Optional)
- I - Swing Check Valve

VALVE NUMBER	DESCRIPTION	*NORMAL VALVE POSITION	
		Automatic System	Manual System
1	Manual concentrate shut-off - by others	N.O.	N.C.
2	Water pressure shut-off - by others	N.O.	N.C.
3	Sight Gauge shut-off	N.C.	N.C.
4	Tank water vent	N.C.	N.C.
5	Diaphragm concentrate vent	N.C.	N.C.
6	Water drain/fill	N.C.	N.C.
7	Concentrate drain/fill	N.C.	N.C.
8	**Automatic concentrate isolation - by others	N.C.	N.C.
9	Fill line master shut-off	N.C.	N.C.

\* N.O. - Normally Open      N.C. - Normally Closed



## 7.0 INITIAL CONCENTRATE FILLING INSTRUCTIONS

CAUTION: USE ONLY AFFF OR ARC CONCENTRATE APPROVED FOR THIS SYSTEM. AVOID CONTACT WITH EYES. IN CASE OF CONTACT, IMMEDIATELY FLUSH EYES WITH WATER. SYSTEM NOMINAL CHARGE IS NOT NECESSARILY MAXIMUM CHARGE.

### 7.1 UNCRATING PROCEDURE:

1. Remove all banding.
2. Remove sight gauge assembly and concentrate controller from packing boxes.
3. Remove all support blocks.
4. Raise unit to upright position using adequate nylon webbing slings or equal, as required.

### 7.2 PLACEMENT PROCEDURE:

1. Place unit in desired location(s).
2. Level and shim, as necessary.
3. Anchor unit with suitable bolts or other anchoring devices.  
(See installation drawing for bolt pattern.)

**NOTE:** ALL BOLT PATTERN DIMENSIONS ARE NOMINAL. FIELD VERIFY BEFORE PROCEEDING WITH ANCHOR BOLT LAYOUT.

### 7.3 CONNECTION PROCEDURE:

1. Remove piping protectors.
2. Confirm that all bolts and threaded connectors remain tight after shipment of tank. Flanged nozzles on tank should not be tightened beyond 80 foot lbs.

CAUTION: DO NOT WELD ON TANK. HIGH TEMPERATURES CAN DAMAGE INTERNAL BLADDER

3. Install controller(s) in sprinkler riser/water supply according to drawings provided by design engineer. Refer to the technical bulletins located elsewhere in this manual for information regarding location and installation of controller.
4. Assemble interconnecting pipe and valves between tank and sprinkler riser/water supply (see typical schematic diagrams) according to drawings provided by design engineer. The automatic concentrate valve (No. 10), if used, should be installed normally closed. It should be trimmed for proper activation by electric current or hydraulic (water) pressure.
5. Attach the lower end of the sight gauge assembly to the lower fill pipe using the supplied "1" union. Attach this assembly to the tank at the tank support bracket using the supplied support ring.

**NOTE:** THE CCS UNIT HAS BEEN PRESSURE TESTED BEFORE SHIPMENT FOR QUALITY ASSURANCE. DO NOT FILL TANK WITH WATER IN PREPARATION FOR HYDROTESTING WATER SUPPLY OR SPRINKLER SYSTEM PIPING. DO NOT PRESSURIZE TANK. ISOLATION VALVE NO.'s 1 AND 2 MUST REMAIN CLOSED DURING PIPING HYDROTEST.

# **WARNING**

## **DO NOT WELD ON VESSEL**

THIS VESSEL CONTAINS A RUBBER DIAPHRAGM WHICH WILL BE DAMAGED BY WELDING TEMPERATURES.

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**IMPROPER FILLING OF THIS VESSEL WILL DESTROY THE RUBBER DIAPHRAGM IT CONTAINS**

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**CAREFULLY READ AND FOLLOW THE FILLING INSTRUCTIONS FURNISHED BY THE "CCS SYSTEM" MANUFACTURER TO AVOID DAMAGE**

**THE VIKING CORPORATION  
HASTINGS MI 49058**



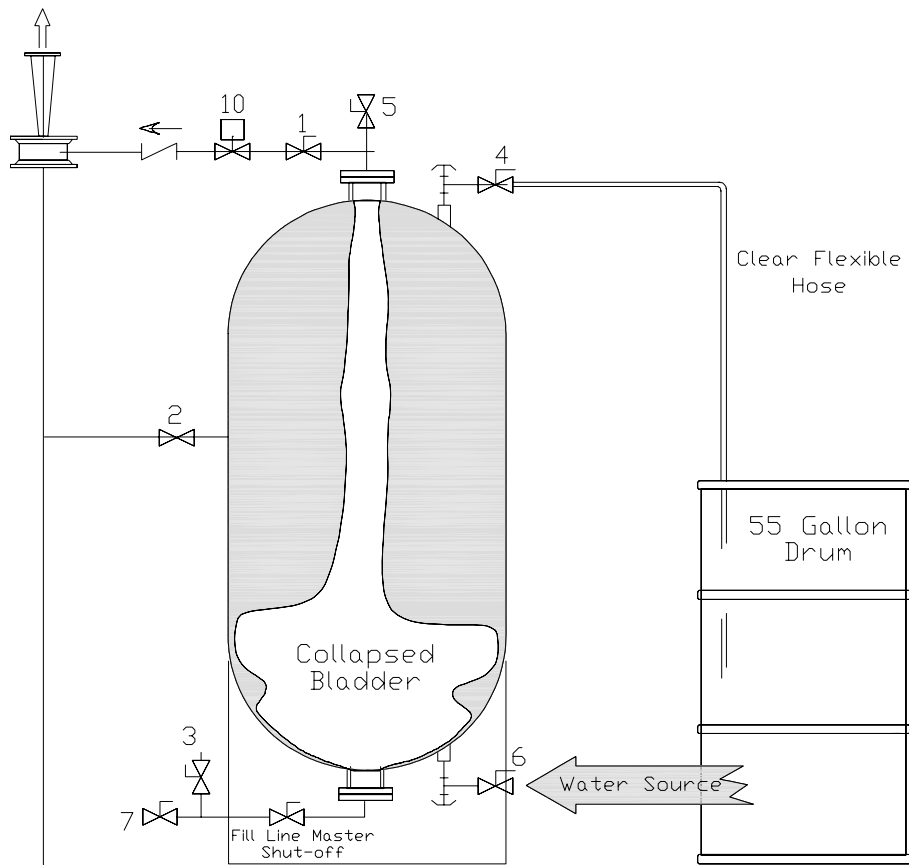


Figure 3

## 9.0 CCS FILLING SEQUENCE

Before starting the fill procedure, attach the following:

- a. 3/4" clear, flexible hose to Valve No. 4 and terminate in a 55 gallon drum.
- b. Water source to Valve No. 6 (garden hose).

Refer to the appropriate concentrate schematic for valve descriptions.

- Step 1:** Close all valves except No.'s 4, 5, 6, and 7, and fill line master shut-off (Valve No. 11 for AFFF units, Valve No. 9 for ARC units), WHICH MUST BE OPEN.
- Step 2:** Fill the shell with water through Valve No. 6 (do not exceed 25 PSIG water pressure) until a steady full flow occurs from Valve No. 4. DO NOT CLOSE VALVE No. 4 WITH LINE WATER PRESSURE ON VALVE NO. 6. CLOSE VALVE NO. 6, THEN CLOSE VALVE NO. 4.
- Step 3:** Check for water at Valve No. 7. If water has appeared, and if water flow continues, consult the CCS supplier before proceeding. If no water appears, proceed to next step.
- Step 4:** Close Valve No. 7.

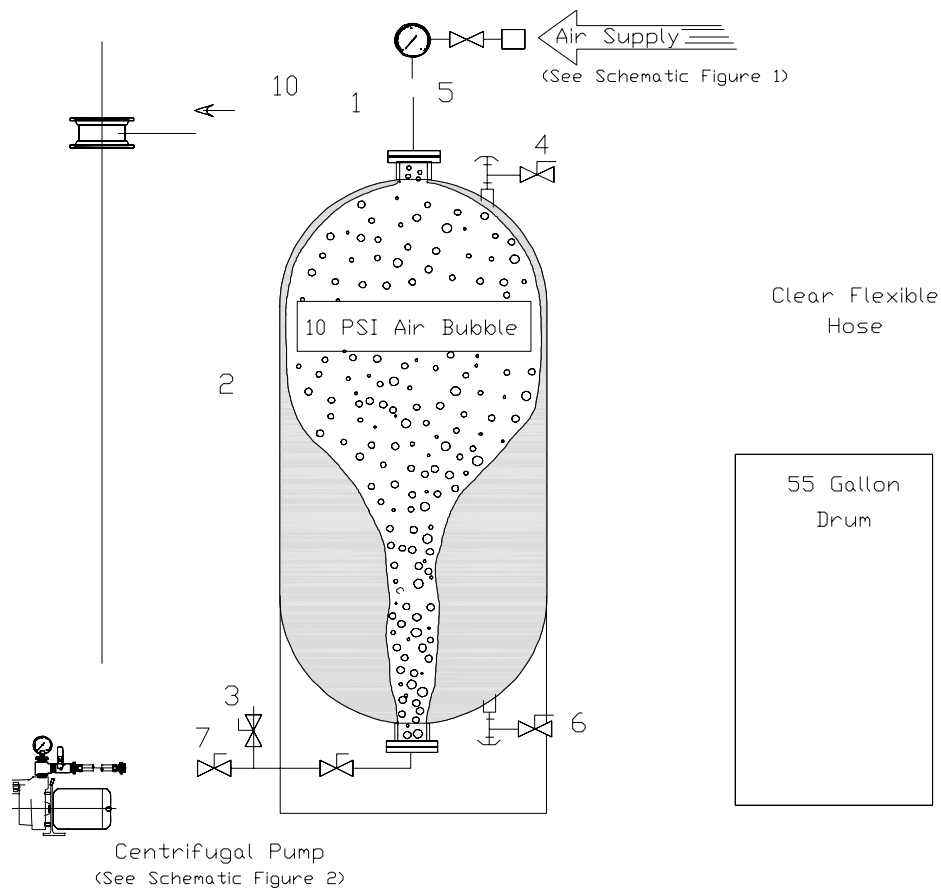


Figure 4

**Step 5:** Connect air source to Valve No.5 (see Figure No.1 and Figure No.4 and fill bladder with air (10 PSI maximum) through Valve No. 5 while displacing water through Valve No. 4. Continue until 25% of the water volume (10% for a horizontal unit) has been displaced.

Water volume is to be measured with the 55 gallon drum.

**Step 6:** When the required water volume has been displaced, close ¼" shut-off valve on the air regulator to trap air inside the bladder, disconnect the air supply, and close Valve No. 4.\* Remove the air regulator.

A 10 PSI air bubble has now been formed within the bladder. This lifts the excess bladder material off the bottom of the vessel, allowing for uniform expansion of the bladder as the concentrate is pumped in.

**Step 7:** Prime and connect the concentrate pumping apparatus (see Figure No. 2 and 4) to Valve No. 7, as shown above. Use a Centrifugal Pump only.

**Step 8:** Remove the water hose from the 55 gallon drum, and terminate to drain.

**Step 9:** Start the concentrate pump, open Valve No. 4, then Valve No. 7, pumping concentrate into bladder.

- *If Valve No. 4 is left open at this point, water will continue to flow out, reducing the pressure in the bladder.*

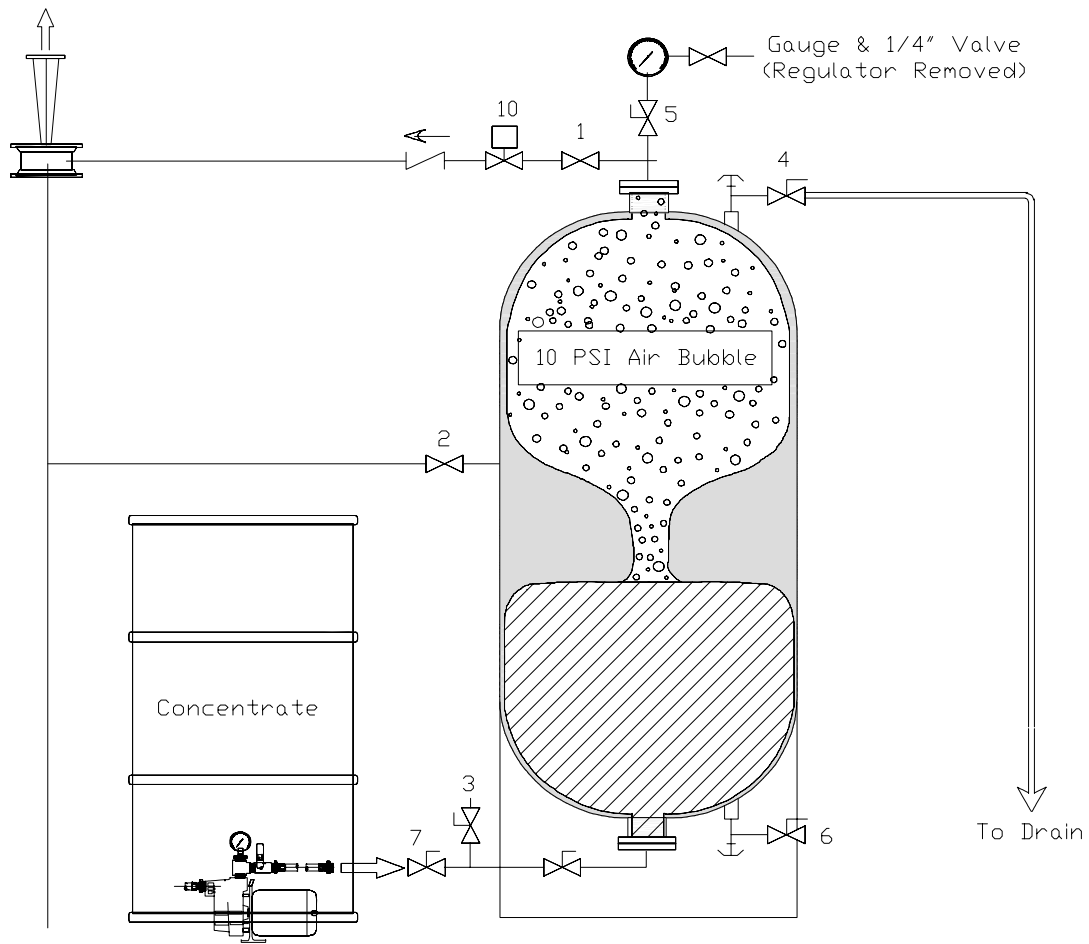


Figure 5

The concentrate displaces the shell water. If tank pressure steadily decreases, it will be necessary to partially close Valve No. 4 to slow down the discharge of water. If tank pressure steadily increases, it will be necessary to partially (or fully) open Valve No. 6 to allow the pressure to drop back to 10 PSI. Slowing the pump discharge will also lower the tank pressure.

When approximately 75% of the nominal charge has been attained, (90% for horizontal tanks), shell water will stop flowing and the tank pressure will begin to exceed 10 PSI.

**Step 10:** Partially open ¼" shut off at Valve No. 5 to vent and slowly allow air pressure to drop to 0 PSI while continuing to pump the concentrate to the rated capacity.

**IMPORTANT:** IF CONCENTRATE OVERFLOWS FROM VALVE NO. 5, DRAIN BACK SEVERAL GALLONS TO ALLOW FOR EXPANSION OF AGENT. FILL ONLY TO RATED CAPACITY! OVERFILLING MAY DAMAGE THE BLADDER!

**Step 11:** Close Valve No. 7, shut off the pump, and remove ¼" valve and gauge assembly from Valve No. 5.

## 10.0 SIGHT GAUGE PROCEDURE

**Step 12:** Open Valve No. 3 (also Valve No.'s 8 and 9, if AFFF), and allow sight gauge to fill. Mark level for future reference. Close sight gauge valves and drain concentrate from tube.

## 11.0 SHELL WATER REFILL PROCEDURE

The installed bladder tank will be either normally pressurized or non-pressurized, depending upon the type of system (wet or deluge), and the piping design. If pressurized (wet pipe), refer to Steps 13-18; if non-pressurized (deluge) refer to Steps 13 and 19-21.

**NOTE: IN SOME DELUGE INSTALLATIONS, THE PIPING DESIGN MAY REQUIRE THE TANK TO BE NORMALLY PRESSURIZED. IF SO, FOLLOW STEPS 13-18. SHOULD THERE BE QUESTIONS CONCERNING WHEN OR HOW TO PRESSURIZE THE TANK, CONTACT THE DESIGN ENGINEER OR VIKING.**

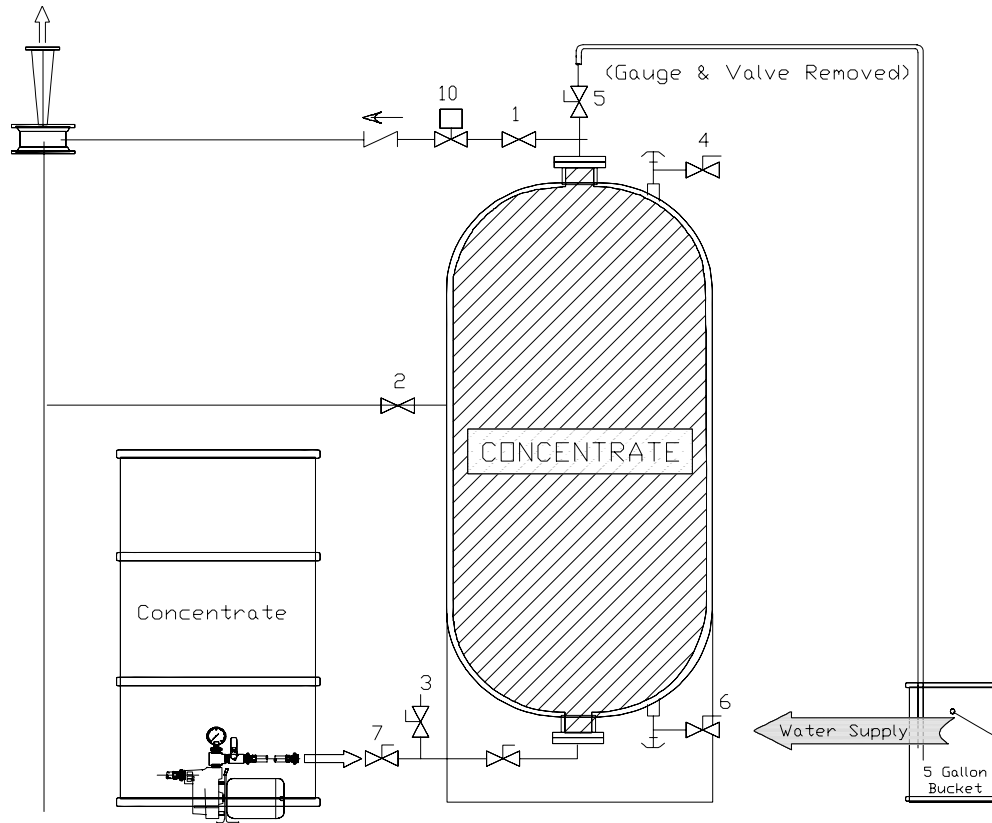


Figure 6

**Step 13:** Attach a water supply hose to Valve No. 6 and the clear flexible hose to Valve No. 5. Terminate the clear hose into a 5 gallon bucket (see Figure No. 6).

### 11.1 NORMALLY PRESSURIZED

**Step 14:** Close all valves except for No. 4 and No. 5.

**Step 15:** Open Valve No. 6 (allowing water into the shell) until water overflows from Valve No. 4 and concentrate overflows from Valve No. 5. Close Valve No.'s 4, 5, and 6.

**Step 16:** Carefully and partially open Valve No. 2 to allow water from the main supply to enter tank and equalize to line pressure. When pressurized, open valve to full.

**VERIFY AUTOMATIC VALVE NO. 10 IS CLOSED!**

**Step 17:** Open Valve No. 1. Place all valves in normal position. Install all lock pins in proper locations (refer to “Valve Descriptions” on pages 5-6).

**Step 18:** Inspect for piping leaks and correct, as necessary.

## 12.2 NORMALLY UN-PRESSURIZED

**Step 19:** Close all valves except for Valve No.’s 4 and 5.

**Step 20:** Open Valve No. 6 (allowing water into shell) until water overflows from Valve No. 4. Close Valve No. 6, then Valve No.’s 4 and 5.

**VERIFY AUTOMATIC VALVE NO. 10 IS CLOSED (IF VALVE NO. 10 IS USED)!**

**Step 21:** Open Valve No.’s 1 and 2.\*

- There should be no water pressure on the tank. Lock all valves in proper locations (refer to “Valve Descriptions” on page 5-6).

## 12.0 CONCENTRATE LEVEL CHECK

### 12.1 AFFF CONCENTRATE LEVEL CHECK (Refer to AFFF Schematic on Page 5)

**Step 1:** Close Valve No.’s 1 and 2 to isolate tank.

**Step 2:** Attach a hose to Valve No. 6 and terminate to drain. Be aware that the tank may be under pressure.

**Step 3:** Open Valve No. 6 carefully to relieve pressure. Once pressure is relieved, fully open Valve No. 6, draining water from the shell, then slowly vent Valve No.’s 4 and 5.

**Step 4:** After the water has completely stopped draining, open Valve No.’s 3, 8, 9, and 11. Observe sight gauge level (Figure 7).

- a. If the level is normal, follow the “Shell Water Refill Procedure” on page 13.
- b. If the level is below normal, add concentrate (per the “Refill Procedure” on page 16), to the desired level. Again, follow the “Shell Water Refill Procedure” on page 13.
- c. Close Valve No.’s 3, 8, 9, and 11. Drain concentrate from the level gauge using drain cock on Valve No. 9.

### 12.2 ARC CONCENTRATE LEVEL CHECK (Refer to ARC Schematic on Page 6)

**Step 1:** Close Valve No.’s 1 and 2 to isolate tank.

**Step 2:** Attach a hose to Valve No. 6 and terminate to drain. Be aware that the tank may be under pressure.

**Step 3:** Open Valve No. 6 carefully to relieve pressure. Once pressure is relieved, fully open Valve No. 6, draining water from the shell, then slowly vent Valve No.’s 4 and 5.

**Step 4:** When water has completely stopped draining, open Valve No.’s 9 and 3. Observe the sight gauge level (because of the thick viscosity of ARC, allow time for level to rise).

- a. If the level is normal, follow the “Shell Water Refill Procedure” on page 13.



- b. If the level is below normal, add concentrate (per the "Refill Procedure" on page 18), to the desired level. Again, follow the "Shell Water Refill Procedure" on page 13.
- c. Drain concentrate from the level gauge by closing Valve No. 9, then slowly open Valve No.'s 7 and 3 (Figure 8).

**Step 5:** After concentrate is completely drained, close Valve No.'s 3 and 7.

**NOTE:** BECAUSE OF THE THICK VISCOSITY OF AR FOAM, THE SIGHT GLASS MAY NOT ACCURATELY MEASURE THE LEVEL. TO DETERMINE THE AMOUNT OF CONCENTRATE INSIDE THE UNIT, CONTINUE TO FOLLOW THE PROCEDURE ON "CONCENTRATE LEVEL CHECK," BUT MEASURE THE AMOUNT OF WATER DRAINED FROM THE SHELL.

**EXAMPLE:** THE DESIGNED CAPACITY OF AN 1800 HORIZONTAL UNIT IS 1800 GALLONS, THE ACTUAL CAPACITY IS 1980 GALLONS. IF 180 GALLONS OF WATER IS DRAINED FROM THE SHELL, 1800 GALLONS OF CONCENTRATE REMAIN. CONSULT VIKING FOR ACTUAL CAPACITIES OF AR UNITS.

## 13.0 REFILL PROCEDURE -

### 13.1 50% OR MORE DISCHARGED

This method is to be used when the tank has been isolated from the system water drained from the shell and 50% or more of the nominal tank volume has been discharged and determined. See page 15 for instructions on concentrate level check.

Refer to page 9 for the schematic on pumping apparatus.

**Step 1:** Close Valves No.1, 2, 3, 6, and 7.

**Step 2:** Fill the tank shell with water through Valve No. 6 until water flows from Valve No. 4 and/or concentrate from Valve No. 5. Close Valve No.'s 5 and 6.

**Step 3:** Proceed with "CCS Filling Procedure" on page 10, Steps 5 through 21.

### 13.2 LESS THAN 50% DISCHARGE

This method is to be used when less than 50% of the nominal tank volume has been discharged and determined. See page 15 for instructions on concentrate level check.

**Step 1:** Close Valve No.'s 1, 2 (isolating the tank from the system), and 3.

**Step 2:** Open Valve No.'s 4, 5, and 6, and fill line master (No. 11 for AFFF units, No. 9 for AR units).

Refer to page 9 for the schematic on pumping apparatus.

**Step 3:** Attach a 3/4" clear flexible hose to Valve No. 5 and terminate into a 5 gallon bucket.

**Step 4:** Prime and connect the pumping apparatus to Valve No. 7. Start the pump, open Valve No. 7, and pump concentrate to the rated capacity.\*

**Step 5:** Refer to "Sight Gauge Procedure" (page 10) and "Shell Water Refill Procedure" on page 13.

### 13.3 AFFF FILL CUP PROCEDURE

This method can be used to add small volumes of AFFF concentrate. It is not recommended for initial filling of the tank or for AR units.

**Step 1:** Close all valves. Slowly open Valve No. 4 to relieve pressure. Open Valve No. 6 to drain.

**Step 2:** Open Valve No.'s 3, 5, 8, 9 and 11. Observe liquid level in sight gauge.

**Step 3:** Add concentrate via fill cup to required level.\*

**Step 4:** Close all valves and proceed to "Shell Water Refill Procedure." Drain sight gauge.

**IMPORTANT! IF CONCENTRATE OVERFLOWS FROM VALVE NO. 5, DRAIN BACK SEVERAL GALLONS TO ALLOW FOR EXPANSION OF AGENT.**

***FILL ONLY TO RATED CAPACITY!***

## **14.0 MAINTENANCE PROCEDURES**

The bladder proportioning system you have purchased has three (3) main components: a carbon steel ASME pressure tank, Buna-N® bladder, and a ratio controller. This simple design requires no outside source of energy, other than water, to proportion foam concentrate.

Despite this basic design, routine inspections, tests, and maintenance should be performed to verify the unit is full and in operating condition. This routine should extend to all the components which make up the fire extinguishing system to verify that all are in working order.

Testing and maintenance of these components is covered in Chapters 6 and 7 of NFPA 11, 16 & 25.

### **14.1 RECOMMENDATIONS FOR MAINTENANCE AND INSPECTIONS**

1. The designated inspector should be a responsible and experienced person with a basic knowledge of fire-equipment and the specific fire protection system.
2. Initial test data information is important for reference points.
3. Proper personnel should be notified of shut down for service. This includes, but is not limited to, area workers, alarm company, underwriters, etc.
4. Before working on a CCS tank or any sprinkler riser components, close the manual concentrate valve (No. 1) and the water pressure valve (No. 2). Be aware that the CCS tank may still be under pressure.
5. Check the general appearance, including name plates and decals, for readability.
6. Inspect for corrosion, leaks, or mechanical damage. Repair and/or repaint where necessary.
7. Verify the concentrate level. Follow the procedure for "Concentrate Level Check" on page 15. If the concentrate is lower than recommended, refer to the Refilling Instructions on page 16.

**NOTE: DRAIN THE SIGHT GAUGE FOLLOWING A LEVEL CHECK.**

While water is draining from the tank, observe for presence of foam concentrate. A small amount of foam is not uncommon. Large amounts of foam or pure concentrate can be a sign that further inspection or maintenance is required. Contact Viking for further instructions.

8. Collect a sample of foam concentrate according to the guidelines per Dyne Technologies.
9. Examine all auxiliary equipment in accordance with the manufacturer's instructions; check the electric or hydraulic isolation valves for operation.

**NOTE:** BECAUSE OF LACK OF USE, VALVES MAY STICK. LUBRICATE WHERE NECESSARY. WHEN VALVES AT CONCENTRATE POINTS LEAK OR DO NOT FULLY CLOSE, CONCENTRATE MAY ESCAPE, AND (ESPECIALLY IF A CHECK VALVE IS NOT INSTALLED) LET WATER ENTER THE FOAM TANK. REFER TO THE SECTION ON FOAM MIGRATION.

10. Refer to "Shell Water Refill Procedure."
11. Verify all valves are in the proper position with pins locked into place (refer to the schematic for "Normal Valve Position"). Spray locking pins with a lubricant such as WD-40®.
12. Notify the proper personnel that the system is back in service.
13. Record the date of the inspection and any service provided.

**NOTE:** BECAUSE OF THE THICK VISCOSITY OF AR FOAM, THE SIGHT GLASS MAY NOT ACCURATELY MEASURE THE LEVEL. TO DETERMINE THE AMOUNT OF CONCENTRATE INSIDE THE UNIT, CONTINUE TO FOLLOW THE PROCEDURE ON "CONCENTRATE LEVEL CHECK", BUT MEASURE THE AMOUNT OF WATER DRAINED FROM THE SHELL.

**EXAMPLE:** THE DESIGNED CAPACITY OF AN 1800 HORIZONTAL UNIT IS 1800 GALLONS, THE ACTUAL CAPACITY IS 1980 GALLONS. IF 180 GALLONS OF WATER IS DRAINED FROM THE SHELL, 1800 GALLONS OF CONCENTRATE REMAIN. CONSULT VIKING FOR ACTUAL CAPACITIES OF AR UNITS.

**NOTE:** DISPOSE OF ALL FOAM SOLUTION DISCHARGED DURING TESTING OR MAINTENANCE IN ACCORDANCE WITH LOCAL CODES AND REGULATIONS. CONTACT VIKING, OR THE CONCENTRATE MANUFACTURER, FOR PRODUCT DATA OR DISPOSAL RECOMMENDATIONS.

## 15.0 INSPECTION OF FOAM CONCENTRATES

As per NFPA 16, inspection of foam concentrates:

Periodic inspection shall be made at least annually of foam concentrates and their containers for excessive sludging or deterioration. Inspection shall include a qualitative test of the foam concentrate normally conducted by the manufacturer.

Eight ounce (8 oz.) samples of foam concentrate should be taken from the top concentrate Valve No.5 on the tank, and from the bottom concentrate drain/fill Valve No.7. Foam samples may be sent to the following address:

Dyne Technologies  
2357 Ventura Drive, Suite 108  
Woodbury, MN 55125  
Tel: 651/917-0644  
Fax: 651/917-0646

E-mail: [jmleedy@dynetechologies.com](mailto:jmleedy@dynetechologies.com)

Dyne Technologies offers three types of foam testing:

1. Foam Concentrate Testing is used to determine whether your undiluted foam concentrate still meets manufacturer specifications, or whether it has degraded in storage.
2. Foam Solution Testing is used to ensure that your foam system is proportioning correctly.
3. On-site Inspection is performed addition to our in-laboratory testing services, Dyne Technologies can arrange for on-site testing, inspection and maintenance of your foam and sprinkler systems through one of our experienced partnering organizations.

**Contact Dyne Technologies for more details.**

**NOTE:** DISCARD CONCENTRATE (PER MANUFACTURER'S RECOMMENDATIONS) IF FOUND DILUTED. CORRECT THE SOURCE OF DILUTION BEFORE REPLACING THE NEW CONCENTRATE INTO TANK. CONSULT VIKING FOR PROCEDURES ON TESTING INTEGRITY OF BLADDER.

## 16.0 BLADDER INTEGRITY TEST

With the schematics for valve descriptions and the air test equipment for your reference, the air integrity test of the bladder is as follows:

1. Isolate the tank from the water system by closing the water supply valve #2 and the concentrate valve #1.
2. Attach a garden hose to water drain valve #6, open, and terminate to the drain.
3. Slowly open water vent valve #4 and concentrate vent valve #5.

**Note:** Continue with the following steps when the water has completely drained.

4. Perform concentrate level check. (Refer to page 15)
5. Thread the air test equipment (see enclosed schematic) to concentrate vent valve #5. Connect an air supply to the air regulator.

**Note:** Important to use 3-lb pressure gauge!

6. Begin filling the bladder with air until pressure gauge reads 1 PSI maximum. Do not be alarmed at the air escap-

ing through valves #4 and #6. This is normal as the bladder expands within the shell. Allow enough time to fill bladder volume with air. Once the bladder has expanded out against the shell, air pressure will begin to build.

7. After reaching the specified pressure, close the air isolation valve on the air test equipment, trapping air within the bladder. Pressure should maintain if there are no holes in the bladder. Pressure may drop several ounces. If so, open the air isolation valve, raising the pressure back to the starting point.
8. If no significant drop in pressure occurs, remove the airline and carefully release air from bladder.
9. If air pressure cannot be maintained within the bladder, please call Viking at 877-384-5464.

The above test is best performed with the foam concentrate drained from the bladder. Since most damage occurs in the upper portions of the bladder, this test will work with the bladder partially filled with concentrate. While draining water from the shell, observe closely to determine if a large quantity of AFFF is present. If this is the case, you may need to contain this solution rather than running it directly down a drain.

**FORM CCS-1**

**Bladder and Hydrostatic Test Procedure - After Installation**

Each new CCS unit shall be tested using the following procedures, A, B, and C, in the sequence, as listed.

Model No.: \_\_\_\_\_ Serial No.: \_\_\_\_\_

Job No.: \_\_\_\_\_

**A. BLADDER INTEGRITY TEST PROCEDURE**

Inspector: \_\_\_\_\_ Date: \_\_\_\_\_

1. Open Valve No.'s 4, 5, 6, 7, and 11.
2. Close Valve No.'s 1, 2, 3, 8, and 9.
3. Fill the shell with water via Valve No. 6 until water flows from Valve No. 4. Close Valve No. 4.
4. Observe for water drain at Valve No. 7 during filling and for a 15 minute period after the shell is full.
5. There shall be no water drain from Valve No. 7.
6. Proceed to test B and C, if no rupture or leak is evident.

**B. HYDROSTATIC TEST PROCEDURE (This procedure is to follow "A" test procedure)**

Inspector: \_\_\_\_\_ Date: \_\_\_\_\_

1. Close all valves. Open Valve No.'s 3 and 5.
2. Fill the bladder with water via Valve No. 7 until water flows from Valve No. 5.
3. Close Valve No.'s 3 and 5.
4. Attach the pressure pump to Valve No. 7 and a suitable pressure gauge to Valve No.'s 4 and 5. Open Valve No.'s 4, 5, and 7.
5. Apply and maintain 263 PSI pressure via Valve No. 7. Close Valve No. 7.
6. Pressure shall be maintained for 30 minutes.
7. There shall be no visible leaks during the 30 minute pressure test.
8. Correct any piping leaks and re-pressure.
9. Close Valve No.'s 4 and 5, remove gauges, and carefully release pressure via Valve No. 4.
10. Open Valve No.'s 3, 5, 6, and 7 to drain water from the tank shell and bladder.

**C. BLADDER AIR TEST (This procedure is to follow "B" test procedure)**

Inspector: \_\_\_\_\_ Date: \_\_\_\_\_

1. Close all valves. Open Valve No.'s 4 and 5.
2. Install 0-3 PSI pressure gauge to Valve No. 5 and connect air hose.
3. Fill bladder with air to 1.5 PSI and hold for 15 minutes.
4. There should be no pressure drop or air loss through Valve No. 4.
5. Close Valve No. 5. Remove air connection and gauge.
6. Relieve pressure through Valve No. 5.

## 17.0 BLADDER REPLACEMENT PROCEDURES FOR CCS UNITS

### 17.1 MATERIALS

- Cotton clothes line
- Large jar of Vaseline®
- Sharp pocket knife
- Appropriate size replaced bladder
- Flashlight
- Drop cloth

### 17.2. VESSEL PLACEMENT

- 17.2.1 Disconnect the vessel from the existing piping system.
- 17.2.2 Remove sight gauge assembly.
- 17.2.3 Place the vessel in a horizontal position with ALL flanged connections easily accessible (vertical vessel has 2 flanged connections, horizontal vessel has 4 flanged connections).

### 17.3. REMOVAL OF DAMAGED BLADDER

- 17.3.1 Remove all flange bolting and flanges
- 17.3.2 CAREFULLY remove plastic support pipes through the open nozzles (1 pipe in vertical vessels, 2 pipes in horizontal vessels).
- NOTE: For horizontal vessels, remove the vertical tube first through the top flange, followed by the horizontal tube through either end flange.
- 17.3.3 Carefully fold over ALL bladder nozzles EXPECT the nozzle where the bladder is to be removed, and push them inside the vessel.
- 17.3.4 Clean an area on the floor or ground large enough to lay down the fully opened bladder without cutting or puncturing it. Place a drop cloth or polyethylene sheet over the clean area to place the bladder on.
- 17.3.5 Reach inside the bladder nozzle (which is still in its original position) as far as possible and grasp the bladder which is inside the vessel and begin pulling it into the nozzle so that the bladder nozzle itself moves free of the vessel. DO NOT PULL ON THE BLADDER NOZZLE. At this point, take both hands and begin squeezing the bladder together and pulling it through the vessel nozzle. Continue this operation until the bladder has been removed from the vessel. USE CARE WHEN REMOVING BLADDER NOZZLES FROM THE VESSEL, remember, DO NOT PULL ON THE BLADDER NOZZLES.

### 17.4. INSERTION OF THE NEW BLADDER

- 17.4.1 Clean an area on the floor or ground large enough for the new bladder to be fully opened up without cutting or puncturing it. Place a drop cloth or polyethylene sheet over the clean area to place the bladder on.
- 17.4.2 Using a pole or long rod, feed sufficient lengths of clothes line to reach from each vessel nozzle (1 nozzle on vertical vessels, 3 nozzles on horizontal vessels) to the vessel nozzle which the bladder will be inserted through, with enough extra line to tie it to the vessel nozzle flange and the appropriate bladder connection.
- 17.4.3 Lay out the new bladder so that the A.I.R. stamp on both end flanges are on the top and parallel with each other. CAUTION: When inserting the bladder, the A.I.R. stamp must be kept in the same orientation to ensure against twisting of the bladder in the vessel (which would cause a failure of the bladder when filling it).

- 17.4.4 Using the line from the vessel nozzle opposite the insertion nozzle, squeeze the bladder together near the bladder nozzle, and wrap the line 3 times and tie it 12" from the bladder nozzle. DO NOT TIE THE LINE ON THE BLADDER NOZZLE. Take the other lines (if working on a horizontal vessel) and tie them to the appropriate nozzles. Again, align A.I.R. stamp located on bladder nozzles for proper orientation.
- 17.4.5 Liberally smear Vaseline® around the inside of ALL vessel nozzles.
- 17.4.6 Station one man by the bladder and another man at the opposite end of the vessel. The man on the bladder end shall carefully fold the first nozzle to a size which will pass through the vessel nozzle, and then begin squeezing the bladder together and PUSHING it into the vessel. For horizontals, insert side nozzle through tank flange, one at a time. Continue this operation until the bladder is in the vessel and the last nozzle is in place. CAUTION: Make sure the A.I.R. stamps are parallel on the bladder and kept in the same orientation during the entire bladder insertion. During this time, the man at the opposite end shall look inside of the vessel using a flashlight to ensure that the bladder is not getting twisted or bunched up, all the while taking up the slack in the line. DO NOT PULL THE LINE, as it may cause damage to the bladder. Remove the lines as necessary. When the final bladder nozzle is moved into place, the A.I.R. stamp orientation should be identical at both ends (if they are not the same, take corrective action).
- 17.4.7 Take the longest plastic support pipe assembly and carefully insert it through the bladder. It may be necessary for one man at the opposite end of the vessel to take his hand and periodically push up on the inside of the bladder if the pipe begins to hang up on it. Then insert the shorter pipe (if working on a horizontal vessel) from the top, down through the cross. Place the PVC support pieces back into original position.
- 17.4.8 Position all vessel flanges and securely bolt them in place. Alternately tighten these bolts to a maximum of 80 foot pounds. Properly tightened, the bladder nozzle should not protrude more than 3/8" beyond the outside diameter of the tank flange.

### **VIKING CONCENTRATE SYSTEM WARRANTY**

LIMITED WARRANTY. Viking products are warranted against defects in material and workmanship solely to original purchasers from Viking. Viking agrees to repair or replace, or to refund the purchase price of, Viking products demonstrated to be defective in material and workmanship for a period of one year from date of shipment, provided that the original buyer provides written notice to Viking within thirty (30) days following discovery of such defect. To demonstrate a defectiveness, products must be sent, along with the written notice to The Viking Corporation, attention Returns Dept., 210 N. Industrial Park Road, Hastings, Michigan 49058. This warranty shall not apply, however, to any Viking products which have been repaired or altered outside of Viking's factory, have been subject to misuse, negligence or accidents, have been incorporated as a part or component of a product or system manufactured by an entity other than Viking, or have been used in a manner contrary to Viking's instructions or recommendations. VIKING SHALL NOT BE LIABLE FOR ANY EXEMPLARY, INCIDENTAL, CONSEQUENTIAL OR SPECIAL DAMAGES RESULTING FROM SUCH DEFECTIVE GOODS, WHETHER BASED UPON CLAIMS OF WARRANTY, CONTRACT OR TORT (INCLUDING NEGLIGENCE).

THIS WARRANTY IS EXPRESSLY MADE IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS. VIKING NEITHER ASSUMES NOR AUTHORIZES ANY ENTITY TO ASSUME FOR IT ANY OTHER OBLIGATION IN CONNECTION WITH ITS PRODUCTS.