

SUPPLEMENTARY PAPER ON TECHNICAL GUIDANCE NOTE 1 (TGN 1) ADDRESSING OVERCOMING NEGATIVE SUCTION CONDITIONS

Option 4: Detailed specifications for installation of header tank or break tank for 20 minutes in a positive suction condition

1. Background

Negative suction condition for fire protection system has been discussed during the Technical Sub Committee (TSC) meeting where TSC has agreed an alternative solution alongside with 03 regulatory requirements to address the negative suction condition of fire pump. The RSC has developed an independent implementation guidance based on the outcome of the discussion, which may aid industry in completing their remediation plan in a timely manner.

3 regulatory requirements are as below-

1. Where the top of the reservoir is accessible, and it has the required structural strength, a listed vertical turbine fire pump may be installed.
2. Where there is an existing below ground reservoir, excavate a pit beside the reservoir such that a horizontal fire pump can be installed beside the reservoir at its lowest level.
3. The installation of an appropriately located water reservoir to facilitate a listed horizontal fire pump to be installed in a positive suction arrangement adjacent to the reservoir.

And alternative solution-

4. Install a header tank or break tank in a positive suction arrangement sized to supply the sprinkler system demand plus the inside hose stream allowance for a period not less than 20 minutes. The remaining required water supply may be in an accepted negative suction arrangement.

This supplementary paper to address and provide the technical specifications and implementation guidance on- "Install a header tank or break tank in a positive suction arrangement sized to supply the sprinkler system demand plus the inside hose stream allowance for a period not less than 20 minutes. The remaining required water supply may be in an accepted negative suction arrangement."

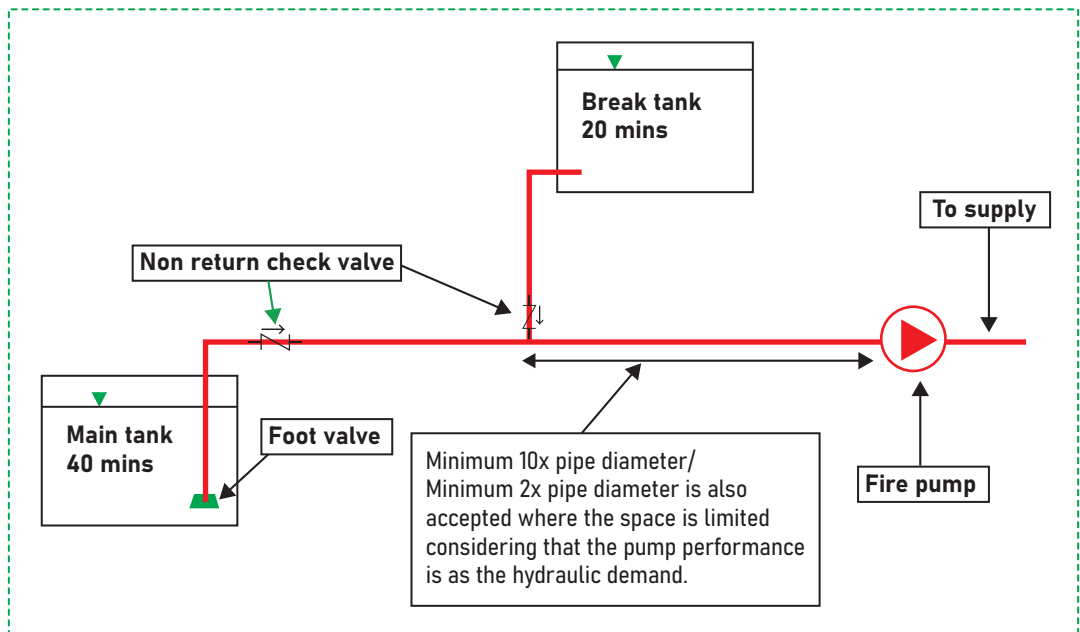
2. Implementation Guidance Note:

- A. All piping size shall be according to NFPA 20 Table 4.26.
- B. According to NFPA 13 Section 8.16.1.1.3; check valves shall be installed in each connection as more than one source of water supplies are being used.



- C. Water level indicators shall be provided in both break tank and main tank.
- D. Autofill mechanism is not required to be incorporated, as the water supply demand for the main tank shall be minimum 40 minutes and for break tanks shall be minimum 20 minutes. Fire pump after running of 20 minutes at initial stage, fluid within the suction pipe will gain the sufficient momentum to overcome negative head without hampering the performance of the fire pump obviously meeting the hydraulic requirement according to NFPA 14.
- E. Fire pumps shall be equipped with automatic air release valves which would prevent the trapped air within the pump column as mentioned in NFPA 20 Section 7.3.5.2.
- F. Proper maintenance procedure for foot valve must be in place to maintain the proper performance of the system.
- G. Verification of structural stability is a pre-requisite depending upon the location of break tanks. A proper review on structural integrity must be in place with accurate load considerations to check the adverse effect of structural load increment concerns. Updated DEA/ design report shall be reviewed by the RSC.
- H. Proper structural design of break tank shall be ensured capable to hold the amount of water equivalent to 20 minutes (effective) supply duration. The structural design of break tank shall be reviewed by the RSC.

3. Schematic diagram:



The minimum water supply demand required for the fire protection system shall be of 60 minutes according to TGN-2. As an alternate acceptable solution, provide minimum 20 minutes durable break tank shall be sized by considering the required capacity of fire pump upon hydraulic demand and remaining minimum 40 minutes durable tank can be in negative suction condition upon the requirement on back calculation. "Inadequate water reservoir size" can also be addressed by incorporating break tank with needed additional water supply duration but not less than 20 minutes.



4. Frequently asked questions:

A. What is accepted negative suction arrangement? Is it accepted if the pressure loss at only the negative part goes beyond -3 psi?

Answer:

As clearly stated, the remaining water supply beyond the required capacity of the break tank can be in Negative Suction. Refer also to NFPA 20 Ch 4, 4.14.3.2

B. In case of break tank would a refill system would be required. If required what shall be the arrangement?

Answer:

A refill mechanism needs to be provided but not auto. As long as there are adequate valve assemblies between connecting feed pipework form Break Tank to Main tank.

C. In case of a system how to control the flow of both tanks, whether there will be a check valve to stop back flow from the break tank to tank in negative suction or foot valve is enough, If only foot valve is there, does it required to monitor the condition of foot valves?

Answer:

Yes Check valves and appropriate valve assemblies shall be provided in accordance with NFPA 13, Ch 8, 8.16.1.1.3(1) (which states where more than one source of water supply then a check valve shall be installed in each connection) also refer to NFPA 14, Ch 6, 6.3.1(1), 6.3.5 for combined Sprinkler & Standpipe systems and NFPA 20 Ch 4, 4.31. The break tank connects directly to the Fire Pump assembly/set it does not feed the existing main tank.

D. In the cases mentioned above, if the break tank is not provided with refill system, the water from the break tank will finish first and the rest of the time air vortex will create. Are Solenoid Valves required?

Answer:

A refill mechanism needs to be provided but not auto. As long as there are adequate valve assemblies between connecting feed pipework form Break Tank to Main tank.

E. In case of negative suction part, does a condition where $NPSH_r > NPSH_a$, acceptable?

Answer:

Yes only at the Negative Suction part of the existing tank, refer to NFPA 20 Ch 4, 4.14.3.2. During the use of the Break Tank $NPSH_a > NPSH_r$ or otherwise cavitation and negative suction shall occur, and this is not acceptable.

F. If pump performance does not satisfy the standard/manufacturer's guideline especially when pump will start taking water from bottom tank (after finishing water from overhead tank) then what shall be our comment? And to maintain the test procedure using both tanks can we permit isolation valve on the pipe in between overhead tank and suction header incorporating interfacing facility with fire alarm system?

Answer:

The pump performance shall meet the manufacturers guidance for the duration of the Break Tank, thereafter as it switches over to the existing tank it will probably not meet the manufacturers performance curves as it goes into Negative Suction.



This shall be acceptable at this point only. Refer to NFPA 20, Ch14,14.2.4 (Certified Pump Curves) and Ch 4, 4.4(FP performance). It shall be necessary to provide valves in accordance with item 3, to prevent backflow or pressure difference between the two interconnected inlets to the pump. Appropriate interfacing and alarms shall also be provided in accordance with the relevant NFPA's and Chapters.

5. References:

NFPA 13, Standard for the Installation of Sprinkler Systems.

NFPA 14, Standard for the Installation of Standpipe and Hose Systems.

NFPA 20, Standard for the Installation of Stationary Pumps for Fire Protection.

NFPA 22, Water Tanks for Private Fire Protection.

NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems.

Technical Guidance Notes for Fire and Building Safety Remediation in Bangladesh

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