MEMORANDUM

(AMENDMENT)

TO: Technical Committee on Fire Pumps

FROM: Chad Duffy, Staff Liaison

DATE: June 15, 2012


At the June 2012 Technical Session, held June 13-14, 2012, NFPA 20 was amended by the acceptance of the following:


In accordance with Section 4.7 of the Regulations Governing Committee Projects, the committee must now be balloted on the Association meeting action. Should the ballot not pass, the wording of that portion of the Report affected by the amendment would return to the text of the previous edition, if any. If there is no previous edition text, the text is simply deleted.

Please review this item, complete the attached ballot, and return it to NFPA as soon as possible, but no later than June 28, 2012. If you disagree or abstain on an amendment please indicate your reason(s) for doing so.

The transcripts from the Annual 2012 Association Technical Meeting (June 13 and June 14) will be available within two weeks at: http://www.nfpa.org/itemDetail.asp?categoryID=1424&itemID=33784

Note: Please remember that the return of ballots and attendance at Committee Meetings is required in accordance with Section 3.1.3.1 of the Regulations Governing Committee Projects.
Comment 20-25 Return a portion of a Report in the form of a proposal and related comments

Final Action: Accept
(4.19.2)

Submitter: Technical Committee on Fire Pumps,
Comment on Proposal No: 20-46, 20-47
Recommendation: Revise as follows:
High Rise Task Group Recommended Committee Comment on Series Pumps

4.19.2 Series Fire Pump Unit Arrangement Pumps Arranged in Series
4.19.2.1* Fire pumps operating in series Except as permitted by 4.19.2.2, all of the pumps that are a part of a series fire pump unit shall be located within the same fire pump room.

A.4.19.2.1 Where pumps are installed in series and are located in the same pump room, the discharge pressure from the second (or third) pump is typically at a pressure that is too high for the outlets on a fire sprinkler or standpipe system on the lower floors of the building. Rather than use this high discharge pressure with pressure reducing valves, it is a common, and accepted practice, to take the fire protection supply from the discharge of the preceding pump through a connection between that pump and subsequent pump(s) as shown in Figure A.4.19.2.1.

Figure A.4.19.2.1 Series Fire Pump Unit with Discharge from First Pump Feeding the Low Zone Fire Protection Systems

4.19.2.2 Pumps that are a part of a series fire pump unit shall be permitted to be located in separate pump rooms when all of the following conditions are met:
(a) Each pump is capable of having a positive pressure at the suction flange at maximum flow in accordance with section 4.14.3.1 even if all preceding pumps fail to start,
(b) The interconnect control wiring between the controllers in different pump rooms complies with Section 4.19.2.9,
(c) The alarms and signals are annunciated in the other pump rooms for all pumps that are a part of the series fire pump unit in accordance with Section 4.19.2.8,
(d) A pump room communication system that complies with Section 4.19.2.9 is provided.

4.19.2.3 No more than three pumps shall be allowed to operate in series as a part of a series fire pump unit.

4.19.2.4 No pump in a series fire pump unit shall be shut down automatically for any condition of suction pressure.

4.19.2.5 No pressure reducing or pressure regulating valves shall be installed between fire pumps arranged in series as a part of a series fire pump unit.

4.19.2.6 The pressure at any point in any pump in a series fire pump unit, with all pumps running at shut off and rated speed at the maximum static suction supply, shall not exceed any pump suction, discharge, or case working pressure rating.

4.19.2.7 Protection of Control Wiring for Series Fire Pump Units
4.19.2.7.1 Interconnect control wiring of fire pumps in series which are not located in the same room and which affects starting of the supply (lower zone) pump(s) shall be protected against fire and physical damage in the same manner as power conductors described in NFPA 70, Article 695.

4.19.2.7.2 The following methods should be considered acceptable:
(1) Be encased in a minimum 50 mm (2 in.) of concrete
(2) Be protected by a fire-rated assembly listed to achieve a minimum fire rating of 2 hours and dedicated to the fire pump circuit(s)
(3) Be a listed electrical circuit protective system with a minimum 2-hour fire rating
(4) Be protected by a listed fire-rated assembly that has a minimum fire rating of 2 hours and contains only emergency alarm and control wiring, circuits dedicated to fire pumps or emergency systems, generators or legally required generators, and no power wiring circuits

4.19.2.7.3 The following audible and visual signals shall be provided in each pump room indicating the status of the associated series pump(s) which is not located in the same pump room.
4.19.2.8 Status Signals for Series Fire Pump Units

4.19.2.8.1 Audible and visual status signals shall be provided in each pump room for each series electric fire pump(s),
(1) Pump running in accordance with paragraph 12.4.3(1)
(2) Control Switch in Off or Manual position in accordance with paragraph 12.4.3(2)
(3) Trouble on controller or engine in accordance with paragraph 12.4.3(3)

4.19.2.8.2 The following audible and visual signals shall be provided in each pump room for each series diesel fire pump(s),
(1) Pump running in accordance with paragraph 10.4.7.2.1
(2) Phase loss in accordance with paragraph 10.4.7.2.2
(3) Phase reversal in accordance with paragraph 10.4.7.2.3
(4) Controller connected to alternate source in accordance with paragraph 10.4.7.2.4
(5) Alternate circuit breaker open or tripped in accordance with 10.8.3.12.1

4.19.2.8.3 The following audible and visual signals shall be provided in each pump room for each series electric fire pump(s),
(1) Pump running in accordance with paragraph 12.4.3.1
(2) Control Switch in Off or Manual position in accordance with paragraph 12.4.3.2
(3) Trouble on controller or engine in accordance with paragraph 12.4.3(3)

4.19.2.8.4 Communications for Series Fire Pump Units

4.19.2.9 A two-way, in-building emergency services communications system in accordance with NFPA 72 shall be provided in each pump room where pumps in series are not located in the same room.

4.19.2.9.1 The communication system shall meet the survivability requirements of NFPA 72.

Substantiation: The term “series fire pump unit” was inserted to consistently use the term that was defined last cycle and refined by Proposal 20-19.

The combination of a flooded suction condition for the second (or even third) pump, even if the first (or second) pump does not start along with improved communication and protected interconnection controls between pumps and controllers in separate pump rooms creates an acceptable condition under which pumps can be located in separate pump rooms, even when they are a part of a series fire pump unit, as long as the communication and circuit protection requirements are followed.
Committee Meeting Action: Accept
Committee Statement: The term “series fire pump unit” was inserted to consistently use the term that was defined last cycle and refined by Proposal 20-19.

The combination of a flooded suction condition for the second (or even third) pump, even if the first (or second) pump does not start along with improved communication and protected interconnection controls between pumps and controllers in separate pump rooms creates an acceptable condition under which pumps can be located in separate pump rooms, even when they are a part of a series fire pump unit, as long as the communication and circuit protection requirements are followed.

This action supersedes the actions taken in proposal 20-46 and 20-47.

Number Eligible to Vote: 32
Ballot Numbers: Affirmative: 28 Negative: 4
Explanation of Negative:
BEALS, J.: The proposed language as written is too restrictive in that fire pumps arranged in series and separated vertically are limited to the water pressures available through the water supply system (defined as a “positive pressure...at maximum flow” in the proposed revision). I do not feel that there is sufficient evidence to support such a limitation. No actual reliability or operational data has been presented to suggest a problem. I would support an option to have a redundant “primary” fire pump arrangement for a fire pump used in series with a second pump not able to comply with the positive pressure requirement.

HAAGENSEN, D.: Acceptance of this Comment will likely lead to frequent use of master pressure reducing valves and zone pressure reducing valves, which this Committee has been opposed to for proper reasons. Property owners in this economy meet the minimum requirements of the standard, not necessarily what is good fire protection. The diagram shows a very good way to start pumps in series without the same problem as single-stage pumps in multiple-zones. However, property owners, in meeting the minimum design requirements, will likely go with a single pump with pressure reducing valves in the lower elevations, as opposed to installing multiple pumps in the suggested (non-required) arrangement.

HAGUID: It is still not clear what problem the committee is attempting to solve with this proposed change. The substantiation for Proposal 20-46 makes reference to only two case studies suggesting problems associated with pumps in series. In both case studies, the fire pumps either did not start or started inadvertently indicating that an inspection or maintenance problem, not a design problem, exists. This committee has made an effort to determine how often fire pumps fail to start or to determine how often pumps in series are used in highrise buildings. Further, no information has been provided by the committee indicating how often the lower level pump in a series pumping arrangement fails to start.

The submitter of proposal 20-46 indicates that previous floor testimony regarding this issue was inaccurate, yet fails to specifically point out what these inaccuracies are. The submitter also claims that the only impact of water filled tanks on the building structure of the upper floors of a highrise building will result in minimal impact: citing that a 30,000 gal. steel tank filled with water weighs 3,000,000 lbs. A 30,000 gallon steel water tank full of water weights approximately 300,000 lbs. a value that is less than 10% of the weight of concrete on one floor. This comparison alone is cause for questioning the accuracy of the statement. An actual comparison was provided by Marinus Both, who reported an actual case on the impact of water storage tanks on the structural design.

Backup Proposal 20-46 and 20-47 to Comment 20-25

20-46 Log #140 Final Action: Accept in Part (4.19.2.1)

Submitter: Gayle Pennel, Aon Fire Protection Engineering
Recommendation: Add new text to read as follows:

4.19.2.1 Fire pumps operating in series and their controllers shall be located within the same fire pump room.

Substantiation:
The requirement for series fire pumps to be in the same room was accepted by the NFPA 20 Committee by a significant margin, but was overturned on floor action at the NFPA Technical Meeting. Much of the discussion centered on the inaccuracy of the four test standpipe pump tests conducted by the committee showing that series fire pumps did not provide 70 psi at the test standpipe. The test standpipe pump tests were considered inaccurate and the committee was instructed to conduct additional tests.

More than any other occupancies, high rise occupants are dependent on the building fire pump to function reliably during a fire. High rise evacuation plans, which can incorporate “refuge floors”, depend on the building automatic and manual fire fighting systems to be fully operational. It is typical that automatic sprinkler systems and standpipes to be integrated into a single system served from one or more fire pumps.

There is some inherent decrease in reliability and increase in operational complexity when pumps operate in series. Vertical staging of fire pumps adds to both the decrease in reliability and the increase in operational complexity. While the concept of reducing pressures by placing pumps on different levels is appealing as a way to lower pressures, with this arrangement, failure of the low zone fire pump would result in the loss of fire protection to all zones supplied. In addition, damage to the higher zone pumps could result in significant protection interruption. There are known instances of the high zone pump failing when the low zone pump failed. The potential for service interruption, damage, and operational, testing and reliability issues override this consideration. Inadvertent operation of the high zone pump when working on the low zone is more likely when the pumps are on different levels.

Placing interdependent pumps on different level increases (not decreases) their susceptability to deliberate harm. This appears counterintuitive, because independent pump located in separate locations do increase reliability. With independent pumps, the system will still function when there is damage to a single location. However, with interdependent pumps located at separate locations damage to either location results in the loss of the system.

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The additional cost of structural improvements required for supporting water tanks has been noted as a reason to allow vertical staging. This additional cost is dubious. A 20,000 sq. ft. slab of 6-inch concrete weights approximately 3,000,000 lbs. A 30,000 gallon steel water tank full of water weighs approximately 290,000 lbs. This is less than 10% of the weight of concrete on one floor. This comparison alone is cause for questioning the accuracy of the statement. An actual comparison was provided by Marinus Both, who reported an actual case on the impact of water storage tanks on the structural design.
The building was the 51 story, Condos & Time Share Units, Planet Hollywood Towers by Westgate in Las Vegas. During construction, and after structural design was completed, the fire department added the requirement of backup water to be located in the tower. Two steel water tanks were added on the roof: One tank had a capacity of 27,800 gallons with a water filled weight of 247,100 lbs. The second tank had a capacity of 4,500 gallons with a water filled weight of 42,500 lbs. The required structural modifications were minimal. On the roof deck, the re-bar sizing was increased, additional re-bar was added, and equipment pads were provided underneath the tanks. This was the extent of the structural changes, and an accurate cost comparison can be made as follows:

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Calculation</th>
<th>Total Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Tank</td>
<td>2 tanks</td>
<td>$50,000</td>
</tr>
<tr>
<td>Water Piping</td>
<td>For both tanks</td>
<td>$15,000</td>
</tr>
<tr>
<td>Additional Structural</td>
<td>Changes</td>
<td>$2,000</td>
</tr>
<tr>
<td>Water Management System</td>
<td>Installation and Start Up</td>
<td>$10,000</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>$87,000</td>
</tr>
</tbody>
</table>

This is now a moot point. With the removal of 350 psi pressure limit for express risers from the current NFPA 14, fire pumps located in the same room can serve the same building height without needing water tanks as vertical staged fire pumps.

5. Requiring series fire pumps in the same room simplifies fire department response and monitoring of the fire pumps.

6. Requiring series fire pumps in the same room simplifies fire pump maintenance and restoring fire pumps to operation in the event of an emergency occurring during maintenance.

7. Requiring series fire pumps in the same room provides higher reliability against an intentional harm event.

8. Requiring series fire pumps in the same room simplifies acceptance testing and maintenance, and allows testing of each zone independently. The complexity of operation is reduced if any cost savings gained by vertical staging of fire pumps by eliminating express risers must be offset by 1) the cost of running a pump test header from the upper level pump to the ground level, 2) the cost of running electrical power to the higher floor, and 3) the loss of rentable space necessary to house the fire pump on the upper level.

4. Requiring series fire pumps increases the discharge pressure on the 2nd (and 3rd) pump over vertical staging, but does not increase reliance on pressure reducing valves. The higher pressures are applied to express risers where pressure reducing valves are not required.

A separate proposal is being submitted to address the potential misinterpretation that prevents feeding a fire pump in a high rise building from a “campus style” distribution loop.

The fire department may need to do more than monitor the fire pumps from a fire alarm control panel. The fire department can tell if the fire pumps are running from the main fire alarm panel once the alarm system is operating correctly. But it cannot tell if the fire pumps are running from the automatic shutdown. The fire pump room to be supervised by personnel when a fire pump is running. It should also be noted that the fire alarm system may not be reporting correctly at the time of commissioning, and that until the alarm system is total verified information presented at the panel may not be accurate.

The city of Chicago requires all fire pumps to be on automatic shutdown. In August 2007, the fire pumps passed an acceptance test. On September 8, 2007, the high zone pump was found operating without the low zone pump. Pumping was shut down at 3:00 PM. The high zone pump was shut down to avoid the fire pump running. With series pumps in the same room water will pass though a non running pump and prevent cavitation of the second pump at churn and low to moderate flows. In addition, if a pump bypass is provided, cavitation will be prevented even at high flows. This is confirmed by both pump manufacturers, and a case history, discussed later in this rational, where the low zone pump to start. In this case history, the fire pumps were in the same room and the high zone pump was not damaged even though it ran without the low zone pump.

Requiring series fire pumps does increase the discharge pressure on the 2nd (and 3rd) pump over vertical staging, but does not increase reliance on pressure reducing valves. The higher pressures are applied to express risers where pressure reducing valves are not required.

9. For an accurate cost comparison, any cost savings gained by vertical staging of fire pumps is counter productive.

5.4.19.2.1 Fire pumps operating in series shall be located within the same fire pump room.

Committee Statement: The phrase “and their controllers” is redundant, since the controller is already required to be in the same room with its pump. The Technical Committee has appointed a Task Group to develop Annex information to address this issue.

Number Eligible to Vote: 30

Ballot Results: Affirmative: 29 Negative: 1

Explanation of Negative:

HAGUE, D.: Action should be Accept in Principle with reference to 20-47, (Log #141).

PENNEL, G.: Although I think the justification submitted for this proposal is adequate, comments questioning the justification should be addressed. Vertical staging of fire pumps is permitted by NFPA 20 and NFPA 14. The vertical staging is not limited to conditions where the lower pump is on the ground floor. There is currently nothing in NFPA 14 or NFPA 20 that would prevent installing a tank and fire pump on the 50th floor of a high rise building, and then vertically staging a fire pump in series on the 80th floor. Redundancy requirements in NFPA 20 must be met, but vertical staging is currently permitted.

While modifying the requirement to allow series fire pumps in different rooms where the second pump will have water even if the first pump does not start, addresses one very real concern, it does not address the issue of monitoring the fire pumps during operation. It is unclear to me why putting series fire pumps in different rooms on the same floor is such a hardship that it deserves special consideration.

Comment on Affirmative:

HAGUE, D.: Action should be Accept in Principle with reference to 20-47, (Log #141).

PENNEL, G.: Although I think the justification submitted for this proposal is adequate, comments questioning the justification should be addressed. Vertical staging of fire pumps is permitted by NFPA 20 and NFPA 14. The vertical staging is not limited to conditions where the lower pump is on the ground floor. There is currently nothing in NFPA 14 or NFPA 20 that would prevent installing a tank and fire pump on the 50th floor of a high rise building, and then vertically staging a fire pump in series on the 80th floor. Redundancy requirements in NFPA 20 must be met, but vertical staging is currently permitted.

While modifying the requirement to allow series fire pumps in different rooms where the second pump will have water even if the first pump does not start, addresses one very real concern, it does not address the issue of monitoring the fire pumps during operation. It is unclear to me why putting series fire pumps in different rooms on the same floor is such a hardship that it deserves special consideration.
2.26 Log #13  
Final Action: Reject  
(4.19.2.1)

Submitter: David R. Hague, Liberty Mutual Commercial Markets  
Comment on Proposal No: 20-46  
Recommendation: Revise text to read as follows:  
A.4.19.2.1 Fire pumps operating in series and their controllers should be located with the same fire pump room.  
Substantiation: This issue was acted on during the previous revision cycle and was ultimately overturned on the floor of the Association Meeting. An appeal to the standards council was not accepted. It is clear that the association membership wishes to allow the vertical staging of series fire pumps to be determined by the registered design professional and the AHJ and not mandated by NFPA 20.  

There still is no technical justification for the change. The substantiation provided in the proposal is anecdotal at best. There are arguments for either configuration and as such, each project should be based on the judgment of the engineering team, building owner and AHJ. Until such time as technical loss data can be presented indicating a problem exists, this proposal should be rejected.  

Committee Meeting Action: Reject  
Committee Statement: The technical committee believes that the pumps in series should be installed in the same pump room to ensure the best possible performance and reliability of the pump system. NFPA 20-25 (Log #CC2) provides some degree of flexibility where there are building limitations that make the installation in the same room impossible.  
Number Eligible to Vote: 32  
Ballot Results: Affirmative: 29 Negative: 3  
Explanation of Negative:  
HAAGENSEN, D.: See my Explanation of Negative on Comment 20-25 (Log #CC2).  
ISMAN, K.: See my Explanation of Negative on Comment 20-25 (Log #CC2).

20-27 Log #32  
Final Action: Accept in Principle  
(4.19.2.1)

Submitter: Kenneth E. Isman, National Fire Sprinkler Association, Inc.  
Comment on Proposal No: 20-46  
Recommendation: Revise the two new sections that were both given section numbers 4.19.2.1 as follows:  
A.4.19.2.1 Fire pumps operating in series.  
Substantiation: First, the committee needs to deal with the fact that it adopted two revisions to section 4.19.2.1 and it does not want to lose either one of them.  
Second, the committee needs to use the term “Series Fire Pump Unit” that it adopted in Proposal 20-19. The whole purpose of this new definition was to help clarify this issue, so the committee needs to use the term in the section where the issue is discussed.  
Committee Meeting Action: Accept in Principle  
Committee Statement: See committee action on 20-25 (Log #CC2).  
Number Eligible to Vote: 32  
Ballot Results: Affirmative: 31 Negative: 1  
Explanation of Negative:  
HAAGENSEN, D.: See my Explanation of Negative on Comment 20-25 (Log #CC2).  

20-28 Log #33  
Final Action: Reject  
(4.19.2.1)

Submitter: Kenneth E. Isman, National Fire Sprinkler Association, Inc.  
Comment on Proposal No: 20-46  
Substantiation: The committee has never addressed the issues we have brought up in our negative ballots in the NOP for this cycle or the ROP and ROC for the previous cycle. While the committee chair has attempted to begin to address the issues in his affirmative ballot, these statements do not appear to be correct given the combination of requirements in NFPA 20 and NFPA 14.  
If the committee is truly concerned with super high rise buildings, they could put this rule in the new Chapter 5 with less push-back from the installation and design community. While the chair may not see the value in clarifying installation rules for other than super high-rise situations where water can get to the second pump in series even if the first pump does not start, the installation and design community see this design option often enough to not want to fight against the requirements of the standard each time it comes up.  
If the committee is aware of an installation technique that is valid and works correctly, they should not specifically outlaw that technique just because they don’t want to take the time to address it.  
This comment was agreed to by the E&S Committee at the April 2011 meeting.  

Committee Meeting Action: Reject  
Committee Statement: The technical committee believes that the pumps in series should be installed in the same pump room to ensure the best possible performance and reliability of the pump system. NFPA 20-25 (Log #CC2) provides some degree of flexibility where there are building limitations that make the installation in the same room impossible.  
Number Eligible to Vote: 32  
Ballot Results: Affirmative: 30 Negative: 2  
Explanation of Negative:  
HAAGENSEN, D.: See my Explanation of Negative on Comment 20-26 (Log #13).  
ISMAN, K.: See my Explanation of Negative on Comment 20-25 (Log #CC2).

20-29 Log #52  
Final Action: Reject  
(4.19.2.1)

Submitter: Terry L. Victor, Tyco/SimplexGrinnell  
Comment on Proposal No: 20-46  
Recommendation: Reject proposal 20-46 (Log #140).  
Substantiation: This proposal contradicts other requirements and allowances related to fire pumps in series. The action taken on proposal 20-19 and the revisions to the definition of a Series Fire Pump Unit makes it clear that pumps in series are only to be considered a “unit” when in the same building. The new annex text explains that campus type water distribution systems do not have to have the pumps in series in the same pump room.  
Proposal 20-46 doesn’t address or allow an exception for campus or plant type arrangements where one or more pumps feed a dedicated underground fire loop and other pumps boost pressure in individual buildings coming off of the loop. There are many other applications where it’s not practical to have pumps in series in the same pump room, including foam water systems and water mist systems.  
This comment is being submitted by the Tyco Codes and Standards Sprinkler Task Group.  

Committee Meeting Action: Reject  
Committee Statement: The technical committee believes that the pumps in series should be installed in the same pump room to ensure the best possible performance and reliability of the pump system. NFPA 20-25 (Log #CC2) provides some degree of flexibility where there are building limitations that make the installation in the same room impossible.  
Number Eligible to Vote: 32  
Ballot Results: Affirmative: 29 Negative: 3  
Explanation of Negative:  
HAAGENSEN, D.: See my Explanation of Negative on Comment 20-26 (Log #13).  
HAGUE, D.: See my Explanation of Negative on Comment 20-25 (Log #CC2).  
ISMAN, K.: See my Explanation of Negative on Comment 20-25 (Log #CC2).