Fire hydrant and System Design, Installation, Commissioning and Testing

VICTORIAN BUILDING AUTHORITY
BUILDING CONFIDENCE

PRACTICE NOTE 38-2018

This updates the previous Practice Note-2014-38 issued June 2014.

Reference to the Building Code of Australia (BCA) in this Practice Note means Volumes One and Two of the National Construction Code Series.

Purpose

The purpose of system design, installation and testing of fire hydrants is to produce a system that is fully functional in any fire situation. Designers, installers, testers and relevant building surveyors (RBS) all play a part in ensuring system performance meets AS 2419.1. The large number of test failures, system faults and interpretation inconsistencies indicate a need for a better understanding of system design, installation and maintenance requirements.

New installations and alterations to existing systems must conform to the Standard and the Building Regulations 2018.

This Practice Note provides further guidance on the design, installation, commissioning and maintenance of fire hydrant installations.

Design and Installation

Fire hydrant systems are required to be installed in accordance with AS 2419.1 by Clause E1.3 of the Building Code of Australia which satisfies Performance Requirement EP1.3.

Pressure at operating hydrants and working pressure are two aspects of AS 2419.1 that require more attention and understanding when hydrant systems are designed.

Pressure at operating hydrants

The minimum residual pressure required at a hydrant outlet when flowing at a rate of 10L/s, measured at operating hydrants, while the required number of hydrants are operating (refer to Clause 2.3 of AS 2419), is set out in Table 2.2 of the Standard. This residual pressure is required to overcome the pressure losses due to the equipment likely to be connected by the local fire authority. exerted

Working pressure

Working pressure is the maximum pressure achieved within the system by the fire authority, the system pumping equipment, or both, when the most hydraulically disadvantaged hydrant or hydrants are operated at the design flow. Refer to Clause 7.1 of the Standard when there is a booster connection installed.

The working pressure of a fire hydrant system should be determined by the system designer, and clearly indicated at the booster connection. The Standards Australia Handbook, SA HB 93, Commissioning of Fire Hydrant Systems, sets out a method of recording design, installation and operating capability information relating to a fire hydrant system.

Commissioning and Testing – New Installations

Section 10 of the Standard sets out the required testing procedures for hydrant systems. The large number of failures that occur when these tests are conducted indicate a need for a better understanding of system design, installation and maintenance requirements.

To achieve compliance with AS 2419.1, all tests as nominated in Section 10 must be satisfactorily carried out. The RBS should ensure that independent testing has been carried out and that compliance with the testing requirements of the Standard is demonstrated, or that the Chief Officer (relevant fire authority) has granted consent under regulation 129 to non-compliance with some or all of the required testing. This must occur before issuing an occupancy permit or certificate of final inspection.

Apart from visual inspection of the installation (hydrant and hose reel location, type and method of installation of pipework and installation adequacy), the following tests are required to confirm system integrity and hydraulic adequacy.

Hydrostatic test

Pipework is required to be hydrostatically tested to the greater of 1700 kPa or 1.5 times the highest working pressure to which the system will be subjected, for a period of at least 2 hours. A number of installations have failed this test, due mainly to inadequate or undersized flanges and thrust blocks, or poor workmanship.

Commissioning (flow) test

This test requires simultaneous discharge of the required number of the most hydraulically disadvantaged hydrants, each at not less than the required outlet pressure and flow, to confirm that the required minimum total flow rate can be achieved. The test results must be adjusted to design pressure conditions in order to check compliance (refer to AS2419.1 Appendix F).

Clause 8.5.10 (Test Facility) requires provision for disposing of test water to a suitable drain. This is important when the system is subjected to full flow testing, nominally every 3 years. Clause 10.3 emphasises the need to dispose of water without damaging private or public property- hydrants installed in buildings or on roofs are often difficult to test without discharging water onto adjacent properties. Fixed drainage systems will reduce the possibility of flood damage.

Booster connection and pump tests

Where a system incorporates a booster or a suction point from static storage, verification of performance is required. Pump pressure and flow tests must be conducted wherever pumps are installed.

Where boosters are connected in series with building pumps which allows for the connection of a fire brigade appliance in series with the inlet connection an additional test is to be undertaken. The most hydraulically disadvantage hydrant shall discharge water at the required. While maintaining the recorded flow rate the system shall be boosted to achieve an additional 300kPa at the hydrant outlet. The pressure on the building pump discharge pressure gauge at this condition shall not exceed the system design operating pressure as displayed at the booster.

The tests are carried out by independent testers, using pumps that adequately simulate the performance of a fire authority pump. Verification that reasonable vehicle access is available will also be required.

These tests also enable confirmation that the maximum friction loss of 150 kPa in the pipework between the booster connection and the most hydraulically disadvantaged hydrant is not exceeded.

Commissioning and testing – Alterations to existing installation

Test criteria for new installations may not be appropriate for an existing installation. Where alterations to an existing installation are carried out, the RBS should ensure that independent testing has been carried out and that it demonstrates compliance with appropriate test criteria, or that the Chief Officer has granted consent under regulation 129 to non-compliance with some or all of the required testing.

This process must be completed before issuing an occupancy permit or certificate of final inspection.

Where a new booster connection is installed, the test criteria applicable to a new system must be applied to the whole system served by the booster connection.

Where an existing booster connection serves new pipework extended from existing pipework, only the new pipework must meet the test criteria applicable to a new system. However, in order to apply these test criteria to the new pipework, some existing pipework may need to be upgraded. *Refer to Appendix 1 -Hydrostatic test*

Notes: *Where operation* dates of legislation overlap, the highest requirements should be applied.

Fabricated junctions occur in both copper and steel pipe systems. Early copper pipe systems used prefabricated joints and later systems were fabricated on-site. Fabricated steel pipe systems were typically above-ground systems and used square elbows.

Where no test duration is specified in the Table above, the time should be sufficient to allow all joints in the system to be inspected and should not be less than 2 hours.

Some sources in the table above use terms such as 'no significant leakage' or 'no leakage'. In practice, it is very difficult to achieve complete water tightness.

However, leaks should be monitored, as they have the potential to affect the maintenance and reliability of the system. Minor leakage that does not affect the performance of the system during a flow test will not impact on operational firefighting. If the rate of leakage increases with time, the source of the leak should be located and repair work carried out before system failure occurs.

If the leakage rate is constant and reduces with a reduction in pressure, the leak is likely to be through a valve bonnet, or similar. In this case, 'topping up' during a test to maintain the pressure is acceptable, provided that the leakage rate is less than 15 L/minute.

If the hydrostatic test criteria applicable at the time of installation cannot be established, an alternative is to determine the working pressure by testing.

Multiply the result by a factor of 1.5 to give a hydrostatic test pressure which provides a 50 per cent safety margin, including an allowance for water hammer.

Maintenance

Fire hydrant systems form part of a building's essential safety measures. They are required to be maintained in accordance with Part 15 of the Building Regulations 2018. Adequate testing and maintenance can highlight design and installation faults, leading to their correction and ensuring that the system is functional and reliable.

Clause 10 of AS 2419.1-2005 sets out details of the flow rate tests to be recorded. The RBS should require systems installed in accordance with this Standard to be maintained in accordance with AS 1851 as applicable at time of installation. All flow and hydrostatic tests should be undertaken in accordance with AS 2419.1 Section 10 (or the equivalent criteria applicable at the time the system was installed), at the recommended intervals.

Although clause 4.2 of AS 2419 requires the source of water supply for fire hydrants to be not less than that necessary to maintain minimum specified flow rates for a duration of not less than 4 hours, it is not uncommon for hydrant systems to be used for a much longer duration. A major fire could result in the hydrant system being in continuous use for a number of days before the fire is brought under control.

The purpose of system design, installation and testing is to produce a system that is fully functional in any fire situation

Further information

Want to know more?

If you have a technical enquiry, please email technicalenquiry@vba.vic.gov.au or call 1300 815 127.

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Appendix One –

Hydrostatic test

Operation dates of legislation	Source	Hydrostatic test pressure requirements – greater of
1 May 2006 to present	AS 2419.1-2005 Published 26 November 2006. Called up in Building Code of Australia 2006.	1700 kPa or 1.5 x highest working pressure for at least 2 hours
1 Nov 1994 to 1 May 2006	AS 2419.1-1994 Published 18 July 1994. Called up in Building Code of Australia 1990, 1996, 2004 and 2005.	1700 kPa or 1.5 x highest working pressure for at least 2 hours.
8 April 1991 to 31 Oct 19941	AS 2419.1-1988 Published 17 June 1988. Called up in Building Code of Australia 1990.	1400 kPa or 1.5 x highest working pressure for 2 hours.
1 Feb 1987 to 1 July 19941	Victoria Water Supply and Sewerage Plumbing Regulations 1986 (S.R. 330/1986)	System with fabricated branch junctions2 - 1700 kPa. Other pipework - 700 kPa or mains pressure.
29 June 1983 to 1 Feb 1987	Melbourne and Metropolitan Board of Works Act 1958 By-Law No. 193: Water Supply (S.R. 116/1983).	System with fabricated branch junctions2 - 1700 kPa. Other pipework - 700 kPa or mains pressure.
Not called up in legislation	AS 2419 - 1980 Published 31 December 1980.	1400 kPa or 400 kPa greater than highest working pressure where the working pressure is greater than 1000 kPa.