NZS 4510:1998

FIRE HYDRANT SYSTEMS FOR BUILDINGS

Superseding NZS 4510:1978

COMMITTEE REPRESENTATION

This Standard was prepared by the Fire Sprinkler Committee (30/1/2) for the Standards Council established under the Standards Act 1988.

The committee consisted of representatives of the following:

Institute of Fire Engineering
Institute of Professional Engineers of New Zealand
Insurance Council of New Zealand
New Zealand Fire Equipment Association
New Zealand Fire Protection Association
New Zealand Fire Service

In addition, three members representing sprinkler design, supplies and insurance broker interests were co-opted onto the Committee.

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AMENDMENTS

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RELATED DOCUMENTS

Reference is made in this Standard to the following:

NEW ZEALAND STANDARDS

NZS/BS 750:1984	Specification for underground fire hydrants and surface box frames and covers
NZS 3404:- - - -	Steel Structures Standard
Part 1:1997	Steel Structures Standard
Part 2:1997	Commentary to the Steel Structures Standard
NZS 3603:1993	Timber Structures Standard
NZS 4203:1992	General structural design and design loadings for buildings
NZS 4219:1983	Seismic resistance of engineering systems in buildings
NZS 4501:1972	Code of practice for the location marking of fire hydrants
NZS 4505:1977	Fire-fighting waterway equipment
NZS 4510:1978	Riser mains for fire service use
NZS 4521:1974	Boxes for fire brigade connections
NZS 4541:1996	Automatic fire sprinkler systems
NZS 4711:1984	Qualification tests for metal-arc welders
NZS 5807:1980	Code of practice for industrial identification by colour, wording or other coding

JOINT AUSTRALIAN/NEW ZEALAND STANDARD

AS/NZS 1221:1997	Fire hose reels

AUSTRALIAN STANDARDS

AS 1101.5:- - - -	Graphical symbols for general engineering
Part 5:1984	Piping, ducting and mechanical services for buildings
AS 1939:1990	Degrees of protection provided by enclosures for electrical equipment (IP Code)
SAA HB20:1996	Graphical symbols for fire protection drawings

INTERNATIONAL STANDARD

AS/NZS ISO 9000:- - - -	Quality management and quality assurance standards

AMERICAN STANDARD

ASTM A312/A312M Rev A 1995	Seamless and welded austenitic stainless steel pipes

BRITISH STANDARDS

BS EN 837-1:1998	Bourdon tube pressure gauge dimensions, metrology requirements and testing
BS 1387:1985	Screwed and socketed steel tubes and tubulars and for plain end steel tubes suitable for welding or for screwing to BS 21 pipe threads
BS 2971:1991	Class II arc welding of carbon steel pipework for carrying fluids
BS 3600:1997	Dimensions and masses per unit length of welded and seamless steel pipes and tubes for pressure purposes

GERMAN STANDARD

DIN 16005:1995	General purpose pressure gauges with elastic pressure response elements; requirements and testing

OTHER PUBLICATIONS

New Zealand Fire Service, Region 1. Interim Code of Practice for Charged Riser Compliance 1990.

NEW ZEALAND LEGISLATION

Building Act 1991
Building Regulations 1992
Electricity Regulations 1997
Fire Service Act 1975
Hazardous Substances and New Organisms Act 1996

The users of this Standard should ensure that their copies of the above-mentioned New Zealand Standards or of overseas Standards approved as suitable for use in New Zealand are the latest revisions or include the latest amendments. Such amendments are listed in the annual Standards New Zealand *Catalogue* which is supplemented by lists contained in the monthly magazine *Standards* issued free of charge to committee and subscribing members of Standards New Zealand.

REVIEW OF STANDARDS

Suggestions for improvement of this Standard will be welcomed. They should be sent to the Chief Executive, Standards New Zealand, Private Bag 2439, Wellington 6020.

FOREWORD

NZS 4510:1998 *Fire hydrant systems for buildings*, supersedes NZS 4510:1978 *Code of practice for riser mains for fire service use.*

The purpose of this Standard is to set out minimum technical and performance requirements for fire hydrant systems installed in buildings. Hydrant systems are primarily for Fire Service use when attending and dealing with fire emergencies in buildings.

The change in title reflects the fact that low rise buildings with very large plan areas as well as multi-storeyed buildings may require internal hydrant systems in order to allow the Fire Service to operate efficiently.

There are several new concepts incorporated in this Standard reflecting a decision to revise the previous Standard from a zero based perspective.

The performance criteria in terms of flow and pressure requirements at each outlet have been determined by field testing by Fire Service operational staff conducted according to procedures determined by the Standards New Zealand technical project committee. A variety of hose streams using standard Fire Service equipment were investigated leading to the selection of a minimum outlet pressure of 600 kPa and a minimum flow rate per hose stream of 440 L/min.

The requirement concerning the number of simultaneous hose streams was developed to allow for Fire Service standard tactics when making an interior attack. In multi-storeyed buildings the calculated number of hose streams must be able to be provided simultaneously on at least two floors. It does not preclude a fire involving fire attack on more than two floors. Overseas there have been several such instances. Two floors was considered a reasonable compromise taking into account international advice, the other fire safety features found in most New Zealand buildings, and the ongoing testing and maintenance requirements of the Standard. However, some requirements have been included to avoid excessive pressure loss being designed into the system, should large flows be required.

Although an adequate water supply is necessary, the Standard does not require a water supply sufficient for firefighting to be permanently piped to the hydrant system. Since the purpose of the hydrant system is to provide for Fire Service use, it is assumed that as with any other building, the Fire Service will, on arrival, access the available water supply and couple-in to the riser system. However, in some industrial buildings for example the owner may opt to provide a permanently piped supply for use by a private fire brigade. The Standard permits this and provides appropriate criteria.

All fire hydrant systems within buildings complying with this Standard are required to be charged and pressurized with water and maintained in this condition. It is hoped that this will resolve previous serious integrity problems of the former "dry riser" systems.

On multi-storeyed buildings where the combination of pressure loss due to height (static) and friction means that Fire Service pumps cannot provide the performance criteria pressure at the highest outlet, booster pumps are required. The Standard provides for the National Commander of the Fire Service to declare the highest Fire Service pumping pressure to be used in calculating whether pumps are necessary.

Particular attention has been given to the problem of pressure control at the various levels within multi-storeyed buildings. It is important that firefighters are not confronted with excessively high pressures. Requirements have been included concerning the setting, calibration and testing of pressure control valves in an effort to overcome very serious problems that have arisen in overseas fires as a result of incorrectly set valves.

The Standard provides incentives to recognize the advantages (in terms of firefighter safety and operational efficiency) of locating outlets in multi-storeyed buildings within a protected lobby. Location within stairtowers, while permissible, creates congestion in a fire and reduces the effective reach of standard length hose lines because of the need to base the fire attack from the landing below.

Internal fire hydrant systems need to be operational during both construction and demolition periods – both activities providing a heightened risk of fire. The Standard specifies that during construction, the hydrant system must be enlivened progressively (including pumps, if required) as construction advances. New requirements to better mark the location of the Fire Service inlet during construction/ maintenance periods have been added.

The Standard includes a "means of compliance" section for hydrant systems designed to and previously approved to earlier codes. Subject to specific approval, such systems can be deemed to comply with this Standard if certain critical criteria are met even although matters of detail do not comply.

Previous problems concerning the commissioning and on-going testing and maintenance of hydrant systems have been addressed. Each hydrant system is required to be subject to a maintenance contract in order to retain compliance with the Standard. The requirements of the Building Act regarding compliance schedules and warrants of fitness have been recognized.

The correct operation and function of these systems during a fire may be of critical importance to firefighting safety, the Standard therefore assumes that the authority having jurisdiction, the designer and the contractor installing the system have appropriate technical competencies and experience. A list of these attributes is provided in the Standard for information. On certain matters consultation with the New Zealand Fire Service at the design stage is mandatory as is notification of planned impairments during the operating life of the system.

The terms "normative" and "informative" are used in this Standard to define the application of the appendix to which they apply. A "normative" appendix is an integral part of a Standard, whereas an "informative" appendix is only for information and guidance.

NEW ZEALAND STANDARD

FIRE HYDRANT SYSTEMS FOR BUILDINGS

1 GENERAL

1.1 Scope

1.1.1
This Standard specifies requirements for the design, installation, commissioning and testing of fire hydrant systems within buildings.

1.1.2
The system shall allow water supplied by Fire Service pumping appliances to the inlet to be reticulated to outlets within the building and spaced to facilitate and ensure reasonable safety for Fire Service operations. Where the pressure available from Fire Service pumps is not able to deliver the nominated flows at the outlets within the permitted pressure ranges, pumps and or pressure control devices are required as part of the system.

1.1.3
The type of system shall, unless otherwise approved by the authority having jurisdiction, be a wet-pipe system, charged and pressurized with water to ensure the integrity of the system and maintained in this condition. The water supply for firefighting shall be supplied by the Fire Service through the Fire Service Inlet.

1.1.4
An optional secondary purpose which may be required by the owner, is the reticulation of firefighting water for use by staff, prior to the arrival of the Fire Service. In such cases, the hydrant system may be supplied with a permanently connected pressurized water source sufficient to allow staff to establish hose streams direct from the hydrant system outlets. Use of this secondary option must not diminish the objective.

1.1.5
Fire hydrant systems complying with this Standard are suited to firefighting operations using either uncontrolled or manually controlled branches.

1.1.6
Systems designed to this Standard are not suitable for the use of automatic branches i.e. those which optimize flow rate in order to maintain a constant nozzle pressure.

1.2 Objective

The objective of this Standard is to provide specifiers, users, manufacturers, suppliers, installers and maintenance persons with requirements and guidance to assist in the design, construction and maintenance of a fire hydrant system for a building, that will facilitate Fire Service firefighting operations within the building during construction, normal operation and demolition.

1.3 Definitions

1.3.1
For the purposes of this Standard the following definitions shall apply:

APPROVED. Approved by the authority having jurisdiction, except where specifically stated otherwise, in respect of the design criteria and other matters pertaining to an individual fire hydrant system.

AUTHORITY HAVING JURISDICTION. A regulatory authority having statutory powers or responsibility for determining conformance of the hydrant system, including components or design details thereof, and technical competence to make judgment of such matters, and, any individual being independent of the owner, designer and installer and having contractual responsibility to determine compliance and the necessary technical competence and experience for doing so.

APPROVED CONTRACTOR. A Company deemed by the authority having jurisdiction to be sufficiently competent for the purposes of correctly carrying on design, fabrication installation, testing and maintenance of fire hydrant systems to this Standard. Guidelines for the evaluation of contractors by the authority having jurisdiction are given in Appendix A.

DESIGN ENGINEER. A person who, on the basis of experience or qualifications, and by virtue of their fundamental education and training, is competent to design the system elements of the building under consideration by applying scientific methods in the solution of engineering problems associated with fire hydrant systems.

FIRE HYDRANT. An assembly usually contained in a pit or box below ground level and comprising a valve and outlet connection from a water supply main to permit a controlled supply of water for firefighting.

FIRE REGION. Is a geographical area of New Zealand established as such pursuant to the Fire Service Act.

FIRE REGION COMMANDER. The officer of the New Zealand Fire Service appointed to be in charge of the Fire Region in which is located the fire hydrant system, and includes any other officers specifically delegated by the Fire Region Commander to fulfill the functions of the Fire Region Commander in respect of this Standard.

FIRE RESISTANCE RATING (FRR). The term used to classify fire resistance of primary and secondary elements as determined in the standard test for fire resistance, or in accordance with a specific calculation method verified by experimental data from standard fire resistance tests. It comprises 3 numbers giving the time in minutes for which each of the criteria; stability, integrity, and insulation are satisfied, and is presented always in that order.

FIRE SERVICE INLET (FSI). An exterior assembly connected to the hydrant system through pipework and comprising male hose couplings and clapper valves, for the purposes of allowing the Fire Service to pump water into the hydrant system.

LANDING VALVE. An assembly comprising a single valve and outlet connection from a wet or dry riser.

LISTED. In respect to items of equipment, means listed by any of the following organizations in respect of the intended service: Insurance Council of New Zealand, Underwriters Laboratories, Factory Mutual, provided that the item complies in all other respects with this Standard.

NATIONAL COMMANDER. Means the National Commander of the New Zealand Fire Service appointed pursuant to the Fire Service Act.

OUTLET ASSEMBLY. An assembly connected to the landing valve outlet comprising 2 valves each with female hose couplings and related appurtenances (including an enclosure where provided) to allow water to be supplied from the hydrant system through Fire Service hoses.

PROTECTED LOBBY. An enclosed part of a floor of plan area at least 6 m^2 and no dimension less than 2 m, directly accessible from a stairtower with all elements having a fire resistance rating of 60/60/60 and with access doors self-closing and of the same fire resistance rating as the enclosure.

RATIO VALVE. A form of pressure reducing valve in which the ratio between the inlet and outlet pressures is fixed irrespective of flow.

RISER MAIN, DRY. A vertical pipe installed in a building for firefighting purposes, fitted with inlet connections at fire brigade access level and landing valves at specified points, which is normally dry but is capable of being charged with water usually by pumping from Fire Service appliances.

RISER MAIN, WET. A vertical pipe installed in a building for firefighting purposes and permanently charged with water from a pressurized supply sufficient for firefighting, and fitted with landing valves at specified points.

1.3.2
For the purposes of this Standard the word "shall" refers to practices that are mandatory for compliance with this Standard, while the word "should" refers to practices which are advised or recommended.

2 GENERAL REQUIREMENTS

2.1 Approval of fire hydrant system

A fire hydrant system shall be deemed to conform to this Standard when:

(a) The system has, in the case of a new system or extension to an existing system, been installed by an approved contractor and the contractor has submitted an application for its approval to the authority having jurisdiction. In the case of an existing system whereby approval is sought in accordance with 2.5, application for approval has been submitted by an approved contractor to the authority having jurisdiction.

(b) The technical requirements of the Standard are met;

(c) There exists to the satisfaction of the authority having jurisdiction, a testing and maintenance contract with an approved contractor;

(d) The authority having jurisdiction has approved the system and such approval remains in force.

2.2 Materials

2.2.1 *General*

2.2.1.1
All materials used in a new fire hydrant system or in any extension or alteration, shall be new, of a quality fit for the purpose, conform to the relevant requirements of this Standard, and be free from defects. The materials shall be appropriate to the environment and rated for the maximum pressure range. In marine or other corrosive environments application may be made for listing of materials other than those used in this Standard. The listing shall stipulate pressure ratings and jointing systems and any applicable Standards.

2.2.1.2
Pipework shall consist of the following materials:

(a) Mild steel – either black or galvanized and manufactured to a pressure tubing Standard;

(b) Copper;

(c) Stainless steel.

2.2.1.3
The pipework materials shall conform to the following requirements concerning standard of manufacture, pressure rating and method of jointing.

2.2.2 *Pipework materials*

2.2.2.1
Hydrant systems used to supply hose reels, shall not be reticulated in black steel piping or fittings. In systems containing a booster pump, the pipework on the upstream side of the pump cooling water discharge shall not be of black steel.

2.2.2.2
Pipework materials shall conform to:

(a) Mild Steel

(i) Piping to BS 1387 shall not exceed working pressures set out in table 1. Acceptable methods of jointing are:

(A) Lightweight piping: welded flange; mechanical coupling.

(B) Medium or heavy weight piping: screwed and socketed; welded flange; mechanical coupling.

(C) Flanges and mechanical couplings shall have a test pressure rating of 1.5 times the maximum working pressure but not less than 1500 kPa.

Table 1 – Maximum working pressures of pipes to BS 1387

Nominal bore (mm)	Piping weight and jointing method: Welded flange or mechanical coupling			Screwed and socketed	
	Light (kPa)	**Medium** (kPa)	**Heavy** (kPa)	**Medium** (kPa)	**Heavy** (kPa)
15	–	8700	10700	4500	6200
20	–	7000	8500	3500	5100
25	–	6800	8500	3400	5100
32	–	5400	7600	2700	4000
40	–	4700	5900	2400	3500
50	3600	4300	5300	2400	3400
65	3200	3400	4200	1900	2700
80	2700	3200	3800	1900	2600
100	2400	2800	3300	1800	2300
150	–	2100	2300	1400	1700

(ii) The working pressure rating of carbon steel piping manufacture to other BS, AS or ASTM pressure tubing standards shall be calculated using the following equation to provide a safety factor of 8:

$$P_w = \frac{f \times 2t}{8 \times D_o} \qquad \text{(Eq. 1)}$$

where

P_w is the working pressure rating (kPa)
f is the stress (kPa) as specified in the manufacturing Standard
t is the tubing thickness (mm);
D_o is the outside diameter (mm).

Piping shall be jointed using welded flanges or mechanical couplings with a working pressure rating at least 1.5 times the maximum working pressure to which they will be subject, but not less than 1500 kPa.

(iii) Black steel piping shall have at least one coat of priming paint.

(iv) Where galvanized piping is required, it shall be hot dipped.

(b) Copper

(i) Copper piping shall be manufactured to conform to either ASTM, BS or New Zealand pressure tubing Standards and shall be jointed using brazed fittings.

(ii) The working pressure rating of the piping shall be calculated by dividing the theoretical bursting pressure by 6 but shall not be less than 1500 kPa.

(iii) Fittings shall have a working pressure rating at least 1.3 times the highest working pressure to which the fittings will be subject, but not less than 1500 kPa.

(c) Stainless steel

(i) Stainless steel piping shall be manufactured to ASTM pressure tubing Standards.

(ii) All sizes shall be jointed with welded flanges suitable for the working pressures involved.

(iii) Welding shall be post heat treated as required by ASTM A312 for the grade of steel concerned.

(iv) Working pressure rating of piping shall be calculated by dividing the theoretical bursting pressure by 4 but shall not be less than 1500 kPa. Flanges shall have a working pressure rating at least 1.2 times the highest working pressure to which the flange will be subject but not less than 1500 kPa.

2.2.2.3
All welding on steel piping shall comply with the requirements of BS 2971 for Class 2 operating conditions. The provision in BS 2971 to allow alternative joint preparation is permitted by this Standard whether or not there is a specific agreement between the contracting parties, provided that for butt welded piping there is adequate weld penetration.

2.2.2.4
All welds shall be completed by welders holding current certification in terms of NZS 4711 for the type of welding employed.

2.2.2.5
Piping supports shall be ferrous or copper alloy. Dissimilar metals shall be separated by an insulating material to prevent corrosion.

2.2.2.6
Piping supports and their fixings shall conform to NZS 4203 and 2.3 of this Standard. Vertical hydrant mains should generally be supported from main structural elements of the building rather than floor membranes.

2.2.2.7
Explosive driven fasteners shall not be used.

2.3 Seismic resistance

2.3.1 *General*
All components of the hydrant system shall be designed, detailed and installed so as to remain functional at the earthquake loadings specified in NZS 4203 having regard to the seismic design of the building elements which support, or are connected to the system.

NOTE –

(1) In new buildings the seismic design of the system should be developed in conjunction with that of the building.

(2) Design examples are set out in NZS 4219.

2.3.2 *Equipment*
Adequate horizontal restraint shall be provided for all heavy components e.g. pumps, tanks, valves, engines and batteries, and ensure that connections to the plant are secure in accordance with NZS 4219.

2.3.3 *Pipework*

The system pipework shall be supported to resist seismic loads by either:

(a) A complete piping support system based on a dynamic seismic analysis such that the pipework system performance shall be at least equal to that of the building structure under the earthquake loadings of NZS 4203; or

(b) A piping support system which shall comply with the requirements of 2.3.4 to 2.3.9 inclusive.

NOTE – The design of the support system to resist seismic loads on pipework is based on the following principles:

(a) Lateral supports are of sufficient stiffness to force piping to move with the immediate support structure.

(b) Lateral supports are spaced to limit piping deflections under resonating dynamic load such that piping joints and intermediate vertical supports are not over-stressed.

(c) Lateral supports are ductile and fixings designed over-strength.

(d) Stresses due to differential movements of building structures are minimized through the use of piping flexibility or clearances.

2.3.4 *Pipework support*

2.3.4.1

All supports shall be designed to resist repeated forces due to seismic acceleration of 1.0 g acting on the mass of the pipework in any direction in addition to the gravity force.

NOTE – This load which may be greater than the requirements of NZS 4203, and may increase the support size but it eliminates the need for a more detailed study.

2.3.4.2

All fixings in materials which fail in a brittle manner, such as concrete or timber, shall have a safety factor of not less than 2.

NOTE – The pipework lateral supports are detailed for limited ductility and over-strength is required in fixings to prevent brittle failure at loadings greater than the design earthquake.

2.3.5 *Flexibility*

2.3.5.1

Pipework shall have sufficient flexibility to prevent over-stressing of pipes, hangers and braces in an earthquake. Flexibility shall be provided in the X, Y, and Z axes at structural separations.

NOTE – A swing joint able to take movements of ±100 mm is shown in figure 1.

2.3.5.2

Sufficient flexibility shall be provided in the main waterway to allow for ±80 mm horizontal movement per 4 m of height of the building. Where piping crosses structural separation an allowance for relative horizontal movement is required of either ±160 mm per 4 m of height of the structural separation, or the building design movement where known. Where the main waterway passes through more than one floor and is more than 1 m from a column, or structural shear wall either the form of the fixing, or the pipework flexibility, shall allow for differential movement between floors.

2.3.5.3

Flexibility shall be achieved through piping flexibility or by the use of flexible couplings of the mechanically housed type providing axial and lateral pipe connection which is equivalent to the piping strength.

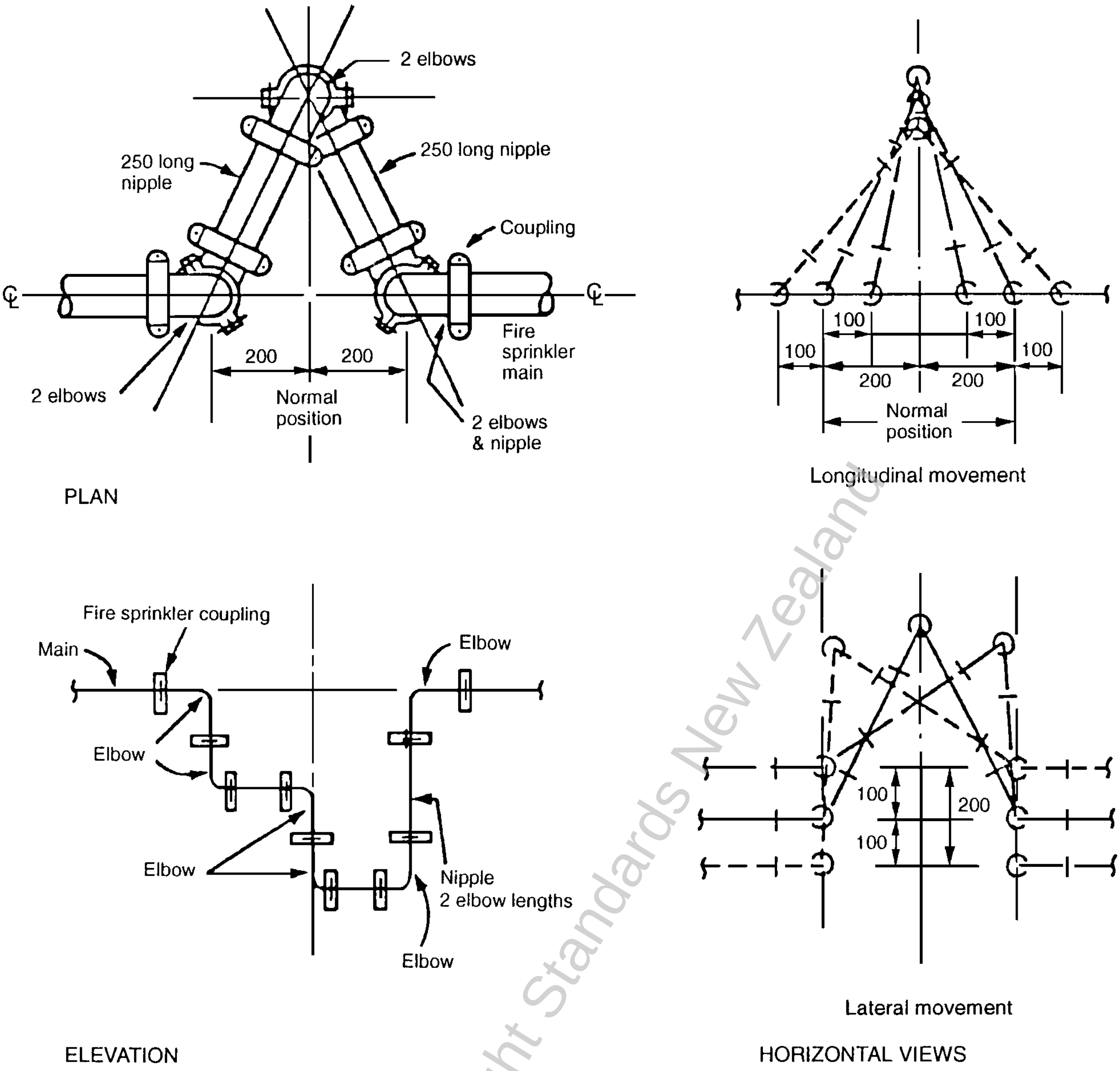


Figure 1 – Seismic flexible joint

2.3.5.4
Thin-walled metal expansion bellows type couplings may be used only where:

(a) The ends of the piping being connected are fixed to the structure; and

(b) The rating of the bellows allows for 150 % of the anticipated differential movement in all directions.

2.3.5.5
Rubber couplings are not acceptable.

2.3.5.6
Flexible couplings shall be provided within 600 mm to 900 mm of non-structural concrete or masonry walls to which pipework is rigidly fixed, or alternatively ensure adequate piping flexibility. This requirement shall also apply to sections of pipework attached to different parts of a building that may respond differently in an earthquake, e.g. between a wall and a roof or between basement walls and the ground.

2.3.6 *Bracing – general requirements*

2.3.6.1
The requirements of this section apply to steel pipework only. Bracing shall be provided to restrain pipework under seismic load. Hangers not longer than 150 mm can be used for lateral bracing and, if clamped tightly to the pipe for longitudinal bracing, provided that in both cases the hangers will not break or detach under the seismic load.

2.3.6.2
Bracing shall be positioned and aligned in conjunction with flexible couplings such that no bracing is subject to seismic load from pipework outside its immediate vicinity. Typical locations of pipework bracing within a building are shown in figure 2.

NOTE – Piping hangers that do not provide lateral restraint are not braces.

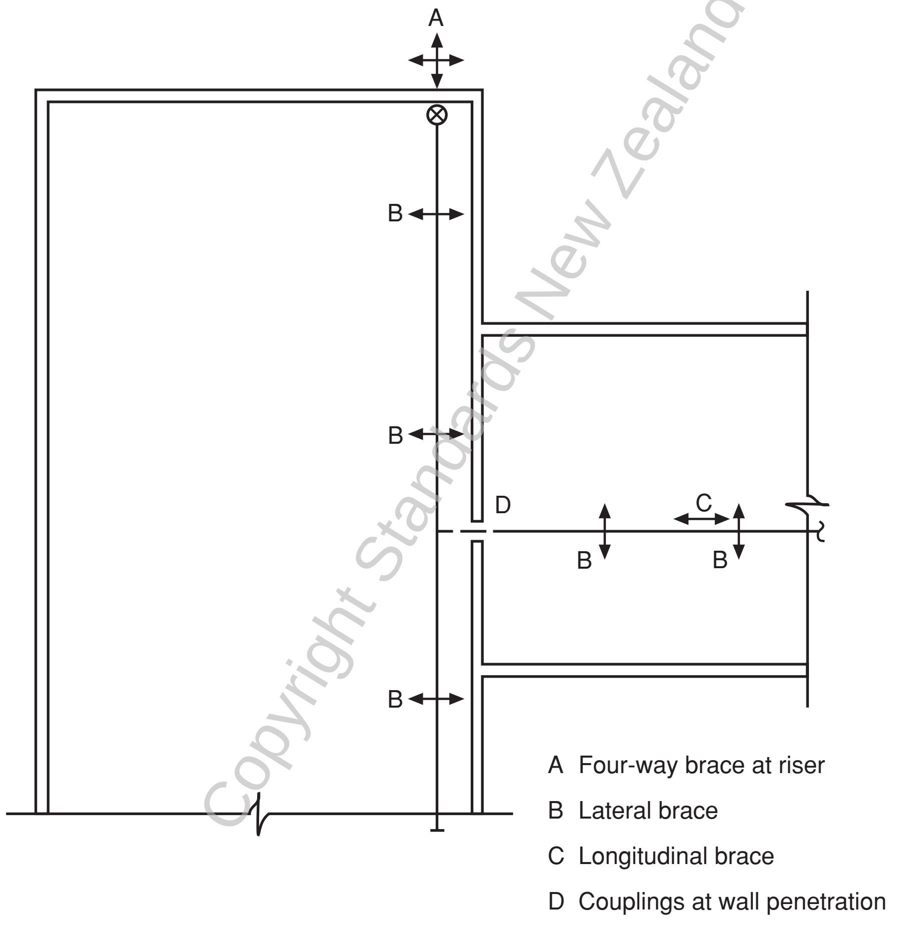


Figure 2 – Location of pipework bracing

2.3.7 *Bracing – specific requirements*

2.3.7.1
Piping in the main waterway, including those supplying a particular outlet zone, shall be provided with bracing as follows:

(a) Laterally at less than 1.2 m from unrestrained ends;

(b) Laterally at a maximum spacing of 6 m;

(c) Laterally within 600 mm of a flexible coupling (on at least one side);

(d) Laterally within 600 mm of both sides of a swing joint crossing a structural separation;

(e) Which includes at least one longitudinal brace.

2.3.7.2

A branch pipe connected to the main waterway can provide the required longitudinal restraint provided the branch pipe is of equal or larger size and is laterally restrained within 600 mm of the branch connection.

2.3.7.3

Tension/compression braces shall be at an angle to the vertical of not less than 30º. Acceptable types of bracing are shown in figure 3. The following shall also apply:

(a) The slenderness ratio L/r of compression braces shall not exceed 200

where

L is the length of brace
r is the radius of gyration of brace.

(b) The maximum horizontal loads that can be resisted by compression braces at various brace angles are shown in table 2.

NOTE – For a seismic acceleration of 1.0 g the required restraining force F_p is given by:

$F_p = W_p \times 0.00981 \times L_p$ (kN)

where

L_p is the length of piping under restraint.

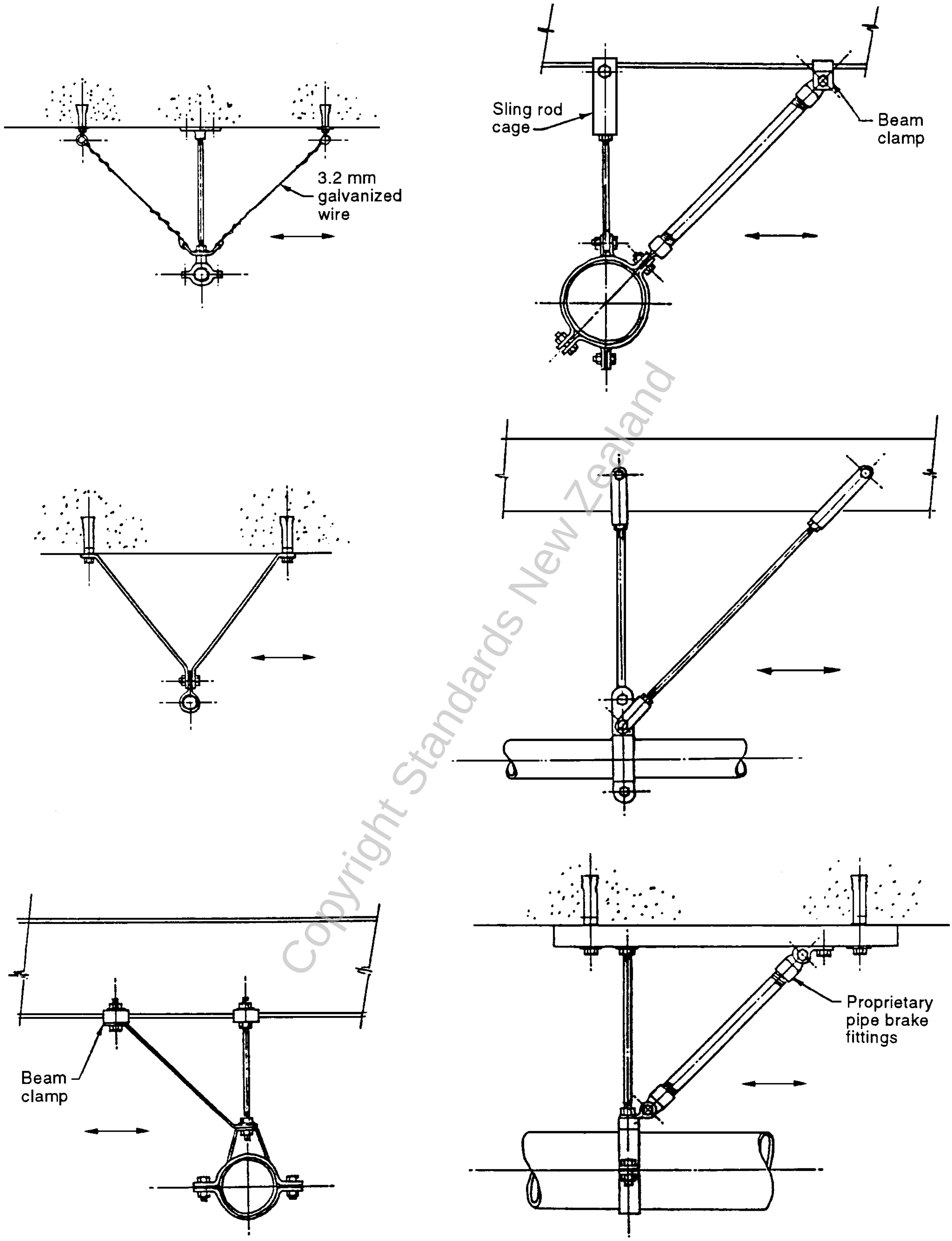


Figure 3 – Bracing details

Table 2 – Allowable horizontal loads of typical pipework braces

Shape and size (mm)	Brace length for *L/r* = 200 (m)	Allowable horizontal support load			
		30° angle from vertical (kN)	45° angle from vertical (kN)	60° angle from vertical (kN)	Horizontal (kN)
Galvanized steel wire 3.2 dia.	(tension only)	0.23	0.33	0.40	0.45
Mild steel rod					
10 dia.	0.50	1.0	1.4	1.7	1.9
12 dia.	0.60	1.4	2.0	2.4	2.8
16 dia.	0.80	2.5	3.5	4.3	5.0
20 dia.	1.00	3.9	5.5	6.8	7.8
BS 1387 medium tube					
20 NB	1.7	2.5	3.5	4.3	5.0
25 NB	2.2	3.9	5.5	6.8	7.8
32 NB	2.8	5.0	7.1	8.7	10.1
40 NB	3.2	5.7	8.1	9.9	11.5
50 NB	4.0	8.1	11.5	14.0	16.2
65 NB	5.1	10.4	14.7	18.1	20.8
Mild steel flat					
40 x 6	0.35	3.0	4.2	5.2	6.0
50 x 8	0.46	5.0	7.0	8.6	10.0
50 x 10	0.58	6.2	8.8	10.8	12.5
Mild steel angle					
25 x 25 x 3	0.96	1.7	2.5	3.0	3.5
30 x 30 x 5	1.1	3.4	4.9	6.0	6.9
40 x 40 x 5	1.5	4.7	6.7	8.2	9.4
50 x 50 x 5	1.9	6.0	8.4	10.3	12.0
60 x 60 x 6	2.3	8.6	12.2	14.9	17.2
80 x 80 x 6	3.1	11.6	16.5	20.2	23.3

2.3.7.4

Bracing shall be tight and concentric. All parts and fittings of a brace should be in a straight line to avoid eccentric loading on fittings and fastenings. The connection of brace to piping shall be snug and tight and shall be able to transfer load from the pipe to the brace and remain tight under vibration. Lateral bracing shall be perpendicular to the piping.

2.3.7.5

Bracing fixings to the piping and to the immediate support structure shall be designed to resist the earthquake loading specified in 2.3.4.1. The horizontal loads that can be resisted by typical fixings for various bracing configurations for horizontal piping are shown in table 3 subject to the following provisions:

(a) Masonry anchors shall be installed to the manufacturer's specifications;

(b) Bolts to steel members shall comply with the requirements (e.g. edge distances) of NZS 3404;

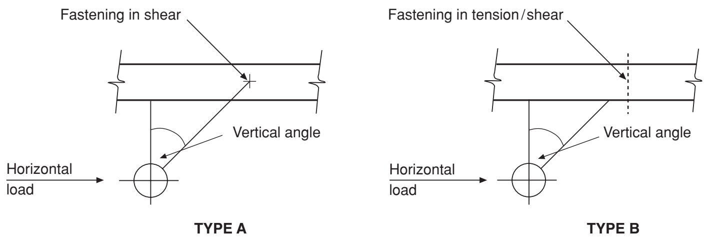
(c) Bolted and screwed connections to timber shall comply with the requirements of NZS 3603.

Table 3 – Horizontal load capacity of typical connections

Fastening type	Horizontal load capacity					
	Vertical angle 30°		Vertical angle 45°		Vertical angle 60°	
	Type A (kN)	Type B (kN)	Type A (kN)	Type B (kN)	Type A (kN)	Type B (kN)
Masonry anchors						
M6	1.7	1.3	2.4	2.0	2.9	2.6
M8	3.0	2.0	4.2	2.9	5.2	3.8
M10	4.4	2.9	6.2	4.3	7.6	5.5
M12	6.8	4.3	9.5	6.3	11.7	8.7
M16	12.0	5.7	17.0	8.7	20.9	12.3
Bolts to steel						
M6	1.7	1.9	2.4	2.6	2.9	3.0
M8	3.0	3.5	4.2	4.6	5.2	5.4
M10	4.7	5.5	6.7	7.3	8.1	8.5
M12	6.8	7.9	9.5	10.5	11.7	12.3
M16	12.0	14.4	17.0	19.1	20.9	22.0
Bolts to BP 450 purlins						
M6	1.7	–	2.4	–	2.9	–
M8	2.9	–	4.1	–	5.0	–
M10	3.6	–	5.1	–	6.2	–
M12	4.3	–	6.1	–	7.4	–
M16	5.7	–	8.1	–	9.9	–
Bolts to timber						
M12	2.1	–	3.3	–	4.4	–
M16	2.9	–	4.8	–	7.1	–
M20	3.7	–	6.4	–	10.0	–
Coach screws to timber						
M8	–	0.75	–	0.95	–	1.1
M10	–	1.3	–	1.8	–	2.2
M12	–	1.8	–	2.6	–	3.4
M16	–	3.0	–	4.2	–	5.6
M20	–	4.3	–	6.2	–	8.4

NOTE –

(1)



(2) Bolted shear (type A) connections to timber assume a nominal timber thickness of 50 mm.

(3) Tension/shear (type B) connections to timber assume coach screws penetrate timber 10 times the shank diameter and have a minimum thread length 6 times the shank diameter.

(4) The loads for timber connections are for dry timber. For green timber reduce the loads by 30 %.

2.3.7.6
Bracing for piping of diameter 80 mm or larger shall not be restrained by timber members which are less than 100 mm in the direction(s) of the plane(s) of bending. The distance of the point of fastening from any edge of the timber shall be not less than 30 mm or 4 fastener diameters whichever is the greater. In addition the following apply:

(a) Braces shall not be welded to cold rolled sections 3 mm or less in thickness;

(b) Explosive driven fasteners shall not be used;

(c) Expansion fasteners in concrete which are secured by driving the fastener against a wedge at the bottom of the hole shall not be used.

NOTE – This type of expansion fastener has performed poorly in earthquakes.

2.3.7.7
The building element to which the brace is fixed shall be capable of withstanding the force which the brace imposes on it.

2.3.8 *Clearance*

2.3.8.1
Clearance, as specified below, shall be provided around all piping extending through non-structural walls, floors, platforms and foundations; clearance on all sides from the building elements shall not be less than:

(a) Piping up to 40 mm nominal diameter .... 25 mm
All other piping .... 50 mm

(b) The gap may be sealed provided that a flexible or frangible material is used.

2.3.8.2
No clearance is required for piping passing through partitions or walls of frangible materials (such as gypsum board) unless the wall is required to have a fire resistance rating.

2.3.8.3
No clearance is required if the piping is attached rigidly to the wall and there is adequate piping flexibility on both sides of the wall to prevent damage from movement of the pipework under seismic loads.

2.3.8.4
In walls required to be fire rated the gap shall be filled with a flexible material which will preserve the fire rating of the wall.

2.3.9 *Hangers*

Hangers shall be connected to the piping and to the immediate support structure by fixings that cannot detach in an earthquake.

2.4 Labelling and signs

2.4.1
All markings, signs and labels required by this Standard shall incorporate indelible markings and unless otherwise specified, or approved as a feature of listed equipment, or required by law shall comply with NZS 5807 and be safety red and white with red as the predominant colour ("Dymotape" labels – or similar, do not conform).

NOTE – Attention is drawn to requirements of the Building Regulations for certain signs which are subject to a building consent.

2.4.2
Labelling on the Fire Service Inlet and on outlets (where enclosed) shall incorporate letters at least 50 mm high.

2.4.3
Pipework associated with the hydrant system shall be identified in accordance with the requirements of NZS 5807.

2.4.4
Pressure gauges and valves shall be clearly labelled as to function and, in the case of valves, the correct normal position.

2.4.5
All doors, along a route leading from the outside of the building to any fire hydrant system pumps shall have a reflective sign at least 75 mm x 40 mm with the words "TO FIRE PUMPS – NZ FIRE SERVICE".

2.4.6
In stairtowers which do not contain outlets, signs (as required by 3.2.2) shall be at least 600 mm x 300 mm, with the words "NO FIRE HYDRANTS IN THIS STAIRWELL".

2.5 Means of Compliance – existing systems

2.5.1
An existing hydrant system shall be deemed to comply with this Standard if, on application by an approved contractor it can be demonstrated to the satisfaction of the authority having jurisdiction, to have been designed and installed in accordance with:

(a) NZS 4510:1978 *Riser mains for fire service use*, if the criteria specified in NZS 4510:1998 subclause 2.5.2 are conformed to, the information specified in NZS 4510:1998 subclause 2.5.3 is provided and the system continues to be maintained and tested in accordance with NZS 4510:1998 section 9, or

(b) The 1990 *Interim Code of Practice for Charged Riser Compliance* issued by the Commander Region 1, New Zealand Fire Service, a copy of which is lodged with Standards New Zealand.

2.5.2
Any application made pursuant to 2.5.1(a) for compliance of a system installed to NZS 4510:1978 shall meet all of the relevant criteria of this Standard specified in either (a) or (b) below as appropriate:

(a) Hydrant systems designated as "Dry Risers" which:

- (i) Are charged with water and comply with 3.5.
- (ii) Are provided with booster pumps as required by 3.4, and conform to section 7.
- (iii) Have pressure control devices, where required, installed to conform with section 6 to ensure pressures at outlets are within the limits specified in 6.2.
- (iv) Incorporate in the riser inlet assembly, a pressure gauge to conform to 5.4.2 and 6.4.
- (v) In areas having a seismic factor greater than 1.2, as defined in NZS 4203, either conform to 2.3 or in the opinion of a design engineer, are capable of remaining functional at the earthquake loadings specified in NZS 4203.
- (vi) Have the Fire Service inlet enclosure labelled in conformance with 5.3.1.
- (vii) Have Fire Service reference documents provided in conformance with 5.5.

(b) Hydrant systems designated as "Wet Risers" which:

(i) Are provided with one or more booster pumps capable of developing the pressure required at each outlet as specified in section 3 when flowing either the number of simultaneous hose streams per 3.3 at the design flow rate specified at 3.2, or at a flow calculated as 1200 L/min multiplied by the largest number of outlets on any one floor whichever is the lesser flow.

(ii) Have pressure control devices, where required, installed to conform to section 6 to ensure pressures at outlets are within the limits specified in 6.2.

(iii) Have each booster pump unit found on inspection, and to the satisfaction of the authority having jurisdiction, to be in good working order.

(iv) Incorporate in the riser inlet assembly, a pressure gauge to conform to 5.4.2 and 6.4.

(v) In areas having a seismic factor greater than 1.2, as defined in NZS 4203, either conform to 2.3 or in the opinion of a design engineer is capable of remaining functional at the earthquake loadings specified in NZS 4203.

(vi) Have the Fire Service inlet enclosure labelled in accordance with 5.3.1.

(vii) Have Fire Service reference documents provided in accordance with 5.5.

NOTE – It is recommended that prior to modifying an existing system to conform to 2.5.2, a preliminary application be made to the authority having jurisdiction.

2.5.3
Any application made pursuant to 2.5.1 shall include the following data:

(a) A diagram of the entire hydrant system and floor plans of the building;

(b) Hydraulic calculations;

(c) Details of any pumps (including drivers).

2.5.4
In the event that an existing system requires substantial extension or alteration as a consequence of building alterations, the authority having jurisdiction may require the system to be suitably altered for new systems so as to comply with the requirements of this Standard. In such cases, it shall be a permitted exception, subject to the agreement of the authority having jurisdiction, to reuse components of the original system which remain in good order.

2.6 Systems under multiple ownership

Where due to the nature of titles and ownership of a building or group of buildings, a hydrant system is under multiple ownership, it shall not be possible for such a system to conform to this Standard unless there exists, to the satisfaction of the authority having jurisdiction, a binding obligation on all parties through whose property the system passes to maintain the system in good working order at all times and to comply with the requirements of section 9.

2.7 Preliminary approval of basic design decisions

2.7.1
Prior to commencement of installation, approval may be sought from the authority having jurisdiction for the following features of a fire hydrant system intended to comply with this Standard. The features are:

(a) Location of outlets;

(b) Location of inlet;

(c) Location of piping forming the main waterway;

(d) Location of pump units (where required);

(e) Intended method of disposal of water discharge during testing;

(f) System design flow;

(g) Pressure required at the downstream flange of the inlet;

(h) Type of pump unit driver;

(j) Intended characteristics flow/pressure curve for each pump.

2.7.2
An application for such approval shall be in the form required by the authority having jurisdiction and shall include:

(a) Typical cross sections and floor plans;

(b) Height of the highest outlet above the inlet;

(c) FRR details of spaces in which main waterway piping will be run;

(d) A schematic of the hydrant system.

2.7.3 *Electrical bonding*
All sections of the hydrant system shall be electrically bonded to the main building earth. The hydrant system shall not be used as an earth continuity conductor.

3 DESIGN CRITERIA

3.1 Pressure required at outlet
The pressure available at each outlet when the design number of hose streams are in simultaneous operation at the design flow, shall be not less than 600 kPa or more than that permitted by 6.2.1.

3.2 Number and spacing of outlets per floor

3.2.1
There shall be at least one outlet per floor, including the roof where there is door access to the roof, and including mezzanine or intermediate floors, which can be accessed by lifts or stairtowers. However, where every point on the floor is not within 50 m, measured:

(a) In the case of a floor where the outlet is situated in a protected lobby, from that outlet, or

(b) In all other cases, from the nearest outlet on the level of the floor below via the stairway,

there shall be such additional outlets as to ensure that every point on the floor is within a 50 m arc of at least one outlet.

3.2.2
Except in the case of a scissors stair (see 3.2.3), it shall not be required to have outlets in every stair (or in a protected lobby directly accessible from the stair) provided that there is a warning sign, as specified in 2.4, to that effect at each level with external access (or in the landing at that level) of each stair which does not have outlets.

3.2.3
Where hydrants are located in a scissors stair, outlets shall be located in both stairways at each floor level (or in a protected lobby directly accessible from the stair) although both outlets may be served by a common section of the hydrant main.

3.2.4
In determining the number of outlets required per floor for the purposes of table 4, it shall not be necessary to assume that the outlets in both scissors stairs are operating, unless that is necessary, in order to satisfy the spacing requirements in 3.2.1. The same shall apply in the case of buildings where outlets have been provided in all stairs on an optional basis.

NOTE – See section 4 concerning location of individual outlets.

3.3 Required flow rates

3.3.1
The required minimum flow rate for each hose stream in operation shall be 440 L/min.

3.3.2
The design flow for the hydrant system shall be calculated in accordance with 6.5.4 by determining the design number of hose streams required to be in simultaneous use from table 4.

Table 4 – Determination of design number of simultaneous hose streams

Greatest number of outlets required on any floor (see 3.2)	**Design number of flowing streams per floor**	**Number of simultaneous floors** (see Note)	**Design number of simultaneous hose streams**
1	2	2	4
2	4	2	8
3	5	2	10
4 or more	6	2	12

NOTE – In single storeyed buildings, this value reduces to 1.

3.4 Requirement for booster pumps

3.4.1
If, in order to meet the pressure required at every outlet (as specified in 3.1) the pressure required at the downstream side of the Fire Service Inlet (P_R) is greater than (P_A) as derived by the formula in equation 2, then one or more booster pumps shall be provided in accordance with 3.4.2.

$$P_A = P_{NC} - \Delta P_I \quad \text{(Eq. 2)}$$

where

P_A is the pressure available

P_{NC} is the pressure declared by the National Commander (see Appendix E).

ΔP_I is the loss or gain of pressure due to friction and elevation in the hoselines between the Fire Service pumping appliance and the Fire Service Inlet, and in the Fire Service Inlet assembly calculated in accordance with 6.5.

3.4.2
If $P_R - P_A$ is not greater than 0.15 P_{NC} , one booster pump shall be required, otherwise 2 pumps shall be required.

3.5 Pipework to be charged with water

3.5.1
Every section of the hydrant system pipework shall be kept charged with water at a positive pressure of at least 15 kPa by means of a permanently connected pressurized water supply.

NOTE – If a pressurizing pump is used to pressurize the system, a larger pressure differential may be required in order to detect pressure drop to start the pump.

3.5.2
The pressurized supply shall be via a pipe of not less than 25 mm diameter and be capable of maintaining a flow of 25 L/min. It shall be controlled only by a locked open, indicating valve labelled “Fire Service Hydrant System: Normally Open”.

3.5.3
On systems including booster pumps, the point of connection shall be in accordance with figure 4 or 5 and the flow rate shall also be sufficient to provide the total water required for pump and driver cooling when all pumps are operating at maximum load under test conditions. (See 7.5.4).

3.5.4
Where the hydrant system forms part of the reticulation for hose reels in the building, the required flow rate in 3.5.3 shall be increased by a flow equivalent to the simultaneous operation of the 2 hydraulically most favourably placed hose reels. The required pressure shall be sufficient to ensure compliance with AS/NZS 1221, according to the Standard of manufacture, when any 2 reels are operating.

NOTE – Attention is drawn to the pressure limits of various hose reel assemblies.

3.6 Optional provision of pressurized water source

3.6.1
An owner may elect to provide a permanently piped connection from a reliable pressurized water source to the hydrant system to permit firefighting hose streams to be established prior to Fire Service arrival. This shall only be permitted if, having regard to the flow and pressure characteristics of the water source, there will be available at any outlet, a pressure of at least 600 kPa when the system is delivering a flow of 1320 L/min and that this will be sustained for at least 30 min.

3.6.2
Should it be necessary to utilize a booster pump to meet this requirement, either an electric motor or diesel engine driven pump, conforming to section 7 and, additionally, arranged to start automatically on detection of pressure drop shall be provided for this purpose. The pump may, additionally, function as a booster pump in respect of the primary function of the hydrant system.

The automatic starting arrangements and components shall be of a type which is listed in terms of NZS 4541.

3.6.3
The Fire Service Inlet enclosure shall be labelled in accordance with 5.3.1.

NOTE – Incorporation of a pressurized water source is not recommended unless, associated with the hydrant system outlets, there are cabinets containing adequate hose and branches, that such equipment is routinely maintained in good condition, and staff are trained in the safe and correct use of the equipment. The NZ Fire Service should be consulted in respect of these matters.

4 OUTLETS

4.1 Location

4.1.1
Outlets shall be so located to allow ready and efficient use by the Fire Service. Clearances shall conform to 4.2.3.

NOTE – Attention is drawn to any Standard Operating Procedures declared by the National Commander.

4.1.2
Outlets not located in a protected lobby having a plan area of at least 6 m^2 and no dimension less than 2 m, or in a stairtower shall be situated in an enclosure with a fire resistance rating of 60/60/60.

4.1.3
Outlets in stairtowers shall be situated on floor landings.

4.1.4
Locks on enclosures, where permitted, shall comply with NZS 4521. The door of any such enclosure shall be frangible.

NOTE – Other types may be declared acceptable by the National Commander.

4.1.5
Outlet enclosures may incorporate a hose reel or other fire equipment but in all cases, the clearances specified in 4.2.3 shall be maintained and the door shall not be locked. Hose reels shall not be mounted on the enclosure door.

4.1.6
Enclosures shall be clearly marked with the words “FIRE HYDRANT”.

4.2 Outlet assembly

4.2.1
Each outlet shall incorporate 2, 70 mm double lugged instantaneous female hose couplings conforming to NZS 4505. Each coupling shall be controlled by a lever operated ball valve or by a ratio valve (one per coupling) or by a pressure reducing valve incorporating a handwheel shut-off (one per coupling) and a tool-adjusted pressure reducing setting which shall be sealed at the set pressure.

NOTE – Lever operated ball valves should be self locking or manual locking to prevent movement during operation in a partially open position.

4.2.2
The axis of each coupling shall be horizontal with lugs positioned at right angles to a line drawn between the axes.

NOTE – Couplings need not be side by side.

4.2.3
There shall be a 150 mm clear space around the outer edge of the lugs and the operating arc of the lever of the ball valves (and, on existing systems, the handwheel).

4.2.4
A clear space of 1200 mm shall be maintained in front of the couplings. Couplings shall not be closer than 600 mm to the floor or further than 1350 mm.

5 FIRE SERVICE INLET

5.1 Location

5.1.1
The Fire Service inlet assembly shall be within 18 m, and in clear view of, a point on a roadway or area of hard-standing which is readily accessible by a fire appliance. Access to the inlet shall be unobstructed.

5.1.2
The inlet assembly shall be either adjacent to a fire alarm panel and on the exterior wall of a building or in a position otherwise agreed with the NZ Fire Service.

5.1.3
It shall be so positioned that the axis of the highest and lowest coupling is not closer to the surrounding standing surface than 600 mm or further than 1350 mm.

5.1.4
A space measuring 600 mm either side of the inlet enclosure, 1200 mm out from the face of the enclosure and extending up 2000 mm from the surrounding standing surface shall be clear of all objects. Couplings shall be so arranged as to provide ready connection and release of any coupling when the other inlets are in use.

5.1.5
Where the door of the enclosure is on a glazed exterior wall of a multi-storey building, either a verandah or other assembly shall be provided extending at least 1 m in front and 1 m either side of the enclosure to provide protection from falling glass.

5.2 Waterway equipment

5.2.1
Each inlet shall comply with the requirements of section 13 of NZS 4505 which requires the provision of a 70 mm male instantaneous coupling and a flap valve.

5.2.2
The required number of inlet couplings shall be half the design number of simultaneous hose streams specified in table 4.

5.2.3
Inlet couplings shall be flanged to a manifold or connected by a rigid mechanical coupling and in turn be connected to the hydrant system. No part of the waterway shall be of a diameter smaller than the coupling flange. Sharp bends are not permitted. A 15 mm quarter turn valve shall be provided in the enclosure to release pressure in the pipework between the inlet flap valves and the non-return valve.

5.2.4
The pressure loss across the inlet assembly from the face of any coupling to the point of connection of the manifold to the hydrant system pipework (assuming all couplings are in use) shall not exceed 50 kPa at the design flow.

5.3 Enclosure

5.3.1
The waterway equipment together with such other equipment described in 5.4 shall be housed in an enclosure conforming to NZS 4521 except in respect of 6.1 whereby the following designation shall be used:

FIRE HYDRANT INLET

Fire hydrant systems deemed to comply with this Standard pursuant to 2.5.2(b), shall, if the town main connection remains connected to the system, have the following designation:

FIRE HYDRANT INLET (WET RISER)

5.3.2
Within the enclosure, there shall be a document holder, fixed to the enclosure and of dimensions to permit the insertion of an A4 size folder 15 mm thick.

5.4 Other equipment in enclosure

5.4.1
For each pump forming part of the fire hydrant system, the following equipment shall be housed in the enclosure as part of a unit conforming to IP 65 of AS 1939:

(a) Pump start switch marked either “DIESEL PUMP START” or “ELECTRIC PUMP START”;

(b) Pump running lamp (red bezel).

There shall also be an indelibly marked sign in a clearly visible position in letters at least 25 mm high stating as follows:

CHARGE FEEDERS BEFORE STARTING PUMP

5.4.2
On hydrant systems incorporating pumps, there shall be within the enclosure, a 100 mm pressure gauge fed from a tapping on the hydrant system downstream of the pump delivery check valve.

The gauge shall be marked “HYDRANT SYSTEM PRESSURE”.

5.5 Fire Service reference documents

5.5.1
A diagram of the hydrant system showing all valves, outlets, pressure control devices and pumps, using the drawing conventions illustrated in Appendix C shall be placed in a water resistant ring binder and located in the fire hydrant inlet enclosure. The diagram shall include the settings of all pressure reducing valves, the ratio of all ratio valves and the flow and pressure characteristics of each fire pump at design flow.

5.5.2
A copy of the manufacturer’s pump curve for each pump shall be included in the binder.

5.5.3
The binder shall be clearly labelled "FIRE HYDRANT SYSTEM – DETAILS" and all pages shall be enclosed or encapsulated in such a way that the contents can be read without removal and are waterproof.

5.6 Duplicated Fire Service inlets

5.6.1
Where duplicated inlet enclosures are provided, each inlet assembly shall be connected to the entire hydrant system and comply in all respects with 5.1 to 5.5 inclusive.

6 PIPEWORK AND PRESSURE CONTROL

6.1 Piping sizing

6.1.1
Piping forming the waterway of the hydrant system shall (subject to 6.1.2) be sized, using hydraulic calculations, so that the design criteria set out in section 3 will be achieved having regard to the available pressure provided by the Fire Service (see Appendix E) and by booster pumps (where installed). However the main waterway shall not be less than 100 mm and the loss of pressure due to friction between the inlet and the booster pumps (when fitted) shall not exceed 200 kPa at the design flow.

6.1.2
The method of calculation shall conform to 6.5.

6.2 Pressure control and test devices

6.2.1
The pressure at every outlet coupling shall, under any conditions of flow from zero to 440 L/min at the coupling (and from zero to the system design flow in the array which the coupling forms part), be in the range of 600 kPa to 1200 kPa. For existing systems where outlet couplings are single lugged, the permissible pressure range shall be 600 kPa to 1050 kPa.

6.2.2
If conformance to 6.2.1 requires pressure control devices, these shall conform to the following:

(a) Orifice plates and parity valves are not permitted;

(b) Individual outlets may be controlled by a ratio valve or by a pressure reducing valve unique to that outlet. Ratio valves are only permitted for ratios in the range 1:0.99 to 1:0.80. The actual ratio shall be indelibly marked on the valve and the valve accessible for inspection.

(c) Several outlets arranged in a vertical pressure zone, may have common pressure control using one or more pressure reducing valves provided that:

(i) The working pressure of each valve is greater than the maximum pressure to which it could be subject in the event of a failure of other pressure reducing valves.

(ii) The pressure reducing valve is not located in a position vulnerable to impact damage or tampering.

(iii) Pressure reducing valves are accessible for inspection (without causing damage to the building or interior finishes) and capable of being tested for correct operation *in situ* while flowing a range of flows between 440L/min and the design flow for that zone. Suitable appurtenances to permit this testing shall be provided.

➤

(d) Pressure reducing valves shall be configured so as to fail in the open position and be post factory, pre-installation tested, certified and tagged as to date of test, operating range and intended outlet location.

6.2.3
In addition to test devices referred to in 6.2.2, permanent facilities must be provided to allow the design flow to be induced throughout each main pipe of the hydrant system. These arrangements shall include a valved tapping for a pressure gauge at the discharge point (and at any other high point) and may include either permanently installed in line flow measuring devices or appropriate fittings to allow flow test devices to be temporarily connected without having to shut down the hydrant system. Permanent arrangements for the safe disposal of tested water shall be provided and may include discharge diffusers.

6.2.4
If the discharge from the forgoing tests falls in part or in total on the roof of the building, adequate permanent drainage shall be available so that at the system design flow, no damage will occur. Subject to agreement of the territorial authority in each case, an acceptable means of disposing of the design flow will be free discharge of the flow into the air through a diffuser nozzle.

6.3 Location, materials and support

6.3.1
In a multi-storeyed building, vertical sections of the main waterway shall be located in a stairtower or protected shaft in which the FRR is no less than 60/60/60.

6.3.2
Horizontal sections of the main waterway or of branches serving individual outlets, shall be supported by elements of the building structure. The FRR of piping supports shall not be less than that of the structure to which they are attached.

6.4 Gauges and valves

6.4.1
Pressure gauges shall comply with BS EN 837-1 or DIN 16005, or equivalent, be calibrated in kPa and have a scale range not more than 150 % of the highest pressure to which the gauge will be subject (see 2.4 concerning labelling). Dampening shall be provided where required, to avoid excessive needle fluctuation. A quarter turn valve shall be provided at each pressure gauge to allow removal without shut down of the piping to which it is connected.

6.4.2
Manually operated valves (other than quarter turn valves) shall be right hand closing with the direction of closing clearly indicated and ball valves and other quarter turn valves shall have a stop to prevent operation through greater than a 90° arc.

6.4.3
Each valve shall have an indicator so that it can be seen when the valve is fully open and fully closed. The valve shall be labelled as to the correct normal position.

6.4.4
Valves associated with the waterway through and around pumps, shall be chained and padlocked in the correct position (see 2.4 concerning labelling).

6.4.5
Isolating valves are not permitted in the waterway other than:

(a) Those on the suction and delivery of pumps;

(b) Those located on either side of a pressure reducing valve.

Where permitted, isolating valves shall be padlocked in the open position.

6.4.6
Pressure reducing valves, ratio valves, and isolating valves shall be of a listed type.

6.4.7
All valves shall be rated for the pressure range to which they will be subject.

6.5 Hydraulic calculation

6.5.1
The pressure and flow requirements of a hydrant system shall be calculated with pressure loss determined in accordance with 6.5.3. The authority having jurisdiction may accept computer calculations generated by a programme demonstrated to be in common use in fire protection application, subject to receiving a printout of inputs and outputs.

6.5.2
Pressure loss due to friction in piping shall be calculated using the (Hazen Williams) formula in equation 3:

$$\Delta P = \frac{0.605 Q^{1.85} \times 10^{8}}{C^{1.85} \times d^{4.87}} \qquad \text{(Eq. 3)}$$

where

ΔP is the loss of pressure per metre of piping (kPa)

Q is the flow rate (L/min)

d is the mean inside diameter (mm)

C is a constant according to the internal roughness of the piping as derived from table 5.

Table 5 – Hazen Williams 'C' values

Type of piping	'C' value
Steel, galvanized after fabrication	110
Steel, black or galvanized	120
Copper	140
Stainless steel	140

6.5.3
Pressure loss in piping fittings shall be based on equation 3 with the equivalent length (in metre) determined by multiplying the nominal diameter (mm) of the smallest piping connected to the fitting, by the factor obtained from table 6.

Table 6 – Equivalent length factors for various fittings

'C' value (from table 5)	**110**	**120**	**140**
Tees into branches	0.050	0.060	0.080
Elbows	0.025	0.030	0.040
Bends (see Note 1)	0.012	0.015	0.020

NOTE –

(1) A "bend" is a fitting where the radius of the turn, divided by the nominal piping diameter is at least 1.5.

(2) Pressure loss arising from flow through valves or other waterway devices shall be calculated according to published manufacturer's data.

6.5.4

Pressure loss or gain due to difference in elevation to be calculated as 10 kPa per metre difference in height.

6.5.5

In order to demonstrate that the design criteria (see section 3) will be achieved, a set of hydraulic calculations shall be provided for the authority having jurisdiction. The calculations shall incorporate a dimensioned node diagram of the hydrant system waterway, as built, including details of pumps (where included), pressure control valves and all fittings.

6.5.6

The following shall also be an acceptable method of calculating the pressure and flow characteristics:

(a) Determine the most hydraulically remote array of outlets required by section 3 to be considered in simultaneous operation;

(b) Assume a flow of 440 L/min at 600 kPa at each coupling of the most hydraulically remote outlet;

(c) Calculate the loss/gains of pressure (ΔP_3) between the couplings of the outlet (with both couplings flowing) to the piping junction serving the next outlet in the array under consideration;

(d) Repeat step (c) for the next outlet to give (ΔP_4) but adjust the flow in the branch having the lower calculated pressure loss using the formula:

$$Q_2 = \sqrt{\frac{\Delta P_4 \times Q_1}{\Delta P_3}} \quad \text{(Eq. 4)}$$

(e) Add Q_2 and Q_1 and calculate to the next junction, then repeat the process for the balance of the array;

(f) Using the calculated flow for the array, calculate the pressure requirement at the system reference point – i.e. either the downstream end of the Fire Service inlet or, where fitted, at the discharge flange of each pump. Allowance must be made in the calculation for pressure control devices.

If there is no pump, the pressure required at the reference point may not exceed P_A in equation 2.

(g) In calculating ΔP_I

(i) Assume that 1 x 30 m length of 90 mm lined hose will be used between the fire appliance and each coupling of the Fire Service Inlet required by 5.2.2 and table 4.

Assume that the flow in each such hose connection is 1760 L/min (or in some single storey buildings 800 L/min – see table 4) according to the total system design flow, and that the pressure loss due to friction is accordingly 60 kPa (or 20 kPa for 880 L/min).

(ii) Assume the flow rate through each inlet coupling in service is equal, and not greater than 1760 L/min and calculate the pressure loss across the assembly (see 5.2.4).

(iii) Add together (i) and (ii) and subtract or add allowance for elevation difference between the level of the inlet and the surface of the hard standing area within 25 m of the inlet which may be used by the Fire Service appliance.

6.5.7
The hydraulic calculation shall also demonstrate that the available pressure at every outlet on the hydrant system will comply with 6.2.1. For systems incorporating booster pump(s) this shall be demonstrated with pump(s) operating.

7 PUMPS

7.1 Pump unit

7.1.1
The pump unit shall comprise the unit frame, pump, driver, main controller, remote control panel, appurtenances.

7.1.2
The pump and driver shall be direct coupled and mounted on a unit frame in such manner that the alignment of the coupling can be readily checked and on diesel engine driven pumps the oil changed and sump cover removed.

7.1.3
The pump unit shall be installed in a suitable secure enclosure having a FRR of not less than 60/60/60 which is free of any hazard which might imperil the pump unit. The enclosure shall be readily accessible to the Fire Service via sign-posted doors. If situated below grade the enclosure shall be at least one floor above the lowest floor.

NOTE – A diesel fuel tank associated with the pump may be located within the enclosure.

7.1.4
Installation and pump cooling shall comply with 7.3.5.

7.2 Pumps

7.2.1
Pumps shall be centrifugal, single or multi-staged, fitted with stainless steel shafts and mechanical seals and:

(a) Where the pump outlet is fitted with a pressure relief valve the pump casing rating shall be not less than the set pressure of the relief valve plus 300 kPa;

(b) Where no pressure relief valve is fitted the pump casing rated pressure shall be at least equal to the highest head on the pump curve at duty speed (no flow) plus P_{NC}, plus the static difference between the Fire Service Inlet and the pump suction, plus 300 kPa.

7.2.2
Only pumps with a manufacturer's curve that meets the following shall be used:

(a) At the hydrant system design flow, the pump must provide 110 % of the additional pressure required (P_R) at the pump suction inlet in order to develop the pressure required at the reference point (see 6.5.5(f));

(b) At 65 % of P_R the pump must also produce 150 % of the hydrant system design flow;

(c) The maximum head of the pump curve shall not be greater than 120 % of P_R. However, to achieve this, it shall be permissible to use a pressure relief valve on the pump discharge, arranged to relieve to the pump suction.

(d) Where there are pumps in parallel, the curve of each pump shall show a constantly reducing head as flow increases;

(e) If more than one pump is diesel engine driven, the pumps shall have identical curves.

7.2.3
The pressure available at the pump suction inlet (P_S) shall be calculated using equation 5.

$$P_s = P_{NC} - \Delta P_I - \Delta P_2 \pm \Delta P_H \quad \text{(Eq. 5)}$$

where

P_{NC} is the maximum assumed pressure at Fire Service pumping appliance outlet (see Appendix E)

ΔP_I is the pressure loss in the feeder hose and inlet assembly (see 6.5.5(g)

ΔP_2 is the pressure loss in the waterway between the inlet and the pump suction at the design flow (Q) using the formula given in equation 3 in 6.5.2

ΔP_H is the pressure gain or loss due to difference in height between the inlet assembly and the pump suction.

7.3 Drivers

7.3.1 *Single and twin pump arrangements*

7.3.1.1
Where only one pump is required (see 3.4), the driver may be either:

(a) A direct coupled diesel engine, or

(b) An electric motor with the power supply from an electrically reliable and physically secure source by means of a separate circuit from the line side of the main switchboard incomer.

7.3.1.2
If 2 pumps are required, one driver shall be a direct coupled diesel engine and the other may be either:

(a) A direct coupled diesel engine; or

(b) An electric motor with power supply from a reliable source; or

(c) An electric motor as in 7.3.1.1(b).

NOTE – In 7.3.1.1 and 7.3.1.2 the availability of an engine-driven emergency generator does not constitute a reliable power source or provide a substitute for a direct coupled diesel engine.

7.3.2 *Electric motors*

7.3.2.1
Electric motors, where used shall be of the three-phase, low voltage, squirrel cage, drip-proof or totally enclosed type.

7.3.2.2
The continuous motor rating shall be 110 % of the current required to allow the pump unit to operate at the required speed under any conditions of discharge.

NOTE – This margin is intended to allow for voltage fluctuations.

7.3.2.3
The locked rotor current shall not exceed 750 % of the full load current of the motor.

7.3.2.4
A nameplate shall be affixed to the motor on which is indelibly marked:

(a) Make;

(b) Motor type and serial number;

(c) Continuous rated power output;

(d) Speed at full load;

(e) Full load current.

7.3.3 *Power supply*

7.3.3.1
Power supply shall be from an electrically reliable and physically secure source by means of a separate circuit from the live side of the main switchboard incomer.

7.3.3.2
Power supply cabling to the motor shall be mineral insulated, metal sheathed and the route of the cabling and fixings shall minimize exposure to a fire in the building.

7.3.3.3
Cabling shall be so sized to ensure that the voltage drop along the conductors does not exceed 10 volts lead and return at full load motor current.

7.3.3.4
Every switch controlling the power supply to an electric motor shall be labelled in accordance with 2.4 with the words:

FIRE HYDRANT SYSTEM – DO NOT SWITCH OFF

7.3.4 *Diesel engines*

7.3.4.1
Diesel engines where used shall be multi-cylinder, direct injection and capable, at continuous duty, of providing 110 % of the power absorbed by the pump under any conditions of discharge.

7.3.4.2
The engine shall be derated for altitude and temperature in accordance with the manufacturer's specification.

7.3.4.3
The engine speed shall be regulated within 5 % of the no load setting for all conditions of load up to full power at that speed.

7.3.5 *Engine cooling*

7.3.5.1
Engine cooling shall be by means of closed circuit liquid cooling with a raw water heat exchanger.

7.3.5.2
The raw cooling water supply shall be from the hydrant system pipework on the delivery side of the pump upstream of any stop valve.

7.3.5.3
The supply to the heat exchange shall be via a manual isolate valve, strainer with manual and automatic by-pass, and a reliable automatic device to prevent flow when the engine is not operating.

7.3.5.4
Piping associated with the cooling system shall be rigid, threaded and of sufficient diameter to ensure that under any conditions of motor load, the discharge from the heat exchanger does not exceed 80 ºC. Piping in the discharge from the heat exchanger shall be at least one size larger than the raw water inlet to the exchanger. No valves are permitted.

7.3.5.5
The raw water flow shall be readily visible (e.g. via an active indicator or tundish).

7.3.5.6
If it is possible that the pressure in the heat exchange could exceed the manufacturer's rating under conditions of maximum developed pump pressure, a pressure control valve shall be provided.

7.3.5.7
The closed circuit cooling loop shall incorporate a thermostat.

7.3.5.8
If clamp type cooling hose connections are unavoidable, pairs of stainless steel clamps shall be provided and the tubing accepting the hose shall incorporate a ridge between the clamps and the end of the tubing.

7.3.5.9
The coolant in the closed circuit shall include corrosion inhibitors as specified by the manufacturer.

7.3.6 *Fuel tanks*

7.3.6.1
Each engine shall have a separate fuel tank of sufficient capacity to permit the engine to be run continuously at full load for eight hours.

7.3.6.2
Subject to meeting the requirements of Regulations issued under The Hazardous Substances and New Organisms Act , the tank(s) may be co-located in the pump enclosure.

7.3.6.3
The fuel tank shall be made of stainless steel at least 1.25 mm thick. A cleaning port of at least 100 mm diameter is required.

7.3.6.4
The tank shall be mounted with the fuel outlet between 500 mm and 1000 mm above the injectors unless this voids the manufacturer's warranty. The manufacturer's recommendations shall be strictly adhered to.

7.3.6.5
A fuel level gauge, with the tank capacity marked, and a "REFILL" mark corresponding with the "70 % full" level shall be provided.

7.3.6.6
The following connections to the fuel tank shall be provided either in stainless steel or copper or black steel (galvanized steel is not permitted):

(a) Fuel refill, 25 mm diameter, permanently piped to a manually operated pump fitted with a flexible suction hose of fuel resistant material;

(b) Vapour vent, 25 mm diameter, carried outside the building, terminating in an inverted "U" bend with gauze;

(c) Overflow, 32 mm diameter carried to a suitable container which shall be kept empty at all times;

(d) Fuel line, diameter as specified by the engine manufacturer, incorporating a lockable valve, agglomerator and, at the engine, a flexible connection;

(e) Drain valve, plugged, at the lowest point of the tank and at least 25 mm lower than the fuel line outlet;

(f) Excess fuel return, diameter as specified by the engine manufacturer, returning through the top of the tank to a point 100 mm above the bottom of the tank remote from the fuel line outlet;

(g) Fuel filters as recommended by the manufacturer.

7.3.6.7
Fuel shall be of a specification in accordance with the engine manufacturer's requirements. A sludge and bacteria inhibitor shall be included in the initial fill and thereafter, whenever refilling occurs.

7.3.7 *Fuel lines*

7.3.7.1
The fuel line shall be well protected from physical damage and supported wherever horizontal.

7.3.7.2
Where possible, the fuel line should be installed with a continuous down-gradient to the engine. If this is not practical, it shall rise from a single low point to both fuel tank and engine.

7.3.7.3
Air bleed points shall have screwed plugs.

7.3.7.4
The excess fuel return line shall be similarly protected and supported and fitted with a flexible piping at the engine. Stop valves are not permitted in this line but a non-return valve may be installed.

7.3.8 *Engine exhaust*

7.3.8.1
The engine exhaust shall discharge in a safe place so arranged and designed to prevent entry of water.

7.3.8.2
Piping shall be black steel or stainless steel and be not smaller than the manifold outlet.

7.3.8.3
A seamless or welded corrugated (not interlocked) flexible connection shall be provided at the engine.

7.3.8.4
A plugged connection shall be provided close to the manifold to allow back pressure to be checked. Back pressure shall not exceed the manufacturer's recommendations.

7.3.8.5
The exhaust shall be separated from combustible material and fitted with a metal slotted safety guard or cage where it is within 2 m of the floor. Mineral fibre or other insulating wrapping on the piping is not permitted.

7.3.9 *Batteries*

7.3.9.1
Each engine shall have 2 storage batteries, indelibly marked A and B, rack mounted with cover and secured against seismic displacement.

7.3.9.2
The batteries shall be normally electrically separate and kept charged by means of individual chargers. The capacity of each battery shall be sufficient at 5 °C ambient temperature, to maintain cranking speed for one minute.

7.3.9.3
At any time, one battery shall not be older than 2 years and the other, not older than 4 years. The date of installation shall be indelibly marked on the battery.

7.3.9.4
It shall be possible to by-pass the controller and by means of labelled devices, directly energize the starter from the batteries.

7.4 Controllers and starting

7.4.1
Each pump shall have a main controller and a remote control panel located in the Fire Hydrant Inlet enclosure.

7.4.2
Controllers shall be listed, secured to a structural wall or the floor and be separate from the pump unit.

7.4.3
Remote control panels shall conform to 5.4.1 and be connected to the main controller by means of mineral insulated metal sheathed cable.

7.4.4
Each diesel engine driven pump shall be electrically started by means of a manual push button. Activation of the start button in the remote panel shall cause both batteries to be connected in parallel to the starter motor.

7.4.5
The main controller for *diesel engines* shall comprise a cabinet housing the following components:

(a) Pump delivery and suction pressure gauges (labelled);

(b) Separate labelled start buttons for both Battery A and Battery B;

(c) Tachometer (either digital or analogue) and hourmeter;

(d) Oil pressure gauge and cooling water;

(e) Two listed constant voltage battery chargers, each capable of restoring 100 % of the ampere hour capacity of a battery from a fully discharged state within 24 hours without causing damage to the battery, also;

(i) The charger rate shall not exceed 500 mA when the battery is fully charged.

(ii) The chargers shall be protected against, or be capable of withstanding reverse polarity.

(f) A suppressed range ammeter for each charger and a voltmeter having an expanded scale between 9 and 15 volts for each battery;

(g) A speed sensing device to switch the "pump running" lamp on the remote control panel. This shall not illuminate unless the engine speed exceeds 600 rpm;

(h) A compartment for dry secured storage of the required spare parts, and pump, engine and controller manuals. A wiring diagram of the controller is to be provided.

7.4.6
The controller cabinet shall be provided with 230 V and have adequate ventilation.

7.4.7
All gauges and devices shall be indelibly labelled as to function and there shall be affixed to the cabinet a nameplate bearing the following data:

(a) Make of pump set, unit number and date of manufacture;

(b) Engine make, model, number and continuous power rating (kW);

(c) Pump make, model, impellor diameter and duty speed (at duty flow);

(d) Duty flow and pressure.

7.4.8
The controller shall be connected to the pump unit by means of a protected flexible cable terminating at the controller in a restrained multi-pin plug.

7.4.9
Remote stopping devices on the controller are not permitted.

7.4.10
The main controller of an *electric motor driven pump* shall comprise a cabinet housing the following devices:

(a) Start contactor – either direct-on-line or auto-transformer;

(b) Isolating switch;

(c) Manually operated start button and stop button (on the face of the controller);

(d) Pump delivery and suction pressure gauges (labelled);

(e) A form of indicator to demonstrate that there is power on to the live side of the contactor;

(f) Speed sensing device to switch the "pump running" lamp at the remote control panel;

(g) A run hour meter;

(h) A compartment for dry secured storage of the pump and controller manual, pump spare parts and a wiring diagram of the controller.

7.4.11
A nameplate shall be located on the face of the controller showing the following information:

(a) Make of pump set, unit number and date of manufacture;

(b) Make, model, impellor diameter and rotational speed of pump;

(c) Motor make, serial number and continuous power rating;

(d) Duty flow and pressure.

7.4.12
All gauges and devices on the controller shall be indelibly labelled as to their function.

7.4.13
The main controller shall be located in the pump enclosure, as close as practicable to, but separate from, the pump unit. All electrical components shall be at least 450 mm above the floor.

NOTE – Attention is drawn to the need for all wiring to comply with the Electricity Regulations.

7.5 Pump unit installation and enclosure

7.5.1
Pump units shall be grouted into position on plinths at least 100 mm thick. The base shall be shimmed to avoid distortion. After the hold down bolts are finally tightened, the driver and pump shall be checked for both angular and parallel misalignment, corrected as necessary and dowelled into final position. Alternatively, the unit may be mounted on purpose designed spring fittings equipped with limits to resist seismic forces of 1g.

7.5.2
The pump suction and delivery flanges shall be connected to the hydrant system waterway by means of flexible couplings of corrugated steel, multiple braided according to the required pressure rating.

7.5.3
Each pump shall be installed in the waterway according to figure 4 or 5. Butterfly type valves are not permitted closer than 10 piping diameters to the pump suction flange. Pipework shall be arranged to ensure that air cannot become trapped upstream of any pump suction.

7.5.4
Each pump shall be kept primed by means of a connection to the suction side of the pump capable of providing the following flows (simultaneously where there is more than one pump) at not less than 20 kPa residual pressure:

(a) Diesel engine driver .... 0.75 L/min/kW

(b) Electric motor driver .... 0.25 L/min/kW

7.5.5
The pump test return around the pump (see figures 4 and 5) shall be of the same diameter as the main waterway of the hydrant system and shall include:

(a) An indicating stop valve and a calibrated orifice plate assembly, so sized to allow the system design flow to be induced with the stop valve fully open, and a pressure gauge; or

(b) A calibrated double regulating valve, set to allow the system design flow, and pressure gauge(s).

7.5.6
A pump bypass shall be of equivalent diameter to the main waterway, with check valve.

7.5.7
Each electric motor driven pump shall have a pressure relief valve connected to a tapping on the pump delivery, set to open at 100 kPa above the pressure of the primary water connection when the pump is stopped. The PRV shall be piped to waste and be so sized as to limit the temperature rise in the discharged water to 20 °C when the pump is operating under minimum flow conditions.

7.5.8
In addition to the forgoing, every pump set shall have a normally closed valve-controlled connection on the pump delivery so sized, that when the pump is being run at full load via the by-pass load loop, the temperature rise in the load loop does not exceed 20 °C.

7.5.9
The arrangement of pump units in the pump enclosure, shall permit the removal of any pump unit without having to remove or disable other components of the hydrant system.

7.5.10
The enclosure shall be kept dry, secure and free of materials or equipment which could create a hazard to the reliable operation of the pump units. Where necessary, heating devices shall be provided in order to maintain the temperature above 10 °C.

7.5.11
The enclosure shall have a supply of fresh air which is not dependent on the operation of powered devices.

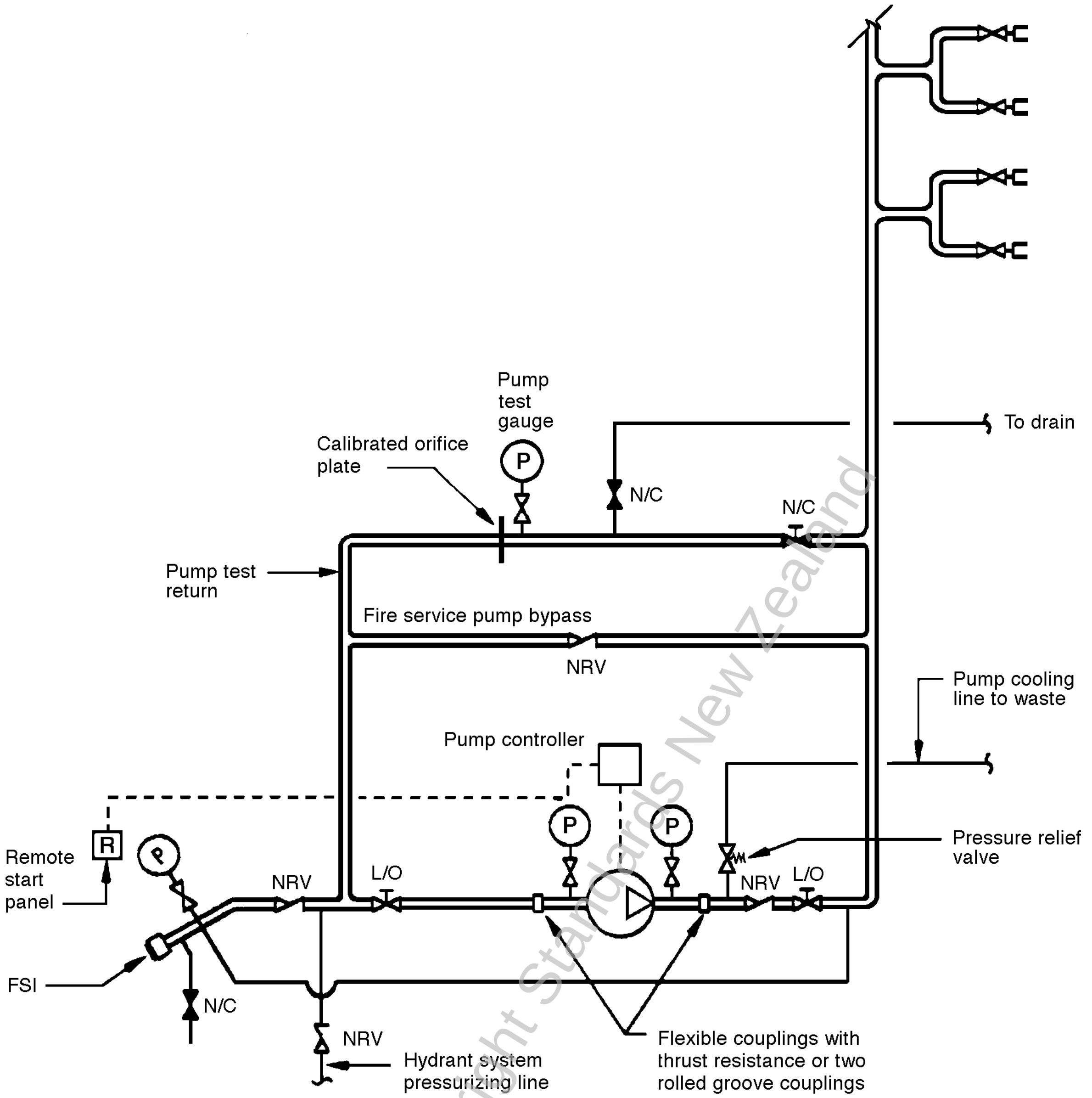


Figure 4 – Pump unit installation – Arrangement for single booster

8 CONSTRUCTION AND DEMOLITION

8.1 Hydrant system availability

8.1.1 *Construction*

8.1.1.1
Where building *construction* includes installation of a permanent fire hydrant system, the system shall be installed and brought into commission, progressively as building work proceeds.

8.1.1.2
In multi-storeyed buildings, the system shall be functional, with outlets on every floor, up to a level not lower than 9 m below the highest floor slab.

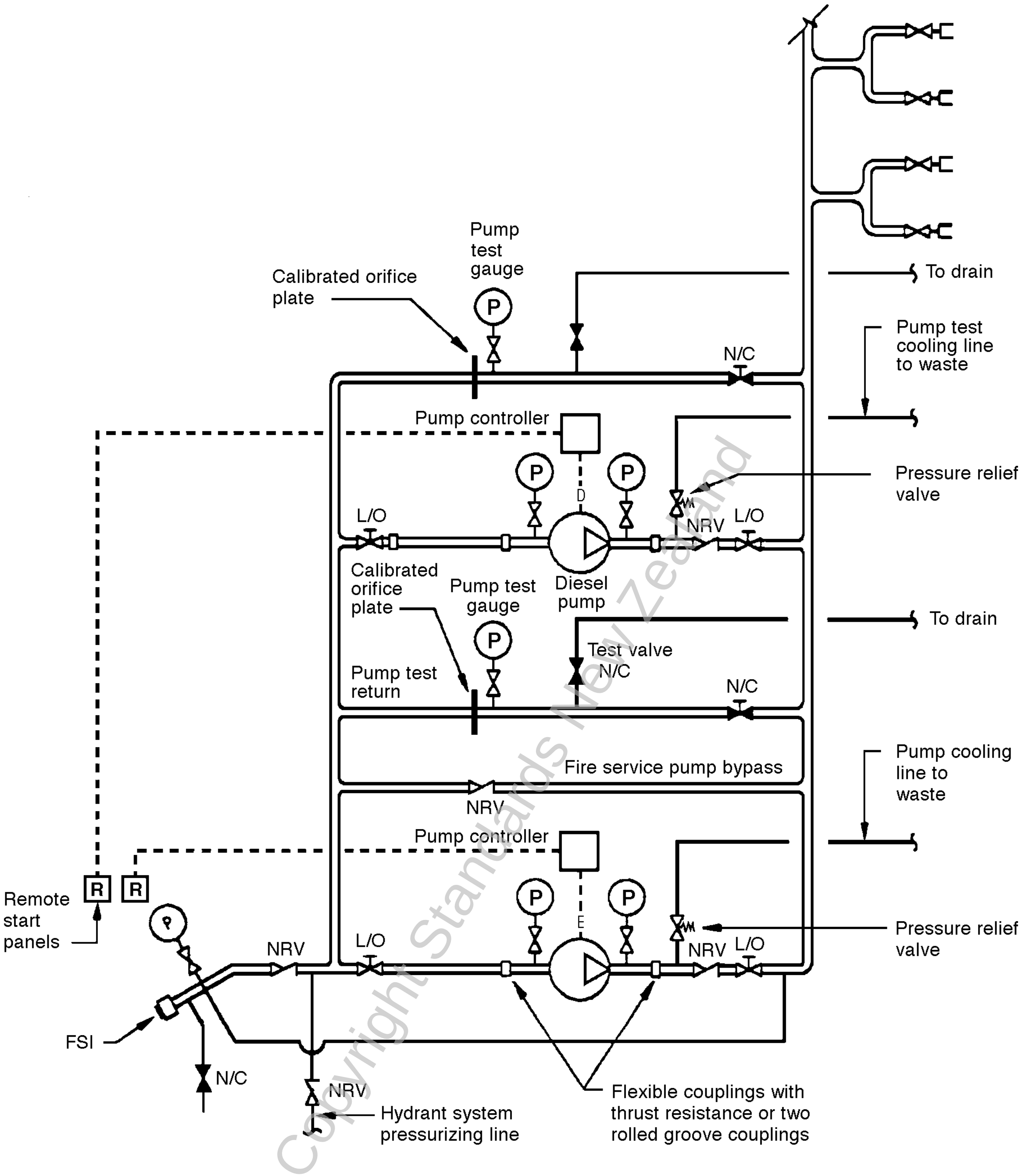


Figure 5 – Pump unit installation – Arrangement for dual boosters

8.1.2 *Demolition*

8.1.2.1
In buildings under *demolition* which are fitted with a fire hydrant system, the system shall be maintained in a functional state for as long as possible and shall be the last service removed.

8.1.2.2
Removal shall not occur before combustible contents of the building have been removed.

8.1.2.3
In multi-storeyed buildings, the hydrant system shall remain functional on the floor below the highest intact floor.

8.2 Precautions during installation

8.2.1
As each section of the waterway is installed, it shall be immediately capped to prevent entry of foreign material into the pipework.

8.2.2
Once the height of the highest outlet above the road surface closest to the hydrant system inlet exceeds 25 m, at least one pump, having the performance characteristics specified in 7.2 shall be connected to the hydrant system. The pump unit may be part of a permanent pumping installation in which case it shall, at the stage that it is required to comply with this subclause, conform in all respects with section 7 *et seq*.

8.2.3
Alternatively, it may be a temporary pump unit in which case the location, means of starting, power supply and labelling shall be approved by the authority having jurisdiction, both during demolition and construction.

8.2.4
Where pressure control arrangements are required to conform to 6.2, they shall be progressively installed.

8.2.5
The area around outlets shall be kept clear, both during demolition and construction. The authority having jurisdiction may require temporary signs to be provided to mark the location of outlets during construction.

8.2.6
In multi-storeyed buildings, the highest outlet shall be provided with a temporary tag, "HIGHEST FUNCTIONAL OUTLET", unless it is readily obvious from observing the "piping runs" that this is the case.

8.3 Temporary inlets

8.3.1
During the course of construction and demolition, the Fire Service Inlet must be accessible from the street frontage. This may necessitate installation of a temporary inlet; for example, the site security fence.

8.3.2
The location of such temporary inlets shall be marked by a red panel in the perimeter fence, extending the full height of the fence and with the words clearly painted in white 'FIRE SERVICE INLET – KEEP CLEAR'.

9 TESTING, MAINTENANCE AND IMPAIRMENTS

9.1 Acceptance tests

9.1.1
A fire hydrant system shall not be deemed to comply with this Standard unless the following acceptance tests have been undertaken by the approved contractor. The tests shall be to the satisfaction of the authority having jurisdiction, and the results found to meet the relevant requirements of the Standard:

(a) The entire system including components, fastenings, supports and braces to be physically inspected;

(b) A hydraulic static test of 2 hours duration to 150 % of the highest design pressure of each section of piping without leakage;

(c) The design flow induced through the main waterway and the pressure drop through the system shown to be, at the most distant point, consistent with the as-built hydraulic calculations;

(d) The correct functioning of all stop valves;

(e) A check of the settings of all pressure reducing valves and the ratio of all ratio valves (where installed) to confirm conformity with the as built drawings and hydraulic calculations;

(f) Full inspection of pump sets including power supplies and appurtenances. This shall include a 6 hour continuous run of any diesel engine driven pumps.

(g) Inspection and check of all required signs;

(h) Inspection and check of the contents of the "Fire Hydrant System – Details" manual (see 5.5.3).

9.1.2
Flow and pressure measurement associated with acceptance tests shall be by means of certified test gauges. Certificates shall not be older than 12 months.

9.1.3
A signed report on the above acceptance test shall be provided by the contractor to the authority having jurisdiction. This shall include:

(a) Details of all tests including time, date, and the names of those undertaking the test;

(b) Details of the test instruments and copies of the latest certification of each instrument;

(c) A copy of the as built drawings and hydraulic calculations.

9.1.4
The authority having jurisdiction may require all or any part of the test to be repeated if there is reason to believe that the test has not been undertaken satisfactorily.

NOTE – In the case of repeating the test required in 9.1.1 (b), it may be necessary to isolate components attached to the piping not rated for the test pressure.

9.1.5
Notwithstanding 9.1.4, the authority having jurisdiction may require retest of up to 10 % of the pressure control devices.

9.1.6
Acceptance tests shall be undertaken by the contractor on:

(a) New systems;

(b) Systems installed to superseded standards for which approval under this Standard is sought (see 2.5.1);

(c) Existing systems required to comply with this Standard which, in the opinion of the authority having jurisdiction, have been substantially altered or extended since original installation.

9.2 Routine tests

9.2.1
Routine tests set out in 9.2.2 shall be undertaken by an approved contractor at the specified frequency. A record of all tests and results shall be made in a log book kept within the premises. Deficiencies found during tests shall be immediately notified to the owner.

9.2.2
If routine tests disclose conditions which would prevent the correct functioning of the hydrant system, a rectangle of 150 mm side, coloured buff, with the word "DEFECT" in black on one side and details of the defect and date of inspection on the reverse, shall be displayed in the Fire Service inlet enclosure for as long as the condition remains.

9.2.3
The following tests and procedures shall be carried out at the specified intervals:

(a) Monthly –

(i) Each diesel pumping unit shall be exercised under load for a period of at least 15 minutes and shall be checked for correct start, run and stop functions and for battery acid density, age, external cleanliness, belt tightness, filter state, fuel, oil and water levels.

This test shall be carried out twice monthly until the pump unit has run for a total of 50 hours.

(ii) Electric motor driven pumps which do not have the power supply continuously monitored by an audible alarm device shall be exercised under load for a period of at least 5 minutes and shall be checked for correct start, run and stop functions.

(iii) The correct position of valves associated with the pump shall be checked.

(b) Six monthly – electric motor driven pumps with monitored power supply.

(c) Annually –

(i) All parts of the system and components shall be visually inspected for defects and for compliance with this Standard. Such inspection shall have due regard to building changes or other issues external to the system which relate to compliance.

(ii) The waterway shall be hydrostatically tested to a pressure not less than the maximum working pressure i.e. N_c plus the maximum pressure from the pump curve plus 50 % of the sum.

(iii) On systems with pressure reducing valves controlling zones, a flow test over the range 440 L/min to the design flow through the length of each main waterway and through each pressure reducing valve controlling a zone. The correct operation of each pressure reducing valve shall be checked.

(iv) Diesel engine driven pump sets shall, in addition to the requirements of the monthly test, be overhauled by an A grade certified diesel engine mechanic in accordance with Appendix B and be test run on full load for at least 2 hours. Batteries shall be replaced as required by 7.3.9.3. Pressure relief valves if fitted, shall be tested for correct operation.

(d) 2-yearly

(i) Replace thermostats of diesel engines.

(ii) Pressure reducing valves and ratio valves controlling single outlets shall be tested either by means of an *in situ* flow test or by removing, disassembling and checking the valve. If such checks cannot be performed at the site of the outlet a temporary valve or cap shall be installed so that the hydrant system remains serviceable.

(e) 5-yearly

For systems without pressure reducing valve controlled zones, a flow test over the range 440 L/sec to the design flow through the full length of each main waterway.

9.3 Maintenance

9.3.1
Fire hydrant systems shall be maintained at all times in correct working order, free from external corrosion.

9.3.2
Any deficiencies detected in the course of routine or other tests shall be immediately remedied.

9.4 Building alterations

9.4.1
Appropriate alterations shall be made to the fire hydrant system in cases where building alterations affecting the location of outlets, signage, the setting of pressure control devices, or other matters result in the hydrant system no longer conforming to this Standard.

9.4.2
During the course of building alterations, fire hydrant systems shall remain operational.

9.5 Impairments

9.5.1
In order to comply with this Standard, if it is necessary to disable or otherwise impair a fire hydrant system, (for example, to make alterations or repair) the following precautions shall be implemented by the building owner:

(a) At least 48 hours prior notice shall be given to the Area Commander by the owner unless the impairment is necessary to make emergency repairs, in which case, the soonest possible advice shall be given to the nearest Fire Service Control Room.

NOTE – Control Rooms are found in the 6 main centres in New Zealand.

(b) In unsprinklered buildings hot work shall be suspended during the impairment.

(c) Notice shall be given to tenants of the intended impairment.

9.5.2
Once the system is restored to service, the following checks shall be made:

(a) That the pressure at the highest point on the waterway conforms with 3.5;

(b) That all valves are in the correct position, and where required, locked;

(c) That the water make-up line is fully open;

(d) That all pumps will correctly start;

(e) Any newly installed part of the system functions correctly;

(f) Any temporary blanking pieces or other disabling devices have been removed and a note of the actions taken inserted in the test record book.

APPENDIX A
GUIDELINES FOR EVALUATION OF CONTRACTORS
(Informative)

A1
This Standard is drafted on the basis of an assumption that contractors undertaking, and having responsibility for, the design and/or installation and maintenance of hydrant systems in buildings will have:

(a) A sufficient understanding of the practical use of such systems;

(b) An adequate technical knowledge of the materials and components which comprise such systems and of the relevant engineering and scientific principles involved in their design and installation;

(c) The necessary integrity, experience, resources, competence and organization for the successful completion of contractual obligations in accordance with the Standard;

(d) An appropriate form of quality system to ensure consistent and adequate standards of work.

A2
Because firefighters involved in interior fire suppression within a building are wholly dependent upon the hydrant system for their personal safety, it is implicit that an approved contractor should meet the foregoing criteria at all times and not simply at the time of formal evaluation. Accordingly it is envisaged that:

(a) The authority having jurisdiction may withdraw its approval at any time but that 30 days notice of any shortcoming would be given to the contractor before doing so, to afford an opportunity to the contractor to remedy same.

(b) Approval will lapse routinely 24 months from the date of granting and that:

(i) The date of this routine expiry would be included in the documentation of the approval.

(ii) Responsibility for applying for re-approval would lie with the contractor.

(iii) Restoration of an approval would be based on the ability to satisfy criteria and standards of competence relevant at the time, having regard to technological and trade practices current at the time.

A3
Any request for approval or restoration of approval should be supported by written information and evidence in a form presented by the authority having jurisdiction and include, inter alia:

(a) Authority having jurisdiction from which approval is sought;

(b) Name of contractor and postal address;

(c) Name of manager, contact address and telephone number;

(d) Date from which approval is sought;

(e) Details of previous experience in related work;

(f) Names and *curriculum vitae* (c.v.) information of employees responsible for design, installation supervision, commissioning tests and routine tests;

(g) Fire Service areas in which the contractor proposes to operate;

(h) Copy of written quality system, i.e., the practices, policies and procedures by which the contractor will ensure adequacy of design, materials, fabrication, installation, documentation, calculation and testing. Where the quality system has been externally accredited to one of the ISO 9000 suite of Standards evidence of such accreditation should be provided.

A4

The authority having jurisdiction may conduct a written test to determine adequacy of knowledge of the applicant and/or the applicant's staff. The general format of the test, amount of time available and intended "pass" criteria should be notified in advance and in the event of failure of the applicant to achieve such criteria, a copy of the completed test paper and the correct answers should be provided on request to the applicant.

A5

In considering whether to grant reapproval, the authority having jurisdiction may take into consideration work undertaken in connection with hydrant systems during the preceding period of 2 years and in particular the technical adequacy of that work. Renewal shall not be granted if such work has been unsatisfactory unless the contractor has instituted remedial measures to staffing, quality systems or other factors contributing to inadequate past performance.

APPENDIX B
ANNUAL INSPECTION AND MAINTENANCE SCHEDULE FOR DIESEL ENGINES
(Informative)

Tick each item if satisfactory and record test results where indicated.

1. Check ease of starting from both remote and local panels ☐

2. Run engine on load for 15 min and check pump bearings and engine for any overheating ☐

3. Check cooling system for loss of coolant ☐

4. Check for the free movement of all moving parts, including controls, governor equipment etc. ☐

5. Check for knocks and other audible signs of wear or maladjustment ☐

6. Stop engine ☐

7. Drain engine oil and refill crankcase with manufacturer's recommended grade of oil ☐

8. Clean electrical apparatus and check that battery charge rate is correct: ☐

   Charge voltage (no load) ....
   Charge current ....

9. Check that the battery paralleling apparatus operates correctly ☐

10. Check starter commutators and if necessary clean with cloth ☐
    Check length of brushes and ensure free movement in holders

11. Ensure all electric wiring to batteries and remote and local control panels etc. is in good order ☐

12. Check the voltage of each battery with a load tester and record: ☐

    Battery A .... volts. Installed date ....
    Battery B .... volts. Installed date ....

13. Clean fuel sludge sump, check fuel tank breather, filler cap and gauge ☐

14. Check condition of all fuel lines ☐

15. Visually check fuel pump and injectors. Replace any doubtful parts ☐

16. Ensure all belts are correctly adjusted. Replace every 2 years or if badly worn or cracked. Date drive belt last replaced .... ☐

17. Drain, flush and refill engine cooling system with water and inhibitor ☐

18. Replace thermostat every 2 years. Date last replaced .... ☐

19. Check condition of cooling system hoses and tightness of connectors ☐

20. Check and adjust tappet clearances ☐

21. Check around oil sump and remedy any leaks ☐

22. Lubricate all parts such as control rods, bearings, linkages etc. ☐

23. Clean or renew all oil filters, air filters and fuel filters ☐

24. Check condition of all lubricating oil pipelines. Replenish all grease cups with correct grade of grease ☐

25. Check the compression of each cylinder every 2 years and record pressure or date last done: Date last checked .... ☐

Cyl No.	1	2	3	4	5	6	7	8
Pressure								

26. Drain pump bearings and refill with oil or grease of the correct grade as appropriate ☐

27. Examine any pump glands and if necessary repack with correct type and quantity of packing. Check mechanical seals ☐

28. On completion of the above checks carry out a full monthly check (see 9.2.3 (a)) and run on full load for at least 2 hours ☐

29. Check that neither battery has been in service longer than 4 years and that installation dates are clearly marked ☐

I have carried out a thorough inspection of the engine, including all the above checks and instructions. I consider that (subsequent to the maintenance outlined below)* the engine is*/will be* in good running order.

* Delete where not applicable

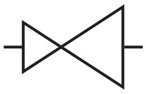
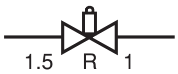
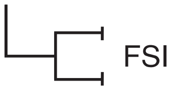
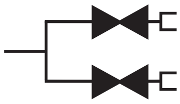
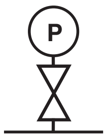
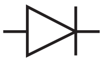
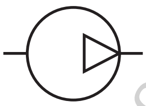
Signed .... Certified A-grade diesel engine mechanic

of ....(Company)

Date ....

APPENDIX C
DRAWING CONVENTIONS FOR USE IN HYDRANT SYSTEM DIAGRAMS
(Informative)

C1
The following graphical symbols may be used for fire protection drawings and are based on SAA HB20 and AS 1101:Part 5. These should be sought for further information:

No	SYMBOL	MEANING
1.		Stop valve – normally open (general symbol)
2.		Stop valve – normally closed (general symbol)
3.		Pressure reducing valve
4.		Ratio valve
5.		Fire Service Inlet
6.		Outlet
7.		Pressure gauge
8.		Direction of flow
9.		Non-return valve (direction of flow)
10.		Pump (general symbol)(D = Diesel)(E = Electric)
11.	R	Remote start panel
12.	FLOW PRESSURE Design l/min .... No flow l/m	Shut off and design flow/pressure for pumps
13.	PUMP ACCESS	Entry point for access to pumps

APPENDIX D
CHECKLIST FOR PUMP INSTALLATIONS
(Informative)

Address of installation:..

....

Date installed: ....

Name of installer: ....

Address of installer: ....

....

Contact telephone no:..

PUMP ENCLOSURE:

Location of pump/s: ....

Enclosure constructed of: .... Fire rated:.....................................

Size:......................... m x ....m Non flood:...

Free from hazards: ....

Exclusive use: .... Shared with other plant:.................................

Drainage: Gravity .... Sump & pump:..

Ventilation: (Natural) .... Adequate for aspiration:...............................

Cooling:........................... What was enclosure temperature rise during 2 hour full load test?:

.... max. permitted 18 °C

Heating:... Thermostatic control:...

Low temperature alarm (below 10 °C):...

Lighting: (Adequate for Servicing Emergency):...

Sufficient room for maintenance & service: ....

Access big enough for pump removal: ....

Sign-posted access for fire service:..

Is enclosure sprinkler protected:...

Extinguisher: Type: .... Capacity: .... Mounted by door: ....

PUMP UNIT: DIESEL

What emergency start device is provided?: ....

Is it easily seen and used?: ....

Is the unit frame on?: 100 mm Plinth: .... or: Spring fittings: ....

Who checked pump alignment after installation?: ....

Is driptray fitted under motor?: ....

Access to remove sump: ....

Access to change oil: ....

PUMP CONTROLLER:

Is the controller approved?: ....

Is the controller physically separated?: ....

Secured to structural floor/wall?: ....

Remote controller inlet enclosure?: ....

Water-proof unit to IP65: AS 1939: ....

Pump start switch: ....

Marked with “Diesel Pump Start: or “Electric Pump Start”: ....

Pump running lamp (Red Bezel): ....

Indelibly marked signage “Start Pump after charging feeders” (min. 25 mm high): ....

100 mm pressure gauge (Hydrant system pressure): ....

Remote controller to main controller – Mineral insulated metal sheathed cable: ....

Details from name plate:

(a) Manufacturer of pumpset: ....

(b) Unit number: ....

(c) Date of manufacture: ....

(d) Engine make: ....

(e) Model: ....

(f) Number: ....

(g) Continuous power rating: (kW) ....

➤

(h) Pump make: ....

(i) Model: ....

(j) Impeller diameter: ....

(k) Duty speed (at duty flow): ....

(l) Duty flow: ....

(m) Pressure: ....

Connected to pumpset by protected flexible cable: ....

At controller end – restrained multi-pin plug: ....

Pump delivery pressure gauge: ....

Pump suction pressure gauge: ....

Separate labelled “green” start buttons for Battery A: .... Auto Reset: ....

Battery B: .... Auto Reset: ....

Tachometer (either digital or analogue): ....

Hourmeter: ....

Oil pressure gauge: ....

Cooling water temperature gauge: ....

Two approved constant voltage battery chargers: ....

Suppressed range ammeter for each charger: ....

Voltmeter (9 V to 15 V) for each battery: ....

Speed sensing device for “pump running” lamp: ....
(NB: Do not illuminate unless engine speed exceeds 600 rpm)

Compartment for dry-secured storage: ....
Pump: Manual .... Engine: Manual ....

Controller: Manual .... Wiring diagram of controller: ....

Fuel filter: .... Oil filter: .... Belts: .... Gaskets: ....

Hoses: .... Injectors: .... Tools: .... Hydrometer: ....

Pump gland packing: .... 230 V power supply: ....

Two batteries indelibly marked A and B .... Date of installation: Indelibly marked: ....

Not exceeding 2 years: .... Not exceeding 4 years: ....

Adequate ventilation for cabinet: ....
(NOTE – NO REMOTE STOPPING DEVICES ON THE CONTROLLER ARE PERMITTED)

PUMP SUCTION:

Diameter: .... mm

Connected by flexible coupling of corrugated steel and
multiple braided according to pressure rating:

No butterfly type valves closer than 10 diameters to pump suction flange: ....

Each pump kept primed by connection to suction side of pump: ....

What provision made for releasing trapped air?:..

Back pressure valve B.I.C. / pump suction: ....

Suction pressure gauge: ....

PUMP DELIVERY:

Diameter: .... mm

Delivery pressure gauge: ....

Remote delivery pressure gauge in Fire Service inlet enclosure: ....

Maximum pump casing pressure rating: .... kPa

Highest casing pressure achieved: .... kPa

If PRV used to eliminate pressure:

Size: .... mm Setting: .... kPa Location: .... Discharge to: ....

Size: .... mm Setting: .... kPa Location: .... Discharge to: ....

Size: .... mm Setting: .... kPa Location: .... Discharge to: ....

Size: .... mm Setting: .... kPa Location: .... Discharge to: ....

Size: .... mm Setting: .... kPa Location: .... Discharge to: ....

Size: .... mm Setting: .... kPa Location: .... Discharge to: ....

What type of low flow pump case cooling is provided? : ....

....

If a boosted town main, is a labelled 25 mm discharge to waste cooling valve fitted: ....

What routine flow test facility is provided?: ....

Is the test flow facility locked closed?: ....

Is test flow facility adequate for 150 % of design flow?: ....

Did the pump run up to full load from start signal in less than 30 s?: ....

Performance: Inlet pressure: .... kPa

Discharge pressure: .... kPa

Flow: .... L/min

MOTOR COOLING:

Is motor air cooled?: ....

Is hot air ducted to outside?: ....

Make-up air supply: ....

Closed room – full load test – ambient temperature rise less than 18 °C: ....

If the motor is water cooled – state method used: ....

The cooling water discharge pipe is one diameter larger than inlet: ....

The cooling water discharge pipe does not return directly into the suction: ....

The cooling water discharge pipe freely discharges and has no valves in it: ....

Pressure control valve provided to ensure limitation of
heat exchanger pressure to manufacturer's requirements: ....

EXHAUST:

Exhaust exclusive, discharge to a safe place with provision to prevent entry of water: ....

Does it have ? :

An adequate silencer: ....

A condensate drain at the lowest point: ....

Adequate guards within 2 m of floor: ....

Provision for checking back pressure close to manifold: ....

Back pressure not to exceed manufacturer's recommendations: ....

Actual back pressure: .... kPa

Exhaust well supported: .... at least 225 mm from combustibles ....

Flexible connection provided at engine: ....

FUEL SUPPLY:

Complies with Dangerous Goods Regulations – may be co-located in pump enclosure: ....

Tank supply capacity .... litre; Sufficient for 8 h at full load: .... Fuel gauge: ....

Refill 70 % Full: ....

Substantially supported – separate from the motor: ....

Constructed of stainless steel (min. 1.25 mm thick) .... Cleaning port – min. 100 mm ....

The fuel outlet between 500 mm and 1000 mm above injectors: ....

Confirm the following connections are made in non-galvanized metal pipe:

Fuel refill – 25 mm diameter – permanently piped to manually operated pump: ....

Vapour vent – 25 mm diameter – terminating outside building in an inverted “U” bend with gauze: ....

Overflow – 32 mm diameter – piped to suitable container: ....

Fuel line – required diameter – incorporating lockable valve, agglomerator and flexible connection at engine: ....

Fuel line to be well protected from physical damage: ...., and supported wherever horizontal: ...., where possible a continuous down-gradient to engine .... or single low point-rise to both fuel tank and engine: ....

Air bleed points shall have screwed plugs: ....

Drain valve – plugged – at lowest point of tank and at least 25 mm lower than fuel line outlet: ....

Excess fuel return, required diameter by engine manufacturer – returning through top of tank to a point 100 mm above tank bottom and remote from the fuel line outlet: ...., stop valves not permitted, but non-return valve may be installed.

Well protected and supported: ....

Pump unit – electric

Is the unit frame on?: 100 mm Plinth.................................. or: Spring fittings..............................

Who checked pump alignment after installation?:..

Are all current carrying parts of drip proof motor at least 450 mm above the floor?: ....

Electric motor controller: ....

Is controller approved?: ....

Secured to structural floor/wall?: ....

Remote controller inlet enclosure: ....

Water proof unit to IP 65: AS 1939 ....

Is the controller separate but close to the pump?: ...., with all electrical components

450 mm above the floor: ....

Are the controller name plate details easily seen?:...

(a) Make of pumpset: ....

(b) Unit number: ....

(c) Date of manufacture: ....

(d) Pump make: ....

(e) Pump model: ....

(f) Duty speed: ....rpm

(g) Impeller diameter: .... mm

(h) Duty flow: .... L/min

(i) Duty pressure: ....kPa

(j) Motor make: ....

(k) Serial number: ....

(l) Continuous power rating: ....

(m) Working: .... volts ....hertz

(n) Speed at full load: ....rpm

(o) Full load current: .... amps

Start contactor: Direct-on-line: .... or Auto-Transformer: ....

Isolating switch: ....

Manually operated green start button: .... Labelled: ....

Manually operated red stop button: .... Labelled: ....

Labelled compound suction pressure gauge: ....

Labelled pump delivery pressure gauge: ....

A form or indicator to demonstrate that there is power on to live side of contactor: ....

Speed sensing device to switch "Pump Running" lamp at the remote control panel: ....

Hourmeter: ....

Compartment for dry secured storage: ....

(i) Pump manual: .... (ii) Controller manual: ....

(iii) Wiring diagram of controller: .... (iv) Set of fuse cartridges of size used: ....

Pump gland packing: ....

Spare indicator lamps: ....

Remote controller to main controller – Mineral insulated metal sheathed cable: ....

PUMP SUCTION:

Diameter .... mm

Connected by flexible coupling of corrugated steel and
multiple braided according to pressure: ....

No butterfly type valves closer than 10 diameters to pump suction flange: ....

Each pump kept primed by connection to suction side of pump: ....

What provision made for releasing trapped air:

Back pressure valve – BIC/Pump suction: ....

Suction pressure gauge: ....

PUMP DELIVERY:

Diameter: .... mm

Delivery pressure gauge: ....

Remote delivery pressure gauge in Fire Service inlet enclosure: ....

Maximum pump casing pressure rating: .... kPa

Highest casing pressure achieved: .... kPa

Connected by flexible coupling of corrugated steel and multiple braided

according to pressure: ....

If PRV used to eliminate pressure:

Size: .... mm Setting: .... kPa Location: .... Discharge to: ....

Size: .... mm Setting: .... kPa Location: .... Discharge to: ....

Size: .... mm Setting: .... kPa Location: .... Discharge to: ....

Size: .... mm Setting: .... kPa Location: .... Discharge to: ....

Size: .... mm Setting: .... kPa Location: .... Discharge to: ....

Size: .... mm Setting: .... kPa Location: .... Discharge to: ....

What type of low flow pump case cooling is provided?: ....

If a boosted Town main, is a labelled 25 mm discharge to waste cooling valve fitted: ....

What routine flow test facility is provided?: ....

Is the flow test facility locked closed?: ....

Is the flow test facility adequate for 150 % of Design Flow?: ....

Performance: Inlet pressure .... kPa

Discharge pressure: .... kPa

Flow: .... L/min

MOTOR

Confirm that motor is 400 V; 3 phase; drip proof: .... or squirrel cage: .... or totally enclosed: ....

At nominal voltage, has the motor 10 % more power than required by the pump at max. duty load? : ....

Confirm the locked motor current does not exceed 750 % of full load current: ....

Name plate affixed to motor and indelibly marked:

(a) Make: ....

(b) Motor type: ....

(c) Serial number: ....

(d) Continuous rated power output: ....

(e) Speed at full load: ....

(f) Full current load: ....

POWER SUPPLY:

Who supplies the reliable secure power? : ....

Is the connection from: (a) The live side of the main switchboard incomer?: ....

or (b) The emergency services bus bar?: ....

Can the premises power be isolated, while leaving the pump power on?: ....

Power supply cabling to motor : mineral insulated sheathed: ....

: minimum exposure risk to cable route: ....

Cabling sized to ensure voltage drop does not exceed 10 V
– lead and return at full load motor current: ....

Every switch controlling the power supply to an electric motor is be labelled –

FIRE HYDRANT SYSTEM – DO NOT SWITCH OFF: ....

Signage – indelible marking – white letters on red background: ....

Is the "ON/OFF" isolate switch for the motor contactor locked "ON"?: ....

Confirm no switches between pump motor isolator and power supply switch: ....

DATE OF INSPECTION: ....

APPENDIX E
MATTERS DECLARED BY FIRE SERVICE NATIONAL COMMANDER

(Normative)

E1

For the purposes of determining the maximum pressure (P_{NC}) assumed to be available at the outlet of any Fire Service pumping appliance, the value shall be that declared from time to time by notice in the New Zealand Fire Service Gazette by the National Commander.

E2

In declaring such values, the National Commander shall have due regard to the characteristics of Fire Service equipment, the General Statement of Purpose, and to all other specific requirements of this Standard.

E3

The National Commander may declare such Fire Service standard operating procedures in relation to use of hydrant systems as are necessary and require consideration in the application of this Standard. To the extent that this Standard provides for such consideration the National Commander's declaration shall be binding and form part of this Standard.

Approved by the Standards Council on 10 July 1998 to be a New Zealand Standard pursuant to the provisions of section 10 of the Standards Act 1988.

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