



Department of Consumer
and Employment Protection
Energy Safety

Guideline

Gas tightness testing of consumer gas piping systems above 200 kPa

This document is issued to assist gas fitters to comply with their regulatory obligations for the pressure testing of consumer gas installation piping systems designed to operate at pressures above 200 kPa

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Director of Energy Safety
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Preface

This guideline is provided to assist gas fitters to comply with their regulatory obligations for the pressure testing of consumer gas installation piping systems designed to operate at pressures above 200 kPa. This guideline does not take precedence over the *Gas Standards (Gasfitting and Consumer Gas Installations) Regulations 1999* and is not intended to cover the commissioning of pipe work.

Further information on commissioning of pipe work is available in Energy Safety's publication "Guidelines for Safe Working with Gas in Consumers' Installations" (available from Energy Safety's website).

Suggestions and comments to improve this Guideline are welcomed and should be forwarded to:

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Introduction

Schedule 6 Clause 401(2) of the *Gas Standards (Gasfitting and Consumer Gas Installations) Regulations 1999* requires that a fitting line or fitting on a consumer's gas installation that is to operate at a pressure exceeding 200 kPa must comply with AS 4041 "Pressure piping". Schedule 7 of the Regulations provides for AS 1697 "SAA Gas Pipeline Code" or AS 2885 "Pipelines – Gas and liquid petroleum" Parts 1, 2 and 5 to be used as an alternative.

AS 4041, AS 1697 and AS 2885 relate predominately to the design, construction and strength testing of pipe sections, including joints, welds and pipe components.

The testing process does not necessarily require all the system components to be included in the testing.

Often, to comply with the pressure tests nominated in the standards, components such as pressure control devices, valves and meters etc are isolated or removed (spooled out) before testing and replaced afterwards. This may be necessary because components are not pressure rated to the test pressure required to prove the strength of the pipe work. This does however mean that when these types of tests are performed, the complete system has not been tested for soundness, only the pipe work.

Note that after testing of the pipe sections only as per technical standards, the gas fitter must ensure that each fitting line is thoroughly cleaned internally (requiring the removal of all water if the system has been subjected to hydrostatic testing).

In addition to the testing of pipes only as per technical standards, the whole piping system including valves, pressure control devices etc, must also be tested to ensure that the complete, assembled system is gas-tight and free from leaks. **This guideline provides advice on how to carry out overall testing, to comply with the following regulation.**

Regulation 26 "Pressure testing" states [in part]:

- "(1) If a gas fitter installs or does any work on a consumer's gas installation, the gas fitter must ensure that, before the installation is commissioned —
- (a) the requirements of these regulations as to pressure testing are satisfied and the system is made gas-tight;
 - and
 - (b) if the gas supply is available for connection, the system is purged of all air or other gas except the gas on which the system is to operate."

Recommended testing procedure

After complying with the testing required by the relevant Australian Standard and immediately before fuel gas is introduced into a new consumer's gas piping system, the complete system (including components) must be tested, to establish that the system is gas-tight. For additions to existing installations, the new sections must be tested.

For installations that have a piping system volume of less than 0.5 m³, industry practice (AS 5601 "Gas installations" Appendix E) is to test for a period of 5 minutes for each 0.03 m³ (30 litre) of volume or part thereof.

For installations that have a piping system volume of more than 0.5 m³, Energy Safety recommends a 24-hour test and minimum test pressure of 1.1 times operating pressure.

Testing must be carried out in a safe manner and the installation must be left safe to use. The testing equipment shall be of a sufficient quality and standard to ensure the test is accurate.

A gas supplier may require additional testing to that outlined in this guideline. Contact the gas supplier before leak testing an installation to determine their requirements.

While the system is being tested for soundness, the test pressure should be continually recorded using a calibrated certified recording device and the chart made available to an inspector on request.

Test Method

The following points should be considered when testing pipe work for soundness:

- Identify any risks associated with the testing eg. test pressure, location, volume, length, testing medium, complexity of the installation.
- Where necessary and before carrying out any testing, prepare written procedures to address the identified risks and the testing process to be followed.
- Isolate appliances and gas supply apparatus (meter or tank) from the installation being tested.
- After isolating the appliance/s and the gas supply, ensure all the valves in the piping system are open and all the components are installed.
- Determine gas system operating set pressure:
 - For new installations, this information will be available from the gas supplier or network operator.
 - For existing installations, the operating set pressure at the line regulator immediately upstream of the new pipe section must be determined.
- Where a line regulator is not installed, determine the operating set pressure at the gas meter or tank supply regulator.
- Calculate the testing time based on volume of the installation and subject the installation to a pressure of 1.1 times operating set pressure using an approved testing medium (see examples).
- Allow a suitable stabilising period before timing the test.
- Round up test time calculations to the next full 5 minutes eg. 62.5 rounds up to 65 minutes.
- Equalisation of the system may be necessary where pressure control and safety devices are installed such as over/under pressure shutoff, regulators and normally closed automatically activated valves.
- Commission the system only after completion of the test and after establishing the system is gas-tight (not leaking) to the satisfaction of the gas supplier.
- Purge the system of air or test gases using a safe purging procedure. Energy Safety's publication "Guidelines for Safe Working with Gas in Consumers' Installations" and AS 5601 Appendix D provides some guidance
- When testing has been completed following purging and introduction of the fuel gas, any joints not included in the test (typically the tie in connections) must then be tested using soapy water, an approved testing agent or apparatus to ensure these joints are sound.

Approved testing medium

Gas fitters must use one of the following mediums for pressure testing [Regulation 26(2)] or for locating a leak in a consumer's gas installation:

- air;
- carbon dioxide;
- nitrogen;
- the gas proposed to be used in the consumer's gas installation (see Note below);
or
- such other medium as is approved in writing by the Director of Energy Safety or an authority recognised by the Director as a competent authority for that purpose.

Notes:

1. For new installations where fuel gas is intended as the testing medium or where gas installations are designed to operate with liquid gas, contact the gas supplier for approval.
2. When testing with liquid gas, contact the gas supplier for pressure test details.

Example 1

Operating set pressure: 220 kPa
Pipe size / material: 100 mm nominal bore steel
Length: 25 m

$$\begin{aligned}\text{Test pressure} &= \text{operating set pressure} \times 1.1 \\ &= 220 \text{ kPa} \times 1.1 \\ &= 242 \text{ kPa (Round up to 245 kPa)}\end{aligned}$$

To obtain the test time, calculate the piping system volume using formula:

$$\begin{aligned}\text{Volume} &= \pi r^2 \times L \\ &= 3.142 \times 0.05 \times 0.05 \times 25 \\ &= 0.1963 \text{ m}^3\end{aligned}$$

$$\begin{aligned}\text{Divide by } 0.03^{(\text{Note 1})}: & \\ &= (0.1963 \div 0.03) \\ &= 6.5433 \text{ (Round up to 7)}\end{aligned}$$

$$\begin{aligned}\text{Multiply by 5 to obtain testing time:} & \\ &= (7 \times 5) \\ &= 35 \text{ minutes test time}\end{aligned}$$

Notes:

1. This provides for a test time of 5 minutes for each 0.03 m³.
2. An alternative method of determining volume and test times is provided in examples 2 and 3.
3. The rounding up of time and pressure is used to simplify calculations. The rounding up of test pressure must not cause a hazard to property or personnel.

For the above example, the requirement is to pressure test the piping system to 245 kPa with an approved testing medium. Following pressurising of the piping system, isolate or remove the source of pressure, allow the testing medium to stabilise record the test pressure and leave the piping system pressurised at the test pressure for 35 minutes.

No loss of pressure during the test period indicates the system is gas-tight and fuel gas can be introduced into the system. A drop in the test pressure must be investigated, any leaks rectified and the system retested for the full 35 minutes.



Example 2

Operating set pressure: 450 kPa
Pipe sizes / material: 80 mm and 40 mm steel
Lengths: 45 m of 80 mm and 100 m of 40 mm

Test Pressure = 450×1.1
= 495 kPa

Calculate system volume using Table E1 AS5601 Appendix E: (see Table, page 6):

45 m of 80 mm steel = $45 \div 6$
= 7.5

100 m of 40 mm steel = $100 \div 20$
= 5

Determine volume (45 m of 80 mm steel):
= 7.5×0.03
= 0.225 m^3

Determine volume (100 m of 40 mm steel):
= 5×0.03
= 0.15 m^3

∴ Total volume = $0.225 + 0.15$
= 0.375 m^3

Calculate test time: = $0.375 \text{ m}^3 \div 0.03 \times 5$
= 62.5 (Round up to 65) minutes test time



Example 3

Operating set pressure: 600 kPa
 Pipe sizes / material: 90 mm PE and 80 mm steel
 Lengths: 110 m of PE and 150 m of steel

Test pressure = 600 x 1.1
 = 660 kPa

Calculate system volume using Table E1 AS 5601 Appendix E: (see Table below)

110 m of 90 mm PE = 110 ÷ 6
 = 18.33

Estimate volume = 18.33 x 0.03
 = 0.5499 m³

Note: There is no need to calculate the steel pipe volume as the PE volume is in excess of 0.5m³. Therefore, a 24-hour recorded test at 660 kPa is required for this installation.

The following table is extracted from Australian Standard AS 5601:

Pipe material	Approximate pipe length for a volume of 0.03 m ³ m										
	Nominal pipe size DN										
	18	20	23	25	32	40	50	63	80	90	100
Steel	-	80	-	50	30	20	15	-	6	-	3.5
Copper	-	130	-	70	40	30	16	-	7.5	-	4
UPVC	-	75	-	45	25	20	15	-	6	-	3.7
PE (To AS 4130)	-	150	-	-	-	29	-	13	-	6	-
Polyamide	153	-	88	-	-	28	18	11	-	5.3	-