This publication has been compiled by the Petroleum and Gas Inspectorate, Department of Natural Resources Mines and Energy.

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Summary

In 2018 the Queensland Petroleum and Gas (P&G) Inspectorate conducted a study of Liquefied Petroleum Gas (LPG) cylinders and butane canisters to identify the level of risk to the people of Queensland from the use of portable gas containers that have been imported into Australia.

Although the study found no evidence of declining standards in imported products and that importers have processes in place to check that products meet regulatory requirements, it highlighted a number of issues including:

- The majority of safety incidents involving LPG cylinders relate to LPG leaking from the cylinder valve.
- Information gathered from other regulators and industry bodies highlights the failure of the overpressure safety device as a factor in the ongoing incidents with butane cookers.

In response to the research findings the P&G Inspectorate commissioned the Australian Gas Association (AGA) to conduct testing on a sample of leisure LPG cylinders and butane cartridges sold in Queensland for public use. Testing confirmed there are issues with LPG cylinder valves and high pressure in butane cartridges due to irregular contents (i.e. higher propane).

Based on the test results, the P&G Inspectorate makes the following recommendations:

2. Make a formal request to the Joint Standards Australia/Standards New Zealand Committee ME-002, Gas Cylinders to consider whether AS 2473 *Valves for compressed gas cylinders* requires changes to improve the quality of the valves.
3. Make a formal request to Standards Australia to develop a standard for butane cartridge construction and content for sale in Australia.
4. Make a formal request to the Gas Technical Regulator Committee for a national approach to these issues.
5. Source and test a sample of non-AGA LPG cylinders, of a similar capacity to those already tested, in 2019/2020.
6. Release a Safety Alert advising consumers of the issues surrounding faulty LP Gas cylinder valves and appropriate actions to be taken when using LP Gas cylinder valves.
Purpose

The Queensland Petroleum and Gas (P&G) Inspectorate works with industry and the public to maintain and improve safety and health in the petroleum and gas industry. Due to safety concerns highlighted in a previous study, the P&G Inspectorate has recently completed testing a sample of leisure Liquefied Petroleum Gas (LPG) cylinders and butane cartridges sold in Queensland for public use. This report provides a summary of the results and makes a number of recommendations to enhance the safety of the public when using portable gas containers.

Background

The use of LPG cylinders and butane fuelled portable appliances is widespread throughout Queensland. While the actual number in use is not known, it is believed that most people in Queensland will come in contact with an appliance fuelled by LPG or butane, in either a private or commercial setting.

With limited Australian manufacturing of LPG cylinders and butane canisters, an increasing number of cylinders, canisters and associated valves and fittings are being imported into the country.

In 2018, the P&G Inspectorate conducted a study\(^1\) of the current state of LPG cylinders and butane canisters to identify the level of risk to the people of Queensland from the use of portable gas containers.

Although the study found no evidence of declining standards in imported products and that importers have processes in place to check that products meet regulatory requirements, it highlighted a number of issues. Key findings from the study include the following:

- There is no overwhelming evidence of cylinder or canister manufacturing faults leading to safety incidents.
- Gas suppliers and other retailers of LPG cylinders have confirmed that they require the cylinders to be manufactured to the relevant Australian standards.
- Information found in the most recent literature on LPG cylinder safety, and from discussions with other state and territory regulators, indicates that the majority of safety incidents relate to LPG leaking from the cylinder valve.
- Gas Energy Australia has identified several different styles of valves that could be used to enhance safety and has provided some direction in proposing safe cylinder valve designs.
- Verification testing of a sample of butane cartridges revealed that a substantial proportion of the tested appliances did not comply with the Australian Gas Association (AGA) standard requirements as the overpressure protection activated at a higher pressure than permitted by the standard or failed to activate at all. A number of appliances also did not comply with requirements relating to the protection of the overpressure and canister retention mechanisms however they had previously been accepted by the certification body. As a result

of the non-compliances a majority of the product certifications were suspended and non-compliance products were withdrawn.

As a result of the study, the P&G Inspectorate identified strategies to:

- undertake a targeted audit and inspection program of gas suppliers and LPG cylinder retailers to ensure cylinders are being purchased to the required standards.
- conduct a program of inspection and verification on a sample of:
  - leisure LPG cylinders sold in Queensland for public use; and
  - those in the cylinder exchange business supplied by various gas suppliers to ascertain if these cylinders comply with the relevant Australian standards.
- inspect to ensure LPG cylinder design registration obligations for gas suppliers and retailers are being met.
- continue, and possibly enhance, the level of gas safety campaigns and stakeholder engagement.

These strategies are ongoing and form part of the P&G Inspectorate's Compliance Assurance Program.

**Verification program**

In May 2019, the P&G Inspectorate completed one of the above recommendations by engaging AGA to conduct testing on a sample of leisure LPG cylinders and butane cartridges sold in Queensland for public use, to ascertain if these cylinders and cartridges comply with the relevant Australian standards.

**Testing requirements**

The P&G Inspectorate provided AGA with a random selection of 8.5-9kg and 4kg LPG cylinders and 220g butane cartridges from various retailers from the Australian market to test against relevant standards namely AS 2030, AS 2469, AS 2337.1, AS 2473.1 and AGA 301.

Currently there are no design, performance requirements or standards called up under any Australian State or Territory legislation to cover 220g Butane cartridges. AGA 301 is a standard which was developed and published by AGA to cover all the dimensional and safety performance requirements.

**Approach**

All cylinders were tested for marking assessment (AS 2030.1 and AS 2469), external inspection (AS 2337.1) and proof and pneumatic leakage test (Clause 9.2 and 9.3 of AS 2469) at 1MPa.

All other tests were conducted on a limited number of cylinders or gas cartridges from the samples provided by the P&G Inspectorate (test samples).
Results

Test results from the AGA report\(^2\) are summarised in Table 1 below.

**Table 1: AGA test results on sample LPG cylinders and butane cartridges**

<table>
<thead>
<tr>
<th>Test</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cylinder tests</td>
<td>• No leakage was observed from any cylinder and valve assembly tested pneumatically to 1 MPa.</td>
</tr>
<tr>
<td></td>
<td>• All cylinders were received in good condition with no defects in the welding or construction.</td>
</tr>
<tr>
<td></td>
<td>• All cylinders in the tested samples passed the internal inspection, strength of valve protection test, valve leakage test, cylinder dimension measurements, hoop stress test, pulsation test and stretch test.</td>
</tr>
<tr>
<td>Cylinder valve tests</td>
<td>• All cylinders in the tested sample passed the leakage test on the cylinder valve.</td>
</tr>
<tr>
<td></td>
<td>• One of the four cylinders in the tested sample failed the cyclic endurance test on the cylinder valve.</td>
</tr>
<tr>
<td></td>
<td>• One of the four cylinders in the tested sample failed the closing torque test to failure on the cylinder valve.</td>
</tr>
<tr>
<td></td>
<td>• Three of the four cylinders in the tested sample failed the opening torque test to failure on the cylinder valve. There were instances where, after applying torque, the valve no longer operated, the valve could not be fully closed or the handle operated freely in the opening direction.</td>
</tr>
<tr>
<td>Gas cartridge tests</td>
<td>• Testing had to be suspended for one batch of cartridges due to high pressure during the gas tightness test. Additional samples were purchased and tested in an explosion proof container.</td>
</tr>
<tr>
<td></td>
<td>• All of the gas cartridges in the tested sample failed the gas percentage requirements.</td>
</tr>
<tr>
<td></td>
<td>• One of the three gas cartridges in the tested sample did not meet the minimum force to cause gas flow.</td>
</tr>
<tr>
<td></td>
<td>• All other tests were passed by all cartridges in the tested samples.</td>
</tr>
</tbody>
</table>

\(^2\) Australian Gas Association (AGA), April 2019, ‘AGA Laboratory Report R18081502’. 
Figure 1: Strength of valve protection test

Figure 2: Valve closing torque test valve failure

Figure 3: Pressure testing
Conclusions

Testing conducted by AGA on a random selection of LPG cylinders and butane cartridges has confirmed there are issues with LPG cylinder valves and high pressure in butane cartridges.

The standard for LPG cylinder valve design should be revised to improve safety and an Australian standard for butane cartridges should be developed to specify performance and design requirements.

Recommendations

Based on the test results, the P&G Inspectorate makes the following recommendations:


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3. Make a formal request to Standards Australia to develop a standard for butane cartridge construction and content for sale in Australia.

4. Make a formal request to the Gas Technical Regulator Committee for a national approach to these issues.

5. Source and test a sample of non-AGA LPG cylinders, of a similar capacity to those already tested, in 2019/2020.

6. Release a Safety Alert advising consumers of the issues surrounding faulty LP Gas cylinder valves and appropriate actions to be taken when using LP Gas cylinder valves.