Gas Cartridges

Quality Assurance & Gas Composition

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GAS CARTRIDGES – QUALITY ASSURANCE & GAS COMPOSITION
Background

• Gas Cartridges come in different shapes and sizes
  220g, 435g, 450g, short fat, tall skinny
• Different connections and sealing means
  Re-sealable valve, screw type, pierceable
• Mass produced in 100’s of millions
Background
Background

This presentation will focus on the 220g Butane cartridges
In the Australian market to date, most 220g cartridges come from Korea, but are also manufactured in many other countries. Differences in design criteria and quality assurance protocols. They are shipped, transported, and stored with gas in them, usually >95% Butane. Usually sold full in packs of 4 or 6. Predominately used with camping and leisure products.
Background

Standards

• EN 417
• UL 147B
• KGS AC211
• JIA F 006
• DOT 39
• ...

• AS 2030 (Not a design Standard)
• AS 2278 (Aerosol Standard)
Gas Composition

• Gas compositions vary
• Predominately Butane (either I-Butane or N-Butane)
• Some Propane – higher vapour pressure
Background

Composition

- Random selection from the Australian market
Energy

- Butane contains ~50MJ/kg of energy
- ~12 MJ of energy in a 220g cartridge
- Equivalent to 2.6kg of TNT
- 1 MJ = 1,000,000 J
- LPG expands ~270 times the volume from liquid phase to gaseous phase
Energy

• Accelerate a 1 tonne car from 0 – 100km/h
  ~ 0.4 MJ (30 times less energy)
Energy

- Running for 1 hour
  ~ 3 MJ (4 times less energy)
Energy

- AGA Experiment (explosion without ignition)
Energy

- AGA Experiment (explosion with ignition)
Why the injuries and fatalities?

Number of gas product recalls since 2006

Number of gas appliance product recalls in Australia

GAS CARTRIDGES – QUALITY ASSURANCE & GAS COMPOSITION
Why the injuries and fatalities?

- Incidents involving fires and explosions of gas cartridge cookers escalated over the last few years
- Fatalities and serious injuries
- Rely heavily on the quality and design of the appliances
Why the injuries and fatalities?

- Do not have a safety device of their own
- Rupture pressure at ~1.5MPa compared to a refillable cylinder at ~10MPa
Why the injuries and fatalities?

- The nozzle dimensions are critical to ensure safe sealing with appliances
- Standards may vary around the world
- Some Standards do not include dimensions
- May not be compatible with appliances
What are we doing about it?

- Improving cartridge cooker requirements
  - Extreme temperature hazard test
  - Two independent shut off devices
  - Etc.

- Improving the quality assurance of gas cartridges
What are we doing about it?

- Liaised with the world leaders in cartridge manufacturing
- Shared information with leading notified and testing bodies globally
- Liaised with government regulators in Australia and internationally
- Developed the AGA Certification Scheme and Standard
What does the Scheme encompass?

• Factory Inspections
  Inspection and testing requirements along the production line

• Type Testing
  Laboratory testing by independent AGA Authorised Laboratories
AGA Certification

• Post Certification Surveillance

On-site

GAS CARTRIDGES – QUALITY ASSURANCE & GAS COMPOSITION
AGA Certification

- Random market surveillance & Laboratory Testing
Cartridge Standard AGA 301 covers:

- Dimensions
- Gas composition
- Pressure testing
- Drop Testing
- Durability Testing
- Leakage Testing
- Vibration Testing
- Material Testing
- Connection nozzle tests
Safety Devices

Manufacturers developed safety devices

- CRV
- RVR
- PRV
- Shut-off
Safety Devices

CRV (Countersink release vent) and RVR

- Releases gas in a controlled manner before rupture occurs
- Prevents an explosion
- Gives enough time for the operator to react and clear the area
Safety Devices

PRV (Pressure relief valve)

• Relieves the pressure in the cartridge before the deformation pressure is reached.

• Re-seats when pressure drops to allowable limit
Safety Devices

Shut off

- Shuts the gas off at a pre-determined pressure
- Stops the flow of gas to the appliance
Future Work

• Develop Standard for Safety Devices
• Share information with leading international bodies such as JIA, KGS, CSA, BSI & TUV
• Work closely with the manufacturers
• Liaise with government bodies nationally and internationally