TÜV SÜD Industrie Service

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Report-No.: IS-DDG-MUC-08-07-671279-001-002

Test report

Applicant: TÜV SÜD Korea Ltd.
12F, "KLI63" Bldg., #60, Yoido-Dong,
Youngdeungpo-Gu, Seoul, 150-763, Korea

Manufacturer: Tae Yang Industrial Co., Ltd.
#485-5, Upseng-Dong, Cheonan-City
Chungnam 330-290
Korea

Product: Non-refillable metallic gas cartridges for LPG with valve, Type Primus Power Gas
3 variants:
Primus Gas 2206
Primus Gas 2207
Primus Gas 2202

Purpose: **Type testing conforming ADR[1] / EN 417[2]**

Datum: 10.07.2008

Unsere Zeichen:
IS-DDG-MUC/hn

Das Dokument besteht aus 9 Seiten.
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Die Prüfergebnisse beziehen sich ausschließlich auf die untersuchten Prüfgegenstände.

[1] ADR = European Agreement concerning the international carriage of dangerous goods by road
[2] EN 417: 2003, Non-refillable metallic gas cartridges for liquefied petroleum gases, with or without a valve, for use with portable appliances – Construction, inspection, testing and marking

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Content

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1. Application

TÜV SÜD Korea Ltd. applied for Company Tae Yang Industrial Co., Ltd. type testing conforming to the ADR and the EN 417 to the authorised inspection organisation TÜV SÜD Industrie Service GmbH.

Type testing is required for modified cartridges. The original version has been tested by TÜV Industrie Service GmbH, TÜV SÜD Gruppe. The results are described in test report IS-DDG-MUC-06-02-671279-001 dated 02.02.2006. Tests have been performed with cartridges with 1 Layer Threaded Valve Plates.

The EN 417:2003 requires in sec. 4.4.1.2 the 2 Layer Threaded Valve Plates with a transition period until September 2008.

In order to test cartridges with 2 Layer Threaded Valve Plates TÜV SÜD Korea Ltd. provided us with

- Drawings of cartridges in original version and version after modification
- Sample cartridges of modified version as described in section 7

The type testing procedure as described in section 6 of EN 417 has been carried out in the test laboratories of TÜV SÜD Industrie Service GmbH and TÜV SÜD Product Service GmbH in Germany. As the original version has been type tested in the year 2006 a reduced test programme has been performed.

2. Description of the cartridges

Type of cartridge:	three piece cartridge with valve, 3 variants
Model Variants:	Primus Gas 2206 (100 g) Primus Gas 2207 (230 g) Primus Gas 2202 (450 g)
Drawing no.:	assembly drawings, modified version: 100 g Bombe TY-10-AL-061020-04, not dated 230 g Bombe TY-10-AL-061020-05, not dated 450 g Bombe TY-10-AL-061020-06, not dated
Material:	Electrolytic Tin Plate
Outer diameter:	89.6 mm (100 g) 108.9 mm (230 g) 110.0 mm (450 g)
Height of cartridge (with valve):	65,70 mm (100 g) 88,70 mm (230 g) 147,0 mm (450 g)
Volume (ml):	marking on cartridge 240 (100 g) 520 (230 g) 990 (450 g)
Net (filling) weight:	100 g 230 g 450 g
Gas:	UN 2037, RECEPTACLES; SMALL; CONTAINING GAS; (GAS CARTRIDGES) without a release device, non-refillable; Hydrocarbon Gas Mixture.

Inner pressure (35°C):	0.5 MPa
Deformation Pressure:	no information
Burst Pressure	no information

3. Application Documents

Assembly drawings, modified version:
100 g Bombe TY-10-AL-061020-04, not dated
230 g Bombe TY-10-AL-061020-05, not dated
450 g Bombe TY-10-AL-061020-06, not dated
Detailed drawings for valve:
M-51 (2 Layer Threaded Mt/Cup), A-E1-026 Rev. - dated 2007.12.7
SBN-189 (2 Layer Threaded M/T Cup), A-P1-095 Rev. - dated 2007.12.07
SH-189, A-F1-064 Rev. – dated 2007.12.06
SR-189 Rubber, (2 Layer Threaded Mt/Cup), A-H1-027 Rev. – dated 2007.12.06
SS-189, A-G1-043, Rev. – dated 2007.12.06

4. Test specification

- **ADR 2007** (European Agreement concerning the international carriage of dangerous goods by road) especially par. 6.2.4 and
- Euronorm **EN 417:2003**

5. Design review

The design review has to be carried out by TÜV Korea (i.e. mill test certificates) as far as it could not be performed by TÜV SÜD Industrie Service GmbH.

5.1 Materials

The materials did not change. The body and the valve of the cartridges (except sealing material) are made of steel material. The used material (electrolytic tin plate) is suitable for gas cartridges.

The compliance of documents (e.g. mill certs) with EN 417 section 4.1 has to be proved by TÜV Korea Ltd.

5.2 Design and construction - General

The dimensioning of the gas cartridges meets the requirements. The adequate construction has been proven during the type testing process as described in section 7 of this report. The dimensions of the cartridge, especially the connection to the appliance, ensure that it is compatible with the appliances designated on the cartridge.

5.3 Cartridges with valves

The design of the cartridge makes sure that the valve can not be unintentionally opened.
The valve can be operated after connection with the appliances (e.g. gas cooker). This can be considered as a special adapter as required in EN 417 section 4.4.1.1.
Besides this the cartridge is equipped with a protection cup.
The valve is of such a design that it will close after removing the cartridge from the gas appliance.
The valve is – under conditions of normal use – self-closing because it is loaded by a spring.

It shows no leaks or other defects after 50 opening and closing operations (for reference: see section 7.6 of the report dated 02.02.2006).

6. Requirements for filled gas cartridges

As the volume and indicated net weight did not change, capacity, net weight and filling ration have not been tested.

7. Type testing and test results

The type testing has been performed in the test laboratories of TÜV Industrie Service GmbH, TÜV SÜD Gruppe, and TÜV Product Service GmbH in Germany, Munich. A reduced test programme has been carried out. The detailed results are described following.

7.1 General

The necessary amount of cartridges has been chosen from a production batch and sent to our test laboratories.

7.2 Dimensions

Comparison of approved and modified cartridges has been made on behalf of the drawings. Only the outer diameter of the crimp has increased by 0,2 mm due to use of 2 Layer Threaded Valve Plates instead of 1 Layer Threaded Valve Plates.

Therefore the other dimensions have not been checked. The modified dimension corresponds to the drawing.

7.3 Net capacity

Net capacity has not been checked.

7.4 Pressure strength

The following requirements are based on the pressure of the filling at 50°C:

Type	Average pressure at 50 °C, measured at 3 cartridges of each size (bar)	Test pressure = 1.5 times Average pressure at 50 °C
2206	6.2	9.3
2207	6.4	9.6
2202	6.4	9.6

3 cartridges of each size have been subjected to a hydraulic test as described in section 6.4 of EN 417.
The above calculated test pressure has been maintained for more than 25 s at room temperature. There were no signs of leaks or permanent deformation at this stage.

Afterwards the pressure has been increased until 1.2 x above calculated test pressure. At this pressure the cartridge still did not leak or rupture. The concave bottom did not show any signs of reversion nor did the dome show permanent extensions.

Afterwards the pressure has been increased until reversion of the bottom and further on until rupture or leakage of the cartridge.

The results are as follows:

Type / Sample no.	Deformation pressure (bar)	Burst pressure (bar)	Remark
Requirement	11.2	9.3	Leak in connection cylinder/bottom
2206 / 1	19.72	17.5	- " -
2206 / 2	18.92	16.9	- " -
2206 / 3	19.82	17.9	- " -
2206 / 4	19.64	17.2	- " -
2006 / 5	19.78	18.0	- " -
Requirement	11.5	9.6	
2207 / 1	18.13	14.7	- " -
2207 / 2	17.62	14.3	- " -
2207 / 3	17.60	14.2	- " -
2207 / 4	17.57	13.8	- " -
2207 / 5	17.74	14.4	- " -
Requirement	11,5	9,6	
2202 / 1	21.46	19.05	- " -
2202 / 2	22.96	20.2	
2202 / 3	21.52	19.7	
2202 / 4	22.0	18.8	- " -
2202 / 5	22.44	20.0	- " -

The values fulfil the requirements of the EN 417.

7.5 Gas tightness of cartridges

The requirements as stated in section 4.2.6 of EN 417 have been verified on 5 sample cartridges of each size.

- Firstly the cartridges have been cooled to -20°C and immersed in a liquid. No bubbles could be detected within the examination period of 3 minutes.
- Secondly the cartridges have been immersed in a liquid at 0°C for 1 hour. Afterwards no bubbles could be seen during the observation period of 3 minutes.
- Finally the cartridges have been left at ambient temperature of about 20°C for 1 hour. Afterwards the cartridges were warmed in a water bath until a temperature of 70°C was reached, within more than 30 minutes. While observing the cartridges for 3 minutes no leakage could be detected.

The design and construction of the cartridges meet the requirement of section 4.2.6 that no leaks should occur at temperatures between –20°C and +70°C.

7.6. Gas tightness of valve

Gas tightness of the valves after executing 50 opening and closing operations at ambient temperature has not been tested. Relevant gas appliances were not available.

7.7 Drop test

5 cartridges of each size have been subjected the drop test. All cartridges will be delivered with protective cups. Therefore the drop test has been carried out on cartridges with fitted protective cups. The cartridges dropped from a height of 1.2 m onto a plane concrete ground.

- The following drop tests were performed:
- drop on the top
- drop on the base
- drop on the side

The test has been performed in a way that all sizes fell on all positions.

Afterwards the cartridges were placed into a water bath at 20°C. During an observation period of 3 minutes no bubbles could be seen.

The requirements are met.

7.8 Threaded boss valve

The test has been carried out on 5 cartridges with a test device as in EN 417 picture 5. The torque has been increased in a speed of ca. 1 Nm/s until 15 Nm.

No rupture of the valves has been observed.

The requirements are met.

7.9 Gas pressure at 50°C

3 cartridges each of type 2206, 2207 and 2202 were placed in a warm water bath of 50°C until the content of the cartridge warmed up to this temperature.
The average pressures of the gas at this temperature in the cartridges were
Type 2206: 6.2 bar
Type 2207: 6.4 bar
Type 2202: 6.4 bar
The test pressures have been calculated on the basis of these values. The requirements in the technical tests (test pressure, burst pressure) were met.

8. Manufacturing and filling

8.1 General

Tae Yang company manufactures the complete cartridge. For the valves drawings of company Sun Seung Il Corporation were presented. The assembly and filling of the cartridges is performed at Tae Yang company. The inspection of the manufacturing and filling facilities including the performance of the production tests has to be done by TÜV Korea Ltd. During this audit it has to be verified that Tae Yang has adequate manufacturing and testing facilities and methods and sufficiently trained personnel.

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9. Marking

9.1 General

The marking on the provided cartridges is durable and readable.
The marking has not been checked.

10. Summary

Tae Yang Industrial Co., Ltd., applied for type testing of 3 modified variants of cartridges with valve
Type Primus Gas 2206 (100 g)
Type Primus Gas 2207 (230 g) and
Type Primus Gas 2202 (450 g).

The original version has been tested by TÜV Industrie Service GmbH, TÜV SÜD Gruppe. The results are described in test report IS-DDG-MUC-06-02-671279-001 dated 02.02.2006. Tests have been performed with cartridges with 1 Layer Threaded Valve Plates.

The EN 417:2003 requires in sec. 4.4.1.2 the 2 Layer Threaded Valve Plates with a transition period until September 2008.

As the original version has been type tested in the year 2006 a reduced test programme has been performed with modified cartridges.

Remarks:
The following remarks should be considered for future shipments to Europe:

- The manufacturing and filling facilities have to be inspected by an expert of TÜV SÜD Korea at or before begin of manufacturing and then in regular periods of maximum one year.
- The markings are printed in several languages, therefore the individual markings are sometimes very small. Effort should be taken to make individual markings better readable. Marking, if new, has to be checked by TÜV SÜD Korea
- Compliance of mill certificates with EN 417 has to be verified by TÜV SÜD Korea Ltd.

The tested modified cartridges meet the requirements of EN 417 and ADR, provided the above mentioned remarks are observed. Cartridges for future shipments to Europe shall correspond to the tested cartridges.

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The expert

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TÜV SÜD Industrie Service GmbH

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Annex

Drawing 100 g Bombe TY-10-AL-061020-04, not dated
Drawing 230 g Bombe TY-10-AL-061020-05, not dated
Drawing 450 g Bombe TY-10-AL-061020-06, not dated
Drawing A-E1-026 Rev. - dated 2007.12.7, M-51 (2 Layer Threaded Mt/Cup),
Drawing A-P1-095 Rev. - dated 2007.12.07, SBN-189 (2 Layer Threaded M/T Cup),
Drawing A-F1-064 Rev. – dated 2007.12.06, SH-189
Drawing A-H1-27 Rev. – dated 2007.12.06, SR-189 Rubber, (2 Layer Threaded Mt/Cup),
Drawing A-G1-043, Rev. – dated 2007.12.06, SS-189