SGS 7 - 06

JASIC comments to SGS 6-03 Draft proposal

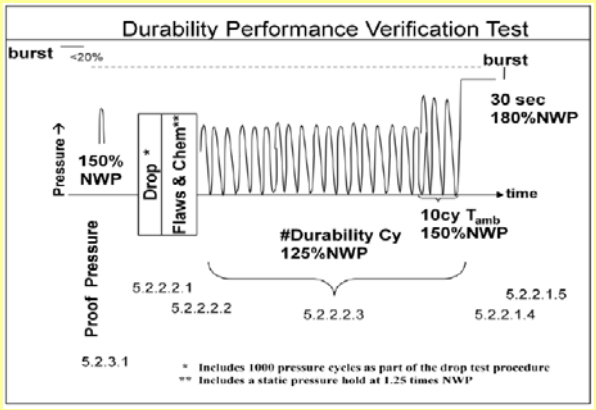
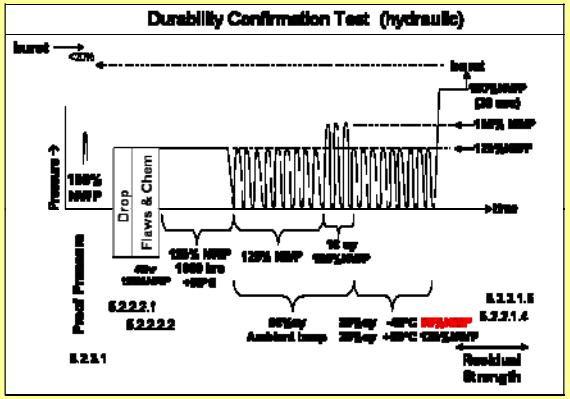
Date: 30.06.2009	Document:

1	2	4		5	(6)
Page	**Ref. Clause No./ Annex** (e.g. 3.1)	**Type of comment[2]**	**Text**	**Proposed change by the Requestor**	**Comment (justification for change)**
Page 2	5.2.2		When hydrogen effect of the container can be evaluated by the material test, paragraph 5.2.2.1 and 5.2.2.2 may be replaced by paragraph 5.2.2.4.	Remove	Review entire structure (See the support document)
Page 2	Table 1		<table><tr><td>Tests</td><td>Alternative</td></tr><tr><td>5.2.2.1.1 Fueling Performance Verification Test: Gas Pressure Cycling at Environmental Temperature Limits 5.2.2.1.1.a and 5.2.2.1.1.b</td><td>5.2.2.4.1.2 Fueling Performance Verification Test: Extreme temperature and Extended Usage</td></tr><tr><td>5.2.2.1.2 Parking Performance Verification Test: Static Gas Pressure Exposure at Extreme Temperature 5.2.2.1.2.a and 5.2.2.1.2.b</td><td>5.2.2.4.1.1 Parking Performance Verification Test: Static Pressure Exposure at Extreme Temperature</td></tr><tr><td>5.2.2.1.3 Leak/Permeation Test</td><td>5.2.2.4.2 Permeation Test</td></tr><tr><td colspan="2">5.2.2.1.4 Proof Pressure Test (Hydraulic and / or Pneumatic) to be done in 5.2.2.1 and 5.2.2.2 and 5.2.2.4</td></tr><tr><td colspan="2">5.2.2.1.5 Residual Strength Burst Test (Hydraulic) to be done in 5.2.2.1 and 5.2.2.2 and 5.2.2.4</td></tr><tr><td></td><td>Material Test</td></tr><tr><td colspan="2">5.2.2.2.1Drop (Impact) Test</td></tr><tr><td colspan="2">5.2.2.2.2 Surface damage and Chemical Exposure Test</td></tr><tr><td colspan="2">5.2.2.2.3 Extreme Fueling Usage; Extended Pressure Cycling Test **</td></tr><tr><td colspan="2">5.2.2.3.1 Engulfing Fire (Bonfire) Test</td></tr><tr><td colspan="2">5.2.2.3.2 Penetration Test</td></tr><tr><td colspan="2">5.2.2.3.3 Ultimate Burst Pressure</td></tr><tr><td colspan="2">5.2.2.3.4 Ambient Cycling Test in Design Qualification Test (Leak Before Break Test)</td></tr><tr><td colspan="2">5.2.3.1 Routine Production Quality Tests * *still missing in the text – to be done in 5.2.2.1 and 5.2.2.2 and 5.2.2.4</td></tr></table>	<table><tr><td>Tests</td></tr><tr><td>5.2.2.1 Expected Service (Pneumatic) Performance Test</td></tr><tr><td>5.2.2.1.1 Fueling Performance Verification Test: Gas Pressure Cycling at Environmental Temperature Limits 5.2.2.1.1.a and 5.2.2.1.1.b</td></tr><tr><td>5.2.2.1.2 Parking Performance Verification Test: Static Gas Pressure Exposure at Extreme Temperature 5.2.2.1.2.a and 5.2.2.1.2.b</td></tr><tr><td>5.2.2.1.3 Leak/Permeation Test</td></tr><tr><td>5.2.2.1.4 Proof Pressure Test (Hydraulic and / or Pneumatic) to be done in 5.2.2.1 and 5.2.2.2 and 5.2.2.4</td></tr><tr><td>5.2.2.1.5 Residual Strength Burst Test (Hydraulic) to be done in 5.2.2.1 and 5.2.2.2 and 5.2.2.4</td></tr><tr><td>5.2.2.2 Durability (Hydraulic) Performance Test</td></tr><tr><td>5.2.2.2.1 Drop (Impact) Test</td></tr><tr><td>5.2.2.2.2 Surface damage and Chemical Exposure Test</td></tr><tr><td>5.2.2.2.3 Extreme Fueling Usage; Extended Pressure Cycling Test **</td></tr><tr><td>5.2.2.3.1 Engulfing Fire (Bonfire) Test</td></tr><tr><td>5.2.2.3.2 Penetration Test</td></tr><tr><td>5.2.2.3.3 Ultimate Burst Pressure</td></tr><tr><td>5.2.2.3.4 Ambient Cycling Test in Design Qualification Test (Leak Before Break Test)</td></tr><tr><td>5.2.2.3.5 Maximum Defect Size Inspection Test in Design Qualification Test</td></tr><tr><td>5.2.3.1 Routine Production Quality Tests * *still missing in the text – to be done in 5.2.2.1 and 5.2.2.2 and 5.2.2.4</td></tr></table> (1) Remove Alternative Path. (2) Add “5.2.2.3.5 Maximum Defect Size Inspection Test in Design Qualification Test”	(1) Review entire structure (See the support document) (2) JASIC propose to add Maximum Defect Size Inspection Test in Design Qualification Test because the pneumatic cycle test(5,500cy) is impossible for too long test period. This test is same as NGV

2 **Type of comment:** **ge** = general **te** = technical **ed** = editorial
NOTE Columns 1, 2, 4, 5 are compulsory.

1	2	4		5	(6)
Page	**Ref. Clause No./ Annex** (e.g. 3.1)	**Type of comment[2]**	**Text**	**Proposed change by the Requestor**	**Comment (justification for change)**
Page 3	5.2.2.1		5.2.2.1 Expected Service (Pneumatic) Performance Test	5.2.2.1 Expected Service (Pneumatic) Performance Test(Comment: This pneumatic test is under investigation. The test condition of temperature and cycle times should be review.) Expected Service (Pneumatic) Performance Test applies to the nonmetal liner containers. If alternative test is effective technically for the failure, manufactures can select the alternative test instead of the gas test. Add paragraph above.	The objective of "Expected Service (Pneumatic) Performance Test" is thought to evaluate the failures related to leak and permeation.
Page 5	5.2.2.2		→ Routine Production Quality Tests (5.2.3.1) → Drop Test (5.2.2.2.1) → Surface Damage and Chemical Exposure (5.2.2.2.2) → Ambient Temperature Pressure Cycling Tests (5.2.2.2.3) → Proof Pressure Test at 180% NWP (5.2.2.1.4) → Residual Strength Burst Test (5.2.2.1.5)	→ Routine Production Quality Tests (5.2.3.1) → Drop Test (5.2.2.2.1) → Surface Damage and Chemical Exposure (5.2.2.2.2) →Static High Pressure Test (5.2.2.3.a) → Pressure Cycling Tests (5.2.2.3.b) → Proof Pressure Test at 180% NWP (5.2.2.3.c) → Residual Strength Burst Test (5.2.2.1.4)	Add static pressure test of 1000hr and 85C. Add extreme temperature condition to the hydraulic cycle test. The durability of containers for extreme temperature should be evaluated by maximum cycle times.

2 **Type of comment:** **ge** = general **te** = technical **ed** = editorial
NOTE Columns 1, 2, 4, 5 are compulsory.

1	2	4		5	(6)
Page	**Ref. Clause No./ Annex** (e.g. 3.1)	**Type of comment[2]**	**Text**	**Proposed change by the Requestor**	**Comment (justification for change)**
					
	5.2.2.2.3		5.2.2.2.3 Extreme Fueling Usage; Extended Pressure Cycling Test The container shall not leak or burst after exposure to pressure cycles of < 2 MPa to 125% NWP. The required number of test cycles is defined in 5.2.2. Durability pressure cycling tests are conducted at 15 – 25 °C ambient temperature. The tests are performed on the storage system using hydrogen gas or on the containment vessel using a non-corrosive fluid at 15 – 25 °C. • The first 1000 cycles are conducted on vessels as part of drop tests in 5.2.2.2.1 per the test procedure defined in Annex **TBD**. • The remaining 4500 cycles are conducted on one vessel that has been exposed to a shoulder drop impact (5.2.2.2.1) and to surface damage and chemicals (5.2.2.2.2). Chemical exposures	5.2.2.2.3 Extreme Fueling Usage; Extended Pressure Cycling Test Tests shall be conducted as follows: a. Static High Pressure Test. The vessel should be pressurized with a fluid to 125% NWP and held for 1000 hrs at +85 ° C. Storage systems that are being qualified for commercial heavy-duty use shall be pressurized to 135% NWP. b. The container should demonstrate durability (resistance to leak and burst) throughout exposure to pressure cycles of < 2 MPa to 125% NWP. The minimum required number of test cycles is defined in 5.2.2. The first 50% of pressure cycles should be conducted at 15 – 25 ° C ambient temperature. [See Appendices C.5 and C.6 for guidance.] The last 10 cycles	Add static pressure test of 1000hr and 85C. Add extreme temperature condition to the hydraulic cycle test. The durability of containers for extreme temperature should be evaluated by maximum cycle times.

2 **Type of comment:** **ge** = general **te** = technical **ed** = editorial
NOTE Columns 1, 2, 4, 5 are compulsory.

1	2	4		5	(6)
Page	**Ref. Clause No./ Annex** (e.g. 3.1)	**Type of comment[2]**	**Text**	**Proposed change by the Requestor**	**Comment (justification for change)**
			are maintained throughout the pressure cycling. During pressure cycling, the systems shall show no evidence of rupture, unintended release or physical deterioration such as fiber unraveling. The last 10 cycles are performed at 150% NWP. The hydrogen storage system shall then be pressurized to 180% NWP and held for 30 seconds without rupture or evidence of leak.	within the first half of cycles should be pressure cycles of ≤2MPa to 150% NWP. Half of the remaining 50% of pressure cycles should be cycles of ≤2MPa to 80% NWP with the first 25% conducted at -40oC and the final remaining 25% cycles should be cycles of ≤2MPa to 125% NWP conducted at +85oC. During pressure cycling, the systems should show no evidence of rupture, unintended release or physical deterioration such as fiber unraveling. c. The hydrogen storage system shall then be pressurized to 180% NWP and held for 30 sec without rupture or evidence of leak.	
	5.2.2.3.4		3. The ambient cycling test of Paragraph 1 shall meet the both of the following requirements. (1) The container does not fracture, and there are no damages to fiber. (2) There is no leakage from the container less than 5,500 cycles. (11,250 cycles for commercial vehicles)	3. The ambient cycling test of Paragraph 1 shall meet the both of the following requirements. (1) The container does not fracture, and there are no damages to fiber. (2) There is no leakage from the container less than 5,500 cycles. (11,250 cycles for commercial vehicles) When the cycle of the vessel in personal vehicles is less than 11,250 cycles, the manufacturer should explain the adequacy of test result by 5.2.2.3.5 Maximum Defect Size Inspection Test in Design Qualification Test.	Although the cycle number of 5,500 is sufficient for personal vehicles, we should confirm design adequacy for the container of reducing cycles.

2 **Type of comment:** **ge** = general **te** = technical **ed** = editorial
NOTE Columns 1, 2, 4, 5 are compulsory.

1	2	4		5	(6)
Page	**Ref. Clause No./ Annex** (e.g. 3.1)	**Type of comment[2]**	**Text**	**Proposed change by the Requestor**	**Comment (justification for change)**
Page 6	5.2.2.3.5			Add 5.2.2.3.5 5.2.2.3.5 Maximum Defect Size Inspection Test in Design Qualification Test The containers (except plastic liner containers) shall be performed the maximum defect size inspection test in accordance with the terms of the paragraph a. to f. and then shall meet the test. The maximum depth and length of defect which does not cause damage due to fatigue or rupture of the container within a period of 15 years shall be calculated in according to the following paragraph. a. The level-surface defect model shall be used for analysis. Calculation method shall be the fatigue assessment in Chapter 3 on Guidance covering the test method for assessing tolerable defects in welds structural material, BS7910 (2005). b. The stress condition at the fatigue-susceptible part is determined by a stress analysis in the case of the pressure at 2 MPa or less and 125% of pressure of the maximum filling pressure or more. Bending stress and membrane stress can be calculated independently. c. The number of pressurizing shall be 5,500 cycles (11,250 cycles for commercial vehicles) or more. d. The fatigue crack propagation rate shall be determined by the average of three results in accordance with the Standards for measurement and inspection of the fatigue crack propagation rate, ASTME647. In this case the fatigue crack propagation rate shall be measured in hydrogen of 99.99% or greater and the pressure shall be 125%	JASIC propose to add Maximum Defect Size Inspection Test in Design Qualification Test because the pneumatic cycle test(5,500cy) is impossible for too long test period. This test is same as NGV

2 **Type of comment:** **ge** = general **te** = technical **ed** = editorial
NOTE Columns 1, 2, 4, 5 are compulsory.

1	2	4		5	(6)
Page	**Ref. Clause No./ Annex** (e.g. 3.1)	**Type of comment[2]**	**Text**	**Proposed change by the Requestor**	**Comment (justification for change)**
				of the maximum filling pressure or higher. In accordance with the standard test method for planestrain fracture toughness of metallic materials, ASTM E399, the crack surface direction shall be parallel to the longitudinal direction of the container and perpendicular to the circumferential direction of the container. The test shall be performed at ambient temperature. The frequency of the test shall be 1 Hz or less. When fatigue crack propagation rate data of the same material and conditions, the data can be used for the analysis. e. The crack propagation per cycle in the longitudinal direction and in the direction of thickness shall be determined from the fatigue crack propagation rate as measured in item 4 above and the stress intensity factor, in accordance with Section 14.2 of fracture dynamics analysis of plane surface flaws in Chapter 3 on fatigue assessment in Guidance Covering the Test Method for Assessing Tolerable Flaws, BS7910 (2005) f. In accordance with paragraph f. above, the maximum defect size shall be calculated which does not lead to any damage from fatigue or burst during the use of the container for a period of 15 years. The maximum defect size designated by the container manufacturer should be within the range of the maximum depth and length of defect which is calculated above.	

2 **Type of comment:** **ge** = general **te** = technical **ed** = editorial
NOTE Columns 1, 2, 4, 5 are compulsory.

JASIC comments to SGS 6-03 Draft proposal

Date: 30.06.2009	Document:

1	2	4		5	(6)
Page	**Ref. Clause No./ Annex** (e.g. 3.1)	**Type of comment[2]**	**Text**	**Proposed change by the Requestor**	**Comment (justification for change)**
Page 7	5.2.2.4 5.2.2.4.1 5.2.2.4.2		5.2.2.4 Expected Service and Durability Performance Test 5.2.2.4.1 Expected Service and Durability Performance Test(hydraulic) 5.2.2.4.2 Permeation Test	Remove	Review entire structure (See the support document)

2 **Type of comment:** **ge** = general **te** = technical **ed** = editorial
NOTE Columns 1, 2, 4, 5 are compulsory.