

Test Report No. S08MEC07709-1-CLC
dated 15 APRIL 2009



PSB Singapore

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SUBJECT:

Testing of Tap/Mixers Fittings.

TESTED FOR:

Vola A/S
Lunavej 2
DK 8700 Horsens
Denmark

Attn: Mr. Tommy Jorgenson

SAMPLE SUBMISSION DATE

30 Dec 2008

METHOD OF TEST:

1. PUB Requirement for Water Efficiency Labelling Scheme
2. BS EN 817 : 1998
Sanitary tapware – Mechanical mixer (PN 10) – General technical specifications
3. BS 5412 : 1996 Specification for low-resistance single taps and combination tap assemblies (nominal size $\frac{1}{2}$ and $\frac{3}{4}$) suitable for operation at PN 10 max.



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TUV[®]

Test Report No. S08MEC07709/CLC
dated 15 APRIL 2009



PSB Singapore

DESCRIPTION OF SAMPLE:

Product : Tap/Mixers Fittings
Brand Name : Vola


S/N	Description	Model
1.	Deck mounted sink mixer	500T1
2.	Wall mounted shower mixer	2471
3.	Deck mounted mixer	590V
4.	Bidet mixer	HV 4
5.	Deck mounted basin mixer w/standing spout	500/090 FM 100
6.	Wall mounted basin mixer	121

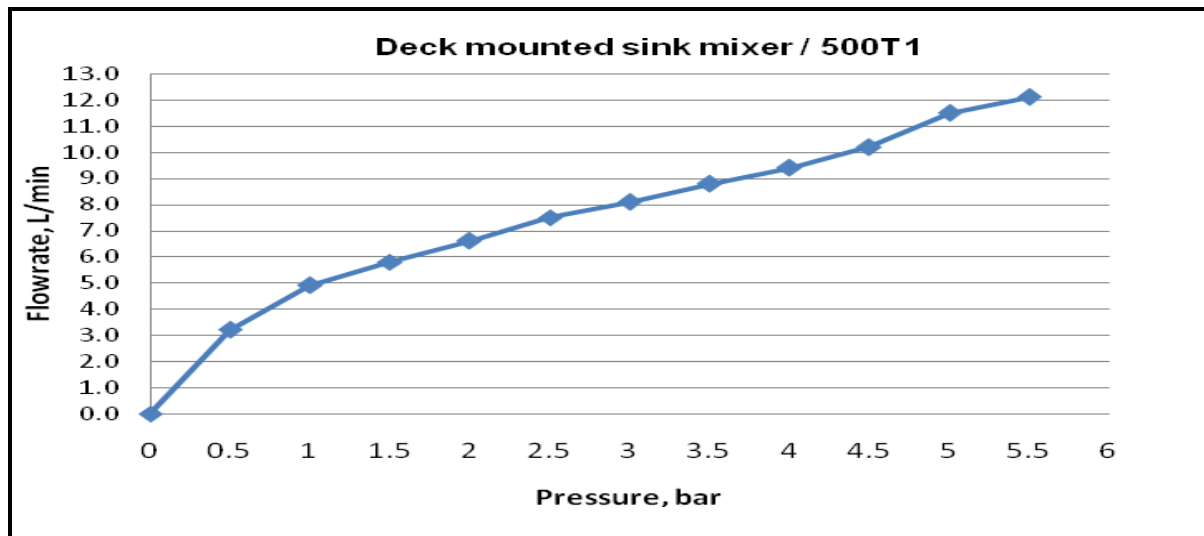
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TEST RESULTS:

Hydraulic Characteristics

- 1) Description: Deck mounted sink mixer
Model: 500T1

Flow Pressure (bar)	Flow Rate (litres/min)	Flow Rate Requirements for Water Efficiency Labelling	Photo
0	0	<p>Products/Fittings Sink Taps & Mixers/Bib Taps</p> <p>6 to 8 litres/min (1 tick) 4 to 6 Litres/min (2 ticks) 4 litres/min or less (3 ticks)</p>	
0.5	3.2		
1.0	4.9		
1.5	5.8		
2.0	6.6		
2.5	7.5		
3.0	8.1		
3.5	8.8		
4.0	9.4		
4.5	10.2		
5.0	11.5		
5.5	12.1		




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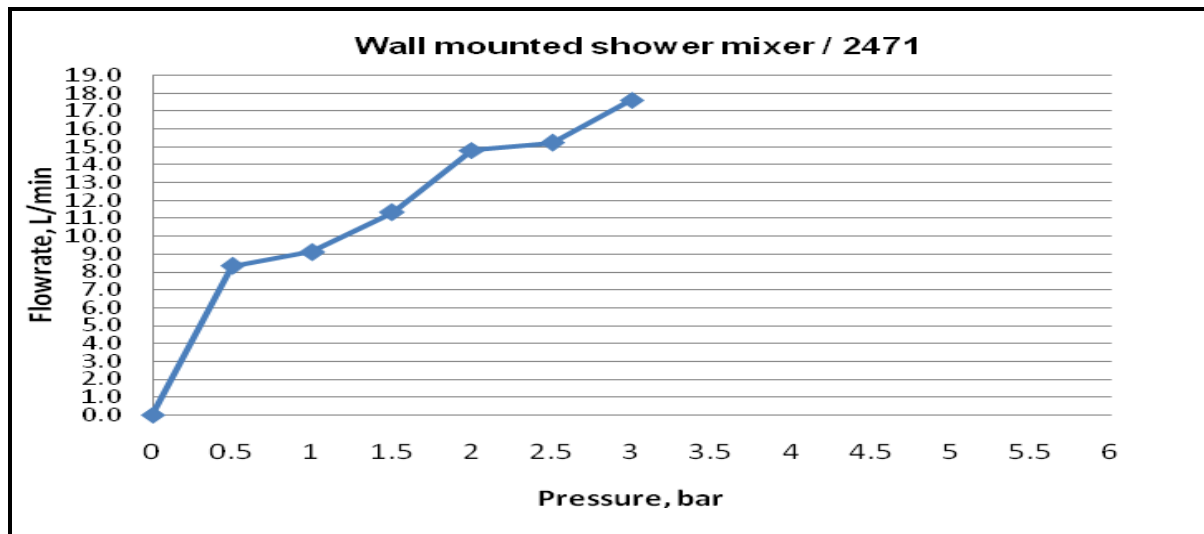
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TEST RESULTS: Cont'd

Hydraulic Characteristics

2) Description: Wall mounted shower mixer
Model: 2471

Flow Pressure (bar)	Flow Rate (litres/min)	Flow Rate Requirements for Water Efficiency Labelling	Photo
0	0	<p>Products/Fittings Shower Taps & Mixers</p> <p>7 to 9 litres/min (1 tick) 5 to 7 litres/min (2 ticks) 5 litres/min or less (3 ticks)</p>	
0.5	8.3		
1.0	9.1		
1.5	11.3		
2.0	14.8		
2.5	15.2		
3.0	17.6		
3.5	_*		
4.0	_*		
4.5	_*		
5.0	_*		
5.5	_*		



“*” Over measured limit.


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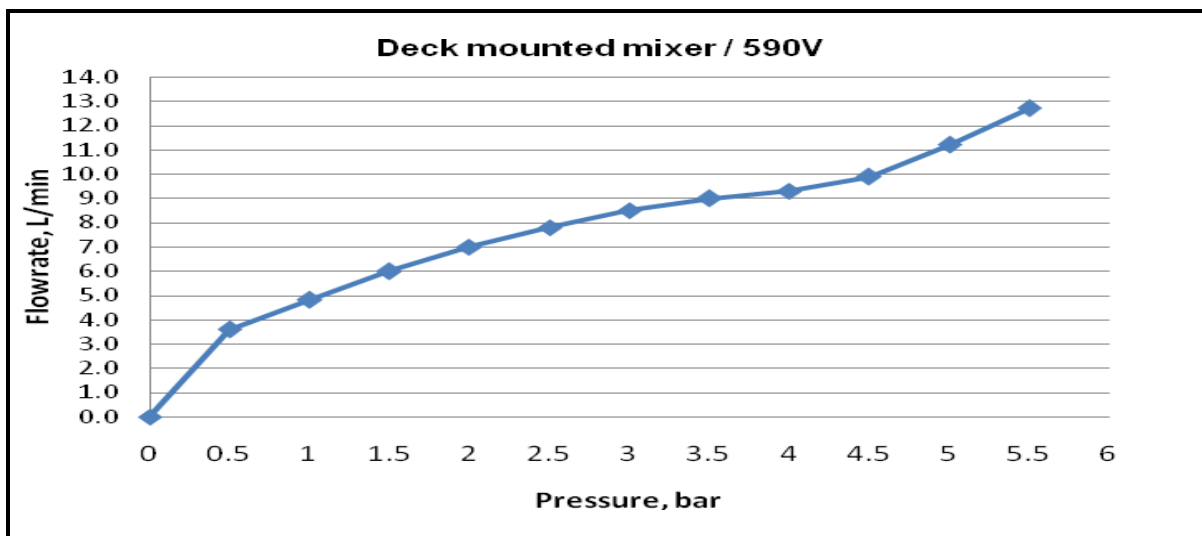
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TEST RESULTS: Cont'd

Hydraulic Characteristics

3) Description: Deck mounted mixer
Model: 590V

Flow Pressure (bar)	Flow Rate (litres/min)	Flow Rate Requirements for Water Efficiency Labelling	Photo
0	0	<p>Products/Fittings Sink Taps & Mixers/Bib Taps</p> <p>6 to 8 litres/min (1 tick) 4 to 6 Litres/min (2 ticks) 4 litres/min or less (3 ticks)</p>	
0.5	3.6		
1.0	4.8		
1.5	6.0		
2.0	7.0		
2.5	7.8		
3.0	8.5		
3.5	9.0		
4.0	9.3		
4.5	9.9		
5.0	11.2		
5.5	12.7		




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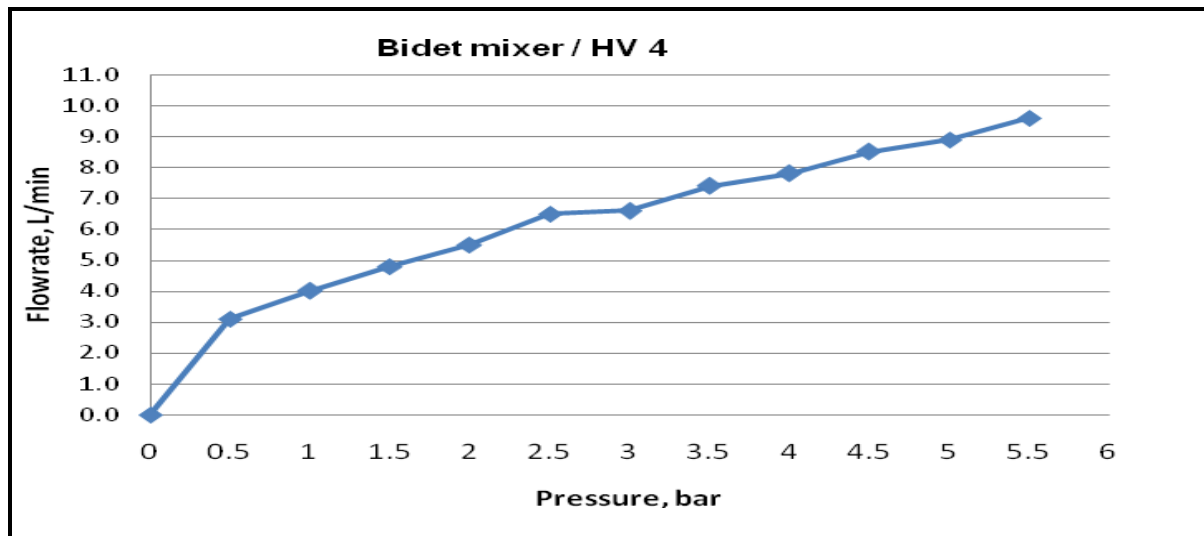
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TEST RESULTS: Cont'd

Hydraulic Characteristics

4) Description: Bidet mixer
Model: HV 4

Flow Pressure (bar)	Flow Rate (litres/min)	Flow Rate Requirements for Water Efficiency Labelling	Photo
0	0	<p>Products/Fittings Sink Taps & Mixers/Bib Taps</p> <p>6 to 8 litres/min (1 tick) 4 to 6 Litres/min (2 ticks) 4 litres/min or less (3 ticks)</p>	
0.5	3.1		
1.0	4.0		
1.5	4.8		
2.0	5.5		
2.5	6.5		
3.0	6.6		
3.5	7.4		
4.0	7.8		
4.5	8.5		
5.0	8.9		
5.5	9.6		




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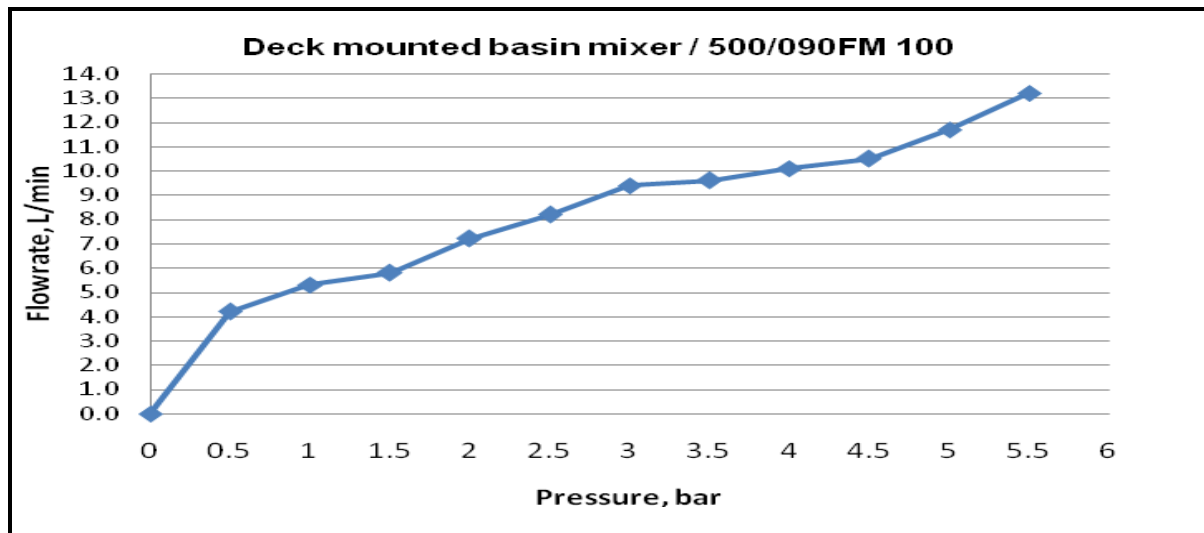
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TEST RESULTS: Cont'd

Hydraulic Characteristics

5) Description: Deck mounted basin mixer w/standing spout
Model:500/090 FM 100

Flow Pressure (bar)	Flow Rate (litres/min)	Flow Rate Requirements for Water Efficiency Labelling	Photo
0	0	<p>Products/Fittings Basin Taps & Mixers</p> <p>4 to 6 litres/min (1 tick) 2 to 4 Litres/min (2 ticks) 2 litres/min or less (3 ticks)</p>	
0.5	4.2		
1.0	5.3		
1.5	5.8		
2.0	7.2		
2.5	8.2		
3.0	9.4		
3.5	9.6		
4.0	10.1		
4.5	10.5		
5.0	11.7		
5.5	13.2		




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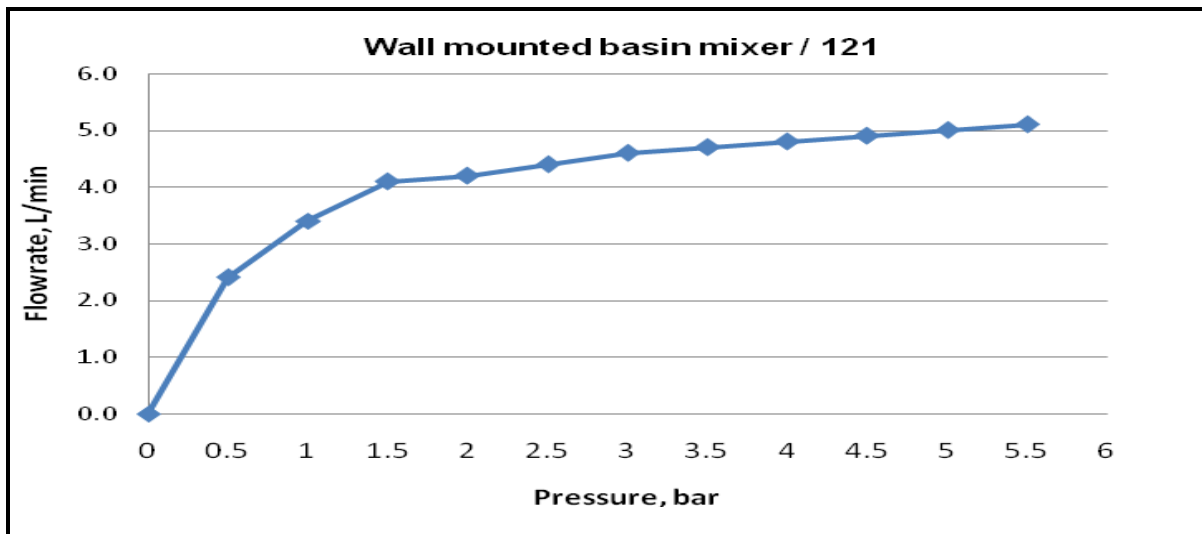
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TEST RESULTS: Cont'd

Hydraulic Characteristics

6) Description: Wall mounted basin mixer
Model: 121

Flow Pressure (bar)	Flow Rate (litres/min)	Flow Rate Requirements for Water Efficiency Labelling	Photo
0	0	<p>Products/Fittings Basin Taps & Mixers</p> <p>4 to 6 litres/min (1 tick) 2 to 4 Litres/min (2 ticks) 2 litres/min or less (3 ticks)</p>	
0.5	2.4		
1.0	3.4		
1.5	4.1		
2.0	4.2		
2.5	4.4		
3.0	4.6		
3.5	4.7		
4.0	4.8		
4.5	4.9		
5.0	5.0		
5.5	5.1		



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TEST RESULTS:

(A1) Leaktightness Characteristics

Sample Reference Characteristics	Sink mixer 500T1	BS EN 817 : 1998 Requirements
Leaktightness of the mixing valve upstream of the obturator, and of the obturator	Passed	Clause 9.3.2 a) Leaktightness upstream of the obturator: Throughout the duration of the test, there shall be no leakage or seepage through the walls
	Passed	b) Leaktightness of the obturator: Throughout the duration of the test, there shall be no leakage at the obturator.
Leaktightness of the obturator: cross flow between hot water and cold water	Passed	Clause 9.4.2 Throughout the duration of the test, there shall be no leakage or seepage at the end of the unconnected inlet.
Leaktightness of the mixing valve downstream of the obturator	Passed	Clause 9.5.2 Throughout the duration of the test, there shall be no leakage or seepage.

(B1) Hydraulic Characteristics

Sample Reference Characteristics	Sink mixer 500T1	BS EN 817 : 1998 Requirements
Flow rate test at 3.0 bar running pressure	Combined 8.1**	Combination taps assemblies (both tap fully open). ½" tap : (20 l/min) for baths, (12 l/min) for wash-basin, bidets sinks and showers.

****Non-compliance with BS EN 817 : 1998 requirements (Please refer to page 21 of 25)

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TEST RESULTS: Cont'd

(C1) Torsion Resistance Characteristics

Sample Reference Characteristics	Sink mixer 500T1	BS EN 817 : 1998 Requirements
Resistance of the control device to the opening, closing & pivoting stresses	Passed	There shall be no visible deformation on any component

(D1) Mechanical Performance under Pressure Characteristics

Sample Reference Characteristics	Sink mixer 500T1	BS EN 817 : 1998 Requirements
Static pressure of 25 bar for 60 sec in the closed position	Passed	Clause 11.3.2 There shall be no permanent deformation of the mixing valve upstream of the obturator
Static pressure of 4 bar for 60 sec in the closed position	Passed	Clause 11.4.2 For the duration of the test, there shall be no permanent deformation of the mixing valve

(E1) Mechanical Endurance Test of Swivel Nozzles

Sample Reference Characteristics	Sink mixer 500T1	BS EN 817 : 1998 Requirements
Number of cycles : 80,000	Complied	Clause 12.3.3. After testing, the tap shall again satisfy the watertightness criteria given in clause 9.5 and there shall be no failure of leaktightness leakage in the assembly, fracture of components, stoppage of machine due to control difficulties, etc.

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TEST RESULTS: Cont'd

(A2) Leaktightness Characteristics

Sample Reference Characteristics	Deck mounted mixer 590V	BS EN 817 : 1998 Requirements
Leaktightness of the mixing valve upstream of the obturator, and of the obturator	Passed	Clause 9.3.2 a) Leaktightness upstream of the obturator: Throughout the duration of the test, there shall be no leakage or seepage through the walls
	Passed	b) Leaktightness of the obturator: Throughout the duration of the test, there shall be no leakage at the obturator.
Leaktightness of the obturator: cross flow between hot water and cold water	Passed	Clause 9.4.2 Throughout the duration of the test, there shall be no leakage or seepage at the end of the unconnected inlet.
Leaktightness of the mixing valve downstream of the obturator	Passed	Clause 9.5.2 Throughout the duration of the test, there shall be no leakage or seepage.

(B2) Hydraulic Characteristics

Sample Reference Characteristics	Deck mounted mixer 590V	BS EN 817 : 1998 Requirements
Flow rate test at 3.0 bar running pressure	Combined 8.5**	Combination taps assemblies (both tap fully open). ½" tap : (20 l/min) for baths, (12 l/min) for wash-basin, bidets sinks and showers.

***Non-compliance with BS EN 817 : 1998 requirements (Please refer to page 21 of 25)

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TEST RESULTS: Cont'd

(C2) Torsion Resistance Characteristics

Sample Reference Characteristics	Deck mounted mixer 590V	BS EN 817 : 1998 Requirements
Resistance of the control device to the opening, closing & pivoting stresses	Passed	There shall be no visible deformation on any component

(D2) Mechanical Performance under Pressure Characteristics

Sample Reference Characteristics	Deck mounted mixer 590V	BS EN 817 : 1998 Requirements
Static pressure of 25 bar for 60 sec in the closed position	Passed	Clause 11.3.2 There shall be no permanent deformation of the mixing valve upstream of the obturator
Static pressure of 4 bar for 60 sec in the closed position	Passed	Clause 11.4.2 For the duration of the test, there shall be no permanent deformation of the mixing valve

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TEST RESULTS: Cont'd

(A3) Leaktightness Characteristics

Sample Reference Characteristics	Bidet mixer HV 4	BS EN 817 : 1998 Requirements
Leaktightness of the mixing valve upstream of the obturator, and of the obturator	Passed	Clause 9.3.2 a) Leaktightness upstream of the obturator: Throughout the duration of the test, there shall be no leakage or seepage through the walls
	Passed	b) Leaktightness of the obturator: Throughout the duration of the test, there shall be no leakage at the obturator.
Leaktightness of the obturator: cross flow between hot water and cold water	Passed	Clause 9.4.2 Throughout the duration of the test, there shall be no leakage or seepage at the end of the unconnected inlet.
Leaktightness of the mixing valve downstream of the obturator	Passed	Clause 9.5.2 Throughout the duration of the test, there shall be no leakage or seepage.

(B3) Hydraulic Characteristics

Sample Reference Characteristics	Bidet mixer HV 4	BS EN 817 : 1998 Requirements
Flow rate test at 3.0 bar running pressure	Combined 6.6**	Combination taps assemblies (both tap fully open). ½" tap : (20 l/min) for baths, (12 l/min) for wash-basin, bidets sinks and showers.

***Non-compliance with BS EN 817 : 1998 requirements (Please refer to page 21 of 25)

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TEST RESULTS: Cont'd

(C3) Torsion Resistance Characteristics

Sample Reference Characteristics	Bidet mixer HV 4	BS EN 817 : 1998 Requirements
Resistance of the control device to the opening, closing & pivoting stresses	Passed	There shall be no visible deformation on any component

(D3) Mechanical Performance under Pressure Characteristics

Sample Reference Characteristics	Bidet mixer HV 4	BS EN 817 : 1998 Requirements
Static pressure of 25 bar for 60 sec in the closed position	Passed	Clause 11.3.2 There shall be no permanent deformation of the mixing valve upstream of the obturator
Static pressure of 4 bar for 60 sec in the closed position	Passed	Clause 11.4.2 For the duration of the test, there shall be no permanent deformation of the mixing valve

(E3) Mechanical Endurance Test of Obturator (Headwork)

Sample Reference Characteristics	Bidet mixer HV 4	BS EN 817 : 1998 Requirements
Number of cycles : 70,000	Complied	Clause 12.1.3.4 After testing, the tap shall again satisfy the watertightness criteria given in clause 9.1 to 9.4 and there shall be no failure of leaktightness leakage in the assembly, fracture of components, stoppage of machine due to control difficulties, etc.

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TEST RESULTS: Cont'd

(A4) Leaktightness Characteristics

Sample Reference Characteristics	Deck mounted basin mixer 500/090 FM 100	BS EN 817 : 1998 Requirements
Leaktightness of the mixing valve upstream of the obturator, and of the obturator	Passed	Clause 9.3.2 a) Leaktightness upstream of the obturator: Throughout the duration of the test, there shall be no leakage or seepage through the walls
	Passed	b) Leaktightness of the obturator: Throughout the duration of the test, there shall be no leakage at the obturator.
Leaktightness of the obturator: cross flow between hot water and cold water	Passed	Clause 9.4.2 Throughout the duration of the test, there shall be no leakage or seepage at the end of the unconnected inlet.
Leaktightness of the mixing valve downstream of the obturator	Passed	Clause 9.5.2 Throughout the duration of the test, there shall be no leakage or seepage.

(B4) Hydraulic Characteristics

Sample Reference Characteristics	Deck mounted basin mixer 500/090 FM 100	BS EN 817 : 1998 Requirements
Flow rate test at 3.0 bar running pressure	Combined 9.4**	Combination taps assemblies (both tap fully open). ½" tap : (20 l/min) for baths, (12 l/min) for wash-basin, bidets sinks and showers.

***Non-compliance with BS EN 817 : 1998 requirements (Please refer to page 21 of 25)

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TEST RESULTS: Cont'd

(C4) Torsion Resistance Characteristics

Sample Reference Characteristics	Deck mounted basin mixer 500/090 FM 100	BS EN 817 : 1998 Requirements
Resistance of the control device to the opening, closing & pivoting stresses	Passed	There shall be no visible deformation on any component

(D4) Mechanical Performance under Pressure Characteristics

Sample Reference Characteristics	Deck mounted basin mixer 500/090 FM 100	BS EN 817 : 1998 Requirements
Static pressure of 25 bar for 60 sec in the closed position	Passed	Clause 11.3.2 There shall be no permanent deformation of the mixing valve upstream of the obturator
Static pressure of 4 bar for 60 sec in the closed position	Passed	Clause 11.4.2 For the duration of the test, there shall be no permanent deformation of the mixing valve

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TEST RESULTS: Cont'd

(A5) Leaktightness Characteristics

Sample Reference Characteristics	Wall mounted basin mixer 121	BS EN 817 : 1998 Requirements
Leaktightness of the mixing valve upstream of the obturator, and of the obturator	Passed	Clause 9.3.2 a) Leaktightness upstream of the obturator: Throughout the duration of the test, there shall be no leakage or seepage through the walls b) Leaktightness of the obturator: Throughout the duration of the test, there shall be no leakage at the obturator.
Leaktightness of the obturator: cross flow between hot water and cold water	Passed	Clause 9.4.2 Throughout the duration of the test, there shall be no leakage or seepage at the end of the unconnected inlet.
Leaktightness of the mixing valve downstream of the obturator	Passed	Clause 9.5.2 Throughout the duration of the test, there shall be no leakage or seepage.

(B5) Hydraulic Characteristics

Sample Reference Characteristics	Wall mounted basin mixer 121	BS EN 817 : 1998 Requirements
Flow rate test at 3.0 bar running pressure	Combined 4.6**	Combination taps assemblies (both tap fully open). ½" tap : (20 l/min) for baths, (12 l/min) for wash-basin, bidets sinks and showers.

***Non-compliance with BS EN 817 : 1998 requirements (Please refer to page 21 of 25)

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TEST RESULTS: Cont'd

(C5) Torsion Resistance Characteristics

Sample Reference Characteristics	Wall mounted basin mixer 121	BS EN 817 : 1998 Requirements
Resistance of the control device to the opening, closing & pivoting stresses	Passed	There shall be no visible deformation on any component

(D5) Mechanical Performance under Pressure Characteristics

Sample Reference Characteristics	Wall mounted basin mixer 121	BS EN 817 : 1998 Requirements
Static pressure of 25 bar for 60 sec in the closed position	Passed	Clause 11.3.2 There shall be no permanent deformation of the mixing valve upstream of the obturator
Static pressure of 4 bar for 60 sec in the closed position	Passed	Clause 11.4.2 For the duration of the test, there shall be no permanent deformation of the mixing valve

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TEST RESULTS: Cont'd

(A6) Water Tightness & Pressure Resistance Characteristics

Sample Reference Characteristics		Wall mounted shower mixer 2471	BS 5412 : 1996 Requirement
Obturator on seat and upstream of obturator		Passed	Clause 8.2.2.1 (a) Watertightness of the obturator: Throughout the duration of the test, there shall be no leakage past the obturator. (b) Watertightness upstream: Throughout the duration of the test, there shall be no leakage or seepage through the walls.
		Passed	
Downstream of obturator		Passed	Clause 8.2.3.1 Throughout the duration of the test, there shall be no leakage, or seepage through the seals.
Mechanical behaviour upstream		Passed	Clause 9.2.2 There shall be no deformation or leakage.
Mechanical Behaviour Downstream	Tap without jet regulator	-	Clause 9.2.3 No permanent deformation shall be produced in that part of the tap situated downstream of the obturator.
	Tap with jet regulator	Passed	

(B6) Hydraulic Characteristics

Sample Reference Characteristics		Wall mounted shower mixer 2471	BS 5412 : 1996 Requirement
Flow rate test at 0.1 bar running pressure	Left tap	-	Combination taps assemblies (each side tested separately). ½" tap : 7.5 (l/min) min.
	Right tap	-	
	Combined	5.4**	Combination taps assemblies (both tap fully open). ½" tap : 10.8 (l/min) min.

****Non-compliance with BS 5412 : 1996 requirements (Please refer to page 21 of 25).

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TEST RESULTS: Cont'd

(C6) Mechanical Endurance Test of Obturator (Headwork)

Sample Reference Characteristics	Wall mounted shower mixer 2471	BS 5412 : 1996 Requirement
Number of cycles : 200,000	Passed	Clause 12.1.4 After testing, the tap shall again satisfy the watertightness criteria given in clause 8 and there shall be no permanent deflection or failure of any component part.

(D6) Repeat Watertightness Test

Sample Reference Characteristics	Wall mounted shower mixer 2471	BS 5412 : 1996 Requirement
Obturator on seat and upstream of obturator	a) Passed	Clause 8.2.2.1 a) Watertightness of the obturator: Throughout the duration of the test, there shall be no leakage past the obturator.
	b) Passed	b) Watertightness upstream: Throughout the duration of the test, there shall be no leakage or seepage through the walls.
Downstream of obturator	Passed	Clause 8.2.3.1 Throughout the duration of the test, there shall be no leakage, or seepage through the seals.

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REMARKS:


S/N	Type of tap fittings	Model	BS EN 817 : 1998 Requirements	Characteristics
1.	Deck mounted basin mixer	500T1	Complied	A) Leaktightness Characteristics C) Torsion Resistance Characteristics. D) Mechanical performance under pressure Characteristics E) Mechanical Endurance
2.	Deck mounted mixer	590V	Complied	
3.	Deck mounted mixer	590V	Complied	
4.	Bidet mixer	HV 4	Complied	
5.	Deck mounted basin mixer w/standing spout	500/090 FM 100	Complied	

- a. The above test samples complied with BS EN 817 : 1998 requirements except hydraulic characteristics.
- b. The hydraulic characteristics complied with SS CP 48: 1989 requirements.

S/N	Type of tap fittings	Model	BS 5412 : 1996 Requirements	Characteristics
1.	Wall mounted shower mixer	2471	Complied	A. Watertightness & pressure resistance C. Mechanical endurance D. Repeat watertightness

- a. The above test samples complied with BS 5412 : 1996 requirements except hydraulic characteristics.
- b. The hydraulic characteristics complied with SS CP 48: 1989 requirements.


Chua Lee Choong
Associate Engineer


Chua Peck Cheong
Product Manager
Industrial & Polymer Products
Mechanical Centre

APPENDIX



(Photo.1) Deck mounted sink mixer 500T1



(Photo.2) Wall mounted shower mixer 2471



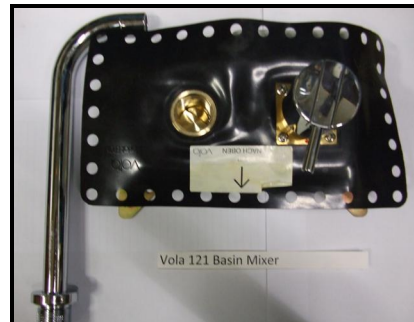
(Photo.3) Deck mounted mixer 590V



(Photo.4) Deck mounted basin mixer w/standing spout 500/090 FM 100



(Photo.5) Bidet mixer HV 4



(Photo.6) Basin mixer 121

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Test Report No. S08MEC07709/CLC
dated 15 APRIL 2009



PSB Singapore

Test Results Summary (Ref : S08MEC07709/CLC)

Test Standard : BS EN 817: 1998, BS EN 248:2002, AS/NZS:4020:1999, SS375 :2001

Product, Model	Tests Instructions	Leaktightness, Torsion Resistance & Mechanical Performance	Hydraulic	Endurance		Effect on Water	Metal Toxicity	Salt Spray
				Headwork	Swivel			
500T1**	If done, Pass/Fail	Pass	Pass	-	Pass	Pass ¹	-	-
	If not done, reference	-	-	HV 4	-	-	Pass ²	Pass ³
	If not done, no reference	-	-	-	-	-	-	-
590V**	If done, Pass/Fail	Pass	Pass	-	NA	Pass ¹	-	-
	If not done, reference	-	-	HV 4	-	-	Pass ²	Pass ³
	If not done, no reference	-	-	-	-	-	-	-
HV 4**	If done, Pass/Fail	Pass	Pass	Pass	NA	Pass ¹	Pass ²	Pass ³
	If not done, reference	-	-	-	-	-	-	-
	If not done, no reference	-	-	-	-	-	-	-
500/090** FM100	If done, Pass/Fail	Pass	Pass	-	NA	Pass ¹	-	-
	If not done, reference	-	-	HV 4	-	-	Pass ²	Pass ³
	If not done, no reference	-	-	-	-	-	-	-
121**	If done, Pass/Fail	Pass	Pass	-	NA	Pass ¹	-	-
	If not done, reference	-	-	HV 4	-	-	Pass ²	Pass ³
	If not done, no reference	-	-	-	-	-	-	-

“***”The test sample complied with BS EN 817 : 1998 requirements except hydraulic characteristics.

“1” Effect on Water Reference : S08MEC07709-1A&1B-LYP dated 08/04/2009 and S08MEC07709-2A&2B-LYP dated 08/04/2009

“2” Metal Toxicity Reference : S08MEC07709-Ow dated 24/04/09

“3” Salt Spray Reference : S08MEC07709-PGK dated 01/04/2009

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Test Report No. S08MEC07709/CLC
dated 15 APRIL 2009



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Test Results Summary (Ref : S08MEC07709/CLC)

Test Standard : BS5412:1996, BS EN 248:2002, AS/NZS:4020:1999, SS375 :2001

Product, Model	Tests Instructions	Leaktightness, Torsion Resistance & Mechanical Performance	Hydraulic	Endurance		Effect on Water	Metal Toxicity	Salt Spray
				Headwork	Swivel			
2471*	If done, Pass/Fail	Pass	Pass	Pass	NA	Pass ¹	-	-
	If not done, reference	-	-	-	-	-	Pass ²	Pass ³
	If not done, no reference	-	-	-	-	-	-	-

“*”The test sample complied with BS 5412 : 1996 requirements except hydraulic characteristics.

“1” Effect on Water Reference : S08MEC07709-1A&1B-LYP dated 08/04/2009 and S08MEC07709-2A&2B-LYP dated 08/04/2009

“2” Metal Toxicity Reference : S08MEC07709-Ow dated 24/04/09

“3” Salt Spray Reference : S08MEC07709-PGK dated 01/04/2009

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This Report is issued under the following conditions:

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2. Unless otherwise requested, a report shall contain only technical results. Analysis and interpretation of the results and professional opinion and recommendations expressed thereupon, if required, shall be clearly indicated and additional fee paid for, by the Client.
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