

Test Report Nr. 7467/24

Vibration and compression test according to customer's specification related to DIN EN 60068-2-6 and DIN 55440 on two pallet cushions

Client:	PENN – ELCOM Ltd. Tyne & Wear 9-10 Parsons Rd NE37 1HB WASHINGTON Great Britain
Date of order:	23 rd September 2024
Customer reference:	Email from Mr. Drumm (Penn-Elcom) to Mr. Homann (BFSV)
Test samples:	Two pallet cushions, see Table 1
Received on:	5 th September 2024
Date of testing:	26 th and 27 th September 2024
Test reference:	Customer specification related to DIN EN 60068-2-6 and DIN55440, see Table 2
Officials in charge:	Dipl. Ing. (FH) M. Homann
Number of text pages	2
Number of figures:	19
Date of issue:	30 th October 2024

1 Content of the order

The BFSV Verpackungsinstitut Hamburg GmbH was authorized to perform vibration and compression tests related to DIN EN 60068-2-6 and DIN 55440 on two pallet cushions. This series of tests is intended to compare the suitability of various pallet cushions.

2 Test samples

For testing, two pallet cushions were delivered at the BFSV Verpackungsinstitut Hamburg GmbH by the client, The test samples before testing are shown in [Fig. 1](#) and [Fig. 2](#).

On delivery no irregularities on the pallet cushions could be observed. A specification of the test sample is given in [Table 1](#).

3 Testing

The test sequence was performed according to [Table 2](#) and the tests were performed at ambient laboratory conditions.

The test setups for the tests are shown exemplarily in [Fig. 3](#) and [Fig. 4](#) (vibration test) as well as [Fig. 11](#) (compression test). The used test and measuring equipment are listed in [Table 3](#).

After completion of the tests, the test samples were subjected to an external visual inspection.

4 Results

Two pallet cushions were delivered by the client. The test sequence according to DIN En 60068-2-6 and DIN 55440 were performed on the test samples (PM1 to PM2).

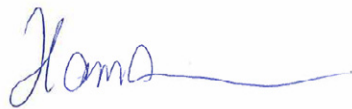
The vibration spectrum measured by the acceleration sensor is shown in Fig. 5 to Fig. 10. The compression test was passed by the test sample. The corresponding Force vs. Displacement curves are given in Fig. 12 and Fig. 13.

The condition of the test sample on completion of testing is shown in Fig. 14 to Fig. 19.

A functional test of the test samples was not part of this test.

The evaluation of the test result falls to the client.

Official in charge



Dipl. Ing. (FH) M. Homann



Table 1: Specification of the test sample

Attribute	Value
Number of test samples	2
Test sample designation	Pallet Cushion PM1 and PM2 are made of identical material
Outer dimension	PM1 = Ø150 x 70 mm PM2 = Ø150 x 70 mm
Weight of the test samples	PM1 = 238, 45 g PM2 = 238, 00 g

Table 2: Vibration and compression test related to DIN EN 60068-2-6 (vibration) and DIN 55440 (compression)


Schedule	Type of Test	Test Parameter	Test Load	Reference																
1	Vibration test	Sinusoidal Vibration: acceleration: 0,5 g frequency cycle: 4...2000...4 Hz sweep rate: 1 oct / min	40 kg 88 lb	DIN EN 60068-2-6																
2	Compression test	Test speed 10 mm / min	Test Data <table border="1"> <thead> <tr> <th>Sub-Series</th> <th>h₀</th> <th>L_{Fmax}</th> <th>F_m</th> </tr> <tr> <th>Nr</th> <th>mm</th> <th>mm</th> <th>N</th> </tr> </thead> <tbody> <tr> <td>1.1</td> <td>70,8</td> <td>5,4</td> <td>3189</td> </tr> <tr> <td>1.2</td> <td>70,6</td> <td>5,2</td> <td>3176</td> </tr> </tbody> </table> Legende 	Sub-Series	h ₀	L _{Fmax}	F _m	Nr	mm	mm	N	1.1	70,8	5,4	3189	1.2	70,6	5,2	3176	DIN 55440
Sub-Series	h ₀	L _{Fmax}	F _m																	
Nr	mm	mm	N																	
1.1	70,8	5,4	3189																	
1.2	70,6	5,2	3176																	

Table 3: Test and measuring equipment.

Description, Manufacturer, Type	BFSV registration no.
Scales, Kern & Sohn, FKB16K0.05, W1406532 (max. 16 kg)	Vp 808
Steel measure, Helios Preisser, 04029713002206 (1000 mm)	Vp 1034
Compression tester, Zwick, SMZ020	Vp 431
Load cell (50 kN), Xforce K, serial no. 64658	Vp 1135
Electro-dynamic vibration generator, Unholtz Dickie, SA 61-T1000	Vp 369
Field amplifier, Unholtz Dickie FS/HE	Vp 369A
Power amplifier, Unholtz Dickie, SA60	Vp369B
Vibration control system, L.A.B VR 9500 Controller (Channel 1 – 4)	Vp 972
Vibration control system, L.A.B VR 9500 Controller (Channel 5 – 8)	Vp 973
Piezo-electric ICP® acceleration sensor, PCB, M352C65, Channel 1, control channel	Vp 664
Piezo-electric ICP® acceleration sensor, PCB, M352C65, Channel 2, surveillance channel	Vp 665
Piezo-electric ICP® acceleration sensor, PCB, 352C22, Channel 3, measurement channel	Vp 710



Fig. 1: Test sample before testing (PM1)



Fig. 2: Test sample before testing (PM2)



Fig 3: Exemplarily test setup for 'vibration'; PM1



Fig 4: Exemplarily test setup for 'vibration'; PM2

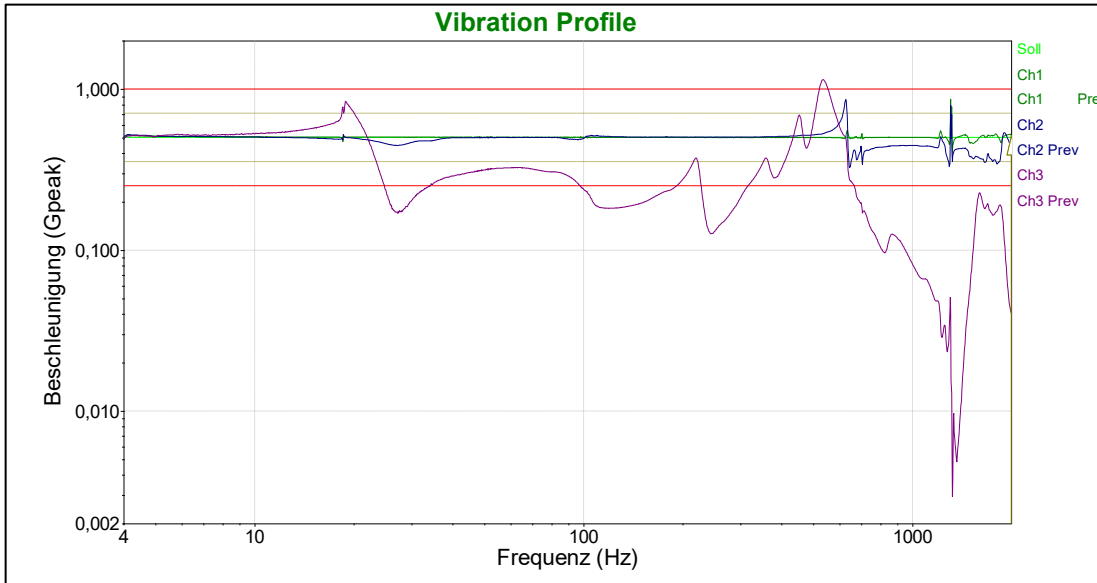


Fig 5: Vibration profile of sinusoidal vibration PM1, 4 Hz to 2000 Hz

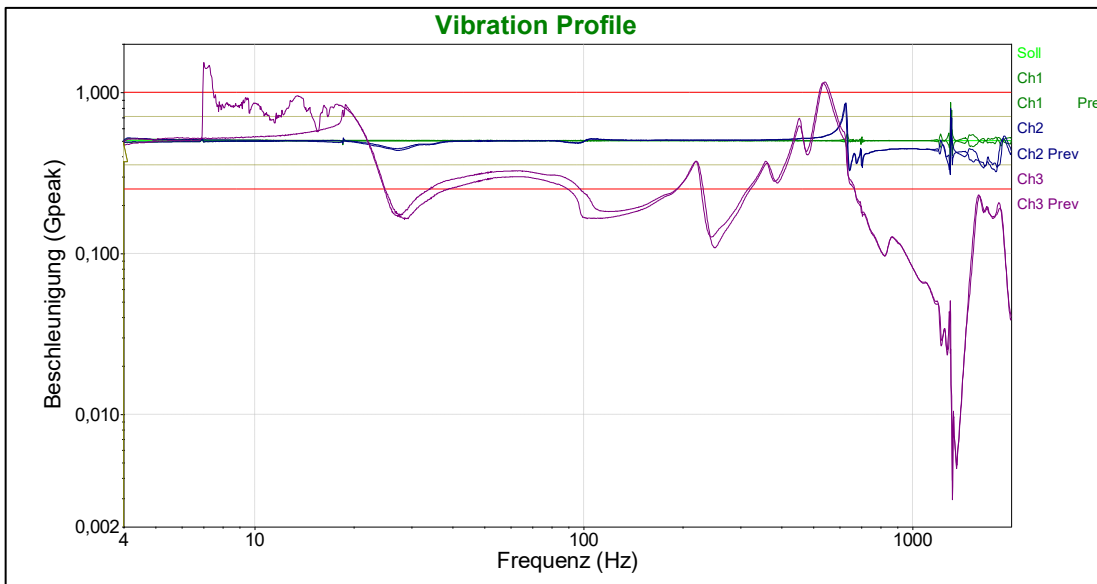


Fig 6: Vibration profile of sinusoidal vibration PM1, 2000 Hz to 4 Hz

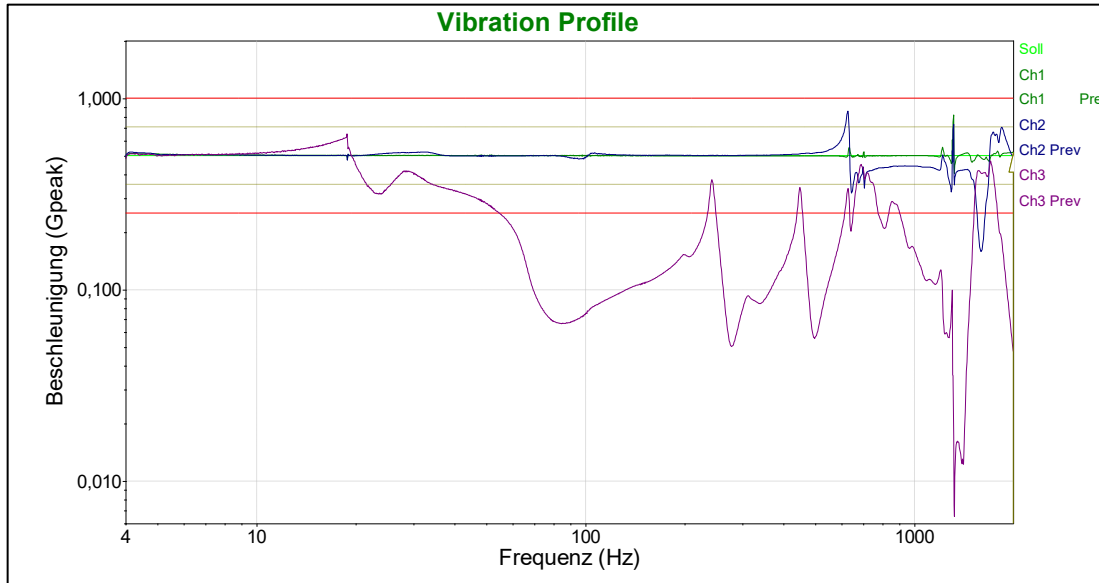


Fig 7: Vibration profile of sinusoidal vibration PM2, 4 Hz to 2000 Hz

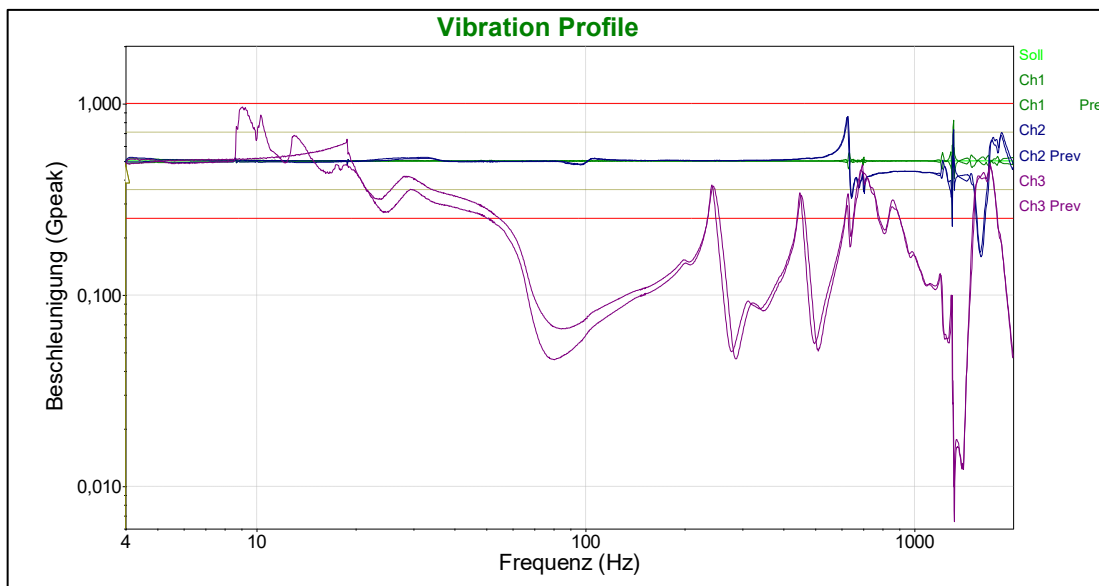


Fig 8 : Vibration profile of sinusoidal vibration PM2, 2000 Hz to 4 Hz

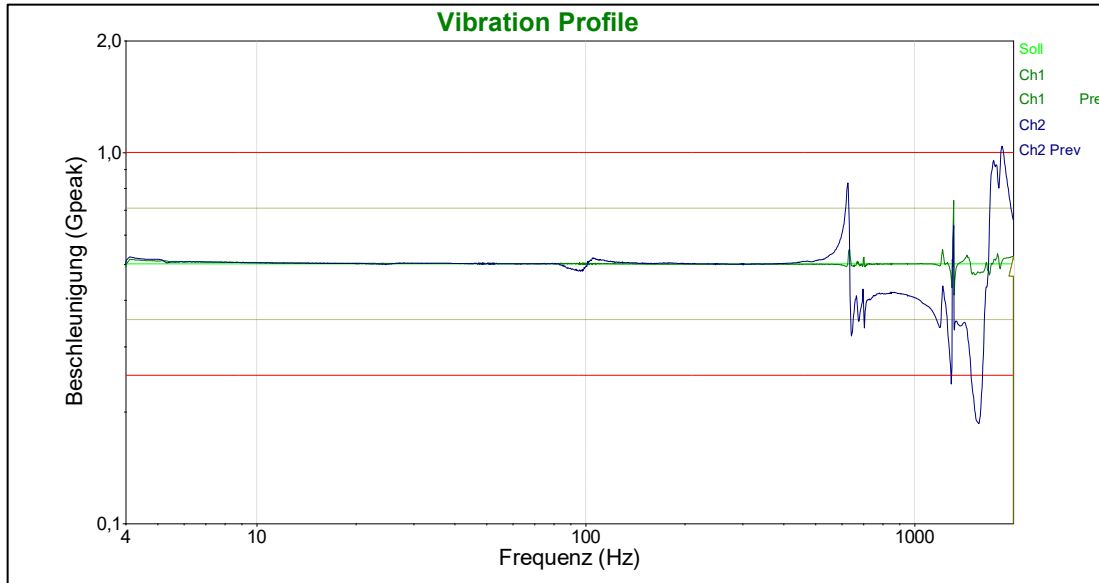


Fig 9 : Vibration profile of sinusoidal vibration empty test set up, 4 Hz to 2000 Hz

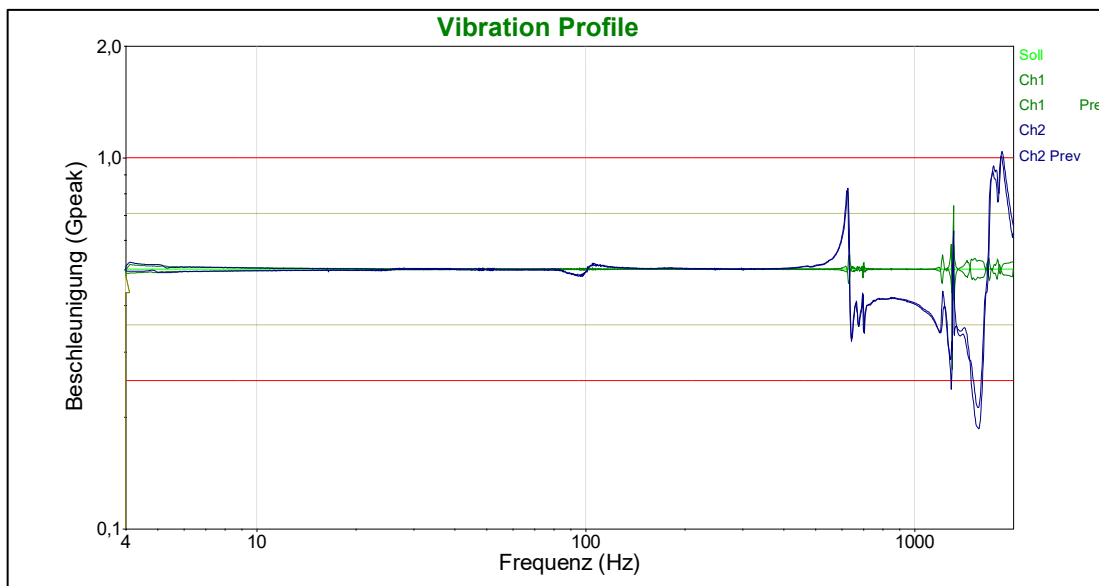


Fig 10: Vibration profile of sinusoidal vibration empty test set up, 2000 Hz to 4 Hz

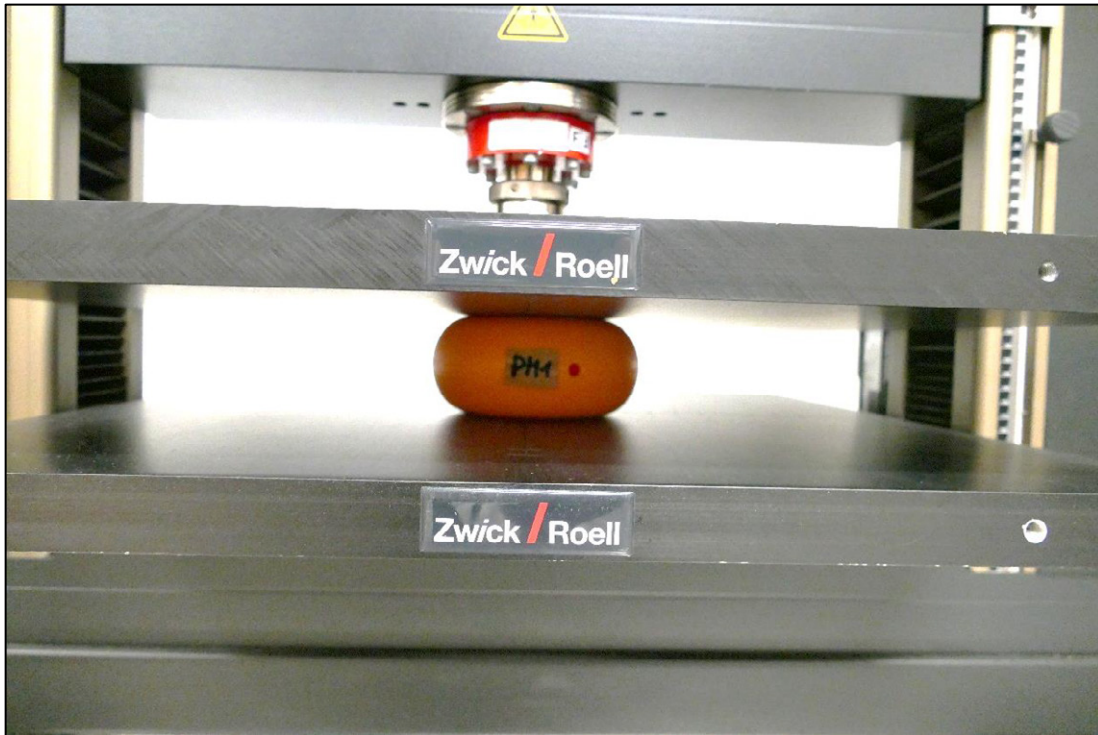


Fig. 11: Exemplarily test setup – ‘compression test’

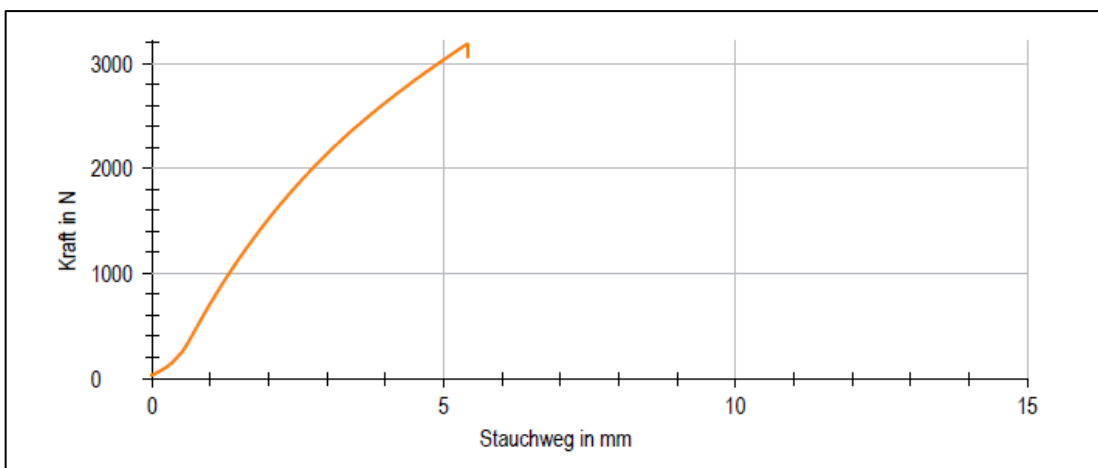


Fig. 12: Force-vs.-Displ. curves measured during the ‘compression test’ force limitation at 3000N manually stopped (PM1 = yellow)

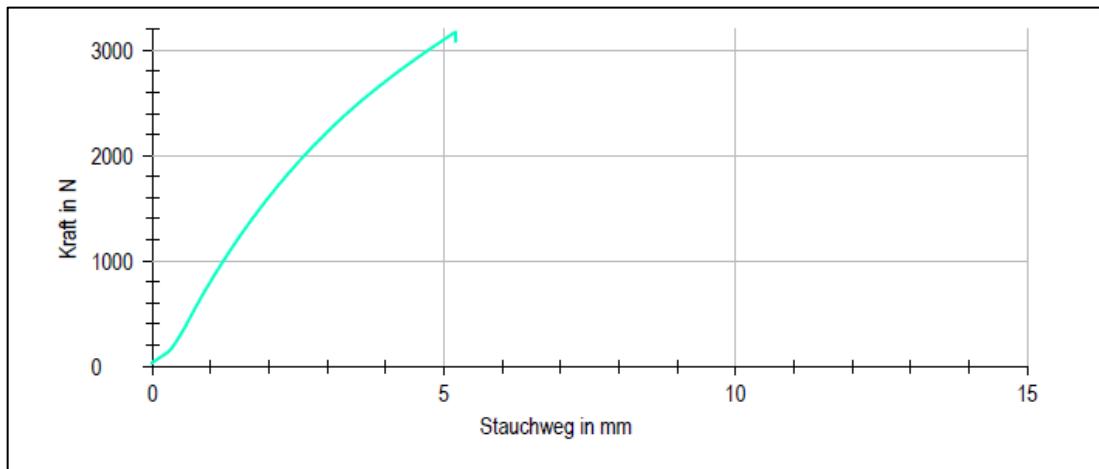


Fig. 13: Force-vs.-Displ. curves measured during the 'compression test' force limitation at 3000N manually stopped (PM2 = green)



Fig 14: Visual check on completion of testing, test sample PM1, front view



Fig 15: Visual check on completion of testing, test sample PM1, top view



Fig 16: Visual check on completion of testing, test sample PM1, bottom view



Fig 17: Visual check on completion of testing, test sample PM2, front view



Fig 18: Visual check on completion of testing, test sample PM2, top view



Fig 19: Visual check on completion of testing, test sample PM2, bottom view