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Your Ref.: - **Our Ref.: CT-18733/JAS** **Date: 13/02/2012**

TEST REPORT

(This Report is issued subject to the terms & conditions set out below)

Subject : Resistance to hydrostatic pressure test with potable Water on PENEBAR SW-55 Waterstop submitted by Penetron International Ltd on 01/12/2011.

Tested for : **Penetron International Ltd**
45 Research Way
Suite 203 East Setauket
New York 11733
United States
Attn.: Mr. Gary Loh

Test Method : Test Method for Hydrostatic Testing in Cast In Place Joint Assembly for Waterstop by Penetron International Ltd

Description of Sample : One roll of 2m x 25mm x 19mm PENEBAR SW-55 Waterstop was received, (see photograph 1 attached in Annex A).

1. Introduction

SETSCO has been engaged to carry out tests on PENEBAR SW-55 Waterstop to evaluate its performance against hydrostatic pressure with potable water when cast in a place joint assembly.

The objective of the test program is to assess the effectiveness of the PENEBAR SW-55 Waterstop against potable water pressure up to 6 bar.

2. Sample Preparation

Preparation of Concrete Substrate

Mix Proportion : The mix proportion of Fresh Concrete was as follows:

Cement	-	380 kg/m^3
Sand	-	784 kg/m^3
Coarse Aggregate	-	1165 kg/m^3
Water	-	200 kg/m^3

Mixing Procedure : The mixing procedure of Fresh Concrete was in accordance with BS EN 480-1:2006.

3. Casting of Test Specimens

Test Assembly Preparation:

1. A 350mm diameter x 80mm thick circular shaped concrete was cast onto a 10mm thick steel plate as the bottom test specimen and its surface was flattened by trowel. The steel plate has 4 evenly spaced threaded rods mounted on it to allow for the tight assembly of the top specimen against the bottom specimen. The bottom specimen was cured for 24 hours.

The bottom test specimen with four evenly spaced threaded rods

2. Two circular pieces of release paper were placed on the surface of the bottom test specimen and together covered the entire surface except the area where the waterstop was to be placed

The release paper placed onto the bottom test specimen

The release paper placed onto the control bottom test specimens

3. A single piece of waterstop was glued with PENEBAR SW Primer to the exposed surface of the bottom test specimen. The ends of the waterstop were cut at diagonal angle, glued together with PENEBAR SW Primer and moulded into a continuous seal. A circular funnel of 75mm diameter with a 25mm height and a 50mm diameter pipe protruding from its top was placed in the center of the specimen. The placement was such that the entire circumference of the cup will be in contact with the release paper as such creating a cavity for applying potable water and pressure to the test assembly.

The ends of the PENEBAR SW-55 waterstop glued together with PENEBAR SW Primer

The PENEBAR SW-55 waterstop glued with PENEBAR SW Primer onto the bottom test specimen and the circular funnel with the pipe. A steel form of 80mm in height was clamped onto the bottom test specimen to be filled up with fresh concrete.

Fresh concrete placed onto the PENEBAR SW-55, release paper and the bottom test specimen

Completed casting of the concrete

The test assembly fully cured and mounted with a 10 mm steel plate on the top part and tightened together for pressure.

4. The test assembly was cured for 28 days to allow the concrete to reach maximum strength. The average compressive of the concrete components of the test assembly was 44.5N/mm^2.

Test Procedure

1. The center cavity of the test assembly was filled with potable water allowing the concrete to become saturated for 72 hours.

The center cavity being filled with Potable water

2. The test assembly was fitted with a constant potable water supply and a pressure gauge to measure the water pressure applied to the center cavity.

Fully set test assemblies ready for test

3. Potable water pressure was applied to the assembled test fixture at predetermined pressure at predetermined length of time. The test assembly was monitored for leakage or pressure loss. Dripping water from the joint area of the test assembly or loss of pressure registered by the pressure gauge constitutes a failure.

4. Two test assemblies were set up with a PENEBAR SW-55 waterstop and one control without any water stop.

Test Results

1. The results of the compressive strength of the bottom test specimen and the top test specimen are given in Table 1

2. The results of the resistance to hydrostatic pressure for the control test assembly is given in Table 2 and the test assemblies with the PENEBAR SW-55 waterstop are given in Table 3 and 4.

Table 1: Compressive Strength of Bottom and Top test specimen

Specimen Reference	1	2	3	4
Size of Cube (mm)	150			
Date of Cast	05/12/2011		06/12/2011	
Date of Test	03/01/2012		03/01/2012	
Age at Test (days)	29		28	
Compressive Strength (N/mm^2)	44.5	44.5	45.0	45.0
Average Compressive Strength (N/mm^2)	44.5		45.0	

Table 2: Control Test Assembly

Specimen Reference	**Control Test Assembly**		
From Test Date	**To Test Date**	**Pressure (PSI)**	**Observation**
03/01/2012	06/01/2012	0	Potable water introduced into the centre cavity. Test specimen allowed to stabilise for 72 hours without pressure
06/01/2012	06/01/2012	0.2	Potable water leakage and pressure loss observe after applying of water pressure (see photo 2 attached)
The test for control test specimen was stop after water leakage (See photograph 2 attached in Annex A)			

Table 3: Test Assembly Number 1 with PENEBAR SW-55 Waterstop

Specimen Reference	Test Assembly No. 1		
From Test Date	**To Test Date**	**Pressure (Bar)**	**Observation**
03/01/2012	06/01/2012	0	Potable water introduced into the centre cavity. Test specimen allowed to stabilise for 72 hours without pressure
06/01/2012	09/01/2012	0.34 (5 psi)	No potable water leakage or pressure drop
09/01/2012	11/01/2012	0.69 (10 psi)	No potable water leakage or pressure drop
11/01/2012	16/01/2012	1	No potable water leakage or pressure drop
16/01/2012	19/01/2012	2	No potable water leakage or pressure drop
19/01/2012	25/01/2012	3	No potable water leakage or pressure drop
25/01/2012	30/01/2012	4	No potable water leakage or pressure drop
30/01/2012	02/02/2012	5	No potable water leakage or pressure drop
02/02/2012	09/02/2012	6	No potable water leakage or pressure drop
The test was stopped after 7 days at 6 bar water pressure without any leakage or pressure loss			

Table 4: Test Assembly Number 2 with PENEBAR SW-55 Waterstop

Specimen Reference	Test Assembly Number 2		
From Test Date	**To Test Date**	**Pressure (Bar)**	**Observation**
03/01/2012	06/01/2012	0	Potable water introduced into the centre cavity. Test specimen allowed to stabilise for 72 hours without pressure
06/01/2012	09/01/2012	0.34 (5 psi)	No potable water leakage or pressure drop
09/01/2012	11/01/2012	0.69 (10 psi)	No potable water leakage or pressure drop
11/01/2012	16/01/2012	1	No potable water leakage or pressure drop
16/01/2012	19/01/2012	2	No potable water leakage or pressure drop
19/01/2012	25/01/2012	3	No potable water leakage or pressure drop
25/01/2012	30/01/2012	4	No potable water leakage or pressure drop
30/01/2012	02/02/2012	5	No potable water leakage or pressure drop
02/02/2012	09/02/2012	6	No potable water leakage or pressure drop
The test was stopped after 7 days at 6 bar water pressure without any leakage or pressure loss			

See Annex A for photographs 3 to 10 attached for treated sample

Ravi Vaiamalai
Testing Officer

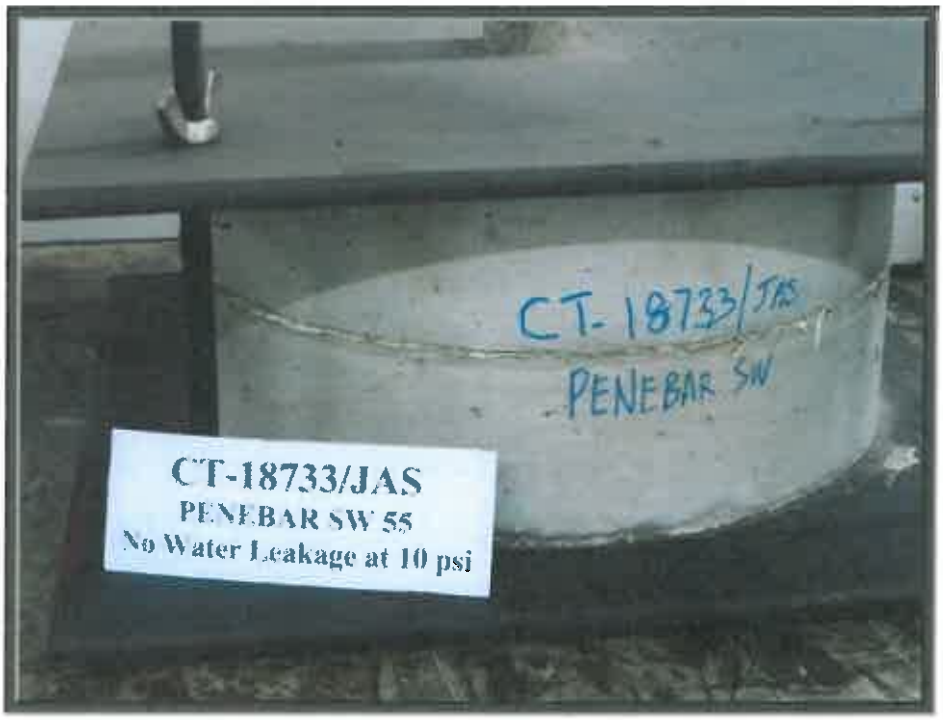
Jasbeer Singh
Assistant Engineer (CMTD)
Construction Technology Division

Annex A

Photograph 1: Shows one roll of PENEBAR SW-55 waterstop as received

Photograph 2: Control sample shows water leakage at 0.2 psi

Photograph 3: Treated Sample at 5 psi water pressure



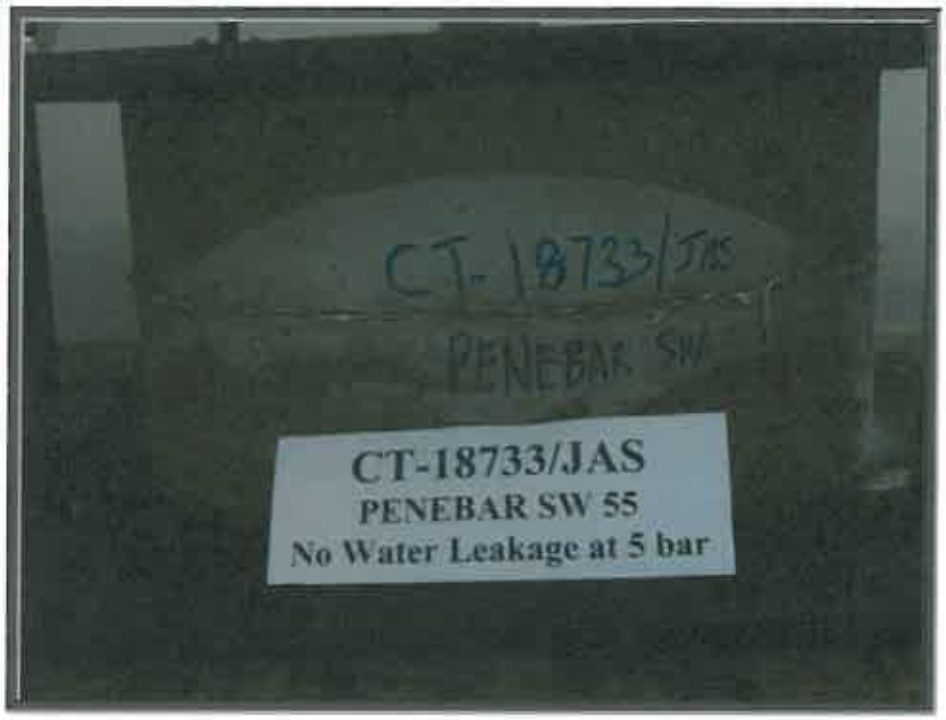
Photograph 4: Treated Sample at 10 psi water pressure

Photograph 5: Treated Sample at 1 bar water pressure

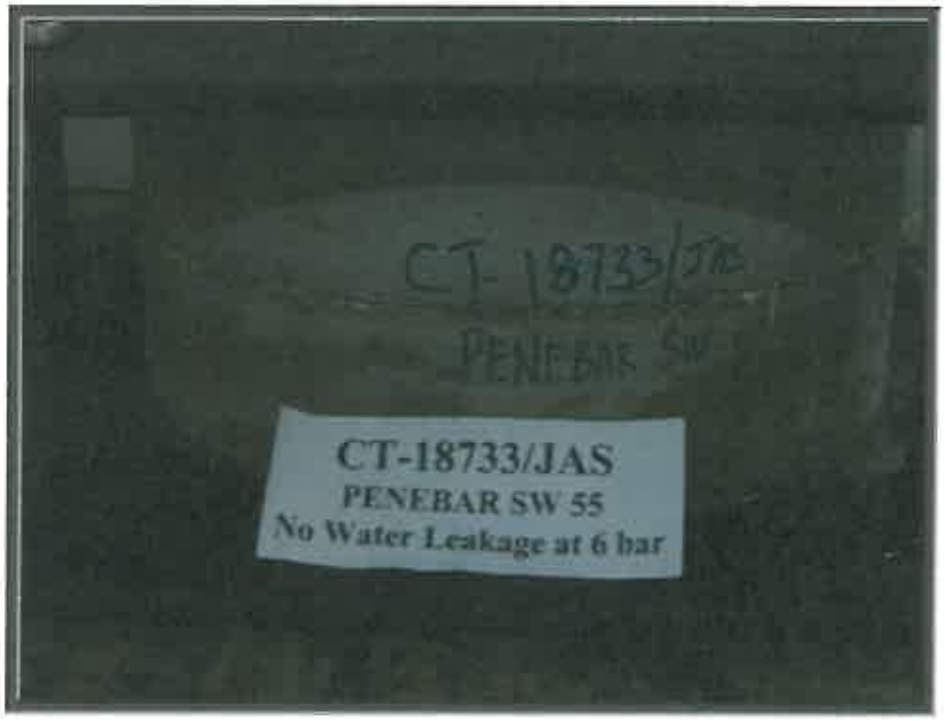
Photograph 6: Treated Sample at 2 bar water pressure

Photograph 7. Treated Sample at 3 bar water pressure

Photograph 8: Treated Sample at 4 bar water pressure



Photograph 9: Treated Sample at 5 bar water pressure.



Photograph 10: Treated Sample at 6 bar water pressure.