

Procedure: Creep Test at SNL

Version Date:

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Form Completed By: Tina Lynn / Laramie Parker

1 Test Description

Parameters	Value
Test Name	UNM-WP-HY-90-07
Salt Provenance (Circle One)	Avery Island / <u>WIPP</u>
Test Type (Circle One)	<u>Hydrostatic</u> / Shear
Salt Can Label	4H
Water Added to Salt (Circle One)	<u>yes</u> / no
Target/Actual Water Added (Percent by Mass [%])	1% / 0.99%
Temperature: [°C / °F]	90°C
Pressure [MPa / psi]	20 MPa
Jacketing Components (Circle All)	Outer <u>Lead</u> - Outer Viton - Inner <u>Lead</u> - Inner <u>Copper</u>
Tested In (Circle One)	<u>Frame 2</u> Frame 3
Test Target (permeability / <u>fractional density</u> / etc)	0.95

Table 1: Description of Test

$$I_n = \frac{\#1}{0.469} \quad \frac{\#2}{0.232}$$

$$\#1: i_n = -0.0623 \frac{\text{in}}{\text{mA}} * + 1.267$$

2 Pre-Test Measurements

2.1 Height of components:

Components	Count	Component Label	Recorded Height [mm]
Platens	1	C1	37.32
	2	C8	34.32
Chamfer Discs	1	CP1	12.75
	2	CP7	8.28
Mesh Discs	1	NA	1.16
	2	NA	1.15
Cumulative Height of Components		94.98	mm

Table 2: Itemized List of Components for Height Measurements (No Salt).

2.2 Jacket Dimensions

2.2.1 Jacket Componentenets

For all tests, the jacketing materials will be -> one outer lead jacket and two inner copper jackets.

2.2.2 Height of Outer Jacket

This value will vary depending on which platens (steel or aluminium) and chamfer pieces are used, in general:

1. Outer Jacket: 10.125 inches (257.17 mm) to 10.5 inches (266.7 mm);
2. INNER SHELL: 12.0 INCHES (304.8 MM) -> THIS IS FOR BOTH A1 AND A2;
3. Specimen Clearance: 1.875 inches (47.62 mm) to 1.5 inches (38.1 mm);

NOTE: the maximum height inside Frame 2 and 3 is 12 inches (304.8 mm) - If the upper internal port of the shell is plugged, the available height is decreased to 11.75 inches (298.45 mm)

Jacket Description	Height	No. of Jackets Used
Outer Lead Jacket (mm)	225 215	1
Outer Viton Jacket (mm)	—	—
Inner Lead Jacket (mm)	130	1
Inner Copper Jacket (mm)	134	
Height of Total Sample (mm)		NA

Table 3: Height of Jacketing Components (if jacket not used, write "NA")

2.2.3 Checklist of Jacketing Materials:

Components	Count	Verification Checkmark (and Component Label is Applicable)
Platens	1	
	2	
Platen O-rings	1	
	2	
	3	
	4	
Platen Screws (0.25 inch 20 rnd)	1	
	2	
Screw-In Nipples	1	
	2	
Nipple O-rings	1	
	2	
	3	
	4	
Nipple Adapter (HIP HF4 connection)	1	
	2	
Nipple Plugs (HIP HF4 plugs)	1	
	2	
Chamfer Discs	1	
	2	
Mesh Discs	1	
	2	
Inner Copper Jacket (indicate No. used)		Thickness of 1 Sheet of Copper (mm)
Outer Lead Jacket	1	Jacket Thickness (mm)

Table 4: Itemized List of Components for Mass and Volume Measurements (No Salt).

Measured Value	Values	Units	Comments
Prior to Dunk: Water Level Reading on Burette	73.1	mL (burette)	
After Dunk: Water Level Reading on Burette	64.2	mL (burette)	
Volume of Components (No Salt)	4.3996	mL	1019.03 mL - 4.9 = 1014.1
Mass of Components (No Salt)	4.3996 - 0.0394	kg	4.3601
Approximate Diameter of Salt	104.48	mm	
Approximate Height of Salt		mm	
Dunk Tank Volume Factor: 114.4978 mL/Burette Unit			

Table 5: Measurements of All Components (No Salt)

2.3 Measured Mass of Salt

2.3.1 Date:

Trimmed lead mass = 0.0394 grams

Parameters	Value	
Salt Can Label	4H	
Before Making Sample: Mass of Salt and Can (with lid)	1717.1 grams	kg
After Sample is Made: Remaining Mass of Salt and Can (with lid)	.224.9	kg
Mass of Salt Used for Sample	1.4922	kg
Cumulative Mass of Components and Salt	5.8528	kg

Table 6: Mass of Salt

3 Pre-consolidation Measurements

3.0.2 Date: 7/24/15

Average diameter = 107.9 mm

Average height = 215.2 mm

3.0.3 Data Sample Rate:

Volume Displayed on ISCO Pump	Volume [mL]	Pressure [psi]	Time [hh:mm]
Initial Reading: prior to consolidation	37.54	53	2:28 PM
Reading: When at pre-consolidation pressure	251.31	2900	2:34 PM
Final Reading: after pre consolidation	336.08	13	2:42 PM

Table 7: Pre-consolidation Details

Parameter	Values	Units
Prior to Dunk: Mass of Specimen (with all components)	5.8589	kg
Prior to Dunk: Water Level Reading on Burette	73.2	mL (burette)
After Dunk: Water Level Reading on Burette	57.3	mL (burette)
Preconsolidated Specimen (all components listed above plus salt)	1820.52	mL
After Dunk: Mass of Specimen (with all components)	5.8576	kg
Total Height of Specimen	208.5	mm
Approximate Outside Diameter of Specimen	102.02	mm
Preconsolidated Salt (Salt Only) - Volume and Mass		mL
		kg
Dunk Tank Volume Factor: 114.4978 mL/Burette Unit		

Table 8: Measurements Made After Preconsolidation of Specimen.

Pre Consolidation on
A 3

4 Moved to A2 for
Tc = T

p = 1850.4
0.857

4 Application of Heat to Obtain Test Temperature

Frame A2

4.0.4 Data Sample Rate: 100 sec/sample

Event	Date	Time	Confining Pressure [psi]	Expelled Silicone Oil Volume (mL)
Start Temperature Increase	7/27/15	13:43	0.9	0 mL
End Temperature Increase		15:44	2 psi	230 mL

⇒ 87.1°C

Table 9: Dates of Details of Temperature Increase

5 Creep Test

5.0.5 Date (Start Test): 7/27/15

5.0.6 Data Sample Rate: 10 sec/sample for ≈ 10 min ⇒ 100 sec/sample

Event	Value	Comment
ISCO Pump Volume (Pre Pressure Increase)	507.49 mL	
ISCO Pump Pressure (Pre Pressure Increase)	-4 psi	
Begin Pressure Increase	Time: 15:52	
End Pressure Increase	Time: 16:00	
ISCO Pump Volume (Post to Pressure Increase)	300.70	
ISCO Pump Pressure (Post Pressure Increase)	2860 Pa	After stopping Program
ISCO Pump Flow Rate (Post Pressure Increase)	3.3 mL/min	

Table 10: Details of Test Initiation

5.0.7 Date (End Test): 8/17/15

Parameters	Values	Units
Final Mass of Specimen	5.8575	kg
Initial Dunk Tank Values	62.4	mL (burette)
Final Dunk Tank Values	47.3	mL (burette)
Volume of Specimen	1728.92	mL
Specimen Diameter	97.79	mm
Specimen Height	203.03	mm
Density of Salt only	2087.61	kg/m ³
Dunk Tank Volume Factor: 114.4978 mL/Burette Unit		

See back page for Average Data

5.8573
After Dunk

105.1

FD
0.946

Table 11: Post Test Measurements

$$V = \frac{\pi d^2 h}{4}$$

$$\sqrt{\frac{V \cdot 4}{\pi h}} = d$$

Final Dim

String — 31.0 mm
98.68 mm
~~98.68 mm~~

Caliper

$$H_1 = \overset{204}{2004.21} \text{ mm}$$

$$H_2 = 202.16$$

$$H_3 = 202.42$$

$$H_4 = 203.32$$

$$H_{AV} = 203.03$$

$$D_1 = 98.69 \text{ mm}$$

$$D_2 = 97.58 \text{ mm}$$

$$D_3 = 98.27 \text{ mm}$$

$$D_4 = 96.61 \text{ mm}$$

$$\boxed{D_{AV} = 97.79 \text{ mm}}$$