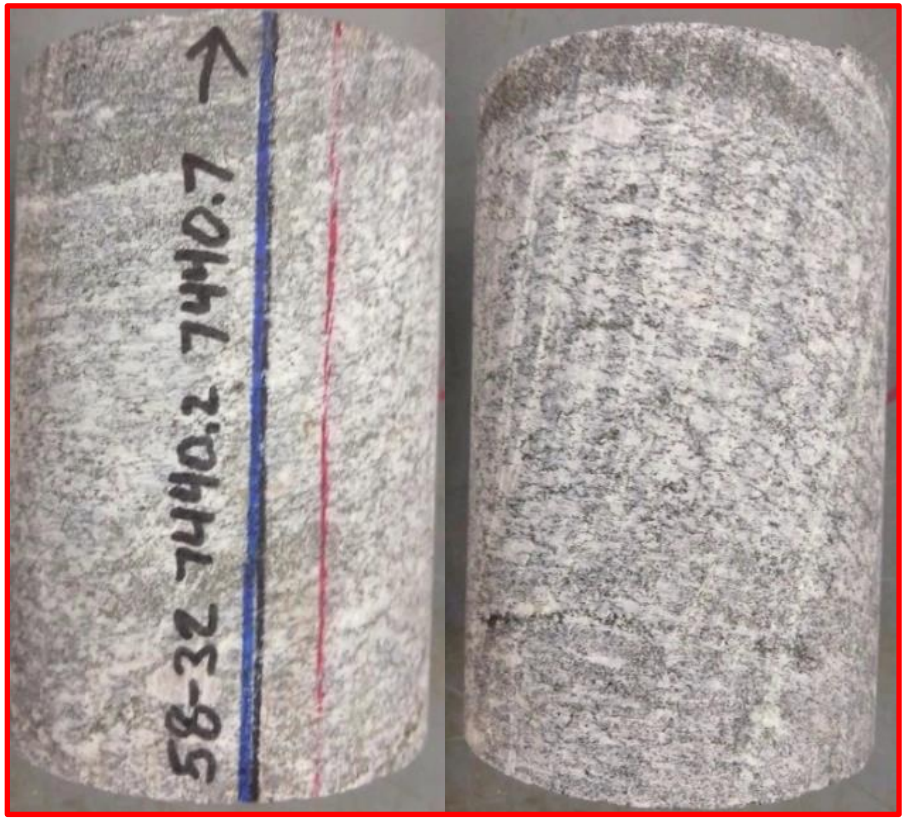
METAROCK LABORATORIES MR-210000850_FORGE_GRANITE THERMAL PROPERTIES UPDATE: 5.4.2021

Prepared for

University of Utah

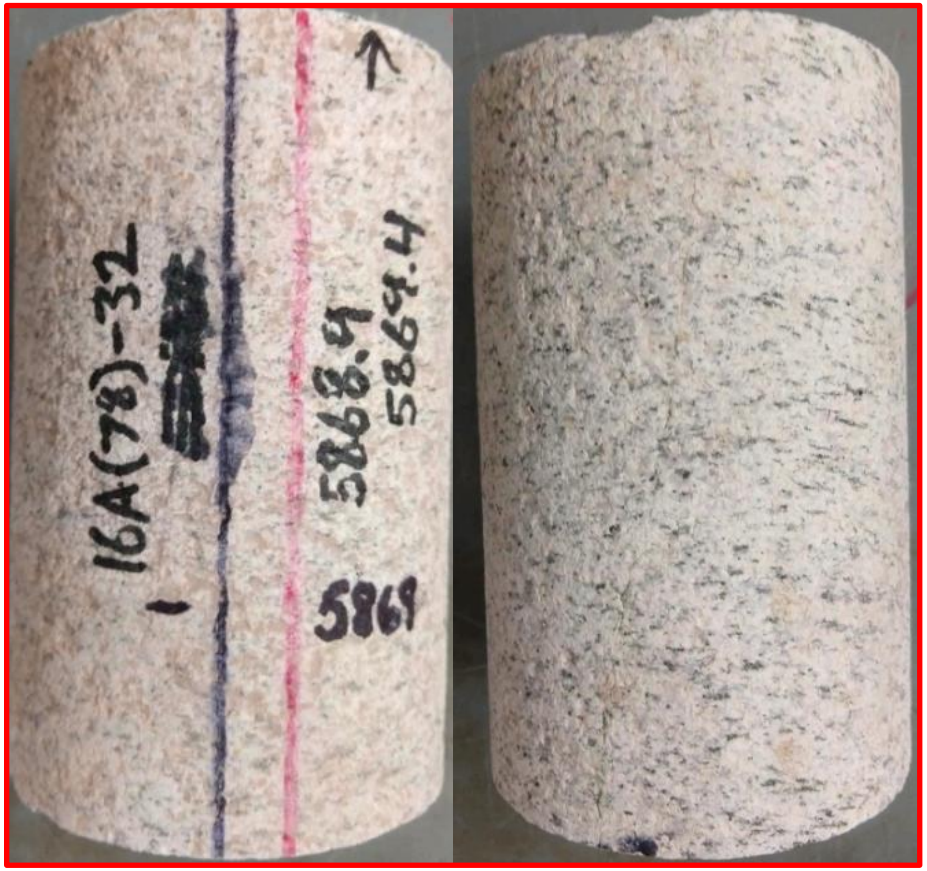
METAROCK LABORATORIES

As Received Cores
58-32

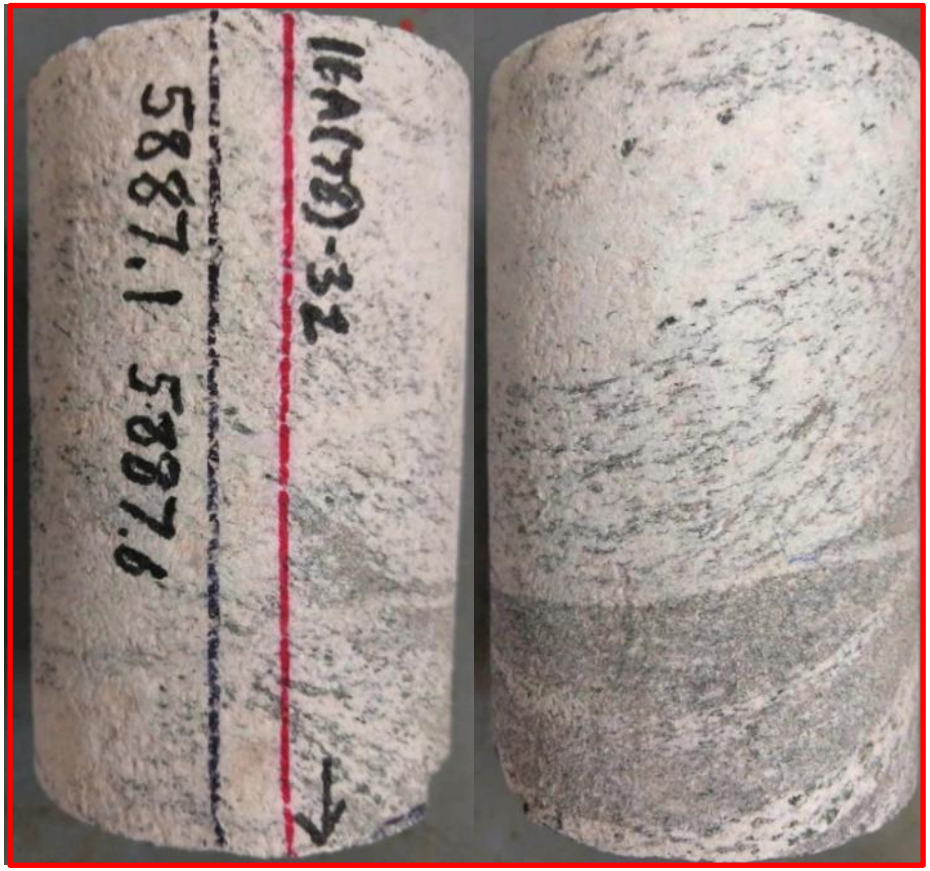


(A)

As Received Cores
16A(78)-32



(A)

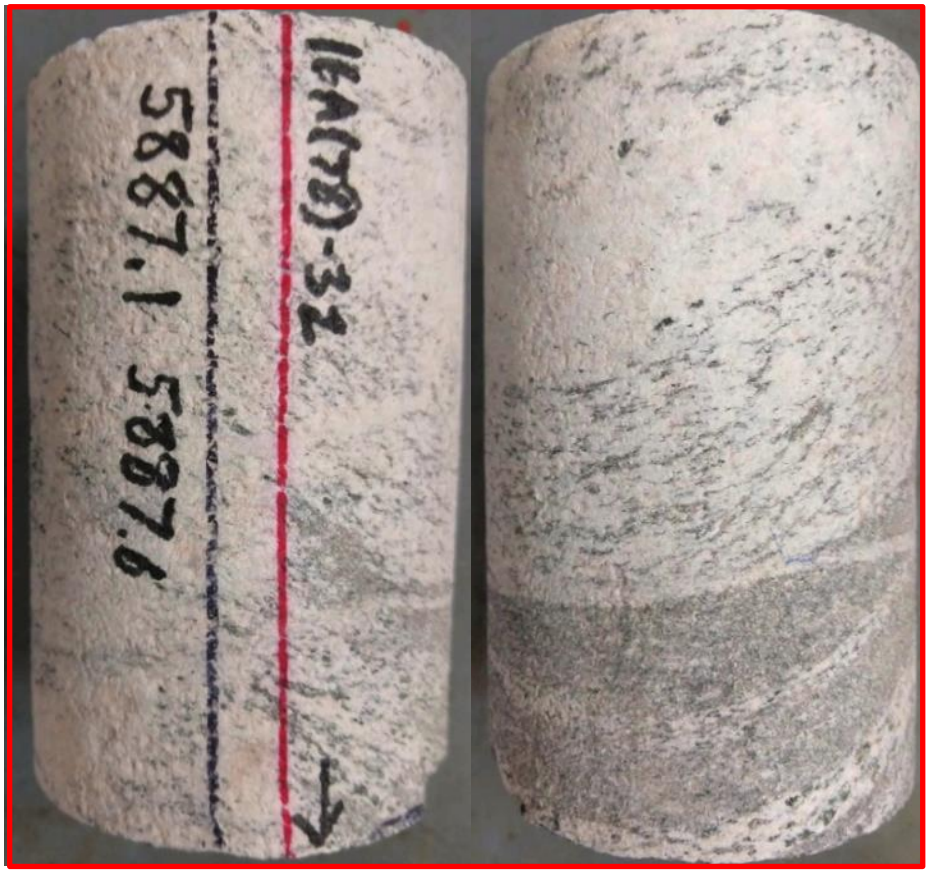


(B)

As Received Core Details

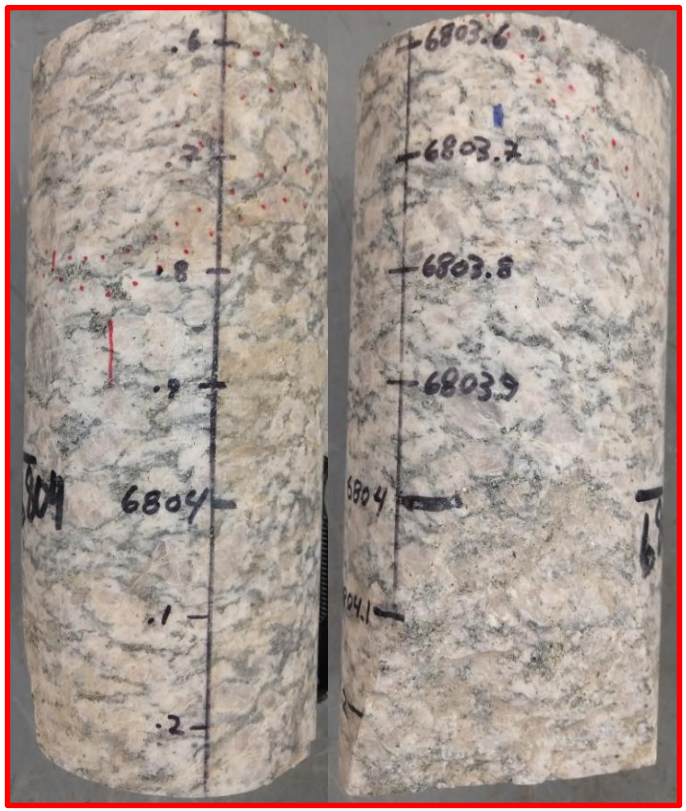
Well	Top (ft MD)	Bottom (ft MD)	Core length (ft)
16A(78)-32	5868.9	5869.4	0.5
16A(78)-32	5887.1	5887.6	0.5
58-32	7440.2	7440.7	0.5

Core suggested for replacement
16A(78)-32-B



(B)

Replacement Core
58-32_B



Thermal Expansion Test

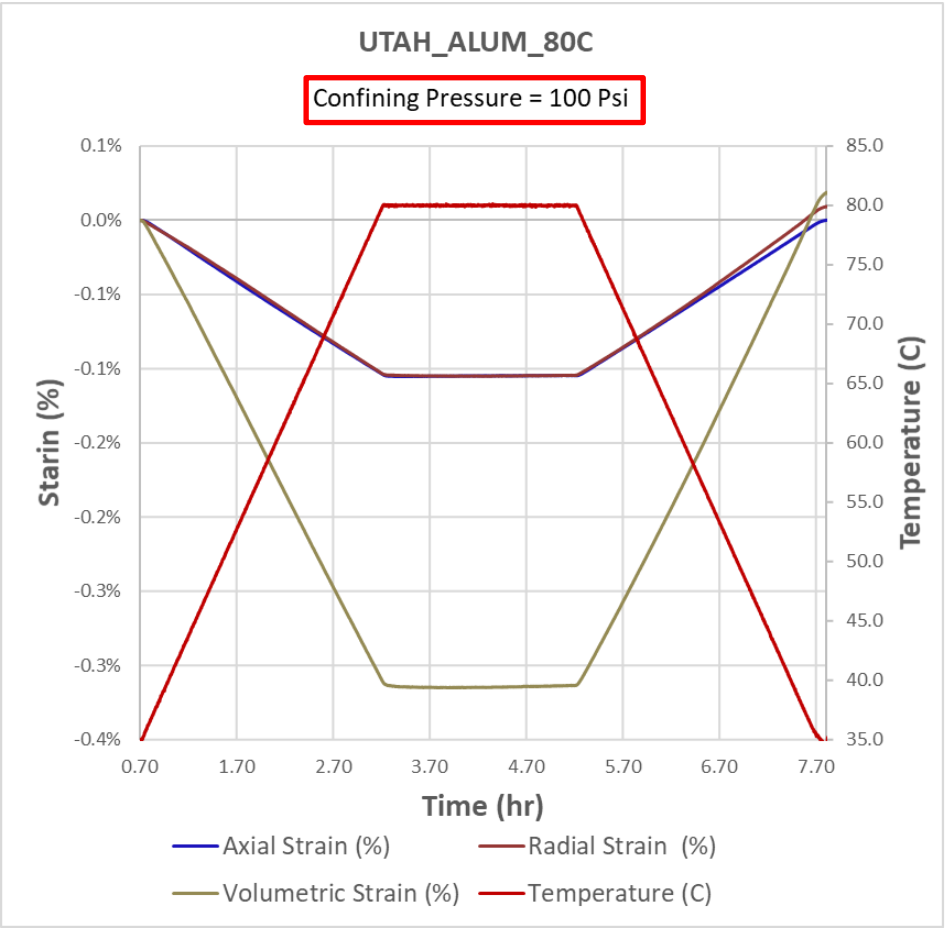
Aluminum Calibration up to 80 C at different confining pressures

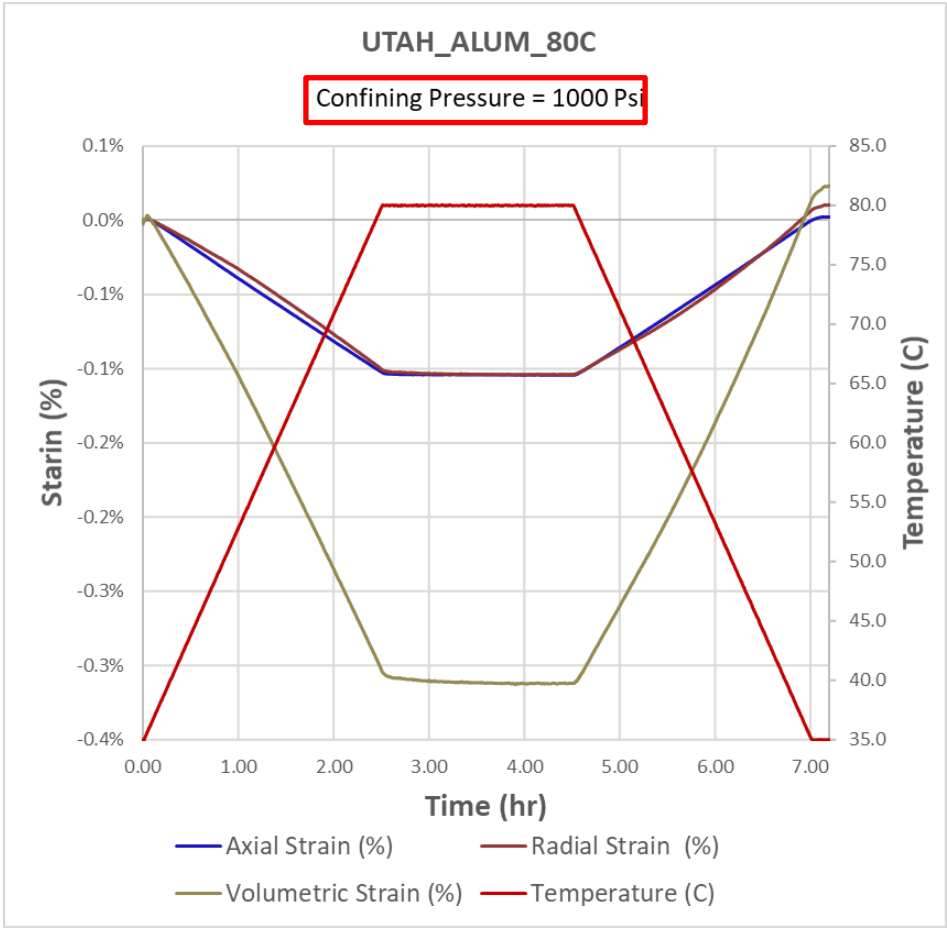
Thermal Expansion Test

Aluminum Calibration up to 80 C at different confining pressure

UTAH_ALUM_80C

Test Overview



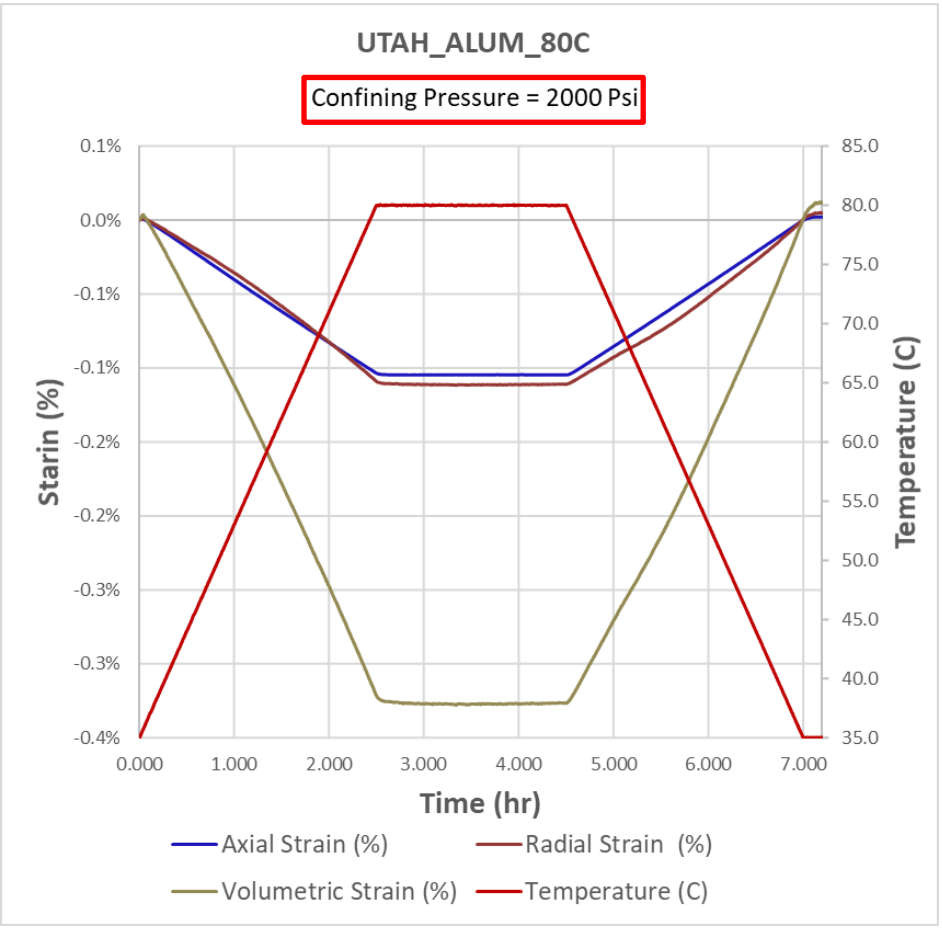


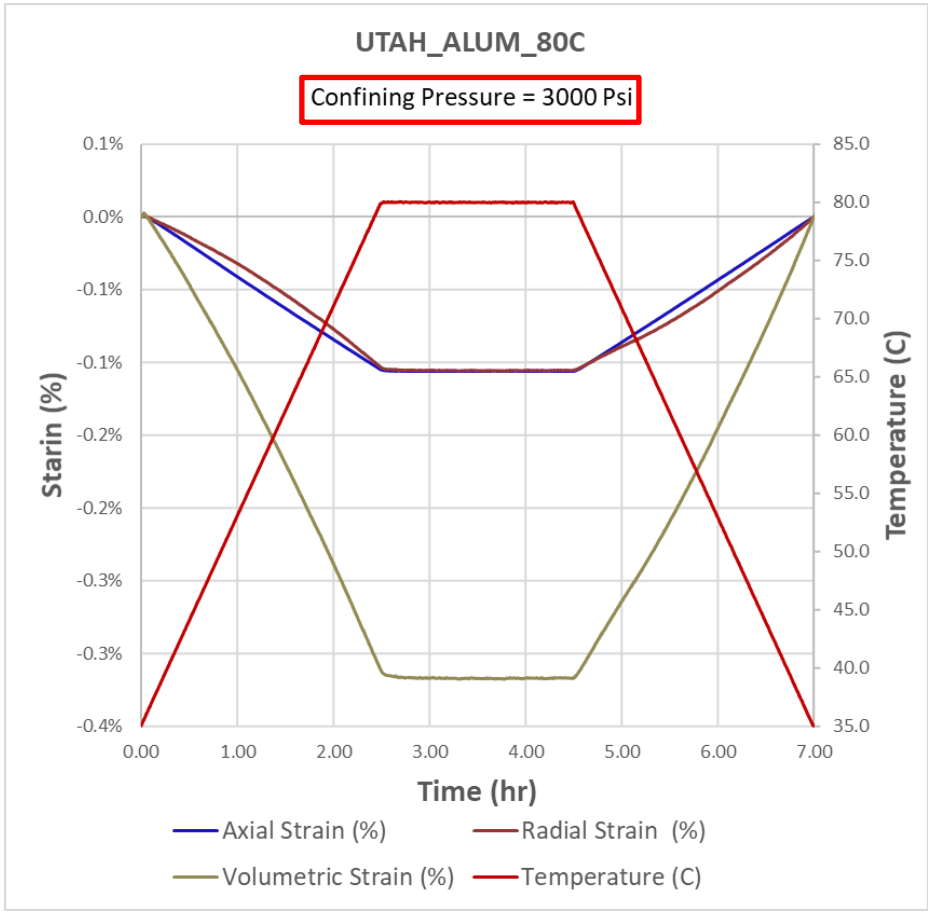
Thermal Expansion Test

Aluminum Calibration up to 80 C at different confining pressure

UTAH_ALUM_80C

Test Overview



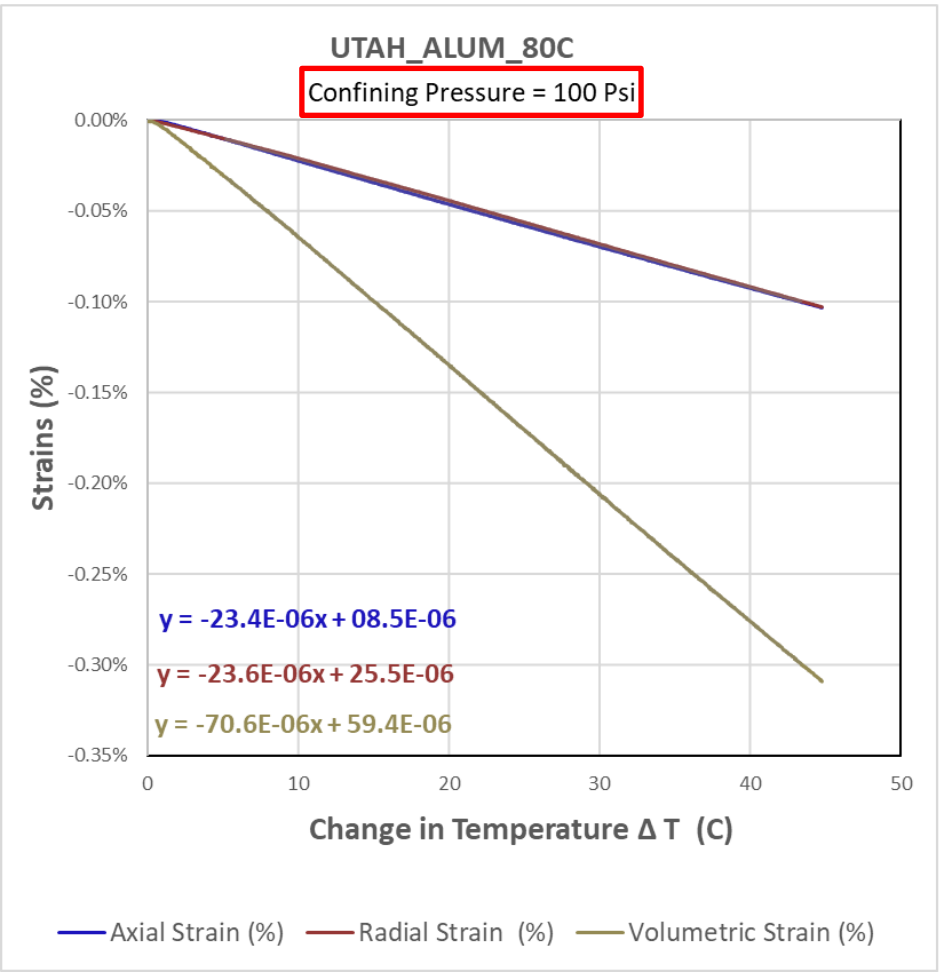


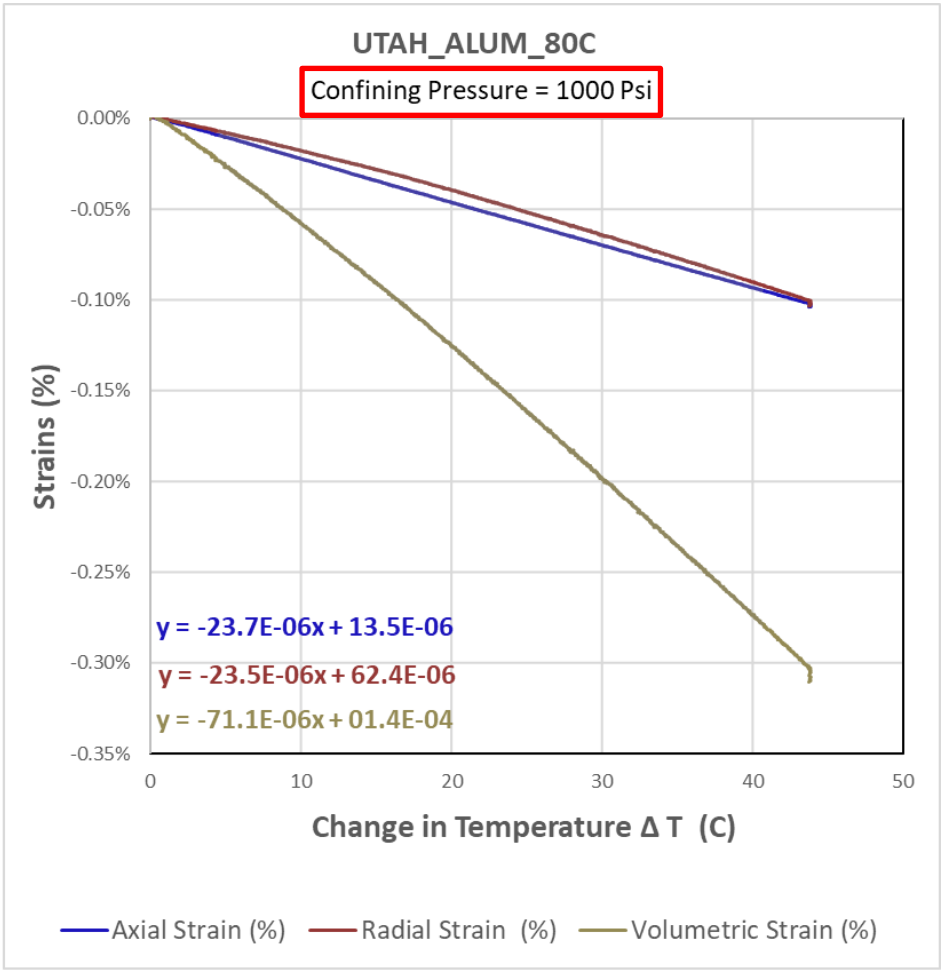
Thermal Expansion Test

Aluminum Calibration up to 80 C at different confining pressure

UTAH_ALUM_80C

Thermal Expansion Coefficient



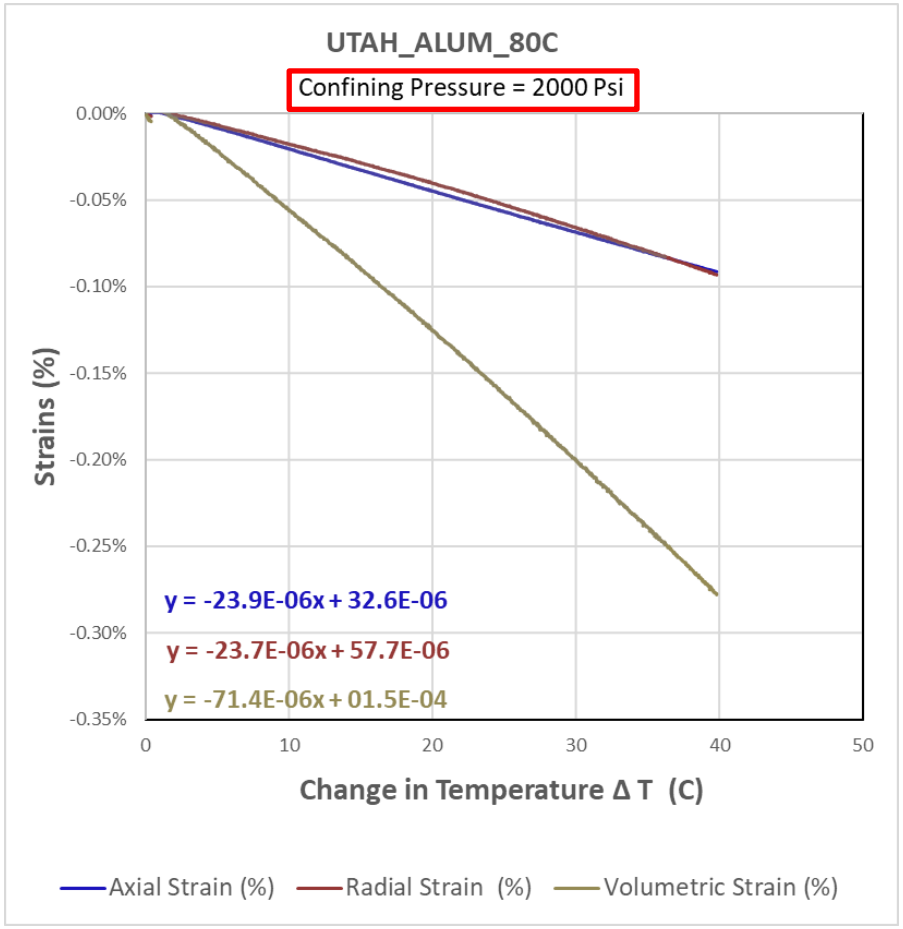


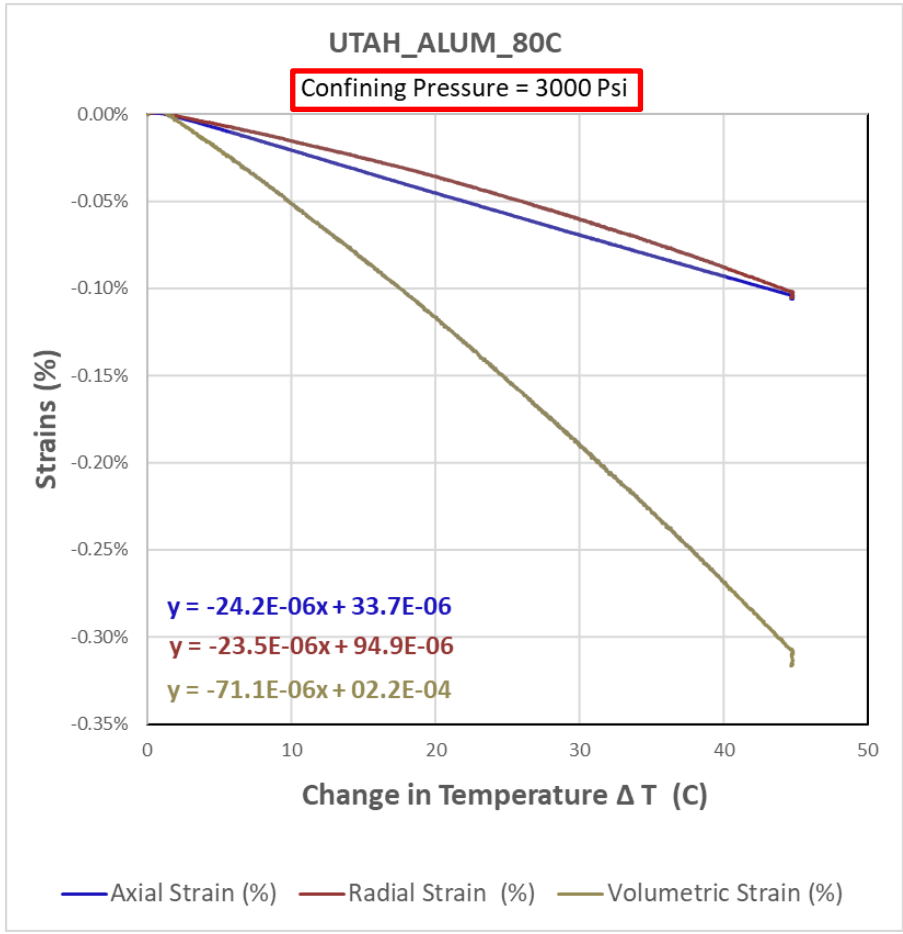
Thermal Expansion Test

Aluminum Calibration up to 80 C at different confining pressure

UTAH_ALUM_80C

Thermal Expansion Coefficient





Thermal Expansion Test

Aluminum Calibration up to 80 C at different confining pressure

Summary

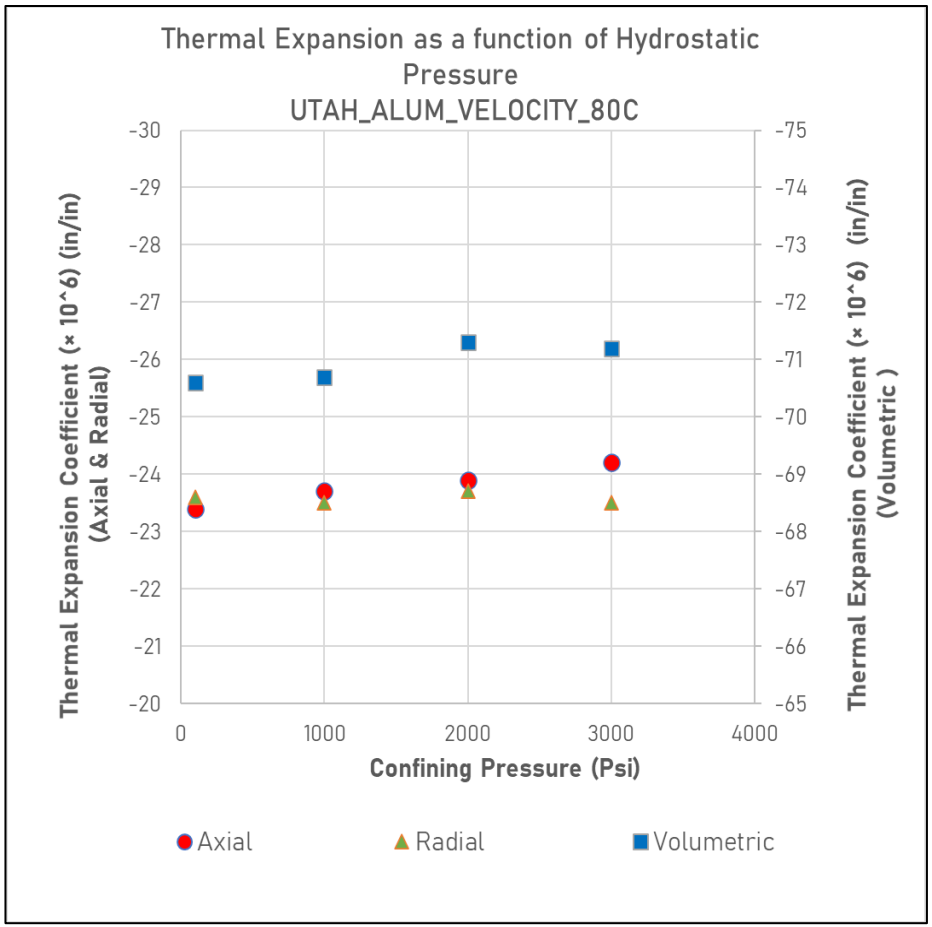
Confining Pressure (Psi)	Thermal Expansion Coefficient (× 10^-6)			Compressional Velocity	Change in Compressional Velocity
	Axial	Radial	Volumetric	(ft/sec)	(ft/sec)
3000	-24.20	-23.50	-71.20	21215	667
2000	-23.90	-23.70	-71.30	21202	653
1000	-23.70	-23.50	-70.70	20909	361
100	-23.40	-23.60	-70.60	20548	0

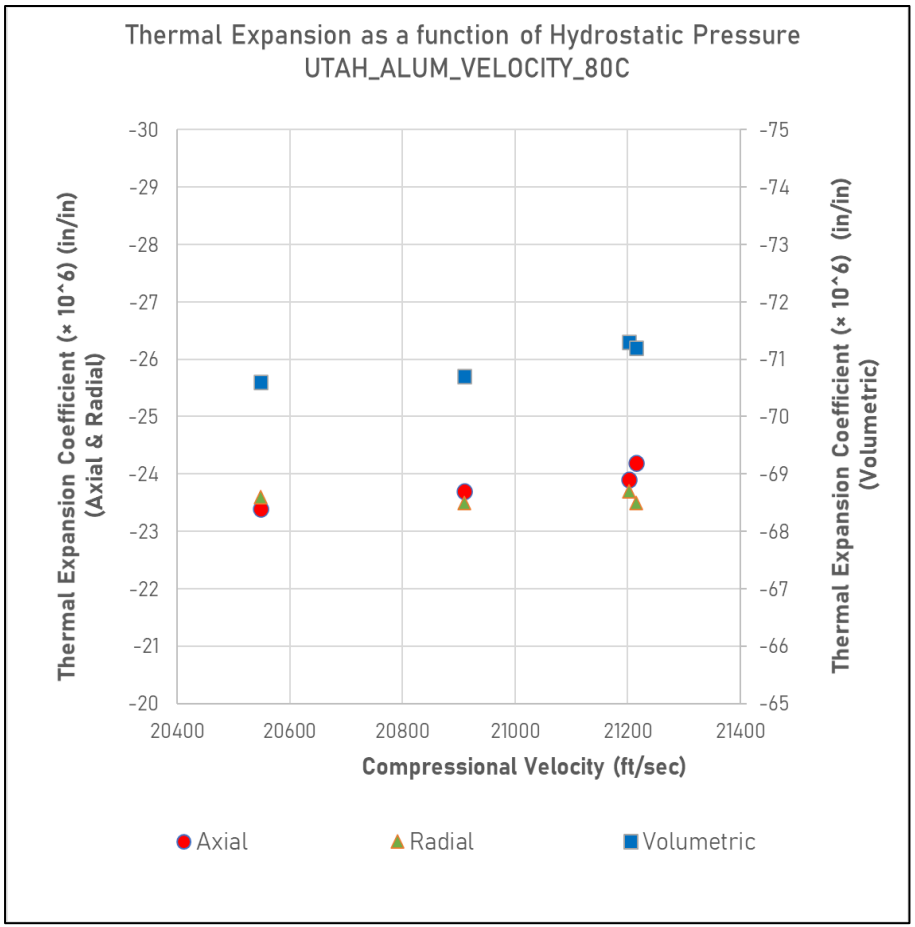
Thermal Expansion Test

Aluminum Calibration up to 80 C at different confining pressure

UTAH_ALUM_VELOCITY_80C

Summary





METAROCK LABORATORIES

Thermal Expansion Test

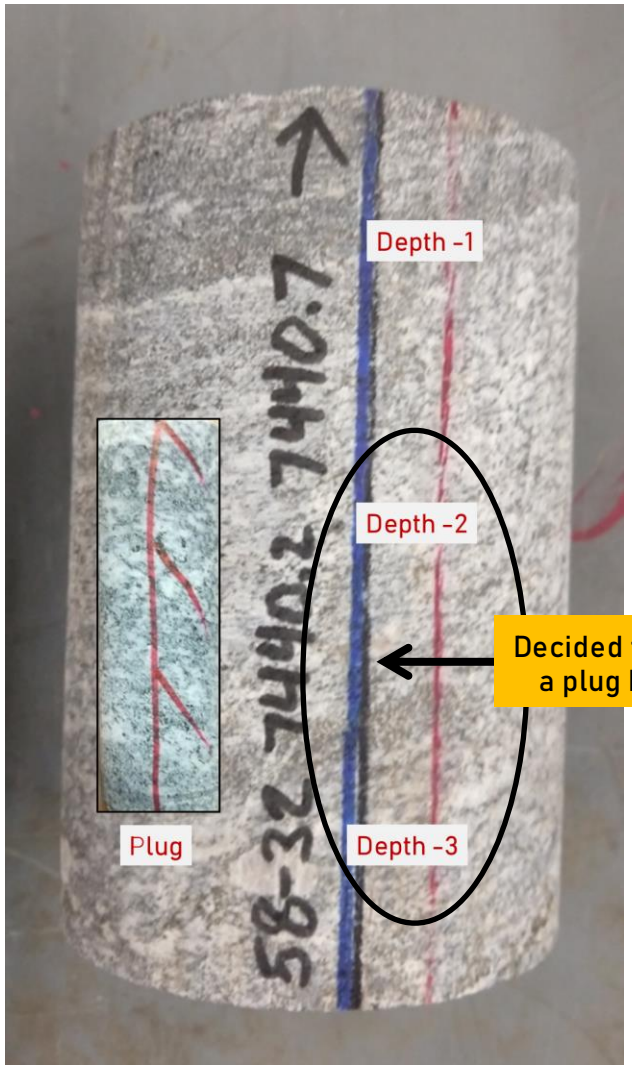
58-32_A_01_1V1.A_HT

7440.43 ft

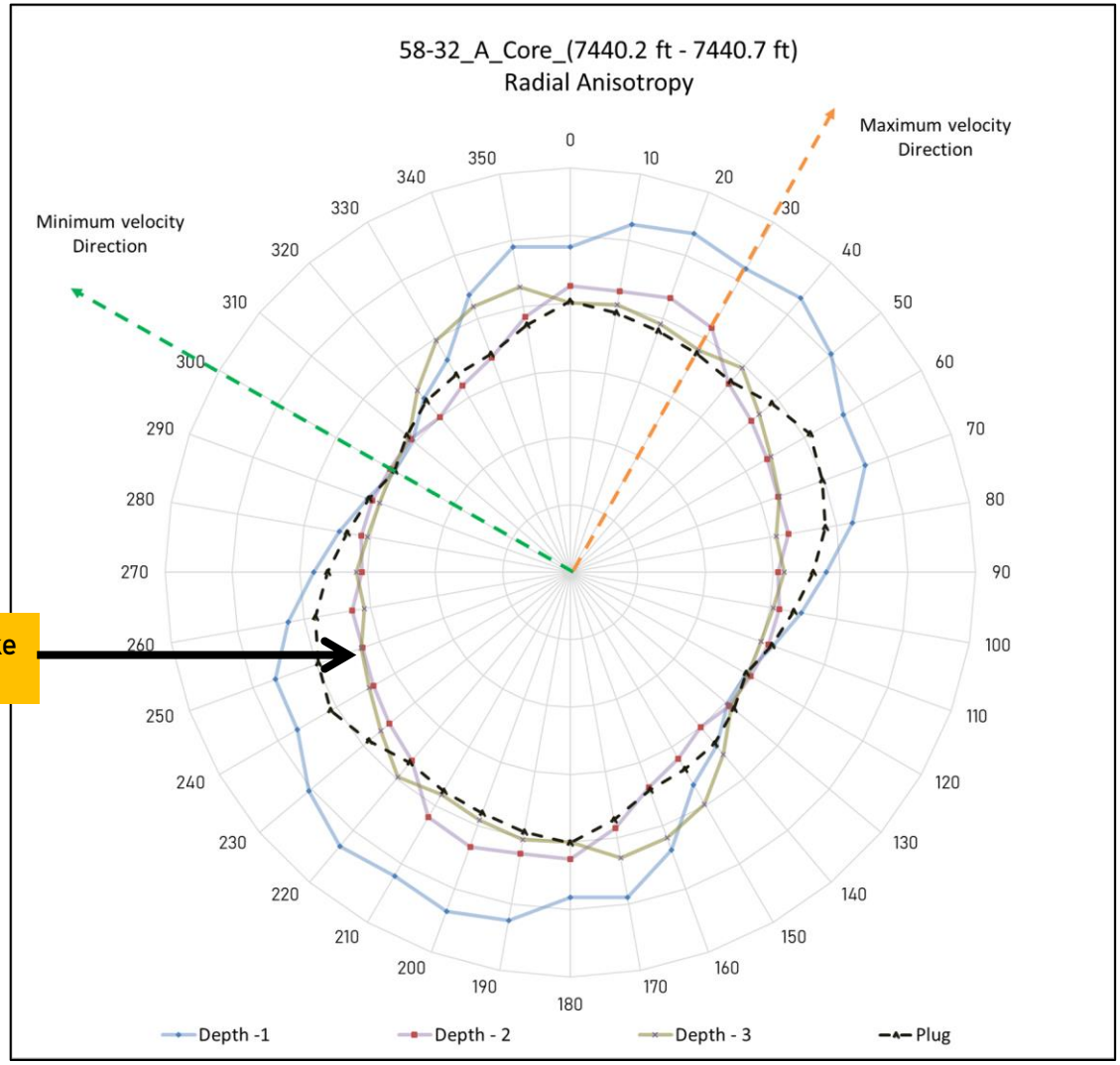
Sample Name	Depth (ft.)	Archimedes Bulk Volume (cc)	Grain Volume (cc)	Pore Volume (cc)	Grain Density (g/cc)	Bulk Density (g/cc)	Porosity (%)
58-32_A_01_1V1	7440.430	26.025	25.830	0.196	2.689	2.669	0.751

Radial Velocity Measurement

58-32_A
(7440.2 – 7440.7 ft)



Decided to take a plug here



Set01: 58-32_A_01

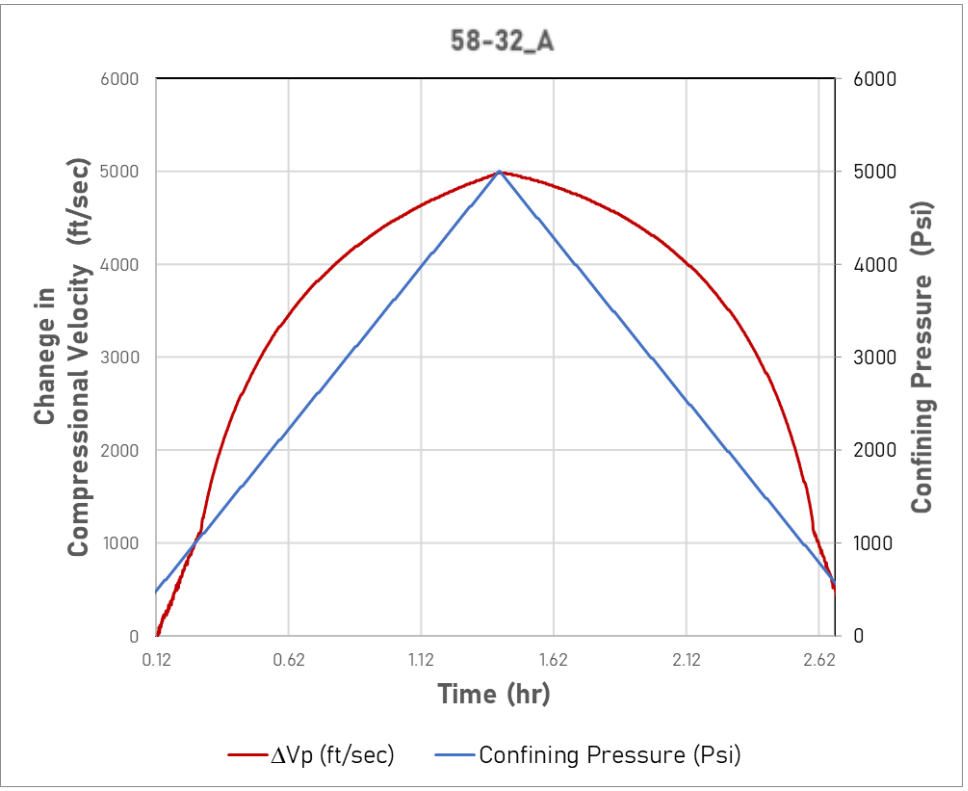
58-32_A_01_1V1
7440.43 ft.

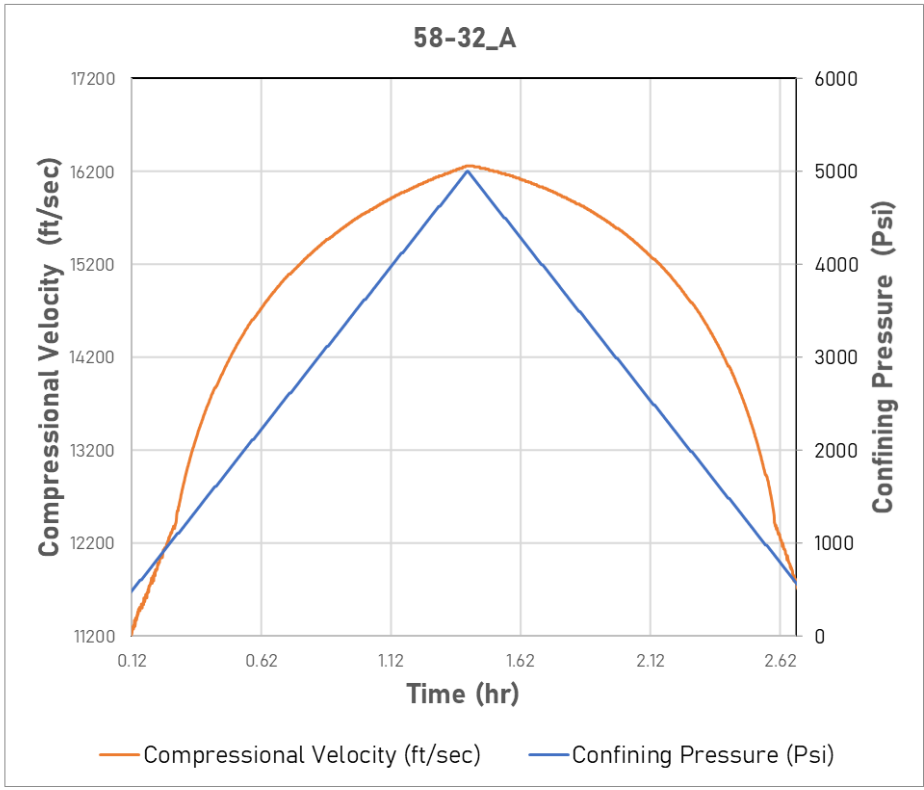
58-32_A_01_1V2
7440.43 ft.

Hydrostatic Test

58-32_A

(Iso – Test on End-Trim))



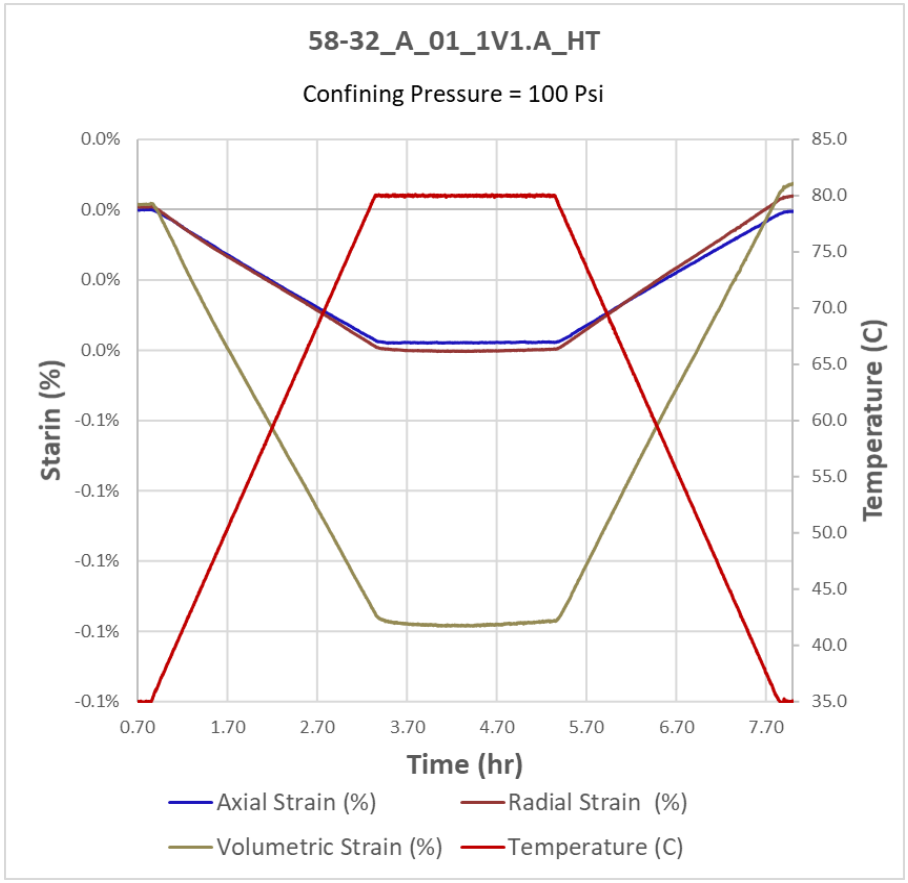


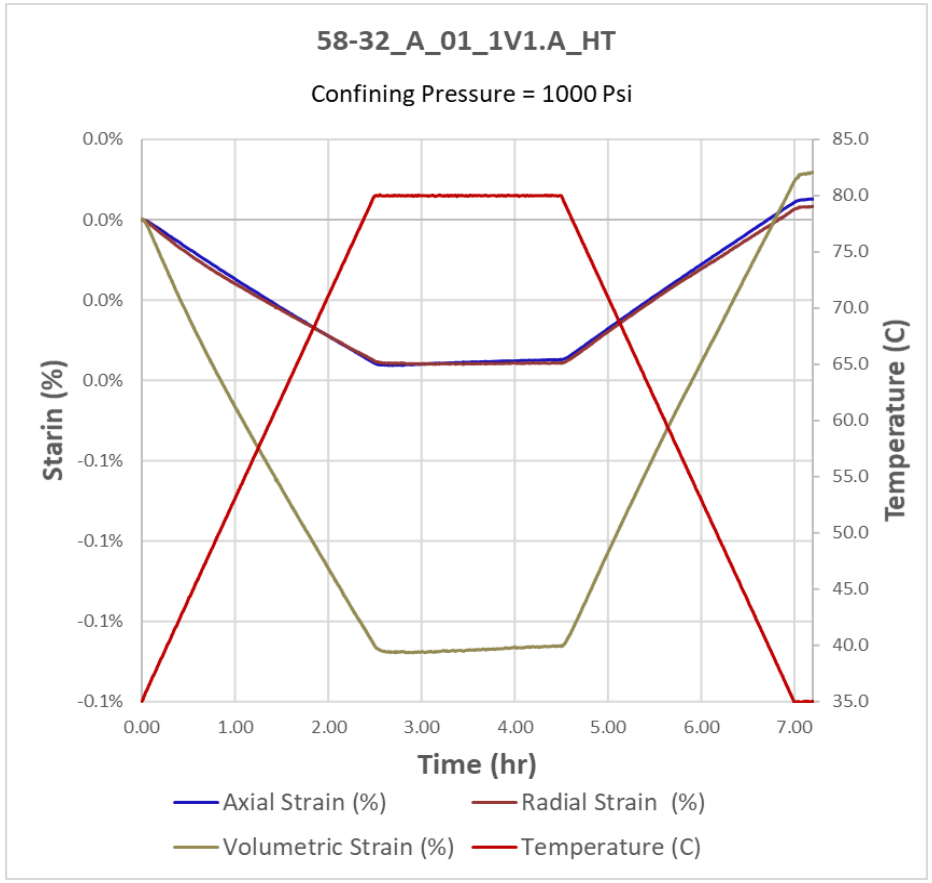
Decided to include two additional confining stages to get the more representative thermal expansion

Thermal Expansion Test

58-32_A_01_1V1.A_HT

Test Overview

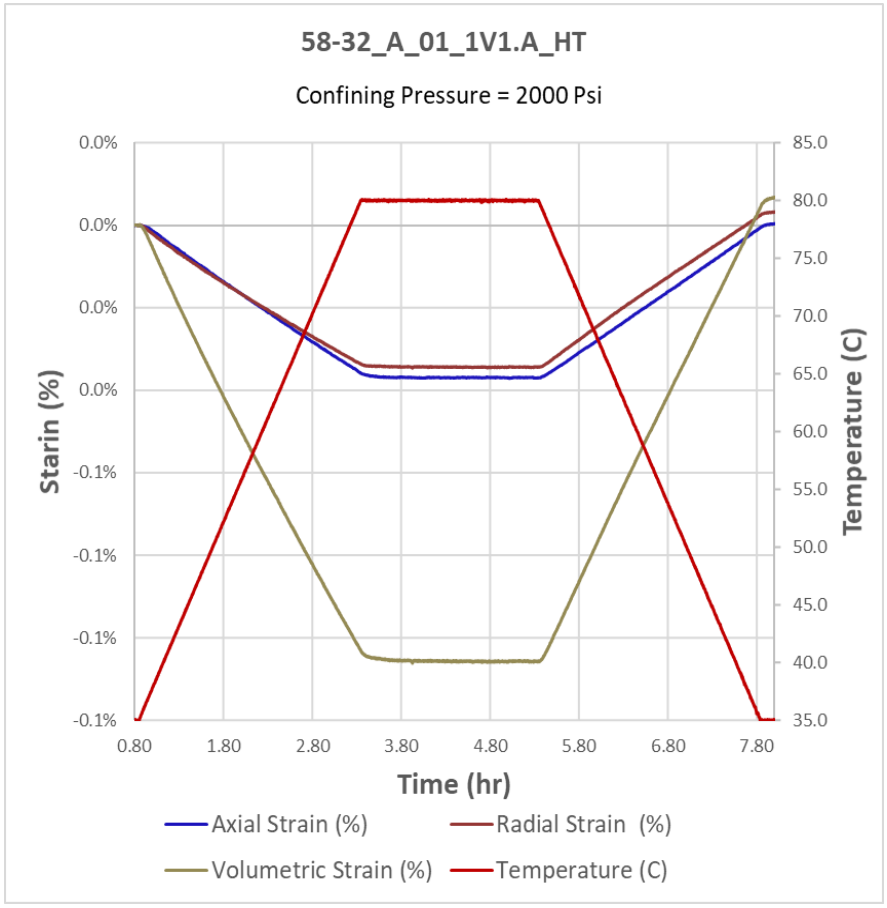


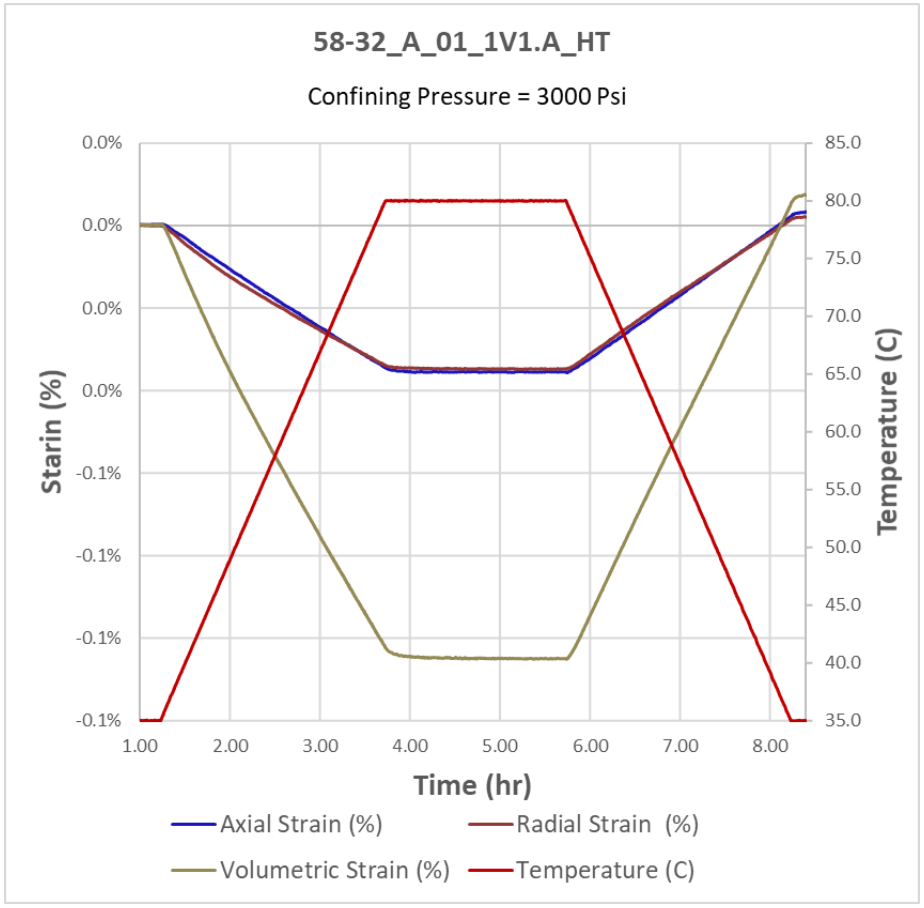


Thermal Expansion Test

58-32_A_01_1V1.A_HT

Test Overview

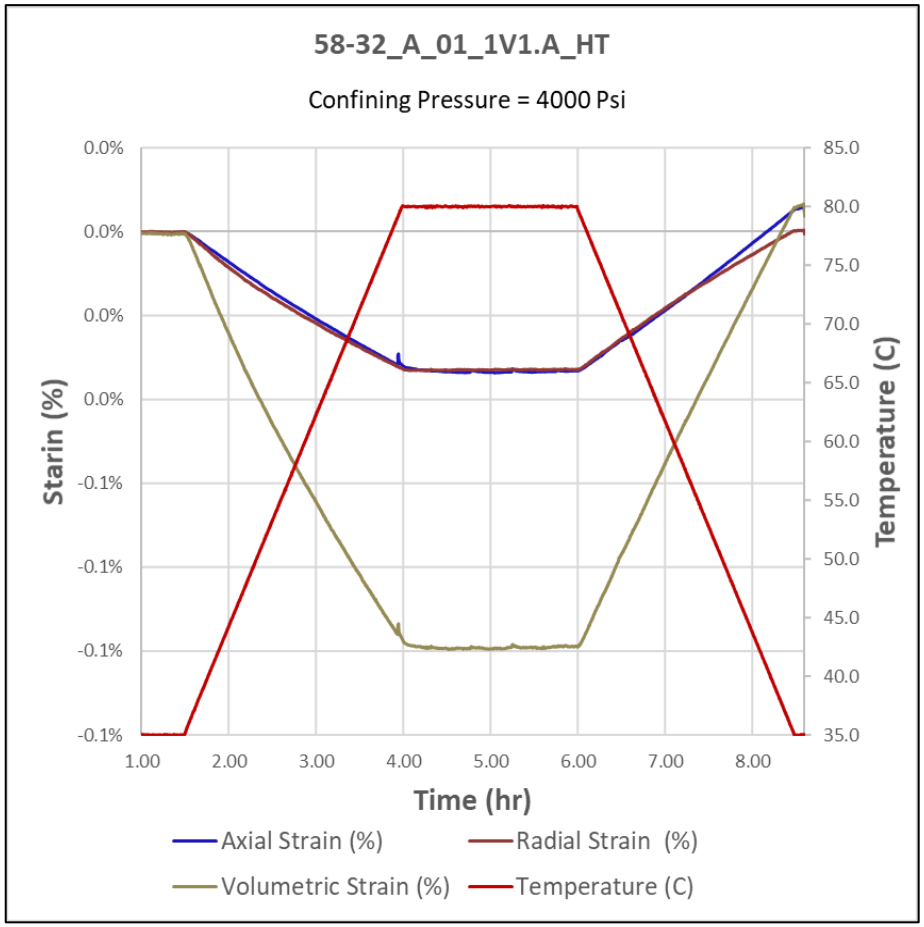


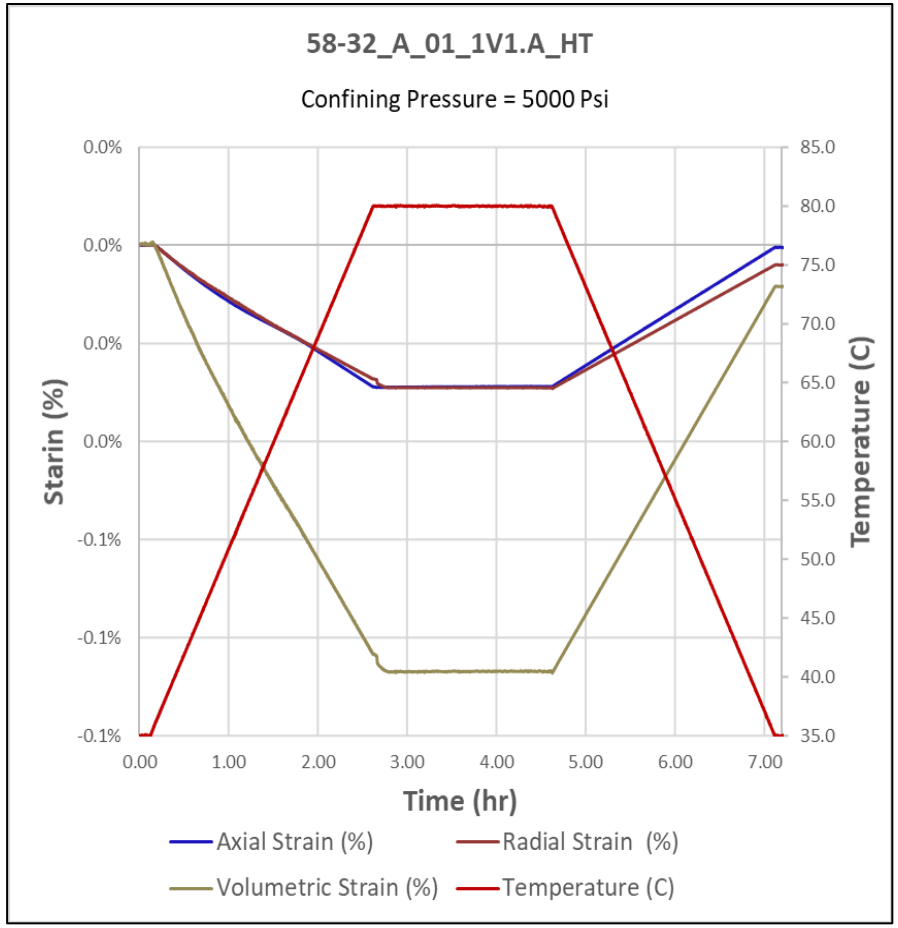


Thermal Expansion Test

58-32_A_01_1V1.A_HT

Test Overview

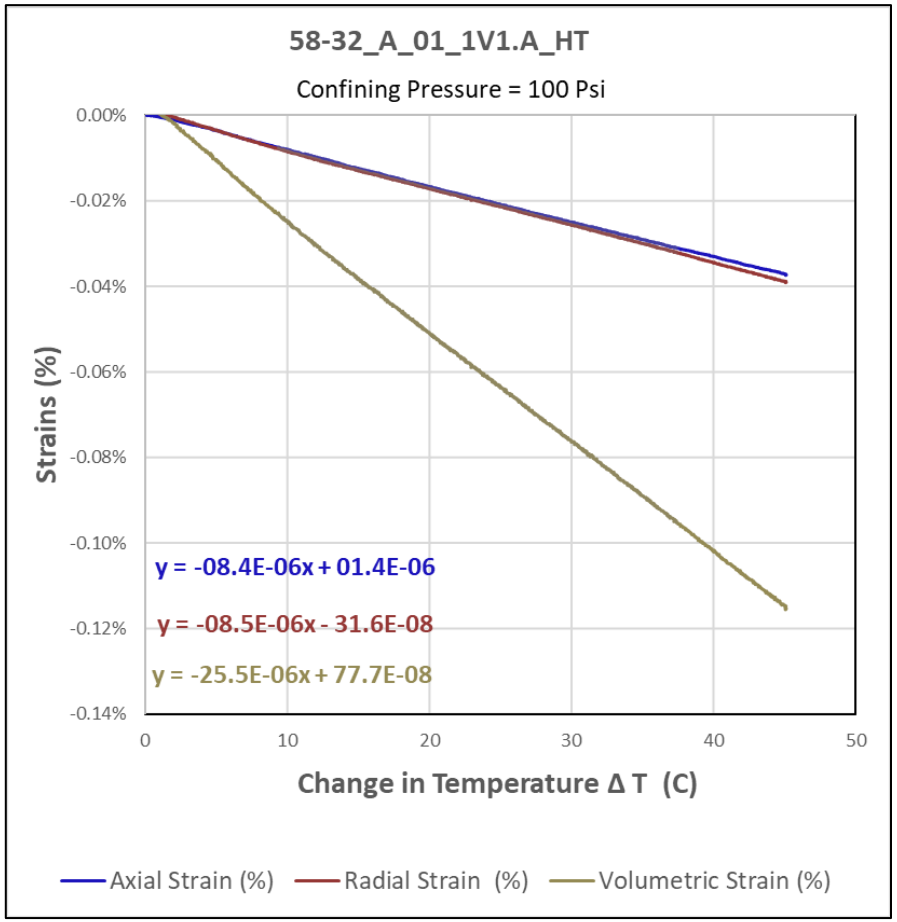


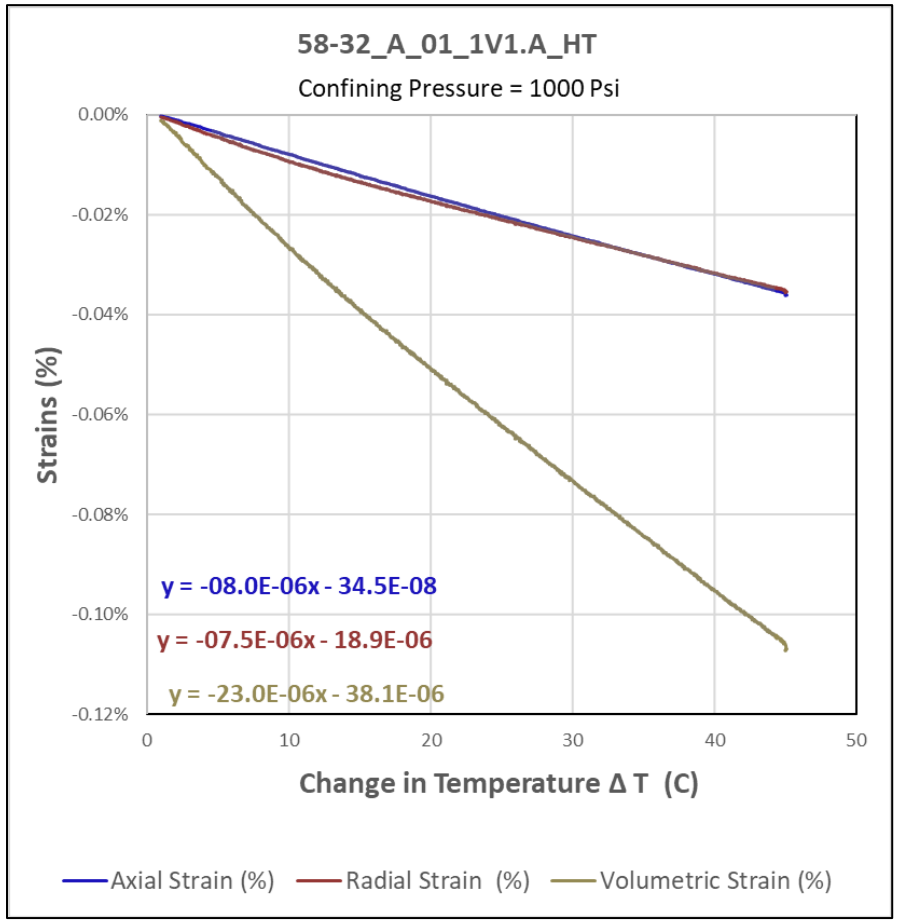


Thermal Expansion Test

58-32_A_01_1V1.A_HT

Test Overview

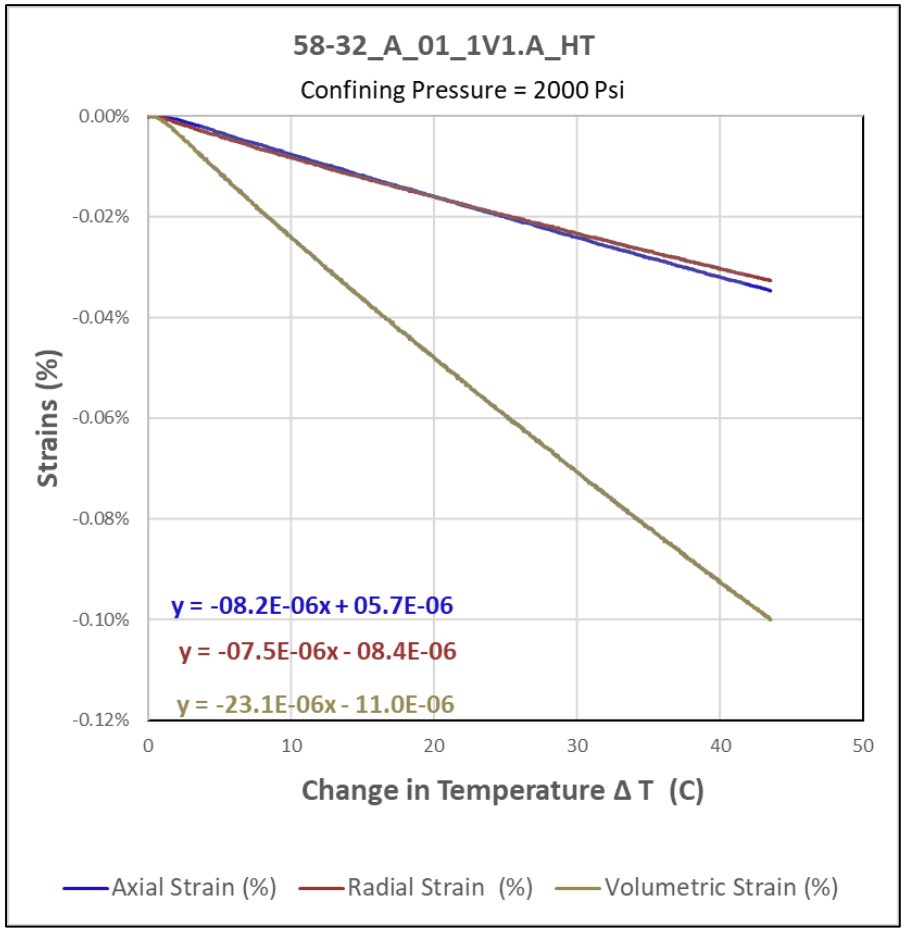


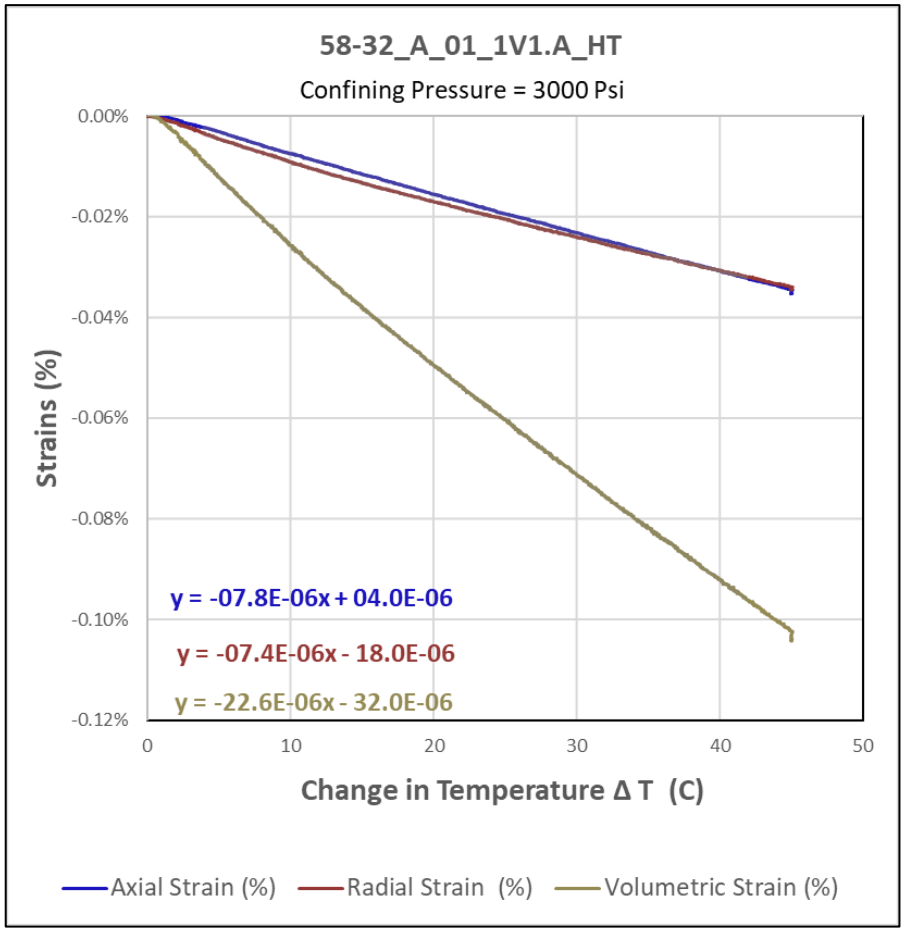


Thermal Expansion Test

58-32_A_01_1V1.A_HT

Test Overview

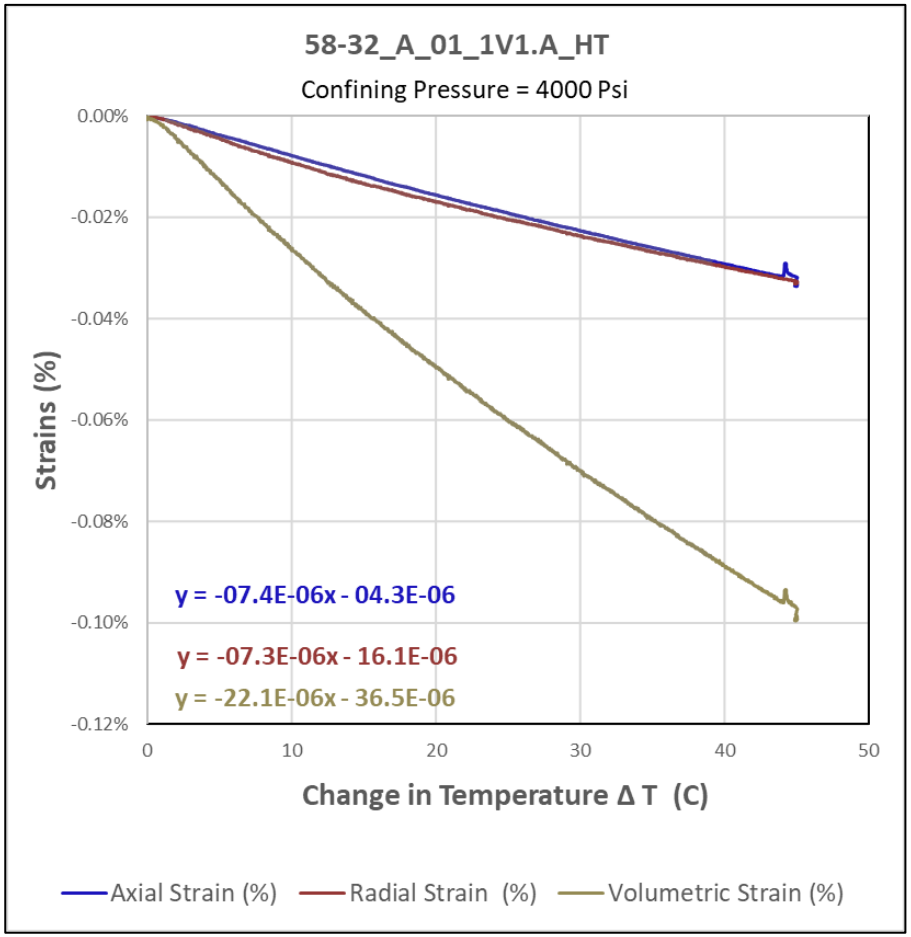


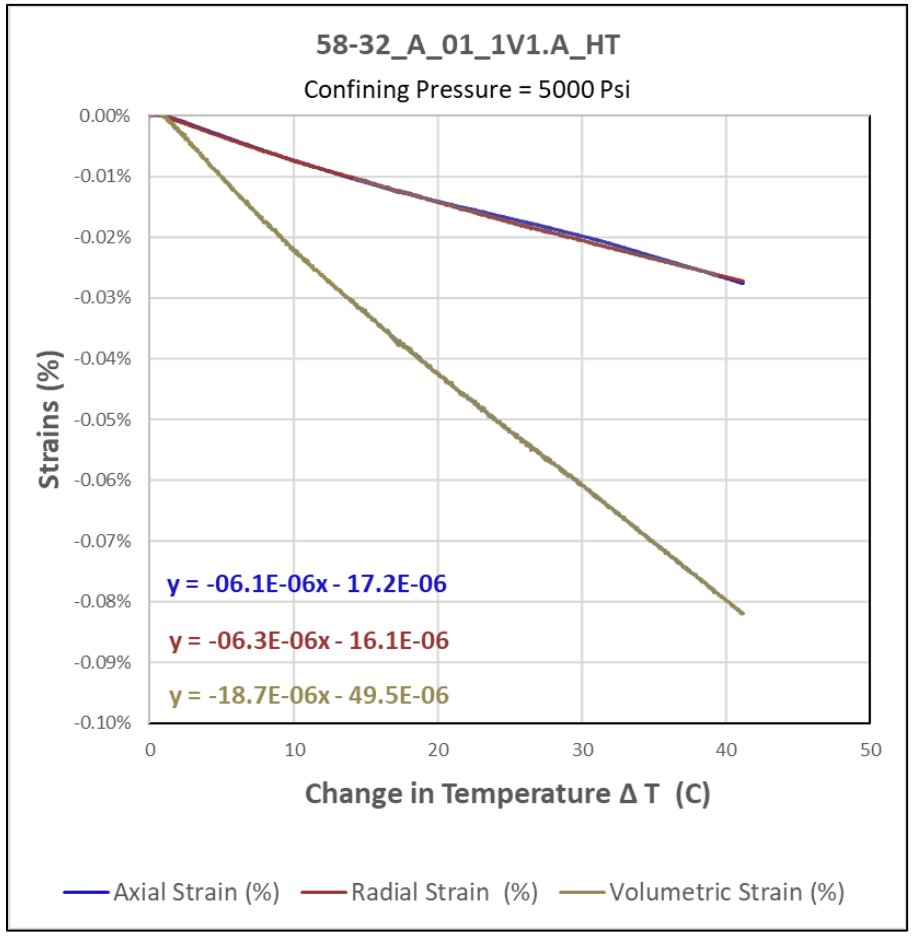


Thermal Expansion Test

58-32_A_01_1V1.A_HT

Test Overview





Thermal Expansion Test

58-32_A_01_1V1.A_HT

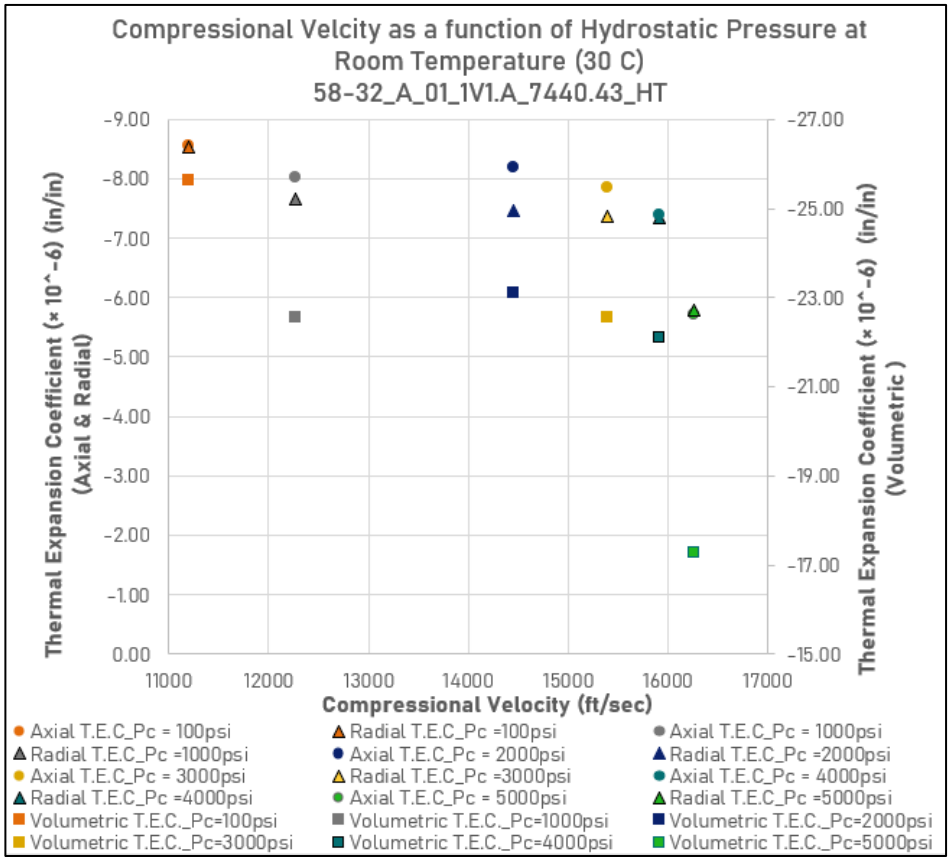
Summary

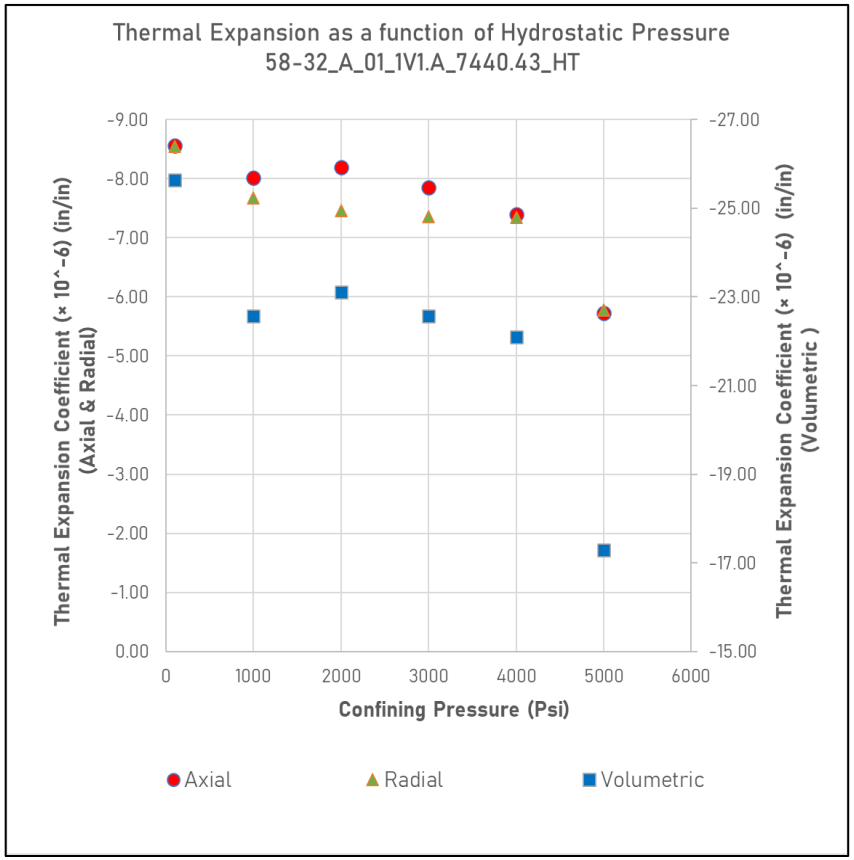
Confining Pressure (Psi)	Thermal Expansion Coefficient (× 10^-6)			Compressional Velocity	Change in Compressional Velocity
	Axial	Radial	Volumetric	(ft/sec)	(ft/sec)
5000	-5.72	-5.78	-17.29	16257	5057
4000	-7.39	-7.35	-22.09	15917	4717
3000	-7.85	-7.36	-22.56	15390	4190
2000	-8.20	-7.45	-23.10	14456	3256
1000	-8.01	-7.67	-22.57	12272	1072
100	-8.55	-8.54	-25.64	11200	0

Thermal Expansion Test

58-32_A_01_1V1.A_HT

Summary





Set02: 16A(78)_32_A_02

16A(78)-32_A_02_1V1
5868.9 ft.

16A(78)-32_A_02_1V2
5868.9 ft.

Set02: 16A(78)_32_A_02

16A(78)-32_A_02_2V1
5869.15 ft.

16A(78)-32_A_02_2V2.A
5869.15 ft.

16A(78)-32_A_02_2V2.B
5869.15 ft.

Set: 58-32_B_03

58-32_B_03_1V1
6803.975 ft.

58-32_B_03_2V1
6804.125 ft.

THANK YOU

METAROCK LABORATORIES