



MULTICRETE™ THERMAL '50'



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MULTICRETE SYSTEMS INC.
in conjunction with



INTEGRA
Laboratory Services Ltd

**INTEGRA LABORATORY
SERVICES LTD.**



**ENG-TECH
CONSULTING LTD.**



Multicrete™ Thermal '50'

For Wellbore Application - *TECHNICAL DATA SHEET*

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DESCRIPTION

In an environment where wellbore temperatures exceed 115°C, due to well depth, processes such as steam flooding, etc., there is a need for a special cement. Under these types of conditions, regular cement undergoes severe chemical structural changes causing a rapid breakdown of the cement integrity. Multicrete's Thermal '50' overcomes this degradation by blending higher content of silica (SiO₂), which extends the Thermal '50's stability to extreme temperatures up to +/-360°C

CEMENT SYSTEM

Cement System

API Certified Medium SRCement + Silica Flour

Slurry Density

1884 kg/m³

Slurry Yield

0.74 m³/Tonne

Water Requirement

0.40 m³/Tonne

CEMENT BLEND

Cement Blend

0-1-0 API Cert. Med

SR Silica Flour

Highend Gypsum

Silica Fume

CaCl₂ Polycarboxylate

FLA-6

WELL DATA

Well Data

Depth

+/- 300 meters

BHST

15

BHCT

20

PROPERTIES- PHYSICAL

- Appearance is a fine textured greyish-white powder
- Composition is a combination of Type 50 cement and silica flour
- Bulk Density is 0.740 m³/tonne

PROPERTIES- CHEMICAL

- Solubility is that the product is insoluble in water pH ranges between 10-12 (in fresh water)
- Water requirement to mix product is 0.40 m³/tonne
- Product is a Thermally Stable Oilwell Cement



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MIXING & HANDLING

Storage Precautions-Thermal Cement is not hazardous. Keep dry and avoid excessive humid conditions. Best stored in cool, dry place.

Handling Precautions-When mixing with water, some heat will occur due to heat of hydration process. Mix continuously once started. Mixed it is caustic in nature pH 10-12, can cause burns to eyes and skin. Wearing appropriate PPE is a must. See SDS sheet for further information.

TESTS PERFORMED

ENG-TECH

Set Times, Initial and Final

Compressive Strength, 6 hour, 8 hour, 24 hour, 4 day, 7 day, 28 day

INTEGRA

Thickening Time

Rheology

Fluid Loss

Free Water, Vertical and 45° Angle

Compressive Strength, 24 hour & 48 hour



ENG-TECH Consulting Limited (ENG-TECH) was retained by Multicrete Systems Inc. to evaluate the set time and compressive strength of a Thermal '50' base blend (API Certified SR + Silica Flour for wellbore applications). This report summarizes the testing program and final test re-sults.

Three 3 L batches of Thermal '50' slurry were produced with water that had a temperature of 14 °C, 20 °C, or 28 °C, at initial contact between cement and water. The batches had a water to cement ratio of 0.415, as reported in the technical data sheet submitted to ENG-TECH by Multicrete. The slurry was mixed in a mortar mixer for 5 minutes; then cast in 508 mm cubes: and finally cured in a controlled environment that had an ambient air temperature of 25±5 °C and a relative humidity of 50±5%.

A total of 6 set of 3 cubes were cast for each of the water temperatures in order to determine the compressive strength of the material after 6 h, 8 h, 24 h, 4 days, 7 days, and 28 days, of curing. The compressive testing was conducted according to CSA A3000.

For each of the 3 batches, a slurry sample was taken and tested according to ASTM C266 in order to determine the initial and final set times of the material.

Below is a table summarizing the compressive strength and set times results:

Water Temp* (°C)	Mix Temp** (°C)	Compressive Strength (MPa)						Set Times (min)	
		6 hr	8 hr	24 hr	4 day	7 day	28 day	Initial	Final
14	21	0.1	0.9	19.6	37.1	44.3	52.0	205	345
20	26	0.3	1.0	21.8	40.5	45.7	52.0	260	375
28	30	0.3	1.0	24.0	43.5	41.5	50.9	285	385

*Water temperature at initial contact between cement and water

**Mix temperature 5 minutes after the initial contact between cement and water

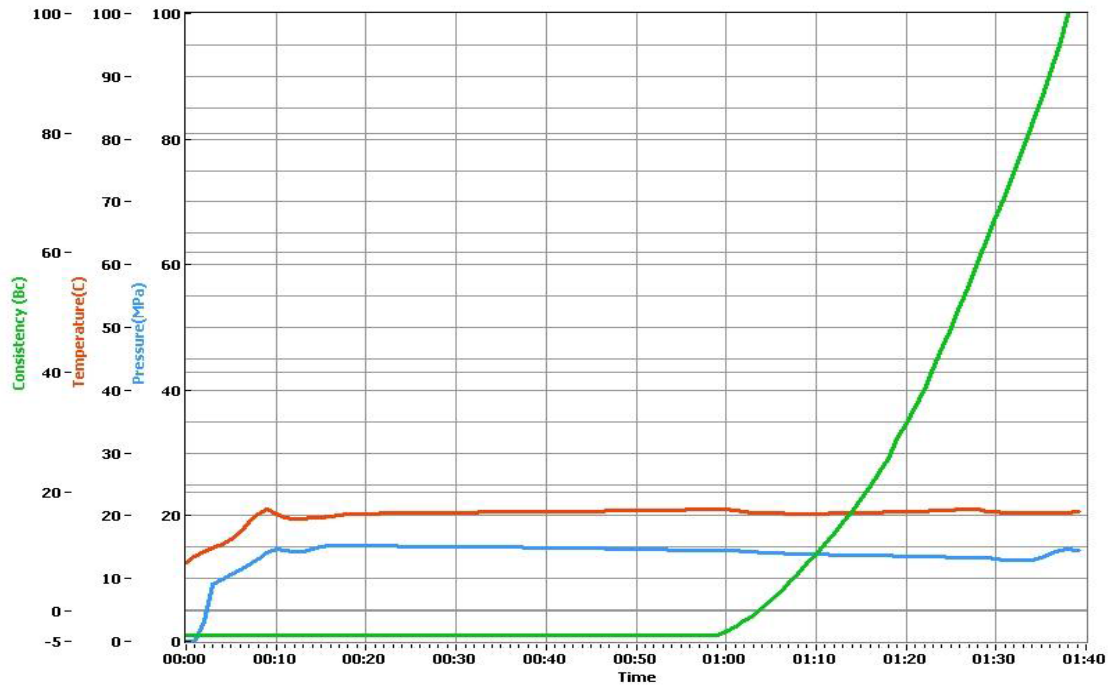


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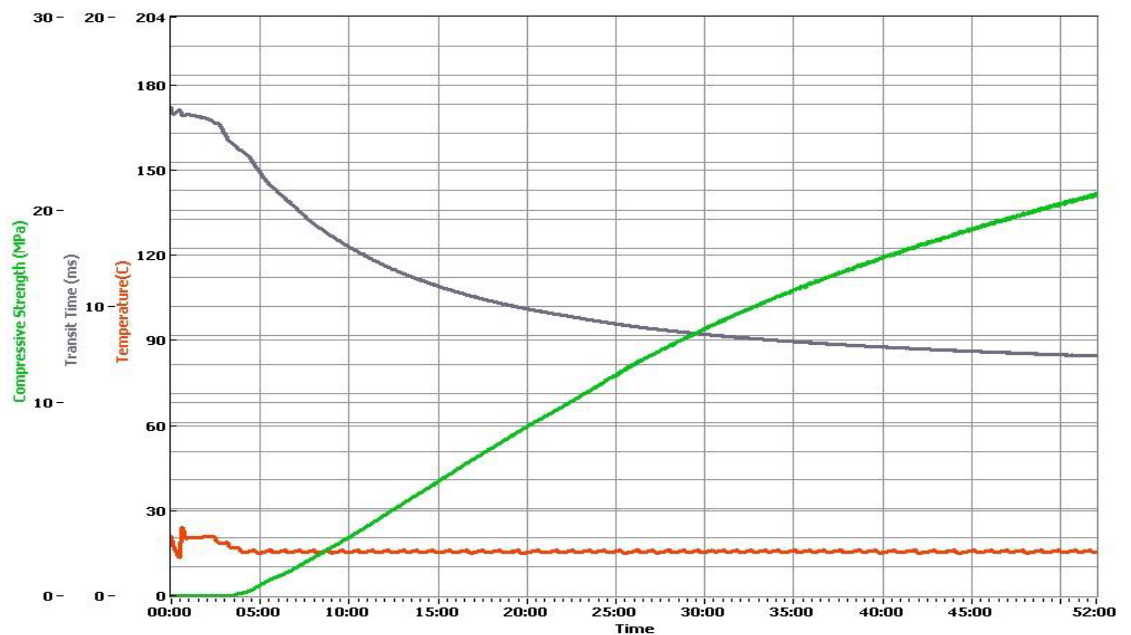
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Thickening Time



Compressive Strength Development





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Rheology, Fluid Loss, Free Water

Rheology

n': 0.6617 k': 1.3373

Hole (mm)	Pipe (mm)	Plug Flow Rate (m ³ /min)
158.8	114.3	0.22
200	114.3	0.35
200	139.7	0.32
222.3	139.7	0.40
222.3	177.8	0.32
250.8	177.8	0.44
311.2	244.5	0.55
311.2	219.1	0.61

Fluid Loss

22 cc API (11 cc/30 minutes)

Free Water

Vertical: 0.00%^{45°}

Angle: 0.00%

COMMENTS

This slurry mixes very easily and remains thin throughout the majority of the pumping time before the set.

The rheological data table displays the pump rates which must be exceeded to avoid a plug flow regime.

Strengths are for reference only. Actual strength values may vary under changing conditions in the wellbore, water quality, density variations. Strength samples should be taken during the application process and compared to the estimated wellbore temperature for additional strength development.

If the wellbore temperatures are typically below 30 °C , Thermal Cement can be augmented with a small amount of calcium chloride which accelerates set time. Typical dosages of calcium chloride is 0.5-1.0% w/w, depending on wellbore depth & temperature. Viscosity and working time will reduce with the addition.

Caution working with calcium chloride should be taken as it is an extremely corrosive material. Using it incorrectly may lead to a flash set of the Thermal cement caused by excessive heat of hydration.



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GLOSSARY OF TERMS (Alphabetically)

BHCT-Bottom Hole Circulating Pressure

BHST-Bottom Hole Static Pressure

CaCl₂-Calcium Chloride

cement blend-Cement powder, other cementitious and any added admixtures

cement system-Cementitious composition

final set -a degree of stiffening of a mixture of cement and water greater than initial set, generally stated in an empirical value indicating time in hours and minutes required for cement paste to stiffen sufficiently to resist to an established degree

FLA6-Dicorp's oil cement admixture base PVA (poly vinyl acetate)

API Certified Med SR-or commonly known as Type 50 cement blend. API approved moderate sulfate resistant cement

initial set-a degree of stiffening of a mixture of cement and water less than final set, generally stated in an empirical value indicating time in hours and minutes required for cement paste to stiffen sufficiently to resist to an established degree

MPa-megapascal, a unit of measurement for pressure

SDS-Safety Data Sheet

Highend Gypsum-Oil cementing grade 60-Gypsum

PPE-Personal Protective Equipment for Safety

rheology-the study of the flow of matter, primarily in the liquid or soft-solid states

silica flour-very finely divided silica, a siliceous binder component that reacts with lime under autoclave curing conditions

silica fume-a very fine noncrystalline silica produced in electric arc furnaces as a by product of the production of elemental silicon or alloys containing silicon

slurry-a mixture of water and any finely divided insoluble material, such as portland cement, slag, or clay in suspension

polycarboxylate-high range water reducing and superplasticizing admixture

water to cement ratio-the ratio of the mass of water to the mass of portland cement identified as "w/c"
wellbore-any hole drilled for the purpose of exploration or extraction of natural resources such as water, gas or oil