



Multicrete Thermal '50'

Technical Data Sheet

Wellbore Application Material

Product Description

In an environment where wellbore temperatures exceed 115°C, due to well depth, processes such as steam flooding and more; there is a need for 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' stability to extreme temperatures up to +/- 360°C.

Cement System

Cement System	API Certified Medium SRCement & Silica Flour
Slurry Density	1884 kg/m ³
Slurry Yield	0.74m ³ /tonne
Water Requirement	0.40m ³ /tonne

Cement Blend

0-1-0 API Certified Med

SR Silica Flour

High-end Gypsum

Silica Fume

CaCl₂ Polycarboxylate

FLA-6

Well Data

Depth	+/- 300 Meters
BHST	15
BHCT	20

Physical Properties

- Appearance is a fine textured greyish-white powder
- Composition is a combination of Type 50 Cement and Silica Flour
- Bulk Density is 0.740m³/tonne

Chemical Properties

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

Mixing & Handling

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

Handling Precautions: When mixing with water, some heat will occur due to heat of hydration process. Mix continuously once started. Once mixed it is caustic in nature (pH 10-12.) This can cause burns to eyes and skin. Wearing appropriate PPE is a must. Refer to the SDS sheet for additional information.



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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°C Angle

Compressive Strength, 24-hour and 48-hour

For each of the 3 batches, a slurry sample was taken and tested according to ASTM C266 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 Strengths (MPa)						Set Times (Min)	
		6 hr	8 hr	24 hr	4 days	7 days	28 days	Initial	Final
14	21	0.1	0.9	19.6	37.1	44.3	52	205	345
20	26	0.3	1	21.8	40.5	45.7	52	260	375
28	30	0.3	1	24	43.5	41.5	50.9	285	385

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

Water temperature at initial contact between cement and water

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

Three, 3L batches of Thermal '50' slurry was produced with water that had a temperature of 14°C, 20°C and 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 un 508mm cubes; then 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 to determine the compressive strength of the material after 6-hours, 8 hours, 24-hours 4-days, 7-days and 28-days of curing. The compressive testing was conducted according to CSA A3000.

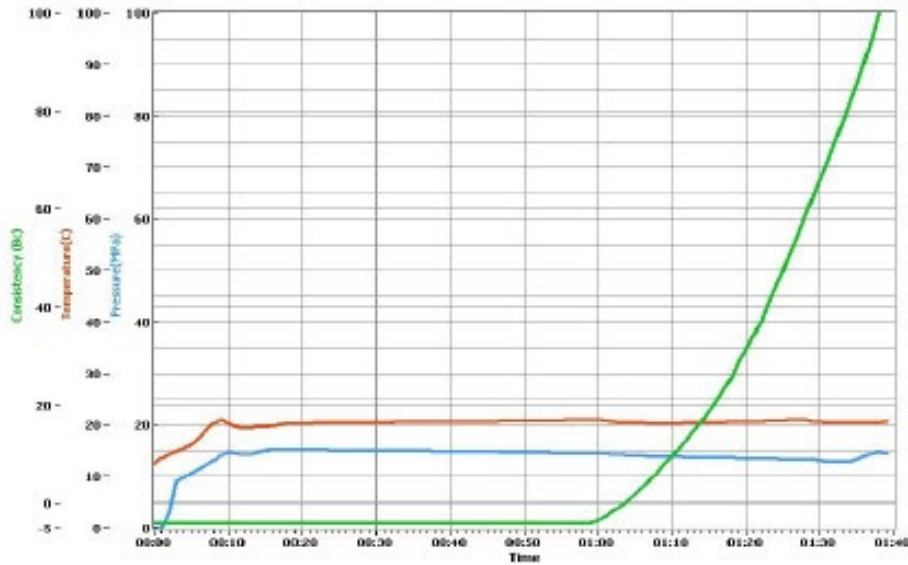


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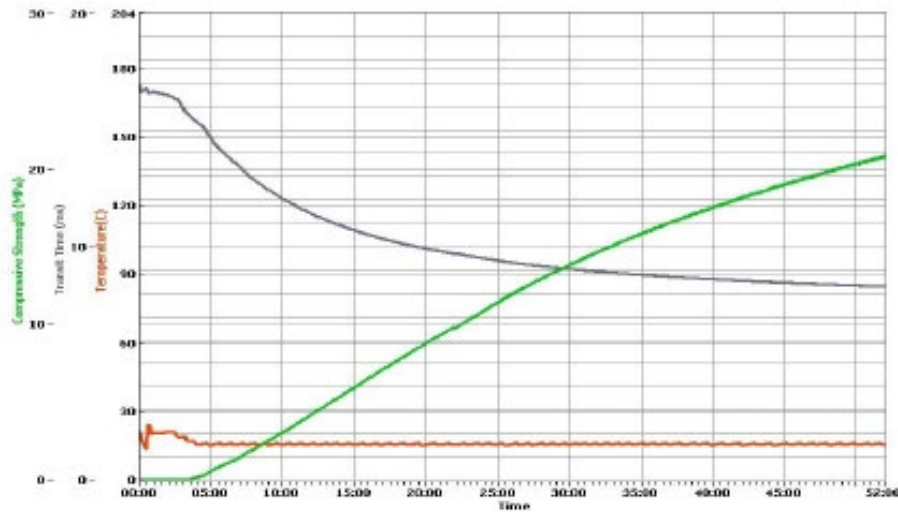
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Thickening Time



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 (11cc /30 Minutes)

Free Water

Vertical: 0.00% (45°)

Angle: 0.00%

Comments

The slurry mixes very easily and remains thin throughout most 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 typical below 30°C, Thermal Cement can be augmented with a small amount of calcium chloride which accelerates set time. Typical dosages of calcium chloride are 0.5 – 1% w/w depending on wellbore depth and temperature. Viscosity and working time will reduce the addition.

Caution working 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

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 resist to an established degree

FLA-6 – Discorps oil cement admixture base PVA (Poly Vinyl Acetate)

API Certified Med SR – 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 hour and minutes required for cement paste to stiffen sufficiently to resist to an established degree

MPa – Megapascal, a unit off measurement for pressure

SDS – Safety Data Sheet

High-end Gypsum – Oil cementing grade 60-Gypsum

PPE – Personal Protective Equipment

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 react with lime under autoclave curing conditions

Silica Fume – A very fine non-crystalline silica produces 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 super plasticizing 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