



# Case Study

## TUBESCOPE Powder Coat Oven Base December 2008

**Project Date:** 3 December 2008

**Location:** Tuboscope Facility, 8600 Pineland Rd, Houston, TX

**Purpose:** Utilize **Firerok®**, CERATECH's heat resistant cement for interior concrete floor slab for installation of a powder-coat oven to withstand heat generated in the powdercoating process.

### Overview

Tuboscope is an international producer of drill pipe assemblies for the oil and gas industry. During the powdercoating process, pipes are sprayed with a paint-like finish, then rolled into an oven via a rail system and "baked" at a temperature of 450°F for several hours. This oven installation requires a heat resistant durable concrete base capable of withstanding long term thermal cycling. The oven floor slab measured 25' x 60' x 1', and would require 56 cu yds of **Firerok®**.



**BULK FIREROK** Thermal Resistant Cement  **Case Study**

**Mix Design and Specifications**

The slab was designed to float on a 24" compacted base of select materials over a clay sub-grade. To resist the concentrated loading from the rail system, a 4000 psi@28 day compressive, 12" slab with a double layer #5 rebar mat was required, as was a hard trowel finish. Given the sustained exposure (approx. 12 hours) to 450°F from the baking process, the slab was also required to be thermally stable and resist expansion/contraction cycles and associated desiccation from high heat environments. Initially, CERATECH engineers designed the following mix to meet the requirement on 5 September:

Component	Specific Gravity	Lbs/Cuyd	Absolute Volume
Firerok Cement	2.605	750	4.614
Sand SSD (C-33 Nat. River)	2.615	1683	10.255
Stone SSD (#67 Granite)	2.674	1567	9.352
Water	1.00	165	2.644
Air	.5 %		.135
Total		4165	27.00

Water/Cementitious ratio: .22

Slump: 5" +/- 1"

Coarse Agg/Fine Agg ratio (by weight): 48/52



**Mix Design and Specifications (Continued )**

The CERATECH engineering team inspected all aggregates and conducted checks of the moisture content. Moisture contents for the sand and stone were 2.0% and .1% respectively and were consistent with sampling produced by the plant. However, several 1½”+ particles were observed in the coarse aggregate stockpile, indicating that the material was more likely #467. When asked, the ready mix supplier produced specifications for #57 coarse aggregates. With coarse aggregate specs in doubt, we adjusted the mix design to match #57, thus splitting the difference:

Component	Specific Gravity	Lbs/CuYd	Absolute Volume
FR 403	2.605	750	4.614
Sand SSD (C-33 Nat. River)	2.615	1660	10.113
Stone SSD (#57 Granite)	2.674	1590	9.494
Water	1.00	165	2.644
Air	.5 %		.135
Total		4165	27.00

Water/Cementitious ratio: .22

Slump: 5" +/- 1"

Coarse Agg/Fine Agg ratio (by weight): 49/51

CERATECH internal testing indicated that the initial mix design would yield 8 hour compressive strengths of 3150 psi and a 28 day compressive of 8500 psi, thus exceeding the strength requirement. Since the adjustments made to the sand and stone content were relatively minor, there was no reason to expect that performance would be adversely



# BULK **FIREROI** *Thermal Resistant Cement* **Case Study**

## Mix Design and Specifications (Continued)

affected. Mix design was calculated using the AVM as prescribed by ACI, with 10% being subtracted from the initial coarse aggregate content, and the fine aggregate content increased accordingly.

## Weather and Material

Weather for the morning of 3 December was mostly cloudy, 70.6% relative humidity, with a 2-8 mph breeze blowing across the site. Ambient temperature at the start of the pour was 73°F and 78°F at the finish. Material temperatures generally reflected ambient conditions. A light rain fell on the slab after final set early afternoon, followed by a heavier rain later in the day.



# BULK **FIREROK** Thermal Resistant Cement **Case Study**

## Execution

By 8:30AM the last truck had arrived on site and supersacks of **Firerok**® cement were already being charged into the awaiting trucks. When two of the three trucks were fully charged and in position, the first was activated by introducing CERATECH's proprietary admixture and used to prime the 32 meter (106') boom pump. No priming grout was used. Material placement began at 9:00 AM. Initially, the pump needed a low slump mix to facilitate priming, after which a higher slump could be pumped, if desired. The first truck was mixed with 4 gal of water over the design total of 179 gal per batch. After observing the material discharge at the hose end, it was decided to stay with the water addition for the rest of the placement, as it was a more workable and placeable mix.

By 10:04 AM, all material had been discharged from the trucks and placement completed. Final water/cementitious ratio was 0.238.



# BULK FIREROI *Case Study*

Thermal Resistant Cement

## Conclusions

Overall, the finish was judged acceptable and both the owner and contractor were pleased with the finished slab. We instructed the contractor to cut joints after the material had reached 3000 psi compressive, based on the 6"x12" cylinder samples they'd taken from the last batch of material. **At 4½ hours, the material tested at 3490 psi compressive,** and the joints were cut the following morning.

The specifications for this project only required a 4000 psi material at 28 days, which was (presumably) achieved in a day. **The steel erectors loved it, since they could start earlier than anticipated and potentially shorten the construction schedule.**