EXHAUST-STACK CERAMIC FIBER MODULES TAKE HEAT

Castable refractories are the traditional choice for lining exhaust stacks in wasteheat-recovery units (HRUs). But newer materials-such as ceramic fiber-based Pyro-Bloc modules, supplied by Thermal Ceramics, Augusta, Ga-offer tangible advantages in such situations as those faced by the Cochrane Extraction Plant in Alberta, Canada.

The Cochrane plant, owned by Williams Energy, Tulsa, Okla, is a gas-turbine cogeneration facility, supplying thermal energy to a natural-gas liquids and ethane extraction operation. Waste heat fro111 Cochrane's two aero derivative gas turbines enters an HRU from each side, then passes through a bank of tubes to recover thermal energy in a hot-oil loop. When thermal energy is not needed for the gas-extraction process, operators throttle dampers to direct all or some portion of the waste heat to 56-ft-high "dump stacks."

On unit startup. Cochrane's HRU stacks are hit with temperatures of 960F. The stacks therefore need to be lined with an insulation material that can withstand significcll1t thermal shock (Fig 4). That ruled nut the use of castable refractory, which needs to have the temperature bought up slowly during the initial "dry out" or it will be prone to cracking. The insulation material also would have to withstand direct exposure to Alberta's harsh winter weather, because Cochrane's stacks could not be capped.

According to Erin Bradley, Cochrane's plant engineer, facility personnel asked an engineering firm, Born, Calgary, Alta, to use an insulation that met three additional requirements. They wanted a lightweight material that would minimize the need for structural support in the stacks and that could be installed during shop fabrication rather than on site; and a product that did not need the curing process that castables require. Winter curing can be tricky in climates such as those in western Canada. Castables can't be allowed to freeze before they set, and they must be kept above SOF for 24 to 48 hours after setting, to achieve proper strength,

Although Born had not used Pyro-Bloc modules on exhaust stacks before, the company had successfully listed the product in HRU interiors, thus it was confident the product could withstand thermal shock and meet the other criteria (Fig 5).

Pyro-Bloc is the only high-temperature module on the market made of a solid mass of ceramic fiber, according to the supplier. The material minimizes the number of joints and allows for compression of the module in all directions during installation. Thermal Ceramics also reports that the Pyro-Bloc module design greatly reduces the likelihood of gaps opening up at elevated temperatures.

For Cochrane's exhaust stack, Born elected to use Pyro-Bloc "M" modules in a density of 10 Ib per cubic foot (pet} Engineers specified the "R" grade product, which has an alumina-silica chemistry, a maximum temperature rating of 2400F, and a continuous use rating of 2200F.

Born installed the modules during shop fabrication by anchoring them to the steel casing with stainless-steel studs, prewelded to the steel shell. Prewelding created a reliable and secure base of attachment. Special installation hardware was used to precompress the modules. The fiber modules were easily cut and modified in the field, enabling installers to trim module rings to fit both concentrically and lengthwise, and to work around structural obstructions.

"Pyro-Bloc modules are easier to install than castables, and they make for easier repairs," says Tom Swift, Born's YP and operations manager. If users have problems with an area of the stack lining, they just unscrew the damaged modules and replace them. With castables, users would have to go through the drying process each time they repair a section of the lining, incurring expensive downtime.

To protect the fiber modules against the high-velocity turbine exhaust gas, Born treated the modules with Thermal Ceramics' Kaowool Rigidizer. This spray or brush-on coating hardens the surface of fiber materials after it dries.

The lightweight fiber blocks also met the plant's need to minimize structural support of the stacks. Density of the PyroBloc modules was 10 pcf; density of a castable lining would have been approximately 83 pcf. The lower mass of the

Pyro-Bloc modules allows for quicker cool-downs too, which further reduces plant downtime.

The lining in Cochrane's uncapped stacks has weathered two Alberta winters and, according to Bradley, they have held up well. She notes that small areas of the lining were damaged because of higher than expected turbulence. "When we went in to repair those areas and install additional retainers, we found that the unaffected areas of lining were in good condition," she says.

Although the initial material cost of the Pyro-Bloc modules was more expensive than refractory castables, their ease of installation, thermal flexibility, and modularity make them competitive in price on a life-cycle basis.