

3M Advanced Materials Division

# 3M™ Nextel™ Ceramic Fibers and Textiles for Petrochemical Applications

## Introduction

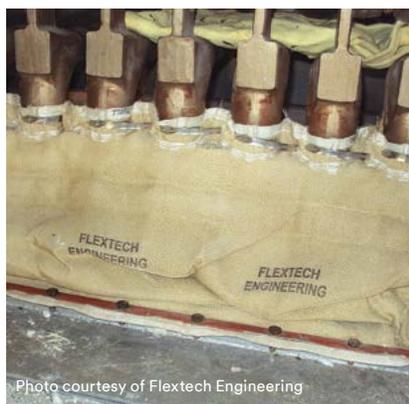
3M™ Nextel™ Ceramic Fabrics 312 and 440 are high performance materials used for a variety of high temperature sealing and heat shielding applications. They meet the toughest thermal, mechanical and electrical performance requirements, performing beyond the limits of common high-temperature textiles such as aramids, carbon, quartz and glass. They are also oxidation resistant, chemically inert, lightweight, flexible, flame resistant, and electrically insulating at high temperatures. As such, they are an excellent choice for service in petrochemical industries (e.g. process heaters, furnace reformers).



Image showing Nextel 440 fabricated pillow used for the insulation to make expansion joint.

## Tube Seals

If tube seals do not adjust as tubes expand, they rupture or vibrate and let excess air into the system. This air can produce excess NO<sub>x</sub> emissions and reduces the efficiency of heaters and furnaces. Engineered to operate at temperatures 900°F–2372°F (482°C–1300°C), Nextel ceramic fabrics 312 and 440 help tube seals



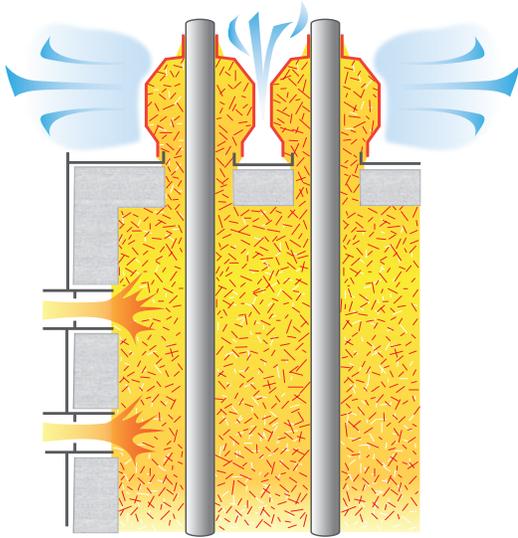
Tube seals mounted while the furnace is in the cold or contracted condition. When the furnace comes to temperature, the tubes will expand and put pressure on the seals.

maintain their shape in environments like process heaters and furnace reformers while helping to prevent the formation of harmful emissions. Because they are flame resistant, they are also a safety measure against potentially damaging flames from a draft fan failure.

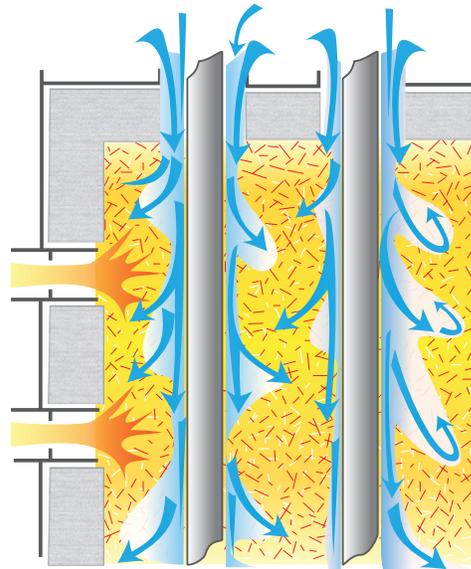


Tube seal fabricated from 3M™ Nextel™ Ceramic Fabrics.

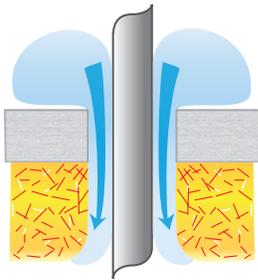
## Examples of the process in tube seal applications



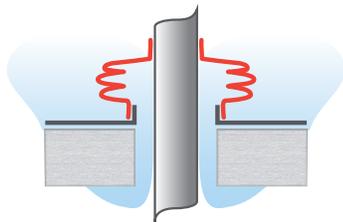
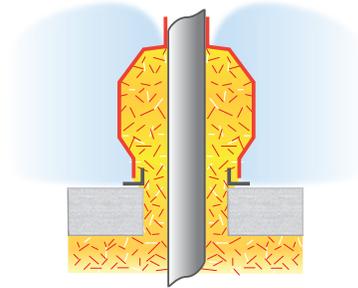
This is a process heater outfitted with tube seals made using 3M™ Nextel™ Ceramic Textiles. They prevent the ingress of tramp air and save money by decreasing fuel consumption, reducing heat losses and controlling excess oxygen.



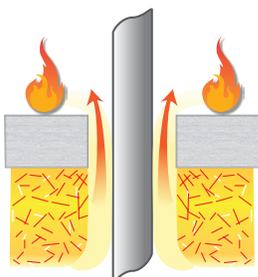
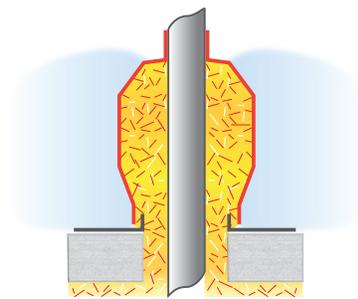
Tube seals are designed to stop the ingress of cold air into a furnace heater box. Draft fan induced, negative pressure process heaters, such as steam methane reformers, ethylene heaters and ammonia reformers, draw in air through the openings around each tube penetration. This cold air is an added load. The money spent heating this may be recovered in less than six months with the successful installation of a tube seal made using Nextel ceramic textiles.



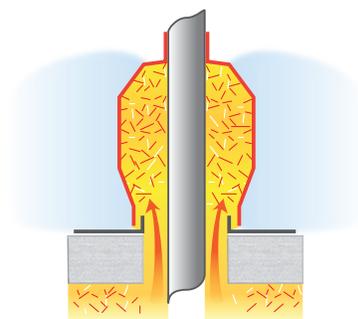
A draft fan  $\Delta P$  of 0.35" of water draws outside air through a nominal 1 ft<sup>2</sup> gap at a rate of 1.92 lbs/sec., every day, every month, every year. Tube seals made using Nextel ceramic textiles help stop the ingress of air.



Tube seals are designed to flex to allow for the expansion of the process tube relative to the furnace roof. Tube seals made using Nextel ceramic textiles remain flexible for years of continuous operation up to 2200°F.



The temperatures inside a process heater can reach 2000°F and above. In instances of draft fan failures, this heat may cause extreme damage to a furnace penthouse. Nextel fiber can withstand direct flame impingement and prevent flame penetration.



## Proven Performance

Tube seals made from 3M™ Nextel™ Ceramic Fabrics 312 and 440 have been used in several industries for decades, often operating for years without replacement.

## High performance. Quick payback.

Tube seals made from Nextel ceramic fabrics 312 and 440 can improve furnace efficiency, reduce NOx generation, and reduce the need for maintenance- and replacement-related shutdowns. They can also be reusable after a tube change or furnace turnaround. Tube seals made from Nextel ceramic fabrics 312 and 440 can provide excellent economic value due to their potentially long service life.

## More uses. More reliability.

With high flexibility and durability at extreme temperatures, Nextel ceramic fabrics 312 and 440 are ideal for applications with heat-induced expansion and vibration. They have been used for decades in several industries as key ingredients of high-temperature products such as:

- Penetration Seals
- Furnace Curtains and Linings
- Gaskets
- Chemical Processing
- Furnace Heater Boxes
- Expansion Joints

## Technical Support

For more information on Nextel products or design support, call 1-800-367-8905 or visit [3M.com/ceramics](http://3M.com/ceramics).

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