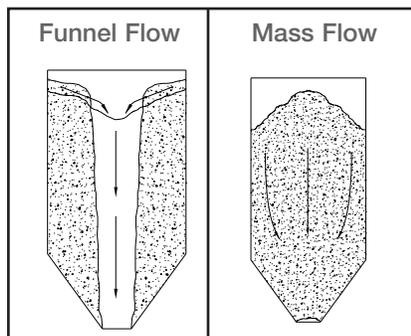


Spontaneous Combustion; Common Sense Safety Procedures and Fastener Options

► SPONTANEOUS COMBUSTION

Most bunker fires are caused by spontaneous combustion and it is a generally accepted fact that stagnant coal (coal that remains stationary in a bunker or bin for an extended time) is one of the main causes for spontaneous combustion. The longer coal is allowed to remain stagnant, the more susceptible it becomes to self-ignition. Therefore, the ideal situation is to keep only fresh coal in the bunker—an environment that can be achieved with a mass flow pattern. Mass flow can be defined as a first-in first-out flow pattern. In fact, according to NFPA 850 Section 5-4 and 8503 Section 2-6, mass flow is necessary in order to prevent stagnant coal build-up, which is one of the main elements leading to bunker fires.



Contrary to mass flow is the funnel flow pattern which can be described as a first-in last-out flow pattern. When a funnel flow pattern exists within a coal bunker or when stagnant coal is

allowed to stick or cement itself to the bin walls for an indefinite period of time, the stagnant coal becomes very susceptible to spontaneous combustion. Lining coal bunkers with TIVAR[®] 88 is a proven method for achieving mass flow and eliminating the potential for stagnant coal and related bunker fires.

Coal will not readily hang-up or cement itself to TIVAR[®] 88 under normal conditions. The low friction surface of TIVAR[®] 88 promotes the flow of coal along the bunker walls, which is associated with a mass flow discharge pattern. This flow pattern would eliminate regions of stagnant coal that could lead to spontaneous combustion. And this flow pattern could be achieved by using TIVAR[®] 88 liners. In fact, it was this attribute that led Xcel Energy (formerly Northern States Power) to choose TIVAR[®] 88 as the hopper wall liner at its Riverside Plant.

An article in the September 1995 issue of Power Engineering Magazine explained how stagnant coal regions leading to spontaneous combustion were eliminated from the bunkers at Northern States Power (Xcel Energy). The full case history can be found on pages 11–16 in this book or can be downloaded (pdf format) from our website, www.tivar88.com. This technical paper, titled "Case Study: How Xcel Energy Uses TIVAR[®] 88 to Solve Sub-Bituminous Coal Handling Problems" was also presented at POWER-GEN AMERICAS '94 Conference held in Orlando, Florida, USA, December 7-9, 1994. That TIVAR[®] 88 liner is still in use today at the power plant and continues to be a success.

► COMMON SENSE SAFETY PROCEDURES

Some power plants have put hot coal into bunkers lined with TIVAR[®] 88. **THIS IS NOT A RECOMMENDED PRACTICE**, although the TIVAR[®] 88 liner survived in many instances because the hot coal did not elevate the surface temperature of the TIVAR[®] 88 high enough to start a fire. Although TIVAR[®] 88 will ignite under certain conditions, it is not considered to be any more toxic than burning wood according to a study conducted by The Earth Technology Corporation. And it is interesting to note, that if a fire is detected within a properly designed mass flow bunker, the

TIVAR[®] 88 will allow a faster and more complete discharge of the coal from the bunker before major damage occurs.

TIVAR[®] 88 should be treated much like a rubber conveyor belt; therefore, precautions such as the following are necessary to prevent accidental fires from occurring.

- Use **CAUTION SIGNS OR PLACARDS** (NFPA 850 Section 5-6.5.3.2) on all equipment having a TIVAR[®] 88 liner, alerting employees and contractors that the interior liner is flammable. In addition, the caution sign on the

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combustion; safety; fasteners

TIVAR® 88 HIGH PERFORMANCE LINING SOLUTION

structure should include a statement "to have water or some other type of extinguishing media available in case of an accidental fire".

- Continuous **structural welding** should not be done directly on the structure without removing a portion of the liner first. If it is not possible to remove the liner, **intermittent welding** has been used successfully, although it is not recommended. If intermittent welding is attempted, it should be done responsibly **and only if water is readily available and another person is present to alert the welder if the liner starts to burn.**

- The structure's surface temperature should not be allowed to get so hot that it creates a problem for the liner. If the surface of TIVAR® 88 does catch fire due to welding or some other very hot ignition source, the immediate surface area will degrade, but the material below the surface will not lose its physical properties if it is quickly extinguished.

▶ FASTENER OPTIONS

It is very common to use weldable fasteners to attach the TIVAR® 88 liner to a steel substrate. The welding equipment used to install a weld washer will be either a MIG welder or a stick welder. The welding electrodes for stick welding should be a maximum diameter of 3mm. Welding in the pre-drilled fastener holes in a TIVAR® 88 sheet does not create a problem if done responsibly. The welder should never use excessive heat.

Stud welding is also a popular installation method in which the molten weld is contained under the ceramic ferule. This method will also reduce human error, compared to MIG or stick welding, if the equipment is properly setup.

Weldable fasteners have been used with tremendous success to install TIVAR® 88 for more than 20 years.

Common sense and preparedness in case of fire should be sufficient to prevent problems.

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Important: Most plastics will ignite and sustain flame under certain conditions. Caution is urged where any material may be exposed to open flame or heat generating equipment. Use Material Safety Data Sheets to determine auto-ignition and flashpoint temperatures of material or consult Poly Hi Solidur. **WARRANTY:** Characteristics and applications for products are shown for information only and should not be viewed as recommendations for use or fitness for any particular purpose. TIVAR® and SystemTIVAR® are registered trademarks of Poly Hi Solidur, Inc. 2004© Poly Hi Solidur, Inc., 2710 American Way; Fort Wayne, IN 46809; USA.