



Repair Materials for Glasteel®/Nucerite® Equipment

Data Sheet DS83-001-3



3-Piece Repair Plug

Introduction

In Glasteel and Nucerite equipment, any damage to the lining must be repaired immediately to prevent corrosion of the base metal and possible loss of the entire equipment.

It is important that you select the right type of repair and the proper repair materials. The characteristics of the various metals, repair components and types of repair are summarized below. For complete details and instruction procedures, refer to the Pfaudler/GPS instruction manual for the specific repair type or contact Pfaudler or GPS.

Metals

Tantalum, due to its excellent corrosion resistance and formability, is the metal most often used in making repairs. An alloy of 97.5% tantalum, 2.5% tungsten is used in Pfaudler repair parts to provide greater strength than pure tantalum. Such repairs, correctly installed, should provide years of service in most chemical environments that are suitable for glass.

Tantalum and its alloy have limitations. Improper use of tantalum may result in equipment damage. Avoid the following conditions:

- At temperatures above 125° F, tantalum is attacked by fuming sulfuric acid, sulfuric acid at concentrations above 98%, or any chemical that contains (or breaks down to form) free SO₃.
- Mixtures of bromine and/or bromine-containing chemicals, and primary alcohols, especially methanol.

- Nascent hydrogen (e.g. reaction of acid on metal chips or fillings) can cause embrittlement. Note that hydrogen gas can be introduced into the vessel without causing embrittlement. Hydrogen embrittlement can be prevented by noble-metal spotting. Contact Pfaudler or GPS for details.
- Galvanic action may occur when two dissimilar metals such as a tantalum plug and a dip pipe of another metal are present in the liquid phase, provided the liquid is an electrolyte, and also by coupling of the noble-metal repair to the less noble substrate via electrolyte leakage. Failure due to galvanic action can take one or two forms:
 - a. The tantalum acts as the cathode; nascent hydrogen will be evolved on the surface, causing embrittlement.
 - b. If tantalum acts as the anode, it will be corroded. There is no hard and fast rule as to which specific metals may cause failure due to galvanic action. For this reason, Pfaudler and GPS strongly recommend that you avoid the use of dissimilar metals.

Fillers

Special filler materials are used in all metal and FEP repairs to Glasteel. The main purpose of a filler is to displace entrapped air under the repair in order to eliminate any pressure gradients between the vessel interior and the volume under the repair. This reduces the tendency to pump corrodant under the repair. Equipment damage may occur if filler material is used as the primary barrier to corrosion. Use only in conjunction with a suitable metal or FEP repair material. Also, do not substitute other types of filler without first consulting with Pfaudler or GPS.

Cement

A repair cement is available for use as a temporary repair only until a metal repair can be installed. It should not be used under metal or over 200° F.

Types of Repair

The material used in a given repair depends on the corrosion condition. The type of repair also depends on the size and location of the damage. Following are the standard types of repair and the specific applications:

FEP Teflon Boot/Sleeve

The FEP Boot/Sleeve is used to cover areas where glass has been damaged or where protection of glass is required. The installation consists of heat-shrinkable FEP Teflon tubing used in conjunction with an F-Filler material. Closed-end tubing is typically used for agitator blades, finger baffle blades, and baffle tips. Open-end tubing is used for accessible straight-sided agitator shafts, dip pipes, and baffles. This type of repair is temporary for the majority of the highly corrosive situations in which Glasteel equipment is used. Some factors which affect the service life of FEP are:

Plasticization – low molecular weight species, such as amines, may plasticize the FEP, thereby reducing its strength.

Permeation – FEP, like most polymers, is permeable to a variety of chemical species such as brominated, nitrated, or chlorinated chemicals, and water vapor. Consequently, interaction with the filler materials is possible.

Stress Cracking – some organic solvents, such as carbon disulfide, chloroform, acetone and ethers in conjunction with agitation force may promote a type of stress cracking.

Abrasion Resistance – because of its moderate degree of resiliency, FEP is sometimes used as a primary barrier to abrasion, especially on agitator blades. Caution is strongly advised in such applications because abrasion resistance depends on the complex interactions of many factors including type of solvent, particle size and distribution, particle hardness, temperature, velocity effects including type of agitator and baffling, and chemical species.

Maximum operating temperature should be limited to 300° F (150° C) and minimum is -20° F (-29° C). Contact Pfaudler or GPS for more information on the factors which may affect the service life of the FEP Boot/Sleeve.

Filler Types

F-Filler is used as a filler under metal/polymer repairs of Glasteel equipment or as a sealcoat on the surface of AFT42 black repair cement. F-Filler/sealcoat has good resistance to most acids, alkaline and neutral solutions, and organic solvents and plasticizers. Do not use F-Filler/sealcoat with strong oxidizers such as bromine, nitric acid, sulfuric acid over 50%.

The sealcoat is used to cover over the rather porous structure of the stand-alone AFT42 black cement type repair.

Silicate-Filler repair material is also used under repairs on glass-lined equipment. Silicate-Filler has excellent thermal stability and can be used over the same temperature range as Glasteel. It is resistant to most solvents, acids, and strong oxidizers such as nitric acid, bromine, chromic acid, high concentrations of sulfuric acid, etc. Generally, the same chemical limitations that apply to Glasteel also apply to Silicate-Filler.

P & PT Fillers are two part high strength tear-resistant RTV materials used under repairs on glass-lined equipment. They have excellent thermal stability and can be used over the same temperature range as Glasteel. When mixed, P-Filler is a viscous free flowing liquid which is best used under metal patches. PT-Filler is a non-flowing, thixotropic material designed to be used under metal plugs. Both P & PT kits come as two part (liquid/liquid), pre weighed in the correct 10:1 ratio, easy to use injection style cartridge. P & PT Filler have good resistance to most acids, alkaline, and neutral solutions, and to most organic solvents.

Kwikure™ Repair System

The Kwikure Repair System is designed to provide quick, durable repairs for glass-lined equipment and possesses good chemical resistivity to many corrosive species. Another favorable characteristic of Kwikure is its ability to be applied to damaged areas difficult or impossible to repair using standard repair techniques, including flanged surfaces, nozzle throat-swage areas, agitator blades, shaft seal areas, and sharp radii areas. It can also be used to fill the glass damaged areas under metal repairs to provide increased corro-

sion protection to the substrate metal. The installation of the Kwikure Repair System is not a simple procedure and is currently being installed only by GPS service specialists.

Metal Patches

Metal patches are used for temporary repairs of damaged areas in Glasteel and Nucelite vessels where neither plugs nor shields can be applied and recommended only for repair of damaged areas up to 48 inches in perimeter. Patches are not satisfactory for all service conditions. Consult Pfaudler or GPS if you have any questions.

A standard patch consists of a sheet of tantalum, tantalum studs, and nuts, a sheet of PTFE gasket material, and F-Filler. Other metals and fillers are available when required.

Nozzle Repair Shields & KwikShields™

Shields are used to repair glass-lined nozzles. Standard shields do not provide adequate protection at vessel pressures above 40 psi. A standard shield consists of a tantalum sleeve, tantalum studs and nuts when required, F-Filler, and PTFE gaskets. Other filler materials may be substituted when the application requires it. An outside shield, consisting of a metal shield and a gasket, is used to cover damage on the flange and on adjacent areas in the neck of the nozzle. A combination inside-outside shield is used when damage is so extensive that an outside shield alone will not suffice. The latest addition to the nozzle repair family is the KwikShield. This shield requires no drilling into base metal and can be used in full vacuum service. For more information on the KwikShield refer to DS83-304.

Three-Piece Metal Repair Plug & KwikPlugs™

Three-piece repair plugs are used in glass-lined steel equipment to cover areas, with damage up to just under 5 inches in diameter, where glass has been damaged and/or steel is exposed. A standard three-piece repair plug consists of a metal stud and nut, a metal disc, several porous PTFE filler gaskets, and one solid PTFE sealing gasket. A filler material is used when installing a three-piece repair plug. The latest addition to the

repair plug family is the KwikPlug. This plug requires no cure time after installation, thus enabling the equipment to be ready for use immediately. For more information on the KwikPlug refer to DS83-205.

Periodic Inspection

Repairs to the glass lining must be inspected periodically. Although a correctly installed metal repair should provide years of service in most chemical environments that are suitable for glass-lined steel, repairs may be disturbed during normal use, maintenance or cleaning operations. Repairs exposed to severe corrosive conditions, high temperatures, etc. should be inspected more frequently than those exposed to relatively mild service conditions. If a repair has leaked in any way or become loose, it must be replaced.

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