LETTER BALLOT #3

Subj: Replacing the word acetone in Supplement 3

Explanation: The proposal is to replace the requirement for cleaning parts with acetone, a toxic substance, to the generic "hydrophilic solvent".

PM: Ed Soltow

Background: There are several places in Supplement 3 where "acetone" is used to clean graphite parts or to locate cracks. Acetone is toxic. A hydrophilic solvent (acetone is one) is generic in nature but has the desired property of acetone.

Existing Text: See the attachments.

Proposed Revision: The revision is shown as a strikethrough with the replacement shown in a text box.

Rationale:

Notes during discussion:

dure, and the economics of repair versus replacement.

c) Impervious graphite is a machinable material. Parts can be modified or repaired in the field, or in a repair shop.

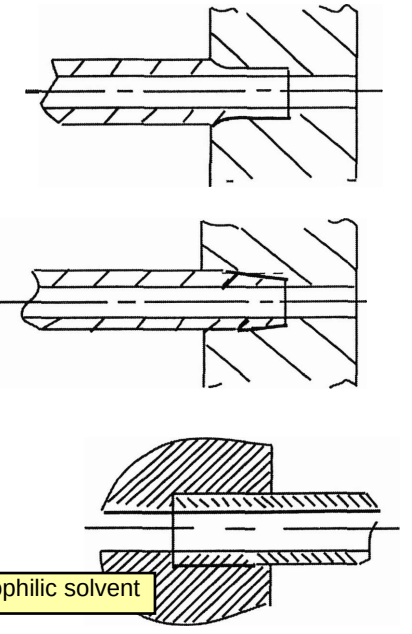
d) Machining operations may be handled with high-speed steel tools. Extensive machining requires tungsten carbide or diamond tooling. No cooling or flushing fluid is required, nor should either be used.

e) Cleanliness is important. Dusty, dirty, and chemically contaminated surfaces prevent proper cement adhesion. Poor cement adhesion will result in a low strength joint or a joint which leaks. All surfaces should be neutralized to a pH of 7. Graphite parts should be cleaned and washed with ~~acetone~~ a hydrophilic solvent to remove all moisture.

f) All damage should be examined and evaluated to determine the cause. Identification and elimination of the cause is essential in helping to prevent a recurrence.

g) ~~An acetone~~ A hydrophilic solvent wash on the surface of the damaged part is useful in identifying the full extent of the cracks. The ~~acetone~~ hydrophilic solvent will quickly evaporate from the surface, leaving the cracks damp and clearly visible.

FIGURE S3.5.1-a
Typical Tube-Tubesheet Joints



S3.5.2 TYPICAL GRAPHITE FRACTURES

S3.5.2.1 MAJOR FRACTURE

An extensive fracture, such as shown in Figure S3.5.2.1, is best repaired by completing the break and re-cementing the two pieces. Temporary steel banding around the circumference is a method of clamping the repair until the cement is cured.

S3.5.2.2 INTERMEDIATE FRACTURE

The break is too minor to warrant completing the fracture. A pie-shaped cut may be made and the segment re-cemented in place. (See Figure S3.5.2.2).

S3.5.2.3 MINOR FRACTURE

For minor fractures, such as those shown in Figure S3.5.2.3, plug stitching can be used. The crack is removed by drilling and plugging a continuous chain of overlapping holes along the length and depth of fracture.

S3.5.3 GRAPHITE REPAIR BY PLUG STITCHING (SEE FIGURE S3.5.3)

a) Plug stitching is a form of repair by material inlaying. In this case, the inlays are small cylindrical impervious graphite plugs. The crack or fracture is removed by drilling and plugging a continuous series of overlapping holes along its length and depth.

b) Most plug stitching is done with 7/8 in. (22 mm) diameter plugs. The plugs are laid out along the fracture line on a pitch of 5/8 in. (16 mm) centers. The overlap of plug material is 1/4 in. (6 mm) along the fracture line. A number of plug sizes are available and are used in repair, and the amount of overlapping is proportional to their diameters.

S3.5.3.1 PLUG STITCHING PROCEDURE (SEE FIGURE S3.5.3)

The following procedure is defined for 7/8 in. (22 mm) diameter plugs (an undersized plug will allow the use of common size tooling). Dimensions for other size plugs shall be adjusted proportionally to the diameter.

a) Trace the line of fracture with ~~acetone~~ a hydrophilic solvent and mark its length and direction.

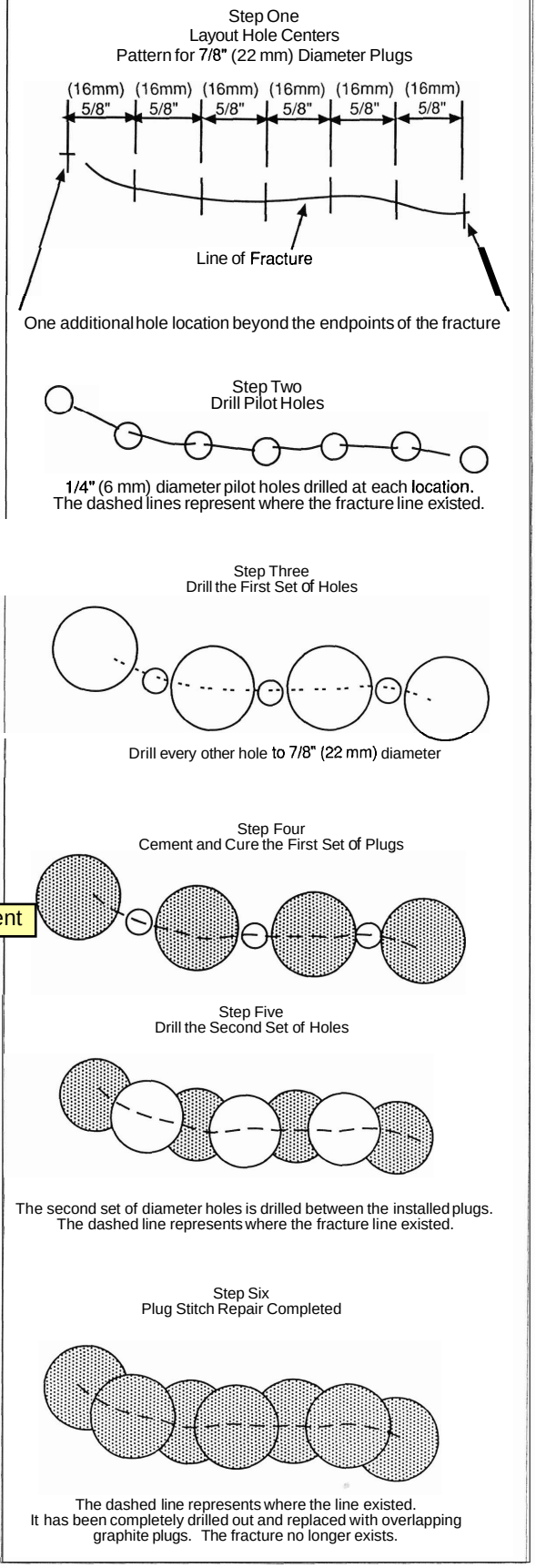
b) Beyond the end points of the fracture (crack), one additional plug shall be installed.

c) Starting 5/8 in. (16 mm) beyond the end point of the crack, mark drilling centers every 5/8 in. (16 mm) along its length. Make sure there is a plug to be installed outside both end points of the line of fracture.

d) Drill a 1/4 in. (6 mm) pilot hole at each location.

e) Redrill a 7/8 in. (22 mm) hole at every other pilot hole. Holes must be drilled the full depth of the crack. The depth and direction of the crack can be checked with ~~acetone~~ a hydrophilic solvent.

FIGURE S3.5.3



f) A 7/8 in. (22 mm) diameter reamer may be used to true the drilled holes.

g) Dry fit a plug into the holes. There should be 0.005 in. to 0.010 in. (.13 mm to .25 mm) clearance for the cement joint. At no time should there be a force fit of plugs into any drilled hole. Provisions shall be provided for venting trapped air.

h) Sand the outside surface of the plugs. Thoroughly clean all the surfaces of the repair, plugs, and drilled holes with ~~acetone~~ a hydrophilic solvent.

i) Apply graphite cement to both plugs and holes. All surfaces of plugs and holes to be joined are to be wetted with cement.

j) Insert the cemented plugs into the holes allowing 1/16 in. (1.5 mm) of the plug to extend beyond the surface of the graphite part.

k) Cure the graphite cement according to the cement Manufacturer's instruction.

l) At this point, half of the plug stitch repair is completed. A row of plugs has been installed with 1/4 in. (6 mm) pilot holes between them.

m) Redrill the remaining pilot holes to 7/8 in. (22 mm) diameter. The drill will remove part of the plugs that were installed. It is important to have the plugs replace all of the fracture. If the new holes do not cut into the installed plugs, it will be necessary to repeat the procedure between these holes and plug locations to ensure that all of the crack has been repaired. The line of fracture is completely removed by the overlapping effect of the graphite plugs.

n) After the second set of holes have been drilled, repeat the plug cementing procedures.

o) Contour the plugs to provide a smooth transition into the adjoining surface area. The finished repair may be coated with a wash coat for appearance.

S3.5.3.2 FIGURES TYPICAL PLUG STITCHING PROCEDURE SEE FIGURE S3.5.3

a) Step one: Layout hole centers.

b) Step two: Drilling pilot holes.

c) Step three: Drilling the first set of holes.

d) Step four: Cementing and curing the first set of plugs.

e) Step five: Drilling the second set of holes.

f) Step six: Plug stitching repair completed.

S3.5.4 RE-IMPREGNATION OF GRAPHITE PARTS (TUBESHEETS, HEADS, AND BLOCKS)

a) As a function of time, temperature, and chemical exposure, the resin used to impregnate graphite may shrink and/or degrade. As such, it is possible for voids to develop in impregnated graphite that has been in chemical service for a period of time. The resin loss can vary from slight to almost complete loss of impregnation. There is no practical way to determine the amount of resin remaining in the pores. However, a pressure test will determine if the graphite has continuous porosity. **A08**

b) Re-impregnation of a graphite component may be used to reduce porosity in an existing graphite component, which in turn will improve the performance and expected life of the existing graphite components. A written re-impregnation procedure acceptable to the Inspector is required. The re-impregnation procedure shall include as a minimum:

1) Decontamination and drying of the graphite component

2) Subjecting the component to a vacuum