

NB15-2209 – SG Graphite – Mar-28-17 rev7**Supplement X Installation of Graphite Pressure Equipment****SX.1 SCOPE**

This supplement provides guidelines for the installation of impregnated graphite pressure vessels.

SX.2 Definitions: SX.2 Glossary of terms/definitions: “see last page of this document...”

Prior to installation, the

Sx3 General requirements**Sx3.1 Receiving and Initial Inspection of Graphite Pressure Equipment**

Graphite equipment should be thoroughly inspected and tested as it is received in order to identify any in transit damage. Whenever possible, this inspection should be made before the exchanger is removed from the carrier. To verify the unit has arrived in an undamaged condition, a pressure test may be performed. The bolt torques and spring heights should be verified prior to a pressure test. This pressure test shall not exceed the MAWP of the vessel. Where freezing could occur, open all vents and drains after a pressure test to drain out all water from all passes and pockets to prevent freeze damage. Follow other good practices such as to prime the unit with an antifreeze solution and/or drain and dry it completely. Graphite equipment may arrive from the manufacturer under low pressure and/or with shock detectors as an indication of undamaged arrival. Any crating should be inspected both for direct damage and/or evidence of improper handling. If there is any evidence of damage, notify the manufacturer.

Graphite pressure equipment may be shipped unassembled for later assembly. Review any packing or check list. All parts should be carefully inspected. The surfaces of graphite parts should be thoroughly examined. Avoid pry bars, chisels, wedges or excessive force to separate any protective covers from graphite nozzles or openings. Activity around graphite surfaces should progress gently and with caution.

Prior to installation, bolt torques and spring heights should be verified. Additionally, the manufacturer may be consulted for recommended commissioning activities such as thermal cycling and bolt retorquing.

Sx3.2 Equipment parameters/ Clearances /Movement

In many cases, graphite pressure equipment is of modular construction and may be assembled or disassembled in the field. The construction details can be obtained by consulting the bill of materials and the assembly drawing provided by the manufacturer. Sufficient space for assembly and installation should be provided. Consideration should be given to the orientation of the equipment for maintenance or disassembly.

Impregnated graphite is more susceptible to damage from mishandling than metal components. Therefore, the following recommendations should be considered:

- a) Lifting and transportation should be done at designated lifting points or per manufacturer's recommendations;
- b) Use only soft slings when handling;
- c) Graphite parts should be protected with a barrier if steel cables or chains are employed; and
- d) Avoid lifting by placing slings directly around the graphite.

Sx3.x Supports/Foundations

See NBIC Part 1, 1.6.1 for general requirements on supports, foundations, and settings.

Foundations and supports should be adequate to prevent settling or the transmission of stresses, vibrations or shock loads to the graphite pressure vessel. Any base structure should be designed to support the exchanger and also to eliminate movements or moments caused by, but not limited to, possible hydraulic thrusts of process and service fluids. Additionally, graphite pressure equipment should be level and square so that all piping connections may be made without excessive force.

Graphite pressure equipment may include lined components that may or may not be insulated. Any structural support attachments should avoid direct contact with lined components, which could create a cold wall effect.

Sx3.x Piping Connections

Impregnated graphite pressure equipment may require connection to graphite nozzles. Before connecting piping, graphite gasket surfaces including serrations should be thoroughly cleaned to prevent any leakage of fluids. A suitable solvent should be used to completely remove all dirt or contaminants from connections. Use caution so as not to scratch or gouge the graphite surface. Graphite piping connections require gaskets specific for graphite applications. Refer to graphite equipment manufacturer for any spring settings, gasket recommendations, and bolt torque recommendations.

Flexible attachments such as expansion joints and bellows are recommended for impregnated graphite connections. Flexible attachments should be installed as close to the nozzles as possible. These are recommended to isolate the equipment from stress caused by vibration, misalignment, thermal expansion of the piping, or other loads.

After positioning and initial tightening of graphite connections, the bolts/ nuts should be tightened to the torque value on bolt torque charts or assembly drawings provided by the manufacturer. Bolts should be tightened in multiple stages and in a diametrically staggered (i.e. star) pattern starting with a torque value that is a small percentage of the final torque value until design values are achieved.

Sx3.x Instruments and controls.

Pressure: See NBIC Part 1, 4.4.2 and 4.5 for requirements related to pressure indicating devices and pressure relief devices.

Temperature control: Automatically controlled systems, such as for heating of impregnated graphite pressure equipment, may be considered. The temperature control should provide for over temperature protection such that temperature is

regulated to maintain a specified operating limit which shall be less than the maximum allowable temperature.

Sensors: Continuous monitoring is suggested since process streams used in graphite heat exchangers are usually corrosive and a failure path or crossover to the service side should be identified with immediate corrective action.

Flow control: In order to avoid damage (e.g., erosion, hammering, shock) to the graphite components, instrumentation should be installed to control and monitor flow.

Sx3.1 Post-Installation Activities

- Due to the nature of impregnated graphite, the surface is subject to light scratches and it is often difficult to distinguish scratches from cracks without further investigation. Consult the manufacturer as required.
- Graphite pressure equipment may be damaged by concentrated hydroblasting or pressure washing. Avoid sandblasting graphite pressure equipment.
- Careful consideration should be given to painting graphite pressure equipment because improper painting can damage the equipment.

SX.2 Glossary of terms/definitions:

Impregnated graphite is a composite manufactured by impregnating porous graphite with chemically resistant synthetic resins used in the construction of graphite pressure equipment. With special processing the graphite becomes impregnated, even to gases & under pressure. The final product partakes of the properties of both graphite and resin, but the predominant characteristics are similar to graphite which gives the most useful properties with its natural corrosion resistance and conductivity as a heat exchange material. Unlike corrosion resistant metals, graphite does not depend on the formation of a surface film or oxide for corrosion resistance, nor does it exhibit a measurable corrosion rate. Once rendered impregnated, however, the chemical inertness of graphite may be limited by the characteristics of the resin such as a phenolic resin which is resistant to most acids, salt solutions and organic compounds but not suitable to alkalis and strong oxidizing chemicals that may degrade & weaken the material with no visible/measurable sign of material loss.

End components – Components attached to the main shell of graphite pressure equipment including heads, channels, domes, and tubesheets

Cold wall effect – a detrimental condition that promotes corrosion due to a temperature gradient between a vessel and its supports

NB15-2210 – SG Graphite – 3-28-17

To be added to S3.5.5 Plugging of leaking or damaged tubes:

f) As an alternative to e) any R Certificate Holder, with the concurrence of the Inspector, may install graphite tube plugs utilizing a tube plugging kit provided by an ASME Certificate Holder authorized to use the G designator. The kit shall include the following items:

1. Certified graphite plugs and certified cement ingredients, both accompanied by the appropriate documentation (Partial Data Report).
2. The qualified cementing procedure of the ASME Certificate Holder authorized to use the G designator, and a step-by-step procedural checklist that shall be followed explicitly. The procedure shall address the entire tube plugging process including plug configuration, tube hole cleaning and preparation, mixing and applying of the cement, application of the plugs, securing the plugs during the curing process, controlling the curing process, and leak testing, thereby meeting S3.3.
3. To qualify the cement technician performing the repair, additional materials shall be provided and used to prepare a demonstration plug joint prior to performing the repair. This demonstration plug joint shall be tested for integrity by a hand twist test. A successful twist test, in conjunction with the procedural checklist, shall serve as a valid cement technician certification for a single repair operation.

The R Certificate Holder shall review the material certifications including verification that the shelf life of the cement has not been exceeded, and assure that the certified cement technician has completed the qualification demonstration, and has access to the procedure and checklist. The Inspector shall review and verify that the procedure and the other elements of the certified kit, as provided by the authorized G-designated ASME Certificate Holder, have been administered and completed prior to his acceptance. The R-certificate Holder shall note on Line 8 of the R-1 Form the installation of cemented graphite tube plugs in accordance with this section. The R Certificate Holder shall identify and document the location of the plugged tubes on the R Form.

Item Number: NB16-1302	NBIC Location: Part 3, S3.2<p>p)</p>
-------------------------------	---

p) Completed repairs shall be subjected to a pressure test. The test pressure shall not be less than ~~the maximum allowable working pressure or twice the operating pressure, whichever is lower~~operating pressure or more than maximum allowable working pressure. The test pressure shall be maintained for 30 minutes minimum.

Justification:

Present pressure range requirements are excessive and cause unnecessary hardship. This action brings them more in line with the general requirements in Part 3.

Page A-6

Item Number: NB16-1303	NBIC Location: Part 3, S3.5.1f)
-------------------------------	--

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

Page A-7