Minutes

ASME BPV VIII PRESSURE VESSEL
SG-GPE / NATIONAL BOARD
SUBGROUP GRAPHITE

COLUMBUS, OH

APRIL 6 & 7, 2015

Wednesday, April 6th – ASME SG-GPE

Call to Order – Chair Ed Soltow called the meeting to order at 8:45am local time.

Adoption of the Agenda – Chris Cary pointed out for record 10-776 that the reference to Equity Engineering should instead say Integrity Engineering Solutions.

The agenda was adopted as modified by a unanimous vote of the subgroup.

Announcements – Chair Ed Soltow announced that he would be stepping down as Chair of the ASME Subgroup, with Vice Chair Aaron Viet taking the position for the next meeting.

Membership – Membership issues were discussed. There will be follow-up about the membership status of Tracy Rudy and Christophe Maqua. Chris Cary expressed his interest in joining the ASME subgroup. A vote was held to appoint Vice Chair Aaron Viet to the position of Chair at the end of current Chair Ed Soltow's term. Aaron Viet was appointed to the position of chair by a unanimous vote of the subgroup. A vote was held to appoint Chris Cary as a member of the ASME subgroup. Chris Cary was appointed as a member of the subgroup by a unanimous vote of the subgroup. Justin Clements expressed his interest in becoming a member of the ASME and National Board Graphite subgroups. A vote was held to appoint Justin Clements as a member of the ASME subgroup. Justin Clements was appointed as a member of the subgroup by a unanimous vote of the subgroup.

The attendance was as follows for April 6th, 2016:

Ed Soltow – ASME/NBIC Chair
Aaron Viet – ASME Vice Chair, NBIC Member
Greg Becherer – ASME/NBIC Member
Shawn Malone – ASME/NBIC Member
Andrew Stupica – ASME/NBIC Member
Bradley Besserman – ASME Visitor/NBIC Secretary
Chris Cary – Visitor
Justin Clements – Visitor

Errata – Errata was not discussed at the meeting.

Approval of the Minutes - Chris Cary pointed out for record 10-776 that the reference to Equity Engineering should instead say Integrity Engineering Solutions.

The minutes for the ASME subgroup were adopted as modified by a unanimous vote of the subgroup. The minutes for the NBIC subgroup were adopted as presented by a unanimous vote of the NBIC Committee.

Old Business

1.) Block H.E. rules (Record 10-776)

- C. Maqua has been pulled from working on the project, FEA work will need to be re-assigned, or done via external contractor
- A. Viet to begin the verbiage for "UIG-35" along with a version of the ligament rules
- A. Viet reported, via C. Cary, an approximate $40,000 cost to outsource block rules to Equity Engineering

Meeting Report: Aaron Viet reported that Christophe Maqua planned to submit additional FEA information to the subgroup, but was unable to do so for this meeting. Shawn Malone reported that a group at Mersen separate from Mr. Maqua was working to validate equations with FEA, and would present more information on this item at some point in the future. Discussion was held about the scope of the item and block failure methods. Discussion was held about hydro test pressure, and whether the 150% design pressure hydro test requirement was excessive. The group will coordinate with the U-2(g) task group to understand how their work affects this item. Mr. Becherer clarified that these requirements will apply only to cylindrical vessels and not square cross section vessels.

2.) Shared Loads

- Nothing new to report

Meeting Report: There was no progress made on this item.

3.) Record 15-684

- E. Soltow was to discuss with U. Miller for advice on how to proceed

Meeting Report: This was a request for interpretation and a response was previously sent. This record was closed at a previous meeting.

4.) Open invitation letter to users

- S. Malone to update and distribute

Meeting Report: The discussion on this item was concluded at a previous meeting. It will no longer be included on the agenda.

New Business

1.) UHX/UIG-34 Issues

- C. Cary to present his findings and open discussion

Meeting Report: Mr. Cary presented findings on how the calculations currently in the code do not accurately reflect the actual mechanical situation in graphite vessels. This

makes it very difficult to design a vessel that satisfies all the requirements of the code. He presented an alternative mechanical model that better reflected the mechanical situation, and explained why this model is better. Discussion was held about Mr. Cary's improved model. The committee discussed whether the calculations were acceptable as is, or if there was sufficient reason to pursue improved calculations in the code based on Mr. Cary's model. Mr. Cary will meet with the chair of the UHX subgroup to discuss his alternative model. Designers from MERSEN will also ask questions to the chair of UHX.

2.) Low Toughness Issues: CS pipe, flanges, fittings

- E. Soltow to share a presentation from Code Week, BPV VIII meeting

Meeting Report: Mr. Soltow gave a presentation on Low Toughness Issues based on the manganese ratio in carbon steel.

Adjournment

The meeting was adjourned by a unanimous vote of the subgroup at 4:31pm local time on April 6th, 2016.

Thursday, April 7th ASME SG-GPE/NBIC SG

Call to Order – Chair Ed Soltow called the meeting to order at 8:55am local time.

Adoption of the Agenda – The agenda was adopted by a unanimous vote of the subgroup.

Membership

The attendance was as follows for April 7th, 2016:

Ed Soltow – ASME/NBIC Chair
Aaron Viet – ASME Vice Chair, NBIC Member
Greg Becherer – ASME/NBIC Member
Shawn Malone – ASME/NBIC Member
Andrew Stupica – ASME/NBIC Member
Francis Brown – ASME/NBIC Member
Bradley Besserman – ASME Visitor/NBIC Secretary
Chris Cary – Visitor
Justin Clements – Visitor

Old Business - ASME

1.) Review "Guide for Review Teams"

- T. Rudy was to present the most recent version for a final review. This will need to be assigned a new PM.

Meeting Report: Mr. Rudy is no longer a member of the committee. The document was reviewed and found to have no issues. Mr. Malone will check with Mr. Rudy to see if there is a more recent file.

2.) Certificate of Authorization Scopes

- F. Brown to report, if anything to report

Meeting Report: Mr. Brown reported that no progress has been made. Mr. Brown explained the problem that the current scopes allow manufacturers to build pressure equipment outside of their proven capability. This item is put on hold until the issue is resolved in higher ASME committees.

3.) Charter

- F. Brown to present proposed charter

Meeting Report: Mr. Brown reported that he will compose a charter statement explaining the purpose of this subgroup.

4.) Reduced Hydrotest Pressure on UIG vessels

- E. Soltow to open a record number.
- Need to put together some back up information
- Look at testing welded parts independently at 1.3*, and then assembled vessel at design pressure.

Meeting Report: Discussion was held about the hydro test level. Mr. Brown explained a precedent in Section X. The hydro test level for a Section X vessel with metal parts is 1.3 times the set pressure. The committee decided they should pursue reducing the pressure test for UIG vessels from 1.5 times the set pressure to 1.3 times the set pressure. A proposal was developed to modify UIG-99. Discussion was held about the process to get this change to be approved. Aaron Viet volunteered to write the explanation for change for this item. A proposal was created to lower the test pressure to 1.3. The proposal was approved by a unanimous vote of the subgroup. (Attachment Page 1)

5.) Use of UM stamp for UIG vessels

- E. Soltow was to open a record number

Meeting Report: Discussion was held about requirements for UM stamped pressure vessels. Mr. Soltow proposed removing the last sentence of UIG-1, which would allow graphite UM stamped vessels. This proposal was approved by a unanimous vote of the subgroup. Ed Soltow volunteered to write the explanation for change for this item. (Attachment Page 2)

New Business

1.) Referenced Standard review for 2017 edition of Section VIII Div. 1

- E. Soltow to provide all standards for review

Meeting Report: Mr. Soltow reported that four ASTM standards which are referenced in the UIG section have been updated. They need to be reviewed to ensure that the references within UIG are still correct. Aaron Viet will review ASTM E4, Ed Soltow wil review ASTM E177, Greg Becherer will review E691, and Andy Stupica will review ASTM C695.

NBIC Business

1.) Item NB15-0512

- E. Soltow (PM) Result of PR15-0121, should UIG-79 and UIG-80 be referenced in their entirety in this section?

Meeting Report: Discussion was held about the basis for change. The committee decided they agreed with the commenter, and that UIG-79 and UIG-80 should be referenced in their entirety in this case. A proposal was presented. The proposal was approved by a unanimous vote of SG Graphite. (Attachment Pages 3-4)

2.) Item NB15-2203

- A. Viet (PM) How to diagram common damage in graphite pressure equipment. In the book, or a separate paper?

Meeting Report: The group discussed if it was possible to diagram damage. The group decided that it was not reasonable to diagram the damage without color photographs. The item was closed with no action taken by a unanimous vote of the SG Graphite.

3.) Item NB15-2204

- T. Rudy (PM) Post construction inspection methods. Will need a new PM.

Meeting Report: Andrew Stupica was assigned as the new PM. Discussion was held about what inspection methods can be used for graphite pressure equipment.

4.) Item NB15-2205

- G. Becherer (PM) Remove allowance for reimpregnation of graphite pressure equipment as a repair method

Meeting Report: Discussion was held about the importance of reimpregnation as a repair method. Mr. Malone and Mr. Cary expressed their desire to keep reimpregnation in the code. Discussion was held about whether reimpregnation of tubes should be allowed. The committee decided that reimpregnation of tubes should not be allowed, but other reimpregnation should be allowed. The item was closed with no action taken by a unanimous vote of the SG Graphite.

5.) Item NB15-2206A/B

- T. Rudy (PM) Review Part 2 & 3 graphite supplement to ensure proper use of "shall", "should", "may". Will need a new PM.

Meeting Report: Discussion was held about the purpose of this item. Brad Besserman volunteered to highlight the instances of "shall", "should", and "may" for review at the July 2016 meeting.

6.) Item NB15-2207

- A. Viet (PM) Revise Requirements for amount of plugs needed when plugging tubes

Meeting Report: Aaron Viet reported that work has not progressed on this item. Discussion was held about alternative tube plugging methods in Europe that require less plugs. A proposal was written to address this issue. The proposal was approved by a unanimous vote of SG Graphite. (Attachment Page 5)

7.) Item NB15-2208

- G. Becherer (PM) Investigate repair options for graphite block heat exchangers

Meeting Report: The group discussed which methods of repair for graphite already present in the code. The group discussed adding information about tube plugging in graphite blocks. The group also discussed adding a definition for graphite block heat exchangers.

8.) Item NB15-2209

- A. Stupica (PM) Develop guidance and requirements for installation of graphite pressure equipment

Meeting Report: Mr. Stupica presented a proposal for a new supplement to NBIC Part 1 regarding installation requirements for graphite pressure equipment. The committee discussed several minor revisions to the draft. (Attachment Pages 6-11)

9.) Item NB15-2210

- C. Cary (PM) Reduce cementing requirements for plugging of tubes

Meeting Report: Chris Cary presented a proposal for code change that reduces the requirements for cementing technicians for the plugging of tubes. Mr. Cary expressed the industry need for a plugging method because the current stringent requirements make it difficult and expensive to plug a tube. The group decided not to add any additional requirements for mechanical plugging. The subgroup discussed cementing technician certification, and how it makes it difficult to do a simple repair like plugging tubes. The subgroup discussed alternative options for tube plugging that would be less cumbersome. The subgroup plans to coordinate with National Board staff and Subcommittee Repairs and Alterations for feedback if any of the alternative options are acceptable. The

committee discussed manufacturers producing certified plug kits, which are then installed by the user and certified by the "R" Stamp Holder. Shawn Malone and Chris Cary will draft a proposal, which will be sent to SC Repairs and Alterations for review and comment prior to the July 2016 NBIC meeting.

10.) Item NB16-1301

- Update scope of Graphite supplement to include "G" in Certificate of Authorization

Meeting Report: Mr. Besserman presented a proposal for a change to the scope in NBIC Part 3, S3.1. The proposal was approved by a unanimous vote of the subgroup. (Attachment Page 12)

Next Meeting

The next meeting of the subgroup will be held July 18th-19th, 2016 at the National Board headquarters in Columbus, OH.

Adjournment

Chair Ed Soltow adjourned the meeting at 1:52pm local time.

Respectfully submitted,

Brad Besserman
NBIC Secretary

4/7/2016

ASME UIG Subgroup Reduced Hydrotest Pressure Proposal

UIG-99 PRESSURE TESTS

Completed pressure vessels shall be subjected to a hydrostatic test in accordance with the requirements of UG-99~~, except that the test pressure shall not be less than 1.5 times design pressure (1.75 for lethal service vessels)~~. The lowest ratio for impregnated graphite material for the stress value at the test temperature to the stress value at the design temperature shall be taken as 1.0. The inspection for leaks of all joints and connections shall be made at a pressure not less than the design pressure.

4/7/2016

ASME UIG Subgroup Allow UM Stamped Graphite Vessels Proposal

GENERAL

UIG-1 SCOPE

The rules in Part UIG are applicable to pressure vessels and vessel parts that are constructed of impervious graphite and graphite compounds and shall be used in conjunction with the rules in this Division insofar as these requirements are applicable to graphite materials. ~~Impregnated graphite vessels may not be constructed under the rules of U-1(j) or UG-90(c)(2).~~

S3.5.5 PLUGGING OF LEAKING OR DAMAGED TUBES

a) The material used for plugging tubes shall comply with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG.

b) The point(s) of leakage shall be verified, and the corresponding leak site(s) shall be marked/labeled on the tubesheet, and recorded.

c) A minimum of two (2) graphite plugs, each with a minimum length of 1 in. (25 mm), shall be used to plug each end of the tube(s) in question. This represents a minimum total of four (4) plugs per tube.

d) The tube(s) shall be prepared for plugging by enlarging the inside of the tube(s) with a suitable drill bit or reamer.

1) To ensure a sound cement joint between the tube sidewall and the plug, a slightly smaller diameter plug shall be selected. The maximum clearance between the tube inside diameter and the outside diameter of the plug shall not exceed 3/32 in. (2.4 mm).

2) As an alternative to d)1) a mandrel with an abrasive, such as sandpaper, may be used, as long as the maximum tube I.D. to plug O.D. clearance of 3/32 in. (2.4 mm) is not exceeded.

3) The minimum plug insertion depth of the prepared hole(s) shall meet the minimum combined plug length requirements of “c”. When the minimum plug length of “c” is exceeded, the total insertion depth of the plugs may exceed the combined length of the plugs; however, the longer plugs shall not project outside the face of the tube(s) being plugged.

e) Plugging of leaking or damaged tubes shall be performed by certified cementing technicians, using qualified cementing procedures, in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG.

f) The cement shall be prepared per the cement manufacturer’s instructions.

g) When cementing the plugs, 100% of individual plugs, as well as the inside diameter of the tube opening(s), shall be coated with cement. The plugs shall then be inserted one by one, against each other, into each end of the tube(s) being plugged.

h) Once the plugging is completed, and before the cement cures, the endplugs may need to be held in place, as newly cemented plugs may exhibit a tendency to dislodge from the plugged tube(s) prior to final curing of the cement.

i) Curing time is dependent upon the cement manufacturer’s instructions, and is considered complete when the cement is hardened to the point that it cannot be indented with pressure from a flat screwdriver or other similar instrument.

j) After the cement is completely cured, the plugged, cemented area(s) on the tubesheet face may be dressed with sandpaper or other suitable abrasive.

k) Repaired tubes shall be tested in accordance with this code, using a method acceptable to the Inspector, with a written procedure as approved by the manufacturer’s internal quality system, to ensure leaks have been repaired.

l) The scope of the work completed shall be described and reported on a Form R-1.

S3.5.6 TUBE REPLACEMENT (15)

Tube replacement should be performed with the unit preferably in the horizontal position. Avoid replacing adjacent tubes simultaneously because the replacement areas may overlap or reduce the ligament between

holes and possibly damage the tubesheet. The general steps used in horizontal tube replacement follow below.

a) The material used for tube replacement shall comply with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG.

b) Tube replacement shall be performed by qualified cementing technicians, using qualified cementing procedures, in accordance with the requirements of the ASME Boiler and Pressure Vessel Code, Section VIII, Division 1, Part UIG-79~~(b), (c),~~ and UIG-80~~(b)~~.

c) Determine the thickness of each tubesheet and inside distance between the tubesheets to obtain tube and sleeve length.

d) Access each tubesheet face, clearly identify and mark each tube hole on each tubesheet of the tubes to be replaced.

e) Prepare/clean the existing tube hole in preparation for extracting the damaged tube. Some holes may contain plugs which require removal. A boring tool slightly larger than the outside diameter of the tube being replaced is required.

f) Drill/bore out the tube hole in each tubesheet to release the tube from the tubesheet. Exercise caution when centering and align cutting to the common axis of the tube.

g) The damaged tube should disengage and become loose. Using guides, remove the damaged tube. Ensure that no debris is trapped in the space where the tube was removed (Fig. S3.5.6-a).

h) Replacement tube shall have sleeves at the ends cemented in the bored holes to replace the material in the tubesheet that was bored out to access the damaged tube (Fig. S3.5.6-b and S3.5.6-c).

   1) Dry-fit a new tube and sleeve.

   2) The sleeve length may vary.

   3) Prior to applying cement, prepare and clean all surfaces to be cemented.

i) Cement the ID of the prepared bore in the floating tubesheet and the tube end OD at the fixed tubesheet. (Fig. S3.5.6-b).

j) Insert the tube through the fixed tubesheet and through the floating tubesheet cemented bore so that it protrudes. Cement the ID of the fixed tubesheet bore as shown in (Fig. S3.5.6-c). The use of alignment dowels can assist/guide in tube handling.

k) Cement the OD of the tube end protruding from the floating tubesheet. Cement the ID of the mating sleeve end, fit it to the cemented tube end and push the assembly part-way into the floating tubesheet. Cement the remainder of the OD of the floating tube end sleeve. Push this cemented assembly the rest of the way into the floating tubesheet (Fig S3.5.6-c).

l) Cement the ID and OD of the sleeve for the fixed tubesheet and insert it until it mates with the tube end inside. Push together cemented tube/sleeve assemblies. (Fig S3.5.6-d). Clean/wipe away any excess cement.

m) Apply slight pressure on the sleeves to seat the joints. Remove excess cement.

n) Maintain pressure and cure both ends of the cemented assembly according to the cement manufacturer's instructions.

o) Sleeves may be trimmed after curing.

NB15-2207 – 4-6-16

Part 3, S3.5.5 c)

~~c) A minimum of two (2) graphite plugs, each with a minimum length of 1 in. (25 mm), shall be used to plug each end of the tube(s) in question. This represents a minimum total of four (4) plugs per tube.~~

c) A plug shall be used to plug each end of the tube(s) in question and each plug shall have a minimum length of 1 in. (25 mm). Multiple plugs may be used.

Installation, Impervious graphite Equip.: **NB 15-2209**
as submitted by Andrew Stupica to Graphite SG Graphite for discussion

July 2015 & (Nov 2015 Rev2) & (Dec2015 rev3)

SX.1 SCOPE

This supplement provides requirements and guidelines for the installation of impervious/impregnated graphite pressure vessels.

SX.2 Definitions: SX.2 Glossary of terms/definitions: "see last page of this document…"

Sx3 General requirements

Sx3.1 Transport of units to install site

Receiving and Initial Inspection

For users protection it is suggested graphite equipment to 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. Graphite equipment may arrive from the manufacturer with shock indicators and or a slight pressure as an indication of un-damaged arrival. Any crating should be inspected both for direct damage and evidence of improper handling (such as chains/cables secured to critical graphite heads/chambers or components). If there is any evidence of damage, notify the manufacturer. Some pressure not to exceed design can be applied on the service side to verify the unit has arrived in an undamaged condition.

Some large type heat exchangers/units may be shipped unassembled for later assembly by authorized personnel. A service side hydrostatic test may be used to verify transit damage but an added careful inspection of all parts is necessary for a thorough assessment. Review any packing or check list and pay special attention to graphite parts surfaces. 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.

Impervious graphite exchangers/equipment may have multiple pass designs on both service and process sides in the end chambers.

For extended storage where a chance of freezing could occur, open all vents and drains in chambers on service side and all vents and drains in on the process side after a pressure test to drain out all water from all passes to prevent freeze damage. Follow other good practices such as to prime the unit with an antifreeze solution and drain it. DO NOT EXCEED THE NAME PLATE PRESSURE LIMIT or SEVERE DAMAGE can RESULT.

Sx3.2 Equipment parameters/ Clearances

These impregnated graphite heat exchangers and vessels are units which utilize the properties of graphite to primarily transfer heat in corrosive application and with those properties usually contain corrosive media. Proper handling, operation and maintenance of these units will ensure many years of trouble-free service. The construction details can be obtained by consulting the bill of materials and the assembly drawing provided by the manufacturer.

In many cases, the units are of a modular construction and design & are able to be disassembled in the field. Installation then should consider proper clearances particularly that the impregnated graphite heat exchangers usually have a fixed and floating end in which case the shell/tank (in a shell and tube or block unit) can be lifted of the internal graphite assembly. This is done preferably in a vertical position based on the orientation of the vessels and disassembly technique.

For safety, keep the following points in mind when handling impervious graphite heat exchangers as impervious graphite is easier damaged than metal componnts. Use only soft slings when handling. If steel cables are employed, provide some type of protection/barrier for the parts. Lift and transport impervious graphite heat exchangers only at designated lifting points. Never lift impervious graphite equipment by placing slings directly around the graphite.

Sx3.x Supports/Foundations

Support considerations for graphite pressure equipment is similar to this pressure vessel installation section found in this part 1.

Foundations and supports must be adequate to prevent settling or the transmission of stresses, vibrations or shock loads. Any base structure should be designed to support the exchanger and also to eliminate movements or moments caused by possible hydraulic thrusts of process and service fluids.

Heat exchangers should be set level and square so that all piping connections may made without excess force. Equipment may be in various orientations such as vertical, horizontal or other but a vertical installation is usually recommended as this position minimizes air entrapment.

Graphite equipment may be built with bolted on lined vessel parts that contain the same corrosive materials that is handled by the graphite pressure equipment. These lined parts may or may not be insulated. Any design of side bracing should avoid direct contact with outer vessel wall that could promote hot/cold reactions.

Sx3.x Piping

Impregnated graphite components are strongest in compression; weakest in tension and thus most all connections are bolted in compression. Before reassembling the heat exchanger, grooves and surfaces on the blocks and headers for gaskets and baffles should be cleaned thoroughly to prevent any leakage between the two fluids. Use a suitable solvent if possible to remove completely all dirt or contaminants if any. Be careful not to scratch or gouge the graphite surface as it is not as immune to damage as metallic components. Gaskets are recommended to be flat thus avoiding any high spots and stress concentrations.

Carefully connect to units and prevent undue stress from being transmitted to the exchanger's graphite parts. Flexible connections such as expansion joints and bellows are recommended for the graphite connections to considerably reduce

the piping loads. These are typically made from a suitable corrosion resistant material & installed as close to the exchanger nozzles as possible. These are recommended to isolate the unit from but not limited to vibration, misalignment and thermal expansion of the piping or other loads which can impose stress on the impregnated graphite components or other nozzles that would transmit loads to the graphite.

After positioning and initial tightening of connections to graphite parts, the bolts/ nuts should be secured up by means of a torque wrench set to the value given by the manufacturer. Use of bolt torque charts or assembly drawing may be utilized for these values. Tighten bolts in multiple stages in a diametrically staggered pattern.

Sx3.x Instruments and controls.

Pressure: Need for pressure indicating devices/controllers should be considered in the installation of graphite pressure equipment and should not allow the vessel to exceed mawp. Additionally, the installation of pressure relief devices on both process and service sides of the exchanger are recommended or may be required by rules or laws.

Temperature control. Automatically controlled heating to impregnated graphite equipment shall allow for over temperature protection such that inlet temperature heat is regulated to maintain a operating limit and shall be less than the maximum allowable temperature.

Sensors control Automatic monitoring of the service is suggested since process streams used in Graphite equipment are usually corrosive and a failure path or crossover to the service side would need to be identified as soon as possible with immediate correction & action.

Sx3.1 Nondestructive exam

- Nondestructive examinations (NDE) of impregnated graphite and its PRI's is performed by those certified in the visual exam methods as specified in the governing code of construction.

- Additional NDE exams may be employed by or under the guidance of the OEM. Due to the nature of impregnated graphite as a composite material, the surface is subject to light scratches (much more than a metallic material) and difficult sometimes to distinguish them from cracks without further investigation.

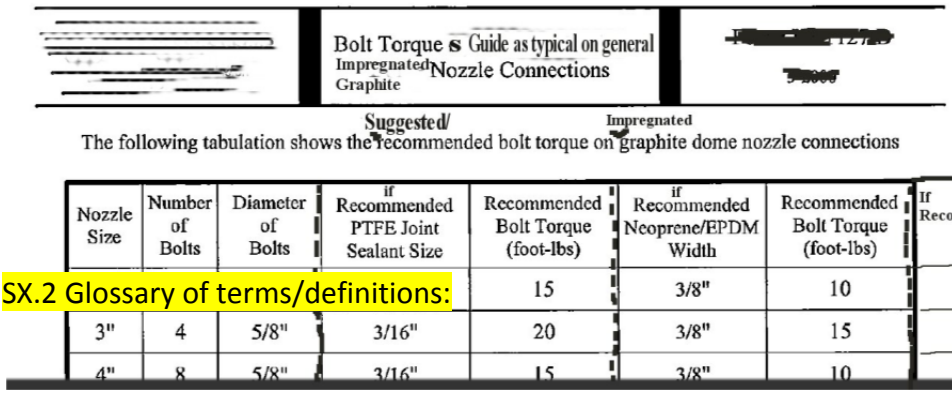
Consider the following as basic torque values if none are provided but contact & use any supplier/manufacturer data first and as primary resource. Bolting is usually tightened in 4 of 5 stages in a diametrically staggered pattern starting with a torque value that is 25% or less of the final torque value.

Division

Bolt Torque on Nozzle Connections

The following tabulation shows the recommended bolt torque on graphite dome nozzle connections

Nozzle Size	Number of Bolts	Diameter of Bolts	Recommended PTFE Joint Sealant Size	Recommended Bolt Torque (foot-lbs)	Recommended Neoprene/EPDM Width	Recommended Bolt Torque (foot-lbs)
2"	4	5/8"	3/16"	15	3/8"	10
3"	4	5/8"	3/16"	20	3/8"	15
4"	8	5/8"	3/16"	15	3/8"	10
5"	8	3/4"	3/16"	20	3/8"	10
6"	8	3/4"	3/16"	20	3/8"	15
8"	8	3/4"	3/16"	25	1/2"	15
10"	12	7/8"	3/16"	25	1/2"	15
12"	12	7/8"	1/4"	30	1/2"	20
14"	12	1"	1/4"	35	1/2"	25
16"	16	1"	1/4"	35	1/2"	25
18"	16	1 1/8"	1/4"	45	1/2"	30
20"	20	1 1/8"	3/8"	45	1/2"	30
24"	20	1 1/4"	3/8"	50	1/2"	35
30"	28	1 1/4"	3/8"	50	1/2"	35



Bolt Torque s Guide as typical on general
Impregnated Graphite Nozzle Connections

Suggested/ Impregnated

The following tabulation shows the recommended bolt torque on graphite dome nozzle connections

Nozzle Size	Number of Bolts	Diameter of Bolts	if Recommended PTFE Joint Sealant Size	Recommended Bolt Torque (foot-lbs)	if Recommended Neoprene/EPDM Width	Recommended Bolt Torque (foot-lbs)	If Recom..
				15	3/8"	10	
3"	4	5/8"	3/16"	20	3/8"	15	
4"	8	5/8"	3/16"	15	3/8"	10	

Continued with other Mfg input?

SX.2 Glossary of terms/definitions:

sample of layout

Impervious 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 impervious, even to gases & under pressure. The final product partakes of the properties of both graphite and resin, but the predominate 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 impervious, 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.

S3.1 SCOPE

a) Repairs to graphite pressure equipment require the use of certified impregnated graphite and cement. The determining factor in establishing the desired material properties is the resin impregnation cycle. If the resin impregnation cycle is not controlled, it is not possible to meet the minimum design values.

~~a)~~b) The letter “G” shall be included on the “R” *Certificate of Authorization* for those organizations authorized to perform repairs/alterations of graphite pressure equipment.