CGThermal

ASME CODE SECTION VIII DIV 1 MARKINGS AND DESIGN OPTIONS FOR GRAPHITE HEAT EXCHANGERS

Since the implementation of part UIG to the ASME Section VIII Division 1 Rules for Construction of Pressure Vessels there has been some confusion in the industry regarding what options are currently available to end users if it is determined that, because of either Company policy or jurisdictional requirements, a graphite heat exchanger requires the ASME Certification Mark with the U designator to be applied to the assembled unit. Currently, there are three options available for applying the Certification Mark with the U designator, both with or without the G mark designator. The G mark designator is applied when the rules of part UIG are followed.

The ASME Sec. VIII Div. 1 Certification Mark with the U designator can be applied to a graphite heat exchanger without the need to apply the G mark designator when the following conditions have been met:

- All of the metal pressure retaining components of the completed unit have been designed and fabricated per the requirements of ASME Sec. VIII Div. 1.
- The assembled unit is tested per Code requirements.
- There are no external graphite pressure retaining components.

The Certification Mark with the U designator applies to the completed unit, covering both the service and process sides of the heat exchanger as a single chamber pressure vessel. This is a safe and reliable option because it requires that all graphite components are fully encased within metal components, as explained above, which act as the pressure boundary. This design does not allow the use of external graphite pressure-retaining components.

It is important to note that CG Thermal uses a minimum design safety factor of 5 on these graphite components in addition to encasing them in a metal shroud and/or skirt. This approach not only protects the graphite from potential external damage, but it has the added advantage of greatly reducing operating stresses on the floating tube sheet. In that graphite is not a ductile material, and its yield strength is the same as its ultimate strength, a failure in a pressure-retaining graphite component can be very difficult to predict and may be catastrophic, immediately exposing the surrounding environment to a potentially hazardous and dangerous process fluid should it occur. The metal covers have the positive effect on minimizing the exposure of the process fluid to the environment and persons while the system is being shutdown.

The second option is to design the unit using graphite components such as tube sheets and process domes as external pressure-retaining components (the pressure boundary) and not encasing them in metal. In this case, a Certification Mark with the U designator can be applied along with a G mark designator by meeting the requirements of ASME Sec. VIII Div. 1 and applying the rules of Part UIG. This design option is openly acceptable to the industry and has the advantage of potentially reducing manufacturing costs due to the elimination of the metal pressure-retaining components on the graphite tube sheet and domes. An end user can elect to use this option with the metal encased design described above, for added protection against catastrophic failure.

The third option is to apply a Certification Mark with the U designator to the shell of the unit, **using *exposed pressure retaining graphite components without following the design rules for Part UIG of SEC VIII Div 1.*** This approach was used by graphite heat exchanger manufacturers prior to ASME accepting the metal encased design 30 years ago. Since the addition of part UIG to the Code in 2010, it is rare that this design approach is used in new units.