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Purpose: To clarify the PWHT temperature controls to be consistent with ASME PWHT standards.

Rationale A received Inquiry asked, with the current PWHT wording, when stress relieving items in the range of 1100F to 1200F, (600 °C to 650 °C), when at the hold temperature, can the 85 °C (150 °F) be added to the 650 °C or subtracted from the 600 °C (1100F) throughout the portion of the tank being heated. This is not acceptable. The requirements need to be clarified to state PWHT should be conducted at a minimum temperature of 600 °C (1100F) and the item must be held at not more than 85 °C (150 °F) throughout the portion of the item being heated. The proposal states the minimum PWHT temperature and that during the hold the entire unit must be within the 85 °C (150 °F).

Source: Inquiry – External
Impact: Neutral

API 620 12th Edition wA1A2 – Proposed Changes are shown with yellow highlight with following:
Underline = Additions/Changes; / Strikethrough = Deletions

API action 620-2031 & 620-2049 not yet published are shown with blue highlight with following:
Underline = Additions/Changes; / Strikethrough = Deletions

Para 5.27.3 – Current Words:

5.27.3 Stress Relieving

The reinforced connection shall be completely preassembled into a sidewall plate. The completed assembly, including the sidewall plate that contains the connections, shall be thermally stress relieved at a temperature of 1100 °F to 1200 °F for a period of 1 hour per in. thickness of sidewall-plate thickness, *td*.

Para 6.18 – Current Words:

6.18 Thermal Stress Relief

6.18.1 General thermal stress relief of an entire tank is not visualized for tanks of this type, but sections of tanks shall be stress relieved before erection where required by the provisions of 5.25.

6.18.2 Parts of a tank that require stress relief according to the rules in 5.25 shall be stress relieved in an enclosed furnace before shipment from the fabricators' shops. The procedure used shall be as outlined in 6.18.2.1 through 6.18.2.5.

6.18.2.1 The temperature of the furnace shall not exceed 600 800 °F at the time the part or section of the tank is placed in it.

6.18.2.2 The rate of heating in excess of above 600 800 °F shall be not more than 400 °F per hour divided by the maximum metal thickness, in inches, of the wall plate being heated, but in no case shall it be more than 400 °F per hour.

6.18.2.3 During the heating period, the temperature throughout the portion of the tank being heated shall not vary more than 250 °F within any 15-ft interval of length and when at the hold temperature not more than 150 °F throughout the portion of the tank being heated. A minimum temperature of 1100 °F (except as permitted in

6.18.2.5) shall be maintained for a period of one hour per in. of metal thickness (maximum metal thickness of the tank wall plates affected). During the heating and holding periods, the furnace atmosphere shall be controlled to avoid excessive oxidation of the surface of the material being treated. The furnace shall be designed to prevent direct impingement of the flame on the material.

6.18.2.4 At temperatures over ~~600 800~~ °F, cooling shall be done in a closed furnace or cooling chamber at a rate not greater than 500 °F per hour divided by the maximum metal thickness, in ~~in. inches~~ of the plates affected, ~~but~~ in no case shall the rate be more than 500 °F per hour. ~~During the cooling period above 800 °F, the temperature variations within the heated portion of the tank during the cooling phase shall not be greater than 250 °F within any 15-ft interval.~~ At temperatures ~~below of 600 800~~ °F ~~and below~~, the material may be cooled in still air.

6.18.2.5 When stress relieving at a temperature of 1100 °F is impracticable, it is permissible to carry out the stress relieving operation at lower temperatures for longer time periods in accordance with Table 6-4.

Proposed Changes:

5.27.3 Stress Relieving

The reinforced connection shall be completely preassembled into a sidewall plate. The completed assembly, including the sidewall plate that contains the connections, shall be thermally stress relieved at a ~~minimum~~ temperature of 1100 °F ~~to 1200 °F~~ for a period of 1 hour per in. thickness of sidewall-plate thickness, *td*. ~~(See 6.18)~~

6.18 Thermal Stress Relief

6.18.1 General thermal stress relief of an entire tank is not visualized for tanks of this type, but sections of tanks shall be stress relieved before erection where required by the provisions of 5.25.

6.18.2 Parts of a tank that require stress relief according to the rules in 5.25 shall be stress relieved in an enclosed furnace before shipment from the fabricators' shops. The procedure ~~used~~ shall be as outlined in 6.18.2.1 through 6.18.2.5.

6.18.2.1 The temperature of the furnace shall not exceed ~~600 800~~ °F at the time the part or section of the tank is placed in it.

6.18.2.2 The rate of heating ~~in excess of above 600 800~~ °F shall be not more than 400 °F per hour divided by the maximum metal thickness, in inches, of the wall plate being heated, but in no case shall it be more than 400 °F per hour.

6.18.2.3 During the heating period, the temperature throughout the portion of the tank being heated shall not vary more than 250 °F within any 15-ft interval of length. ~~During the holding period, there shall not be a greater difference than 150°F between the highest and lowest temperature throughout the portion of the item being heated, and when at the hold temperature not more than 150 °F throughout the portion of the tank being heated.~~ A minimum temperature of 1100 °F (except as permitted in 6.18.2.5) shall be maintained ~~at all locations in the assembly~~ for a period of one hour per in. of metal thickness (maximum metal thickness of the tank wall plates affected). During the heating and holding periods, the furnace atmosphere shall be controlled to avoid excessive oxidation of the surface of the material being treated. The furnace shall be designed to prevent direct impingement of the flame on the material.

6.18.2.4 At temperatures over ~~600 800~~ °F, cooling shall be done in a closed furnace or cooling chamber at a rate not greater than 500 °F per hour divided by the maximum metal thickness, in ~~in. inches~~ of the plates affected, ~~but~~ in no case shall the rate be more than 500 °F per hour. ~~During the cooling period above 800 °F, the temperature variations within the heated portion of the tank during the cooling phase shall not be greater than 250 °F within any 15-ft interval.~~ At temperatures ~~below of 600 800~~ °F ~~and below~~, the material may be cooled in still air.

6.18.2.5 When stress relieving at a temperature of 1100 °F is impracticable, it is permissible to carry out the stress relieving operation at lower temperatures for longer time periods in accordance with Table 6-4.

For Committee Review Only

FOR REFERENCE INFORMATION – NOT PART OF THE ACTION

ASME PWHT

(d) The operation of postweld heat treatment shall be carried out by one of the procedures given in UW-40 in accordance with the following requirements:

(1) The temperature of the furnace shall not exceed 800°F (425°C) at the time the vessel or part is placed in it.

(2) Above 800°F (425°C), the rate⁷⁶ of heating shall be not more than 400°F/hr (222°C/h) divided by the maximum metal thickness of the shell or head plate in inches, but in no case more than 400°F/hr (222°C/h). During the heating period there shall not be a greater variation in temperature throughout the portion of the vessel being heated than 250°F (140°C) within any 15 ft (4.6 m) interval.

(3) The vessel or vessel part shall be held at or above the temperature specified in Tables UCS-56-1 through UCS-56-11 or Table UCS-56.1 for the period of time specified in the Tables. During the holding period, there shall not be a greater difference than 150°F (83°C) between the highest and lowest temperature throughout the portion of the vessel being heated, except where the range is further limited in Tables UCS-56-1 through UCS-56-11.

(4) During the heating and holding periods, the furnace atmosphere shall be so controlled as to avoid excessive oxidation of the surface of the vessel. The furnace shall be of such design as to prevent direct impingement of the flame on the vessel.

Table UCS-56-1

Postweld Heat Treatment Requirements for Carbon and Low Alloy Steels — P-No. 1

Normal Holding
Temperature, °F (°C), - - For P1 materials 1100 (595) degrees F / C
Minimum