The National Institutes of Health | Division of Technical Resources | Office of Research Facilities

Design Requirements Manual **News to Use**

February 2021

Vol. 02, No. 50

The formulae $\frac{\partial \rho \bar{U}_i}{\partial t}+\frac{\partial}{\partial x_j}(\rho \bar{U}_i \bar{U}_j)=-\frac{\partial \bar{P}}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu \frac{\partial \bar{U}_i}{\partial x_j}\right)+g_i(\rho-\rho_0)$ for building $\frac{\partial}{\partial x_j}(\rho \bar{U}_i \bar{U}_j)=-\frac{\partial \bar{P}}{\partial x_i}+\frac{\partial}{\partial x_j}\left(\mu \frac{\partial \bar{U}_i}{\partial x_j}-\rho \overline{u_i' u_j'}\right)+g_i(\rho-\rho_0)$ state of the art $\frac{\partial}{\partial x_i}(\rho \bar{U}_i \bar{H})=\frac{\partial}{\partial x_i}\left(\lambda \frac{\partial \bar{T}}{\partial x_i}-\rho \overline{u_i' h'}\right)$ biomedical research facilities.

Sealant Joints – Part 1: Sealant Properties

In construction, sealants are used to join and fill the gaps between materials to prevent the passage of energy, such as sound, and substances, such as liquids, air, pests, dust, smoke, etc., while mitigating the tendency for joints to accumulate soiling. The most ubiquitous sealant in biomedical facility construction is 100% silicone (ASTM C920), referred to in the DRM as JS-2 in both the Appendix-L Sealant table and the CH-13 Exhibit 13.6 Sealant Table for Aseptic Processing Facilities. This article will focus on the design of JS-2 joints.

Sealant Properties

The following sealant properties must be considered when selecting a sealant for an application:

- **Movement:** When joining materials, the designer must account for the anticipated differential movement of the surfaces being joined. Movement tolerance is expressed as a percentage of the joint width, per ASTM C920 Standard Specification for Elastomeric Joint Sealants.

- **Flexibility:** This characteristic describes the joint movement capacity of the sealant as well as the hardness of the material after it has cured. The selected sealant should be classified Non-Sag (NS), which means it is appropriate for both vertical and horizontal applications. It should be noted that, although low and medium modulus sealants are better at accommodating cyclic movement because they create lower stress at the sealant bond line, they are more susceptible to chemical damage, while high modulus sealants (Class 12-25) are generally more resistant to such damage.

- **Adhesion:** Sealant joint failures in the biomedical facility environment are frequently due to adhesion failures between the sealant and one or more of the substrates being joined. Adhesion failures are correlated to several factors, including poor Material Of Construction (MOC) selection, joint design, and execution (especially failure to adequately prepare the surfaces being joined).

- **Type:** Type-S (single-component) sealants are generally easier to use than Type-M (multi-component), although they tend to have longer cure times and higher unit cost. Type-M sealants are typically faster-curing and often have better durability, flexibility, and adhesion properties than Type-S, but introduce quality control concerns related to their preparation and frequently shorter installation working times. There is also an elevated risk of unacceptable variation in the field preparation of Type-M sealants, compared with Type-S.

- **Durability:** Generally, the durability considerations for sealants include their ability to withstand UV (which is seldom an issue for silicones as the energy required to break silicon-oxygen bonds is higher than that afforded by sunlight), heat, aging, cracking, chalking, and discoloration. Use in biomedical facilities, however, adds chemical resistance requirements, including exposure to oxidizers, such as hydrogen peroxide and peracetic acid.

- **Aesthetic vs Inspectability:** The sealant should be aesthetically compatible with the abutting materials being joined. However, it is even more important to select a sealant that promotes inspection of the joint both at installation and periodically throughout its service life to detect failure early in its progression and initiate repair or replacement. Clear sealants are difficult to inspect for cracks, holidays, and pinholes, so their use should be limited to glass to glass joints and glass/mirror to stainless steel joints. Opaque sealants are easier to inspect and should generally be white, except for stainless steel to stainless steel joints which should be gray, aluminum, or a similar color, depending on the manufacturer's naming convention. Other color options exist but should be similarly evaluated.

- **Other Considerations:** All sealant joints have a design life that is impacted by sealant joint MOC (including the substrate materials), sealant joint design, installation methods, and environmental exposure.

Additional Information

ASTM C794 Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants
ASTM C920 *Standard Specification for Elastomeric Joint Sealants*
ASTM C 1193 *Standard Guide for Use of Joint Sealants*

Next Month This is the first article of a 3-part Sealant Joint series, which will be followed by Part 2: Joint Design and Part 3: Quality Execution Performance.

'Design Requirements Manual (DRM) News to Use' is a monthly ORF publication featuring salient technical information that should be applied to the design of NIH biomedical research laboratories and animal facilities. NIH Project Officers, A/E's and other consultants to the NIH, who develop intramural, extramural and American Recovery and Reinvestment Act (ARRA) projects will benefit from 'News to Use'. **Please address questions or comments to:** shawm@nih.gov

Further details on this month's topic are available on the DRM website DRM Appendix-L
https://www.orf.od.nih.gov/TechnicalResources/Pages/DesignRequirementsManual2016.aspx