

Guidelines for Selection of Sanitary Steam Traps

The terms “Clean Steam” and “Sanitary Steam” are often misunderstood and sometimes lead to the improper selection of equipment such as steam traps. Some applications that are referred to as “Clean Steam” may only require steam traps with slight variations over typical industrial steam traps, while applications such as Clean-in-Place (CIP) & Sterilization-in-Place (SIP) have stringent requirements for materials, surface finishes, end connections, and design elements. Therefore, understanding the various grades of steam is critical to the proper selection of steam traps.

Various Grades of Steam to Satisfy Specific Applications

Clean Steam refers to the level of its purity. In general, clean steam is produced in a manner to reduce contamination, and is made from deionized or distilled water in specialty boilers or steam generators. It is typically used in pharmaceutical applications such as sterilizers, fermenters, and bioreactors as well as in the food production industries, distilleries, and hospitals. Clean Steam should be used on any process where steam may come into direct contact with the end product and can cause contamination.

Industrial grade steam, the most common type, is not suitable for direct product contact because it contains contaminants from boiler additives, rust, and heat transfer equipment. However, if industrial grade steam is generated to meet the requirements of [3A Standard 609-03, Method of Producing Culinary Steam](#) and passes through fine stainless steel filters before use, then it is referred to as Culinary or Filtered Steam. This grade of steam is common in the food and beverage processing industry and is suitable for direct product contact.

Pure Steam is clean steam that is produced to be virtually free of pyrogens and endotoxins, and is defined as “USP Purified Water for Injection” or (USP-WFI) grade. This type of steam exceeds the requirements of the food and beverage industry and is the steam predominantly used in pharmaceutical and biotechnology sectors.

Materials of Construction

The Ultra-Pure water that is used to make clean steam has been depleted of all of its ions during the purification process, making it very chemically aggressive to metals or “ion hungry.” Therefore, only corrosion resistant metals such as 316 Stainless Steel can be used in products that handle clean steam.

It is often required that the stainless steel in contact with Clean Steam must be passivated, a chemical process that removes any residual surface iron and promotes chrome oxide formation, further improving corrosion resistance.

Surface Finish

Smoothing the surfaces by means of polishing reduces the ridges and crevices where microorganisms (bacteria) may grow. While mechanical polishing will reduce the surface ridges significantly, electro-polishing is required to meet the standards of sanitary systems. Electro-polishing is an electrochemical process that smooths the surface of a metal object by removing surface metal ion by ion. Roughness Average (Ra) is measured in microinches and refers to the smoothness of a surface. The lower the Ra number, the smoother the surface and the less chance for surface contamination and microorganism growth.

Sanitary Steam Traps vs. Clean Steam Traps

Sanitary steam traps installed in sanitary piping systems must adhere to more stringent design standards than clean steam traps that are suitable for clean steam applications. Sanitary Steam Traps are designed to offer free flow through internal passages by incorporating very smooth internal finishes. The internal electro-polish finish on a sanitary steam trap must typically be between 20-25 Ra, although some requirements as low as 10 Ra are possible. The external finish is usually between 25-32 Ra. Because the system must be periodically passivated to provide sterilization, these traps offer a sanitary tri-clamp connection on the body to allow for removal of the thermal element. Removal of the element allows unobstructed flow through the trap during passivation.

Clean-in-Place (CIP) & Sterilization-in-Place (SIP)

CIP is a system which allows the automatic cleaning and disinfecting of plant equipment without dismantling, using cleaning fluids such as detergents, acids, alkalis, and water. CIP uses a high flow, highly turbulent solution to remove soil in the system. Chemicals are used to break up and remove the remaining soil. Sanitizer is then used to kill remaining microorganisms.

SIP is the process of sterilizing plant equipment without dismantling, usually following CIP procedures. SIP uses low pressure steam for sterilization purposes – typically 30 – 35 psig. The steam trap bodies must be passivated to remove any residual iron deposits as well as to promote a chrome oxide layer to enhance corrosion resistance of the stainless steel.

Proper Selection of Sanitary Steam Traps

Understanding the different grades of steam will help you make the proper steam trap selection for the application. The term “Clean Steam” is often used very generally to describe applications, so it is important to confirm the specific requirements of the application to determine if a steam trap designed for Sanitary service is needed. This knowledge will reduce frustration and possibly prevent costly production losses from steam trap misapplication.

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