# Selections of Thermowells

## Material – The Longevity Factor

In general, the Thermowell material chosen for the installation is governed mainly by the corrosion conditions the well will face. The high polish given to all stainless and other wells provides maximum corrosion resistance.

Occasionally, the material consideration is one of strength rather than corrosion resistance. For example, a stainless steel well may be required for high-pressure water service instead of a brass well, which would be satisfactory from a corrosion standpoint. Consult the pressure-temperature rating for each well type.

Wells are also available in special grades of stainless steel, Chrome-molybdenum steel, Inconel 600, Hastelloy B & C, Nickel, Titanium, and Monel. Tantalum jackets are also available.

## Connection – The Installation Factor

In our catalog pages, you will find standard bore wells of threaded flanged (A.S.A. and Van Stone), and socket weld types.

All threaded wells are made in easily welded or brazed materials. This is important for installations requiring seal welding or brazing. The pipe thread provides the mechanical strength; the weld or braze provides the seal.

Flanged wells (other than Van Stone type) consist of a bar stock well, which is solidly welded to a top quality flange. Standard construction uses a primary “J” groove weld and a bevel groove secondary weld. The underside weld is machined to produce a clean fillet. This double welded construction eliminates the possibility of crevice corrosion since no open joints are exposed from either inside or outside the installation.

Socket weld wells are simple to install – merely weld them into place. These wells fit A.S.A. standard socket weld couplings or flanges. The resulting installation is clean and tight.

## Insertion Length – The Accuracy Factor

The distance from the tip of the well to the underside of the thread, or other connection means is the insertion length (designated as “U”). For best accuracy, this length should be long enough to permit the entire temperature sensitive part of the element to project into the medium being measure. A properly installed element will project into liquid an amount equal to its sensitive length plus at least one inch. In air or gas, the element should be immersed its sensitive length plus at least three inches.

Thermocouples and thermistors have short sensitive lengths. They can be used with the shorted insertion length Thermowells.
Bimetal thermometers, resistance thermometers, and liquid-in-glass thermometers have sensitive portions between one and two inches long. Therefore, the minimum standard insertion length of 21/2” (63.5 mm) must be entirely immersed in liquid for proper accuracy.

Filled system thermometer bulbs may have sensitive portions from one to several inches in length. Determine the sensitive length of the bulb before choosing an insertion length.

Above all, be sure that dead length, i.e. that required to pass thru walls, pipe fittings, etc., is taken into account when choosing the necessary well insertion length.

## Bore Size – The Interchangeability Factor

Almost any installation uses several types of temperature measuring senors. The selection of a standard bore diameter can produce extreme flexibility within the plant. The same well can accommodate either thermocouple, resistance, thermometer, bimetal thermometer, or test thermometer.

The bore sizes of wells shown in our catalog are the most commonly used temperature sensing elements as follows:

| | |
|---|---|
| 0.260” (6.6 mm) Diameter Bore: | Bimetal Thermometers ¼” (6.4 mm) Stem Thermocouples – (#20 Gage)<br>Liquid – in – glass Test Thermometers (unarmored)<br>Other elements having 0.250” maximum diameter |
| 0.385” (9.9 mm) Diameter Bore: | Thermocouples (# 14 Gage)<br>Liquid - in – glass Test Thermometers (armored)<br>Other elements having 0.35” (9.5 mm) maximum diameter |

## The Velocity Rating Factor For Tapered or Straight Wells

Tapered shank wells provide greater stiffness for the same sensitivity. The higher strength – to – weight ratio gives these wells a higher natural frequency than the equivalent length straight shank wells, thus permitting operation at higher fluid velocity. Refer to "Velocity Ratings of Wells."

## Velocity Rating of Wells

Well failures, in many cases, are not due to the effect of pressure and temperature alone. Inadequate strength of well can be due to improper choice of well thickness or material.

Less familiar, and more dangerous, are the vibrational effects to which wells are subjected. Fluid, flowing by the well, forms a turbulent wake (called the Von Karman Trail) which has a definite frequency based on the diameter of the well and the velocity of the fluid. It is important that the well have a sufficient stiffness so that the wake frequency will never equal the natural frequency of the well itself. If the natural frequency of the well were to coincide with the wake frequency, the well will vibrate to destruction and break off in the piping.

Recommended maximum velocity rating can be found for every standard well length and material cataloged. To reduce the complexity of presenting this information, the ratings given are based on operating temperatures of 1000 degrees F (537 degrees C) for wells made of Carbon Steel (C-1018), A.I.S.I. 304, & A.I.S.I. 316. Values for brass wells are based on 350 degrees F (177 degrees C) operation. Limits for Monel wells are based on 900 degrees F (482 degrees C) service. Slightly higher velocity may be possible at lower temperatures.

Where single values appear in the velocity tables, theses may be considered safe for water, steam, air or gas. In the shorter insertion lengths, consideration is given to the velocity pressure effect of water flowing at higher velocities. The values in parenthesis, therefore, represent safe values for water flow while the unbracketed value may be used for steam, air, gas and similar density fluids.

It should be pointed out that the values given are intended primarily as a guide. To be safe, check each well with your own calculation.

If you have operating conditions requiring special well designs, our U-Design walls on catalog pages 24, 25, and 26 may fit your requirements.