

Thermowells

General Specifications

Material - The Longevity Factor

In general, the thermowell material chosen for the installation is governed mainly by the corrosion conditions the well will face.

Recommended material for various services are given in the Corrosive Service Guide. The high polish given to all stainless and monel wells provides maximum corrosion resistance and strength.

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

The standard materials listed for each well series will cover most requirements. Optional materials include special grades of Stainless Steel, Chrome-molybdenum, Naval Brass, Hastelloy B&C, Nickel and Titanium.

Connection - The Installation Factor

In these pages you will find standardized wells of threaded, flanged (A.N.S.I. and Van Stone) and socket weld types with standard bore sizes. Threaded wells are all made in readily welded or brazed materials. This is important for installations requiring seal welding or brazing. The pipe thread provides the mechanical strength, the weld merely seals. 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. Both welds are machined to produce a clean fillet. This double welded construction eliminates the possibility of crevice corrosion and stress problems since no open joints are exposed from either inside or outside the installation. Socket welding types are simple to install by merely welding into place. These wells fit A.N.S.I. standard socket weld couplings or flanges. The resulting installation is clean and tight.

Insertion Length - The Accuracy Factor

The distance from the end of the well to the underside of the thread, or other connection means, (designated as "U") is the insertion length. For best accuracy, this length should be long enough to permit the entire temperature sensitive part of the sensor to project into the temperature medium being measured.

A properly installed RTD or thermocouple will project into liquid an amount equal to its sensitive length plus at least one-inch. In air or gas, the bulb should be immersed to its sensitive length plus at least three inches. Thermocouples and thermistors have short sensitive lengths, therefore they can use the smallest insertion lengths. Bi-metal thermometers, resistance thermometers and liquid-in-glass thermometers have bulbs with 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 are required to pass through 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 instruments. The selection of a standard bore diameter can produce maximum flexibility within the plant. The same well can accommodate either thermocouple, RTD, bi-metal thermometer, or test thermometer. The bore size of wells shown in this catalog cover the most commonly used temperature sensing elements as follows:

.260" Diameter Bore

.385" Diameter Bore

Tapered or Straight Shank - The Velocity Rating Factor

Tapered shank wells provide greater stiffness for the same sensitivity. The higher strength-to-weight ratio gives these wells a higher natural resonant frequency than for an equivalent length straight shank well, permitting operation at higher fluid velocities. Refer to "Velocity Ratings of Wells" in Thermowell General Specifications.

Tapered or Straight Shank - The Velocity Rating Factor (cont.)

Well failures, in most cases, are not due to the effect of pressure and temperature. The calculations necessary to provide adequate strength, under given conditions, are familiar enough to permit proper choice of wall thickness and 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 velocity of the fluid. It is important that the well have 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 would vibrate to destruction and break off in the piping.

On the following pages, a 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°F 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°F operation. Limits for Monel wells are based on 900°F service. Slightly higher velocity is possible at lower temperatures.

Where single values appear in the velocity tables, these 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 extremely conservative and intended primarily as a guide. Wells are also safe if the resonant frequency is below the wake frequency or if the fluid velocity is constantly fluctuating through the critical velocity point. If the installation is not hampered by the use of a sufficiently stiff well, we recommend the values given are not to be exceeded. If you have operating conditions requiring special well designs, our Engineering Staff is available to assist you.

Following are some of the special tests or procedures that we offer. Please contact your sales representative for additional cost and delivery.

Tests and Services:

Hydrostatic test

- Internally for screwed wells
(specify pressure rating)
- Externally for flanged and Van Stone
(normally 1.5 times flange rating)

Dye Penetrant test

Ultrasonic test

X-ray

- Per ASME (code UW51)

Stress Calculations

- Per ASME PTC 19.3

Procedures:

Stress Relieving

- Solution Annealing

Heat Treating

- Meets N.A.C.E. MR-01-75 specification

Passivating

Electropolishing

Full Penetration Weld

Positive Material Identification (PMI)

Cleaning for Oxygen Service

Stellite #6 and other wear-resistant coatings

Other:

Source Inspection

Premium Delivery Service

Stamp or Vibro Etch Tag Number or Heat Number

Certified Mill Test Reports (MTR's)

Certified Reproducible drawings

Standard Manufacturing Tolerances

Lengths:

- ± 1/16" on length 12" or less
- ± 1/8" on length 12" or less

Wells 30" overall length and longer will be drilled through end, plugged and heliarc welded, if solid bored is specified. Built up design must be specified. Built up design must be specified beyond 42 1/4" overall length.

O. D. Tolerances:

- Fractional: ± .015
- Decimal: ± .005 on .000 place
- ± .010 on .000 place

Bore I.D. Tolerances:

- + .005
- .003

End Thickness:

Gun drill Bottom, 1/4" to bottom ± 1/16", 3/16" min. end.

Concentricity of Bore to O.D.:

- ± 10% of min. wall thickness

Surface Finish:

- 16-32 Ra standard
- 4-12 Ra available at an extra charge. Must be specified on order.

Wetted surface finish of 80 Ra is available at a savings on some wells.

Must be specified on order.

Radius under Threads and Flanges:

- 1/8" is standard, ± 1/16"
- 1/16" on Van Stones

Male Threads: (NPT)

± 1" on thread gage

Female Threads:

(1/2" NPSM) standard, 1/2" NPT available upon request.
Go gage to 5/8" depth of thread.
No go gage 2 turns max.

End of Wells:

Break corners - no burrs.

Threaded Wells:

Round stock with wrench flats will be used if hex stock is not available. Lagging extension may be left as hex or as machined diameter.

Stamping:

Material code identification and type of material stamped on Hex or round facing open end of well.

Flanged Wells:

Made in accordance with ANSI B16.5. Raised Face is serrated. 125 RMS Smooth Face must be specified on order if needed.

Front "J":

Groove welds are 1/4" wide by 1/4" deep. Welds are machined, leaving 1/8" radius. Rear welds are 1/8" wide by 1/8" deep "V". Welds are machined, leaving 1/4" radius. Full penetration welds are available upon request. Must be specified on order if needed.