

Thermowells



Thermowells are principally used with Thermocouples, RTDs (Resistance Temperature Detectors) and Bimetal Thermometers in applications where it is necessary to measure temperature at high pressure (above 75 psig) or in hostile environments. Thermowells are machined from solid barstock. Safe working pressures depend on the well material, operating temperature and the velocity of the flowing medium.

Tapered wells are used in many process applications and provide greater strength, faster response times and more resistance to vibration than straight wells. The taper provides a higher natural frequency which permits use at higher fluid velocities. The reduced tip on a straight well improves response time when it is used with a length sensitive sensor such as an RTD or Bimetal Thermometer. Thermowells are more likely to fail from vibratory stress than from the effects of temperature and pressure. ASME calculations can be used to determine if the selected thermowell dimensions are adequate to withstand the specified service conditions of temperature, pressure, velocity and vibration.

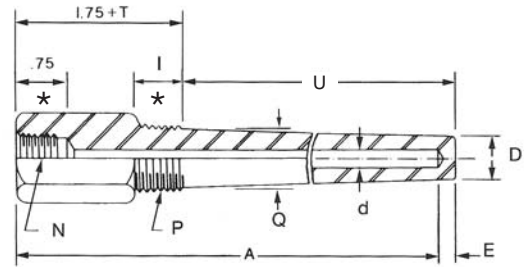
Thermo-Kinetics stocks a complete range of standard thermowells to meet most applications. Flanged, Socket Weld, Van Stone, Ground Joint and Weld-in thermowells are also available. Special wells in various materials, sheaths and coatings are also available to meet unique requirements. A Material Selection Guide is included in this Product Reference Guide.

Please visit our website for our other Product Literature Guides : T-PAK® Thermocouples, Resistance Temperature Detectors, Industrial Thermocouples, Protection Tubes, Calibration Services

toll free 1-800-268-0967 • www.thermo-kinetics.com

Toronto • Montréal • Québec • Calgary • Edmonton • Vancouver

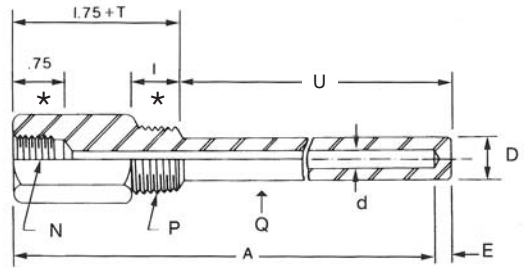
Tapered Thermowell



N = 1/2" NPT
E = .25" nominal
* Dimensions reversed when P = 1/2"

| Catalog Number | Bore Size d | Process Conn P | Root Diam Q | Tip Diam D |
|----------------|-------------|----------------|-------------|------------|
| WT21-12 | .260" | 3/4" NPT | .875" | .625" |
| WT21-16 | .260" | 1" NPT | 1.063" | .625" |
| WT31-16 | .385" | 1" NPT | 1.063" | .766" |

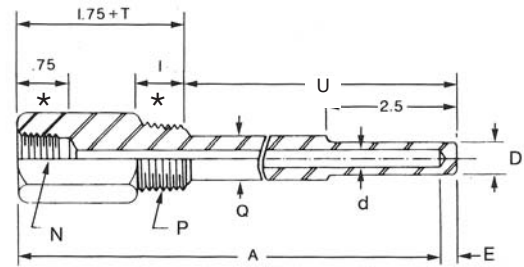
Straight Thermowell



N = 1/2" NPT
E = .25" nominal
* Dimensions reversed when P = 1/2"

| Catalog Number | Bore Size d | Process Conn P | Root Diam Q | Tip Diam D |
|----------------|-------------|----------------|-------------|------------|
| WT22-08 | .260" | 1/2" NPT | .625" | .625" |
| WT22-12 | .260" | 3/4" NPT | .750" | .750" |
| WT22-16 | .260" | 1" NPT | .875" | .875" |
| WT32-12 | .385" | 3/4" NPT | .766" | .766" |
| WT32-16 | .385" | 1" NPT | .875" | .875" |

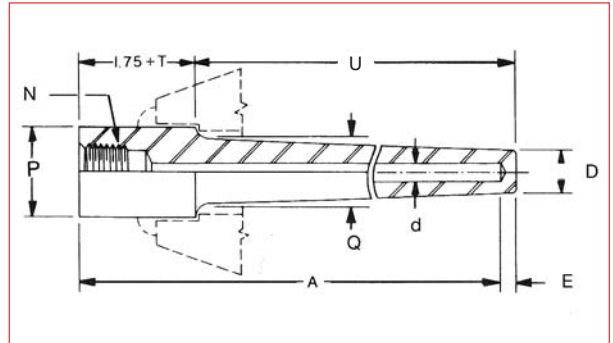
Reduced Tip Thermowell



N = 1/2" NPT
E = .25" nominal
* Dimensions reversed when P = 1/2"

| Catalog Number | Bore Size d | Process Conn P | Root Diam Q | Tip Diam D |
|----------------|-------------|----------------|-------------|------------|
| WT23-08 | .260" | 1/2" NPT | .625" | .500" |
| WT23-12 | .260" | 3/4" NPT | .750" | .500" |
| WT23-16 | .260" | 1" NPT | .875" | .500" |

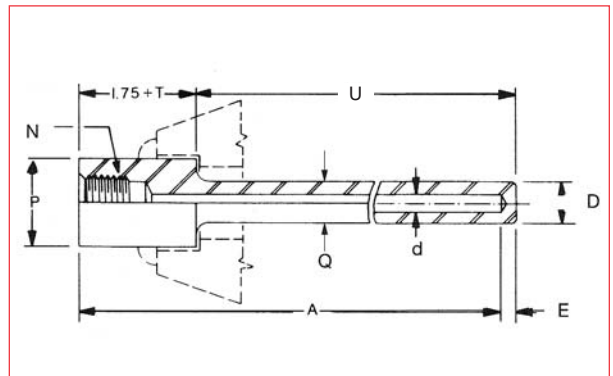
Tapered Thermowell



N = 1/2" NPT
E = .25" nominal

| Catalog Number | Bore Size d | Pipe Size | Conn Diam P | Root Diam Q | Tip Diam D |
|----------------|-------------|-----------|-------------|-------------|------------|
| WS21-12 | .260" | 3/4" NPT | 1.050" | .875" | .625" |
| WS21-16 | .260" | 1" NPT | 1.315" | 1.063" | .625" |
| WS31-16 | .385" | 1" NPT | 1.315" | 1.063" | .766" |

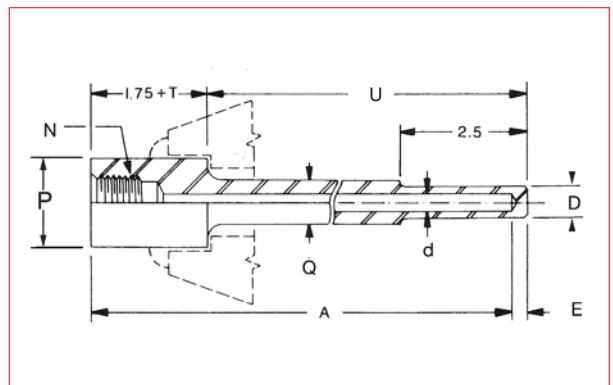
Straight Thermowell



N = 1/2" NPT
E = .25" nominal

| Catalog Number | Bore Size d | Pipe Size | Conn Diam P | Root Diam Q | Tip Diam D |
|----------------|-------------|-----------|-------------|-------------|------------|
| WS22-12 | .260" | 3/4" NPT | 1.050" | .750" | .750" |
| WS22-16 | .260" | 1" NPT | 1.315" | .875" | .875" |
| WS32-12 | .385" | 3/4" NPT | 1.050" | .766" | .766" |
| WS32-16 | .385" | 1" NPT | 1.315" | .875" | .875" |

Reduced Tip Thermowell

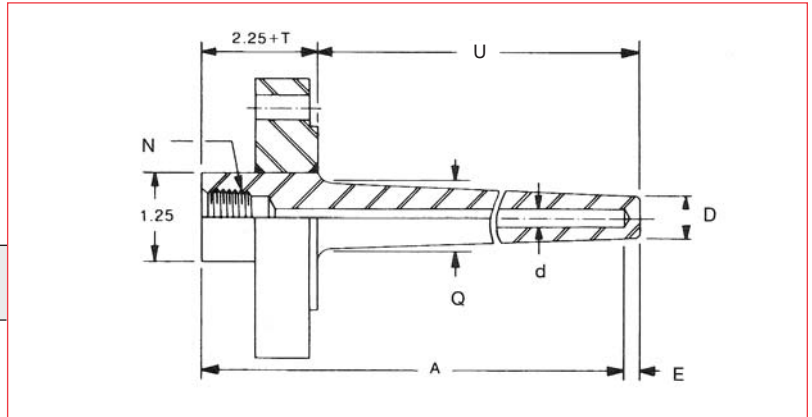


N = 1/2" NPT
E = .25" nominal

| Catalog Number | Bore Size d | Pipe Size | Conn Diam P | Root Diam Q | Tip Diam D |
|----------------|-------------|-----------|-------------|-------------|------------|
| WS23-12 | .260" | 3/4" NPT | 1.050" | .750" | .500" |
| WS23-16 | .260" | 1" NPT | 1.315" | .875" | .500" |

Tapered Thermowell

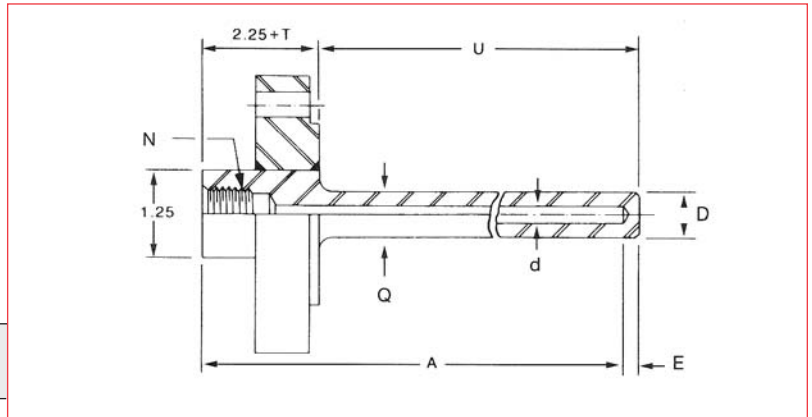
| Catalog Number | Bore Size d | Flange Size | Root Diam Q | Tip Diam D |
|----------------|-------------|-------------|-------------|------------|
| WF21 | .260" | 3/4" | .750" | .625" |
| | | 1" | .875" | .625" |
| | | 1 1/2" & > | 1.063" | .625" |
| WF31 | .385" | 3/4" | .750" | .625" |
| | | 1" | .875" | .766" |
| | | 1 1/2" & > | 1.063" | .766" |



N = 1/2" NPT
E = .25" nominal

Straight Thermowell

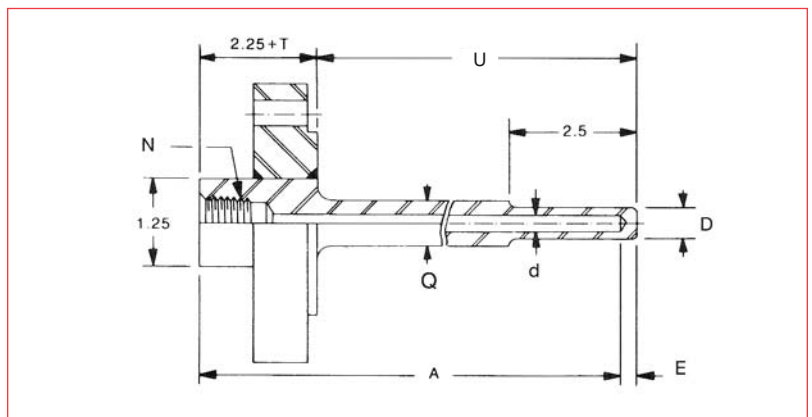
| Catalog Number | Bore Size d | Flange Size | Root Diam Q | Tip Diam D |
|----------------|-------------|----------------|----------------|----------------|
| WF22 | .260" | 3/4" 1" & > | .750" .750" | .750" .750" |
| WF32 | .385" | 3/4" 1" & > | .750" .875" | .750" .875" |



N = 1/2" NPT
E = .25" nominal

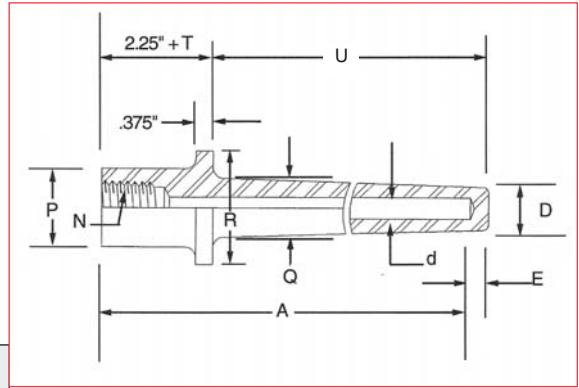
Reduced Tip Thermowell

| Catalog Number | Bore Size d | Flange Size | Root Diam Q | Tip Diam D |
|----------------|-------------|-------------|-------------|------------|
| WF23 | .260" | 3/4" | .750" | .500" |



N = 1/2" NPT
E = .25" nominal

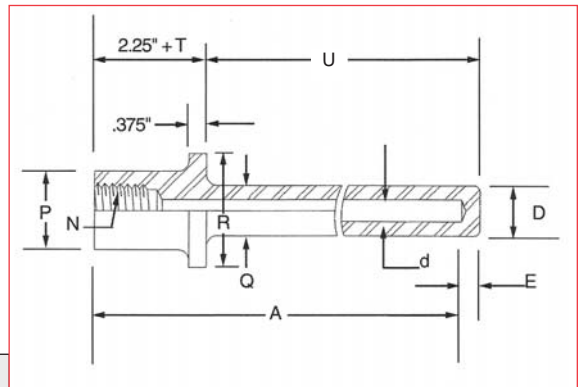
Tapered Thermowell



N = 1/2" NPT
E = .25" nominal

| Catalog Number | Bore Size d | Nominal Pipe Size | Actual Diam P | R.F. Diam R | Root Diam Q | Tip Diam D |
|----------------|-------------|-------------------|---------------|-------------|-------------|------------|
| WV21-16 | .260" | 1" NPT | 1.315" | 2.000" | .875" | .625" |
| WV21-24 | .260" | 1 1/2" NPT | 1.900" | 2.875" | 1.063" | .625" |
| WV31-16 | .385" | 1" NPT | 1.315" | 2.000" | .875" | .766" |
| WV31-24 | .385" | 1 1/2" NPT | 1.900" | 2.875" | 1.063" | .766" |

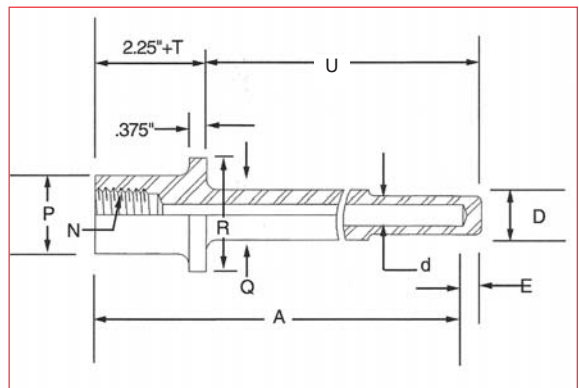
Straight Thermowell



N = 1/2" NPT
E = .25" nominal

| Catalog Number | Bore Size d | Nominal Pipe Size | Actual Diam P | R.F. Diam R | Root Diam Q | Tip Diam D |
|----------------|-------------|-------------------|---------------|-------------|-------------|------------|
| WV22-16 | .260" | 1" NPT | 1.315" | 2.000" | .750" | .750" |
| WV22-24 | .260" | 1 1/2" NPT | 1.900" | 2.875" | .875" | .875" |
| WV32-16 | .385" | 1" NPT | 1.315" | 2.000" | .766" | .766" |
| WV32-24 | .385" | 1 1/2" NPT | 1.900" | 2.875" | .875" | .875" |

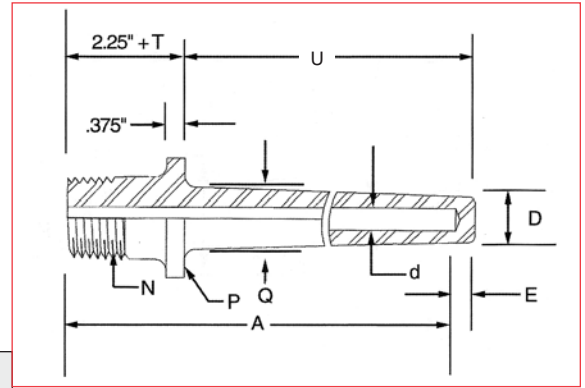
Reduced Tip Thermowell



N = 1/2" NPT
E = .25" nominal

| Catalog Number | Bore Size d | Nominal Pipe Size | Actual Diam P | R.F. Diam R | Root Diam Q | Tip Diam D |
|----------------|-------------|-------------------|---------------|-------------|-------------|------------|
| WV23-16 | .260" | 1" NPT | 1.315" | 2.000" | .750" | .500" |
| WV23-24 | .260" | 1 1/2" NPT | 1.900" | 2.875" | .875" | .500" |

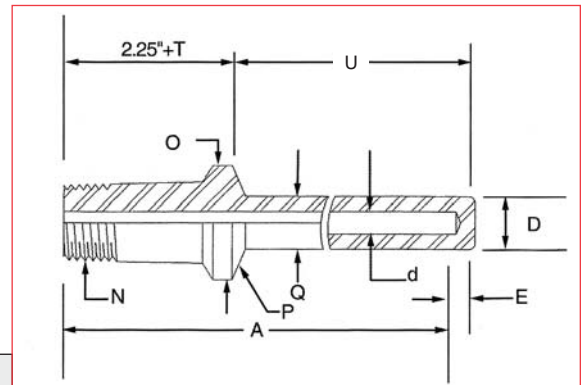
Tapered Thermowell



| Catalog Number | Bore Size d | Spherical Radius P | Conn Diam R | Root Diam Q | Tip Diam D |
|----------------|-------------|--------------------|-------------|-------------|------------|
| WG21-16 | .260" | 1" NPT | 1.375" | .875" | .625" |
| WG21-24 | .260" | 1 1/4" NPT | 1.750" | 1.063" | .625" |
| WG31-16 | .385" | 1" NPT | 1.375" | .875" | .766" |
| WG31-24 | .385" | 1 1/4" NPT | 1.750" | 1.063" | .766" |

N = 3/4" NPT
E = .25" nominal

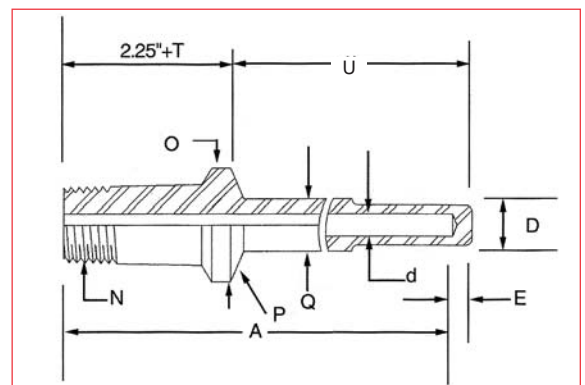
Straight Thermowell



| Catalog Number | Bore Size d | Spherical Radius P | Conn Diam R | Root Diam Q | Tip Diam D |
|----------------|-------------|--------------------|-------------|-------------|------------|
| WG22-16 | .260" | 1" NPT | 1.375" | .750" | .750" |
| WG22-24 | .260" | 1 1/4" NPT | 1.750" | .875" | .875" |
| WG32-16 | .385" | 1" NPT | 1.375" | .766" | .766" |
| WG32-24 | .385" | 1 1/4" NPT | 1.750" | .875" | .875" |

N = 3/4" NPT
E = .25" nominal

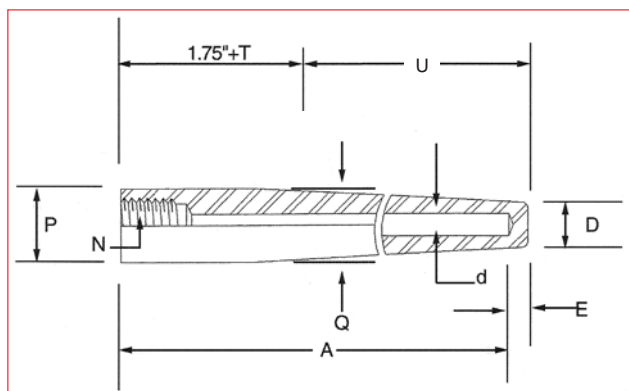
Reduced Tip Thermowell



| Catalog Number | Bore Size d | Spherical Radius P | Conn Diam R | Root Diam Q | Tip Diam D |
|----------------|-------------|--------------------|-------------|-------------|------------|
| WG23-16 | .260" | 1" NPT | 1.375" | .750" | .500" |
| WG23-24 | .260" | 1 1/4" NPT | 1.750" | .875" | .500" |

N = 3/4" NPT
E = .25" nominal

Tapered Thermowell



N = 1/2" NPT
E = .25" nominal

| Catalog Number | Bore Size d | Nominal Size P | Root Diam Q | Tip Diam D |
|----------------|-------------|----------------|-------------|------------|
| WW21-24 | .260" | 1 1/2" NPT | 1.500" | .625" |
| WW31-24 | .385" | 1 1/2" NPT | 1.500" | .766" |

STANDARD MANUFACTURING TOLERANCES

| | | | |
|-------------------|-----------------------|------------------------|----------------------------|
| "U" Length: | ± .063" for "U" < 25" | Bore Concentricity: | .0015" drift/in, .035" max |
| Overall Length: | Nominal | Stem Diameter: | ± .010" |
| Outside Diameter: | +0/-.032" | Tip Thickness: | .250" ± .063" |
| Bore Diameter: | +.005/-.003" | Instrument Connection: | 1/2" - 14 NPT, 5/8" deep |
| Bore Depth: | +.030/-0" | Surface Finish: | 16-32 RMS |

THERMOWELL IMMERSION LENGTH

The insertion length ("U" length) of a thermowell should be long enough to permit the entire length of the sensing element to project into the medium being measured in order to prevent errors resulting from insufficient immersion.

For liquids, insertion length = sensitive length + 2 diameters

For air & gases, insertion length = sensitive length + 4 diameters

Pipes should be insulated to minimize heat loss due to heat flow along the thermowell.
For higher velocities, refer to chart on page 9 or the calculations on our web site.

PRESSURE-TEMPERATURE RATINGS

(per ASME PTC 19.3)

$P = k_1 \times S$

P = Max Operating pressure (psi)

S = Allowable Stress (psi)

$k_1 = .41$ (for .260" bore)

| Material | ALLOWABLE STRESS (PSI X 1000) | | | | | | |
|-----------|-------------------------------|-------|-------|-------|-------|--------|--------|
| | TEMPERATURE (°F) | | | | | | |
| | 70°F | 300°F | 500°F | 700°F | 900°F | 1100°F | 1300°F |
| C.Stl | 14.3 | 14.3 | 13.6 | 11.9 | 5.0 | - | - |
| 304 SS | 20.0 | 15.0 | 12.9 | 11.7 | 10.8 | 9.8 | 3.7 |
| 310 SS | 20.0 | 16.1 | 14.3 | 13.3 | 12.5 | - | - |
| 316 SS | 20.0 | 15.6 | 13.3 | 12.1 | 11.5 | 11.1 | 4.1 |
| 321 SS | 20.0 | 16.5 | 14.3 | 13.0 | 12.3 | 6.9 | 1.7 |
| 446 SS | 18.6 | 18.3 | 18.1 | 17.9 | - | - | - |
| Inconel | 23.3 | 19.9 | 18.6 | 18.2 | - | - | - |
| Hast C-22 | 28.6 | 24.6 | 21.5 | 19.6 | 18.6 | 17.5 | - |
| Hast B-3 | 31.4 | 30.3 | 27.4 | 25.4 | - | - | - |
| Hast X | 23.3 | 19.2 | 16.5 | 15.1 | 14.5 | - | - |
| F22 SS | 21.4 | 20.9 | 20.5 | 20.0 | 15.8 | 3.2 | - |

Inconel is a trademark of International Nickel.

Hastelloy is a trademark of Haynes International Inc.

Tapered vs Straight Wells

Tapered shank wells provide greater stiffness with the same sensitivity. The higher strength-to-weight ratio gives these wells a higher natural frequency than the equivalent length straight shank well, thus permitting operation at a higher fluid velocity.

If vibratory stress is a potential problem, tapered wells should be used.

Velocity Rating

Thermowells are more likely to fail from the vibratory stress to which they are subjected, rather than from the effects of temperature and pressure.

Fluid flowing past a thermowell creates a turbulent wake, which causes alternating lateral forces on the well perpendicular to the direction of flow. This wake (or Strouhal) frequency (fw) is proportional to fluid velocity and well dimensions. If the wake frequency coincides with (or comes within 20% of) the natural frequency of the well, the resultant vibration could cause mechanical failure of the well. Thermowells are also normally safe if the natural frequency is well below the wake frequency or if the fluid velocity continually fluctuates through the critical velocity point.

The ASME calculations (PTC 19.3) are used to determine if the selected well dimensions provide a well strong enough to withstand the specified service conditions of temperature, pressure, velocity and vibration. The calculations are applicable for tapered wells with a fluid velocity less than 300 fps.

Recommended Maximum Fluid Velocity (fps)

The maximum velocities were calculated using the equations from the paper "Power Test Code Thermometer Wells" by J W Murdock. Based on well material 316 SS, water at 25 °F, air at 100 °F, steam at 1000 °F & 1000 psig. Maximum velocity limited to 300 fps. () # indicates velocity at which in-line resonance may occur.

| WT, WS, WG, WW | | | | "U" Length (in) | | | | | | | |
|----------------|------|------|-------|-----------------|--------------|-------------|------------|------------|------------|------------|------------|
| Liquid | Bore | Tip | Root | 2.5 | 4.5 | 7.5 | 10.5 | 13.5 | 16.5 | 19.5 | 22.5 |
| Water | .260 | .625 | 0.875 | 121 | 67 | 40 (38) | 29 (20) | 22 (12) | 15 (8) | 11 (6) | 8 (4) |
| | | | 1.063 | 170 | 94 | 56 (49) | 40 (25) | 30 (15) | 20 (10) | 14 (7) | 10 (5) |
| | | | 1.500 | 300 (74) | 167 (38) | 100 (23) | 71 (15) | 45 (11) | 30 (8) | 21 (13) | 16 (10) |
| | .385 | .766 | 0.875 | 92 | 51 | 30 | 22 | 17 (14) | 14 (9) | 11 (7) | 10 (5) |
| | | | 1.063 | 146 | 80 | 48 | 42 (30) | 26 (18) | 23 (12) | 17 (9) | 13 (7) |
| | | | 1.500 | 272 | 151 | 90 (89) | 64 (45) | 50 (28) | 36 (18) | 26 (13) | 19 (10) |
| Air | .260 | .625 | 0.875 | 300 | 211 | 76 | 39 | 23 | 15 | 11 | 8 |
| | | | 1.063 | 300 | 269 | 97 | 49 | 30 | 20 | 14 | 10 |
| | | | 1.500 | 300 | 300 | 147 | 75 | 45 | 30 | 21 | 16 |
| | .385 | .766 | 0.875 | 300 | 251 | 91 | 46 | 28 | 18 | 13 | 10 |
| | | | 1.063 | 300 | 300 | 116 | 59 | 36 | 24 | 17 | 13 |
| | | | 1.500 | 300 | 300 | 177 | 90 | 55 | 36 | 26 | 19 |
| Steam | .260 | .625 | 0.875 | 300 | 188 (94) | 68 (34) | 34 (17) | 27 (14) | 18 (9) | 13 (7) | 9 (5) |
| | | | 1.063 | 300 | 243 (122) | 87 (44) | 44 (22) | 27 (14) | 18 (9) | 13 (7) | 9 (5) |
| | | | 1.500 | 300 | 300 (185) | 133 (67) | 68 (34) | 41 (21) | 27 (14) | 19 (10) | 14 (7) |
| | .385 | .766 | 0.875 | 300 | 227 (114) | 82 (41) | 42 (21) | 25 (13) | 17 (9) | 12 (6) | 9 (5) |
| | | | 1.063 | 300 | 292 (146) | 105 (53) | 54 (27) | 32 (16) | 21 (11) | 15 (8) | 11 (6) |
| | | | 1.500 | 300 | 300 (222) | 161 (80) | 82 (41) | 49 (25) | 33 (17) | 23 (12) | 17 (9) |

| WF, WW | | | | "U" Length (in) | | | | | | | |
|--------|------|------|-------|-----------------|--------------|-------------|------------|------------|------------|-----------|-----------|
| Liquid | Bore | Tip | Root | 2 | 4 | 7 | 10 | 13 | 16 | 19 | 22 |
| Water | .260 | .625 | 0.875 | 151 | 75 | 43 44 | 30 (27) | 23 13 | 16 8 | 11 6 | 8 4 |
| | | | 1.063 | 213 | 106 | 60 (56) | 42 (27) | 32 (16) | 21 (11) | 15 (8) | 11 (6) |
| | .385 | .766 | 0.875 | 115 | 57 | 33 | 23 (26) | 17 (15) | 14 (10) | 12 (7) | 10 (5) |
| | | | 1.063 | 181 | 90 | 51 | 36 (33) | 27 (20) | 22 (13) | 18 (9) | 13 (7) |
| Air | .260 | .625 | 0.875 | 300 | 267 | 87 | 43 | 25 | 16 | 11 | 8 |
| | | | 1.063 | 300 | 300 | 111 | 54 | 32 | 21 | 15 | 11 |
| | .385 | .766 | 0.875 | 300 | 300 | 104 | 51 | 30 | 20 | 14 | 10 |
| | | | 1.063 | 300 | 300 | 134 | 65 | 39 | 25 | 18 | 13 |
| Steam | .260 | .625 | 0.875 | 300 | 300 (121) | 79 (40) | 38 (19) | 23 (12) | 15 (8) | 10 (5) | 8 (4) |
| | | | 1.063 | 300 | 300 (154) | 100 (50) | 49 (25) | 29 (15) | 19 (10) | 13 (7) | 10 (5) |
| | .385 | .766 | 0.875 | 300 | 300 (144) | 94 (47) | 46 (23) | 27 (14) | 18 (9) | 12 (6) | 9 (5) |
| | | | 1.063 | 300 | 300 (184) | 121 (61) | 59 (30) | 35 (18) | 23 (12) | 16 (8) | 12 (6) |

TANTALUM SHEATH

Tantalum sheaths protect Thermowells in corrosive processes such as chlorine, bromine, hydrochloric, nitric and sulphuric acids. Tantalum's high thermal conductivity and the thin-wall design of the sheath allow for rapid heat transfer. Since corrosion is not a problem with tantalum, it is best suited for Thermowells immersed directly into the process. The sheath covers the wetted parts of the well and must be ordered with the well to ensure correct fit. Standard thickness is .013" with a .015" flange. When using a sheath, a lower grade material may be used for the well.

Option code **A** is for tantalum, code **B** for user specified material. Other sheath materials include titanium, zirconium, and molybdenum.

Applies to straight wells only.

PROTECTIVE COATINGS

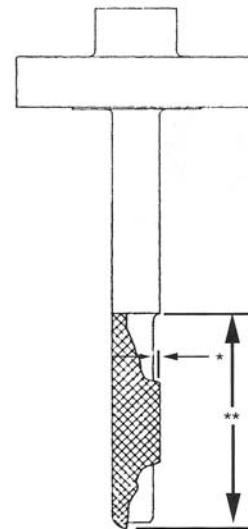
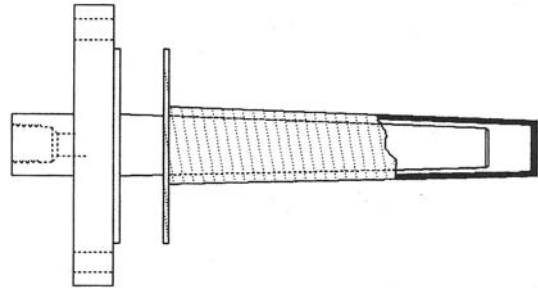
Chemical corrosion resistance can be improved by the addition of a fluoroplastic protective coating such as Teflon, to the thermowell. Teflon's ability to tolerate harsh chemical environments, makes it ideal for use in highly corrosive applications such as acid and caustics, food and beverage, pharmaceuticals, etc, where the temperature is less than 200°C (400°F). The Teflon coating is applied to the wetted parts of the thermowell (most commonly to flanged or Van Stone type) and is approximately 8 – 10 mil thick.

Option code **C** specifies Teflon coating; code **E** is for user specified material. Other protective coatings are materials such as Kynar, Tantalum, Hastelloy C are available.

Hard facing the thermowell with wear resistant material such as stellite, can enhance wear resistance and minimize erosion due to particle bombardment encountered in processes such as coal pulverizing, decoking, etc.

The hard face coating is usually applied on the finished dimensions of the well, and is approximately 1/32" thick (therefore the well OD will be 1/16" larger).

Option code **D** is for Stellite #6 coating; code **E** allows for user specified coating. Other hard face coatings can include: tungsten carbide, metco, alumina ceramic, boron nitride, chrome oxide. Specify coating material, length to be coated, thickness of coating and finish to be applied to coating.



*Coating thickness

**Coated length

Teflon is a trademark of E I du Pont
Kynar is a trademark of Pennwalt Corp.
Stellite is a trade name of Deloro Stellite
Hastelloy is a trademark of Haynes International Inc.

| Process Fluid | Conc. | Temp. | Well Material | Process Fluid | Conc. | Temp. | Well Material | Process Fluid | Conc. | Temp. | Well Material |
|----------------------|-----------|--------|---------------|---------------------|--------|--------|---------------|----------------------|--------|--------|---------------|
| Acetate Solvents | All | | Monel | Cottseed Oil | | | C.Stl. | Petroleum Ether | | | 304SS |
| Acetic Acid | 10% | 20°C | 304SS | Creosols | | 100°C | 304SS | Phenol | All | 100°C | 316SS |
| Acetic Acid | 50% | 100°C | 316SS | Cyanogen Gas | | | 304SS | Phosphoric Acid | 10% | 20°C | 316SS |
| Acetic Acid | 99% | 100°C | Monel | Dowtherm | | | C.Stl. | Phosphoric Acid | 85% | 100°C | Hast.C |
| Acetic Anhydride | | | Monel | Epson Salt | | | 304SS | Picric Acid | | 20°C | 304SS |
| Acetone | All | 100°C | 304SS | Ether | | 20°C | 304SS | Pot.Permanganate | 5% | 20°C | 304SS |
| Acetylene | | | 304SS | Ethyl Acetate | | | Monel | Potassium Bromide | | 20°C | 316SS |
| Alcohols | All | | 304SS | Ethyl Chloride | | 20°C | 304SS | Potassium Carbonate | 20% | 100°C | 316SS |
| Aluminum | | Molten | Cast Iron | Ethylene Glycol | All | 100°C | 304SS | Potassium Chlorate | | 20°C | 304SS |
| Aluminum Acetate | Saturated | | 304SS | Ethylene Oxide | | 20°C | C.Stl. | Potassium Chloride | 20% | 20°C | 316SS |
| Aluminum Sulphate | All | 100°C | 316SS | Ethyl Sulphate | | 20°C | Monel | Potassium Chloride | 20% | 100°C | Monel |
| Ammonia | All | 20°C | 304SS | Ferric Chloride | 1% | 20°C | 316SS | Potassium Hydroxide | 30% | 100°C | 316SS |
| Ammonium Chloride | All | 20°C | 316SS | Ferric Chloride | | 100°C | Tant. | Potassium Nitrate | 40% | 100°C | 316SS |
| Ammonium Fluoride | 25% | 65°C | Hast.C | Ferric Nitrate | | 100°C | Tant. | Potassium Nitrite | 20% | 20°C | 416SS |
| Ammonium Nitrate | All | 20°C | 304SS | Ferric Sulphate | All | 150°C | Tant. | Potassium Sulphate | 30% | 100°C | 316SS |
| Ammonium Sulphate | 5% | 20°C | 304SS | Fluorine | | 100°C | Hast.C | Potassium Sulphide | 10% | 100°C | 304SS |
| Ammonium Sulphate | All | 100°C | 316SS | Fluosilicic Acid | | 20°C | Carp.20 | Potassium Sulphite | 30% | 100°C | 304SS |
| Aniline | All | 20°C | 304SS | Formaldehyde | 40% | 100 °C | 316SS | Propane | | 150°C | C.Stl. |
| Amyl Acetate | All | 150°C | Monel | Formic Acid | All | 150°C | 316SS | Pyrogallic Acid | | | 304SS |
| Asphalt | | 120°C | 304SS | Furfural | | 200°C | 316SS | Quinine Bisulphate | Dry | | 316SS |
| Barium Carbonate | | 20°C | 304SS | Galic Acid | 5% | 65°C | Monel | Quinine Sulphate | Dry | | 304SS |
| Barium Chloride | Saturated | 20°C | Monel | Gasoline | | 20°C | 304SS | Resin | | | 316SS |
| Barium Chloride | Aqueous | | 316SS | Glucose | | 20°C | 304SS | Salicylic Acid | | | Nickel |
| Barium Hydroxide | | | C.Stl. | Glycerine | | 100°C | Brass | Salommoniac | | 20°C | Monel |
| Barium Sulphide | | | 304SS | Glycerol | | 20°C | 304SS | Sea Water | | 20°C | Monel |
| Barium Sulphite | | | Nichrome | Hydrobromic Acid | All | 100°C | Hast.B | Shellac | | | 304SS |
| Baroacic Acid | 5% | | 304SS | Hydrochloric Acid | All | 100°C | Tant. | Silver Chloride | | 20°C | Carp.20 |
| Beer | | 20°C | 304SS | Hydrocyanic Acid | All | 100°C | 304SS | Silver Nitrate | | 100°C | 304SS |
| Benzaldehyde | | | 304SS | Hydrogen Chloride | Dry | 250°C | 304SS | Sodium Bicarbonate | All | 65°C | 316SS |
| Benzene, Benzol | | 100°C | 304SS | Hydrofluoric Acid | 60% | 100°C | Hast.C | Sodium Bisulphate | 20% | 100°C | Hast.B |
| Benzoic Acid | All | 100°C | 316SS | Hydrogen Peroxide | | 100°C | 304SS | Sodium Bisulphite | 20% | 100°C | Hast.C |
| Black Liquor | | | Hast.C | Hydrogen Sulphide | Dry | 100°C | 316SS | Sodium Carbonate | 20% | 100°C | 316SS |
| Bleaching Powder | 15% | 20°C | Monel | Iodine | | 20°C | Hast.C | Sodium Chloride | 30% | 20°C | 316SS |
| Borax | All | 100°C | Brass | Kerosene | | 150°C | 304SS | Sodium Chloride | 30% | 100°C | Monel |
| Bordeaux Mixture | All | 100°C | 304SS | Lactic Acid | 5% | 65°C | 316SS | Sodium Chromate | All | 100°C | 316SS |
| Boric Acid | All | 200°C | 316SS | Lactic Acid | 10% | 100°C | Tant. | Sodium Fluoride | 5% | 20°C | Hast.B |
| Bromine | Wet | 20°C | Tant. | Lacquer | | 100°C | 316SS | Sodium Hydroxide | 30% | 100°C | 316SS |
| Bromine | Dry | 20°C | Tant. | Latex | | 100°C | C.Stl. | Sodium Hypochlorite | | | Tant. |
| Butadiene | | 70°C | Brass | Lime Sulphur | | | | Sodium Nitrate | 40% | 100°C | 304SS |
| Butane | | 200°C | C.Stl. | Linseed Oil | | 20°C | 304SS | Sodium Nitrate | 20% | 20°C | 304SS |
| Butylacetate | | | Monel | Magnesium Carbonate | | 65°C | 304SS | Sodium Peroxide | Fused | | 304SS |
| Butyl Alcohol | | | Copper | Magnesium Chloride | 5% | 20°C | Monel | Sodium Phosphate | 10% | 100°C | C.Stl. |
| Butylenes | | | C.Stl. | Magnesium Chloride | 5% | 100°C | Nickel | Sodium Silicate | 10% | 100°C | C.Stl. |
| Butyric Acid | | 20°C | 304SS | Magnesium Hydroxide | All | 20°C | 304SS | Sodium Sulphide | 10% | 100°C | 316SS |
| Butyric Acid | | 100°C | Hast.C | Magnesium Nitrate | | 65°C | 304SS | Sodium Sulphite | 30% | 100°C | 304SS |
| Calcium Bisulfite | | 20°C | 316SS | Magnesium Oxide | All | 20°C | 304SS | Sodium Sulphate | 30% | 100°C | 316SS |
| Calcium Chlorate | Dilute | 65°C | 304SS | Magnesium Sulphate | 40% | 100°C | 304SS | Steam | | | 304SS |
| Calcium Bicarbonate | | | 304SS | Mailic Acid | | 100°C | 316SS | Stearic Acid | | | 316SS |
| Calcium Carbonate | | | Hast.B | Mercury | 100% | 350°C | C.Stl. | Sulphur | | Molten | 304SS |
| Calcium Chloride | All | 100°C | Hast.C | Methane | | 20°C | C.Stl. | Sulphur | Wet | | 316SS |
| Calcium Fluoride | | | 304SS | Mercuric Chloride | 10% | 20°C | Hast.C | Sulphur Dioxide | | 250°C | 316SS |
| Calcium Hydroxide | 20% | 100°C | 304SS | Methyl Chloride | Dry | 20°C | C.Stl. | Sulphur Trioxide | Dry | 250°C | 316SS |
| Calcium Hydroxide | 50% | 100°C | Hast.C | Methylene Chloride | All | 100°C | 304SS | Sulphuric Acid | All | 100°C | Hast.B |
| Calcium Hypochlorite | 15% | 20°C | Monel | Milk | | 80°C | 304SS | Sulphuric Acid | Fuming | 185°C | Carp.20 |
| Carbolic Acid | All | 100°C | 316SS | Molasses | | 150°C | 304SS | Sulphurous Acid | 20% | 20°C | 316SS |
| Carbon Dioxide | Dry | | C.Stl. | Muriatic Acid | | 20°C | Tant. | Tannic Acid | 40% | 20°C | Hast.B |
| Carbon Dioxide | Wet | | C.Stl. | Naphta | | 20°C | 304SS | Tar | | | C.Stl. |
| Carbon Tetrachloride | All | 20°C | Monel | Natural Gas | | 20°C | 304SS | Tartaric Acid | | 20°C | 304SS |
| Carbonic Acid | | 100°C | 304SS | Neon | | 20°C | 304SS | Tartaric Acid | | 65°C | 316SS |
| Chloracetic Acid | All | 150°C | Hast.C | Nickel Chloride | | 20°C | 304SS | Tin | | Molten | Cast Iron |
| Chlorex Caustic | | | 316SS | Nickel Sulphate | | 100°C | 304SS | Tinan. Tetrachloride | All | 20°C | 316SS |
| Chlorine Gas | Dry | 20°C | C.Stl. | Nitric Acid | 50% | 100°C | 304SS | Toluene | | | 304SS |
| Chlorine Gas | Moist | 20°C | Hast.C | Nitric Acid | 65% | 100°C | 316SS | Trichloracetic Acid | All | 20°C | Hast.B |
| Chloroform | Dry | 100°C | Monel | Nitric Acid | 100% | 100°C | Tant. | Trichlorethylene | Dry | 150°C | Monel |
| Chromic Acid | 5% | 20°C | 304SS | Nitrobenzene | | 20°C | 304SS | Turpentine | | 20°C | 316SS |
| Chromic Acid | 50% | 100°C | Hast.C | Nitrous Acid | | 20°C | 304SS | Varnish | | 65°C | C.Stl. |
| Cider | All | 150°C | 304SS | Oleic Acid | All | 200°C | 316SS | Vegetable Oils | | | 304SS |
| Citric Acid | 15% | 20°C | 304SS | Oleum | | 20°C | 316SS | Vinegar | | | 304SS |
| Citric Acid | All | 100°C | Hast.C | Oxalic Acid | 5% | 20°C | 304SS | Water | Fresh | | Copper |
| Coal Tar | | Hot | 304SS | Oxalic Acid | 10% | 100°C | Monel | Whiskey, Wine | | | 304SS |
| Coke Oven Gas | | 20°C | Alum. | Oxygen | | 20°C | C.Stl. | Xylene | | | Copper |
| Copper Nitrate | All | 150°C | 316SS | Oxygen | Liquid | | 304SS | Zinc | | Molten | Cast Iron |
| Copper Sulphate | All | 150°C | 316SS | Palmitic Acid | All | 200°C | 316SS | Zinc Chloride | All | 100°C | Hast.B |
| Corn Oils | | 100°C | 316SS | Pentane | | | 304SS | Zinc Sulphate | All | 100°C | 316SS |

The materials recommended above are a guide only. This information does not imply a guarantee of adequate or successful use of any of the listed materials in any specific application.

WF 22 - 16 - 316 - 125 - 20 - 1R - 316 - 0
 1 2 3 4 5 6 7 8 9

1: STYLE CODE

- WT – Threaded
- WS – Socket Weld
- WV – Van Stone
- WF – Flanged
- WW – Weld-In
- WG – Ground Joint

2: BORE / STEM CODE

- | | |
|----------------------|----------------------|
| 21 – .260", Tapered | 31 – .385", Tapered |
| 22 – .260", Straight | 32 – .385", Straight |
| 23 – .260", Reduced | 99 – Special |

If root/tip dimensions are not standard. Use Code 99 and specify details.

3: PROCESS CONNECTION CODE

- | | |
|-------------------------|-----------------------------|
| Threaded: 08 – 1/2" NPT | Van Stone: 16 – 1" Pipe |
| 12 – 3/4" NPT | 24 – 1 1/2" Pipe |
| 16 – 1" NPT | |
| Weld-In: 24 – 1 1/2" | Socket Weld: 12 – 3/4" Pipe |
| | 16 – 1" Pipe |
| Flanged: 16 – 1" Flg | Ground Joint: 16 – 1" |
| 24 – 1 1/2" Flg | 20 – 1 1/4" |
| All std sizes | |
| | Special:* 99 |

4: WELL MATERIAL CODE

- | | |
|-------------------|----------------------|
| 304 – 304 SS | TAT – Tantalum |
| 310 – 310 SS | TIT – Titanium |
| 316 – 316 SS | CST – Carbon Steel |
| 321 – 321 SS | ALM – Aluminum |
| 347 – 347 SS | HSB – Hastelloy B-3 |
| 446 – 446 SS | HSX – Hastelloy X |
| 600 – Inconel 600 | HSC – Hastelloy C-22 |
| 601 – Inconel 601 | TEF – Teflon |
| 825 – Incoloy 825 | KYN – Kynar |
| 020 – Carp 20 | PVC – PVC |
| 400 – Monel 400 | ZIR – Zirconium |
| NIK – Nickel | XXX – Special* |
| BRS – Brass | |

Inconel, Incoloy & Monel are trademarks of International Nickel
 Hastelloy is a trademark of Haynes International Inc.
 Carp 20 is a trademark of Carpenter Technology Corp.
 Stellite is a trademark name of Deloro Stellite

5: "U" LENGTH CODE

- 3-digit code representing "U" length
 Code = length in mm x .3937 (eg: U = 150mm; Code = 059)
 = length in inches x 10 (eg: U = 7.5", Code = 075)
 Standard lengths for WT, WS, WG, WV:
 with no lag ext: 2.5", 4.5", 7.5", 10.5",
 13.5", 16.5", 22.5"
 with std lag ext: 2.5", 4.5", 7.5", 10.5",
 13.5", 19.5"
 Standard lengths for WF, WW:
 with no lag ext: 2, 4, 7, 10, 13, 16, 22
 with std lag ext: 2, 4, 7, 10, 13, 19

6: "T" LENGTH CODE

- 2-digit code representing "T" length
 Code same as for "U" length code (except 2 digits)
 Use "00" for no lag extension
 Standard lag extension is 3" (Code 30); 2" for U = 2 1/2"

7: FLANGE RATING/FACE CODE

- | | |
|------------|----------------------------|
| 1 – 150 # | R – Raised Face |
| 3 – 300 # | F – Flat Face |
| 4 – 400 # | J – Ring Joint |
| 6 – 600 # | |
| 9 – 900 # | XX – Special* |
| 5 – 1500 # | 00 – not applicable |
| 2 – 2500 # | (for Styles other than WF) |

8: FLANGE MATERIAL CODE

- Same codes as Well Material
 (Use for backing flange for WV and WG, if required)
 000 – none or n/a (use for Styles WT, WS, WW)

9: OPTION CODE

- | | |
|----------------------------|-------------------------------|
| 0 – None | A – Tantalum Sheath |
| 1 – Brass Plug/Chain | B – User Specified Sheath |
| 2 – SS Plug/Chain | C – Teflon Coated |
| 3 – Hydrostatic Test | D – Stellite Coated |
| 4 – Dye Penetrant Test | E – User Specified Coating |
| 5 – Full Penetration Weld | F – 4-10 RMS Hi Polish Finish |
| 6 – Heat Treat | G – 6-100 RMS Satin Finish |
| 7 – Mill Test Report | H – Stress Relieving |
| 8 – O ₂ Cleaned | J – Radiograph (X-Ray) |
| | S – Special* |

*specify details