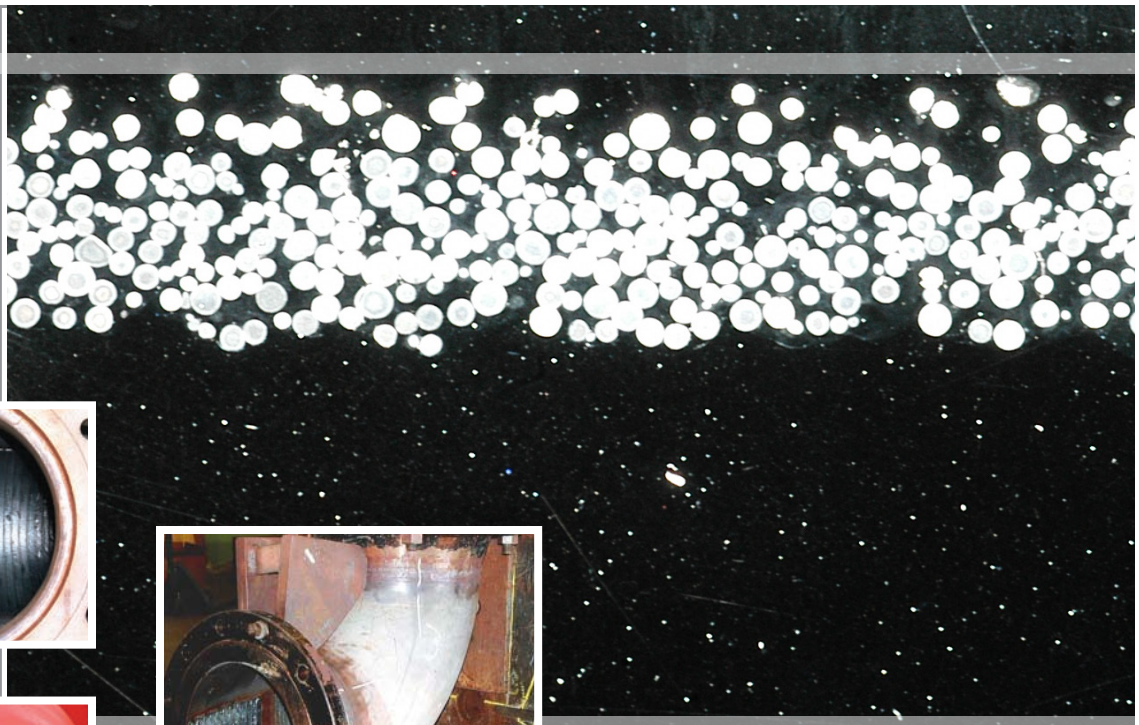
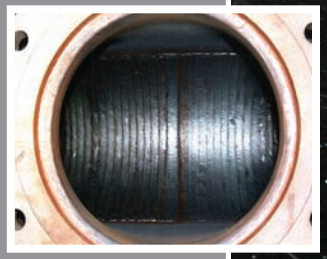
VALVTECHNOLOGIES





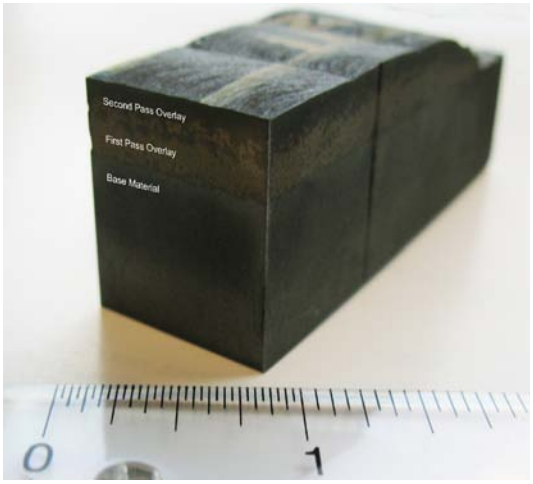


# Rhinoite™

## Tungsten Carbide Hardfacing

# Rhinoite™

**Rhinoite™ is a patented process that wears five to seven times longer in service operation than bare metal.**




## The Rhinoite™ process is an innovative, patented MIG weld overlay that utilizes state of the art equipment — producing extraordinary results.

The process can be adapted to all service environments, in every wear application: erosion, corrosion, adhesion and high temperature applications (2200°F). Rhinoite™ has been a proven leader of hard metal overlay on elbows, t-sections and choke tubes in chemical plants and refineries for the past six years with zero failures. The Rhinoite™ weld process focuses on minimizing loss of production time by wearing five to seven times longer than bare metal. Rhinoite™ overlays can be completely refurbished after years of service, reducing overall material and maintenance costs.

### Rhinoite™ Provides Bottom-line Cost Savings

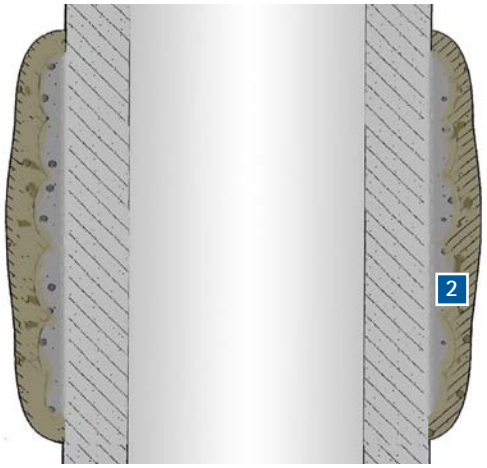
- Minimizes loss of production time by wearing five to seven times longer in service operations than bare metal
- Reduces number of shutdowns servicing times to years rather than months
- Eliminates equipment rentals, insulation replacement, and inspection frequency
- Reduces required man-hours for overall maintenance of units
- Overlays onto most refining used materials
- Reduces overall material cost by being able to be completely refurbished after years of service; eliminating the need to purchase new components

# Rhinoite™ Weld Hardfacing Application Process

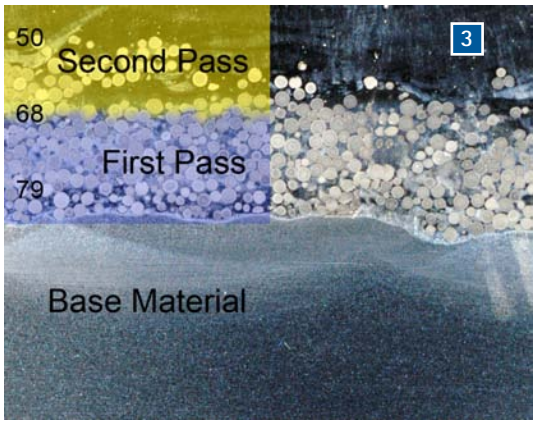
**1 Pre-heating of component.**
Selection of weld material; carbon steel, stainless steel, Duplex steel, Colmonoy and Inconel. The component has been preheated. The first pass of overlay is weld wire plus carbide content.


**2 Step two, second pass.**
Overlaying of first pass with weld material only (zero carbide). The second pass normalizes the first pass with base material, minimizing the Heat Affected Zone (HAZ) with base material. The first pass then becomes molecularly homogeneous with the base material.

This process establishes the matrix of the overlay. A percentage of the saturated carbide is diluted, with the remainder migrating to form a new alloy material called the matrix.




**3 Finishing overlay to desired dimensions.**
Outside diameter dimensions are accomplished by diamond grinding only. Inside diameter dimensions, depending upon application, are generally left as welded. Vertical grinding is available upon request, based upon diameter and length of product.




## Applications

Elbows
Pumps
Valves
Stabilizers
Bearings
T-Sections
Furnace Bends
Furnace Caps
Coker Nozzles
Choker Tubes

## Exceptional Wear Resistance

**Pictured left:** *Syngas choker tube processes water discharge at 9,000 psi / 800°F. Duplex 312 stainless steel overlay.*

**Pictured right:** *a 12-inch diameter Flexi-Coker 90 degree short radius elbow. It can process coke particles in excess of 600 feet per second and at approximately 400°F. Overlay is .350 thick and Duplex 312 stainless steel.*

The Rhinoite™ weld process has been subject to extensive corrosion and erosion testing. Once tested for 2000 hours with direct salt spray fog, microscopic examination of the carbide coated surfaces at the interim inspection showed little to no effect on the carbide surfaces throughout the test period. Additionally, upon removal of the Rhinoite™ overlaid products after glass bead abrasive blasting, the component surfaces were virtually unaffected. (ASTM B117 - 90 - Standard Test Method of Salt Spray)

## Test Parameters

- 48,000 psi Water Jet
- 250 g/min of 80 Mesh Fresh Garnet
- .040 inch Diamond Orifice @ 1/8 inch stand-off with 1/8 inch min traverse speed
- Depth of Kerf in Rhinoite™ - .025/.050 inch
- Comparable Wear Resistance: 1/4 inch Rhinoite™ = 16 inch Inconel 718

**Pictured left:** *6-inch diameter short radius furnace bend. Duplex 312 stainless steel overlay, base material 304H.*

**Pictured right:** *5-inch in length radius furnace bends. The overlay is Duplex 312 stainless. These bends operate at 1200°F.*

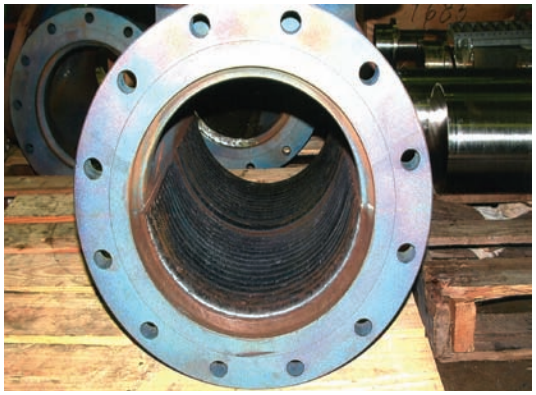
## Rhinoite™ Hardfacing

**Pictured left:** *is a 14-inch diameter, Flexi-Coker t-section.*

**Pictured right:** *is a 5-inch diameter 304H stainless steel, short radius furnace bend. This elbow's operating temperature is 1200°F. The Rhinoite™ weld overlay makes it extremely fluid erosion resistant.*

Using a MIG weld process an initial overlay of mild steel wire with dispersed cemented metal carbide pellets is applied to a base material. As the second pass is applied, a portion of the hard metal particles in the first overlay are dispersed in the weld puddle forming the Rhinoite™ matrix. The result is a steel hybrid matrix that can be diamond ground down to desired dimensions. The process provides improvements in wear resistance that enable the component to have an extended service life even when used in highly erosive and/or corrosive environments.

- Custom Matrix of Duplex Stainless Steel, 309L Stainless, Carbon Steel, Inconel, Colomony 56, Tool Steel and Nickle Alloys
- Tungsten Carbide Content Up to 80% Weight
- Fluid Erosion Resistant
- Corrosion Resistant
- Oxidation Resistant
- Hot Hardness - 1200°F
- Thickness up to 5/8 inch



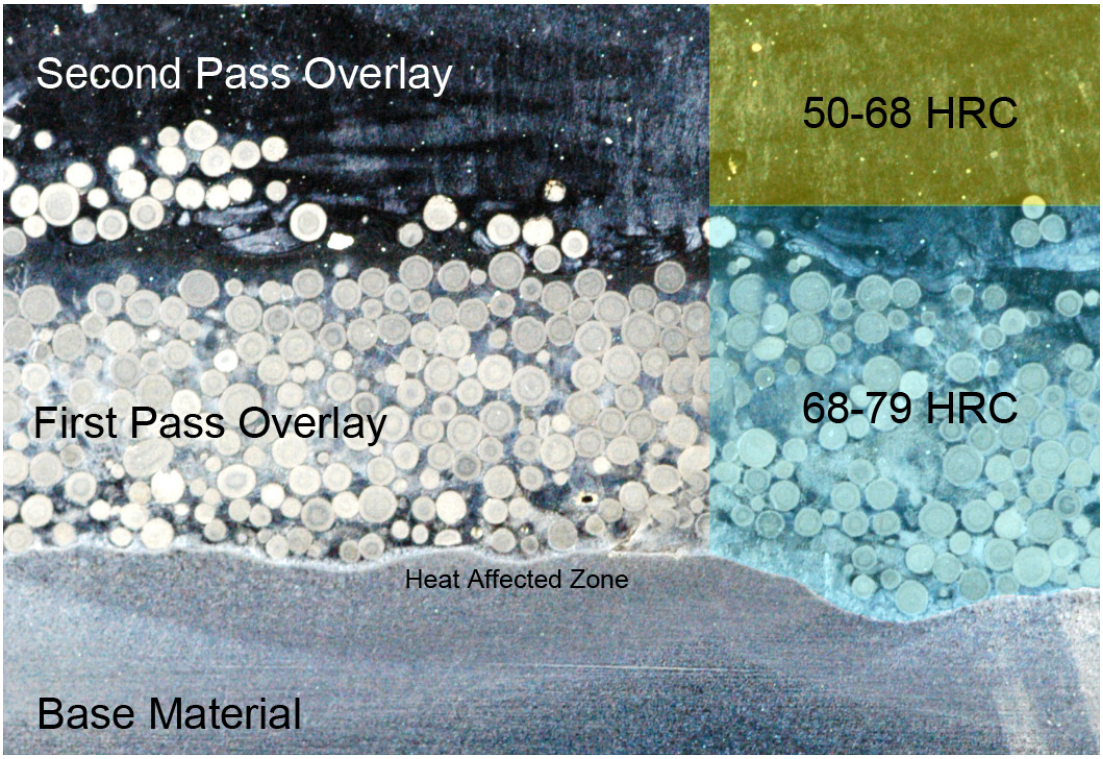
**Pictured left:** *is a 10-inch diameter, de-coke t-section. The overlay is 200 degree grid, .350 thick.*

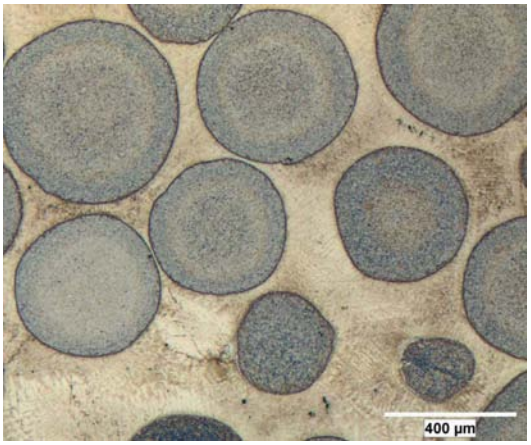
**Pictured right:** *is a coker scrubber nozzle, 316 stainless steel, Duplex 312 overlay. This nozzle can process 3,000 gallons of water per minute.*

# Rhinoite™ Hardfacing

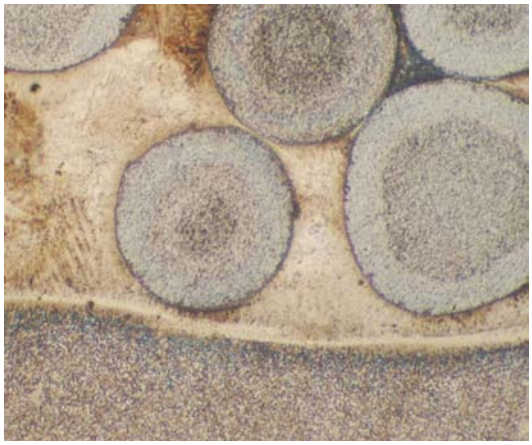
## Cross Section

The second pass of the overlay acts as an oven baking the first pass of the overlay releasing tungsten particles into the matrix




50X zoom showing tungsten pellets in the matrix. Notice the inner-ring shape of the pellets where the molecular reaction releases the tungsten into the matrix.



50X Zoom showing pellets next to Substrate condition of heat affected zone showing no cracking or stress.

## Hardness Profile

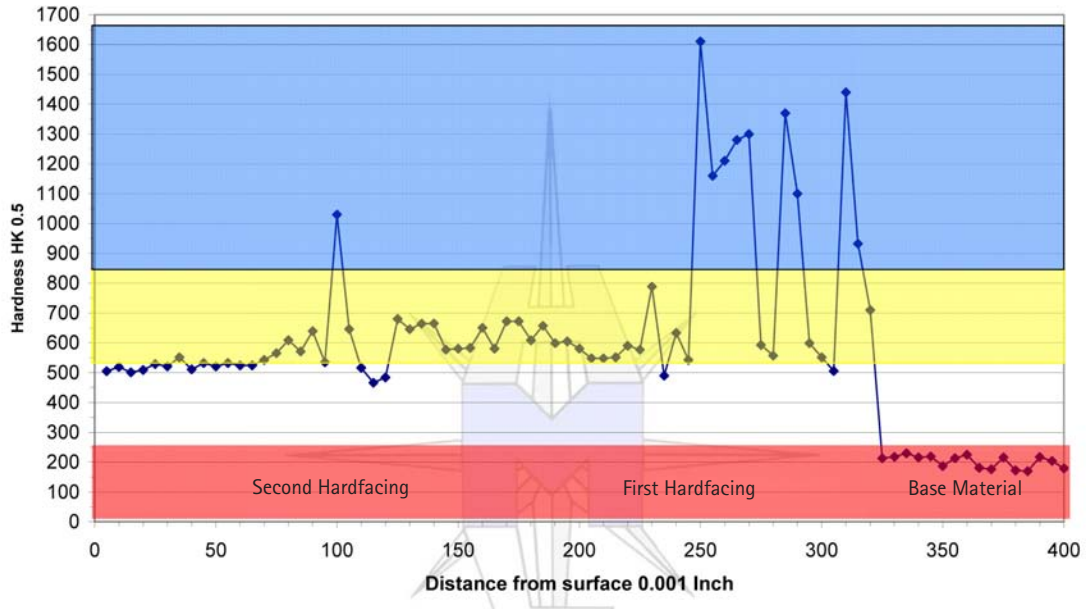
**RHINOITE ™ HARDFACING**
**DATE OF TEST: 01/04/11**
**REPORT OF HARDNESS PROFILE**

**KNOOP 0.5 Kg (500 g) LOAD TEST RESULTS**
**HRB Readings in RED**

| SPECIMEN NO: | # | Distance from surface inches | Reading HK 0.5 | HRC Converted | # | Distance from surface inches | Reading HK 0.5 | HRC Converted | # | Distance from surface inches | Reading HK 0.5 | HRC Converted |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1558-10 | 1 | 0.005 | 505 | 48 | 28 | 0.140 | 665 | 57 | 55 | 0.275 | 593 | 53 |
| | 2 | 0.010 | 519 | 49 | 29 | 0.145 | 577 | 52 | 56 | 0.280 | 557 | 51 |
| | 3 | 0.015 | 501 | 47 | 30 | 0.150 | 580 | 52 | 57 | 0.285 | 1370 | <80 |
| | 4 | 0.020 | 509 | 48 | 31 | 0.155 | 583 | 52 | 58 | 0.290 | 1100 | <80 |
| | 5 | 0.025 | 529 | 49 | 32 | 0.160 | 650 | 56 | 59 | 0.295 | 599 | 53 |
| | 6 | 0.030 | 521 | 49 | 33 | 0.165 | 580 | 52 | 60 | 0.300 | 551 | 51 |
| | 7 | 0.035 | 551 | 51 | 34 | 0.170 | 672 | 57 | 61 | 0.305 | 506 | 48 |
| | 8 | 0.040 | 511 | 48 | 35 | 0.175 | 672 | 57 | 62 | 0.310 | 1440 | <80 |
| | 9 | 0.045 | 532 | 49 | 36 | 0.180 | 609 | 54 | 53 | 0.315 | 932 | <80 |
| | 10 | 0.050 | 521 | 49 | 37 | 0.185 | 657 | 56 | 64 | 0.320 | 710 | 59 |
| | 11 | 0.055 | 532 | 49 | 38 | 0.190 | 599 | 53 | 65 | 0.325 | [illegible] | [illegible] |
| | 12 | 0.060 | 524 | 49 | 38 | 0.195 | 605 | 54 | 66 | 0.330 | [illegible] | [illegible] |
| | 13 | 0.065 | 524 | 49 | 40 | 0.200 | 580 | 52 | 67 | 0.335 | [illegible] | [illegible] |
| | 14 | 0.070 | 543 | 50 | 41 | 0.205 | 548 | 50 | 68 | 0.340 | 216 | 93 |
| | 14 | 0.075 | 565 | 51 | 42 | 0.210 | 548 | 50 | 69 | 0.345 | 219 | 94 |
| | 16 | 0.080 | 609 | 54 | 43 | 0.215 | 551 | 51 | 70 | 0.350 | 187 | 87 |
| | 17 | 0.085 | 571 | 52 | 44 | 0.220 | 590 | 53 | 71 | 0.355 | 213 | 92 |
| | 18 | 0.090 | 639 | 56 | 45 | 0.225 | 577 | 52 | 72 | 0.360 | 225 | 95 |
| | 19 | 0.095 | 535 | 50 | 46 | 0.230 | 788 | 62 | 73 | 0.365 | 181 | 85 |
| | 20 | 0.100 | 1030 | <80 | 47 | 0.235 | 490 | 47 | 74 | 0.370 | 176 | 84 |
| | 21 | 0.105 | 646 | 56 | 48 | 0.240 | 633 | 55 | 75 | 0.375 | 216 | 93 |
| | 22 | 0.110 | 516 | 48 | 49 | 0.245 | 543 | 50 | 76 | 0.380 | 172 | 83 |
| | 23 | 0.115 | 466 | 45 | 50 | 0.250 | 1610 | <80 | 77 | 0.385 | 170 | 82 |
| | 24 | 0.120 | 484 | 46 | 51 | 0.255 | 1160 | <80 | 78 | 0.390 | 217 | 93 |
| | 25 | 0.125 | 680 | 58 | 52 | 0.260 | 1210 | <80 | 79 | 0.395 | 204 | 91 |
| | 26 | 0.130 | 646 | 56 | 53 | 0.265 | 1280 | <80 | 80 | 0.400 | 179 | 85 |
| | 27 | 0.135 | 664 | 57 | 54 | 0.270 | 1300 | <80 | | | | |

Hit Base Material
HRB Scale
Not Converted

Readings <50 are not highlighted
Readings 50-68 are highlighted in Yellow
Readings 68-79 are highlighted in Blue
Readings >80 are highlighted in Red and are HRB and not HRC

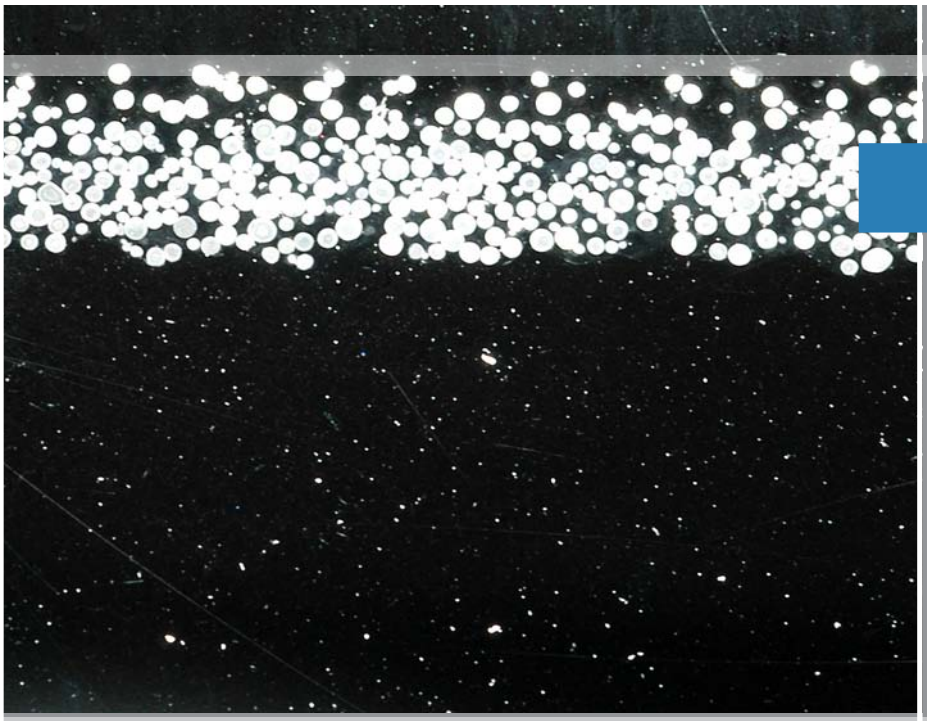



A full report of the Rhinoite™ hardness test results can be requested by contacting:
sales@valv.com
+1 713 860 0400

Note: The surface hardens as it wears down towards the molecular structure of the Rhinoite™ hardfacing layer as it gets closer to the base material.

# Rhinoite™

## Tungsten Carbide Hardfacing



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**ValvTechnologies products are certified to:**

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