Wear-resistant coatings of thermowells

Abrasive wear for thermowells

Abrasive wear, or abrasion, is the term used with thermowells to describe the loss of material caused by the mechanical action of a solid on the thermowell caused by a flowing medium. Typical applications are, for example, an FCC unit (Fluid Catalytic Cracking unit) in a refinery or coal-dust pipes in power plants.

In order to prevent abrasion, attention must be paid to a suitable material selection when designing the thermowell. Less sensitive to abrasive wear than the most commonly used stainless steel are metallic cobalt-chromium based hard alloys.

The most commonly used hard alloy for thermowells is Stellite® 6. This can be used as solid-body material, in welded or sprayed form. Alongside Stellite® 6, Stellite® 12 is also used.

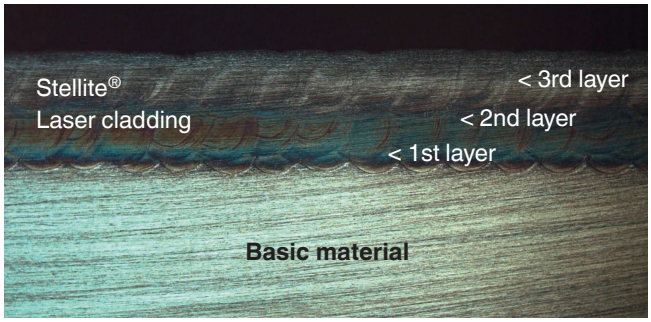
Stellite® is a registered trademark of Kennametal Stellite.

Damage to abrasively loaded thermowells (examples)

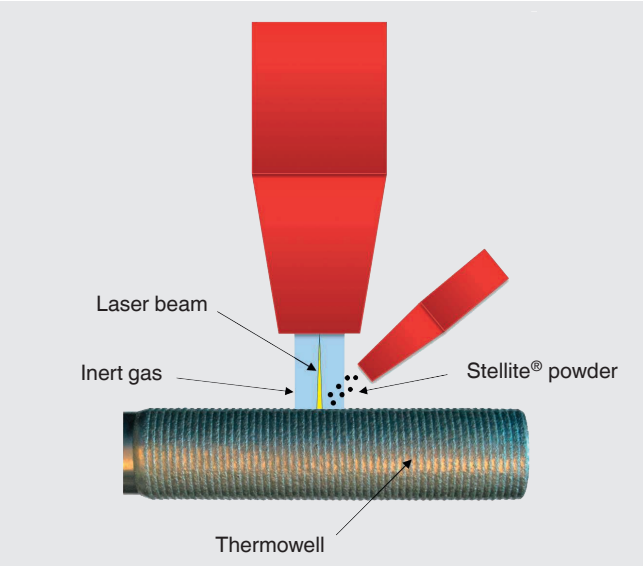
Coating with Stellite® through melting

Coating with Stellite® through melting is the highest quality method, since the Stellite® powder is firmly welded to the carrier material of the thermowell body. Therefore, this method is highly recommended for heavy-duty applications in refineries of the oil and gas industry.

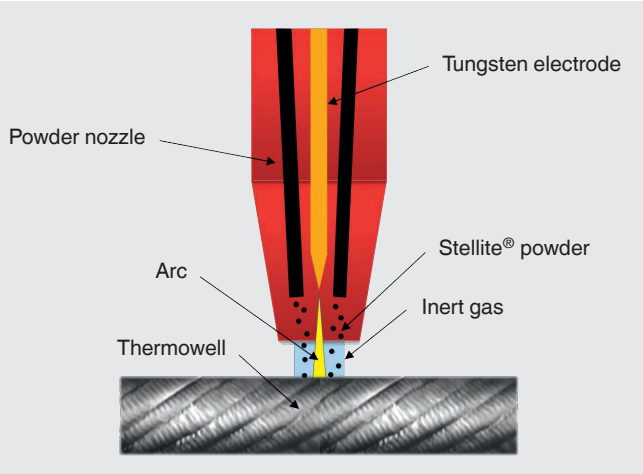
We distinguish between 2 processes:



- **Laser cladding**
  With this process, the Stellite® powder is introduced into a laser beam and welded to the thermowell surface. The precisely meterable energy input enables a very low-distortion coating. By building-up in several layers welded to each other, large layer thicknesses are possible.



- **Plasma Transfer Arc (PTA)**
  With the PTA process (Plasma Transfer Arc), an arc is created between a tungsten electrode and the thermowell body. The Stellite® powder is introduced to the arc and melted onto the thermowell material.

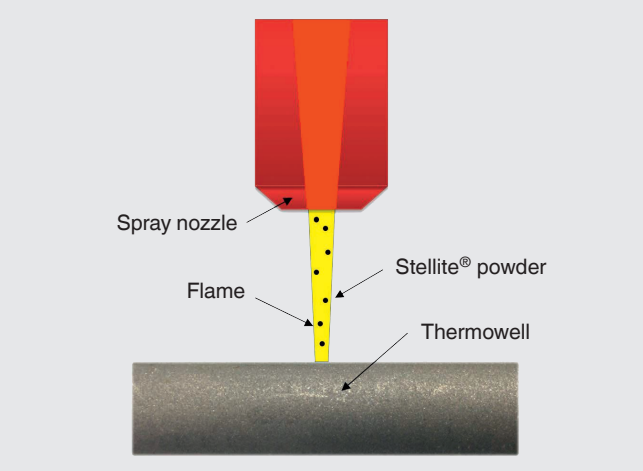


Coating with Stellite® in spray process

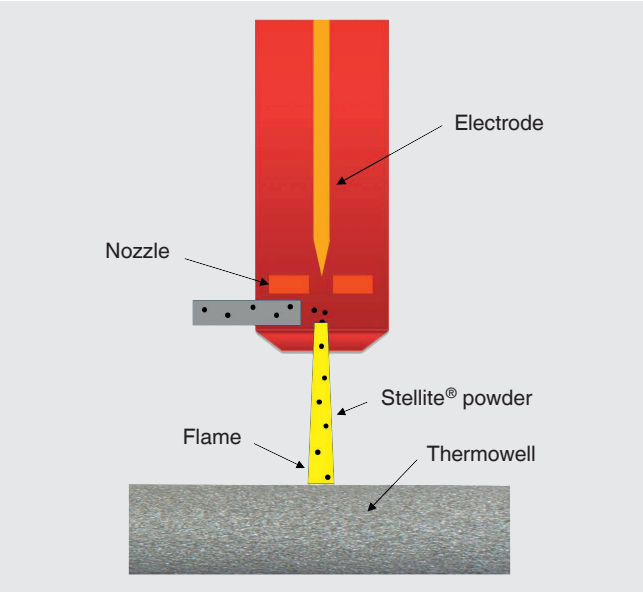
Coating with Stellite® through spraying is a process through which the Stellite® powder is permanently adhered to the surface of the thermowell body. This procedure is recommended for normal applications, such as in wastewater treatment plants.

Here we also distinguish between 2 processes:

- **High Velocity Oxygen Fuel spraying (HVOF)**
  The HVOF process (High-Velocity-Oxygen-Fuel) involves continuous combustion under high pressure, using a wide variety of fuels. The Stellite® powder is fed into the escaping gas jet and accelerated by it. On impacting on the thermowell surface, the layer is applied through the adhesion of the powder particles.



- **Atmospheric Plasma Spraying (APS)**
  The APS process (Atmospheric Plasma Spraying) features an arc ignited between an electrode and the cathode, through which the plasma gas is passed. The Stellite® powder is introduced into the plasma flame emerging from the nozzle, and it is melted by the high temperatures, impacts the thermowell and adheres to it.



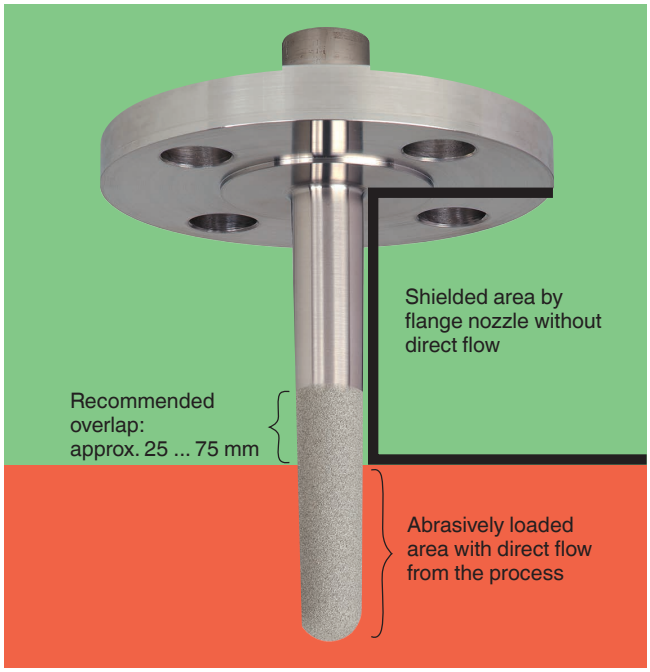
Coating process in overview

Coating process	Resistance	Layer thickness	Costs	Application (typical application)
Laser cladding	**++++**	> 3.2 mm possible	€€€	Oil and gas industry
Plasma Transfer Arc (PTA)	**+++**	1.6 mm (standard)	€€	Oil and gas industry
Atmospheric Plasma Spraying (APS)	**++**	< 1.6 mm	€	Wastewater
High Velocity Oxygen Fuel spraying (HVOF)	**+**	< 0.8 mm	€	Pulp industry

Recommended length of the Stellite® coating

In principle, it is possible to coat the thermowell with Stellite® over its entire insertion length, whereby the area of the process connection (flange or thread) is basically excluded from the coating.

Since the length of the thermowell shielded by the flange nozzle is not directly exposed to the abrasive process loads, limiting the coated length should be considered for economic reasons. In general, an overlap of 25 ... 75 mm is considered as sufficient.



Wake frequency calculation

ASME PTC 19.3 TW-2016, in Section “1 - 2 Scope”, excludes coated thermowells from the scope of the standard.

Original text from ASME PTC 19.3 TW-2016:
“Thermowells … including flame spray or weld overlays, at any place along the length of the shank or at the tip are outside the scope of this Standard.”

For this reason, any wake frequency calculation commissioned can only be informative in nature.

WIKA Alexander Wiegand SE & Co. KG
Alexander-Wiegand-Straße 30
63911 Klingenberg/Germany
Tel. +49 9372 132-0
Fax +49 9372 132-406
info@wika.de
www.wika.de