UNDERSTAND THE SURFACE BEFORE DESIGNING THE COATING.

Flange & Heating Element Socket (Bottom Flange) — The same hot water, pressure and pH environment as the tank; plus local thermal cycling and scale build-up around the heating element. Before designing the right coating, we evaluate the material chemistry, the geometry and the service conditions together.

PART DIAGRAM — FLANGE & HEATING ELEMENT SOCKET (BOTTOM FLANGE)



COATING CROSS-SECTION



Five questions define a coating system

1. **MATERIAL**
   Enamelling-grade low-carbon steel flange with heating element/sensor guide pipes welded to it; a complex geometry with heavy sections and pipe-flange joints.

2. **SURFACE**
   Weld seams, pipe mouths and the flange seating face must be cleaned; spatter and oxide are removed for a uniform surface.

3. **GEOMETRY**
   Narrow inner passages and blind spots where heating element and sensor pipes are welded to the flange; a Faraday zone risk inside the pipes and edge pull-back at weld seams.

4. **SERVICE CONDITIONS**
   The same hot water, pressure and pH environment as the tank; plus local thermal cycling and scale build-up around the heating element

5. **PRODUCTION TARGET**
   Volume matched to the tank line; continuous enamel coverage on all wetted surfaces except the sealing face.

CONCLUSION: For the Flange & Heating Element Socket, the goal is not just a good-looking finish; it is a corrosion-resistant enamel surface, pore-free even at pipe mouths and welded joints, continuous with the inner tank.

FROM SURFACE TO PROCESS ENGINEERING FLOW

The Flange & Heating Element Socket cannot be coated like just any part. A sound process needs measurement, pretreatment, the right coating selection, application and verification to work together.

01 **ANALYSIS** Substrate + surface
02 **PRETREATMENT** Cleaning + surface
03 **ENAMEL** Chemistry + coat
04 **APPLICATION** Electrostatics + flow
05 **FIRING** Time + temperature
06 **VERIFICATION** Test + record

A. Surface Characterisation

The condition of the substrate surface (cleanliness, roughness, oxide/scale and any weld zones) is determined. The right process starts with the right definition of the surface.

MEASURABLE INPUTS
Surface cleanliness • roughness • weld marks

B. Pretreatment Design

Degreasing, scale/rust removal and rinsing; pretreatment and activation that reach into the pipes and weld zones.

CORE TARGET
Clean, active, uniform, repeatable surface

C. Enamel System Selection

The same acid-resistant vitreous enamel system as the inner tank is selected; CTE matching and continuous coverage at the flange-tank interface are targeted, and the gasket seating face is masked.

DECISION CRITERIA
Durability • appearance • service life • cost

D. Application Engineering

Electrostatic powder enamel; gun angle, insertion depth and charge recipe are set for coverage at pipe mouths and blind spots, and controlled firing manages outgassing in heavy sections.

GEOMETRY EFFECT
Pipe mouth • Welded joint • Flange face

Managing the process with data, not by eye

µm
COAT THICKNESS
Enamel coat uniformity

°C
FIRING TEMPERATURE
Actual firing condition

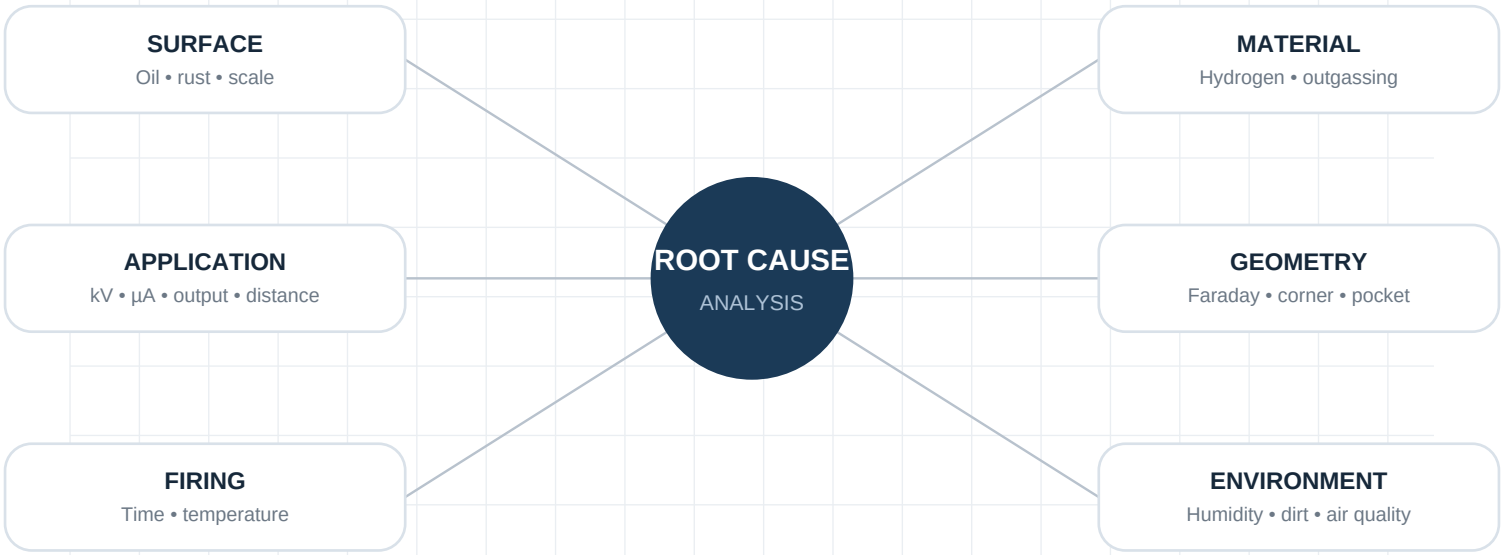
kV / µA
ELECTROSTATIC CHARGE
Transfer and penetration

Ω
GROUNDING
Charge dissipation and stability

ENGINEERING PRINCIPLE In the Flange & Heating Element Socket process, we define a process window rather than a single parameter. The aim is to reproduce the same surface quality across different shifts and part conditions.

A SURFACE DEFECT IS A SYMPTOM, NOT THE ROOT CAUSE

Enamel defects rarely come from a single setting. The same symptom may stem from surface preparation, the steel structure, electrostatic behaviour, coat thickness or firing.



Common defects and diagnostic approach

POOR ADHESION

The enamel detaches from the substrate or fails the impact test.

CHECK: surface / pretreatment / firing

FISH-SCALING

Scale-shaped enamel spalling appears after firing.

CHECK: steel / hydrogen / firing

PINHOLE / BLISTER

Pinholes or blisters form on the surface.

CHECK: dirt / gas / humidity / oven

FARADAY ZONE

Insufficient penetration in deep corners and pockets.

CHECK: geometry / kV-µA / air

BACK-IONIZATION

Star/blister defects from overcharging.

CHECK: current / distance / thickness

UNEVEN THICKNESS

Thin and thick areas on the same part.

CHECK: position / motion / output

DIAGNOSTIC PROTOCOL

1 Define the symptom → **2** Measure the data → **3** Isolate the cause → **4** Test one variable → **5** Standardise

A GOOD SURFACE PROCESS must be measurable • repeatable • traceable • optimisable. This approach is the basis of part-specific application guides for parts such as the Flange & Heating Element Socket.

THE RIGHT EQUIPMENT, AT THE RIGHT SCALE.

For the Flange & Heating Element Socket, production volume drives the equipment choice. At low and medium volume, manual systems give flexibility; in series production, automatic systems apply the same recipe to every part.

LOW / MEDIUM VOLUME

Manual application



Smart (Powder Enamel)
Control unit for powder enamel application.



Powder Enamel Gun
Manual gun suited to enamel powder.



Powder Enamel Injectors
Feeding for abrasive enamel powder.



Powder Enamel Booth
Part-specific manual application booth.



Box Enamel Furnace
Firing in batch production.

SERIES PRODUCTION

Automatic line



Smart Automatic Powder Enamel
Line application with automatic guns.



OWL + Smart AI
Zone-by-zone application on corners, cavities and difficult areas.



Reciprocator
Automates the gun motion.



Automatic Powder Enamel Booth
In-line application and powder recovery.



Ultrasonic Recovery
Sieves recovered powder and separates foreign metal.



Powder Enamel Firing Furnace
Continuous firing, U-type or line-type.

OWL INTEGRATION In difficult areas such as pipe mouth, welded joint, flange face, OWL applies targeted, zone-by-zone coating with a Smart AI recipe. For details, see the “OWL — Cavity” application sheet.

PROJECT SUPPORT Share your line, your part and your production target, and we will define the equipment selection and the booth, oven and conveyor layout together. strong3000.com · info@strong3000.com · WhatsApp +90 537 353 54 19