

How to Reduce the Surface Roughness Value of Manganese Phosphate Coatings on Steel Components

Technical Notes

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1. Problems faced by the client in Manganese Phosphate Coated Steel Components

1. The Manganese phosphate coated components have more roughness.
2. The requirement of surface roughness is 0.8 Ra.
3. The original surface roughness of the bare metal component is 0.4 Ra.
4. The surface roughness increases to 1.6 Ra to 2.0 Ra after phosphating.

2. Existing Process of Manganese Phosphate Coating

1. 1018 Steel Component is supplied with slight tool marks and 0.4 Ra surface roughness value.
2. The components have no rust in any form.
3. The machined components are delivered at the phosphating plant with a thin coat of rust preventive oil. (Please mention the grade of RPO and manufacturing brand name.)
4. The distance between the fabricator and phosphating is less than 100 km only.
5. The phosphating job is undertaken within 48 hours of fabrication.
6. There is no sand blast operation.
7. The Existing Manganese phosphate process flowchart is given below.
 - a. Solvent cleaning is done by soaking cotton rags in Diesel and the components are wiped off manually.
 - b. Alkaline degreasing with the Degreasing Chemicals at 5% w/v concentration between 65 and 70 degree Centigrade for 10 to 20 minutes.
 - c. Water rinse-1

- d. Water rinse-2
 - e. Derusting with inhibited HCl at 40% concentration at room temperature.
 - f. Water rinse-3
 - g. Water rinse-4
 - h. Surface conditioning with surface condition chemical at 5% concentration for 3 to 5 minutes at room temperature.
 - i. Manganese phosphating with the chemical dosage of 60 to 70 g/L along with appropriate dosage of accelerator at higher temperature. (Please mention the temperature)
 - j. DM Water rinse
 - k. Passivation (chrome free)
 - l. Water evaporation in Hot air oven
8. The manganese phosphate component is not sealed with any top coat or wax coat or sealer coat.

3. Notes and Suggestions by the Consultant

To reduce the surface roughness during manganese phosphating follow these steps.

1. Surface Preparation – Ensure the surface is clean and free of contaminants before phosphating. Remove oil and grease with solvent cleaning followed by alkaline degreasing.
2. When it comes to cleaning rust preventive oil from steel components, both kerosene and diesel oil are commonly used solvents. However, their effectiveness can vary based on several factors. Let me give a comparison to determine which might be the better option:
 3. Kerosene
 - a. Cleaning Efficiency: Kerosene is a highly effective solvent for removing rust preventive oils and other similar substances due to its lower viscosity and better penetration properties.
 - b. Volatility: It is more volatile than diesel oil, which means it evaporates faster. This can be advantageous in cleaning processes as it leaves less residue and speeds up drying time.

- c. Residue: Leaves minimal residue, which can be beneficial when preparing the surface for further processing, such as painting or coating.
- d. Odor: Kerosene has a distinct odour, which some might find unpleasant but it is generally less strong compared to diesel oil.
- e. Safety: It is relatively safer to handle compared to diesel oil in terms of skin contact and inhalation, though proper safety precautions should still be followed.

4. Diesel Oil

- a. Cleaning Efficiency: Diesel oil can also effectively clean rust preventive oils but is generally less efficient compared to kerosene because of its higher viscosity.
- b. Volatility: Diesel oil is less volatile, meaning it evaporates more slowly. This can result in a longer drying time and potentially more residue left on the surface.
- c. Residue: Diesel oil tends to leave a more substantial oily residue compared to kerosene, which might require additional cleaning steps if the surface needs to be free of oils.

- d. Odour: Diesel oil has a stronger and more lingering odor compared to kerosene, which might be more noticeable and unpleasant in enclosed spaces.
 - e. Safety: Diesel oil can pose greater health risks upon prolonged skin contact and inhalation of fumes. Proper ventilation and protective equipment are essential.
5. Hence, Kerosene is generally the better solvent for cleaning rust preventive oil from steel components due to its higher cleaning efficiency, faster evaporation rate, and lower residue. It is especially useful when the cleaned surface needs to be prepared for further processing. However, safety precautions should always be observed when handling any solvents.
 6. Immerse the RPO coated components in a clean tank containing the solvent for a few minutes and wipe off with pressurised air blow.
 7. Avoid manual contact or finger prints with dirty gloves after cleaning with solvent.
 8. Proceed with the regular alkaline degreasing bath.
 9. Monitor the bath parameter periodically and remove oil sludges regularly.
 10. Use agitation in the bath to ensure effective cleaning.

11. Since the components are totally free from rust the derusting process can be skipped.
12. Proceed with surface condition after the alkaline degreasing followed by double water rinse.
13. Use grain refiner additives in the manganese phosphating solution to produce finer crystalline phosphating. Get the technical service from the phosphate chemical supplier for monitoring bath parameters.
14. The surface roughness can be brought down to the required standard by adopting this procedure.
15. Send the feedback of the result after the trial.
16. Surface roughness can also be brought down by the following these methods.
 - a. Post-Phosphate Burnishing by using mechanical methods like tumbling or burnishing to smooth phosphate layer.
 - b. A suitable lubricant can be applied to fill in the microscopic valleys.
 - c. A thin coat of transparent sealer coating may be given.
 - d. Surface grinding or polishing may be performed to smoothen the surface further.

4. Training Conducted by the Consultant in Phosphating

1. To know the complete chemistry of phosphating we invite your technical team to attend the One Month Training Course conducted by the consultant.
2. Course Details: One Month Certificate Course in Phosphating.
3. Weekly Classes on Friday for one hour through our online classes.
4. Study materials are provided with case studies to help the candidates for trouble shooting.
5. Course contents – Chemistry of corrosion and prevention, Detergent action, cleaning methods, iron phosphating, zinc phosphating, manganese phosphating, passivation, wax applications, testing methods, quality standards.
6. There will be an assessment with online tests and quiz.
7. Successful candidates will be issued a Certificate in Phosphating signed by our consultant.
8. Fees: Rs. 12,000 per head.
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