



Technologies

TECHNICAL INFORMATION THERMOIL GRANODINE 112

1. INTRODUCTION

Thermoil Granodine 112 (or Parco Lubrite 5) can be run at a lower temperature range if **Accelerator 131** is used in the bath operation. **Thermoil Granodine 112** is formulated to produce non-metallic, oil-absorptive coatings on iron and steel bearing surfaces. These corrosion-resistant coatings consist chiefly of iron and manganese phosphates, and reduce wear on such articles as pistons, rings, liners, camshafts, tappets, motor blocks and similar bearing surfaces. Other beneficial effects may be summarised as follows:

- i. The treatment permits rapid break-in of moving parts without scuffing or welding by preventing metal-to-metal contact between the bearing surfaces.
- ii. It increases lubrication of treated surfaces due to the oil-absorptive coating.
- iii. It removes light metal scratches remaining from machining operations.
- iv. It retards corrosion.

2. OPERATING SUMMARY

CHEMICAL	BATH PREPARATION PER 1,000 LITRES
Thermoil Granodine	102 kg (80 Litres)
Toner TG101	7 kg
Accelerator 131	300 mL

OPERATING & CONTROL	
Total Acid	7 – 8 points (mL)
Acid Ratio (TA/FA)	5.5 – 7.0
Accelerator	0.8 – 1.2 points (mL)
Time	10 – 15 minutes
Temperature	82 – 85°C

3. THE PROCESS

The coating is usually applied on precision parts which are expensive, and care must be exercised in their cleaning and processing to avoid rejects. In carrying out the treatment, suitable cleaning and processing equipment should be provided. Articles of established manufacturing limits and tolerances should first be processed on an experimental basis and submitted for approval before they are processed on a production basis. The same cleaning and processing procedures should be followed on articles treated in production that were employed on the experimental trial. In view of the wide variety of articles and many types of steel and iron treated with the process, no general instructions can be given which will apply in every case. However, the instructions given herein have been derived from commercial experience and if carefully followed, should produce satisfactory results.

The complete process for the treatment normally consists of the following steps:

- i. Cleaning
- ii. Water rinsing
- iii. Treating with the **Thermoil Granodine 112** processing solution
- iv. Water rinsing
- v. Post treatment (required only for corrosion resistance)
- vi. Drying (not required if a soluble oil is to be applied) and
- vii. Oil finishing.

4. MATERIALS

Accelerator 131

Toner TG 101

Parco Cleaner

Thermoil Granodine 112

Parcolene (post treatment, required only for corrosion resistance)

Testing Reagents and Apparatus

5. EQUIPMENT

Process tanks and housings may be fabricated from mild steel plate, however, equipment life will be greatly extended by using a 300 series alloy stainless steel, such as 304L or 316L. The 316L being preferred for maximum tank life. Process pumps should be constructed of 316 or 304 stainless steel alloys. In all cases approved welding techniques must be used.

Heat exchanger plates should be polished 316 stainless steel. If gas fired burner tubes are used, they should be made of Schedule-80 mild steel pipe or equivalent. All process circulation pump seals, valve seats, etc., which come into contact with the process solution and occasional acid equipment cleaners, should be EPDM, Viton® or Teflon®. Note that while Hypalon® is compatible with the process solution, it is not compatible with acid equipment cleaners which may be used.

Chemical feed pump parts and other elastomers which may come into contact with the concentrated replenishing chemical should be EPDM, Hypalon, Viton or Teflon. Support equipment available from Henkel Technologies for this process includes: chemical feed pumps, level controls, transfer pumps and bulk storage tanks. Our sales representative should be consulted for information on Henkel Surface Technologies automatic process control equipment for this process and any additional questions. In addition, the "Henkel Technologies Equipment Design Manual" may be consulted.

6. SURFACE PREPARATION

Cleaning:

All metal must be clean and free from rust, oil, grease, buffing and polishing compounds, drawing compounds, smut, and dirt before the treatment. The type of cleaning used is very important in promoting uniform etching of the metal by the processing solution and in avoiding excessive coating buildup. Unless specified, no strong alkali or acid pickle should be used in the cleaning operation. When it is necessary to use stronger cleaners, the crystalline structure of the coating may be modified by the incorporation of **Parcolene VM** in the process. For instructions for the use of **Parcolene VM**, see separate Technical Data Sheet.

Precision parts may be cleaned in a solvent such as mineral spirits, followed by wiping dry with a clean cloth. In some instances, light-duty alkaline cleaners may be desirable. A complete line of cleaners is available for spray and immersion applications. Our representative will recommend the proper one for each installation.

Pressure spray application of kerosene emulsion-type cleaners or the equivalent, and grit blasting have been used successfully prior to the treatment. Any procedure for cleaning and treating articles in the processing solution should first be approved by the treatment of experimental lots before production lots are processed.

Water Rinsing:

A cold water spray rinse followed by a hot water dip is suggested following grit blasting or kerosene emulsion-type cleaners. A hot water rinse, preferably sprayed, is recommended after most other cleaning methods, such as a solvent wipe or mild alkali cleaner. The temperature of the hot water rinse should be within 6°C of the temperature of the **Thermoil Granodine 112** processing solution.

The rinses should be overflowed continuously at a rate which will keep them clean and free from scum and contamination.

7. TREATING WITH THE THERMOIL GRANODINE 112 PROCESSING SOLUTION

Buildup:

Fill the tank about $\frac{3}{4}$ full with water. Add 105 kg (80 Litres) of **Thermoil Granodine 112** for each 1,000 Litres of working volume. (Next add the slurry formed by mixing with water, 4.8 kg of **Toner TG101** per 1,000 Litres of working volume. Considerable gas is given off during the addition of **Toner TG101** and if added too rapidly, the solution may foam over the top of the tank.) Add water to bring the solution up to the working level, then mix thoroughly by stirring and heat to the operating temperature. *Only add **Toner TG101** to adjust the acid ratio into range. Add the slurry formed by mixing slowly 4.8 kg of **Toner TG101** with water in a bucket to the bath.

Immediately before processing any work, add 300 ml of Accelerator 131 per 1,000 Litres and mix thoroughly.

Operation:

Time: 10 to 15 minutes.

Temperature: 82 – 85°C

The temperature must be maintained within the specified range. Operating at higher temperature will cause excessive use of accelerator and operating at lower temperature will result in increased metal attack and a higher microinch finish.

The coating thickness obtained with this treatment depends on the method of cleaning, the type of metal or alloy and the hardness and surface finish. Generally the coating thickness varies from 0.00005 to 0.0001 inch (1.27 – 2.54 microns). In applications where the coating buildup is excessive, part of the coating can be removed by buffing, brushing, wiping or burnishing.

NOTE: The parts should not be machined to allow for the buildup of the coating. This friable coating is essentially removed in the very early stages of operation and the parts will return to their original dimensions.

8. TESTING AND CONTROL

Never pipette by mouth, use pipette filler.

Total Acid:

Pipette a 2 mL sample into a 150-mL beaker. Add 5 drops of Indicator 3. Titrate with Titrating Solution 11 to the development of a permanent pink colour. The mL of Titrating Solution 11 used is the total acid value in points.

Total acid range: 7 to 8 points (mL).

To increase value 0.1 point: 1.2 kgs (0.9 Litres) of **Thermoil Granodine 112** per 1,000 Litres.

Frequent small additions of **Thermoil Granodine 112** give more uniform results than occasional additions of large amounts.

Free Acid:

Pipette a 2 mL sample into a 150-mL beaker. Add 5 drops of Indicator 11. Titrate with Titrating Solution 11 until the yellow colour just changes to bluish green by daylight or fluorescent light, or to blue-violet by incandescent light. The mL of Titrating Solution 11 used is the free acid value in points. Use this value to calculate the Acid Ratio.

Acid Ratio:

The acid ratio is obtained by dividing the Total Acid value by the Free Acid value. Thus if the Total Acid is 8 points and the Free Acid is 1.2 points, then the acid ratio is:

$$8.0 \text{ divided by } 1.2 = 6.7$$

8. TESTING AND CONTROL Cont...

It is not possible to establish a definite ratio between free and total acid which is applicable to all steels and alloys. Generally, the ratio of free acid to total acid should be between 1:5.5 and 1:7.0.

The free acid value usually stays within the operating range without difficulty. If too low, the condition may be due to use of too much Accelerator, or operating at a temperature below 82°C. It may be remedied by heating the solution for a few hours without processing work.

A free acid value above the operating range may result from long heating without processing work. This condition is remedied by neutralisation. An addition of 300 grams of **Toner TG101** per 1,000 Litres will reduce the free acid approximately 0.1 point. Add water to **Toner TG101** in a container to form a slurry which is distributed over the surface of the processing solution. The solution should then be stirred thoroughly.

Accelerator:

Dip a strip of Indicator Paper 17 into the processing solution. If the paper turns pink or red, add 60 – 120 mL of Accelerator 131 per 1,000 Litres. Add the Accelerator with stirring and mix thoroughly after each addition before retesting with Indicator Paper 17.

Pipette a 25 mL sample into a 150 mL beaker and add 10 to 20 drops of Reagent Solution 44. Titrate with Titrating Solution 15 while swirling the solution constantly until the addition of one drop produces a pink colour which lasts for at least 10 seconds. The mL of Titrating Solution 15 used is the Accelerator value in points.

Concentrations of Accelerator in the range of 0.8 to 1.2 points (mL) are satisfactory for most types of work. However, it is best to maintain the concentration at the minimum which will produce satisfactory coatings. This will keep the solution in better balance and will reduce the cost of operation.

An addition of 60 mL of Accelerator 131 solution per 1,000 Litres will increase the concentration approximately 0.5 point.

Accelerator is lost during intermittent use or prolonged idle standing of the processing solution. For this reason, whenever the bath has been allowed to stand overnight or longer without use, add enough Accelerator just before processing to raise the test to the usual operating value.

9. AFTER TREATMENT

Water Rinsing:

After treatment with the processing solution, the work is rinsed in water for 30 to 60 seconds. A cold rinse is satisfactory if the work is to be given a post treatment or a water-soluble finish. If the work is to be dried immediately, a hot rinse is preferable to facilitate drying. Rinse the work as soon as possible after processing, as the **Thermoil Granodine 112** solution tends to "set up" on hot metal making it difficult to rinse off.

The rinse should be continuously overflowed, and the flow should be regulated with the rate of production so that the main body of the rinse never becomes excessively contaminated.

9. AFTER TREATMENT Cont...

Treating with a Post Treatment Solution:

The post treatment has no effect on the wear resistance of the coating but does substantially improve the corrosion resistance. Use of the post treatment is recommended in all cases where corrosion resistance is important. For other applications it may be omitted. A number of post treatment chemicals are available under the PARCOLENE trademark, and the proper one for each installation will be recommended.

Drying:

The articles should be dried immediately after the water rinse or post treatment (unless a water-soluble finish is to be applied). Articles which do not dry quickly should be force-dried with an air blow-off or a drying oven, by centrifuging, or by spreading on a heated tray. Temperatures above 107°C are not recommended.

Oil Finishing:

The type of finish to use over parts treated with the **Thermoil Granodine 112** process depends on individual requirements. A number of excellent finishes are available under the **Parcolac** trademark, and the proper one for each installation will be recommended.

10. STORAGE REQUIREMENT

No special storage requirements are needed for **Thermoil Granodine 112**. If the product does freeze after extended storage at low temperature, thaw in a warm place and stir thoroughly before using.

11. GENERAL MAINTENANCE

In the operation of the process, some insoluble residue is formed as a by-product of the chemical reaction. The residue settles to the bottom of the tank and should be removed regularly before its presence causes dusty coatings. An excellent method of removal is an arrangement whereby a portion of the processing solution and sludge is pumped into a settling tank from which the settled sludge may be periodically discharged into containers, preferably after the solution is returned to the processing tank. Another satisfactory method is to transfer the solution to a rinse tank, leaving as much sludge as possible in the bottom of the processing tank. The sludge may then be removed by any convenient means.

When the solution has been heated for some time, scale will form on the heating unit and must be removed at intervals so that adequate heat transfer will occur and the proper processing temperature will be maintained. To remove the scale, dry the heat transfer surface either by removing it from the solution or by pumping the solution from the tank. The scale may then be removed by a suitable chemical or mechanical method.

12. WASTE DISPOSAL INFORMATION

Applicable regulations covering disposal and discharge of chemicals should be consulted and followed.

Disposal information for the chemicals, in the form as supplied, is given on the Material Safety Data Sheet for each product.

The processing bath is acidic and contains phosphates, nitrates and heavy metals. Waste treatment may be required prior to discharge to the sewer.

The processing bath and sludge can contain ingredients other than those present in the chemical as supplied and analysis of the solution and/or sludge may be required prior to disposal.

13. PRECAUTIONARY INFORMATION

When handling the chemicals in the form as supplied, the precautionary, first aid and handling recommendations on the Material Safety Data Sheet for each product should be read, understood and followed.

The processing bath is acidic and can cause irritation of the skin and eyes. Do not get in eyes, on skin, or on clothing. In case of contact, follow the recommendations on the Material Safety Data Sheet for **Thermoil Granodine 112** chemical.

DISCLAIMER

Any information given is, to the best of our knowledge, the best currently available, with respect to our products and their use, but it is subject to revision as additional knowledge and experience is gained. Such information is offered as a guideline for experimentation only and is not to be construed as a representation that the material is suitable for any particular purpose or use. Customers are encouraged to make their own enquiries as to the material's characteristics and, where appropriate, to conduct their own tests in the specific context of the material's intended use. This information is not a license to operate under nor is it intended to suggest infringement of any patent. We guarantee a uniform quality standard for this product. The only conditions and warranties accepted by Henkel in relation to this product or process are those implied by either Commonwealth or State statutes.