BONDERITE M-MN LUBRITE 2
MANGANESE PHOSPHATE
(KNOWN AS PARCO LUBRITE 2)

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1. Introduction:

BONDERITE M-MN LUBRITE 2 (known as PARCO LUBRITE 2) is formulated to produce nonmetallic, 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 summarized as follows:

A. Permits rapid break-in of moving parts without scuffing or welding by preventing metal to metal contact between the bearing surfaces.
B. Increases lubrication of treated surfaces due to the oil-absorptive coating.
C. Removes light metal scratches remaining from machining operations.
D. Retards corrosion.

2. Operating Summary:

Chemical:	Bath Preparation per 100 gallons:
BONDERITE M-MN LUBRITE 2 (known as PARCO LUBRITE 2)	120 pounds (11 gallons)
BONDERITE M-AD 1 (known as Additive 1) or BONDERITE M-AD 10 (known as Additive 10)	2 pounds, or 0.5 - 1 gallon
Steel wool/scrap iron	Immersed 1 hour at 150 - 160°F
Operating and Control:	
Total Acid	11.5 to 12.5 points (ml)
Free Acid	2.0 to 2.2 points (ml)
Iron	0.2 to 0.3% (2 to 3 ml)
Time	Approximately 15 minutes
Temperature	205° to 210° Fahrenheit

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:

A. Cleaning
B. Water rinsing
C. Conditioning (optional)
D. Treating with the BONDERITE M-MN LUBRITE 2 (known as PARCO LUBRITE 2) processing solution;
E. Water rinsing
F. Post treatment (required only for corrosion resistance)
G. Drying (not required if a soluble oil is to be applied)
H. Oil finishing.

4. Materials:

BONDERITE M-AD 1 (known as Additive 1) or BONDERITE M-AD 10 (known as Additive 10)(or steel wool or scrap iron, used only for buildup)
Neutralizer 200
BONDERITE CLEANER
BONDERITE M-MN LUBRITE 2 (known as PARCO LUBRITE 2)
BONDERITE (oil finish)
BONDERITE (post treatment, required only for corrosion resistance)
BONDERITE M-AC M (known as FIXODINE M) (conditioning agent, optional)
Hydrogen peroxide
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, FKM or PTFE. Note that while CSPE 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, CSPE, FKM or PTFE.

Support equipment available from Henkel Surface Technologies for this process includes: chemical feed pumps, level controls, transfer pumps and bulk storage tanks.

Your local sales representative should be consulted for information on Henkel Surface Technologies automatic process control equipment for this process and any additional questions.

6. Surface Preparation:

Cleaning:
All metal must be clean and free from rust, oil, grease, buffing, polishing and 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 using BONDERITE M-AC M (known as FIXODINE M) conditioning agent.

Precision parts may be cleaned in a solvent such as mineral spirits, followed by wiping dry with a clean cloth. PARCO CLEANERS 110 and 302 were especially developed for use prior to the PARCO LUBRITE treatment. PARCO CLEANER 110 is a solvent cleaner designed for the immersion cleaning of machined parts and requires no hand wiping. PARCO CLEANER 302 has no combustive solvents, and is used cold by either immersion or spray application. In some instances, light duty alkaline cleaners may be desirable. A complete line of cleaners is available for spray and immersion applications. Our representative should be consulted.

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 like PARCO CLEANER 110. A hot water rinse, preferably sprayed, is recommended after most other cleaning methods, such as a solvent wipe or mild alkaline cleaner like PARCO CLEANER 302. Rinses should be overflowed continuously at a rate which will keep them clean and free from scum and contamination.

7. Treating with the BONDERITE M-MN LUBRITE 2 (known as PARCO LUBRITE 2) Processing Solution:

Buildup:
Fill the tank about 3/4 full with water. Heat to 120° to 160° Fahrenheit, (do not exceed 160°) then add 120 pounds (11 gallons [U.S.]) of BONDERITE M-MN LUBRITE 2 (known as PARCO LUBRITE 2) chemical for each 100 gallons of working volume. Add sufficient water to bring the solution up to the working level, then mix thoroughly by stirring.

Coatings produced from a freshly prepared bath do not retard wear as well as coatings obtained from an "aged" bath. Consult your HT representative for the recommended aging Procedure for each specific application. To age the bath, keep the temperature at 120° to 160° Fahrenheit and sprinkle 2 pounds of BONDERITE M-AD 1 (known as Additive 1) per 100 gallons of solution volume over its surface or add BONDERITE M-AD 10 (known as Additive 10) (0.5-1 gal per 100 gal bath), or hang steel wool or scrap iron in the solution for about an hour. Remove the scrap pieces, replace the water lost by evaporation and mix the solution thoroughly. Test for total acid, and then add enough BONDERITE M-MN LUBRITE 2 (known as PARCO LUBRITE 2) chemical to raise the total acid to the required value. BONDERITE M-AD 10 (known as Additive 10) may be used only to artificially age a fresh bath for applications other than retarding, wear by adding 0.5 to 1.0 gallons per 100 gallons. Continuous use of BONDERITE M-AD 10 (known as Additive 10) is not recommended to increase or maintain the level of iron. After thoroughly mixing the bath again and heating to the operating temperature, the solution is ready for use.

Operation:
Time: 15 minutes.
Temperature: 205° to 210° Fahrenheit.

The properly cleaned articles are immersed in the solution. Complete reaction time is indicated by the cessation of gassing, and should this not occur within 15 minutes, excessive etching of the metal surface is likely to take place. Continued gassing and excessive etching are usually caused by too high free acid, and may be corrected by adding Neutralizer 200.

The coating weight obtained with this treatment depends on the method of cleaning, the type of metal or alloy and the hardness and surface finish. 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 pipet by mouth, use a pipet filler.

Total Acid:
Pipet 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 color. The ml of Titrating Solution 11 used is the total acid value in points.

Total acid range: 11.5 to 12.5 points (ml).

To increase value 0.1 point: 1.0 pound (0.7 pint) of BONDERITE M-MN LUBRITE 2 (known as PARCO LUBRITE 2) chemical per 100 gallons of solution volume.

Normally the total acid is maintained at 12 points, however, in some instances solutions with a total acid as low as 8 points give satisfactory results. Frequent small additions of BONDERITE M-MN LUBRITE 2 (known as PARCO LUBRITE 2) chemical give more uniform results than occasional additions of large amounts, and it is desirable to control the solution within ± 0.5 point of the value found to give best results.

Free Acid:
Pipet a 2 ml sample into a 150-ml beaker. Add 2 drops of Indicator 8, then titrate with Titrating Solution 11 until the purple changes to green. The ml. of Titrating Solution 11 used is the free acid value in points.

Free acid range: 2.0 to 2.2 points (ml) for total acid value of 12 points.

To decrease value 0.1 point: 4 ounces of Neutralizer 200 per 100 gallons of solution volume. (Slurry the Neutralizer 200 in water before making the addition. Stir thoroughly.)

The presence of too much free acid in the solution may be caused by heating the solution without processing work, or by processing only a small amount of work in a large volume of solution. A solution containing too much free acid etches the work surface excessively; fails to produce a complete coating within the normal 15 minute processing time as indicated by continued gassing; produces a smudgy and nonadherent coating, a part of which can be wiped off; produces a maroon, instead of dark gray coating; or gives an unusually rough coating.

Iron:
Dip a strip of Indicator Paper 17 into the solution. The paper should turn pink indicating the presence of iron. If no iron is present, the paper will not turn pink. In this case, add a solution of potassium permanganate (about 0.5 pound of potassium permanganate per gallon of water) in small quantities to the bath at 150° to 160° Fahrenheit until the bath turns a light pink. Avoid a large excess, then add iron to the bath as directed for buildup.

Determine the iron content: Pipet a 10 ml sample into a 150-ml beaker and add 10 to 20 drops of Reagent Solution 44. With a 5-ml measuring pipet, titrate with Titrating Solution 18 to a persistent (10 seconds), faint pink. Each ml of Titrating Solution used indicates the presence of 0.1% iron.

Iron range: 0.2 to 0.3% (2 to 3 ml titration)

The iron content of a 12 point BONDERITE M-MN LUBRITE 2 (known as PARCO LUBRITE 2) solution should be maintained at 0.2 to 0.3%, but production experience has shown that satisfactory coatings are obtained on certain steels outside this range. The iron should be controlled within the limits required to produce a satisfactory coating on the particular type of steel or alloy processed. A high iron content can be reduced by precipitation and removal of part of the iron with hydrogen peroxide and neutralization of the free acid resulting there from with Neutralizer 200.

The amount of iron removed at one time should not exceed 0.05%. For each 100 gallons of processing solution, mix 2.0 pounds of Neutralizer 200 with sufficient water to form a slurry. Add 1/2 pound (1/2 pint) of 35% hydrogen peroxide to the slurry and distribute the mixture over the surface of the solution. Stir the solution vigorously. Allow the precipitate to settle to the bottom of the tank (shortest time required is when temperature is between 200° and 205° Fahrenheit).

Too much iron in the solution results from overworking the bath or from failure to control the iron in solution. A processing solution high in iron results in an incomplete coating in the normal processing time; in a nonadherent coating of poor wear and corrosion resistance; in a light, instead of dark, gray thinner-than-normal coating; and in an uneven etch of the metal surface.

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 PARCOLENE 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 BONDERITE M-MN LUBRITE 2 (known as PARCO LUBRITE 2) 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.

Post Treatment:
The post treatment has no effect on the wear resistance of the coating but does substantially improve the corrosion resistance. Its use 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, and the proper one for each installation will be recommended.

Drying:
The articles should be dried immediately after the water rinse or PARCOLENE treatment (unless a water soluble finish is to be applied). Articles which do not dry quickly should be dried with an air blow-off or a drying oven, by centrifuging, or by spreading on a heated tray. Temperatures above 225° Fahrenheit are not recommended.

Oil Finishing:
The type of finish to use over parts treated with the PARCO LUBRITE 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 is required for BONDERITE M-MN LUBRITE 2 (known as PARCO LUBRITE 2). 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. (Refer to Waste Treatment Information Bulletin No. WT1002, available on request.)

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 BONDERITE M-MN LUBRITE 2 (known as PARCO LUBRITE 2) chemical.

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Testing Reagents and Apparatus
(Order only those items which are not already on hand)

Code	Quantity	Item
******	1	Acid Dropping Bottle
******	3*	Beaker, 150-ml
592478	1	Buret Assembly, 5 ml
592477	1	Buret Assembly, 25-ml Automatic
592398	1 qt	Indicator 3 (Phenolphthalein)
592400	1 qt	Indicator 8 (Methylorange-xylene cyanole)
******	2	Indicator Dropping Bottle
******	2 bottles	Indicator Paper 17
******	2*	Pipet, 5-ml Measuring
******	2*	Pipet, 2-ml Volumetric
******	2*	Pipet, 10-ml Volumetric
******	1	Pipet Filler
******	1	Pitcher, Graduated, Plastic
593846	1 pt	Reagent Solution 44 (50% H_2SO_4)
******	1	Supply Bottle, 1-pint Amber
******	1	Thermometer, Floating
592427	1 gal	Titrating Solution 11 (0.1N NaOH)
592429	1 gal	Titrating Solution 18 (O.18N $KMnO_4$)

* Includes one more than actually required, to allow for possible breakage.

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