



Technical Data Sheet

Product Advantages

- Can be applied in conventional immersion systems
- Deposits high quality zirconium films at low application temperatures
- Prepares surface for optimum paint adhesion
- Specially formulated for multi metal applications
- High performance and compatibility with cationic electrocoats
- No post rinse sealer is required

Product Description

ZIRCOBOND 4200DM is a zirconium-based thin film pretreatment formulated to provide excellent corrosion resistance for steel, galvanized steel and aluminum substrates.

The **ZIRCOBOND 4200DM/DR** system is designed to provide performance that is equivalent to zinc phosphate when protected with cationic electrocoats.

ZIRCOBOND 4200DR is the preferred replenisher.

Technical Properties

	<u>4200DM</u>	<u>4200DR</u>
Composition:	Liquid	Liquid
Appearance:	Clear Light Blue	Clear Light Blue
Foaming:	Low	Low
Recommended Concentrations:	3% by volume	Replenisher Only
Recommended Temperatures:	60 - 115°F	60 - 115°F

Caution

- The application of this technology requires the use of suitable process equipment.
- Proper cleaning and rinsing prior to application of **ZIRCOBOND 4200** should be confirmed for optimum performance.
- Customers should evaluate, on an experimental basis, all metals to be coated to confirm **ZIRCOBOND 4200** conforms to all relevant specifications. The process used for experimental validation of **ZIRCOBOND 4200** should be representative of the process used on a production basis.



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Use & Control Instructions

Product Operating Ranges

pH:	4.4 - 5.2
Concentration:	1.5 - 4% by volume.
Temperature:	60 - 115°F (15 – 46°C)
Contact Time:	1 - 3 minutes
Zirconium:	150 - 225 ppm
Additive ED:	15 - 25 ppm
Free Fluoride:	less than 100 ppm

Normal Operating Parameters

pH:	4.6 - 4.8
Concentration:	3.0 % by volume.
Temperature:	75 - 95°F (24- 35°C)
Contact Time:	2 minutes
Zirconium:	175 -200 ppm
Additive ED:	18 - 22 ppm
Free Fluoride:	50 - 80 ppm

Note

Specific process conditions may require operating the above parameters outside of the normally specified ranges. For example, short dwell times may require operating at higher chemical concentrations. Please consult your PPG representative to establish the optimum operating parameters.

Typical Process Sequence

STAGE 1 – CHEMKLEEN, MAGNUSPRAY or ULTRAX ALKALINE CLEANER #
STAGE 2 – CITY WATER RINSE
STAGE 3 – CITY WATER RINSE
STAGE 4 – **ZIRCOBOND 4200DM/DR**
STAGE 5 – CITY WATER RINSE
STAGE 6 – DEIONIZED or REVERSE OSMOSIS WATER RINSE

Cleaner recommendations will be based on the metal mix, soils and application equipment.

Process Equipment

Process equipment should be constructed of 304 or 316 stainless steel. Mild steel equipment should be lined with an appropriate corrosion resistant coating. Process piping and pumps should also be constructed of 304 or 316 stainless steel. Pump seals and gaskets should be compatible with acidic solutions, for example, Teflon™.



Charge Instructions

Fill the tank $\frac{3}{4}$ full with fresh water (deionized or RO water is recommended over hard water). For each 100 gallons (378 L) of working volume, add 3.0 gallons (11.3 L) of **ZIRCOBOND 4200DM** and then mix thoroughly. Bring the solution level close to the working level and check the pH. If the pH level is < 4 proceed as directed. If the pH level is 4.4 or more, no CHEMFIL BUFFER is required. While mixing, add 13 fluid ounces (390 mL) of Chemfil Buffer to 100 gallons (378 L) of bath. Check the pH. Slowly add additional CHEMFIL BUFFER to bring the pH within the operating range of 4.4 - 5.2. (The target pH for most operations is 4.6 - 4.8.)

Note

The amount of CHEMFIL BUFFER necessary for pH adjustments will vary for each installation due to water quality and initial pH. Water hardness exceeding 150 ppm (as calcium carbonate) should be replaced by deionized or reverse osmosis water.

ZIRCOBOND 4200DM Control

The **ZIRCOBOND 4200DM** bath is best controlled by pH. Automated pH control is the best way to replenish the **ZIRCOBOND 4200** bath. This method continuously maintains the optimum bath pH. When pH rises only slightly, the controller activates a pump to feed **ZIRCOBOND 4200DR** (dip replenisher) into the bath. The use of a pH controller provides the best method to minimize chemical consumption and to maintain uniform process conditions. **ZIRCOBOND 4200DR** and CHEMFIL BUFFER should be added in different areas of the tank.

Equipment Needed

- pH Controller
- 2 Metering Pumps (24 gal/day or 44 gal/day)

Reagents Needed

- pH 4 buffer solution
- pH 7 buffer solution

The pH controller needs to be calibrated prior to use and periodically according to the Manufacturer's instructions. The pH of the **ZIRCOBOND 4200DM/DR** bath should be maintained in the range of 4.4 - 5.2; however, for optimum quality a target pH of 4.6 - 4.8 is typically desired. In general, the pH probe tip needs to be cleaned at least once per week. This can be accomplished using a tooth brush and a mild alkaline cleaner. Thoroughly rinse the probe tip with fresh water before reintroducing the probe into the **ZIRCOBOND 4200DM/DR** bath. The metering pump setting depends on the combination of square footage throughput and tank size.

pH Adjustments

- To raise the pH approximately 0.1 unit, add 11mL of CHEMFIL BUFFER per 100 gallons (378 L) of operating solution.
- ZIRCOBOND ADDITIVE LPH** should normally be used to lower the pH. In certain situations, **ZIRCOBOND 4200DM/DR** or **ZIRCOBOND ADDITIVE ZR** can also be used.

Zirconium Concentration Adjustments

The zirconium concentration can be increased by 10 ppm using of the one the following options.

- 260mL of **ZIRCOBOND 4200DR** per 100 Gallons (378L) of bath. Additions of **ZIRCOBOND 4200DR** will also increase the **ZIRCOBOND ADDITIVE ED** concentration by 4.6 ppm; or
- 190mL of **ZIRCOBOND ADDITIVE ZR** per 100 Gallons (378 L) of bath will only increase the Zirconium concentration



Iron Control

ZIRCOBOND 4200 baths are usually white and cloudy when processing steel. However, if the solution starts to turn yellow, the iron level has begun to increase beyond recommended levels. This can be confirmed by using iron test strips (e.g., from Fisher Scientific, cat# M100041). To reduce the iron level, add ZIRCOBOND ADDITIVE P. Contact your PPG representative to determine how much additive to use. **Note:** Ensure good mixing when using this additive.

ZIRCOBOND 4200DM/DR Concentration

The **ZIRCOBOND 4200DM/DR** concentration can be monitored using a colorimetric technique to measure the soluble zirconium concentration in an operating Zircobond bath.

Equipment and Supplies

- Hach DR890 Colorimeter, Hach catalog # 4847000
- 2 – 30 mL Sample Cells (cuvette) for DR890, Hach catalog # 2401906; or DR900 (contact PPG technical)
- Test Solution #4, (0.1N Sulfuric Acid (H₂SO₄)), Reagents Inc. catalog # TS4-4L
- Reagent XO (Xylenol Orange, 0.05 %), Reagents Inc. catalog # 83050-1L
- Reagent C (ascorbic acid, 1 %), Reagents Inc. catalog # 83055-500ML
- 100 mL volumetric flask, Fisher Scientific catalog # 10-200C
- 2 – 20 mL pipettes (class A), Fisher Scientific catalog # 13-646-59
- 4mL pipette (class A), Fisher Scientific catalog # 13-646-51
- Pipette bulb, Fisher Scientific catalog # 13-681-51
- 0.5 mL pipette, Fisher Scientific catalog # 11-382-33E
- Accuwipes or Kim wipes for wiping off glassware, Fisher Scientific catalog # 06-666-A
- 30 mL syringe, Fisher Scientific catalog # 03-377-25
- 5 µm syringe filter, Fisher Scientific catalog # DDR50T3050
- Various beakers
- Deionized water

Hach: 1-800-227-4224 / Reagents: 1-800-732-8484 / Fisher Scientific: 1-800-766-7000

Important Notes

1. A newly purchased meter must be calibrated prior to use for this test by PPG-Euclid Technical
2. The lab ware used should be clean, dry, and stain free prior to use. The lab ware should be cleaned immediately after use to prevent staining.
3. Do not use the syringe to measure accurate volumes, use pipettes only.
4. Baths with Zr content below 40 ppm and above 300 ppm will require a different or additional dilution; contact your PPG representative for information.
5. The ZIRCOBOND bath should be filtered prior to testing the solution for zirconium. Sludge particles can interfere with the Zr reading.



Procedure

1. Filter 25 mL of the bath to be tested using a syringe and a 5 µm syringe filter.
2. Pipette 20 mL of the filtered Zircobond bath into a 100mL volumetric flask and dilute to the 100 mL mark with DI water. Place a stopper onto the flask and invert several times to thoroughly mix the sample.
3. Turn on the DR890 and select program 106 by pressing **PROGRAM** then **1 0 6** then **ENTER**.
4. Pipette 20mL of Test Solution #4 (0.1N H₂SO₄), 0.5 mL Reagent C, and 4.0 mL of Reagent XO into a clean cuvette. This will be the blank and should be orange in color. Cover; shake vigorously for 5 seconds, wipe clean, and place the cuvette into the meter, and place the meter cover over the sample.
5. Press **TIMER**, then **2 0** then **ENTER**. This will start a 20 second timer. When 20 seconds has elapsed, a beep will sound. At this time, press **ZERO** (0.0 should be displayed on the readout).
6. Remove the blank from the meter, uncap the cuvette, and add 0.5 mL of previously diluted sample (from step 2) to the blank. Cap the cuvette, shake vigorously for 5 seconds, and place the cuvette into the meter, place the meter covers over the sample.
7. Press **TIMER**, then **2 0** then **ENTER**. This will start a 20 second timer.
8. When 20 seconds has elapsed, a beep will sound. At this time press **READ**. The displayed value is the actual Zr concentration expressed as mg/L or ppm.

Zirconium Concentration Adjustments

The zirconium concentration can be increased by 10 ppm using one of the following options:

- c) 256mL of **ZIRCOBOND 4200DR** per 100 Gallons (378 L) of bath. Additions of **ZIRCOBOND 4200DR** will also increase the ADDITIVE ED concentration by 2.5 ppm; or
- d) 193mL of **ZIRCOBOND ADDITIVE ZR** per 100 Gallons (378 L) of bath will only increase the Zirconium concentration.

ZIRCOBOND ADDITIVE ED Concentration

ZIRCOBOND ADDITIVE ED may need to be added periodically to the ZIRCOBOND bath.

Equipment Needed

- DR890 Colorimeter from HACH.
- 20mL pipette for bath
- 25mL sample cell from HACH
- 100mL volumetric flask
- CuVer2 Reagent from HACH. Product # 2188299 (Bicinchoninate). Each test uses one pillow.



Procedure

1. The bath sample needs to be diluted by a factor of five (5) with deionized or distilled water, for example, take a 20 ml sample of the bath and place it in the 100 ml volumetric flask. Add deionized or distilled to the mark (place stopper in the opening) and shake well and set aside for step 5.
2. Turn on the instrument (press the EXIT Button)
3. Press PROGRAM
4. Press 20 and then press ENTER
5. Pour 25 ml of the diluted bath sample (from step 1) into the sample cell. (DO NOT ADD THE CuVer 2 at this point)
6. This is your blank. Wipe the outside of the sample cell with a paper towel. Replace the sample lid.
7. Place sample cell into holder and cover the sample cell with the instrument cap.
8. Press the ZERO button. Wait for 0 mg/L to show on the screen.
9. Remove the sample cell from the HACH meter and add the contents of one CuVer2 powder pillow to the sample cell. Wipe the outside of the sample cell with a paper towel. Replace the sample lid and shake the sample well to mix (about 10 seconds).
10. Place the sample cell back into the HACH meter and replace the instrument cap.
11. Press TIMER.
12. Press ENTER. The pre-set timer will start counting back from 2 minutes.
13. When the timer beeps, press READ.
14. The Concentration is displayed in mg/L which equates to ppm of XB Additive ED.
15. Multiply this number by 5 to obtain the Additive ED concentration.

If the ZIRCOBOND ADDITIVE ED concentration is between 15 - 20 ppm, do not add any additional ZIRCOBOND ADDITIVE ED to the bath. If the ZIRCOBOND ADDITIVE ED level is less than 15 ppm, add sufficient product to raise the level back to 20 ppm. The addition of 3.0 mL of ZIRCOBOND ADDITIVE ED per 100 gallons (378 L) of ZIRCOBOND bath will increase the additive level by 1 ppm.

Free Fluoride Determination

Free fluoride will continually rise in the ZIRCOBOND bath while processing work. The zirconium coating can be adversely affected at high *free fluoride* levels. The desired target range for *free fluoride* is 50-100 ppm. At all times the concentration of *free fluoride* should be maintained less than 125 ppm.

Free fluoride determinations require the use of a pH/mV meter or ion specific electrode meter (ISE) in conjunction with a fluoride specific *electrode*.

Procedure

- The ISE meter should be calibrated according to the manufacturer's instructions using 100, 1000, and 10,000 ppm fluoride standards. Also, follow the manufacturer's recommendations for the proper use, maintenance and storage of the fluoride specific electrode.
- Place fluoride electrode in the ZIRCOBOND bath sample at ambient temperature without dilution.
- Stir the bath sample using a magnetic stirrer.



- The reading on the ISE divided by 26 gives the *free fluoride* of the bath.

Reducing Free Fluoride

1. When the *free fluoride* exceeds 125ppm, add an appropriate amount of ZIRCOBOND ADDITIVE FCA or FCN to bring the value below 100ppm.
2. Adding 12.8 ounces (378 mL) of ZIRCOBOND FCA or FCN will lower the *free fluoride* in a 1000 gallon (3780 L) bath by 9 ppm.
3. ZIRCOBOND ADDITIVE FCA or FCN should be mixed into the bath using agitation; avoid adding the fluoride control additive near the replenishment point for the **ZIRCOBOND 4200SR**.
4. If the *free fluoride* reaches 40 ppm, the feed of ZIRCOBOND ADDITIVE FCA or FCN should be turned off.

Replenishment Guide

Use the following table to determine product additions based only on bath samples at 4.4 - 5.2 pH.

ZIRCOBOND 4200DR Replenishment Chart

Zirconium Concentration	Amount of ZB4200DR to add per 100 gal (378 L) bath	
ppm	Ounces	Liters
175	--	--
165	9	0.26
155	18	0.52
145	27	0.78
135	36	1.04
125	45	1.32

Example

If the measured Zirconium is 135 ppm, a 100 gallon (378 L) bath can be adjusted back to the target level of 175 ppm by slowly adding 36 ounces (1 L) of **ZB4200DR** to the bath.

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