

Scale and carbon removing aid

1 General description

Ardrox[®] 188 is an alkaline powder blend containing an oxidising material whilst Ardrox[®] 188RFU (Ready For Use) is a liquid version of Ardrox[®] 188 powder. It is primarily intended as an aid in removing difficult heat scale such as those produced on high chromium steels and nickel and cobalt alloys, which are notoriously difficult to remove even with strong acids. Ardrox[®] 188RFU or Ardrox[®] 188 will not normally remove such scales by itself, but will chemically and physically modify them in such a manner as to make them more easily removable by milder and less dangerous methods than the use of strong acids.

The main field of use for Ardrox[®] 188RFU or Ardrox[®] 188 is the overhaul of "hot end" components of gas turbine engines. Ardrox[®] 188RFU and Ardrox[®] 188 have also been found useful for the removal of adherent carbon smut produced after heat treatment.

Approvals

✓ CFM International	CFM56 CPM – CP2021	(only Ardrox [®] 188)
✓ GE Commercial Engines	SPM 70-80-04, Ref. C04-58	
✓ Pratt & Whitney	SPM 70-22-00, SPMC 114-1/-2	(only Ardrox [®] 188RFU)
✓ Honeywell	HTF 7000 SPM S1012 & S1001	
✓ SNECMA	DMR 70-620	
✓ Turbomeca	TS 00540L & CTB 70-20-03	(only Ardrox [®] 188)

Ask your Chemetall representative for a complete list of approvals.

2 Physical and chemical properties

Property	Unit	Typical Value
Appearance	-	188RFU: Dark purple liquid 188: Purple and white, speckled powder
Density	g/ml	188RFU: Approx. 1.13 @ 20 °C / 68 °F 188 (bulk): Approx. 1.47 @ 20 °C / 68 °F

These are typical values only and do not constitute a specification.

3 Application

Ardrox[®] 188 RFU is used as received (Ardrox[®] 188 at a concentration of 160 g/l in water) and at an operating temperature of 88-99 °C (190 -210 °F).

Run cleaning solution as per the instructions of the engine manufacturer standard procedure.

When making up a new bath the following procedure should be adopted:

Fill the tank three quarters full with cold water. Add Ardrox[®] 188 powder whilst agitating the solution. Fill the tank to the required volume with water and then heat up to the operating temperature.

The product must not be allowed to form a concentrated layer at the bottom of the tank. It is essential that the bath is fitted with an automatic water make-up device to maintain the volume. If evaporation proceeds too quickly the concentrated solution will tend to decompose and lose its efficiency.

Ardrox® 188RFU or Ardrox® 188 is normally used in conjunction with Ardrox® 185L/185 and Ardrox® 1873A as a process sequence.

4 Effects on materials

When Ardrox® 188RFU or Ardrox® 188 is used in the prescribed manner no significant corrosion will take place on ferrous alloys and "Nimonic" alloys but aluminium, tin and zinc will be attacked. Stainless steel (Grade 304 or equivalent) is recommended for the construction of tanks and heating element sheaths.

5 Shelf life

The shelf life is 3 years from date of manufacture.

6 Storage

Store under normal conditions in a dry place with containers tightly closed.

7 Safety guidance

Before operating the process described it is important that this complete document, together with any relevant Safety Data Sheets, be read and understood.

8 Waste release

All waste waters must be treated in accordance with national legislation and local regulations prior to discharge to the sewer.

9 General information

Chemetall supplies a wide range of chemical products and associated equipment for cleaning, descaling, paint and carbon removal, metal working and protection and non-destructive testing. Sales Executives are available to advice on specific problems and applications.

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Head Office
Chemetall GmbH
Trakehner Straße 3
60487 Frankfurt am Main
Germany

T +49 69 7165 0
F +49 69 7165 3018
surfacetreatment@chemetall.com
www.chemetall.com

® registered trademark.

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Method of Control

Changes in the composition of Ardrox[®] 188 solutions occur in the following ways:

- + evaporation of water,
- + drag-out losses,
- + reduction of the oxidising agent,
- + carbonation of the alkali.

Testing chemicals and equipment required

- + 1x 50 ml burette (graduated to 0.1 ml)
- + 1x 10 ml pipette
- + 1x 25 ml pipette
- + 1x 250 ml Erlenmeyer flask
- + 1x 250 ml beaker
- + 3x 100 ml beakers
- + 3x 50 ml measuring cylinders
- + sintered glass filter
- + hotplate
- + pH meter and suitable electrode assembly
- + magnetic stirrer (optional)
- + thermometer (0 – 100 °C)
- + barium hydroxide solution (saturated)
- + 1.0 N sulfuric acid
- + 0.2 N oxalic acid

Procedure

Before sampling, restore the volume of the solution to its original level with water and thoroughly mix.

- 1) Take a sample from the bath and immediately filter through a sintered glass filter. Pipette 10 ml of the hot filtered solution (use a safety pipette or suction device) into a 100 ml beaker containing 50 ml of saturated barium hydroxide solution. Shake well and filter through a sintered glass filter.
- 2) Pipette 25 ml of the filtrate into a 250 ml Erlenmeyer flask, add 40 ml of 1.0 N sulfuric acid and 50 ml of distilled water. Heat to 70 - 80 °C (158 – 176 °F) on a hot plate and titrate with 0.2 N oxalic acid to the absence of the brown precipitate (MnO₂) produced during the initial stages of the titration. A small quantity of slightly pink or grey precipitate will remain (BaSO₄). Let the volume required to dissolve the last traces of brown precipitate be V₁ ml.
- 3) Pipette 10 ml of the hot filtered bath sample into a beaker, dilute with 50 ml of distilled water and cool to room temperature.
- 4) Carry out a pH titration using 1.0 N sulfuric acid to a pH of 11.0. Let this titration be V₂ ml.

(In view of the etching effect of strong solutions of sodium hydroxide on glass, it is recommended that one pH electrode is used solely for Ardrox[®] 188 determinations. After use it should be thoroughly rinsed in water and left in 1.0 N hydrochloric acid until next required.)

Calculations

Potassium permanganate g/l = 1.517 x V₁ ml.

For a new bath this should be 60 g/l.

Sodium hydroxide g/l = 4 x V₂ ml.

For a new bath this should be 100 g/l.

Bath replenishment

If the bath is dark purple:

Restore the concentration of potassium permanganate to 60 g/l by addition of Ardrex® 188 or Ardrex® 188 RFU at 2.67 g/l for each 1 g/l of potassium permanganate required. Each 2.67 g/l will also increase the sodium hydroxide level by 1.67 g/l. The concentration of potassium permanganate should not be allowed to drop below 30 g/l; there is no critical upper limit.

The concentration of sodium hydroxide should be in the range 80 - 120 g/l. If, when the bath has been corrected for potassium permanganate strength, the sodium hydroxide concentration is still low, then add the requisite amount of caustic soda (100° TW) to restore the concentration to 100 g/l.

If the bath is dark green

In this case the potassium permanganate concentration will be found to be very low and the bath should be corrected for sodium hydroxide concentration first by addition of Ardrex® 188 at 1.6 g/l for each 1 g/l of sodium hydroxide required. Each 1.6 g/l will also increase the potassium permanganate concentration by 0.6 g/l. When this has been done, make up the remaining deficiency of potassium permanganate by adding potassium permanganate technical grade as required.

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