

## PRODUCT DATA SHEET MCX

(Includes MCX-LH)

### SELECTION DATA

**CHEMICAL NAME / SYNONYMS:** Aluminum filled metallic ceramic coating.

#### PRODUCT DESCRIPTION:

MCX "CermaKrome" is a metallic ceramic coating capable of providing extremely high levels of corrosion and chemical protection in very thin films. When applied to exhaust systems MCX will withstand **substrate temperatures of over 1500°F with no delamination** which is a higher rating than any other Metallic Ceramic Coating available. MCX will handle environmental temperatures of up to 1600°F. Due to its unique ceramic nature, the coating also functions as a very effective thermal barrier, with reduced thermal radiation characteristics. After curing, the coating requires "burnishing" to be sealed. This burnishing process can produce a very high luster, near chrome, appearance. The coating cures out to a very hard surface with excellent adhesion. The water based solvent system provides for an environmentally friendly material with a bake/cure cycle that is not as hazardous as other thermally cured resin systems. It is also available in a Low Humidity version (MCXLH) for application when the humidity is low, and the drying time needs to be slow for proper flow out. **Nonhazardous for Shipping. Requires a 400°F cure.**

**RECOMMENDED USES:** Can be applied in a "thicker" film, without cracking or flaking. MCX, has excellent "hiding" characteristics, where surface flaws need to be covered. Designed for single coat coverage. May be applied to virtually any metal part for a durable, chrome like finish.

**NOT RECOMMENDED FOR:** Magnesium.

#### CHEMICAL RESISTANCE GUIDE:

<u>Exposure</u>	<u>Splash &amp; Spillage</u>	<u>Fumes</u>
Acids	Poor	Poor
Alkaline	Poor	Poor
Solvent	Excellent	Excellent
Fluids	Excellent	Excellent
Fuels	Excellent	Excellent
Salt	Excellent	Excellent
Water	Excellent	Excellent

**TEMPERATURE RESISTANCE:** (non-immersion)  
1500°F substrate, 1600°F maximum environmental

**CermaKrome has been qualified to Ford Specification WSA-M2P170-A3**

**SUBSTRATES:** May be applied to both ferrous and non-ferrous.

**Coating Adhesion (ASTM D4541) Flexibility (ASTM D522) Impact (SABS 16):** MCX 4.0 Very Good 180° Full load 14 Joules

**Adhesion testing: ASTM 4541 (MPa), average MCX 3.5**  
**ADHESION (Tape Test ASTM D 3359):** 5B (Excellent)

**IMPACT TEST (ASTM D 2794 2 lb. Weight):**  
Passed at 48"

**Flexibility Test: ASTM D522:** 180° full load flexibility

**Condensation water test protocol: DIN 50'017**  
**Coating System Blistering, Disbondment From Scribe, Other-surface anomalies**  
No, No, None

**Salt Spray (ASTM B117):** 6500 hours no failure

**Cross Cut ISO 2409:** 0

**Impact Test SABS method 146:** >14 jules

**Flexibility Test SABS method 145:** <5mm

#### Cryogenic and heat test:

1. Plates fully immersed in liquid nitrogen (- 273°C) for one hour.
2. Plates immediately heated to (+1300°C).
3. Plates re immersed in liquid nitrogen.
4. Continues cycle of test for 8 hours.

**For more details see the following pages**

# TECH LINE Coatings

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## MANIFOLD COATING:

**CERMAKROME BASE COAT; AND BLACK SATIN TOP COAT:** APPLIED TO EXHAUST MANIFOLDS AND TURBO EXHAUST HOUSINGS BOTH INSIDE AND OUT. THE GOAL WAS TO REDUCE THE SURFACE TEMPERATURE BELOW THE FLASH POINT OF HYDRAULIC FLUID.

\***TEST MACHINE:** HITACHI EX3500-2 HYDRAULIC EXCAVATOR

\***TEST ENGINES:** CUMMINS K-T38 C 900, 900HP @ 1,800 R.P.M.

\***ENGINE LOAD FACTOR:** 85%+

\***TEST INSTRUMENT:** TESTO 177-T4 TEMPERATURE DATA LOGGER. (GERMAN)  
TEST INSTRUMENT WAS PROGRAMMED TO TAKE A TEMPERATURE READING EVERY 1 MINUTE FOR THE TEST PERIOD.

\***TEST PROBES:** STAINLESS SHROUDED 4 METRE THERMOCOUPLES.

**OPERATING HOURS OF EXCAVATOR DURING UNCOATED TEST:** 23 HOURS.

**OPERATING HOURS OF EXCAVATOR DURING COATED TEST:** 23.5 HOURS

## TEST RESULTS:

### UNCOATED ENGINE:

**NUMBER OF READINGS:** 1,388  
**MAX TEMPERATURE RECORDED:** 346.2 C  
**MIN TEMPERATURE RECORDED:** 68.5 C  
**AVERAGE TEMPERATURE RECORDED:** 263.1 C  
**NUMBER OF READINGS ABOVE 207 C (IGNITION POINT OF HYDRAULIC OIL):** 1,193  
**AVERAGE PERCENTAGE OF READINGS ABOVE 207 C: (IGNITION POINT OF HYDRAULIC OIL):** 85%  
**AVERAGE PERCENTAGE OF READINGS BELOW 207 C: (IGNITION POINT OF HYDRAULIC OIL):** 15%

### CERAMIC COATED ENGINE:

**NUMBER OF READINGS:** 1,388  
**MAX TEMPERATURE RECORDED:** 211.7 C  
**MIN TEMPERATURE RECORDED:** 47.4 C  
**AVERAGE TEMPERATURE RECORDED:** 94.0 C  
**NUMBER OF READINGS ABOVE 207 C (IGNITION POINT OF HYDRAULIC OIL):** 2  
**AVERAGE PERCENTAGE OF READINGS ABOVE 207 C (IGNITION POINT OF HYDRAULIC OIL):** .001%  
(NOTE 2 READINGS OUT OF 1388 WERE ABOVE 207C. ONE WAS 207.1C)

**AVERAGE PERCENTAGE OF READINGS BELOW 207 C: (IGNITION POINT OF HYDRAULIC OIL):**

99.99%

**PERCENTAGE OF TEMPERATURE REDUCTION CERAMIC COATED MANIFOLDS VERSUS UNCOATED MANIFOLDS: MAX TEMP DROP: 39%**  
**PERCENTAGE OF TEMPERATURE REDUCTION CERAMIC COATED MANIFOLDS VERSUS UNCOATED MANIFOLDS: MIN TEMP DROP: 31%**  
**PERCENTAGE OF TEMPERATURE REDUCTION CERAMIC COATED MANIFOLDS VERSUS UNCOATED MANIFOLDS: AVG.TEMP DROP: 64%**

## SUPERIOR SALT/CORROSION PROTETCION (INDEPENDENT TESTING)

### TEST PANELS AFTER 6524 HRS OF SALT SPRAY:



### COMPETOR'S TEST PANELS AFTER 4000 HOURS:



## Thermal Shock Testing:

Test objective:

Coatings to be tested for extreme thermal shock and ability to protect and survive in the harshest environment. Ranging from - 200°C to +1300°C.

### Application:

Oil refinery, liquid oxygen and liquid hydrogen tanks.

### Test:

50mm by 100mm mild steel plates coated to manufactures specifications with above mentioned coatings.

### Cryogenic and heat test:

1. Plates fully immersed in liquid nitrogen (- 273°C) for one hour.
2. Plates immediately heated by blow torch to (+1300°C).
3. Plates re immersed in liquid nitrogen.
4. Continues cycle of test for 8 hours.

### Adhesion (ASTM D4541) Flexibility (ASTM D522) Impact (SABS 16)

4.0 Very Good 180° Full load 14 Joules

**Adhesion testing: ASTM 4541:** The adhesion of a protective coating system to the substrate is considered a good indicator of the coating's ability to resist corrosion and therefore represents the longevity of the coating.

An alcometer adhesion tester was used to evaluate the adhesive properties of the coatings. To quantify bonding strength between the coating and the substrate, ASTM standard D4541 was employed. Aluminum dolly's were glued onto the paint surface (as-received condition), allowed to cure for 24 hours, after which the "pull-off" strength of the coating was appraised.

**Coating system Adhesivity results (MPa), average**  
**MCX/CermaKrome 3.5**

**Dry Film evaluation - (DFT): ASTM D1186-87:** The DFT of the coatings was determined according to ASTM D1186-87. Test procedure: The test method covers the measurement of DFT of coating applied to a ferrous-based metal. An average of 10 readings were taken using the Quanix 1500. Readings were taken approximately 25mm from the edge of the sample and the results are given in Table 4.

**Coating System Average DFT, µm Std. Deviation**

**MCX/Cerma Krome 11.6 2.06**

**Comment:** The DFT on the as-received test plates are on the lower envelope specified, and should be applied to the optimum DFT required.

## ACCELERATED WEATHERING TEST PROTOCOL

### Thermal Shock: Cyclic Test Protocol

An experiment involving continuous thermal cycling was chosen for accelerated testing because it provides a severe environment that accelerates degradation of a coating system. The test method employed exhaustive temperature shock cycling [0°C to 250°C] as presented below:

### Thermal shock test protocol.

**Cycling Protocol Temperature, °C Duration, hours Cycles per day**

**Heating** 200 to 250 ~1.5 7

**Cooling** 0 to 5 ~1.5 7

**Weathering** 25 to 40 ~15 1

**Total test duration:** 2.5 weeks

Heating and cooling rate were immediate.

### Weathering test protocol

#### Condensation water test protocol: DIN 50'017

Materials are subjected to a natural climate change cycle. The test simulates condition in a hot-humid atmosphere with the formation of condense water which can occur with the impact of humidity, condensing humidity or water. It is suitable for testing protective coating systems. Condense water can form because of temperature change, for instance when a cold sample is transferred into a warm environment. For the test, a test plate is subjected to a wet/humid cycle, which results in a compression of the test duration without deviating from natural loading mechanisms. An illustration of this protocol is shown below.

### Weathering test duration 15 hour continuous cycle per day

#### Evaluation methodology and tested systems

Visual evaluation methodology of test plates:

**Coating System Blistering Disbondment**

**From Scribe:** No

**Other-surface:** No

**Anomalies:** None

**CermaKrome MCX shows the highest Salt Spray and Corrosion resistance of any metallic Ceramic Coating and maintains excellent Adhesion.**

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