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North-West Spray Production Company

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July 14, 2009

Director General of VELV JSC

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Seal: St.Petersburg, JSC; North-West Spray Production Company; VELV

Opinion Report

Results of tests in electrolyte solution for NANO PROTECH ANTICORROSION protective lubricant spray produced by Innovatsionnye Tekhnologii LLC

Research Laboratory of VELV JSC performed protective property test in electrolyte solution for the lube with high-quality construction carbon steel ('08KP') samples in the period from October 30, 2008 to Jul.08, 2009.

Protective properties were tested for compliance with GOST 9.054-75 requirements by method 4 "Common corrosion and ageing protection system. Conservation oil, lubricants and thin-film petroleum coatings. Express protection test methods".

Test results can lead to following conclusions:

NANO PROTECH ANTICORROSION lubricant spray provides reliable corrosion protection in electrolyte for 8 months (test duration) for high-quality carbon steel of '08 KP' grade used in production of rolled cab, frame and fender parts.

Appendix: Test method and results obtained, in 2 sheets.

<signature> Deputy Director General in research issues

July 14, 2009 L.E. Shmatov

## Test method

Monitoring method applied in tests of protective properties in for NANO PROTECH ANTICORROSION lubricant spray manufactured by Innovatsionnye Tekhnologii LLC.

### 1. Materials and equipment

Steel plates per GOST 16523, '08KP' grade, size of 50x50x0.8-1.0 mm.

Water-proof polishing sand paper per GOST 10054, grain size M28-M40.

Aviation gasoline per GOST 1012.

Toluene per GOST 5789.

White spirit per GOST 3134.

Ethanol per GOST 18300.

Metal measuring ruler per GOST 427, measurement limit of 300 mm, scale factor 1 mm.

Cotton wad.

Glass fluid thermometer per GOST 28498, measurement range of 0° to 100 °C, scaling factor 1°C.

Chronometer with second hand.

### 2. Test preparations.

2.1. The plates are degreased by a solvent (white spirit, gasoline, etc.) first, then scales and rust are removed by polishing paper. Degreasing is repeated. The plates are wiped by cotton wad soaked in ethanol until the wad is clean after wiping. The plates shouldn't have traces of corrosion, scaling, mechanical defects.

Further the plates are laid with a tilt, and spray lube is applied on both sides according to the application instructions. Then the plates are put vertically and remain in that position for (24±1) hours at (20±2) °C.

2.2.1. Electrolyte (salts dissolved in distilled water) is prepared by the following formulation:

Salt	Concentration, g/L
Magnesium chloride	11.0
Calcium chloride	1.2
Sodium sulfate	4.0
Sodium chloride	25.0

25 % solution of sodium carbonate in distilled water is prepared. Electrolyte pH is adjusted within 8.0-8.2 by adding sodium carbonate.

### 3. Test procedure

Plates with the lubricant applied are submerged into electrolyte solution and matures at  $(20\pm 2)$  °C for defined time.

Top surface of the plates should under at least 10-15 mm of electrolyte. After the test, the samples are taken out, wiped by a wad soaked in toluene or gasoline, and examined.

### 4. Review of the results

Protective properties of the lube are assessed by the time when the first minimum corrosion center. The following defects can be considered a minimum corrosion center:

- one corrosion spot of 2-3 mm diameter
- two corrosion spots of less than 1 mm diameter yet visible to unaided eye.

Corrosion centers on the plate ends and within 3 mm from the plate edges are not taken into account.

Test results are given in the table.

Sample No.	State of substrate (initial)	Maturing period	Substrate state after the test
1	Without lube	6 days	Black, with multiple corrosion centers
2	With lube	1 month	Glossy, no corrosion centers
3	With lube	5 months	Glossy, no corrosion centers
4	With lube	8 months	Glossy, no corrosion centers

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