English translation

Approved

Deputy General Director
Scientific and Production Association "Soyuz"

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CERTIFICATE

on Vibration and Shock Resistance Test Results for aerosol fire extinguishing generators of MAG type

Scientific and Production Association "Soyuz" has conducted vibration and shock resistance tests for aerosol fire extinguishing generators of MAG type.

Types of mechanical and temperature impacts were selected in accordance with "Automotive Electrical Equipment" GOST 3940-84 (ST CMEA 3264-81 - Standard of the Council for Mutual Economic Assistance) which sets up the requirements on temperature, vibration and shock impacts as applied to automotive electrical equipment, those requirements imitating the real working conditions for the generators.

In accordance with mentioned GOST electrical equipment shall withstand temperature conditioning at minus 60 C and plus 70 C and the vibration and shock resistance impacts as listed in Table 1 without becoming inoperable.

Table 1.

Impact	*Frequency of vibration, Hertz*	*Maximum acceleration, g*	*Duration of testing*
Vibration	*50...250*	*5*	*8 hours*
Shock	-	*10*	*10,000 impacts*

When tested in Scientific and Production Association "Soyuz" generators were subjected to even more severe conditions than specified in the above mentioned Standard by extending duration vibration and increasing the number of shock impacts by three times.

Testing procedure was as follows:

Generators were mounted on the stand, then controlled thermostatically at minus 60 C or plus 70 C until aerosolforming composition reached those temperatures, then wrapped up into the overcoat fabric and subjected to vibration or shock impact tests. The same generators were to be subjected to both vibration and shock impact tests.

After each cycle which included thermostatic control plus vibration and shock impact tests, the generator was examined for integrity of igniter's electric circuit, then disassembled and examined again for integrity of operating parts and components.

Tests conducted are given in table 2.

Examination of integrity of igniter's electric circuit and operating parts of the generators revealed no changes as compared to its initial state.

Preservation of operable conditions was examined by:
- conducting tests on efficiency for fire extinguishment;
- observing no flame in released aerosol;
- measuring pressure inside the generator; and
- measuring working time of the generators.

Test results showed that vibration and shock impacts selected in accordance with GOST 3940-84 "Automotive electrical equipment" have not affected operation of the generators and have not reduced its fire extinguishing capability.

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Table 2.

NN	Temperature of thermostatic control, C	Duration of thermostatic control, hours	Type of impacts	Frequency of vibration, Hertz	Maximum acceleration, g	Duration of testing, hours	Orientation axe of vibration
1	- 60	4.5	vibration	120	5	4	along generator's axis
2	+ 70	3	vibration	50	5	4	along generator's axis
3	+ 70	3	shock		10	13,200 shocks (5.5 hours)	across generator's axis
4	+ 70	3	vibration	50	5	4	across generator's axis
5	- 60	4.5	vibration	50	5	4	along generator's axis
6	- 60	4.5	shock	50	10	13,200 shocks (5.5 hours)	along generator's axis
7	- 60	4.5	vibration	50	5	4	along generator's axis
8	+ 70	3	vibration	50	5	4	across generator's axis
9	+ 70	3	shock	50	10	6,600 shocks	across generator's axis
10			vibration	50	5	2	

English Translation

Approved
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CONCLUSION

on corrosive activity of the aerosol combustion products generated by MAG type generators towards model materials

Aerosol generators of MAG type (MAG-1...MAG-4) have been developed by LNPO "Soyuz". They come with coolant devices designed to suppress flame at the discharge outlet of the generators.

Aerosol-forming elements of the generators are made of PT-4 and PT-50-2 compositions. Combustion products of generators do not contain clorine.
Since construction and combustion products of the aerosol-forming elements are similar for all types of MAG generators, tests have been performed for generator MAG-2 only as MAG-2 is currently in a higher demand.

The following materials have been taken as model materials for testing:
- cast iron 20
- steel 35
- aliminium alloys A6, AMg3
- brass L63

The face sides of the samples have been exposed to the combustion products at concentration 100 g/m3 for 20 minutes in enclosed premises with the degree of opening around 1%. Nine samples have been used for each type of composition: 3 were moistened with water, 3 with surfactants and 3 were left untouched. Additional 3 samples were not exposed and served as reference.

Impact of climate during application of generators was imitated by cyclic thermostating (6 hours at 60 C and 18 hours at 20 C) for 30 days at air humidity of 98%. This procedure provides permanent moistering due to the condensation at 20 C and accelerates corrosion at elevated temperatures.

TEST RESULTS

1. The combustion products of the aerosol-forming elements in MAG generators do not exhibit corrosive action towards cast iron and steel. Traces of corrosion appears simultaneously for test and reference samples. Subsequent corrosion proceeds at the same rate for test and reference samples.

2. For aluminium alloys no corrosion had been observed. But these materials are highly resistible for corrosion. Presence of potassium alkali, nitrate and carbon in aerosol might cause corrosion for the less resistible aluminium alloys.

3. Brass samples after having been exposed to the combustion products of PT-50-2 and PT-4 compositions showed darkening of working surface (dark film). After cyclic thermostating of the samples a weak surface corrosion had been observed between the film and metal of non-working surface. When samples were exposed to combustion products of PT-50-2 after having

been thermostated no corrosion of working surface had been noticed. Combustion products of PT-4 show higher corrosion activity for brass - small affections have been observed on working surface. Moistening with surfactant excludes corrosion almost completely. Moistening with water decreases corrosion but not so effectively. Chemical refining or etching in 20% solution of sulfuric acid or mixture of sulfuric and nitric acids have to be carried out to remove the dark film.

CONCLUSIONS

1. Combustion products of the aerosol-forming elements at concentration of 100g/m3 show either no corrosive activity towards model materials (steel 35, cast iron 20, corrosive stable alumunium alloys A6, AMg3), or wear corrosion activity (brass L63 or high alloyed aluminuim alloys).

2. No corrosion is expected during exploitation of materials (after being exposed to combustion products) under usual conditions (humidity 60-70%, temperature 50-60 C).

3. Weak corrosion may occur during exploitation of materials (after being exposed to combustion products) under unfavorable conditions (humidity 90-98%, temperature 50-60 C).

4. To exclude corrosion of materials after their exposure to combustion products a moistening with surtactant or mechanical refining are required. Reduction in the concentration of the combustion products below 100 g/m3 decreases corrosion activity as well.

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