Dynameco: is the trade mark of the German Company Dynamit Nobel, manufacturer of explosive materials and derived products. It is derived by the old russian Mag products. These products contain one of the first aerosol forming compound based on pyrotechnical materials, e.g. nitrocellulose. This technology was developed by Soyuz, in Russia more than 20 years ago and was never improved since then, i.e. the solid compound composition and the cooling material composition is the same. The only difference from the old composition and Dynameco composition is that in place of nitrocellulose there is a similar product: nitroguanidine.

FirePro® is the trade mark of FirePro Systems Ltd., a Cyprus based International Group, which owns the International Patent of the technology, developed after many years of research and development by a group of international scientists. The technology is derived by the old Russian technology, with a different and improved chemical composition, which does not contain any pyrotechnic material neither in the solid compound composition nor in the cooling material composition.
FirePro® is the most widely certified, approved and listed aerosol system.

A)- <u>Classification of the product under the " Dangerous Goods Regulations" codes</u>:

Dynameco:
Class 4.1

Flammable solid, organic, n.o.s., pyrotechnical material

75%	Potassium Nitrate
22.4%	Plasticized Nitroguanidine
8.5%	Organic Resin

FirePro:
Class 9.1

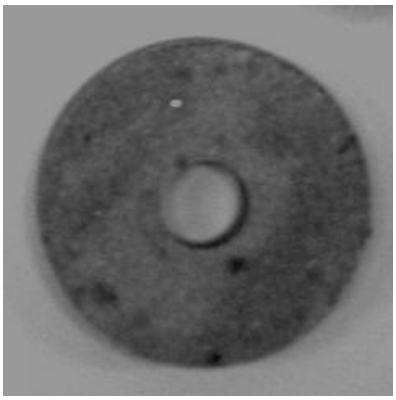
Miscellaneous, solid, n.o.s., aviation regulated solid material.

77%	Potassium Nitrate
4.0%	Potassium Carbonate
19%	Epoxy Resin

According to the information mentioned in the MSDS, Dynameco is classified as a pyrotechnical material, due to the characteristics of nitroguanidine, which has got high detonation (explosive) velocity. Important disadvantages related to pyrotechnical materials are: instability versus temperature increase, decay of its mechanical properties with the time, reduced life time and as a consequence loss of efficiency.

B)- <u>Aerosol Forming Compound</u>:

Dynameco : the appearance of the compound is of a black oily thermoplastic solid material, which has a self ignition temperature below 230°C. The chemical composition is of pyrotechnic nature, as indicated in the MSDS, and is classified as Class 4.1 (flammable solid, organic, n.o.s.). Pyrotechnic substances such as nitrocellulose or nitroguanidine, are contained in a percentage higher than 20 % in the Dynameco chemical composition (it is described it the patent as “derivate of cellulose and low-volatile plasticizer”).



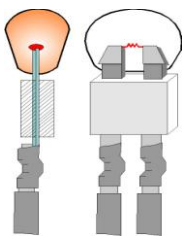
Thus it is subject to all the disadvantages related to pyrotechnic materials. The life time (shelf life) declared by the Manufacturer is 10 years, although similar pyrotechnic materials do not exceed 5 years life time. No certification issued by accredited laboratories are available by the Manufacturer confirming the life time.

FirePro®: the appearance of the compound is of a off-white – beige color indicating various color shades of the different ingredients in the composition, which is solid and of strong consistency; it brakes into large pieces only if subjected to a strong pressure, thus it is of strong mechanical stability and strength. The mechanical stability and strength are vital factors for aerosol generator units, which may be subjected to vibrations and shocks in certain applications.

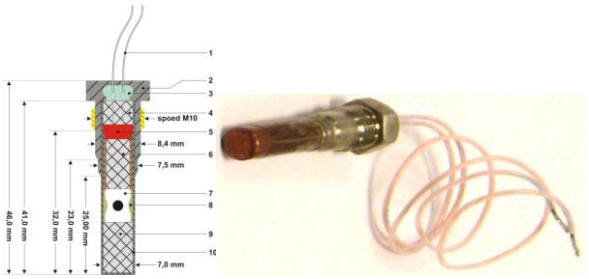
The chemical composition, is non pyrotechnic, as indicated in the MSDS, and is classified as Class 9.1 (Miscellaneous, solid, n.o.s. no otherwise specified), aviation regulated solid material. It does not contain nitrocellulose or nitroguanidine or any derivate of cellulose, thus it is not subject to the disadvantages related to pyrotechnic materials; its life time (certified by accredited laboratories such as Kiwa) is minimum 15 years.

C)- <u>Igniter-activator</u>:

Dynameco: the electrical activator is made of an ignition material of pyrotechnic nature (similar to an ignition match).



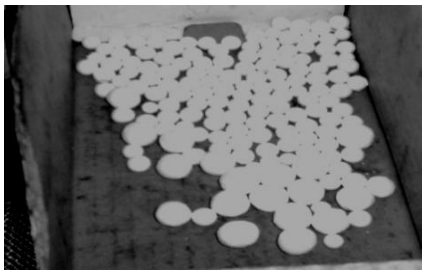
FirePro®: the electrical activator is made of a simple and reliable heat element enclosed inside a steel metal housing, which contains the aerosol compound in solid form.



It is therefore evident the drastic difference between the two activators: it is easy to expect that the Dynameco activator is subject to all the disadvantages related to pyrotechnic materials, i.e. instability versus the temperature increase, decay of its mechanical properties with the time, reduced life time and as a consequence loss of reliability.

D) - <u>Cooling system</u>:

Dynameco: a chemical material based on cellulose.



Dynameco cooling material consists of a chemical compound containing derivates of cellulose, which inter-react chemically with the aerosol and forms by-pass chemical products such as Nitrogen Oxides, Ammonia, Hydro cyanic acid, which are toxic.

Furthermore, due to the chemical nature of Dynameco cooling material and its sensitivity to the temperature increase, when the hot aerosol passes through, it changes its physical-mechanical properties thus blocking the outlet free flow of the discharged aerosol.
No detailed chemical analysis on the discharged aerosol composition are available from the Manufacturer.

FirePro®: a natural heat absorbing material (ceramic type).
The heat absorption is derived by a physical reaction and the heat is exchanged without involving any chemical reaction, thus without changing the chemical composition of the discharged aerosol. The chemical composition of the discharged aerosol has been analyzed by accredited Institutes, such as KEMA, and it is clearly indicated in the KEMA Report.

E) - <u>Toxicity and corrosion issue</u>:

Dynameco: No toxicological test Reports are available in the Manufacturer documentation. It is expected that in the Dynameco gas phase are present toxic gases such as NOx, NH3, HCN Hydrogen Cyanide (which are derived by the chemical reaction of the solid compound and the cooling material, which inter-react chemically during the aerosol formation and heat exchange). No investigations and assessments have been made by any accredited Institute in order to assess the corrosion on components, especially electronics.

FOR DYNAMECO THERE ARE NO TOXICITY AND CORROSION REPORTS OF ACCREDITED LABORATORIES.

FirePro®: Many tests have been conducted by accredited laboratories and the Reports are available from the Manufacturer. Specifically the KEMA Institute has carried out a very detailed series of

analysis (See Kema Report), and TNO has tested the impact on electronics for a period of 15 months (See TNO Report). The NLR (Dutch Aerospace Laboratories) has lately tested the corrosion on metals (See NLR Report), with positive results. The Ministry of Environment, member of the European Union Eco-Labeling Board (EUEB) has listed FirePro as an environmentally friendly product and authorized the green label marking.

F) – Certifications

Dynameco: The list of Certifications and Listings is none; only a few approvals issued by local authorities are referred to test reports not complying with International Standards' protocols .

FirePro®: The list of Certifications and Listings has reached an impressive number (68) and includes European Listings (KIWA, ANPI), UL, ULC (Underwriters Laboratories USA/Canada), BSI (British Standard Institute), Fire Brigades Authorities, Shipping Inspectorates (large vessels), Ministries, etc. (See list of Certifications).

For this purpose FirePro Systems has employed the services of the foremost name in fire protection engineering consultancy, Hughes Associates, Inc. Baltimore (HAI)/Hughes Associates Europe, srl (HAE) Italy.

HAI with its staff of professionals have conducted and are continuing to do so, experimental research, development and testing for the military, federal and commercial/industrial fire issues in the USA and around the world. They are the fire risks consultants of the US Coast Guards, Pentagon, US Navy, US Government, etc.

HAI is currently supporting ***FirePro®*** to undergo further international certifications, develop scientific issues, and many more specific services. It has already finalised its major "Due Diligence Audit Report on Certifications Record" showing in the words of HAI that:

"The certifications and reports owned by ***FirePro®*** demonstrate that the characteristics of the product/technology are consistent with the most stringent environmental requirements stated by the international regulatory bodies.
The approvals on applications obtained from several Authorities proves the ***FirePro®*** capability to comply with the specific requirements and the reports on performance testing demonstrate the repeatability and consistency of result on testing run by different Authorities and Laboratories in many different countries, giving a high level of credibility to the data published by the manufacturer.
The ***FirePro®*** quality assessment certifications issued by different Authorities are also giving a consistent reliability on the manufacturing process standards."

HUGHES ASSOCIATES USA, Ltd
FIRE SCIENCE & ENGINEERING

G) – Fire class

Dynameco : B (limited) , C
fire class

FirePro®:
fire class

Dynameco has been approved only for Class B (limited) and C.

Therefore it is not suitable for extinguishing fires of class A (solid materials such as plastics, cellulose, cables, wood, etc.) and F (fats, oils, lubricants, etc.)

Extract from Dynameco web site www.dynameco.com

Dynameco Fire Extinguishing Generators are certified according to DIN EN2 for B (limited) and C fire-protecti

Fire-protection classes according to DIN EN 2
Fire-protection classe B are flammable liquid or liquefiable materials (open flames)

- petrol
- benzene
- oil
- grease
- paint
- tar
- alcohol
- stearin
- paraffin
- etc...

Fire-protection class B limitation means that Dynameco Fire Extinguishing Generators are not appropriate as hand extinguishers and m
fire extinguishing systems.

Fire-protection classes according to DIN EN 2
Fire-protection classe C are Gas fires (open flames)

- methane
- propane
- hydrogen
- acetylene
- town gas
- letan
- etc...

FirePro is Certified and Listed by Accredited laboratories/Institutes for Classes of Fire: A,B,C and F.

H) – Project References

Dynameco: References of real projects are an indication of how well the Markets accepts a product/technology. Not many prestigious projects are indicated by the Dynameco Manufacturer. In addition the few projects are of small size and related to protection of small enclosures.

***FirePro®*:** References of real projects are available and cover small, medium and large enclosures (thousands of cubic meters), including a list of impressive International Clients (Ministries, Insurance companies, Philips, Coca Cola, Sheraton, Hilton, Vodafone, Orange telecom, Central Banks, Petrochemical Groups, Emirates Airline, Kardex, and more).

Disclaimer: All above information are derived by public documents and technical data issued by each Manufacturer.