

Catalogue of magnetic-impulse installations IM

Research and production enterprise 'MITEK' LLC (Mykolaiv, Ukraine) has been specializing in the field of magnetic-impulse engineering and is the leading developer and unique producer of **magnetic-impulse installations of IM type** designed for:

- collapse of bridging, prevention and elimination of arching, ratholing in bins and hoppers;
- for cleaning and stripping the walls of bins, hoppers, silos, chutes and other surfaces from different hanging, sticking, freezing powder&bulk solids;
- cleaning the internal surfaces of railway cars from adhering, frozen bulk materials, both during bottom unloading of railway cars, and when they are unloaded on railway car dumpers;
- shaking the hoses of bag filters in order to regenerate them.

Fields of application - in all fields that use storage and processing of bulk solids, such as iron-ore, bauxites, charge, concentrate, limestone, coal, coke, mixed fodders, cement, flour, dried milk molding mixtures, other loose granular substances and materials.

IM installations **are certified in CE system of European Union** and have the **certificate of conformity CE** to Directives of the European Parliament and of the Council of electrical safety and electromagnetic compatibility. The installations IM have a Declaration of Conformity with the Technical Regulations of the Eurasian Economic (Customs) Union №004/2011 "On the Safety of low-voltage equipment", №020/2011 "Electromagnetic compatibility of technical means", as well as a Declaration of conformity with the Technical regulations of Ukraine "On the safety of low-voltage electrical equipment" and "Electromagnetic compatibility of equipment".

Method of cleaning, device to perform it as well as trade mark **MITEK Magnetic Impulse®** are registered in **patent authorities of Ukraine** (№ 133300, 118299, 111179, 110225, 101692, 101691, 100623, 100622, 100621, 90172, 90023, 86639, 44783), **Russia** (№ 2153403, 196679), and **Germany** (№ 212019000226). Certificate for the trade mark №97672.

The quality management system in accordance with EN **ISO9001:2015** standard was introduced at our enterprise, TÜV AUSTRIA CERT GmbH certificate is available.

RPE "MITEK" LLC is the constant participant of numerous contests and exhibitions. Production of RPE "MITEK" Ltd was awarded different prizes. The enterprise holds leading positions in national ratings and obtains status "Enterprise of year" annually.

According to the results of state statistics in the area of foreign economic activity the enterprise is regularly awarded the title of "Exporter of the year".

Since **1993** the enterprise "MITEK" LLC has produced and introduced more than **600** magnetic-impulse installations IM on different enterprises of Ukraine, Kazakhstan, Russia, Republic of Belarus, Kyrgyzstan, Uzbekistan, Azerbaijan, Armenia, Georgia, Moldova, Czech Republic, Slovakia, Hungary, Finland. Among them there are the iron and steel works ArcelorMittal (Ostrava, Temirtau, Kryvyi Rih), U.S. Steel, s.r.o. Kosice, ISD Dunafer, Azovstal Iron&Steel Works, Zaporozhstal Integrated Iron&Steel Works, Alchevsk Iron&Steel Works, Dneprovsky Iron&Steel Integrated Works, as well as Kazzinc, Nokian Tyres, PhosAgro AG, Belaruskali, Gomel chemical plant, Kuzbass fuel company, a lot of bakeries and confectionaries, cement factories, butter-cheese factories, milk plants, mixed fodders factories and other enterprises.

The composition of magnetic-impulse installations IM is the following (fig.1): power block (1), control box or operator panel (2), control cable(3), power coaxial cables (4), connection boxes (5), complete set of executive mechanisms (6).

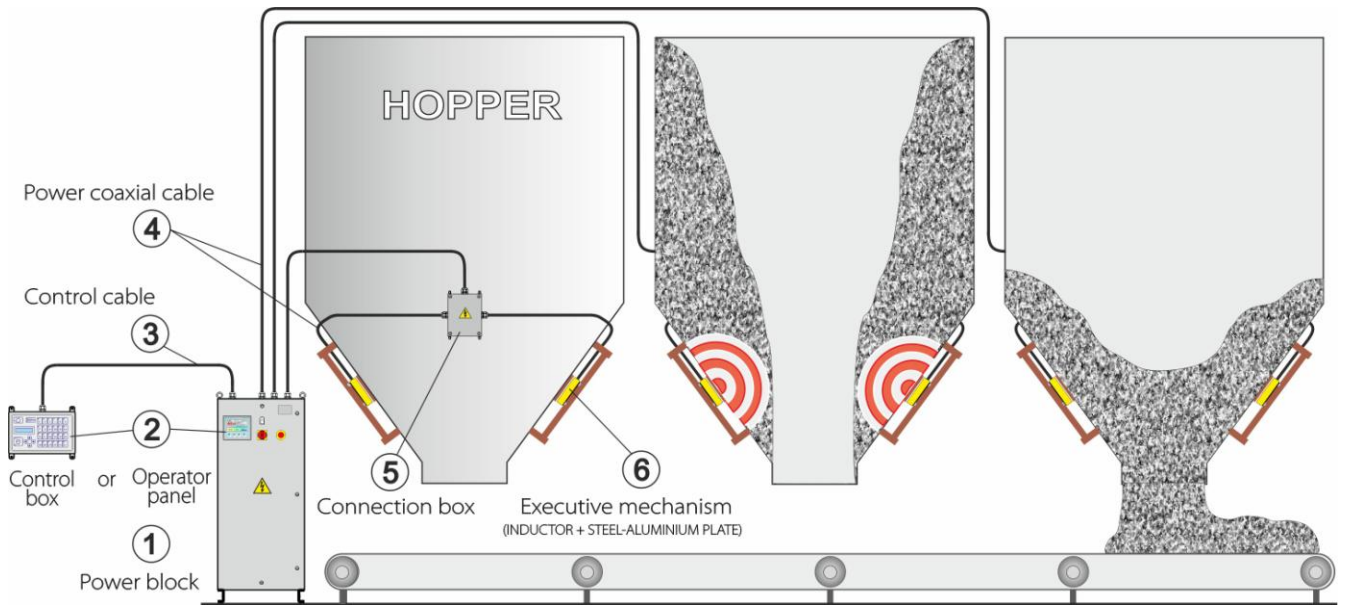


Fig.1 Hoppers equipping by magnetic-impulse system of arches collapsing based on installation IM.

The power block is designed to generate powerful current impulses. It is assembled in a dust- and moisture-proof cabinet and consists of a charger, a capacitive energy storage unit, a block of thyristor switches, control and protection systems. The power block is made multi-channel, and each channel can be connected through connection boxes and a power coaxial cable to one or two executive mechanisms.

Flow diagram of installation IM

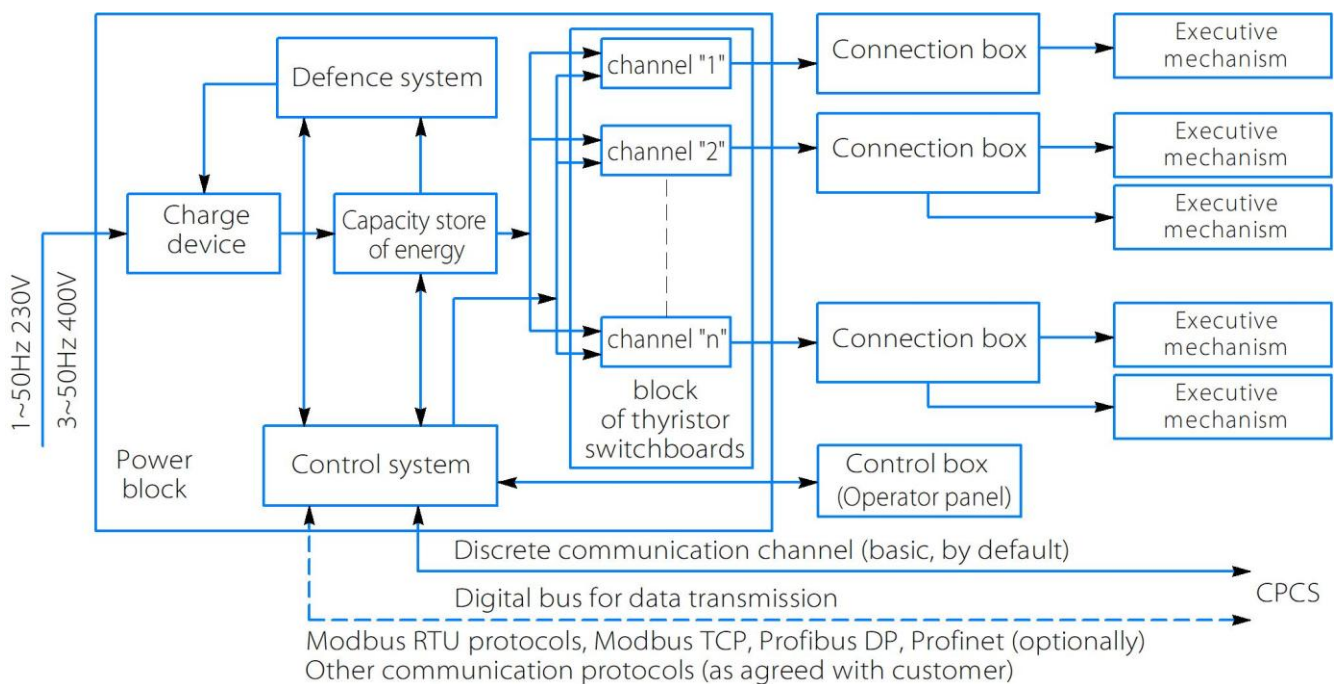


Fig.2 Flow diagram of installation IM

Executive mechanism consists of inductor and steel-aluminium plate. Control box is connected to power block through control cable.

The original appearance of magnetic-impulse installation IM components



Fig.3 Original appearance of installation IM components.

Installations **IM** are divided into types according to the size of maximal working voltage: **IM1** - to 1000V, **IM2** - to 2000V, **IM3** - to 3000V, **IM4** - to 4000V, **IM5** - to 5000V.

Installations IM are produced with the various power characteristics defining the maximum possible size of mechanical impulse influence on the cleared surface, and with various quantity of channels (from one to thirty two), defining the number of points of the impulse influence realized by one installation.

Reference designation's structure of installation **IM** types is presented on a fig.4:

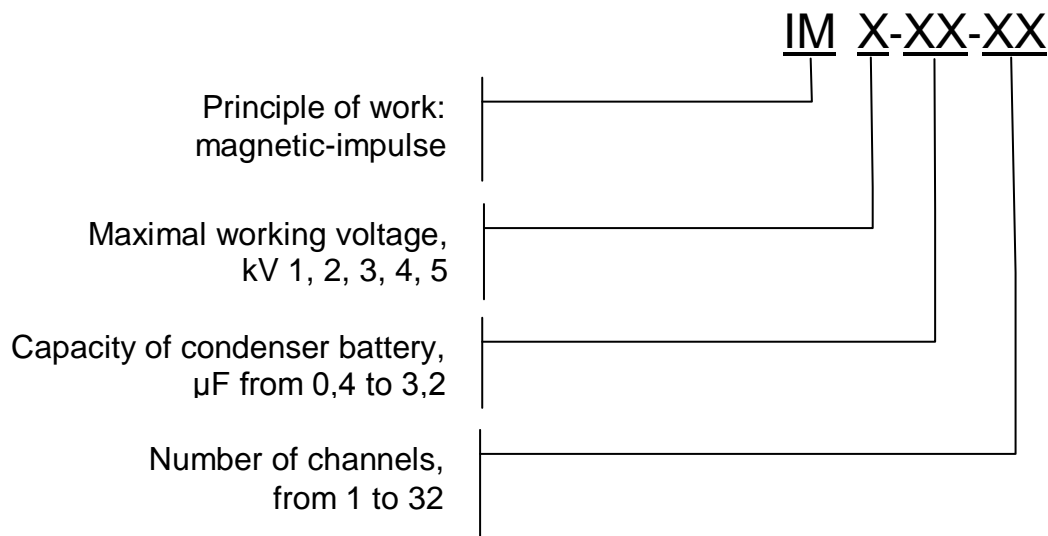


Fig.4 Structure of reference designation of types of installation IM.

Example of designation: **IM3-1,5-8**, i.e. installation with maximal working voltage 3 kV, by the capacity of condenser battery 1,5 μF, by the number of channels 8.

Overall dimensions and mass of components, included in the installation IM, are given in table 1.

Table 1

Name	Overall dimensions mm, no more			Mass, kg, no more
	Length	Width	Height	
Power block	600	510	1500	150
	700	560	2100	250
	1000	560	2100	350
	1200	640	2100	450
Control box	250	185	65	1,0
Inductor	260	260	30	6,0
Steel-aluminium plate	270	270	8	2,5
Connection box for one inductor in channel	230	125	100	1,0
Connection box for two inductors in channel	300	255	110	1,5
Note - The standard size of the power block for a specific modification of the installation IM is determined by the manufacturer depending on the capacity of the condenser battery and the number of channels.				

The operating principle of installations IM

A power block generates the powerful impulse of current in the winding of inductor. The magnetic field of inductor, created by this current, induces the impulse of current in the plate set near by an inductor. As a result of co-operation of impulsive currents, flowing on a winding of inductor and pointed in a plate, a plate renders impulsive mechanical influence on the cleared surface, that results in the origin of local resilient deformation in the cleared surface, and in the layer of sticking material - to the origin of shear stress. The united action of these processes violates integrity of layer of sticking material, destroys adherence of material to the cleared surface and results in its cleaning. Power of mechanical influence and amount of impulses are regulated and are got out sufficient for the assured bringing down of sticking materials.

At surface (walls of a hopper) clearing a series of impulses is transmitted in a sequence on each involved channel of installation (two of executive mechanisms). Quantity of impulses in a series and an interval between them are regulated, usually 3÷6 impulses in a series with an interval 3÷8 seconds between impulses. After consecutive transmission of a series of impulses to all involved channels installation comes in an expectation mode. The following transmission of impulses in executive mechanisms occurs according to the established operating mode (either from a manual signal, or from a transducer signal, or according to the established program).

Depending on size, capacity and construction of hopper, thickness of the cleared walls and surfaces, presence of ribs of inflexibility, physical and chemical properties and humidity of the loaded material the different variants of constructions of fastening and placing of executive mechanisms on the cleared surfaces are possible.

At high inflexibility of walls (large thickness, presence of the close located ribs of inflexibility) hoppers are equipped by additional flat sheets (vibrating sheets) inside having as compared to a wall less inflexibility, on which power influence is made (fig.5).

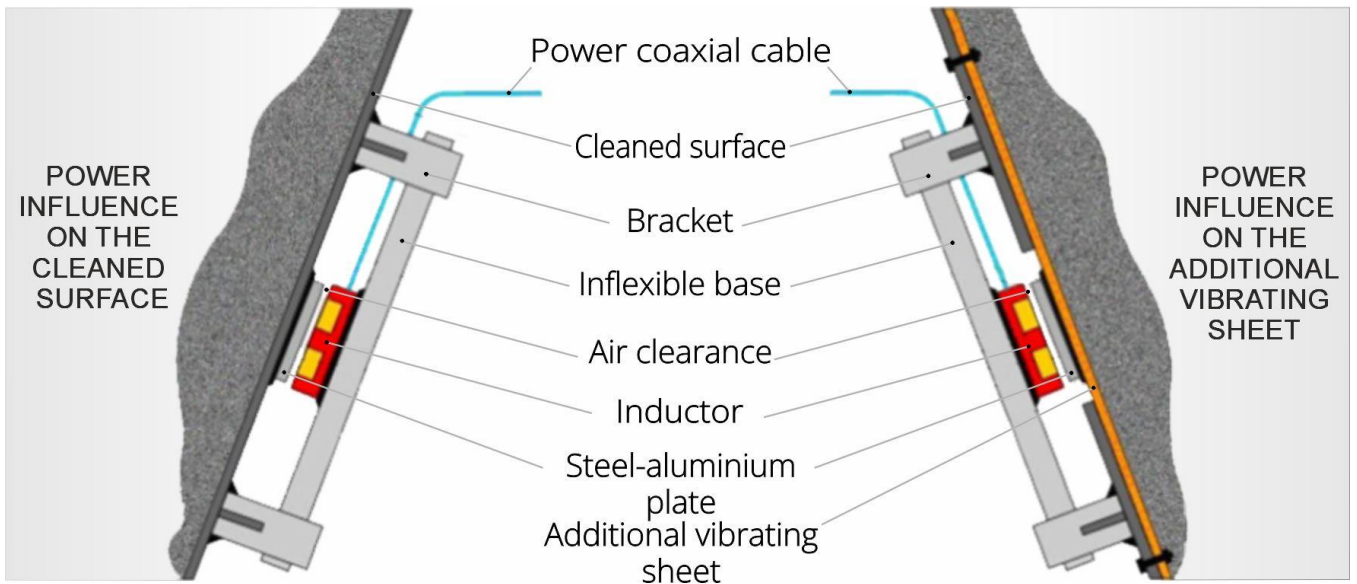


Fig. 5 . Original appearance of the mounted executive mechanisms.

Scope of installation IM supply is given in table 2.

Table 2

№	Name	Note
1	Power block	1 pcs.
2	Control box	1 pcs.
3	Inductor	1 pcs. or 2 pcs. per channel
4	Steel-aluminium plate	1 pcs. or 2 pcs. per channel
5	Connection box	Number amounts number of channels
6	Power coaxial cable	The length is determined by the relative position of the power block and executive mechanisms (recommended no more than 30 m per channel)
7	Control cable	The length is determined by the relative position of the power unit and the control panel (recommended for more than 100 m)
8	Fasteners kit (bolts, washers, nuts)	1 complete set
9	Plate for inductor fastening	1 pcs. or 2 pcs. per channel
10	Protective plate	1 pcs. or 2 pcs. per channel
11	Passport	1 pcs.
12	Setting and maintenance manual	1 pcs.
13	Operation manual	1 pcs.
Note: A set of spare parts and mounting parts, specified in the appendix to the supply contract, may be additionally included.		

The constructions of fastenings of executive mechanisms are usually made by a Customer in accordance with the projects decisions concerted with RPE "MITEK" LLC.

Magnetic-impulse installations IM1, IM2



Fig. 6. Power block of installations IM1, IM2.

Technical characteristics of installations IM1, IM2

Table 3

Type of installations	IM1, IM2
Power supply voltage, V	230
Power frequency, Hz	50
Installed power, kW	from 0,5 to 1,6
Maximum voltage, kV	from 1 to 2
Capacity of condenser battery, μF	from 0,4 to 3,2
Maximum accumulating energy, kJ	from 0,2 to 6,4
Number of channels	from 1 to 32
Number of inductors in a channel, items	1 or 2
Pulse repetition period, s	to 10
Mass of installation (maximum number of channels), kg	to 750
Mode of operation	manual and (or) automatic with integration into PCS of customer

Installations of IM1, IM2 type can be used:

- **in bakery, confectionary and macaroni industries** for collapse of bridging of flour in production hoppers (1-5 tons);

- **in butter-cheese and milk industries**, namely in the drying spray installations for production of the dried milk, dry subcheese whey.

For example, the drying installations A1-OP4, A1-OP24, A1-OP24-01, A1OP3, produced by "Kalynovsky machine-building plant", Ltd are completed by the installations IM1, IM2 for cleaning of internal volumes of drying chambers and cyclones.

- **in flour-grinding-groats and mixed fodder industries** can be equipped for the hoppers of macrodosage, operative, other objects.

- **in the systems of gas cleaning** for shaking of hoses of bag filters during the regeneration.

Magnetic-impulse installation IM3



Fig.7 Power block of installation IM3

Technical characteristics of installation IM3

Table 4

Type of installations	IM3
Power supply voltage, V	400
Power frequency, Hz	50
Installed power, kW	from 1,6 to 4,0
Maximum voltage, kV	3
Capacity of condenser battery, μF	from 0,4 to 2,4
Maximum accumulating energy, kJ	from 1,8 to 10,8
Number of channels	from 1 to 24
Number of inductors in a channel, items	1 or 2
Pulse repetition period, s	to 10
Mass of installation (maximum number of channels), kg	to 850
Mode of operation	manual and (or) automatic with integration into PCS of customer

Installations of type IM3 type can be used:

- **on metallurgical and mining enterprises** for hoppers with forming mixtures, coal, industrial hoppers, different chutes and others.
- **in flour-grinding-groats and mixed fodder industries** for the bulk storage silos of flour hoppers of type, of mineral raw material (30-60 tons), service hoppers, other objects.
- **in the systems of gas cleaning** for the hoppers of collection and storage of dust of bag and electric filters, dust catching cyclones, for shaking hoses and electrodes of bag and electric filters.
- **at production of building materials** for hoppers with cement, lime, etc.

Installations IM4, IM5



Fig. 8 Power block of installations IM4, IM.

Technical characteristics of installations IM4, IM5

Table 5

Type of installations	IM4, IM5
Power supply voltage, V	400
Power frequency, Hz	50
Installed power, kW	from 2,5 to 4,0
Maximum voltage, kV	from 4 to 5
Capacity of condenser battery, μF	from 0,4 to 2,4
Maximum accumulating energy, kJ	from 3,2 to 30
Number of channels	from 1 to 24
Number of inductors in a channel, items	1 or 2
Pulse repetition period, s	to 10
Mass of installation (maximum number of channels), kg	to 1400
Mode of operation	manual and (or) automatic with integration into PCS of customer

Magnetic-impulse installations IM4, IM5 can be used:

- **on metallurgical and mining enterprises** for hoppers with forming mixtures, coal, limestone, for the hoppers of sinter machines, receiving hoppers, dosage of charge, loading devices of blast furnaces, bins of wagon tipper, loading chutes of sinter machines, etc.;
- **at production of building materials** for hoppers with crushed stone, lime, cement, clinker, cinders, clay, slag, aleurolite, others.

BASIC ADVANTAGES of magnetic-impulse systems for collapse of bridging and cleaning:

- **More high efficiency** of the magnetic-impulse systems of cleaning, realized by the magnetic-impulse installations IM, as compared to other systems (vibrators, pneumocollapse) due to possibility of concordance of amplitude-frequency characteristics of influencing impulse with the physiotopological parameters of hopper and friable material and, as a result, to achievement of the assured collapse of sticking material with minimum power expenses;
- **Low operating costs.** Magnetic-impulse technologies in the essence are power-saving. The rated power of installations makes 0,5-4,5 kW. The average consumption of electric power is to 0,2-1,0 kW per hour. Unlike the system of pneumocollapse compressors and devices of preparation (drainages) of air are not required. Maintenance costs of magnetic-impulse installations IM are minimal.
- **Increase of labour productivity, volumes of the produced products** due to the increase of carrying capacity of hoppers, conveyor tracts, diminishing of time of the forced outage related to the manual purging of hoppers, chutes, loadings shoots of sinter machines, especially using damp mix materials ;
- **Increase of quality, decline of reject of the prepared products** due to the timely exit of materials from hoppers, that promote the observance of requirements of technology of production;
- **Increase of safety of labour** due to the considerable diminishing, and in some cases exclusions of necessity of application of manual labour for cleaning of hoppers and other objects. Structural execution of **IP54** and contactless impulsive influence on the wall of hopper provides possibility of application of installations **IM** in the premises of enhanceable danger;
- **Providing integrity of walls of hoppers** at their cleaning, unlike application of eccentric vibrators or hand labour;
- **Reliability and longevity** of the magnetic-impulse systems due to absence in the executive mechanisms colliding details and interacting surfaces, application of original schemes decisions, presence of a number of protections from the nonpermanent modes. Term of service of installations IM to major repairs is **no less than 10 years**. In practice the term of exploitation is considerably longer at timely repair-prophylactic service;
- **Possibility of the installations IM operation both in manual and automatic modes**, with the implementation of various operation algorithms, in conjunction with modern automated process control systems (PCS).
- **Magnetic-impulse installations IM have the European certificate CE** of Ukraine declaration and RF on the directives of electrosafety and electromagnetic compatibility, as well as conformity declaration with ATEX Directives, do not have harmful influence on sensitive elements of control and measuring apparatus, compatible with various strain gauge devices.

The main advantages of installations IM by MITEK in comparison with magnetic-impulse installations of other manufacturers

1. The presence in the executive mechanisms of a guaranteed gap between the inductor and a steel-aluminum plate rigidly fixed on the surface to be cleaned. Due to this design, the method of completely non-contact impact on the surface to be cleaned with a special-shaped power impulse is implemented, patented by the MITEK enterprise, providing both

high efficiency in preventing arching and cleaning the surface, and reliability and durability of the installations IM.

2. The existence of types of IM installations with a maximum stored energy of up to 30 kJ, which enables to use the installations IM on complex objects - hoppers with a capacity of 200 tons or more, thick-walled, lined, with rigid fins and filled with difficult flowing material. "MITEK" enterprise has manufactured and implemented about 200 installations IM with a maximum stored energy of more than 14 kJ and an operating voltage of 4 kV and more. The use of magnetic-impulse installations with lower energy performance may not provide a sufficient free collapsing effect on the above complex objects.

The main modifications of installations IM manufactured by MITEK

Designation	Maximum operating voltage, kV	Capacity of condenser battery, μF	Maximum stored energy, kJ	Main equipped objects
IM1-1,2-n	1,0	1200	0,6	Hopper (to 5 tons) with flour, compound feed, plastic, sand. Drying towers and cyclones of spray drying installations.
IM1-2,4-n	1,0	2400	1,2	
IM2-1,2-n	2,0	1200	2,4	
IM3-0,8-n	3,0	800	3,6	Hoppers (to 100 tons) with flour (BFS), mineral raw materials, compound feed, molding sand, slag, gypsum, cement, mineral fertilizers, dust collection. Dust collecting cyclones, transfer chutes, hoses and electrodes of bag filters and electric precipitators.
IM3-1,5-n	3,0	1500	6,8	
IM3-1,9-n	3,0	1900	8,6	
IM4-1,8-n	4,0	1800	14,4	Hoppers (up to 1000 tons and more) with ore, concentrate, charge, limestone, coal, cement, under the railway car dumper. Dust towers.
IM5-1,8-n	5,0	1800	22,5	

Note: n – number of channels (from 1 to 24), 1 or 2 executive mechanisms in one channel.

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