

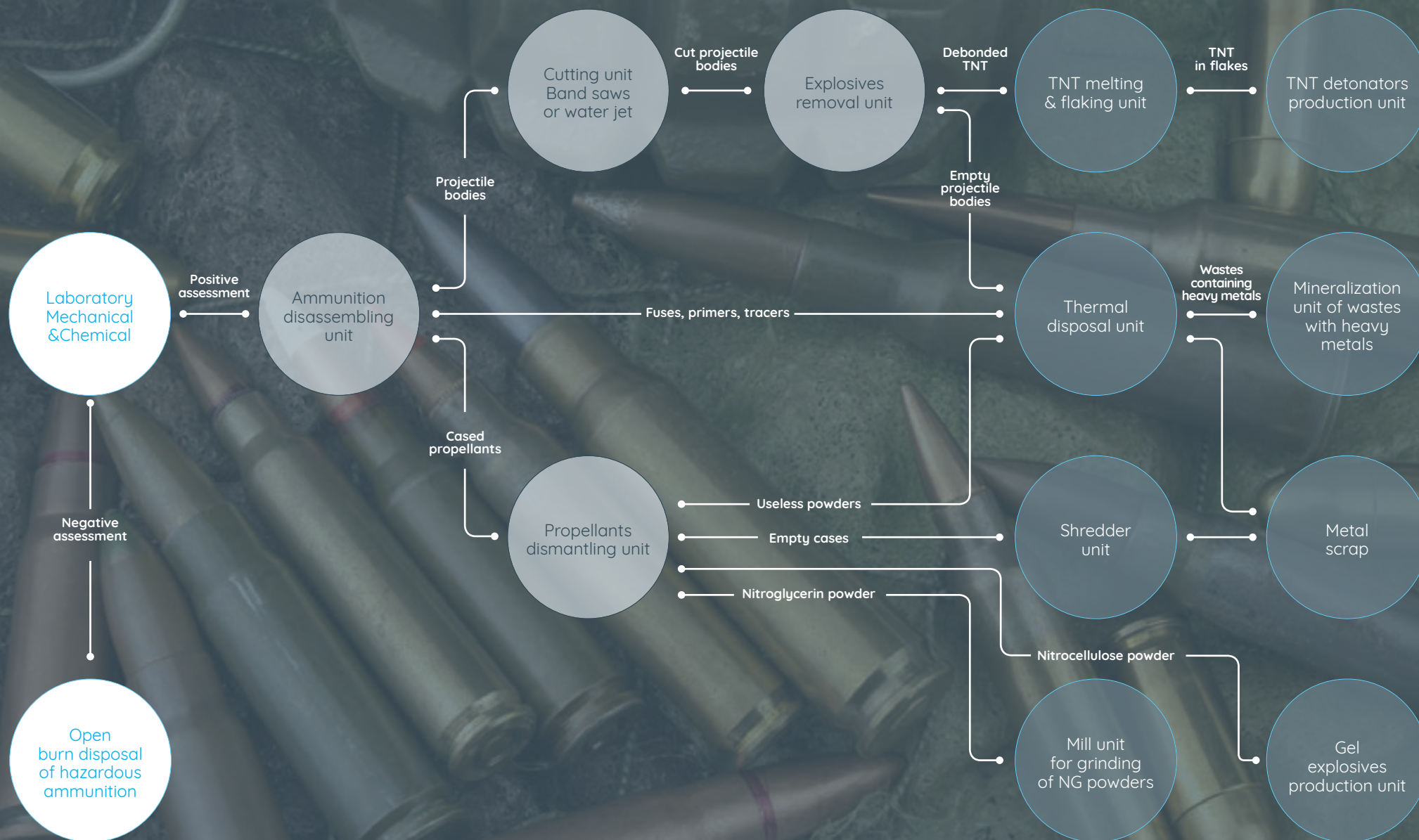
technologies
for industrial disposal
of munitions



Assessment of the technical condition of ammunition

Disassembling of ammunition

Disposal & recycling of ammunition components





Technologies for industrial disposal of munitions

JAKUSZ Sp. z o.o. (Ltd.) has particular expertise in the field of safe disassembling and disposal of almost all types of conventional ammunition as well as recycling of materials obtained from that process for their reuse in the civil industry.

We offer technologies for disposal of ammunition in the range of calibers from 5,45 mm up to 203 mm, mortar ammunition to max 240 mm caliber and special ammunition, rockets, mines and air munitions.

Disposal technologies are applied wherever:

- depots of obsolete out-of-date ammunition, which may present threat of uncontrolled detonation or environmental pollution, are existing;

- destruction of defective ammunition from the production process is required,
- safe disposal of confiscated ammunition is necessary, preventing from its fall into wrong hands.

Continuous growth of the company's potential within ammunition disposal technologies is allowed by i.a.:

- construction and technological facilities,
- high competences and extensive knowledge of the employed ammunition experts,
- long-term cooperation with military research institutes eg. Military Institute of Armament Technology (WITU),
- experience in disassembling of post-Soviet ammunition,
- execution of the new project for disposal of various calibers, types of ammunition,

- conducting own research & development works and dynamic detonation tests.

JAKUSZ provides complex ammunition disposal plants in stationary or mobile option together with assembly, start-up of the plant and training of Enduser's operators.

Installation of the equipment inside compact containers is possible, provided that dimensions of ammunition to be disassembled allow it.

Containers are equipped with all necessary installations and media.

Aerial and sea ammunition of large calibers is disassembled in specialized halls and tents.



Advantages of the disposal technologies of JAKUSZ company

SAFETY AND ENVIRONMENTAL PROTECTION

- remote control of equipment,
- monitoring systems,
- gases cleaning systems,
- toxic substances neutralization systems eg. mineralization lines of processing wastes that contain heavy metals, enabling their mineralization in the concrete products.

For operational and environmental safety the containers are equipped with:

- armored chambers/sections or light blast surfaces (walls, ceilings) for protection against effects of potential detonation during the most dangerous operations – for instance screwing out of initiators,
- ventilating and air conditioning installations,

- grounding installations,
- anti-electrostatic installations,
- fire-fighting and fire extinguishing installations.

JAKUSZ is the prizewinner of the Greenevo Program under patronage of the Ministry of the Environmental Protection for pro-ecological solutions in used technologies.

MOBILITY

Containerized installations allow the following:

- elimination of risk associated with the transport of ammunition,
- shortening and simplifying of on-site assembly (hardened foundation surfaces, water and electricity, compressed air sources are only required),
- possibility for moving of the installations to another destination,
- exclusion of investment costs for construction of buildings.

FLEXIBILITY

JAKUSZ as an engineering company with technological background always offers solutions tailored to individual requirements of its customers.

Based on the arrangements with the Enduser we design individually:

- technological processes,
- work logistics,
- configuration of the containers adapted to the required line capacity,
- safety zones,
- requirements for infrastructure – utilities, access roads, sand barriers, temporary explosives storages.

COMPLEXITY

With gradual growing and gaining experience, the company developed the package of various technologies ensuring complete dismantling of ammunition and recycling its components.



List of offered equipment and technological units for munitions disposal

1. Laboratories

Laboratories – substantial part in the process of ammunition resources management. Laboratory holder can assess whether if ammunition:

- should be destroyed,
- can be disassembled with recycling of its compounds,
- is suitable for further use.

JAKUSZ offers design and delivery of equipment for laboratories together with analytical methods and training of personnel. The company is the representative and business partner of the Czech OZM Research company, which for many years has been one the

leaders on the market of equipment and services in the field of testing the chemical properties of explosives.

1.1. MECHANICAL LABORATORY – Laboratory for determination of the technical condition of the ammunition qualified to disposal

- Intended to assess the risk of dismantling of ammunition compounds,
- fuses, igniters, primers, detonators and other ammunition elements are tested,
- equipped with a number of devices to destructive and non-destructive tests (specialized X-ray chambers).

1.2. CHEMICAL LABORATORY – Laboratory of the qualitative assessment of explosives obtained from the process of ammunition disassembling

Used to evaluation of:

- stability, sensitivity, durability of explosive materials for the safety of disassembling process,

- quality of the materials achieved from the a.m. process and their further shelf life including industrial applications.

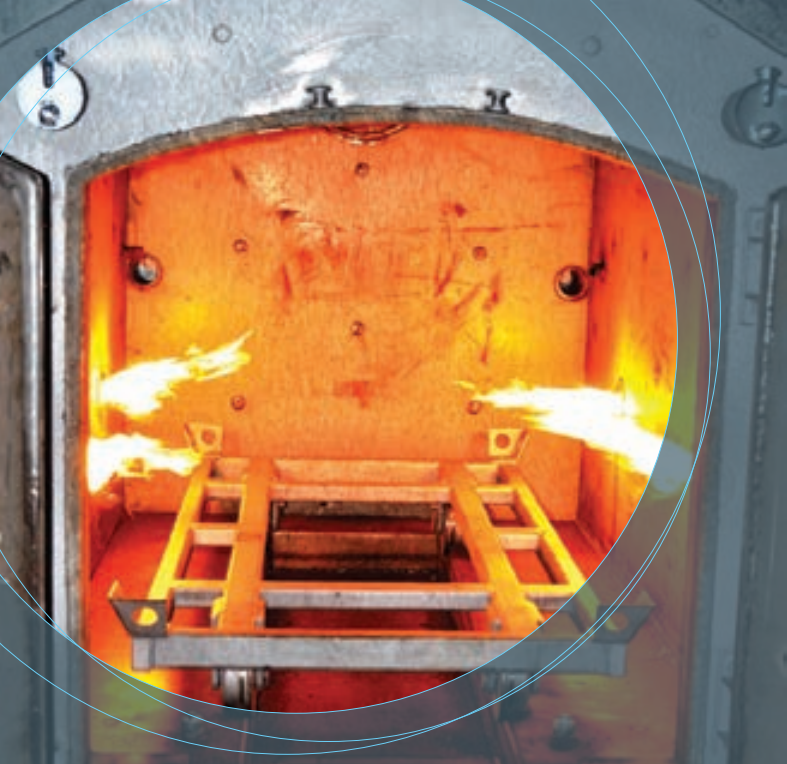
2. Thermal disposal

Disposal incinerator lines for munitions and their components – in options which depend on capacity and ammunition caliber.

2.1. LUNAR – ROTARY DETONATION KILN for disposal of small and medium caliber ammunition from 5.45 mm up to 37 mm or ammunition compounds, containing mainly such groups of explosives as:

- high explosives e.g. TNT, RDX, A-IX-1 and others,
- propellants e.g. nitrocellulose or nitroglycerine powders.

The kiln heated with fuel oil achieves combustion efficiency (in TNT equivalent) to 125 kg of explosive per hour.



The major post disposal products are metal scrap and gases. Gases that are produced during the incineration are directed into gas cleaning system.

Elements of gas cleaning system:

- Buffer chamber with cyclone system,
- Afterburner,
- Heat Exchanger,
- Optional cooler (quench),
- Optional absorbent's feeder together with sleeve filter,
- Fan,
- Absorbent filter,
- Emitter.

2.2. JUPITER – containerized incinerator for small caliber ammunition to 12,7 mm of capacity to several dozens of kg/h.

2.3. CALYPSO – universal and economic version of small caliber ammunition incinerator on the trailer:

- mobility is its key advantage,
- incinerator can be used in places where the material must be destroyed in the place of finding or confiscation,
- for example wood from ammunition packages can be used as a heating fuel.

2.4. STATIC FURNACE - the static furnace is designed for the safe incineration of explosives such as TNT nitrocellulose powders, nitroglycerine powders, and other explosives in bulk form.

2.5. FURNACE TYPE „BABA-YAGA” – applied to the burning of the explosive residues, paints, varnish, varnish from shells recovered from disassembly process for the purpose of recycling and possible sale of pure steel scrap.

3. Detonation disposal – Andromeda detonation chamber

Gas-tight detonation chamber ANDROMEDA is designed for disposal of explosives, munitions and combat means, ammunition elements, unexploded ordnance (UXO) and improvised explosives devices (IED) up to 2 kg of TNT equivalent at a single detonation.

- detonations can be carried every 15 minutes,
- estimated quantity of detonations at ANDROMEDA chamber is max. 100,000 times,
- possibility of replacement of internal armor,
- dimensions of detonation chamber allow its location on 20' container frame.



Detonation chamber ANDROMEDA can be used:

- as research laboratory, e.g. for evaluation of the velocity of detonation of explosive materials or analysis of fragmentation and toxicity of gases, owing to controlled detonation of combat means,
- in munitions disposal processes: to destruction of fuses rocket propellants, some types of mines and ammunition components, which for the safety reasons cannot be dismantled mechanically.

MERKURY – line with a set of workshops to disassembling of ammunition (basic option).

Historically, the line included screwing out initiators, dismantling of ammunition, removal of propellant charges and TNT melting out. This technology was developed in cooperation with WITU. In the course of next projects the range of MERKURY system was extended by the other types and calibers of

ammunition as well as by recycling or thermal disposal of some components.

4. Medium & large caliber munitions disassembling line

Used for munitions cal. 20 mm to 203 mm and mortar rounds cal. 160mm up to 240 mm.

Medium & large caliber munitions disassembling line consists of independent technological units in various configurations, selected accordingly to kind, caliber and type of ammunition as well relevant to the needs of Enduser.

The line can consist of the following units:

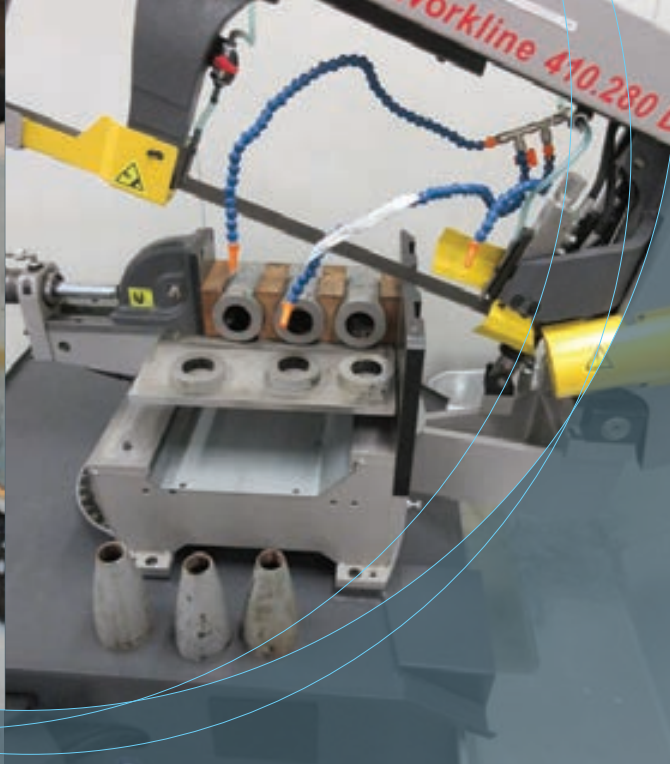
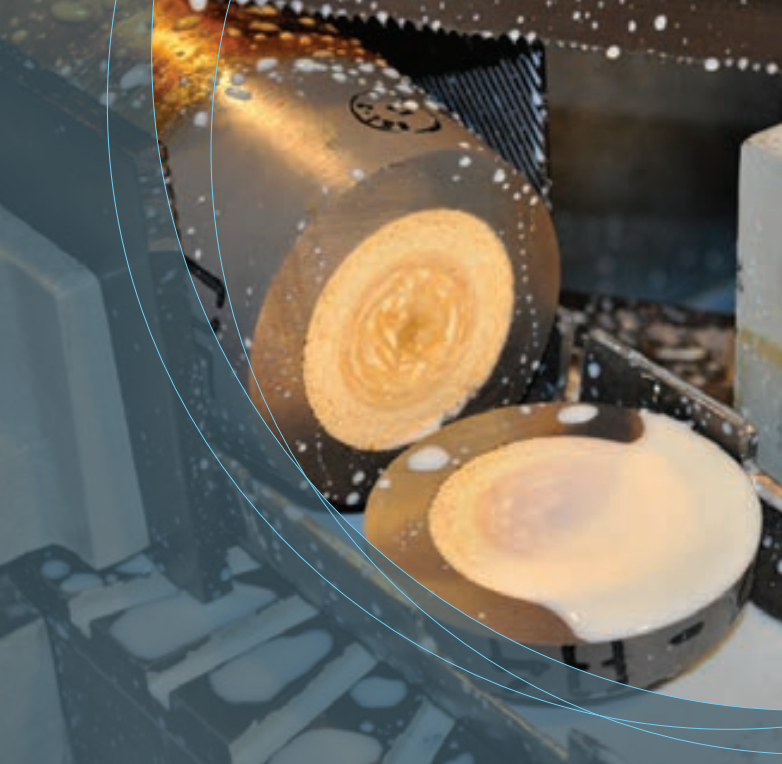
4.1. 20-37 MM MUNITIONS DISMANTLING OR BRAKING UNIT

- in configuration depending on required capacity and the Customer's requirements;

- propellant charges other components obtained during disassembly process are moved to subsequent operations, recycling or incineration.

4.2. DISASSEMBLING UNIT FOR MUNITIONS CAL. 40-203 MM AND MORTAR ROUNDS CAL. 160-240 MM

- intended for disassembly of artillery, tank, anti-aircraft and mortar ammunition,
- operations generating risk of detonation such as screwing out initiators are always carried out remotely, by automatic process, in armored chambers by application of blast walls or ceilings,
- after disassembly the ammunition is pulled apart, while propellant charges and explosive materials are forwarded to the further processing or disposal.



4.3. SHELL CUTTING UNIT- BAND SAWS & WATER JET

- both technologies ensure complete safety,
- band saws unit containers are equipped with lighting system, air-conditioning, electricity and water connections, drains, and a CCTV system;
- separate control rooms allow remote control and supervision of the cutting processes.

A. BAND SAWS CUTTING UNIT:

- dedicated to i.a. cutting of the shells of HE rounds for the purpose of their transfer to the further disposal processes,
- band saws consist of working tables with hydraulic clamps and removable inserts for cutting various ammunition round types.
- projectiles are cooled down during processing with a double cooling system,
- the metal fillings and explosive dust generated during the process are separated from the cooling

agent and collected in a bin, while the clean cool agent is recycled to the process.

B. WATER JET CUTTING UNIT:

- dedicated to i.a. cutting of HEAT rounds,
- the water jet cutting unit elements comprise:
 - processing vat with a shell rotating and alignment fixture;
 - water jet head and its drive system;
 - high-pressure water booster;
 - process water treatment system;
 - control & monitoring system

4.4. SHREDDER UNIT FOR CRUSHING AND GRINDING OF CASES AND OTHER METAL COMPONENTS

- metal scrap obtained during disposal process is directed to the shredder unit where the scrap is grinded to a form unusable for recovery and military application,

- grinding process significantly decreases the scrap metal volume, which reduces the costs of shipping for remelting and the required storage capacity.

A. DRIVING RING REMOVAL UNIT

The unit is intended for safe removal of driving rings from complete or split (cut) projectiles / shells which have been emptied of explosive materials.

4.5. EXPLOSIVES REMOVAL UNITS

A. STEAM MELTING UNIT FOR REMOVAL OF EXPLOSIVES

Cut projectiles bodies from band saws unit are directed to steam melting unit for removal of TNT. The unit consists of autoclaves, slots for different calibers of projectiles and dedicated carts, which are moved under the steam melting chambers.



B. EXPLOSIVES HYDRO WASHOUT UNIT

Explosives hydro washout unit consists of:

- processing vat with a shell mounting unit;
- head drive system with nozzles for washing out of the explosive;
- high-pressure water booster;
- explosives recovery and process water treatment systems;
- control & monitoring system.

4.6. SPECIAL AMMUNITION, MINES AND AERIAL BOMBS DISASSEMBLING LINES

Each of the customers possesses different types of the combat means. JAKUSZ designs technological lines, units or stands dedicated for each group of munitions, with all necessary modifications based on individual analysis of each case.

Exemplary installations to disassembly of special ammunition are following:

A. WHITE PHOSPHORUS EXTRACTION UNIT

White phosphorus belongs to particularly toxic materials and can be found in smoke and lighting ammunition. It burns continuously in contact with air, therefore it is especially important to observe safety procedures and rules at the installation.

The dismantling process begins with the melting of white phosphorus under water, and then pouring the substance into containers for safe storage and transport, aimed to their further use by chemical plants.

B. UNIT FOR DISASSEMBLING OF 122 MM ROCKET MISSILES OF „GRAD”

The unit is equipped with anti-electrostatic installation protecting from accumulation of electrostatic charges

and arising differences of potentials between devices and clothing of workers. It is also equipped with safety system that clears away high temperature gases released during ignition of rocket engine.

C. ANTI-TANK MINES DISASSEMBLING UNIT

The unit is dedicated for crushing and removal of explosive material from various anti-tank mines.

D. AIR BOMBS DISASSEMBLING LINE

The unit is intended for disassembling of FAB air bombs. For safety reasons the line is built from 3 different stations as well as from stirring and controlling container surrounded by protective shields.



5. Lines for processing / recycling of recovered materials

5.1. UNIT FOR MANUFACTURING OF TNT FLAKES

- is intended for melting of TNT and manufacturing of TNT flakes,
- a melter is installed in the unit, where TNT melting process takes place, which is then fed through a pipeline to a flaking unit, where TNT flakes production process takes place,
- harmful fumes that occur during TNT melting process are cleaned away by ventilation system with water scrubber,

5.2. UNIT FOR PRODUCTION OF PRESSED TNT OR TNT-RDX DETONATORS

- is dedicated for manufacturing of pressed TNT or TNT-RDX detonators from flaked TNT or from shredded RDX .
- pressed charges can be used e.g. in mining as initiating materials or during soldiers' training as materials for fighting simulation, specialized trainings.

5.3. MILL UNIT FOR GRINDING OF POWDERS

- it allows recycling of nitroglycerine powders coming from munitions disassembling process which can be used again e.g. in production of gel explosives.

5.4. UNIT FOR MANUFACTURING OF GEL EXPLOSIVES

- powder coming from disassembling process in other units is used in company's technology of production of gel explosives, apart from line of other necessary substances;

- gel explosives can be used in mining as an inexpensive, easy to use and safer substitute of traditional explosive materials, especially dynamite.
- Explosive gels can be also used in destruction of munitions in detonation chamber or for trainings.

Explosive materials and powder charges gained in dealaboration process, after shredding or melting, cleaning and processing into flaked or granulated material can be used as additives to different explosive compositions or emulsion explosives for military or mining purposes.



JAKUSZ – well-established position in the global defense market

JAKUSZ offers wide range of installations for ammunition disposal. Company supplies to many countries cooperating with authorised companies ensuring technical support and service in client's country.

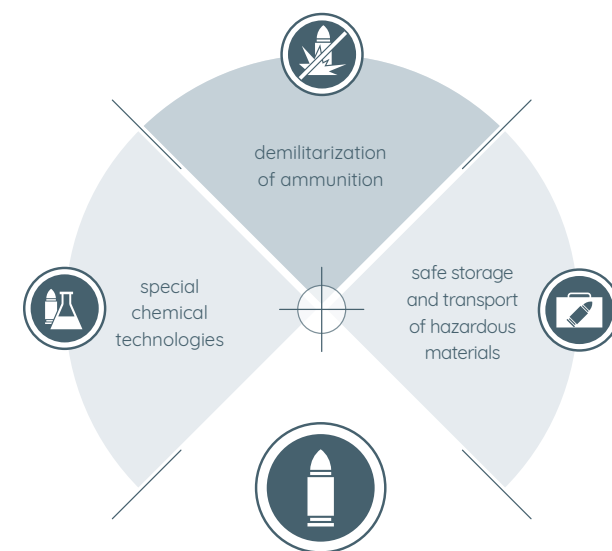
Company guarantees supervision during commissioning, two-level trainings (for service technicians and for end users), upgrade, post warranty support and access to spare parts during whole time of use.

JAKUSZ Ltd. is a Polish company with a well-established position on the defense market and 35 years of experience in the design and implementation of special products and technologies.

The major strengths of company are our own construction, production and laboratory capabilities, comprehensive solutions and experienced engineering team.

The company's portfolio covers three main business areas - ammunition disposal, containers for safe storage and transport of hazardous materials and special chemical technologies.

The latest achievements of the Company include successful execution of the technological projects in Asia, Central Europe, North Africa and Middle East. Another success is performing R&D programs for the European Space Agency concerning oxidizers and propellants (solid and liquid).





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