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The partner for
international marketing and sales
of manufacturing plants
and services for

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chemie
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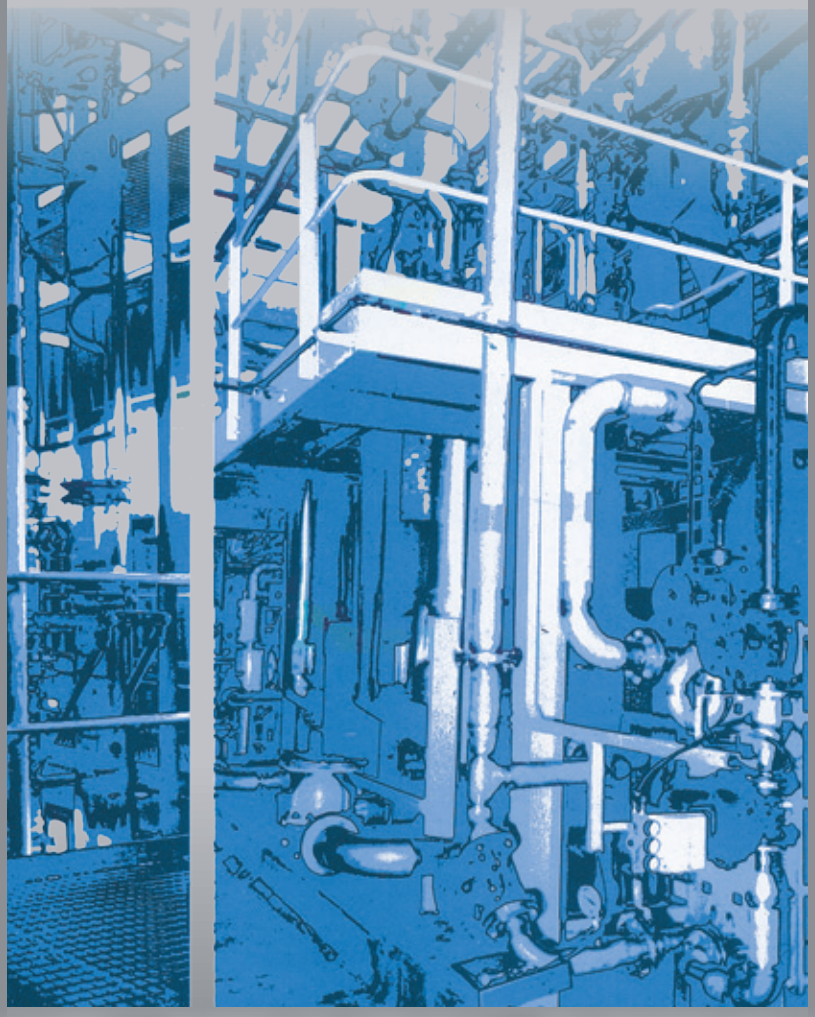

with

bowas
tec gmbh
Salzburg/Austria

for

DMP
DOTT. MARIANO PRAVISANI & C. SRL
Udine/Italy

WITH DEDICATION, EXPERIENCE, COOPERATION

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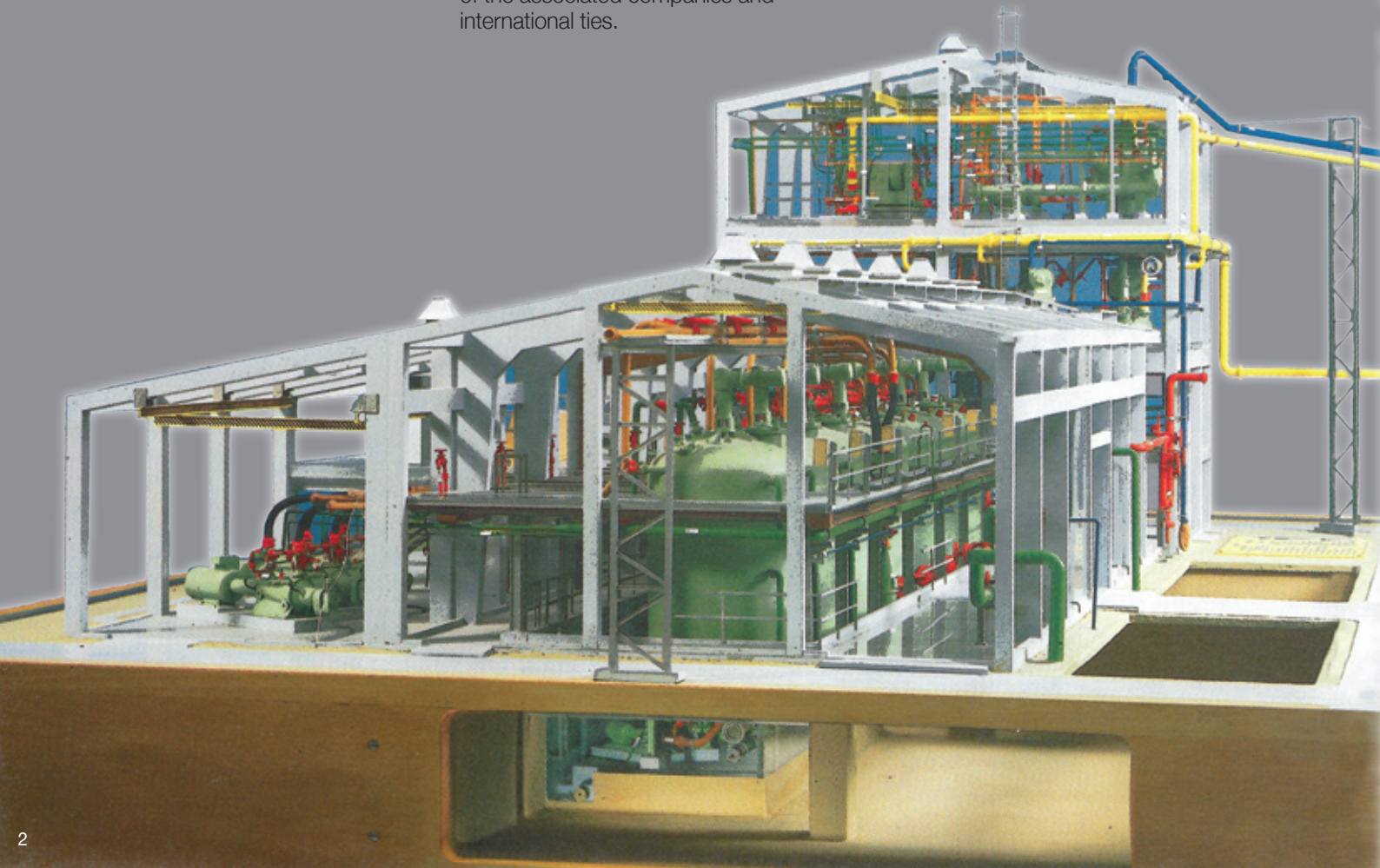
BOWAS-INDUPLAN CHEMIE GMBH, originally founded in 1974 as Induplan Chemie Ges.m.b.H., is an engineering company which designs and plans special chemical plants. We offer experienced management and skilled enigneering personnel capable of untertaking supply, erection and commissioning of a wide range of plants and equipment for the chemical and explosives industry.
Our considerable knowledge and engineering experience, built up over the past years, with the back-ground of the much longer experience of the Wasag Engineering Division, whose activity was integrated into BOWAS-INDUPLAN in 1983, is available to our clientele worldwide.
BOWAS-INDUPLAN is an independent company, member of an internationally orientated group of companies and financially controlled by the families Berthold and Harald von Bohlen und Halbach. This enables BOWAS-INDUPLAN to draw upon the resources of a wide range of practical manufacturing expertise of the associated companies and international ties.

Know-how derived from plants belonging to the group, as well as the successful application of chemical and technical processes, guarantees that only thoroughly proven processes and equipment will be incorporated into plants designed and supplied by BOWAS-INDUPLAN.

Its subsidiaries, CHEMO-NITRO Chemieexport GmbH and ASSET Handelsgesellschaft m.b.H., handle the commercial and technical merketing of technology, individual machines, spare parts and any other activity which ist part of after-sales servoce.

RANGE OF ACTIVITIES

BOWAS-INDUPLAN's own processes as well as our extensive know-how from associated companies form a solid basis for the design of plants which are in use in almost all parts of the world.



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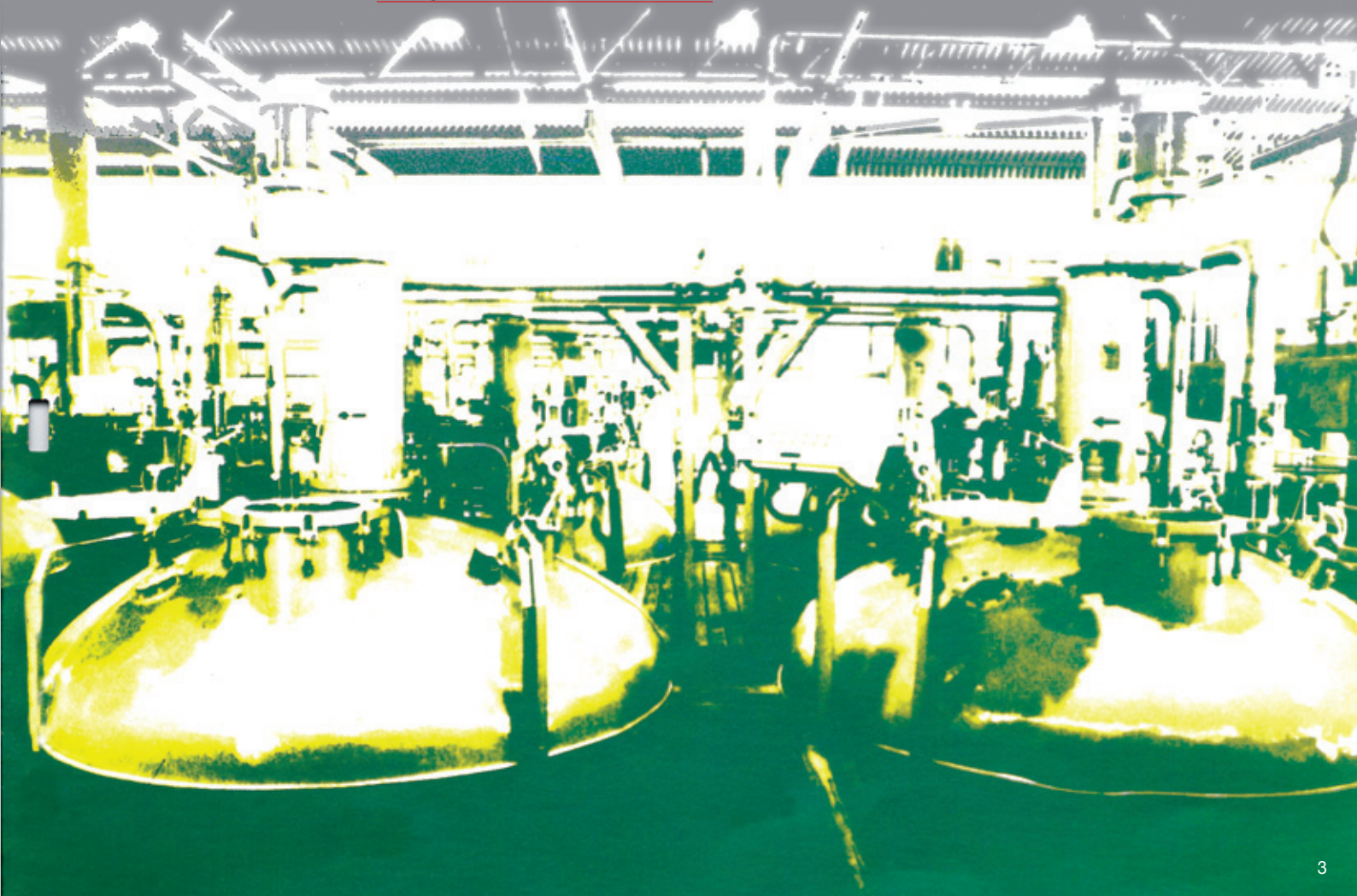
BOWAS-INDUPLANI has already constucted and is still successfully engaged in building plants in parts of Europe, Africa, South America as well as in the Near, Middle and Far East.
Apart from the planning and construction of completely new plants of partial plants (also on the basis of turn-key projects), BOWAS-INDUPLAN is involved in the modernization of existing plants with emphasis on safety, savin of raw materials, economy in energy and personnel needs as well as on the particular requirements of environmental protection.

A dynamic team of highly specialized experts, coming from Austria as well as abroad, and having extensive experience and detailed knowledge in their respective fields, will endeavor that the client receives the best possible service.

Our Services

BOWAS-INDUPLAN provides a complete service including

- Feasiblitly Studies
- Project Management
- Basic and Detail Engineering
- Specification, Procurement, Acceptance and Shipment of Equipment
- Process Know-h ow
- Technical Assistance, e.g. Installation, Supervision, Start-up, etc.
- Training of Personnel
- Management Assistance



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Cotton Linters

Cotton linters, or simply "linters" are the short staple part of the fibres attached to the cotton seeds, which cannot be utilized for mechanical spinning in cotton mills. The fibres attached to the seeds are usually distributed over a certain range of length and a vertain number of seeds are embedded inside one cotton ball.

Cotton, and linters in particular, is the purest type of cellulose existing, which is naturally reproduced year by year. The growing demand for cellulose all over the word necessitates the exploitation of this natural source as comprehensive as possible for further processing in the different areas of the cellulose and paper industries.

Exploitation of linters

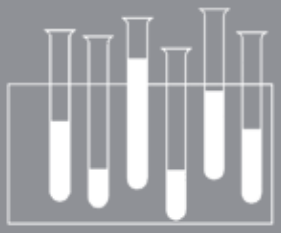
Seed with lint and linters before processing in cotton gin

Seed after ginning

Seed after delintering (second cut)

The long fibres (30 to 50 mm) are separated from the seeds in cotton gins and then further processed in cotton industry.
The seeds are subsequently delintered i.e. the remaining fibres are cut off.

If there is only one cutting process, the cut fibres are referred to as "mill-run" quality and their length is from 3,5 to 5 mm.
The application of two consecutive cutting operations results in two different fibre qualities, "first cut" linters (fibre length 3,5 to 7 mm) and "second cut" linters (fibre length 2 to 3 mm).



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Purification of Linters

Our delivery programme covers batchwise and continuously working plants with a wide range of capacities.
The basic steps in the process, either batchwise or continuous operation, are shown below.

Bucking and bleaching process

Raw material storage

Bale opening

Mechanical purification

Bucking and bleaching

Pulping

Blending

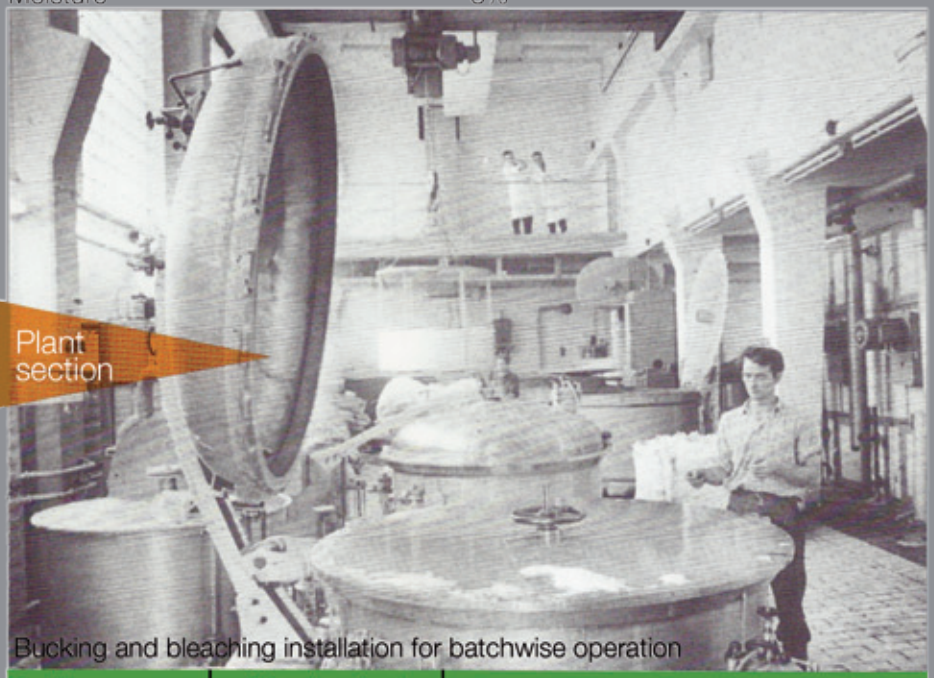
Dehydration

Drying

Baling

Characteristic data of raw material (air-dry)	
Cellulose	73%
Fats and waxes	2%
Pectic substances	1%
Proteins	2%
Hull fines	11%
Ash	2%
Sand	1%
Moisture	8%

Plant section



Bucking and bleaching installation for batchwise operation

Further processing and applications	Mechanical processing	Chemical transformation	
	Paper for ● Filters ● Insulations ● Chromotography ● Banknotes ● Documents ● Writing ● Drawing Fillers for plastics Filter aids	Nitrocellulose Acetate ● Films ● Silk Estron Triacetate ● Films ● Silk ● Foils ● Injection mould-ing compounds Acidic	Methylcellulose Carboxymethyl-cellulose (CMC) Copper rayon Rayon Foils Tyre fabrics Sponges Sausage skins Alkaline

Characteristic data of finished product (lacquer grade)	
Alphacellulose	min. 98%
Viscosity (0,5% cuen solution)	10 ... 50 cP
Ash contents	max. 0,15%
Humidity (after drying)	max. 10%
Copper number	0,3

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Nitrocellulose

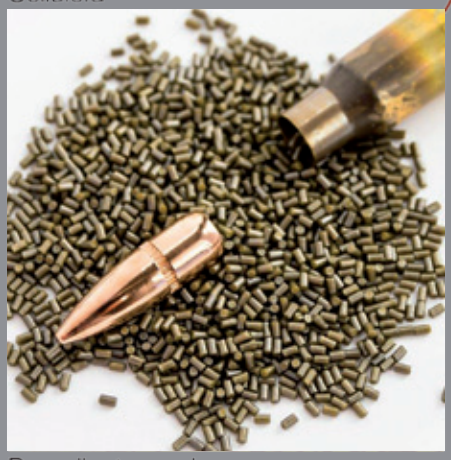
Production Range

Basic Materials	Bleached cotton linters or woodpulp
Nitrogen Contents	10,8% to 13,4%
Viscositiy	20 cP to 6000 cP
Solubility	Ester of alcohol soluble

Nitrocellulose for

Celluloid


Lacquers and adhesives


Propellant powders


Rocket propellants


Dynamites

Flow Diagram of Nitrocellulose Production

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Acid Facilities

High Concentration of Nitric Acid

By means of the high concentration process, diluted or preconcentrated nitric acid is brought up to a 98-99% HNO content. The high concentration is reached by extractive distillation: Concentrated sulphuric acid, which is added to the nitric acid/water mixture, as a third component, alters the vapour pressure/relative volatility relationship which allows production of high concentration HNO by distillative means above the normal azeotropic point.

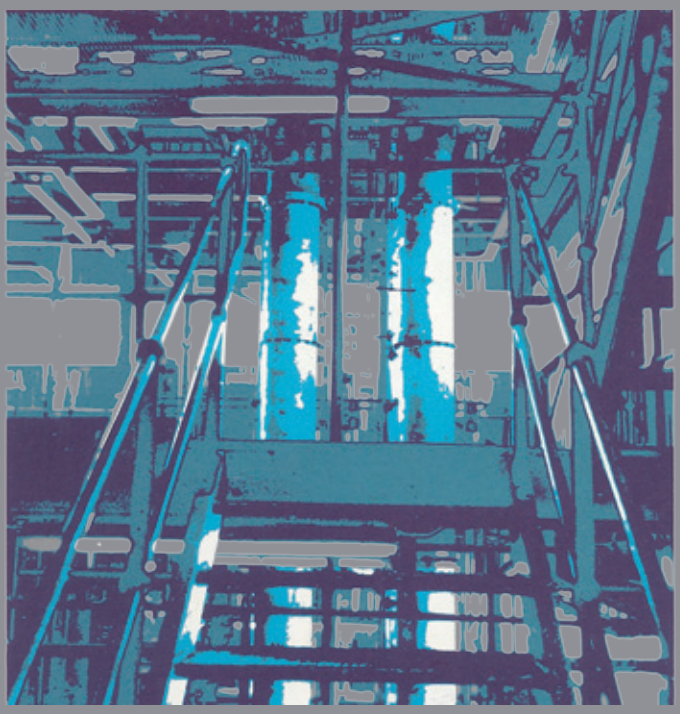
High Concentration of Suplhuric Acid

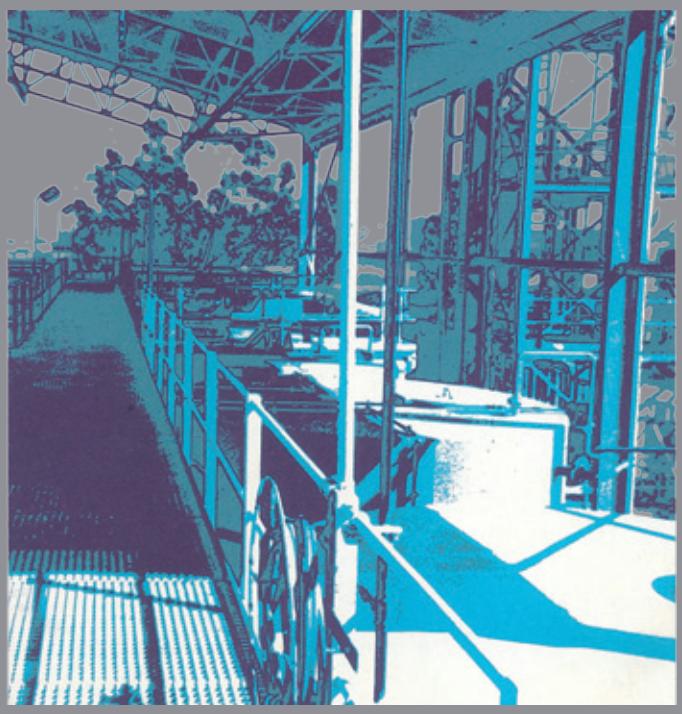
By means of the high concentration process, diluted or preconcentrated sulphuric acid is brought up to a 96-97% HSO content. The high concentration takes place by rectification in columns with packing or bubble trays.
Water as the lower boiling constituent is evaporated and escapes from the top of the concentration unit.
The heavier, less volatile sulphuric acid is kept boiling in concentrated form in the concentration boiler, where the acid is free of organic impurities.

Major problems:

Materials of construction withstand the highly corrosive environment at the high temperature required.

Elimination of impurities and corrosive products.





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Acid Facilities

Denitration

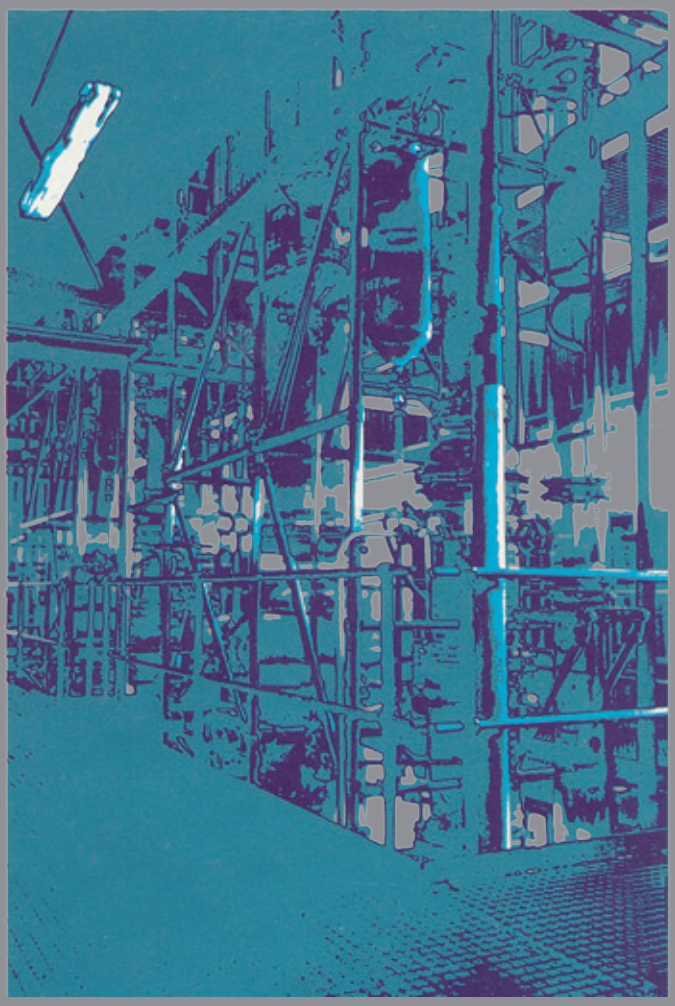
Denitration is a process for purification of residual mixed acids, which contain as main constituents nitric acid, sulphuric acid, as well as quantities of nitrous acid and organic impurities such as nitro compounds, nitric acid esters and, of course, water. Such residual acids are fumed in the production of NG, NC, DNT, TNT etc.
In order to be able to re-concentrate the spent acid for further use the main components, nitric acid and sulphuric acid must first be separated from each other. This, so called denitration process is achieved by means of extractive distillation.

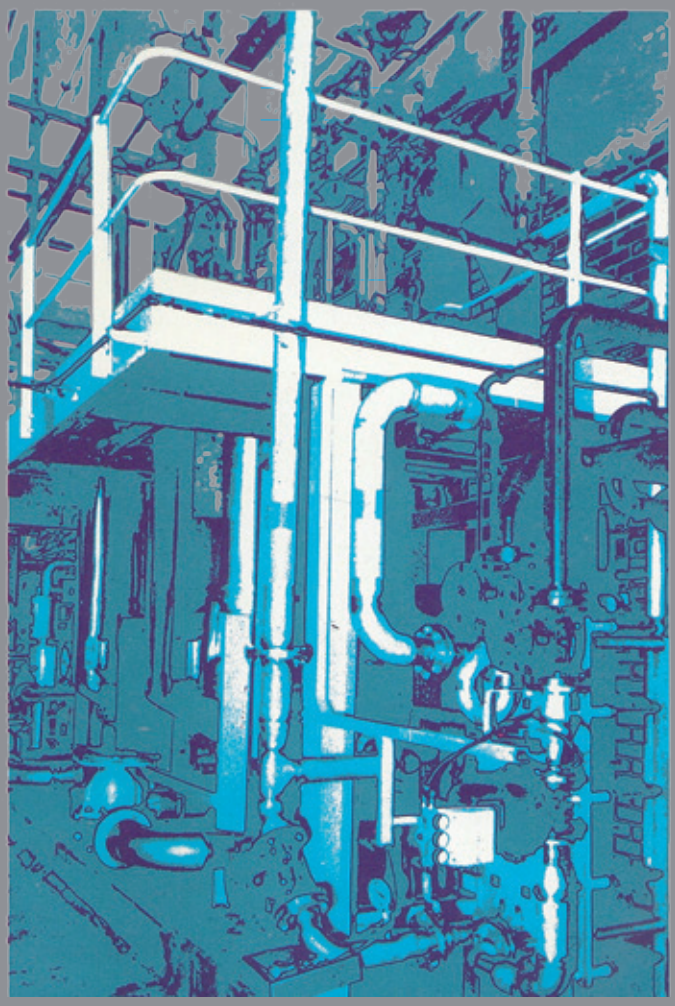
Major problems:
- Azeotropic point
- Intergration with sulphuric acid high concentration
- Destruction/removal of impurities

Nitrous Fume Absorption

Nitrous fumes occur as by-products e.g. in the nitration of organic compounds, in the decomposition of nitro-compounds of nitric acid, and in the denitration of spent-acids, vapours from acid reconcentration.
During absorption the major portion of the nitrogen oxides are oxidised by atmospheric oxygen. The higher oxides so formed dissolve in water and produce, by reaction, nitric acid.

Major problems:
- Corrosion
- Cooling
- Optimization of Pressure
- Temperature
- Apparatus Volume
- Control





Absorption of nitrous gases (ABS)

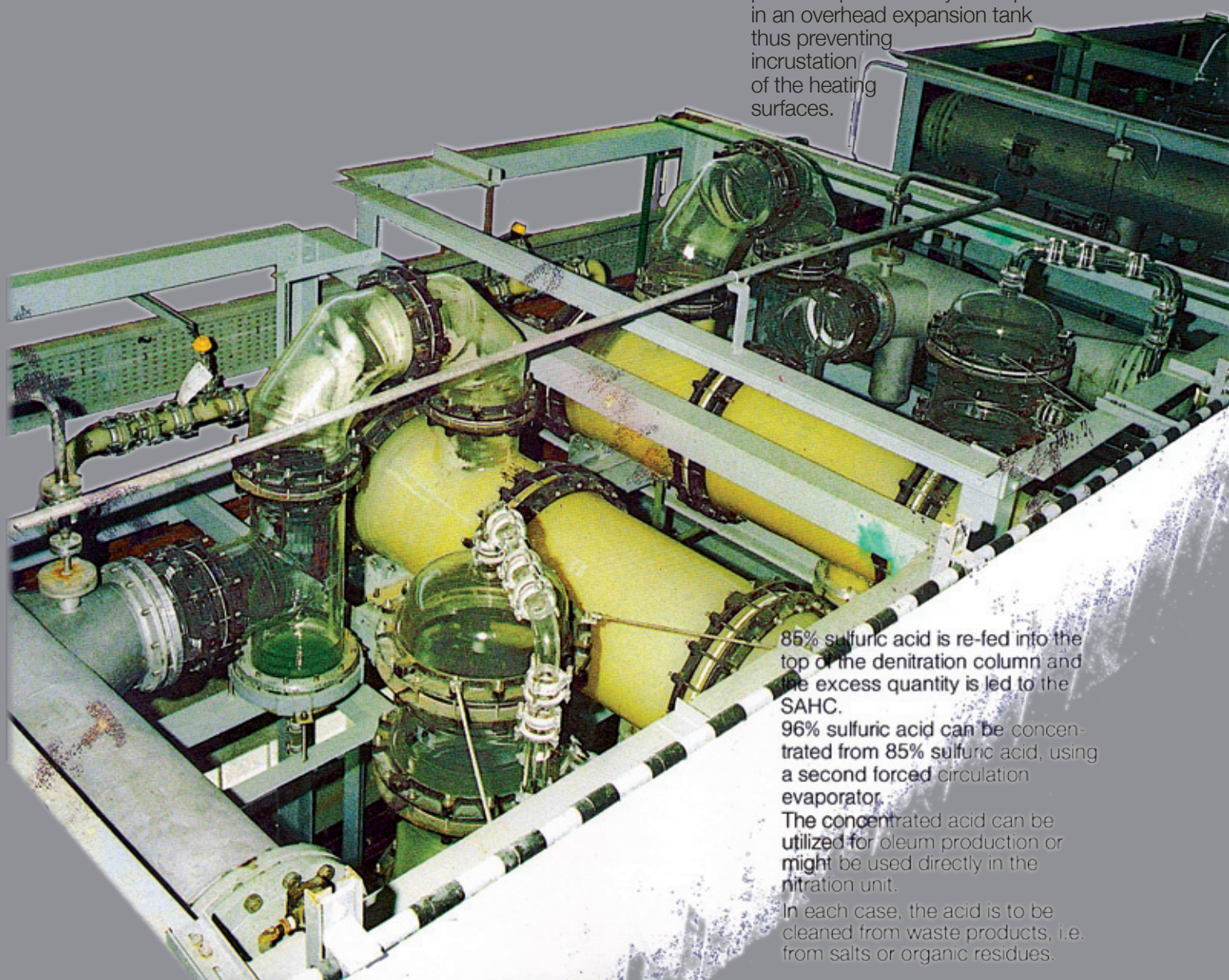
Poisonous nitrous gases, NOx are formed in the production of nitric acid as well as in nitration and denitration processes and in the decomposition of nitrobodies.

Depending on the circumstances, several processes can be chosen for their treatment. Mostly, however, the NOx contained in the off-gases are further oxidated, thus producing 50% nitric acid. The subsequent cleaning step can be achieved either by oxidation or by means ofcatalytic reduction.

Nitirc acid with approx. 50-55% strength, depending on the concentration of the nitrous gases, is obtained and is of value for further use.

Sulfuric acid pre-concentration (SAPC) and high concentration (SAHC)

Forced circulation vacuum evaporators which are extremely efficient, are used to recycle the 70% sulfuric acid and to achieve a concentration of 85%. In a subsequent step, it is also uitilzed for high concentration.
Corrosion resistant materials such as glass, enamel and tantalum were required and found for this process.
Under vacuum the acid boils under notably lower temperatures. The sulfuric acid is pumped into a circulation system with the heat exchanger placed on the lowest point. Evaporation only takes place in an overhead expansion tank thus preventing incrustation of the heating surfaces.

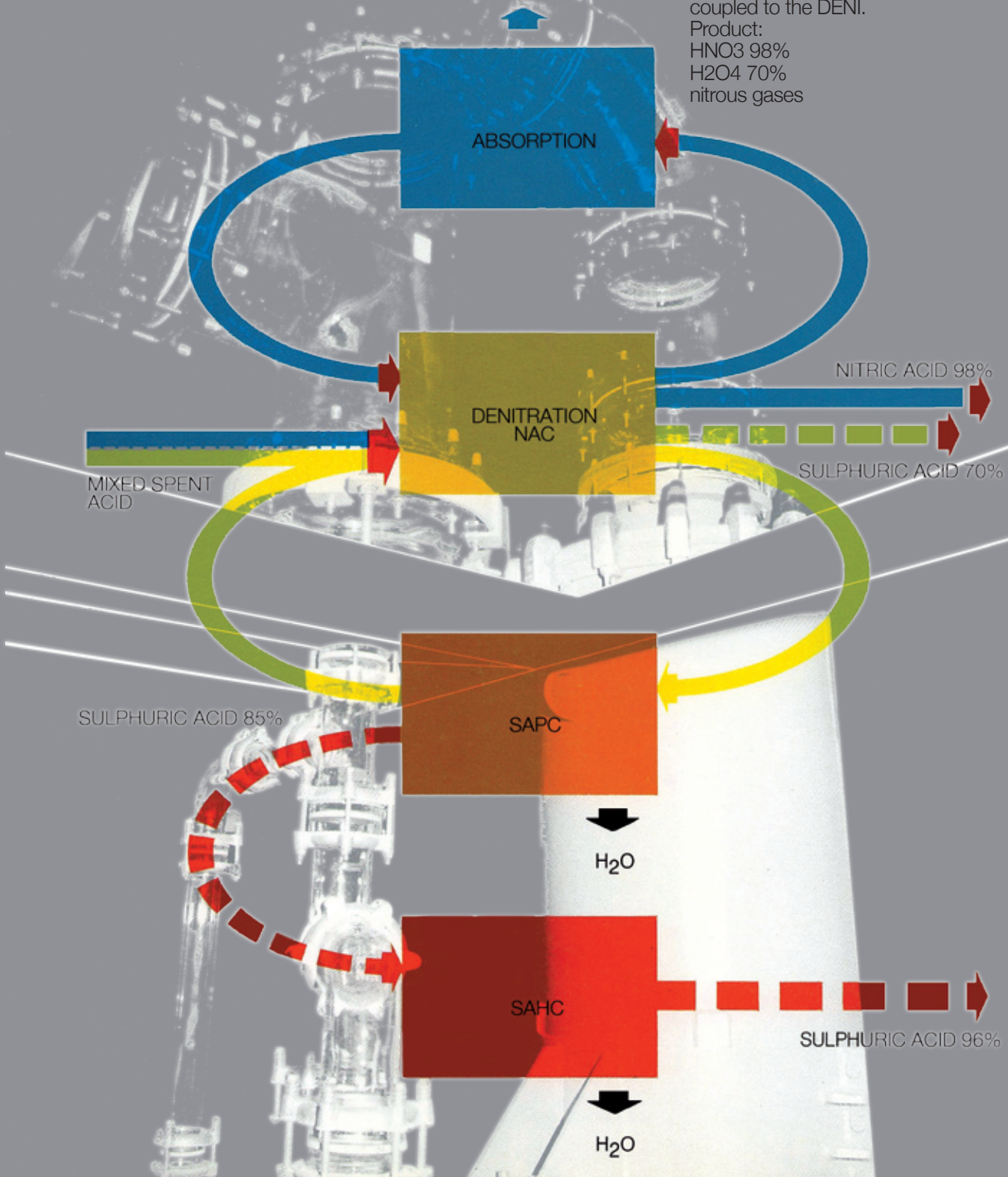


85% sulfuric acid is re-fed into the top of the denitration column and the excess quantity is led to the SAHC.
96% sulfuric acid can be concentrated from 85% sulfuric acid, using a second forced circulation evaporator.
The concentrated acid can be utilized for oleum production or might be used directly in the nitration unit.
In each case, the acid is to be cleaned from waste products, i.e. from salts or organic residues.

Denitration-nitric acid reconcentration (DENI)

Concentrated nitric acid HNO3 is a very essential raw material in the production of plastics, paints and explosives. It is usually used as so-called nitration acid, i.e. mixed with concentrated sulfuric acid (H2SO4) or Oleum (with free SO3).

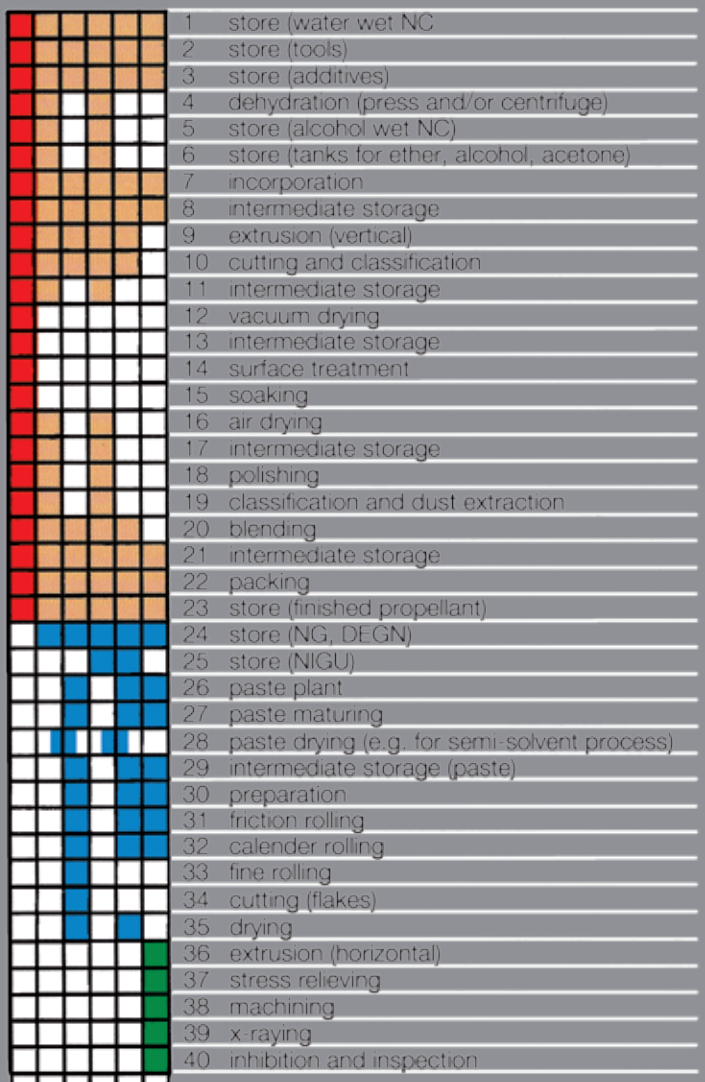
The remaining mixed acid from the nitration process is diluted by the reaction water and contains also product residue.
In the denitration unit, this waste acid is divided into its components: nitirc acid and 70% diluted sulfuric acid, the less stable nitrobodies being destroyed. Preferably, concentration of nitric acid is done in the same apparatus.
This process is only possible if sufficient sulfuric acid has been added to the waste acid. This sulfuric acid can be reconcentrated (SAPC) in the internal circulation coupled to the DENI.
Product:
HNO3 98%
H2O4 70%
nitrous gases

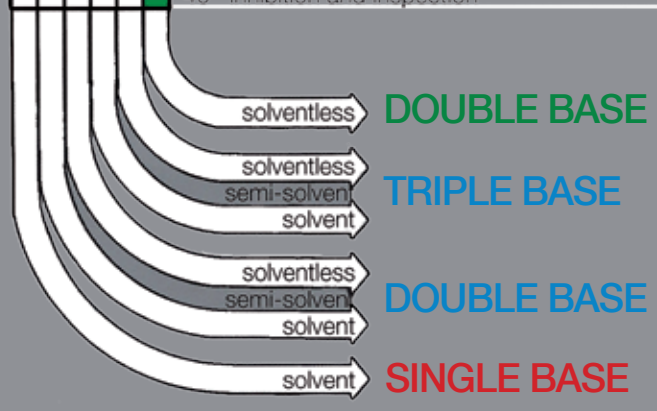


Layout of a Versatile Plant for the Manufacture of

– Double – Single
– Double – Triple

base Propellants





DOUBLE BASE

TRIPLE BASE

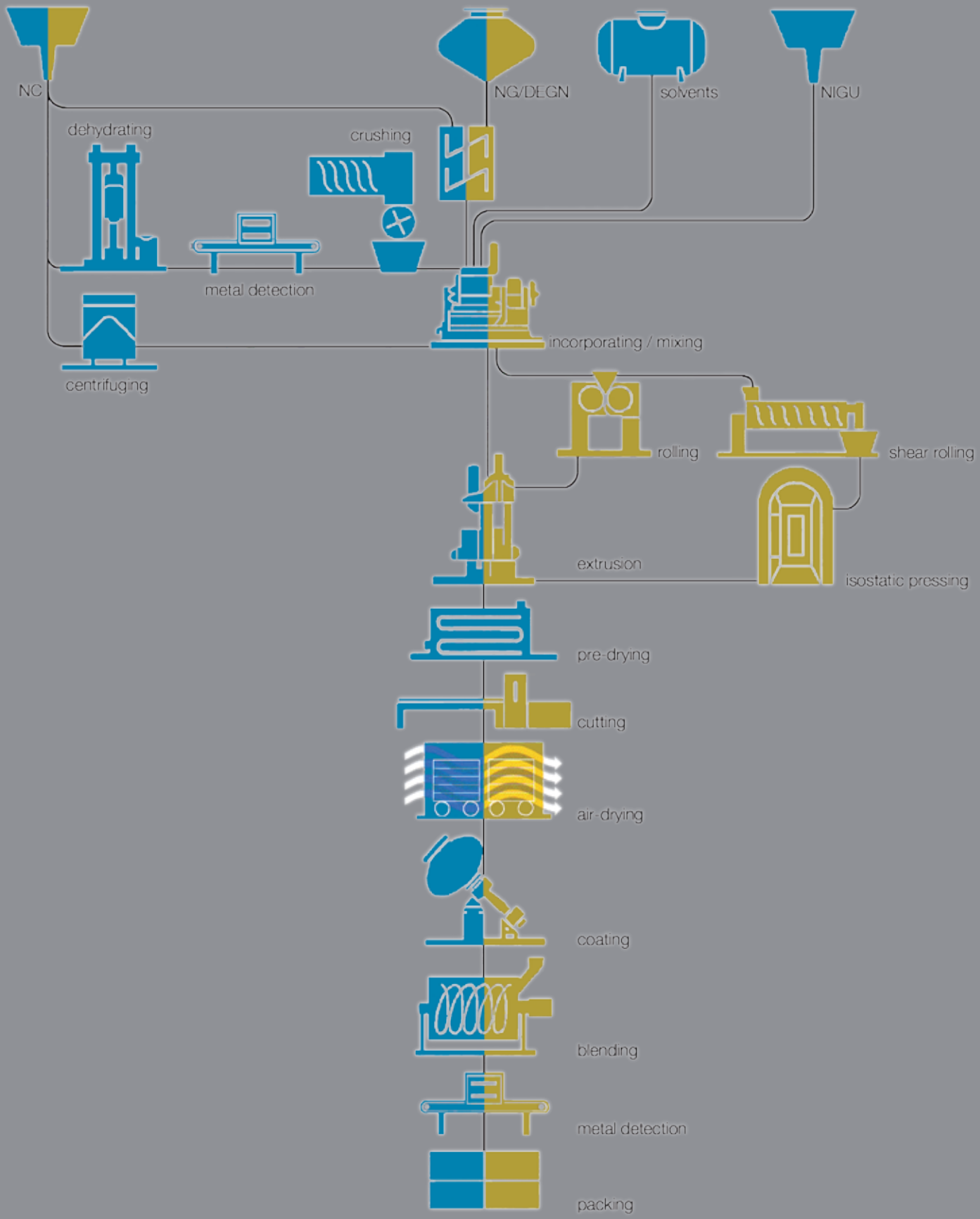
DOUBLE BASE

SINGLE BASE

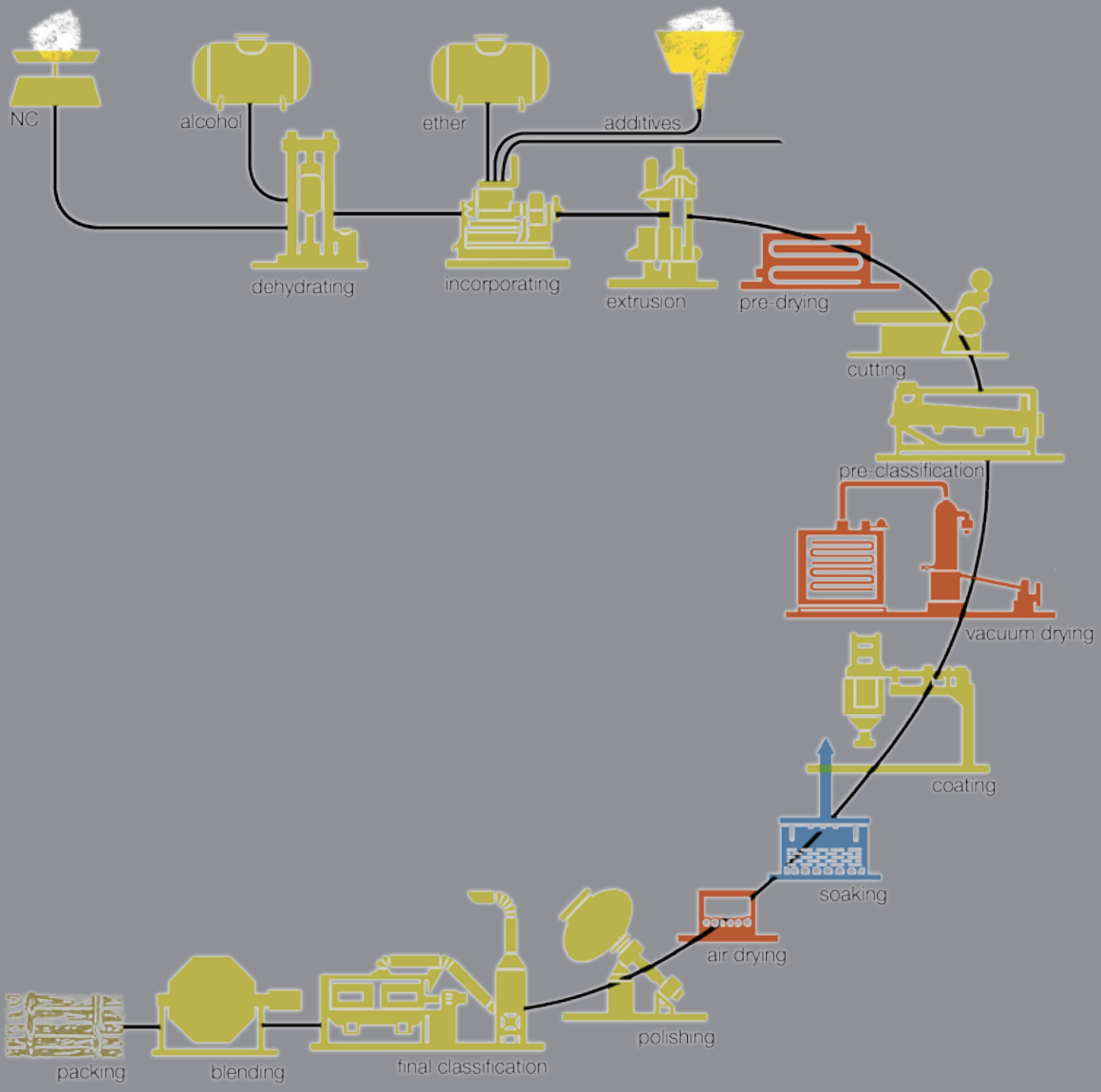
ROCKET MOTOR GRAINS

POWDERS AND PROPELLANTS

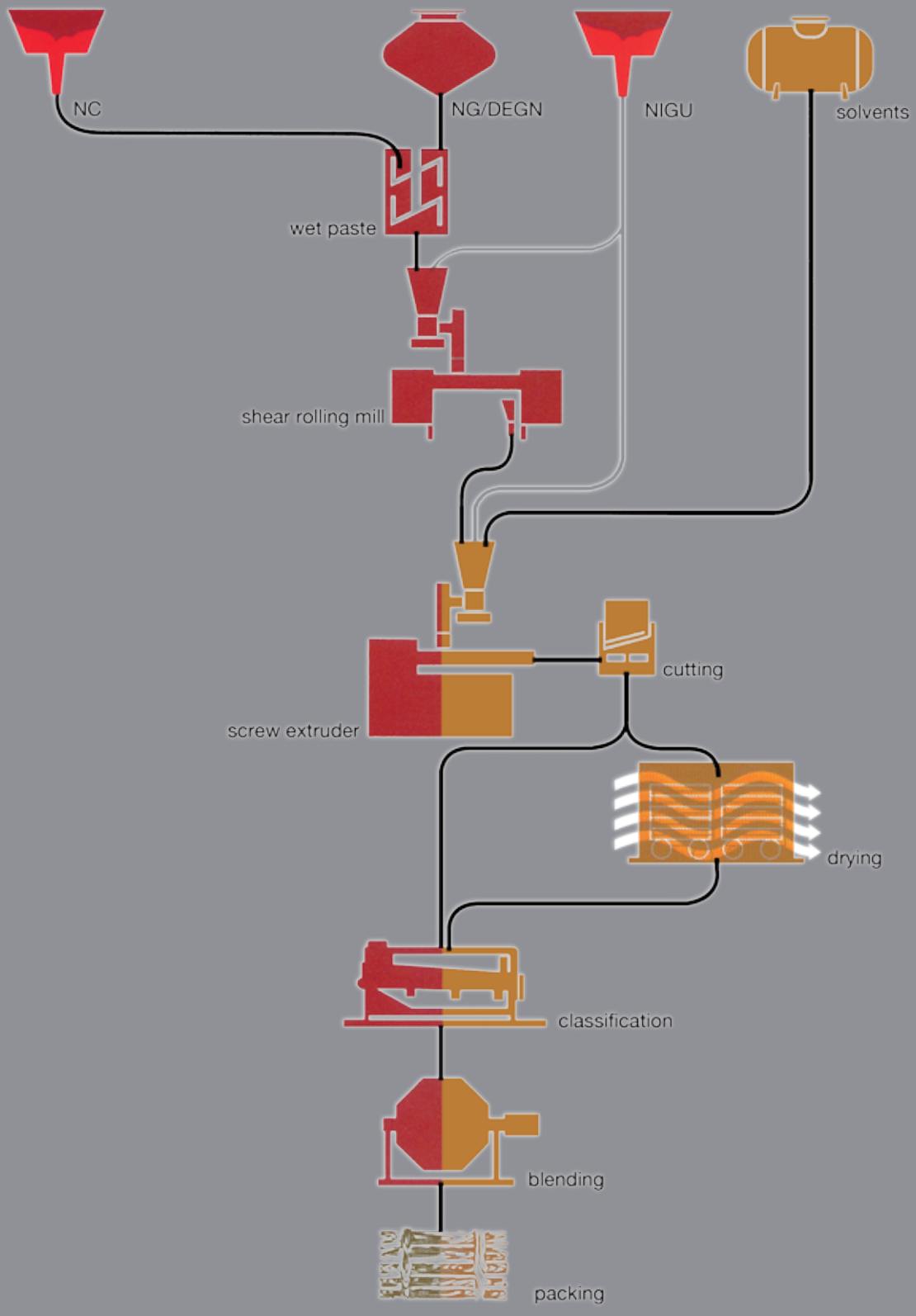
Conventional process Flowsheet double/ triple base propellant solvent/solventless



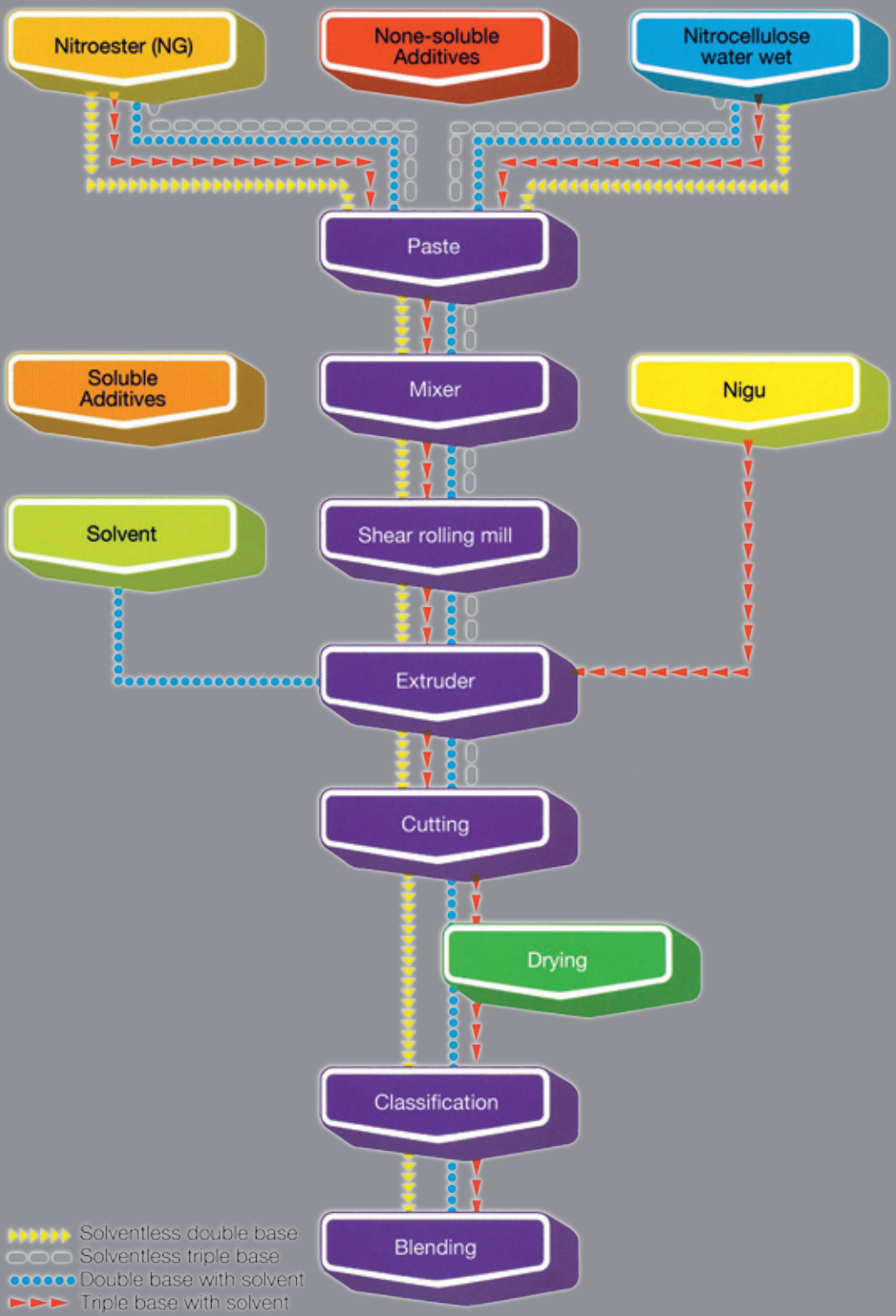
Conventional process
Flowsheet
Single base propellant

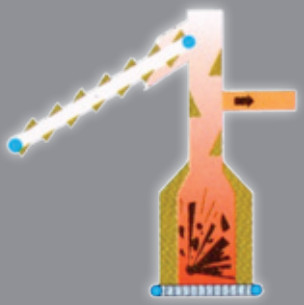


Continuous process Flowsheet double/ triple base propellant solvent/solventless



Continuous process Flowsheet double/ triple base propellant solvent/solventless



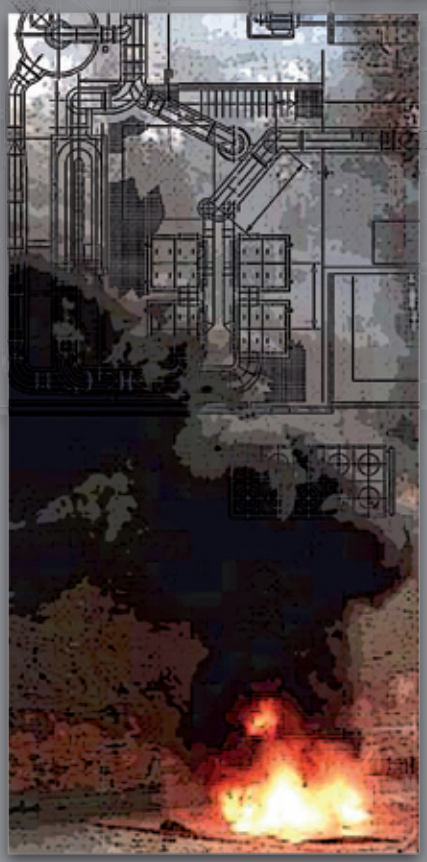


Explosive Ordnance Disposal

Thermal Disposal of Explosives and Ammunition

Stationary Plant – EMKO
Containerized Plant – ConTEx

- Disassembly of ammunition
- Thermal disposal of explosives and ammunition
- Recycling of explosives and ammunition
- Thermal treatment of soil, contaminated with explosives



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Combustible Cartridge Cases

Combustible components are used in place of cloth bags or metal cartridge cases. They are manufactured from compositions on the following groups of materials:
Energetic materials (e.g. nitrocellulose)
Reinforcing materials (e.g. kraft fibres)
Binders (e.g. artificial resins)
Stabilisers (e.g.substituted ureas)
Additives (e.g. talc)

Special emphasis is placed on both the mechanical combustible properties of the combustible material which are adjusted to ensure debris-free-combustion of the components in the gun.

BOWAS uses an advanced manufacturing method which permits varying the composition andthe wall thickness within the individual unit.

As a result of the energy produced on combustion, combustible components increase the efficiency of gun charges and, due to the production of a relatively cool gas stream along the barrel wall, reduce barrel erosion. After firing, no metal cartridge case remains to be ejected into the fighting compartment.

Problems
of gun design particularly with the high gas pressure of modern high performance guns
of logistics
of adjusting charge increments
of automatic loading of separate ammunition
can be effectively solved by the use of combustible cartridge cases

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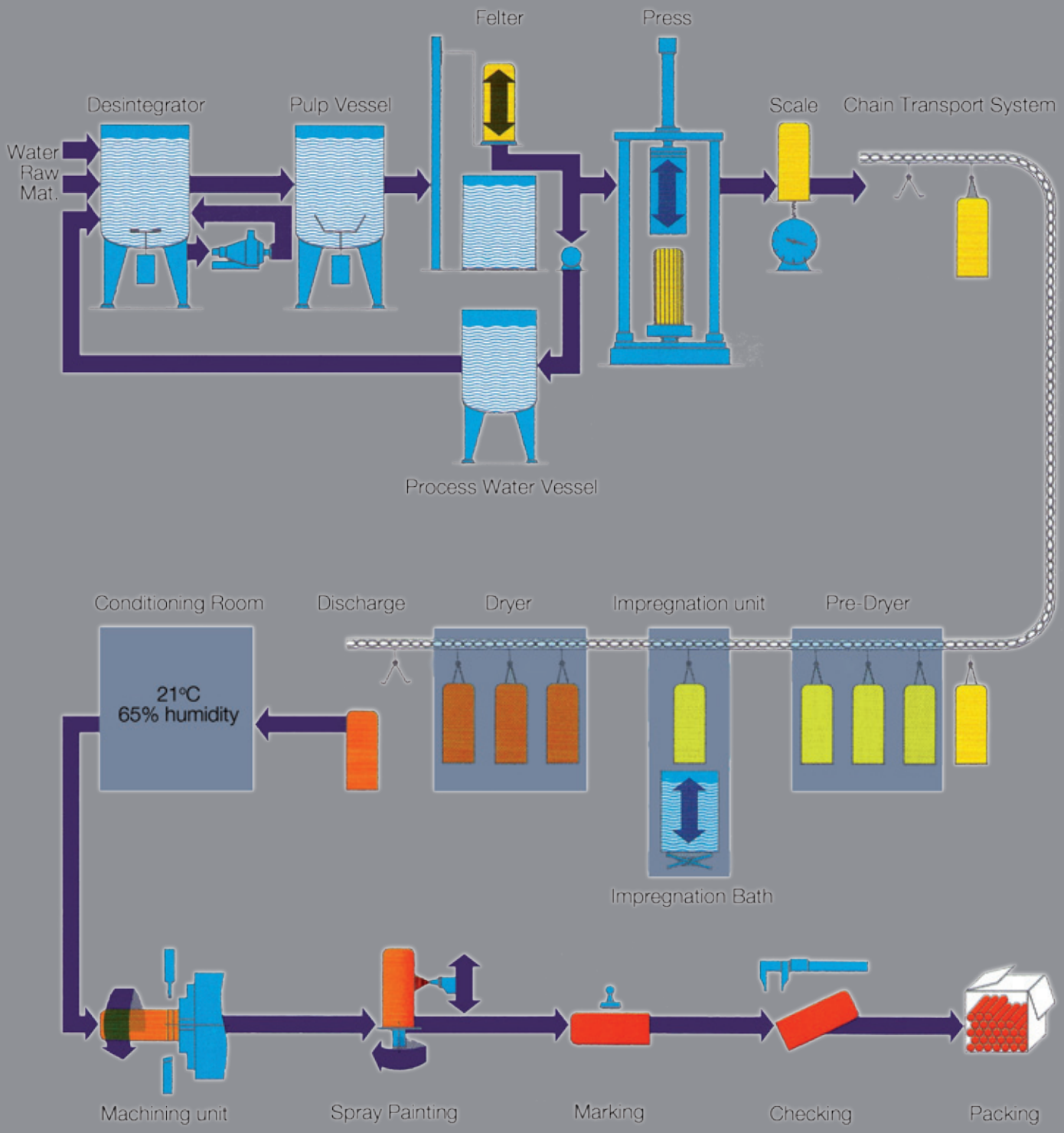
Flow Diagram of Combustible Cartridge Cases Production



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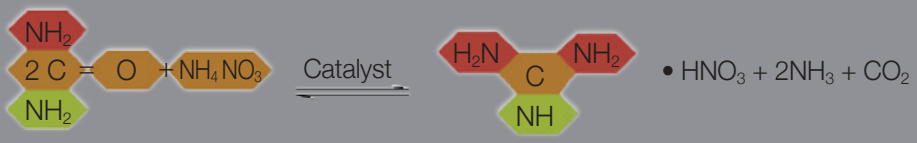
Manufacture of Guanidine Nitrate

Guanidine Nitrate is manufactured from an ammonium nitrate/urea melt in reactors at 180–190°. This method is the most modern. Of course other production routes can also be used.

The actual raw materials are urea and nitric acid since the ammonium nitrate used is extracted from the neutralization of the produced ammonia and the nitric acid.

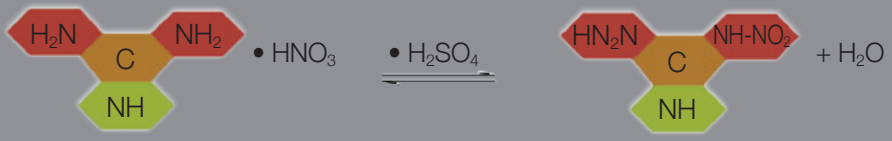


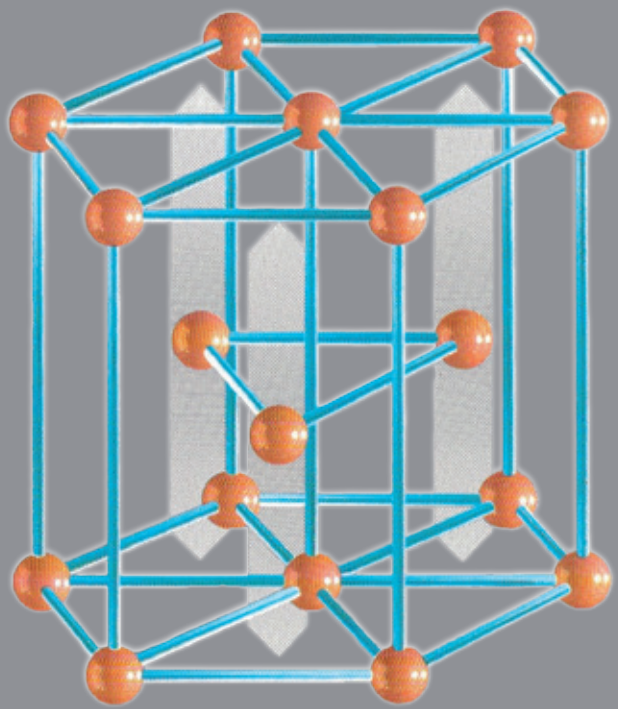
Manufacture of Nitroguanidine

Nitroguanidine is manufactured in reactors by dehydrating guanidine salts in presence of sulfuric acid as a reaction agent and solvent.

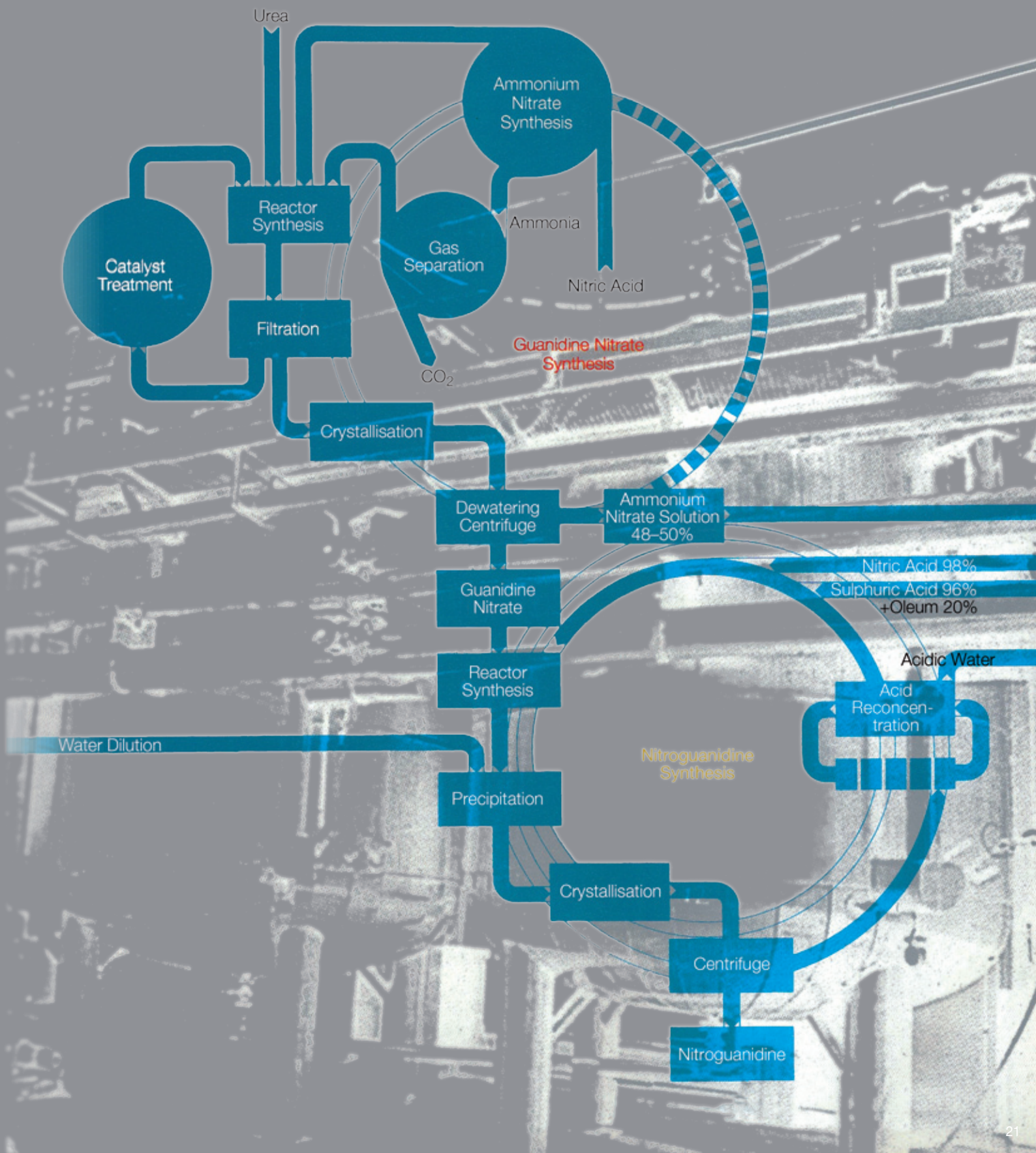
Further processes are:
Precipitation of the nitroguanidine by mixing with water in a precipitation apparatus which has a large influence on the quality and crystal size.

Separation and neutralization of the crystals on a rotating filter.
Dewatering in the centrifuge and dryer.
Finally grinding.
The diluted sulphuric acid is concentrated in a multi-stage plant to the required acid strength and again used in the reactor.





Flow-Sheet Guanidine Nitrate – Nitroguanidine (Picrite)



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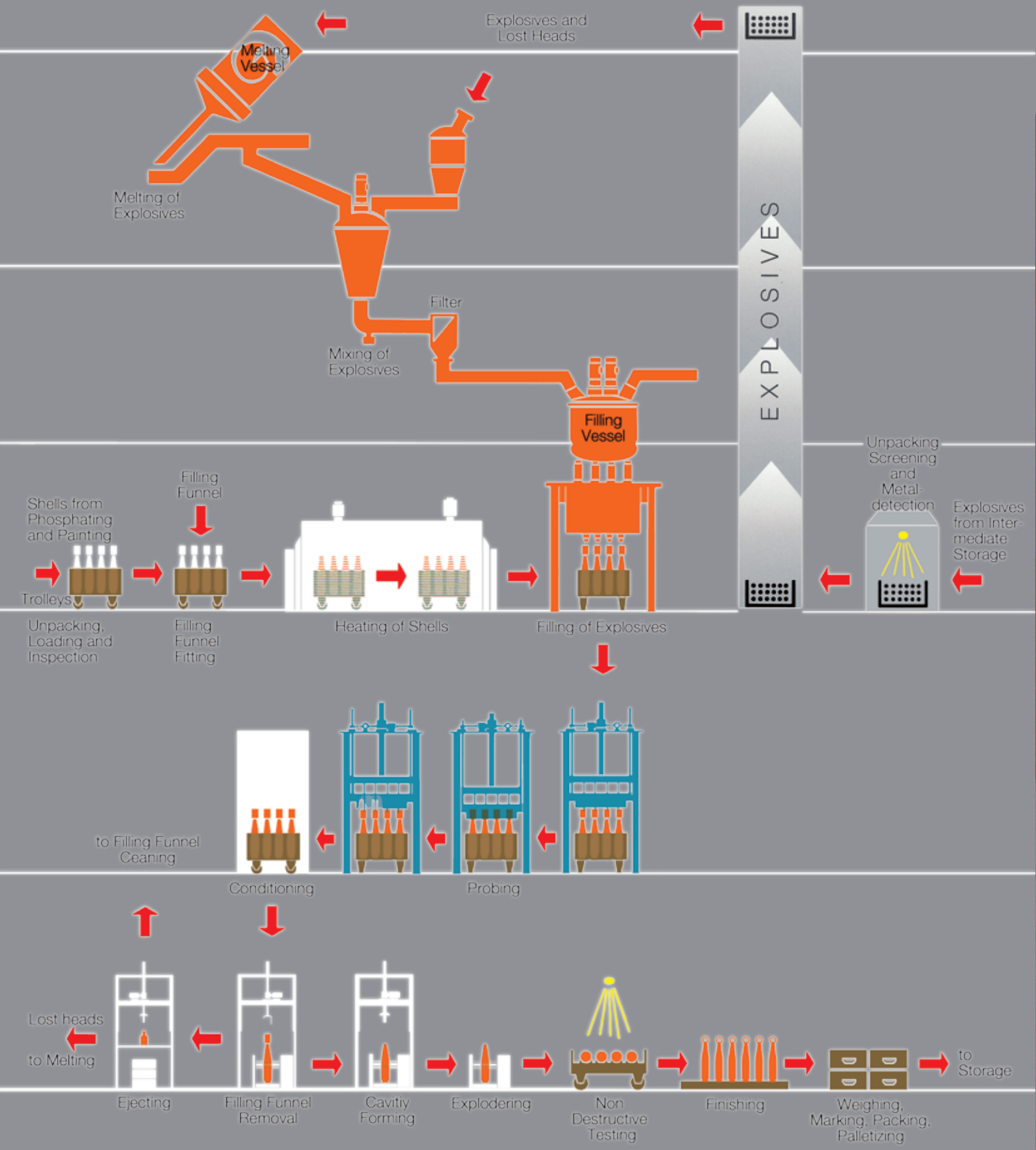
Explosive Cast Filling Plant

for meltable explosive compositions



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Explosives for Industrial Applications

Our background is closely linked to PRAVISANI's activities related to the development of a great number of gelatinous, pulvurulent, and slurry explosives.

Today our program comprises the supply of all modern types of explosives and auxiliary equipment as well as of the production facilities such as:

Explosives for rock blasting
Seismic Explosives
Permitted Explosives
Dynamites
Powderous Explosives
Anfo Explosives
Emulsions, bulk of cartridged

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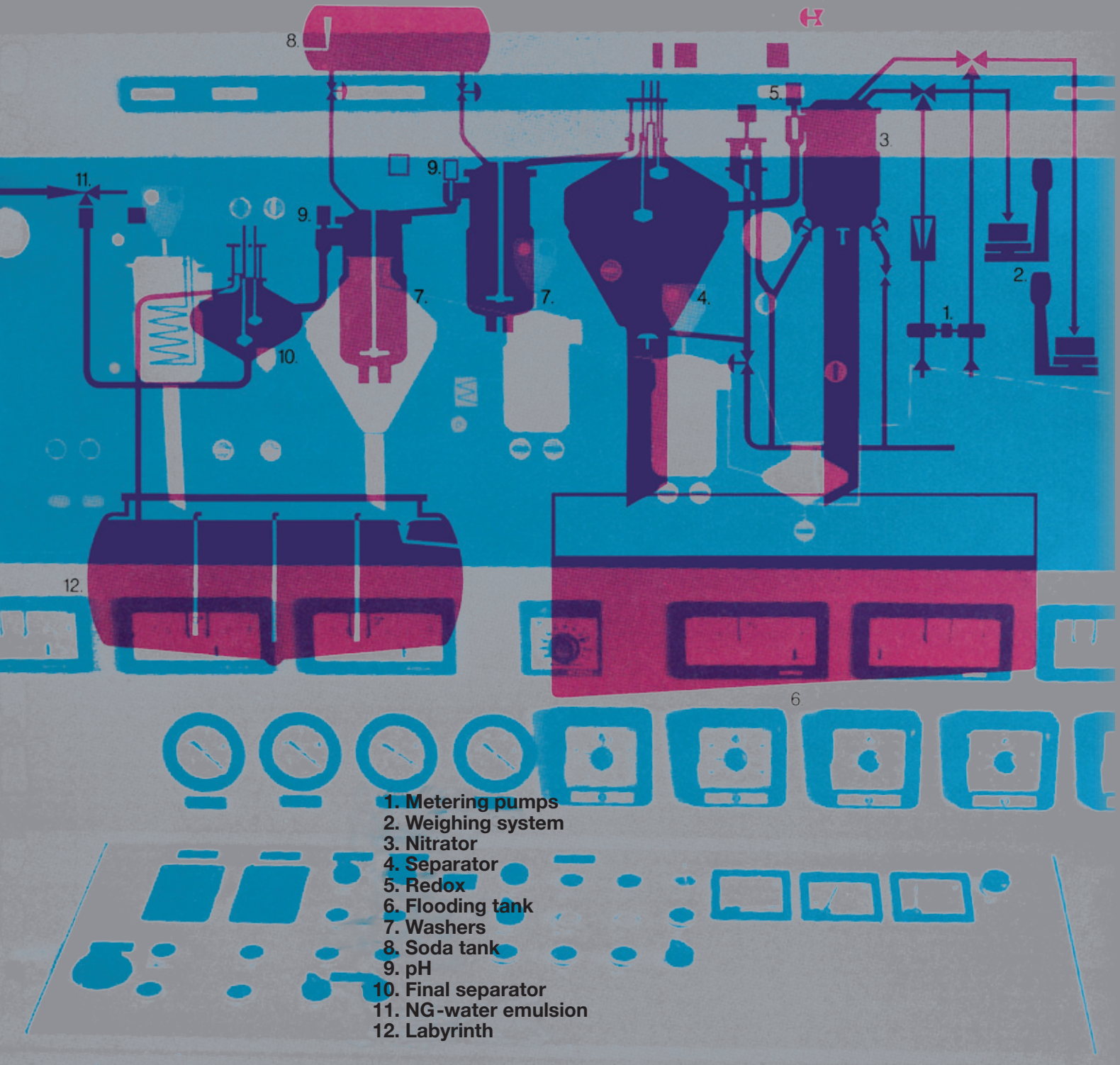
Continuous plant for the manufacture of Nitroglycerine



1. Metering pumps
2. Weighing system
3. Nitrator
4. Separator
5. Redox
6. Flooding tank
7. Washers
8. Soda tank
9. pH
10. Final separator
11. NG-water emulsion
12. Labyrinth

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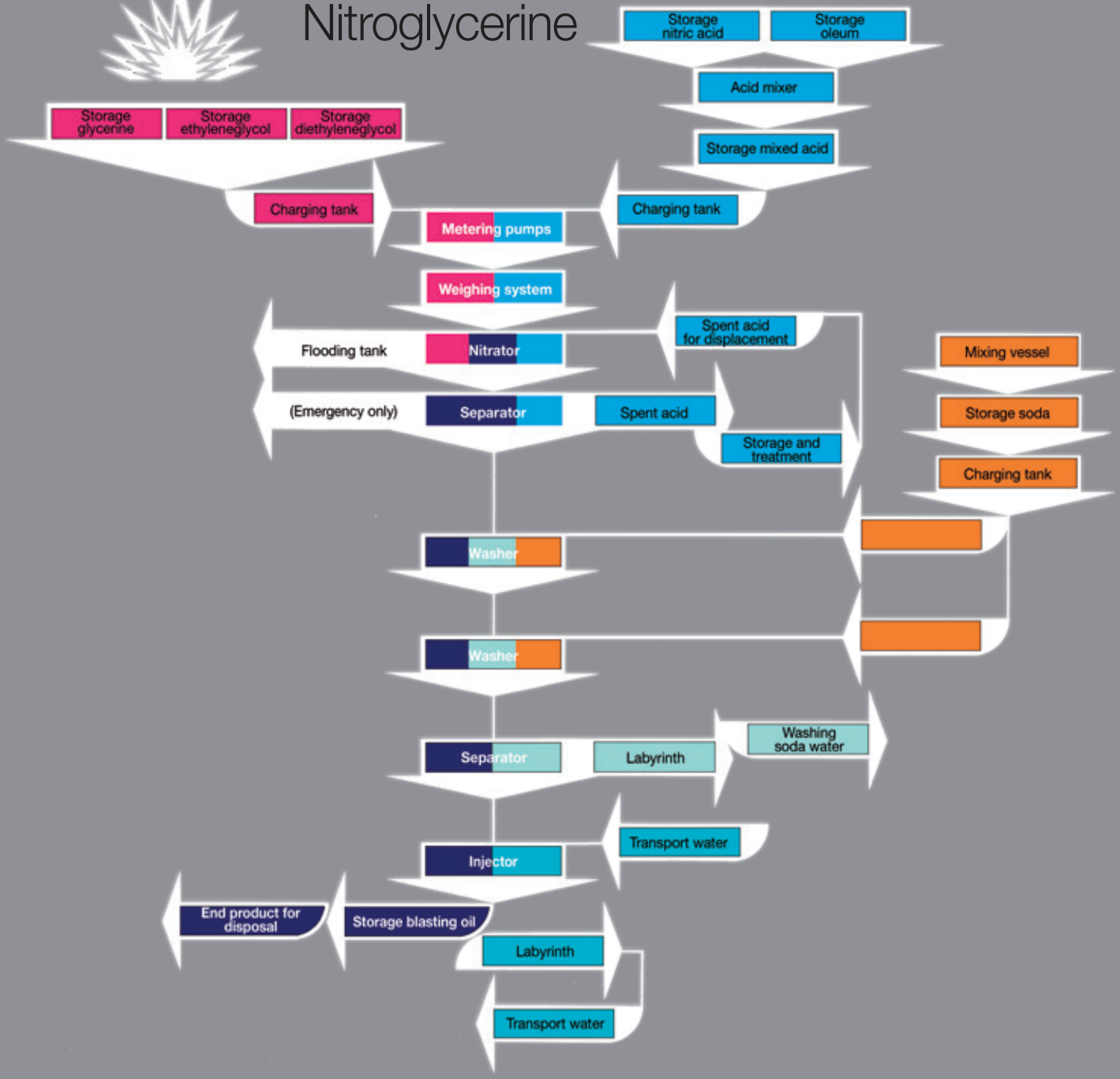
Process Flow-Sheet Nitroglycerine



Nitration possibilities

With almost the same basic equipment, the nitration process used in this plant allows not only the production of Nitroglycerine (NG) but also Ethyleneglycoldinitrate (EGDN) for dynamites, Diethyleneglycoldinitrate (DEGN) for propellants, Mixtures of any desired ratio of NG and EGDN or of NG and DEGN.

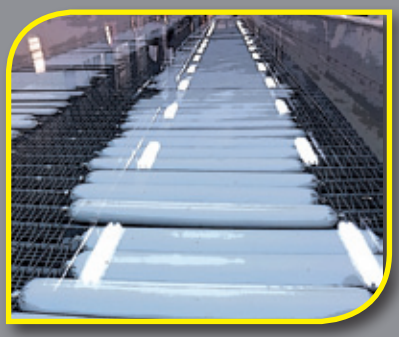
Process

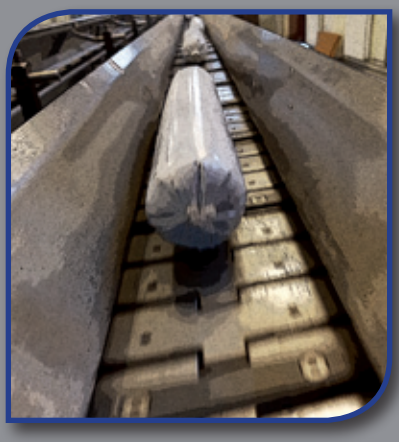
The nitration process is based on the injection by metering pumps of a precise proportion of acid and organic mixtures into a nitrator with a strong stirring.
The process temperature ist automatically controlled by a very large cooling surface.
The separation of blasting oil in the separator occurs by gravity without any dangerous mechanical movements.
The washing and neutralization with intermediate and final pH control guaranties an absolutely neutral blasting oil.

Safety and Advantages

A great deal of care has been taken in regard to the safety of the plant.
All apparatus are designed and built in accordance with the most modern process design and current practice, recommendations and explosive design, purpose and experience.
The study and the concept of the plant have resulted in increasing the yield of blasting oil and in decreasing the consumption of acid and soda without detriment to the safety.
The process and its control is completely automatic. One operator has only to supervise the plant from a save room.

Emulsion Explosives





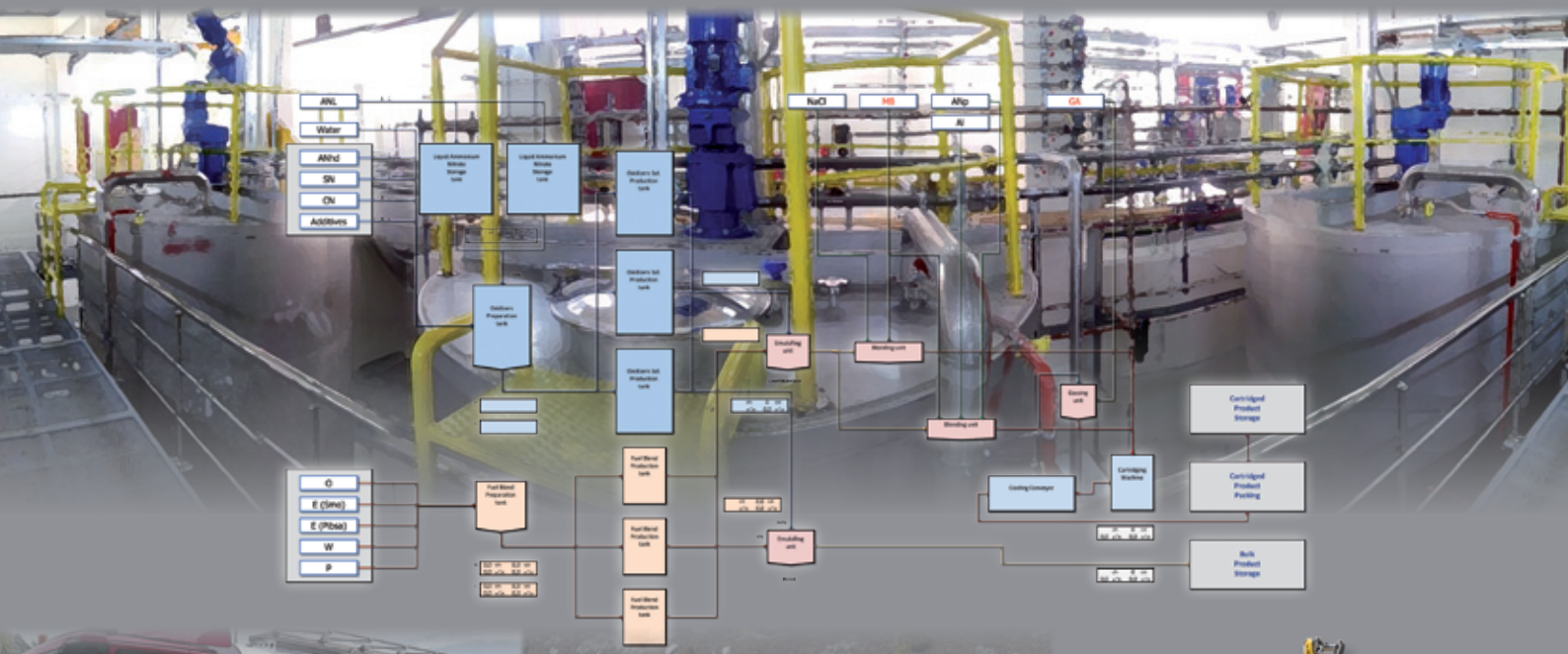
Emulsion Explosives have now proven to be the most cost efficient and safe solution for most civil blasting operations. Emulsion is based on a production and mixing process using easily accessible raw materials, mainly Ammonium Nitrate, Sodium Nitrate, Oil, Emulsifier and Paraffin, Wax, and/or other additives.

The wide range of recipes and adjustable setting make this type of explosive suitable for most kinds of civil blasting operations and perfectly adjustable to surrounding soil and rock conditions.

BOWAS fields Emulsion plants based on technology developed by *Dott. Mariano Pravisani & C. Srl* and further leading experts in Europe, joining the best knowledge and experience in design, engineering, production and blasting.

BOWAS / DMP offer the full range of production plants and related equipment and services to enable the highest grade of independence of the client.

- Production of Emulsion Cartridges and Bulk Emulsion/matrixproduction
- Containerized and modular plants that can be set up where they can be fielded near blasting operations to maximize efficiency and logistics.
- Mobile Pumping and Charging/Sensitizing Units
- MEMU trucks
- Underground Charging vehicles



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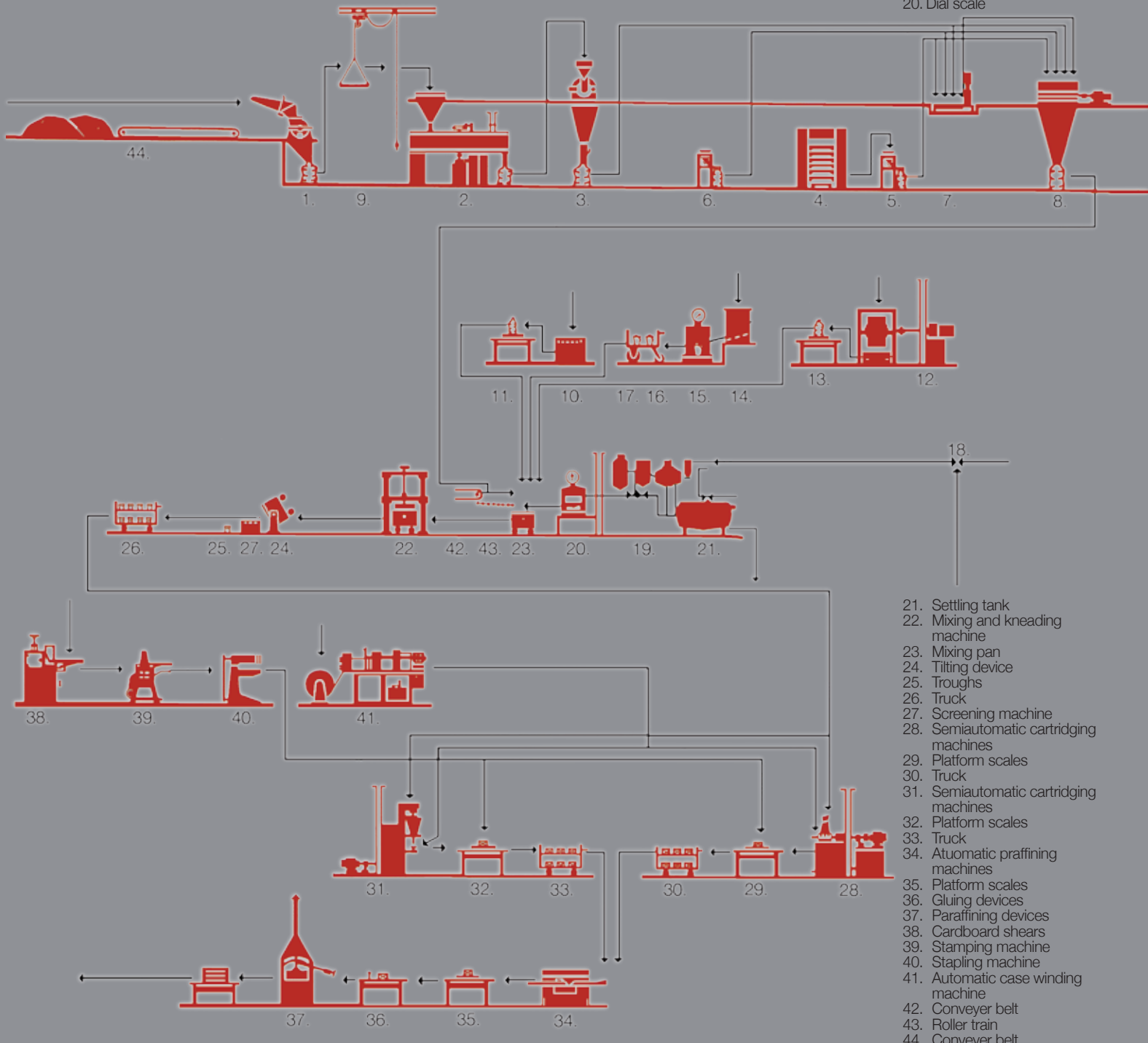
Flow Sheet Industrial Explosives

1. Swing-hammer mill
2. Pan dryer
3. Pulverizer
4. Circulating-air drying chamber
5. Hand sifter
6. Hand sifter
7. Dial scale
8. Screening machine
9. Electric hoist
10. Hand sifter
11. Sliding-weight scale
12. Mill
13. Sliding-weight scale
14. Melting kettle
15. Dial scale
16. Plastic cans
17. Truck
18. Water-jet injector
19. Separator
20. Dial scale



21. Settling tank
22. Mixing and kneading machine
23. Mixing pan
24. Tilting device
25. Troughs
26. Truck
27. Screening machine
28. Semiautomatic cartridging machines
29. Platform scales
30. Truck
31. Semiautomatic cartridging machines
32. Platform scales
33. Truck
34. Atuomatic praffining machines
35. Platform scales
36. Gluing devices
37. Paraffining devices
38. Cardboard shears
39. Stamping machine
40. Stapling machine
41. Automatic case winding machine
42. Conveyer belt
43. Roller train
44. Conveyer belt

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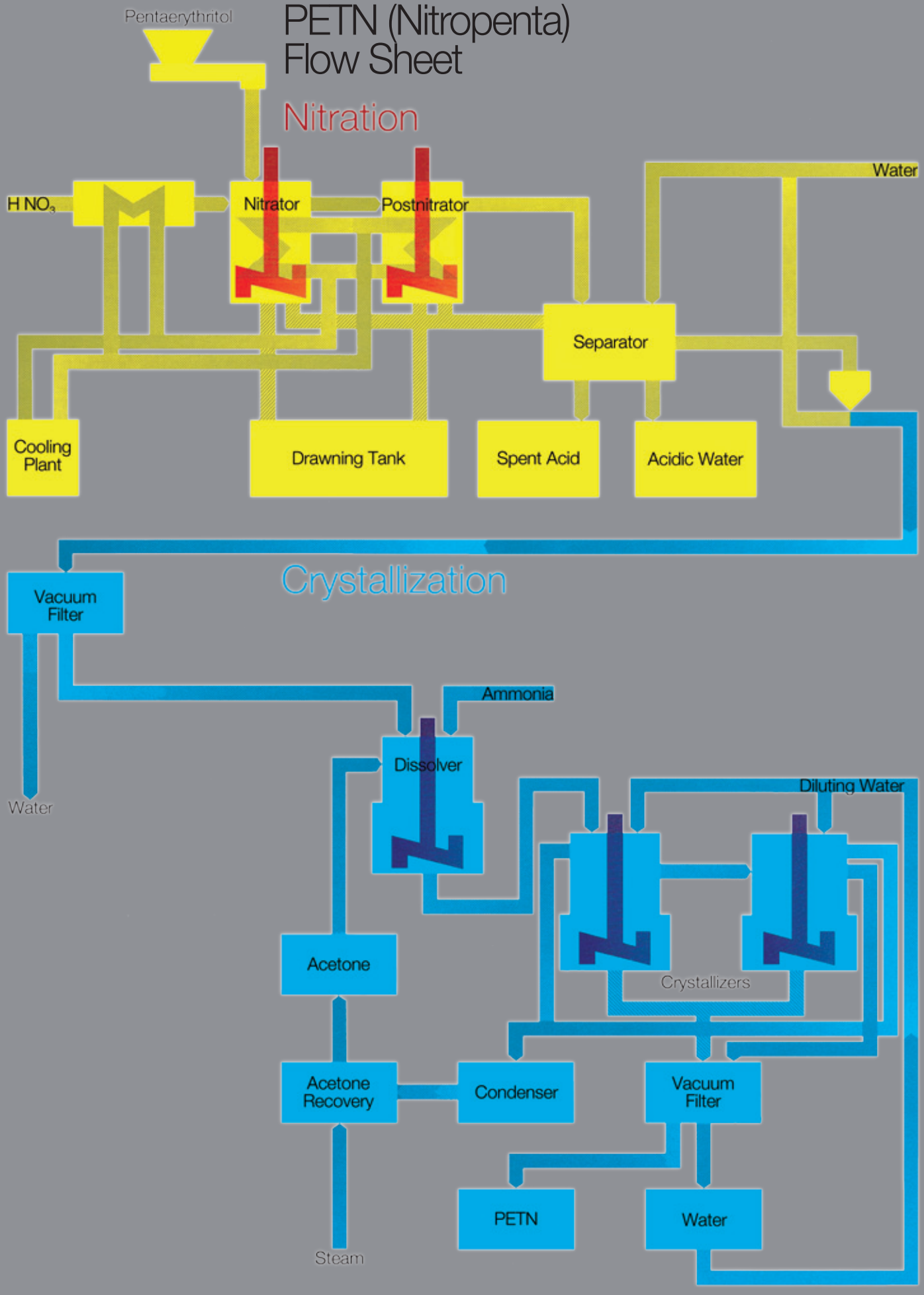
PETN (Nitropenta) Flow Sheet



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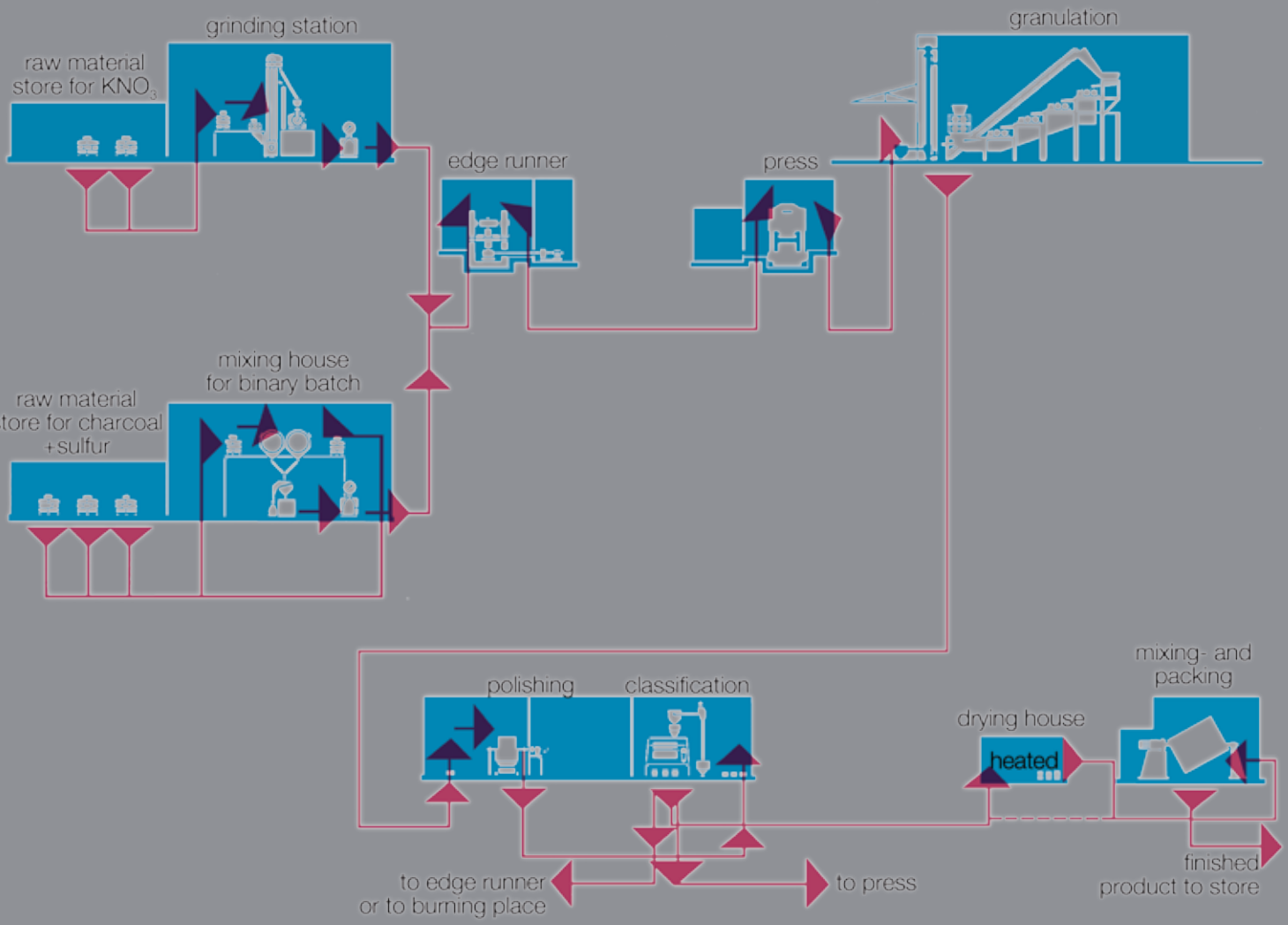
Flow Sheet Black Powder

Production of
Safety fuse black powder
MIL black powder (1-6)
Hunting powder



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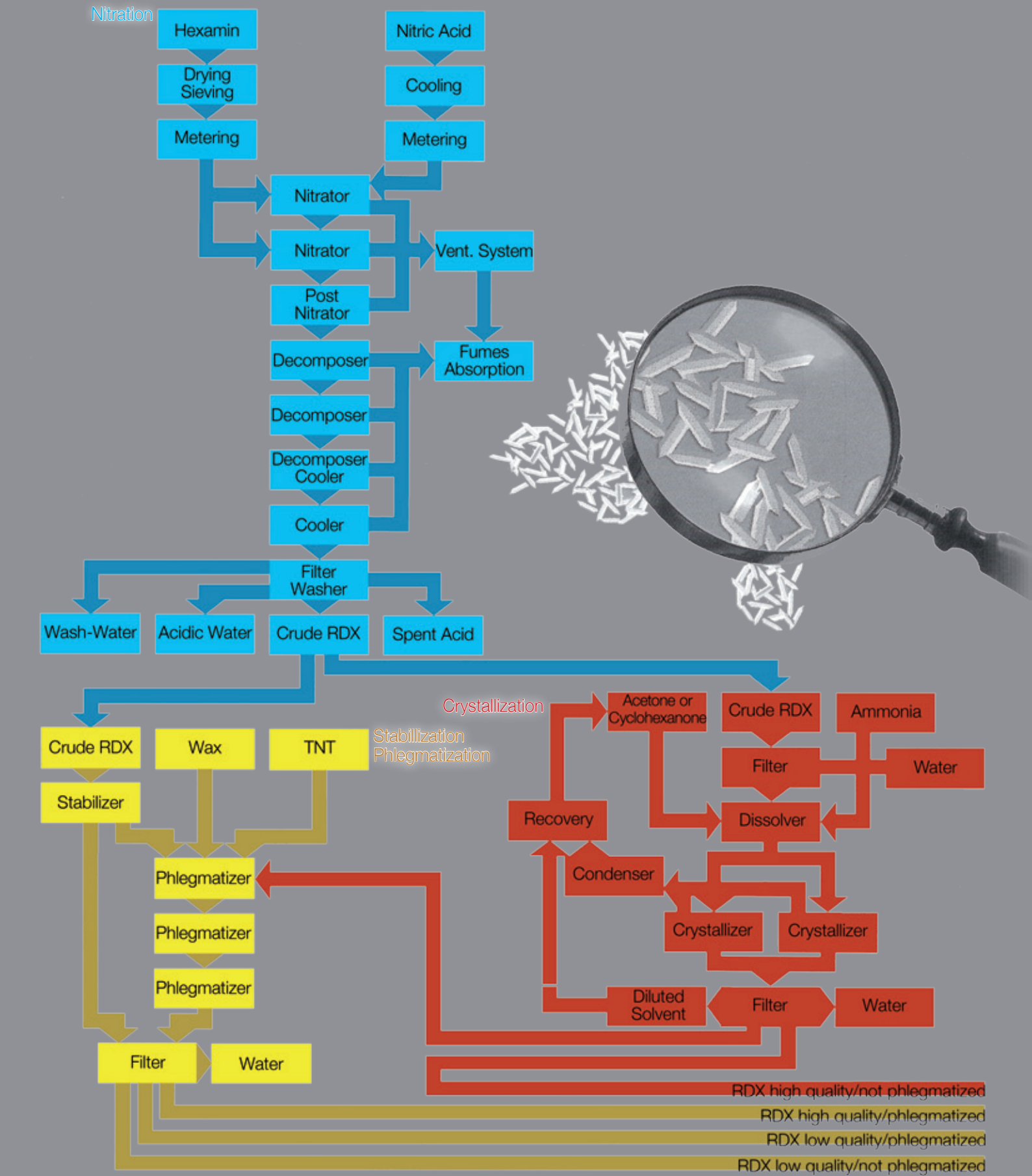
RDX Flow-sheet



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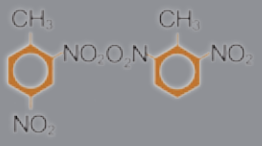
DNT-TNT

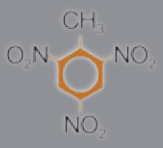
Production of DNT

DNT made of 2/4 isomer (high solidification point) as additive for propellants.
DNT isomers mixture (low solidification point) for civil explosives.



Production of TNT

for blasting charge of projectiles (cast or pressed)
preparation of composition B with RDX
for phlegmatization of high explosives
for plastic explosives
as components of propellants and industrial explosives



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Initiating Explosives

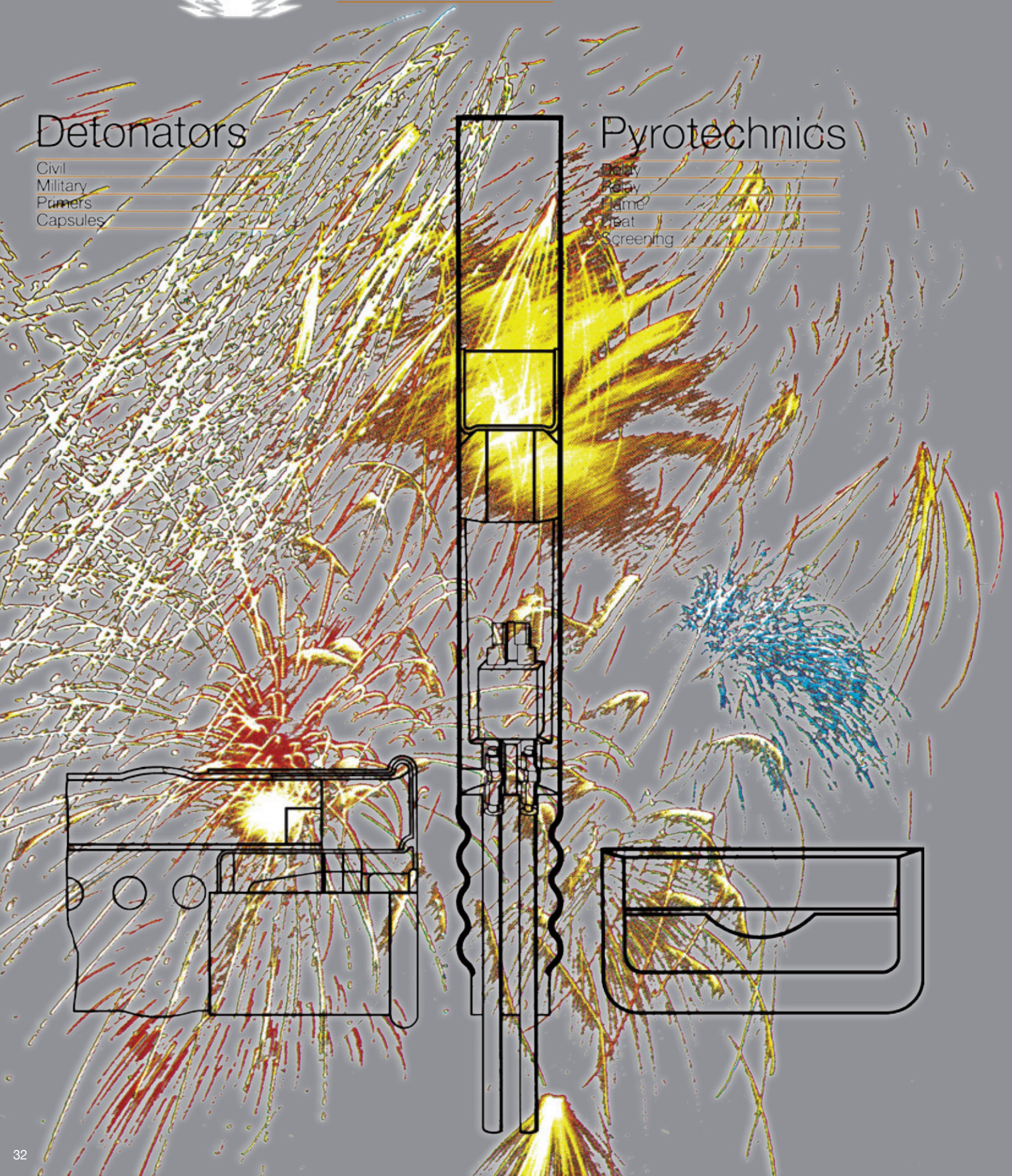
- Pure Lead azide
- Dextrinated Lead azide
- Normal Lead Styphnate
- Basic Lead Styphnate
- Tetrazene

Detonators

- Civil
- Military
- Primers
- Capsules

Pyrotechnics

- Delay
- Relay
- Flame
- Heat
- Screening



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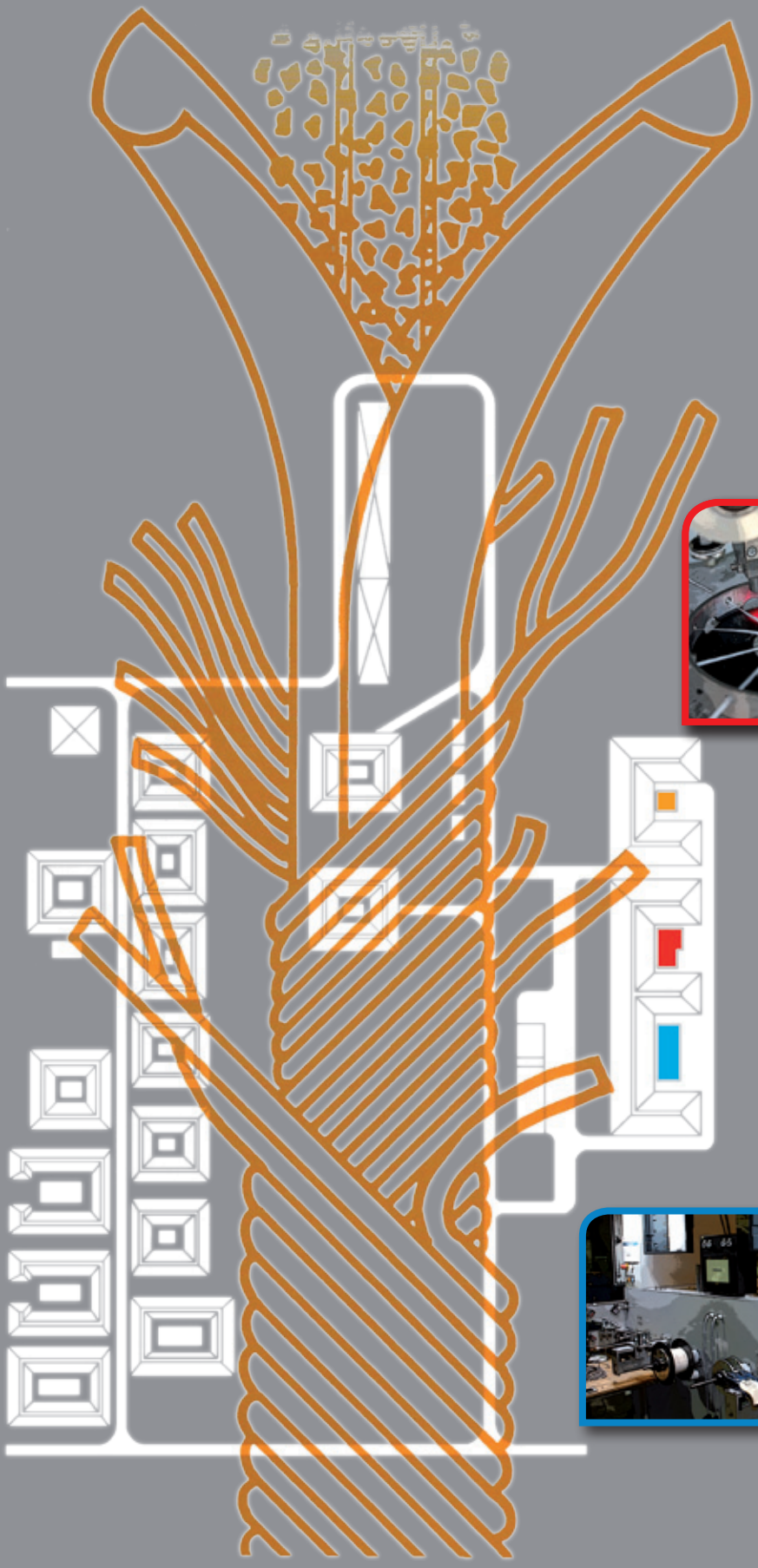
Detonating Cord Safety Fuse



PETN drying

Spinning

Coating/Rewinding

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Raw Materials and Chemical Intermediates

Because of our activity in the civil and military explosives fields we have developed our program according to the main raw materials needed

- Linters (purification and bleaching)
- Nitrocellulose
- Nitroguanidine
- DNT
- TNT
- recycle TNT
- Propellant additives

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Our Machine Program

- Pusher Centrifuges
- Dehydration Presses
- Kneaders
- Extrusion Presses
- Rolling Mills
- Shear Rolling Mills
- Cutting Machines
- Blenders
- Sieving Devices
- Drying Equipment
- Metal Detection
- Quality Control
- Conveyors
- Fire Fighting Plants
- Automation
- Laboratory Equipment
- Spare Parts

Your inquiries and needs
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