RECOVERED CARBON BLACK

Processing systems for the highest product quality

HOSOKAWA MICRON GROUP

The Hosokawa Micron Group offers you innovative technology and customised solutions from a single source. Based on our many years of experience in your process, we can deliver system solutions with the highest quality machines to ensure your process and product reliability. Customers all over the world trust in our technologies and in the know-how of our experts.

» ENERGY-EFFICIENT RECOVERED CARBON BLACK FINISHING

» PRECISE CONTROL OF THE QUALITY AND TARGET FINENESS OF THE END PRODUCT

» HIGH PROCESS AND SYSTEM RELIABILITY

» COMPLETE SYSTEMS FROM DOSING TO PACKAGING

THREE TIMES COMPETENCE

We create synergies

The Hosokawa Micron Group, headquartered in Japan, is represented at various locations around the globe. Our know-how is pooled together at competence centres to deliver complete processing solutions from grinding to packaging. This enables our customers to process the carbon black granules recovered from pyrolysis into a high-quality product for applications in the tyre and rubber industries.

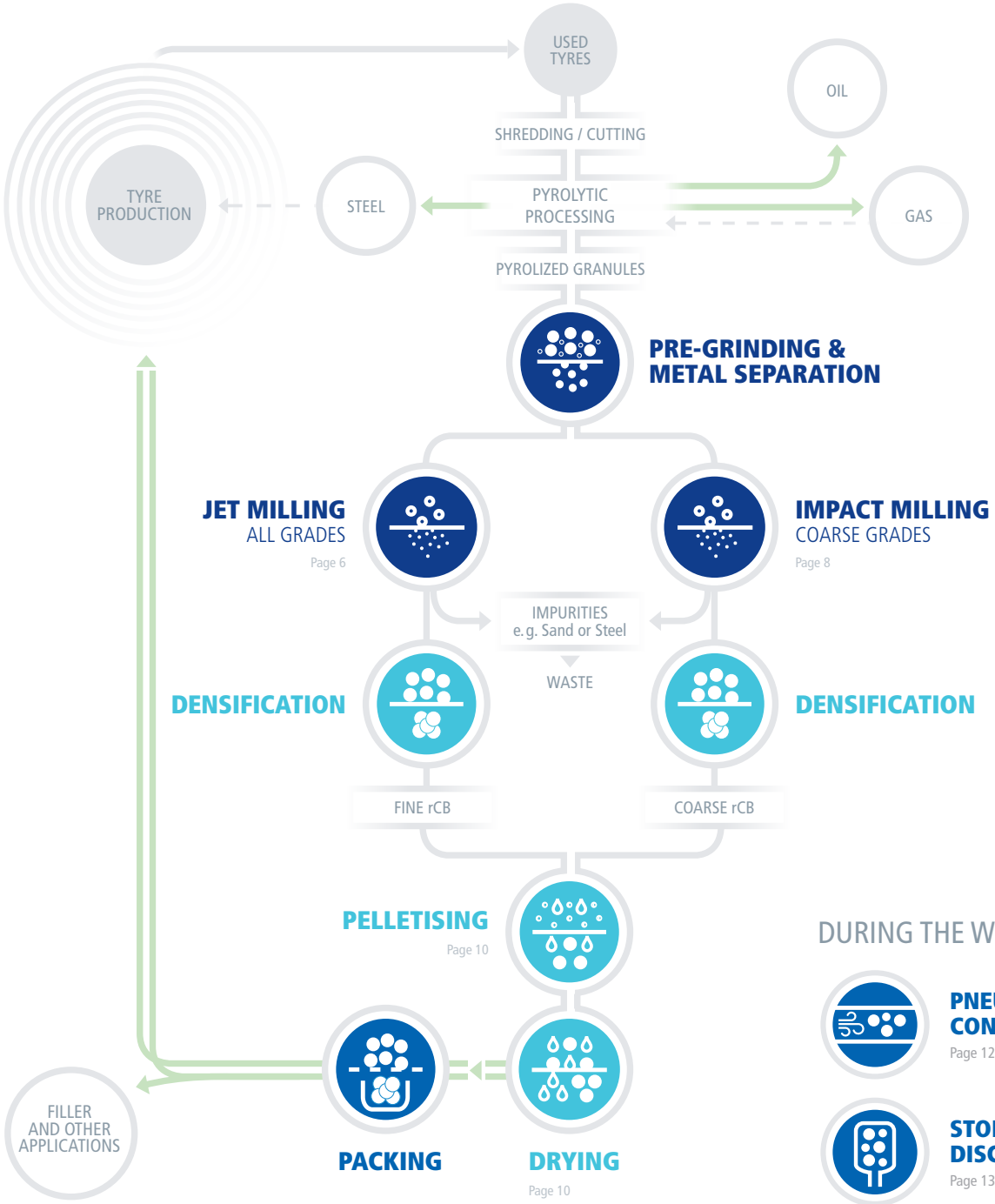
HOSOKAWA MICRON B.V.
Mixing | Drying | Pelletising

HOSOKAWA ALPINE AG
Milling | Classifying | Compaction

HOSOKAWA SOLIDS
Conveying | Weighing | Storage

ALL FROM ONE MANUFACTURER

Complete solutions for recovered carbon black finishing



DURING THE WHOLE PROCESS:

PNEUMATIC CONVEYING
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STORAGE, CHARGE & DISCHARGE
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DOSING, FILLING & LOADING
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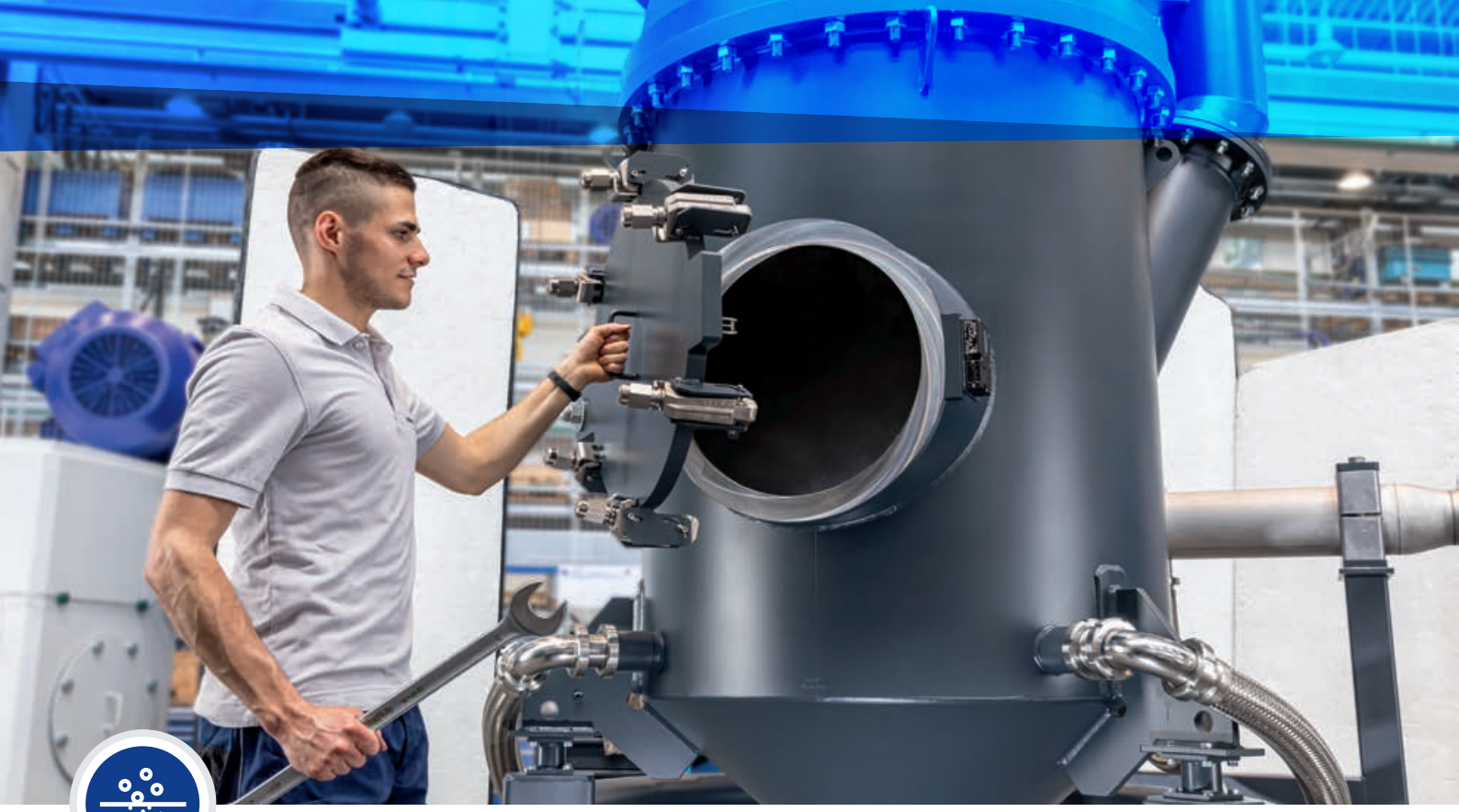


FINE GRINDING

With the TDG fluidised bed opposed jet mill

After pyrolysis, an intermediate process step is required. The carbon black granules are pre-crushed and prepared for the fine grinding stage using a magnet/metal separator.
For fine grinding, Hosokawa Alpine primarily uses the TDG fluidised bed opposed jet mill with integrated dynamic high-performance classifier. Everything is possible here, from the very highest fineness to coarser levels. The TDG optimises the conversion of compressed grinding air into jet energy via nozzles positioned opposite each other. The proven hot gas process with low pressure is used here, which results in efficient grinding. The NG classifier wheel with bearings on both sides ensures excellent selectivity and upper particle size limitation. The uniform product flow minimises the wear load on the classifier wheel. The large free surface of the classifier enables high throughput rates even with the highest fineness levels.

THE ADVANTAGES AT A GLANCE

- Covers the fineness range between d_{97} = 4 – 40 µm through a simple change of the classifier wheel speed (flexibility) *
- Steep particle size distribution with exact upper particle size limitation due to excellent selectivity (quality)
- High throughput rates with very fine end products (OPEX)
- Minimised wear load (OPEX)
- Selective grinding combined with automated discharge of foreign particles from the grinding chamber (OPEX/quality)
- Reduced investment and operating costs due to low-pressure grinding with hot gas, energy-saving NG classifier wheel and compact design (CAPEX/OPEX)
- Reduced personnel costs due to high degree of automation and remote control (OPEX)
- System concepts according to CE and ATEX directives (safety)

** Direct customer benefit in brackets, e. g. more flexbilty, positive influence on costs*

TDG fluidised bed opposed jet mill

TECHNICAL SPECIFICATIONS

SIZE	*TDG 400*	*TDG 630*	*TDG 800*
Fineness range* d_{97} (µm)	3 – 25	4 – 35	4 – 40
Scale-up factor	1	2.5	6.25
Grinding air requirement** (Nm^3/h)	1200	3000	6500

** Measured with laser diffraction, Malvern, dry, 2 bar*
*** Low pressure application 3 bar overpressure – hot gas*

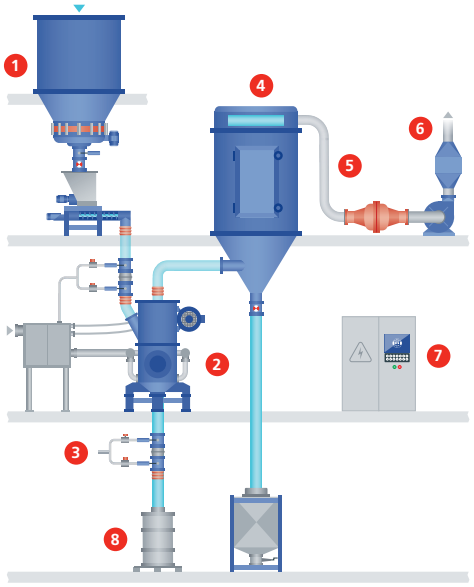
CASE STUDY TDG

Example system values related to market-oriented fineness requirements

	TDG 800	*TDG 800*
Feed size	< 3 mm	< 3 mm
Fineness: d_{97} = * (µm)	10	20
Throughput capacity (t/h)	2.1 – 2.5	4.1 – 4.5

SYSTEM DESIGN

The TDG grinding system is continuously supplied with feed material via a dosing unit. Low compressed hot gas is supplied at the same time. The end product is discharged from the system in a controlled manner for further processing. This is ensured by a specially designed bag filter and a regulated extraction fan. One special feature is the time-controlled discharge of foreign particles directly from the grinding chamber. The safety concept of the grinding system is adapted to fit each different grinding material. The valid ATEX directives are always applied.

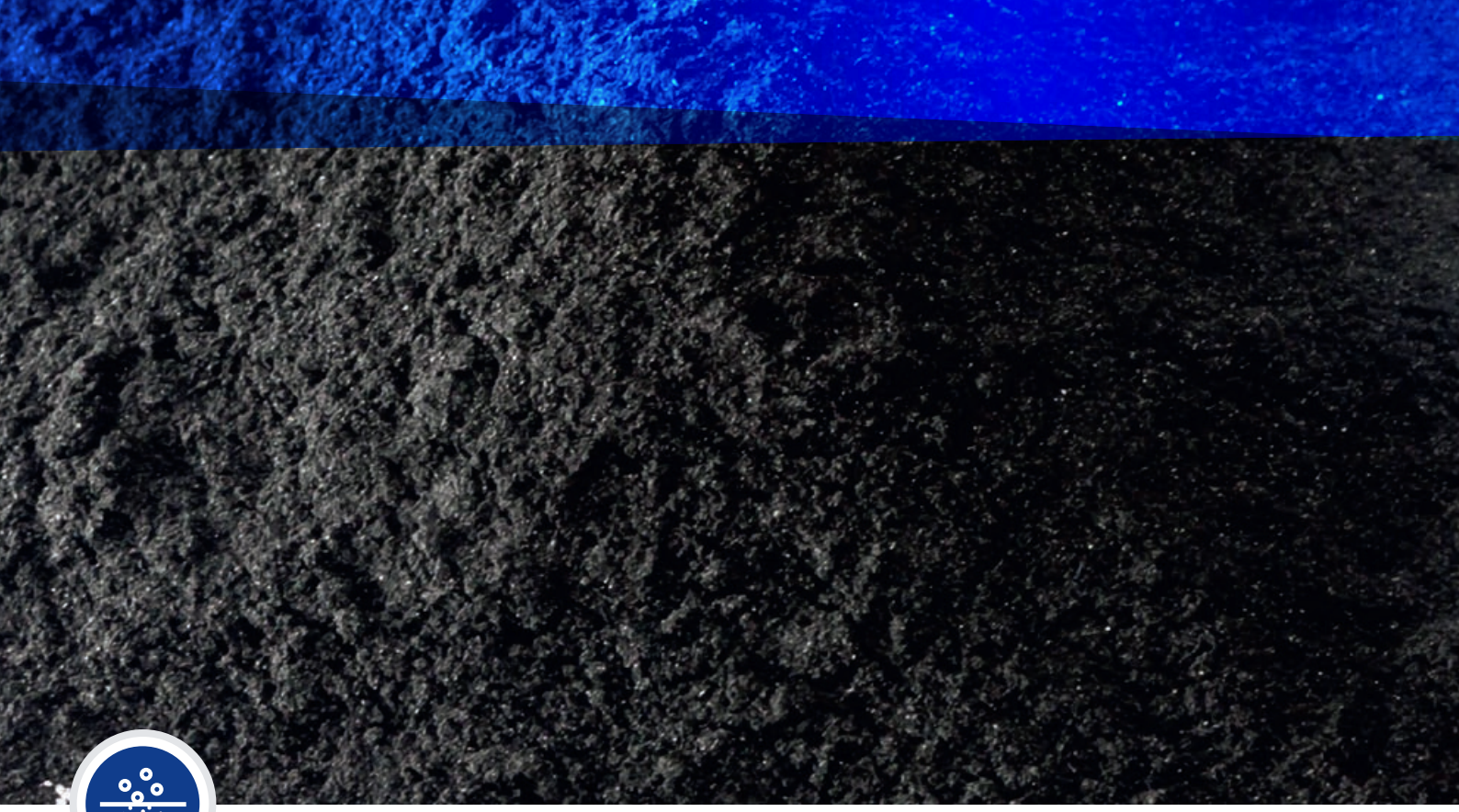


1	Feeding system
2	Fluidised bed opposed jet mill
3	Discharge unit for foreign particles
4	Bag filter
5	Explosion protection valve (only for pressure-shock-resistant version)
6	Exhaust fan
7	System control
8	Impurities (e. g. metal particles)

THE ANALYTICS ARE DECISIVE

Method	*d_{99} = (µm)*	*d_{97} = (µm)*	*d_{50} = (µm)*	*d_{10} = (µm)*
Malvern wet	10.7	9.3	2.8	0.4
Malvern dry	7.6	6.7	2.0	0.6
Sympatec dry	8.6	7.2	1.9	0.6
Cilas wet	9.5	7.9	2.5	0.5

Hosokawa Alpine has worked out a comparison of classical particle analysis methods based on laser diffraction. This study was carried out in close cooperation with the ASTM committee. The objective was to contribute to the standardisation of the fineness determination for the various end product qualities of recovered carbon black. Using the correct measuring method can have a decisive influence on the correct system design. Therefore, a clear definition of the analytics is important here.



FINE GRINDING

with the classifier mill Mikro ACM

The mechanical classifier mill ACM is the right choice for medium product finenesses or if the ash content in the raw carbon black feed material is only present in moderate quantities.
The coaxial drive system and optimum coordination between the rotor/stator grinding sector and the classifier wheel located in the centre ensure a continuous production process. The modular design of the grinding elements and classifier wheel facilitates access for replacing wear parts.

THE ADVANTAGES AT A GLANCE

- Covers the industrially required fineness range of d_{97} = 15 – 40 µm
- Simple adjustment of the end product fineness via the classifier wheel speed
- Easy Clean design in modular construction for quick replacement of wear parts in the grinding area (for certain sizes)
- Robust drive system via the proven coaxial bearing
- Space-saving due to compact design
- System concepts based on the applicable CE and ATEX directives

Micro ACM classifier mill

TECHNICAL SPECIFICATIONS

	ACM 60	ACM 75	ACM 100	ACM 120
Recommended fineness range d_{97} = (µm)	15 – 40	15 – 40	18 – 40	18 – 40
Scale-up factor	5.4	6.75	9	10.8
Motor power (kW)	45/55	55/75	75/90	90/110
Classifier power (kW)	7.5	11	15	15
Grinding air requirement (Nm^3/h)	5400	6750	9000	10,800

CASE STUDY MIKRO ACM

Example system values related to market-oriented fineness requirements

	ACM 100	ACM 100
Feed size	< 3 mm	< 3 mm
Fineness: d_{97} = * (µm)	20	30
Throughput capacity (t/h)	1.2 – 1.4	3.5 – 4

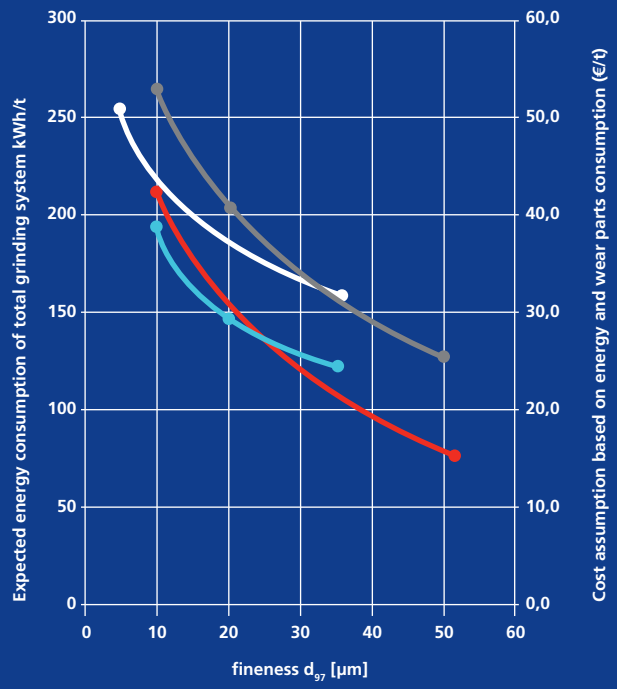
** Measured with laser diffraction, Malvern, dry, 2 bar*

COST EFFECTIVENESS

Cost comparison of jet mill and classifier mill

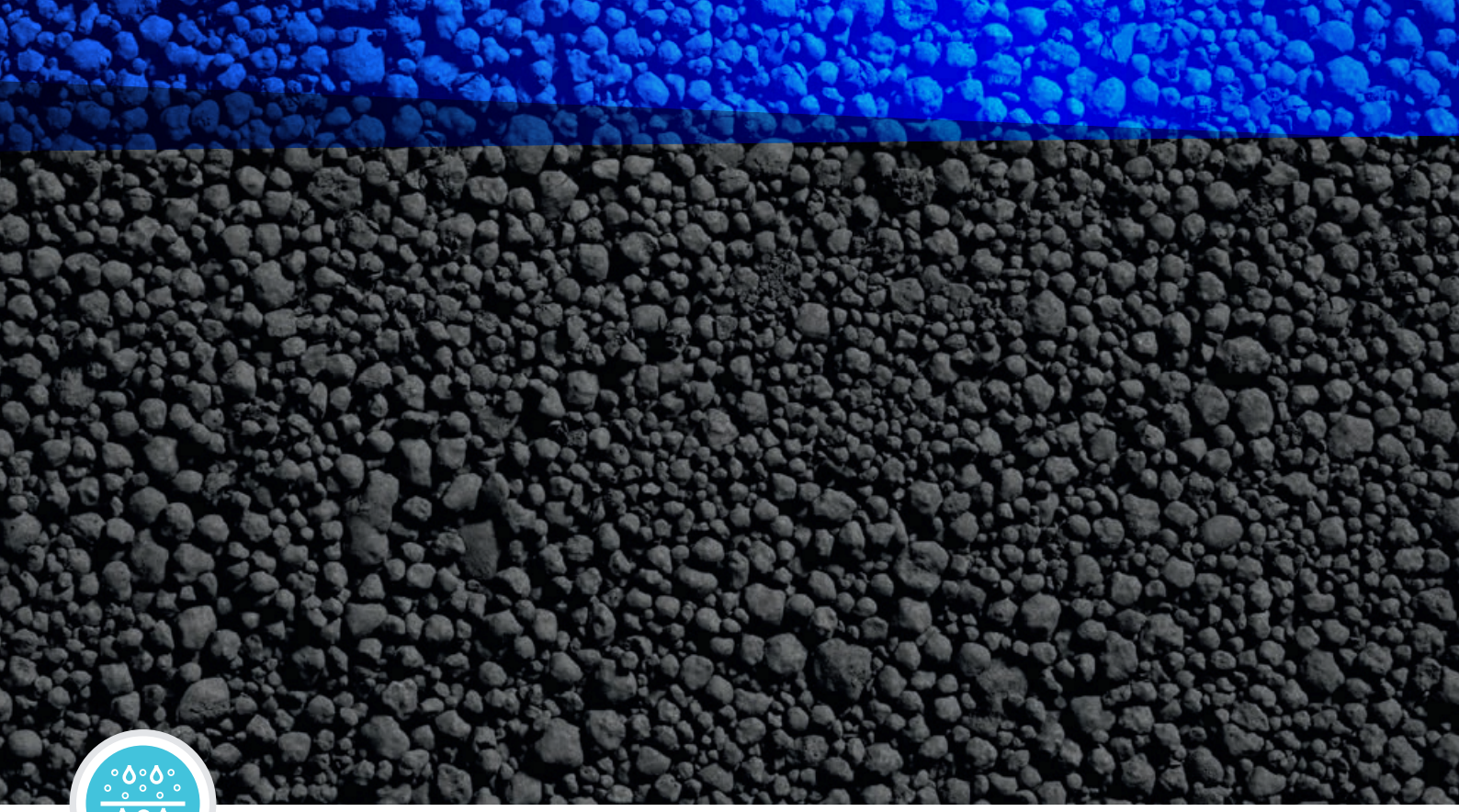
Energy costs influence the cost effectiveness of the system. At the same time, the wear costs of the grinding elements and the associated system downtimes required for replacing parts must be included when considering the OPEX. The following table is intended to provide an assessment. Conclusion: Only considering the grinding energy leads to an incorrect assessment. In order to determine the right grinding system, the costs of wear parts must also be taken into account.

SPEC. ENERGY/COSTS VS. FINENESS



The energy data in the diagram refers to the total systems. The values are based on practical data and self-conducted studies. The values are for informational purposes and may vary depending on the ash content and energy costs.

- spec. Energy milling plant TDG
- spec. Energy milling plant ACM
- spec. costs energy milling plant + wear ACM
- spec. costs energy milling plant + wear TDG



PELLETISING & DRYING

Easy to handle, dry and stable

The pelletising systems from Hosokawa Micron B.V. first of all consist of a mixer to mix the finely ground carbon black together with the binding solution. After mixing, the wet carbon black pellets need to be dried in order to produce easy-to-handle, dry and stable pellets.

MARS MINERAL PIN MIXER

The Mars Mineral Pin Mixer is a horizontal high intensity pin mixer. Here, the carbon black is agglomerated by mixing it with the binder (usually water). This is supplied by a precise binder feeding system. The pin mixer produces strong, dense and spherical pellets.

› *Mars Mineral Pin Mixer*

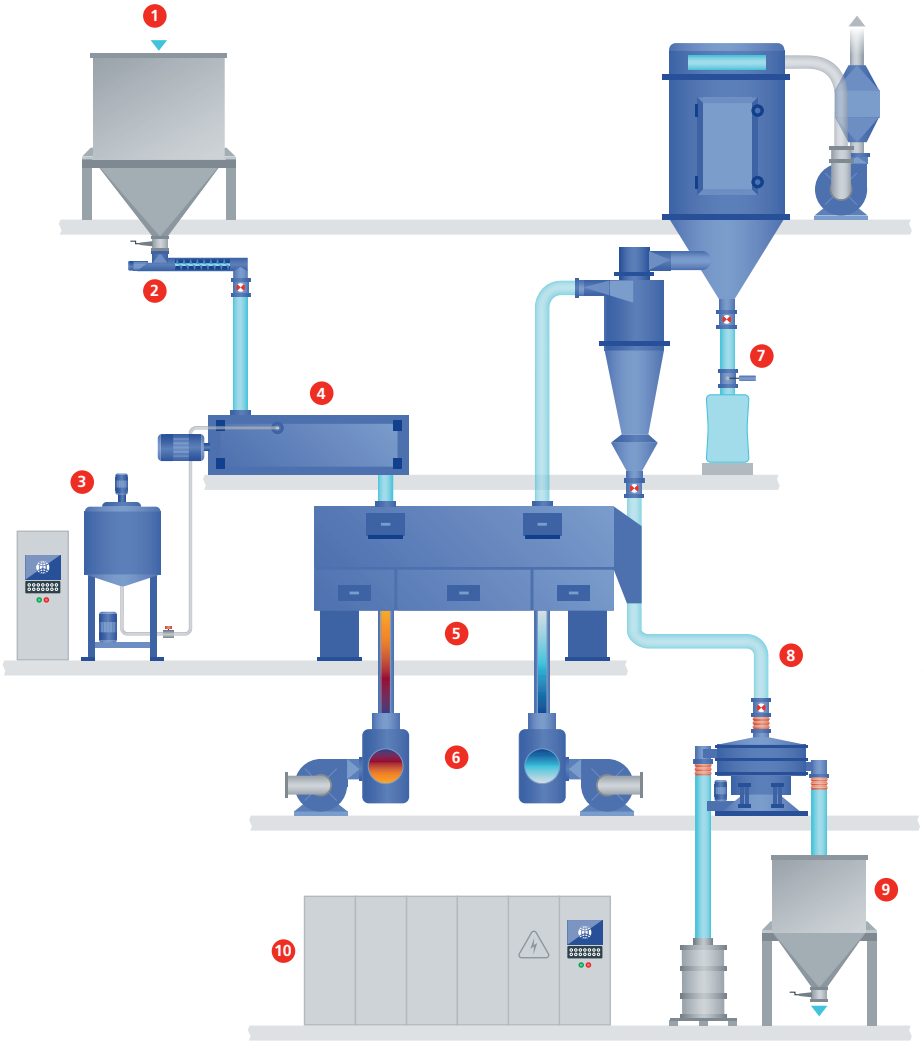
DRYING

After the mixing is complete, the drying process takes place in a specially designed fluidised bed dryer directly under the mixer. This ensures that all the moistened carbon black falls freely into the fluidised bed. The dry carbon black can also be cooled in the last section(s) of the fluidised bed.
The mixing and drying processes are continuous and can be tested at the test centre of Hosokawa Micron B.V. in Doetinchem, the Netherlands.

› *Fluidised bed dryer*

TECHNICAL SPECIFICATIONS

	DIAMETER	CAPACITY (m^3/h)
12D54Li	12"	1
16D80Li	16"	2.5
20D90Li	20"	5
22D90Li	22"	6
26D100Li	26"	10
30D120Li	30"	15.5
40D160Li	40"	36.5



1. Powder storage
2. Powder dosing
3. Binder preparation and dosing
4. Mars Mineral Pin Mixer
5. Schugi fluid bed dryer and cooler
6. Air preparation system including heating/cooling
7. Air exhaust system including cyclone and filter
8. Product classification (and crusher)
9. Big bag filling station
10. Integrated system and process controls

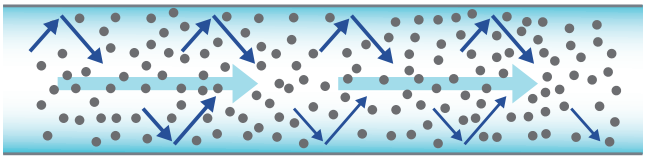
PNEUMATIC CONVEYING

of powder and pellets

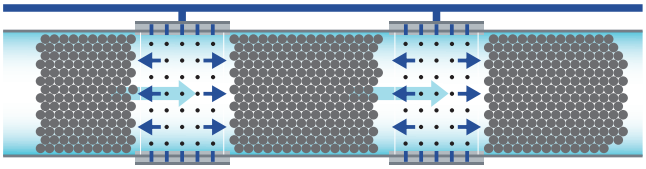
In order to guarantee optimum product quality, different conveying methods have to be used in different process stages. While simple flight conveying is possible with the carbon black powder, the sensitive pellets have to be conveyed more gently at the end of the process. This is done via Puls Pneu plug conveying.

THE ADVANTAGES AT A GLANCE

- Slow and gentle conveying starting at approx. 0.5 m/s
- Loading 20 – 60 kg product/kg gas
- No blockage at low speed and high loads
- Virtually no grain destruction and minimal abrasion of highly sensitive products such as recovered carbon black
- Low energy costs thanks to efficient use of pressure energy



With carbon black powder, flight conveying is possible.



Solids Pulse Pneu: Plugs are created and as such gently pushed through the conveyor lines.

STORAGE AND DISCHARGE

Product-specific stocking of carbon black

In the production process for carbon black, it is necessary to stock raw materials, to buffer intermediate products and to store finished products. The subsystems have to match the bulk material and the process requirements. For example, a mass flow silo with the appropriate discharge aids is required for storing recovered carbon black

THE ADVANTAGES AT A GLANCE

- No adhesion or clumping of fine dusts
- No bridging
- Gentle treatment of the material to be discharged without grain destruction
- Low maintenance and low noise

Vibrating discharge base

DOSING, FILLING, LOADING

Recording the filled quantities

Finished carbon black is filled into BigBags or sacks or transported in silo vehicles. The filling process is often combined with weighing and dosing in order to record and reproduce the filled quantity.

THE ADVANTAGES AT A GLANCE

- Dust-free loading
- User-friendly suspension device
- Integrated control for high operational reliability
- Incl. product compaction for volume reduction and increase in stability with BigBags
- Low maintenance

BigBag filling station

ONLINE-SUPPORT FOR COMMISSIONING

The individual steps for commissioning, from testing the functionality to handing over the ready-to-operate system to the customer, can be mapped out via our online support. Together with you, we decide on the options for remote commissioning and help support your specialist personnel with expert knowledge using innovative tools – ***worldwide and around the clock.***

SYSTEM DESIGN

Explosion and fire protection

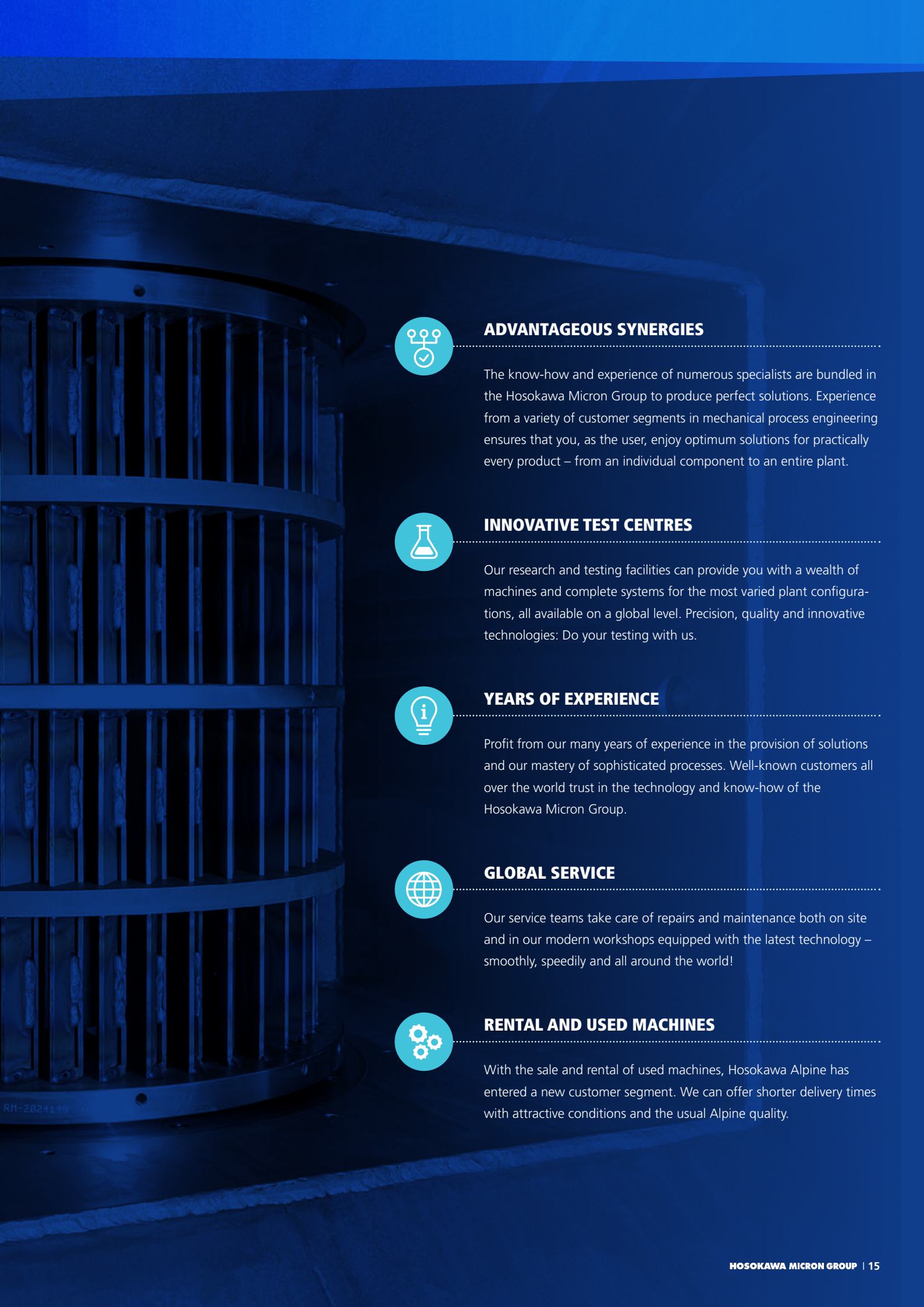
When working with combustible dusts, the formation of hazardous explosive atmospheres must always be expected (explosion hazard). The use of equipment and systems in potentially explosive atmospheres is regulated by EU Directives 2014/34/EU for manufacturers and 1999/92/EC for operators. For the use of equipment requiring testing by a notified body, Hosokawa Micron Group holds the EU type approvals and IECEx CoC for the relevant machine series.

PRIMARY EXPLOSION PROTECTION

- Prevention of ex atmosphere
- Prevention of ignition sources
- Use of ex protected components
- Machines and safety systems according to ATEX Directive 2014/34/EU for use in dust explosive environments

SECONDARY EXPLOSION PROTECTION

- Pressure-shock-resistant design
- Pressure release
- Explosion suppression systems



ADVANTAGEOUS SYNERGIES

The know-how and experience of numerous specialists are bundled in the Hosokawa Micron Group to produce perfect solutions. Experience from a variety of customer segments in mechanical process engineering ensures that you, as the user, enjoy optimum solutions for practically every product – from an individual component to an entire plant.

INNOVATIVE TEST CENTRES

Our research and testing facilities can provide you with a wealth of machines and complete systems for the most varied plant configurations, all available on a global level. Precision, quality and innovative technologies: Do your testing with us.

YEARS OF EXPERIENCE

Profit from our many years of experience in the provision of solutions and our mastery of sophisticated processes. Well-known customers all over the world trust in the technology and know-how of the Hosokawa Micron Group.

GLOBAL SERVICE

Our service teams take care of repairs and maintenance both on site and in our modern workshops equipped with the latest technology – smoothly, speedily and all around the world!

RENTAL AND USED MACHINES

With the sale and rental of used machines, Hosokawa Alpine has entered a new customer segment. We can offer shorter delivery times with attractive conditions and the usual Alpine quality.

HOSOKAWA MICRON GROUP

HOSOKAWA ALPINE

Milling | Classifying | Compaction

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