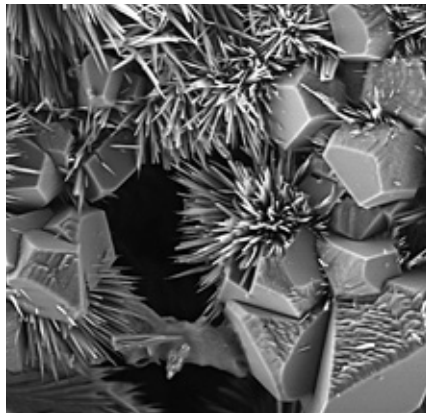
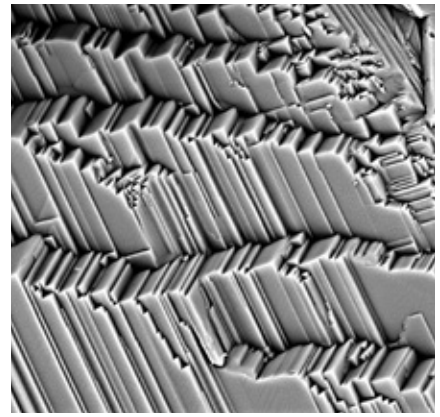


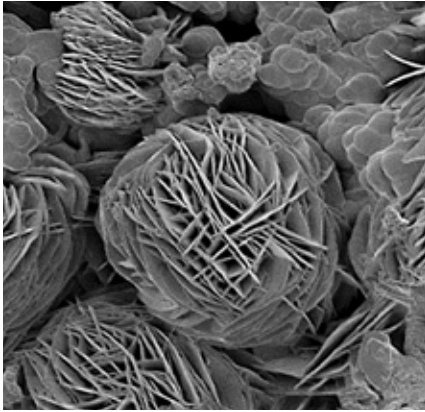
Quartz (SiO_2) 50 μm



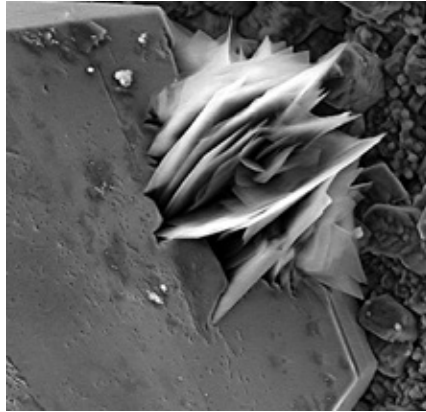
Calcite (CaCO_3) 20 μm



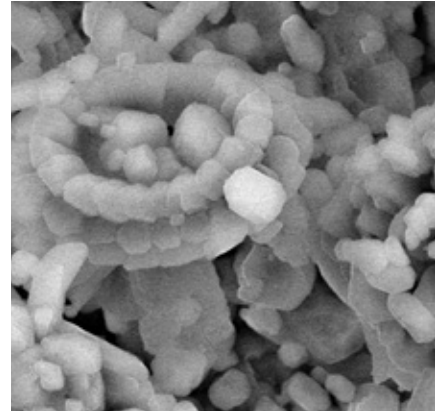
Aluminum oxide (Al_2O_3) 5 μm



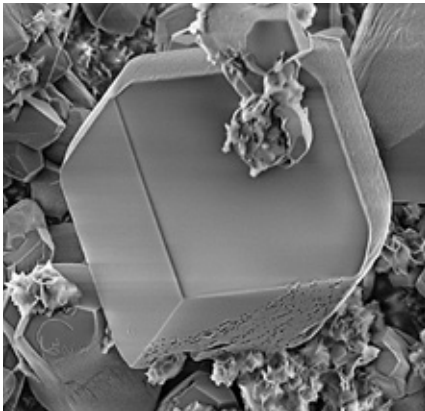
Iron oxide (Fe_2O_3) 20 μm



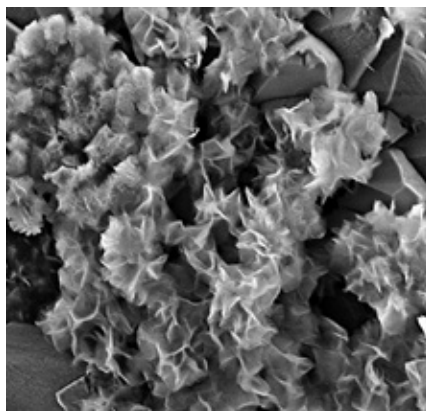
Dolomite ($\text{CaCO}_3 \cdot \text{MgCO}_3$) 20 μm



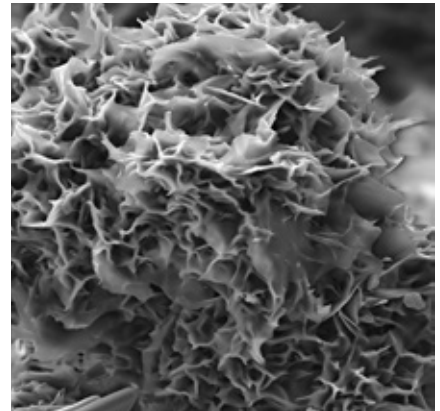
Chalk (CaCO_3) 2 μm



Hydromagnesite + Calcite 5 μm



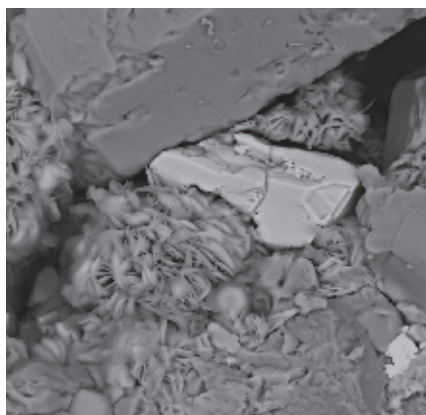
Hydromagnesite + Calcite 2 μm



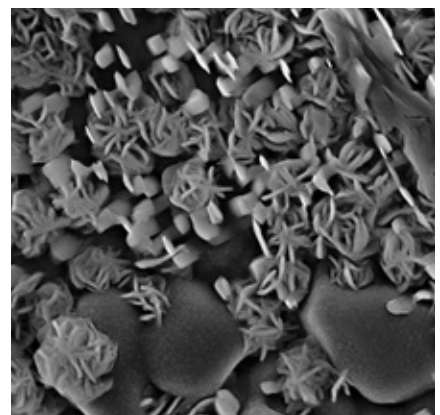
Clay 30 μm



Air-cooled blast furnace slag 1 μm



Iron oxide, Titanium oxide and Orthoclase 30 μm



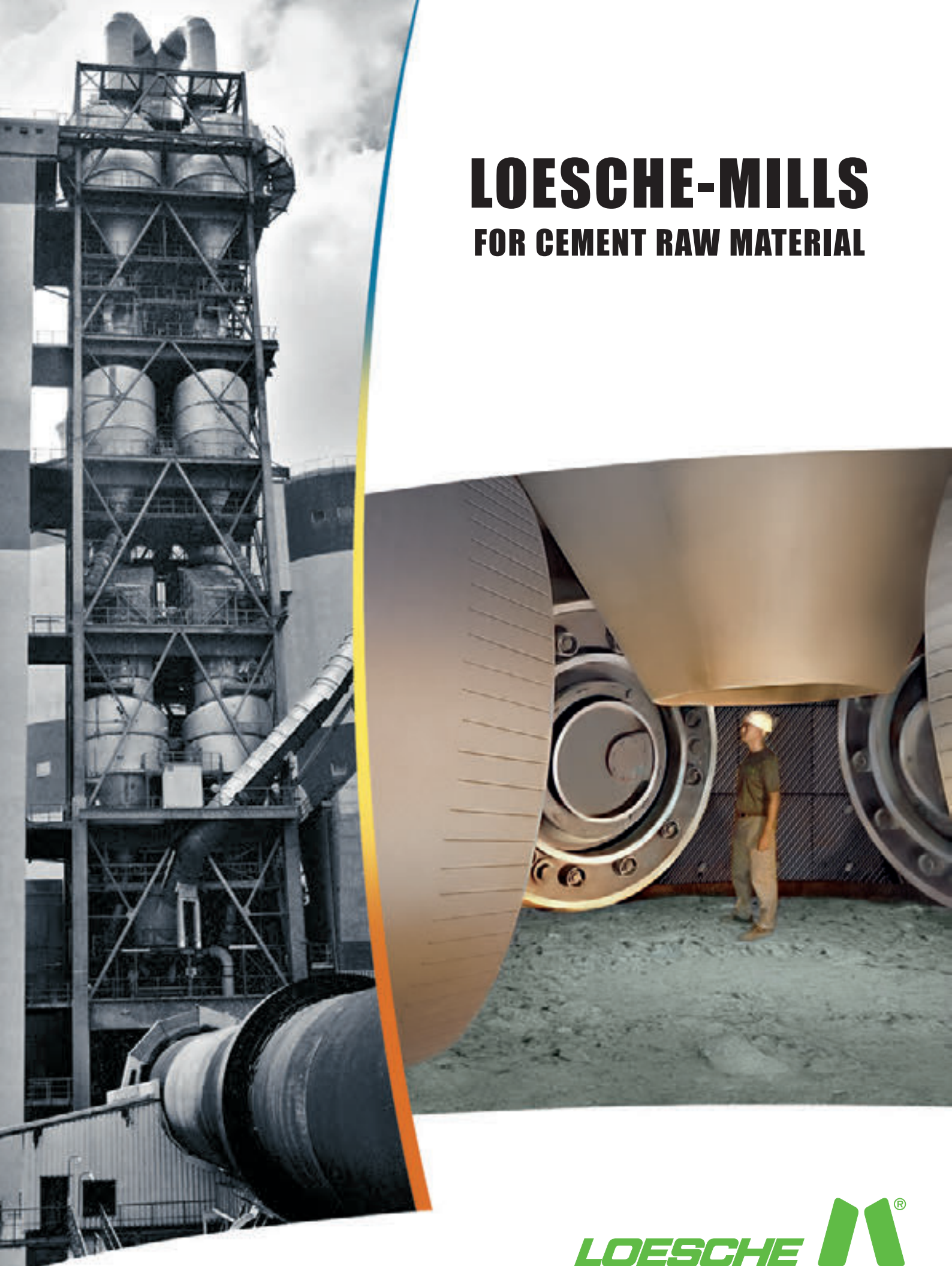
Air-cooled blast furnace slag 5 μm

Pictures originated at the electron microscope laboratory of Bauhaus-Universität Weimar

154_Loesche-mills for cement raw material_EN 12/2015

LOESCHE-MILLS

FOR CEMENT RAW MATERIAL



Loesche technology – always a step ahead



Cement raw material has been almost exclusively ground in roller mills (vertical air-swept grinding mills) since the second half of the 20th century. Loesche was and is the pioneer of this technology. Hundreds of Loesche mills have been used in the cement industry across the world to the present day. They operate with two, three, four and six rollers.

1928 The first spring-loaded air-swept grinding mill in the world, constructed by the original company Curt v. Grueber Maschinenbau-Anstalt, Teltow near Berlin, is launched onto the market under the name Loesche mill and has 2 grinding rollers. It already has all the essential features of modern air-swept vertical grinding mills built today. Even the first Loesche mills had an integrated dynamic classifier. Several examples of this are deployed in Klingenberg, Europe's first coal dust-fired large-scale power plant in Berlin for coal grinding with a raw coal rate of approx. 12 t/h.

1934 Loesche mills are increasingly also used worldwide for limestone and cement raw material.

1937 400 Loesche mills have already been sold for coal, phosphate and cement raw material.

1939 The largest Loesche mill at this time is an LM 16 with two steel spring-loaded rollers, a grinding track diameter of 1,600 mm and product throughput of 22 t/h.

1948 The company in Teltow is nationalised; the company is newly established under the name Loesche KG in Düsseldorf (West Germany).

1949 – 1960 Loesche mills supplied in the sizes LM 16 to LM 20 in modern welded construction with two steel spring-loaded rollers and product throughputs up to approx. 55 t/h.

1961 – 1970 Development of 2-roller Loesche mills in the sizes LM 22 to LM 28 with the world novelty of a hydropneumatic spring assembly system for product throughputs up to 140 t/h.

Loesche mill Type LM 46.4,
Lengerich, Germany, 2003

1971 Introduction of a modular system in mill construction: creation of replacement groups of components such as rollers, rocker arm and hydropneumatic spring for constructing mills with 2, 3 and optionally 4 rollers of the same size. The first LM 30.4 and LM 32.4 4-roller mills are sold and have product throughputs of 178 t/h and 215 t/h.

1973 Sale of LM 36.4 und LM 43.4 mills with product throughputs of 260 t/h and 425 t/h.

1989 Sale of the first LM 50.4 with a throughput of 490 t/h.

1996 Sale of the first LM 63.4 with a throughput of 800 t/h.

2005 Sale of the first 6-roller Loesche mills LM 60.6 with a throughput of 740 t/h

2006 – 2008 14 mills Type LM 69.4 and LM 69.6 with product throughputs of up to 1200 t/h are sold.

In the 1930s Loesche mills are used to grind cement raw material for the first time. The major breakthrough came at the start of the 1960s when rotary kilns with heat exchangers (dry process) are introduced. The following Loesche technological features make the deployment of these mills so successful in the cement industry:

- Low specific energy consumption
- Low pressure loss through large cross-sectional flow areas in Loesche mills
- Minimal sound emissions so that no sound insulation measures are required
- Rapid reaction to fluctuating raw material qualities
- Rapid readjustment to different product qualities
- Use of the kiln exhaust gases for dry grinding and as a transport medium for the final product to dust separators



Loesche mill Type LM 45.4 roller mill, Elmadag, Turkey, 1995



Loesche mill Type LM 63.4, Hereke, Turkey, 2002

Benefits to customers and customer satisfaction

Quality and reliability right from the start are the globally recognised benefits to be derived from Loesche grinding plants. As early as 1928, when the first Loesche mill came onto the market, the grinding principle of the vertical roller grinding mill, with a driven grinding track and spring-loaded rollers was shown to be particularly energy-efficient and reduced the use of natural resources. These advantages of Loesche mills will become ever more important in the light of increasing plant size and the obligation to make more careful use of primary energy.

Moreover, the high product throughputs of Loesche mills (up to 1,300 t/h for cement raw material and already 350 t/h for cement clinker and granulated blast furnace slag) result in considerably reduced investment costs compared to two smaller grinding plants.

Loesche is a competent partner for its customers from the initial sale to customer service and from punctual project planning to the handing over of the plant. Our maxim is "Every Loesche grinding mill must be a reference mill!"

Our competence is founded on the following key features:

- Tailor-made plant concepts from planning to commissioning, based on our own experience combined with customer wishes
- Individual problem solutions through optimised process technology
- Rational solutions with simultaneous planning of cement clinker/granulated blast furnace slag mills and raw meal mills through the use of exchangeable components for all models of mill, extending to the use of identical gear drives
- Close cooperation with suppliers of rotary kilns in line with customer wishes
- Customer service: plant optimisation and advice in the case of further technical developments
- Long-term delivery capability when supplying spare parts
- Certification in accordance with EN ISO 9001: 2008.



Loesche mill Type LM 60.4, Ras Al-Khaimah, United Arab Emirates, 2005



Grinding table of an LM 69 in the foundry



Transport to the port



Shipment for further processing



Assembly of the lower part of the mill



Assembly of the grinding table



Mill with classifier under construction

Working principle, construction and function of Loesche mills

Working principle

The material to be ground is crushed between the rotating grinding track and the individually guided grinding rollers.

Grinding is carried out primarily through the application of compressive force. A small amount of shear force supports the displacement of crystalline layers in the raw material. This effect occurs through conical rollers whose axes are inclined at 15° compared to the horizontal grinding track. As already demonstrated through comparative studies in the 1930s, this permits ideal fine grinding and at the same time ensures minimum wear.

A higher specific grinding pressure is applied compared to coal grinding and a lower specific grinding pressure is applied compared to the fine grinding of clinker and granulated blast furnace slag.

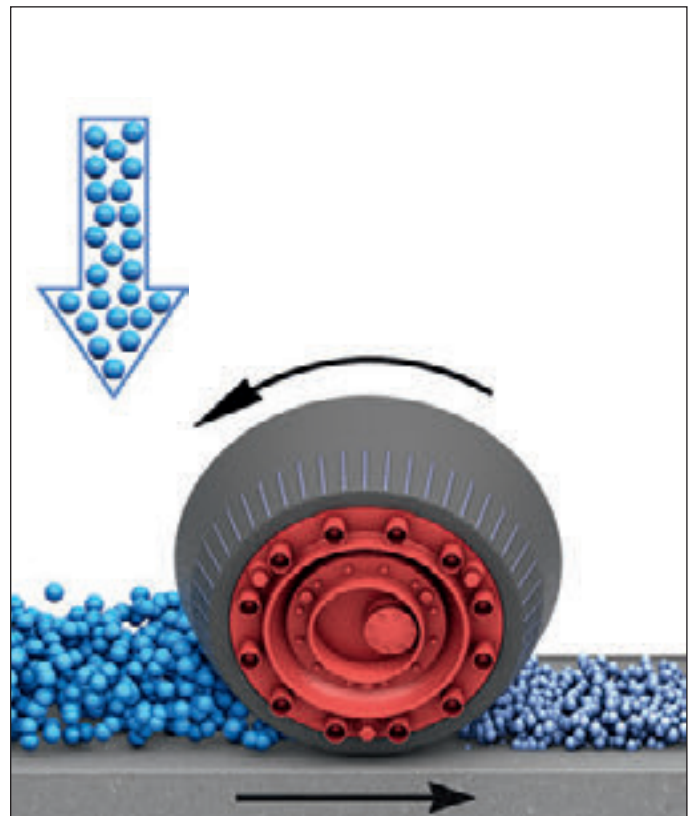
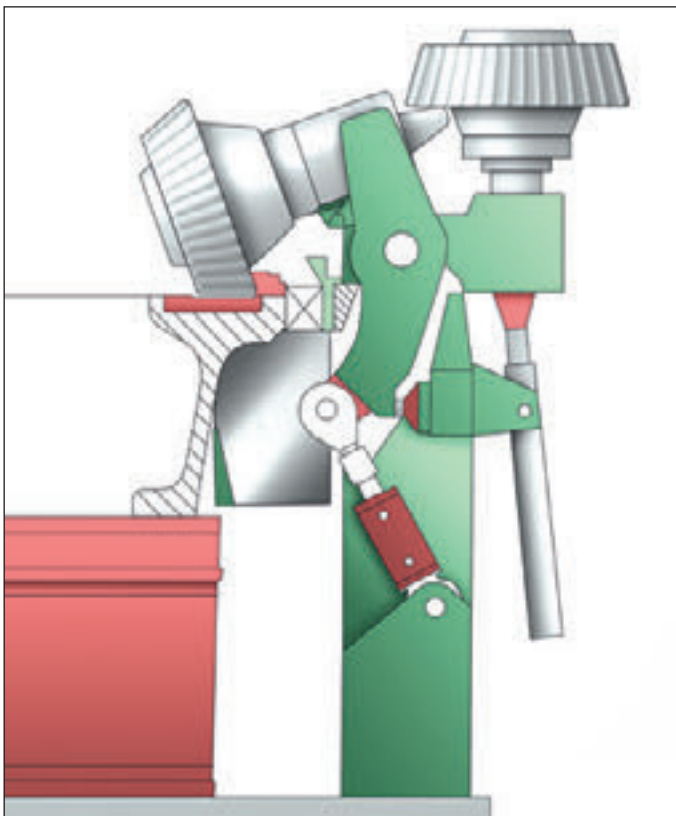
Hot gases are added in the dry-grinding process to evaporate material moisture. Use is predominantly made of the exhaust gases from the rotary kilns, the heat exchanger or the cement clinker cooler. If none of these sources are available or the heat content of these exhaust gases is insufficient, Loesche's own hot gas generators are deployed. In the classifier above the grinding chamber the ground product is separated from the grit which then falls back onto the grinding track for renewed grinding.

Construction

The familiar basic principle of the modular system patented in 1970 is applied to Loesche mills with two, three, four and six rollers. The rollers together with their lever systems, hydropneumatic springs and hydraulic control systems make up a functional unit. Large or small modules with a different number of rollers (between two and six) can be deployed in the same mill sizes (grinding table diameter). This makes it possible to customise the product to meet specific customer requirements.

The following features characterise Loesche technology:

- The support and precise guiding of the rocker arm roller system with its roller bearings takes place in a pedestal with integrated spring system.
- Hydropneumatic spring loading of the roller rocker arm unit with integrated mechanism to lift the rollers serves as an aid for the mills when starting up with a filled grinding track.
- The rollers are connected in pairs to a common hydraulic unit (except in the case of 3-roller mills).
- An almost parallel grinding gap is maintained between the grinding rollers and the grinding plates during the entire service life of the grinding parts.





Loesche mill Type LM 69.6, Idhan, United Arab Emirates, 2009



Gas spring system



Rocker arm in working position



Hydraulic cylinder



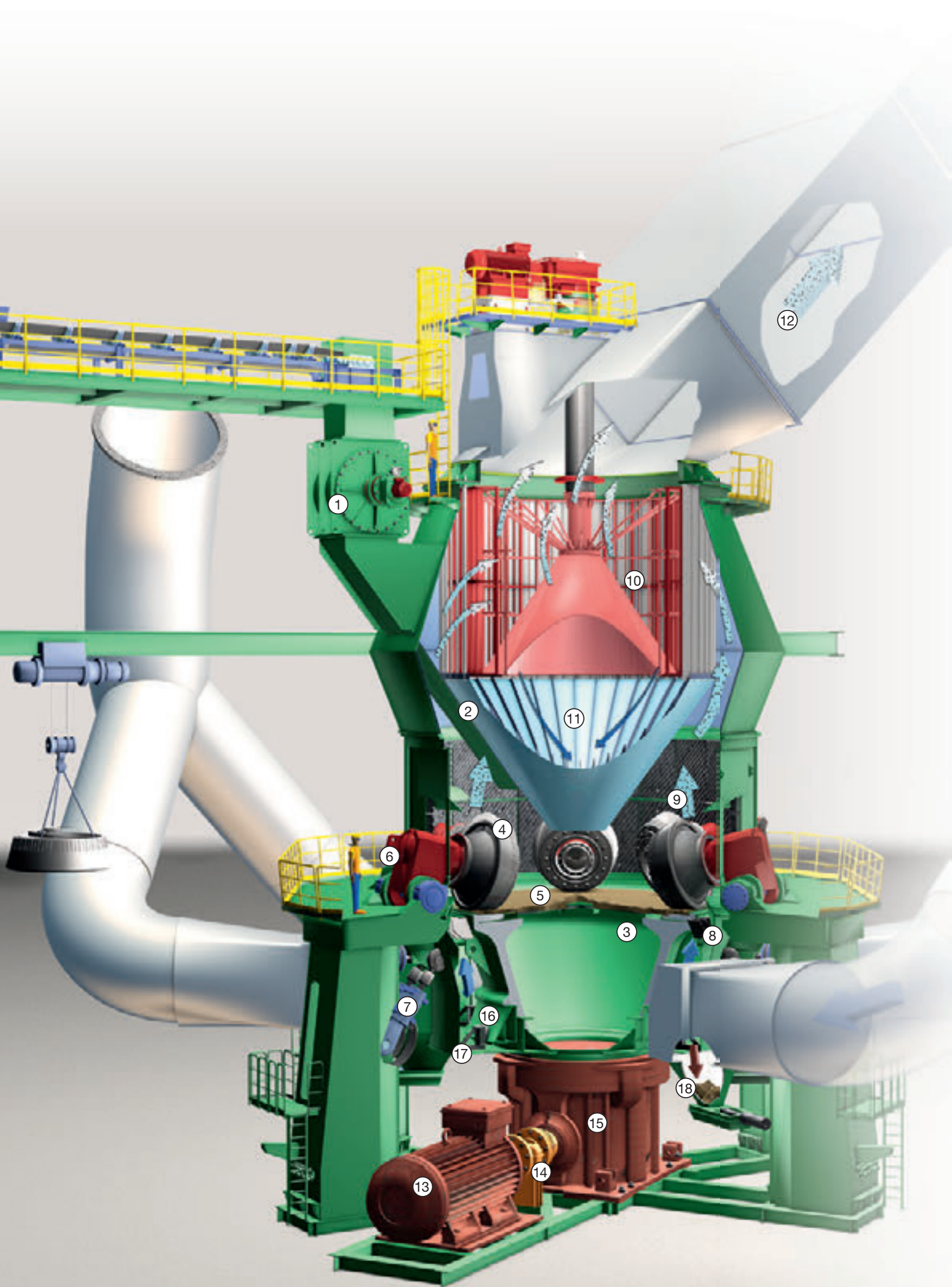
View of the grinding chamber of an LM 69.6



Rollers of an LM 69.6



Mill gearbox



Mill function

The cement raw material is fed via a rotary feeder ① and falls via the chute ② onto the centre of the grinding bed ③. Free ferrous foreign objects are separated out from the feed material magnetically before reaching the rotary feeder ① and removed via a diverter gate. A metal detector operates in a similar way and ensures the separation of non-magnetic metal parts. The material to be ground moves on the grinding track towards the edge of the grinding table under the effect of centrifugal force and in this way passes under the hydro-pneumatically spring-loaded grinding rollers ④. The material that has been drawn in is ground in the material bed in the gap between the rollers and grinding track. The rollers ④ are displaced upwards as they roll over the material bed ⑤. As a result the functional unit consisting of rocker arm ⑥, spring rod and pistons from the hydraulic cylinder ⑦ is moved. The piston displaces the hydraulic oil from the cylinder into the gas-filled bladder accumulator unit. Nitrogen-filled rubber bladders in the accumulator units are compressed and act as gas springs. The gas springs can be set to be harder or softer by selecting the gas pressure in relation to the hydraulic operating pressure, depending on the fracture behaviour of the material to be ground.

The ground material is subjected to centrifugal force and rotates outwards and over the edge of the grinding table. In the area of the louvredam ring ⑧ which surrounds the grinding table ③ the stream of hot gas ⑨ directed upwards captures the mixture of ground material and material as yet not completely ground and conveys this to the classifier ⑩.

Depending on settings of the classifier ⑩ it rejects coarse materials. This falls into the internal grit return cone ⑪ and then onto the grinding table ③ for re-grinding. The ground material passes from the classifier and is conveyed from the Loesche mill with the gas stream ⑫.

Foreign matter and small amounts of coarse material fall through the louvre ring ⑧ into the ring channel ⑬ as reject material.

Scrapers ⑭ connected to the grinding table transport foreign matter into the reject hopper ⑮.

Cement raw material usually has differing degrees of moisture content when extracted from the quarry. As soon as the ground material leaves the grinding table in the area above the louvre ring ⑧, the water contained in the working material evaporates spontaneously upon intimate contact with the hot gas stream. Therefore the required mill outlet temperature of the dust/gas mix of approx. 80 ° to 110 °C is already achieved in the grinding chamber.

The mill is driven by an electric motor ⑯ via a flexible coupling ⑰ and the mill gearbox via an output flange ⑱. A segmental thrust bearing in the top of the gearbox absorbs the grinding forces.

The grinding rollers ④ are hydraulically lifted from the grinding track before the mill motor is started. The mill can then not only be started empty but also partially filled with a low starting torque. Metallic contact of grinding parts on an empty or loaded mill is prevented by automatic lifting of rollers via a grinding bed depth control.

A so-called “auxiliary drive” for starting up a filled mill at low revolutions is not required!

Servicing

Worn grinding parts, roller tyres and grinding track segments can be simply and quickly replaced. The rollers are retracted from the grinding chamber into a vertical position using a retracting cylinder. Complete rollers, roller tyres and grinding plates are then made accessible to hoisting devices.

When grinding cement raw material the metallic particles usually cause uniform wear throughout their entire service life so that the mill throughput only declines when mill parts are completely worn. Partial wear may occur if, for reasons of cement chemistry, free quartz sand needs to be used as concrete aggregate. This can be offset by targeted hard facing in the mill.

Loesche has the required know-how for in-situ welding using appropriate welding equipment.

Mill selection sizing – models – dimensions – drives

Dimensioning parameters

The following standard parameters are decisive for dimensioning Loesche cement raw material mills:

- **GRINDING PRESSURE**
This lies between the minimum value for solid fuels and the maximum value for cement clinker/granulated blast furnace slag.
- **MATERIAL MOISTURE**
The Loesche mill can process material with moisture of up to 25%.
- **PRODUCT FINENESS**
The fineness of the final product is between 6% and 30% R 0.09 mm, depending on the composition of the raw material.
- **DRIVE PERFORMANCE**
The specific energy consumption in the grinding test is decisive for gearbox and motor sizing.

Models

- Mill sizes are identified according to the outer effective diameter of the grinding track in decimetres [dm].
- The identification is followed by a digit, separated by a full stop. This specifies the number of rollers operated in the mill.
- The number and size of rollers is geared to the required product throughput in conjunction with the “Loesche performance factor” as well as the product which is influenced by factors of grindability, moisture and fineness. The required gas stream is decisive for the housing dimensioning of mill and classifier.
- The Loesche cement and raw meal mills are constructed in a modular fashion. Modules are understood as units comprising rollers, rocker arms and roller-related spring components with their pedestal. This is arranged from between 2 and 6 times around a grinding table as required.

Dimensions

- The coordinates of the grinding table diameter and number of rollers can be read off from the following table. The x-coordinate indicates which product throughputs can be generated using the respective mills. The width of the fields is a measurement of the output factor (see above).
- The dimensions H, A and D in turn describe the height of mills with classifier, the footprint diameters and the overall space required, taking a service area (for replacing grinding parts) into consideration.

Drives

An electric motor serves as the drive. It drives a planetary gearbox using a torsionally flexible coupling. The drive shaft lies horizontally, the vertically mounted flanged output shaft rotates in a horizontal plane. The gearbox contains a segmental thrust bearing that accommodates the grinding force at the top of the housing. Loesche mill gearboxes are developed in cooperation between Loesche GmbH and reputable gearbox manufacturers. The dynamic safety factors are suitably chosen for the application. Decades of experience operating Loesche mills determine the design of the (mill) gearbox and their peripheral equipment, bearing in mind all climatic conditions.

Modern gearboxes today are constructed in a modular manner in the same way as Loesche mills. Torque split ensures a reduction in the rotating masses and simultaneous multiple use of machine construction elements in gearboxes with different sizes and performance.

A lubrication unit ensures that adequate oil is supplied to the gear teeth, the shaft bearings and the segmental thrust bearing. Filters and cooling equipment condition the oil. Electrical and hydraulic instruments that are monitored in the customer's PLC guarantee safe operation.

The modular construction principle of gearboxes permits further increases in performance in line with the current state of the art without the need to develop a new construction concept.

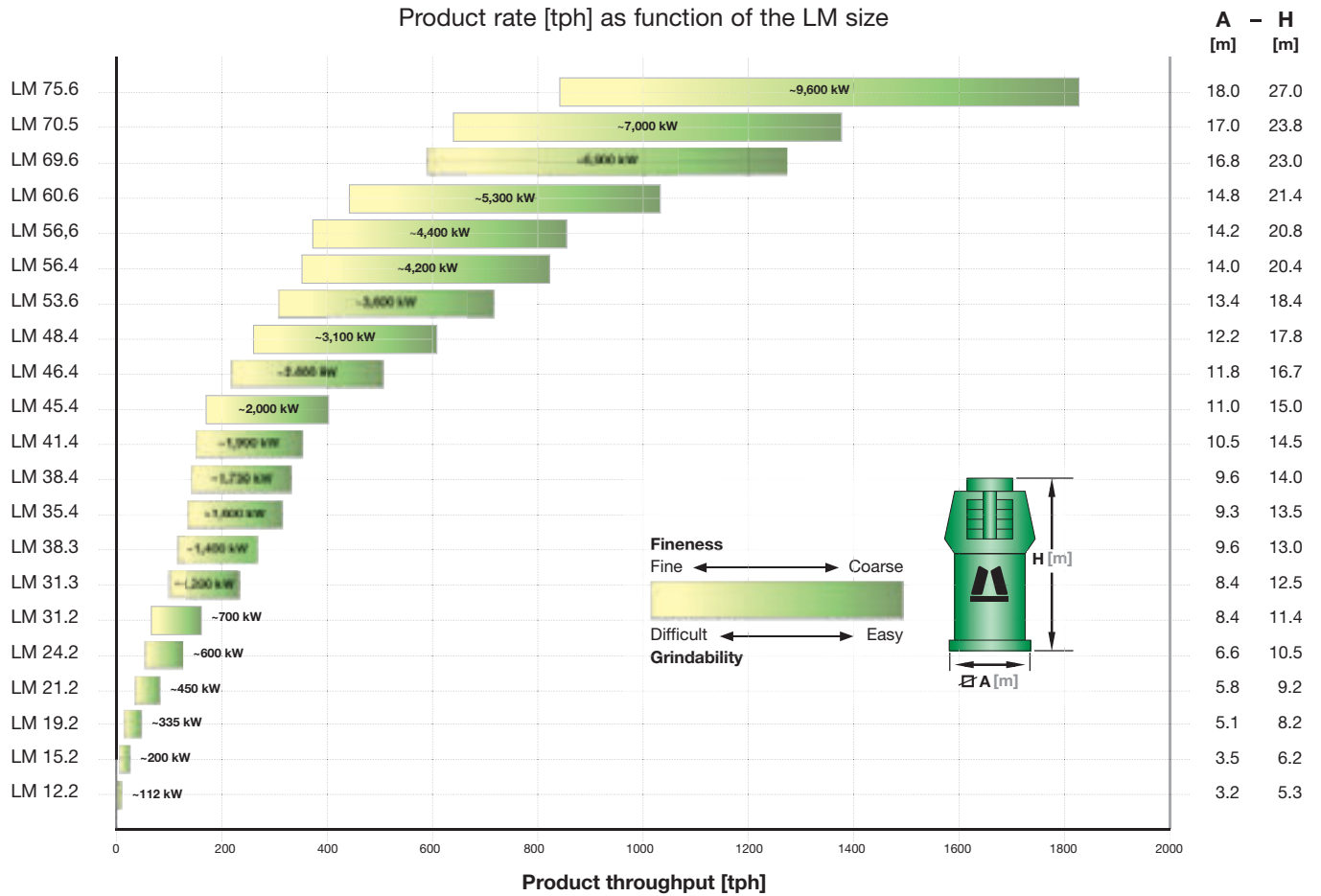
The Loesche mill does not require a motor with increased starting torque. Since the rollers are raised hydraulically, the break-away torque for the filled mill only comprises 40% of the full load torque. This starting torque can be achieved by a “standard motor” without a problem.

The installed motor power is sized according to the energy requirements of the mill. This is established in the test plant using a grinding test. The next suitable commercially available motor is selected and recommended to the customer.



LM for Raw Material and Minerals

Product rate [tph] as function of the LM size



Raw materials for grinding

Cement raw material; deposits

Cement raw material is principally a compound made of limestone and argillaceous rock, which undergoes mechanical and thermal treatment to create cement clinker. The geological formation, material composition and water content influence the grinding dryness and energy requirements.

The raw materials are classified according to their origin into

- **natural mineral raw materials** and
- **synthetic mineral materials**

that are by-products or waste products from other branches of industry deploying raw materials.

The suitability of natural and synthetic mineral raw materials for manufacturing binding agents is primarily determined by their chemical composition.

The following fields are chiefly used for the provision of the most important components:

- **Carbonate fields,**
consisting for example of shell limestone, white Jura, chalk etc.
- **Silicate aluminate deposits,**
consisting for example of sandstone and argillaceous rock, magmatic and metamorphic rocks etc.



For a good and fast reaction during the firing process it is more favourable to use those materials whose composition is by nature closer to the desired chemical compound.

The compositions of raw material compounds used in practice can be most easily represented using the table from LABAHN & KOHLHAAS (1982).

Chemical composition of cement raw material; ignition loss-free.

[LABAHN & KOHLHAAS, 1982]

MINERAL	OXIDE	min. and max. mass[%]
LIMESTONE	CaO	60 – 69
SILICATE	SiO ₂	18 – 24
CLAY	Al ₂ O ₃	4 – 8
FERRIC OXIDE	Fe ₂ O ₃	1 – 8
MAGNESIUM OXIDE	MgO	< 5.0
POTASSIUM OXIDE/SODIUM OXIDE	K ₂ O; Na ₂ O	< 2.0
SULPHUR TRIOXIDE	SO ₃	< 3.0

According to Labahn & Kohlhaas the following terms are common for the raw materials used arranged with diminishing CaCO_3 content:

- Pure limestone > 95 M. – % CaCO_3
- Marly limestone 85 – 95 M. – % CaCO_3
- Lime marl 70 – 85 M. – % CaCO_3
- Marl 30 – 70 M. – % CaCO_3
- Argillaceous marl 15 – 30 M. – % CaCO_3
- Marly clay 5 – 15 M. – % CaCO_3
- Clay < 5 M. – % CaCO_3

Cement raw materials require a CaCO_3 content of between 74 and 79 M %. The desired raw material composition is rarely found in a natural raw material.

For this reason materials containing SiO_2 and ferric oxide as well as fluorites must be used as correcting materials to precisely adjust the required raw material compounds and to improve sintering.

Some of these grinding materials additives are highly abrasive and lead to the disproportionate wear of grinding parts, areas of machines and in ducts through high speeds of gas-solid mixtures. Loesche takes suitable protective measures against wear when materials of this nature are used.



The homogeneity and fineness of the cement raw meal also plays an important role in the downstream sintering process in addition to the correct chemical composition of the raw meal mixture.

There are high demands with respect to the permitted residual moisture in the ground product.

The residual moisture (max. 0.5 M %) must be just as homogeneous as the distributed chemical components.

This also means that where water content varies, for example in the case of limestone and clays, the residual moisture content of each component of the finished material must be approximately the same. The process control system of the Loesche mill guarantees this.

CEMENT RAW MATERIAL

Tests on materials to be ground

The characteristics of the cement raw material must be known in order to determine the size of the mill and classifier. The material properties are examined in the Loesche test plant. Ideally the customer supplies the test plant with a representative sample of the cement raw material compound as used in his factory. If a quarry has not yet been opened in the case of

new construction projects, specified quantities of individual components are supplied and chemically analysed. Their moisture is measured and under some circumstances adjusted. A quantity of feed material amounting to at least 1.5 t is prepared from the supplied or manufactured raw material compound. If the supplied grain size is too coarse for the Loesche laboratory mill, the required feed material grain size is generated in the Loesche laboratory crusher in an intermediate stage before grinding. The raw material is then completely ground, dried and classified in the Loesche test plant mill in continuous operation.

The test grinding delivers the following representative results:

- Loesche grindability factor “MF”;
- Loesche fineness factor “FF”;
- Moisture factor “WF” with water content of > 8 %;
- Specific energy consumption “e” [kWh / t] ;
- Wear factor “V_p”.

The appropriate Loesche mill is determined using these parameters and standard charts.

Notwithstanding these standardised methods, other decisive variables flow into the dimensioning of the mill, the classifier and also the mill fan, such as extremely high grinding material moisture or very high differences in the case of grindability factors of individual raw material components.

Loesche mill Type LM 38.4, Testi, Italy, 2004



Complete grinding plants with components

Until the end of the 1950s Loesche mills were deployed in the power station industry as coal direct firing mills for steam furnaces in model sizes up to LM 16. In the limestone and fertiliser area mill sizes of up to LM 18 with product throughputs of up to 40 t/h were common. Relatively few vertical mills are still being used for grinding cement raw material in cement works. Most can be found in cement works with shaft kilns. The biggest mill in 1960 was an LM 20 with approx. 50 t/h product throughput and drive power of 400 kW.

The need for Loesche mills for grinding cement raw material skyrockets at the start of the 1960s. The reason for this trend is the technological development in the cement manufacturing process which moves away from the energy-intensive wet procedure to the semi-dry process and ultimately to the dry process with precalcination. As a result the kiln throughput increased dramatically with simultaneous significant reduction in specific energy consumption.

From the beginning Loesche develops mill sizes that are adapted to the throughput of the cement rotary kiln.

The mills launched onto the market satisfy the following requirements:

- Mill capacities adapted to the raw meal requirements of the rotary kilns and which permit parallel operation of the kiln and mill.
- Mill sizes that permit the parallel operation of a kiln with a mill, a concept that is specifically up to 30% more cost effective than the parallel operation of a rotary kiln with 2 roller mills! This Loesche philosophy has been proven to be correct and is today generally accepted by customers.
- Mills which make ideal use of the exhaust gases of the rotary kiln for dry grinding and for transportation of the grinding materials with low specific energy consumption [kWh/t].
- Grinding, drying, classifying in one machine unit through to the ground product with the required grain distribution and residual moisture.
- Grinding plants which can be quickly adjusted in line with the operational requirements of the firing process.

Feed of the materials to be ground

The cement raw material is crushed up in the traditional manner and stored in raw material hoppers according to components. From there it is proportioned and added to the mill feed belt. The speed of the conveyor belt can be regulated.

A belt magnet and a metal detector for separating larger metallic parts of foreign matter are situated in the path of the material to the mill.

The material then passes into the mill hermetically sealed through a rotary feeder or a gate feeder. The rotary feeders are

specially adapted to the properties of the feed material. Thus oversized pieces, so-called “fish” or tree roots are used as reference for the maximum filling level of the cells. The calculated filling level of the chambers is less than 40 % of the pocket volume in order to prevent the rotor clogging. Both types of gate can be heated using process gas in the case of moist feed material.

Rotary and gate feeders are equipped with wear protection.

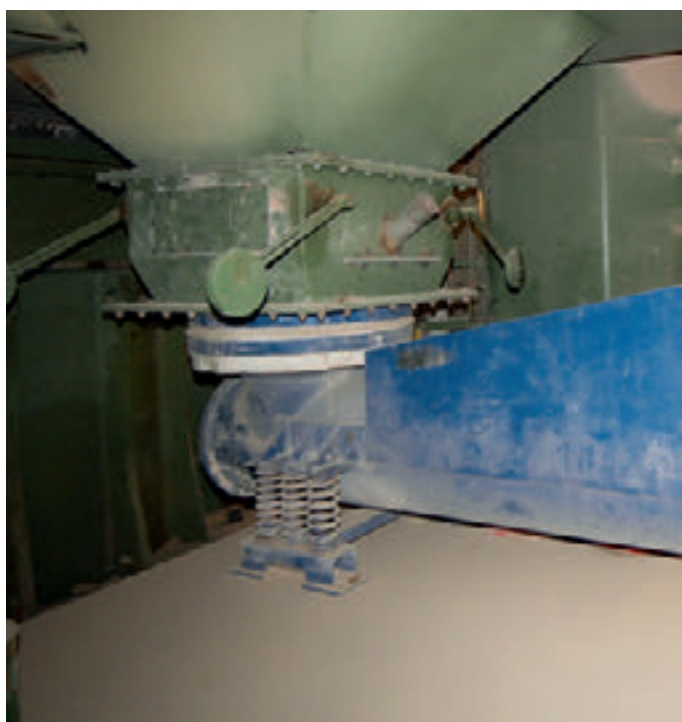
Grinding and classifying

The raw material is ground and dried in the mill. Mills with 2 rollers have one hot gas entry channel, while those with three and four rollers have two and mills with six rolls have four. The process gas is distributed from there uniformly by means of guide vanes into the grinding bed chamber. When it leaves the grinding table the ground material together with the process gas, which has since been cooled by water evaporation to below 100°C, is fed to the classifier on the mill. The powdered ground product leaves the classifier and is separated in a downstream filter or a combination of cyclone battery with (smaller) filter. Separated grit falls back onto the grinding track along with fresh material.



Reject treatment

The reject material passing through the louvre ring is automatically cleaned out and transported off via an airtight encapsulated conveyor and bucket elevator. The flow of feed material to the mill, which is the sum of the fresh material and reject material, is maintained at a constant level by the proportioning system.



Mill fan

The mill fan requires no wear protection due to the high efficiency of the dust separator. It is generally equipped with an inlet vane control and / or a variable speed drive.

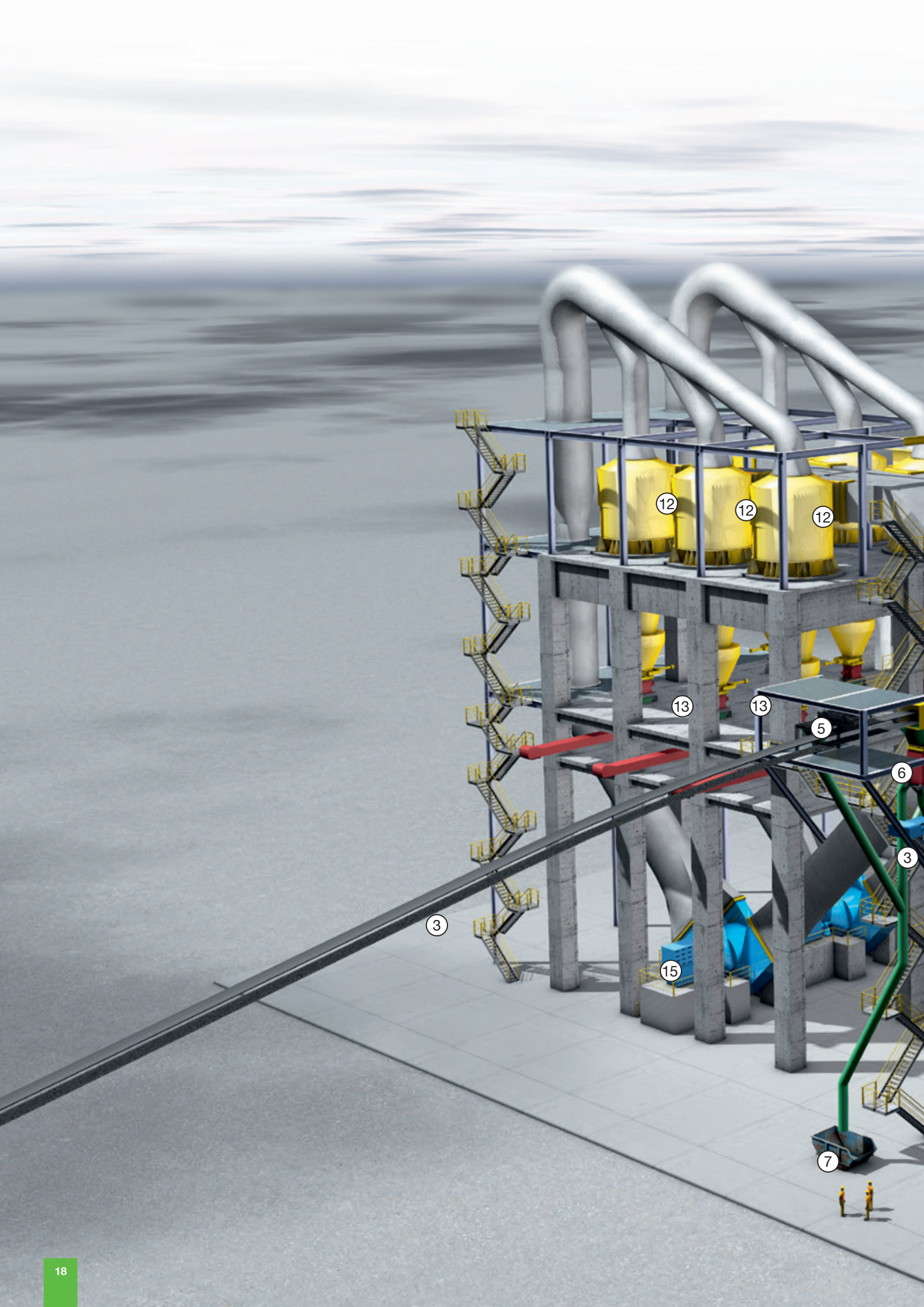


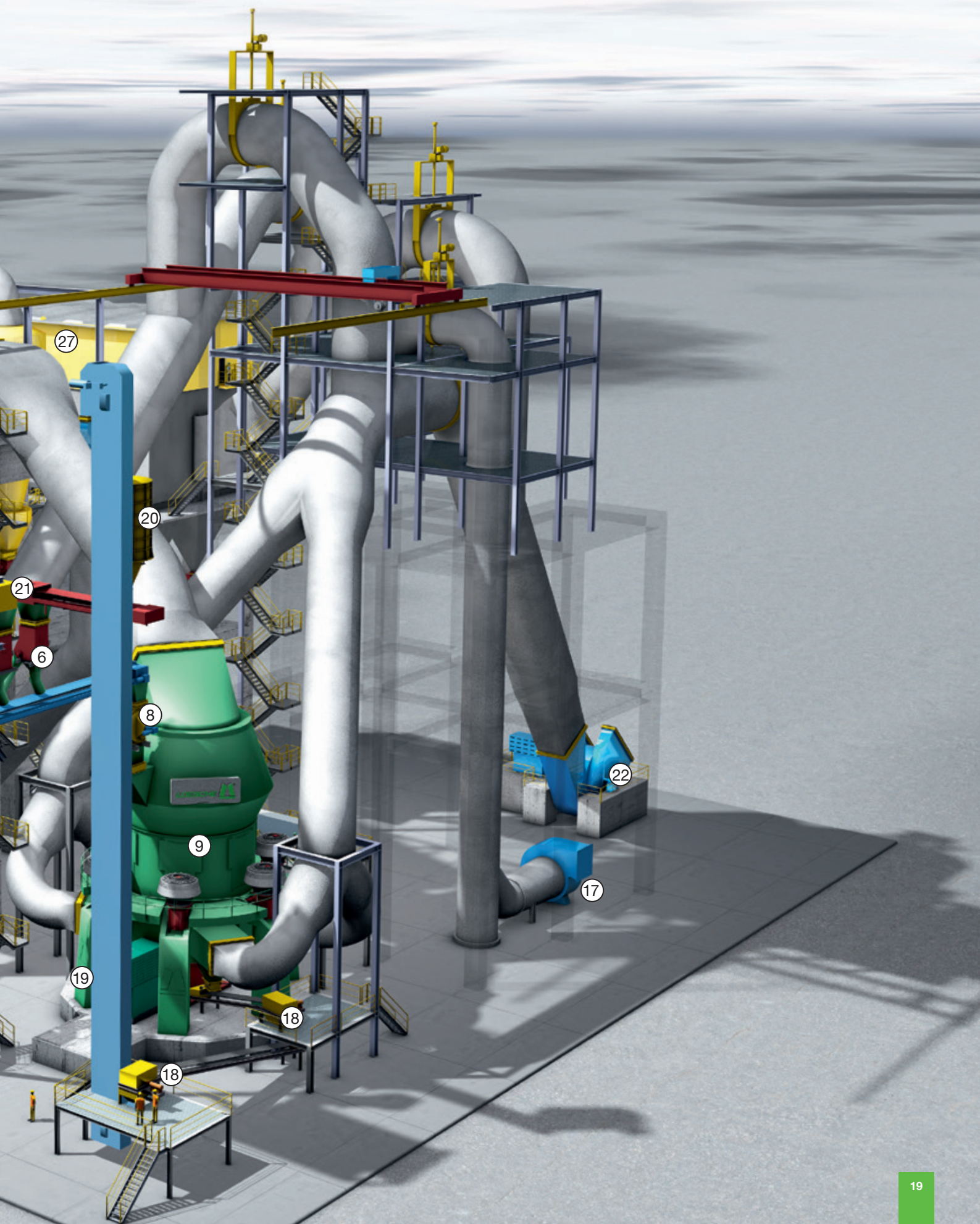
Process and measuring and control equipment

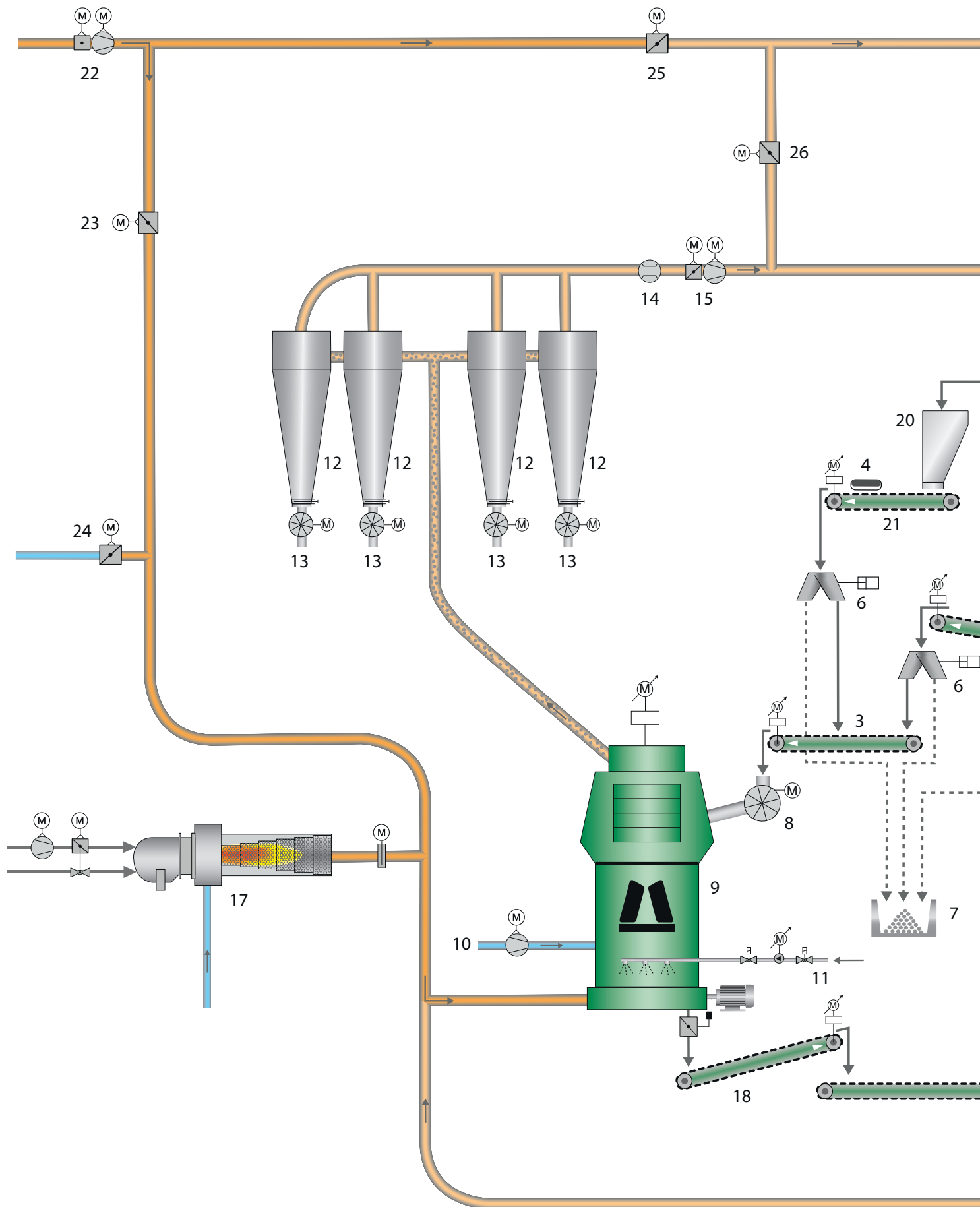
The heat required to dry the material to be ground is controlled by the process control system such that that gas temperature at the mill outlet remains constant. The preferred source of the heat energy required is provided by the exhaust gas flow of the rotary kiln. If this is insufficient, heat must be provided from other sources. A separate hot gas generator (LOMA combustion chamber) as well as gases from other processes such as preheated waste gases, clinker cooler exhaust gases and exhaust gases from diesel generators etc. are suitable for this.

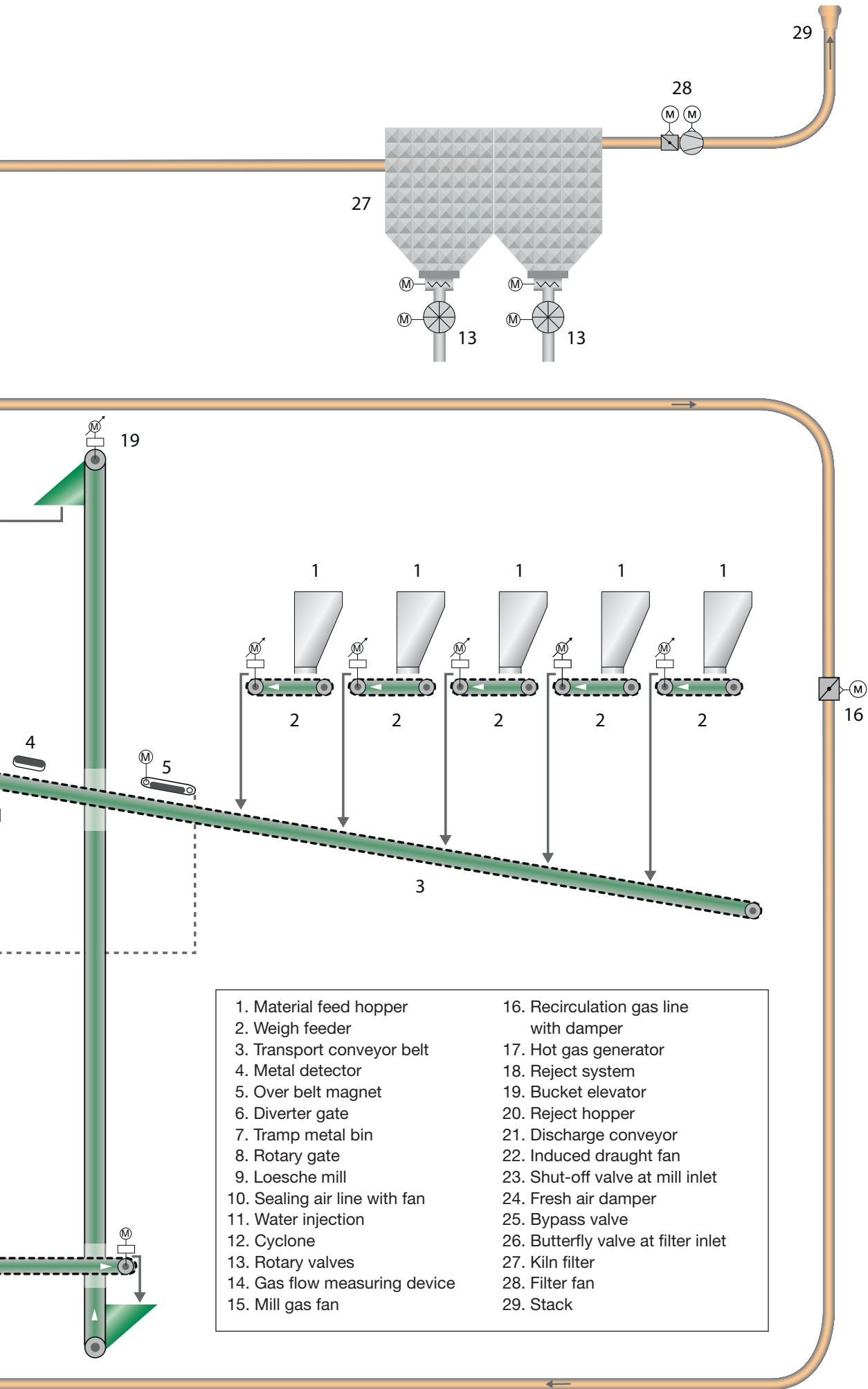
Part of the process gas is recirculated upstream of the dust separator in order to utilise its heat content. The remaining part is exhausted via a stack. A fresh air flap is located in the recirculation gas duct to the mill. Where exhaust gas temperatures reach over 100°C at the mill outlet cold fresh air can be sucked in from the atmosphere; this fresh air reduces the temperature of the mill exhaust gas to the desired temperature. The upper temperature limit is determined by the thermal resistance of the filter (bag material), the lower temperature limit by the dew point of the stream of dust gas. Levels must under no circumstances fall below this lower limit in order to prevent condensation.





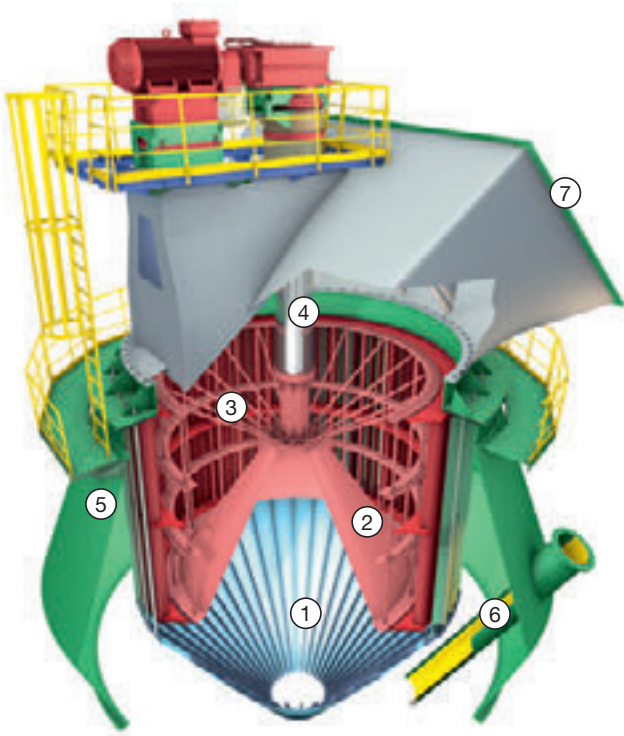






- | | |
|-------------------------------|--|
| 1. Material feed hopper | 16. Recirculation gas line with damper |
| 2. Weigh feeder | 17. Hot gas generator |
| 3. Transport conveyor belt | 18. Reject system |
| 4. Metal detector | 19. Bucket elevator |
| 5. Over belt magnet | 20. Reject hopper |
| 6. Diverter gate | 21. Discharge conveyor |
| 7. Tramp metal bin | 22. Induced draught fan |
| 8. Rotary gate | 23. Shut-off valve at mill inlet |
| 9. Loesche mill | 24. Fresh air damper |
| 10. Sealing air line with fan | 25. Bypass valve |
| 11. Water injection | 26. Butterfly valve at filter inlet |
| 12. Cyclone | 27. Kiln filter |
| 13. Rotary valves | 28. Filter fan |
| 14. Gas flow measuring device | 29. Stack |
| 15. Mill gas fan | |

Dynamic Loesche classifier LSKS



Structure:

- ① Grit return
- ② Guide vane
- ③ Rotor with classifier blades
- ④ Rotor shaft
- ⑤ Housing
- ⑥ Material feed chute
- ⑦ Product discharge

The classifier can separate particle sizes of up to 1 μm (and generate products with residues of 1% R 10 μm). The mechanical components of the classifier in combination with process influencing parameters can produce various particle size distributions.

The LSKS classifier is able to operate both at high selection efficiency for a narrow particle size distribution, as well as with a wide particle size distribution.

The gas / particle stream from the mill is passed to the classifier chamber via a static guide vane device (2). The gas-solids mixture flows through the adjustable guide vane (2) and is presented to the radially bladed, concentrically placed, classifier rotor (3).

The rotor accelerates the gas-solids mixture tangentially. The centrifugal force produced rejects the oversize material.

Through selection of the rotor speed, in combination with the gas stream and its direction of flow, the required separation grain size can be adjusted within a wide range.

A special feature of this classifier type is the continuous reclassification of the particle stream rejected by the rotor. When the particles are thrown outwards by centrifugal force into the annular gap between static guide vane and rotor they are again subjected to the upwards/inwards directed gas stream. In this way agglomerated particles can be more easily separated, so that they follow the product stream as single grains and do not fall back onto the grinding table with oversize material as apparent oversize.



Loesche hot gas generator

The perforated jacket combustion system developed by Loesche in the mid 1960's consists of a combustion chamber of heat resistant steel with burner muffle, and is well known in the market under the name LOMA Hot Gas Generator. The LOMA Hot Gas Generator has been used worldwide for decades in many different types of thermal processes for optimization.

Design and operation:

- The combustion chamber consists of heat resistant steels – no refractory brickwork is necessary.
- When starting up the hot gas generator heat losses are minimised since it is not necessary to heat up refractory brickwork. A start at full load is therefore possible.
- Very good thermal shock resistance and rapid load changes with only a short delay.
- High cooling rate of the combustion chamber prevents thermal overloading of following units. An EMERGENCY chimney stack is not necessary in EMERGENCY-OFF SITUATIONS and when starting and stopping.
- Accessible within a short time for inspection
- Low wear
- Short installation times, low weight, small space requirement. Can be installed in existing plants. Complete pre-assembly is carried out – also for larger LOMA combustion units.

Loesche hot gas generators are used where hot gases are required for direct drying, e.g. in the cement, steel, industrial minerals, ore, wood, cattle food, agri-food and chemical industries.

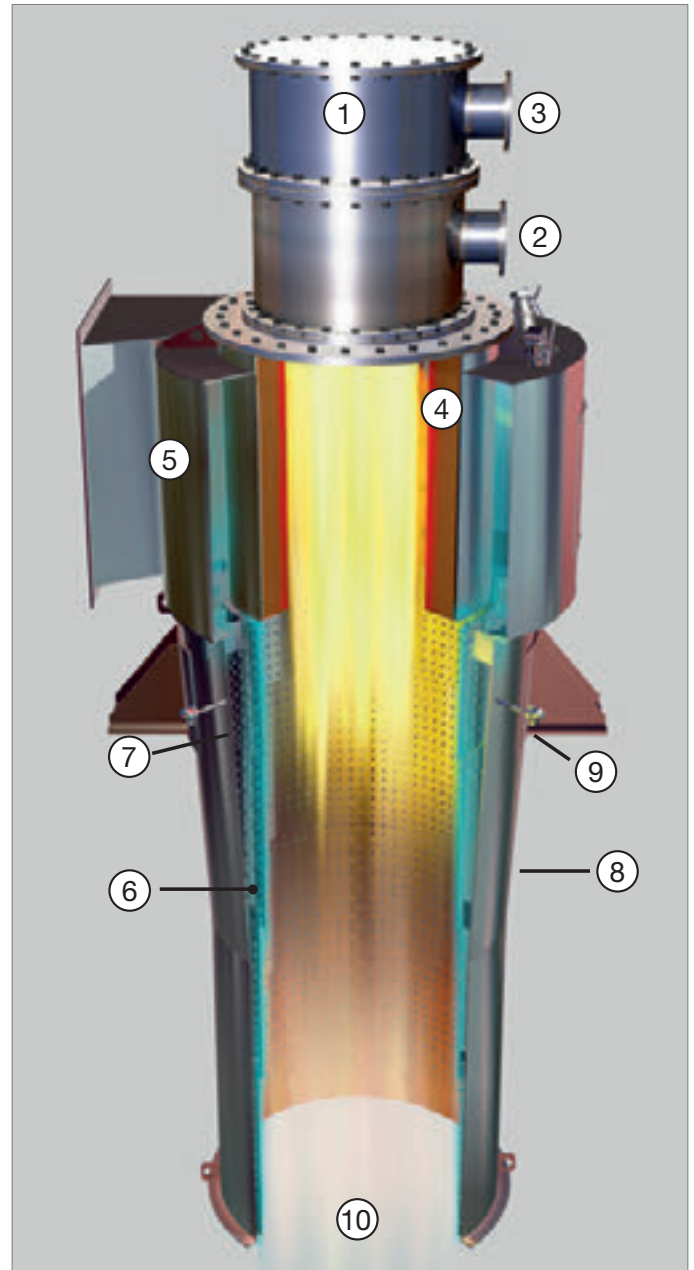
Mode of operation

The process gas stream which enters the spiral housing ⑤ cools both the protective jacket housing ⑧ and the perforated jacket ⑥. as a result of the flow pattern. The process gas enters the interior of the combustion chamber through the annular gap ⑦ and holes in the perforated jacket, and mixes there with the hot flue gases from combustion. At the same time the flame and hot flue gases are kept away from the perforated jacket.

Heating media

- Natural gas, bio gas, coke gas, blast furnace gas and other low calorific value gases
- Light and heavy oils, wood and lignite dust

LOMA Hot Gas Generator units are constantly being developed and conform to current technical standards. More than 600 hot gas generators of this type have been commissioned for a heat flow of between 100 kW and 64,000 kW.



Construction

- ① Burner
- ② Fuel
- ③ Combustion air
- ④ Burner muffle
- ⑤ Spiral housing
- ⑥ Perforated jacket
- ⑦ Annular gap
- ⑧ Protective casing
- ⑨ Temperature control
- ⑩ Hot gas outlet

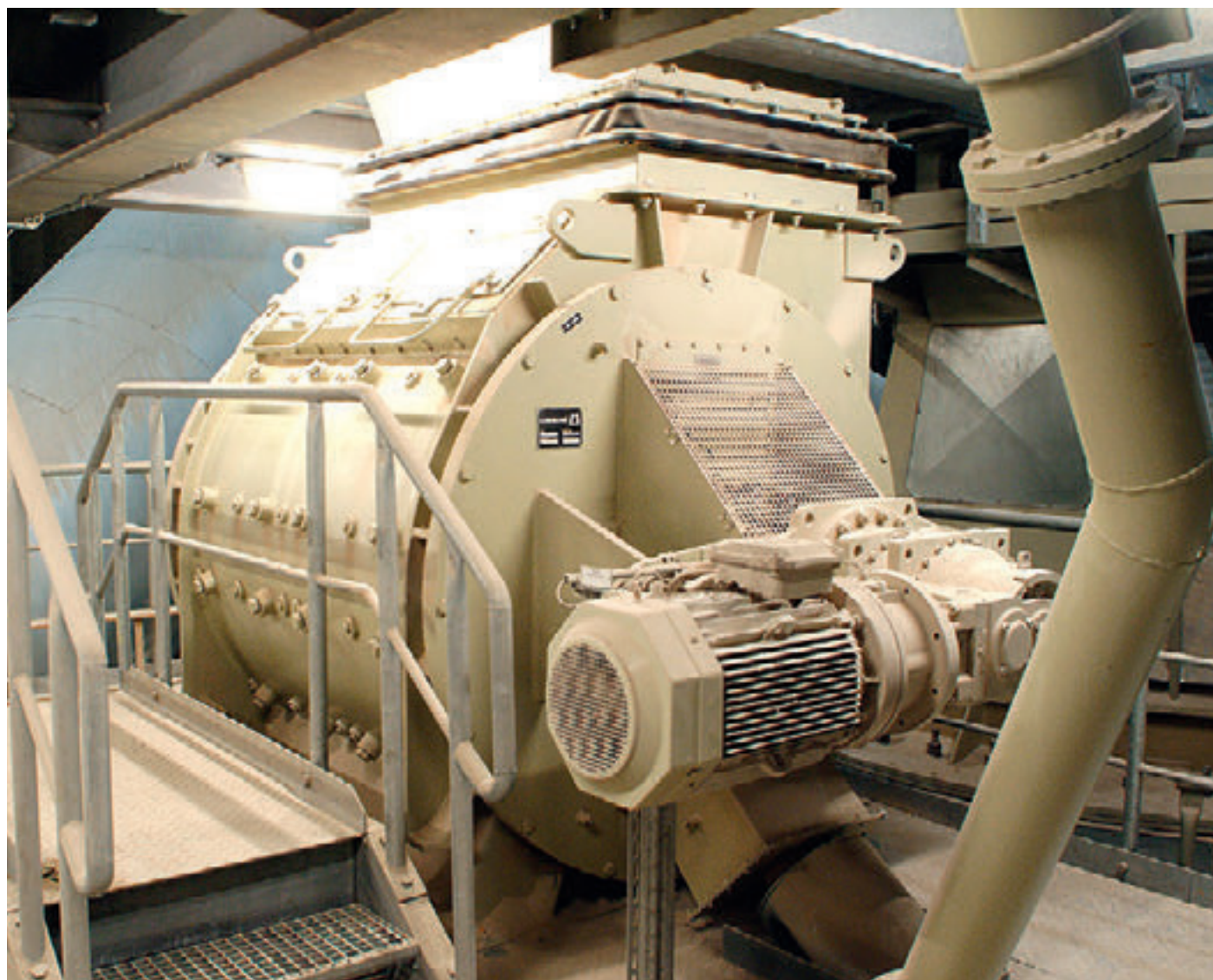
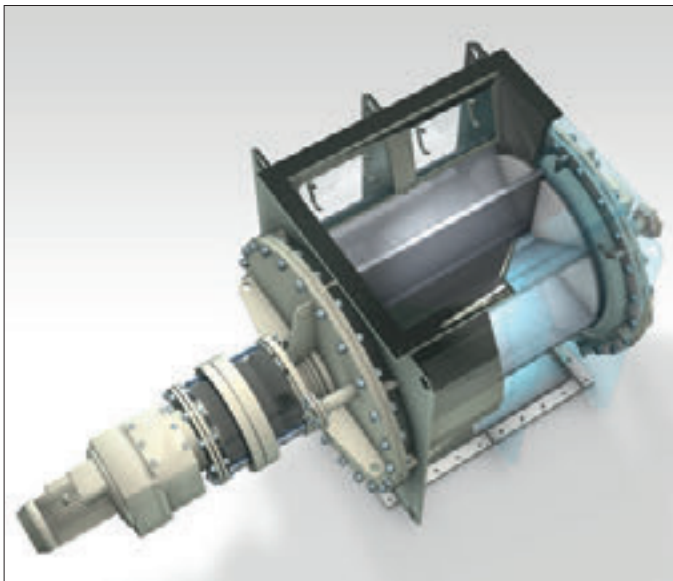
LOMA combustion unit type LF 25 with a natural gas burner, 2005

Loesche rotary vane feeder

Feeding of Loesche mills is carried out via a rotary vane feeder in order to prevent infiltration air ingress into the mill interior.

Material is fed continuously from above via the inlet hopper into every vane pocket of the slowly rotating vane feeder. In order to reduce wear from the abrasive feed stock the peripheral speed is low and the filling level limited to 40%. Adjustable sealing strips on the rotor prevent any large gaps between the wearing plate of the housing and the rotor. The material is discharged downwards into the feed chute of the mill.

Hot gas can be passed through the inside of the rotary feeder to prevent material caking. It is easy to dismantle for maintenance purposes.





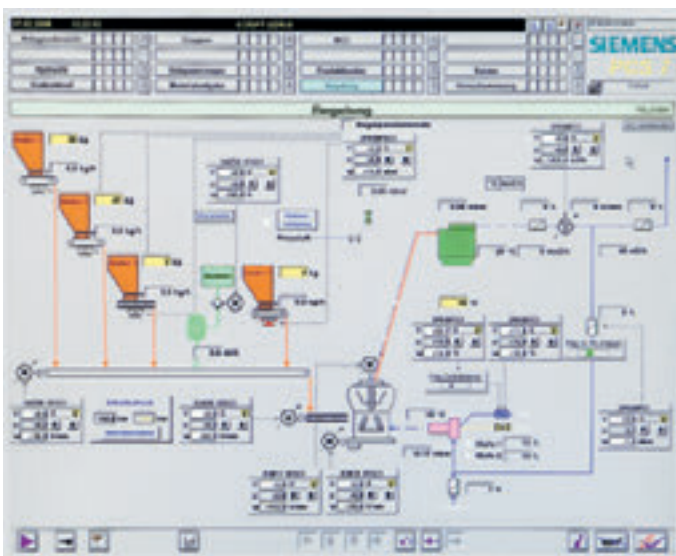
The Loesche test facility for raw materials testing, Research and Development

Calibrated standard grinding tests for mill sizing

Loesche has many years of experience in designing grinding mills. The most important prerequisite for correctly designed grinding mills is an exact knowledge of the physical properties of the materials to be ground.

The most important characteristic values of a material to be ground are the Loesche grindability factor and the specific power demand in relation to a defined fineness. Depending on the geological formation of the material to be ground, materials with highly different properties are found in nature, even with materials which appear visually to be similar.

Three well equipped laboratory LM 3.6 grinding mills are available in the Loesche test plant for performing standard grinding tests.



Fully-automatic operation with PLC

Analysis possibilities

- Pure density determination with gas pycnometer
- Determination of mass-related surface according to Blaine
- Grain size analysis with Cilas laser granulometer
- Sieve analyses with Alpine air-jet screening method
- Sieve analyses with Retsch vibrating sieves
- Grindability according to Hardgrove
- Grindability according to Zeisel
- Microscopy with Zeiss Stemi SV11
- Drying ovens for moisture determination
- Coal testing (Cfix, volatile matter, ash content)



LM 3.6 laboratory mill

Technological development through practical laboratory grinding tests

One of the first steps in introducing new technologies is the practical laboratory test.

Within the framework of our research and development projects the following actions are carried out:

- New materials for grinding of future market requirements are examined
- Optimised mill settings for special products are determined
- Plant components and process configurations are optimised
- New wear materials and concepts are tested

Our test plant is constructed in such a way that various modes of operation and plant process configurations can be simulated in the tests.

Loesche – worldwide presence

Loesche is an export-oriented company run by the owner, which was established in 1906 in Berlin. Today the company is internationally active with subsidiaries, representatives and agencies worldwide.

Our engineers are constantly developing new ideas and individual concepts for grinding technologies and preparation processes for the benefit of our customers. Their competence is mainly due to our worldwide information management.

This ensures that current knowledge and developments can also be used immediately for our own projects.

The services of our subsidiaries and agencies are of key importance for analysis, processing and solving specific project problems for our customers.

Please visit our homepage at www.loesche.com for up-to-date information on our overseas companies.

