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ready2grind – the boom continues **ready2grind – der Boom hält an**

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SUMMARY

In contrast to the trend towards increasingly larger grinding plants, recent years have also shown a shift towards smaller and compact grinding units. Various different reasons are in favour of smaller production systems, depending on the respective local markets. The small, compact and to a great extent prefabricated construction provides for shorter delivery times, simplified transportation and fast installation. This results in lower investment costs and shorter amortisation periods. Gebr. Pfeiffer recognised the potential of these small grinding plants early on and offers the ready2grind system as a solution for cement manufacturers. The contribution describes the design of this grinding system, points out the advantages of modular grinding systems and documents these on the basis of completed projects. ◀

ZUSAMMENFASSUNG

Entgegen dem Trend zu immer größeren Mahlanlagenkapazitäten, gibt es in den vergangenen Jahren auch eine Bewegung zu kleineren und kompakten Mahlanlagen. Verschiedene Gründe sprechen für kleinere Produktionsanlagen in Abhängigkeit von den lokalen Märkten. Durch eine kleine, kompakte und weitgehend vorkonfektionierte Bauweise sind kurze Lieferzeiten, ein vereinfachter Transport sowie eine schnelle Installation möglich. Dadurch kommt es zu geringeren Investitionskosten und zu kürzeren Amortisationszeiträumen. Das Unternehmen Gebr. Pfeiffer hat das Potenzial dieser kleinen Mahlanlagen früh erkannt und bietet den Zementherstellern als Lösung das ready2grind-System an. Der Beitrag beschreibt den Aufbau dieses Mahlsystems, zeigt die Vorteile auf und dokumentiert diese am Beispiel abgeschlossener Projekte. ◀

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1 Introduction

After Gebr. Pfeiffer put the first ready2grind plant R2G equipped with an MVR- mill 1800 C-4 plant into operation at Mombasa Cement in Vipingo, Kenya in 2017, the second plant started production in the middle of 2018, a ready2grind plant R2G 2500 C-4 at Cementos Fortaleza Elementia in Caldera, Costa Rica.

At the beginning of this year, two more plants will start operation, one in North America and one in Central America. Four more plants are now ready for dispatch, the next two are being manufactured and additional orders have been received. At the present time, a total of

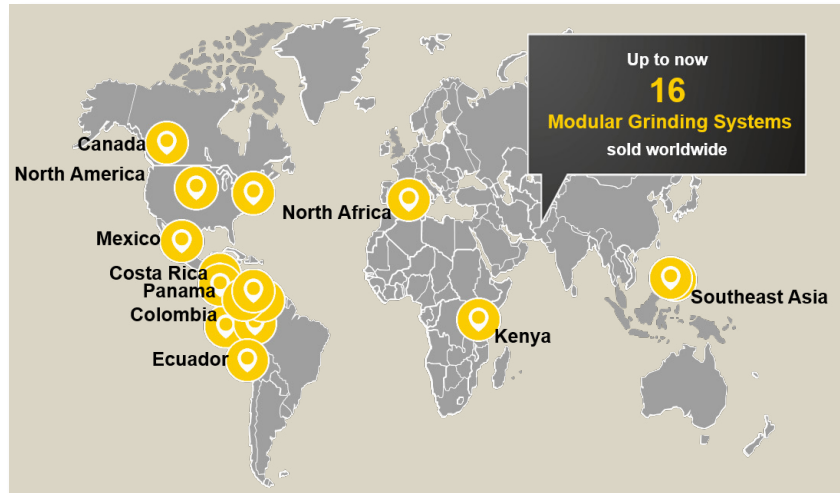


Figure 1: References for ready2grind modular grinding plants

16 modular grinding plants have been ordered from Gebr. Pfeiffer (► Fig. 1).

The great interest in modular grinding plants remains unbroken. With every ready2grind plant, the customer also buys increased operational reliability due to the 4-roller mill concept and the resulting active redundancy, the plant can continue production at a reduced throughput rate even during maintenance.

The MVR vertical roller mill of Gebr. Pfeiffer can now note over 70 references for grinding cement, cement raw materials, granulated blast-furnace slag and limestone and among these are many large-scale mills with an installed drive power of up to 11 500 kW. The “active redundancy” concept was brought to the market through the MVR mill. The smooth running is also a key characteristic for this type of mill.

Table 1: Operational results of the ready2grind plant, equipped with an MVR-mill 2500 C-4 in Caldera

Designation	Unit	Cement a)	Cement b)
Feed mix	mass %	86 clinker, 7 limestone, 3 pozzolan	74 clinker, 8 limestone, 15 pozzolan
Capacity	t/h	51	54
Fineness acc. to Blaine	cm ² /g	4370	4800
Water injection	%	0 to 0.6	0
Spec. energy (mill)	kWh/t	16.8	16.4
External heat ¹⁾	%	0	up to 3.6 in mix

¹⁾ Necessary in dependence on the feed moisture

However, the ready2grind technology is not designed solely for the cement sector. Thanks to the mill configuration, the ready2grind plant can also be employed for grinding limestone, coal and gypsum as well as other materials. For gypsum processing it even serves as a combined grinding and calcining system in the ready2grind+calcining version. For cement, it is ready to go for different types and degrees of finenesses. Grinding an OPC cement and the entire portfolio of blended cements presents no problems.

Every type of cement with a fineness of 5000 cm²/g acc. to Blaine and more is possible. For example, in Brazil, a Portland cement of the type CEM I with a specific surface of 5500 cm²/g acc. to Blaine is being produced in a MVR mill from Gebr. Pfeiffer.

2 Operating data of the ready2grind plant R2G 2500 C-4 at Cementos Fortaleza Elementia in Caldera, Costa Rica

As a representative example for the grinding of different cement types, an excerpt from the operating data for the ready2grind plant in Costa Rica is shown in ► Table 1.

In Caldera, different types of cement are ground with certain percentages of pozzolan. This makes clear, that a variance of the fineness for cement, can be accomplished easily with a vertical roller mill. At the cement plant, the products are ground without water injection. In the case of cement a), if the feed material is very dry, a small amount of water is added in order to stabilize the grinding process. Depending on the feed moisture, no or only a little external gas is required from the hot gas generator. The operating data of the plant in Caldera demonstrate the efficiency of the ready2grind plant for grinding cement. ► Fig. 2 shows a view of the plant in Caldera.



Figure 2: ready2grind plant R2G equipped with an MVR mill 2500 C-4 in Caldera, Costa Rica

2.1 The boom in modular, containerized grinding plants

Customers demand as short a time to market as possible! Consequently, the time between the order of a new grinding plant and the manufacture of the first product is a deciding factor. The reasons are diverse and are frequently also influenced by the local market. This means that it is common for customers to look for a grinding system from a single source with a very short delivery time, simple transport and uncomplicated assembly in the shortest possible time. The pre-assembled construction of the modules with standard container dimensions makes precisely these factors possible in comparison to conventional grinding plants. Moreover, the majority of the steel construction for the grinding plant is integrated in the container structure. On top, the need for building works is consequently reduced to a minimum (▶ Fig. 3). With these arguments, the modular, containerized grinding terminal beats a conventionally built grinding plant hands down!

2.2 The ready2grind system as a modular grinding plant

Gebr. Pfeiffer can satisfy all of the requirements and arguments mentioned as well as offering additional benefits: From the order to the first bag of cement in < 12 months! The modular design using containers and container dimensions means not only simpler and faster transport, but also a standardized on-site assembly procedure for the plant. The mechanical assembly of the ready2grind system is completed within four weeks.

The electrical control system (▶ Fig. 4) is also pre-assembled and wired and arrives at the construction site in an air-conditioned container. There, the cables for the large consumers, such as the main mill drive, classifier drive and fan, only need to be routed to the switchgear unit from which the electrical supply for the system is provided.

The savings resulting from the modular and standardized construction can be achieved up to 35 % as compared to conventionally built plants. Less time is required which saves money both in terms of assembly and the equipment required.

The savings potentials offered by the ready2grind plant make the amortization period significantly shorter than that of conventionally built plants and is only about two to three years for normal applications. The minimization of the assembly risks which usually exist at the construction site also enables more accurate calculation of the overall risk for the entire investment. This is further improved by the possibility of moving the plant to a new installation site if needed.

Additional benefits are gained with the ready2grind plant due to the use of the MVR vertical roller mill as the key equipment. The investment costs which appear higher at first



Figure 3: Containerized modules with integrated steel construction



Figure 4: Electrical system, container module (A. 5)

glance when compared to simplistic grinding systems are relativized within a very short time by the low operating costs of the MVR mill. In comparison to the MVR mill, systems with ball mills consume up to 40 % more energy. Because the MVR mill allows the processes of grinding, drying and classifying to be carried out in a single machine, there are also less auxiliary consumers.

The same holds true for maintenance and servicing costs because vertical mills offer significant advantages in comparison to ball mills in this area as well, which reduces the operating costs for the system even more. When changing products the MVR mill delivers further advantages; short material retention times have a positive effect on the changeover of products and – in contrast to ball mill systems – no unsaleable intermediate material results, which would need to be discarded.

Thanks to active redundancy, the MVR mill with its four grinding rollers stands for a high level of availability. This benefits the owner because it ensures that the mill remains operational during maintenance of the grinding rollers. Two opposed rollers can be swung out and the maintenance can be carried out while production continues at a capacity of more than 50 %.

3 Details of the modular design

The entire system can be adapted flexibly to suit the customer's individual needs in terms of material feed and product handling as well as the on-site layout, thanks to its modularity. Table 2 lists the base plant modules and the optional modules regarding equipment and service. The basic configuration (A) with one possible layout plan is shown in the Fig. 5.

The arrangement of units A. 3 and A. 4 with mill, filter, hot gas generator and fan is fixed. The modules for the material feed with the feed bins (A. 1) and the conveyor

belts (A. 2) can be adapted to suit the local circumstances. For example, as shown here, in an L shape relative to the unit with mill, filter, etc., or else in a U or I shape, means in-line.

This basic configuration can be expanded with various Optional Equipment Modules (B). These optional modules, such as silos, packing plants, palletizing systems and others, allow modular adaptation of the plant to suit customer needs. In addition to the equipment aspect, Gebr. Pfeiffer also offers additional services (C), Optional Service Modules, such as personnel training by experienced specialists or service agreements. Figs. 6, 7 and 8 show some Optional Equipment Modules (B) of the ready2grind plant in Caldera, Costa Rica.

4 The ready2grind installation sizes

The installation sizes of the 16 modular plants sold of the most common ready2grind plants is the type R2G 2500 C-4 with a production rate of 50 to 72 t/h of cement, depending on the composition and the fineness. Another preferred installation size is the ready2grind plant R2G 1800 C-4, which is designed for a production rate of 20 to 30 t/h Table 3).

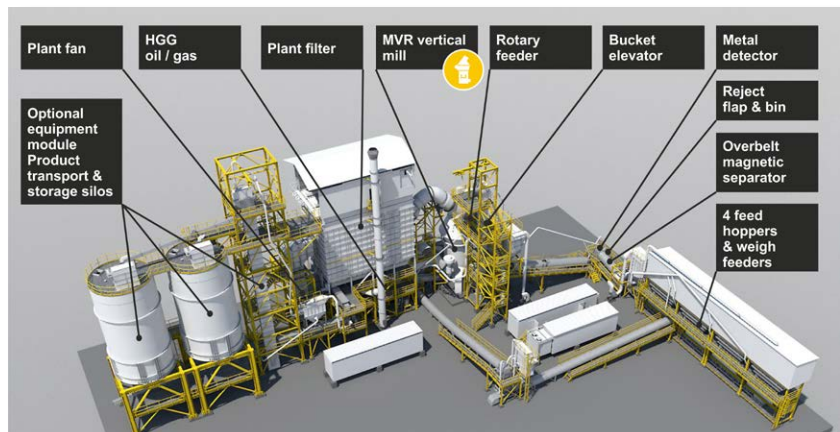


Figure 5: Layout of a ready2grind plant

Table 2: List of different ready2grind modules

A. Base plant modules	
A. 1	Feed material dosing and feed hoppers
A. 2	Material feeding to mill
A. 3	Mill, classifier and ancillaries
A. 4	Process filter, hot gas generator and fan
A. 5	Electrical controls and drives
B. Optional equipment modules	
B. 1	Production transport and storage silos
B. 2	Packing and truck loading
B. 3	Palletizing equipment
B. 4	Bulk loading equipment
B. 5	Big bag loading equipment
B. 6	Laboratory equipment
B. 7	Pre-feed system equipment
B. 8	Transformer station
C. Optional service modules	
C. 1	Operator training
C. 2	Maintenance training
C. 3	Service contracts

The advantages of the Gebr. Pfeiffer ready2grind plants are the following:

- 】 Proven concept with the highest reliability
- 】 Cost-effective transport due to modules in standard container dimensions
- 】 Fast delivery, assembly and commissioning
- 】 High-level availability with a moderate investment of capital
- 】 Low operating costs
- 】 Rapid market entry, short amortization period, low investment risk
- 】 Maximum flexibility for quick reactions to changing market conditions

5 Outlook

With respect to typical indicators of success, such as investment costs, operating costs, flexibility, return of investment and a short go-to-market time, the ready2grind system proves to be a perfect solution for businesses. The



Figure 6: Feed bin (A. 1) with optional pre-feed system (B. 7) of the ready2grind plant in Caldera

Table 3: Technical and technological data of the two ready2grind systems

R2G 1800 C-4/R2G 2500 C-4							
Product	–	CEM I		CEM II/B-L		GGBFS	
Fineness acc. to Blaine	g/cm ²	3300	4000	4000	5000	3800	4500
Grindability	kWh/t	18	22	15	19	23	27
Throughput	t/h	25/60	20/50	30/72	23/57	21/47	18/44
Max. feed grain size	mm	35/50					
Approx. production	t/a	up to 220 000/up to 550 000					
Installed mill motor power	kW	630/1 450					
Total installed power	kW	about 1 400/about 2 750					
Consumables	–	upon requirement: water, fuel					



Figure 7: Product silos (B. 1) of the ready2grind plant in Caldera



Figure 8: Packing and palletizing plant (B. 2 and B. 3) of the ready2grind plant in Caldera

trend towards smaller grinding units continues unbroken, as is evidenced by the increased number of Gebr. Pfeiffer ready2grind systems since 2017. In recent years the main interest has been in smaller grinding units with sizes designed for a production rate of approx. 70 t/h. The next few years will show whether the trend for these sizes will continue or whether the market will demand other production rates. It continues to be an exciting time! ◀