

ARIAN GROUP

Industries

Tel: +61(03)94677563

Fax: +61(03)94677563

Mob:+61(0)400747385

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1.0 Project conditions

Evaluation of the project conditions will be undertaken, geological and geographic quality variation of the limestone reserve will be computed, minable reserves will be determined. Final design will be site specific and will be based on location of the project proximity of the quarry to the plant site and a range of geological and topographic elements of the site.

2.0 Mass Balance

Cement design option 1

At 6,000 tonnes per day cement production it is 250 tonne per hour. The report on Geological Investigation and Reserve Calculation in Figure 24 presents the mass balance as:

Limestone	6,178 tonne per day
Siliceous limestone	2,920 tonne per day
Claystone	2,854 tonne per day
Total quarried	11,952 tonne per day

The Loss on Ignition (LOI), hence mainly the loss of carbon dioxide from the limestone, is given in Table 11 of that report as 34.64%, which is to be expected. That means for a production of clinker at 6,000 tonnes per day, the raw material mix excluding any solid fuel must be $6000 / (1 - 0.3464) = 6000 / 0.6536 = 9,180$ tonne per day which matches values from the literature on cement plant design. Therefore, the calculations in the cited report will be replaced by the following values:

Limestone	4,745 tonne per day
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Siliceous limestone 2,243 tonne per day

Claystone 2,192 tonne per day

Total quarried 9,180 tonne per day use 384 tonne per hour

Bauxite at 1.5% of raw mix = 140 tonne per day

Gypsum at 4% of cement = 240 tonne per day

Cement design option 2

At 6,000 tonnes per day cement production, the mass balance for cement design option 2 is:

$0.5 \times 250 = 125$ tonne per hour cement

$0.3 \times 250 = 75$ tonne per hour calcined clay

$0.15 \times 250 = 37.5$ tonne per hour fine limestone

$0.05 \times 250 = 12.5$ tonne per hour gypsum

In view of the loss of carbon dioxide when calcining the limestone, about 1.6 tonne raw material is used per tonne cement produced, therefore, the cement raw material is $1.6 \times 125 = 200$ tonne per hour limestone and claystone fed to the cement reactor.

Bauxite at 1.5% of raw material = 73 tonne per day

Claystone contains 15 mass % bound water, so the uncalcined clay fed to the calcining reactor is $75/(1 - 0.15) = 88$ tonne per hour

Process flow sheet and unit operations

The process flowsheet for both Options 1 and Option 2 will be different from a conventional cement plant and consists of the following processing units:

1. Quarrying, crushing and screening of limestone and siliceous limestone to -5 or 10 mm, truck transport to plant.
2. Quarrying and crushing claystone to -5 or -10 mm, truck transport to plant.
3. Stack and reclaim stockpiles of crushed limestone, siliceous limestone and claystone at plant, preferably under cover.
4. Raw materials with 2% bitumen and 1.5% bauxite are fed into individual hoppers and flow onto weighing conveyors fed to blenders that feed directly into the Zeobond reactors.
5. For Option 1, combine 384 tonne per hour limestone, siliceous limestone and claystone in eight (8) Zeobond reactors operated in parallel at 50 tonne per hour each to produce cement.
6. For Option 2, combine 200 tonne per hour of limestone, siliceous limestone and claystone in four (4) Zeobond reactors operated in parallel at 50 tonne per hour each to produce cement.
7. For Option 2, fine-grind limestone in a Zeobond reactor at 37.5 tonne per hour, so one (1) 50 tonne per hour reactor is proposed.
8. For Option 2, calcine claystone in a Zeobond reactor at 88 tonne per hour, so two (2) 50 tonne per hour reactors in parallel will be used.
9. Intermediate silo buffer storage for 1 day of production of (5) or (6), (7) and (8), hence three silos of sizes 6,000 tonnes for cement, 1,000 tonnes for fine limestone, and 2,000 tonnes for calcined claystone. Silo capacity is also required for 7 days of bauxite and gypsum, so 1,000 tonnes bauxite and 2,000 tonnes gypsum.

10. leanding of the three product streams from the intermediate storage and intergrinding with gypsum in three (3) Zeobond reactors each handling 100 tonne per hour. The throughout is high as no further processing or grinding is required, so the purpose is just to grind the gypsum and get it coated on the outside of the other cement components.
11. In total eleven (11) Zeobond reactors will be installed, with flexibility to switch between Option 1 and Option 2 blends. Additional equipment will be installed to switch between the raw materials streams fed to the reactors.
12. Storage of the final cement product(s), either pure Portland cement for Option 1, and/or the LC³ cement for Option 2 for 7+ days, i.e. total storage of 50,000 tonnes, which will be one or two large silos.
13. The relative size of cement bagging facility and four bulk cement loading bays for pneumatic tanker trucks will be determined by more market investigation. For this estimation it is assumed that 3,000 tonne per day is bagged, hence 60,000 bags per day, hence 150 trucks of 20 tonne each, which requires say ten loading bays. The bulk cement of 3,000 tonne per day is dispatched in 120 pneumatic tankers per day, which means ten loading bays each loading one tanker every hour for 12 hours.
14. If GAS or HFO is used as fuel for power generation and the compressors, substantial storage will be required, 2 X 2000 cubic meter storages have been proposed.
15. It is proposed that petroleum coke will be used as a cheap source of energy in the reactors, similar to the use of fine coal in cement plants. The coke can be mixed with the raw materials and fed to the reactors. Storage of coke is also simple, that is if used as source of energy.
16. Part of the energy required in the Zeobond reactors is by compressed air using modified two stage turbine compressors burning GAS or HFO. The total capacity of compressors for both Option 1 and Option 2 is 13 MW.
17. Electricity will also be generated from combustion of GAS or HFO and is 15 MW in total.

- 18. Roads and walkways, administrative buildings, fencing, foundations for equipment
- 19. Laboratory equipment
- 20. Plant-wide control and enterprise-wide management system

3.0 Main Equipments:

3.1 CRUSHING AND SCREENING EQUIPMENT

Crushing equipment will be used in the quarry and not part of the plant itself. We manufacture a range of crushing equipments including:

3.1.1 Jaw Crushers



Jaw crusher is designed for primary crushing of hard rocks with minimum rubbing action. This is achieved by incorporation of an ingenious linkage system which makes sure that the jaw plates move squarely against the rock. Jaw crushers are generally used as primary crushers for material like :- Granite, Black trap rock,

Cupriferrous slag, River gravel, Cuprondrum(fused aluminium oxide), Emery, Carborundum(silicon carbide), Calcium carbide(fused), Blast furnace slag, Bauxite, Lime stone, Ferro manganese, ferro silicon, ferro vanadium, ferro tungsten, ferro molybdenum and other ferro alloys. Coal, coke, petroleum coke etc. Quartzite, Manganese ore and iron ore.

There are two types of Jaw Crushers

Jaw Crusher Single & Jaw Crusher Double Toggle

3.1.2 Impact Crusher



Our Cement Plants unit manufacturing various type of Impact Crushers used in both primary and secondary crushing applications of hard rocks and crushing needs, and in recycle crushing of reinforced concrete, asphalt and other construction and demolition debris.

Built for rugged durability and simplicity of operation, crusher designs which produces an excellent product.

They offer material producers a high

ratio of reduction. Hammers have four crushing positions to maintain a more constant gradation and greater top size control.

3.2 CONVEYORS FOR CEMENT PLANT

Material handling automation technology used to transport raw materials to the different units of the plants. Based on the plant condition and requirement we manufacture and supply various types of conveyor belts like.

3.2.1 BELT CONVEYORS

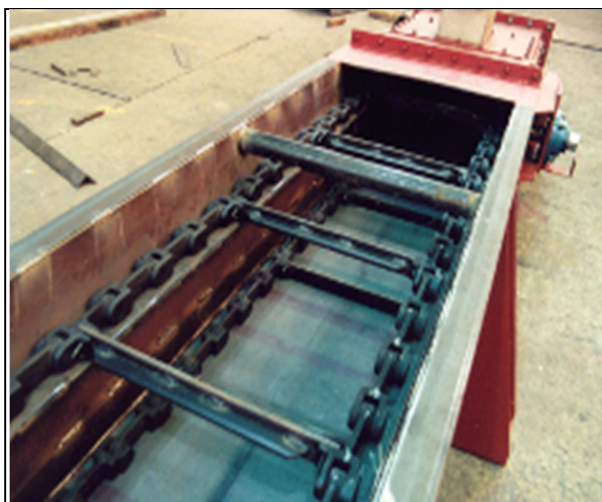


Belt conveyors are used to transport bulk raw and or finished material. The versatility, dependability and economy of the belt conveyor are demonstrated in transporting a wide variety of material. Belt conveyors come in different size ranges from 1000mm TO 5000mm Width. The adaptation of belt conveyor for special purpose and the integration of belt

conveyor with other equipment have increased their usefulness.

The complete unit of conveyors are consists of all types of Idlers/Roller, Idlers Frames, Pulleys, Conveyor Belts, Gear, gearboxes & Motors, Input & Output Coupling, Internal & External Scrappers, Skirt Boards, Deck Plates, Stringers, Short Support, Hood, VGTU, Safety Switches etc.

3.2.2 DRAG CHAIN CONVEYOR



A Drag Chain Conveyor is a conveyor in which the open links of chain drag material along the bottom of a hard faced MS or SS trough. It generally have a low bed height and are open type.

The flights are fixed between two strands of chain, drags the material from feeding end to the discharge

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end in open or closed trough. These are available in difference widths and lengths as per the site requirements and are also used for handling slightly sluggish, loose or lumpy hot material.

Generally these conveyors are easy to install and have very minimum maintenance for the clients. These are available in different widths and lengths as per the clients/site requirements. The conveyors we manufacturing are dust proof, low noise and sealed design.

2.3- STACKER AND RECLAIMER

Comparison between Longitudinal and Circular in terms of benefits, disadvantages and costs. The most important decision is to select the type of storage for different materials.

Name	Space occupied	Land size efficiency	homogenizing effect	Enlargement flexibility
Longitudinal	occupies more space than Circular storage	Low efficiency	suitable for many kinds of Stacking method	convenient for enlarge, suitable for the project which may consider next stage
Circular	It can save upto 30% of space	high efficiency	Only few kind of stacking method can be used ,	Can't be enlarged

Longitudinal storage is preferred for auxiliary and additive material and Circular storage is selected for limestone.

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Longitudinal Storage

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Tel: +61(03)94677563

Fax: +61(03)94677563

Mob: +61(0)400747385



Circular Storage

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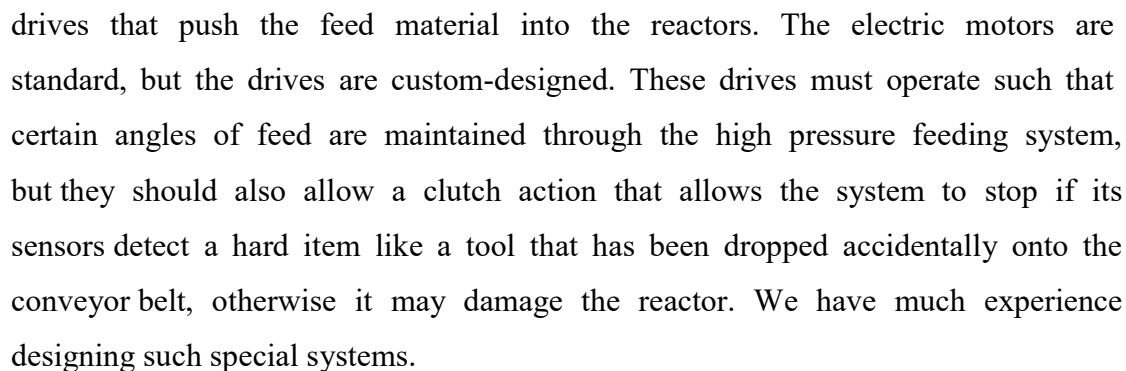
3.4 REACTORS

Our unique state of art cement plant technology consists of a number of reactors that replace these equipments in traditional cement plants:

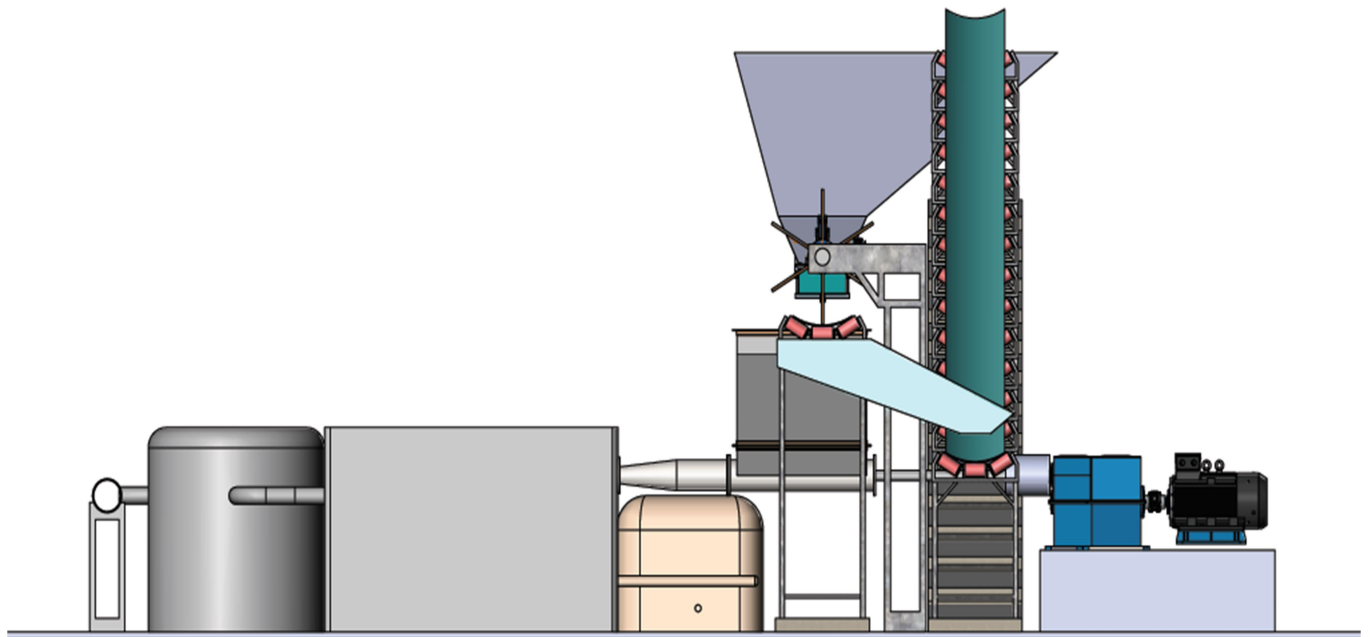
- a- material grinding machine
- b- raw meal silo (serve as a combined storage and blending silo)
- c- preheat waste gas treatment system,
- d- pre-heater & calciner
- e- clicker and associated equipments
- f- ID fan
- g- Rotary Klin
- h- cooler
- i- clincker cooler exhaust exhaust gas treatment
- j- clicker storage and transport
- k- cement grinding system

Below plain view drawing showing our reactor lay out. Please be advised real photos are not used because we are protecting our precious technology from being stolen.

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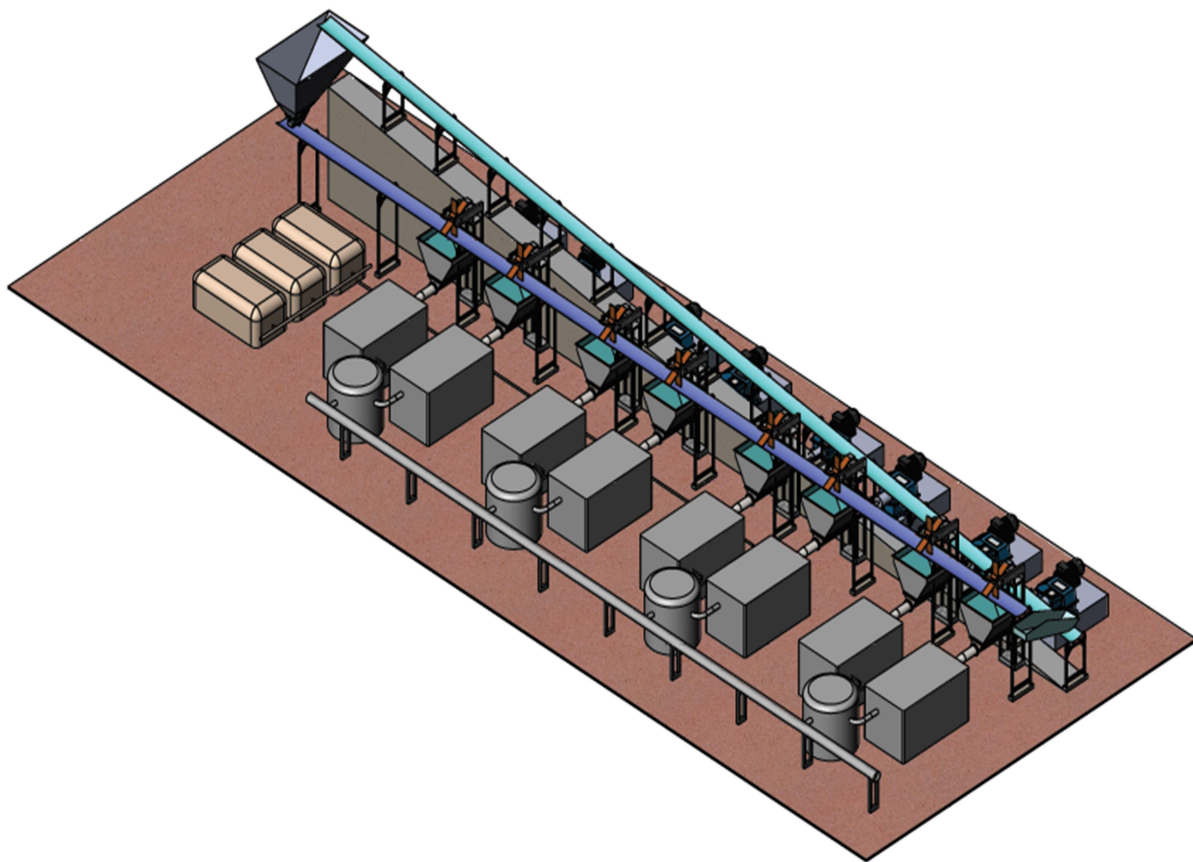
3.4.3 Feed Screw: The source material is fed into an auger type screw, but it is not a standard item. The feed screw is configured in a uniquely designed manner that allows feeding into the high pressure reactor.



3.4.4 Reactors: The eight reactors shown as beige rectangles consist of

- (a) the high pressure feed system for the solids,
- (b) a series of nozzles for injecting compressed air to hit the solid feed at supersonic speed causing shockwaves,
- (c) a custom-made high wear resistant conductive ceramic catalytic element (see patents) that is gradually fed into the reactor and consumed slowly at about 2mm per day, so no need to stop for maintenance,

- (d) electrical supply to the catalytic element,
- (e) venturi exit system for cooling product particles,
- (f) custom-made high wear resistant ceramic shell and internal components for the reactor.



3.4.5- Compressors: Three compressors shown as orange rectangles at the left of the drawing operating on fuel oil or GAS or HFO to supply compressed air to the reactors.

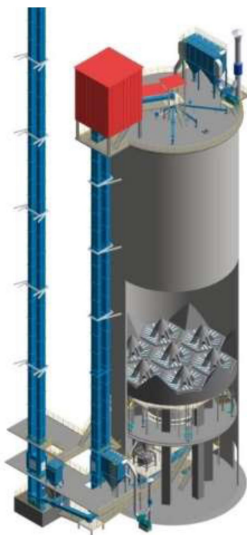
3.4.6- Fluidised beds: The reactors are grouped together in pairs and their product

is combined and fed to cylindrical fluidised beds at the bottom of the drawing. The function of the fluidised beds is to control the final cooling of the hot particles out of the reactor, and to blend and intergrind gypsum to balance the cement chemistry. The final product is fed to the cement product silo(s).

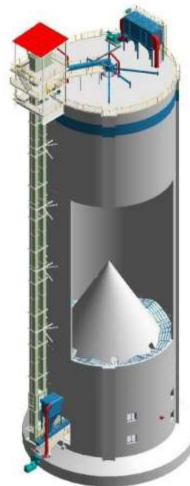
3.4.7- Control System: The dedicated control system for the reactors controls not just the temperature, flow rates and pressures, but also the current and frequency of the electrical field across the catalytic element. The result is a control of not just the cement phases but also the product particle size.

3.5 CEMENT SILOS

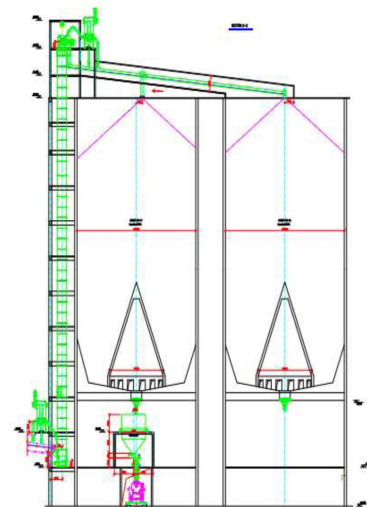
There are different types of cement silos, they all do the job



CF type silo



IBAU type silo



CP type silo

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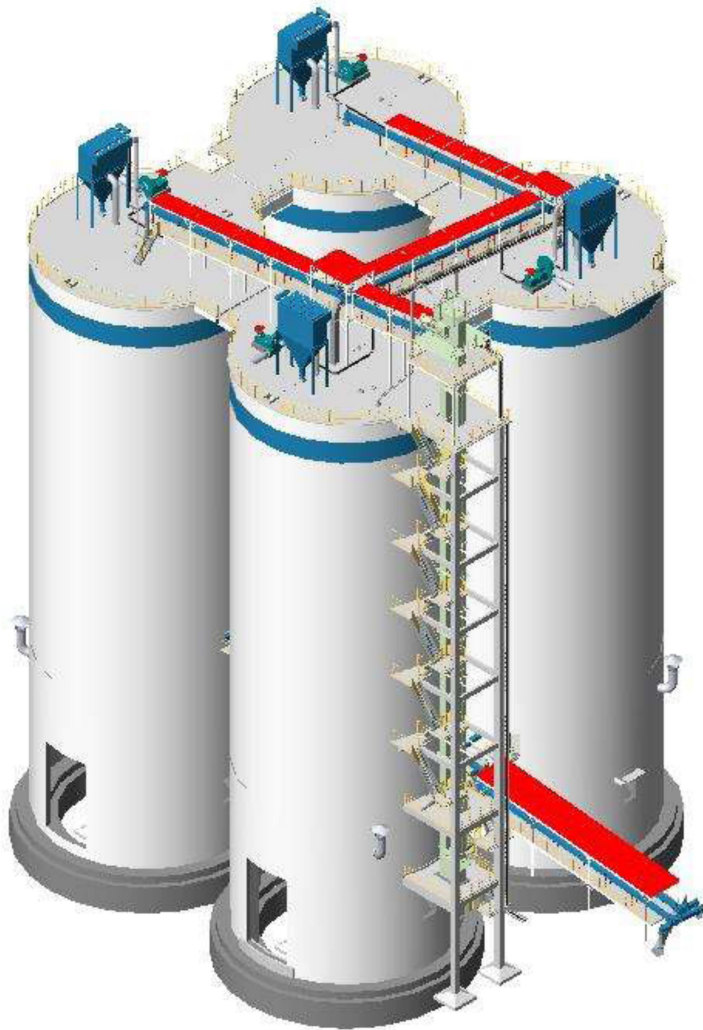
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Four CF type silos of 10,000 tonne capacity recommended (18m radius). There is no inner concrete cone inside of the silo, construction operation easier and quick. Our silos come with specialised components and safety accessories for silo filling, venting and de-dusting, level and pressure monitoring, aiding of material flow and discharge, as well as discharge flow interception and outlet closure.



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3.6 PACKING HOUSE



Tow (2) cement bulk loading machines with capacity of 300 t/h will be installed

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Tow (2) high capacity, cement packing servo motor control type automatic rotary will be supplied. It has 8 bag filling rotating arms enables to fill 8 bags at the same time. This series of machine is mainly used for filling cement into 25-50kg bags. Except manually bag inserting, all the other filling processes can be done by the packing machine automatically and continuously.

The control system of the packing machine adopts technology of microcomputer and servo motor. It has main features of more accurate measuring accuracy, higher capacity, low failure rate and environmental protection.

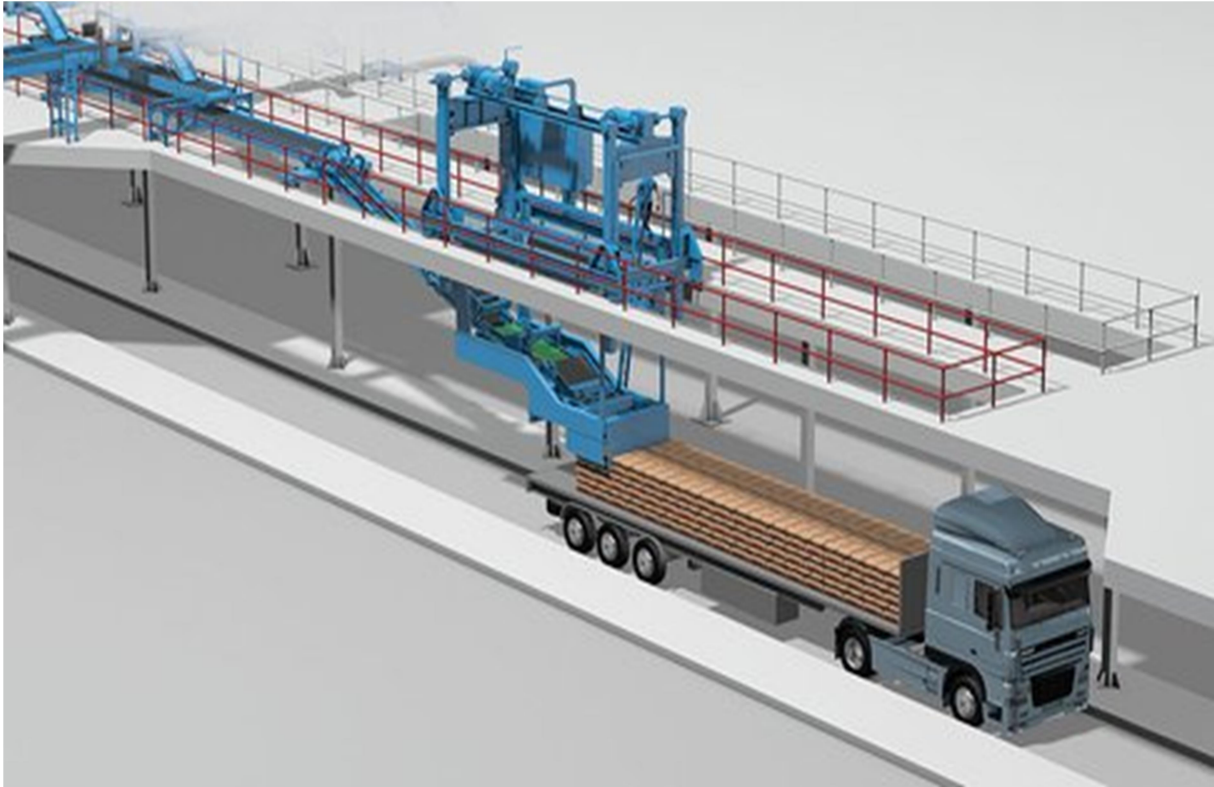
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Three (3) cement bag loading machines with capacity of 150 t/h each totaling 450 t/h will be installed. Two of the machines will be used for continuous operation and the third one can be on standby.

Installed cement bag loading machines are automatic machines that pack the bags onto the truck and do not require manual handling.

4.0 Storage capacity list

Storage capacity design and requirements may vary depending on the final design of the plant and quarry machinery. Proposed standard storage capacity for a 6,000 t/day cement plant listed in below table:

No	Material	Type	quantity	total Capacity(t)
1	Limestone	90m Circular preblending storage	1	38,000
2	Clay	preblending storage shed	1	8,000
		covered storage shed	1	17,000
3	Silicouse limestone	preblending storage shed	1	5,000
		covered storage shed	1	2,500
4	bauxite	preblending storage shed	1	5,000
		covered storage shed	1	1,500
5	Gypsum	preblending storage shed	1	7,000
		covered storage shed	1	2,500
6	Cement	circular silos x 4	4	40,000
7	HFO or Gas	circular silos x 2	2	4,000 cubic meters

5.0 Electrical and Automation

Power Demand

- ① Total installed capacity of cement plant: 15.00MW
- ② Actual power consumption of cement plant: 12.70MW

Our electrical and automation system is part of our reactor system and we cannot include details in this abstract.

6.0 Water system

It's understood that a water well will be drilled provide water supply but the water system will be determined according to the final design of the plant that fit the topography and the location.

7.0 Air-conditioning system

Ventilation and air conditioning systems will be provided throughout the plant as per design.

- all operation and administration rooms shall have air conditioning;
- Departmental substations shall have ventilation and air cooling as needed.

8.0 Power station



The Power Plant to be installed is innovative, cost-effective and environmentally-friendly – a model for forward-thinking solutions to provide required power to the cement plant, it will use natural gas or HFO to generate 15 MW of power.

1- Gas generated power plant

Three large gas generators of 8.3MW each will be installed and used for power generation. A total output of 24.9MW at ISO conditions.

Two (2) sets of generators will be used for continuous power generation and one (1) set will be on standby.

2- HFO generated power plant

Twenty one (21) sets of the prime mover continuous operation HFO generators will be used for power generation with single unit power of 900KW and total output about 18.6KW at ISO conditions.

The eighteen gas generators proposal will be suitable for all kinds of operation conditions of cement plant demand. The power plant will supply electrical power to cement plant, eighteen (18) generator sets will be working at any time and three (3) generators will be on standby.



3- Hygen Plus Power Plant (Optional)

This plant type is not included in the price but can be purchased for extra cost, which it will be differences between cost of Hygen Plus power plant and price for included power plant type).

This type of plant is a new technology that does not required any fuel and almost negligible cost to run. The process is based on continuous active and reactive cycles of conversion and reformation hydrostatic potential energy in a closed-cycle.

Thank you

For more information please contact:

Christian Strauss – Chief Engineer

ARIAN INDUSTRIES PTY LTD.