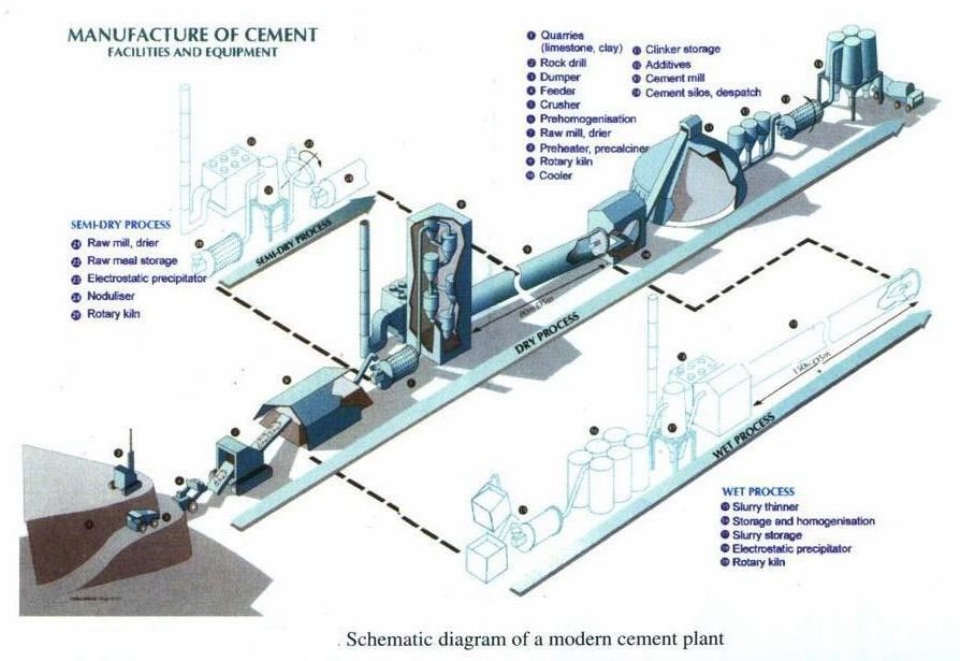
Some problems on the cement rotary kiln shell

Rotary kilns are used to heat solids to the point where a required chemical reaction(s) takes place. The rotary kiln is basically a rotating inclined cylinder. Solids retention time in the kiln is an important design factor and is set by proper selection of the diameter, length, speed, slope and internals design. There are two basic types of rotary kilns; directfired and indirectfired.

The cement rotary kiln is composed of cylinder,gears,support device,kiln liner and tail sealing,kiln head hood and combustion.

Applications of rotary kilns:

Rotary kiln are widely used for proppent manufacture, clays, thermal Desorption of Organic /Hazardous Waste, mineral Roasting, Specialty Ceramics, Plastics Processing, Gypsum Calcining, Tire Pyrolysis, Bauxite Calcining, Pigments, Catalysts, Phosphate Pnxluction, Waste Lime Recovery.



Schematic diagram of a modern cement plant

Some problems and answers on the cement rotary kiln shell:

How to measure Kiln Shell Hot

The traditional techniques used to measure the temperature of a rotary kiln, due to extreme environmental conditions, heat, vibration and corrosive atmospheres, have a number of limitations. The current technologies are:

The latest wireless temperature measurement technology helps to mitigate the risks highlighted before: temperature sensors are mounted directly on to the rotating kiln and the readings are sent to the control and monitoring system through wireless communication, without any external wiring. This solution, quick and easy to install, with no special knowledge required, leaves the simplicity and effectiveness of thermo couple reading, removing all the technical and process issues related to the kiln movement. The cost of this solution can be approximately 5K EURO per Kiln. The wireless transmitter is installed on the rotary kiln external surface and is getting the reading from the thermocouple installed inside the kiln. A mechanical cover is mitigating the heat irradiation from the kiln surface, protecting the transmitter electronics from the high temperature. The temperature transmitter sends real time data to a wireless receiver installed not far from the rotary kiln. The receiver is connected either with a 4-20mA or a Modbus connection to the control system.

1. What is the maximum continuous shell temperature a kiln stands without permanent damage to the shell?

The maximum recommended kiln shell temperature varies by plant, by country and by kiln manufacturer, despite the fact that most kiln shells are made of low alloy carbon steel. Age of the kiln shell, distance between the tires, and structure of the shell are some important points should be considered

before deciding what the maximum allowable temperature for a kiln is. Let us explain these points briefly:

1. Age and condition of the kiln shell: Old kilns shells have been exposed to creep for a long time and are more prone to develop fatigue cracks than newer shells.
2. Distance between tires: The longer the shell span, the less it will resist high temperatures without sagging. Therefore, longer spans have more tendencies to develop permanent deformation than shorter spans.
3. Kiln shell structure: Kiln shells are made with structural rolled steel plate, such as A.S.T.M. A36. The tensile strength of this type of steel at room temperature is 50,000 to 80,000 psi. As stated before shell strength is measured at a room temperature.

What is the maximum red spot temperature on the shell force kiln to stop?

The short answer is 550ºC if the spot is permanent and persistent. This is a short answer, but when we talk about red spot, damaging of shell, long kiln stoppage, and losing millions of Riyals or Dollars; this answer cannot be acceptable. A number of factors are absolutely necessary to be considered in any red spot before taking the decision of kiln stoppage:

1. Proximity of the red spot to the tires or gear: Red spots near tires and bull gears require immediate action. These spots almost invariably force the kiln down. Shutdown procedure must start immediately to avoid damaging the kiln shell.
2. Extension of the red spot: The longer the circumferential extension of the red spot, the greater the risk of shell permanent deformation or collapse. If there is any persistent red spot covering more than 10% of the kiln circumference; Kiln should stop immediately.
3. Kiln alignment conditions: Misaligned kilns induce localized stresses along the kiln length. If the red spot coincides with an area of stress concentration, the shell sometimes elongates or twists beyond recovery.
4. Whether the red spot is exposed or under roof: If the kiln shell is directly exposed to the elements and a heavy rainstorm hits the red spot, the shell may develop cracks under sudden quenching. Sometimes the brick results severely crushed in the red spot area.
5. The presence of shell cracks in the vicinity of the spot: The presence of cracks in the vicinity of the hot spot calls for an immediate kiln shutdown avoids shell splitting.

Specifications:

Model	Output (t/d)	Main Drive (r/min)	Motor (kW)	Regulating Range (r/min)	Gearbox Velocity Ratio	Weight (t)
Φ2.2×50	96	0.125-1.25	30	132-1320	157	130.71
Φ2.5×50	130	0.516-1.549	55	440-1320	99.96	167.5
Φ3×48	850	0.3309-3.309	90	100-1000	32.11	237
Φ3.2×48	1000	0.375-3.75	160	100-1000	27.469	252
Φ3.2×50	1200	0.398-3.975	190	150-1500	40.85	263
Φ3.3×52	1200	0.391-3.91	190	100-1000	27.707	280.8
Φ4×60	2500	0.396-3.96	315	100-1000	34.601	487.5
Φ4.2×60	2800	0.4165-4.165	420	100-1000	35.526	576.1
Φ4.3×62	3000	0.398-3.98	420	100-1000	35.714	598.5
Φ4.3×64	3200	0.449~4.49	450	100~1000	24.365	585
Φ4.5×66	4000	0.41~4.1	630	100~1000	34.069	710.4
Φ4.8×70	5000~5500	0.4~4.0	630	100-1000	30.876	845.3
Φ4.8×72	5000	0.403~4.03	560	100~1000	30.365	847
Φ4.8×74	5000	0.35~4	630	130~1500	42.226	841

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