

# Coke calcining systems





Two coke calciners in Bahrain

## KVS Coke calcining systems

Metso provides systems and equipment for thermal processing of solid materials such as ores, minerals, bulk granular chemicals, agricultural products, and waste materials to change their physical and/or chemical properties.

With over 80 years of successful experience in serving the minerals and chemical processing industries, Metso has the proprietary technology and know-how to design and build coke calcining systems best suited to the specific requirements of each customer.

### Proven experience

Metso is the world's leading supplier of coke calcining systems and equipment, having furnished 50 plants representing approximately 70 percent of the world's coke calcining capacity. These plants range in capacity from 50,000 STPY to over 400,000 TPY.

### Energy efficient

Due to the rotating action in a rotary kiln, the coke bed is in constant gentle motion exposing coke particles to the process heat. Additionally, the incinerator will convert volatile matter and fine coke particles entrained in the kiln exit gases into energy for steam and/or electrical power generation.

### Flexibility in operations

KVS rotary kilns can handle a wide range of green coke feeds including needle, sponge, shot, fluid or tar pitch green cokes. The rotary kiln is also able to optimize the coke calcining operating parameters, be it residence time, temperature gradient, and heat up rate, all of which impact product quality.

### Product quality

KVS' coke calcining systems can produce a quality product specification from sponge, needle, shot, fluid or tar pitch cokes. The real and vibrated bulk densities are optimized in the KVS rotary kiln calcining system. Also, fines in the calcined product are decreased thus enhancing critical elements of product quality.



*Two 250,000 MPTY Rotary kiln coke calciners*



*Heavy duty carrying station*

## Rotary Kiln

The KVS rotary kiln is a tried and proven technology successfully used in various pyro-processing industries around the world. Rugged construction and conservative design is the trademark of KVS's rotary kilns. Operators find them easy to operate and maintenance is minimal.

Calcining of petroleum coke is done in the rotary kiln. The kiln components consist of shell, tires, carrying stations, seals, refractory and a drive train which includes girth gear, pinion, speed reducer and variable speed motor. The drive train also includes an auxiliary drive for use during startup and periods of power failure.

## Burner systems

Process heat is furnished to the rotary kiln from two sources. The first is the kiln burner system, which can be designed to handle gaseous, liquid, or solid fuels. The second source of process heat is the burning of a controlled amount of the evolved volatile matter and a small amount of coke fines in the kiln.

Combustion of volatile matter is enhanced by the introduction of secondary and tertiary combustion air. Secondary air is introduced through the firing hood and tertiary air introduced through ports in the kiln shell to control combustion of the volatile matter and coke fines. Tertiary air utilization results in significant reduction in kiln fuel requirements.

## Afterburners

KVS' cylindrical afterburners are designed for sufficient residence time, temperature, and effective mixing to affect the required volatile matter and particulate combustion. Combustion air to the afterburner is furnished by a combustion air fan and preheated air from the cooler exhaust system. Afterburners can be designed for 100% firing capacity when the kiln is down, thus providing the operator uninterrupted steam production and/or electrical power generation.



*Efficient cylindrical afterburner*



### Coolers

Metso's rotary cooler design utilizes both a direct water quench of the hot coke at the cooler entrance and counterflow movement of ambient air to cool the coke. The direct quench type is the most widely used method of cooling in the coke calcining industry.

### Kiln feed pipe

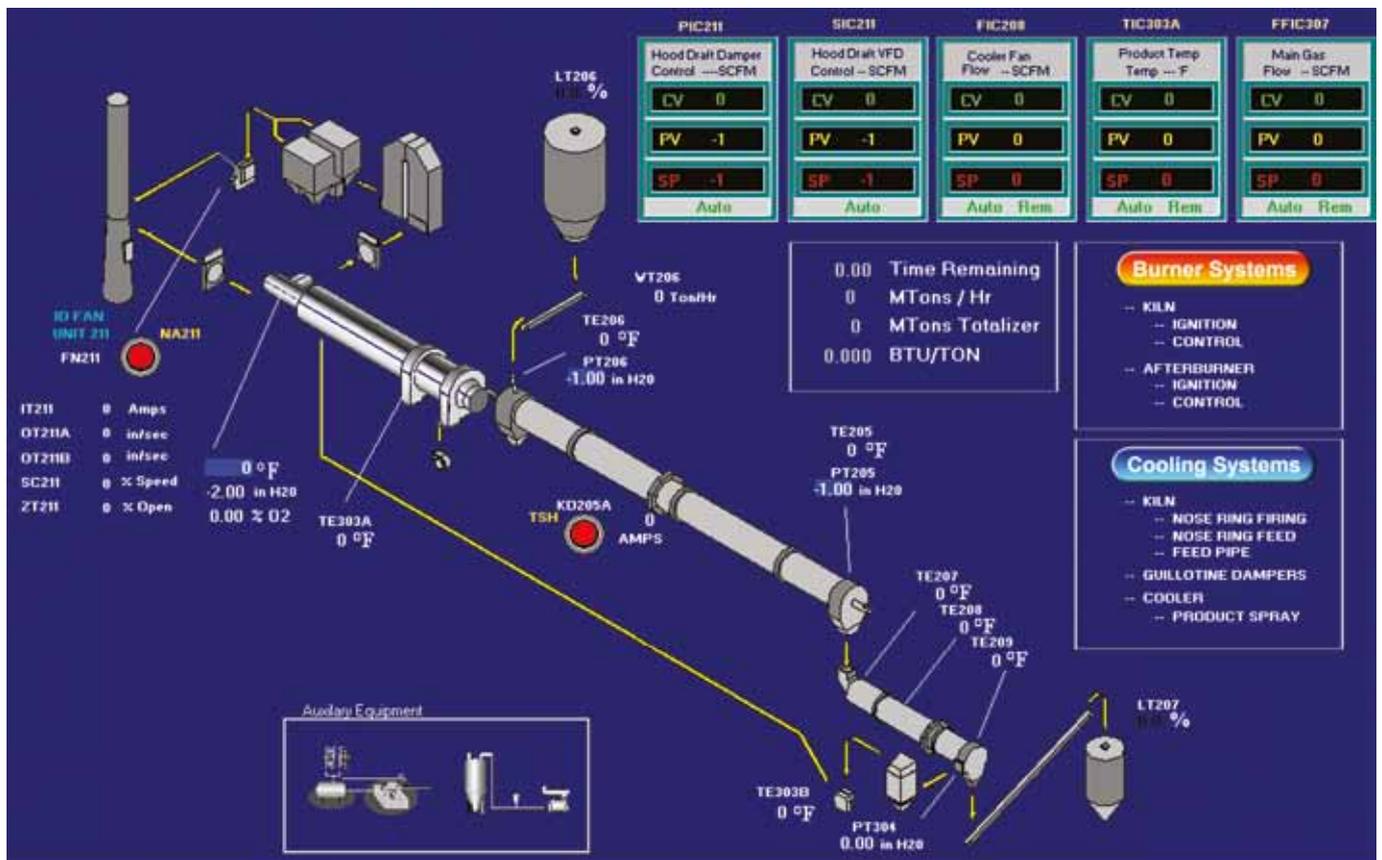
The stainless steel double wall construction, refractory lining, and forced fluid cooling of the pipe enhances the design reliability and extends its operating life. A carbon steel 'Y' piece outside the kiln hood provides easy cleanout access.

### Air seals

Metso's air seals (marketed as Goodeal and Superdeal seals) with their overlapping steel plates provide an air seal that significantly reduces ambient air infiltration into the rotary kiln. By limiting air infiltration, fuel efficiency is improved and power consumption is reduced. The seals' simple, yet effective design requires little maintenance and allows for easy replacement.

### Heat recovery/air pollution control equipment

metso's total project capabilities provide the client with a 'one stop shopping' approach. Metso includes in our total equipment package waste heat boilers to recover a large percentage of heat released in the afterburner and air pollution control systems to meet applicable environmental regulations.



### Programmable Logic Controller (PLC)

A Programmable Logic Controller (PLC) – the heart of the control system – provides monitoring and interlocking functions. The PLC constantly checks for any abnormal conditions. Based upon its intended sequence, the PLC will take appropriate corrective action to keep the process or sequence within proper operating conditions. Metso programs and pre-commissions the PLC at its facility or sequence within proper operating conditions. Metso programs and pre-commissions the PLC at its facility before shipping to the calcining plant.

Metso supplies the Man-Machine Interface software, which provides access to the operating system through industrial personal computers. The total coke calcining plant as well as exploded details of sections of the plant area are readily available to the system operator through the graphic screens provided by Metso.

### Optimization Control System (OCS)

Metso has developed an advanced control system using our proprietary Optimization Control System (OCS), which is superimposed on top of the PLC control system. OCS is an upper level control application used to determine set points and to stabilize and maximize coke kiln performance. This software can be run on the same computer as the existing Man-Machine Interface or on a stand-alone computer. The OCS will execute a proprietary set of rules created by Metso for the coke calcining system. OCS has improved product quality, system capacity, fuel and electrical consumption.

# Technical specification

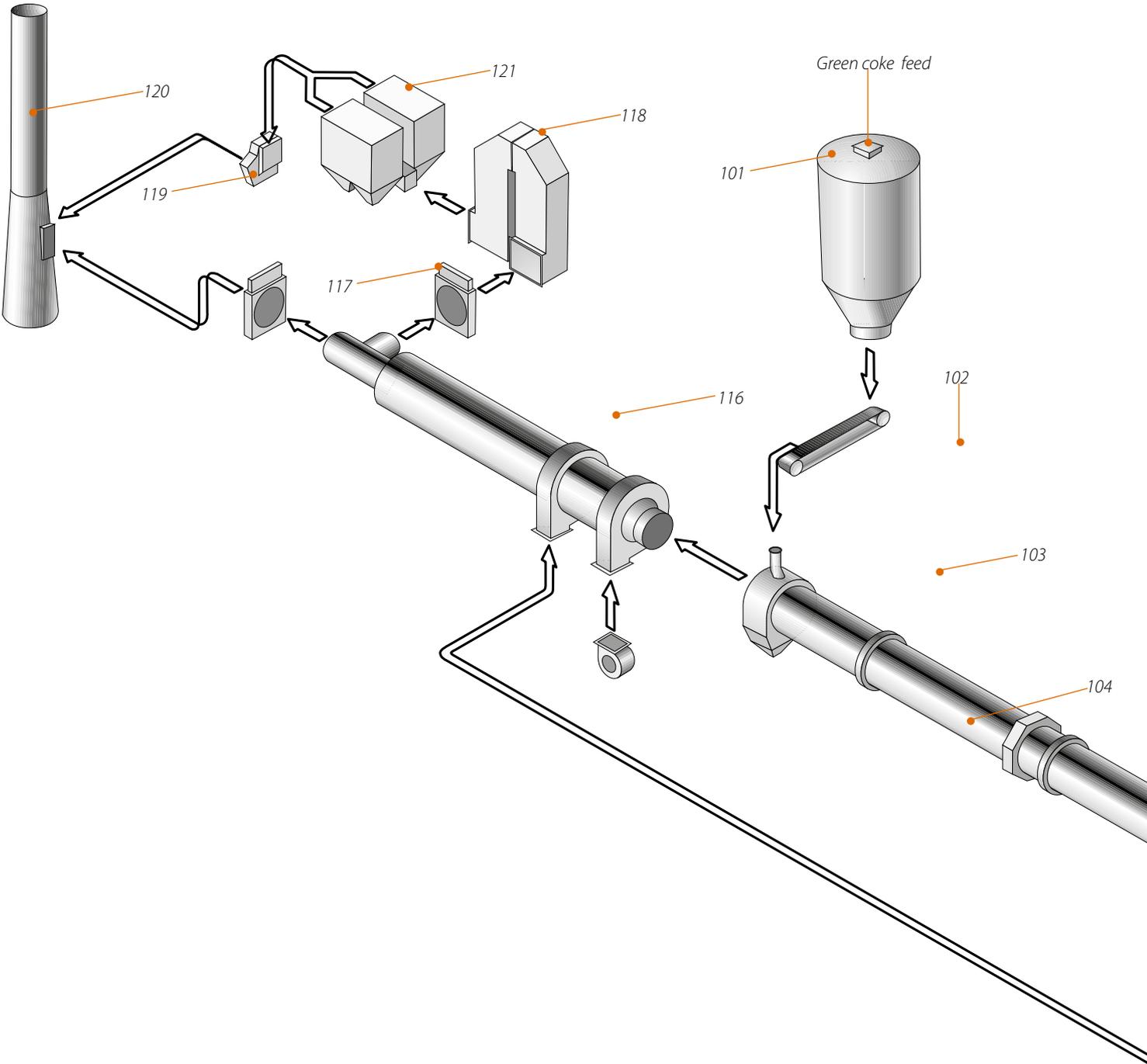
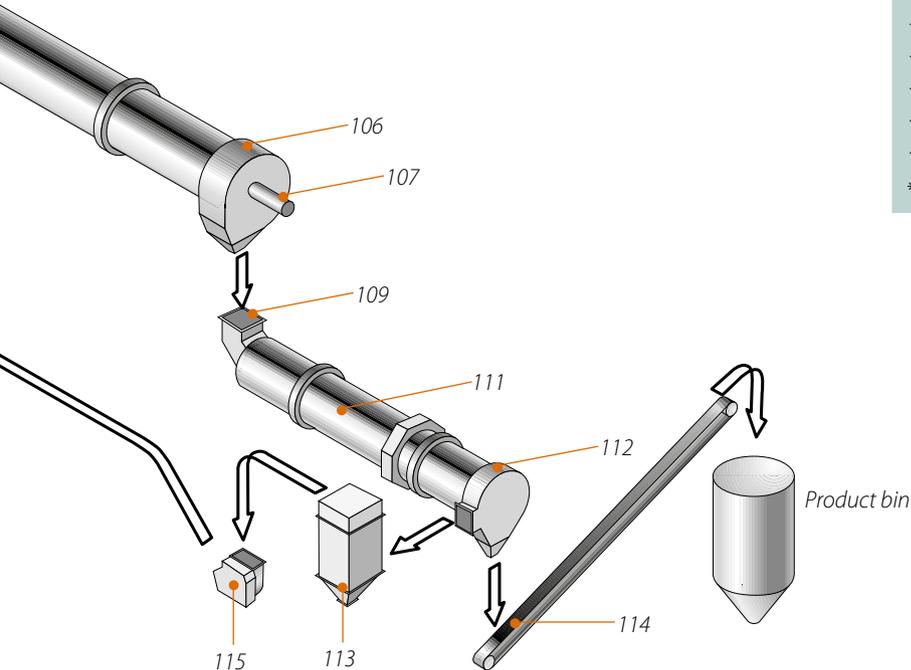


Table 1. Typical sponge coke specifications		
Item	Green coke	Calcined coke
Moisture	6%-14%	0.1%
Volatile Matter	8%-14%	0.5%
Sulfur	1.0%-4.0%	1.0%-4.0%
Silicon	0.02%	0.027%
Iron	0.013%	0.02%
Nickel	0.02%	0.03%
Ash	0.25%	0.4%
Vanadium	0.015%	0.3%
Bulk Density	45-50 PCF (720-800 Kg/m <sup>3</sup> )	45-50 PCF (720-800 Kg/m <sup>3</sup> )
Real Density		2.06 g/cm <sup>3</sup>

Table 2. Typical needle coke specifications		
Item	Green coke	Calcined coke
Moisture	6%-14%	0.1%
Volatile Matter	4%-7%	0.5%
Sulfur	0.5%-3.0%	0.5%-3.0%
Silicon	0.02%	0.025%
Iron	0.013%	0.02%
Nickel	0.02%	0.03%
Ash	0.25%	0.4%
Vanadium	0.01%	0.02%
Bulk Density	45-50 PCF (720-800 Kg/m <sup>3</sup> )	45-50 PCF (720-800 Kg/m <sup>3</sup> )
Real Density		2.11 g/cm <sup>3</sup>

Reference no.	description
101	Kiln feed bin
102	Weigh feeder
103	Feed hood
104	Rotary kiln
105*	Tertiary air system
106	Firing hood
107	Firing system
108*	Secondary air fan
109	Transfer chute
110*	Cooler inlet w/water quench
111	Rotary cooler
112	Cooler discharge housing
113	Dust collector
114	Product conveyor
115	Cooler exhaust fan
116	Afterburner
117	Bypass and draft control guillotine dampers
118	Waste heat boiler
119	Induced draft fan
120	Natural draft stack
121	Baghouse dust collector
122*	Dust bin
123*	Control room
124*	Mcc room

\*Denotes items not shown





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