

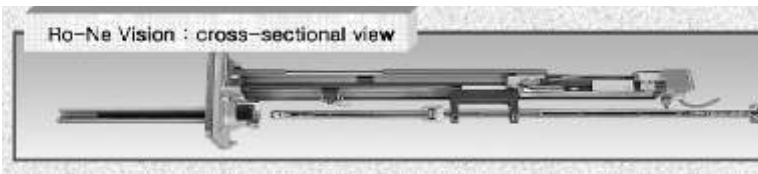
## FURNACE MONITORING SYSTEM

◆ 10.1 INTRODUCTION : Furnace monitoring systems are essential for viewing inside conditions of the hot furnace. Traditionally peep holes were provided in the furnace for this purpose, but with advent of better protections and technology available for getting this picture ion the control room had provided a big advantage for the operator and the plant management.



Furnace monitoring cameras are being used for Cement, Steel, Glass and power plants; for viewing inside the rotating kilns, clinker coolers, melting furnace, boiler burner furnace etc.

The detail of advance furnace camera is as under:



Parts		Description
Vision Tube	Lens	- Block-type : Easy assembly/ disassembly by user. (Easy installation/ maintenance & repair, cost-saving)
	Camera	- Ultra small high definition ¼" Sony CCD SENOR camera installed inside the tube. (Decreased weight to enable self-powered retraction by windup-spring)
	Inner Tube	- Part where block type lens is located.
	Outer Tube	- Made of special materials to protect inner tube from high temperatures.
Retractor	Windup Spring	- Do not need to use motor or pneumatic of the past. - Using windup-springs. Vision Tube can be retracted without a power source.
	Electric Lock	- Prevents arbitrary retraction caused by spring elasticity. Receives signals from the control panel and unlock to enable automatic retraction.
Control Panel	Electric Control	- Alarm goes off when power supply is cut. - Sends signal to electric lock - Automatic, manual, semi-automatic control.
	Air Control	- Alarm goes off when air-pressure goes below a certain level. - Prevents damage to Vision Tube inflicted by high temperatures inside furnace caused by a cut of air supply. - Cooling Vision Tube by consistent provision of compressed air.



**Relay lenses**



**Miniature CCD camera**



**Wind up spring**

Special air cooled high temperature lenses with a color CCD cameras provide real time monitoring inside the boiler or furnace. The new furnace vision camera employs air cooled probe which is designed for continuous operation in furnace temperature up to 1700°C. The latest furnace monitoring system is built up in a block camera, which provides faster and cheaper maintenance of the furnace camera, which is a big problem faced with other camera on the market. The Ro-Ne-Vision system is much lighter and does not uses water cooling.

The retraction system assists in protecting the camera in case of failure of power of air supply for cooling the camera, reducing the chances of camera breakdown.

The system is flexible and easy to install on the furnace wall and incorporated a 68° horizontal and 50° vertical field of view; giving an overall better view. The traditional straight view lens tube is typically used for most wall fired boilers. The offset angle lens can be used in smaller tangential fired (corner-fired) boilers.

Thermal view camera is also available with a possibility of providing the average temperature display of any 32 points/area. The data can be used for control or can be recorded for further analysis.

## ◆ 10.2 BRIEF APPLICATION DETAILS

### 10.2.1 CEMENT KILNS AND COOLERS

The kiln operator must have reliable data from the kiln to make best firing decision. The furnace camera provides the view of inside the kiln right in the control room. The furnace camera provides the view of the flame, monitoring the length, the direction and its effect on the feed. Better monitoring aids in getting the best operating conditions for the flame and helps with fuel efficiency. Flame temperature can be monitored as well when burning coal or petroleum coke, by observing color changes or choosing for the thermal imaging camera.

The camera for the coolers section provides the view inside the coolers and is important for monitoring the cement clinker condition, which is very important for the product quality.

### 10.2.2 POWER UTILITY BOILERS

Cameras have been used to view inside the coal and oil fired power utility boilers for decades to facilitate startup or "light off". The potential for explosion inside the boiler exists when the fuel does not light as it should, thus viewing this process helps prevent this type of unwanted reaction. In the past, flame detectors were used to assist in light-of but were not as reliable as necessary. Black and white cameras were also used assistance but often pulled out once the boiler was on full load, since they rarely performed well across the full dynamic range of the boiler. Now, with the new systems it is possible to continuously monitor the furnace conditions.

The camera is positioned relatively low above the top row of burners while obtaining a full view of the entire boiler (all four corners). This is critical when the operator wants to see the entire "fireball". The fireball is formed by the combustion process of all the four corner burners. As the fuel is injected and ignites, a circular motion takes place and as heat rises, created a fireball reaction in the center of the boiler. Being able to see this fireball aids the operation in controlling overall burner performance and fuel costs.

### 10.2.3 STEEL

The furnace camera provides a clear view of the steel slab progression in batch or continuous steel reheat furnace and the burner performance. The camera is ideally mounted near the exit of the furnace on the opposite sides above the products. The combined view of the cameras provides 360 degree view of the furnace.

The camera is also useful when mounted just below the height where the slab travels. This aids in viewing the level of scale deposited beneath the steel.

### 10.2.4 GLASS

The furnace camera provides the clear view of the condition inside the glass furnace. This is used to check the molten glass condition, refractory healthiness and the firing pattern inside the furnace.

Thermal view is employed in some cases to provided the thermal view of the furnace. Recording of the data is possible to use for analysis of the refractory life etc.

These camera are also used in the steel kiln applications for viewing the inside of the kiln and the burner flame.

The furnace camera mounted at the entrance of the rolling mill assists the operator in monitoring the slab as it enters the mill.