

## SKYFFOLDING™

Platform-supported Boiler in-furnace Scaffolding & Lifting Systems

## SAFETY PLUS SYSTEM

Smart Scaffolding Safety-Management System

**KLES**

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**KLES**





We Create

Day in day out, for the sake of the safety in places yet uncharted, KLES is vigilantly watching out and adventurously taking chances to push the envelope.

Being rearmed with newly fashioned competitiveness befitting the seachange on the industrial landscape nowadays, we are wholly committed to rendering values to our customers' lives and therewith growing up into a global specialist enterprise.

Safety

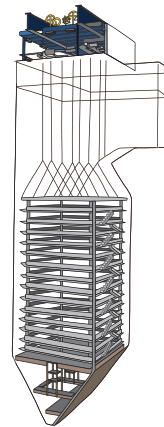
# SKYFFOLDING™

## Platform-supported Boiler in-furnace Scaffolding & Lifting Systems

### The innovatory topdown scaffold system through the changeover of the idea

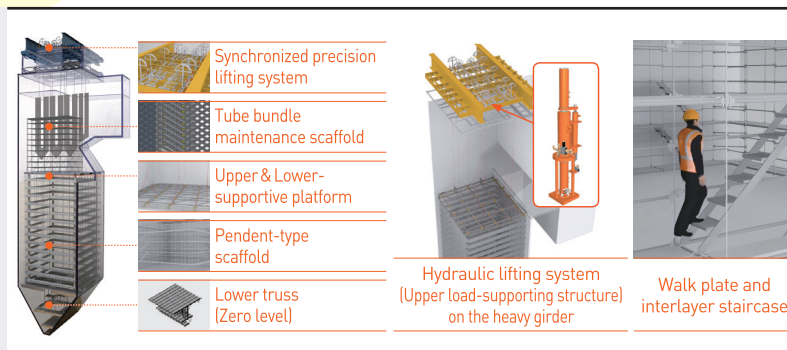
SKYFFOLDING™ is KLES's flagship product systemized for maintenance work inside the boiler furnace of the thermal power plant, made up of "Platform-supported boiler in-furnace scaffolding & lifting systems", and "Smart safety-management system".

KLES SKYFFOLDING™ disruptively innovating the existing boiler scaffold system, first off builds up 'Hydraulic lifting system' on the topmost of the boiler (Heavy girder), and then pendant scaffolds assembled at ground level are lashed down with wire ropes and lifted to systematize layer by layer, whereupon stepping up work efficiencies by way of stabilization of the system with minimized swaying, while proactively warding off workplace disaster arising from the chain reaction triggered by a failure of a member component in case of the conventional upright scaffold.



## 01

### Colossal Configuration



#### 01 / Synchronized precision lifting system

A synchronous system capable of lifting safely with load distribution, keeping up lateral and vertical deviation to a minimum.

#### 02 / Tube bundle maintenance scaffold

A scaffold system for maintenance of the Tube bundle by building up a separate platform and lifting system.

#### 03 / Upper & Lower-supportive platform

A type of platform capable of distributing the loads and thus minimizing the risk of chain collapse, due to assembling on ground zero level and lifting layer by layer.

#### 04 / Pendent-type scaffold

Improving worker safety and workability by employing a safety walk plate, while stepping up worker mobility by introducing a staircase put up between layers.

#### 05 / Lower truss (ground zero level)

Assembling the upper & lower supportive platform after construction of the foundation structure up to Zero (0) Level (Slop tube).

## 02

### It's Not an Option!

#### 01 / Problems raised to existing tower type scaffolding

The existing tower type in-furnace scaffolding system, used to maintain and repair the boilers in thermal power plants, resorts to the erection method of stacking scaffolds from the bottom up. When putting up and taking down the scaffolds, the working has to take place inevitably at high places in danger. Furthermore, since all the loads of the system get concentrated to the bottom, it may well lead to the collapse of the whole scaffold system if triggered by missing or breakage of even a tiny part of members. Such workplace accidents brought on by scaffold collapse would be liable to end up with fatal life injuries and losses, while collateral boiler damages and prolonged repair periods give rise to cutting back the power production, on the other hand, thereupon incurring considerable financial losses.

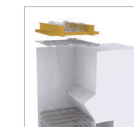
*SKYFFOLDING™, a Disruptive Technology for Boiler maintenance coming up through thinking outside the box.*

#### 02 / A paradigm shift in Scaffold Industry, Cloud Ladder SKYFFOLDING™!

This innovative top-down scaffold systemizer and its exclusive construction method not only ward off the onset of chain collapse of in-furnace scaffolding but also minimize high-site operations by means of enabling working on ground zero level for assembly and disassembly, thus avoiding safety accidents. In addition, the system has dramatically improved conveniences and efficiencies in workability, such as setting up all-around walk plates in front of four sides of the water-cooling wall, laying staircase instead of hanging ladder for the movement between layers, and so on.

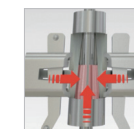
## 03

### Safety-Shield Features



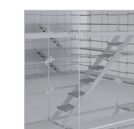
#### 01 / Avoiding the risk of chain collapse

On the Heavy girder in the penthouse of the boiler, the strand lift jacks are installed, and then thereto lashed down by the strand to the platform that supports the upper and lower parts of the system, so that all the loads can be supported from the top.



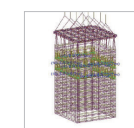
#### 02 / The loosen-proof safety design of wire clamp

The more load is applied, the farther the clamp tightens the wire rope, therewith beefing up its clamping force.



#### 03 / Easy-to-work walk plate & Easy-to-move interlayer staircase

Walk plate designed to ensure easiness and convenience for the working, together with staircase put up between layers taking the mobility into consideration. In an effort to reduce manufacturing costs and improve installation conveniences, the prefabricated system scaffold components and members are used in.



#### 04 / Review of platform & scaffold structure

The structural safety and stability have been secured by verifying the stress and strain amounts at the upper support points when the loads are applied to downward scaffolds. In addition, the working loads on the scaffold have been figured out and reviewed to the extent to work by a total of 20 persons in one layer of all 4 sides, or by 5~6 persons on each side.



#### 05 / Improved work efficiency exceeding 90% in terms of workable spaces

Perfectly improving work efficiencies in detail inspection and repair by way of putting up walk plates onto all fronts of four sides of the water wall.

#### 01 / 02 / 03 / 04

Safety Design  
in priority

#### 05

Economy and  
convenience  
of design

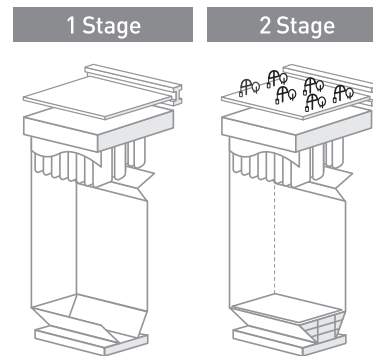
## Erection Procedures

### Strand inlet hole location

Locating and selecting Roof wall tube holes suitable for the avoidance of Boiler internal tubes and HDR interferences.

Building up Hydraulic lifting device on Boiler heavy girder/Constructing Lower truss

- Installation of lifting and loading fixtures at selected positions
- Construction of overall walk plate with Truss structures up to Zero level

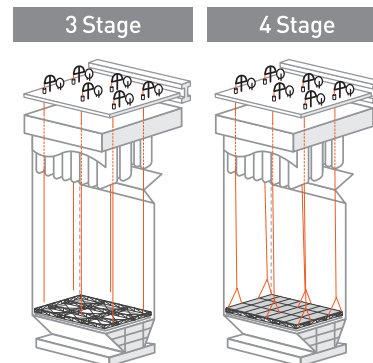


### Installation of the Platform inside Boiler.

- Tying up upper and lower supportive platform to the lifting system

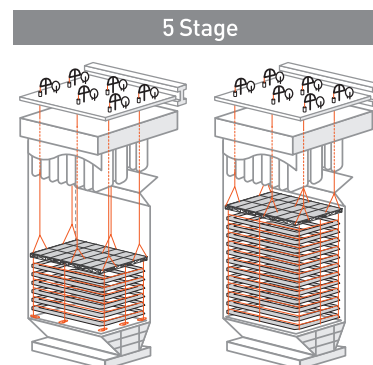
### Construction of Wire Rope Type Scaffold System underneath the Platform

- Constructing the wire rope scaffold underneath by lifting the platform



## Lifting and Assembling Scaffold

Constructing scaffold on four sides of the water-cooling wall, while lifting platform by 2 meters each.



## Track Record

## Certificate and Patent

2020	KOEN	- Samcheonpo power plant #5, 6 - Yeongheung power plant #1~4	
	EWP	- Dangjin power plant #1~4	
	KOMIPO	- Jeju power plant #2, 3	
2019	GS DEP	- Bukpyeong power plant #1, 2	
	Hyundai Greenpower	- Dangjin power plant #1~8	
2018	KOMIPO	- Boryeong Power Plant #7, 8 - Sinboryeong Power Plant #1, 2	
		KOEN	- Yeongheung Power Plant #1~4
2017	KOSPO	- Samcheok Power Plant #1, 2 - Hadong Power Plant #3	
	EWP	- Dangjin Power Plant #5~8 - Dangjin Power Plant #9, 10	
		WP	- Taeon Power Plant #7, 8 - Taeon Power Plant #9, 10
	KOMIPO	- Boryeong Power Plant #3~6	
	2016	KOEN	- Samcheonpo Power Plant #1~4 - Yeongheung Power Plant #5, 6
			KOSPO
WP		- Taeon Power Plant #5, 6	
2015	KOEN	- Samcheonpo Power Plant #5, 6	
	KOSPO	- Hadong Power Plant #7, 8	
2014	KOSPO	- Hadong Power Plant #1~6	



- 1 **Patent** - Pendent assembly type scaffolding system for large scale boiler furnace
- 2 **Patent** - Installation & disassembly methodology for platform-supported in-furnace scaffolding and lifting systems
- 3 **EPC(Excellent Performance Certification)** - Platform-supported lifting system scaffolds
- 4 **Certification for New Excellent Technology** - Installation and disassembly methodology for in-furnace scaffolding and lifting systems



# Safety Plus System

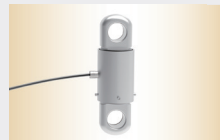
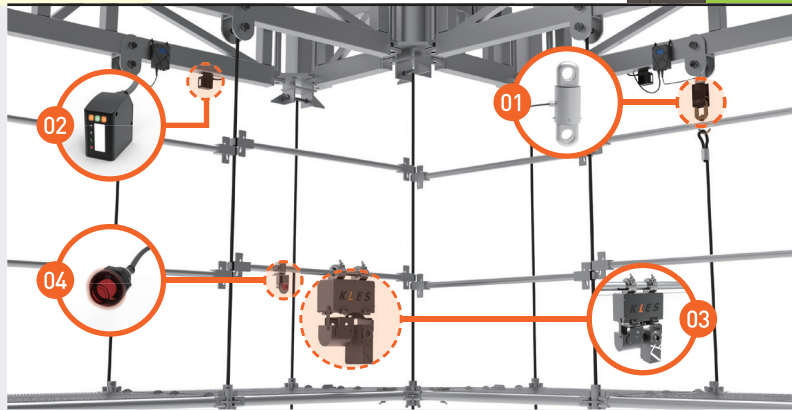
## Smart Scaffolding Safety-Management System

This Smart in-furnace scaffolding safety-management system has been designed and developed for the safety and security of the workmen who are working inside the dark and noisy furnace. By organizing the system along with SKYFFOLDING™, you can efficiently manage the safety and wellness of workers in the furnace exposed to many kinds of dangers.



## 01

### Failsafe Configuration



#### 01 / The load measuring module

Realtime monitoring of load distribution onto in-furnace scaffolds, whereupon preventing any accidents on account of the unbalanced load across the system, and detecting any load changes on in-furnace scaffolds so as to confirm whether the worker is left behind in the furnace workplace.



#### 02 / The displacement measuring module

Measuring the displacement of the support structure (Platform), in order to monitor any outbreak of deformation or displacement anomaly.



#### 03 / The workman monitoring module

Checking if the presence of workmen left behind, by making use of IR thermal image camera which can scan the whole scene with panning and tilting to surveil all the 4 sides and corners throughout the boiler.



#### 04 / The alarm module

Alarming the danger to workers staying in the furnace when any contingency signal(s) is detected, including overloads in the rated or work load on in-furnace scaffolds.

## 02

### Outsmarting Security Features

#### 01 / Usability in managing/supervising workers in the furnace

Detecting in realtime if any outbreak of eccentric load or abnormal displacement of the scaffold support structure, so as to alarm the danger to in-furnace workers when such an abnormal signal(s) takes place; which shall relieve the workers from worksite anxiety as well as beef up supervisory usability. Besides, the system can check if any presence of residual workers inside the furnace workplace, after installing/disassembling the scaffolding or repairing the boiler putting the scaffold to use.

#### 02 / Utilization of Safety Plus management program, mounting user-friendlier interface enabling data visualization

Safety Plus is configured with the Server system and the Client system. The Server collects, stores, and manages the load and displacement data in realtime. Particularly, on the Safety Plus Viewer program installed in the Client system, the user can monitor in realtime the scaffold state in 3D, and whereabouts of the checked-in workers, alongside the functions of thermal image verification, data history trend analysis, alarm history trace management, etc.

#### 03 / Prevention of the deformation or collapse of the scaffold system

Realtime monitoring of the loads acting on the scaffolds and the displacements of the boiler tube makes it feasible to take immediate action in response to the outbreak of abnormalities across the system.

#### 04 / Building up a worksite of security and wellness

The workman monitoring module is designed to check in on any workman if left behind, taking advantage of temperature information acquired from the IR camera; simultaneously to check in & out workman by tracking their whereabouts through wearable gear; additionally to check up on the wholesomeness at the worksite using wireless sensors, such as temperature, humidity, oxygen & carbon dioxide, and dust concentration.

## 03

### Expected Effects

#### 01 / Building up the more safe worksite environment

Due to the harsh working environment in such a noisy and dark boiler, extraordinary cares should be taken of the safety control for the workers in the furnace. The workman monitoring module of KLES Safety-management system furnishes information on the location of the worker through the IR camera, at the same time as tracing the location of the worker using the wearable gear and looking up the worker's access history. Besides, wireless sensors are put into use to collect information on working environments such as temperature, humidity, oxygen and carbon dioxide, and dust concentration. These workman safety control functions assure safe management/supervision for workers in all working environments such as on construction sites as well as in boiler furnace work.

#### 02 / Prevention of the deformation or collapse of the scaffold system

By realtime monitoring the load acting on the scaffold in the furnace and the displacement of the boiler tube, it is possible to immediately catch up and cope with the overload of the scaffold and the outbreak of the displacement, thus avoiding the collapse of the scaffold system.

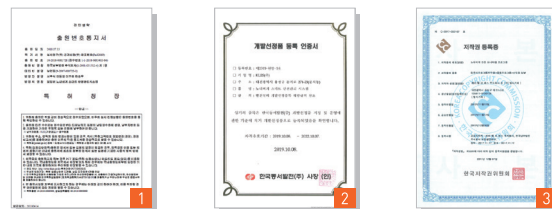
### 03 / Awakening to safety insensibility and Relief from work anxiety

- Detecting and alerting in realtime if any outbreak of unbalanced load in scaffold system or abnormal displacement of the scaffold support structure, so as to ease the anxiety of workers and step up supervisory usability.
- Preventing safety accidents from happening by monitoring if any presence of residual workers inside the furnace workplace, after installing/disassembling the scaffolding or repairing the boiler putting the scaffold to use.

### 04 / Tangible & intangible economical effects

Not only warding off the accidental loss of life due to scaffold collapse as well as the unplanned financial losses including the repurchase of scaffolding system, but it will contribute to making up the safe and secure workplace image by carrying through far more safe inspection and maintenance works, by way of the introduction of this Safety-management system.

2020	KOSPO	- Samcheok power plant #1, 2
	KOEN	- Yeongheung power plant #5, 6
	KOMIPO	- Shin-Boryeong power plant #1, 2
2019	KOSPO	- Hadong power plant #1~8
	EWP	- Dangjin power plant #9~10
2018	GS DEP	- Bukpyeong power plant #1, 2
	KOSPO	- Hadong power plant #6, 7
2017	KOSPO	- Hadong power plant #3



- 1 Patent-pending - Boiler in-furnace scaffold smart safety-management system
- 2 Product Selected for Development - in-Furnace scaffold smart safety-management system by Big Five of KOSPO, KOEN, KOMIPO, KOWEPO, and EWP.
- 3 Program Copyright Registration - in-Furnace scaffold safety monitoring program

# We Create Trust

What we need to create is not just a product,  
but that value of safety.

Because that is a promise we made to the customers,  
a promise we must keep under the name of KLES



## 04

### Track Record

## 05

### Certificate and Patent