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Lift-up Method for the Top Mast on the KLCC Tower, a Very High Building†

1. Introduction

The construction of the KLCC Tower No. 1 Building (**Photo 1**, Malaysia) was completed in 1997. The pinnacle (**Photo 2**) of the topmost section of this building includes a tower portion measuring 65.175 m in total length and weighing 170 t. The portion, the so-called pinnacle mast, was constructed by a jack-up method with step rods, a method developed by JFE Civil Engineering & Construction.

The strategy initially considered for the installation of the pinnacle mast was to divide the mast into sections of 10 t or less and stack them on the site with a 120 R tower crane (lifting load: 10 t). However, this stacking method would have required an outside scaffold in order to install the mast in the prescribed position. The work would have also been quite dangerous, taking place more than 400 m above the ground in frequently strong winds. And once the mast was installed, there would have been additional work to dismantle the outside scaffold and tower crane. As an alternative, the builders decided to adopt the jack-up method, a method requiring no outside scaffold. A temporary opening for jack-up was installed in the middle part of the building and an inside scaffold for welding was provided near the temporary opening[1].

This report introduces the jack-up method for this pinnacle mast.

Photo 1 A view of KLCC Tower

Photo 2 Lift up construction finished

2. Lift-up Method

2.1 Project Outline

Project Name of the work :
KUALALUMPUR CITY CENTRE TOWER 1,
SHELL & CORE CONSTRUCTION WORK
Contractor :
MAYJAUS J.V. Hazama/J.A. Jones Co. (USA)
and others
Construction period : Feb., 1994 to Jan., 1997
Building : 6 levels under ground,
92 levels (88 stories) above ground
Building height : 451.9 m from the ground (eave height:

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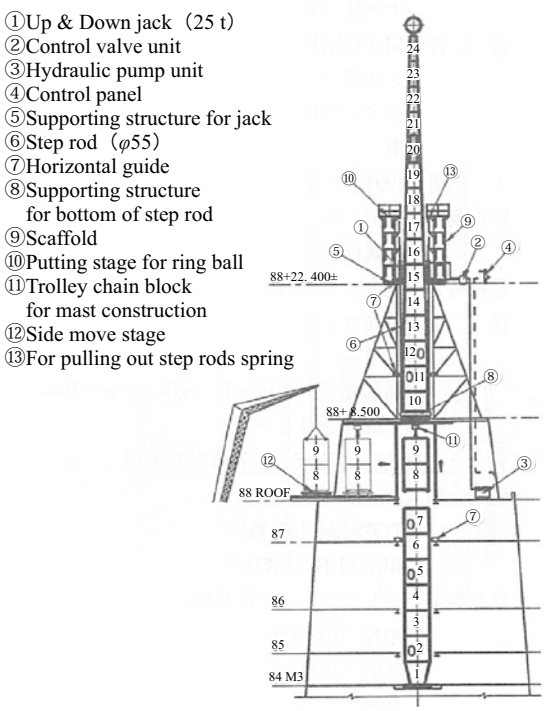

Fig. 1 A cross section of Lift up construction method

382.3 m)[1)]

2.2 Outline of the Lift-up Method

Figure 1 shows a cross section of the jack-up method underway.

Lift-up jacks were installed at the building level L88F22, 400 from the ground. Center-hole-type jacks with step rods were adopted in the lift-up equipment (Photo 2).

The mast was to have a final weight of 170 t after its installation. Therefore, two jacks (capacity: 25 t each) were arranged in each of the four lifting positions to build a lift-up system with the capacity to lift a maximum of 200 t maximum by eight jacks.

The mast was composed of 24 blocks. First, the upper 15 blocks were assembled and lifted up. Next, the lower 9 blocks were assembled next and the single mast obtained by combining the upper and lower blocks was lifted up (see the steps of the jack-up method in **Fig. 2**).

A guide rail method was used to reduce the effects of external forces such as wind during the lift-up work and to reduce the need to correct the plumbing of the mast after the work was completed. Specifically, a roller was provided at the leading end of the mast, and the shaft was inserted and extracted by screws[1)].

2.2.1 Features and mechanism of Jack system

The civil engineering jack-up system of JFE Civil Engineering & Construction with step rods has the following features: (1) loads are held safely and positively by a mechanical locking mechanism; (2) loads can be

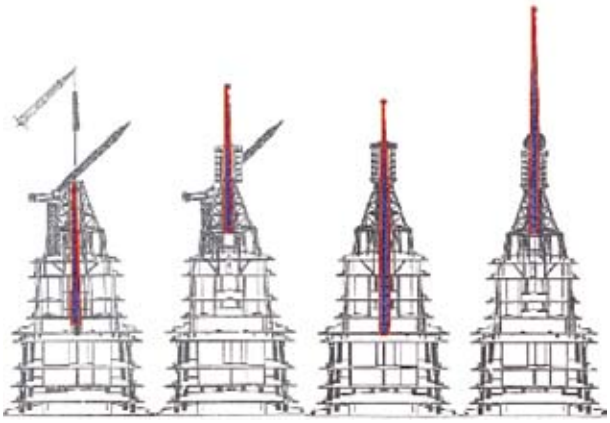

Fig. 2 Steps of Jack up construction

brought into a condition of equilibrium; (3) ascending and descending speeds can be adjusted; (4) bending due to the eccentricity of the rods and jacks is prevented; (5) level errors of lifted bodies during ascent or descent can be monitored by a counter via the control panel and controlled to within specific ranges; and (6) a central control method by an electrical system is adopted.

The hydraulic jack is a center-hole type through which the step rods can be inserted (**Photo 3**, **Fig. 3**). Cone-shaped collets are built in the upper and lower collet desks, and the collets bite the step parts of the rods.

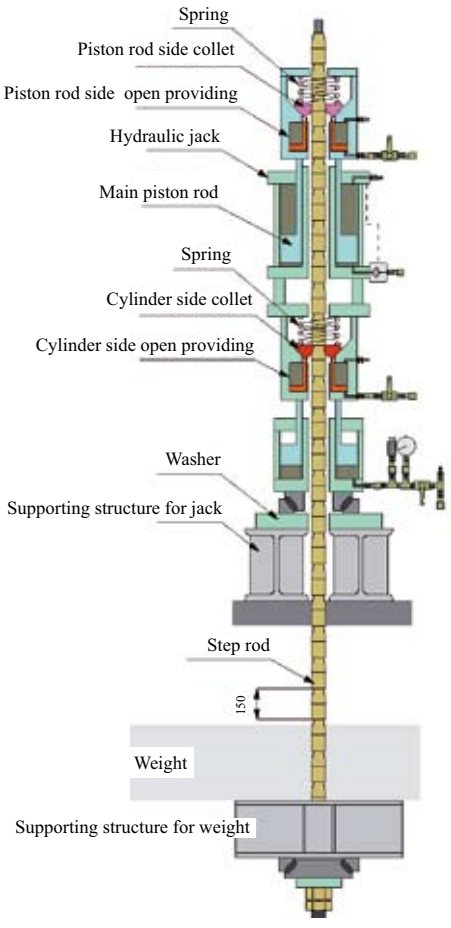

Fig. 3 A cross section of Jack system

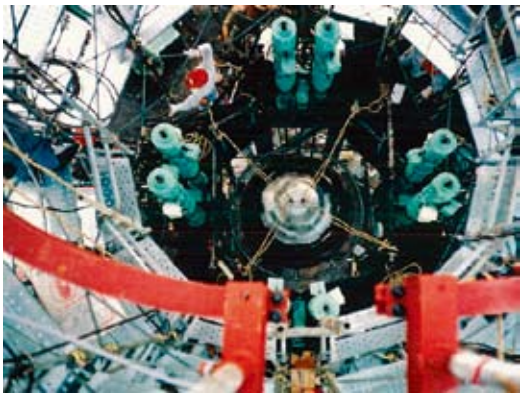

Photo 3 Jack system arrangement, looked down from top frame

3. Conclusion

The jack-up system used in the construction of the KLCC Tower No. 1 Building was introduced. The lift-up work took place at a high elevation of 400 m above the ground. Because the weight was relatively light and the lifted object was a mast, it was difficult to maintain balance during the lift-up process without jack-stroke keep system.

In the construction of what was the world's highest building at that time, the work could be executed in a short period with high accuracy and safety by incorporating the hydraulic jack-up system.

References

1) Pinnacle Lift up Work. Fluid Technology. 1999-03.

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