Zeitschrift: IABSE structures = Constructions AIPC = IVBH Bauwerke
Band: 8 (1984)
Heft: C-30: Industrial cranes

Artikel: Lifting frame for heavy equipment
Autor: Aschrafi, Mehdi
DOI: https://doi.org/10.5169/seals-18829

4. Lifting Frame for Heavy Equipment

Manufacturer and Owner:
DSD Dillinger Stahlbau GmbH

Introduction

The lifting frame, developed and constructed by DSD, has been designed for extraordinary lifting loads and lifting heights of large prefabricated parts, as occur for example in the case of reactors and columns.

The special charactersitics of this lifting frame are worth mentioning:

- the lifting system is designed to be used without guy wires thus eliminating the need for «dead-men» and associated problems: on sites with limited space this is of great importance with regard to economical and speditive execution, and interference with other activity scheduling,
- in cases of adjacent locations for vessels the lifting frame can be moved from one position to the next without dismantling,
- modified versions of the lifting frame can be tailored to suit particular site conditions,
- due to its uncomplicated and lightweight structure, quick erection and dismantling of the lifting frame is ensured,
- the lifting frame is designated to lift six times its own weight,
- in case of poor soil conditions the lifting frame can be placed on sleepers or light slabs, thus reducing the need for expensive ground preparation.

Description of the system

The lifting frame is a space frame system of members and trusses, formed by 2 «A» frame pylons, which are connected at their tops (vertical to their plane) by means of trusses (Fig.1).

In the plane of the «A» frame pylon, the four supporting members are inclined to the vertical at 9.5°; in the plane of the frame the inclination is 4° or 2°, respectively. In the plane of the pylon the bases of the supporting members are held by tension members to avoid «spreading».

Projecting stay girders are arranged on the frame, the ends of which are connected to the bases of the supporting members by means of cables and hydraulic jacks.

By means of active deformation controls, horizontal displacements due to horizontal loads (wind, lateral impact) can be reversed by means of these cables so that any movement of the load to be lifted and thus of the center-line of the lifting frame away from the system center-line is held to the minimum.

The cables are prestressed by means of the hydraulic jacks in steps to suit particular wind loadings.

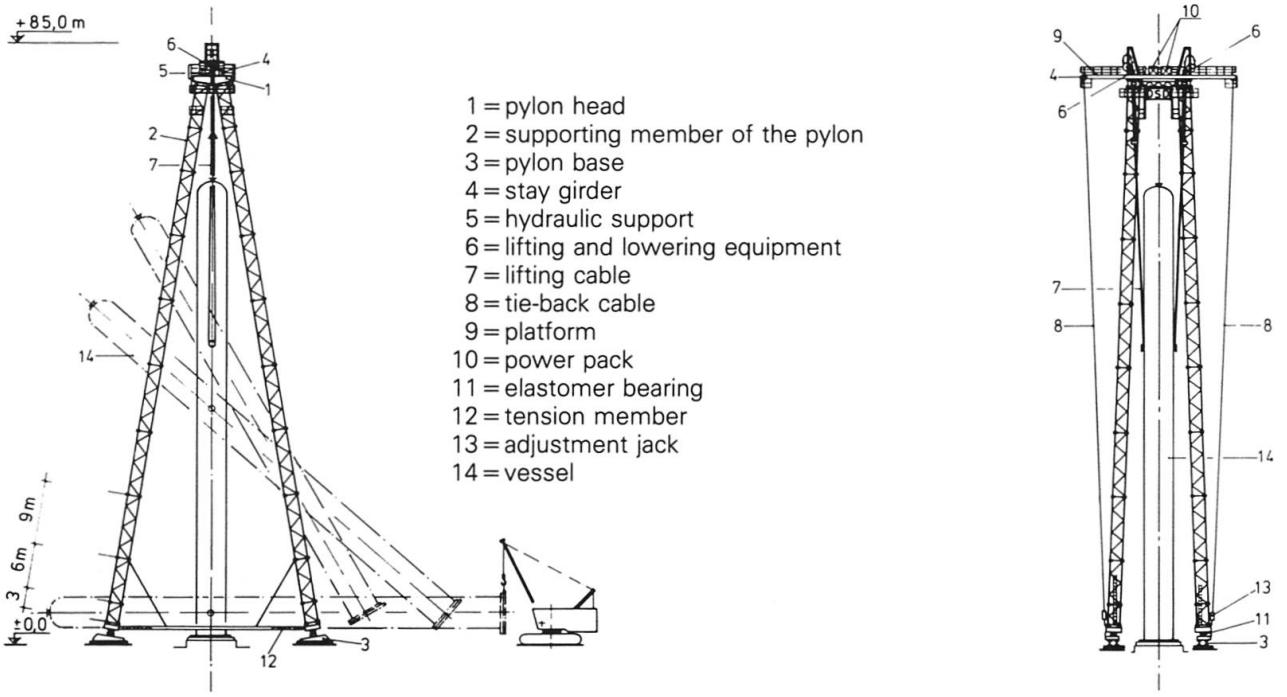


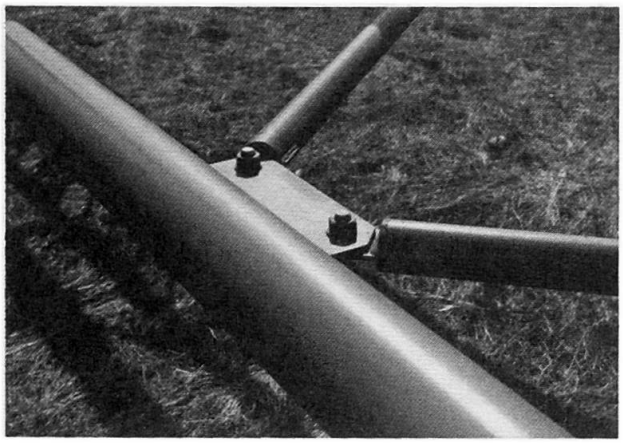
Fig. 1 Lifting frame layout

Structure

Supporting Members of the Pylon

In order to reduce the erection costs and at the same time to ensure the adaptability made necessary by the eight different usage, a modular structural system was created, which makes it possible to adapt to the desired usages by adding only a few accessories. The module is a lattice girder of square section, the chords and bars of which are formed by tube sections. These modules have a section of 1.6 × 1.6 m and a length of 9 m. Parts with equal sections but with lengths of only 3 or 6 m, respectively, permit a better adjustment of the length of the pylons to the respective conditions of usage.

The joints between the components are shown on Fig. 2. They permit , easy and quick assembly.



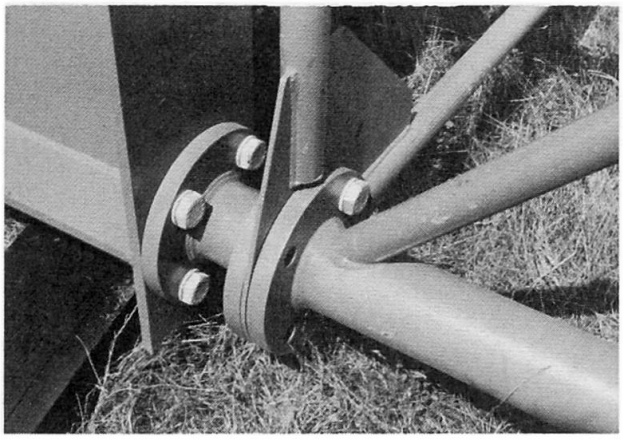


Fig. 2 Joints between individual components a) vertical bars b) diagonal bars

Pylon Head

The pylon head consists of two solid web girders with a structural heigth of approximately 1.2 m, from which the hydraulic support is suspended and which at the same time serve as support for the stay girders.

Pylon Base

The loads due to dead weight and equipment of the lifting frame as well as live load, temperature and wind are transferred to the supporting girders by means of four elastomer bearings.

In order to prevent the horizontal forces (spreading forces) due to vertical loads from being transferred to the foundations, tension members are arranged above the elastomer bearings. In this way it is possible to reduce the dimensions of the foundations of the lifting frame considerably and to take even sleepers into consideration as foundations (Fig. 3).

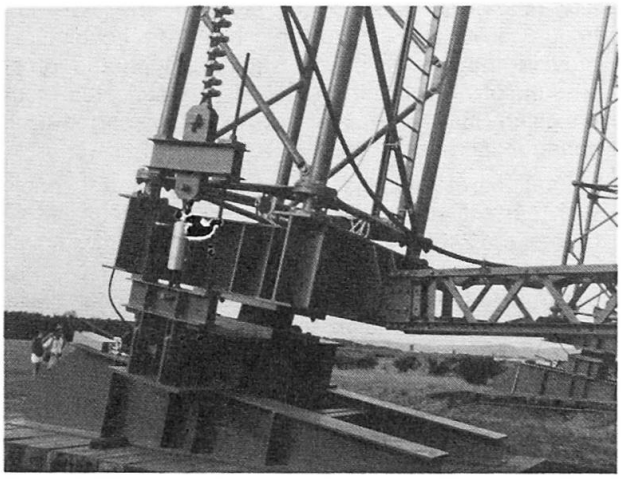


Fig. 3 Pylon base

Stay Girders

The stay girders consist of two HEB 500, which are connected to the pylon head by means of four elastomer bearings. The stay girders simultaneously serve as a working platform and as a platform for the electrical installation.

(Mehdi Aschrafi)

Fig. 4 Lifting frame during the erection of 2 reactors with a weight of 250 t each, in Malaysia