Journal Homepage: - www.journalijar.com
INTERNATIONAL JOURNAL OF ADVANCED RESEARCH (IJAR)
Article DOI: 10.21474/IJAR01/2758
DOI URL: http://dx.doi.org/10.21474/IJAR01/2758
ISSN NO. 2320-5407

RESEARCH ARTICLE

ELIMINATION CONTORTION OR MISS SHAPING EFFECT IN VERTICAL POLE (MAST) OF 50T LEVEL LUFING CRANE.

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Manuscript Info

Manuscript History

Received: 15 November 2016
Final Accepted: 17 December 2016
Published: January 2017

Key words:-
Luffing crane, dockyard, deformation, fixture, mast

Abstract

A level luffing crane is very useful crane in industry as well as at dockyard, ports etc. A level luffing crane consists of a vertical mast which is a very important and supporting structure of crane. Due to various loads of crane like dead load of a crane, load carried by crane etc. the cross section of mast is subjected to deformation. Also changes in diameter occur due to welding is called distortion. The objective of this work is to reduce deformation and distortion of vertical mast. A distortion can be reduced by developing fixture and deformation can be reduced by designing and analysing of mast on software.

Introduction:-

The deformation occurs due to force applied on vertical mast of crane as it is constructed by 13 segments and a flange of 100mm height provided on mast.[1] It consists of mild steel(MS) E250J2 material of thickness 22mm. Outer diameter of vertical mast is 3520 mm and Inner diameter is 3476mm with a length of 14460 mm. As a dead load of 150 tone applied on mast it get deformed by maximum deformation occur on mast.

In material science, deformation refers to any changes in the shape or size of an object due to-

- an applied force
- a change in temperature

Depending of the type of material, size and geometry of the object and the force applied on various types of deformation may result. The different types of deformation occur are as follows.[2]

- Elastic deformation.
- Plastic deformation

Effects of deformation:-

Due to deformation the mast bend littlie downward and can damage the crane. As it is a main support on which crane rotates and carry load can cause damage in machinery and girder. It makes material uncap able to withstand[3].

Distortion:-

Distortion in weld results from the expansion and contraction of the weld metal and adjacent base metal during the heating and cooling cycle of welding process.There are various types of distortion and dimensional change including

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longitudinal, transverse, angular twisting, buckling and bowing. Two or more types of distortion may occur at the same time[4]. In a weld joint, expansion and contraction forces act on the weld metal and on base metal. As the weld metal solidifies and fuses with the base metal, it is in maximum expanded form. On cooling it attempts to contract to the volume it would normally occupy at a lower temperature but it is restrained from doing so. Because of this stress developed between the weld and adjacent base metal[5]. Major effect of distortion are strength of weld joint has been reduced and strength of vertical mast reduces.
In the present study,

Methodology:-

Firstly, for reducing weld distortion, welding was observed and measured the diameter of segments by using mechanical measuring tape. Afterward more knowledge about distortion was taken. The original diameter of vertical mast is ø3520mm outside and inside diameter is ø3476mm. When distortion occurs in first two segments, the diameter was 3526mm and by joining 3rd segment, it becomes 3531mm. But as per company requirement it should be maximum ±5%, which is acceptable.

Heat treatment method:-
When heat treatment method is used, the result is achieved 3533mm which is 13% more than original diameter. But heat treatment method is time consumable method and very costly [6].

Re-rolling method:-
But this method is not possible because it require huge machine for rolling and this also increases the industry cost so, it is not possible to apply [7].

By using fixture:-

Fig.1. Implementation of Fixture

It is also made by mild steel material with a diameter of 3476mm which is internal diameter of vertical mast. The four plate used is of 750mm length, 10mm thickness and long rod is attached which is welded to four plate, It holds the whole fixture tightly[8].

For reducing deformation of vertical mast, collected necessary data of mast, design it on CRE-O software and analyze it on ANSYS software[9]. So first a mast thickness of 22mm and making 13 segments of different height were taken and apply a load of 150 Tone applied and result was found as follows.

The deformation was found 25.478 mm maximum on top of the mast which is high and as per company requirement it has to be reduced up to 10 mm at least. After getting the above result it was decided to increase the thickness of mast but overall thickness of mast will increase the cost so, finally just increased the thickness of upper two segments and one bottom segment on which deformation was high.

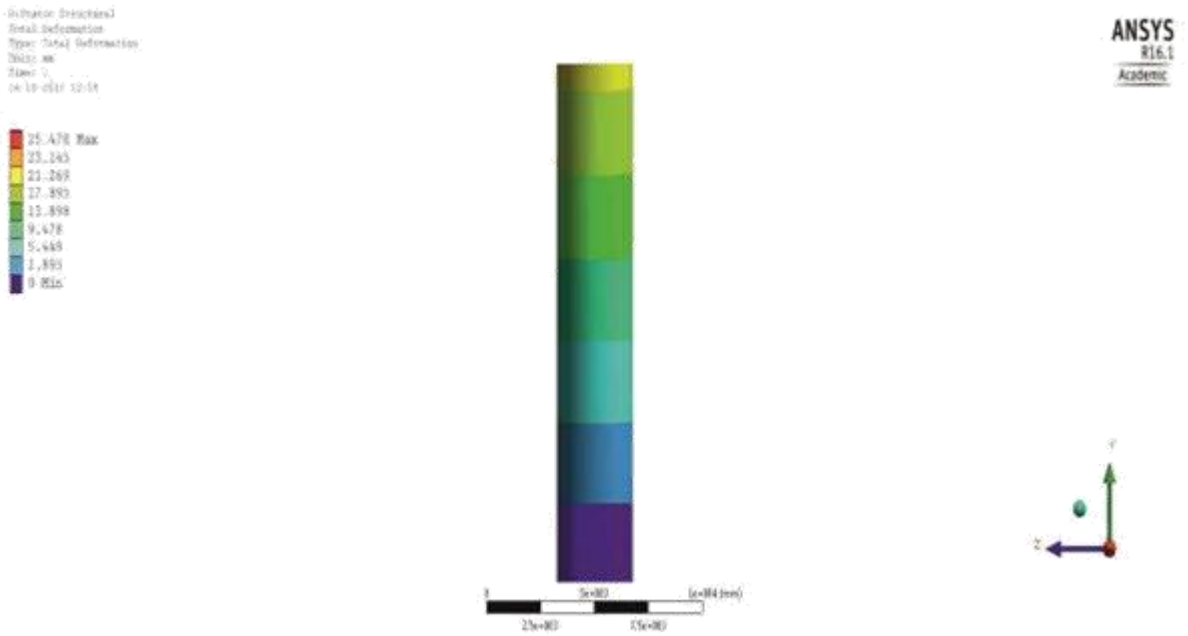

Fig: 2. Design and Analysis of vertical mast for Reduction of deformation

Increasing the thickness of upper two segments and bottom segment thickness from 22mm to 26mm as per standard given by ASME for material and again analysis is done, results are found as follows. Finally found the better achievement of problem as listed in table1. Deformation of mast reduced up to 7.146mm max which is acceptable by company.

Table: 1

Load(Tonnes)	**Segments**	**Thickness(mm)**	**Maximum Deformation(mm)**
150	1 to 13	22	25.478
150	1st ,2nd and 13th	26	7.146

Result and Discussion:-

When this fixture is welded and attached to one segment it reduced the segment distortion up to ±5% which is acceptable in mast. So the distortion reduced and the diameter which was ø3534mm reduced up to ø3523 which was just 3% more than its original diameter which is accepted. Same process was done in all 13 segments by applying 1 or 2 fixtures as per requirement and finally the distortion was reduced.

Table 2:

	Segments	Maximum Dia. of Mast(mm)	
		Before weld	After weld
Without Fixture	1 and 2	3520	3532
With Fixture	1 and 2	3520	3523

Conclusion:-

With the new design for vertical mast by increasing thickness of top two segments and bottom segment, where maximum deformation occurs, for the same analysis was carried out. As a result of deformation, it was reduced to 7.146 mm maximum. With this the objective of the work was achieved.The problem of distortion is minimized with the use of fixture. After designing of fixture, fixture was implemented in two segments of vertical mast and check the maximum diameter after welding has been completed. The max diameter before weld and after weld was compared for two cases as mentioned in table no.2

References:-

1. D. Suverkrop, "Level luffing crane," Google Patents, 1975.
2. K. Hutter, *Theoretical glaciology: material science of ice and the mechanics of glaciers and ice sheets*: Springer, 1983.
3. F. Ju, Y. Choo, and F. Cui, "Dynamic response of tower crane induced by the pendulum motion of the payload," *International Journal of Solids and Structures*, vol. 43, no. 2, pp. 376-389, 2006.
4. Y. Pan, C. Liang, and L. Liu, "The Modeling of Main Hoist Mechanism of Quay Container Crane." pp. 377-381.
5. D. Juergens, "Crane control means employing load sensing devices," Google Patents, 1988.
6. S. Allin Sr George, "Lattice boom construction," Google Patents, 1967.
7. A. Nayfeh, Z. Masoud, and N. Nayfeh, "A smart sway controller for cranes from theory to laboratory to industry," *Vibration problems ICoVP*, pp. 14-29, 2011.
8. K. M. Gyomrey, "Endless chain drive for telescopic jib sections," Google Patents, 1982.
9. V. C. ARVINDKUMAR, "" design and analysis of beam for deformation of floor mounted jib crane," atmiya institute of technology and science, 2015.