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Review on Lifting beam for Electric Overhead Travelling (EOT) Cranes.

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Abstract: *Lifting beam is a solid or fabricated metal beam connects from a hoist/crane, designed to provide multiple lifting point. A lifting beam enable user to attach the load at more than one point there in securing and controlling the load's movement. In today's modern era, crane is very important material handling equipment in industry because of safety reliability, fast speed, economy etc. In this review paper, discussed about how we can improve load carrying capacity of EOT cranes by using lifting beam. Carried out design calculation of lifting beam and analysed its structural and functional aspect. Type of beam used in this paper is I-section. This paper discusses lifting beam arrangement, attachments, stresses, lift capacity determination, lifting loads, design procedure, and other aspect of the subject.*

Keywords*: lifting beam, EOT Crane, I-Section.*

I. Introduction

In some application where load to lift exceeds the capacity of crane, lifting beam is used to increase the capacity of crane not individually but by connecting two cranes. For example we have two cranes of 25 Ton each and the lifting load is up to 35-45 ton then lifting beam of I-Section is used to lift the load. I-Section is preferred instead of rectangular section due to resisting bending moment because, Flags itself resist more than 80% of bending moment in I-Section beam. I-Section has higher moment of resistance because the areas of flanges is away from the neutral axis. In a beam of I-section, more material is positioned near the outer fibers representing the region of greatest stress and hence is stronger than a beam of rectangular cross section.

Structural steel is widely used for making I-Section beams; structural steel is a category of steel used for making constructional material in a variety of shapes. The material of beam in this application is SA516 GR 70. Steel offers much better compressive and tensile strength and enables heavier constructions. Also, steel can be easily recycled. Beams are flexural members that support loads which are applied transverse to their longitudinal axes. Beams have a far more complex load-carrying action than other structural elements such as trusses and cables. The load transfer by a beam is primarily by bending and shear.

For designing beam for this type of application we need some attachments:

- **Lug:** Carry or drag (a heavy or bulky object) with great effort.
- **Hook:** A lifting hook is a device for grabbing and lifting loads by means of a device such as a hoist or crane. For eliminating the disengagement of wire rope sling lifting hook is used so it prevents the disengagement.
- **Wire rope:** Wire rope consist of several strands of metal wire laid (twisted) into a helix, steel is the main material used for wire rope.

Literature review:

[1]Shyam Lal Sharma,(2013),concluded that In this project an overall design the hoists generally confirm to IS: 3177 of the hoisting mechanism of an EOT crane has been carried out. In the designed hoist model trapezoidal Section shows less stress. [2] D.Seetha, (2016) concluded that From this research work of experimental and theoretical investigation, Castellated beam has holes in its web, as holes incorporated various local effects in beams, increase in load causes beams to be failed in different failure mode, which resist them to take load up to their actual carrying capacity is studied. [3] Dhaval H. Kanjariya, (2015), concluded that means

that only single drive mechanism is used for lifting purpose & displacement of an objects[4] P.G. Scholar, (2015),concluded that Also it is not solution to simply weld more number of lifting points say lug to beam, but need of specific and optimum design is requirement which is detail describe in this paper. [5] H.R. Naderian, (2013)concluded that, This paper presents there study on distortional buckling behaviour of steel I-section beam with slender webs .In the first part of the study, a complex finite strip analysis of the distortional buckling of beams was used to study the elastic buckling behaviour of slender web steel I-sections.. [6] I.M.J. Rombouts(2016) concluded that, – The theoretical reference calculation for M-N interaction gives an accurate approximation of the exact theoretical M-N interaction behavior of a cross-section; The material behavior of a HEA cross-section is not as homogenous as often assumed; the 'locked up' root positions show different behavior from other positions.[7] Rachakulla sai krishna(2014) concluded that New computer advances have made finite element analysis (FEA) a practical tool in the study of Lifting Beams, especially in determining stresses.

II. Lifting beam:

A lifting beam is a simple design of a long I-beam with a link on the top to connect the crane or other lifting machine's hook. It also has two or more connection points under where load is connected. Lifting beam are excellent for lifting purpose, as well as for lifting weak flexible loads that require the additional support of equipment like lifting magnets or lifting vacuum. Extra Benefit of a lift beam is the ability to lift more than one load at a time, since it is typically designed with two or more connection points. The design and construction of lifting beam make ideal if there is small headroom available in the lifting area.

Diagram I section with plate for lifting beam:

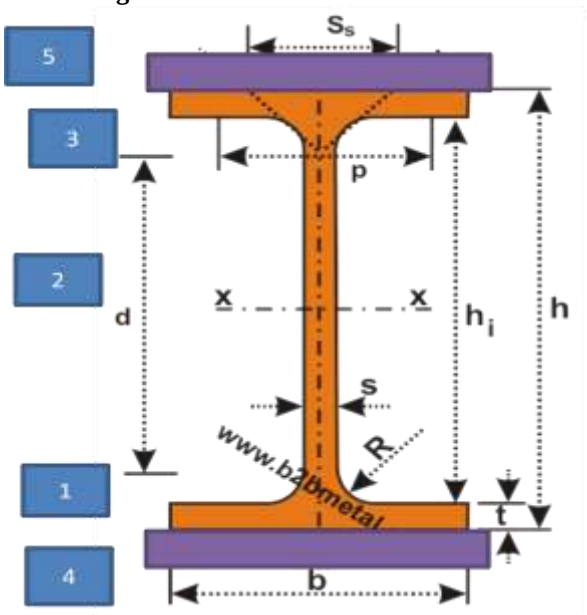


Fig: I section with plate

Types of lifting beam:

Basket Lifting Beams:

Basket lifting beams aim is to use with a lifting sling in a basket hitch configuration. It Features two sets of low profile, bull-horn style lifting hooks, each designed for a sling with a 2" eye width. Custom options are available byspecial order.

Twin Hoist Lifting Beams:

Two hoist beam creates a stable lift for a variety of load point , Alloy swivel hook on the bottom is standard equipment, but load-bearing swivel hook, eye hook, or other custom configurations also available for this type of hoist beam.

Plate Lifting Beams:

Connects openings of beam on the top of each end to sling; bottom of beam lift is designed with large J-shaped hookstoholdliftplates.

Container Lifting Beams:

It designed for lifting soft-side bulk container or other types of flexible containers with lifting hook. The H-shaped beam configuration contains an over sized lifting eye for fast connections. Built-in lugs on each beam

keep the loops of the container from sliding or unbalancing the container. Lug spaces accommodate up to 3" wide webbing/loops.

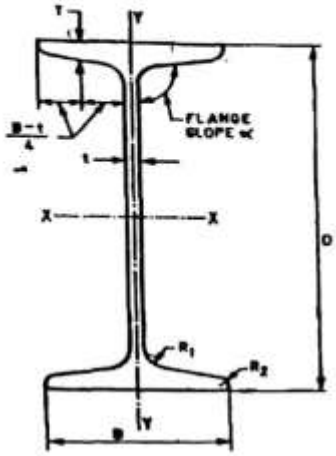
Non Conductive:

Non conductive construction is engineered with natural spark proof insulation, making it excellent for handling large batteries and other similar equipment. Lift lug is painted in safety yellow for increased visibility. Fitted with two shackles on the bottom that adjust accommodate different widths.

III. Lifting beam design

SECTION 2 BEAM SECTIONS

Table 2.1 Nominal Dimensions, Mass and Sectional Properties of Indian Standard Medium Flange Beams



Designation	Mass M	Sectional Area, a	Dimensions							Sectional Properties					
			D	B	t	T	Flange Slope, Max α, deg	R_1	R_2	I_x	I_y	r_x	r_y	Z_x	Z_y
	kg/m	cm²	mm	mm	mm	mm		mm	mm	cm⁴	cm⁴	cm	cm	cm³	cm³
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
MB 100	8·9	11·4	100	50	4·7	7·0	98·0	9·0	4·5	183	12·9	4·00	1·05	36·6	5·16
MB 125	13·3	17·0	125	70	5·0	8·0	98·0	9·0	4·5	445	38·5	5·16	1·51	71·2	11·0
MB 150	15·0	19·1	150	75	5·0	8·0	98·0	9·0	4·5	718	46·8	6·13	1·57	95·7	12·5
MB 175	19·6	25·0	175	85	5·8	9·0	98·0	10·0	5·0	1 260	76·7	7·13	1·75	144	18·0
MB 200	24·2	30·8	200	100	5·7	10·0	98·0	11·0	5·5	2 120	137	8·29	2·11	212	27·4
MB 225	31·1	39·7	225	110	6·5	11·8	98·0	12·0	6·0	3 440	218	9·31	2·34	306	39·7
MB 250	37·3	47·5	250	125	6·9	12·5	98·0	13·0	6·5	5 130	335	10·4	2·65	410	53·5
MB 300	46·0	58·6	300	140	7·7	13·1	98·0	14·0	7·0	8 990	486	12·4	2·86	599	69·5
MB 350	52·4	66·7	350	140	8·1	14·2	98·0	14·0	7·0	13 600	538	14·3	2·84	779	76·8
MB 400	61·5	78·4	400	140	8·9	16·0	98·0	14·0	7·0	20 500	622	16·2	2·82	1 020	88·9
MB 450	72·4	92·2	450	150	9·4	17·4	98·0	15·0	7·5	30 400	834	18·2	3·01	1 350	111
MB 500	86·9	111	500	180	10·2	17·2	98·0	17·0	8·5	45 200	1 370	20·2	3·52	1 810	152
MB 550	104	132	550	190	11·2	19·3	98·0	18·0	9·0	64 900	1 830	22·2	3·73	2 360	193
MB 600	123	156	600	210	12·0	20·3	98·0	20·0	10·0	91 800	2 650	24·2	4·12	3 060	252

Material selection for I-beam depends on its mechanical properties like

- Young's Modulus
- Poisson's Ratio
- Density
- Yield Strength
- Weld Strength

Most common types of cross section used for lifting beam are I-Section and C-Section; mostly use cross section is i section because of its properties like high strength and high resisting to bending moment & stresses.

By use of standard chart first select the dimensions for I-beam. By Trial and Error method select I-beams from standard table. Checking the values for which design will be safe and if it is still unsafe for its highest value, add a plate on beam to increase its strength and load carrying capacity. We can add that plate by use of welding operation.

Lugs are used to connect beam with crane on upper side and connecting to load under beam. Dimensions of lug are selected as per the result from calculation of beam. Lugs are connected with beam with fillet weld.

Analysis of lifting beam is done by Finite Element Analysis using suitable design software. In this analysis failure modes of beam can observed. FEA analysis can done using software like ansys, nastran etc.

IV. Conclusion

This paper reviewed the design procedure and process parameters of lifting beam. In this paper we prepared the design and calculation for selecting the suitable parts required to satisfy required lifting beam condition. Selection of cross section and material for lifting beam, design of lugs, wire rope, hook etc. parts. To decide the operations required for manufacturing lifting beam.

Finite element analysis is used to perform analysis of lifting beam to determine its properties like load carrying capacity, stress, strain etc.

References

1. Shyam Lal Sharma (2013), "Computer Aided Analysis and Design of Hoisting Mechanism of an EOT Crane."
2. D.Seetha (2016), "Flexural Behaviour Of Rolled Steel I- Beam And Castellated Steel Beams",Tiruchirappalli, Tamilnadu, India.
3. Dhaval H. Kanjariya (2015),"A Review on Design and Analysis of Hoisting Machinery in EOT Crane", Gujarat.
4. P.G. Scholar (2015), "Design of Evener Beam for Lifting Plates",Gujarat.
5. H.R. Naderian(2014),"Elastic distortional buckling of doubly symmetric steel I-section beams with slender webs".
6. I.M.J. Rombouts(2016), "Resistance to moment-normal force interaction of I-shaped steel sections" Netherland.
7. Rachakulla saikrishna(2014)," Design And Buckling Strength Evaluation Of A Lifting Beam For 350 Tonnes through FEA."
8. S. Ramamrutham, 2016 Edition, "Strength of Materials."