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HEAVY LIFTING FOR OF E-HOUSE MUDULE 245 T, USING CRAWLER CRANE 1250 T

ANGKAT BERAT UNTUK E-HOUSE MUDULE 245 T, MENGGUNAKAN CRAWLER CRANE 1250 T

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Abstract

Abstract. Heavy lifting on an E-House Module 245 T is using Crawler Crane 1250 T with single lifting while moving on the soft soil ground is most riski and prone to the setllement. The heavy module that are lifted in unstable ground bearing areas will move due to the settlement from soil which can cause damage to module. A site activity of the lifting plan of the module used Crawler Crane 1250 T was conducted to investigate the effect of radius operation and COG Centre of Gravity to be considered for the lifting plan. In this result the rigging sling get safety factor as the lowest it is 1.06, the crawler crane get safety factor is 1.22 and the ground bearing safety factor is 1.53. The load from E-House Module get from the weigingb report is 245 T with the COG XCG 7860 mm , YCG 437 mm and ZCG 5840mm, the module dimension is 18200 mm x and 9000 mm y and 16400 mm z.

Keywords: Rigging, Crane, Ground Bearing, Safety Factor.

Abstrak

Pengangkatan Berat Modul E-House 245 T menggunakan Crawler Crane 1250 T dengan satu Crane, selama proses pengangkatan Crane bergerak dengan Rodanya (Crawler Crane), Crane bergerak pada permukaan tanah lunak umumnya beresiko karena penurunan tanah. Modul yangb berat yang diangkat menjadi tidak stabil akibat terjadi penurunan pada tanah dan roda crane dapat menimbulkan kerusakan pada modul akibat Crane bisa runtuh. Pekerjaan pengangkatan module berat telah dilakukan dengan menggunakan Crawel Crane kapasitas 1250 ton untuk memastikanm Crane aman maka dibuat rencana pengangktan dengan batas radius operasi dan ditentukan titik COG pusat gravitasi module. Hasil factor keamanan pada proses pengankatan ini yang terkecil pada aling 1.06, pada crawler crane 1.22 dan pada tanah 1.53. Berat modul E-House dari laporan penimbangan 245 Ton dengan titik COG pusat gravitasi XCG 7860 mm , YCG 437 mm and ZCG 5840mm, ukuran modul Panjang 18200 mm , lebar 9000 mm dan tinggi 16400 mm.

Kata Kunci*:* *Tali temaliigging, Crane, kemampuan tanah, factor keamanan.*

I. INTRODUCTION

The Forel field is an offshore oil field prospects located in Block B of Natune Sea, 24 km of Northwest Belanak and has 300 feet water depth in average. Forel field was discoverd in 1984 by Forel-1A well exploration drilling and followed by the Forel-2 well in 1985, while the Bronang field is a gas-producing field located 40 km to the northwest of Belanak Field or 70 km to the Southwest from teh Hang Tah MoGPU. Bronang field was discovered in 1993 by Bronang-1 well exploration drilling Forel field development require gas injection source for pressure maintenance and lifting gas to the reservoir. Gas lift source is also required to optimize Forel's crude oil production. The requirement of gas injection and gas lift at Forel will be supplied by Bronang field.

The design of Forel and Bronang field production facilities are dry tree concept where all production weels will be placed on a wellhead platform (WHP) that is designed unmanned with the concept of the Minimum Facility Platfrom (MFP) which is designed with a simple technology system but has a high level of reliability and requires minimum intervention and maintenance.

Forel MFP will be routed to Floating Production, Storage and Offloading (FPSO) via multiphase flexible pipeline for further processing to meet crude oil market requirement, while the gas is boosted to meet the gas lift and gas injection pressure requirement. The Bronang production will be also routed to FPSO via Forel WHP to supply gas injection at initial production phase and fuel gas throughout Forel production lifetime

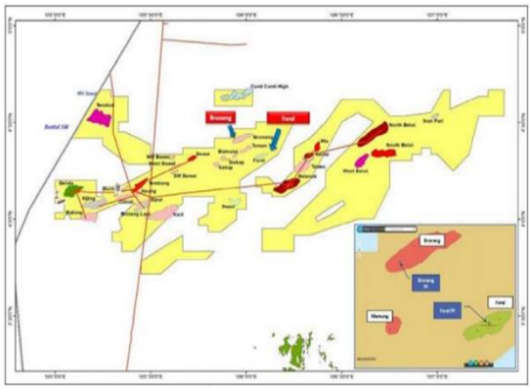

Figure 1. Natuna Block B PSC Location Map

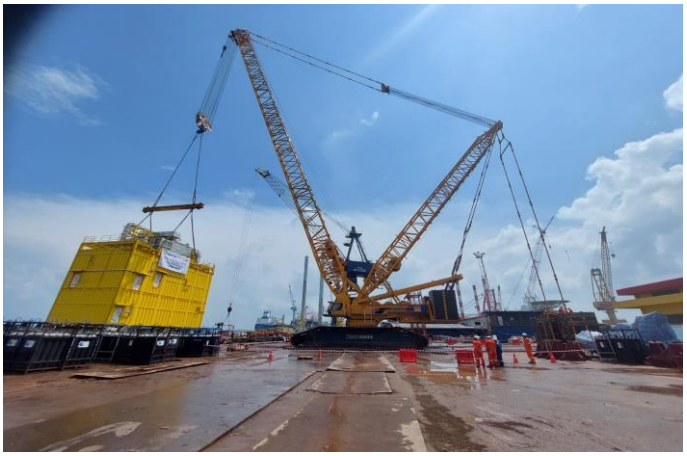

Figure 2. Unloading from Barge

II. METHODE OF RESEARCH

This document provides related information of E-House Module lifting [2] operation and calculation that serves as outline guide or reference to ensure the process is done safely [1]. Lifting from Barge to yard area of Pax Ocean and Lifting From yard area of Pax Ocean to FPSO, including travelling

This document will provide onshore lifting analysis in PaxOcean yard using equipment and tools available on site. Lifting analysis excluding structural analysis of the object lifted and focus on:

a. Rigging capacity check
b. Equipment capacity check
c. Ground bearing capacity check.
d. Weighing Report

Lifting operation document references used in this document are as follow:

HSE-OHS-L3B-S11 R2 Lifting Equipment and Operations

a. DNV GL-ST N001
b. Drawing DC E-House
c. Drawing DC Stool on FPSO
d. Drawing COG
e. Drawing Stowage Plan
f. Drawing Lifting Detail

2.1 Prototype and Instrumentation

The Load Cell is used to monitor the weighing report for the module E-House and in addition the monitoring instrument from the trim and hill is attached on the Vessel FPSO, trims and hill is installed on Vessel FPSO and the data directly can be monitored. The Crane 1250 Ton Capacity will be used for lifting activity. The Crane capacity is limited by radius operation and boom length. Weighing report data to be used for finding the COG central of gravity of module, from the COG then to develop the lifting plan. The COG of module will control the lifting plan, it will define the rigging equipment including the spredaer bar and the length of sling. The lifting plan of for module E-house, as shown in Fig. 1,2.3,4

Figure 3. Lowering to Ground

Figure 4. Lifting from Ground

Figure 5. Loading on to FPSO

2.2 Weight, COG and Dimension E-House Module

Estimated weight (factored) and COG position of module refers to [3] P2104-VD-NAVI-HS-RPT-0001_Rev.1 Weight Control Report E-House Module . COG and factored weight of E-House Module are shown on table 1.

Object dimensions refer module dimension measured for lifting purposes. Object dimensions refer to [4] P2104-VD-NAVI-HS-DWG-0002_R1 Pad eyes And Recommendation for Lifting Arrangement E-House. E-House Module dimensions is shown as Table 1.

Table 1. Estimated Weight , COG and Dimension Module

No.	Parameter	Unit	Average
1	Weight	ton	245
2	COG E-House Module X-CG Y-CG Z-CG	 mm mm mm	 7860 4370 5840
3	Dimension E-House Module Length Width Height	 mm mm mm	 18200 9000 16400

2.3 Rigging, Crawler Crane and Ground Bearing Check Capacity Summary

Rigging capacity check based on working load on each sling during lifting process. Rigging tools are grouped into alphabet code based on capacity and length. Rigging capacity check tabulated in table shown the highest load on rigging tools on each group. Load tabulated has included dynamic and contingency factor. Rigging capacity check summary check is shown as Table 2.One crawler crane 1250T (XGC16000) will be used for E-House unloading from barge to jetty. Crawler crane capacity check summary is shown on Table 2. Unloading process of E-House module from barge to jetty to be done on Jetty 3 Pertama. Estimated ground pressure generated during process is checked with allowable ground bearing pressure at jetty. Ground bearing pressure check is shown om Table 2.

Table 2. Rigging, Crwlwer Crane and Ground Bearing Capacity Check

No.	Parameter	Unit	Average
1	Wire Sling 20m SWL 175T Load SWL SF	 Ton Ton	 165 175 1.06
2	Shackle 200 T Load SWL SF	 ton ton ton	 160 200 1.25
3	Spreader Bar 400 T Load SWL SF	 ton ton	 320 400 1.25
4	Grommet 10.7m SWL 107T Load SWL SF	 ton ton	 78 107 1.37
5	Shackle 120T Load SWL SF	 ton ton	 78 120 1.53
6	Crawler Crane 1250 T Boom length Angle Radius Operation Capacity DHL T SF	 m deg m ton ton	 84 70 34 402 329 1.22
7	Ground Bearing Pressure Load Capacity SF	 ton/m^2 ton/m^2	 26.31 40 1.52

Figure 5. Lifting Plan

2.4 Pre Lifting Operation

The following preparation should be completed prior to lifting:

a. All document for lifting operation should be checked prior to lifting, including all NDT report, and should be accepted by all parties (Yard, Owner, MWS.)
b. To ensure all risk mitigation step has been taken.
c. Evaluate position of crane and barge. Ensure no obstruction on the way of boom, crane, module, and superlift during unloading and positioning on laydown area.
d. Ensure crane path and position has been cleared.
e. To ensure crane conditions, including crane mechanical condition, safety device and monitoring system, is in good condition. Ensure hook color code is valid.
f. To ensure all rigging tools condition are in good condition and certified.
g. Any loose material should be checked and remove/lash the material.
h. To ensure barge has been moored properly for lifting operation.
i. Mooring arrangement can be suited on site by shipwright department.
j. To ensure actual module and barge condition refer to vendor fastening plan.
k. To conduct toolbox talk to brief lifting plan including method and laydown area, ensure all critical position for lifting operation (operator, signal man, rigger, leader) is filled, and ensure all personnel involved understand their responsibilities.
l. To ensure all communication devices are working properly.
m. Competent personnel to check wind speed not to exceed 5.4 m/s.
n. Position crane and structure prior to lifting.
o. Connect all rigging tools on module and crane.
p. Rigger to determine tagline position on site as necessary

2.5 Lifting Operation

The following procedure should be adopted:

a. Lifting supervisor should be in overall control of the operation. Thus, hoist up-down, boom up-down, swing, connect lifting tools and crane release should be done under supervisor command.
b. Toolbox talk should be conducted by lifting supervisor and HSE, attended by Project and Owner/representative.
c. Lifting operation can only be proceed with supervisor, HSE, and owner approval.
d. Uninvolved personnel should be prevented from entering lifting area.
e. Process lifting and unloading on to jetty from material barge.
f. Set up lifting gear and tools as drawing lifting
g. Remove all sea-fastening frames and lashing
h. Hoist up crane to be done gradually.
i. Load shown on crane monitor should be documented by crane operator.
j. Module lifted should float low and to be adjusted as necessary with safe clearance.
k. Hoist down module on jetty to be done gradually and slowly.
l. Double check to ensure there are no personnel or item underneath module during laydown/hoist down process
m. To assist module movement with tag line throughout process.
n. Steel plate to be installed for covering the land route of crawel pad crane
o. Lay down the model on lay down area
p. As advised by lifting supervisor, remove all rigging tools to module.
q. Process Lifting module from lay down area to FPSO
r. Traveling Crane during lifting and movement, install steel plate on the track route of crane
s. Lift the module on to the FPSO on its stool
t. Ballasting to be provided and check by surveyor to get flat on the FPSO
u. Make table of list for Personnel who responsible

III. RESULT AND DISCUSSION

3.1 Analysis of Calculation vs Actual on site

From the result of calculation [5] in table 3, it shows that the Safety Factor SF for Rigging Equipment smalest is on sling 1.06. For Crawler Crane is 1.22 and For Ground Bearing is 1.52 , it can befound in Table 3.

Rigging, equipment, and ground bearing pressure shown to have acceptable safety factor. The relevant lifting drawings is included in picture 6.

Figure 6. Crawler Crane 1250 T with Boom length 84 m

3.2 Rigging Capacity Check Summary

Rigging capacity check based on working load on each sling during lifting process. Rigging tools are grouped into alphabet code based on capacity and length. Rigging capacity check tabulated in table shown the highest load on rigging tools on each group. Load tabulated has included dynamic and contingency factor. Rigging capacity check summary check is shown as Table 3.

Tabel 3. Rigging Capacity Check

Rigging Code	Tools Description	Load (T)	SWL (T)	SF	Remark
A	Wire Sling 20m SWL 175T	165	175	1.06	SAFE
B	Shackle 200T	160	200	1.25	SAFE
C	Spreader Bar 400T	320	400	1.25	SAFE
D	Grommet 10.7m SWL 107T	78	107	1.37	SAFE
E	Shackle 120T	78	120	1.53	SAFE

3.3 Equipment Capacity Checke

One crawler crane 1250T (XGC16000) will be used for E-House unloading from barge to jetty. Crawler crane capacity check summary is shown on Table 4.

Tabel 4. Equipment Capacity Check

Crane ID	Boom (m)	Radius (m)	Angle (deg)	Capacity (T)	DHL (T)	SF	Remark
XGC16000	84	34	70	402	329	1.22	SAFE

3.4 Ground Bearing Capacity Check

Unloading process of E-House module from barge to jetty to be done on Jetty 3 Pertama [6]. Estimated ground pressure generated during process is checked with allowable ground bearing pressure at jetty. Ground bearing pressure check is shown om Table 5.

Table 5. Ground Bearing Capacity Check

Equipment	Est. Ground Pressure (T/m^2)	Allowable Pressure (T/m^2)	SF	Remark
XGC16000	26.31	40	1.52	SAFE with mat $30m^2$ on each crawler

IV. CONCLUSIONS

1. In carrying out the design for lifting E-House module using rigging tools, it should be considered the COG on the stability of the lifting Operation on site.
2. The bigger the radius operation of crane, the lowest will the capacity of the crawler crane get.
3. For maximum lifting load up to 245 ton, Rigging tools, Crawler Crane 1250 T and Goreund Bearing are still below the allowed Safety Factor.

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