



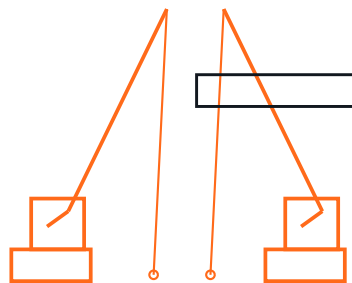
JMR LIFTING SOLUTIONS

Certified Heavy Lift Engineering

LIFT PLAN

Refinery Reactor Tandem Lift

Plan number: LP-2026-001



CLIENT	[CLIENT CONFIDENTIAL]
LOCATION	[LOCATION CONFIDENTIAL]
REVISION	Rev 0 — SAMPLE
DATE	02 August 2026
PREPARED BY	Muthuraj Jeyabal, LEEA Certified Appointed Person
AP CERTIFICATE NO.	8234-13608-8667-27-1
REVIEWED BY	JMR Lifting Engineering
STANDARDS	BS 7121 · LOLER 1998 · ASME B30

01 Executive Summary & Scope

Tandem lift of a hydrocracker reactor from delivery trailer to its final foundation within an operating petrochemical facility. Two crawler cranes work in coordinated tandem to control centre-of-gravity shift as the reactor is raised from horizontal transport to a near-vertical set position.

Key Parameters

Parameter	Value
Load weight (t)	285 t
Dimensions (L × W × H)	42 m x 5.2 m dia
Lift radius (m)	15 m
Lift height (m)	38 m
Duration (est.)	8 hrs
Location	Petrochemical facility

Critical Risks

- Load overload beyond crane rated capacity at working radius
- Loss of control during dynamic/weather-sensitive lift phases
- Rigging failure due to incorrect sling angle or WLL selection
- Ground/foundation bearing failure under crane or outrigger loads

02 Load Data, Centre of Gravity & Dimensions

Hydrocracker reactor pressure vessel, cylindrical shell with domed heads, delivered by SPMT trailer and lifted directly onto a concrete ring foundation.

Weight Breakdown

Component	Weight
Structural shell & heads	268.0 t
Internals (trays/packing)	12.5 t
Lifting attachments	2.0 t
Uncertainty allowance (0.9%)	2.5 t
Total	285.0 t

Centre of Gravity

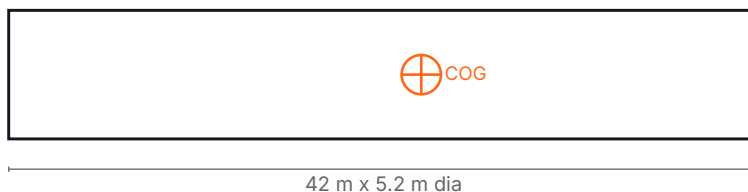
Parameter	Value
X-axis	21.0 m from tail (X)
Y-axis	0.0 m off centreline (Y)
Z-axis	2.6 m above shell base (Z)

Lift Points

4 no. trunnion lugs, 2 per crane, symmetric about mid-length

Dimensional Sketch

Simplified load outline with centre-of-gravity marker (not to scale):



03 Crane Selection & Configuration

Crane 1: Liebherr LR 1600/2

Parameter	Value
Rated capacity	600 t
Boom length	84 m
Configuration	Main boom 84 m, tandem symmetric spread
Working radius	15 m
Capacity at working radius	425 t

Crane 2: Liebherr LR 1600/2

Parameter	Value
Rated capacity	600 t
Boom length	84 m
Configuration	Main boom 84 m, tandem symmetric spread
Working radius	15 m
Capacity at working radius	425 t

Utilization Calculation

$285 \text{ t} / 2 \text{ cranes} = 142.5 \text{ t/crane}$; with DAF 1.10 = 156.75 t (approx 157 t) per crane. Utilization = $157 / 425 = 37\%$.

Utilization result: **37%** (within 85% safe working threshold)

Ground Bearing Pressure

Ground bearing = $(\text{crane wt } 180 \text{ t} + \text{load} \times \text{DAF } 157 \text{ t}) \times 9.81 / 48 \text{ sqm mat area} = 68.9 \text{ kPa}$

Standing / Pick Radius

Working radius maintained at 15 m throughout the critical lift phase.

04 Load Chart & Utilization Calculation

Manufacturer load chart extract for the selected boom/jib configuration:

Radius	Capacity
10 m	560 t
15 m → WORKING POINT	425 t
20 m	340 t
25 m	275 t
30 m	225 t

Dynamic Amplification Factor (DAF)

DAF applied: **1.1**

Total Lifted Load Including DAF

285 t / 2 cranes = 142.5 t/crane; with DAF 1.10 = 156.75 t (approx 157 t) per crane. Utilization = 157 / 425 = 37%.

Ground Pressure Calculation

Ground bearing = (crane wt 180 t + load x DAF 157 t) x 9.81 / 48 sqm mat area = 68.9 kPa

Parameter	Value
Calculated ground pressure	68.9 kPa
Allowable bearing pressure	150 kPa
Crane pad / matting	6.0 m x 2.4 m steel mats, 2 per crawler track, per crane

05 Rigging Configuration

Parameter	Value
Sling type	Wire rope grommet sling, 6x36 IWRC, EIPS grade
Sling angle (min.)	65°
Number of slings	4
WLL per sling	60 t
Shackle grade	Crosby G-2140 100 t bow shackle
Spreader / master link	4-point trunnion spreader frame, rated 200 t

Rigging Schematic (Summary)

Component	Specification
Hook / block	Rated to crane main hoist capacity, latch-equipped
Master link / spreader	4-point trunnion spreader frame, rated 200 t
Sling legs	4 × Wire rope grommet sling, 6x36 IWRC, EIPS grade
Shackles	Crosby G-2140 100 t bow shackle
Sling angle from horizontal	65° (minimum safe angle 60° unless noted)

Sling Length Calculation

With a sling angle of 65° from horizontal, sling length is derived from headroom and spread geometry per rigging arrangement drawing; angle maintained $\geq$ the minimum safe angle for the configuration.

06 Rigging Load Calculations

Individual Sling Load

Formula: Sling load = (Load × DAF) ÷ (n × sin θ)

(157 x 1.10) / (4 x sin 65deg) = 47.6 t per sling -> select 60 t WLL grommet sling

Parameter	Value
Calculated sling load	47.6 t
Selected sling WLL	60 t
Sling utilization	79.3%
Sling safety factor (design)	5:1 minimum
Shackle safety factor (design)	4:1 minimum

Safety Factor Basis

All wire rope slings are selected to a minimum design factor of 5:1 against minimum breaking load, in accordance with LEEA COPSULE guidance. All shackles are selected to a minimum design factor of 4:1. Working load limits (WLL) are marked and certificated per item.

07 Ground Bearing & Site Layout

Ground Bearing Pressure

Ground bearing = (crane wt 180 t + load x DAF 157 t) x 9.81 / 48 sqm mat area = 68.9 kPa

Parameter	Value
Ground bearing pressure (required)	68.9 kPa
Allowable bearing pressure (site)	150 kPa
Margin	54.1% below allowable

Crane Pad / Matting

6.0 m x 2.4 m steel mats, 2 per crawler track, per crane

Site Plan (Schematic)

Simplified site layout showing crane standing position, load path, and exclusion zone (not to scale):



08 Risk Assessment (BS 7121 Format)

Risk scoring uses Likelihood (L) × Severity (S), each rated 1–5. Residual score after controls is shown in the right-hand columns.

Hazard	L	S	Score	Controls	L	S	Score
Overload beyond crane capacity	3	5	15	Load chart verified; utilization capped below 85%; independent AP check	1	5	5
Crane mechanical/structural failure	2	5	10	Pre-use inspection; current LOLER thorough examination certificate	1	5	5
Load drop during lift	2	5	10	Certified rigging, redundant sling legs, trial lift at 25% load	1	5	5
Adverse weather conditions	3	3	9	Weather forecast monitoring; defined go/no-go thresholds	1	3	3
Personnel struck by load/rigging	3	4	12	Exclusion zone enforced; banksman control; no personnel under suspended load	1	4	4
Ground/foundation failure	2	5	10	Ground bearing calculation verified; crane mats/pads sized to load	1	4	4
Sling/shackle failure	2	5	10	Certified rigging to 5:1 (sling) / 4:1 (shackle) design factor; pre-use inspection	1	5	5
Overhead obstruction contact	2	4	8	Route survey completed; spotter assigned; boom angle indicator monitored	1	3	3

Risk score key: **1–6 Low** · **7–12 Medium** · **13–25 High** — all residual scores must be Low or Medium with documented additional controls before lift authorization.

09 Method Statement

1. Confirm current LOLER thorough examination certificates for crane(s), rigging, and lifting accessories.
2. Conduct toolbox talk with all lift personnel; confirm roles per Section 11.
3. Establish exclusion zone and barrier the lift area; brief banksman and signaller.
4. Position crane(s) on verified ground bearing / matting per Section 07; set outriggers (if mobile) to full extension.
5. Rig load per configuration in Section 05; attach taglines; conduct visual rigging inspection.
6. Perform trial lift: raise load approximately 300 mm, hold at 25% of test criteria for a minimum dwell to verify rigging geometry, crane response, and brake holding.
7. Confirm sling angles, load indicator readings, and COG behavior match plan before proceeding.
8. Execute main lift at working radius 15 m
9. Travel/luff/slew load along planned path, maintaining radius and load chart compliance throughout.
10. Position load over set point; lower under controlled taglines to final bearing/foundation.
11. Confirm secure landing, release rigging tension gradually, and inspect for damage.
12. De-rig, remove accessories, and return crane to travel/stow configuration.
13. Conduct post-lift debrief and close out permit-to-work documentation.

10 Roles & Responsibilities

Role	Assignment
Appointed Person	Muthuraj Jeyabal, LEEA Certified Appointed Person (Cert. No. 8234-13608-8667-27-1) — overall lift planning responsibility
Lift Supervisor	[TBD — assigned at mobilization, LEEA/CPCS certified]
Crane Operator(s)	[Certified operator(s), current CPCS/NPORS or equivalent license]
Slinger / Signaller	[Certified slinger/signaller per LEEA/CPCS standard]
Banksman	[Certified banksman — controls exclusion zone and ground personnel]
Reviewed by	JMR Lifting Engineering

Contact

JMR Lifting Solutions — contact@jmrlifting.com

SAMPLE

11 Approvals & References

Signature Block

Role	Name	Signature / Date
Appointed Person	Muthuraj Jeyabal, LEEA Certified Appointed Person	
Client Representative	[CLIENT CONFIDENTIAL]	
HSE Representative	[TBD]	
Client Project Manager	[CLIENT CONFIDENTIAL]	

References

- BS 7121-1:2016 — Code of practice for the safe use of cranes
- LOLER 1998 — Lifting Operations and Lifting Equipment Regulations (UK)
- ASME B30.5 — Mobile and Locomotive Cranes
- LEEA COPSULE — Code of Practice for the Safe Use of Lifting Equipment
- Crane manufacturer load chart (referenced Section 04/05)

This document is a SAMPLE lift plan produced for demonstration purposes only. It does not constitute an approved lift plan for any live lifting operation. Actual JMR Lifting Solutions project deliverables include site-specific surveys, certified equipment schedules, and a signed authorization prior to any lift.