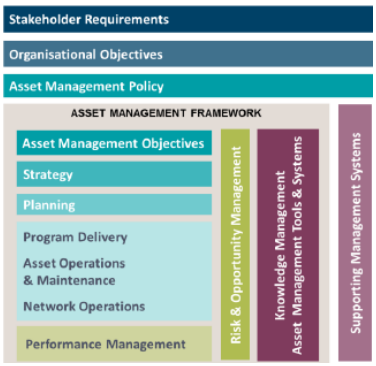
Transmission Substation Lifting Plan Requirements

Design Standard (Technical Specification)



DOCUMENT HIERARCHY

This document resides within the Planning component of Western Power's Asset Management System (AMS).

DOCUMENT DATE

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IMPLEMENTATION DATE

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DOCUMENT CONTROL

Record of endorsement, approval, stakeholders, and notification list is provided in EDM# 52698572 appendix

RESPONSIBILITIES

Western Power's Engineering & Design Function is responsible for this document

CONTACT

Western Power welcomes your comments, questions, and feedback on this document, which can be emailed to standards.excellence@westernpower.com.au

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Contents

Revision Details

Version	Date	EDM Version	Description
0	June 2020	1	First Issue
1	March 2023	2	Review completed – no changes required
2	March 2024	3	Standard Online Update

1. Introduction

This Technical Specification outlines the minimum requirements for lifting heavy loads within Western Power Transmission Substations.

1.1. Purpose and Scope

The requirements outlined in this specification are intended to cover, but not limited to the following areas associated with lifting heavy loads:

- HV transformers
- Transportable buildings (Switchrooms, Relay rooms)
- Prefabricate concrete panels
- Gantry structures

1.2. Acronyms

Acronym	Definition

1.3. Definitions

Terms and definitions used in this document

Term	Definition
AS	Australian Standard
CoG	Centre of Gravity
EDM	Enterprise Document Management
HV	High Voltage
MAD	Minimum Approach Distances
NCC	National Construction Code of Australia
Qty	Quantity
SoW	Scope of Work
SWL	Safe Working Load
WLL	Working Load Limit
Wt	Weight

1.4. References

References which support implementation of this document

Table 1-1 References

Reference No.	Title

2. Supporting Documentation[1]

3. Compliance

3.1. General[2]

All temporary works, drawings, materials, equipment, workmanship, and installation must comply with the latest revision of Western Power technical documents and relevant Australian standards related to the relevant component of the works unless otherwise noted in this specification or advised at the time of Tender.

There should not be any deviation from the of the relevant standards and specifications provisions without first obtaining approval from Western Power in writing.

All work and materials must comply with higher-level Western Power technical documents, such as relevant Network Standards and Functional Specifications.

This Technical Specification should encompass all requirements of the relevant Australian Standards which are current at the time of issue. These relevant Australian Standards are listed in Table 3-1 below. A period will be set when the Technical Specification needs to be reviewed. If significant changes occur on an Australian Standard which affects safety, then an out of cycle review can be completed.

Table 3-1: Standards and Guidelines

Standard Number	Standard Title
AS 2550	Cranes, hoists and winches – Safe use (series)
AS 3775	Chain sling for lifting purposes (series)
	National Code of Practice for Precast, Tilt-up and Concrete Elements in Building Construction
	National Transport Commission - Load Restrain Guide

[1] See Western Power Internal Document
[2] See Western Power Internal Document

3.2. Acceptance Criteria

Compliance with the requirements of this specification for lifting loads shall be based on the minimum requirements and acceptance criteria set out in this specification, the construction SoW of the project included in the project deliverables, and relevant Australian Standards listed in Table 3-1.

3.3. Order of Precedence

Where this specification is inconsistent with another document making up the construction SoW of the project, the following order of precedence shall apply to determine which document prevails to the extent of inconsistency with (a) being the highest precedence and (e) being the lowest:

a. the specific terms and conditions of the construction SoW of the project
b. the 'Policies and Guidelines' of the project
c. any construction drawings included in the project deliverables
d. any specific technical requirements stipulated to the project works
e. this Technical Specification

3.4. Certification

The contractor shall submit certificates for all equipment and workmanship qualifications in lifting activities. The documents must state compliance with this specification, applicable Western Power technical documents, Australian standards as described by these documents, and the project quality plan to the Western Power representative for acceptance.

The documents and the relevant Australian Standards listed in Table 3-1 provide requirements for test reports or test certificates.

4. Lifting

The contractor shall:

- Provide all requirements for lifting, including approvals, materials, inductions, and resources.
- Protect from damage to loads during the loading and unloading activity.
- Provide all licenses and permits necessary for loading, transporting, and placing of the loads involved in the activity.
- Lift the loads only by their designated lifting points shown on shop drawings or equipment drawings

The contractor shall submit the documents, but not limited to, stated in Section 4.1 to Section 4.4 associated with lifting loads to the Western Power representative for review at least ten (10) working days prior to commencement of the respective works.

4.1. Drawing

Lifting Drawing in CAD drawn to scale showing the following:

- Position of crane, truck/low loader (in all positions required for lift)
- Position of load – initial and final
- Ground slopes
- Outage requirements

- Lift radius and swing direction (both pickup and final location)
- Position of outriggers, maximum ‘off centre’ outrigger versus pad centroid
- Laydown areas (e.g., gantry components, concrete panels)
- Above ground prominent obstacles and hazards, edge of bund floor, edge of slabs
- Underground services/conduits trench, basements, soak wells, septic systems, oil separators
- Open excavations and exclusion areas
- Site-specific hazards: energised equipment and overhead power line
- Key distances:
    a. Outrigger to underground services, trenched and surface edges
    b. Position of the crane from prominent site points
- Elevation drawing with rigging arrangements

4.2. Details of Load

- Load weight
- Overall dimensions
- CoG position x, y, z (provided or calculated)
- Lifting/Slinging points and their certified ratings
- Overall weight (load + accessories)

4.3. Details of Crane

- Crane certification
- Crane operator certification (specific to the crane being used)
- Rigger certification
- Make and model
- Capacity, including load charts specific to boom configuration & counterweight used
- Outline drawings
- Jib length
- Outrigger spread

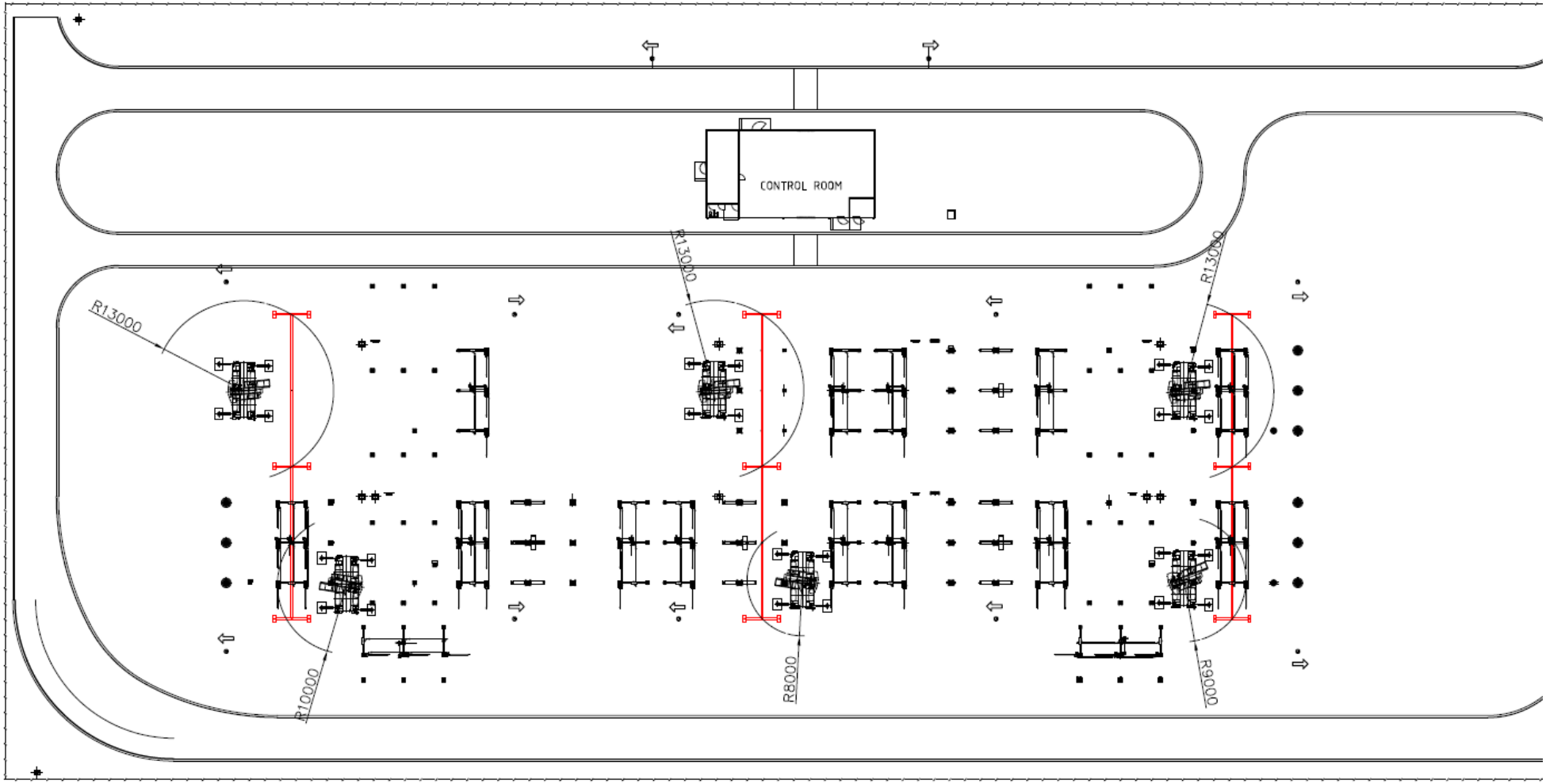
4.4. Details of Lift

- Risk assessment, spotters, minimum approach distances (MADs), communication/briefing, traffic management (including people)
- Height to which the load must be lifted
- Maximum wind speed for lift
- Crane utilisation % (<90%)
- Max pressure under outriggers
- Rigging arrangements

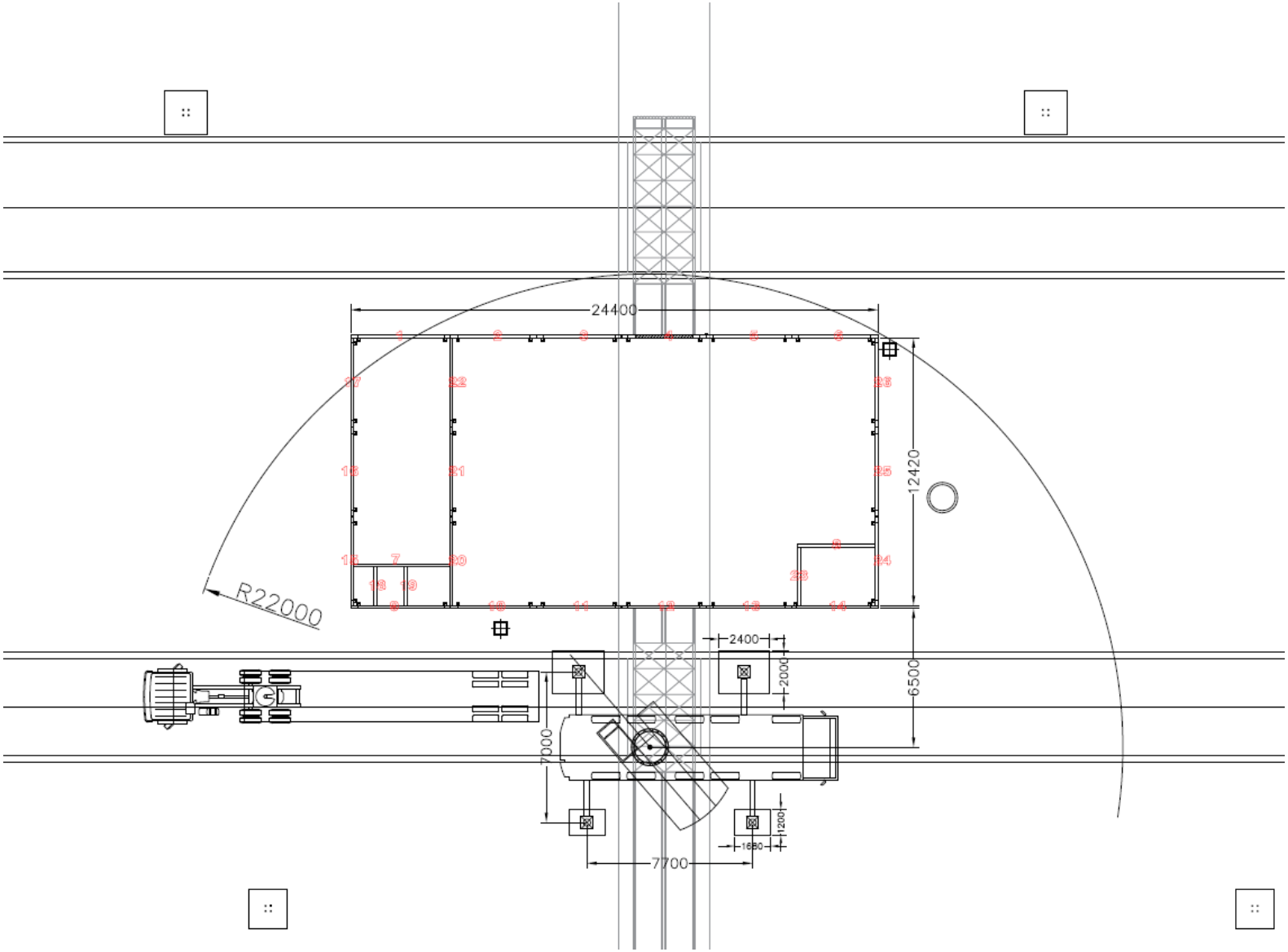
- Rigging details (Items, Qty, WLL, Wt, SWL)
- Spreader beam details, WLL, calculations
- Manufacturer datasheets of outrigger load spreader pads (Wt. WLL)
- Counterweight required and counterweight installation procedure, secondary crane (if required for primary crane assembly)

Appendix A: Examples of Lifting layout, elevation and lifting study

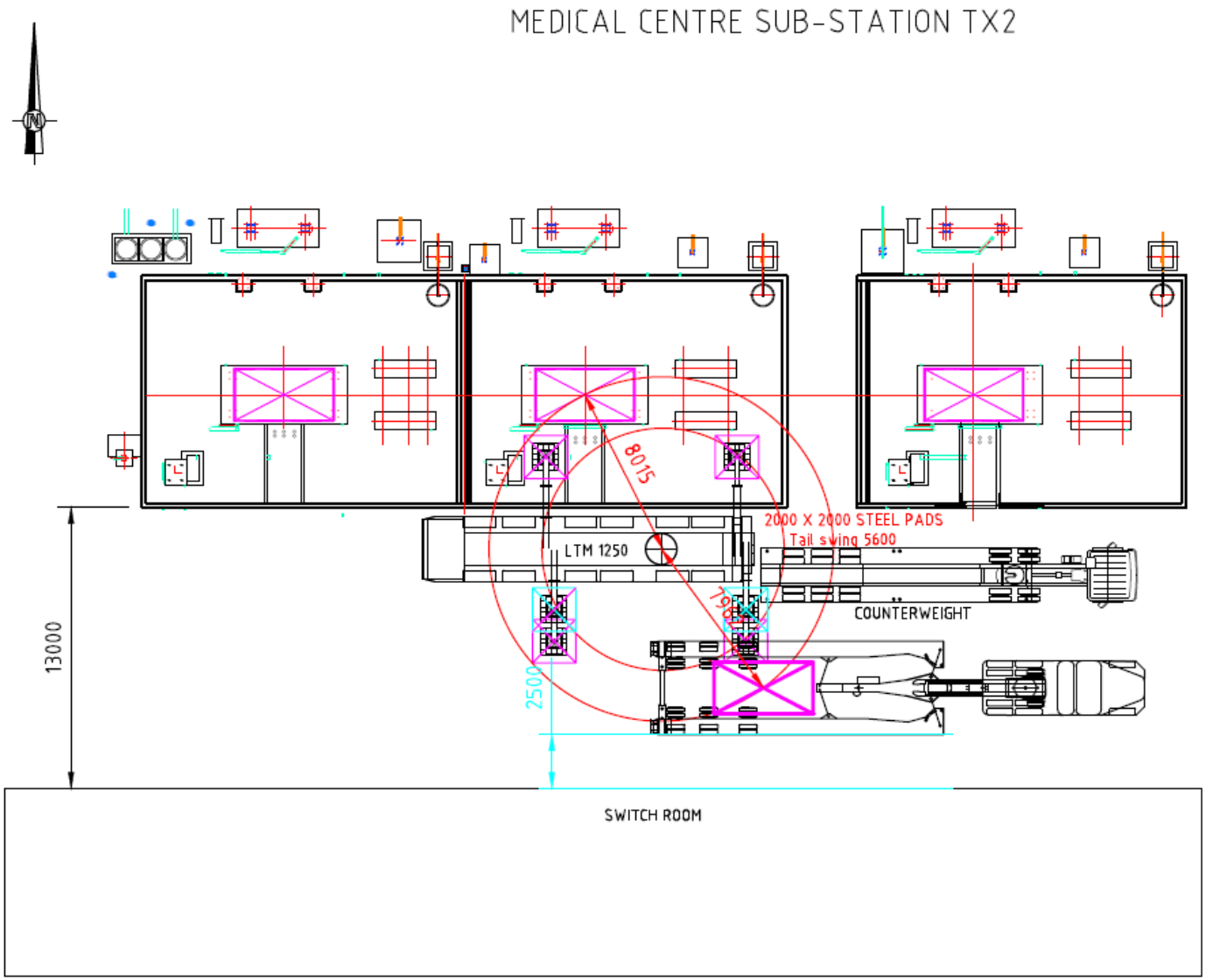
A.1 Figure 1: Gantry structure lifting layout



A.2 Figure 2: Prefabricate concrete panels building lifting layout



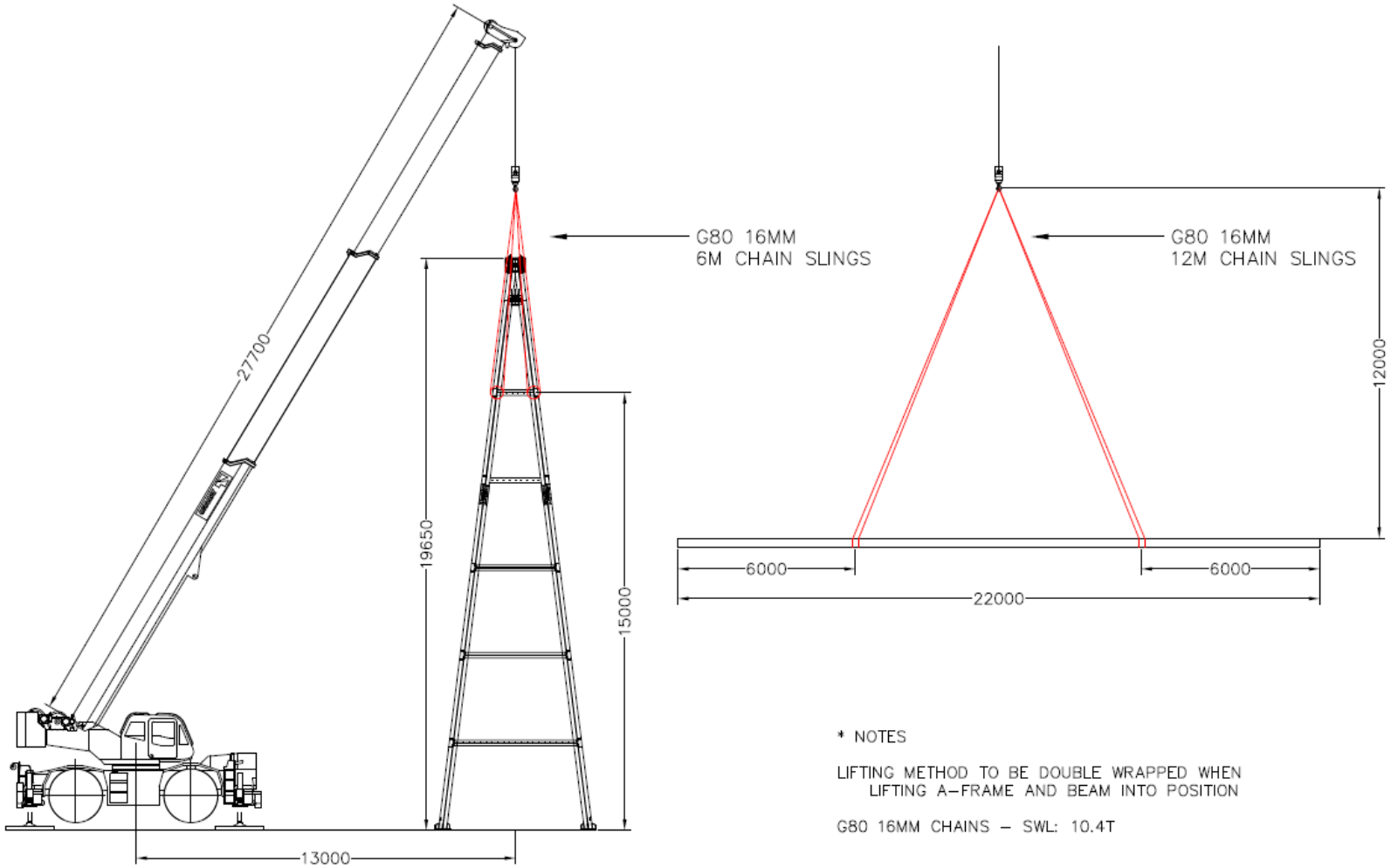
A.3 Figure 3: Transformer lifting layout



CRANE DETAILS	CRANE 1	
MAKE	LIEBHERR	
MODEL	LTM1250	
MAXIMUM SWL	250 METRIC TONNES	
COUNTERWEIGHT	72.5 T	
MAIN BOOM LENGTH	20.7 M 0+46+0+0+0+	
OUTRIGGERS	8.85 M	
MAXIMUM LIFT RADIUS	9 M	
WLL	86000 KG	
LOAD DETAILS	TRANSFORMER TX	
LOAD MASS	66500 KG	
D L ALLOWANCE 20%	N/A	
TOTAL LOAD SHARE	66500 KG	
CRANE COMPONENTS / HOOK	1040 KG	
RIGGING	300 KG	
TOTAL LIFT WEIGHT SCL	67840 KG	
REQUIRED WLL		67840 KG
ACTUAL WLL		86000 KG
UTILIZATION %		78%

CRANE DETAILS	CRANE 1	
MAKE	LIEBHERR	
MODEL	LTM1250	
MAXIMUM SWL	250 METRIC TONNES	
COUNTERWEIGHT	72.5 T	
MAIN BOOM LENGTH	20.7 M 0+46+0+0+0+	
OUTRIGGERS	5.59 M	
MAXIMUM LIFT RADIUS	8 M	
WLL	79000 KG	
LOAD DETAILS	TRANSFORMER TX	
LOAD MASS	66500 KG	
D L ALLOWANCE 20%	N/A	
TOTAL LOAD SHARE	66500 KG	
CRANE COMPONENTS / HOOK	1040 KG	
RIGGING	300 KG	
TOTAL LIFT WEIGHT SCL	67840 KG	
REQUIRED WLL		67840 KG
ACTUAL WLL		79000 KG
UTILIZATION %		86%

A.4 Figure 4: Lifting elevation



A.5 Figure 3: Lifting study

CRANE SPECIFICATION			
MAKE	TEREX DEMAG		
MODEL	EX5500		
CRANE WLL	130		t
CONFIGURATION	HA		
MAX ARTICULATION	N/A		
OUTRIGGER CENTRES	7700 x 7000		mm
COUNTERWEIGHT	21.70		t
RADIUS	22.00		m
BOOM LENGTH	37.10		m
BOOM CONFIGURATION	0,0,90,90,90		
FLY LENGTH	0		m
FLY ANGLE	0		°
HOOK BLOCK	3 SHEAVE		
MAX LINE PULL	314.6		kN
MAX PERMISSIBLE W/S	9.8		m/s
LIFT SPECIFICATION			
LOAD	5888		kg
HOOK	850		kg
RIGGING	400		kg
TOTAL LOAD	7138		kg
SWL	9100		kg
CAPACITY	78.44		%
GROUND PRESSURE BEARING			
MAX CALC. GPB	36.50		t
OUTRIGGER BASE	2.4	2.0	m
OUTRIGGER PAD SIZE	4.80		sqm
CALC. GPB	7.60		t/m2
CALC. GPB	74.60		kPa

Outrigger Reaction Force Supply Service

Working Configuration

Explanation on this page

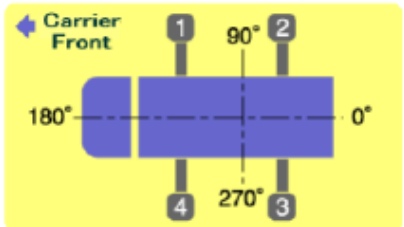
(GR-700E-1-00101,102,211,212,214,215,216 5 SECTION BOOM)

Boom Length(m)	27.7	Counterweight (t)	fixed	Swing Angle	Max_Reaction	Lifting Load (t)	8.27
Jib state (m)	stow	O/R Spread (m)	7.2/1-4	Working Radius (m)	13.0		
Jib Tilt Angle (°)	---	Hook Block (t lifting)		Boom Angle (°)	60.2		

Outrigger Jack Reaction Force

(unit :t)

Swing Angle	1	2	3	4				
133	29.8	10.9	3.8	10.5				
43	10.7	29.8	11.1	4.0				
315	3.7	10.9	29.6	10.5				
225	10.8	4.1	11.2	29.6				



Change Condition | Change Model | Save Result | Readout Result | Clear PDF

[Notes]

1. As to the information we supply in this page on the outrigger jack reaction force, please note that the given value is a calculated value when the outriggers are set on a firm and level surface. It is not an actually measured one. Therefore, we can not guarantee the calculated value to be in conformity with that of your actual machine.
2. As to the data supplied in this page on the outrigger jack reaction force, please note that neither vibration nor shock which may be produced during crane operation is taken into consideration. When setting the outriggers, therefore, be sure to use blocks or steel plates of sufficient strength and size below the outrigger floats.

Appendix B: Approval Record and Document Control[3]

[3] See Western Power Internal Document