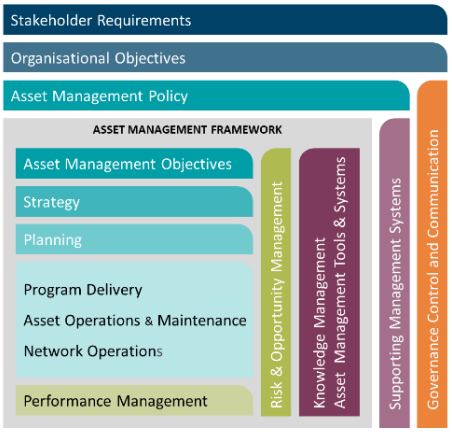
Western Power's Asset Management System



Distribution Substation Plant Manual
Chapter 9 – 33kV Substation Installation

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Document control

Endorsement approvals

	Name	Title	Signature and Date
Author	Samuel Liau	Senior Distribution Standards Engineer	Signature on file
Checked by	Chris Omodei	Principal Engineer	Signature on file
Endorsed by	Ken Tiong	Engineering Team Leader	Signature on file
Approved by	Pep Ngwenya	Distribution Design & Standards Manager	Signature on file

Record of revisions

Revision No.	Date	Version	Compiled by	Description
0	December 2021	EDM 2	Ken Tiong	Original Issue
1	May 2025	Volt 3	Samuel Liau	3 yearly periodic review
2	20/01/2026	Volt 4	Nory Cerrado	DSPM-9-02 & DSPM-9-04 Updated

Key documents providing direction and influencing this document

Doc	Title of document
EDM# 40304923	Asset Management System
EDM# 41965928	Safety in Design Guidelines
EDM# 50473207	DSPM Governance and Technical Documents Register

This document gives direction to and influences the following documents.

Doc	Title of document
Various DQM documents	Distribution Substation Design Projects

Stakeholders (people that were consulted when document was updated)

Business Unit / Function
Asset Management - Asset Performance
Asset Management – Safety Environment Quality and Training
Asset Management - Grid Transformation
Asset Operations – Network Operations
Asset Operations – Operational Services
Asset Operations – Customer Connection Services
Business and Customer Service – Customer Service

Notification list (people to be notified when document is updated)

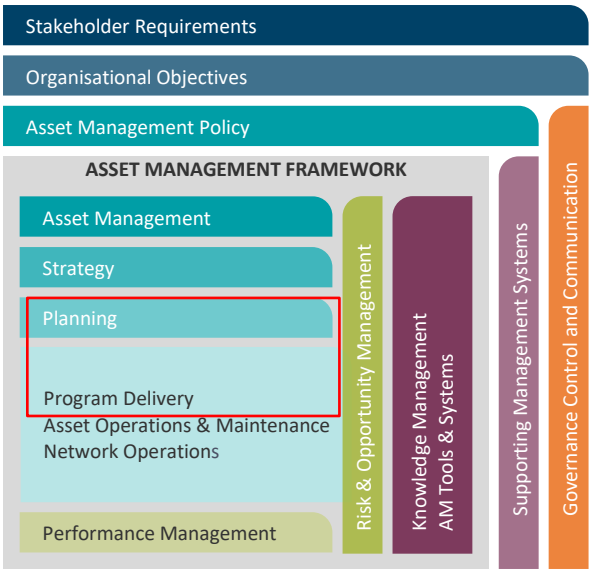
Business Unit / Function
Asset Management - Asset Performance
Asset Management – Safety Environment Quality and Training
Asset Management - Grid Transformation
Asset Operations – Network Operations
Asset Operations – Operational Services
Asset Operations – Customer Connection Services
Business and Customer Service – Customer Service

Document classification and hierarchy

A key requirement of the Western Power Asset Management Policy (AMP) is to develop and maintain an Asset Management System (AMS). This Distribution Substation Plant Manual is defined as a technical document within the AMS document classification and structure and sits within the planning and Program Delivery components of the AMS.

The AMS and the interrelationships between the collection of documents, tools and systems that are used for asset management are described in the AMS document AMS document Volt ID

ID-005-dc7f342fed83eb7f008777ff0463b876.



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DSPM-9-01	3/6	A	33kV District Substation Up To 630 kVA MPS Non-Fire Rated with HV SWGR Equipment Selection and Layout
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DSPM-9-04	2/6	B	33kV District Substation Up To 1000 kVA Non-MPS Non-Fire Rated with HV SWGR Land Requirements And Duct Installation
DSPM-9-04	3/6	B	33kV District Substation Up To 1000 kVA Non-MPS Non-Fire Rated with HV SWGR Equipment Selection and Layout
DSPM-9-04	4/6	B	33kV District Substation Up To 1000 kVA Non-MPS Non-Fire Rated with HV SWGR Clearances
DSPM-9-04	5/6	B	33kV District Substation Up To 1000 kVA Non-MPS Non-Fire Rated with HV SWGR Earthing Arrangement
DSPM-9-04	6/6	B	33kV District Substation Up To 1000 kVA Non-MPS Non-Fire Rated with HV SWGR Screening Arrangements

1. Introduction

This Chapter of the Distribution Substation Plant Manual (DSPM) contains substation plant related information and drawings showing the standard plant arrangements used within Western Power's distribution substations with Tyree and ETEL transformers. This Chapter is being updated progressively as the plant procurement process is being undertaken. As an interim measure this Chapter may contain Distribution Substation Manual (DSM) drawings where legacy plant is still being used and the drawing set has not been updated to demonstrate Western Power's compliance with AS 5577.

2. Disclaimer

The information contained within these drawings shall not be used for anything other than their intended purpose (as stated within this Chapter). Other documents that refer to these drawings shall not change the intended purpose whether it is written or inferred.

This Chapter alone does not claim to demonstrate compliance with any Government Regulations or Industry Standards. These drawings are to be read in conjunction with the following Western Power documents:

i. Western Australian Service and Installation Requirements (WASIR)
ii. Underground Distribution Schemes Manual (UDSM)
iii. Distribution Customer Connection Requirements (DCCR)
iv. Distribution Design Catalogue (DDC)

The drawings within this Chapter are generic in nature and may not be suitable for all substation sites. It is the designer's responsibility to make sure that these drawings are suitable for the proposed substation site prior to use.

3. Compliance with this manual

The project design drawing should include or at least refer to the relevant substation installation drawings from this Chapter of the manual.

Where a customer's site requires a non-standard substation arrangement (e.g., where an alternative plant layout is required or where only an odd sized piece of land is available for a substation site), the drawings within this section can be made available to the customer. It is then the customer's responsibility, in conjunction with their architect and Civil / Structural Engineers and Western Power's Designer / Design Manager, to prepare an alternative design. This design must meet all Western Power's requirements and any relevant Australian Standards.

The non-standard substation or bespoke design must be submitted to Western Power for approval by Western Powers Designer or Design manager with an explanation of how the proposed substation design is safe, fit for purpose and will facilitate installation of "standardised Western Power distribution equipment". Where there is a non-standard layout of a substation building / room or site, the approval process should be undertaken prior to any construction work.

Any non-standard design must be approved by a Team Leader and a Senior Engineer. The design shall be recorded in the register:

Non-standard drawings register for Distribution Construction Standards Handbook (DCSH) and Distribution Substation Manual (DSM/DSPM) (EDM# 34163616)

4. Information Provided on Drawings

The standard substation drawings are grouped into District and Sole Use substations. These drawing sets will consist of the following:

4.1 Non - fire rated substations

Each Non-Fire Rated substation will typically have six standard drawing sheets.

1. Plant Single line diagram
2. Land requirements
3. Plant, equipment and substation layout
4. Clearances
5. Plant earthing single line diagram
6. Permissible screening arrangements

Some drawings may contain additional sheets where information needs to be communicated about the plant that may affect the installation. As previously mentioned, not all substations will have a complete drawing set until Western Power has finalised the plant procurement process. As an interim measure some substation drawings may still contain DSM drawings.

The following sections explain the purpose of, and the typical information that is contained within each drawing sheet.

4.1.1 Sheet 1 – Plant Single Line Diagram

The purpose of this drawing is to provide a diagrammatic representation of the electrical circuit of the substation equipment.

This drawing sheet shows the following information:

1. Location of isolation switches and disconnectors. This includes the utilisation categories of the switches and their and nominal ratings.
2. Operational earthing points
3. Electrical protection
4. Voltage levels
5. Transformer vector group
6. Number of incoming and outgoing circuits

General Designer Notes:

Refer DCCR for the HV feeder and customer connection arrangements.

The protection requirements and fuse chart are published within the Distribution Customer Connection Requirements (DCCR) manual and should be used to select the correct fuse size.

4.1.2 Sheet 2 - Land Requirements

The purpose of this drawing sheet is to show a diagrammatic representation of a piece of land that is to be provided by the landowner for the installation of the substation. This drawing should be used in conjunction with the relevant customer connection manual to determine a suitable site such as the Underground Distribution Schemes (UDSM) or Western Australian Service Installation and Requirements (WASIR).

This drawing sheet shows:

1. Cable ducting requirements.
2. The minimum size land area required for the substation.

The designer may need the landowner to provide additional land to facilitate the following items that are site specific and not shown on the standard substation drawings:

3. Additional grading rings or an extension to the substation earthing system.
4. Personnel access, egress, and equipment transport aisles
5. Oil containment methods and collection bunds.
6. Fire clearances and barriers
7. Earth retaining systems
8. Surface treatments and the methods used to retain them within the site
9. Screening walls and doors
10. Impact protection bollards

Designer Notes:

1. Where these non-standard items are required, they shall be included on the substation design drawing with dimensions to ensure Western Power's unrestricted access to this land is maintained in the future.
2. The designer is to ensure that the substation site is in a position that does not pose a safety risk and allows unrestricted access for Western Power personnel and operational vehicles.

4.1.3 Sheet 3 – Plant, Equipment and Substation Layout

The purpose of this drawing is to show what equipment is required within the substation and its physical arrangement on the site. All equipment shown is based on standard Western Power equipment contained in the Distribution Design Catalogue (DDC).

This sheet serves three purposes:

1. To enable the designer to build up an assembly list for the substation (for cost estimating and creating work orders).
2. To assist in defining construction information to other groups - for example, a marked-up copy can be issued to Kewdale Electrical Workshop for the construction of equipment such as an LV kiosk or automated ring main unit and another copy can be issued to field staff for site installation requirements.
3. To allow "standard substation equipment" to be procured by Western Power reducing the overall cost of a substation. In the event of future equipment failure, the "standard substation equipment" will

facilitate like for like replacement where these standard drawings have been used for the design and construction of the original substation site.

This drawing sheet shows:

a. The layout of distribution plant that can be used within the site such as transformers, ring main units and low voltage switchgear.

b. When required, the arrangement of the LV switchgear.

c. Power cables and connectors that shall be used to interconnect the distribution plant within the site.

d. The dimensions from the edge of the site to the culvert and / or equipment base within the site.

Designer Notes:

1. All dimensions shown on drawings have been rounded up to the nearest 50mm. An equivalent building tolerance of ± 50mm should be permitted.

4.1.4 Sheet 4 - Clearances

The purpose of this drawing is to provide a diagrammatic representation of the clearances that have been provided within the substation site.

This drawings sheet shows:

2. The clearances required around items of equipment to the edge of the substation site that allow the equipment to be operated.

3. The clearances required around items of equipment to the edge of the substation site used as access and egress paths.

4. The clearance from the equipment to the earth grading ring to be used by the designer for calculation of the touch voltages.

5. Fire clearances from transformer tank to combustible surfaces in accordance with DSPM Chapter 5 – Table 6.1 which is derived from AS/NZS 2067 Table 6.1.

6. Noise clearance zones in accordance with UDSM, Clause 5.3.18.

Designer Notes:

1. Where additional clearances are required that are not shown on the standard layout drawing, they shall be included on the substation design drawing and dimensioned to ensure clearances to substation equipment is maintained.

2. The designer is to complete a fire risk assessment as per AS/NZS 2067 Clause 6.7.4.4 to demonstrate how these clearances have been met or the fire risk has been mitigated. Refer DSPM Chapter 5 – Fire Clearances for additional guidance.

4.1.5 Sheet 5 – Plant Earthing Single Line Diagram

The purpose of this drawing is to provide a diagrammatic representation of the earthing circuit. The equipment used for earthing of distribution substations is shown on the compatible unit drawing for the plant within the Distribution Design Catalogue (DDC). The DDC provides details and quantities of the equipment used to make earth connections onto the plant and between pieces of plant within the substation site.

The standard earthing arrangement is based on a combined (HV & LV) system of earthing. Where an alternative earthing arrangement is used (e.g. separate HV & LV earthing system) the standard earthing arrangement can be modified and shown on the substation design drawings. The design drawings shall show the equipment used for the LV earthing system and its location in relation to the substation.

This drawing shows:

1. Number of earth electrodes required within the site
2. Number and types of earth bars (e.g. HV, LV)
3. Neutral earthing connections
4. Equipotential bonding connections (e.g. to exposed metal work on the plant)
5. Grading ring connections
6. Connection points for cable screens

Designer Notes:

1. The Earthing FAQ provides additional information on Western Power's network earthing requirements. This document will be replaced with Western Power's earthing guideline in the near future.

4.1.6 Sheet 6 - Permissible Screening Arrangements

The purpose of this drawing is to provide a diagrammatic representation of acceptable screening layout around the substation site. This sheet is intended to be issued to the customer to allow preparation of architectural drawings that are to be submitted back to Western Power's substation designer for approval.

This drawing shows:

1. Where screening is permissible (i.e. outside the substation site).
2. The required depth of the screening foundations to allow safe excavation within the substation site
3. The additional land that is required (when screening is used) to ensure operational clearances shown on sheet 3 can be maintained.

Designer Notes:

1. Access and egress routes are required to be maintained when screening is used. The land area may need to be increased to facilitate screening so that operational clearances and access routes can be maintained.
2. Where screening is used the designer should include the architectural drawings into the substation design drawing.
3. This drawing should be read in conjunction with the Substation Installation Requirements within the UDSM Clause 6.2.8.25 or WASIR 14.5.4.
4. All buildings shall meet the requirements of the Local Government and the National Construction Code (NCC).
5. Two-hour fire rated screening may be used to reduce the fire clearance zone. See DSPM Chapter 5 for more guidance on fire clearances.

4.2 Fire rated substations (to be developed)

5. Drawings - Substation Arrangements

The following section contains the substation arrangement drawings for the following voltage levels:

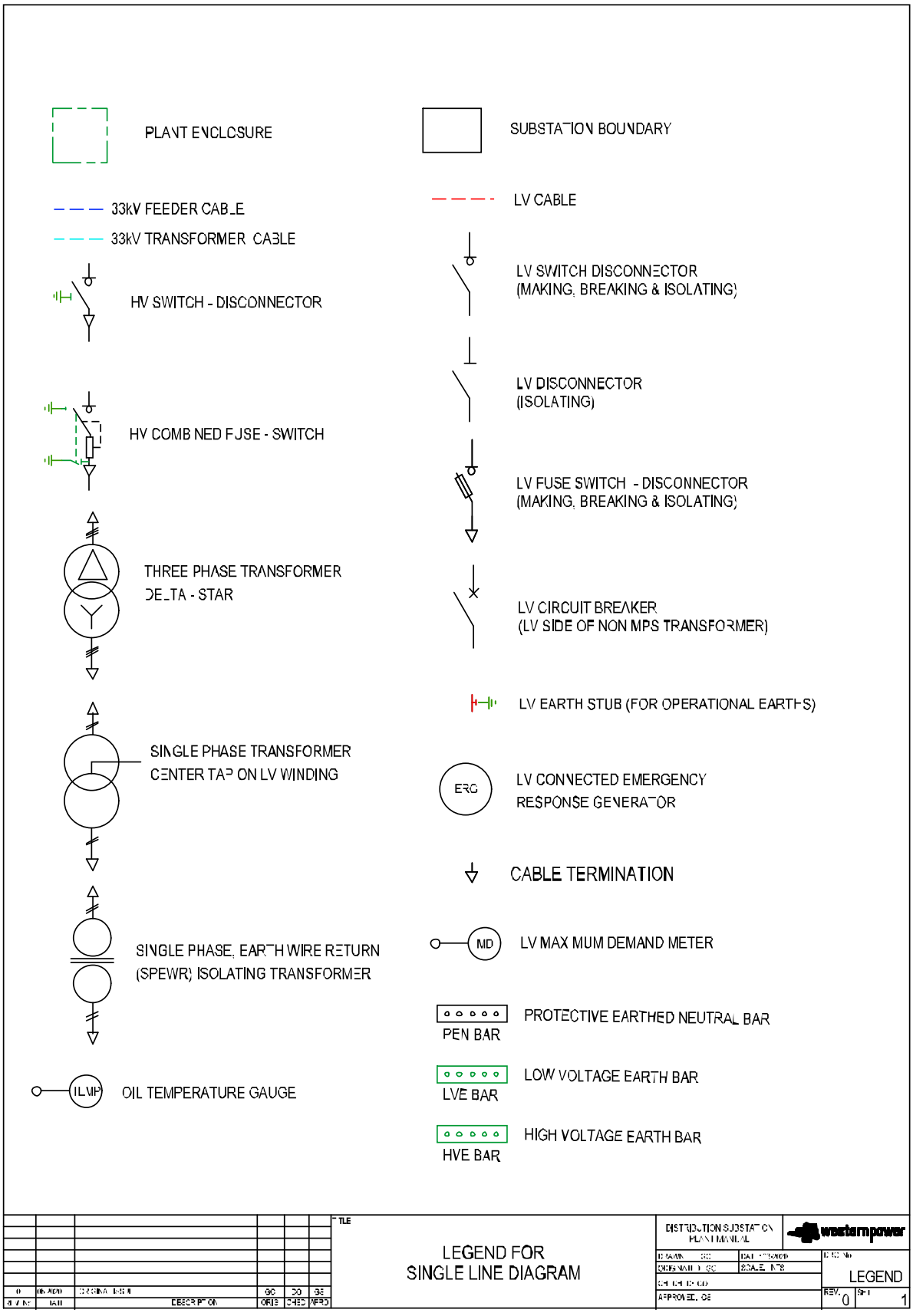
a. 33kV three phase

b. 19.1kV single phase (future)

These drawings are grouped into the following types:

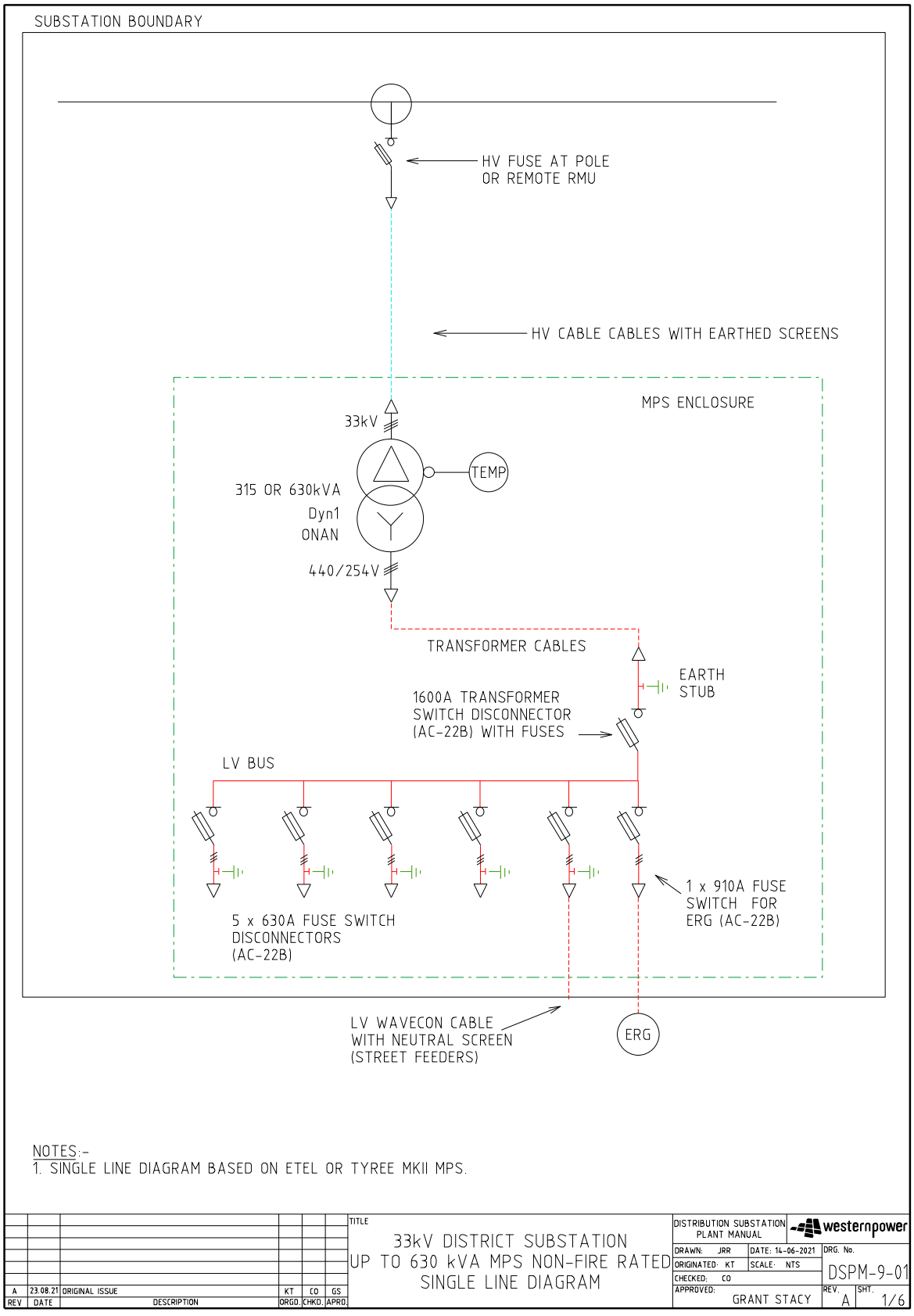
- District Substations, non-fire rated
- Sole Use Substations, non-fire rated (to be developed)
- District Substations, Fire rated (to be developed)
- Sole Use Substations, Fire rated (to be developed)
- Customer Owned Substations, HV metered sites (to be developed)
- Single phase and three phase ground mounted rural substations (to be developed)
- Standalone HV switchgear (to be developed)
- Isolating Transformer (to be developed)

5.1 Drawing Legend

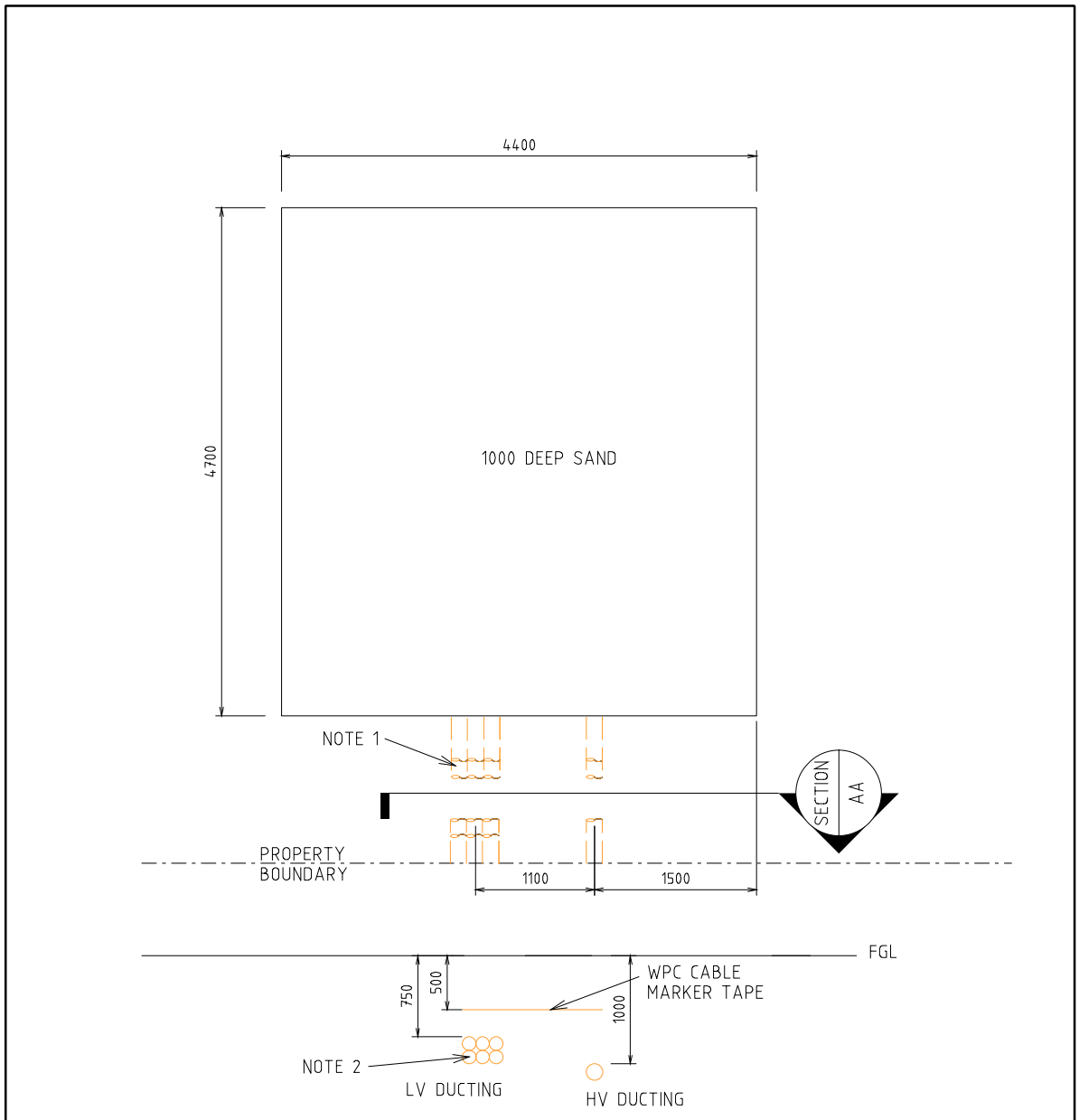


5.2 DSPM 9-01 Up to 630kVA Modular Package Substation (MPS)

5.2.1 Single Line Diagram



5.2.2 Land Requirements and Duct Installation



SECTION AA

NOTES :-
1. DUCTING REQUIRED IF LAND IS SET BACK FROM THE ROAD RESERVE BOUNDARY OR IF SCREENING IS REQUIRED.
2. 6x125 (LV) & 2x150 (HV) ID HEAVY DUTY DUCTS (CN56).

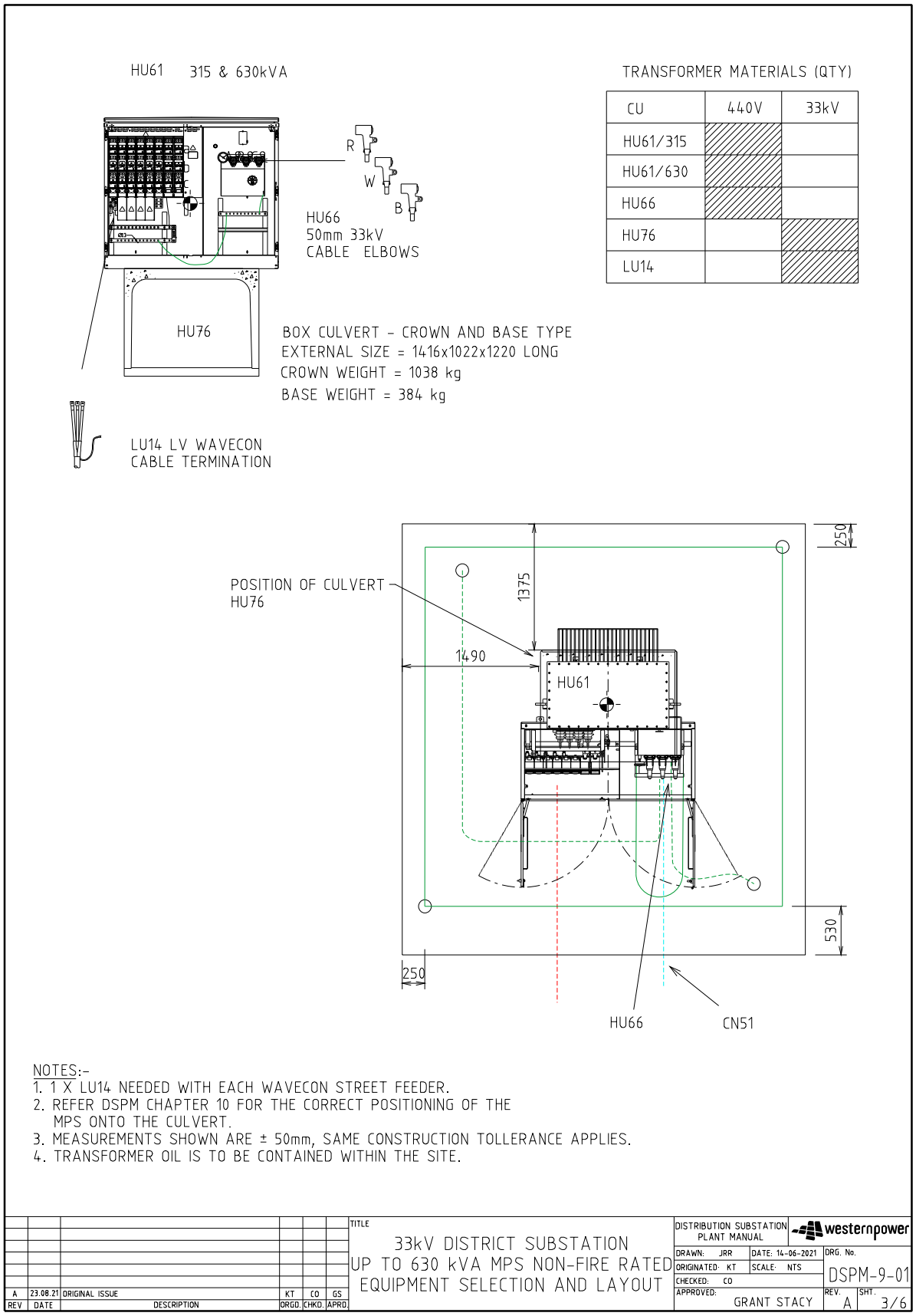
REV	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
A	23.08.21	ORIGINAL ISSUE	KT	CO	GS

TITLE: 33kV DISTRICT SUBSTATION UP TO 630kVA MPS NON-FIRE RATED LAND REQUIREMENTS AND DUCT INSTALLATION

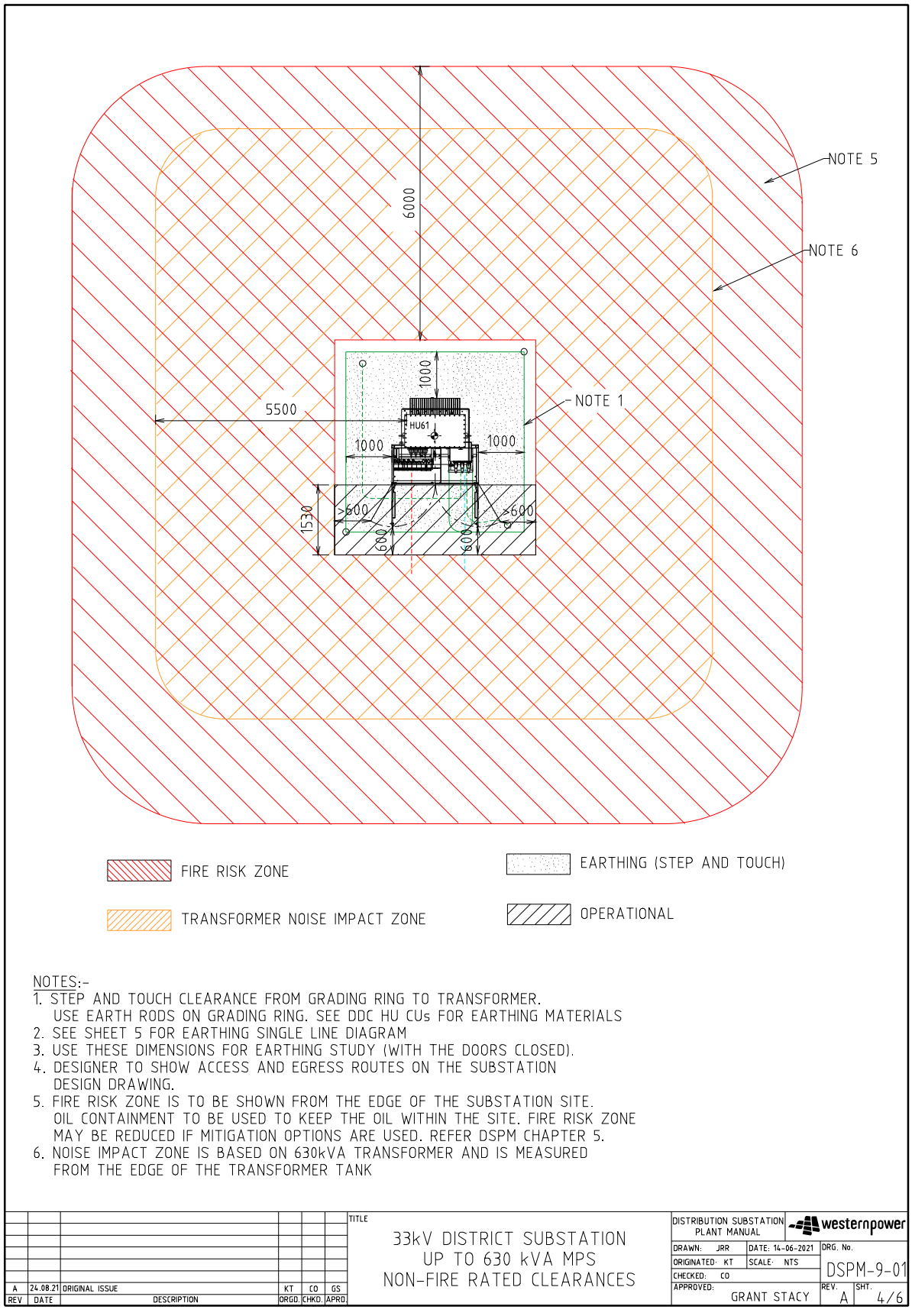
DISTRIBUTION SUBSTATION PLANT MANUAL — westernpower

DRAWN: JRR	DATE: 14-11-2019	DRG. No. DSPM-9-01
ORIGINATED: KT	SCALE: NTS	
CHECKED: CO		
APPROVED: GRANT STACY		REV. A / SHT. 2/6

5.2.3 Equipment Selection and Layout



5.2.4 Clearances



NOTES:-
1. STEP AND TOUCH CLEARANCE FROM GRADING RING TO TRANSFORMER. USE EARTH RODS ON GRADING RING. SEE DDC HU CUs FOR EARTHING MATERIALS
2. SEE SHEET 5 FOR EARTHING SINGLE LINE DIAGRAM
3. USE THESE DIMENSIONS FOR EARTHING STUDY (WITH THE DOORS CLOSED).
4. DESIGNER TO SHOW ACCESS AND EGRESS ROUTES ON THE SUBSTATION DESIGN DRAWING.
5. FIRE RISK ZONE IS TO BE SHOWN FROM THE EDGE OF THE SUBSTATION SITE. OIL CONTAINMENT TO BE USED TO KEEP THE OIL WITHIN THE SITE. FIRE RISK ZONE MAY BE REDUCED IF MITIGATION OPTIONS ARE USED. REFER DSPM CHAPTER 5.
6. NOISE IMPACT ZONE IS BASED ON 630kVA TRANSFORMER AND IS MEASURED FROM THE EDGE OF THE TRANSFORMER TANK

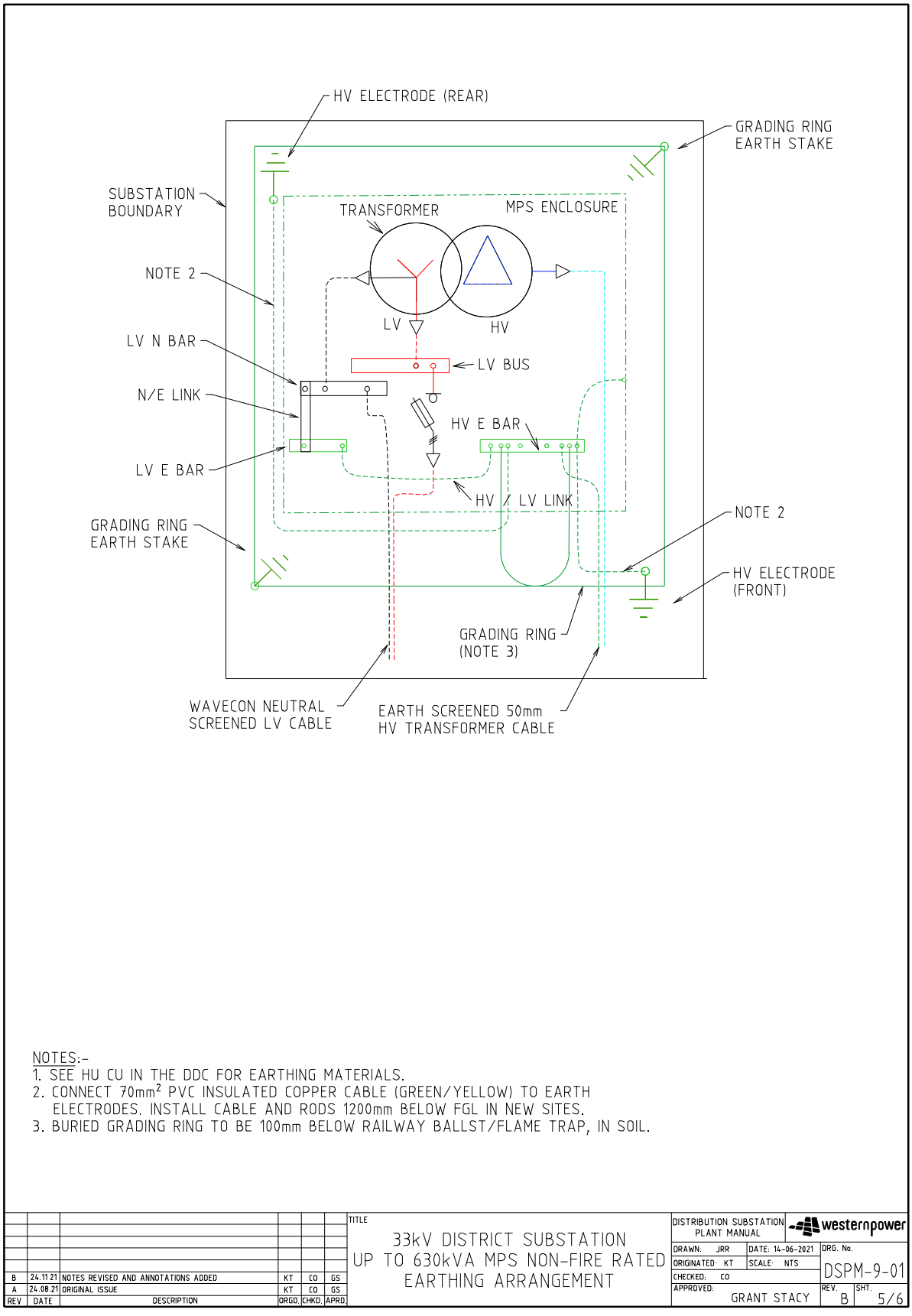
REV	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
A	24.08.21	ORIGINAL ISSUE	KT	CO	GS

TITLE: 33kV DISTRICT SUBSTATION UP TO 630 kVA MPS NON-FIRE RATED CLEARANCES

DISTRIBUTION SUBSTATION PLANT MANUAL — westernpower

DRAWN: JRR	DATE: 14-06-2021	DRG. No.	DSPM-9-01
ORIGINATED: KT	SCALE: NTS		
CHECKED: CO			
APPROVED: GRANT STACY		REV. A	SHT. 4/6

5.2.5 Earthing Arrangement



NOTES:-
1. SEE HU CU IN THE DDC FOR EARTHING MATERIALS.
2. CONNECT 70mm² PVC INSULATED COPPER CABLE (GREEN/YELLOW) TO EARTH ELECTRODES. INSTALL CABLE AND RODS 1200mm BELOW FGL IN NEW SITES.
3. BURIED GRADING RING TO BE 100mm BELOW RAILWAY BALLST/FLAME TRAP, IN SOIL.

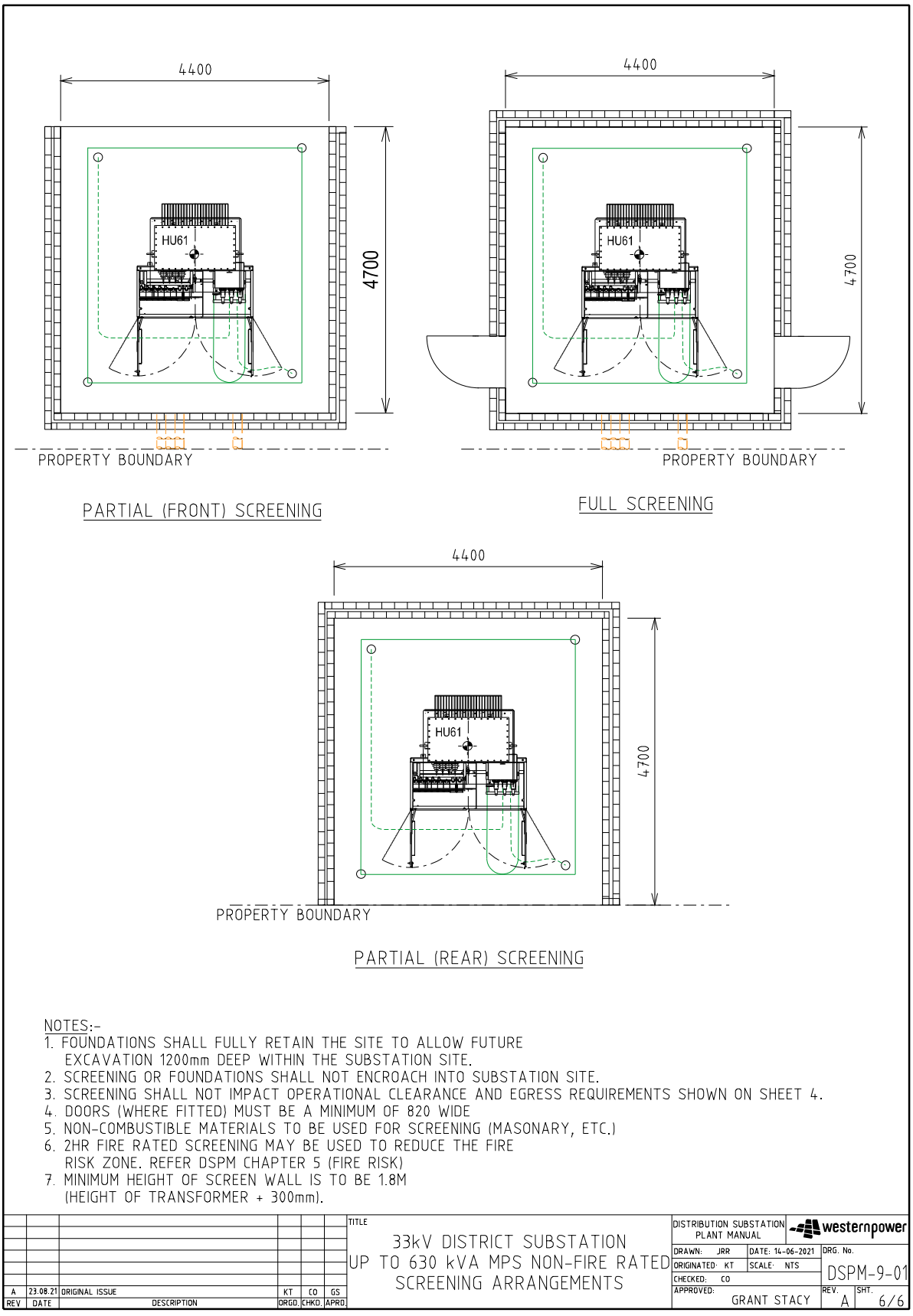
REV	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
B	24.11.21	NOTES REVISED AND ANNOTATIONS ADDED	KT	CO	GS
A	24.08.21	ORIGINAL ISSUE	KT	CO	GS

TITLE: 33kV DISTRICT SUBSTATION UP TO 630kVA MPS NON-FIRE RATED EARTHING ARRANGEMENT

DISTRIBUTION SUBSTATION PLANT MANUAL

DRAWN: JRR | DATE: 14-06-2021 | DRG. No. DSPM-9-01
ORIGINATED: KT | SCALE: NTS
CHECKED: CO
APPROVED: GRANT STACY | REV: B | SHT: 5/6

5.2.6 Screening Arrangement



NOTES:-
1. FOUNDATIONS SHALL FULLY RETAIN THE SITE TO ALLOW FUTURE EXCAVATION 1200mm DEEP WITHIN THE SUBSTATION SITE.
2. SCREENING OR FOUNDATIONS SHALL NOT ENCROACH INTO SUBSTATION SITE.
3. SCREENING SHALL NOT IMPACT OPERATIONAL CLEARANCE AND EGRESS REQUIREMENTS SHOWN ON SHEET 4.
4. DOORS (WHERE FITTED) MUST BE A MINIMUM OF 820 WIDE
5. NON-COMBUSTIBLE MATERIALS TO BE USED FOR SCREENING (MASONARY, ETC.)
6. 2HR FIRE RATED SCREENING MAY BE USED TO REDUCE THE FIRE RISK ZONE. REFER DSPM CHAPTER 5 (FIRE RISK)
7. MINIMUM HEIGHT OF SCREEN WALL IS TO BE 1.8M (HEIGHT OF TRANSFORMER + 300mm).

REV	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
A	23.08.21	ORIGINAL ISSUE	KT	CO	GS

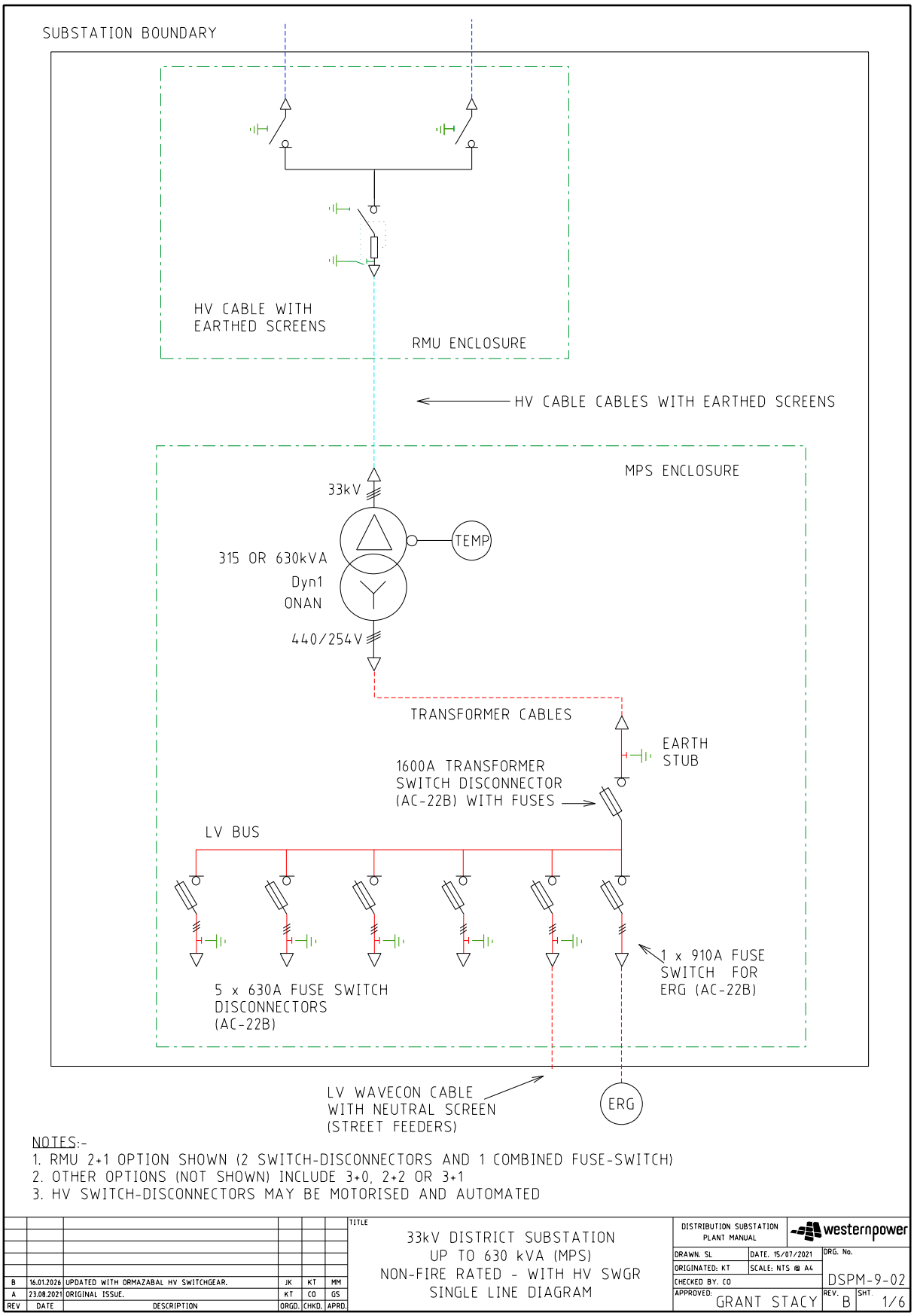
TITLE: 33kV DISTRICT SUBSTATION UP TO 630 kVA MPS NON-FIRE RATED SCREENING ARRANGEMENTS

DISTRIBUTION SUBSTATION PLANT MANUAL

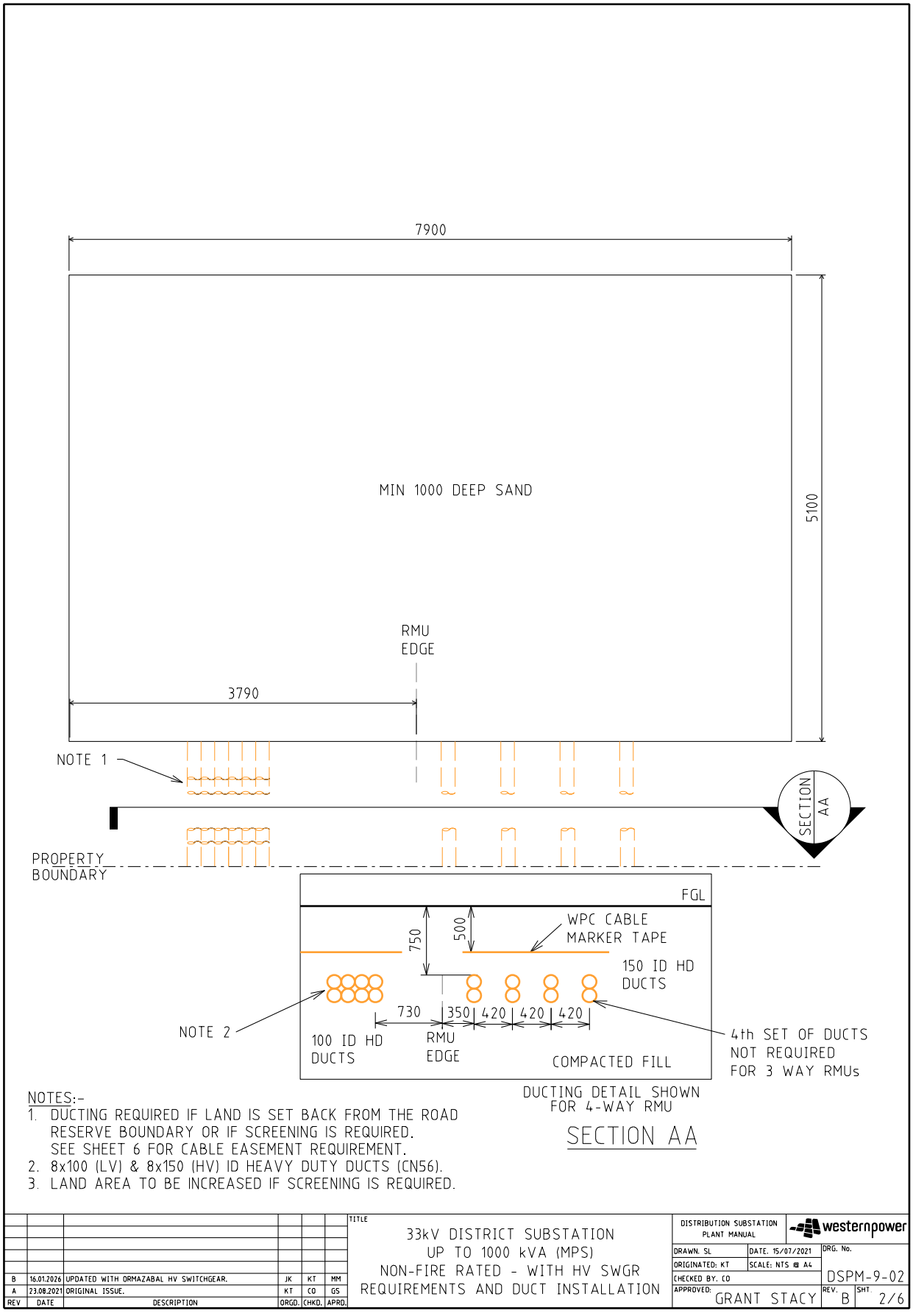
DRAWN: JRR	DATE: 14-06-2021	DRG. No.	
ORIGINATED: KT	SCALE: NTS	DSPM-9-01	
CHECKED: CO			
APPROVED: GRANT STACY		REV. A	SHT. 6/6

5.3 DSPM 9-02 Up to 630kVA Modular Package Substation (MPS) with HV switchgear

5.3.1 Single Line Diagram



5.3.2 Land Requirements and Duct Installation



DUCTING DETAIL SHOWN FOR 4-WAY RMU

SECTION AA

NOTES:-
1. DUCTING REQUIRED IF LAND IS SET BACK FROM THE ROAD RESERVE BOUNDARY OR IF SCREENING IS REQUIRED. SEE SHEET 6 FOR CABLE EASEMENT REQUIREMENT.
2. 8x100 (LV) & 8x150 (HV) ID HEAVY DUTY DUCTS (CN56).
3. LAND AREA TO BE INCREASED IF SCREENING IS REQUIRED.

REV	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
B	16.01.2026	UPDATED WITH ORMAZABAL HV SWITCHGEAR.	JK	KT	MM
A	23.08.2021	ORIGINAL ISSUE.	KT	CO	GS

TITLE: 33kV DISTRICT SUBSTATION UP TO 1000 kVA (MPS) NON-FIRE RATED - WITH HV SWGR REQUIREMENTS AND DUCT INSTALLATION

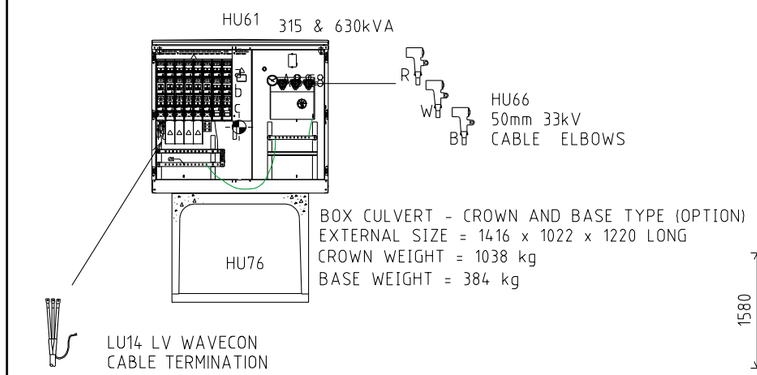
DISTRIBUTION SUBSTATION PLANT MANUAL

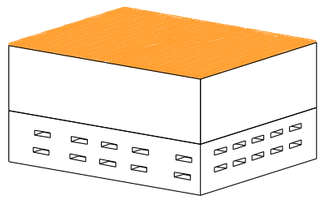
westernpower

DRAWN: SL | DATE: 15/07/2021 | DRG. No.
ORIGINATED: KT | SCALE: NTS @ A4
CHECKED BY: CO
APPROVED: GRANT STACY | REV. B | SHT 2/6

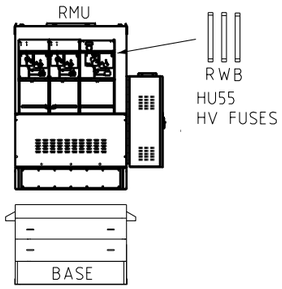
DSPM-9-02

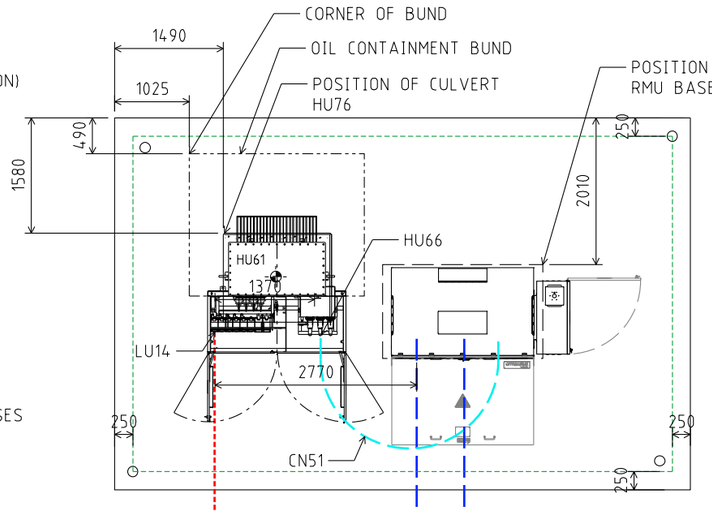
5.3.3 Equipment Selection and Layout

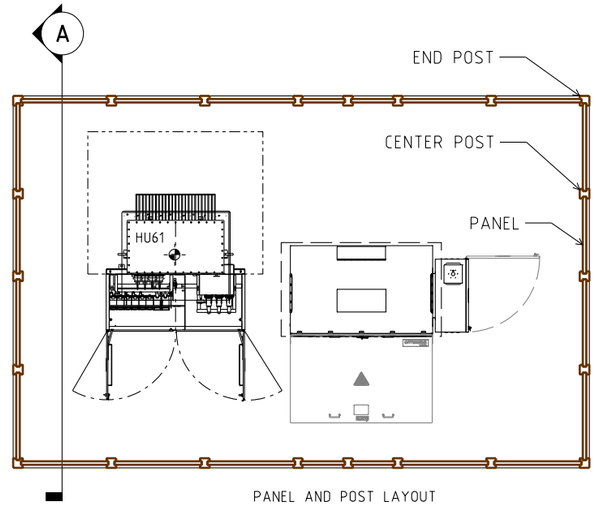




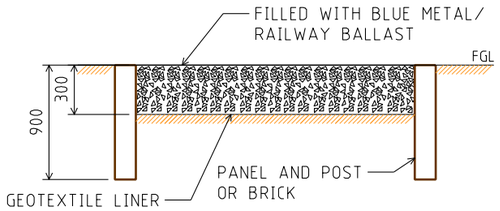
OIL CONTAINMENT BUND (OPTION)
EXTERNAL SIZE = 2400W x 1950D x 1270H
WEIGHT = APPROX. 8000 kg





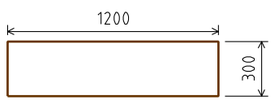


PANEL AND POST LAYOUT

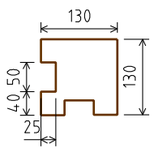


DETAIL A

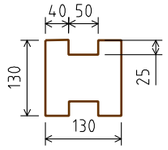
HV MATERIAL		
EQUIPMENT	CU	QTY 33kV
TRANSFORMER	HU55/315	SELECT 1
	HU55/630	
	HU61/315	SELECT 1
	HU61/630	
	BUND	SELECT 1
	HU76	
RMU	HU101 (2+1)	SELECT 1
	HU102 (2+2)	
	HU103 (3+1)	
EARTHING	HU69_2	1
CABLE	HU66	1
	CN51	7
AUTOMATION	DA6_LVS	1
	DA6_NG_SE	1 (OPTIONAL)



TYPICAL PANEL DETAIL



END POST DETAIL



CENTER POST DETAIL

NOTES:-

1. INSTALL CABLE CLAMP ON EACH PHASE OF HV CABLE (FM0200).
2. 1 X LU14 NEEDED WITH EACH WAVECON STREET FEEDER.
3. MEASUREMENTS SHOWN ARE ± 50mm, SAME CONSTRUCTION TOLERANCE APPLIES.
4. REFER TO DSPM CHAPTER 10 FOR THE CORRECT POSITIONING OF THE MPS ONTO THE CULVERT IF CULVERT IS USED.
5. REFER TO DSPM CHAPTER 10 FOR THE CORRECT INSTALLATION OF THE RMU BASE.
6. RMU, KIOSK BASE AND CABLE TERMINATIONS SUPPLIED IN RMU CU.
7. REFER TO DSPM CHAPTER 4 SHEET 3 FOR AUTOMATION T300 CONNECTION DETAILS.
8. TRANSFORMER OIL IS TO BE CONTAINED WITHIN THE SITE.
9. WHERE THE SOLE PURPOSE OF THE RETAINING WALLS IS TO CONTAIN THE RAILWAY BALLAST 900mm LONG POSTS ARE REQUIRED.
10. LONGER POSTS AND MULTIPLE LAYERS OF PANELS ARE TO BE USED AND INSTALLED IN ACCORDANCE WITH THE RETAINING WALL MANUFACTURERS INSTRUCTIONS, WHERE THE RETAINING WALLS ARE USED TO LEVEL THE SITE.
11. POST HOLES ARE TO BE 450mm DIAMETER AND POST ENCASED IN 25 GRADE CONCRETE ONLY WHERE THE RETAINING WALLS ARE USED TO LEVEL THE SITE.
12. IF BUND IS USED, REFER MODIFIED DSPM 4-06 (EDM: 69873797) FOR THE CORRECT POSITIONING OF THE NON-MPS ONTO THE BUND.

REV	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
B	16.01.2026	UPDATED WITH ORMAZABAL HV SWITCHGEAR.	JK	KT	MM
A	23.08.2021	ORIGINAL ISSUE.	KT	CO	GS

TITLE

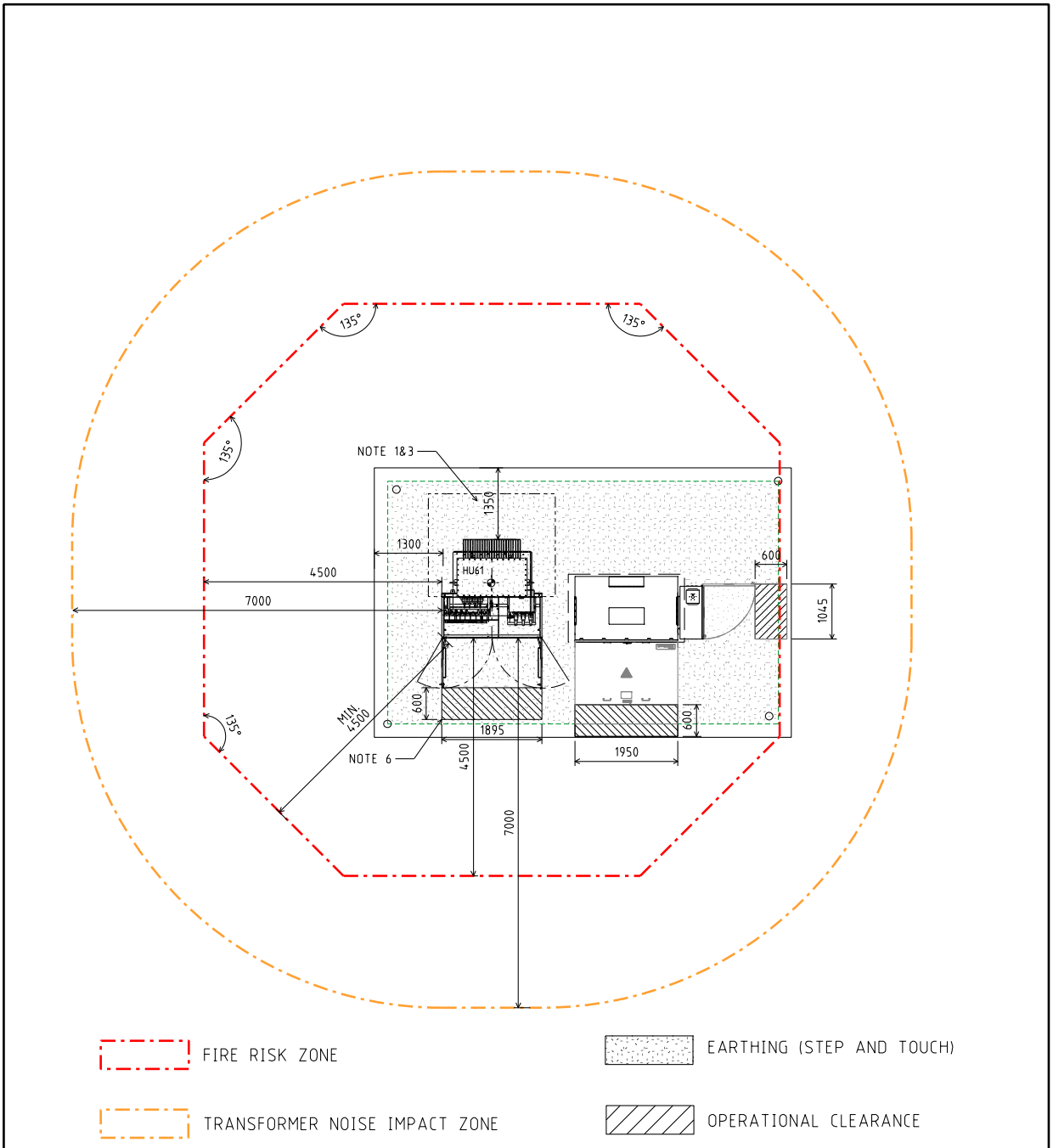
33kV DISTRICT SUBSTATION
UP TO 1000 kVA (MPS)
NON-FIRE RATED - WITH HV SWGR
EQUIPMENT SELECTION AND LAYOUT

DISTRIBUTION SUBSTATION PLANT MANUAL

westernpower

DRAWN: SL	DATE: 15/07/2021	DRG. No.
ORIGINATED: KT	SCALE: NTS @ A4	DSPM-9-02
CHECKED BY: CO		
APPROVED: GRANT STACY	REV. B	SHT. 3/6

5.3.4 Non-Fire Rated Clearances



NOTES:-
1. STEP AND TOUCH CLEARANCE FROM GRADING RING TO TRANSFORMER AND RMU.
2. SEE SHEET 5 FOR EARTHING SINGLE LINE DIAGRAM.
3. USE THESE DIMENSIONS FOR EARTHING STUDY (WITH THE DOORS CLOSED).
4. DESIGNER TO SHOW ACCESS AND EGRESS ROUTES ON THE SUBSTATION DESIGN DRAWING.
5. NOISE IMPACT ZONE IS BASED ON 1000 kVA TRANSFORMER AND IS MEASURED FROM THE EDGE OF THE TRANSFORMER TANK. NOISE IMPACT ZONE MAY BE REDUCED IF MITIGATION OPTIONS ARE USED. REFER TO "NOISE COMPLIANCE REQUIREMENTS FOR DISTRIBUTION TRANSFORMERS" GUIDELINE.
6. OPERATIONAL CLEARANCE IN FRONT OF TRANSFORMER SHOWN WITH DOORS LIFTED OFF.

REV	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
B	16.01.2026	UPDATED WITH ORMAZABAL HV SWITCHGEAR.	JK	KT	MM
A	23.08.2021	ORIGINAL ISSUE.	KT	CO	GS

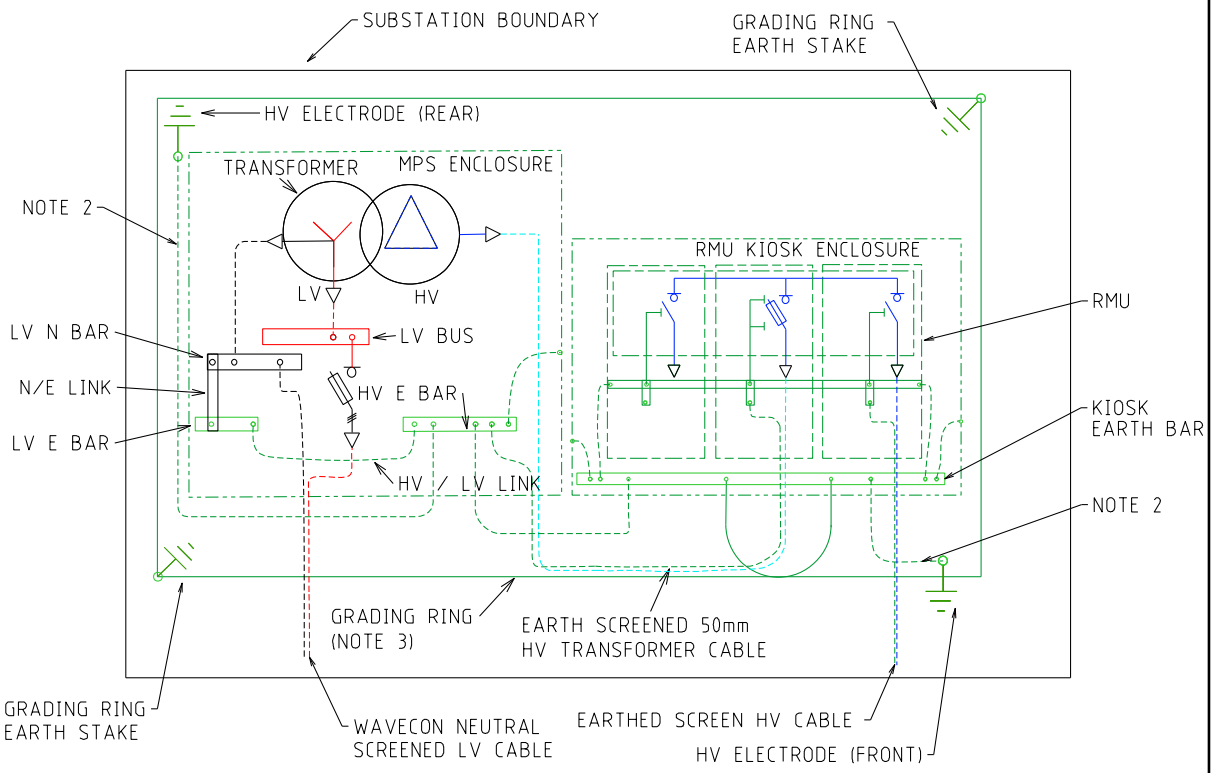
TITLE: DISTRICT SUBSTATION UP TO 1000 kVA (MPS) NON-FIRE RATED - WITH HV SWGR CLEARANCES

DISTRIBUTION SUBSTATION PLANT MANUAL

DRAWN. SL | DATE. 15/07/2021
ORIGINATED: KT | SCALE: NTS @ A4
CHECKED BY. CO
APPROVED: GRANT STACY

DRG. No. DSPM-9-02
REV. B
SHT 4/6

5.3.5 Earthing Arrangement



NOTES:-
1. SEE HU CU IN THE DDC FOR EARTHING MATERIALS.
2. CONNECT 70mm× PVC INSULATED COPPER CABLE (GREEN/YELLOW) TO EARTH ELECTRODES. INSTALL CABLE AND RODS 1200mm BELOW FGL IN NEW SITES.
3. BURIED GRADING RING TO BE 100mm BELOW RAILWAY BALLAST/FLAME TRAP, IN SOIL.

REV	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
B	16.01.2026	UPDATED WITH ORMAZABAL HV SWITCHGEAR.	JK	KT	MM
A	23.08.2021	ORIGINAL ISSUE.	KT	CO	GS

TITLE: 33kV DISTRICT SUBSTATION UP TO 1000 kVA (MPS) NON-FIRE RATED - WITH HV SWGR EARTHING ARRANGEMENT

DISTRIBUTION SUBSTATION PLANT MANUAL

westernpower

DRAWN. SL | DATE. 15/07/2021

ORIGINATED: KT | SCALE: NTS @ A4

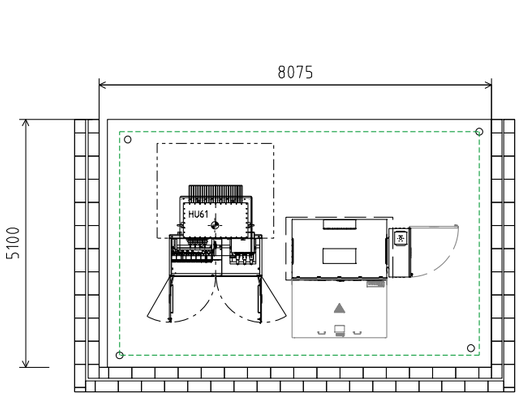
CHECKED BY. CO

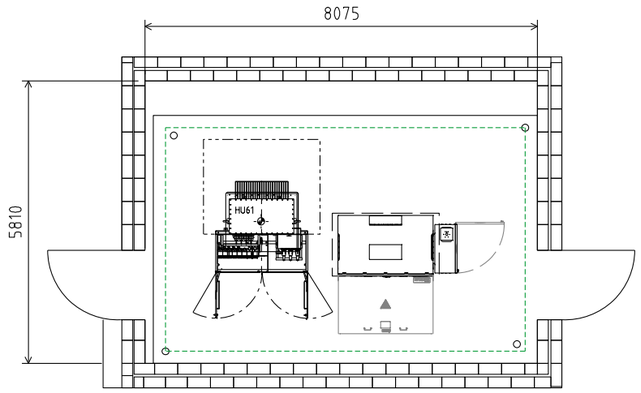
APPROVED: GRANT STACY

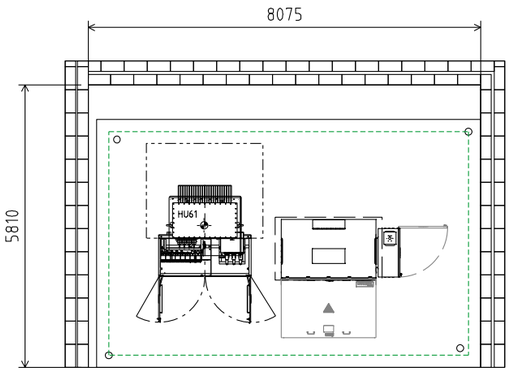
DRG. No. DSPM-9-02

REV. B | SHT 5/6

5.3.6 Screening Arrangement







NOTES:-

1. FOUNDATIONS SHALL FULLY RETAIN THE SITE TO ALLOW FUTURE EXCAVATION 1200mm DEEP WITHIN THE SUBSTATION SITE.
2. SCREENING OR FOUNDATIONS SHALL NOT ENCROACH INTO SUBSTATION SITE.
3. SCREENING SHALL NOT IMPACT OPERATIONAL CLEARANCE AND EGRESS REQUIREMENTS SHOWN ON SHEET 4.
4. DOORS (WHERE FITTED) MUST BE A MINIMUM OF 820 WIDE.
5. NON-COMBUSTIBLE MATERIALS TO BE USED FOR SCREENING (MASONRY, ETC)
6. 2HR FIRE RATED SCREENING MAY BE USED TO REDUCE THE FIRE RISK ZONE. REFER TO DSPM CHAPTER 5 (FIRE RISK).
7. MINIMUM HEIGHT OF SCREEN WALL IS TO BE 1.8m (HEIGHT OF TRANSFORMER + 300mm).
8. EXCAVATIONS FOR SCREENING FOOTING GREATER THAN 1.2m NEEDS TO BE ASSESSED BY A COMPETENT CHARTERED CIVIL ENGINEER TO BE COMPLETED BY THE CUSTOMER.

REV	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
B	16.01.2026	UPDATED WITH ORMAZABAL HV SWITCHGEAR.	JK	KT	MM
A	23.08.2021	ORIGINAL ISSUE.	KT	CO	GS

TITLE

33kV DISTRICT SUBSTATION
UP TO 1000 kVA (MPS)
NON-FIRE RATED - WITH HV SWGR
SCREENING ARRANGEMENTS

DISTRIBUTION SUBSTATION PLANT MANUAL

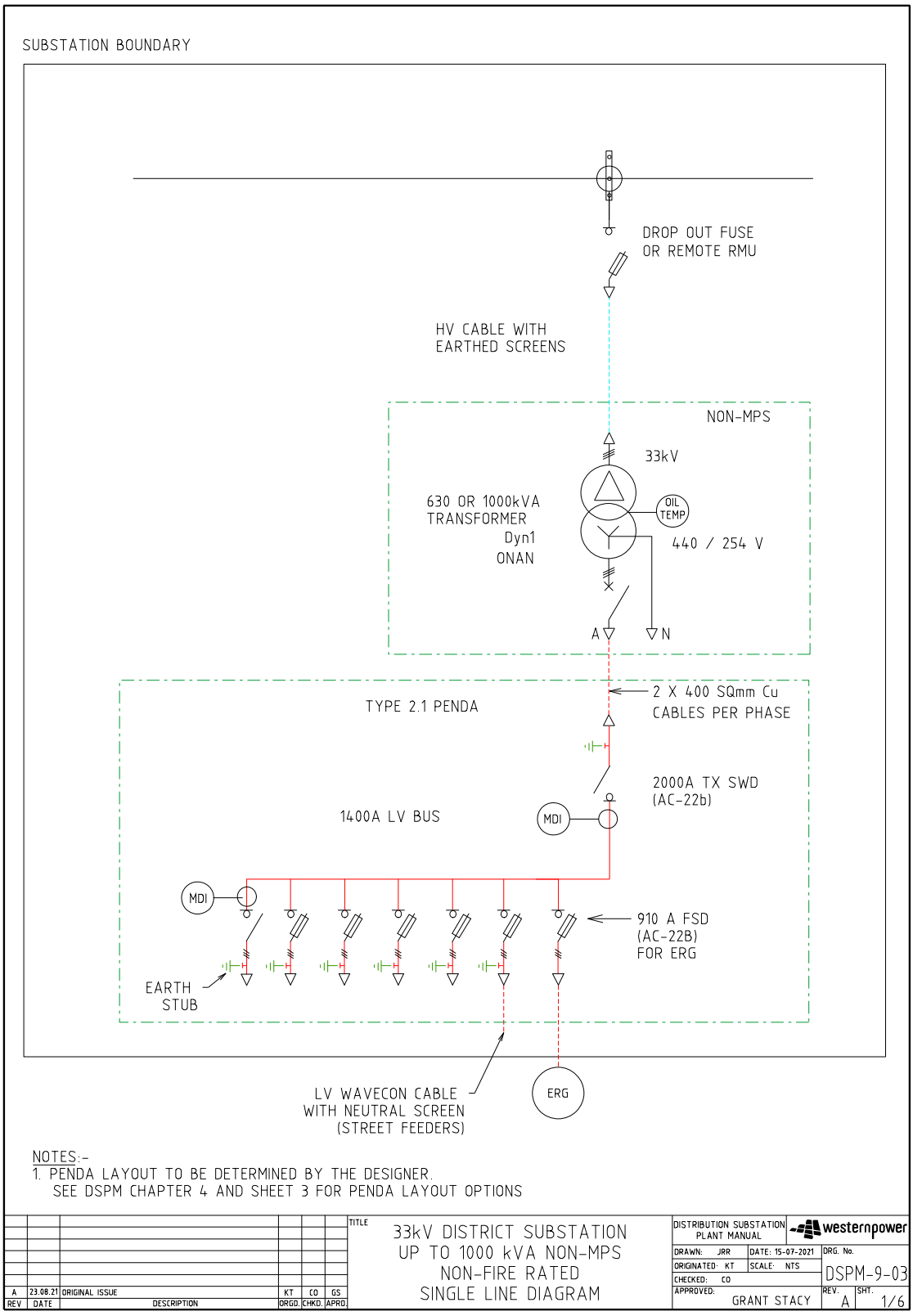
westernpower

DRAWN: SL | DATE: 15/07/2021
ORIGINATED: KT | SCALE: NTS @ A4
CHECKED BY: CO
APPROVED: GRANT STACY

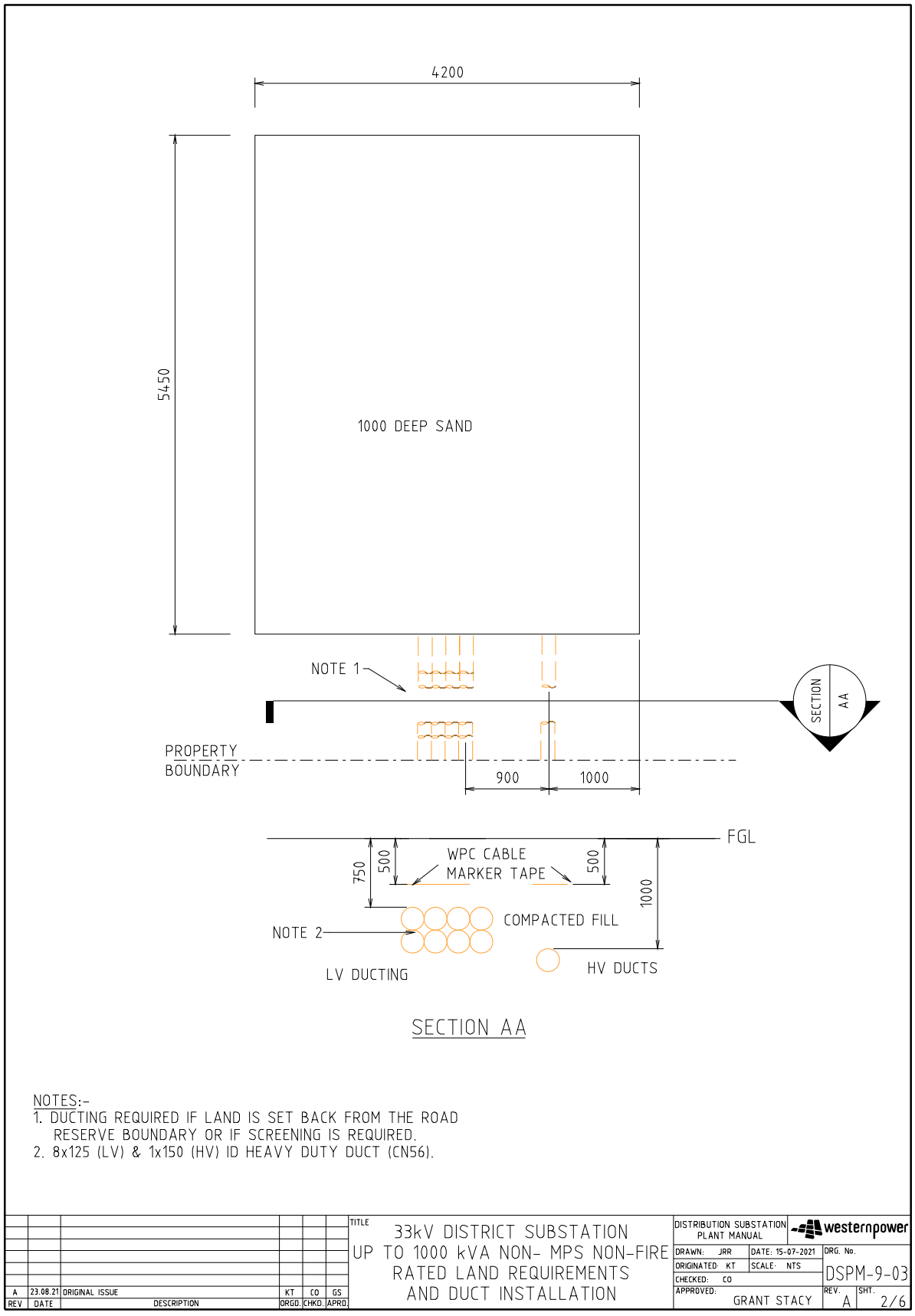
DRG. No. DSPM-9-02
REV. B | SHT. 6/6

5.4 DSPM 9-03 Up to 1000kVA Non MPS District

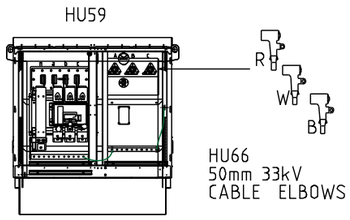
5.4.1 Single Line Diagram



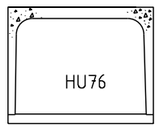
5.4.2 Land Requirements and Duct Installation



5.4.3 Equipment Selection and Layout



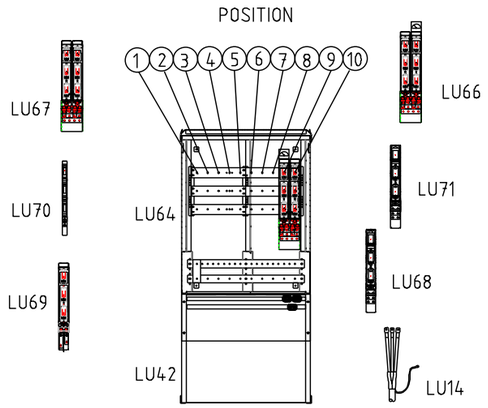
315, 630 & 1000kVA

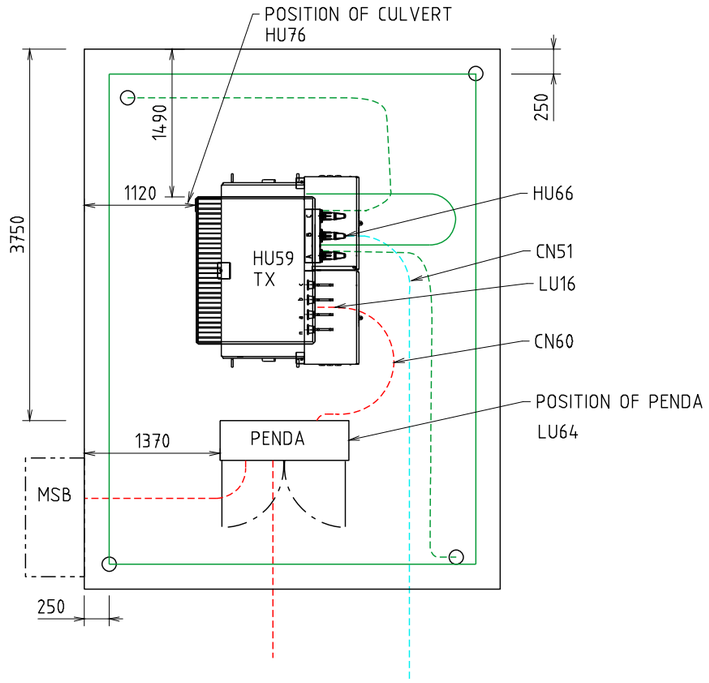


BOX CULVERT - CROWN AND BASE TYPE
EXTERNAL SIZE = 1416 x 1022 x 1220 LONG
CROWN WEIGHT = 1038 kg
BASE WEIGHT = 384 kg

TRANSFORMER MATERIALS (QTY)

CU	440V	33kV
HU59/315		
HU59/630		
HU59/1000		
HU66		
CN60		
LU16		
HU76		





TYPE 2.1 PENDA LAYOUT

SWG	MAX FUSE	CU	1	2	3	4	5	6	7	8	9	10
TYPE 2.1 PENDA		LU64										
PENDA BASE		LU42										
160A FSD	1 X 63A DIN 00	LU70				L	L					
630 FSD	1 X 400A NH2	LU69	C/S	C/S	C/S	C/S	C/S	C/S	C/S			
910A FSD	1 X 630A NH3	LU68								E		
1260A FSD	2 X 400A NH2	LU67	C		C							
1000A SWD	LINKS SUPPLIED	LU71	C									
2000A SWD	LINKS SUPPLIED	LU66	C1								T1	
FSD CABLE TERM	FUSES SUPPLIED	LU14	S	S	S	L/S	S	S	S			
TX CABLE TERM	TX MCCB	LU16									T1	

T = TRANSFORMER L = LIGHTING CIRCUIT E = EMERGENCY RESPONSE GENERATOR
C = CUSTOMER S= STREET CIRCUIT

NOTES:-
1. LU66 CAN BE USED FOR THE TRANSFORMER AND CUSTOMER.
2. EVERY INSTALLATION SHALL INCLUDE AN ERG CONNECTION LU68.
3. 2 x LU70 OR 1 x LU69 CAN BE USED IN POSITION 4.
4. 1 X LU14 NEEDED WITH EACH LU69 STREET FEEDER OR LU70 LIGHTING CIRCUIT.
5. 1 X LU16 NEEDED WITH EACH LU66_TX IN PENDA AND 1 X LU16 FOR LU59 (NON-MPS).
6. LU66_TX WILL DEFAULT TO POSITIONS 9 & 10 UNLESS POSITION 1 & 2 IS SPECIFIED BY THE DESIGNER.
7. STANDARD PENDA LAYOUT SHOWN. DESIGNER MAY DESIGN AN ALTERNATIVE PENDA LAYOUT.
8. NO GANGED FSD OR SWD PERMITTED SPANING POSITIONS 5 & 6 OR 6 & 7.
9. LU71 ONLY TO BE USED WHERE THERE IS UPSTREAM LV PROTECTION (I.E. MKII NON MPS).
10. STANDARD PENDA LAYOUT SHOWN. DESIGNER MAY DESIGN AN ALTERNATIVE PENDA LAYOUT.
11. NO GANGED FSD OR SWD PERMITTED SPANING POSITIONS 5 & 6 OR 6 & 7.
12. REFER DSPM CHAPTER 10 FOR THE CORRECT POSITIONING OF THE NON-MPS ONTO THE CULVERT.
13. MEASUREMENTS SHOWN ARE ± 50mm, SAME CONSTRUCTION TOLLERANCE APPLIES

REV.	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
A	24.08.21	ORIGINAL ISSUE	KT	CO	GS

TITLE

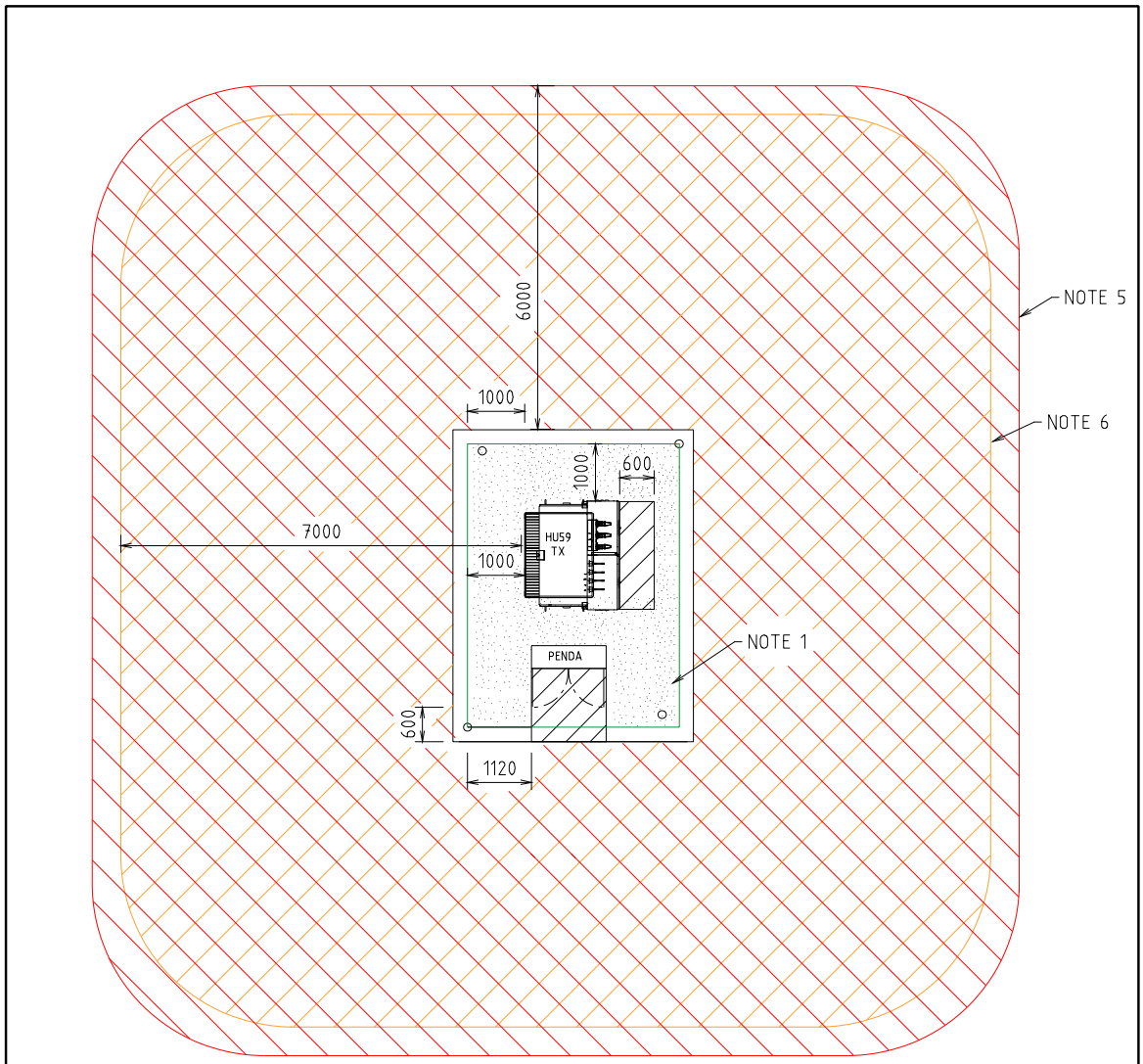
33kV DISTRICT SUBSTATION
UP TO 1000 kVA NON- MPS
NON-FIRE RATED
EQUIPMENT SELECTION AND LAYOUT

DISTRIBUTION SUBSTATION PLANT MANUAL

westernpower

DRAWN: JRR	DATE 15-07-2021	DRG. No. DSPM-9-03
ORIGINATED: KT	SCALE: NTS	
CHECKED: CO		
APPROVED: GRANT STACY		REV. A / SHT. 3/6

5.4.4 Clearances



NOTES:-
1. STEP AND TOUCH CLEARANCE FROM GRADING RING TO TRANSFORMER.
   USE EARTH RODS ON GRADING RING. SEE DDC HU CUs FOR EARTHING MATERIALS
2. SEE SHEET 5 FOR EARTHING SINGLE LINE DIAGRAM
3. USE THESE DIMENSIONS FOR EARTHING STUDY (WITH THE DOORS CLOSED).
4. DESIGNER TO SHOW ACCESS AND EGRESS ROUTES ON THE SUBSTATION DESIGN DRAWING.
5. FIRE RISK ZONE IS TO BE SHOWN FROM THE EDGE OF THE SUBSTATION SITE.
   OIL CONTAINMENT TO BE USED TO KEEP THE OIL WITHIN THE SITE. FIRE RISK ZONE
   MAY BE REDUCED IF MITIGATION OPTIONS ARE USED. REFER DSPM CHAPTER 5.
6. NOISE IMPACT ZONE IS BASED ON 1000 kVA TRANSFORMER

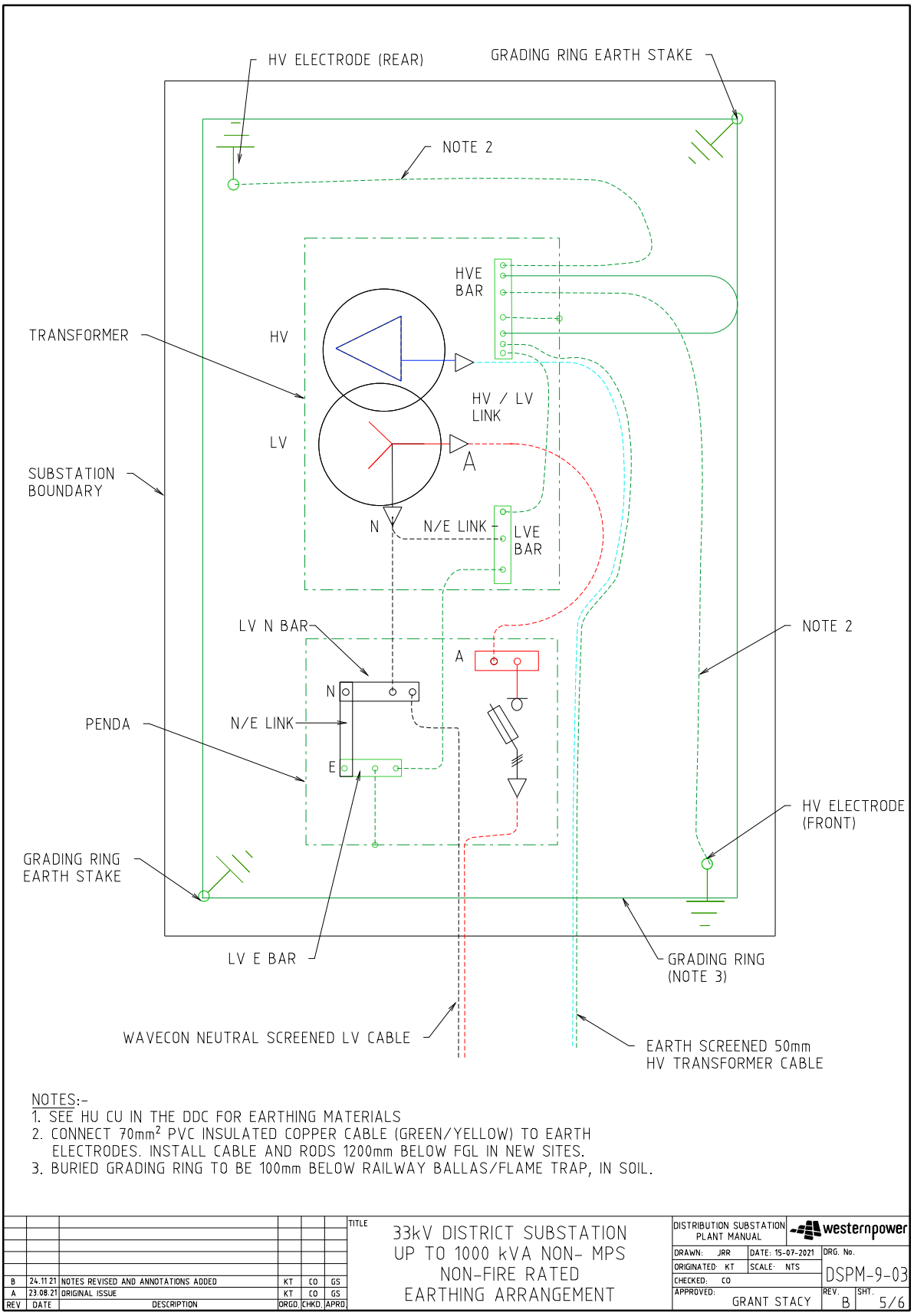
REV	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
A	24.08.21	ORIGINAL ISSUE	KT	CO	GS

TITLE: 33kV DISTRICT SUBSTATION UP TO 1000 kVA NON- MPS NON-FIRE RATED CLEARANCES

DISTRIBUTION SUBSTATION PLANT MANUAL — westernpower

DRAWN: JRR	DATE: 15-07-2021	DRG. No.	
ORIGINATED: KT	SCALE: NTS	DSPM-9-03	
CHECKED: CO			
APPROVED: GRANT STACY		REV. A	SHT. 4/6

5.4.5 Earthing Arrangement



NOTES:-
1. SEE HU CU IN THE DDC FOR EARTHING MATERIALS
2. CONNECT 70mm² PVC INSULATED COPPER CABLE (GREEN/YELLOW) TO EARTH ELECTRODES. INSTALL CABLE AND RODS 1200mm BELOW FGL IN NEW SITES.
3. BURIED GRADING RING TO BE 100mm BELOW RAILWAY BALLAS/FLAME TRAP, IN SOIL.

REV	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
B	24.11.21	NOTES REVISED AND ANNOTATIONS ADDED	KT	CO	GS
A	23.08.21	ORIGINAL ISSUE	KT	CO	GS

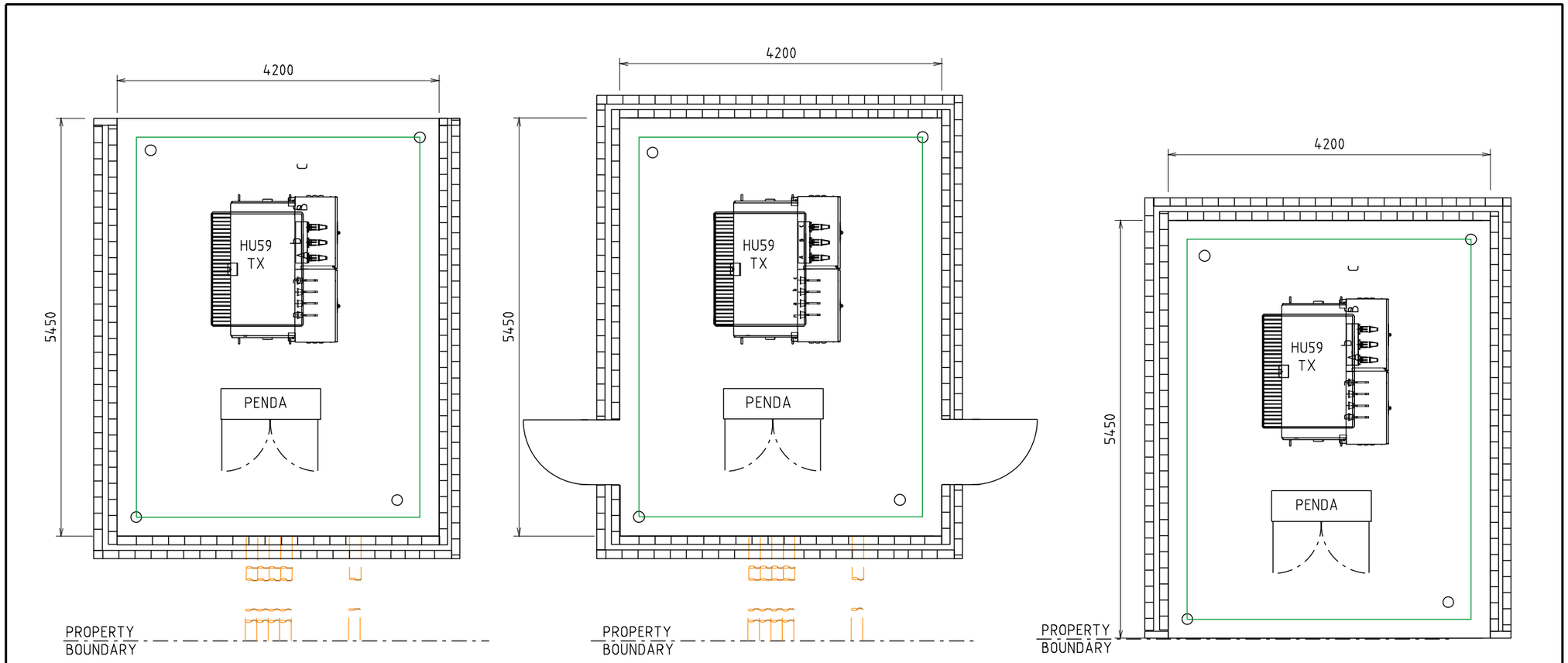
TITLE: 33kV DISTRICT SUBSTATION UP TO 1000 kVA NON- MPS NON-FIRE RATED EARTHING ARRANGEMENT

DISTRIBUTION SUBSTATION PLANT MANUAL

westernpower

DRAWN: JRR | DATE: 15-07-2021 | DRG. No. DSPM-9-03
ORIGINATED: KT | SCALE: NTS
CHECKED: CO
APPROVED: GRANT STACY
REV. B | SHT. 5/6

5.4.1 Screening Arrangement



NOTES:-
1. FOUNDATIONS SHALL FULLY RETAIN THE SITE TO ALLOW FUTURE EXCAVATION 1200mm DEEP WITHIN THE SUBSTATION SITE.
2. SCREENING OR FOUNDATIONS SHALL NOT ENCROACH INTO SUBSTATION SITE.
3. SCREENING SHALL NOT IMPACT OPERATIONAL CLEARANCE AND EGRESS REQUIREMENTS SHOWN ON SHEET 4.
4. DOORS (WHERE FITTED) MUST BE A MINIMUM OF 820 WIDE.
5. NON-COMBUSTIBLE MATERIALS TO BE USED FOR SCREENING (MASONARY, ETC.)
6. 2HR FIRE RATED SCREENING MAY BE USED TO REDUCE THE FIRE RISK ZONE. REFER DSPM CHAPTER 5 (FIRE RISK)
7. MINIMUM HEIGHT OF SCREEN WALL IS TO BE 1.8m (HEIGHT OF TRANSFORMER + 300mm).

REV.	DATE	DESCRIPTION	ORGD	CHKD.	APRD.
A	23.08.21	ORIGINAL ISSUE	GC	CO	GS

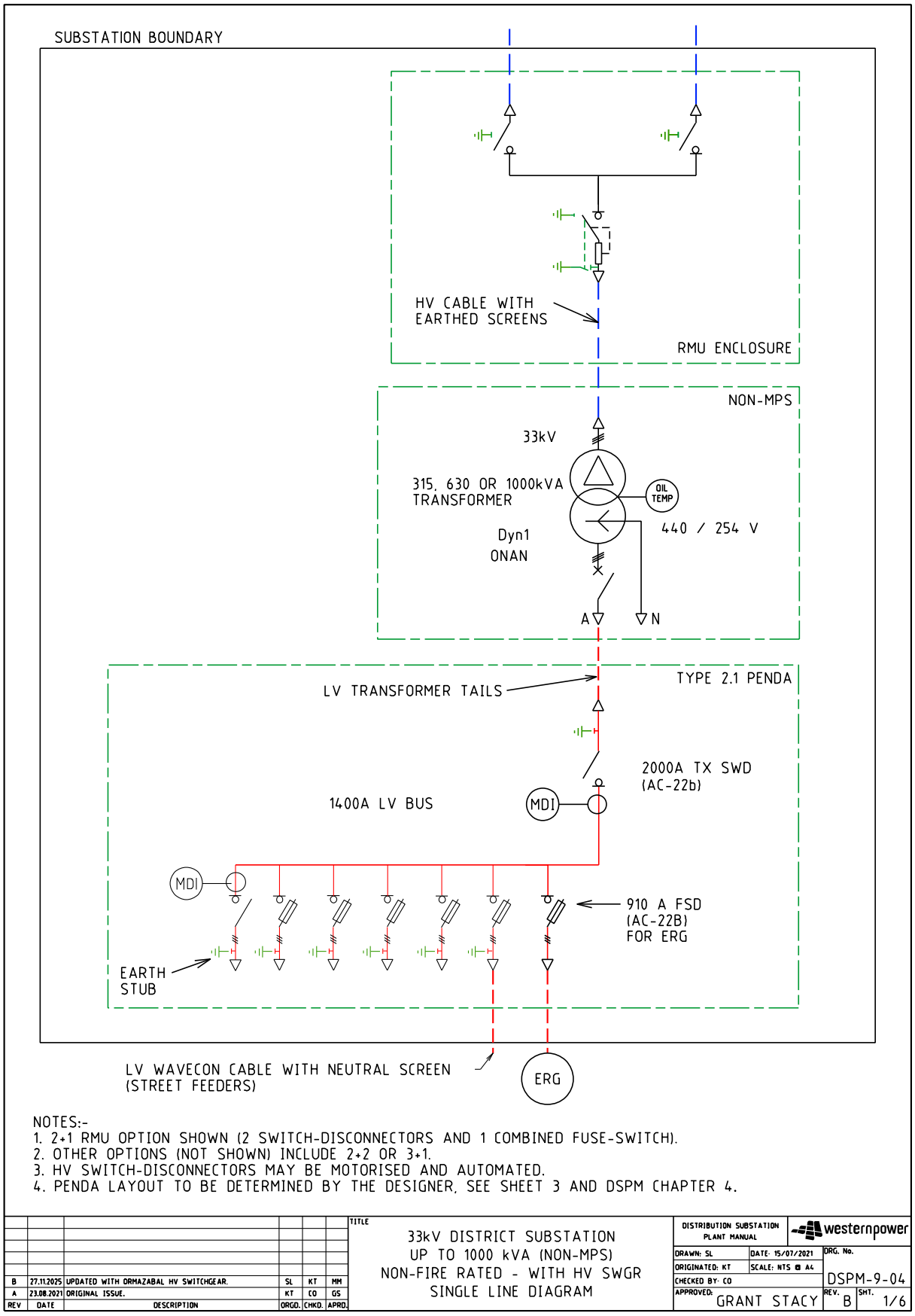
TITLE

33kV DISTRICT SUBSTATION
UP TO 1000 kVA NON- MPS
NON-FIRE RATED - WITH HV SWGR
SCREENING ARRANGEMENTS

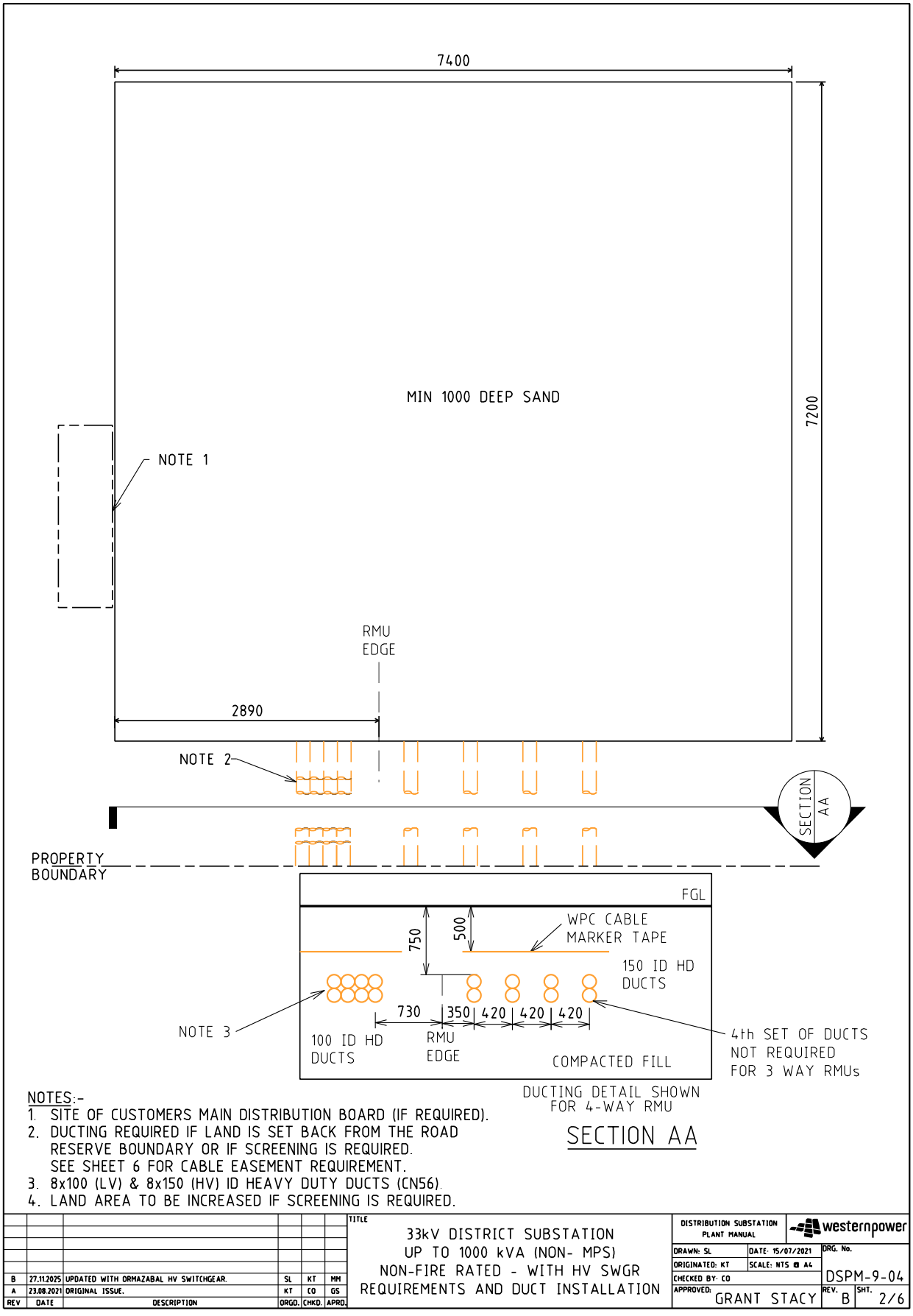
DISTRIBUTION SUBSTATION PLANT MANUAL	westernpower	
DRAWN: JRR	DATE 15-07-2021	DRG. No. DSPM-9-03
ORIGINATED: GC	SCALE: NTS	
CHECKED: CO		
APPROVED: GRANT STACY	REV. A	SHT. 6/6

5.5 DSPM 9-04 Up to 1000kVA Non MPS District with HV Switchgear

5.5.1 Single Line Diagram



5.5.2 Land Requirements and Duct Installation



NOTES:-
1. SITE OF CUSTOMERS MAIN DISTRIBUTION BOARD (IF REQUIRED).
2. DUCTING REQUIRED IF LAND IS SET BACK FROM THE ROAD RESERVE BOUNDARY OR IF SCREENING IS REQUIRED. SEE SHEET 6 FOR CABLE EASEMENT REQUIREMENT.
3. 8x100 (LV) & 8x150 (HV) ID HEAVY DUTY DUCTS (CN56).
4. LAND AREA TO BE INCREASED IF SCREENING IS REQUIRED.

REV	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
B	27.11.2025	UPDATED WITH ORMAZABAL HV SWITCHGEAR.	SL	KT	MM
A	23.08.2021	ORIGINAL ISSUE.	KT	CO	GS

TITLE: 33kV DISTRICT SUBSTATION UP TO 1000 kVA (NON- MPS) NON-FIRE RATED - WITH HV SWGR REQUIREMENTS AND DUCT INSTALLATION

DISTRIBUTION SUBSTATION PLANT MANUAL | westernpower

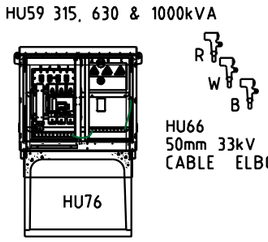
DRAWN: SL | DATE: 15/07/2021 | DRG. No. DSPM-9-04

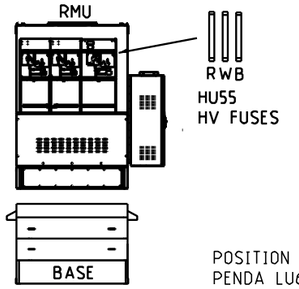
ORIGINATED: KT | SCALE: NTS @ A4

CHECKED BY: CO

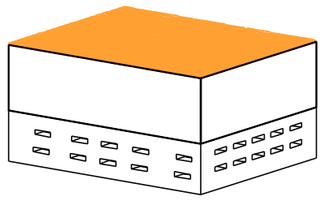
APPROVED: GRANT STACY | REV. B | SHT. 2/6

5.5.3 Equipment Selection and Layout

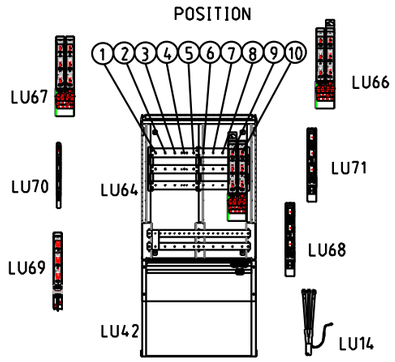


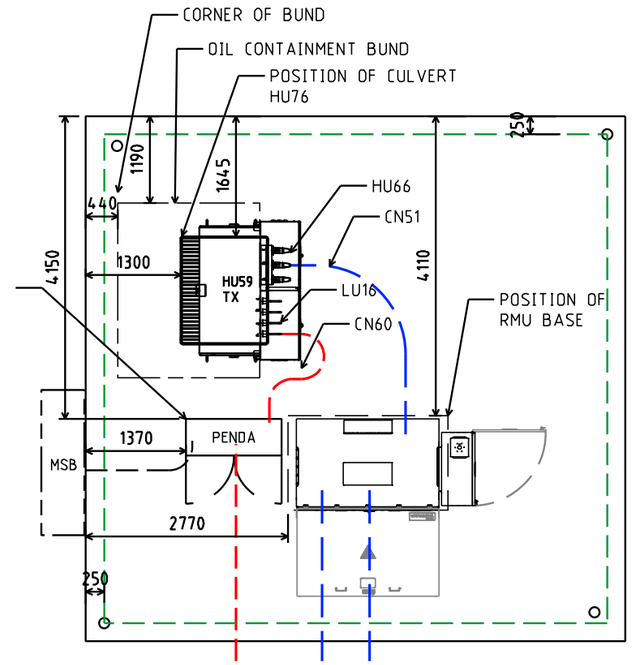


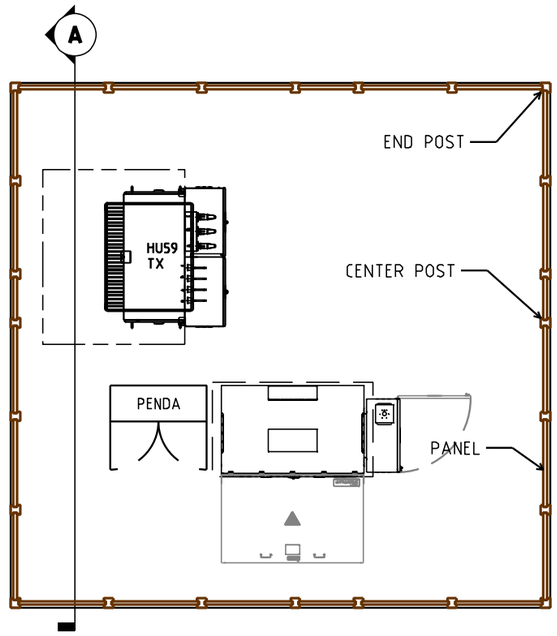
HU76 BOX CULVERT - CROWN AND BASE TYPE (OPTION)
EXTERNAL SIZE = 1416W x 1022D x 1220H
CROWN WEIGHT = 1038 kg
BASE WEIGHT = 384 kg



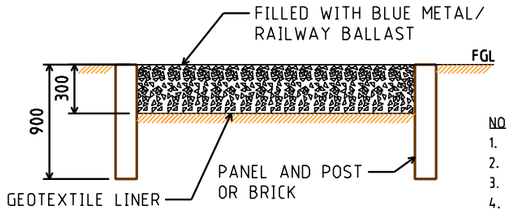
OIL CONTAINMENT BUND (OPTION)
EXTERNAL SIZE = 2400W x 1950D x 1270H
WEIGHT = APPROX. 8000 kg



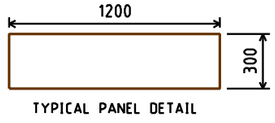




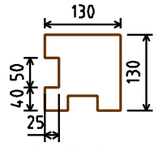
PANEL AND POST LAYOUT



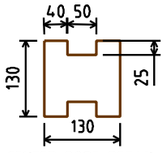
DETAIL A



TYPICAL PANEL DETAIL



END POST DETAIL



CENTER POST DETAIL

LV MATERIAL		
EQUIPEMENT	CU	QTY
PENDA	LU64_0	1
	LU42	1
	LU66	1
	LU68	1
CABLE	CN60	56
	LU16	2

HV MATERIAL		
EQUIPMENT	CU	QTY 33kV
TRANSFORMER	HU55/315	SELECT 1
	HU55/630	
	HU55/1000	
	HU59/315	SELECT 1
	HU59/630	
	HU59/1000	
	BUND	SELECT 1
	HU76	
RMU	HU101 (2+1)	SELECT 1
	HU102 (2+2)	
	HU103 (3+1)	
EARTHING	HU69_2	1
CABLE	HU66	1
	CN51	7
AUTOMATION	DA6_LVS	1
	DA6_NG_SE	1 (OPTIONAL)

TYPE 2.1 PENDA LAYOUT													
EQUIPEMENT	MAX FUSE	CU	1	2	3	4	5	6	7	8	9	10
TYPE 2.1 PENDA		LU64	1 REQUIRED									
PENDA BASE		LU42	1 REQUIRED									
160A FSD	1x 63A DIN 00	LU70				2xL						
630A FSD	1x 400A NH2	LU69	C/S	C/S	C/S	C/S	C/S	C/S	C/S			
910A FSD	1x 630A NH3	LU68								E		
1260A FSD	2x 400A NH2	LU67	C			C						
1000A FSD	LINKS	LU71	C									
2000A FSD	LINKS	LU66	C								TX	
FSD CABLE TERM		LU14	S	S	S	L/S	S	S	S			
TX CABLE TERM		LU16									TX	

TX = TRANSFORMER L = LIGHTING CIRCUIT E = EMERGENCY RESPONSE
C = CUSTOMER S= STREET CIRCUIT GENERATOR

NOTES:-
1. INSTALL CABLE CLAMP ON EACH PHASE OF HV CABLE (FM0200).
2. LU66 CAN BE USED FOR THE TRANSFORMER AND CUSTOMER.
3. EVERY INSTALLATION SHALL INCLUDE AN ERG CONNECTION LU68.
4. 2 x LU70 OR 1 x LU69 CAN BE USED IN POSITION 4.
5. 1 X LU14 NEEDED WITH EACH LU69 STREET FEEDER OR LU70 LIGHTING CIRCUIT.
6. 1 X LU16 NEEDED WITH EACH LU66_TX IN PENDA AND 1 X LU16 FOR LU59 (NON-MPS).
7. LU66_TX WILL DEFAULT TO POSITIONS 9 & 10 UNLESS POSITION 1 & 2 IS SPECIFIED BY THE DESIGNER.
8. STANDARD PENDA LAYOUT SHOWN. DESIGNER MAY DESIGN AN ALTERNATIVE PENDA LAYOUT.
9. NO GANGED FSD OR SWD PERMITTED SPANING POSITIONS 5 & 6 OR 6 & 7.
10. LU71 ONLY TO BE USED WHERE THERE IS UPSTREAM LV PROTECTION (I.E. MKII NON MPS).
11. MEASUREMENTS SHOWN ARE ± 50mm, SAME CONSTRUCTION TOLERANCE APPLIES.
12. REFER TO DSPM CHAPTER 10 FOR THE CORRECT INSTALLATION OF THE RMU BASE.
13. RMU, KIOSK BASE AND CABLE TERMINATIONS SUPPLIED IN RMU CU.
14. REFER TO DSPM CHAPTER 4 SHEET 3 FOR AUTOMATION T300 CONNECTION DETAILS.
15. WHERE THE SOLE PURPOSE OF THE RETAINING WALLS IS TO CONTAIN THE RAILWAY BALLAST 900mm LONG POSTS ARE REQUIRED.
16. LONGER POSTS AND MULTIPLE LAYERS OF PANELS ARE TO BE USED AND INSTALLED IN ACCORDANCE WITH THE RETAINING WALL MANUFACTURERS INSTRUCTIONS, WHERE THE RETAINING WALLS ARE USED TO LEVEL THE SITE.
17. POST HOLES ARE TO BE 450mm DIAMETER AND POST ENCASED IN 25 GRADE CONCRETET ONLY WHERE THE RETAINING WALLS ARE USED TO LEVEL THE SITE.
18. IF BUND IS USED, REFER MODIFIED DSPM 4-06 (EDM: 69873797) FOR THE CORRECT POSITIONING OF THE NON-MPS ONTO THE BUND.

REV	DATE	DESCRIPTION	ORGD.	CHKD.	APRD.
B	27.11.2025	UPDATED WITH ORMAZABAL HV SWITCHGEAR.	SL	KT	MM
A	23.08.2021	ORIGINAL ISSUE.	KT	CO	GS

TITLE

33kV DISTRICT SUBSTATION
UP TO 1000 kVA (NON-MPS)
NON-FIRE RATED - WITH HV SWGR
EQUIPMENT SELECTION AND LAYOUT

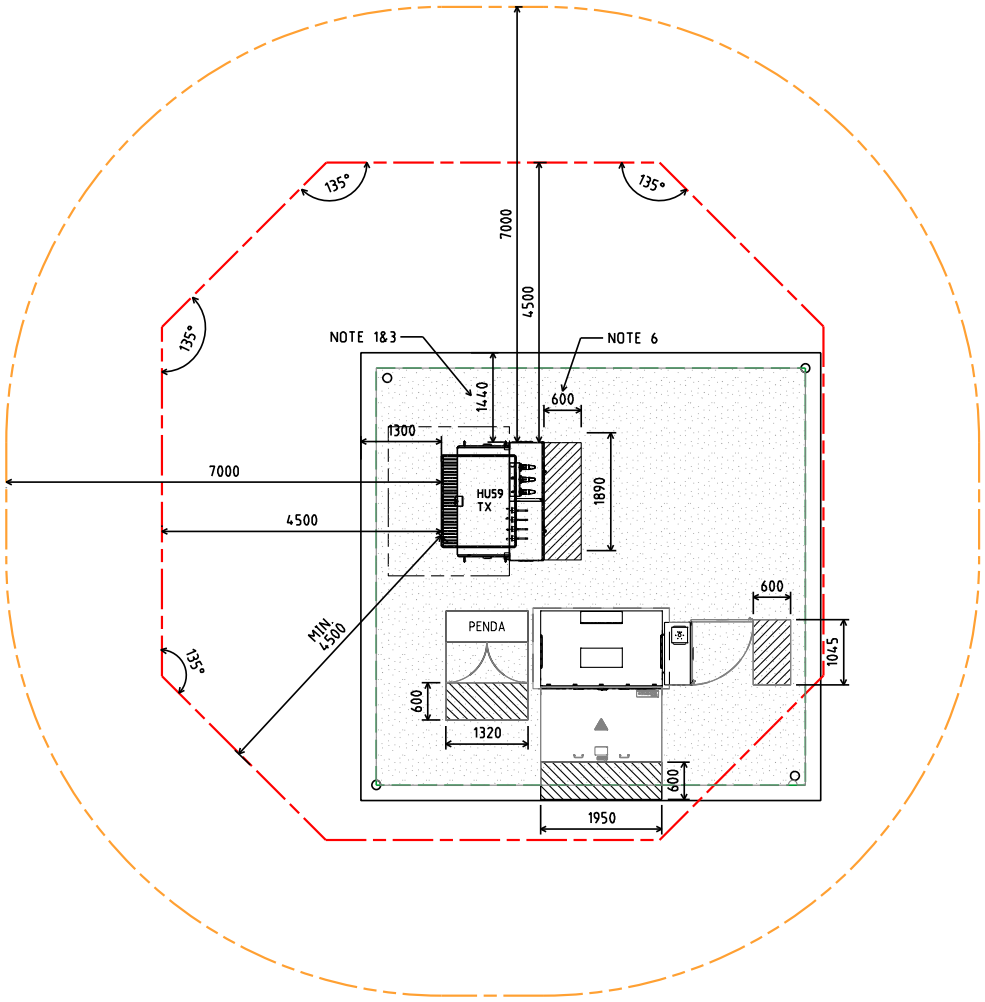
DISTRIBUTION SUBSTATION PLANT MANUAL

westernpower

DRAWN: SL | DATE: 15/07/2021
ORIGINATED: KT | SCALE: NTS @ A4
CHECKED BY: CO
APPROVED: GRANT STACY

ORG. No. DSPM-9-04
REV. B
SHT. 3/6

5.5.4 Clearances



FIRE RISK ZONE

TRANSFORMER NOISE IMPACT ZONE

EARTHING (STEP AND TOUCH)

OPERATIONAL CLEARANCE

NOTES:-
1. STEP AND TOUCH CLEARANCE FROM GRADING RING TO TRANSFORMER AND RMU.
2. SEE SHEET 5 FOR EARTHING SINGLE LINE DIAGRAM.
3. USE THESE DIMENSIONS FOR EARTHING STUDY (WITH THE DOORS CLOSED).
4. DESIGNER TO SHOW ACCESS AND EGRESS ROUTES ON THE SUBSTATION DESIGN DRAWING.
5. NOISE IMPACT ZONE IS BASED ON 1000 kVA TRANSFORMER AND IS MEASURED FROM THE EDGE OF THE TRANSFORMER TANK. NOISE IMPACT ZONE MAY BE REDUCED IF MITIGATION OPTIONS ARE USED. REFER TO "NOISE COMPLIANCE REQUIREMENTS FOR DISTRIBUTION TRANSFORMERS" GUIDELINE.
6. OPERATIONAL CLEARANCE IN FRONT OF TRANSFORMER SHOWN WITH DOORS LIFTED OFF.

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TITLE: DISTRICT SUBSTATION UP TO 1000 kVA (NON- MPS) NON-FIRE RATED - WITH HV SWGR CLEARANCES

DISTRIBUTION SUBSTATION PLANT MANUAL

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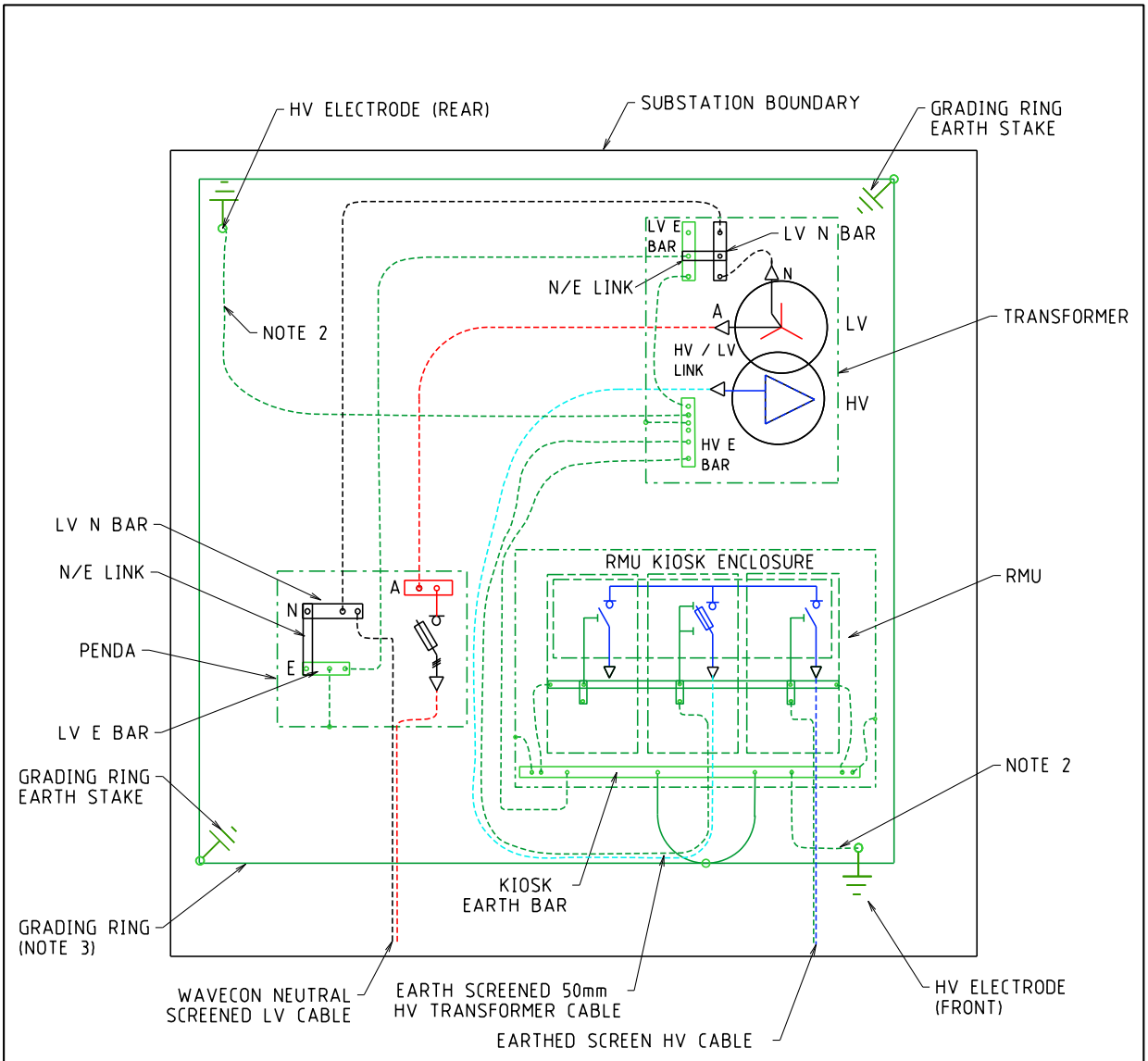
DRG. No. DSPM-9-04

REV. B | SHT. 4/6

5.5.5 Earthing Arrangement



NOTES:-
1. SEE HU CU IN THE DDC FOR EARTHING MATERIALS.
2. CONNECT 70mm× PVC INSULATED COPPER CABLE (GREEN/YELLOW) TO EARTH ELECTRODES. INSTALL CABLE AND RODS 1200mm BELOW FGL IN NEW SITES.
3. BURIED GRADING RING TO BE 100mm BELOW RAILWAY BALLAST/FLAME TRAP, IN SOIL.

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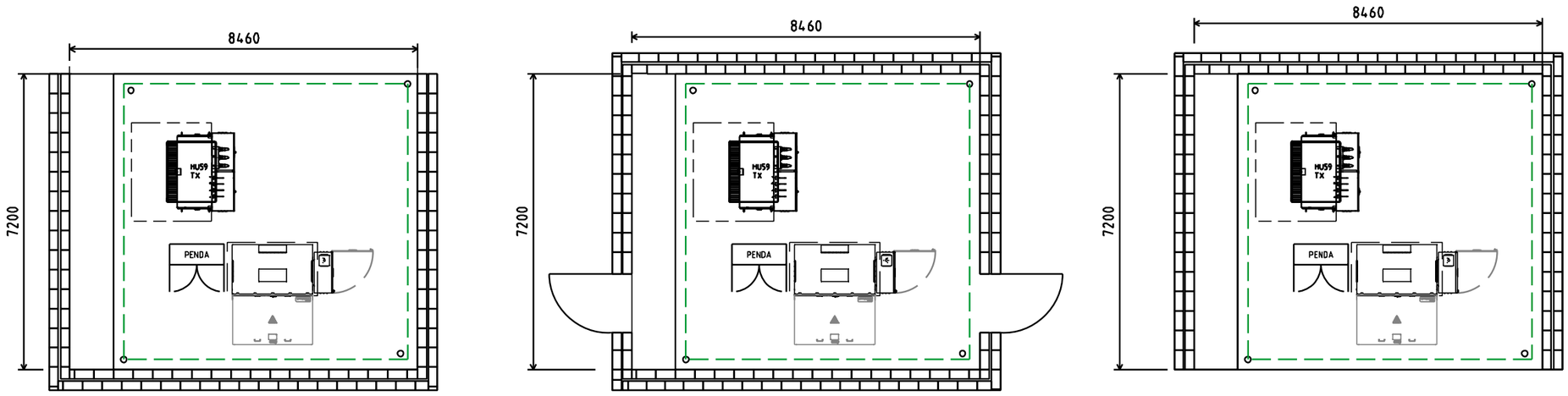
REV. B
SHT 5/6

5.5.6 Screening Arrangement



NOTES:-

1. FOUNDATIONS SHALL FULLY RETAIN THE SITE TO ALLOW FUTURE EXCAVATION 1200mm DEEP WITHIN THE SUBSTATION SITE.
2. SCREENING OR FOUNDATIONS SHALL NOT ENCROACH INTO SUBSTATION SITE.
3. SCREENING SHALL NOT IMPACT OPERATIONAL CLEARANCE AND EGRESS REQUIREMENTS SHOWN ON SHEET 4.
4. DOORS (WHERE FITTED) MUST BE A MINIMUM OF 820 WIDE.
5. NON-COMBUSTIBLE MATERIALS TO BE USED FOR SCREENING (MASONRY, ETC)
6. 2HR FIRE RATED SCREENING MAY BE USED TO REDUCE THE FIRE RISK ZONE. REFER TO DSPM CHAPTER 5 (FIRE RISK).
7. MINIMUM HEIGHT OF SCREEN WALL IS TO BE 1.8m (HEIGHT OF TRANSFORMER + 300mm).
8. EXCAVATIONS FOR SCREENING FOOTING GREATER THAN 1.2m NEEDS TO BE ASSESSED BY A COMPETENT CHARTERED CIVIL ENGINEER TO BE COMPLETED BY THE CUSTOMER.

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TITLE

33kV DISTRICT SUBSTATION
UP TO 1000 kVA (NON-MPS)
NON-FIRE RATED - WITH HV SWGR
SCREENING ARRANGEMENTS

DISTRIBUTION SUBSTATION PLANT MANUAL

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