

Standard 220 kV 1.5 CB Customer Connection (CC) - Designer's Log			
Doc No		Standard 220 kV 1.5 CB CC - Designer's Log (Rev03 - Issue).xlsx	
Doc Rev		18/03/2026	
ID	Item Topic	Reference	Description
1	Purpose/ Overview	General	<p>The purpose of this document is to identify the key decisions and assumptions for a standard 220 kV 1.5 CB substation design to be used as consenting and conceptual design input for all new Customer Connections to Transpower's 220 kV network.</p> <p>Previous work completed includes consenting and conceptual design for: Package 1 - Standard 220 kV single circuit substation Package 2 - Standard 110 kV single circuit substation Package 3 - Standard 220 kV double circuit substation Package 4 - Standard 220 kV single circuit substation with bypass circuit breaker</p>
2	Application	General	<p>The prepared arrangement is generally applicable to 'local' installation where the substation is installed in line with the 220 kV circuits.</p> <p>A 'remote' arrangement is likely to require a 220 kV line deviation with potential 220 kV circuit cross-overs. This is outside of the scope of this project at this time.</p>
3	Demarcation	General	<p>The demarcation between Transpower and the Customer is to be agreed with Transpower on a project specific basis. Transpower will confirm the agreed demarcation is in accordance with TP GG 25.02, Issue 2 (Transpower internal document).</p> <p>Example demarcation points are described below. All components at the site that are upstream of the demarcation point are Transpower owned.</p> <p>Grid injection points: 1) 33 kV cable termination on the LV side of the power transformer (as shown on the concept layouts). Transpower will own the cable termination stand. 2) Conductor support post between the 220 kV ES and the 220 kV SA/ HV bushing of the 220/33 kV power transformer. Transpower will own the conductor support post and the customer will own the 220/33 kV power transformer and 220 kV SA.</p> <p>Grid exit points: 3) 33 kV cable termination within Customer-owned incomer switchgear panel. Transpower will own the 33 kV incomer cable. 4) 33 kV cable termination within Transpower-owned 33 kV bus. Customer will own 33 kV feeder cables connected to Transpower-owned 33 kV switchgear panel.</p>
4	220 kV Line Entry	General	The 220 kV standard line entry will be developed by Transpower and included in a separate design document.
5	220 kV Gantry Type	General	<p>The 220 kV gantry type is a steel H frame sourced from an overseas supplier - note following: - The provided heights represent an expected worst case height - Project-specific design is required and will be completed in the detailed design stage</p>
6	220 kV Bus Arrangement	General	<p>The 220 kV bays for connecting the transformer and lines are based on the Standard 220 kV DCB Substation design with drawing reference TP108052/1. The 220 kV bus and half breaker is based on the Standard 220 kV 1.5 CB AIS Substation design with drawing reference TP58393/1.</p> <p>The following items are fixed: - 220 kV line bay switchgear arrangement, except surge arresters (refer below) - 220 kV half-breaker switchgear arrangement - 220 kV bus arrangement comprising two buses and a back-to-back DCB bus coupler with standalone earth switches - 220 kV transformer switchgear arrangement, except quantity of connections (refer below) - 220 kV bay spacing - 220 kV gantry position relative to the 220 kV bus</p> <p>The following items are variable: - Installation of surge arresters on the line bays (refer item 7) - Quantity of transformer bays. The Customer can choose to install 1 or 2 connections to Transpower</p> <p>Refer also to item 7 for a description of future allowances.</p>
7	220 kV Bus Arrangement - Future	General	<p>The layout considers the following future equipment: a) Expansion of the site 'north' of the transformer bays (G and K) for replacement 220/33 kV power transformers. This is to maintain N-1 security of supply during installation of the replacement 220/33 kV transformer. A switchyard extension only is required since the nominal site footprint allows space for this purpose. b) Potential for expansion of the bus 'south' of the line bays (A and C), provided land is available. Expansion of the site in this direction is not allowed for in the nominal site footprint.</p> <p>The switchyard restricted access area will need to be expanded to accommodate the 15 m future transformer replacement radius distance - refer to TP_INDEX/1 and TP_GENERAL/1 for further details.</p>
8	220 kV Surge Arresters	General	The layout includes 220 kV line surge arresters - these may be omitted if overhead line earth wires extend a minimum of 1 km out from the substation.
9	220 kV Switchgear Arrangement - Base	General	Refer to the SLD and layouts for the base 220 kV switchgear arrangement.
10	220 kV Switchgear Arrangement - Alternatives	General	<p>The layout includes space for the following alternative switchgear arrangements: 1) 220 kV Line Bay: Bus side DS, CB, CT and line side ES/DS/ES. The line side ES/DS/ES is included in the base arrangement. 2) 220 kV Transformer Bay: Bus side DS, CB, CT and transformer side standalone ES. 3) 220 kV Bus Section Bay: Bus 1 side ES/DS/ES, CB, CT and bus 2 side ES/DS/ES. Bus DS may include DS mounted ES on the bus side.</p> <p>Based on procurement advice, DCBs with integral earth switches have a long lead time. As such, the back-to-back DCB bus coupler includes a standalone ES either side of the CT for flexibility in the direction of CT injection testing (refer item 11).</p> <p>If alternative switchgear arrangements are required, this will be advised by Transpower.</p>
11	CT Injection Testing	General	<p>The back-to-back DCB bus coupler provides space for a standalone earth switch on each side of the CT. This is to provide flexibility in the direction of CT injection testing.</p> <p>The half breaker arrangement sets the minimum space required between the two bus. Subsequently, this arrangement including two standalone earth switches within the bus coupler does not require any additional site footprint.</p>
12	Transformer Phasing	General	The bus phasing is RYB from left to right when looking down on the site. The HVUBS bus connection arrangement allows one transformer to be connected RYB from left to right. The second transformer will then be connected BYR with links modified to achieve the same phase rotation on the 33 kV side.
13	33 kV Switchgear Arrangement - Base and Alternatives	General	<p>Refer to the SLD and layouts for the base 33 kV switchgear arrangement.</p> <p>The overall site footprint is able to accommodate a 33 kV indoor or 33 kV outdoor switchgear arrangement.</p>
14	Oil Containment	General	<p>Where Transpower owns the 220/33 kV power transformers and has the designation for the site, the oil containment solution is to be in accordance with TP DS 54.01, Issue 4.</p> <p>Where the customer has the designation for the site, the location and type of system is to be determined by the requirements of the designation.</p>
15	Fire Clearances	General	<p>The fire clearances are based on TP DS 61.06, Issue 6.</p> <p>The following basis has been applied to the layouts based on Table 1 of TP DS 61.06, Issue 6: a) The switchyard security fence is to be placed at the non-combustible building material limit (15 m). The reasons for this approach are: - To control the type of items that are placed within the non-combustible building material extent - To minimise the risk of fire spread - To maintain the integrity of the switchyard security fence in the event of a transformer fire. b) The extent of the <i>Environmental Buffer Zone</i> (refer item 17) is the greater of: - The combustible building material limit for initial and future transformers (30 m) - Allowance for a Transpower access corridor between the 220 kV ES and the barrier fence (refer item 15)</p> <p>The layout sketches also include the <i>Property Boundary</i> limit as per TP DS 61.06 Issue 6, Table 1.</p>
16	Transpower and Customer Barrier Fence	General	<p>Where the Customer owns the 220/33 kV power transformers and installs this adjacent to the Transpower switchyard, a barrier fence will be installed at the demarcation point between Transpower and the Customer.</p> <p>In this case, Transpower's equipment arrangement is modified to include a 9 m space between the 220 kV ES and the barrier fence - this is to allow for a 5 m vehicle access corridor, bus support posts and maintenance of the 220 kV ES (2 m) and a margin (2 m).</p> <p>The purpose of the barrier fence is to prevent inadvertent access to the other party's switchyard where personnel may not have the right competency. The barrier will be the same specification as Transpower's standard security fence but without the possum wire installed.</p>

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17	220 kV Connected NER	General	The 220 kV neutral connected NER is required for some sites only. The Customer is to seek clarification from Transpower.
18	Vehicle Access	General	Vehicle access is based on the requirements of TP DS 62.01 Issue 4.2. Where overall site access from the road does not align with the Transpower site access as shown, a 6 m roadway is to be provided to Transpower's access point.
19	Electrical and Maintenance Clearances	General	Electrical and maintenance clearances are based on the requirements of TP DS 62.01 Issue 4.2. Additional notes: 1) Maintenance/ injection testing of the bus coupler CT can be completed with both bus in service and TP DS 62.01 Issue 4.2 maintenance clearances met. 2) Maintenance of the bus coupler ES will require an outage of the nearest 220 kV bus. 3) The breaker and a half bays are offset in comparison to the transformer/ bus section bays to allow for maintenance of the 220 kV bus on the outer side of the busbar. This is required since half-breaker will be in service to maintain through transmission and connection to the other bus.
20	Digital Substation	General	Transpower's switchyard arrangement is based on a process bus solution (digital substation).
21	Reserve Zone	General	The basis of the <i>Reserve</i> zone is: 1) To provide space for future transformer replacement in a new bay with N-1 security maintained during installation. 2) To restrict development to greater than the combustible building material limit of 30 m. 3) To provide space for an access corridor between Transpower's 220 kV ES and the barrier fence (for cases where the Customer owns the 220/33 kV power transformer). 4) To allow for a 10 m strip of visual screening around the site, with the exception of access points and the 33 kV indoor switchgear building areas. [TP Planning to comment on this point] The <i>Reserve</i> zone, as shown on TP262158/2 is considered a standard development footprint to meet Transpower's requirements.
22	Lightning Protection	General	The lightning protection design is based on a representative calculation of the rolling sphere radius to achieve protection using the method given in TP.DG 01.01. A rolling sphere radius of 36 m has been applied. Project specific calculation is required and will be completed in the detailed design stage.
23	Detailed Design Considerations	General	The following items are to be considered at the detailed design stage: 1) Revise the equipment based on items to be procured on a project specific basis. It is noted that some 220 kV DS have corona rings around terminal palms. This has not been considered in the concept layout. 2) All 220 kV bays are modelled as quad cicada. This could be optimised depending on project specific needs. 3) The 220 kV strung bus is based on standard drawing TP65059/12. Based on AECOM's assessment, the combination of components used could be optimised. 4) The 220 kV line bays include a custom quad spacer component with a tee to the 220 kV SA. This part is indicative and is to be confirmed with PLP. 5) The concept layout does not include earthing horns. 6) The digital substation ODJB foundation requires an update to allow space for an additional conduit. 7) For breaker and a half bays, the busbars could be fabricated with less terminal flags (material and time saving). The above items do not affect the spatial requirements for the site.

Standard 220 kV Customer Connection (CC) Double Circuit Local - Designer's Log

Revision	Date	Prepared by	Checked by	Approved by	Description
1	16/12/2025	AU/ AB	JB	AB	Draft for Transpower comment
2	18/02/2026	AB	JB	AB	Revised based on Transpower comment
3	20/03/2026	AB	JB	AB	Revised based on Transpower comment