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

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ID	Item Topic	Reference	Description
1	Purpose/ Overview	General	The purpose of this document is to identify the key decisions and assumptions for a standard 220 kV double circuit substation design to be used as consenting and conceptual design input for all new Customer Connections to Transpower's 220 kV network. Previous work completed includes: Stage 1 - Consenting and conceptual design for the standard 220 kV single circuit substation Stage 2 - Consenting and conceptual design for the standard 110 kV single circuit substation
2	Application	General	Two site arrangements have been prepared that can both be accommodated within a 140 m by 190 m land parcel. The expected use cases are: 1) The 'local' arrangement is intended to be used where the substation is installed in line with the 220 kV circuits. 2) The 'remote' arrangement is intended to be used where the substation is installed remote to the 220 kV circuits it connects to. In this case, a 220 kV line deviation is likely to be required.
3	Demarcation	General	The demarcation between Transpower and the Customer is to be agreed with Transpower on a connection-specific basis. Alternative demarcation points are described below. Grid injection points: 1) 33 kV cable termination on the LV side of the power transformer (as shown on the layouts). Transpower will own the cable termination stand. 2) Conductor support post between the 220 kV ES and the HV bushing of the 220/33 kV power transformer. Transpower will own the conductor support post. 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.
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	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
6	220 kV H Bus Arrangement	General	The 220 kV H bus arrangement is based on the recently published Standard 220 kV DCB Substation design with drawing reference TP108052/1. The following items are fixed: - 220 kV line bay switchgear arrangement, except surge arresters (refer below) - 220 kV bus arrangement comprising 2 bus sections, connected via a back-to-back DCB bus section arrangement - 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 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 Refer also to item 6 for a description of future allowances.
7	220 kV H Bus Arrangement - Future	General	The layout considers the following future equipment: a) 220 kV reactive power support connected to a spare bay. The spatial allowance for this has not been considered. b) Bay A and Bay J for a replacement 220/33 kV power transformer. This is to maintain N-1 security of supply during installation of the replacement 220/33 kV transformer. The switchyard restricted access area already accommodates the 15 m future transformer replacement radius distance - refer to TP_INDEX/1 and TP_GENERAL/1 for further details.
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 Alternative Switchgear Arrangements	General	The layout includes space for the following alternative switchgear arrangements: 1) 220 kV Line Bay: Bus side DS, CB, CT and line side DS including ES. 2) 220 kV Transformer Bay: Bus side DS, CB, CT and transformer side standalone ES. 3) 220 kV Bus Section Bay: Bus 1 side DS, CB, CT and bus 2 side DS. Bus DS may include DS mounted ES. Where a DCB without an integral ES is used for the bus section DCBs, the bus section is to include at least one standalone ES. This could be installed in place of the CSP and in this case, no change to the site footprint is required. If two standalone ES are required within the bus section, the site footprint will increase. If alternative switchgear arrangements are required, this will be advised by Transpower.
10	Oil Containment	General	Where Transpower owns the 220/33 kV power transformers, the oil containment solution is to be confirmed by Transpower. At a high level, any discharge from bunded areas will meet the 15 ppm minimum requirement. Where the customer owns the 220/33 kV power transformers, the location and type of system is to be determined by the Customer.
11	Fire Clearances	General	The fire clearances are based on TP DS 61.06, Issue 6. 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 *Setback Zone* (refer item 15) 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 10) The layout sketches also include the *Property Boundary* limit as per TP DS 61.06 Issue 6, Table 1.
12	Transpower and Customer Barrier Fence	General	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. In this case, Transpower's equipment arrangement is modified to include a 7m space between the 220 kV ES and the barrier fence - this is to allow for a 5m vehicle access corridor, bus support posts and maintenance of the 220 kV ES (2m). 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.
13	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.**
14	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.
15	Electrical Clearances	General	Electrical clearances are based on the requirements of TP DS 62.01 Issue 4.2.
16	Digital Substation	General	Transpower's switchyard arrangement is based on a process bus solution (digital substation).
17	Setback Zone	General	The basis of the setback zone is: 1) To provide space for future transformer replacement in a new bay with N-1 security maintained during installation. 2) To provide space for Transpower to install future 220 kV reactive power support. 3) To restrict development to greater than the combustible building material limit of 30 m. 4) 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). The *Setback Zone* , as shown on TP_GENERAL/1 is considered a standard development footprint to meet Transpower's requirements.
18	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.

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

Revision	Date	Prepared by	Checked by	Approved by	Description
1	8/11/2024	AU	AB	AB	Draft for Transpower comment
2	9/01/2025	AB	PS	AB	Item 9 updated based on Transpower comment