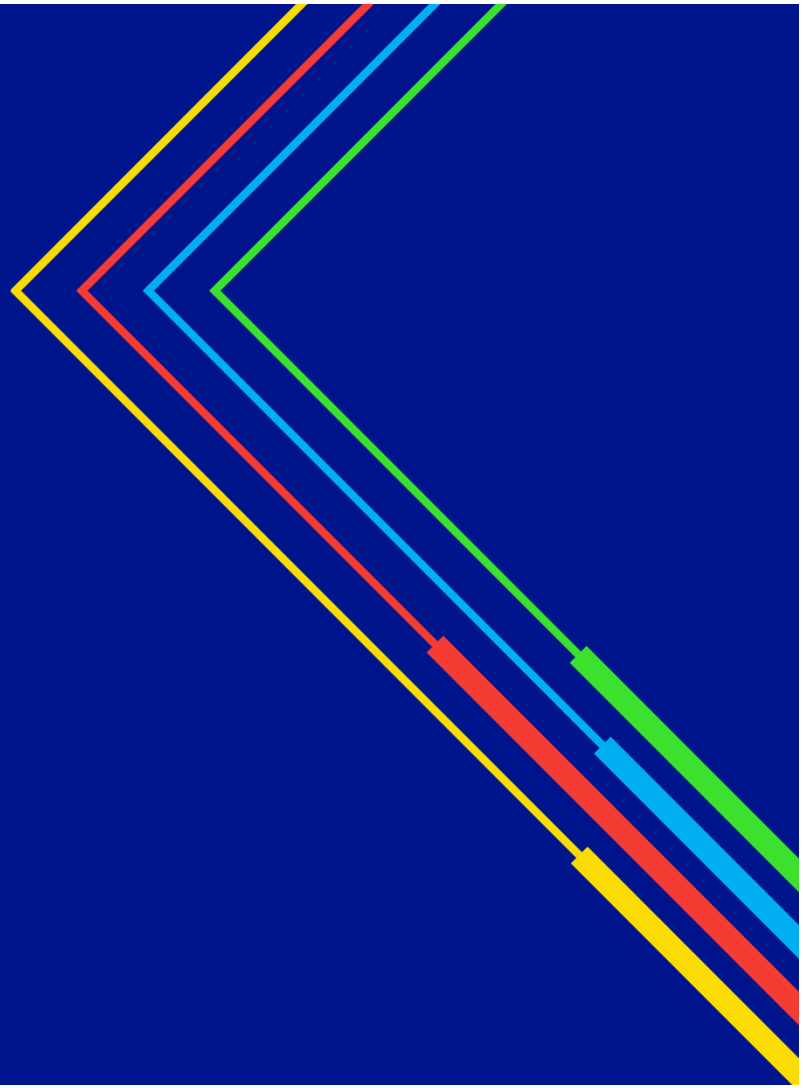
Electricity Distribution

ST: OH2F/2 Briefing – Tee-Off Connections to NGED Steel Tower Overhead Lines



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Introduction

ST: OH2F/2 sets out the minimum requirements that must be met for all tee connections to NGED steel tower overhead lines in order to ensure that the connection arrangement is fit for purpose..

Following consultation with relevant stakeholders including Field Operations, Primary System Design, Senior Management & Customers the Standard Technique has gone through significant change to help provide greater more open information and options relating to permitted Tee-off connections and moves away from the mandatory preferences outlined in the previous version thereby providing great flexibility in our ability to provide suitable, cost effective and reliable connections for our customers

It should be noted the information included within this briefing presentation only relates to those clauses that have been changed, clarified or are new. For the most complete information please refer to the ST: OH2F/2.

Section 2 General Requirements

2.1 Tee-Off connections to NGEDs steel towers require a combination of a tower connection and down / cross lead termination.

The design and development of this combination is critical as it allows for safe construction, future operation and maintenance of the connection as well as ensuring network reliability and resilience.

2.2 When choosing the combination, refer to 2.2.1 and 2.2.2, it must meet the

- System Design requirements outlined in POL: SD2 or POL: SD3.
- General, mechanical, electrical and access requirements as outlined in Sections 2, 3, 4 & 5 of this document.

It must also consider the risks associated with the

- Existing tower type, configuration and capability
- Construction Requirements to facilitate the connection
- Network constraints & configuration
- Operational restrictions when undertaking future outages.
- Site conditions including substation compound, its footprint, layout and orientation in relation to the connection point.
- Environmental issues, objects in the vicinity and topography of ground where the connection is to be made.
- Distance between tower connection and substation compound.

Section 2 General Requirements Cont.

2.2.1 Tower Connection

Where one is available the preferred solution will be to make the tower connection using the most appropriate existing main line section, junction or terminal tower

Where one is unavailable it is permissible to use one of the following

- An existing suspension tower provided it is first converted into a section tower (the use of a semi-tension insulator arrangement is acceptable), and then it meets the required general, mechanical and electrical design criteria (see sections 2, 3 and 4).
- A new junction tower orientated to accommodate any additional spans or downleads.
- A new section tower modified to accommodate any additional spans or downleads.
- A new terminal tower modified to accommodate any additional spans or downleads.

2.2.2 Down / Cross Lead Termination

- Anchor Blocks
- Cable Sealing End Platform
- Steel Chair Arrangement
- Steel Gantry
- Steel Mast
- Wood Pole Chair Arrangement (ST: OH4B)
- Wood Pole Terminal Arrangement (ST: OH4B)

Section 2 General Requirements Cont.

2.3 Double circuit connection from a single arm of a tower or adjacent towers which contain at least one converted suspension tower is only permitted under the following conditions

- The connection agreement is not firm
- The site remains compliant with the requirements of POL: SD02 or POL: SD3.
- The site shall remain P18 compliant when undertaking a single circuit outage.
- The need to undertake an outage of the site for an undetermined length of time shall be included within the contract with the customer.

These requirements are in place because when undertaking work on the tower arms supporting the connection it will, because safety and working and access clearances cannot be maintained, be necessary to switch out both incoming and outgoing circuits under a single circuit outage.

2.4 Where new structures are to be used to support further equipment such as cable terminations, overhead line or switches, the support shall be designed to accommodate the relevant NGED standard equipment (e.g. cable crucifix) where applicable.

2.5 The electrical connection onto an existing circuit shall always be made using non-tensioned jumper loops. T-crimps shall not be used directly onto tensioned conductors.

Crossarms on existing towers will therefore need to accommodate an additional low duty insulator string to support any required down or cross lead.

Section 2 General Requirements Cont.

2.6 Downleads / Cross leads shall be run where practical with standard, NGED approved conductors as outlined in POL: OH2.

2.7 Where a a steel mast is being considered to form part of the connection then this shall be subject to the further requirements outlined in section 6 of the this document.

2.8 Should a customer request a structure be used to terminate the down / cross leads and NGED believes there is a better solution then the provisions of section 7 may be used to mitigate NGEDs risks.

2.9 Guidance on the design process that can be used to identify and determine the most appropriate Tee-Off connection arrangement is contained in Appendix B

Section 3 Mechanical Design

3.1 All structures and foundations used for the tee-off connection shall be subject to a design loading check.

- Lattice steel towers and steel masts shall be assessed to the BSEN50341 design standards as required by POL: OH2.
- Steel masts shall further comply with the requirements of EE SPEC: 133.
- Wood pole structures shall be assessed as required by POL: OH4.

Section 4 Electrical Design

4.1 When existing structures are being modified, conductor-to-structure clearances and insulation levels shall be preserved – for example if a 132kV construction line is being operated at 33kV, any modifications to an existing tower such as conversion to semi-tension sets shall continue to use 132kV insulation and clearances.

4.2 Downleads or crossleads to new Tee-off structures or primary compound may be designed for the intended operating voltage where this is different to the main line construction voltage.

4.3 Wire clearance assessments of a tee-off arrangement shall consider future maintenance and outage requirements. For loop-in-loop-out arrangements in particular, it will usually be necessary to maintain adequate segregation between circuits to allow maintenance activities to be undertaken under single, rather than double, circuit outage conditions. See clause 2.3

Section 5 Access Requirements

5.1 The tee off site shall be designed to accommodate the necessary vehicular and plant access requirements to undertake all subsequent construction, inspection & maintenance and dismantlement activities in a safe, efficient and cost effective way.

5.2 In all cases due consideration shall be given to structure access requirements for subsequent construction, inspection & maintenance activities. Structures should ideally be fitted with an integral climbing system so as to allow access at all times.

5.3 Where a non-climbable structure is being considered e.g. a steel mast then in all cases unfettered 24 hour 365 day access to, at and around the structure base shall be obtained that allows for all subsequent construction, inspection & maintenance activities.

The above access requirements shall be secured within the contract with the customer prior to any works being carried out on the Point of Connection.

5.4 The final details of any access requirements for a specific project shall be determined by the network owner or their designated representative responsible for its on-going inspection and maintenance.

5.5 Where a tower or structure is positioned within the footprint of the substation site it shall be positioned within a separate compound with separate access to the main substation compound.

Section 6 Steel Mast Requirements

Where a Steel Mast is being considered to terminate the down / cross leads then the following shall apply:-

6.1 The mast shall meet the requirements of EE 133.

6.2 The mast together with all associated fittings and conductor shall be supplied and installed by the customer or their agent in accordance with the manufacturers / suppliers instructions.

6.3 NGED shall be responsible for terminating the cross / downleads to the tower and making the final connection; these shall be designed and constructed to facilitate the disconnection of the down / cross leads and for the jumpering through of the of the main line conductors in the event that the Tee-off connection needs to be disconnected.

6.4 Access to the mast shall be ensured in accordance with Section 5 of this document.

6.5 The contract between the customer and NGED shall allow for the above requirements together with an allowance for the disconnection of the mast for an unspecified period so as to allow for subsequent maintenance, repair and replacement of the mast and associated fittings.

6.6 Subject to Section 7.0 below. With all the above requirements in place and following an onsite assessment of the structure and connection by NGED staff NGED can then take ownership and be responsible for all subsequent inspection, maintenance, repair and replacement.

Section 7 Third Party Ownership of Tee-Off Structure

Should a customer request a structure as part of the Tee-off arrangement to terminate the down / cross leads and NGED believes there is a better alternative than the one being suggested then NGED can allow its use providing it still meets the requirements of this document and the following conditions are applied.

7.1 The customer or their agent shall retain ownership of the mast including all associated fittings except the down / cross lead between the tower and the structure which shall be owned by NGED.

7.2 NGED shall inspect the structure, down / cross leads in line with their current inspection regime and inform the customer or their agents of any issues relating to the structure and associated fittings.

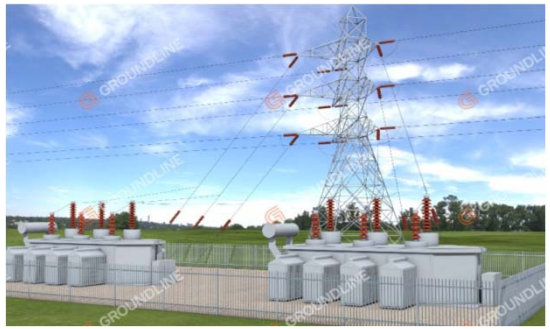
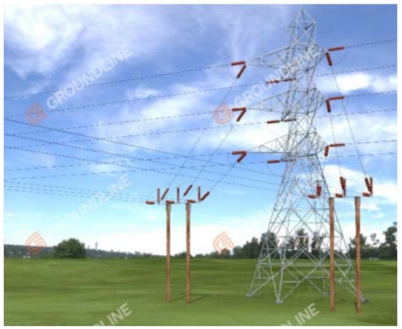
7.3 The customer or their agent shall be responsible for subsequent maintenance, repair or replacement of the mast and associated fittings. NGED shall have responsibility for the down / cross lead between the tower and structure.

7.4 The contract between the customer or their agent and NGED shall clearly and unambiguously allow for the above requirements together with an allowance for the disconnection of the mast for an unspecified period so as to allow for subsequent maintenance, repair and replacement of the structure and associated fittings.

Appendix A – Pictorial Representations of Typical Single Circuit Tee-Off Arrangements

Further examples of arrangements can be found in ST: OH2F Appendix A

Appendix A – Pictorial Representations of Typical Double Circuit Tee-Off Arrangements


Further examples of arrangements can be found in ST: OH2F Appendix A

Appendix B Tee-off Connection Design Development

In order to design and safely construct the most appropriate reliable, operationally friendly and cost effective combination of tower connection and down / cross lead termination that meets the requirements of this document then the connection will need to go through the following design development stages.

B.1 **Evaluation / Optioneering Stage**

The typical starting point for a customer who requests a connection to the network.

Optioneering is suitable when there are multiple options that the customer may want to consider or determine the potential costs or likelihood of success.

The output is a risk assessment of each option considering, engineering, buildability and cost.

B.2 **Feasibility Stage**

An engineering and design based programme of works which can lead on from Optioneering, where a number of options may be taken to feasibility to determine any structural strengthening, foundation upgrades, clearance infringements and costs associated with the potential solutions.

If the options have already been evaluated then the feasibility can be the starting point to a project where the customer is clearer on their desired connection type, or substation location.

The purpose of feasibility is to determine a recommended engineering and cost acceptable solution

B.3 **Detailed Design Stage**

This takes the feasibility and develops it to create drawings, foundation designs, insulator string drawings, sag and tension documents etc.

These documents then go out to tender for a contractor to bid from.

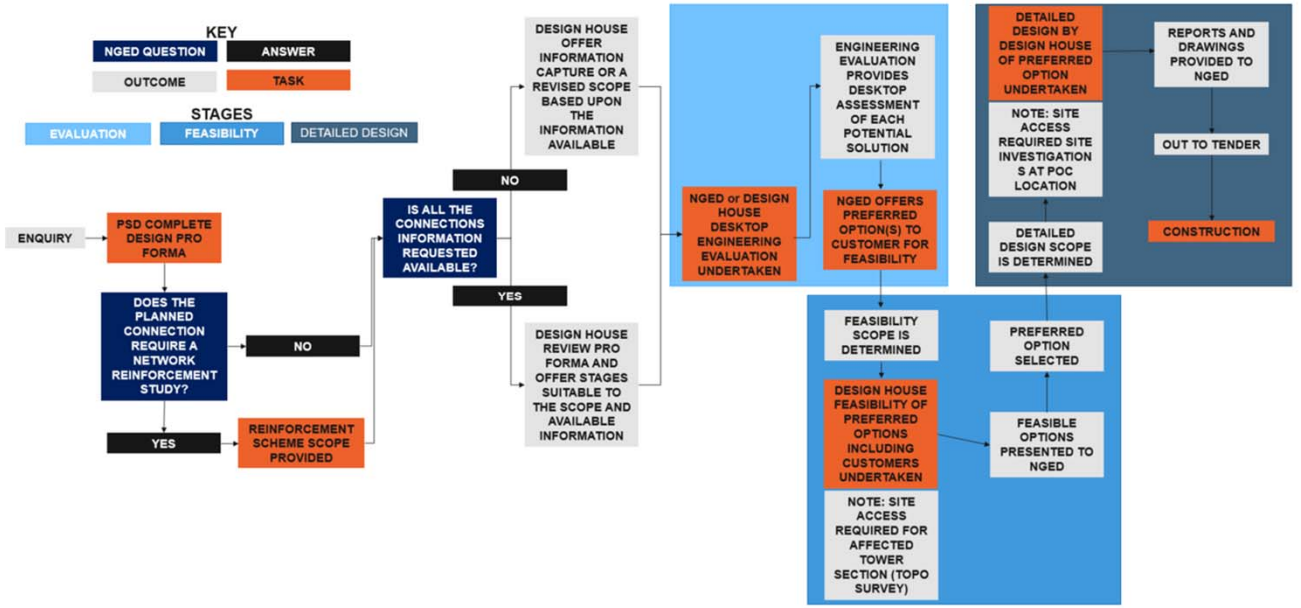
These detailed documents should allow fixed priced tendering from a contractor.

Appendix B Tee-off Connection Design Development Cont.

B.4 Design Development Process

In order for an approved 3rd party design house to successfully develop the most appropriate Tee-Off connection without delay it is vital that the following process and information is provided at the relevant stages.

To that end the design development proforma contained in Appendix B.5 should be used by PSD and read in conjunction with this document and customer Tee-off connections development process outlined below to provide stage 1, 2 & 3 information to an approved design house for the purposes of developing a customer required Tee-off connection.



Appendix B Tee-off Connection Design Development Cont.

B.4 Design Development Process

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ST: OH2F Appendix B.5 – Tower Tee-Off Design Development Pro-Forma

To be used by PSD and read in conjunction with this document and customer connections development process and given to an approved design house for the purposes of developing a customer required Tee-off connection.

Scheme and Contact Information

Date:		PSD Engineer:	
Scheme Name:		PSD Coordinator:	
Route Designation:		Project Engineer:	

Route Information

Operating Voltage:	
Existing Phase Conductor Type:	
Existing Earth Wire Type:	
DCO Available?	

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