Eskom	Standard	Technology

Title: **STANDARD FOR INDEPENDENT POWER PRODUCERS CONNECTIONS AT MAIN TRANSMISSION SUBSTATIONS**

Unique Identifier: **240-68972170**

Alternative Reference Number: **n/a**

Area of Applicability: **Engineering**

Next Review Date: **STABILISED**

COE Acceptance

Subhas Maharaj

Senior Manager: Substation Engineering

Date: 19 March 2021

DBOUS Acceptance

Amelia Mtshali

Senior Manager: Design Base & Operating Unit Support

Date: 22/03/2021

This document is **STABILISED.** The technical content in this document is not expected to change because the document covers: *(Tick applicable motivation)*

1	A specific plant, project or solution	
2	A mature and stable technical area/technology	x
3	Established and accepted practices.	x

PCM Reference: **<xxxxxx>**

SCOT Study Committee Number/Name: **<Number or name>**

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SCOT/SC Chairperson

Date: 13/10/2015

PCM Reference: **<240-53459042>**

SCOT Study Committee Number/Name: **<Substations >**

Content

Figures

1. Introduction

This document provides details and diagrams that refer to the various standards for connecting Independent Power Producers at Main Transmission Substations for Un system voltages ranging from 6,6 kV to 800 kV.

2. Supporting clauses

2.1 Scope

The document only applies to IPP connections made at Main Transmission Substations.

2.1.1 Purpose

The purpose of this document is to lay down clear rules and to assist in the design process to facilitate a logical and standard approach in deciding on the most appropriate connection arrangement based on given criteria.

2.1.2 Applicability

This document shall apply throughout Eskom Holdings Limited Divisions.

2.2 Normative/informative references

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

2.2.1 Normative

[1] ISO 9001 Quality Management Systems.

[2] Substation Layout Design Guide.

[3] 240-61268576 Standard for the Interconnection of Embedded Generation.

[4] South African Grid Code.

[5] 240-61713594 Procedure for Self-Build Customer Projects in Transmission

2.2.2 Informative

[6] NERSA Guidelines on Transmission Connection Charges.

2.3 Definitions

2.3.1 General

Definition	Description
	Circuit Breaker
	Isolator
	Current Transformer
	Voltage Transformer

Definition	Description
	Surge Arrester
'n – 1'	One line or transformer or reactive compensation device out of service (n-1), it shall be possible to supply the entire load under all credible system operating conditions

2.3.2 Disclosure classification

Controlled disclosure: controlled disclosure to external parties (either enforced by law, or discretionary).

2.4 Abbreviations

Abbreviation	Description
CT	Current Transformer
IPP	Independent Power Producer
MTS	Main Transmission Substation
SAGC	South African Grid Code
TNSP	Transmission Network Service Provider
VT	Voltage Transformer

2.5 Roles and responsibilities

Group lead engineers need to be fully briefed on the contents of this document. They will in turn be expected to instruct their direct reports in its use.

2.6 Process for monitoring

The tables at the end of the document are to become part of the design documentation.

2.7 Related/supporting documents

Transmission Line Design

3. Document content

3.1 Requirements

Main Transmission Substations are always constructed with two busbars, both of which are used for normal running under system healthy conditions. Two double busbar philosophies are in use, viz. double busbar selection and breaker-and-a-half. Double busbar selection is employed from 6,6 kV up to and including 400 kV, while breaker and a half is employed at 400 kV and 765 kV. Breaker-and-a-half is also allowed at 275 kV if it can be justified from a security of supply point of view.

According to the SAGC, "All customers shall be connected via a dedicated and fully equipped bay including circuit breaker, links (isolators), earth switches, CT's and VT's (where required) with capability to link to both busbars in case of the double busbar and breaker-and-a-half arrangements. This equipment shall belong to the TNSP"

In the case where one of the busbars is used for bypass purposes (normally labelled Busbar 2), all circuits need to be selected to the No.1 Busbar, while the feeder to go on bypass is selected to the bypass busbar via the bypass isolator. The bus coupler circuit breaker would in this case be used to trip the line on bypass.

3.2 Single Connections (6,6 kV – 275 kV) and 400 kV Single or Multiple Connections

Where an IPP is connected to the Eskom Grid at MTS stations with a single line connection at 6,6 kV through to 275 kV and there is no other connection between the IPP and any other station, it shall be via a feeder equipped for double busbar selection with bypass as illustrated in Figure 1.

Connections at 400 kV, irrespective of them being single or multiple connections shall be with the same philosophy.

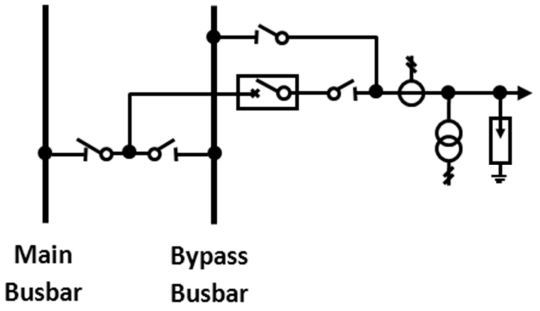

Figure 1: Single Line Connections (Typical 6,6 kV – 400 kV)

3.3 Multiple Connections to the Same MTS (6,6 kV – 275 kV)

Where an IPP is connected to the Eskom Grid at MTS stations with two or more line connections at 6,6 kV through to 275 kV, it shall be via a feeder equipped for double busbar selection without bypass as illustrated in Figure 2. The lines shall be able to transfer the full capacity under an 'n-1' line contingency.

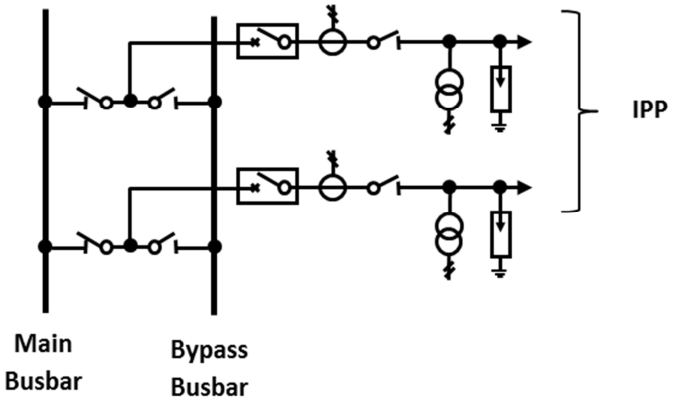

Figure 2: Multiple Connections to the same MTS (Typical 6,6 kV – 275 kV Yard)

3.4 Multiple Connections to the Same MTS (400 kV)

Where an IPP is connected to the Eskom Grid at MTS stations with two or more line connections at 400 kV, it shall be via a feeder equipped for double busbar selection with bypass or transfer as illustrated in Figure 3. The lines shall be able to transfer the full capacity under an 'n-1' line contingency.

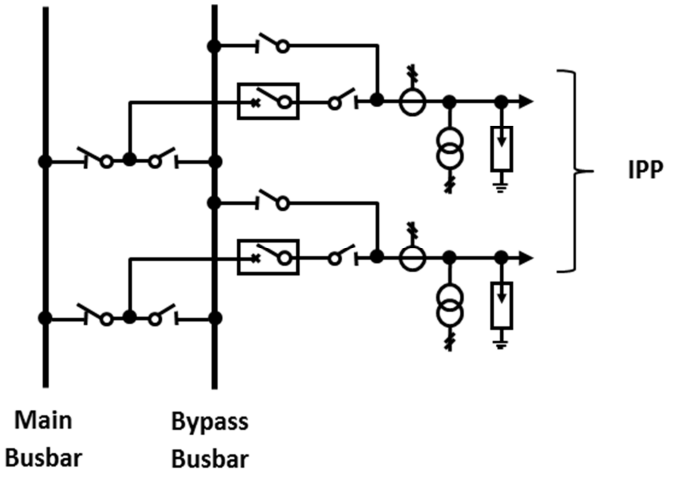

Figure 3: Multiple Connections to the same MTS (Typical 400 kV Yard)

3.5 Single Connections to Different MTSs (6,6 kV – 275 kV)

Where an IPP is connected to the Eskom Grid at two different MTS stations with one line into each station, connections being at 6,6 kV through to 275 kV, it shall be via a feeder equipped for double busbar selection without bypass as illustrated in Figure 4. Each of the lines shall be able to transfer the full capacity under an 'n-1' line contingency.

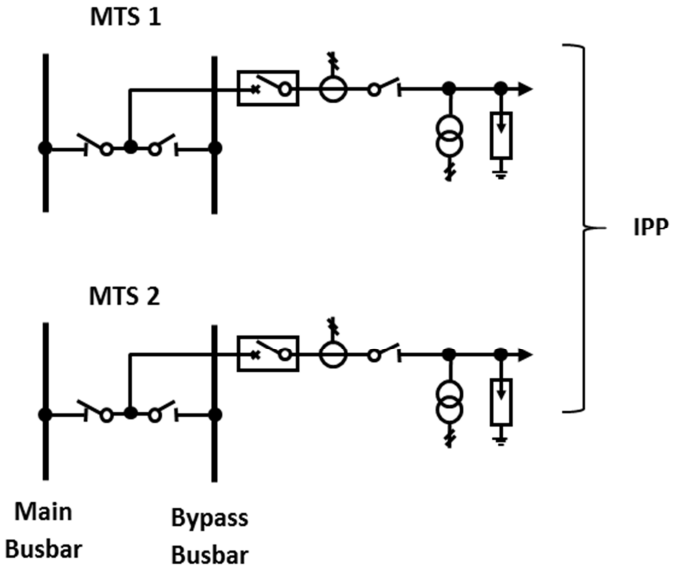

Figure 4: Single Connections to Different MTSs (Typical 6,6 kV – 275 kV Yard)

3.6 Single Connections to Different MTSs (400 kV)

Where an IPP is connected to the Eskom Grid at MTS stations with two or more line connections at 400 kV, it shall be via a feeder equipped for double busbar selection with bypass or transfer as illustrated in Figure 5. The lines shall be able to transfer the full capacity under an 'n-1' line contingency.

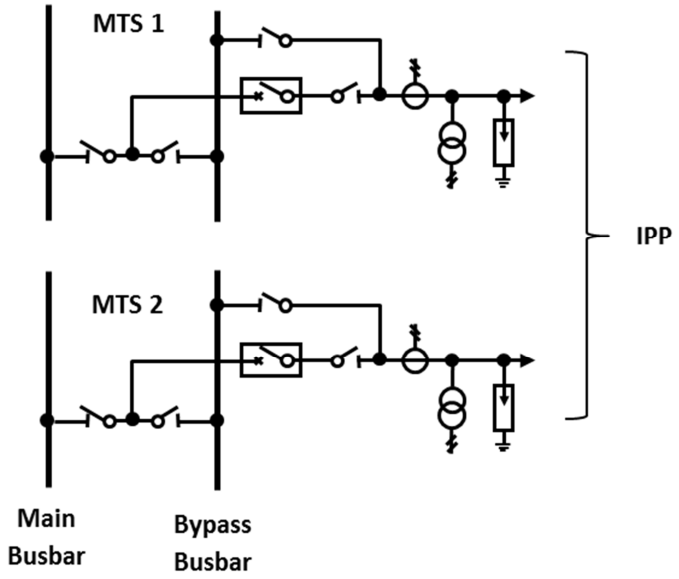

Figure 5: Single Connections to Different MTSs (Typical 400 kV Yard)

3.7 Single Connections with Single Connection to a Distribution Substation (6,6 KV – 132 KV)

Where an IPP is connected to the Eskom Grid at a MTS station and a Distribution, each with a single line, and the MTS and Distribution stations are also interconnected creating a three way tie, providing any of the line routes are able to transfer the full load, the connections shall be via a feeder equipped for double busbar selection without bypass as illustrated in Figure 3. The lines shall be able to transfer the full capacity under an ‘n-1’ line contingency.

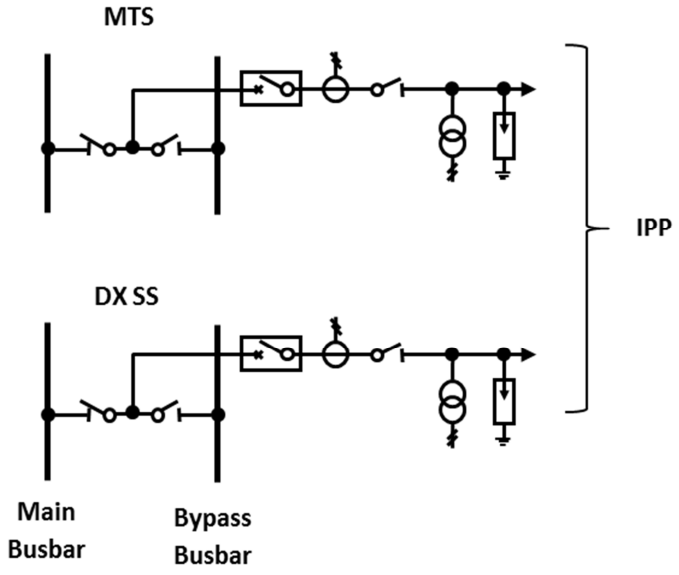

Figure 6: Single Connection to a MTS with a Single Connection to DXS (Typical 6,6 kV – 132 kV Yard)

3.8 Single or Multiple Connections to MTS Built With the Breaker-and-a-Half Philosophy (6,6 kV – 800 kV)

Where an IPP is connected to the Eskom Grid at a MTS station via either a single or multiple line and the busbar system of the connecting voltage is breaker-and-a-half, the connection shall be done with a breaker-and-a-half arrangement as illustrated in Figures 7 and 8.

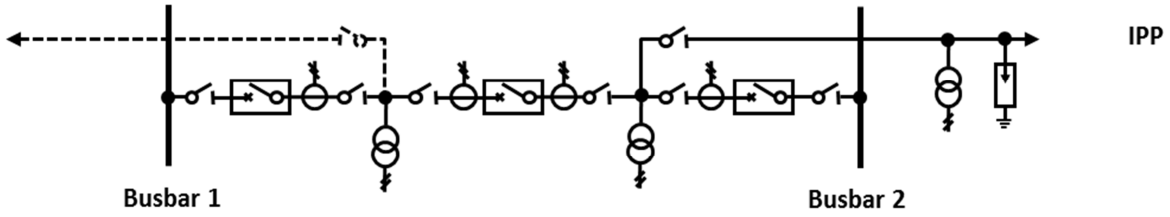

Figure 7: Single Breaker-and-Half Connection (Typical 6,6 kV – 800 kV Yard)

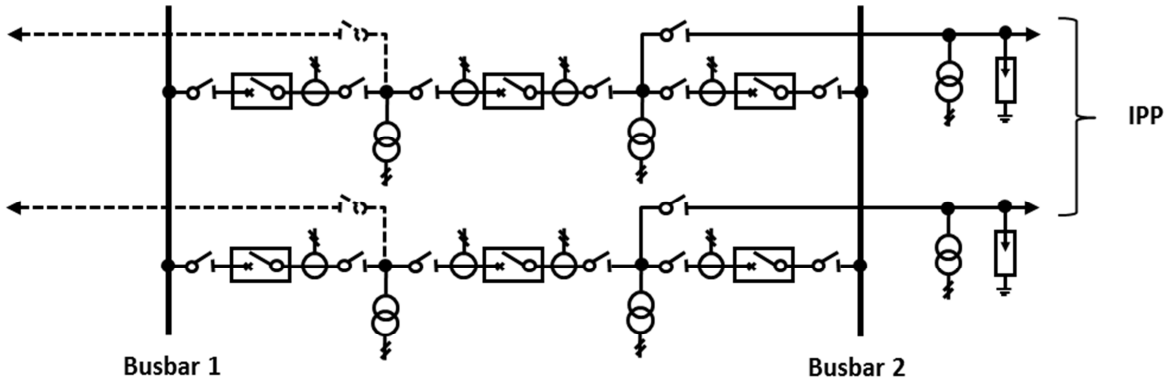

Figure 8: Multiple Breaker-and-Half Connection (Typical 6,6 kV – 800 kV Yard)

4. Authorization

This document has been seen and accepted by:

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5. Revisions

Date	Rev	Compiler	Remarks
Oct 2015	1	AJS Groenewald	First Issue.

6. Development team

The following people were involved in the development of this document:

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7. Acknowledgements

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