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Engineering Recommendation P18

Issue 2 2022

Complexity of Distribution Circuits Operated at or above 22kV

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PUBLISHING AND COPYRIGHT INFORMATION

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Amendments since publication

Issue	Date	Amendment
Issue 1	1978	First published as ‘Complexity of 132 kV Circuits’.
Issue 2	11 July 2022	Major revision of the document which included the following principle changes: • Document structure updated to align with the latest ENA Engineering Document template. • Scope of document extended to include Circuits operating between 22 kV and 132 kV inclusive (previously limited to circuits operating at 132 kV only). • Clause 5, Restrictions: guidance extended and clarified to improve interpretation of restrictions. • New Annex A, Example Circuit Configurations: six example configurations added with commentary on their compliance with the requirements.

Contents

Foreword

This Engineering Recommendation (EREC) is published by the Energy Networks Association (**ENA**) and comes into effect from the date of publication. It has been prepared under the authority of the ENA Head of Engineering and has been approved for publication by the Distribution Code Review Panel (**DCRP**). The approved abbreviated title of this engineering document is “EREC P18”. This replaces the previously used abbreviation “ER P18”.

The previous issue “ENA Engineering Recommendation P18: Complexity of 132 kV Circuits” (Issue 1 1978) has been superseded by this document and Issue 1 has now been withdrawn.

EREC P18 is a Distribution Code v50 Annex 2 document. Whilst it has a material effect on Users[1], it does not implement any Distribution Code requirements and does not form part of the Distribution Code technical requirements.

The restrictions and technical requirements in this EREC have not materially changed (other than the scope being extended to voltages below 132 kV) from the previous issue. Interpretations and guidance on its application have been included.

This EREC is intended primarily for those tasked with design of **Circuit**s operating between 22 kV and 132 kV, inclusive, forming part of a distribution network of a licensed Distribution Network Operator (DNO). These requirements might also be useful information for operational personnel.

Where the term “shall” or “must” is used in this document it means the requirement is mandatory. The term “should” is used to express a recommendation. The term “may” is used to express permission.

NOTE: Commentary, explanation and general informative material is presented in smaller type and does not constitute a normative element.

[1] As defined in The Distribution Code v50.

Introduction

Circuits operated by licensed Distribution Network Operators can range from simple **Radial Circuit**s with two **End**s, through to complex **Circuit**s with teed connections and a greater number of **End**s which may be located at multiple **Site**s. **Circuit**s need to be designed so that they can be constructed, protected (without creating excessively complex protection, intertripping and communications requirements), maintained, isolated and generally operated e.g. in response to a safety related event, without requiring excessive Distribution Network Operator resources or taking an excessive period of time. The intent of this EREC is to set out the limits for **Circuit** complexity taking these factors into account.

1 Scope

This EREC sets out the normal limits of complexity of **Circuit**s operated between 132 kV and 22 kV alternating current (AC) inclusive by stipulating certain restrictions to be applied to them when they are designed.

This EREC applies to **Circuit**s operated by a licensed Distribution Network Operator (DNO).

This EREC applies to new **Circuit**s and significantly modified **Circuit**s. For the purposes of this EREC, significantly modified means the addition of a new **End** or **Site**.

NOTE 1: Any proposed modification shall consider all affected **Circuit**s, and not just the **Circuit** to be significantly modified.

NOTE 2: Although this EREC applies to AC **Circuit**s, the principles may be applicable to DC **Circuit**s.

2 Normative references

The following referenced documents, in whole or part, are indispensable for the application of this document. For undated references, the latest edition of the referenced document (including any amendments) applies.

The Distribution Code of Licensed Distribution Network Operators of Great Britain

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE: Where there is text in square brackets below a definition it indicates the source of that definition.

3.1
Circuit
Part of an electricity system between two or more items of switchgear relevant to the EREC P18 restriction being considered. It may include transformers, reactors, cables and overhead lines. Busbars are not considered as **Circuit**s and are to be considered on their merits.

ENA EREC P2 Issue 7, 3.1

NOTE: The relevant items of switchgear applicable to each restriction are as follows:

- Restriction A1 – Circuit-breakers and/or appropriately rated switches

- Restriction A2 – Circuit-breakers
- Restriction C – Plant suitable for the purpose for isolation

3.2
DCRP
Distribution Code Review Panel.

3.3
Dead
At or about zero voltage and disconnected from any live system.

3.4
ENA
Energy Networks Association.

3.5
End
An item of switchgear connected to a **Circuit** that may be used for making **Dead**, providing **Protection Clearance**, or a point of **isolation**.

3.6
High Voltage (HV)
Voltages exceeding 1000 V AC RMS.

3.7
Isolation
A function to disconnect, for reasons of safety, the supply from every source of electrical energy for a **Circuit**, a discrete section of a **Circuit** or item of switchgear. This can be achieved by isolating equipment that is secured to avoid accidental or inadvertent re-energisation.

3.8
Low Voltage (LV)
Voltages above 50 V AC RMS but not exceeding 1000 V AC RMS.

3.9
Mesh Type Substation
A single busbar substation in which the busbar is formed as an open or closed loop and each **Circuit** is switched by a pair of circuit-breakers in series within the loop. For example, a four-switch mesh substation comprises a single busbar in square configuration with a circuit-breaker and associated switches installed in each side of the square and with **Circuit**s connected to the corners of the square, typically via switches only.

3.10
Protection Clearance
The automatic operation of switchgear to remove all sources of electrical energy to a **Circuit** or section of **Circuit** that has faulted.

3.11
Radial Circuit
A **Circuit** with a single source of electrical energy, other than that from embedded generation, under system intact conditions.

3.12
Site
One or more operational locations, which can have different postal addresses, located such that is it practicable to walk between them in a short period of time (approximately 10 minutes) thus allowing one person to reasonably carry out operations at both locations without causing undue delay.

NOTE: The term 'address' can sometimes be referred to colloquially instead of **Site**.

4 General

Circuits shall comply with this EREC in their intact running configuration(s).

NOTE: Any proposed change to the intact running condition of a **Circuit** to manage load, voltage, fault level or other network constraints shall consider all affected **Circuit**s, not just the **Circuit** to be reconfigured.

The restrictions in Clause 5 should be regarded as being the limits of good planning.

NOTE: The majority of **Circuit**s to which this EREC applies do not reach these limits nor will they be expected to do so. Reasonably practicable **Circuit** and protection designs may dictate further restrictions on complexity for some **Circuit**s. In particular, some types of protection schemes may limit the number of **Circuit End**s to be at two or three **Site**s or may have constraints on the relative impedances of tees forming part off a **Circuit**.

5 Restrictions

5.1 Restriction A1: Making Dead for Operational Purposes

The normal operating procedure for making **Dead** a **Circuit**, by a suitably authorised person, shall not require the opening of more than seven **End**s. For this restriction **End**s can be circuit-breakers and/or appropriately rated switches. These **End**s shall not be located on more than four different **Site**s.

5.1.1 Interpretation of Restriction A1

1. Two circuit-breakers and/or appropriately rated switches on a **Mesh Type Substation** of the same voltage in the mesh controlling a **Circuit** count as being one **End**.
2. Where a **Circuit** is controlled by two circuit-breakers and/or appropriately rated switches which select between main and reserve busbars, these count as being one **End**.
3. Circuit-breakers and/or appropriately rated switches that are normally operated open and are not required to operate to make the **Circuit Dead** as part of a normal operational procedure are not counted as an **End**.
4. Circuit-breakers and/or appropriately rated switches that are not required to operate to make **Dead** the relevant **Circuit** (for example for switchgear associated with an operational overload scheme on other **Circuit**s) should not be counted as an **End**.
5. Circuit-breakers and/or appropriately rated switches that are operated as part of an operational procedure to make the **Circuit Dead** (for example to operate a circuit-breaker to ensure that no part of the **Circuit** would otherwise become unearthed, inadequately protected or to manage voltage) are to be counted as an **End**.

5.2 Restriction A2: Protection Clearance

The **Protection Clearance** of a **Circuit** shall not require the opening of more than seven **End**s. For this restriction, the **End**s must be circuit-breakers. These **End**s shall not be located on more than four different **Site**s.

5.2.1 Interpretation of Restriction A2

1. Two circuit-breakers on a **Mesh Type Substation** of the same voltage in the mesh controlling a **Circuit** count as being one **End**.
2. Where a **Circuit** is controlled by two circuit-breakers which select between main and reserve busbars, these count as being one **End**.
3. Circuit-breakers that are normally operated open and are not required to operate to clear a fault are not counted as an **End** unless there is a need to include the circuit breaker in the protection scheme, in which case that circuit-breaker shall be counted as an **End**.
4. Circuit-breakers that are not required to operate to clear a fault (for example for switchgear associated with an operational overload scheme on other **Circuits**) should not be counted as an **End**.
5. Circuit-breakers that are not required to operate to clear a fault on the relevant **Circuit** but are required to operate to disconnect networks that would otherwise become unearthed, inadequately protected or to manage voltage are to be counted as an **End**.
6. Where a customer is connected to a **Circuit** via a single exit-point circuit-breaker, that circuit-breaker shall be treated as being the **End**, even where fault clearance would actually be achieved by the operation of one or more customer-owned circuit-breakers (for example those associated with the customers Loss-of-Mains (LoM) protection) within the customer's installation.

5.3 Restriction B: Transformer Banking

The normal operating procedure for making **Dead** or **Protection Clearance** of a **Circuit** shall not interrupt supplies to more than three transformers operated by a DNO at any one **Site**.

5.3.1 Interpretation of Restriction B

1. A transformer with two lower voltage windings counts as being one transformer.

5.4 Restriction C: Isolating Facilities

The normal operating procedure for isolating a **Circuit** or item of switchgear that has been made **Dead** shall not require the opening of more than seven **End**s. For the purposes of this restriction, an **End** is a device providing **Isolation**. These **End**s shall not be located on more than four different **Site**s.

5.4.1 Interpretation of Restriction C

1. For the purpose of providing **Isolation**, ancillary equipment (e.g. voltage transformer fuses) are not to be counted as an additional **End** if they are located on the same **Site** as a relevant **End**.
2. Where the normal operating procedure for isolating an item of switchgear directly connected to a busbar does not require the opening of **End**s at more than four **Site**s this restriction does not apply.

NOTE: The intention of Restriction C Interpretation 2 is to not limit the number of **Circuit**s or associated switchgear which are connected to a section of busbar.

Annex A
(informative)
Example Circuit Configurations

This Annex is intended to provide examples to assist in the interpretation of the restrictions, **Circuit** configurations that comply with the requirements of this EREC and to illustrate how the restrictions A1, A2, B and C relate to each **Circuit** configuration.

The examples in this Annex illustrate variations for a typical two **Circuit** (Circuit 1 and Circuit 2) configuration and possible configurations for a new connection at Delta to Circuit 1 and assesses whether those configurations are compliant with this EREC.

A.1 Configuration 1 – Twin transformer feeders

The configuration shown in figure below is an example of a typical configuration where both Circuits 1 and Circuits 2 comply with the requirements of this EREC.

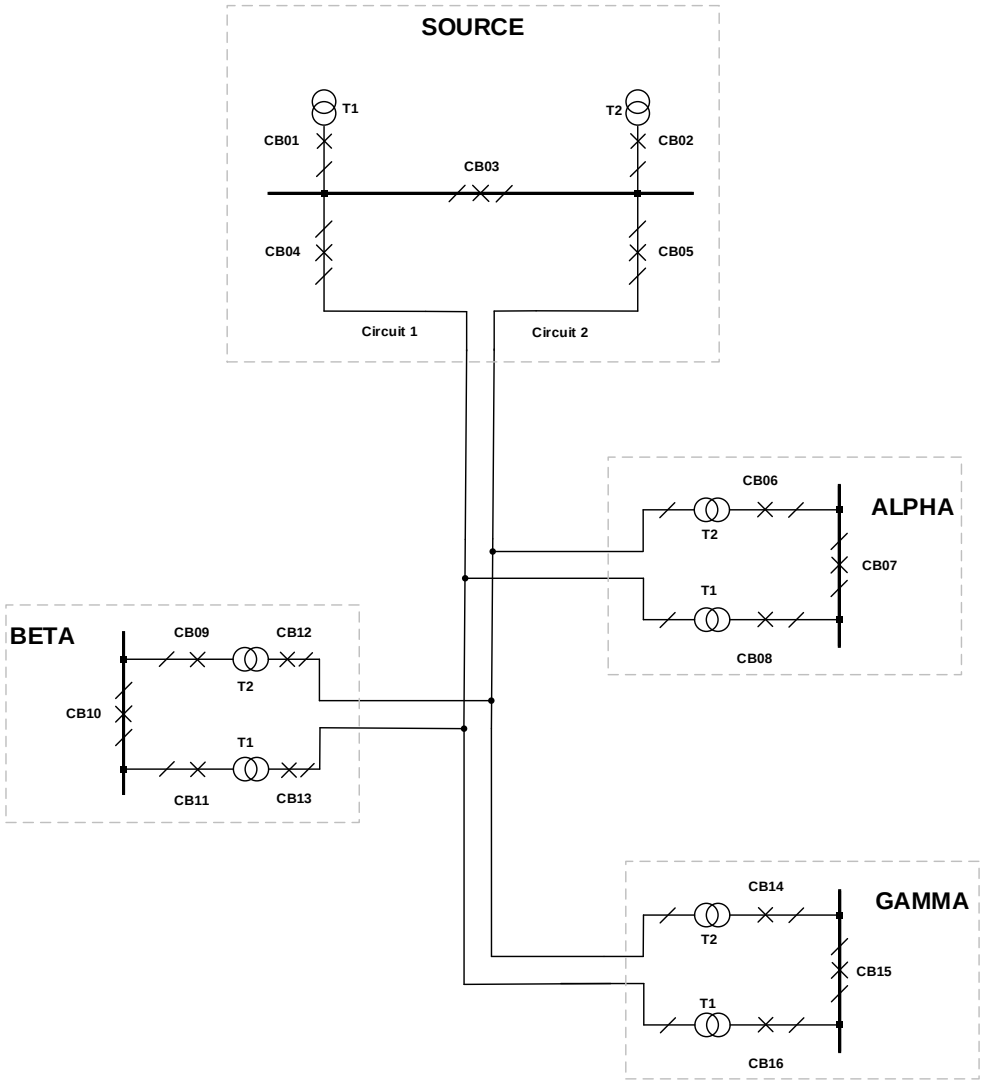

Figure A.1 – Twin transformer feeders

Table A.1 – Circuit 1 compliance

EREC Restriction	Compliance Status	Description
A1 Making Dead for Operational Purposes	Compliant	**Circuit 1 between Source, Alpha, Beta and Gamma:** To make **Dead** Circuit 1 between Source, Alpha and Beta, circuit-breakers would need to be operated at Source (CB04), Alpha (CB08), Beta (CB13) and Gamma (CB16): four **End**s at four **Site**s.
A2 Protection Clearance	Compliant	**Circuit 1 between Source, Alpha, Beta and Gamma:** For **Protection Clearance** for a fault on Circuit 1 between Source, Alpha and Beta, circuit-breakers would need to be operated at Source (CB04), Alpha (CB08), Beta (CB13) and Gamma (CB16): four **Ends** at four **Sites**.
B Transformer Banking	Compliant	N/A – no banked transformers
C Isolating Facilities	Compliant Compliant	**Circuit 1 between Source, Alpha, Beta and Gamma:** To isolate Circuit 1 between Source, Alpha, Beta and Gamma, isolating devices would need to be operated at Source, Alpha, Beta and Gamma: four **Ends** at four **Sites**. In addition to the above there is a need to check that each item of switchgear can be isolated in accordance with this restriction. For example: To isolate the line disconnector adjacent to T1 at Alpha, isolating devices would need to be operated at Source, Alpha (LV disconnector adjacent to CB08), Beta and Gamma: four **Ends** at four **Sites**.
NOTE: Due to the symmetrical nature of the configuration, the compliance of Circuit 2 is similar to that of Circuit 1.		

A.2 Configuration 2 – Twin transformer feeders - Proposed connection at Delta

The configuration shown in the figure below is an example of a **Circuit** configuration where an additional connection to Delta PS has been proposed.

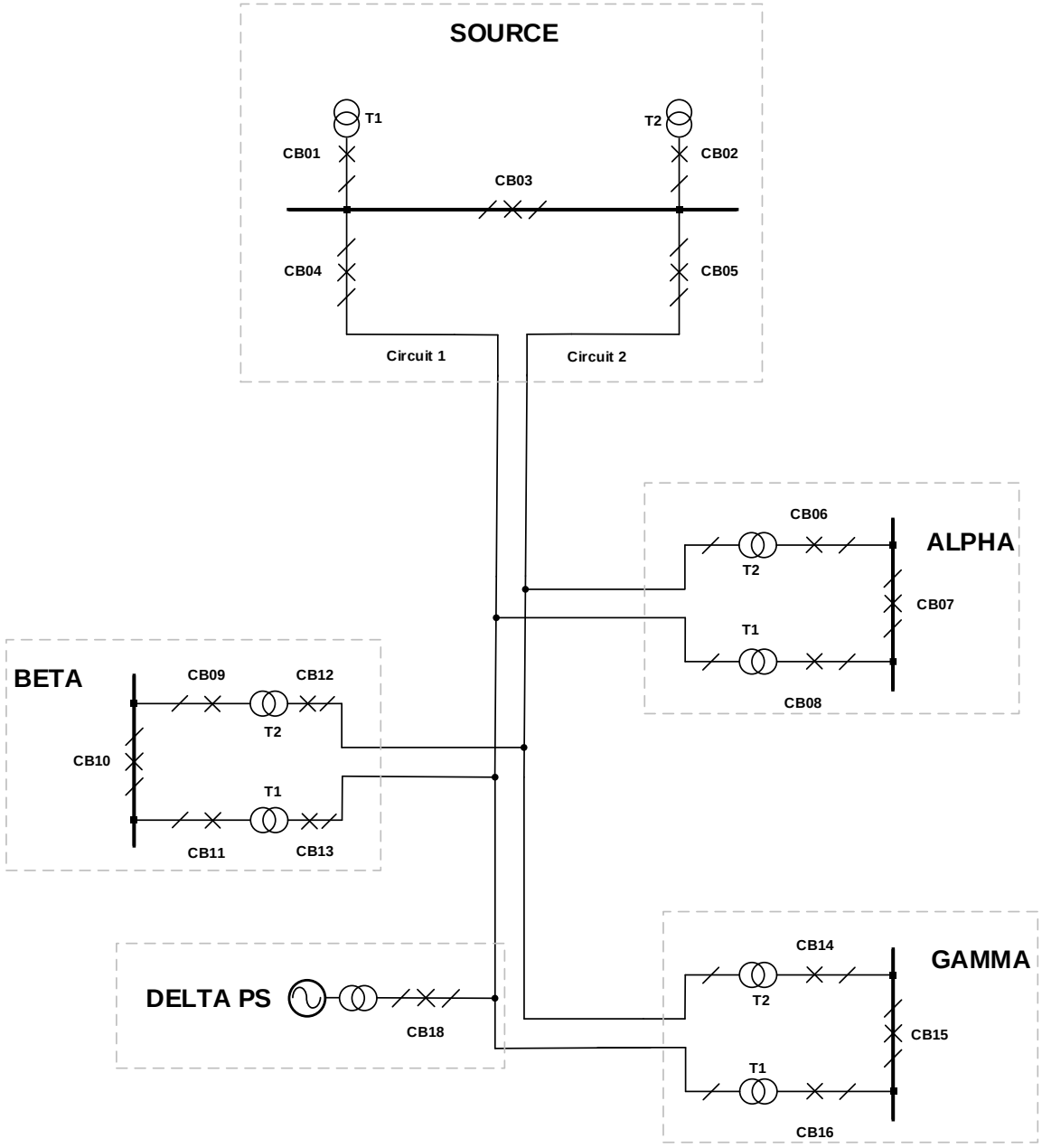

Figure A.2 – Twin transformer feeders - Proposed connection at Delta

Table A.2 – Circuit 1 compliance

EREC Restriction	Compliance Status	Description
A1 Making Dead for Operational Purposes	Non-Compliant	**Circuit 1 between Source, Alpha, Beta and Gamma**: To make **Dead** Circuit 1 between Source, Alpha, Beta, Delta PS and Gamma, circuit-breakers would need to be operated at Source (CB04), Alpha (CB08), Beta (CB13), Delta PS (CB18) and Gamma (CB16): five **End**s at five **Site**s.
A2 Protection Clearance	Non-Compliant	**Circuit 1 between Source, Alpha, Beta and Gamma**: For **Protection Clearance** for a fault on Circuit 1 between Source, Alpha, Beta, Delta PS and Gamma, circuit-breakers would need to be operated at Source (CB04), Alpha (CB08), Beta (CB13), Delta PS (CB18) and Gamma (CB16): five **End**s at five **Site**s.
B Transformer Banking	N/A	N/A – no banked transformers
C Isolating Facilities	Non-Compliant Non-Compliant	**Circuit 1 between Source, Alpha, Beta, Delta PS and Gamma**: To isolate Circuit 1 between Source, Alpha, Beta, Delta PS and Gamma, isolating devices would need to be operated at Source, Alpha, Beta, Delta PS and Gamma: five **End**s at five **Site**s. In addition to the above there is need to check that each item of switchgear can be isolated in accordance with this restriction. For example: To isolate the line disconnector adjacent to T1 at Alpha, isolating devices would need to be operated at Source, Alpha (LV disconnector adjacent to CB08), Beta, Delta PS and Gamma: five **End**s at five **Site**s.
NOTE: The compliance of Circuit 2 is unaffected by the proposed connection configuration.		

A.3 Configuration 3 – Twin transformer feeders - Single inline CB at Beta

This configuration addresses the non-compliance with this EREC associated with Restrictions A1, A2 and C in configuration 2. This has been achieved by adding a circuit-breaker (CB17) between Beta and Delta PS as shown in Figure A.3.

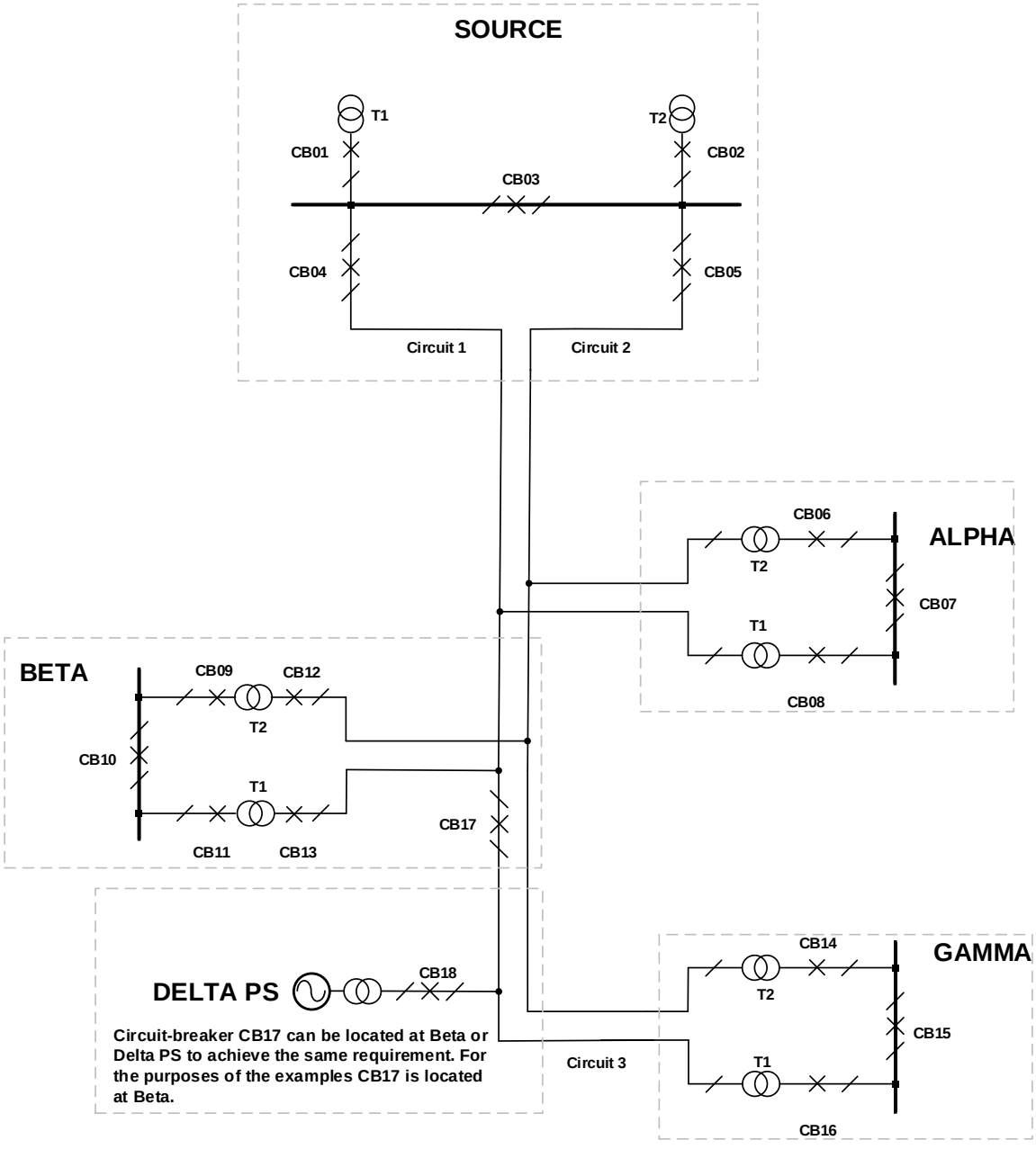

Figure A.3 – Twin transformer feeders - Single inline CB at Beta

Table A.3(a) – Circuit 1 compliance

EREC Restriction	Compliance Status	Description
A1 Making Dead for Operational Purposes	Compliant	**Circuit 1 between Source, Alpha and Beta**: To make **Dead** Circuit 1 between Source, Alpha and Beta, circuit-breakers would need to be operated at Source (CB04), Alpha (CB08) and Beta (CB13 and CB17): four **End**s at three **Site**s. Note that this would leave Circuit 3 between Beta, Delta PS and Gamma back-energised via transformer (T1) at Gamma. This is an unconventional arrangement that may be unacceptable for technical or operational reasons (for example to ensure that no part of the **Circuit** would otherwise become unearthed, inadequately protected or to manage voltage)
	Non-Compliant	If for technical or operational reasons Circuit 3 between Beta, Delta PS and Gamma must be made dead, this will require the additional operation of circuit breakers at Delta (CB18) and Gamma (CB16). This requires switching on five **End**s at five **Site**s.
A2 Protection Clearance	Compliant	**Circuit 1 between Source, Alpha and Beta:** For **Protection Clearance** for a fault on Circuit 1 between Source, Alpha and Beta, circuit-breakers would need to be operated at Source (CB04), Alpha (CB08) and Beta (CB13 and CB17): four **End**s at three **Site**s. Tripping the circuit between Beta (CB17), Delta PS (CB18) and Gamma (CB16) for reasons other than making the **Circuit Dead** (e.g. operational overload scheme to prevent Circuit 3 from being overloaded due to carrying all the export from Delta PS) would not increase the **End** or **Site** count (see Interpretation 4). Tripping the circuit between the Source (CB04), Alpha (CB08) and Beta (CB13 and CB17) would leave the circuit between Beta (CB17), Delta PS (CB18) and Gamma (CB16) back-energised via transformer (T1) at Gamma and this may not be acceptable for operational and technical reasons.
	Non-Compliant	If CB17 is opened, Circuit 3 between Beta (CB17), Delta (CB18) and Gamma (CB16) may become unearthed, inadequately protected, or have unacceptable voltage control meaning that Circuit 3 would also need to be tripped (see Interpretation 5). That would result in operation of five **End**s at five **Site**s, making the **Circuit** non-compliant.
B Transformer Banking	N/A	N/A – No banked transformers
C		**Circuit 1 between Source, Alpha and Beta:**

EREC Restriction	Compliance Status	Description
Isolating Facilities	Compliant	To isolate Circuit 1 between Source, Alpha and Beta, isolating devices would need to be operated at Source, Alpha and Beta: four **End**s at three **Site**s. In addition to the above there is a need to check that each item of switchgear can be isolated in accordance with this restriction.
	Compliant	For example: To isolate the line disconnector adjacent to T1 at Alpha, isolating devices would need to be operated at Source, Alpha (LV disconnector adjacent to CB08) and Beta: four **End**s at three **Site**s.
NOTE: The compliance of Circuit 2 is unaffected by the proposed connection configuration.		

Table A.3(b) – Circuit 3 compliance

EREC Restriction	Compliance Status	Description
A1 Making Dead for Operational Purposes	Compliant	**Circuit 3 between Beta, Delta and Gamma**: To make **Dead** Circuit 3 between Beta, Delta PS and Gamma, circuit-breakers would need to be operated at Beta (CB17), Delta PS (CB18) and Gamma (CB16): three **End**s at three **Site**s.
A2 Protection Clearance	Compliant	**Circuit 3 between Beta, Delta and Gamma:** For **Protection Clearance** for a fault on Circuit 3 between Beta, Delta PS and Gamma, circuit-breakers would need to trip at Beta (CB17), Delta PS (CB18) and Gamma (CB16): three **End**s at three **Site**s.
B Transformer Banking	N/A	N/A – No banked transformers
C Isolating Facilities	Compliant	**Circuit 3 between Beta, Delta and Gamma**: To isolate Circuit 3 between Beta, Delta PS and Gamma, isolating devices would need to be operated at Beta, Delta PS and Gamma: three **End**s at three **Site**s. In addition to the above there is need to check that each item of switchgear can isolated in accordance with this restriction.
	Compliant	For example: To isolate the line disconnector adjacent to CB17 towards Delta PS, isolating devices would need to be operated at Beta (line disconnector adjacent to CB17 towards Source), Delta PS and Gamma: three **End**s at three **Site**s.

A.4 Configuration 4 – Twin transformer feeders - Mesh type substation at Beta

This configuration addresses the non-compliance with this EREC associated with restrictions A1, A2, and C in configuration 2, by installing switchgear at Beta to connect Circuit 1 and Circuit 2 together. This has been achieved by adding a **Mesh Type Substation** at Beta as shown in Figure A.4.

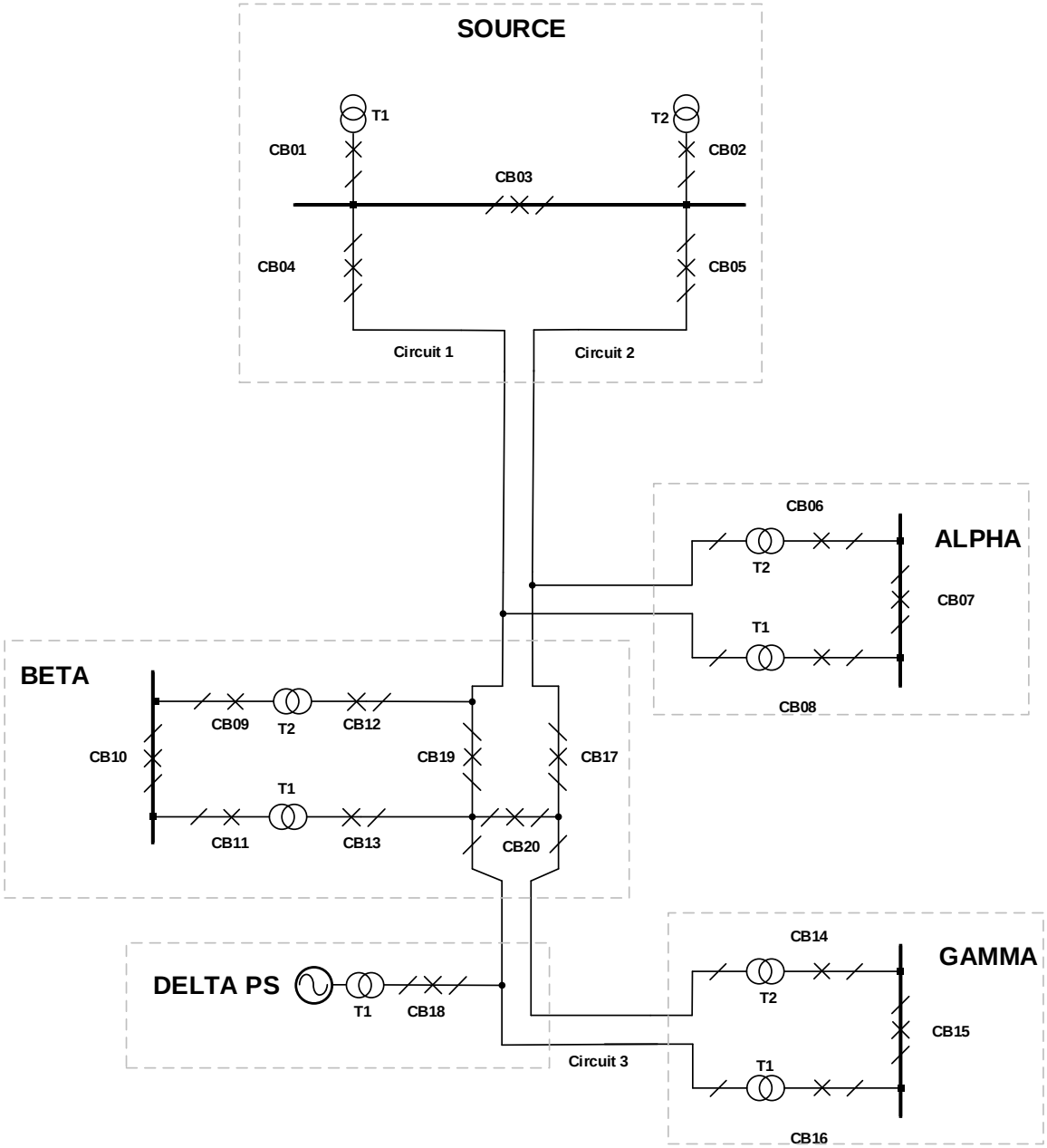

Figure A.4 – Twin transformer feeders - Mesh type substation at Beta

Table A.4(a) – Circuit 1 compliance

EREC Restriction	Compliance Status	Description
A1 Making Dead for Operational Purposes	Compliant	**Circuit 1 between Source, Alpha and Beta**: To make **Dead** Circuit 1 between Source, Alpha and Beta, circuit-breakers would need to be operated at Beta (CB12, & CB19), at Alpha (CB08) and Source (CB04): four **End**s at three **Site**s.
A2 Protection Clearance	Compliant	**Circuit 1 between Source, Alpha and Beta**: For **Protection Clearance** for a fault on Circuit 1 between Source, Alpha and Beta, circuit breakers would need to operate at Source (CB04), Alpha (CB08) and Beta (CB12 and CB19): four **End**s at three **Site**s.
B Transformer Banking	N/A	N/A – No banked transformers
C Isolating Facilities	Compliant Compliant	**Circuit 1 between Source, Alpha and Beta:** To isolate Circuit 1 between Source, Alpha and Beta, isolating devices would need to be operated at Source, Alpha and Beta: four **End**s at three **Site**s. In addition to the above there is need to check that each item of switchgear can isolated in accordance with this restriction. For example: To isolate the line disconnector adjacent to T1 at Gamma, isolating devices would need to be operated at Gamma, Beta and Delta PS, three **End**s at three **Site**s.
NOTE: The compliance of Circuit 2 is unaffected by the proposed connection configuration.		

Table A.4(b) – Circuit 3 compliance

EREC Restriction	Compliance Status	Description
A1 Making Dead for Operational Purposes	Compliant	**Circuit 3 between Beta, Delta PS and Gamma**: To make **Dead** Circuit 3 between Beta, Delta PS and Gamma, circuit-breakers would need to be operated at Beta (CB13, CB19 & CB20), at Delta PS (CB18) and Gamma (CB16): four Ends at three Sites. Note that in accordance with Interpretation 1, CB20 and CB19 are counted as being one **End**.
A2 Protection Clearance	Compliant	**Circuit 3 between Beta, Delta PS and Gamma**: For **Protection Clearance** for a fault on Circuit 3 between Beta, Delta PS and Gamma, circuit-breakers would need to operate at Beta (CB13, CB19 and CB20), Delta PS (CB18) and Gamma (CB16): four Ends at three **Site**s. Note that in accordance with Interpretation 1, CB20 and CB19 are counted as being one **End**.
B Transformer Banking	N/A	N/A – No banked transformers
C Isolating Facilities	Compliant	**Circuit 3 between Beta, Delta PS and Gamma**: To isolate **Circuit 3** between Beta, Delta PS and Gamma, isolating devices would need to be operated at Beta, Delta PS and Gamma: three **End**s at three **Site**s. In addition to the above there is need to check that each item of switchgear can be isolated in accordance with this restriction.
	Compliant	For example: To isolate the line disconnector adjacent to T1 at Gamma, isolating devices would need to be operated at Delta PS, Beta and Gamma: three **End**s at three **Site**s.

A.5 Configuration 5 – Ring created between Source and Gamma

This configuration addresses the potential non-compliance with EREC P18 associated with Restrictions A1 and A2 in configuration 2. This has been achieved by adding switchgear at Gamma to create a ring configuration between Source and Gamma as shown in Figure A.5.

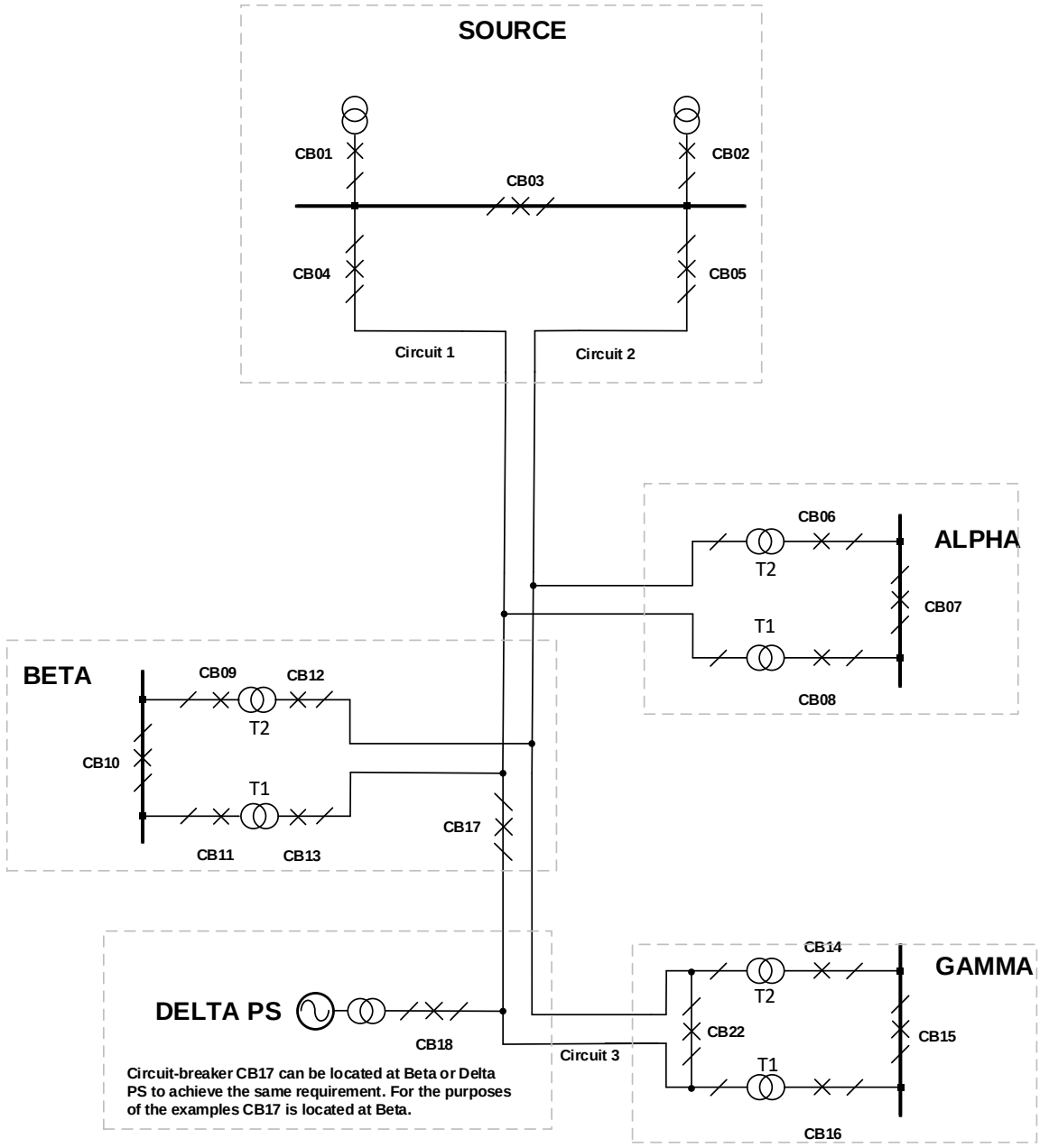

Figure A.5 – Ring created between Source and Gamma

Table A.5(a) – Circuit 1 compliance

EREC Restriction	Compliance Status	Description
A1 Making Dead for Operational Purposes	Compliant	**Circuit 1 between Source, Alpha and Beta**: To make **Dead** Circuit 1 between Source, Alpha and Beta, circuit-breakers would need to be operated at Source (CB04), Alpha (CB08) and Beta (CB13 and CB17): four **End**s at three **Site**s.
A2 Protection Clearance	Compliant	**Circuit 1 between Source, Alpha and Beta:** For **Protection Clearance** for a fault on Circuit 1 between Source, Alpha and Beta, circuit-breakers would need to be operated at Source (CB04), Alpha (CB08) and Beta (CB13 and CB17): four **End**s at three **Site**s.
B Transformer Banking	N/A	N/A – No banked transformers
C Isolating Facilities	Compliant Compliant	**Circuit 1 between Source, Alpha and Beta:** To isolate Circuit 1 between Source, Alpha and Beta, isolating devices would need to be operated at Source, Alpha and Beta: four **End**s at three **Site**s. In addition to the above there is need to check that each item of switchgear can be isolated in accordance with this restriction. For example: To isolate the line disconnector adjacent to T1 at Alpha, isolating devices would need to be operated at Source, Alpha (LV disconnector adjacent to CB08) and Beta: four **Ends** at three **Sites**.
NOTE: The assessment of compliance of Circuit 2 is affected by the proposed connection configuration, by the addition of CB22.		

Table A.5(b) – Circuit 3 compliance

EREC Restriction	Compliance Status	Description
A1 Making Dead for Operational Purposes	Compliant	**Circuit 3 between Beta, Delta PS and Gamma**: To make **Dead** Circuit 3 between Beta, Delta PS and Gamma, circuit-breakers would need to be operated at Beta (CB17), Delta PS (CB18) and Gamma (CB16 and CB22): four **Ends** at three **Site**s.
A2 Protection Clearance	Compliant	**Circuit 3 between Beta, Delta PS and Gamma**: For Protection Clearance for a fault on Circuit 3 between Beta, Delta PS and Gamma, circuit breakers would need to be operated at Beta (CB17), Delta PS (CB18) and Gamma (CB22 and CB16): four **End**s at three **Site**s.
B Transformer Banking	N/A	N/A – No banked transformers
C Isolating Facilities	Compliant	**Circuit 3 between Beta, Delta PS and Gamma**: To isolate Circuit 3 between Beta, Delta PS and Gamma, isolating devices would need to be operated at Beta, Delta PS and Gamma: four **End**s at three **Site**s. In addition to the above there is need to check that each item of switchgear can be isolated in accordance with this restriction.
	Compliant	For example: To isolate the line disconnector adjacent to CB18, isolating devices would need to be operated at Delta PS, Beta and Gamma: four **End**s at three **Site**s.

A.6 Configuration 6 – Single feeder arrangement

The configuration shown in the figure below is an example of a **Radial Circuit** where 5 **Site**s comply with the requirements of this EREC.

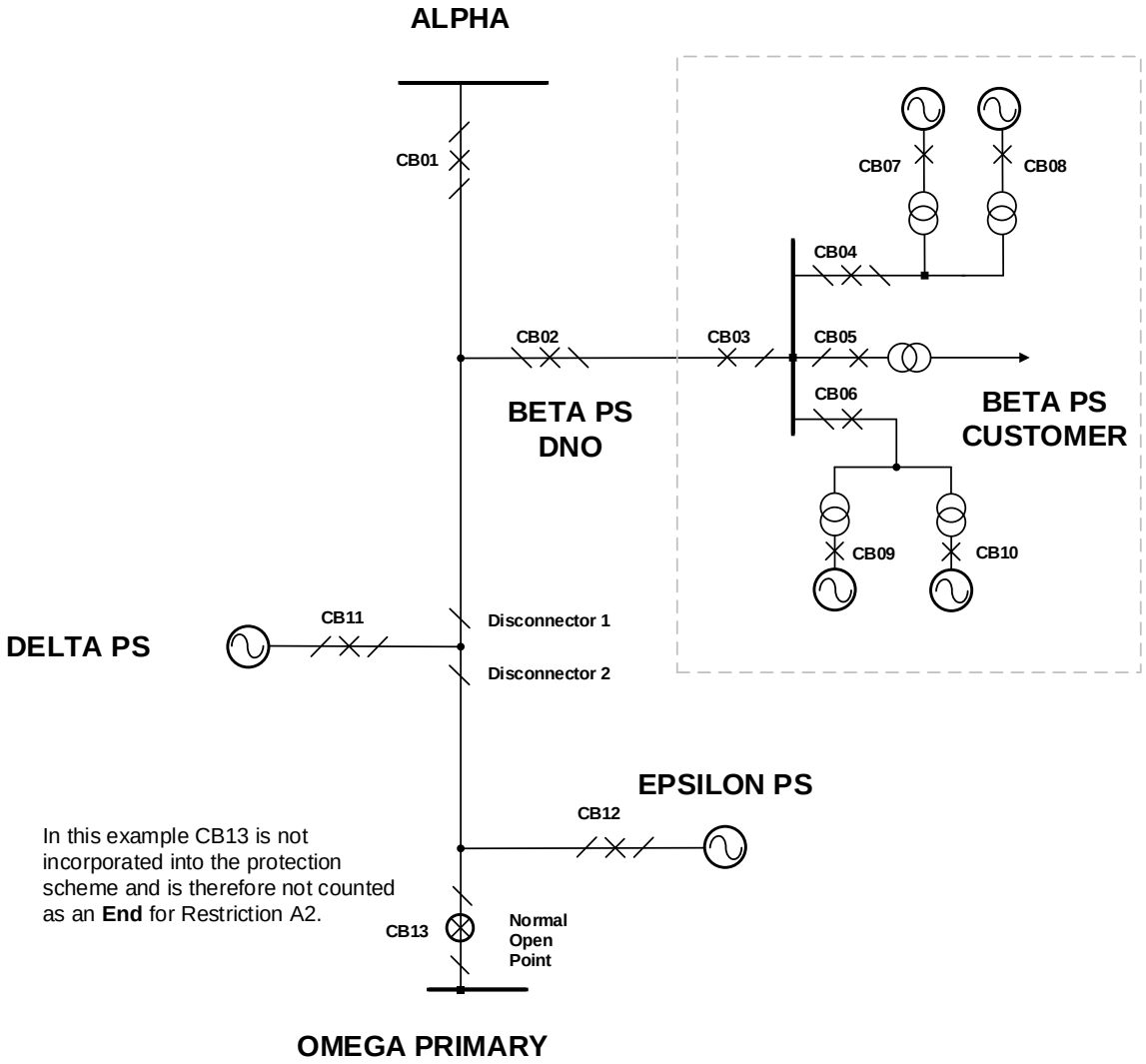

Figure A.6 – Single feeder arrangement

Table A.6 – Circuit compliance

EREC Restriction	Compliance Status	Description
A1 Making Dead for Operational Purposes	Compliant	**Circuit between Alpha, Beta PS, Delta PS, Epsilon PS and Omega**: To make **Dead** the circuit between Alpha and Omega, circuit-breakers would need to be operated at Alpha (CB01), Beta PS (CB02), Delta PS (CB11) and Epsilon PS (CB12): four **End**s at four **Site**s. CB13 at Omega is normally operated open and is not counted for the purposes of this restriction (see Interpretation 3).
A2 Protection Clearance	Compliant Compliant	**Circuit between Alpha, Beta PS, Delta PS, Epsilon PS and Omega**: For Protection Clearance for a **Circuit** fault between Alpha and Omega, circuit-breakers will be required to operate at Alpha (CB01), Beta PS (CB02), Delta PS (CB11) and Epsilon PS (CB12): four Ends at four Sites. If the fault will be cleared by protection embedded within a customer's site (e.g. multiple customer circuit breakers at Beta PS), compliance with Restriction A2 is based on the interface CB (CB02) opening and not the individual CBs within the installation. (see Interpretation 6)
B Transformer Banking	N/A	N/A – No banked transformer on DNO network.
C Isolating Facilities	Conditional Compliance	**Circuit between Alpha, Beta PS, Delta PS, Epsilon PS and Omega**: To provide Isolating facilities, 2 line disconnectors are required at Delta PS (Disconnector 1 & Disconnector 2) For example, without these disconnectors, to isolate the **Circuit** between Alpha and Omega, disconnectors would need to be operated at Alpha, Beta PS, Delta PS, Epsilon PS and Omega: five **End**s at five **Site**s. CB13 at Omega is operated normally open but the disconnector adjacent to CB13 would count as being an **End** for Restriction C.

Bibliography

For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

1 ENA SHE Standard 07 – *Model Distribution Safety Rules*