

	INSTRUCTION	Generation/Duvha Power Station
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Title: **UNIT 380V STANDBY SUPPLIES – SYSTEM DESCRIPTION AND OPERATION**
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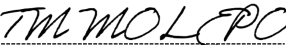
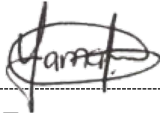
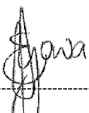
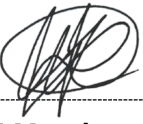
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1. INTRODUCTION

This instruction covers the unit 380V standby supplies and includes a description of the system, and the operation thereof.

2. SUPPORTING CLAUSES

2.1 Scope

2.1.1 Purpose

This instruction describes the correct method of doing chop over on 380V unit diesel gen boards.

2.1.2 Applicability

This instruction is applicable to all 380V unit boards and 380V Unit diesel generator boards.

2.1.3 Effective date

This instruction will be effective the date it will be authorised.

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] N/a

2.2.2 Informative

[1] 240-150642762 Plant Safety Regulations

2.3 Definitions

N/a

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2.4 Abbreviations

Abbreviation	Explanation
CB	Circuit Breaker
KV	Kilo Volt
PPE	Personal Protective Equipment
V	Volt
VT	Voltage Transformer

2.5 Roles and Responsibilities

The Local Control Officer is responsible for ensuring that the chop over system is carried out according to this instruction.

2.6 Process for Monitoring

N/A

2.7 Related/Supporting Documents

2.7.1 Records Generated

- An accurate chronological record of the sequence of events is to be entered in the Local Control Officer's log and summarised in the Shift Manager's log.

3. DOCUMENT CONTENT

3.1 Actions

3.1.1 Function of System

The system is designed such that in the event of a loss of normal electrical supplies to a Unit, alternative supplies to essential equipment will be available, to enable the Unit to be shut down in a safe and orderly manner.

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3.1.2 System Description

The system comprises of the following boards.

3.1.2.1 380V Unit Board A

Normal supply to this board is taken from 11kV Unit Board A.

A standby supply is provided as follows:

3.1.2.1.1 For Units 2 - 3 the standby supply is taken from 11kV Station Board 1.

3.1.2.1.2 For Units 4 - 6 the standby supply is taken from 11kV Sub Station West Board.

3.1.2.1.3 For Unit 1 the standby supply is taken from 11kV Station Board 2.

3.1.2.2 380V Unit Board B

Normal supply to this board is taken from 11kV Unit Board B. Standby supply to this board is the same as for 380V Unit Board A. (See note on preference of standby supplies under "System Operation").

3.1.2.3 380V Unit Diesel Generator Board.

Normal supply to this board is from 380V Unit Board B. An alternative supply is from 380V Unit Board A, which will automatically close if supply to 380V Unit Board B is lost.

NOTE: When supply to 380V Unit Board B is restored, no auto chop-over to this supply will occur. (Supplies must be normalised manually).

Emergency supplies for the 380V Diesel Generator Board come from two Diesel Generators. Each Diesel Generator has an output of one megawatt.

3.1.3 System Operation

3.1.3.1 Normal Operation Conditions (Refer to Appendix 3.3.1):

Under normal circumstances the following breakers are closed:

- On 11kV Unit Board A Breaker A.
- On 11kV Unit Board B Breaker B.
- On 11kV Station/Sub-station West Board Standby supply breaker.

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- On 380V Unit Board A Breaker A and Diesel Generator Board breaker A.
- On 380V Unit Board B Breaker B and Diesel Generator Board breaker B.
- On 380V Diesel Generator Board Breaker 2.
- On 380V Diesel Generator Panel Breaker A and B.

When Diesel Generator Board breaker A on 380V Unit Board A is Closed first, breaker 1 on the 380V Diesel Generator Board will close automatically and lock out breakers 2, 3 and 4.

Similarly, If Diesel Generator Board breaker B on 380V Unit Board B is closed first, breaker 2 on the 380V Diesel Generator Board will close automatically and lock out breakers 1, 3 and 4.

Breakers 1, 2, 3 and 4 have a plus minus 3 second delay on tripping, except under fault conditions when tripping is instantaneous.

NOTE: 380V Unit Board B must be given preference to supply the 380V Unit Diesel Generator Board. The system is designed such that 380V Unit Board B automatically has preference to the standby supply.

3.1.3.2 Operation of the Unit 380V Chop-over system:

- NOTE:** (i) For this system to function, all breakers as described under "Normal operating conditions" must be racked.
- (ii) When any breaker needs racking in, it is advisable to pull the breaker test block out first prior to racking the breaker in. The breakers obtain their operating voltage via auxiliary contacts on the breaker and it may be possible that a condition exists that will cause the breaker to close when the auxiliary contacts "make" without the power contacts being fully "home".

3.1.3.2.1 When the supply to 380V Unit board A fails, breaker A trips automatically (**Refer to Appendix 3.3.2**). The supply voltage is measured on the supply cable VT's.

Standby breaker A closes automatically after a time delay of 2 - 4 seconds.

When normal supply to breaker "A" is restored, standby breaker "A" trips and the normal supply breaker "A" closes automatically without any time delay.

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3.1.3.2.2 When the supply to 380V Unit Board B fails, breaker B trips automatically (Refer to Appendix 3.3.3). The standby supply breaker B will automatically close after a time delay of 0 - 1 seconds. This is to ensure that standby breaker "B" has preference, should the supply to 380V Unit board A fail as well.

When normal supply to breaker "B" is restored, the standby breaker "B" will trip automatically, and the normal supply breaker "B" will close without a time delay.

3.1.3.2.3 When supply to both 380V Unit Boards "A" and "B" is lost, only the standby supply breaker on 380V Unit Board B will close, the standby supply breaker on 380V Unit Board A will not close.

3.1.3.2.4 In the event of total loss of supply to 380V Unit Board B (i.e. normal and standby supply), breaker 2 on the 380V Diesel Generator Board trip and breaker 1 on the 380V Diesel Generator will close without a time delay (**Refer to Appendix 3.1.3.2.4**).

When supply to 380V Unit board B is restored no "Auto chop-over" from breaker 1 to breaker 2 on the 380V Diesel Generator board will occur. This has to be done manually, which will result in temporary loss of supply to the unit auxiliaries. Preferably, the supplies must be changed over as described under "No break chop-over".

3.1.3.2.5 When all supplies to 380V Unit Board A and B fail (i.e. standby and normal supply), breaker 1 or 2, whichever one happens to be closed at the time, on 380V Diesel Generator board will trip after plus minus 5 seconds. Both Diesel Generators (if standby) will start up. The first Diesel Generator that is up to speed will take the load. The other Diesel Generator will run for a pre-set time of plus minus 5 minutes and then shut down. The Diesel Generator board is now fed from the Diesel Generators (Refer to Appendix 3.1.3.2.5).

When normal supplies are reinstated, no auto chop-over will occur, to normalise supplies proceed from step (iv) under "no break chop-over".

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3.1.3.3 No Break Chop-over.

3.1.3.3.1A no-break chop-over from breaker 1 to breaker 2 on the 380V Diesel Generator board can be achieved in the following manner:

- a) Start-up A standby Diesel Generator.
- b) Synchronise the Diesel Generator with the supply from 380V Unit Board "A".

This is done on the Diesel Generator Panel by closing breaker 3 or 4 depending on which Diesel Generator is running. (See "Synchronising a Diesel Generator").
- c) Trip breaker 1 on the Diesel Generator Board.
- d) Synchronise the Diesel Generator with the supply from 380V Unit Board "B" (i.e. close breaker 2 on the 380V Unit Diesel Generator board).
- e) Shut down the Diesel Generator.

3.1.3.4 Synchronising

3.1.3.4.1 Manual synchronising

Synchronising a Diesel Generator onto the Diesel Generator board:

- a) Any Diesel Generator can be started by selecting its selector switch to manual and pressing the start button.
- b) Adjust the Generator frequency to plus minus 50 cycles by altering the engine speed switch.
- c) Equalise the system and Generator voltages by adjusting the Generator voltage switch
- d) Adjust the engine speed so that the synchro disc rotates very slowly.
- e) When the mark on the disc is almost in the 12 o'clock position, close the appropriate breaker on the Diesel Generator board (i.e. breaker 3 or 4).

NOTE: This method should only be used under abnormal circumstances as it is possible to close the breaker out of synchronism due to the synchronising check relay being inoperative.

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3.1.3.4.2 Semi-Auto Synchronising:

When the 380V Diesel Generator board is on normal supply and say Diesel Generator A has to be put on load.

- a) Start the Diesel Generator manually.
- b) On the Diesel Generator synchronising panel, select the CB (circuit breaker) control to auto.
- c) Select the synchro-select switch to CB3.
- d) Equalise the system and Diesel Generator voltages.
- e) Adjust the engine speed so that the synchro-disc rotates very slowly.
- f) When the mark on the synchro-disc is almost at the 12 o'clock position, press the synchronising button. (An auto synchro mechanism is initiated which will close CB 3 when both supplies are in synchronism).
- g) By increasing on the engine speed switch, the Generator will take all the load.
- h) If required CB 1 on the Diesel Generator board can now be tripped and the Diesel Generator will continue to supply the load.

3.1.3.5 Shutting down a Diesel Generator.

In all cases remove the load from the Diesel Generator by adjusting the engine speed selector switch.

3.1.3.5.1 Auto shut-down.

- a) Put the running Generator panel selector switch on auto.
- b) Open CB3 or 4 by pushing its trip button.
- c) This brings in a timer set at plus minus 5 minutes which will keep the Diesel Generator running for no-load cooling purposes.
- b) The Diesel Generator will shut down automatically when the timer runs out.

3.1.3.5.2 Manual shut down.

The Diesel Generator can be stopped by pressing the "stop" push button.

An emergency "stop" push button is also fitted. This should however only be used when a real emergency exist, as frequent use could damage the engine due to the rapid stopping.

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3.1.3.6 Additional information and reminders.

- 3.1.3.6.1 Breakers A and B on the Diesel Generator panel are only used for isolating the Diesel Generators from the 380V Diesel Generator board and for protection purposes.
- 3.1.3.6.2 An electrical interlock prevents synchronising of both diesel generators at the same time.
- 3.1.3.6.3 All circuit breakers on the 380V Diesel Generator board must either be in the "racked in" or "test" position for the chop-over system to function.
- 3.1.3.6.4 When racking in a breaker, the danger exists that it can close automatically before it is fully racked in. A safety measure is to pull the test block out and only replace it when the breaker is fully racked in.
- 3.1.3.6.5 If for any reason the supplies to the Diesel Generator panel are switched off, the chop-over on the 380V Diesel Generator board will not function.
- 3.1.3.6.6 Emergency push button arming selector key switch must be inserted and "ON" before emergency push button arming selector for 380V A & B breakers on 380V Diesel Gen Board will operate.

3.2 Specific Safety Requirements. (P.P.E.)

- a. Safety glasses/goggles.
- b. Full overalls.
- c. Ear protection.
- d. Safety shoes/boots.
- e. Safety gloves.

Any additional safety equipment may be required as directed by the specific Risk Assessment performed prior to executing any task/ activity including any other work related.

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3.3 ANNEXURE A

- 3.3.1 380V Unit board supply - Normal.
- 3.3.2 380V Unit board A on stand-by supply.
- 3.3.3 380V Unit board B stand-by supply.
- 3.3.4 380V Unit board A supplying diesel gen boards.
- 3.3.5 D gen A to D gen board - 11kV black out.

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4. ACCEPTANCE

This document has been seen and accepted by:

Name	Designation
S Mokoatedi, I Nhlengethwa, T Mahlangu, S Ndaba	Shift Managers
S Zungu, P Mapaya, I Dlamini, L Sibiya	Local Control Officers
P Pieterse, V Madela	Senior Controllers

5. REVISIONS

Date	Rev.	Compiler/Reviewer	Remarks
December 2024	7	TM Molepo	Review Date Changed
December 2021	6	TM Molepo	Minor Changes and New Template
March 2019	5	TM Molepo	Review
June 2016	4	TM Molepo	Review Date Changed
April 2013	3		Minor Changes and New Format
November 2009	2		Review
November 2006	1		Review, New Format and Addition of 7.1.3 on Page 1
June 2000	0		Original (DOC ID Changed From OPI5211 To EI008)

6. DEVELOPMENT TEAM

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

- The Ops support team
- Operating department

7. ACKNOWLEDGEMENTS

N/a

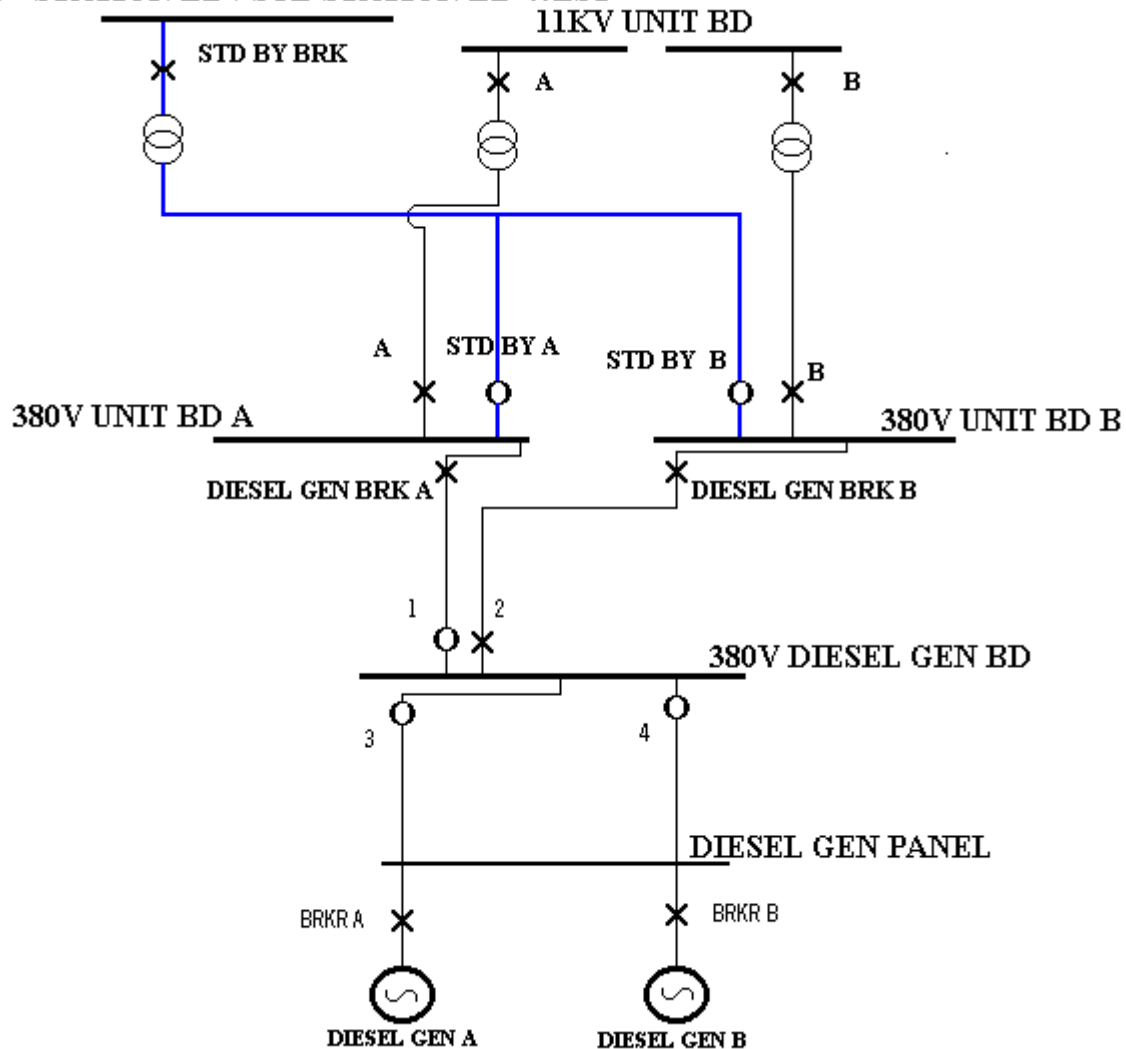
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APPENDIX – 3.3.1 380V UNIT BOARD SUPPLY - NORMAL (Paragraph 3.1.3.1)

11KV STATION BD / SUB STATION BD WEST



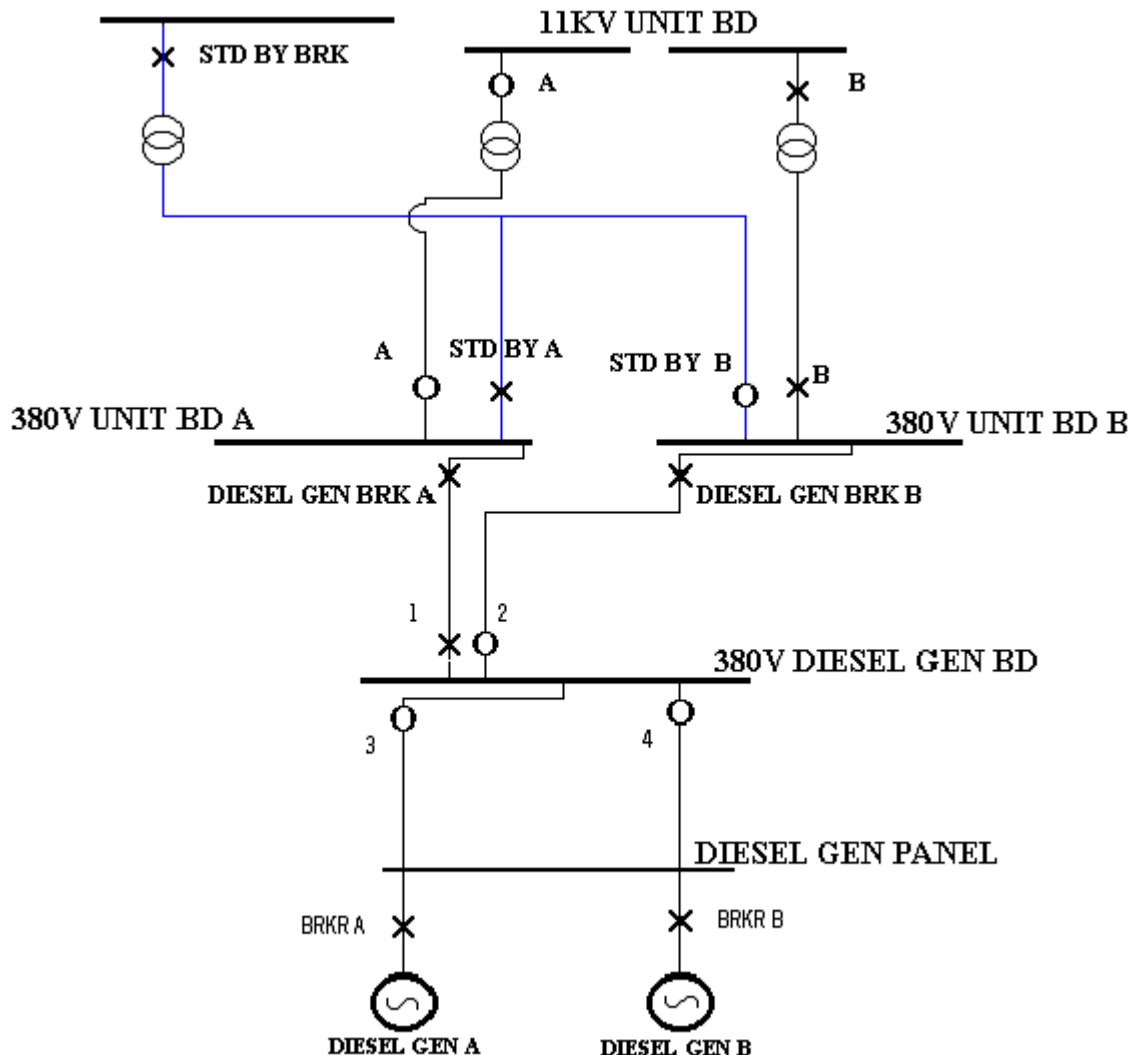
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APPENDIX – 3.3.2 380V UNIT BOARD A ON STAND-BY SUPPLY (Paragraph 3.1.3.2.1)

11KV STATION BD/ SUB STATION BD WEST

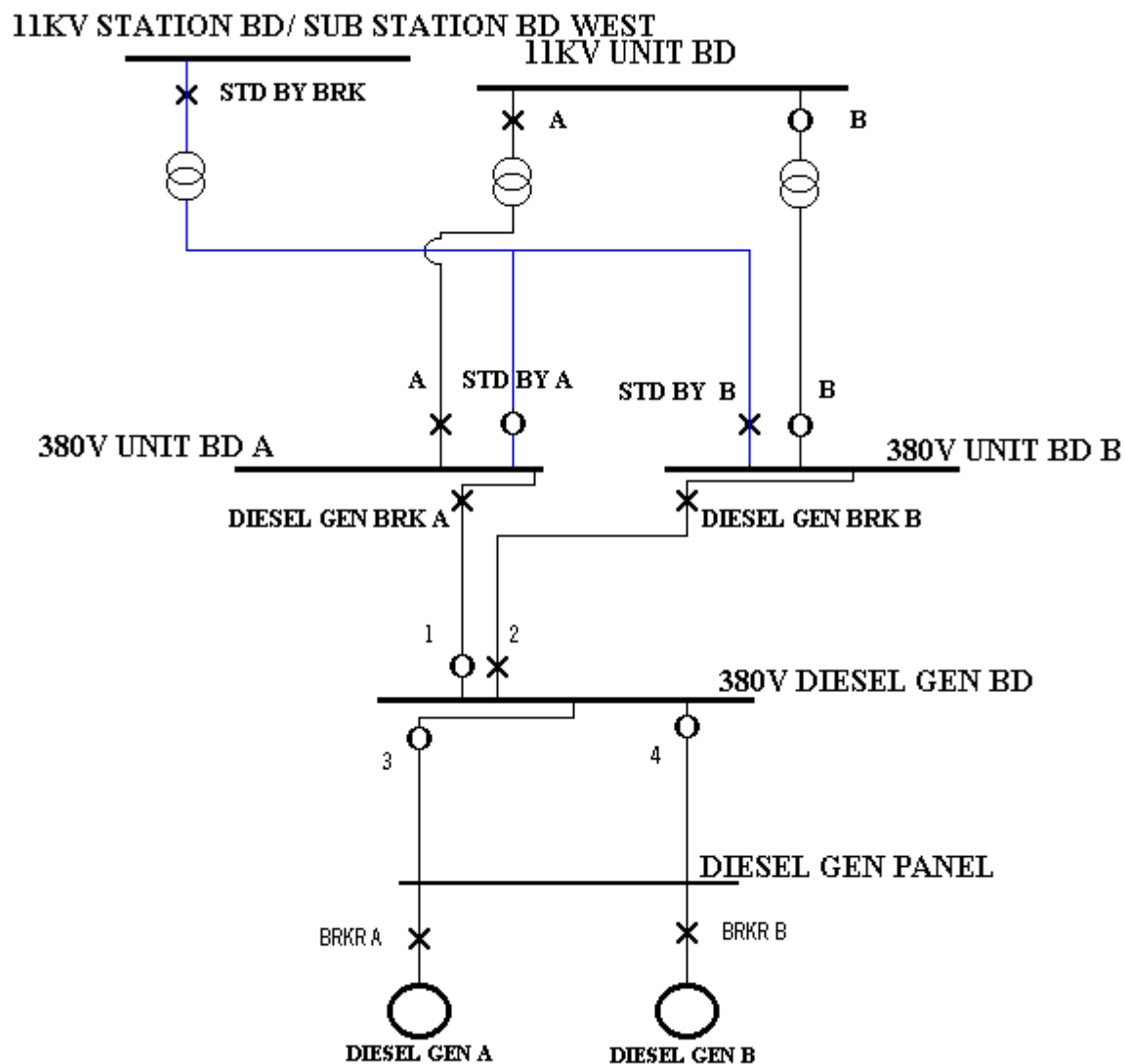


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APPENDIX – 3.3.3 380V UNIT BOARD B STAND-BY SUPPLY (Paragraph 3.1.3.2.2)

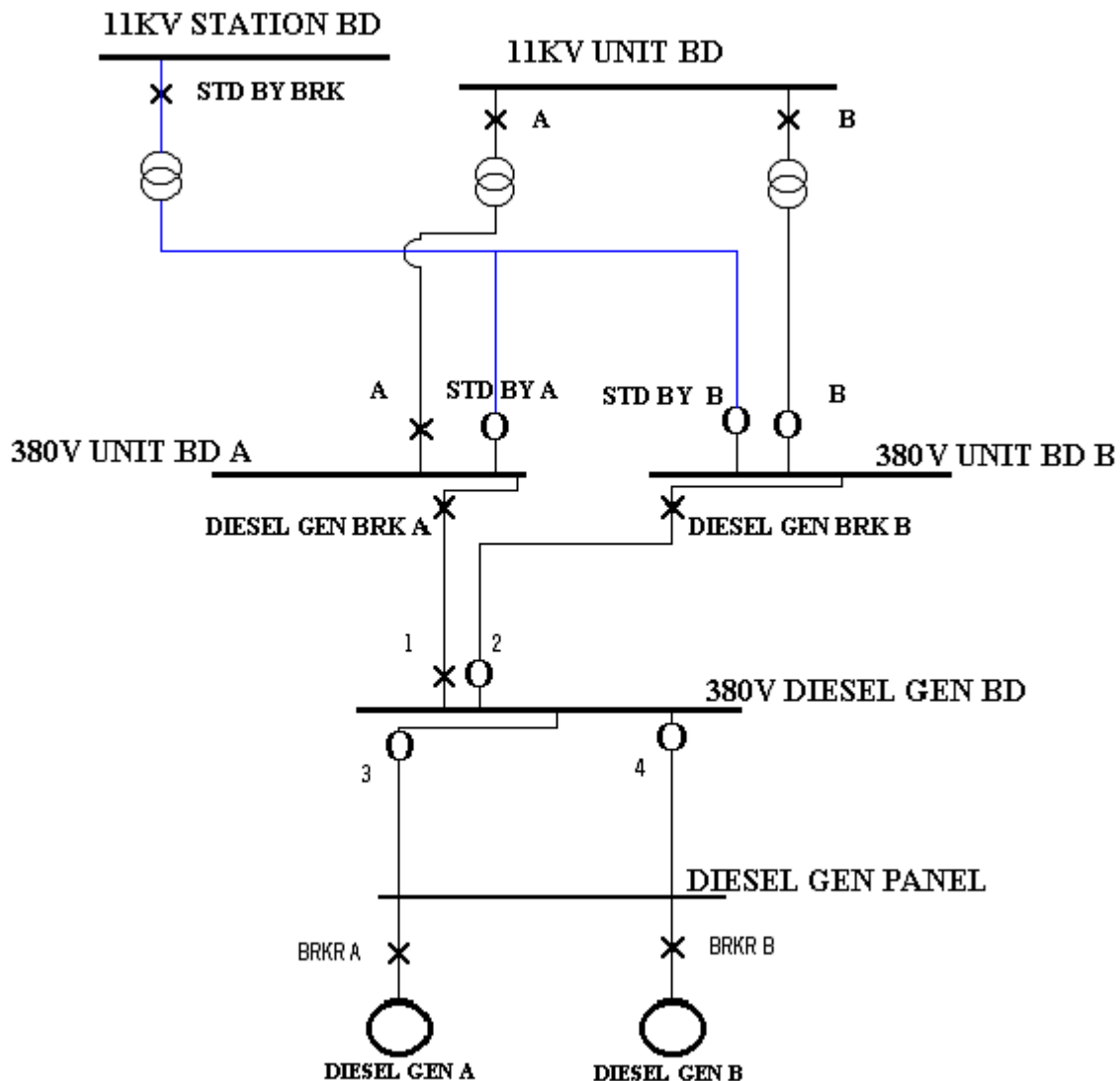


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**APPENDIX – 3.3.4 380V UNIT BOARD A SUPPLYING DIESEL GEN BOARD
(Paragraph 3.1.3.2.4)**



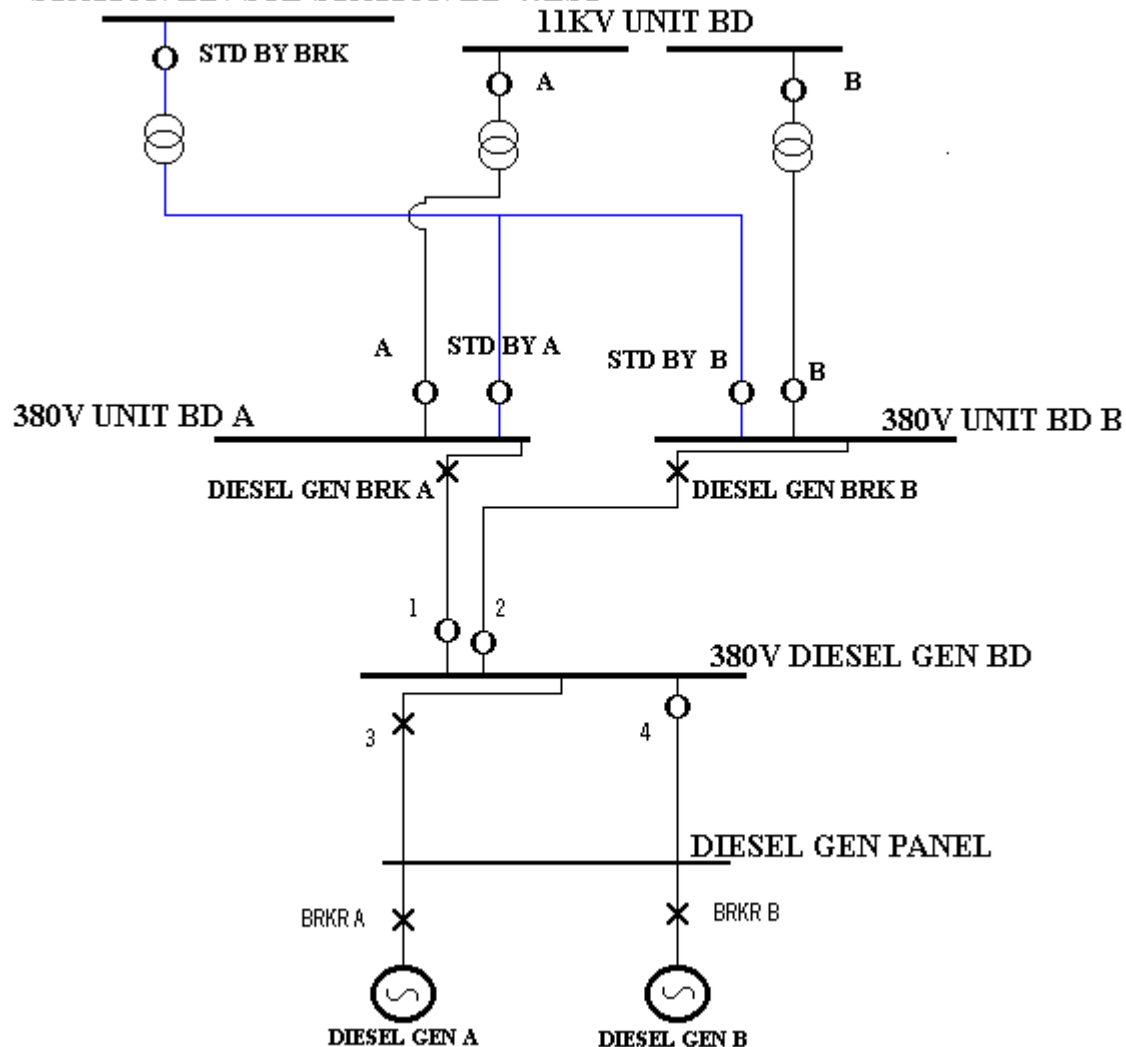
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APPENDIX – 3.3.5 D GEN A TO D GEN BOARD - 11KV BLACK OUT (Paragraph 3.1.3.2.5)

11KV STATION BD/ SUB STATION BD WEST



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