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Engineering Standard - NSW

Category
Electrical

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Electrical Phase Relationships

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About This Standard

This document describes the phase relationships of the various ARTC voltage systems, and the transformer vector connections used by ARTC.

In addition, the phase relationship to the networks of the other NSW Distributors, through which the ARTC network passes, are set out. (This is for information only as the ARTC cannot be responsible for this information.)

Document History

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List of Amendments –

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1.1	11/03/2005	Disclaimer	Minor editorial change

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1 Introduction

Voltages of 33 kV and above are in phase throughout NSW (except for some minor areas mentioned below).

However 11 kV and 415 V system phases differ between the old NSW 'County Council' districts. Since these County Councils have been amalgamated (1995) into six Distributors, different parts of the new Distribution districts are out of phase with each other.

The ARTC network is unusual in that it 'spans' many of the old districts, whereas the Distributors are usually geographically as well as electrically isolated.

2 ARTC System

ARTC uses the following transformer vector connections:-

132/33, 66/33 & 11/2 **Yy0**

66/11, 33/11 & 33/2 **Dy1** (the lv lags the higher voltage by 30^{O})

all voltages/415 **Dy1**

(including 600/415 rectifier aux Tx.)

Note 1: 415V derived from a 33kV/415V Tx is out of phase with the 415V derived from an 11kV/415 Tx. (there is a 60^{O} difference.)

Note 2: the 11 kV and 2 kV systems are in phase.

Note 3: the 33 kV and 66 kV systems are in phase and are 30^{O} ahead of the 11 & 2 kV systems

Additional information on ARTC transformer phasing is available in Drawing E/43686.

3 Other Systems' Transformer Connections

Transformers used by other systems are as shown in Table 1. (Only the areas through which ARTC high voltage lines pass are indicated below.)

	Geographic Area bounded by	**33/11**	**33/415**	**11/415**
ARTC (for comparison)		Dy1	Dy1	Dy1
Sydney County Council	Hawkesbury R, Auburn, Bankstown, East Hills & Waterfall; except old St. George area as below	Dy1	Dy1	Dy1
St George County Council	Rockdale south to the Georges R.	Dy1		Dy11
Central Coast	Hawkesbury River to Doyalson	Dy11		Dy11
Shortland County Council	Doyalson to Newcastle & Hunter Valley	Dy1		Dy11
Prospect County Council	West of Auburn (Duck R). south to Bargo including Liverpool & Campbelltown	Dy1		Dy11
Illawarra County Council	Waterfall (excl.), south to Pt. Kembla & Dapto.	Dy11		

Table 1 Other Distributors' Connections

The 'old Sydney County Council' area of EnergyAustralia uses the same vectors as ARTC so that the old SCC and ARTC systems are totally in phase at all voltages, and all transformers are interchangeable.

4 Phase Comparisons with the ARTC System

Voltage	old SCC area	old St George CC	Central coast area	old PCC area	old Sh. CC area	old ICC area
	now eA	**now eA**	**now eA**	**now Integral**	**now eA**	**now Integral**
66kV	in phase	in phase	in phase	in phase	in phase	in phase
33kV	in phase	in phase	in phase *see note 2*	in phase	in phase	in phase
11kV	in phase	in phase	out of phase	in phase	in phase	out of phase *see note 1*
415V	in phase	out of phase	out of phase	out of phase	out of phase	

Table 2 Other Distributors' Phase Relationships

Note 1: The isolated ARTC 11 kV network in the Wollongong area, fed from Coniston, is in phase with Integral's 11 kV system. This is achieved by swapping two hv and two lv phases in the external bus connections to the 33/11 Tx (Dy1) at Coniston.

Note 2: In the area around Lake Munmorah, the eA 33 kV system is fed from the Munmorah PS auxiliary supplies which are derived from 330/33 kV transformers and the 33 kV is 30^{o} out of phase with all other 33 kV.