NEMA Standards Publication

NEMA C12.24 TR-2011

Definitions for Calculations of VA, VAh, VAR, and VARh for Poly-Phase Electricity Meters

National Electrical Manufacturers Association

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A Technical Report prepared by NEMA and registered with ANSI

Secretariat:

National Electrical Manufacturers Association

Registered May 29, 2011

American National Standards Institute, Inc.

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Published by

National Electrical Manufacturers Association
1300 North 17th Street, Rosslyn, VA 22209

Printed in the United States of America

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Foreword (This Foreword is not part of Technical Report C12.24TR-2011.)

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This Technical Report establishes definitions for calculations of VA, VAh, VAR, and VARh for poly phase electricity meters. It is intended to ease identification of algorithms used in electricity meters and to facilitate accurate testing.

This technical report was processed and approved for submittal to ANSI by Accredited Standards Committee for Electricity Metering, C12. At the time the committee approved this technical report, the C12 Committee had the following members:

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AMERICAN NATIONAL STANDARD NEMA C12.24TR-2011

Definitions for Calculations of VA, VAh, VAR, and VARh for Poly-Phase Electricity Meters

1 Scope

This technical report establishes names and mathematical definitions for the Volt-Ampere (VA), Volt-Ampere hours (VAh), Volt-Amperes Reactive (VAR), and Volt-Ampere Reactive hours (VARh) formulae used by poly-phase electricity meters. The mathematical definitions assume static waveforms.

2 Abbreviations and Letter Symbols

2.1 Abbreviations

netVA	total meter Volt-Ampere
netVAR	total meter Volt-Ampere reactive
netWatt	total meter power
RMS	root mean square
VA	Volt-Ampere
VAh	Volt-Ampere hours
VAR	Volt-Ampere reactive
VARh	Volt-Ampere reactive hours

2.2 Letter Symbols

$\alpha_{(h)i}$ =phase angle of the potential for harmonic order (h) of phase i

$\beta_{(h)i}$ =phase angle of the current for harmonic order (h) of phase i

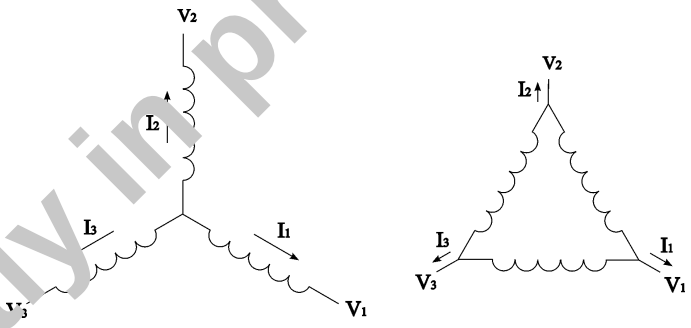
θ_i =phase angle between the fundamental potential and current of phase i, $\alpha_{(1)i}$ minus $\beta_{(1)i}$

τ =start time of integration

ω =fundamental angular frequency, $2\pi f_0$, where f_0 is the fundamental frequency in Hertz

bV_i =Blondel's theorem transformed voltages:

$$bV_1 = V_1 - V_2$$
$$bV_2 = 0$$
$$bV_3 = V_3 - V_2$$



T =VARh and VAh integration interval measured in seconds

h =harmonic order (fundamental=1, second harmonic=2, etc.)

i =phase number in the poly-phase network

I_i =generalized current waveform of phase i (fundamental and all harmonics)