AS 2421—1981

Australian Standard

GUIDE TO THE SELECTION AND USE OF POWER TRANSFORMERS

The following scientific, industrial and governmental organizations and departments were officially represented on the committee entrusted with the preparation of this standard:

Australian-British Trade Association
Australian Electrical and Electronic Manufacturers Association
Confederation of Australian Industry
Defence Standardization Committee
Electrical Testing Laboratories
Electricity Supply Association of Australia
Electricity Supply Engineers Association of N.S.W.
Institution of Engineers, Australia
Railways of Australia Committee

This standard, prepared by Committee EL/8, Static Electrical Machinery, was approved on behalf of the Council of the Standards Association of Australia on 10 October 1980, and was published on 1 February 1981.

This standard was issued in draft form for public review as DR 79187.

AS 2421—1981

Australian Standard

GUIDE TO THE SELECTION AND USE OF POWER TRANSFORMERS

First published 1981

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140

ISBN 0 7262 2133 3

PREFACE

This standard was prepared by the Association's Committee on Static Electrical Machinery. It applies to power transformers complying with AS 2374*.

This standard is intended to assist in the determination and selection of power transformer characteristics. The recommendations herein are not mandatory and are solely for the guidance of purchasers at the time of purchase and subsequent usage.

The standard is technically identical with IEC 606, Application Guide for Power Transformers, and acknowledgement is made of the assistance received therefrom.

It should be noted that AS C61—1970 is similar to the superseded edition of IEC 76. The revised edition of AS C61—1970 will be based closely on the current edition of IEC 76 and will be issued as AS 2374, in six Parts as follows:

Part 1—General

Part 2—Temperature Rise

Part 3—Insulation Levels and Dielectric Tests

Part 4—Tappings and Connections

Part 5—Ability to Withstand Short Circuit

Part 6—Sound Levels

---

* In course of preparation to supersede AS C61—1970.

CONTENTS

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
GUIDE TO THE SELECTION AND USE OF POWER TRANSFORMERS

1 SCOPE. This standard applies to power transformers complying with AS 2374, and is intended to assist in the determination and selection of transformer characteristics.

The recommendations herein are not mandatory and are solely for the guidance of purchasers at the time of purchase and during subsequent usage.

2 SPECIFICATION OF TAPPING QUANTITIES.

2.1 Introduction.

2.1.1 *Purpose of this clause.* The main purpose of this clause is to help the purchaser to determine from the on-load operating conditions of the transformer the tapping quantities to be specified in accordance with Section 1 of AS 2374, Part 4—Tappings and Connections.

Since the tapping quantities are used as a basis for the manufacturer's guarantees and for tests, they should not be unduly complex, since that would make the assessment of guarantees too difficult.

A transformer complying with this standard should be capable of operating under the expected on-load conditions without being needlessly oversized (see Note). Amongst all the solutions meeting this condition, the simplest ones should be sought, account being taken of the information given in AS 2374, Part 4 relating to constant flux voltage variation, variable flux voltage variation and combined voltage variation.

NOTE: For the purposes of standardization and simplification, the theoretically calculated data (rated power, voltage data, etc) resulting from assumed on-load operating conditions may be adjusted when the final transformer data are being decided. Such considerations, which can result in an oversized transformer, are mostly disregarded in this guide.

2.1.2 *Field of application.* In this guide, as in AS 2374, Part 4, the only case considered is the most common, i.e. a transformer having only one tapped winding.

NOTE: To simplify demonstration, consideration is limited to two-winding transformers (to which can be added a stabilizing or auxiliary winding.)

2.1.3 *Abbreviations used in this clause.* To shorten the text and the figures, the following abbreviations are used for certain quantities which often appear (subscript A refers to the tapped winding and subscript B to the untapped winding):

U_A = tapping voltage of the tapped winding

I_A = tapping current of the tapped winding

U_B = tapping voltage of the untapped winding

I_B = tapping current of the untapped winding

K_A = tapping factor (for definition, see AS 2374, Part 1)

n = voltage ratio

n_u = voltage ratio on the maximum voltage tapping

n_i = voltage ratio on the maximum current tapping

n_p = voltage ratio on the principal tapping (rated voltage ratio)

2.2 First Stage of Determination of Tapping Duties (Converting from On-load Voltages to No-load Voltages)—Calculation of Voltage Ratios. To determine from on-load quantities, the tapping quantities to be specified and particularly the tapping voltages (for definition, see AS 2374, Part 1), it will be necessary to replace the on-load voltages of the various windings by no-load voltages by making suitable voltage corrections.

First of all, voltage drop (or voltage rise) ΔU is calculated*, account being taken of the following information:

(a) Load in megavolt amperes (MV.A), power factor cos φ and sin φ.

(b) Direction of the power flow.

(c) Variation range of the high voltage (HV).

(d) Variation range of the low voltage (LV).

Voltage corrections are then made by multiplying the on-load voltage by $\frac{100}{100 - \Delta U}$, where ΔU is expressed as a percentage.

The voltage ratios and particularly their extreme values are then obtained from these calculated no-load voltages.

NOTE: The voltage drop or rise calculations can be based on approximate impedance values. More accurate calculations can be made when the final impedance values are known, but this is not often necessary.

2.3 Choice of the Tapped Winding. For technical reasons it is usually preferable for tappings to be located as follows:

(a) On the high-voltage winding rather than on the low-voltage winding, particularly if the voltage ratio is high.

(b) On a star-connected winding rather than on a delta-connected winding.

(c) On the winding of which the tapping voltage varies the most. This factor is less important than the factors mentioned in items (a) and (b).

* For this calculation, see Clause 6.