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Minimum efficiency values for power transformers

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Preface

This is the second edition of CSA C802.3, *Minimum efficiency values for power transformers*. It supersedes the first edition published in 2001, under the title *Maximum Losses for Power Transformers*, and it replaces the portion of CAN/CSA-C802, *Maximum Losses for Distribution, Power, and Dry-Type Transformers*, that pertains to power transformers. The portions of CAN/CSA-C802 pertaining to liquid-filled distribution transformers and dry-type transformers have been revised and incorporated into CSA C802.1,*Minimum efficiency values for liquid-filled distribution transformers*, and CAN/CSA-C802.2, *Minimum efficiency values for dry-type transformers,* respectively. CSA C802.1, CAN/CSA-C802.2, and CAN/CSA-C802.3 supersede CAN/CSA-C802.

Revisions made to this edition of C802.3 include a change in the efficiency assessment criteria from evaluating “maximum losses” to meeting “minimum efficiency” for power transformers.

CSA Group acknowledges that the development of this Standard was made possible, in part, by the financial support of NRCan, BC Hydro, Manitoba Hydro, Hydro Quebec, Canadian Electricity Association, Ontario Ministry of Energy, and Independent Electricity System Operator (IESO).

CSA Group also acknowledges the contribution made by the Subcommittee on Transformer Efficiency, responsible for the development of CAN/CSA-C802, on the development of this Standard.

This Standard was prepared by the Subcommittee on Maximum Losses for Power Transformers, under the jurisdiction of the Technical Committee on Industrial Equipment Strategic Steering Committee on Performance, Energy Efficiency, and Renewables, and has been formally approved by the Technical Committee.

Notes:

1) *Use of the singular does not exclude the plural (and vice versa) when the sense allows.*
2) *Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.*
3) *This Standard was developed by consensus, which is defined by* CSA Policy governing standardization — Code of good practice for standardization *as “substantial agreement. Consensus implies much more than a simple majority, but not necessarily unanimity”. It is consistent with this definition that a member may be included in the Technical Committee list and yet not be in full agreement with all clauses of this Standard.*
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   d) *rationale for the change.*

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0 Introduction

This Standard specifies maximum losses for power transformers to encourage efficiency in electric power distribution. With adequate accuracy, the losses of a transformer can be described in terms of the losses under unloaded conditions (no-load losses) and its further losses when loaded (load losses). A given electric utility, taking anticipated average load conditions, will assign multipliers to the no-load and load loss values which produce capitalized present worth of those losses for a transformer life of about 30 years. The present values are added to the first cost to derive the total ownership cost (TOC). By using TOC to minimize costs, electric utilities have, at the same time, reduced losses in their transformers. TOC is not readily implemented in many non-utility applications and, in such cases, the maximum losses provided in this Standard are more practical. The limits given are those which typically arise when performing TOC calculations. Thus, though first cost will necessarily be increased, the user will rapidly amortize the increase because of the lower running costs resulting from lower losses. Utilities change the multipliers used in TOC calculations as circumstances change and the loss limits in this Standard will be changed accordingly at appropriate intervals.

When purchasing transformers, it should be recognized that the minimum efficiencies specified in this standard are intended to supplement rather than replace the use of loss evaluation formulas. Loss evaluation formulas take into account specific costs of user location and loading practices, factors that minimum efficiencies at 50% load do not include. The use of loss evaluation formulas is therefore encouraged because of cost effectiveness while minimum efficiency is maintained.

1 Scope

1.1

This Standard applies to all liquid-filled power transformers, except those types listed in Clause 1.3, and specifies minimum efficiency ratings. The minimum efficiencies specified are for transformers at their base kVA rating, as described in Tables 1 to 3. Minimum efficiencies are also specified for some special designs (Clause 4.3).

1.2

This Standard applies to power transformers rated from 501 to 10 000 kVA and operating with a 60 Hz waveform and does not include the effect of any harmonics.

Note: *Transformers designed for harmonic environments are often called K factor transformers*

1.3

This Standard does not apply to autotransformers, grounding transformers, rectifier transformers, reactors, or any units which have load-tap-changing gear or tertiary windings.

