

PETRONAS TECHNICAL STANDARDS

MANUAL

Power Transformer (Amendments/Supplements to IEC 60076)

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This revision of PTS **33.65.40.31 – Power Transformer (Amendments/Supplements to IEC 60076) (February 2011)** has been reviewed and updated to incorporate PETRONAS Lessons Learnt, Best Practice and new information issued by relevant industry code and standards. All updates in the document are highlighted in *italic* font (if any).

The previous version of this PTS **33.65.40.31 – Power Transformer (Amendments/Supplements to IEC 60076) (February 2010)** will be removed from PTS binder / e-repository from herein onwards.

Document Approval

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PREFACE

PETRONAS Technical Standards (PTS) publications reflect the views, at the time of publication, of PETRONAS OPU/Divisions.

They are based on the experience acquired during the involvement with the design, construction, operation and maintenance of processing units and facilities. Where appropriate they are based on, or reference is made to, national and international standards and codes of practice.

The objective is to set the recommended standard for good technical practice to be applied by PETRONAS' OPUs in oil and gas production facilities, refineries, gas processing plants, chemical plants, marketing facilities or any other such facility, and thereby to achieve maximum technical and economic benefit from standardisation.

The information set forth in these publications is provided to users for their consideration and decision to implement. This is of particular importance where PTS may not cover every requirement or diversity of condition at each locality. The system of PTS is expected to be sufficiently flexible to allow individual operating units to adapt the information set forth in PTS to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use PTS they shall be solely responsible for the quality of work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, it is expected of them to follow those design and engineering practices which will achieve the same level of integrity as reflected in the PTS. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the owner.

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PART I GENERAL

1. INTRODUCTION

1.1 SCOPE

This PTS gives the minimum technical requirements for power transformers for use in oil refineries, chemical plants, gas plants, exploration and production and supply/marketing.

This PTS is a revision of the PTS of the same number, dated January 1992.

Transformers shall comply with IEC 60076, as relevant and as amended by this PTS. This PTS gives PETRONAS amendments and supplements to the following IEC publications:

- IEC Publication 60076-1 2000;
- IEC Publication 60076-2 1993 ¹⁾;
- IEC Publication 60076-3 2000;
- IEC Publication 60076-3-1 1987;
- IEC Publication 60076-5 1976 ²⁾;
- IEC Publication 60076-8 1997;
- IEC Publication 60076-11 2006³⁾;

1) as amended by corrigendum dated June 1997.

2) as amended by amendment No. 1 of 1979.

Part II of this PTS covers oil-immersed power transformers.

Part III covers the additional requirements for dry-type transformers, which shall also comply with the relevant parts of Part II.

Part IV covers the requirements for Korndorfer Starting Transformers, and shall be read in conjunction with all relevant clauses elsewhere in this PTS.

Part V covers the documentation requirements and references.

For ease of reference, the clause (or paragraph) numbering of the particular IEC standard has been used throughout its relevant section. Clauses (paragraphs) not mentioned remain unaltered.

The corresponding Requisition, PTS 33.65.40.93, has been extended to cover more project-specific transformer requirements. The requisition shall be completed and returned by the Manufacturer as part of his quotation.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by PETRONAS, the distribution of this PTS is confined to companies forming part of PETRONAS Group or managed by a Group company, and to Contractors and Manufacturers/Suppliers nominated by them (i.e. the distribution code is "F", as described in PTS 00.00.05.05.).

This PTS is intended for use in oil refineries, chemical plants, onshore and offshore oil and gas production facilities, loading terminals, tank farms and interconnecting piping between such installations.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this PTS the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable as regards safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this PTS which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned with the object of obtaining agreement to follow this PTS as closely as possible.

1.3 DEFINITIONS AND ABBREVIATIONS

1.3.1 General definitions

For the purposes of this PTS, the following terms and abbreviations are defined.

The **Contractor** is the party that carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party that manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party that initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant, authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a mandatory requirement.

The word **should** indicates a recommendation.

The **Requisition** is PTS form 33.65.40.93.

1.3.2 Specific definitions

Off circuit tap-changer: a device for changing the voltage ratio of the transformer only after the transformer has been isolated from the high voltage and low voltage sources.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this PTS are made, the referenced section number is shown in brackets. Other documents referenced in this PTS are listed in (Part V;2).

PART II REQUIREMENTS FOR OIL-IMMERSED POWER TRANSFORMERS (AMENDMENTS/SUPPLEMENTS TO IEC 60076-1)

1.2 SERVICE CONDITIONS

Add to this clause:

Transformers shall have a design lifetime of at least 25 years, when delivering rated output under the service conditions specified and maintained according to the Manufacturer's recommendation.

Transformers shall be suitable for continuous operation at full load for at least 40,000 hours without maintenance requiring the transformer to be de-energised.

The system supply voltage and frequency will not vary more than:

Voltage : plus or minus 10 %

Frequency : plus or minus 5 %

The Requisition identifies the maximum site ambient temperature, for either outdoor or indoor transformer installations. Unless otherwise specified in the Requisition, the maximum average daily temperature shall be 10 °C less than the maximum site ambient temperature, and the maximum average annual temperature shall be 20 °C less than the maximum site ambient temperature. The relative humidity shall be taken to be 90 %, maximum.

The atmosphere shall be regarded as dusty, sulphurous, saliferous and corrosive, as commonly encountered in petrochemical installations in close proximity to the sea.

Transformers for outdoor operation shall be designed to operate without protective shelter. The effect of rapid changes in ambient temperature shall also be incorporated in the design.

4. RATING

Add to this clause:

The Requisition identifies the duty of the transformer, e.g., generator transformer.

All "general service" transformers may be used to feed groups of motors and shall be capable of withstanding infrequent restarting loads of up to 1.8 times the transformer's rated current. Five such restarts may take place in succession at 5-second intervals.

Motor unit transformers, i.e., transformers supplying individual motors and Korndorfer starting transformers shall be capable of withstanding three successive motor starts and a further two successive starts after a half-hour cooling-off period. Motor data are stated on the Requisition.

The transformer shall be capable of delivering rated current at applied voltages up to 105 % of rated voltage continuously.

NOTE: Preferred ratings are given in Appendix 1.

7. RATING PLATE

Add to this clause:

Rating plates shall be of stainless steel or other corrosion resistant metal. They shall be permanently fixed to a readily accessible and non-removable part of the transformer.

7.1 INFORMATION TO BE GIVEN IN ALL CASES

Add to this clause:

The Principal's purchase order number shall be stated on the rating plate.

7.2 INFORMATION TO BE GIVEN IN CERTAIN CASES

Add to this clause:

The CT ratios shall be stated on the rating plate.

8. MISCELLANEOUS REQUIREMENTS

8.1 DIMENSIONS OF NEUTRAL CONNECTION

Add to this clause:

The LV neutral conductor and terminal of polyphase, general service, transformers shall be located next to the phase terminals and be dimensioned to carry not less than 50 % of the load of the phase conductors and terminals.