

PETRONAS TECHNICAL STANDARDS

MANUAL

Solar Power System

PTS 33.65.60.30

FEBRUARY 2011



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This revision of PTS **33.65.60.30 – Solar Power System (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 **33.65.60.30 – Solar Power System (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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1. INTRODUCTION

1.1 SCOPE

This new PTS specifies requirements and gives recommendations for the design, engineering, materials, fabrication and testing of a photovoltaic (PV) solar-powered stand alone system consisting of solar module(s), battery bank, control equipment, mechanical support, shelters and associated components.

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 or managed by PETRONAS or managed by a Group company and, where necessary, to Contractors and Manufactureres nominated by them.

This PTS is intended for use in oil refineries, chemical plants, gas plants exploration and production facilities and, where applicable, supply/marketing installations. When PTS are applied, a Management of Change (MOC) process should be implemented; this is of particular importance when existing facilities are to be modified.

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

1.3.1 General definitions

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 or maintenance 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 authorized to act for, or on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.3.2 Specific definitions

Array to Load Ratio (ALR) or Charge factor	The ratio between the quantity of charge supplied to the battery and the quantity of charge taken from the battery on a daily basis.
Autonomy	The number of full days that the system can supply the specified load, using 80 % of the effective battery capacity, without any charging by the solar modules.
Daily depth of discharge (DDOD)	The quantity of charge taken from the battery on a daily basis, expressed as a percentage of the effective capacity of the battery.
Effective battery capacity	Battery's rated capacity, based on the actual-load discharge time, final voltage and reference temperature.
Float charging	The passing of an electric current through a battery by applying a constant voltage from a charger so as to maintain the battery in a full state of charge without excessive gassing.
Hazardous area	An area in which an explosive gas atmosphere is or may be expected to be present in such quantities as to require special precautions for the construction, installation and use of electrical apparatus.
Insolation (or Irradiation)	Integration of irradiance (sunshine) over a specified period of time (kWh/m ² per unit time).
Irradiance	Radiant power incident upon a unit area of surface (W/m ²).
Nominal battery capacity	Battery's rated capacity, selected and declared as such by its Manufacturer, based on a specific discharge time, final voltage and reference temperature.
Requisition	PTS 33.65.60.93, used by the Principal to specify the detailed requirements for a particular installation.
Standard test conditions (STC) (for Solar module ratings)	The standard test conditions are: (1) Cell temperature: 25 ± 2 °C. (2) Irradiance, as measured with a reference device: 1000 W/m ² with the reference solar spectral irradiance distribution. (3) Air mass: 1.5, representing the sun at 42° latitude.
State of charge (SOC)	A ratio, expressed in percent, of the energy remaining in a battery in relation to its capacity when fully charged.
VRLA Batteries	Valve regulated lead acid battery cells in containers which are sealed under normal conditions, and in which the electrolyte is absorbed in plate separator material so that oxygen evolved from the positive plates transfers to the negative plates and 'recombines' to form water. The containers incorporate a pressure relief device to permit the escape of gas if the internal pressure exceeds a certain value. The cell charging voltage of VRLA cells needs to be strictly controlled and high rate charging is not permitted.
Worst case autonomy	The number of full days that that the system can supply the specified load under worst-case conditions i.e. number of full days from the morning of the worst day of the worst month of the worst year.

1.4 UNITS AND QUANTITIES

Technical units, quantities etc. are and shall be expressed, used and abbreviated according to the SI (International System of Units) system as far as practicable.

1.5 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 (9).