

PETRONAS TECHNICAL STANDARDS

DESIGN AND ENGINEERING PRACTICE

TECHNICAL, PROCEDURAL, AND SPECIFICATIONS

INSTRUMENTATION DOCUMENTS AND DRAWINGS

PTS 32.31.00.34

FEBRUARY 2011



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This revision of PTS **32.31.00.34 – Instrumentation Documents and Drawings (February 2011)** has been 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.

The previous version of this PTS **32.31.00.34 (December 1995)** will be removed from PTS binder / e-repository from herein onwards.

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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' OPU/Divisions 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.

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1 INTRODUCTION

1.1 GENERAL

This PTS specifies requirements and gives recommendations for instrumentation documents and drawings prepared or completed during the basic and detailed design engineering stages of a project.

The requirements for as-built documents and drawings in the construction or commissioning phases and during the life-time of the plant are given in [Appendix 1](#).

This is a revision of an earlier PTS of the same number dated December 1995.

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. It may be distributed to Manufacturers/Suppliers nominated by them.

This PTS is intended for use in oil refineries, chemical plants, gas plants and, where applicable, in exploration and production facilities and supply/marketing 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, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this document 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 document as closely as possible.

1.3 DEFINITIONS

1.3.1 General Definitions

The **Contractor** is the party which 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 which manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party which 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 requirement.

The word **should** indicates a recommendation.

1.3.2 Specific Definitions

Distributed Control System (DCS)	A configurable microprocessor-based control system.
Instrumented Protective System (IPS)	The electromechanical, electronic and/or programmable electronic Logic Solver component of the Instrumented Protective Function, complete with input and output equipment.

1.4 ABBREVIATIONS

CCTV Closed circuit television

CR	Control room
CRAR	Control room (Auxiliary room)
DCS	Distributed Control System
EPC	Engineering, Procurement and Construction contract
IPS	Instrumented Protective System
MDF	Main Distribution Frame
MIS	Management Information System
MTBF	Mean time between failures
MTTR	Mean time to repair
SPIR	Spare Parts and Interchangeability Record

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 by this PTS are listed in [\(4\)](#).

2 GENERAL REQUIREMENTS

2.1 GENERAL

A set of instrumentation documents and drawings shall be prepared for each project and shall include *the list specified in Appendix 3, where applicable*.

These documents and drawings shall be issued such that sufficient time is allowed for activities such as instrument design and engineering, purchasing and installation, taking into account the procedures and the time required for review and comment by the Principal.

The content of each document or drawing shall be *accurate, concise and easy to understand* such that it will allow other activities *to be carried out* e.g. purchasing, installation, *pre-commissioning, inspection and testing* of all instrumentation at the construction site and serve as a *reliable* reference for *operations*, maintenance, changes and/or extension to the instrumentation.

The content of documents and drawings, the number of copies required the need for additional documents and the procedures for commenting and/or approval shall be in accordance with requirements which will be stated by the Principal.

Instrumentation electronic design and drawing (software) tools *which are acceptable in the oil and gas industry* shall be used for document and drawing production by the Contractor; however, for exchangeability reasons, approval from the Principal is required on the use of the specific software format.

Self-documenting facilities in DCS and IPS should be used to their fullest capabilities.

2.1.1 Software formats

All documents produced in an electronic form shall be in accordance with Memorandum MFT 168/93 (PPMS-1310-001: Design Engineering Management Manual version 1.0)

Generally accepted software formats are:

- *Smart Plant Instrumentation (SPI)* (supplied by Intergraph, USA) for all instrument drawings, schedules, data sheets, hook-ups
- *MICROSTATION* (version 8 or later) for drawings not available in SPI
- Word for Windows, for all word processing including narrative descriptions
- Excel for Windows, for all spreadsheet processing

The use of 3rd party software and Principal developed software shall be validated prior to being used in the design engineering. The compatibility of the *design and drawing softwares* with computer equipment used on site should be verified by the Principal. If not compatible, the required computer equipment should be included in the scope of the project (e.g. server, software license, dongle).

All parts and sections of any form, sheet or other document which requires filling in shall be completed. Where a particular part of any document is not applicable it shall be so indicated.

All Instrumentation drawings and documents shall be issued for comments and/or approval to the *Lead Instrument design engineer* of the Principal. *The identification and categorisation of all drawings and documents shall be finalised within 1 month after contract award.*

2.2 IDENTIFICATION

All documents and drawings shall be provided with a registration number from the series of numbers allocated to the project, together with a code number for classification and identification. The code number shall consist of a prefix, project number; group number and a symbol. For further information, refer to PTS 40.10.01.11, *section 2, 3 and 4*.

NOTE: Documents and drawings prepared for a specific indent shall also bear the relevant complete indent number.

All documents and drawings shall bear proper references to related documents, construction drawings, and indent numbers for the materials required. The documents and drawings shall bear the titles as indicated in this publication. In addition, all instrument related layout drawings of control rooms, auxiliary rooms and analyser houses, shall indicate the building and room number as appropriate. Where multi-sheet drawings (2.4) consist of a large number of sheets, revisions can be *independent* for each sheet. For each revision, the cover sheet and the revision index sheet shall be re-issued together with the revised sheets. All the revised sheets shall bear the same revision letter irrespective of the last revision letter on the individual sheets, i.e. all revised sheets shall bear the same revision indicator as the cover sheet.

For multi-sheet drawings where signatures are applied for approval or checking, these shall be indicated on the cover sheet only. Where a full title block is applied this shall be used on the cover sheet only. Continuation sheets shall be sufficiently titled to link them clearly to the cover sheet and include project title, drawing title, project, drawing number and sheet number.

2.3 DRAFTING TECHNIQUES

The drafting techniques, drawing sizes, preparation and, where applicable, microfilming of technical drawings shall be in accordance with PTS 02.00.00.10 (*Preparation and Microfilming of Technical Drawings*).

Drawings should be on A4 sized sheets. The basic format of each type of document produced by the Contractor shall be submitted for review by the Principal prior to large scale application.

NOTE: Many drawings can be quite readily prepared using a word processor. This allows very easy updating and manipulation and is accepted.

However, the contractor may include larger drawing sizes where they would be beneficial, taking the ultimate use for the document into account, e.g. for on-site, day-to-day maintenance.

The following order of preference shall then apply:

- A3
- A3 height (297 mm) x A2 length (594 mm)
- A2
- A1

Drawing size A0 shall not be used for instrument documents and drawings. Special attention shall be paid by the contractor to ensure a consistent drawing and documentation package, particularly for those documents which are associated with equipment package units, (2.8). Copies of drawings issued for comments or information shall have a maximum size of A3. Where the size of a standard form is A3, consideration should be given to reducing by copying to A4 size before dispatch. Drafting techniques should then take into account clear readability of the reduced format.

For computer printouts, the use line plotters or laser printers shall be used. The use of dot matrix and ink printers *are not allowed*.

For the mechanical, instrument and electrical symbols and identification systems to be used on drawings, refer to the following

Mechanical	:	PTS 31.10.03.10.
Instrument	:	PTS 32.10.03.10.
Electrical	:	IEC 617 and Standard Drawing S 64.000

2.4 MULTI-SHEET DRAWINGS

Certain documents shall be made in the format of a drawing with a large number of sheets, consisting typically of:

- a cover sheet
- index to sheets, giving the applicable revision indicator of the sheets contained in the set
- listing of symbols and abbreviations used
- detail sheets (as indicated on the index sheet) giving the required information
- listing of the tag numbers with reference to the relevant sheets.

Efficiency is improved if extensive use is made of word processing for such documents.

For multi-sheet drawings, only A3 and A4 sizes shall be used. To facilitate reproduction and filing preference is given to the use of A4 size, and A3 documents shall not be intermixed with A4 documents.

All sheets of a multi-sheet drawing shall have the same size; mixing of A3 and A4 sizes in one multi-sheet drawing set is not allowed.

Where the subject cannot be arranged entirely on one sheet, as may be the case with logic diagrams, relay diagrams or instrument loop diagrams, the subject shall be continued on the following sheet(s) with proper cross-references at the demarcation points. The arrangement shall then be such that a continuous presentation of the subject is formed when the separate sheets are laid side by side.

2.5 CONSTRUCTION / INSTALLATION DRAWINGS

Where constructional details *e.g. hook-up and installation details* are required to ensure adequate supply of instrumentation *materials e.g. tubings, fittings, glands*, such details shall be shown on a separate construction drawing, to which references shall be made in the requisition.

For standard equipment, such drawings are available in Standard Drawing Groups S 31 to S 37.

Where these standard drawings are used in an unmodified form *i.e. no changes* they can be used by referring to their S number, revision indicator and title. However, if for a particular application deviations from the standard drawing are necessary, the Contractor shall prepare an engineering drawing based on the standard drawing. Under no circumstances shall a standard drawing be issued in a modified form.

For non-standard equipment, dedicated engineering drawings shall be prepared showing details and all requirements.

2.6 TECHNICAL SPECIFICATIONS

Where comprehensive descriptions, arrangement drawings and/or construction details are necessary for ensuring the proper supply of equipment, these requirements shall take the form of a technical specification, to which references shall be made in the requisition.

For certain standard equipment, these specifications are available as a PTS publication (e.g. for control valves, system cabling, system cabinets) or *SPIR or SAP reference numbers* (e.g. for transmitters, pressure gauges); where this is not the case a dedicated technical specification shall be prepared in the form of a multi-sheet drawing. *Details and database can be obtained from Group Supply Chain.*

The format of such technical specification shall be based on the lay-out as specified in [Appendix 2](#).

2.7 MANUFACTURER'S DOCUMENTS AND DRAWINGS

Drawings received from Manufacturers shall be identified as engineering *documents and drawings*, see (2.2), and where applicable commented upon and incorporated into the detailed engineering stage of the project.

Manufacturer's *documents and drawings* shall be fully integrated into the overall project documentation package and incorporated into a dedicated Instrument Summary, see (3.2.1.1).

Manufacturers drawings should be produced in a software format (see 2.1), in addition to any hard copies requested.

Standard Manufacturer's manuals/bulletins shall indicate or delete inapplicable items and details, and highlight those which are applicable by underlining, arrowing or similar.

NOTE: Where applicable, the above requirements shall be clearly stated under Documentation in each instrument equipment requisition.

Manufacturer's drawings shall only be used to assist in the production of a comprehensive installation drawing package *i.e. use the info from vendor drawings to produce the construction drawings*, and shall not form a part of the installation package *i.e. info from vendor shall be translated into design engineering documents for issuance for procurement / construction*.

2.8 EQUIPMENT PACKAGE DOCUMENTS AND DRAWINGS

Documents and drawings of an equipment package shall be identified in accordance with (2.2). The drawings shall be commented upon and incorporated into the detailed engineering stage of the project.

The drawings of an equipment package shall be arranged in separate sets for each equipment package unit.

For details, refer to PTS 32.31.09.31.

3 THE PREPARATION OF INSTRUMENTATION DOCUMENTS AND DRAWINGS

3.1 GENERAL

The following sub-sections indicate the types of *instrumentation* documents and drawings generally applied and give guidance on how they should be prepared.

The sections are divided into the Instrument Group Code Numbers which are applied for administration purposes, and further into the various types of documents and drawings in general use included in these instrument groups.

Note: Instrument Group Code Numbers are as per Appendix 1.

3.2 GENERAL INSTRUMENTATION - GROUP

3.2.1 Summaries

3.2.1.1 Summaries of instrumentation documents and drawings

The summary consists of an index sheet for listing *design engineering documents and drawings*. *A separate index sheet shall be prepared for manufacturer's documents and drawings.*

The first issue shall be prepared within *one* month after award of the contract and shall contain, in numerical order, listings of all instrumentation *design engineering documents and drawings* complete with the planned dates for the first issue indicated in the relevant columns.

Revisions of the summary shall be issued *bi-weekly* in updated form and containing all known information.

NOTE: This document, together with the summary of instrument requisitions ([3.2.1.2](#)), will form the basis for progress assessment and reporting (*project control*).

Each revision issued shall contain a complete set of sheets including any non-revised sheet(s). The revision indicator used on the index sheet shall also be used on the attached summary sheets and in the Issue column of each revised item, irrespective of any previous revision indicator(s).

The revision shall *capture the documents and drawings* as soon as these have been received. *This applies to both design engineering and manufacturer's documents and drawings.*

The use of a database to generate summaries is recommended.

Revision numbering format shall be as follows:

Documents

A, B, ...	Issued for Comments
1, 2, 3, ...	Approved for Use

Drawings

A, B, ...	Issued for Comments
1, 2, 3, ...	Approved for Construction

Once documents and drawings already have been approved for use/construction, any changes will result in highly potential rework, loss of time and increase in expenditures. Therefore, the Lead Instrument design engineer of Principal shall ensure that Contractor are fully confident of the completeness and accuracy of the information in the documents and drawings before issuing it as Approved for Use/Construction.

NOTE: The List of Selected Instrument Equipment made by the Principal and which forms part of the Project Specification, shall be included in Group 30.

3.2.1.2 Summary of instrumentation requisitions

This summary consists of an index and a list(s) of requisitions for each group of instruments.

The first issue shall be prepared within *one* month after award of the contract and shall contain, in numerical order, a listing of all instrumentation requisitions, complete with the planned dates for the first issue indicated in the relevant columns.

Revisions of the summary shall be issued monthly in updated form and containing all known information.

Each revision issued shall contain a complete set of sheets including any non-revised sheet(s). The revision indicator used for the index sheet shall also be used on the attached summary sheets and in the Issue column of each revised item, irrespective of any previous revision indicators.

3.2.1.3 Instrument engineering data sheets

For each processing unit and/or major equipment package unit in the project, the design and engineering information for the instrumentation shall be listed on Standard Instrument Engineering Data Sheets as contained in the Requisitioning Binder.

All instrument engineering data sheets shall be prepared in a software format (see [2.1.1](#)); however, content rather than layout is important. Use of a database is recommended.

It should be recognised that the data sheet instrument database contains information used for project implementation but will later remain a key facility document for maintenance. The Principal may require additional database fields to be added and filled in to suit subsequent later maintenance purposes.

Deviation from the standard printed data sheet lay-out is sometimes required when using computerised design tools; however, this requires approval from the Principal.

The left hand part of these data sheets (including the column Component Listing) shall be completed during the Project Specification stage of a project. For this reason the sheets will eventually form part of the design book.

- NOTES:
- 1) The actual operating data for the processing unit and/or major equipment package unit shall be entered on the instrument engineering data sheets. However, the values given for minimum/normal/maximum of flow/level/pressure/temperature shall take into account the turn-down requirements and the operating/design limits of the processing and equipment package unit.
 - 2) In addition to the instrumentation data entered by the process engineers, all other instrumentation data, such as for utilities, shall be included in the data sheets.

The tag numbers on the printed sheets shall be in numerical sequence, see PTS 32.10.03.10. The printed right-hand column shall comprise tag numbers in numerical sequence, the related drawing number, and the location co-ordinates of the instrument concerned on the *P&ID*.

If data has been revised the revision letter shall be placed in the left-hand column.

Data for each process unit and for each major equipment package shall be made up into separate sets and each set shall be supplied with a dedicated printed cover sheet. The set(s) of printed sheets of equipment package(s) shall be combined with and immediately follow the set of printed sheets for its associated process unit. However, the printed cover sheets from each set shall be placed at the front and the combined set shall be numbered accordingly.

Tag numbers for a package unit shall be given in sequence and in a group.

Each set of instrument engineering data sheets shall have a document/drawing number. When more than one processing unit and/or major package unit are involved in the project, a group of consecutive document/drawing numbers shall be used for the various sets of data sheets and, if a database is not used, sufficient spare sheets shall be allowed.