

PETRONAS TECHNICAL STANDARDS

MANUAL

DCS PROJECT WORKS

PTS 32.30.10.11

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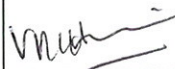
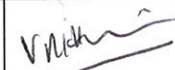
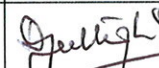
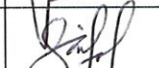
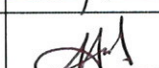
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This new PTS **32.30.10.11 – DCS Project Works** has been developed **inline with current best practices**.

This PTS also includes PETRONAS Lessons Learnt and PETRONAS Best Practice for the subject matter **DCS Project Works**.

Document Approval

	Name	Designation	Signature	Date
Prepared	V R Harindran	Custodian I&C		14 th Dec 2010
Reviewed by	SkG 14 TPs	Circulation		14 th Aug 2011
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Approved	V R Harindran	TP (Technical Authority)		2 nd October 2011
Verified	Dzulkifli A Razak	Senior Manager, PAO Engineering – GTS		03/10/2011
Verified	Saifol Mualim Ahmad Yahaya	General Manager, Engineering, GTS		4/10/11
Endorsed	Pau Kiew Huai	Senior General Manager, GTS		7.10.11

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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 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 standardization.

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 SCOPE

This PTS specifies the requirements for the preparatory works, planning requirements, design requirements, installation requirements and commissioning works when executing a project on a Distributed Control System (DCS). This PTS shall be used for existing installations or for new projects, where the total DCS is being upgraded or newly installed. The objective is to specify the minimum and fit-for-purpose, requirements to ensure flawless execution of the DCS upgrading and project works.

This PTS is not intended for minor upgrades of the DCS such as software version upgrade or minor hardware upgrade.

This PTS is developed together with the Skill Group 14 Technical Professionals and experienced instrument engineers in DCS upgrading works. The Custodian of this PTS shall be consulted for any deviation from this PTS.

This PTS may also be used as a reference document for other computerized system related upgrading works.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorized by PETRONAS, the distribution of this PTS is confined to companies forming part of PETRONAS group and to contractors and manufacturers/suppliers nominated by them.

All publications referred to are listed in Section 6

1.3 DEFINITIONS

1.3.1 General Definitions

The **DCS Vendor** 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 **Plant Owner** is the PETRONAS instrumentation party responsible for the operation and maintenance of the DCS equipment, who in turn, is responsible to the plant management.

The **Principal** is the PETRONAS party which initiates the project (new or upgrade) and ultimately pays for its design and construction. The Principal will generally specify the basic technical requirements.

Site Technical Authority is the PETRONAS party that technically approves the project design and execution, including any design and site installation changes. The party is typically the assigned instrument Technical Professional (TP) for the project.

The **DCS Project Lead** is the PETRONAS instrumentation party responsible to manage the overall project. The DCS Project Lead will generally specify the detail technical requirements for the project.

Lead Project Engineer is the full-time qualified E2 instrument engineer assigned to the project, reporting to the DCS Project Lead.

The **Custodian** is the originator and technical owner of these PTS.

The word **Shall** indicate a requirement.

The word **Should** indicate a recommendation.

1.3.2 Specific Definitions

AFC	Approved For Construction
AMADAS	Analyzer Management and Data Acquisition System
APC	Advance Process Control
CPU	Central Processing Unit
DCS	Distributed Control System
DMZ	Demilitarised Zone
EDMS	Electronic Documentation Management System
ESD	Emergency Shut Down
EWS	Engineering Work Station
FAR	Field Auxiliary Room
FAT	Factory Acceptance Test
FEED	Front-End Engineering Design
HART	Highway Addressable Remote Transducer
HMI	Human Machine Interface
HSE	High Speed Ethernet
HVAC	Heating Ventilation and Air Conditioning
I/O	Input Output
I/P	Current to Pneumatic
IPF	Instrument Protective Function
ITB	Items to Bid
JHA	Job Hazards Analysis
JSA	Job Safety Analysis
LAN	Local Area Network
MAC	Main Automation Contractor
MCB	Main Control Building
MIV	Main Instrument Vendor
MOS	Manual Override Switch
MSSA	Master Site Services Agreement
OPU	Operating Unit
P&ID	Piping & Instrumentation Diagram
PFD	Process Flow Diagram
PIM	Plant Information Management
PSD	Process Shutdown
PSU	Power Supply Unit
RAM	Random Access Memory
RTD	Resistance Temperature Detector
RTU	Remote Telemetry Unit
SAT	Site Acceptance Test
TCO	Total Cost of Ownership
UPS	Uninterruptable Power Supply
USB	Universal Serial Bus

2 GENERAL

There has to be clear technical reasons for embarking on a DCS project and requires a clear mandate and approval from the OPU/Business management and/or Project Management Team. Upgrade projects are normally due to system obsolescence and new project are normally due to new process facilities being built. The other reasons could be the need for plant expansion, the need to integrate with newer sub-systems, improve productivity, reduce life cycle cost, etc.

All DCS manufacturer brands considered shall conform to those manufacturers that have the Master Site Services Agreement (MSSA) with PETRONAS. The current MSSA limits the manufacturers to four manufacturers of Emerson, Foxboro / Invensys, Honeywell and Yokogawa. The MSSAs are between PETRONAS and the PETRONAS registered Malaysian representatives (vendor) of the DCS manufacturer. The intention of limiting the DCS manufacturers is to limit the DCS brand variety within the PETRONAS Group to enable focused Group-wide DCS management and enable focused Group-wide capability building in DCS operation and maintenance.

The general philosophy of executing the DCS upgrade is to use the existing DCS platform if the current DCS conforms to the MSSA manufacturers mentioned above, provided that total life cycle cost of upgrade is cheaper than total replacement with another manufacturer brand within the MSSA manufacturers.

Where the existing DCS manufacturer does not conform to the MSSA manufacturers, evaluation shall be made to replace the existing DCS manufacturer with the MSSA DCS manufacturers.

New projects shall also be limited to the DCS brand variety of the MSSA manufacturers only. Extension or expansion of current facility shall conform to the existing DCS manufacturer provided that the current DCS is within MSSA manufacturer.

The tender selection of the suitable DCS Vendor shall be either on single sourcing basis or multiple sourcing basis, depending on the technical justifications. As DCS is an engineered item, the use of "e-bidding" for selection of DCS Vendor shall not be used. The Principal shall be responsible and accountable for the procurement strategy utilized.

The typical project payment milestones are as follows:-

Completion of detailed engineering site survey and document submission	5%
Submission of engineering configurations and drawings for approval	10%
100% delivery of DCS equipment to vendor staging office	20%
Completion of FAT, including 100% clearance of punchlist items	20%
Completion of Site Acceptance Test	10%
Completion of Performance Test and Initial Acceptance	20%
100% submission of As-Built documentation	10%
Completion of Defects Liability Period (1 year) and Final Acceptance	5%

2.1 UPGRADE PHILOSOPHY

The general DCS upgrade philosophy shall be to upgrade all DCS equipment and accessories from the control room marshalling panel to the Operator HMIs. The upgrade can be a partial or total replacement, as necessary.

2.2 TECHNOLOGY UPGRADE PHILOSOPHY

If the plant originally used pneumatic instrumentation, this is expected that all loops connected to the new DCS to be upgraded to electronic instrumentation. This would entail a change-out of field instrumentation, including replacement of pneumatic positioners with electronic positioners. The use of I/P converters to maintain the existing pneumatic positioners shall be avoided, unless there are justifiable reasons for not doing so, for example, if the pneumatic positioner has been specially designed for specialized application.

The choice of signaling technology of either 4 to 20mA or fieldbus, when upgrading from pneumatic instrumentation, is dependent on the cost benefit analysis and the capability of the personnel to operate and maintain the new technologies. If the personnel are already maintaining and operating other existing 4 to 20mA facilities, it is prudent to upgrade the pneumatic facility to 4 to 20mA technology. If the personnel operating and maintaining the facility are already familiar with fieldbus technology, then the use of such technology should be considered.

If the plant originally used 4 to 20mA or fieldbus signaling technology, the same signaling platform shall remain with the DCS upgrade. However, the latest proven vendor technology shall be utilized to ensure the longest possible product lifecycle before the next major upgrade investment is required. The use of unproven (less than 18 months in the market and/or never been used by any other major oil and gas company) technologies shall require the necessary risk assessment to be made by the assigned Instrument Technical Professional and be approved by the DCS Project Lead or higher, if the DCS Project Lead is also the Instrument Technical Professional.

If the plant originally used 4 to 20mA signaling technology, the use of fieldbus technology shall not be utilized for the upgrade, unless it has been justified and approved by the OPU management operating the plant. The following are some reasons why upgrade to fieldbus technology, from 4 to 20mA, shall be avoided:-

- a. The upgrade will require the change-out of all field instrumentation, resulting in an increase in the upgrade project cost. This will also require the removal of all the existing working 4 to 20mA field instrumentation from the plant site, which further increases the project cost.
- b. The upgrade will require the installation of new fieldbus cables, which are more expensive than general 4 to 20mA cables already in existence in the plant. The existing 4-20mA cables will also have to be removed from the plant site, which increases the project cost.
- c. The fieldbus instrumentation is more expensive than the standard 4 to 20mA instrumentation.
- d. The fieldbus instrumentation project will require specialized installation and commissioning contractors who are more expensive than the general 4 to 20mA based instrumentation contractors.
- e. Specialized fieldbus calibration and testing tools will have to be purchased to ensure the long term sustainability and operational reliability of the fieldbus instrumentation. The fieldbus tools are more expensive than standard 4 to 20 mA instrumentation tools.
- f. The existing OPU instrumentation and Operations personnel will have undergo specialized training on fieldbus technology, from basic fieldbus technology training to detailed training on the fieldbus instrumentation installed.

The minimum technology used shall be 4 to 20mA with standard industry HART capability. The use of DCS Vendor proprietary digital transmission system shall not be used.

The use of fieldbus technology shall conform to PTS 32.30.10.10

Ultimately, the technology selection shall be based on Total Cost of Ownership (TCO) and business requirements.

2.3 PROJECT ENGINEERING PHILOSOPHY

The DCS Project Lead or Plant Owner shall develop the DCS Basic Engineering Requirements for the issuance of ITB to the DCS Vendor. The DCS Vendor shall execute the detailed engineering for the project. External third party consultants shall not be used to develop the DCS Basic Engineering Requirements due to potential conflicts in requirements between the DCS Project Lead or Plant Owner, the external third party consultants and the DCS Vendor. However, the Principal or Plant Owner or DCS Project Lead may engage Group Technical Solutions (GTS) to assist in the development of the Basic Engineering package.

2.4 PLANNING PHILOSOPHY

The project award to the DCS Vendor for the DCS upgrade should be at least twelve (12) months before actual execution of the DCS upgrade at site. For large scale upgrades, comprising of more than 2,000 I/Os, the project award shall be done much earlier, before actual execution of the DCS project at site. The more time given to the DCS Vendor to execute detailed engineering, purchasing of DCS equipment, system configuration and site execution, the more successful the project would be. Typically for large scale projects, the DCS Vendor is given eighteen (18) months to complete the project.

Depending on the complexity of the upgrade project, the upgrade project may also be staggered over two or more shutdown periods.

A minimum of seven (7) days shutdown shall be planned for the site execution of the DCS upgrade. A longer shutdown period may be required or several shutdown periods may be required, depending on the scope and complexity of the DCS upgrade.

If an on-line DCS upgrade is being considered, without any shutdown, the necessary Risk Assessments shall be carried out with the DCS Vendor to ensure flawless DCS upgrade execution.

The typical planning for a DCS project is as per Appendix 1.

2.5 PROJECT ORGANIZATION

The DCS site execution and management shall be handled by qualified instrument personnel at E3 managerial level who is responsible and accountable to ensure the success of the project. For the project, an Instrument Engineer qualified at E2 level shall be assigned permanently, as the Lead Project Instrument Engineer, to the project until completion, reporting to the DCS Project Lead. In cases where an E2 engineer is not available within the organization, the DCS Project Lead shall seek external E2 resources from the PETRONAS organization, such as, from GTS. The E2 Instrument Engineer shall call upon relevant resources to assist in the project, as and when necessary. Experienced resources that should be typically called upon to assist in the project are Operations personnel, Electrical Engineers, Process Engineers, APC Engineers and Shutdown Planners.

A dedicated Instrument Technical Professional (TP) shall be assigned as Site Technical Authority and to provide technical support to the E2 Lead Project Engineer.

For projects of more than 2,000 I/Os, the Instrument TP shall be the DCS Project Lead who shall be responsible and accountable for the project, relieving the Instrument Head of this responsibility.

The typical project organization chart is as per Appendix 2.

2.6 MAINTENANCE MANAGEMENT SYSTEM

Updating of the PETRONAS Maintenance Management System with the details of the new DCS shall be executed by the project team.

3 PREPARATORY WORKS

The following section provides some guidelines of preparatory works required before the ITB for the DCS project can be issued. Clearly, the more complex the project works, the more preparatory works are required.

3.1 JUSTIFICATIONS & APPROVALS

For new process facilities being built, the need for a DCS is an agreed requirement. The justifications and approvals required are related to the overall process facilities project governance requirements.

However, DCS upgrading projects requires the necessary justifications and management approvals. DCS Upgrading projects shall be initiated and managed through plant-specific eMOC process in compliance with PTS 60.2201 MOC. The justifications may be in the form of manufacturer's statement on obsolescence and required migration or upgrade path or the need to utilize up-to-date technologies to further enhance plant performance, etc. The justification should include the risk assessment on the pros & cons of the proposed upgrade project and the estimated budget to execute the complete upgrade project.

Once the necessary approvals have been obtained, it is important to secure management support, as the project sponsor, for the DCS project.

3.2 RESOURCES

As part of the justifications and approvals, the necessary resources from the Plant Owner have to be allocated to the project. Resources cover both personnel and the support facilities required to execute a successful project. The project leader / manager and the experienced E2 personnel, to be the dedicated project lead engineer, are required to be identified. The success of the project rest heavily on the experiences and competencies of the DCS Project Lead and the Instrument Project Lead Engineer. Where experienced resources are not available within the organization, external resources within the PETRONAS organization, such as GTS, should be utilized. The use of third party resources from Consultants or Contractors to manage the project is not encouraged.

If the project consists of more than 2,000 I/Os, a dedicated project room shall be provided for the duration of the project. The project room shall be sufficient to store all project documentation. It shall have photocopying facilities, fax, telephone, internet, computers and printers. It shall be staffed with a project clerk and shall have sufficient room to office all permanent project members.

3.3 DOCUMENTATION

Upgrade Projects

Before embarking on an upgrade project, an assessment shall be made on the availability and accuracies of the documentation required for the upgrade project. If it is assessed that the documentation is inadequate, time has to be allocated to get the documentation to be at least 90% accurate and available to the DCS Vendor, before initiating the upgrade project.

Documents shall be 100% accurate at the point of Detail Engineering.

Documentation shall meet the requirements of PTS 32.31.00.34 Instrumentation Documents and Drawings and PTS 60.2203 PSI.

Typical documentation required for the upgrade project are:

- a. Total I/O listing for the DCS upgrade project (must be at least 90% accurate)