

PETRONAS TECHNICAL STANDARDS

DESIGN AND ENGINEERING PRACTICE

ALARM MANAGEMENT GUIDELINES

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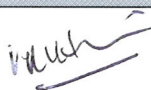
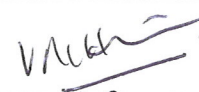
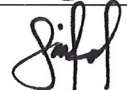
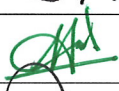
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This new PTS **32.30.60.19 - Alarm Management Guidelines** has been developed to provide **guidelines to alarm management for plant.**

This PTS also includes PETRONAS Lessons Learnt and PETRONAS Best Practice for the subject matter **Alarm Management Guidelines**

Document Approval

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PREFACE

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

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(s) 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, the Principal will expect 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 Principal or its technical advisor.

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1.0 INTRODUCTION

1.1 SCOPE AND OBJECTIVES

This document describes the guidelines for the management of Distributed Control System (DCS) alarms within PETRONAS plants, both new and existing.

The objectives of this guideline are:

- Establish the work processes in alarm management for PETRONAS;
- Provide engineering guidelines for consistent and efficient alarm configuration; and
- Achieve world class alarm system performance for all areas by implementing the work processes described.

This guideline shall apply to all audible and visual alarms generated by the DCS on the operator consoles.

This PTS is developed together with the Technical Professionals and experienced plant personnel of Skill Group 14. The Custodian of this PTS shall be consulted on any deviation.

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 and to contractors and manufacturers/suppliers nominated by them.

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/Vendor** is the party which manufactures or supplies equipment and services to perform the duties specified by the Contractor or the Plant Owner.

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

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

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

The word **Shall** indicate a requirement.

The word **Should** indicate a recommendation.

1.3.2 TECHNICAL DEFINITIONS

Absolute alarm

An alarm generated when a set limit is exceeded.

Acknowledge

The operator action that confirms recognition of an alarm.

Activate

The process of enabling an alarm functions within the alarm system.

Adjustable Alarm

An alarm for which the limits are changed, automatically or manually, based on operating conditions.

Alarm

An audible and/or visible means of indicating to the operator an equipment malfunction, process deviation, or abnormal condition requiring a response.

Alarm class

A grouping, or class, used to specify design, operation, monitoring and audit requirements for an alarm.

Alarm condition

The indication of the type and level of an alarm.

Alarm deadband

The range through which an input must be varied from the alarm limit necessary to clear the alarm.

Alarm flood (Alarm Shower)

A period of time with a greater number of alarms than the operator can effectively manage.

Alarm group

A set of alarms associated with a process unit or within a process area.

Alarm limit (Alarm trip point, Alarm setpoint)

The threshold value or discrete state of a process variable that triggers the alarm indication (see alarm setpoint).

Alarm log

The historical record of alarm messages.

Alarm management (Alarm system management)

The processes and practices for determining, documenting, designing, operating, monitoring, and maintaining alarm systems.

Alarm philosophy

A document that establishes the basic definitions, principles, and processes to design, implement, and maintain an alarm system.

Alarm priority

The level of importance assigned to an alarm within the alarm system to indicate importance (e.g. seriousness of consequences) and urgency.

Alarm summary

A display that lists alarm with selected information, such as date, time, priority, and alarm condition.

Alarm system

The collection of hardware and software that detects an alarm state, transmits the indication of that state to the operator's attention, and records changes in the alarm state.

Alert

An audible and/or visible means of indicating to the operator an equipment or process condition that requires awareness and that action may be needed when time permits.

Bypass

To manually modify a function to prevent its activation. (This term is used to describe instrumented functions other than alarms.)

Control system

A system that responds to input signals from the equipment under control and/or from an operator and generates output signals that cause the equipment under control to operate in the desired manner.

Chattering alarm

An alarm that repeatedly transitions between the alarm state and the normal state. For example, any parameter that crosses its alarm threshold three (3) times or more within a one (1) minute period.

Clear

An alternate description of the state of an alarm that has transitioned to the normal state.

Console

The interface for an operator to monitor the process, which may include multiple displays or annunciations.

Deviation alarm

An alarm generated when the difference between two analog values exceeds a set limit.

Disabled Alarm

An alarm that is disabled by the operator such that the alarm will not be generated even though the base alarm condition is present.

Note : Uncontrolled disabling of alarm(s) is not allowed.

Discrepancy alarm

An alarm generated by error between the comparison of an expected plant or device state to its actual state (e.g. when a motor fails to start after it is commanded to the ON state).

Dynamic alarming

The automatic modification of alarms based on process state or conditions.

First-out alarm (First-up Alarms)

An alarm method, in a multiple-alarm scenario, of determining which alarm occurred first.

Initiating event

A malfunction, failure or other condition that can cause an alarm indication.

Latching alarm

An alarm that remains in alarm state after the process has returned to normal and requires an operator action beyond acknowledgement before it will clear.

Nuisance alarm

An alarm that transitions from the normal state to the alarm state more frequently than the response action is needed.

Operator

The primary person responsible for ensuring the process parameters are maintained within limits.

Operator response time

The time between the annunciation of the alarm and when the operator takes the correct action in response to the alarm.

Operator-set alarm

An alarm in which the setting may be manually adjusted by the operator to suit his needs.

Out-of-service

A state that suppresses the alarm indication so that maintenance can be performed.

Plant state

A defined state of operation of a process plant (e.g., shutdown, start-up, operating).

Prioritization

The process of assigning to an alarm a level of importance, or priority, which can be implemented within the alarm system.

Rate-of-change alarm

Alarm generated when a limit value for the rate of change of a process parameter $d(PV)/dt$ is exceeded.

Rationalization

The review of a potential alarm against the principles of the alarm philosophy to establish and document the rationale and design requirements for the alarm.

Remote alarm

An alarm from a remotely operated facility or a remote interface.

Reset

The operator action that unlatches a latched alarm.

Re-triggering alarm

An alarm that is automatically re-annunciated to the operator under certain conditions.

Return to normal

The alarm system indication that an alarm condition has transitioned to the normal state.

Shelve

To prevent the transmission of the alarm indication to the operator through a controlled methodology initiated by the operator. The controlled methodology shall be determined by the OPU.

Stale alarm

An alarm that remains in the alarm state for 24 hours or more.

Standing alarms

A measure of the number of stale alarms.

Station

A single human machine interface within the operator console.

Suppress

To prevent the indication of the alarm to the operator when the base alarm condition is present, initiated automatically by logic or manually by the operator.

Unacknowledged

An alarm in the alarm state which has not been acknowledged by the operator.

1.4 ABBREVIATIONS

AMT	- Alarm Management Team
ASM®	- Abnormal Situation Management®
MOC	- Management Of Change
DCS	- Distributed Control System
EEMUA	- Engineering Equipment and Materials Users Association
HAZOP	- Hazard & Operability Study
IPF	- Instrumented Protective Function
P&ID	- Piping & Instrumentation Diagram
SS	- Shift Superintendent
RAM	- Risk Assessment Matrix
ACK	- Acknowledge or Acknowledged

BPCS	- Basic Process Control System
cGMP	- Current Good Manufacturing Practice
CLR	- Clear
HMI	- Human Machine Interface
PFD	- Process Flow Diagram or Probability of Failure on Demand
PHA	- Process Hazards Analysis
PIMS	- Plant Information Management System
RTN	- Return To Normal (see definition)
SIL	- Safety Integrity level
SIF	- Safety Instrumented Function
SIS	- Safety Instrumented System
UNACK	- Unacknowledged

2. CODES AND STANDARDS

There are no codes or standards related to alarm management yet established at the time this guideline is written. The Instrument Society of America is currently drafting the ISA SP18.02 Instrument Signals and Alarms Standard. The standard is in final review stage and is due for release in 2008. However, the EEMUA Publication No. 191, published in 2007, entitled "Alarm Systems, A Guide to Design, Management and Procurement" is widely accepted in the industry as the reference document for alarm management. Pending the establishment of an international standard on alarm management, pertinent recommendations found in the EEMUA document shall be the reference for this guideline, together with the ASM® Consortium Guidelines on Effective Alarm Management Practices Version 5, which documents the best practices for alarm management.

3. ALARM GUIDELINES

Alarms are signals annunciated to the operator typically by an audible sound and by some form of visual indication on the operator display, both of which differs according to the alarm priority.

Alarms are important in that they help the operator to monitor deviations from desired operating conditions which may lead to the hazardous situations. Alarms help the operator to maintain the plant within a safe operating envelope. The general philosophy for configuring an alarm should be any one or more of the following:-

- b. the alarm shall indicate a need for Operator intervention
- c. the alarm shall indicate when a control system can no longer control
- d. the alarm shall indicate the need for timely Operator response

Alarms shall not be configured if the intent cannot be met by any of the above three.

In order to ensure that alarms remain relevant and helpful to the operator, each configured alarm in the DCS shall comply with the following set of guidelines:

3.1 ALARM PARAMETERS SHALL NOT BE ALTERED WITHOUT PROPER MANAGEMENT OF Change (MOC)

Modifications to existing alarms or additions of new alarms shall be part of **MOC**, where proper justification and an alarm design review are required.

3.2 ALARMS ARE NOT A SUBSTITUTE FOR AN OPERATOR'S ROUTINE SURVEILLANCE OF UNIT operation

- 3.1.2 Process changes that should be caught by operators during their normal monitoring of the process, and pose no safety issues, shall not be alarmed.
- 3.1.3 The alarm system should be an aid for the operator, not a replacement.
- 3.1.4 Operators are expected to investigate alarms occurring by accessing the appropriate graphic and reviewing trends.
- 3.1.5 The normal and expected process conditions shall not be alarmed. i.e. Sequence process or ON/OFF control

3.3 AN ALARM MUST REQUIRE IMMEDIATE ACTION BY THE OPERATOR

- 3.3.1 Alarms shall not be configured for which there is no Operator's corrective action possible.
- 3.3.2 The action required in response to each alarm shall be specified.
- 3.3.3 The consequence of the action not being taken shall be specified in the Alarm Reference Database (sect. 4.4)
- 3.3.4 All alarms are important and should be acted upon as soon as possible.

3.4 THERE SHALL NOT BE MULTIPLE ALARMS THAT PROMPT THE SAME OPERATOR ACTION

- 3.3.5 Redundant instrumentation due to shut down systems will either
- not be alarmed,
 - use logic to prevent multiple alarms, or
 - have alarm on deviation between the primary (alarmed) variable and other instruments.
- 3.3.6 Common alarms should be created for multiple alarms on different variables that require the same response
- 3.3.7 If there are many alarm points, determine which is the best to use based on factors such as measurement reliability, minimization of nuisance alarms, speed of initiation, close logical association with the problem cause.
- 3.3.8 Alarms shall be configured within the DCS controller or Input/output block in order to avoid any redundant alarm, as follows :
- Loop with Controller – All alarm shall be configured in the controller block inclusive with analog input alarm, analog output and bad input.
 - Loop without Controller- Alarm shall be configured in the individual block i.e. Digital input or output block, analog input or output block

3.5 **ALARM PRIORITY DEFINES THE DEGREE OF URGENCY OF CORRECTIVE ACTION BY THE OPERATOR**

- 3.3.9 The degree of urgency of an alarm at any instant, and thus its priority, are dependant on these factors:
- The severity of the consequences (in safety, environmental and economic terms), of failing to take the corrective action associated with the alarm (refer Appendix 2).
 - The time available and required for the corrective action to be performed (Process Safety Time – refer Figure 2) and to have the desired effect.
- 3.5.2 Thus, the order in which an operator should take corrective action when a number of alarms are present shall be based on the alarm priorities, where the alarm with the highest priority shall receive operator attention (see Section 5 for Priority Assignment).
- 3.5.3 Each alarm priority shall be configured with a different audible sound, with the highest 'pitch' sound reserved for Emergency / Urgent priority and so forth.
Note: Muting of alarms is not allowed.

3.6 ALARMS SHOULD PROVIDE TIMELY ADVICE THAT THERE ARE PROBLEMS REQUIRING OPERATOR INTERVENTION

- 3.6.1 An alarm setpoint shall be configured to give the operator at least 5 minutes to take corrective action. The alarm setpoint shall depend on the 'process safety time', which is defined as the time between the process value reaching the alarm setpoint and the consequences occurring if not acted upon under normal operating conditions. This time gap depends on the normal rate of change of the process value e.g. a small tank with high receiving flow shall have a lower high level alarm setpoint than a large tank with small receiving flow.

3.7 AN ALARM SHOULD HELP THE OPERATOR TO QUICKLY IDENTIFY THE CAUSE OF A PROBLEM

- 3.6.2 Clear and understandable alarm tag descriptors are important to help identify the cause.
- 3.6.3 Consistent abbreviations shall be used so that it is clearly understood by all operators.
- 3.6.4 An alarm tag's Associate Display parameter shall be configured to provide quick access to the relevant schematic.

3.8 SIGNALS WHICH DO NOT QUALIFY AS ALARMS

The following signals do NOT qualify as alarms but may be classified as "journal" or "message" signals

- Status change of switches through automatic sequence i.e starting or stopping pumps or opening/closing valves as normal (on/off) control behaviour.
- Status changes of switches manually initiated by panel operators such as a maintenance override switch / bypass switch, manual trip command etc.
- Status change of operating mode by automatic sequence or manual initiation e.g. TSA (Temperature Swing Adsorbers) sequence
- Status change of control mode by automatic sequence or manual initiation i.e. MANUAL-AUTO, AUTO-CASCADE
- Generally, system alarms shall not be alarmed in the DCS, unless deemed critical for Operator's action.

However if the maintenance override switch / bypass switch is located and operated outside the control room, its initiation shall be alarmed. Common bypass alarm shall be sent to DCS.