

DEP SPECIFICATION

HUMAN FACTORS ENGINEERING – HUMAN MACHINE INTERFACE DESIGN FOR SITUATION AWARENESS

DEP 30.00.60.16-Gen.

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DESIGN AND ENGINEERING PRACTICE



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies Human Factors Engineering (HFE) quality control requirements and gives recommendations for the design of Human Machine Interfaces (HMIs) in process control systems.

These requirements and recommendations aim at the development of HMIs that support high levels of usability and situation awareness among panel operators and others who rely on HMIs for awareness and control.

This DEP should be read in conjunction with other HFE DEPs in the 30.00.60.xx series. In particular, this DEP is intended to be used in association with DEP 30.00.60.10-Gen. and DEP 30.00.60.15-Gen. as well as other HMI related DEPs such as DEP 32.30.20.11-Gen., DEP 32.80.10.10-Gen. and DEP 32.80.10.14-Gen.

This DEP is a revision of the DEP of the same number dated August 2009; see (1.5) regarding the changes.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorised by Shell GSI, the distribution of this DEP is confined to Shell companies and, where necessary, to Contractors and Manufacturers/Suppliers nominated by them. Any authorised access to DEPs does not for that reason constitute an authorisation to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in oil refineries, chemical plants, gas plants, exploration and production facilities and supply/distribution installations. This DEP may also be applied in other similar facilities.

When DEPs are applied, a Management of Change (MOC) process shall 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 could be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable with regards to the safety, environmental, economic and legal aspects. In all cases, the Contractor shall inform the Principal of any deviation from the requirements of this DEP 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, the objective being to obtain agreement to follow this DEP 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 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 it. 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

Term	Definition
Action	The activity initiated when an operator invokes a command on the HMI, for example, by selecting a menu option, or action button. Sometimes supported by a double mouse-click. In some cases, the act of selecting an object also implies taking action on it (e.g., where selecting a display name opens that display).
Area of Control	The process areas, including equipment and any other facilities or resources which define the scope of responsibility of an individual panel operator role.
Basic Process Control System	This generic name covers any control system architecture albeit based on a BPCS or a PLC platform. The term includes DCS, PLC and SCADA process control systems but excludes the Safety Instrumented System.
Cognitive Compatibility	The term applied to the Human-Machine Interface (HMI) when the information used by console operators for the mental activities and mental operations that they perform is displayed consistent with how the console operators use that information to make decisions and complete their work activities.
Display	A software component that determines the spatial format and layout of visual outputs of the human machine interface on the hardware elements referred to in this document as screens.
HFE Technical Authority	The individual assigned as Technical Authority for HFE on the project in compliance with Business Unit and Group standards.
Human-Machine Interface	The combination of software and hardware elements that determine the nature of human interactions with equipment and people in the workplace through command inputs and data outputs. The Human-Machine Interface includes both visual and audio interfaces.
Overview Display	Higher level abstraction of low-level of detail of the system, covering the areas of control/responsibility. NOTE: An overview display supports a console operator in obtaining an overall view of systems status by bringing to their attention significant changes in system conditions and presenting those that are important. The focus should be on overview displays for operator positions. There may be overview displays for other control room personnel that have different content or scope.
Panel Operator	An individual who fulfils their work obligations, whether full or part-time, by interaction with a process control system. Panel (console) operators are usually provided with workstations comprising a combination of screens, work-surfaces, a chair and associated devices (such as phones, radios, and keyboards).
Proactive Monitoring	The term defined as part of the ESP work process that requires a defined panel round within a defined time frame (e.g., once every three hours). (Source: ESP Documentation)
Proactive Situation Awareness	The Panel Operator shall review, through the use of trends, overview displays, and summary displays of those variables that comprise the set of key process status and leading indicator variables to maintain their continuous moment-to-moment 'big picture' situation awareness.
Salience	The attribute of standing out from the background; the attribute of having attention-grabbing qualities.

Salience Coding	The Human-Machine Interface design technique that applies the appropriate salience (i.e., attention-grabbing qualities) to the data and information, based on the importance of that information relative to other content in the display.
Screen	A hardware component that supports viewing the visual outputs of the human-machine interface.
Select	The interaction with the Human-Machine Interface by which an operator indicates an on-screen object or element without invoking any command other than on-screen functionality. For example, selecting an on-screen icon will often open a menu or change a display.
Shared Display	On-workstation visual display which needs to be used by more than one panel operator while at their control workstation.
Situation Awareness	The mental state of being aware of what is happening around you and the associated understanding of what that means now and in the future relative to a particular job, function or goal.
Usability	The property of a human machine interface that is measured in terms of its ease of use, learnability, efficiency, and error tolerability.
Validation	The process of determining the extent to which a system meets its requirements.

1.3.3 Abbreviations

Term	Definition
ASM	Abnormal Situation Management
BPCS	Basic Process Control System
ESP	Ensure Safe Production
DCS	Distributed Control System
FAT	Factory Acceptance Test
GAME	Global Asset Management Excellence
HFE	Human Factors Engineering (synonymous with "Ergonomics")
HMI	Human-Machine Interface
MAC	Main Automation Contractor
PACO	Process Automation, Control and Optimization
SA	Situation Awareness
SAT	Site Acceptance Test
SCADA	Supervisory Control and Data Acquisition
TA	Technical Authority

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets (). Other documents referenced by this DEP are listed in (5).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated August 2009. Background and explanation content has been moved to a companion Informative document. The following are the main, non-editorial changes.

Section	Change
1.3.2	Added Specific definitions
1.3.3	Added Abbreviations
2	Simplified and moved some sections to companion Informative
3.2.2 Step 3(e)	Revised (e) and added (g), (h) and (i)
3.2.2 Step 4	Simplified and moved some content to companion Informative
3.3.2 Step 3	Added (d), (e) and (f)
4	Removed DR1 (Ensure Cognitive Compatibility with Legacy systems) as standalone design requirement (DR) and renumbered the remaining 6 DRs
-	Deleted Bibliography
Appendix 1	Original content moved to companion Informative and replaced with "Dealing with Legacy Systems"
Appendix 3 to Appendix 9	Moved to companion Informative and renamed Annex 1 to Annex 6

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be submitted to the Administrator using one of the following options:

Shell DEPs Online (Users with access to Shell DEPs Online)	Enter the Shell DEPs Online system at https://www.shelldeps.com Select a DEP and then go to the details screen for that DEP. Click on the "Give feedback" link, fill in the online form and submit.
DEP Feedback System (Users with access to Shell Wide Web)	Enter comments directly in the DEP Feedback System which is accessible from the Technical Standards Portal http://swww.shell.com/standards . Select "Submit DEP Feedback", fill in the online form and submit.
DEP Standard Form (Other users)	Use DEP Standard Form 00.00.05.80-Gen. to record feedback and email the form to the Administrator at standards@shell.com .

Feedback that has been registered in the DEP Feedback System by using one of the above options will be reviewed by the DEP Custodian for potential improvements to the DEP.

1.7 DUAL UNITS

This DEP contains both the International System (SI) units, as well as the corresponding US Customary (USC) units, which are given following the SI units in brackets. When agreed by the Principal, the indicated USC values/units may be used.

2. THE ROLE OF THIS DEP

2.1 THE NEED FOR SITUATION AWARENESS

Panel operators need to be able to perform their tasks proactively, detecting and responding to abnormal situations (including deviations from planned production as well as potentially unsafe situations) before they lead to incidents or production upsets. This contrasts with operators performing re-actively, largely in response to alarms.

Achieving proactive operator performance requires the HMI to have at least the following features:

- Be easy to use. Make minimal demands on the panel operator to understand and interact with the process control system, i.e., allow operators to concentrate on controlling the process rather than interacting with the BPCS.
- Allow operators to develop and maintain a high level of real-time awareness of the state of the process, while also allowing them to work at a detailed level with individual process units and equipment.

Combined, these two features are addressed by this DEP under the overall term 'Situation Awareness' (SA).

2.2 PURPOSE OF THIS DEP

1. To define a minimum level of quality control to be applied to the process of specifying, developing and validating HMI designs, where usability and operator situation awareness can be critical to process safety and/or production; and
2. To specify the minimum technical requirements to be applied to the design and validation of HMIs to ensure high levels of usability and situation awareness.

NOTE: The purpose of this DEP is not to unduly constrain the Supplier's experience or capability. Rather it is to define a minimum degree of control, direction and consistency in how different Suppliers' systems are used to develop HMIs. This is based on both industry best-practice, as well as experience of where there has been lack of adequate control in the past. The aim is to ensure quality and consistency of HMIs that meet the requirements for process control (as defined, for example, by the GAME ESP processes).

3. HMI DEVELOPMENT PROCESS

3.1 INITIATION

The HMI Development Process shall be initiated as part of the HFE screening conducted during SELECT or DEFINE phase of the project lifecycle (as required by the Shell HSSE & SP Control Framework and DEP 30.00.60.10-Gen.).

The HFE screening shall determine:

- Whether this DEP shall be included in the project baseline, and, if so,
- The level of quality control to be applied to the HMI design.

Figure 1 shows the decision tree to be used to screen projects for these two factors.

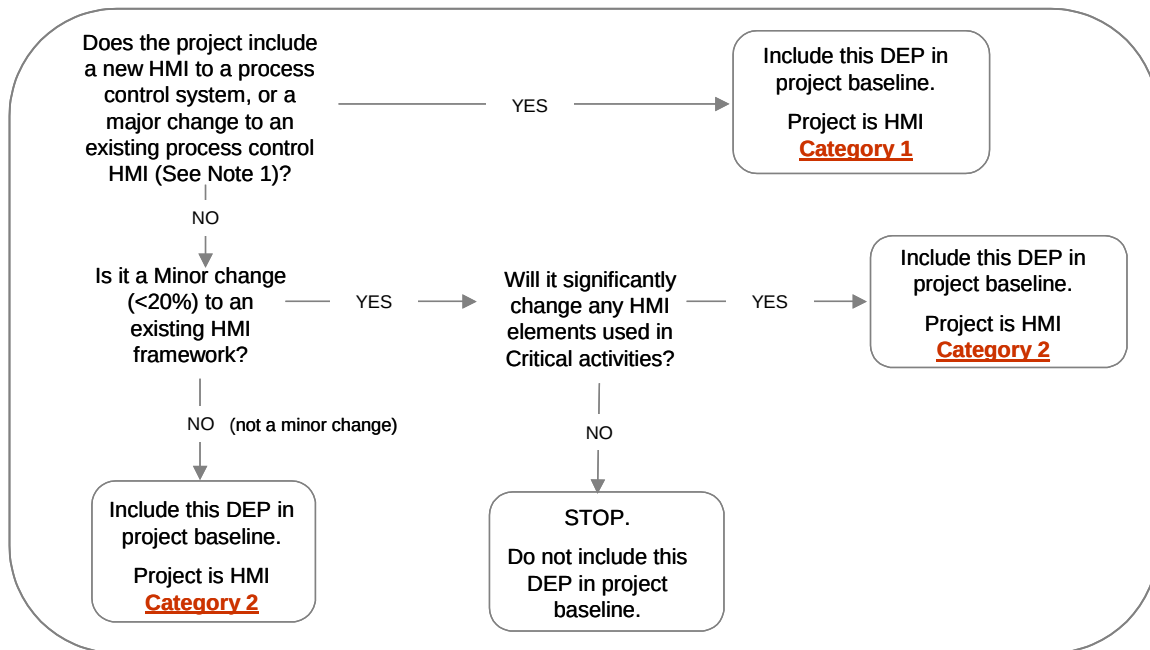


Figure 1 Decision tree for deciding whether to include this DEP in project baseline

NOTES: 1) As a guide, a 'major change' is a project in which:

- one or more new workstations will be introduced; or
- more than 50 % of the existing displays will be changed; or
- the number of new displays to be introduced will exceed 50 % of the existing total.

2) As a guide, a 'Minor change' is a project in which:

- changes will affect operator interaction with fewer than 20 % of the existing displays; AND
- the number of new displays will be less than 10 % of the existing total; AND
- the changes will be implemented in the same software system and version as the existing HMI.

3) 'Critical' activities include:

- startup or shutdown of process units;
- communications, including shift-handovers, start-of-shift-orientation, shift team meetings;
- proactive situation awareness of process units;
- performance of tasks that are known to be particularly difficult, time-consuming, stressful, or that may be carried out over extended periods;
- execution of activities identified in Safety Critical Elements or shown as barriers in Bow-Ties at the asset (including responding to alarms).

Projects identified as HMI Category 1 (i.e., projects involving development of new BPCS HMIs or a major change to an existing system) shall follow the development process defined in (3.2).

Projects identified as HMI Category 2 (i.e., projects involving significant change to existing HMI, or change to existing HMIs supporting critical activities) shall follow the process in (3.3).

Recognizing that projects in some cases may have difficulty in deciding which HMI Category is best suited for their project, they are directed to the project or regional Human Factors Engineering (HFE) Technical Authority (TA) as detailed in the Project Controls and Assurance Plan (PCAP) or Discipline Controls and Assurance Framework (DCAF) Discipline Authorities Manual.