

HUMAN FACTORS ENGINEERING - DESIGN AND PROCUREMENT OF SKID-PACKAGED UNITS

DEP 30.00.60.18-Gen.

January 2010

DESIGN AND ENGINEERING PRACTICE



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for the Human Factors Engineering (HFE) aspects to be applied to the design and procurement of skid-packaged units to comply with the Human Factors Engineering requirement contained in the Shell Group HSSE & SP Health Standard and the HSSE & SP Control Framework Health Manual Section, 'Human Factors Engineering'.

This DEP should be read in conjunction with other HFE DEPs in the 30.00.60.xx series.

This is a revision of the DEP of the same number dated November 2006; see (1.7) regarding the main 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.

This DEP is intended for use in oil refineries, chemical plants, gas plants, exploration and production facilities and supply/distribution installations.

When DEPs 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 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 regard 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/Vendor** 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, 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

HFE Authorised Person	A person authorised and assigned responsibility to perform work in accordance with HFE Procedures. An HFE Authorised Person has Proficiency assured at Skill level (see DEP 30.00.60.10-Gen. for a definition of HFE skill levels).
HFE Co-ordinator	The project HFE Co-ordinator is an individual assigned responsibility within a project for management and organization of the project HFE activities, including coordination with the HFE Technical Authority, HFE Authorised Person and HFE Authorised SME, as appropriate. An HFE Co-ordinator shall have competence at least at HFE Knowledge level.
HFE Technical Authority	The individual assigned as Technical Authority for HFE on the project
Human Error	A human error is an inappropriate or undesirable human decision, behaviour or omission that reduces, or has the potential to reduce, the effectiveness, safety, or system performance. Human errors can be both intentional as well as unintentional.
Hybrid	An otherwise off-the-shelf item modified to meet specific project requirements.
New Design Skid	Largely new design, where the Vendor's scope of supply includes responsibility for design of the unit. Typically, the design work involves integrating a number of smaller off the shelf components into a single skid packaged unit.
Operability and Maintainability	Ease and efficiency of performance of operational and maintenance activities during all phases of the project and during the life of the facility, with all HSE risks kept as low as reasonably practicable.
Process Safety	Process Safety is a blend of engineering and management skills focused on preventing catastrophic accidents, particularly explosions, fires, and toxic releases, associated with the use of chemicals and petroleum products.
Skid-packaged Unit	Equipment designed and supplied as a largely self-contained physical unit, and mounted on a portable skid. Skid-packaged units are designed, built and tested at the Vendor's premises and delivered for integration into the overall plant.
Very Toxic (substances)	Substances that are very hazardous for the environment or human health, as specified in DEP 01.00.01.30-Gen. (which also identifies "toxic" substances by reference to chemical substances databases).

1.4 ABBREVIATIONS

FAT	Factory Acceptance Test
FEED	Front-End Engineering Design
HFE	Human Factors Engineering
ITT	Invitation to Tender
OTS	Off-the shelf. Units that have already been designed. (Such units are often operational at other facilities and installations).
SAT	Site Acceptance Test
TRA	Task Requirements Analysis

1.5 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 (4).

1.6 CONFLICTING REQUIREMENTS

Compliance with the HFE requirements shall not relieve the Vendor of the obligation to follow sound engineering practice throughout.

In case of conflicting requirements with any other specification or standard issued on the project, the Vendor shall notify the Contractor for resolution.

1.7 SUMMARY OF MAIN CHANGES

This DEP is a revision of the original issued in November 2006. Changes have been made based on experience using the DEP in projects across Shell globally. A summary of the main changes is as follows:

- Reduced HFE competence requirement for conducting Skid Package screening from Skilled Level to Knowledge Level;
- Simplified the Skid Categorization process in Appendix A by changing to a scoring system;
- Addition of a new Appendix B and reference to DEP 30.00.60.81-Gen. that has worked examples from past projects;
- Updating of HFE Design Specifications.

1.8 COMMENTS ON THIS DEP

Comments on this DEP may be sent to the DEP Administrator at standards@shell.com. Shell staff may also post comments on this DEP on the Surface Global Network (SGN).

2. BACKGROUND INFORMATION

2.1 GENERAL

A significant proportion of equipment is procured in the form of skid-packaged units. Examples of typical skid-packaged units include:

Large:

- Generators, Compressors
- Turbines
- Motor Controlled / Switchgear buildings (MCCs)

Medium:

- Chemical Injection units
- Firewater pumps
- Sand-wash units

Small:

- Utility air compressor units
- Hydraulic power units (HPUs)
- Wire-line units
- Vent snuffing units

Experience from many areas shows significant variation in the application of standards in the design and procurement of skid-packaged units. Although over-application of standards can lead to increased costs and/or reduced performance, failure to apply standards can be much more expensive in terms of total life-cycle costs.

2.2 APPLICATION OF HFE

HFE is the process of integrating current knowledge of human capabilities, limitations, in the form of expectations into the design of products, workplaces and work systems (plant and facilities) to ensure effective, efficient, safe and healthy functioning of human beings, thereby improving operational and maintenance task performance. Benefits of effective HFE in design can be both tangible (such as improved utilisation and performance of assets and resources and reduced overheads) and non-tangible (reduced risk, improved working conditions, improved workforce motivation, etc.).

2.3 KEY PRINCIPLES OF HFE DESIGN ANALYSIS PROCESS FOR SKID-PACKAGED UNITS

The HFE design analysis is based on the following principles:

- The process can be applied quickly and efficiently. It shall, however, be led by an individual with appropriate HFE Competence (as defined in DEP 30.00.60.10-Gen. and section 3.3). It also requires input from Operations and Maintenance representatives.
- The process is integrated with the overall Shell HFE Process as defined in the HSSE Control Framework manual – 'Human Factors Engineering in Projects' and in DEP 30.00.60.10-Gen. The overall process ensures compliance with the Shell Group HSSE & SP Health Standard for HFE..
- HFE effort shall be focused on areas where there are significant opportunities to add value by either reducing HSE risk or improving ease of operation or maintainence of the unit. The process therefore concentrates on skid-packaged units that are considered critical to the asset in terms of HSE or Production, or that require significant levels of human interaction for operation or maintenance.

- For procurements assessed as critical and with significant human interaction, HFE quality controls, commensurate with the risks and opportunities identified, should be applied to the design and development process.
- Skid procurements that are entirely off-the-shelf are handled differently from projects where the procurement includes design activity.

2.4 AIMS AND BENEFITS

The HFE design quality of skid-packaged units can often be greatly improved. Poor HFE design in skid-packaged units has been found to impact business performance in a number of ways:

- Avoidable accidents and lost-time injuries;
- Inefficiency in operations and maintenance, such as maintenance activities being more complex, and requiring longer shutdowns than necessary;
- Potential for human error arising from poor layout of controls and displays, as well as difficulty in accessing and operating valves.

DEP 30.00.60.12-Gen. provides a tool for assessing whether any proposed changes to skid designs arising from HFE analysis can be justified in terms of the benefits sought.

2.5 TIMING OF PROCESS

The HFE process should be initiated during either SELECT or DEFINE phase, as soon as it is reasonably clear which work systems are likely to be procured as skid-packaged units.

The requirement to apply this process should be identified as part of the initial HFE screening (required by DEP 30.00.60.10-Gen).

3. HFE DESIGN ANALYSIS OF SKID-PACKAGED UNITS

3.1 PROCESS DESCRIPTION

Figure 1 summarises the steps involved in implementing this DEP.

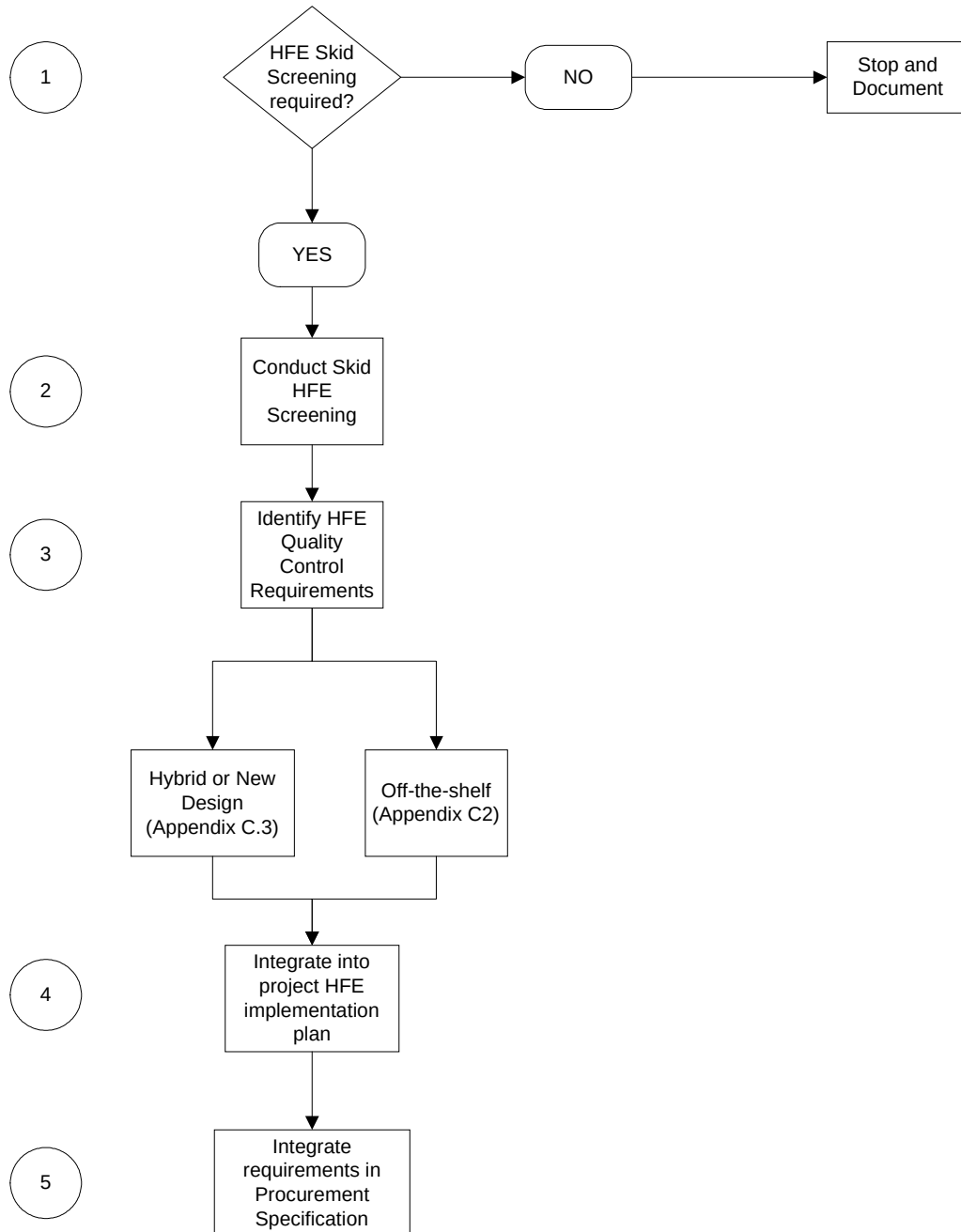


Figure 1 Flow scheme of activities for HFE skid analysis

3.2 KEY STEPS OF FIGURE 1

1. Is an HFE Skid Screening required?

The project manager, supported by the project HFE Coordinator, is responsible for deciding whether the scope of the project justifies a more detailed HFE screening of likely skid-packaged units. This can be efficiently carried out as part of the project HFE Screening required by DEP 30.00.60.10-Gen.

2. Arrange and conduct an HFE screening for skid-packaged units