

DEP SPECIFICATION

FOUNDATION™ FIELDBUS - DESIGN AND CONFIGURATION

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DESIGN AND ENGINEERING PRACTICE



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1. INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for FOUNDATION™ Fieldbus design and configuration.

The use of this DEP is primarily for engineers and designers involved in projects that make use of FOUNDATION™ Fieldbus devices. The inclusion of FOUNDATION™ Fieldbus devices in the Process Automation System introduces changes to work processes, project schedules, deliverables etc., and this DEP provides a guide to the management of these project tasks.

Excluded from the scope of this DEP are:

1. Advanced diagnostic modules for troubleshooting the physical layer.
2. FOUNDATION™ Fieldbus device maintenance.
3. Use of FOUNDATION™ Fieldbus in Safety Instrumented Systems.
4. Use of HSE linking devices to connect H1 segments. An H1 card in the DCS shall be used for FOUNDATION™ Fieldbus topology.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

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This DEP is intended for use in facilities related to oil and gas production, gas handling, oil refining, chemical processing, gasification, distribution and supply/marketing. This DEP may also be applied in other similar facilities.

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 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

The following are definitions of terms used in this DEP. A comprehensive list of definitions related to FOUNDATION™ Fieldbus can be found on the Fieldbus Foundation web site at <http://www.fieldbus.org/>.

Term	Definition
Acyclic Period	That portion of the communication cycle time during which information other than Publish/Subscribe data is transmitted. Typical information transmitted during this time includes Alarms/Events, Maintenance/Diagnostic information, Program invocations, Permissives/Interlocks, Display information, Trend Information and Configuration.
Automation System	A process automation, control and diagnostic system that is composed of distinct modules. These modules may be physically and functionally distributed over the plant area. The automation system contains all the modules and associated software required to accomplish the regulatory control and monitoring of a process plant. This definition of automation system excludes field instruments, remote terminal units, auxiliary systems and management information systems.
Basic Device	Any physical device not having the capability to control communications on an H1 Fieldbus segment.
Bus	A H1 Fieldbus cable between a host system and field devices connected to multiple segments, sometimes through the use of repeaters.
Capabilities File	A file which describes the communication objects in a Fieldbus device. A configuration device can use Device Description (DD) Files and Capabilities Files to configure a Fieldbus system without having the Fieldbus devices online.
Common File Format File (CFF)	A software file used by the host system to know the device's detailed FOUNDATION™ Fieldbus capabilities without requiring the actual device. This file format is used for Capabilities and Value files.
Complex Control	For FOUNDATION™ Fieldbus based control, complex control shall be considered when more than three field devices are involved in the control scheme, the use of advanced functionality where blocks are not available in the FF devices, or where advanced control or specific failure behaviours are required. Project deviation from this definition shall require approval from the SME.
Configurable	The capability to select and connect standard hardware modules to create a system; or the capability to change functionality or sizing of software functions by changing parameters without having to modify or regenerate software.
Configuration	The physical installation of hardware modules to satisfy system requirements; or the selection of software options to satisfy system requirements.
Connector	A coupling device used to connect the wire medium to a Fieldbus device or to another segment of wire.
Console	A collection of one or more workstations and associated equipment such as printers and communications devices used by an individual to interact with the automation system and perform other functions.

Term	Definition
Control Loop	A group of Function Blocks (FBs) that execute at a specified rate within a Fieldbus device or distributed across the Fieldbus network.
Coupler	A physical interface between a trunk and spur, or a trunk and a device.
Cycle	The scanning of inputs, execution of algorithms and transmission of output values to devices.
Deterministic	Ability to measure the maximum delay in delivery of a message between any two nodes in a network. Any network protocol that depends on random delays to resolve mastership is nondeterministic.
Device Description (DD)	A Device Description (DD) provides an extended description of each object in the Virtual Field Device (VFD), and includes information needed for a control system or host system to understand the meaning of data in the VFD.
Discrete Input (DI)	The signal is from the field device to the host system.
Discrete Output (DO)	The signal is generated by the host system and transmitted to a field device.
Enhanced Electronic Device Description Language (EDDL)	Language for FOUNDATION™ Fieldbus, Profibus and Hart to create DD and Enhanced DD files as part of the IEC 61804 standard.
Ethernet	Physical and data link layer used by HSE Fieldbus
Factory Acceptance Test (FAT)	The final test at the Vendor's facility of the integrated system being purchased.
Fieldbus	A digital, two-way, half-duplex, multi-drop communication link among intelligent measurement and control devices and automation and display systems. It can also transfer electrical power to devices and serves as a Local Area Network (LAN) for advanced process control, remote input/output and high-speed factory automation applications.
H1	A term used to describe a FOUNDATION™ Fieldbus network operating at 31.25 Kbit/s.
Host Interoperability Support Test (HIST)	A test performed by the foundation to test host system conformance to the FOUNDATION™ Fieldbus specifications.
Host System	Control system that has FOUNDATION™ Fieldbus capabilities to configure and operate FOUNDATION™ Fieldbus segments.
I/O subsystem Interface	A device used to connect other types of communications protocols to a Fieldbus segment or segments
Input	The signal is from the field device to the host system.

Term	Definition
Instantiable	The ability of function blocks to create multiple tagged function blocks of different types from a library as required by the application. Quantity per device may be restricted by software licensing, device I/O hardware, device memory and other resources.
Interoperability	Interoperability is the capability of a device from one Manufacturer to interact with that of another Manufacturer on a Fieldbus network without loss of functionality.
Interoperability Test Kit	Kit used by the Foundation to tick mark devices and confirm compliance with the relevant FOUNDATION™ Fieldbus standards. This is a pass/fail test. Only devices passing the full suite of tests receive the FOUNDATION™ Fieldbus "tick mark" (See http://www.fieldbus.org).
Link	The logical medium by which H1 FOUNDATION™ Fieldbus devices are interconnected. It is composed of one or more physical segments interconnected by bus, Repeaters or Couplers. All of the devices on a link share a common schedule, which is administered by that link's current LAS. It is the data link layer name for a network.
Link Active Scheduler (LAS)	A LAS is a deterministic, centralized bus scheduler that maintains a list of transmission times for all data buffers in all devices that need to be cyclically transmitted. Only one Link Master (LM) device on an H1 Fieldbus Link can be functioning as that link's LAS.
Link Master (LM) Device	Any physical device containing Link Active Scheduler (LAS) functionality that can control communications on an H1 Fieldbus Link. There shall be at least one LM device on an H1 Link; one of those LM devices shall be elected to serve as LAS; typically the H1 card for that segment.
Macrocycle	The repetitious scheduling of the function block within all the devices on a segment. The LAS is responsible for scheduling of the segment macrocycle.
Methods	An optional (but highly desirable) addition to Device Descriptions (DDs). Methods are used to define/ automate procedures (such as calibration) for operation of field devices.
Mode	Control block operational condition, such as manual, automatic, or cascade.
Output	The signal is generated by the host system and transmitted to a field device.
Physical Layer	The Physical Layer receives messages from the Communications Stack and converts the messages into physical signals on the Fieldbus transmission medium, and vice-versa.
Redundant Configuration	A system/subsystem configuration that provides automatic switchover, in the event of a failure, without loss of a system function.
Regulatory Control	The functions of process measurement, control algorithm execution, and final control device manipulation that provide closed loop control of a plant process.

Term	Definition
Resource Block (RB)	An RB describes characteristics of the Fieldbus device such as the device name, manufacturer and serial number. There is only one RB in a device.
Segment	A section of a H1 Fieldbus that is terminated in its characteristic impedance. Segments can be linked by Repeaters to form a longer H1 Fieldbus. Each Segment can include up to 16 physical devices (although the practical or project limit can be lower).
Spur	An H1 branch line final circuit connecting the field device to the Trunk. A Spur can vary in length from 1 m (3.3 ft) to 200 m (650 ft).
Standard Function Block (FB)	FBs are built into Fieldbus devices as needed to achieve the desired control functionality. Automation functions provided by Standard FBs include Analogue Input (AI), Analogue Output (AO) and Proportional/Integral/Derivative (PID) control. The Fieldbus Foundation has released specifications for 21 types of Standard FBs. There can be many types of FBs in a device. The order and definition of Standard FB parameters are fixed and defined by the specifications.
Tag	A collection of attributes that specify either a control loop or a process variable, or a measured input, or a calculated value, or some combination of these, and all associated control and output algorithms. Each tag is unique.
Terminator	Impedance-matching module used at or near each end of a transmission line that has the same characteristic impedance of the line. Terminators are used to minimize signal distortion, which can cause data errors by converting between current variations and voltage variations. An H1 terminator also has another even more important function. It converts the current signal transmitted by one device to a voltage signal that can be received by all devices on the network.
Topology	Shape and design of the Fieldbus network (for example, tree branch, daisy chain, point-to-point, bus with spurs, etc.).
Transducer Block (TB)	A TB decouples Function Blocks (FBs) from the local Input/Output (I/O) functions required to read sensors and command output hardware. TBs contain information such as calibration date and sensor type. There is usually one TB channel for each input or output of an FB.
Transmitter	A Transmitter is an active Fieldbus device containing circuitry, which applies a digital signal on the bus.
Trunk	A Trunk is the main communication highway between devices on an H1 Fieldbus network. The Trunk acts as a source of main supply to Spurs on the network.
Workstation	A set of electronic equipment including, at a minimum, one monitor, keyboard(s) and associated pointing device(s).

1.3.3 Abbreviations

Term	Definition
AI	Analogue Input
ALARP	As Low As Reasonably Practicable
AO	Analogue Output
CI	Control in the Field
CFF	Common File Format
DCS	Distributed Control System/Digital Control System
DI	Discrete Input
DD	Device Description
DO	Discrete Output
EDDL	Electronic Device Description Language
ESL	Enhanced Smart Loops (part of SPI)
FAT	Factory Acceptance Test
FB	Function Block
FDT/DTM	Field Device Tool/Device Type Manager
HIST	Host Interoperability Support Testing
HSE	High Speed Ethernet
IAMS	Instrument Asset Management System
IEC	International Electro technical Commission
IMAN	Initialised Manual
I/O	Input Output
IPF	Instrument Protective Function
IS	Intrinsic Safety
ITK	Interoperability Test Kit
LAS	Link Active Schedule
LM	Link Master
LOTAM	List of Technically Accepted Materials
MAC	Main Automation Contractor
MAI	Multi Analogue Input
PACO	Process Automation, Control and Optimisation
P&ID	Piping & Instrumentation Diagram
PID	Proportional-Integral-Derivative Control
PV	Process Variable
RB	Resource Block
RCM	Reliability Centered Maintenance
SIL	Safety Integrity Level
SPI	SmartPlant Instrumentation (previous called INtools)
TB	Transducer Block
UPS	Uninterruptible Power Supply

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 (9).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated August 2008..

This DEP has been completely updated and brought in-line with lessons learnt from projects applying Foundation Fieldbus.

1.6 COMMENTS ON THIS DEP

Comments on this DEP may be sent to the Administrator at standards@shell.com, using the DEP Feedback Form. The DEP Feedback Form can be found on the main page of "DEPs on the Web", available through the Global Technical Standards web portal <http://www.shell.com/standards> and on the main page of the DEPs DVD-ROM.

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. FOUNDATION™ FIELDBUS PROJECT REQUIREMENTS

2.1 INTRODUCTION

Proper utilization of FOUNDATION™ Fieldbus technology in projects requires the following changes compared to traditional technologies for connection of field devices:

1. The microprocessor based field devices are distributed in H1 segments and hence these segments now become an integral part of the DCS. This requires an integrated configuration, data management, and system architecture approach to field network design.
2. The system integration aspects of FOUNDATION™ Fieldbus requires more design and testing activities to be performed earlier in the project lifecycle when compared to 4-20 mA based projects.
3. The ability to distribute control between the DCS and the FOUNDATION™ Fieldbus field devices requires additional consideration when designing device segments and process control solutions.
4. System, Field Device, and Segment Component testing processes require more attention than for simple analogue connections.

When implemented correctly, the benefits associated with FOUNDATION™ Fieldbus based devices includes:

- a) Diagnostic abilities associated with the devices themselves and the device related process measurements and the ability to self-alert on these detected performance issues.
- b) Fully digital process measurements, both to/from the field devices and the DCS system, thereby avoiding the errors associated with digital to analogue (and vice versa) conversions.
 - Consistent accuracy over the device measurement span
 - No drift that is commonly associated with the analogue-digital conversion and hence no calibration requirements
 - Multiple process measurements available from the devices in a timely fashion (e.g., transmitter body temperature, temperature sensor multiplexers)
- c) Less time spent during the loop check and commissioning activities
- d) Very fast deterministic loop response associated with control in the field

The benefits from FOUNDATION™ Fieldbus devices enables the migration from a reactive, preventative, or predictive based maintenance behaviour to a proactive behaviour thereby adding additional value to the services and time spent by the site's maintenance organization.

2.2 USE OF APPROVED PRODUCTS

Project staff shall utilize Systems, Field Devices, and Segment Components that have passed rigorous approval processes. These processes include:

1. Release testing by the Vendor
2. FOUNDATION™ Fieldbus tests (HIST, ITK)
3. Host system Vendor integration tests
4. Integration tests (specific system and device combinations) performed by the Principal. In Shell, the PACO organization ensures fully tested interoperability and correctly configured device diagnostics.
5. In Shell, the list of PACO tested devices shall form the basis of site and project approved FOUNDATION™ Fieldbus field device list.

Project staff shall not assume that any FOUNDATION™ Fieldbus device in combination with any Host system will provide full functionality of all advertised features of the device or system without the Principal's testing and the associated reports/templates.

2.3 VERSION AND VARIETY MANAGEMENT OF FF PRODUCTS

Within the project Define Phase, the FOUNDATION™ Fieldbus devices to be used on a project shall be selected. Additionally, the version of the specific devices to be used for the project shall be decided and frozen. The purchase orders for the devices shall state the device version to be supplied (DD / CFF version).

The starting point for device selection shall be from the Principal's (in Shell the PACO controlled list) of tested devices, identified by manufacturer, model number, and DD version. This will allow identification of project devices (device manufacturer, device model number, or device version) that have not yet been tested by the Principal (in Shell, PACO).

From a variety control aspect, a project shall minimize the different types of devices used for instrumentation. For example, having all control valves provided with the same positioners (as much as possible) will help reduce project testing effort and also minimize life cycle costs for instrumentation (spare parts, training, maintenance procedures, etc.).

2.4 PROJECT PROCEDURES

Project staff shall utilize test or development systems during the project design phase. Typical configurations of hardware and software shall be thoroughly tested before high volume replication. These tests shall not be postponed until FAT. Some examples of integration test procedures are given in the DEP Informative.

FAT shall utilize simulated I/O including FOUNDATION™ Fieldbus I/O if the host systems support adequate simulation. In that case Field devices are not required at FAT. However, when FOUNDATION™ Fieldbus Control in the Field is utilized, the FAT shall test the control solution using the actual devices to ensure correct device alerts, presentation of the diagnostics, alarms, and graphic indication are available.

In addition, the FAT shall confirm correction operation of the IAMS to ensure the configured alerts and prioritization/routing of the alerts meets the project specifications. The IAMS shall be fully configured and tested prior to starting commissioning of the facility.

The DEP Informative provides examples of field tests procedures for FOUNDATION™ Fieldbus devices and segments. These procedures are generally covered in more depth in other documents. These procedures shall be planned for execution during the design phase and may be tested during integration tests as described in the DEP Informative.

3. FOUNDATION™ FIELDBUS DCS SYSTEM REQUIREMENTS

3.1 INTRODUCTION

Only host systems as defined in the Shell Global Procurement MAC Strategy shall be used.

The selection of the correct DCS is essential for a successful FOUNDATION™ Fieldbus technology implementation. The various DCSs reflect different levels of FOUNDATION™ Fieldbus development. The Fieldbus Foundation now provides a test, FF-569, for host systems. The HIST does not guarantee the required FOUNDATION™ Fieldbus performance, it only confirms that the host system supports the required FF functionality.

The status of and approved release information on DCS testing shall be obtained from the Principal if the system is new or revamped.

3.2 USE OF STANDARD PRODUCTS

The DCS shall be composed of the Manufacturer's standard hardware, systems software and firmware that can be configured to meet the stated requirements. The Vendor's standard system operating software shall not be modified to meet any of the user's requirements.

Application software shall be designed in a manner that requires no modification to the system operating software. Software design shall be such that future revisions or updates of the system operating software will not affect the successful operation of the system.

The DCS H1 network topology and settings shall comply with the recommended FOUNDATION™ Fieldbus practices to enable communication with all targeted FOUNDATION™ Fieldbus devices.

3.3 SUPPORT FOR FOUNDATION™ FIELDBUS FUNCTIONALITY

3.3.1 DCS FOUNDATION™ Fieldbus functionality

The DCS functionality shall be designed to integrate the features of FOUNDATION™ Fieldbus as follows:

NOTE: All Shell Global Procurement Strategic MAC listed DCSs support this functionality.

- a) Prevention of duplicate node addresses; preferable via automatic node addressing
- b) Interoperability as per the ITK test kits
- c) Direct configuration of devices (using DD or EDDL [preferred] technology)
- d) Direct integration of FOUNDATION™ Fieldbus device operating, maintenance and diagnostic data.
- e) Tuning parameters, modes, device alerts and quality of data.
- f) Field devices shall be configurable while the host system is operating without shutting down or resetting the network.
- g) The host system shall enable new field devices to be added to an existing network/segment (i.e., Device Tag/Placeholder) and fully configured without impacting the other devices on that segment.
- h) Device replacements shall be plug and play without requiring any special commissioning or start-up requirements (including automatic integration into the LAS schedule).
- i) The host system shall enable field device firmware to be updated (over the H1 bus protocol) without shutting down or impacting the publish/subscribe cycle of that H1 segment.
- j) Only ITK approved FOUNDATION™ Fieldbus DD and CFF files shall be used.

- k) The DCS shall have a library of templates built from standard DD and CFF files or dedicated Vendor files pre-installed. In Shell, these templates shall be provided by PACO.

NOTE: This will promote easy commissioning of the FOUNDATION™ Fieldbus devices.

- l) Instantiation of Function Blocks functionality shall not be used.

NOTE: Instantiation of function blocks means that the blocks will be created within the device upon demand. Function blocks will be installed from the DCS into the Fieldbus device usually because these function blocks do not exist by default in the device and hence, "instantiated" within the device when required. FDT/DTM technology shall be supported within the DCS Instrument Asset Management System (IAMS) (this also includes FDI technology when commercially available).

- m) Device replacement services shall be wizard or method based technology

3.3.2 Data transfer capabilities

A single master database in the DCS will hold all the FOUNDATION™ Fieldbus device parameters (it is preferred that the same database shall be used by both the DCS and IAMS). External configuration tools that bypass this master database shall not be used.

The FOUNDATION™ Fieldbus devices shall enable diagnostic information based upon NAMUR NE-107 (part of ITK 6.0). Integrated asset management packages should be employed to handle this diagnostic information.

3.4 SPARE CAPACITY AND EXPANSION

The DCS shall be supplied with minimum 20 % hardware spare capacity at Mechanical Completion for all elements of the system configuration, including application software, graphics, history, reports, and trends. In addition the system shall have sufficient spare performance (e.g., communication idle time) to execute all required communication including diagnostic information.

Communication networks within the DCS shall include 20 % unused node addresses at Mechanical Completion for future system expansion. Each FOUNDATION™ Fieldbus H1 segment shall be capable of supporting at least 12 FOUNDATION™ Fieldbus physical devices. With a spare capacity of 20 % this implies that the actual segment loading shall be no more than 10 physical devices per segment with 2 spares at design freeze of the project.

Power supplies for FOUNDATION™ Fieldbus segments shall be sized to support all future requirements including the 20 % spare. In addition, there shall be sufficient room in field junction boxes to support the 20 % spare requirement.

The redundant power supplies shall be sized taking the following considerations:

- The power supply spare capacity shall be 30 % after using all the spares and taking into account the requirement under (7.5.1).

NOTE: This requirement is for segment in-rush current requirements associated with initial power-up of the devices.

- In case of failure of one power supply unit, the backup unit shall be able to take the full load (including the spare capacity requirements).

3.5 REDUNDANCY

For availability reasons, the following redundant components shall be used:

- a) Redundant power feeds shall be provided to the bulk power supplies. The redundant power feeds shall be independent (e.g., one power feed from Power Bus A and the second power feed from Power Bus B). At least one of these power feeds shall be from a UPS unless the DCS power system has battery backup.
- b) Redundant bulk power supplies for supply of power to the FOUNDATION™ Fieldbus segment power supplies. Each bulk power supply shall be able to supply full load (including spare capacity) and shall annunciate loss of AC power and low battery voltage via separate discrete contacts or other H1 bus independent method.

Where the bulk power supplies are comprised of multiple power modules, it shall be possible to remove and insert a power module under power. Each module shall annunciate trouble or error conditions via separate discrete contacts. In all cases, the discrete contacts shall be capable of supporting contact sense or voltage sense wiring and shall be energized with closed contact output when indicating an error free condition.

- c) Redundant system controller power supplies with each controller power supply fed from an independent power source.
- d) Redundant system controllers.
- e) Redundant FOUNDATION™ Fieldbus H1 cards. It shall be possible to replace either H1 card under power with no impact on the H1 segments associated with the redundant cards. It shall be possible to upgrade H1 card software/firmware without impacting communications on the related H1 segments. Shell Strategic MAC approved DCSs meet this requirement.
- f) Redundant FOUNDATION™ Fieldbus power conditioners. It shall be possible to replace either FOUNDATION™ Fieldbus power conditioner with no impact on the H1 segment(s) associated with the power conditioners.

For more details on power supply redundancy see (6.2).

For more details on field device redundancy see (7.4).

3.6 ARCHITECTURE OF ENGINEERING AND MAINTENANCE WORKSTATION

It shall be possible to install more than one engineering workstation in a system.

Only one engineering workstation shall be necessary to perform all control and FOUNDATION™ Fieldbus configuration, database generation, and editing within a physical grouping of H1 interface cards. However, it shall also be possible to use multiple engineering workstations simultaneously for configuration, database generation and editing.

The automation system shall provide global configuration for both field devices and IAMS. It is preferred that the automation system has a single, global configuration database to be shared by all components of the system (including DCS and IAMS). User shall not be required to enter the same data or configuration more than once.

The maintenance workstation for diagnostic data handling shall reside next to or be integrated with the engineering workstation, as FOUNDATION™ Fieldbus maintenance requires simultaneous access to both platforms.

An integrated asset management package shall be provided as it is required to gain full benefits of FOUNDATION™ Fieldbus during commissioning and lifecycle activities. Refer to DEP 32.30.20.14-Gen. for asset management requirements.

4. SOFTWARE CONFIGURATION GUIDELINES

4.1 CONTROL SYSTEM GRAPHICS

The control system graphics presentation shall comply with DEP 30.00.60.15-Gen. and DEP 30.00.60.16-Gen. In addition, dedicated FOUNDATION™ Fieldbus faceplates shall be applied; for new projects, the templates, as provided in the MAC toolkits, shall be used

NOTE: FOUNDATION™ Fieldbus provides an abundance of additional information to the DCS system user. A dedicated asset management system shall be employed for the diagnostic data. Appropriate routing of the FOUNDATION™ Fieldbus device alarms/alerts is required: only process related alarms shall be routed to the operator screens. All maintenance and device health related alarms/alerts shall be routed to the maintenance screens (note that exceptions can be made for critical loops).

For additional details see (8.4).

4.2 FOUNDATION™ FIELDBUS DEVICE SEGMENT ADDRESSING

Each Fieldbus device shall have a unique physical device tag and corresponding segment address.

- NOTES:
1. A device tag is assigned to the device when it is commissioned and (for most device states) retains the tag in its memory when it is disconnected. The network address is the current address that the Fieldbus is using for the device.
 2. The Fieldbus Foundation uses node addresses in the range 0-255. Each Vendor allocates the node numbers in a way that is somewhat unique. They all have reserved low numbers for overhead and DCS interfaces, and a group above that for live field devices, and some higher numbers for spares. Addresses as described by the FOUNDATION™ Fieldbus specification are in accordance with the following ranges (note that DCS vendors may have implementation specific changes to the ranges listed below):
 - 0-15 are reserved.
 - 16-247 are available for permanent devices. Some DCSs may further subdivide this range. This range is typically shortened for efficiency.
 - 248-251 are available for devices with no permanent address such as new devices or decommissioned devices.
 - 252-255 are available for temporary devices, such as handhelds.

Third-party systems or configuration tools connected through a communications interface to a H1 network shall NOT be used to:

- a) interrupt the operation of any device within the system;
- b) change device address (handheld devices shall not be used to set the device tag and address due to database inconsistency issues);
- c) affect the link schedule.
- d) provide LAS functionality

Third-party tools shall only use acyclic (client/server) communications. Communication interfaces shall have user-administered security to control read/write access and to select allowed functionality.

NOTE: Default settings in some configuration tools can disrupt link operation without any overt action by the operator of the tool.

The field device management or IAMS implementation shall be capable of completely configuring parameters associated with FOUNDATION™ Fieldbus devices.

NOTE: The Shell Global Procurement Strategic MAC listed DCSs are capable of completely configuring the offline configuration of any approved FOUNDATION™ Fieldbus device using standard Capabilities Files (CFF).

The FOUNDATION™ Fieldbus H1 card in the DCS shall be configured to provide the primary LAS functionality. The redundant H1 card will take over the LAS in case of failure of the first card. In addition a FOUNDATION™ Fieldbus field device can also function as backup LAS. When CiF is implemented, the backup LAS functionality shall be supplied by the redundant H1 card; no field devices shall be configured to provide the backup LAS functionality unless tested and approved by Shell.