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MATERIAL CONTROL AND VERIFICATION FOR PRESSURIZED EQUIPMENT

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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 material control and verification (MC&V) of alloy and carbon steel that needs to be applied during all phases of a project or repair/replacement work, to guard against the installation of rogue materials for pressurized equipment.

Pressurized equipment refers to standard or common types of equipment used in most assets. Unique or specialized equipment for subsea, pipelines or other parts of the business are addressed in the DEPs for these specific applications as the material control and verification requirements in this DEP might not be enough to provide proper controls and assurance.

This DEP is based on having a procurement system in place that obtains materials and fabricated equipment from vendors that have been through a review and approval process similar to that recommended in EEMUA 224.

The material control elements in this DEP apply to bulk and specialty components, and to fabricated piping and equipment.

This DEP defines the minimum required sample (percentage), elemental analysis requirements and other verification steps based on the material of construction and the component type. It includes material traceability to source as part of the process.

This DEP contains mandatory requirements to mitigate process safety risks in accordance with Design Engineering Manual (DEM) 1 - Application of Technical Standards.

This is a revision of the DEP of the same number dated September 2013; 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 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 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 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.

This DEP is consistent with API RP 578 Material Verification programme for New and Existing Alloy Piping Systems.

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 capitalised term **SHALL [PS]** indicates a process safety requirement.

The word **should** indicates a recommendation.

The word **may** indicates a permitted option.

1.3.2 Specific definitions

Term	Definition
Alloy Material	Any metallic material (including welding filler materials) that contain alloying elements that are intentionally added to enhance mechanical or physical properties and corrosion resistance, or a combination thereof, (e.g., Chromium, Nickel, or Molybdenum). The term alloy includes special grades of carbon steel such as those used in low temperature (LT) and sour services.
Fabricator	One who fabricates piping systems or portions of a piping system as defined by ASME B31.3, or process pressure equipment, instrumentation or machinery.
Heat (of Material)	A batch of metal made at the same time, that can be traced from its original constituents and manufacturing process.
Inspection Lot	A group of items or materials of the same type from a common source from which a sample is to be drawn for examination. An inspection lot does not include items from more than one heat.
Inspection Test Plan (ITP)	A step by step plan outlining special inspection steps that should occur during the fabrication/assembly process.
Level of Examination	The specified percentage of the number of components (or weldments when specified) to be examined in an inspection lot.
Lot Size	The number of items available in the inspection lot at the time a representative sample is selected.
Material Control and Verification Program	A documented quality assurance program used to control and verify that the materials installed on a project meet the requirements.
Material Manufacturer	An organization that performs or supervises and directly controls one or more of the operations that affect the chemical composition or mechanical properties of a metallic material.
Material Non-conformance	A material that does not meet specified requirements.

Term	Definition
Material Supplier	An organization that supplies material furnished and certified by a material Manufacturer, but does not perform any operation intended to alter the material properties required by the applicable material specification. Material Manufacturer and Supplier may be the same party if the Manufacturer supplies directly to the shop fabricator, field fabricator, or Principal.
MESC	Material and Equipment Standards and Code. Provides material and final product minimum certification requirements and specifications.
Mill Test Report(MTR)	A certified document that permits each component to be identified according to the original heat of material from which it was produced and identifies the applicable material specification (including documentation of all test results required by the material specification). MTRs are not a substitute for PMI tests.
Positive Material Identification (PMI)	A physical evaluation or test of a material using an analyzer to confirm that it is consistent with the selected or specified alloy material designated by the Principal. Evaluations or tests can provide either quantitative information to verify alloy composition in weight percent or qualitative information that identifies the grade of the material.
Pressure-Containing Components	Items that form the pressure-containing envelope of the operating components and piping systems. This includes on-line instrumentation up to and including the first isolation valve of off-line instrumentation.
Random	Selection process by which choices are made in an arbitrary and unbiased manner.
Representative Sample	One or more items selected at random from the inspection lot that are to be examined to determine the acceptability of the inspection lot.
Rogue Material	Equipment or piping components installed in a specific alloy (or special carbon steel) system that do not meet the material specification for that system. This includes welding consumables.
Standard Reference Materials	Sample materials for which laboratory chemical analysis data are available and are used in demonstrating test instrument accuracy and reliability.
Traceability	The ability to match an installed component to its source.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section or clause number is shown in brackets (). Other documents referenced by this DEP are listed in (8).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a revision of the DEP of the same number dated September 2013. The changes are too extensive to list individually. The following are the main, non-editorial changes.

Section/Clause	Change
Title	Changed from "Positive Material Identification Program" to "Material Control and Verification" to better reflect the entire process.
General	Separated which carbon steel components receive PMI and which receive material verification through traceability.
General	Changed the PMI of weld overlay to a surface verification since the weld procedure is verified at the proper depth.
General	Clarified when PMI testing is to be performed.
General	Allowed the use of alloy identification instead of element identification for PMI of "Standard" materials.

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://swwww.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.

1.8 NON NORMATIVE TEXT (COMMENTARY)

Text shown in italic style in this DEP indicates text that is non-normative and is provided as explanation or background information only.

Non-normative text is normally indented slightly to the right of the relevant DEP clause.

2. GENERAL

1. A material control and verification programme (MC&V) approved by the Principal SHALL [PS] be in place for the installation of all new components of pressure retaining equipment and piping.
2. The MC&V programme shall cover the minimum required sample (percentage), the elemental analysis requirements and other material verification steps contained in this DEP, based on the alloys of construction and the component type.
3. The programme shall include MC&V of non-pressure retaining components that are integral to the pressure equipment.

3. MATERIAL CONTROL AND VERIFICATION PROGRAMME MAIN ELEMENTS

1. The elements covered by the MC&V programme for pressurized equipment shall include the following:
 - a. Levels of examination, including alloy elements required for PMI;
 - b. PMI equipment and methods;
 - c. Materials, components and fabricated assemblies (e.g., pipe spools) subject to PMI;
 - d. Marking and identification of components on which PMI has been performed (i.e., the stamping and colour coding systems);
 - e. PMI of welding consumables and gaskets;
 - f. Material traceability during fabrication and machining, the timing and location of PMI in accordance with the Inspection and Test Plan (ITP), including transfer of identification markings (e.g., heat numbers) and colour coding;
 - g. PMI Inspection reports as defined in (7).
2. The MC&V programme shall include the following controls at both the fabrication and construction sites:
 - a. Receipt of Materials – controls for segregation and storage of materials, material test report validation and PMI and component identification from the Manufacturers/Suppliers per the scope of this specification.
 - b. Issue of Materials – Controls for the issue and tracking of materials and components and welding consumables during fabrication. This includes the following:
 - i. Controls during fabrication, such as the segregation of materials, materials traceability and identification including matching of heat numbers to MTRs during the fabrication process;
 - ii. Segregation of tools where applicable to prevent contamination.
 - c. Surplus Materials – the control and traceability of surplus materials.
 - d. Rejected Materials – the control and traceability of rejected materials, including the return and/or replacement.
 - e. Carbon steel materials – the control and traceability of carbon steel materials where mill test report verification is the means of verifying the correct material was installed.
3. The MC&V programme shall include auditable material traceability records including the following:
 - a. Transmittal of the records as part of the handover documentation packages;
 - b. Final field verification on completed systems.