

DEP SPECIFICATION

COATING OF FASTENERS

DEP 30.48.00.32-Gen.

February 2012

ECCN EAR99

DESIGN AND ENGINEERING PRACTICE



© 2012 Shell Group of companies
All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, published or transmitted, in any form or by any means, without the prior written permission of the copyright owner or Shell Global Solutions International BV.

This document contains information that is classified as EAR99 and, as a consequence, can neither be exported nor re-exported to any country which is under an embargo of the U.S. government pursuant to Part 746 of the Export Administration Regulations (15 C.F.R. Parts 746) nor can be made available to any national of such country. In addition, the information in this document cannot be exported nor re-exported to an end-user or for an end-use that is prohibited by Part 744 of the Export Administration Regulations (15 C.F.R. Parts 744).

PREFACE

DEP (Design and Engineering Practice) publications reflect the views, at the time of publication, of Shell Global Solutions International B.V. (Shell GSI) and, in some cases, of other Shell Companies.

These views are based on the experience acquired during involvement with the design, construction, operation and maintenance of processing units and facilities. Where deemed appropriate DEPs are based on, or reference international, regional, national and industry standards.

The objective is to set the standard for good design and engineering practice to be applied by Shell companies in oil and gas production, oil refining, gas handling, gasification, chemical processing, or any other such facility, and thereby to help achieve maximum technical and economic benefit from standardization.

The information set forth in these publications is provided to Shell companies for their consideration and decision to implement. This is of particular importance where DEPs may not cover every requirement or diversity of condition at each locality. The system of DEPs is expected to be sufficiently flexible to allow individual Operating Units to adapt the information set forth in DEPs to their own environment and requirements.

When Contractors or Manufacturers/Suppliers use DEPs, they shall be solely responsible for such use, including the quality of their work and the attainment of the required design and engineering standards. In particular, for those requirements not specifically covered, the Principal will typically expect them to follow those design and engineering practices that will achieve at least the same level of integrity as reflected in the DEPs. If in doubt, the Contractor or Manufacturer/Supplier shall, without detracting from his own responsibility, consult the Principal.

The right to obtain and to use DEPs is restricted, and is granted by Shell GSI (and in some cases by other Shell Companies) under a Service Agreement or a License Agreement. This right is granted primarily to Shell companies and other companies receiving technical advice and services from Shell GSI or another Shell Company. Consequently, three categories of users of DEPs can be distinguished:

- 1) Operating Units having a Service Agreement with Shell GSI or another Shell Company. The use of DEPs by these Operating Units is subject in all respects to the terms and conditions of the relevant Service Agreement.
- 2) Other parties who are authorised to use DEPs subject to appropriate contractual arrangements (whether as part of a Service Agreement or otherwise).
- 3) Contractors/subcontractors and Manufacturers/Suppliers under a contract with users referred to under 1) or 2) which requires that tenders for projects, materials supplied or - generally - work performed on behalf of the said users comply with the relevant standards.

Subject to any particular terms and conditions as may be set forth in specific agreements with users, Shell GSI disclaims any liability of whatsoever nature for any damage (including injury or death) suffered by any company or person whomsoever as a result of or in connection with the use, application or implementation of any DEP, combination of DEPs or any part thereof, even if it is wholly or partly caused by negligence on the part of Shell GSI or other Shell Company. The benefit of this disclaimer shall inure in all respects to Shell GSI and/or any Shell Company, or companies affiliated to these companies, that may issue DEPs or advise or require the use of DEPs.

Without prejudice to any specific terms in respect of confidentiality under relevant contractual arrangements, DEPs shall not, without the prior written consent of Shell GSI, be disclosed by users to any company or person whomsoever and the DEPs shall be used exclusively for the purpose for which they have been provided to the user. They shall be returned after use, including any copies which shall only be made by users with the express prior written consent of Shell GSI. The copyright of DEPs vests in Shell Group of companies. Users shall arrange for DEPs to be held in safe custody and Shell GSI may at any time require information satisfactory to them in order to ascertain how users implement this requirement.

All administrative queries should be directed to the DEP Administrator in Shell GSI.

TABLE OF CONTENTS

1.	INTRODUCTION	4
1.1	SCOPE.....	4
1.2	DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS	4
1.3	DEFINITIONS	4
1.4	SAFETY	5
1.5	CROSS-REFERENCES	5
1.6	COMMENTS ON THIS DEP	5
1.7	DUAL UNITS.....	5
2.	GENERAL.....	6
2.1	WARRANTY.....	6
2.2	MANUFACTURER/SUPPLIER'S RESPONSIBILITY	6
3.	PROTECTIVE COATINGS FOR BOLTS AND FASTENERS	7
3.1.	GENERAL	7
3.2	COATING PERFORMANCE.....	8
3.3	PHOSPHATING	8
3.4	ZINC BASED COATINGS.....	8
3.5	ALUMINIUM AND ALUMINIUM-CERAMIC TYPE COATINGS.....	9
3.6	ELECTROPLATED ZINC-NICKEL ALLOY COATING	10
3.7	FLUOROPOLYMER/PTFE COATING.....	10
3.8	WAX BASED SYSTEMS	11
3.9	THREAD LUBRICANT SYSTEM.....	11
3.10	PROTECTION OF NUTS.....	11
4.	PROTECTION WITH CATHODIC PROTECTION	12
5.	QUALITY CONTROL REQUIREMENTS	12
5.1	GENERAL	12
5.2	APPEARANCE	12
5.3	THICKNESS.....	12
5.4	ADHESION	12
5.5	CHROMATE CONVERSION TREATMENT	12
5.6	WEAR RESISTANCE	13
5.7	FRICTION COEFFICIENT	13
5.8	HEAT TREATMENT AFTER PROCESSING	13
6.	QUALITY ASSURANCE TEST METHODS.....	14
6.1	MEASUREMENT OF THICKNESS ON PROCESSED PARTS	14
6.2	MEASUREMENT OF ADHESION	14
6.3	TESTING OF CORROSION RESISTANCE	15
6.4	TESTING FOR EFFECTIVENESS OF STRESS RELIEF AND HYDROGEN EMBRITTLEMENT BAKING	15
6.5	THREAD FRICTION	15
7.	REFERENCES	16

1. INTRODUCTION

1.1 SCOPE

This new DEP specifies requirements and gives recommendations for corrosion resistant coatings applied to bolts for both offshore and onshore facilities.

It is applicable to new bolts and nuts. It may also be applied to existing bolts when removed during shutdown.

This DEP covers a number of different types of metallic and non-metallic corrosion protection coatings suitable for the exposure conditions in offshore and onshore environments.

For offshore topside equipment, coating systems typically used on carbon steel and low alloy steel bolting include:

- hot dip galvanised zinc (with or without an organic topcoat),
- zinc/nickel electroplated,
- zinc electroplated,
- PTFE,
- aluminium or aluminium-ceramic.

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 authorization to any documents, data or information to which the DEPs may refer.

This DEP is intended for use in offshore/onshore exploration and production facilities, oil refineries, chemical plants, gas plants, and supply/marketing 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 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, components of 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 and abbreviations

Term	Definition
Bolting	Bolting is a mechanism for creating and maintaining a clamping force between joint members.
Coating System	Details of coating, priming and other intermediate layer materials, together with production procedures pertaining to the pre-treatment and coating work or test pieces.
CRA	Corrosion Resistant Alloy.
Cracking	The splitting of a dry paint film.
DFT	Dry Film Thickness; the thickness of the dried or cured paint or coating film.
Duplex System	Hot dip galvanised steel plus coating.
Fastener	A fastener is any male component with threads (bolts, studs or screw). In this DEP the word bolt and fastener will be used as synonyms.
Holiday/Pinhole	Pinhole or very small size defect in a coating system, penetrating the entire thickness of the coating.
Hot Dip Galvanizing	Formation of a coating of zinc and/or zinc-iron alloys produced by dipping prepared steel in molten metallic zinc.
HSSE	Health, Safety, Security and Environment.
Inspection Lot	An inspection lot shall be defined as a collection of processed parts that are of the same kind, that have been processed to the same specifications, that have been processed by a single Manufacturer/Supplier at one time, or at approximately the same time, under essentially identical conditions, and that are submitted for acceptance or rejection as a group.
MSDS	Material Safety Data Sheet.
NDFT	Nominal (specified) Dry Film Thickness.
PTFE	Polytetrafluoroethylene

1.4 SAFETY

This Standard may call for the use of hazardous substances and procedures. Attention is drawn to the need to comply with statutory and all other legal obligations relating to environment, health and safety at any stage.

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 (7).

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. GENERAL

2.1 WARRANTY

Contractors undertaking the application and supply of coated bolts shall follow the requirements of corrosion protection coating in accordance with this DEP and warranty the quality of their coating work. The corrosion protection system shall be selected from the coating systems listed in Table 1, depending upon the Principal's requirements and service conditions.

Before supply of any coated bolts, the warranty period and associated corrosion protection coating condition shall be agreed by the Contractor with the Principal. A minimum warranty period of five (5) years shall be provided for the coating applied. However, the design life of coating should be as much as the design life of bolt.

The coating systems to be used in accordance with this DEP shall be suitable for the highly corrosive coastal and marine environment, C5-M as specified in ISO 12944-2.

Only surfaces that have mechanical damage or chemical spillage as a result of operational activities may fall outside this warranty.

In case of a dispute over the condition of the coated bolts that has been inspected, an agreed independent and qualified body shall conduct an inspection at the Contractor's cost. Both the Principal and the Contractor shall accept the findings of the inspection by this independent consultant.

2.2 MANUFACTURER/SUPPLIER'S RESPONSIBILITY

2.2.1 General

The Manufacturer/Supplier, in addition to his responsibilities under the general conditions of the contract, shall be responsible for the quality of the coated bolts supplied, which shall be in strict accordance with this DEP and all other relevant documents, such as site regulations, safety rules and requirements, product data sheets, referenced standards and codes.

The Manufacturer/Supplier shall be fully responsible for all Quality Assurance and Control activities.

2.2.2 Safety and environment

The Contractor shall be responsible for all aspects of safety and personal protection related to the corrosion protection coating work to be done on metallic bolts and fasteners. All environmental regulations and rules shall be met.

All personnel shall be provided with personal protection, e.g., protective clothing, safety glasses, safety shoes, hard hats, goggles, respirators, earplugs, fresh air-fed hood and all other necessary safety equipment. Protective clothing for abrasive blasters shall comply with ISO 14877. All safety equipment shall be maintained in a good working condition.