

DEP SPECIFICATION

MARINE LOADING ARMS (AMENDMENTS/SUPPLEMENTS TO OCIMF DESIGN AND CONSTRUCTION SPECIFICATION FOR MARINE LOADING ARMS)

DEP 31.06.15.10-Gen.

February 2014

DESIGN AND ENGINEERING PRACTICE



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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.

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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.

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PART I INTRODUCTION

1.1 SCOPE

This DEP specifies requirements and gives recommendations for Marine Loading Arms (MLAs).

This DEP is based on the Oil Company International Marine Forum (OCIMF) "Design and Construction Specification for Marine Loading Arms", Third Edition 1999. Part III of this DEP amends, supplements and deletes various clauses of OCIMF Part I. In Appendix A, an amended set of the OCIMF Part II Tables are provided.

With respect to floating facilities this DEP can be used as a basis, however specific requirements for a floating environment (such as dynamic analysis and a targeting system) are project specific and are not covered in this DEP.

This is a revision of the DEP of the same number dated September 2010; 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 authorization 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.

NOTE: The word "Owner" as used in the OCIMF Guide shall be taken to mean "Principal".

The word **shall** indicates a requirement.

NOTE: The word "will" is often used in the OCIMF Guide. Where the context implies a requirement, this shall be taken to mean "shall".

The word **should** indicates a recommendation.

1.3.2 Specific definitions

The definitions listed below are additional to the definitions in the OCIMF.

Term	Definition
Apex	Highest point of the MLA where inboard and outboard arm are connected to each other.
Product Seal/Primary Seal	A seal located in a swivel joint to prevent product entry into the bearing chamber. This seal is also referred to as primary seal on swivels that have double seal arrangements like LNG Marine Loading Arms or arms for hazardous products.
Process Safety	The management of hazards that can give rise to major accidents involving the release of potentially dangerous materials, release of energy (such as fire or explosion) or both.
Riser	The vertical structural member, which supports the arm assemblies. For non cryogenic and refrigerated products the riser is both the structural member as well as the product carrying line.
Secondary Seal	The second seal of the double seal arrangement of the swivel. This seal acts as the last line of defence after leakage through the primary seal.
Reducer Spool Piece	A short length of pipe with flanges of different diameter for matching the ship's manifold flange to the presentation flange.
Swivel Joint	A combination of parts that provides a rotatable connection between pipe sections whilst internally allowing the leak free transfer of product. A swivel joint commonly consists of an outer body which can rotate around the inner body.

1.3.3 Abbreviations

Term	Definition
AC	Alternating Current
CS	Carbon Steel
DBV	Double Ball Valve
DC	Direct Current
DEP	Design and Engineering Practice
DL	Dead Load
EL	Earthquake Load
ERC	Emergency Release Coupling
ERS	Emergency Release System
ESD	Emergency Shut Down
FAR	Field Auxiliary Room
FAT	Factory Acceptance Test
FL	Fluid Load
FMEA	Failure Mode and Effects Analysis
HAZID	Hazard Identification
HPU	Hydraulic Power Unit
IPS	Instrument Protective System

Term	Definition
ISGOTT	International Safety Guide for Oil Tankers and Terminals
ITP	Inspection Test Plan
LNG	Liquefied Natural Gas
LPG	Liquefied Petroleum Gas
MESC	Material and Equipment Standards and Codes
MLA	Marine Loading Arm
MOV	Motor Operated Valve
MPI	Magnetic Particle Inspection
NDE	Non Destructive Examination
NDT	Non Destructive Testing
OCIMF	Oil Companies International Marine Forum
PEFS	Process Engineering Flow Scheme
PERC	Powered Emergency Release Coupling
PL	Design Pressure Load
PLC	Programmable Logic Controller
PLT	Test Pressure Load
PMS	Position Monitoring System
PTFE	Poly Tetra Fluor Ethylene (Teflon)
QC/DC	Quick Connect / Disconnect Coupling
SIL	Safety Integrity Level
SWL	Safe Working Load
TL	Thermal Load
UPS	Uninterrupted Power Supply
WLM	Wind Load in Maintenance Mode
WLO	Wind Load in Operating Mode
WLS	Wind Load in Stored Mode

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 (Part IV).

1.5 SUMMARY OF MAIN CHANGES

This DEP is a minor revision of the DEP of the same number dated September 2010. The following are the main, non-editorial changes.

Section/Clause	Change
Part III, 7.1.1	Made ERS systems described in DEP 31.06.10.20-Gen. applicable for all types of loading arms
Part IV	Added DEP feedback form.

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.

PART II GENERAL

Part III of this DEP is written as amendments and supplements to the Oil Company International Marine Forum (OCIMF) "Design and Construction Specification for Marine Loading Arms", Third Edition 1999, referred to herein as OCIMF. Wherever reference is made to OCIMF, it shall be understood to mean OCIMF as amended/supplemented by this DEP.

For ease of reference, the clause numbering of OCIMF has been used throughout Part III of this DEP.

Clauses of OCIMF not modified by this DEP shall remain valid as written.

All MLAs shall be designed and documented to fulfil the requirements as listed in the amended OCIMF tables contained in (Appendix A). These tables shall be completed by the Principal.

PART III AMENDMENTS/SUPPLEMENTS TO OCIMF

1.0 DESIGN AND CONSTRUCTION STANDARDS AND PRACTICES

Add to this clause:

In case of conflict between the listed standards and codes and OCIMF, the most stringent requirements shall take precedence.

Documents referenced in this DEP are listed in (Part IV).

Ship shore interfacing for liquefied gases shall be designed in accordance with the requirements of ISGOTT latest edition as well as ISO 28460.

2.0 DESIGN DETAILS AND REQUIREMENTS

A jetty design verification shall be executed to ensure that the structural capacity of the jetty is sufficient to withstand all loads implied by the new MLAs.

The Manufacturer shall include the estimated, calculated pressure loss across the MLA in the technical proposal.

3.0 MATERIALS

3.1 *Add to this clause:*

Metallic material selection shall be in accordance with the following DEPs:

- DEP 31.38.01.12-Gen. "Piping classes - Refining and chemicals – Introduction"
- DEP 30.10.02.11-Gen. "Metallic materials – Selected Standards"
- DEP 30.10.02.31-Gen. "Metallic materials- Prevention of brittle fraction"

Hydraulic hoses shall be in accordance with EN 853 / ISO 1436.

When approved by the Principal, cabinets may use GRE/GRP (or alternative).

3.4 *Add to this clause:*

Welding electrodes (consumables) shall be in accordance with standards published by an internationally recognized body.

3.7 *Add to this clause:*

For details, refer to the material specification in (3.1).

3.8 *Replace the last sentence of this clause with:*

"Hose lengths shall be the minimum required for the duty and kept well clear from any mechanical part. Hoses shall only be used if required for the operation of the MLA and not to facilitate installation."

4.0 DESIGN

4.1 General

4.1.1 *Add to this clause:*

Electric control systems and instrumentation for ESD and ERS shall be compliant with the jetty/plant wide selected Instrument Protective System (IPS) safety PLC (Programmable Logic Controller). For standardisation purposes, all components (e.g. instruments) shall be selected from the recommended manufacturer list of the project.

4.1.5 *Add to this clause:*

The operating envelope shall take the ships railing into account.

4.1.6 *Add to this clause:*

The operating envelope drawing shall provide the spotting line (point) for each MLA. In addition, the spotting line (point) for the various connection combinations shall be provided. The connection combinations are specified in OCIMF Table 1.

4.1.9 *Add to this clause:*

When the arm is connected to the dummy manifold, a working area (floor space) of at least 1 m wide all around the ERS unit shall be available. This connection shall be strong enough to withstand the loads imposed by the connected arm in the empty condition, and shall be capable of carrying the weight of the disconnected ERS coupling valve, elbow, flange, etc.

4.1.10 *Replace the last sentence of this clause with:*

Platforms shall provide safe working areas with sufficient space for inspection and maintenance.

Add to this clause:

Platforms that are provided as a means to step over e.g. from one ladder to another ladder shall have a hand and knee rail as well as sufficient harness tie-off points.

All equipment, hydraulic hoses, accessories, storm locks, greasing manifolds, grease extraction points, and instrumentation that need to be operated, visualised, inspected, or removed shall be easily accessible. Consequently, the design shall provide necessary space and access means (e.g. platforms and ladders). Preferably the MLA will be equipped with vertical ladders complete with cages (depending on the space with respect to clashing). If not, ladders shall be provided with adequate provisions for safety belts.

Access provisions such as ladders and platforms shall be included in the scope of the HAZID workshop.

In particular to tall multi-loading arm arrangements, it shall be considered in an early stage of the design to provide the loading arm arrangement with a common elevated maintenance platform.

Add the following new clauses:

4.1.15 External nozzle forces and moment

The Manufacturer shall provide the values of maximum acceptable loads on the riser connection outlet flange.

4.1.16 Welded connections

Piping connections at the battery limit shall be welded, unless approved by the Principal.

4.1.17 Outboard arm envelope

The product contained in the outboard arm after an emergency release shall be drained towards the shore. Therefore, the range of arm movement should allow the outboard arm to be positioned sloping towards the apex swivel.

4.1.18 ESD Fire Proofing

The ESD/2 hydraulic tubing of the outboard arm shall have fire proofing over 50 % of the length of the outboard arm (or 6 meter as a minimum).

4.1.19 Riser ventilation

Sufficient venting of the riser inner space shall be provided.

4.1.20 In-situ maintenance requirements

Provisions for in-situ maintenance / hoisting devices shall be provided for the exchange of swivels / cylinders and other components without the aid of mobile cranes. These may be temporary fitted.

4.1.21 Voids in between counter weights

The voids between the parts shall be wide enough to allow rainwater to drain.

4.1.22 Drain holes

Sufficient drain holes shall be provided to avoid entrapment of rainwater when the MLA is in stored position.

4.1.23 Grout holes

The base plates shall be provided with sufficient 40 mm diameter grout holes to facilitate grouting of the MLA base plate.

4.1.24 Earthing boss

Each arm as well as the HPU shall be provided with an earthing boss (as per standard S68.004). Each hydraulic / electrical instrument cabinet shall be provided with a suitably sized earthing boss.

4.1.25 Anchor bolts

When specified in OCIMF Table 11, anchor bolts shall be provided by the Manufacturer and are subject to approval by the Principal. Load data shall be provided by the Manufacturer.

4.1.26 Lifting lugs

Lug(s) for lifting the entire arm or arm assemblies shall be incorporated in the structure of the arm as a permanent feature.

Main lifting lugs shall be marked (by a different colour). Stress calculations for the lifting lugs shall be carried out and submitted to Principal for approval.

4.1.27 Diameter of cable sheaves

The minimum ratio of sheaf diameter versus cable diameter shall be 20.

4.1.28 Cabinets

Outdoor cabinets shall be weather proof with sloping roofs.

4.1.29 Welds

All welds of pressure containing parts shall be accessible for NDT and visual inspection. The distance between two welds shall be at least 50 mm.

4.1.30 Surface preparation and painting requirements

The MLAs and ancillaries surface preparation and painting requirements shall be in accordance with DEP 30.48.00.31-Gen. All surface preparation and painting (where practical) shall be done at the Manufacturer's site.

4.1.31 Preparation for shipment

Prior to MLA transportation, all flanged openings shall be protected with steel or aluminium plate covers, properly bolted, using gaskets (sealants). All necessary temporary supports shall be provided to prevent any damage during storage and or shipment. All component weights shall be clearly marked on both the component as well as the transport box.

A MLA transportation plan including all aspects (e.g., lifting, transportation and fastening) shall be submitted for approval to the Principal.

4.1.32 Blind flange pressure rating and support

All blind flanges shall be pressure rated similar to the system pressure rating. Consideration shall be given to ensure no trapped pressure in LA or in the section between the lower ball valve of the ERS and the blind flange can remain unnoticed.

A davit or similar system for handling the blind flange for 10 inch loading arms and above shall be considered.

4.1.33 Cold splash protection

Structural members essential for the integrity of the supporting MLA structure near potential sources of LNG leakage shall be provided with cold splash protection. All potential sources of leakage shall be considered; e.g. flanges, swivels, small bore nipples, small bore valves, etc.

4.1.34 Wire mesh

When specified in OCIMF Table 11, the LNG MLAs shall be fitted with wire mesh over the inboard and outboard arms to prevent lumps of ice melting and dropping off the MLAs. Stainless steel crimped wire mesh shall be selected in line with ISO 4783-3.

4.1.35 Purging

For MLAs with cryogenic applications the process pipe shall be purged with Nitrogen. A pressure gauge shall be included to check positive pressure inside the pipe, Manufacturer shall propose a location for the pressure gauge subject to approval the Principal.

4.1.36 Flexible Piggy back Vapour Return Line

If a flexible vapour return hose is used it shall be of a well proven concept and subject to approval by Principal. Manufacturer shall provide a track record of the proven concept.

4.1.37 Earthing bonding and lightning protection

Unless otherwise required (e.g., for stray current protection) each arm shall be rendered electrically continuous for the purposes of discharging static electricity build up and discharging lightning strikes to earth. Electrical continuity shall be achieved by the installation of bonding conductors (flexible if necessary) of sufficient cross sectional area. The earthing bosses on each arm referred to in section 4.1.24 shall serve as the points to connect the arms to the jetty earthing system.

4.2 Stress Analysis

4.2.7 Add to this clause:

The design of the MLA for cryogenic products shall take cryogenic cycling into account.

4.2.8 Add to this clause:

The MLAs shall be designed for extreme conditions, based on 1/100 yr 3 sec gust wind speed (unless stated otherwise) specified in OCIMF Table 10.

The stress calculations shall be applied to all components of the MLA regardless whether they are product carrying or load carrying.

5.0 SWIVELS AND STRUCTURAL BEARINGS

5.1 Add to this clause:

All greasing points shall be connected to greasing manifold(s). The greasing points shall be fitted with button type grease nipples. The greasing manifolds shall be as close as possible to the respective bearings. The greasing system is specified in OCIMF Table 11.

5.5 Add to this clause:

Manufacturer shall demonstrate either by providing operational data of existing operations or prove by simulation testing (prototype) that the swivels are designed to accept vessel manifold movements (see also 12.9 in section 3.2).

Add the following new clauses:

5.7 Design of bearings:

The design of the bearing shall be as per section 5.5 of the OCIMF.

For the cyclic motions the structural bearings shall be designed / selected with a safety factor to failure of at least 4.