DEP SPECIFICATION

10-¾ INCH RISER THREADED CONNECTOR; GAUGING SPECIFICATION/QUALITY PLAN

DEP 37.81.41.41-Gen.

September 2012

ECCN EAR99

DESIGN AND ENGINEERING PRACTICE

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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.

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1. INTRODUCTION

1.1 SCOPE

This new DEP specifies requirements and gives recommendations for gauging of 10-¾ inch Riser Threaded Connectors and shall be used for gauging 10-¾ inch Riser Threaded Connectors when invoked by the Request for Proposal/Quote (RFP/Q), Purchase Order (PO), Approved Drawing and Parts List (AD&PL), Approved for Construction Drawings (AFC drawings) or General Requirements.

In case of contradiction between this document, the RFP/Q or PO, and the AD&PL or AFC drawings, then the AD&PL or AFC drawings shall govern.

This new DEP-Gen. incorporates the content of and supersedes the local Deepwater standard DW Supplement 32 dated May 1998.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

Unless otherwise authorized 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 authorized 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 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 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 authorized to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

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 (10).

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Comments on this DEP may be submitted to the Administrator using the DEP Feedback Form by:

- Entering comments directly in the DEP Feedback System on the Technical Standards Portal http://sww.shell.com/standards (mandatory for users with access to Shell Wide Web);
- Clicking on the DEP Feedback Form button on the DEPs DVD-ROM main page (for users without access to Shell Wide Web);
- Requesting a copy of the DEP Feedback Form from the Administrator at standards@shell.com (for users without access to Shell Wide Web).

For the last two options, the completed DEP Feedback Form can be attached to an email and submitted to the Administrator at standards@shell.com. Only feedback that is entered into the Feedback Form will be considered.

1.6 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.

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2. GENERAL

2.1 QUALITY ASSURANCE/QUALITY CONTROL

This DEP supplements Principal specifications which .govern the overall fabrication of offshore structures and manufacture of marine mechanical equipment. Unless specifically deleted/waived by this DEP, all provisions of the applicable Principal specifications shall apply, including the requirement for development and implementation of a Principal approved Quality Assurance System and Quality Control/Quality Plan.

The Quality Control/Quality Plan shall define all inspections and the sequence in which they are to be performed during production; threading operations and levels of involvement for the Threader, the fabrication of the Contractor's or marine mechanical equipment Manufacturer's personnel, if applicable, third-party inspection personnel and Principal Project Engineering.

Principal approval shall be obtained of the Quality Control/Quality Plan prior to commencement of production threading operations.

2.2 PREPRODUCTION MEETING

A preproduction meeting shall be held between the Threader, Principal Project Engineering, the fabrication Contractor or marine mechanical equipment Manufacturer, if applicable, and any third-party inspection personnel involved.

The purpose of the meeting is to ensure that all parties involved fully understand job requirements and to resolve any outstanding issues prior to commencement of the machining/threading operations.

If the Principal has contracted directly with the Threader for the machining of riser threaded connectors, no involvement by the fabrication Contractor or marine mechanical equipment Manufacturer is required in this meeting.

2.3 CNC MACHINING

All finish machining of thread forms, metal to metal seals, O-ring grooves and torque shoulders, shall be accomplished with computer numeric control (CNC) machines.

2.4 PREPRODUCTION FUNCTIONAL (MAKE/BREAK) TEST

Unless otherwise allowed by Principal Project Engineering, a preproduction functional (Make/Break) test shall be performed on the first pin and box which meets all AFC·drawing requirements, including phosphate-conversion coating, for every order on each NC machine unless machines are controlled by the same CNC program.

The functional test shall consist of 3 make/breaks to a total torque range of 51,521 Nm to 88,128 Nm (38,000 ft-lbs to 65,000 ft-lbs) for a standard OD connector and 59,384 Nm to 95,991 Nm (43,800 ft-lbs to 70,800 ft-lbs) for an Intermediate Stress Joint Connector and shall be witnessed by the third-party Inspector as a minimum.

The connector shall shoulder in the torque range of 19,659 Nm to 56,266 Nm (14,500 ft-lbs to 41,500 ft-lbs) for standard OD and 19,659 Nm to 56,266 Nm (14,500 ft-lbs to 41,500 ft-lbs) for the Intermediate Stress Joint Connector.

The torque after shoulder shall be controlled to 31,862 Nm to 40,132 Nm (23,500 ft-lbs to 29,600 ft-lbs) for standard OD and 39,725 Nm to 44,606 Nm (29,300 ft-lbs - 32,900 ft-lbs) for the intermediate Stress Joint Connector.

Thread compound for the make-ups shall be Principal-approved. Make/break results shall be recorded on torque versus turn (1/100th turn resolution or better) or torque versus time plots.

Principal Project Engineering shall approve preproduction functional (Make/Break) test results prior to commencement of full scale machining/threading.

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3. GAUGE CALIBRATION

Each Principal-supplied gauge shall be calibrated by Gagemaker, Houston, Texas (or approved equivalent) at least once per every 500 components gauged, every 2 years, or at such time that the gauge has been dropped or deemed non-functional by the third-party or Principal project engineering.

Gagemaker (or approved equivalent) shall provide a "Certificate of Calibration" to the Principal for each gauge.

The Principal will pay for this gauge calibration at the once per 500 frequency. However, additional or more frequent gauge calibration and calibration of Threader-supplied gauges shall be the Threader's responsibility.

4. GAUGING INSTRUCTIONS AND GAUGING SEQUENCE

4.1 PRINCIPAL SUPPLIED GAUGES AND INSTRUCTIONS

The Gauge Instructions (Appendix A) to this DEP contains detailed instructions for use of Principal-supplied gauges and a "truth" table computer program (TOLCAL4). In addition, a gauging sequence is specified, which shall be adhered to. See Table 2 of Gauge Instruction (Appendix A.2.1).

4.2 COORDINATE MEASURING MACHINES (CMM)

As an alternative to conventional type gauges, coordinate measuring machines (CMM) may be utilized by the Threader, subject to Principal approval, to measure diameters, lengths, radii, etc., that are not covered by the Principal's gauges but are toleranced on the prints.

4.3 OVERLAYS AND TEMPLATES

Overlays and templates generated by the Threader shall approved by the Principal.

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5. INSPECTION QUALITY PLAN FOR TLP RISER THREADED CONNECTORS

5.1 INSPECTION QUALITY·PLAN FOR THREADS

Table 1 gives the Principal's minimum requirements for an Inspection Quality Plan for Riser Threaded Connectors.

Table 1 Inspection quality plan for riser threaded connectors

Thread Element	Gage/Specification	Frequency of Inspection By Threader (%)	Level of Surveillance By Third Party Inspector (%)
Make Ready/Set Up			
Drawing/Rev Verification	Principal AFC Drawing	100	100
Gage Calibration Verification			100
First Article/Last Article (NOTE 3)		100	100
Threading Insert Inspection	Product Drawing	100	Audit
Pin-Production Line Inspection			
Outer Metal Seal Diameter	SSD-7000-P	100	Audit
Shoulder Length	STS-4000-P	100	Audit
Inner Metal Seal Diameter	SPN-3002-P	100	Audit
Load-Redirection Groove Diameter	SGD-2001-P	100	Audit
"O" Ring Groove Diameter	SRD-7000-P	100	Audit
"O" Ring Groove Width	Roll Pins	100	Audit
Small Pitch Diameter	SFP-5002-P	100	Audit
Large Pitch Diameter	SRP-5002-P	100	Audit
Taper (Calculated)		100	Audit
Lead (1 inch)	SLG-5000-PB	100	Audit
Thread Height	STH-3000-PB	100	Audit
Thread Profile	SPG-1000-PB	100	Audit
Other Drawing Lengths	Scale, calipers, mic's	10	Audit
Other Drawing Diameters	OD/ID Micrometers	10	Audit
Other Drawing Radii	Templates / Radius gage	10	Audit
Visual	Principal AFC Drawing	100	Audit
Visual Surface Finish	Surface Comparator	100	Audit
Visual Chatter	Electronic Measure	NOTE 1	Audit
Component Identification	Principal AFC Drawing	100	Audit
Weld Bevel	Go/No-Go Gage	100	Audit
Circular Runout	Principal AFC Drawing	100	Audit
Total Runout	Principal AFC Drawing	100	Audit

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Thread Element	Gage/Specification	Frequency of Inspection By Threader (%)	Level of Surveillance By Third Party Inspector (%)
Box-Production Line Inspection			
Box Nose Radius	SNR-1000-B	100	Audit
Outer Metal Seal Diameter	SPN-3002-B	100	Audit
Load-Redirection Groove Diameter	SGD-7000-B	100	Audit
Inner Metal Seal Diameter	SSD-2001-B	100	Audit
Large Pitch Diameter	SFP-5002-B	100	Audit
Small Pitch Diameter	SRP-5002-B	100	Audit
Taper (Calculated)		100	Audit
Lead (1 inch)	SLG-5000-PB	100	Audit
Thread Height	STH-3000-PB	100	Audit
Thread Profile	SPG-1000-PB	100	Audit
Other Drawing Lengths	Scale, calipers, mic's	10	Audit
Other Drawing Diameters	OD/ID Micrometers	10	Audit
Other Drawing Radii	Templates / Radius gage	100	Audit
Visual	Principal AFC Drawing	100	Audit
Visual Surface Finish	Surface Comparator	100	Audit
Visual Chatter	Electronic Measure	NOTE 1	Audit
Component Identification	Principal AFC Drawing	100	Audit
Depth of Box	Principal AFC Drawing	10	Audit
Weld Bevel	Go/No-Go Gage	100	Audit
Circular Runout	Principal AFC Drawing	100	Audit
Total Runout	Principal AFC Drawing	100	Audit
Post-Threading Inspection			
Wet MT	NOTE 2		
Surface Treatment	Principal AFC Drawing		
Data Package Review/Approval	PO		
Packaging/Crating	(Submit written procedure for Principal approval)		

NOTE 1: As warranted based on visual inspection. No visible or detectable chatter allowed on metal to metal seals. Other surfaces, reject if chatter is detectable with .5 mm (.02 in) pencil lead.

NOTE 2: Refer to Attachment 9 of Shell Offshore, Inc. "TLP Marine Equipment Quality Assurance Specification".

NOTE 3: 100% witness and First Articles shall be performed on all tensioner, stress and transition joints.

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5.2 WELD BEVEL AND WELD-NECK LENGTH

Weld Bevel land height, radius, bevel angle and offset and weld neck length shall be verified to be in compliance with AFC drawing requirements on each component. The Principal provides GO/NO-GO gauges. The Supplier should provide mylar overlays for first article/last article verification.

5.3 OD TRANSITION PROFILES AND RUNNING TOOL GROOVES (IF APPLICABLE)

For OD transition profiles and running 'tool grooves, if applicable, the Threader shall verify FA/LA by one of the following, casting (mold), template or (with Principal approval) verify the NC program for those characteristics.

5.4 OVERALL CONNECTOR LENGTH

Threading Manufacturer is responsible for ensuring overall connector length and shall gauge this feature consistent with Table 1 (5.1).

5.5 INSIDE DIAMETER/OUTSIDE DIAMETER

Inside diameter (ID) shall be measured as required by the third-party inspector to verify compliance with AFC drawing requirements.

Threading Manufacturer shall be responsible for ensuring inside diameter (ID) and outside (OD) meet AFC drawing requirements and shall be gauged consistent with Table 1 (5.1).

5.6 RUNOUTS

Circular runouts (↗) and total runouts (↗↗) shall be measured consistent with AFC drawings and Table 1 (5.1).

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6. FIRST ARTICLE/LAST ARTICLE INSPECTION

6.1 PURPOSE AND OBJECTIVE

The objective of a first article (FA) inspection is to demonstrate that the CNC program and machining/threading set-up results in components having a thread form which meets AFC drawing requirements and "nominal" metal to metal seal, "O" ring groove (pin), load redirection groove and torque shoulder geometry. In addition, OD transition, Running Tool Groove, if applicable, and weld bevel geometry shall be confirmed. Usage of the term "nominal" in this context refers to the relationship of dimensions whose machining should logically be controlled by the CNC program, not by machine operator offsets.

The objective of a last article (LA) inspection is to demonstrate that the machine/threading set up has continued to produce components which meet AFC drawing requirements throughout the subject threading lot.

6.2 REQUIREMENTS

Components used for FA/LA inspection shall meet all component gauging and visual inspection requirements; except that thread pitch diameters, metal seal diameters, OD transition profile and Running Tool Groove diameters may be out by an additional 50% beyond AFC drawing tolerance. Even though a component, which is out of tolerance as stated above, can be used to satisfy FA/LA inspection requirements, such out of tolerance components shall not be used to satisfy PO requirements. Thread gauge and visual inspection results of the pin and box used for FA/LA shall be recorded and traceable to the actual part used for FA/LA.

FA/LA inspection shall include geometric evaluation of "O" ring groove (pin) and load redirection grooves, thread form, metal seal, torque shoulder and weld bevel geometry, OD Transition profiles and, if applicable, running tool groove.

Set the Lead gauge to read over a 25.4 mm (1 in) interval. 25.4 mm (1 in) lead shall be inspected by checking the lead on each thread pitch for the entire thread length. Next, measure cumulative (overall) lead by setting the lead gauge to read over a 101.6 mm (4 in) thread interval. Two cumulative (overall) lead measurements shall be made to cover the entire thread length. Some overlap may take place. Record the two 101.6 mm (4 in) cumulative (overall) lead measurements in TOLCAL4 as prompted.

The Threader shall have written procedures detailing the specific processes required to perform a FA/LA inspection (e.g., inspection, use of a contour reader, procedure for taking castings and use of "mylar" overlays). The written procedures shall require Principal approval.

Actual component metal seal, torque shoulder, thread form, load redirection groove, and "O" ring groove may be either traced using a contour tracing machine or replicated with a casting (mold) and then contour traced or replicated with a casting (mold) and used with an optical comparator or shadow graph, at the option of the Threader. In cases where castings are utilized, the casting compound shall be Ostalloy® Number 136 or Principal approved equivalent casting material.

Magnification of contour reader tracings or optical comparator shall be as required by AFC drawings for connector overlays for threads, metal seal, torque shoulder, load redirection groove and "O" ring groove geometries, (typically 10X and 20X capability minimum).

The Principal shall supply "mylar" transparent overlays for use in evaluation of FA/LA, tracings or castings, for component metal seal, torque shoulder, thread form, load redirection groove and "O" ring groove.

A machine is approved for production after the third party inspector or Principal Project Engineering approves the FA inspection. When an acceptable FA inspection has been obtained, the machine operator shall not independently change any critical machine settings except feeds and speeds. Lock out features on CNC machines shall be implemented.

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A failed LA inspection shall require locating the last pin or box as applicable, which meets AFC drawing requirements, except as noted in (6.2). This may be accomplished by working backward in lots of 10 pins or boxes and evaluating every 10th component until an acceptable component is located. Pins or boxes machined/threaded after a failed LA inspection shall be treated as separate thread lots.

6.3 FREQUENCY

An FA and LA inspection shall be performed on the first and last article machined/threaded in each thread lot for each machine. When machining or threading 10 or fewer threads, only an FA inspection is required. A thread lot consists of all components machined/threaded on a given machine during a continuous production cycle that is not interrupted by a “wreck”. ·A “wreck” is defined as a catastrophic tool failure injurious machine malfunction tool holder change or any other malfunction of machining/threading equipment or inspection equipment. Change of rough boring bars, worn tools or minor tool breakage shall not be considered a “'wreck”'.

An FA inspection shall be performed on the first pin and box, which meet the requirements of (6.2). Pins or boxes machined/threaded prior to their respective successful FA inspection shall not be used to fulfill PO requirements. If the FA inspection fails, see (6.2). An FA inspection shall be performed on all tensioner, stress and transition joints.

An LA inspection shall be performed on one of the last 10 pins and boxes of a thread lot. If the LA inspection fails, see (6.2).

7. REPAIRS

There shall be no repairs made to any finished machined surface of components without the approval of the third party inspector or Principal Project Engineering.

8. DOCUMENTATION

8.1 SERIAL NUMBER

All recorded gauging results shall be traceable to the component, which they represent, and to its unique material serial number.

8.2 FA/LA COMPONENTS

All FA and LA gauging results shall be included in the Documentation package for each thread lot.

8.3 ALL OTHER COMPONENTS

For all other components in a thread lot, other than FA/LA components, computer files generated by TOLCAL4 gauging software shall fulfill documentation requirements.

9. NON·CONFORMANCES

The expectation is that there will be no need for any connectors to be offered to the Principal on a waiver. However, should there be a need, waivers shall be approved or accepted by Principal Project Engineering in order to be applied to the contract.

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10. REFERENCES

In this DEP, reference is made to the following publications:

NOTES:
1. Unless specifically designated by date, the latest edition of each publication shall be used, together with any amendments/supplements/revisions thereto.
2. The DEPs and most referenced external standards are available to Shell staff on the SWW (Shell Wide Web) at http://sww.shell.com/standards/.

SHELL STANDARDS

TLP Marine Equipment Quality Assurance Specification, Attachment 9 of Shell Offshore, Inc.	Shell Offshore, Inc.

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APPENDIX A GAUGE INSTRUCTIONS

A.1 TOCAL4 INSTRUCTIONS

The gauge package for the riser threaded connector consists of the Principal-supplied gauges, some of which are mechanical ring and plug (MRP) gauges, a portable laptop computer and a computerized "Truth" table program. The "Truth" table program is based on interrelationships of connector attributes and allows additional deviation from nominal dimensions beyond tolerances given on AFC drawings. The "Truth" table is based on AFC drawing tolerances and the sequential gauge readings. The gauging sequence is specified in this (Appendix A.2.1) and shall be adhered to.

A computer program called TOLCAL4, is used to implement the "Truth" table. TOLQAL4 prompts the user for gauge readings in the correct sequence and calculates the allowable tolerances for subsequent gauge dimensions. The "Truth" table program is executed as follows:

1. For DOS computers, type "TOLCAL4" at the DOS prompt while in the directory that TOLCAL4 is located. For Windows, double click on the TOLCAL4.EXE file. Shortcuts or Icons can be set up for Windows.
2. The gauge readings shall be stored in files in the directory in which TOLCAL4 was run.
3. The program will prompt the user for, the date, time and the inspector's name.
4. The program then asks the user if he wants to continue from a previous test. Enter "Y" to read previous data or "N" to continue.
5. If continuing from a previous set of readings, the program then asks for the name of the file (without extension) that contains the previous data. This file has been stored during a previous execution and has the extension ".RES".
6. If data is not being read from a previous execution, the program will ask for the data file which contains the thread form characteristics, type "10TCALR1.DAT and press "enter". The 10TCALR1.DAT file contains the thread tolerances and diameters the program uses to perform calculations. By opening up or viewing the 10TCALR1.DAT file, the print series that are referenced for the Ø 10 3/4 threaded connector can be viewed.
7. The program will ask for a 1 to 8 character file name. This file name will be used for the output data files. A new file name shall be used for each execution.

NOTE: Two data files are stored each time the program is run. A third file is stored if an output file is requested (Step 9 below). The files stored are:

chkl.EKO	Contains all information displayed on the computer screen during execution of the program.
chkl.OUT	Contains a summary of all gauge readings which have been input during the session.
chkl.SUM	Contains a summary of the average of all readings entered for each gauge for all connectors gauged during the session. This information may be used for statistical evaluation of the threading process.

"chkl" is the 1 to 8 character file name entered in this step (Step 8).

8. The program will ask if an output file is desired. Enter either "Y" or "N". Y or N must be upper case.
9. Input data as requested by the program. All questions requiring an Y or N answer must be uppercase.
10. After the first gauge reading has been entered for the box or the first two gauge readings have been entered for the pin, the user may enter subsequent gauge

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