

DEP SPECIFICATION

TOP TENSION RISER TENSIONING SYSTEMS

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DESIGN AND ENGINEERING PRACTICE



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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	CROSS-REFERENCES	5
1.5	COMMENTS ON THIS DEP	5
2.	INTRODUCTION	6
2.1	TENSIONER OVERVIEW.....	6
3.0	QUALITY AND INSPECTION	7
4.0	MATERIALS AND FABRICATION	7
4.1	CYLINDERS	7
4.2	LOW PRESSURE ACCUMULATORS.....	10
4.3	SHACKLES.....	10
4.4	STRUCTURAL.....	10
4.5	CENTRALIZERS.....	11
4.6	FASTENERS	11
4.7	ACCUMULATORS.....	12
4.8	PIPING, INSTRUMENTATION AND CONTROLS	12
5.0	DESIGN AND ENGINEERING	15
5.1	SPECIFICATIONS	15
5.2	HUMAN FACTORS ENGINEERING	15
5.3	CALCULATIONS AND ANALYSIS	15
6.0	TENSIONER DESIGN REQUIREMENTS	16
6.1	ENVIRONMENTAL CONDITIONS	16
6.2	PRODUCTION AND DRILLING RISER TENSIONER OPERATING MODES.....	16
6.3	TENSIONER LOAD, MOTION AND STIFFNESS REQUIREMENTS	16
6.4	TENSIONER FAILURE MODE CHECKS.....	16
6.5	MAXIMUM ALLOWABLE WORKING PRESSURE	17
7.0	FIT-UP AND TESTING REQUIREMENTS.....	17
8.0	DOCUMENTATION AND REPORTS.....	18
8.1	SPECIFIC DOCUMENTATION REQUIREMENTS	18
8.2	DESIGN BASIS DOCUMENT	18
8.3	DESIGN REPORT	18
8.4	WEIGHT REPORT.....	18
8.5	MANUFACTURING DATABOOKS	18
8.6	TECHNICAL SERVICE AND MAINTENANCE MANUAL.....	18
9.0	PACKAGING, MARKING AND SHIPPING.....	19
10.0	CERTIFICATION VERIFICATION.....	19
11.0.	REFERENCES	20

1. INTRODUCTION

1.1 SCOPE

This new DEP specifies minimum requirements and gives recommendations for the manufacture, testing and inspection of tensioning systems for use in offshore applications. Tensioners governed by this DEP are identified in the RFQ documents.

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.

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. Application in other facilities may also apply.

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 may 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 regard 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

Term	Definition
AFC	Approved For Construction
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
AWS	American Welding Society
Principal	Shell
CVA	Certified Verification Agent
DEP	Design and Engineering Practice

Term	Definition
FEA	Finite Element Analysis
ID	Inside Diameter
ISO	International Standards Organisation
NDT	Non Destructive Testing
OD	Outside Diameter
Tensioner	Production Drilling Riser Tensioner
TLP	Tension Leg Platform
RFQ	Request For Quotation

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 (11).

1.5 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.

2. INTRODUCTION

2.1 TENSIONER OVERVIEW

Each tensioner shall be an independent, self-contained, tensioning system designed to dynamically support a production riser on the TLP over the producing life of the field or a drilling riser over a limited period of time.

The specific type of required tensioner and functional description shall be specified in the scope of work.

Important considerations figuring into the measurement of a fit for purpose tensioner include:

Safety: a foremost design consideration

Cost: critical consideration in project delivery

Reliability: a prime consideration is minimizing the tensioner maintenance burden. Contractor shall identify maintenance requirements and explore options for reducing the maintenance burden associated with the tensioner.

Installation: to facilitate installation and prevent contamination of tensioner fluids and gas, the tensioner design should allow installation with minimal installation and assembly.

Serviceability: The tensioner is an active mechanical system and may require periodic maintenance and occasional repair. Therefore, all serviceable items shall be identified, readily accessible and equipped with lifting/handling appurtenances.

A tensioner system will contain many parts. There are two separate designations of parts categorized. One set of parts are those parts designated in the load path and the other is those parts not in the load path.

Parts in the load path are known to be, but not limited to:

- Cylinders including all parts and associated interface items; Shackles, rod eyes and any other connection parts.
- Centralizers – Lower and upper centralizers

Parts not in the load path are, but not limited to:

- Accumulators – High and low pressure and associated attachment brackets
- Control Panels

This document specifies the minimal functional, material and quality requirements to ensure the tensioner system is fit for the service.

3.0 QUALITY AND INSPECTION

Quality and inspection shall be in accordance with DEP 37.81.21.35-Gen. and project specific requirements.

4.0 MATERIALS AND FABRICATION

4.1 CYLINDERS

The cylinders shall withstand the loading and environmental conditions presented in the work specification. Contractor shall note the governing design condition in the Contractors Design Basis. The Contractor shall submit documentation with supporting calculations verifying that the cylinder design requirements are met with the proposal.

The Contractor shall calculate cylinder expansion and seal extrusion gap for representative pressures up to and including the maximum operating pressure and for piston positions corresponding to the strokes required during the various operating modes. The range of required strokes is provided in the work specification.

The Contractor shall calculate side loads under normal and design conditions and Contractor shall demonstrate that the rod and piston bearing surfaces are adequate under the conditions presented in the work specification.

Performance curves and geometrical interferences shall be submitted in the proposal to insure the Principal that the cylinders are sized adequately in the upstroke position at the most onerous rotation angle specified in the work specification.

Both the piston and the lower head should be liberally proportioned to resist lateral loads/moments imposed by end connection moments, local bending loads and partial system failure. Wear components shall be selected to maximize service intervals.

The cylinder shall be designed to "bottom out" in both the retracted and extended positions for the worst case load as specified in the work specification. Hydraulic cushioning or velocity control devices shall be provided to slow the rod as the piston approaches either end of the barrel.

Seal selection shall include consideration of the following factors: friction, lubrication, operating pressure, surface condition and finish, cycle amplitude and frequency, expected service life and contaminant size and type.

The Contractor shall provide fluid level monitoring for the hydraulic fluid on the low pressure side of the cylinder indirectly through a site glass attached directly to the low pressure accumulator where possible.

Wear components shall be selected to maximize service intervals. Seal selection shall include consideration of the following factors: friction, seal life, lubrication, operating pressures, surface condition and finish, cycle amplitude and frequency and contaminant size and type. The seal friction as a function of service pressure should be provided to the Principal by the Contractor for riser and tensioner coupled response analysis prior to first design review. The Contractor shall provide an early estimate of seal friction for riser system design purposes.

Hydraulic fluid shall be as specified in the work specification.

Other measures such as redundant seals, monitoring ports between seals, external boots, and fluid level monitoring, etc., which may improve system reliability, shall be considered.

The cylinder end connections shall be designed to accommodate riser inclinations and twist to facilitate servicing or change-out of any cylinder/accumulator set while the tensioner is in operation.

The parts of a cylinder are considered critical as they are in the direct load path. The materials and specifications specified shall provide fit for service quality and corrosion protection for the design life.