

Subsea Umbilical Termination (SUT) Design Recommendations

API TECHNICAL REPORT 17TR10
FIRST EDITION, DECEMBER 2015



AMERICAN PETROLEUM INSTITUTE

Special Notes

API publications necessarily address problems of a general nature. With respect to particular circumstances, local, state, and federal laws and regulations should be reviewed.

Neither API nor any of API's employees, subcontractors, consultants, committees, or other assignees make any warranty or representation, either express or implied, with respect to the accuracy, completeness, or usefulness of the information contained herein, or assume any liability or responsibility for any use, or the results of such use, of any information or process disclosed in this publication. Neither API nor any of API's employees, subcontractors, consultants, or other assignees represent that use of this publication would not infringe upon privately owned rights.

API publications may be used by anyone desiring to do so. Every effort has been made by the Institute to assure the accuracy and reliability of the data contained in them; however, the Institute makes no representation, warranty, or guarantee in connection with this publication and hereby expressly disclaims any liability or responsibility for loss or damage resulting from its use or for the violation of any authorities having jurisdiction with which this publication may conflict.

API publications are published to facilitate the broad availability of proven, sound engineering and operating practices. These publications are not intended to obviate the need for applying sound engineering judgment regarding when and where these publications should be utilized. The formulation and publication of API publications is not intended in any way to inhibit anyone from using any other practices.

Any manufacturer marking equipment or materials in conformance with the marking requirements of an API standard is solely responsible for complying with all the applicable requirements of that standard. API does not represent, warrant, or guarantee that such products do in fact conform to the applicable API standard.

Classified areas may vary depending on the location, conditions, equipment, and substances involved in any given situation. Users of this Technical Report should consult with the appropriate authorities having jurisdiction.

Users of this Technical Report should not rely exclusively on the information contained in this document. Sound business, scientific, engineering, and safety judgment should be used in employing the information contained herein.

Copyright reserved. No part of this work may be reproduced, translated, stored in a retrieval system, or transmitted by any means, electronic, mechanical, photocopying, recording, or otherwise, without prior written permission from the publisher. Contact the Publisher, API Publishing Services, 1220 L Street, NW, Washington, DC 20005.

Foreword

Nothing contained in any API publication is to be construed as granting any right, by implication or otherwise, for the manufacture, sale, or use of any method, apparatus, or product covered by letters patent. Neither should anything contained in the publication be construed as insuring anyone against liability for infringement of letters patent.

Shall: As used in a standard, “shall” denotes a minimum requirement in order to conform to the specification.

Should: As used in a standard, “should” denotes a recommendation or that which is advised but not required in order to conform to the specification.

This document was produced under API standardization procedures that ensure appropriate notification and participation in the developmental process and is designated as an API standard. Questions concerning the interpretation of the content of this publication or comments and questions concerning the procedures under which this publication was developed should be directed in writing to the Director of Standards, American Petroleum Institute, 1220 L Street, NW, Washington, DC 20005. Requests for permission to reproduce or translate all or any part of the material published herein should also be addressed to the director.

Suggested revisions are invited and should be submitted to the Standards Department, API, 1220 L Street, NW, Washington, DC 20005, standards@api.org.

Currently in preview, click buy full version

Contents

	Page
1 Scope	1
2 References	1
3 Terms, Definitions, and Abbreviations	1
3.1 Terms and Definitions	1
3.2 Abbreviations	7
4 UTA Configuration	8
4.1 General	8
4.2 Mechanical Considerations	8
4.3 Controls Services	10
4.4 Controls Components	12
5 Structural Design Requirements	15
5.1 UTA Structural Design Basis	15
5.2 Loads and Load Combinations	16
5.3 Umbilical Equipment Considerations	17
5.4 Structural Design Features	18
5.5 Structural Design Considerations	19
6 Geometry	20
6.1 General	20
6.2 UTA Categories	20
6.3 Current UTA Convention	21
6.4 Umbilical Interface	23
6.5 UTA Functionality	23
6.6 Subsea Structure Layout	24
6.7 Installation Equipment	24
6.8 Manufacture/Assemble/Test	24
6.9 Subsea Operability (Onward Connections)	24
6.10 Mounting/Installation Subsea	24
6.11 Interfaces	25
7 Hoses and Tubing	27
7.1 Thermoplastic Hoses	27
7.2 Steel Tubing	28
8 Electrical/Optical Design Requirements	29
8.1 Electrical Connectors	29
8.2 Optical Connectors	29
8.3 Cable Termination	30
8.4 Oil-filled Boxes/Junction Boxes	30
8.5 Cable Management	30
8.6 Mounting—Connectors	31
9 Installers' Handling Requirements	31
9.1 General	31
9.2 Storage Systems and Load Out	31
9.3 Installers' Transport and Storage Systems	31
9.4 Laying Systems	34
9.5 Loadout and Transport	39
9.6 Packing	40

Contents

	Page
9.7 Installation Sequence and Considerations	40
9.8 Handling Requirements for Structures	40
9.9 Lifting and Handling	41
9.10 Installation Aids	48
9.11 Bend Restrictors and Bend Stiffeners	49
Appendix A (informative) Responsibility Matrix	50
Bibliography	52
Figures	
1 SUT Illustration	7
2 Indirect and Direct Cable Terminations	13
3 Closed Tensioner Opening	21
4 Geometric Sketch of Five Faces of the UTA	22
5 SUT Illustration	25
6 Umbilical Reel Packing	32
7 Umbilical Vertical Carousel Packing	33
8 Umbilical Basket Carousel Packing	33
9 Umbilical Under Deck Carousel	34
10 Horizontal Tensioner and Over Boarding System	35
11 Horizontal Tensioner and Over Boarding System	35
12 Horizontal Tensioner with Vertical Over Boarding System (May also be through a Moon Pool)	36
13 Closed Vertical Lay System	36
14 Closed Vertical Lay System Showing Tensioner Opening	37
15 Illustration of Open Vertical Lay System (VLS)	37
16 Side View of Open Vertical Lay System (VLS)	38
17 Open Vertical Lay System	38
18 Rigid Pipelay Vessels	39
19 Below Deck Storage (with Vertical Lay System)	40
20 Transfer of UTS Over Gutter in VLS Tensioners	41
21 Closed Tensioner System—maximum Cross Section Opening	41
22 Second End UTA Transfer and Hang-off in VLS System	42
23 Second End UTA lowering Through VLS—Landing at Deck Level	43
24 Height Restrictions for Typical Closed VLS Systems	44
25 Closed for Use Tensioner Mode	45
26 Open for Production Tensioner Mode	45
27 UTA Deployment Clear of Open Tensioner VLS System	46
28 Locating Umbilical into Open Tensioner System While Taking UTA Weight	46
29 Open Tensioner Now Closed for UTA Deployment	47
30 Deck Handling and Transfer of Umbilical Catenary with UTA	48
Tables	
1 Height Restrictions	43

Currently in preview, click buy full version

0 Introduction

General

This document was generated, by means of the UMSIRE Joint Industry Project (JIP) in response to the increasing difficulties in installation of high-functionality Subsea Umbilical Terminations (SUTs), due to their increasing size. The JIP committee comprised a representative cross section of experienced industry personnel from engineering, installation and operational organizations.

Whilst there are universally accepted standards for the design of an SUT and its sub-systems, none of these standards specifically address the subject of the risks of installation, and the measures required to minimize these risks.

The UMSIRE deliverables are two API documents, 17TR9, *Subsea Umbilical Termination (SUT) Selection and Sizing Recommendations* (under development) and 17TR10, *Subsea Umbilical Termination (SUT) Design Recommendations*.

This document is intended to be used as a reference guide by operators, UTA and umbilical specifiers, installers and FEED companies. It is also intended to be used as a reference document to enable reviews to be undertaken to ensure that installation risk has been properly considered as part of SUT design and operation reviews.

Additionally, the document has been designed to be educational such that persons new to the industry, or, less experienced persons within the industry, can understand the implications of UTA design on installation feasibility.

The intent with describing these project stages (see Figure 0.1) is to clarify when within the umbilical project timeline each UMSIRE document should be referenced, and the interested parties that should be involved in discussions during each stage.

Use of the Document

The users of these Design Recommendation TRs are primarily intended to be operators, SUT designers, and FEED companies. Umbilical system design and manufacturing roles and responsibilities are defined in Annex A.

Applicability

Figure 0.2 and Figure 0.3 are pictorial examples of the equipment covered by this TR.

This Design TR aims at capturing the primary aspects impacting on the overall dimensions and weight of the UTA, and highlighting the consequences of design choices.

This document excludes multibore hub connection-type (MHC) UTAs which can connect the umbilical directly to other subsea hardware. Although MHC UTAs are out of scope, many of the guidelines in this document would apply.

Designers should be aware that integration of multiple distribution outlets leads to a significant increase in size and therefore weight of the UTA. For the purpose of reducing the size and weight of the UTA, this document discourages the use of multiple distribution outlets wherever possible.

It is, however, acknowledged that having a separate Subsea Distribution Unit (SDU) may have an impact on the overall cost. This decision should be made with consideration for the limiting dimension and weight of the UTA.

The document has an educational purpose and is intended to be descriptive rather than prescriptive.

It is important to note that none of the following sections should be read in isolation.

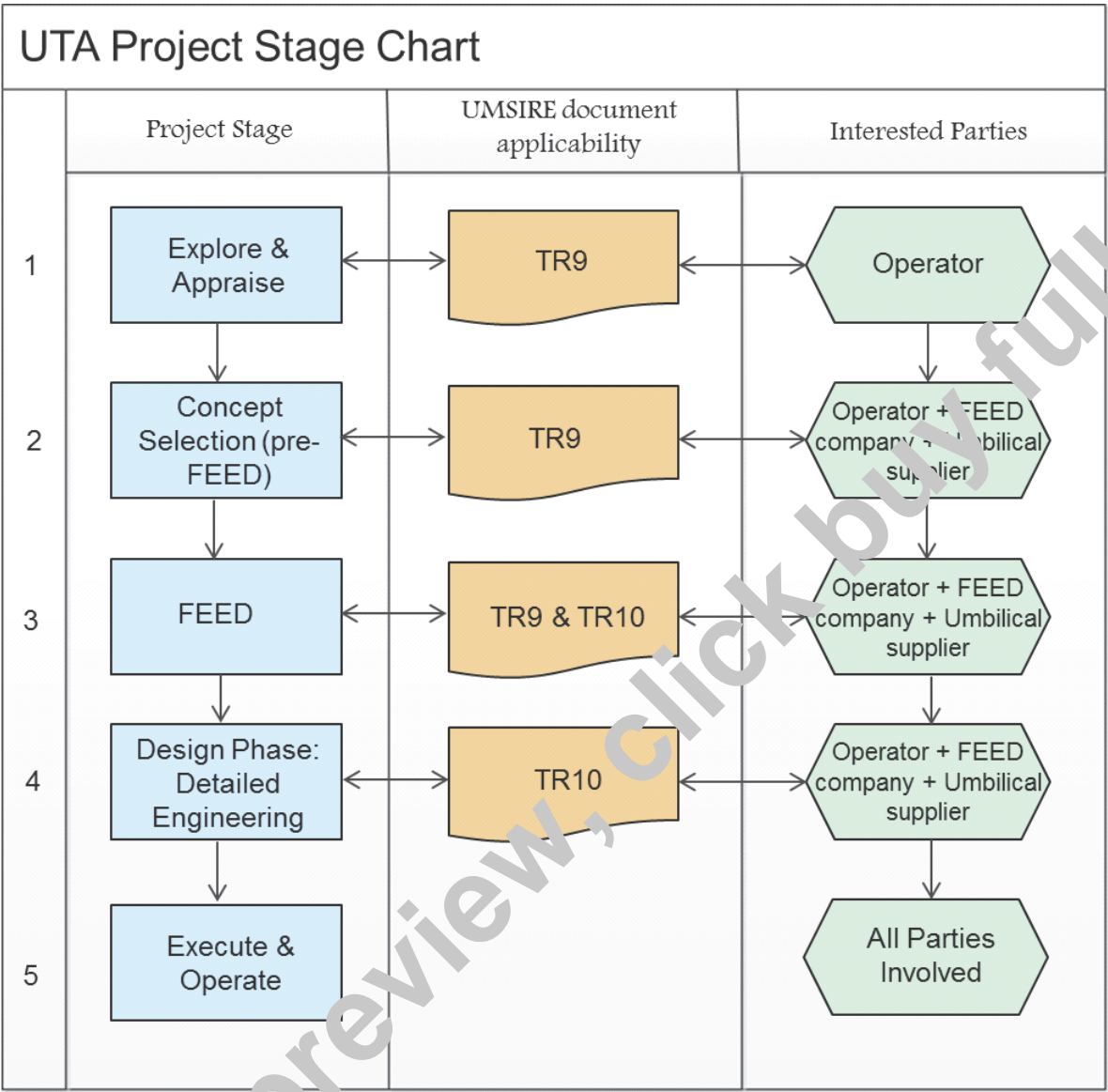


Figure 0.1—Project Stage Chart

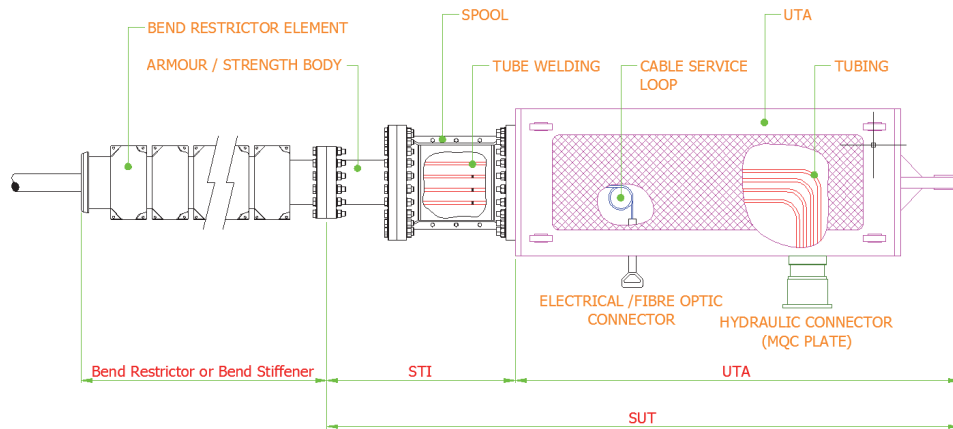


Figure 0.2—Steel Tube Umbilical or Thermoplastic Umbilical with Spool

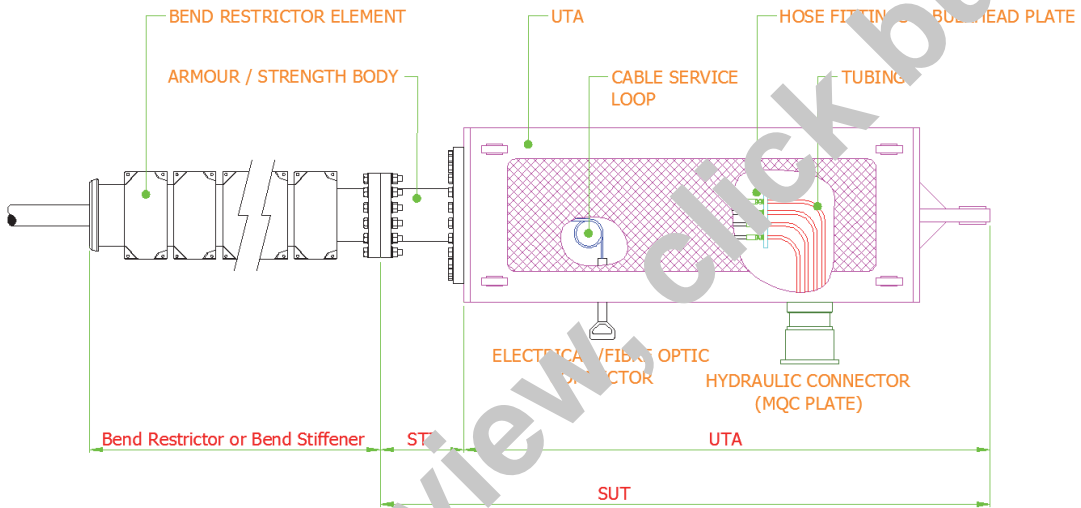


Figure 0.3—Thermoplastic Umbilical

Subsea Umbilical Termination (SUT) Design Recommendations

1 Scope

This document aims to provide best practice technical guidance for SUT design, in order to aid in making informed choices during the design phase.

This document is intended to be read in conjunction with API 17TR9 (under development), which highlights technical and commercial risks associated with high functionality umbilical terminations, the implications of decisions made early in the umbilical and SUT planning, selection and design phases, and provides guidance on specification and sizing of SUTs.

2 References

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

API Recommended Practice 17A, *Design and Operation of Subsea Production Systems—General Requirements and Recommendations*

API Specification 17D, *Design and Operation of Subsea Production Systems - Subsea Wellhead and Tree Equipment*

API Specification 17E, *Specification for Subsea Umbilicals*

API Specification 17F, *Specification for Subsea Production Control Systems*

API Recommended Practice 17H, *Remotely Operated Vehicle (ROV) Interfaces for Subsea Production Systems*

API Recommended Practice 17P, *Design and Operation of Subsea Production Systems - Subsea Structures and Manifolds*

ASME B31.3 ¹, *Process Piping Guide*

ASME B16.5, *Pipe Flanges and Flanged Fittings, NPS 1/2 through NPS 24 Metric/Inch Standard*

ASME B16.47, *Large Diameter Steel Flanges, NPS 26 through NPS 60 Metric/Inch Standard*

DNV RP B401 ², *Cathodic Protection Design*

DNV RP F112, *Design of Duplex Stainless Steel Subsea Equipment Exposed to Cathodic Protection*

DNV RP H103 or DNV VMO (DNV-OS-H101 to H206), *Modeling and Analysis of Marine Operations*

3 Terms, Definitions, and Abbreviations

3.1 Terms and Definitions

For the purposes of this document, the following terms and definitions apply.

¹ ASME International, Two Park Avenue, New York, New York 10016-5990, www.asme.org.

² Det Norske Veritas, Veritasveien 1, 1322, Hovik, Oslo, Norway, www.dnv.com.