OFFSHORE SERVICE SPECIFICATION
DNV-OSS-301

CERTIFICATION AND VERIFICATION OF PIPELINES

OCTOBER 2000

DET NORSKE VERITAS

FOREWORD

DET NORSKE VERITAS (DNV) is an autonomous and independent foundation with the objectives of safeguarding life, property and the environment, at sea and onshore. DNV undertakes classification, certification, and other verification and consultancy services relating to quality of ships, offshore units and installations, and onshore industries worldwide, and carries out research in relation to these functions.

DNV Offshore Codes consist of a three level hierarchy of documents:

— *Offshore Service Specifications.* Provide principles and procedures of DNV classification, certification, verification and consultancy services.
— *Offshore Standards.* Provide technical provisions and acceptance criteria for general use by the offshore industry as well as the technical basis for DNV offshore services.
— *Recommended Practices.* Provide proven technology and sound engineering practice as well as guidance for the higher level Offshore Service Specifications and Offshore Standards.

DNV Offshore Codes are offered within the following areas:

A) Qualification, Quality and Safety Methodology

B) Materials Technology

C) Structures

D) Systems

E) Special Facilities

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SECTION 1
GENERAL

A. General

A 100 Introduction

101 This Offshore Service Specification (OSS) gives criteria for and guidance on certification of complete pipeline systems and verification of the integrity of parts or phases of pipeline systems.

A 200 Objectives

201 The objectives of this document are to:

— describe DNV's certification and verification services for pipeline systems
— provide guidance for owners and other parties for the selection of the level of involvement of those carrying out the certification and verification activities
— provide a common communication platform for describing extent of verification activities.

A 300 Scope of application for certification

301 This Offshore Service Specification applies to certification and verification during the design, construction and operation of pipeline systems.

302 This OSS describes the necessary activities to be carried out to obtain an initial DNV pipeline system certificate of conformity and how to maintain this certificate.

303 Statutory certification of pipeline systems to the requirements of National Authorities is not included specifically in the scope of application of this OSS. Such certification shall be governed by the regulations of the appointing authority. However, if detailed procedures are not given by these authorities, this OSS will be used by DNV as a guideline for its work.

304 The primary scope of the certification work is the verification of the integrity of the pipeline, or its capacity to contain the contents under the specified conditions. Other aspects, such as the verification of the environmental impact of the pipeline system, or its fitness for purpose with respect to flow capacity and flow assurance, may be included in DNV's scope of work, if desired by the client.

A 400 Scope of application for verification

401 This OSS may be adopted for the verification of parts of a pipeline system or selected project phases.

402 This OSS describes the principle of a levelled verification involvement, which easily can be used in communications about the extent and scope of verification activities that are not part of a scheme for pipeline certification.

403 This principle applies both to internal company verification (second party) as well as any obligations of licensees' for external verification (third party) in waters where this is applicable.

404 Guidance note:

The essential difference between the terms Certification and Verification is that Certification is used only where DNV's scope covers the integrity of the entire pipeline system and results in the issue of a DNV pipeline certificate

While Verification is used where DNV's scope applies to the verification of only a single (or more) phase of the project, for example, verification of the design but not of construction, installation or testing. Verification results in the issue of a DNV statement of compliance.

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A 500 Structure of this document

501 This document consist of three sections and five appendices:

Section 1	gives the general scope of the document, informative background information, definitions and references.
Section 2	explains the principles of DNV pipeline system certification with its risk-differentiated levels of involvement, and how to define the level of involvement for a particular project.
Section 3	describes the certification process and the activities for each of the project phases. Furthermore, it describes the documents issued during and as a result of the certification process. The use of quality management systems is addressed here also.
Appendix A	poses trigger questions for the selection of certification or verification level.
Appendix B	lists the instances where DNV-OS-F101 requires acceptance or agreement.
Appendix C	contains generic descriptions of project subphases.
Appendix D	gives example certification documents.
Appendix E	gives detailed scope of work tables for all phases and all level of involvement. These tables are the basis for the development of project specific scope of work tables.

A 600 Structure of pipeline-related documents

601 Reference is made to the foreword of this DNV-OSS. From the structure described there, documents relating to pipeline systems consist of a three-level hierarchy with these main features:

— Principles and procedures related to DNV's *certification and verification services* are separate from technical requirements and are presented in *DNV Offshore Service Specifications*.
— Technical requirements are issued as self-contained *DNV Offshore Standards*.
— Associated product documents are issued as *DNV Recommended Practices.*

Guidance note:

Product documents issued under previous document structures may be called "Classification Notes" or "Guidelines".

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602 This hierarchy is designed with these objectives:

— Offshore Service Specifications present the scope and extent of DNV's services.
— Offshore Standards are issued as neutral technical standards to enable their use by national authorities, as international codes and as company or project specifications without reference to DNV's services.
— The Recommended Practices give DNV's interpretation of safe engineering practice for general use by industry.

Guidance note:

The latest revision of all DNV documents may be found in the publications list in the DNV web site www.dnv.com.

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B. Background (Informative)

B 100 Introduction

101 Certification of pipelines has been carried out historically with a variety of scope and depth of involvement by the certifying body, but with the same end result – a certificate. The depth of involvement, or level of certification, has not always been easily detected from the certificate.

102 This document outlines different levels of certification involvement to be selected by the owner, which will ensure that the certifier's scope is well defined. Further, by stating this level on the certificate, the recipients of the certificate also will be informed of the scope.

Guidance note:

The purpose of the pipeline system certificate is to confirm that the pipeline, as installed and ready for use, is in a condition that complies with the technical requirements. It does not confirm that the schedule or cost of the project has been according to plan.

Strictly, the certificate covers only the as-installed condition of the pipeline and, hence, the conditions affecting this are of particular interest. However, the certification process requires that all the prior phases are verified and that temporary phases are in accordance with DNV-OS-F101 and have an acceptable risk level.

Further, the certification or verification can be a fully re-active process. This means that only the 'final steps' are verified, without regard to the consequences of e.g. detection of non-compliances or flaws late in the design or production processes. 'Final step' means the final step in which a mistake or flaw affecting the pipeline system as installed, can be detected and rectified.

A more supportive certification or verification is achieved when the verification process is pro-active. Then the certifier takes an active part in contributing to the achievement of the project schedule, budget and optimum quality. Typically, this will be achieved through an early involvement and active feedback into the project based on DNV's extensive pipeline experience. Such early involvement in the design or construction processes may help to ensure that no surprises are encountered at such a late stage that it will seriously affect the cost and / or schedule of the project.

The certification or verification will, in both of the described scenarios, provide a Statement of Compliance at the completion of each of the project's stages. A Certificate of Conformity will be provided when the pipeline is ready for operation only when DNV's scope of work is the certification of the complete pipeline project.

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B 200 Justifications for certification

201 Some national authorities require certification of pipeline systems and have appointed specific organisations qualified for this work.

202 Some of these national authorities may have detailed requirements to the certification activity, while others leave the definition of the necessary work up to the appointed organisation. Other national authorities require specific documents to be verified and approved by them, some hold the Owner responsible for the verification activities and others again may not have any specific requirements.

Guidance note:

The term statutory certification is sometimes used to distinguish certification performed by appointment of a national authority from that performed on the general recognition of the certifier.

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203 However, even where national authorities do not require certification of pipeline systems, certification is a convenient tool for the owner to get an independent verification of his contractor(s) work or to show financiers, partners, insurers and the public that the pipeline system complies with the relevant standard.

204 Certification of pipeline systems has the benefit of providing the owner (and other interested parties) confidence that the:

— pipeline system has sufficient integrity to fulfil its specified purpose
— risks to personnel associated with the pipeline system are reduced as low as reasonably practicable.

205 Additionally, it is good business practice to subject critical work to a third-party check as this minimises the possibility of errors remaining undetected. Third-party certification will ensure that the verifier has an independent view and perspective when performing this activity. Furthermore, it will avoid the situation where errors could be overlooked by engineers because of their closeness to the work with the pipeline system.

206 Certification also can be used as a part of the project risk management. The failure of pipeline systems may expose the owner to:

— safety risks
— environmental risks
— economic risks
— political risks.

207 As certification increases confidence that the pipeline complies with the requirements placed on it by national authorities and the owner, it follows that the risk of failure of the pipeline decreases due to independent certification. Thus, certification contributes to project risk management and reduction.

C. Certification

C 100 Certification to DNV-OS-F101

101 The certification process described in this OSS is tailormade for pipeline systems in accordance with DNV-OS-F101.

102 Wherever DNV-OS-F101 refers to acceptance, agreement and qualification this shall be by DNV. A list of these instances is provided in Appendix B.

C 200 Certification to other standards

201 DNV certification to internationally recognised standards other than DNV-OS-F101 shall follow the principles described in this OSS.

202 Where combinations of standards and external criteria are used the exact terms of reference and documents to be issued shall be agreed at the beginning of the project and formally defined in the contract.

203 The use of other standards does not allow for a reduction of the quality management requirements as described in the safety philosophy of DNV-OS-F101.

204 DNV reserves the right to call for additional requirements to cover issues essential to the certification process and not covered by the standards in question.

205 It is recommended strongly not to mix standards due to the possible differences in safety philosophies.

Guidance note:

Most standards are a coherent collection of requirements for all the relevant aspects of a pipeline system. These aspects, e.g. load and resistance, are normally among themselves adjusted to give an overall acceptable safety level. To pick requirements from different standards can then easily result in unpredictable (low) levels of safety.

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D. Verification

D 100 General

101 This OSS describes the principles of verification of the pipeline system for all phases.

102 Applying these principles of verification for distinct smaller or larger parts of the pipeline system or selected phases does not result in a certificate. Therefore, instead of the name certification, the term verification is used to describe this service.

103 Verification to DNV-OS-F101, other standards or clients' specifications may use this OSS as a communication platform and for the preparation of project-specific scope of work tables in the same manner as for certification.

E. Definitions

E 100 General

101 The definitions in DNV-OS-F101 section 1 C200 also apply to this OSS.

102 The most important definitions from DNV-OS-F101 applied in this OSS are repeated. They are marked "(DNV-OS-F101)" between the word and its definition, ref. e.g. verification.

E 200 Verbal forms

201 The terms *will*, *can* and *may* are used when describing DNV's actions or activities, and the terms *shall*, *should* and *may* are used when referring to other parties than DNV.

202 *Shall*: Indicates requirements strictly to be followed in order to conform to this OSS and from which no deviation is permitted.

203 *Should:* Indicates that among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others, or that a certain course of action is preferred but not necessarily required. Other possibilities may be applied subject to agreement.

204 *Will:* Indicates a mandatory action or activity to be undertaken by DNV. (Ref. "shall" for other parties.)

205 *Can:* Indicates an action or activity that DNV not necessarily does unless specifically requested by the client. (Ref. "should" for other parties.)

206 *May:* Verbal form used to indicate a course of action permissible within the limits of the OSS.

E 300 Definitions

301 *Certificate of Conformity:* A document signed by a qualified party affirming that, at the time of assessment, the product or service met the stated requirements (BS 4778: Part 2).

Guidance note:

For this OSS, the document is a DNV Submarine Pipeline System Certificate of Conformity and it is signed by DNV.

This OSS allows, under special agreement, the DNV Submarine Pipeline System Certificate of Conformity to be issued with a validity period past the date of issue.

For this OSS, a Certificate is a short document (often a single page) stating compliance with specified requirements. The results from associated verification shall be contained in a separate (single or multiple volume) report.

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302 *Certification:* Used in this document to mean all the activities associated with process leading up to the Certificate.

Guidance note:

In this OSS when *Certification* is used it designates the overall scope of work or multiple activities for the issue of a Certificate, whilst *Verification* is also used for single activities associated with the work. This in essence means that *Certification* is *Verification* for which the deliverable includes the issue of a *Certificate*.

Other (related) definitions are:

BS 4778 Part 2. *Certification:* The authoritative act of documenting compliance with requirements.

EN 45011. *Certification of Conformity:* Action by a third party, demonstrating that adequate confidence is provided that a duly identified product, process or service is in conformity with a specific standard or other normative document

ISO 8402 1994. *Verification:* Confirmation by examination and provision of objective evidence that specified requirements have been fulfilled.

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303 *Client:* DNV's contractual partner. It may be the purchaser, the owner or the contractor.

304 *Construction phase* (DNV-OS-F101): All phases during construction, including fabrication, installation, testing and commissioning, up until the installation or system is safe and operable for intended use. In relation to pipelines, this includes transportation, on-shore and on-barge welding, laying, rectification, tie-in, pressure testing, commissioning and repair.

305 *Design* (DNV-OS-F101): All related engineering to design the pipeline including both structural as well as material and corrosion.

306 *Design phase:* An initial pipeline phase that takes a systematic approach to the production of specifications, drawings and other documents to ensure that the pipeline meets specified requirements (including design reviews to ensure that design output is verified against design input requirements).

307 *DNV Submarine Pipeline System Certificate of Conformity:* see A.101. The term 'the pipeline certificate' is used in the text of this OSS.

308 *Fabrication* (DNV-OS-F101): Activities related to the assembly of objects with a defined purpose. In relation to pipelines, fabrication refers to e.g. risers, expansion loops, bundles, reels, etc.

309 *Hazard:* A deviation (departure from the design and operating intention) which could cause damage, injury or other form of loss (Chemical Industries Association HAZOP Guide).

310 *HAZOP* (HAZard and OPerability study): The application of a formal systematic critical examination to the process and engineering intentions of new or existing facilities to assess the hazard potential of mal-operation or mal-function of individual items of equipment and their consequential effects on the facility as a whole (Chemical Industries Association HAZOP Guide).

311 *Installation* (activity) (DNV-OS-F101): The operations related to installing the equipment, pipeline or structure, e.g. pipeline laying, tie-in, piling of structure etc., including final testing and preparation for operation.

312 *Manufacture* (DNV-OS-F101): Making of articles or materials, often in large volumes. In relation to pipelines, refers to activities for the production of linepipe, anodes and other components and application of coating, performed under contracts from one or more Contractors

313 *Operations (phase):* The phase when the pipeline is being used for the purpose for which it was designed.

314 *Risk* (DNV-OS-F101): The qualitative or quantitative likelihood of an accident or unplanned event occurring, considered in conjunction with the potential consequences of such

a failure. In quantitative terms, risk is the quantified probability of a defined failure mode times its quantified consequence.

315 *Risk Reduction Measures:* Those measures taken to reduce the risks to the operation of the pipeline system and to the health and safety of personnel associated with it or in its vicinity by:

— reduction in the probability of failure
— mitigation of the consequences of failure.

Guidance note:

The usual order of preference of risk reduction measures is:

1) Inherent safety
2) Prevention
3) Detection
4) Control
5) Mitigation
6) Emergency response.

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316 *Safety Objectives:* The safety goals for the construction, operation and decommissioning of the pipeline including acceptance criteria for the level of risk acceptable to the owner.

317 *Statement of Compliance:* A statement or report signed by a qualified party affirming that, at the time of assessment, the defined pipeline phase, or collection of activities, met the requirements stated by the owner.

318 *Verification* (DNV-OS-F101): An examination to confirm that an activity, a product or a service is in accordance with specified requirements.

Guidance note:

The examination shall be based on information, which can be proved true, based on facts obtained through observation, measurement, test or other means.

See also *Certification*.

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F. References

F 100 General

101 Offshore Standard DNV-OS F-101 Submarine Pipeline Systems, 2000, Det Norske Veritas, Høvik.

102 A Guide to Hazard and Operability Studies, 1979, Chemical Industries Association Limited, London.

103 ISO 8402 Quality – Vocabulary, 1994, International Organization for Standardization, Geneva.

104 BS 4778 Quality Vocabulary, Part 2 Quality Concepts and Related Definitions, 1991, British Standards Institute, London.

105 En 45011 General Criteria for Certification Bodies Operating Product Certification, 1998, European Committee for Standardization, Brussels

SECTION 2
PRINCIPLES OF RISK-DIFFERENTIATED CERTIFICATION AND VERIFICATION

A. General

A 100 Objectives

101 The objectives of this section are to provide:

— introduction to the principles of certification and verification of pipeline systems
— introduction to the principles of risk differentiated levels of verification activity
— guidance on the selection of levels of certification and verification.

B. Verification Principles

B 100 Purpose of verification

101 Verification constitutes a systematic and independent examination of the various phases in the life of a pipeline system to determine whether it has (or continues to have) sufficient integrity for its purpose.

102 Verification activities are expected to identify errors or failures in the work associated with the pipeline system and to contribute to reducing the risks to the operation of the pipeline system and to the health and safety of personnel associated with it or in its vicinity.

103 Verification is primarily focused on integrity and (human) safety, but business risk (cost and schedule) may be addressed also.

B 200 Verification as a complementary activity

201 Verification shall be complementary to routine design, construction and operations activities *and not a substitute for them*. Therefore, although verification will take into account the work, and the assurance of that work, carried out by the o owner and its contractors, it is inevitable that certification will duplicate some work that has been carried out previously by other parties involved in the pipeline system.

202 Verification shall be developed and implemented in such a way as to minimise additional work, and cost, but to maximise its effectiveness. This development of verification shall depend on the findings from the examination of quality management systems, the examination of documents and the examination of production activities.

B 300 Verification management

301 The certification philosophy and verification methods used will be described to ensure satisfactory completion of certification and verification.

302 The philosophy and these methods will ensure that certification and verification:

— have a consistent and constructive approach to the satisfactory completion and operation of the pipeline system
— are available world-wide wherever the owner or his contractors operate
— use up-to-date methods, tools and procedures
— use qualified and experienced personnel.

303 All certification and verification activities will be carried out by competent personnel. Competence includes having the necessary theoretical and practical knowledge and experience of the activity being examined. An adequate verification of some activities may require access to specialised technical knowledge.

304 As well as demonstrating competence of individuals, the verification organisation also will be able to show competence and experience in pipeline verification and certification work.

B 400 Risk-Differentiated Levels of Certification and Verification

401 To achieve a DNV Certificate of Conformity for a pipeline system a verification of the activities described by the scope of work defined within this OSS shall first take place.

402 The level of verification activity is differentiated according to the risk to the pipeline. If the risk to the pipeline is higher, the level of verification involvement is higher. Conversely, if the risk to the pipeline is lower, the level of verification activities can be reduced, without any reduction in their effectiveness.

403 It is emphasised that the activity level describes the depth of the verification involvement and not different certificate levels. It follows, therefore, that an increase in the level of involvement above that considered necessary, based on an evaluation of the risks, involves minimal extra risk reduction for increased cost. This practice is unlikely to be cost-effective.

404 Certification of pipeline systems is categorised into *low*, *medium* and *high*. A summary of the levels of involvement is given in Table 2-1.

Medium is the customary level of certification activity and is applied to the majority of pipelines.

High is the level of certification applied where the risks to the pipeline are higher because, for example, it has highly corrosive contents, it is in adverse environmental conditions, it is technically innovative or the contractors are not well experienced in the design and construction of similar pipelines.

Low is the level of certification applied where the risks to the pipeline are lower because, for example, it has benign contents, it is located in congenial environmental conditions, or the contractors are well experienced in the design and construction of similar pipelines.

405 It is the prerogative of the owner of the pipeline system to choose the level of certification. The selection should consider the factors given in Sec.2 B. The selection of the most suitable certification level may be guided by using the questions proposed in Appendix A.

406 As DNV is issuing the pipeline certificate, DNV will use the same type of questions to evaluate the suitability of the selected level.

407 Different levels of certification can be chosen for different phases of the pipeline system, or even within the same phase if necessary. For example, pipeline design may be innovative and considered high risk whereas the installation method is well known and considered low risk. The converse might be true also.

Additionally, linepipe production from a well known mill may be considered low risk, whereas, production from an unknown mill may be considered high risk.

408 The level of certification can be reduced or increased during a phase if the originally chosen level is considered too rigorous or too lenient, as new information on the risks to the pipeline system becomes available.

409 Certification should be planned in close co-operation with the owner and each of its contractors, to provide a scope of work that is tailor-made to the schedule of each production process/activity, i.e. to make the verification activities, surveillance and hold points, an integrated activity and not a delaying activity.

Guidance note:

Many Contractors have adequate quality control systems and quality control departments, with competent personnel to perform, for example, inspection at mills and coating plants and specialist material engineers competent to review and verify the performance of mills.

In that case, all certification work need not be done by DNV personnel. Where applicable, the various inspections may be carried out by competent persons other than DNV personnel.

In that situation DNV's certification activities can be confined to:

- reviewing the competence of the contractor's personnel
- auditing their working methods and their performance of that work
- reviewing the documents produced by them.

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410 Certification will direct greatest effort at those elements of the pipeline system whose failure or reduced performance will have the most significant impact on safety as well as project risk.

411 The degree of confidence placed in a certificate by its users depends on their degree of confidence in the certification carried out. Therefore, the level of certification will be stated on the pipeline certificate.

412 If more than one certification level has been used for a phase, then the lowest level will be reported on the statement(s) and the pipeline certificate, and the additional verification activities will be identified and described in the verification report(s).

C. Selection of Level of Certification

C 100 Selection factors

101 The selection of the level of certification shall depend on the criticality of each of the elements that have an impact on the management of hazards and associated risk levels of the pipeline system. This is illustrated by Fig. 1.

The contribution of each element shall be judged qualitatively and/or quantitatively and shall use, where possible, quantified risk assessment data to provide a justifiable basis for any decisions made.

Table 2-1 Levels of Certification - Summary of Involvement

Level	*Description of involvement*	*Guidance for application on the level of involvement*
Low	— Review of general principles and production systems during design and construction. — Review of principal design documents, construction procedures and qualification (e.g. MPQT) reports. — Visit-based attendance during system testing and start-up activities. — Less comprehensive involvement than level Medium.	— Proven pipeline designs with benign contents and/or installed in benign environmental conditions. — Straightforward pipelines designed and constructed by experienced contractors. — Low consequences of failure from a safety, environmental or commercial point of view. — Relaxed to normal completion schedule.
Medium	— Review of general principles and production systems during design and construction. — Detailed review of principal and other selected design documents with support of simplified independent analyses. — Full time attendance during (procedure) qualification (e.g. MPQT) and review of the resulting reports. — Visit-based or intermittent presence at site.	— Pipelines in moderate environmental conditions. — Projects with a moderate degree of novelty. — Medium consequences of failure a safety, environmental or commercial point of view. — Ordinary completion schedule.
High	— Review of general principles and production systems during design and construction. — Detailed review of most design documents with support of simplified and advanced independent analyses. — Full time attendance during (procedure) qualification (e.g. MPQT) and review of the resulting reports. — Full time presence at site for most activities. — More comprehensive involvement than level Medium.	— Innovative pipeline designs in extreme environmental conditions. — Projects with a high degree of novelty or large leaps in technology. — Inexperienced contractors or exceptionally tight completion schedule. — Very high consequences of failure a safety, environmental or commercial point of view.

102 Selection factors are the:

— overall safety objectives for the pipeline system
— assessment of the risks associated with the pipeline and the measures taken to reduce these risks
— degree of technical innovation in the pipeline system
— experience of the contractors in carrying out similar work
— quality management systems of the owner and its contractors.

Guidance note:

Each of these factors is addressed also in DNV-OS-F101 Section 2.B.

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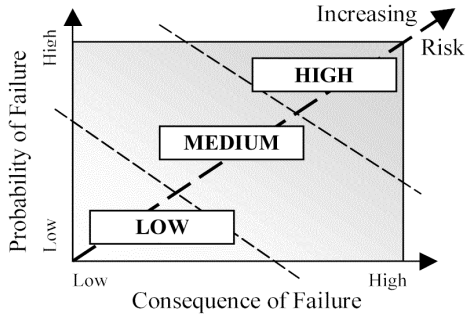

Figure 1
Selection of the required level of certification

C 200 Overall safety objective

201 An overall safety objective covering all phases of the pipeline system from design to operation should be defined by the owner. The safety objective should address the main safety goals as well as establishing acceptance criteria for the level of risk acceptable to the owner. Depending on the pipeline and its location the risk could be measured in terms of human injuries as well as environmental, political and economic consequences.

C 300 Assessment of risk

301 A systematic review should be carried out to identify and evaluate the probabilities and consequences of failures in the pipeline system. The extent of the review shall reflect the criticality of the pipeline system, the planned operation and previous experience with similar pipeline systems. This review shall identify the risk to the operation of the pipeline system and to the health and safety of personnel associated with it or in its vicinity.

302 Once the risks have been identified their extent can be reduced to a level as low as reasonably practicable by means of one or both of:

— reduction in the probability of failure
— mitigation of the consequences of failure.

Guidance note:

Reasonable practicability

The term "as low as reasonably practicable (ALARP)" has come into use through the United Kingdom's "The Health and Safety at Work etc. Act 1974". Reasonable Practicability is not defined in the Act but has acquired meaning by interpretations in the courts.

It has been interpreted to mean that the degree of risk from any particular activity can be balanced against the cost, time and trouble of the measures to be taken to reduce the risk.

It follows, therefore, that the greater the risk the more reasonable it would be to incur substantial cost, time and effort in reducing that risk. Similarly, if the risk was very small it would not be reasonable to expect great expense or effort to be incurred in reducing it.

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303 The result of the systematic review of these risks is measured against the safety objectives and used in the selection of the appropriate certification activity level.

C 400 Technical innovation and contractor experience

401 The degree of technical innovation in the pipeline system shall be considered. Risks to the pipeline are likely to be greater for a pipeline with a high degree of technical innovation than with a pipeline designed, manufactured and installed to well-known criteria in well-known waters.

402 Similarly, the degree of risk to the pipeline system should be considered where contractors are inexperienced or the work schedule is tight.

403 Factors to be considered in the selection of the appropriate certification level include:

— degree of difficulty in achieving technical requirements
— knowledge of similar pipelines
— knowledge of contractors' general pipeline experience
— knowledge of contractors' experience in similar work.

C 500 Quality management systems

501 Adequate quality management systems shall be implemented to ensure that gross errors in the work for pipeline system design, construction and operations are limited.

502 Factors to be considered when evaluating the adequacy of the quality management system include:

— whether or not an ISO 9000 or equivalent certified system is in place
— results from external audits
— results from internal audits
— experience with contractors' previous work
— project work-force familiarity with the quality management system, e.g. has there been a rapid expansion of the work force or are all parties of a joint venture familiar with the same system.

Guidance note:

Most organisations have quality management systems certified by an accredited third party certification body. However, when business increases, they expand their staff quickly by taking on contract personnel often for a fixed period or for the duration of a particular contract.

This influx of new personnel can lead to problems of control of both the whole organisation and of particular projects being undertaking. Quality problems may then occur, as these new personnel have no detailed knowledge of the organisation's business methods, its ethos or its working procedures.

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D. Information Flow

D 100 Communication lines

101 Communication lines are illustrated in Figure 2. Which lines that are open for communication depends on the particular contractual agreements.

102 For instances where DNV (3rd party) does not have a contract with the owner (1st party), DNV recommends strongly that the owner, through his contract with the 2nd party, secures a direct communication line from DNV to owner and vice versa.

Guidance note:

The recommendation springs from DNV's experience with projects where communications difficulties between the parties have jeopardised the issue of the pipeline certificate.

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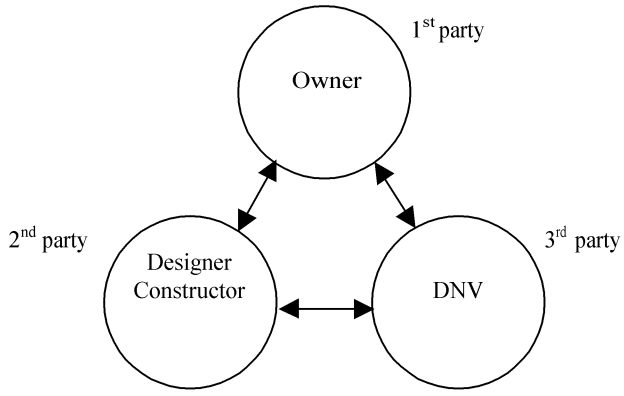

Figure 2
Communication Lines

D 200 Obligations

201 In order to achieve the purpose and benefits of certification the involved parties shall be mutually obliged to share and act upon all relevant information pertaining to the certification scope.

202 The owner shall be obliged to:

— inform DNV about the basis for selecting the level of certification and the investigations and assumptions made in this context
— give DNV full access to all information concerning the certification scope for the pipeline system and ensure that clauses to this effect are included in contracts for parties acting on behalf of the owner and parties providing products, processes and services covered by the certification scope
— ensure that DNV is involved in the handling of deviations from specified requirements within the certification scope
— act upon information provided by DNV with respect to events or circumstances that may jeopardise the pipeline system and/or the purpose and benefit of certification
— ensure that the safety objective established for the pipeline project is known and pursued by parties acting on behalf of the owner and parties providing products, processes and services covered by the certification scope.

203 2nd parties shall be obliged to:

— perform their assigned tasks in accordance with the safety objective established for the pipeline project.
— provide the owner and DNV with all relevant information pertaining to the certification scope.

204 DNV will be obliged to:

— inform the owner if, in the opinion of DNV, the basis for selecting the level of certification or the assumptions made in this respect are found to be in error or assessed incorrectly
— inform the owner of events or circumstances that, in the opinion of DNV, may jeopardise the pipeline system and/or the purpose and benefit of certification
— effectively perform all certification work and adjust the level of involvement according to the actual performance of parties providing products, processes and services covered by the certification scope.

D 300 Notification of certification level

301 An assessment of the required level of certification for a project should be made by the owner before preparing tender documents for design and construction activities. The owner can then specify this level in Invitation to Tender. This will give contractors clear guidance and reference when estimating the extent and cost of efforts associated with certification activities.

302 The required level of certification can be assessed by the owner using this OSS. However, if the owner requires the contractor to carry out this assessment as part of his response to an Invitation to Tender (ITT) the owner should provide the necessary information to enable the contractor to carry out this work. This information should include overall safety objectives for the pipeline system as well as particulars, such as temperatures, pressures, contents and environmental criteria, commonly contained in a design brief.

Guidance note:

Frequently, ITTs contain one line stating "…. the contractor shall arrange 3rd party verification." The use of the information contained in the above paragraphs should assist the owner to specify the required level of certification more precisely.

On other occasions, certification is arranged by the owner but, in this case, it is important that contractors are informed of the level of certification planned.

The contractor's technical activities should not be affected greatly by the contractual arrangements, aside from whether or not the owner or the contractor assesses the required level of certification.

There will be a small administration workload regarding document control or meetings and discussions with the verifier but the contractor can plan what documents are need to be seen by the verifier using the information in this OSS. However, it is emphasised that the verifier should not need to review any document that the contractor would not produce normally when following the requirements of DNV-OS-F101.

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SECTION 3
SERVICE OVERVIEW

A. General

A 100 Objectives

101 The objectives of this section are to provide:

— an overview of certification and verification activities relating to pipeline systems
— details of DNV's certification and verification services for pipelines systems.

B. Service Process

B 100 General principles

101 The process of DNV's certification and verification of pipeline systems is based on distinct project phases and the recognition of key milestones. Verification performed by DNV as part of the certification process, progresses through these project phases and includes all aspects of the project.

102 The certification process follows the project phases:

Pre-certification (optional):

— Conceptual design

Certification:

— Detail design
— Construction
  — Manufacturing of linepipe
  — Manufacturing and fabrication of pipeline components and assemblies
  — Manufacturing of corrosion protection and weight coating
  — Installation
  — Project completion
— Issue of certificate.

Maintenance of certificate (optional):

— Operations, maintenance and repair

Guidance note:

The above phases generally follow the main sections of DNV-OS-F101. Where projects or other standards use other terms, these can be used provided they are well defined and agreed.

Appendix C includes some generic descriptions of typical sub-phases. This may be used as guidance when agreeing the content or completeness of a sub-phase.

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103 Verification need not be performed as part of a complete certification of a pipeline system but can be stand-alone service for all or part of a pipeline project.

B 200 Scopes of work

201 Generic scopes of work for certification and verification at the three levels of verification, *Low* (L), *Medium* (M) and *High* (H), are given in the tables in this section.

202 Typical detailed scope of work descriptions, which are based on the generic scopes of work and which show all the activities to be verified, are given in Appendix E.

203 A specific scope of work description will be made for each particular project. This description will be similar to the tables in Appendix E and will be part of the final DNV verification report.

204 For operations, which are not mentioned directly in the tables, but which are still found critical for a particular project, the same general levels will be described.

C. Pre-certification

C 100 Verification during conceptual design

101 Verification during the conceptual and/or feasibility studies of a project is not a prerequisite for certification. However, verification of the early stages of a project can reduce the need for verification during the design and construction phases.

102 It is advisable to combine the design verification during pre-certification with additional review of:

— environmental aspects
— project schedule
— cost.

D. Certification

D 100 General

101 All design and construction aspects, relevant to pipeline safety and integrity, will be covered by the certification. The split in the scope of work between design and construction is made between set of requirements (specifications) developed during design and description of the steps necessary to satisfy the specification (procedures) showing how construction will be implemented.

102 Verification describes the individual activities undertaken by DNV at the various stages of the design, construction and operation of the pipeline system.

103 Certification describes the totality of verification activities leading up to the issue of a DNV Pipeline Certificate.

Guidance note:

See the Guidance Note to Section 1, A403.

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D 200 Verification of overall project management

201 Verification of the overall project management is the examination of the means of controlling the whole pipeline project.

202 This verification is to ensure that the necessary controls are in place to ensure information flows between the various interfaces. This is especially important where separate contractors have been employed for different phases of the project such as design and installation.

203 No specific documents are required by DNV-OS-F101 but Sec.2 B requires that some documentation must be available.

204 Definition of scope of work for certification of overall project management will follow Table 3-1.

Table 3-1 Scope of work for verification of overall project management

Verification activity	*Level*		
	L	*M*	*H*
Review of the project management process by			
— review of project quality management documentation	x	x	x
— audit of project quality management system		x	x
— review of sub-contractor control		x	x
— review of interface controls		x	x
— review of methods of information flow		x	x

D 300 Verification during design

301 Design verification is the examination of the assumptions, methods and results of the design process and is performed at the specified level of certification to ensure that the specified requirements of the pipeline system will be achieved.

302 Design verification will consist of one, or more, of:

— reviewing the design process
— reviewing specifications for design
— reviewing design reports and drawings
— performing independent parallel calculations
— reviewing specifications for construction and operation, resulting from design.

303 The documents that shall be produced in the project are given in DNV-OS-F101 Sec.3 F200.

304 Definition of scope of work for certification of design will follow Table 3-2.

Table 3-2 Scope of work for certification of design

Verification activity	*Level*		
	L	*M*	*H*
Review of the design process by			
— review of design quality management documentation	x	x	x
— audit of design quality management system		x	x
Review of specifications for design by			
— review of the design basis with emphasis of the survey results and environmental data. Evaluation of the design criteria	x	x	x
— pipeline route and environmental conditions (DNV-OS-F101 Sec.3 C and D)		x[1)]	x[1)]
Review of design reports and drawings by			
— review of the main pipeline documentation to ensure that the main load conditions have been accounted for in design, that the governing conditions are identified, and that the chosen design philosophies are in accordance with specified codes and standards	x	x	x
— evaluation of the main methods used and spot checks of the input data and the calculation results		x	x
— detail review of main design reports			x
Performing independent parallel calculations by			
— check of pressure containment	x	x	x
— simplified independent analysis/calculation(s) performed by spot checks		x	x
— advanced independent analysis/calculation(s) performed by spot checks			x
Review of specifications for construction and operation by			
— spot check of critical aspects	x	x	x
— review of main specifications		x	x
— thorough review of main specifications			x
Review of flow assurance (non-integrity aspects[(2)]) by			
— general principles	x	x	x
— review of main documents supported by simplified analyses		x	x

1) Verification activity to be agreed between owner and DNV case by case considering aspects as:

— general knowledge of the area
— criticality of the results.

2) These are optional certification services.

Guidance note:

Design verification activities may be split up between Basic Design and Detailed Design, or other sub-phase, depending on type of contract.

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D 400 Verification during construction

401 Verification during construction is carried out by means of full time attendance, audits, inspection or spot checks of the work, as appropriate, in sufficient detail to ensure that the specified requirements of the pipeline system will be achieved.

402 Verification of these activities relates not only to the contractor's work but also to the monitoring of this work carried out by others.

403 During construction verification shall consist of one, or more, of:

— reviewing the construction process,
— reviewing construction procedures
— reviewing qualification process
— surveillance during construction activities
— reviewing final documentation.

404 The documents that shall be produced in the project are given in DNV-OS-F101 Sec.3 F300, F400, F500 and F600.

405 Definition of scope of work for certification of construction shall follow Table 3-3 and Table 3-4 for manufacturing and fabrication, Table 3-5 for installation and Table 3-6 for final testing and completion.

Table 3-3 Scope of work for certification of manufacturing and fabrication of linepipe and other PRESSURE CONTAINING components

Verification activity	*Level*		
	L	*M*	*H*
Review of the manufacturing & fabrication process by			
— review of manufacturing and fabrication management systems	x	x	x
— audit of the quality management system		x	x
Review of manufacturing & fabrication procedures by			
— review manufacturing, fabrication and inspection procedures for confirmation of compliance with the manufacturing specification	x	x	x
— review method statements		x	x
Review of qualification process by			
— review the Manufacturing Procedure Specification, (MPS), Manufacturing Procedure Qualification Test (MPQT), if applicable	x	x	x
— full time attendance during MPQT, if applicable, or first day production		x	x

Table 3-3 Scope of work for certification of manufacturing and fabrication of linepipe and other PRESSURE CONTAINING components (Continued)

Verification activity	*Level*		
	L	*M*	*H*
Surveillance during manufacturing and fabrication activities by			
— visit-based attendance during testing, to ensure, based on spot checks, that the delivered products have been produced in accordance with the manufacturing specification	x	x	x
— visit-based or full-time attendance during manufacturing and fabrication to ensure, based on spot checks, that the delivered products have been produced in accordance with the manufacturing specification		x	x
— full-time attendance during manufacturing and fabrication to ensure, based on spot checks, that the delivered products have been produced in accordance with the manufacturing specification			x
— FOR LINEPIPE PRODUCTION ONLY: overall independent verification of production must be sufficient for DNV to operate its independent quality system (QVS) to get an independent verification of the delivered pipes			x
Review of final documentation	x	x	x

Table 3-4 Scope of work for certification of manufacturing and fabrication of coatings, anodes and other NON-PRESSURE CONTIANING components

Verification activity	*Level*		
	L	*M*	*H*
Review of the manufacturing & fabrication process by			
— review of manufacturing and fabrication management systems	x	x	x
— audit of the quality management system			x
Review of manufacturing & fabrication procedures by			
— review manufacturing, fabrication and inspection procedures for confirmation of compliance with the manufacturing specification		x	x
Review of qualification process by			
— review the Manufacturing Procedure Specification, (MPS), Manufacturing Procedure Qualification Test (MPQT), if applicable	x	x	x
— full time attendance during MPQT, if applicable, or first day production			x
Surveillance during manufacturing and fabrication activities by			
— visit-based attendance during testing, to ensure, based on spot checks, that the delivered products have been produced in accordance with the manufacturing specification		x	x
— visit-based attendance during manufacturing and fabrication to ensure, based on spot checks, that the delivered products have been produced in accordance with the manufacturing specification			x
Review of final documentation	x	x	x

Guidance note:

Line pipe and other materials may be ordered with certificates of varying degrees of independent 3rd party verification (e.g. 3.1C according to EN 10204). This can this be integrated in the overall certification activities, so not to duplicate work.

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Table 3-5 Scope of work for certification of installation

Verification activity	*Level*		
	L	*M*	*H*
Review of the installation process by			
— review of installation management systems	x	x	x
— audit of the quality management system		x	x
Review of installation procedures by			
— spot check of Installation Manual, (IM)	x	x	x
— for critical operations (identified from the FMEA and HAZOP studies) review the IM		x	x
Review of qualification process by			
— for critical operations, review the qualification of the IM	x	x	x
— full time attendance during qualification tests, if applicable, or production start-up		x	x
Surveillance during installation activities by			
— visit-based attendance during start up of each offshore operation (i.e. pipelaying, riser installation, intervention works, etc.	x	x	x
— full time attendance during tension trials and associated lay tests: visit- based attendance during laying		x	x
— full time attendance at each offshore operation (i.e. pipelaying, riser installation, intervention works			x
Review of final documentation	x	x	x

Table 3-6 Scope of work for certification of final testing for operation, including as-built survey and project completion

Verification activity	*Level*		
	L	*M*	*H*
Review of the process by			
— review of management systems	x	x	x
— audit of the quality management system			x
Review of procedures by			
— review of the procedures for system pressure test to ensure that the test procedure will test the pipeline system in accordance with the design requirements	x	x	x
Surveillance during testing and completion activities by			
— full time attendance during pressure testing (minimum 24 hrs)	x	x	x
— full time attendance during testing and audit based attendance during cleaning, gauging, de-watering and drying. Visit-based attendance during as-built surveying			x
Review of final documentation by			
— spot check of as-built documentation	x	x	x
— review of as-built documentation			x

E. Certification Documents

E 100 Purpose of certification documents

101 Certification documents are issued by DNV. The purpose of these documents is to provide documentation that objective evidence has been presented to confirm the pipeline system's conformity with the requirements and to document the work performed by DNV.

102 Final certification documents, consisting of Statements and Certificates of Conformity, are formal documents in which DNV states that a particular aspect of the work (a product or service) has been completed in conformance with the requirements specified for the pipeline by the owner.

Guidance note:

Examples of document forms are found in Appendix D.

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103 Intermediate certification documents act as a form of progress reporting showing satisfactory completion of certification activities for various issues, items or phases of the pipeline project.

104 The certification documents are as follows and the hierarchy is shown in Figure 1:

— Certificate of Conformity
— Statement of Compliance
— Verification Report

Intermediate documents

— Audit reports
— Verification Comments
— Visit reports

Figure 1
Document hierarchy for certification

E 200 Certification documents provided

201 The types of documents issued by DNV for the different stages of the certification process are illustrated in Table 3-7.

E 300 Validity of certification documents

301 Certification documents are, in principle, documents confirming that an examination has been carried out, and are valid only at date of issue.

302 However, for Certificate of Conformity, a specified period of validity and maintenance conditions for ensuring this validity may be given in the certificate.

E 400 Certificate of Conformity

401 A DNV pipeline Certificate of Conformity (the pipeline certificate) will be issued as a formal statement confirming that the pipeline system has been completed in accordance with specified requirements.

402 The pipeline certificate will be supported by a dedicated verification report.

403 The pipeline certificate will only be issued when all relevant activities have been satisfactorily completed. Outstanding issues will prevent the issue of the pipeline certificate.

404 The pipeline certificate will contain:

— pipeline system description and item number, if relevant
— application (operational limitations and conditions of use) for which the pipeline system is intended
— codes and standards with which the pipeline system has been found to comply
— level of certification
— appendix containing the accompanying dedicated verification report.

405 The dedicated verification report will include information such as:

— documentation on which the certification is based (documents, drawings, correspondence, including revision numbers, including codes and standards used as reference)
— project specific scope of work tables
— list of deviations from the reference codes and standards (if applicable).

406 The pipeline certificate will be signed by the Regional Manager of the DNV office that has the contract to carry out the certification for the particular pipeline system.

407 The same DNV office will file the project documentation.

408 An example of a typical Certificate of Conformity is shown in Appendix D.

Table 3-7 Pipeline Certification – Documents Provided by DNV

Reference Standard for certification	Offshore Standard DNV-OS-F101 Submarine Pipeline Systems							
	DESIGN		CONSTRUCTION					OPERATION
Project Phases	Conceptual Design	Detail Design	Manufacturing of Linepipe	Manufacturing of Pipeline Components and Assemblies	Manufacturing of Corrosion Protection and Weight Coating	Installation	Project Completion	Operation, Maintenance and Repair
Types of Certification Documents Provided		Statement of Compliance for individual phase or natural part thereof					Certificate of Conformity	Certificate of Conformity (retention)
Certification phase	PRE-CERTIFICATION	CERTIFICATION						MAINTENANCE OF CERTIFICATION

E 500 Statement of Compliance

501 A Statement of Compliance can be issued on completion of each particular project phase, or natural part thereof, and will be based on a dedicated verification report.

502 A Statement of Compliance will be issued as a formal statement confirming that verification of documents and/or activities, has found that the pipeline system, a part thereof, or a certain activity, complies with the requirements applicable for that particular project phase.

503 The technical information on a Statement of Compliance will include information similar to that on the pipeline certificate.

504 A Statement of Compliance will be signed by the DNV Project Manager.

505 An example of a typical Statement of Compliance is shown in Appendix D.

E 600 Verification reports

601 Verification Reports are issued to confirm that the relevant product or service has been completed in accordance with specified requirements.

602 The report will include information such as:

- product or service description and item number, if relevant
- application (operational limitations and conditions of use) for which the product or service is intended
- codes and standards with which the product or service has been verified against
- clear statement of the conclusion from the verification (does it or does it not meet the specified requirements)
- codes and standards used as reference
- documentation on which the verification report is based (documents, drawings, correspondence, including revision numbers)
- project-specific scope of work tables
- any comments
- identification of any non-conformances.

603 The Verification Report will always be dated and have two signatures, the originator and the DNV internal verifier.

E 700 Verification comments

701 Reviews of documents will be reported using Verification Comment Sheets (often called VerComs). These documents give details to the client of aspects of pipeline design and construction that DNV:

- considers do not meet the specified requirements
- does not have enough information to make a decision
- offers advice based on its own experience.

Only in the first two instances does DNV expect a response from the owner or its contractors.

702 An example of a typical Verification Comment sheet is shown in Appendix D.

E 800 Audit report

801 Audit reports are issued to confirm that a company's quality management system has been reviewed to confirm compliance (or not) with the nominated standard and project requirements. In addition, the audit reports confirm compliance with the documented procedures and that these procedures are effective.

802 Audit reports will contain information such as whether:

- the company has a documented quality system
- this quality system has been certified by an accredited Certification *Body for the product (or service) in question*
- the quality system covers the following quality assurance elements adequately for the product:
  - organisation
  - authority/responsibility
  - job descriptions for key persons
  - internal quality audits
  - documentation change control
  - job instructions/procedures
  - non-conformance/corrective action
- there are adequate procedures for activities such as:
  - calibration of equipment
  - material identification and marking
  - control of special processes such as welding, NDT, PWHT
  - non-conformance identification and handling
  - inspection status
  - final inspection
- the company's facilities are, in general, considered adequate for the scope of supply
- a quality plan been prepared for the order concerned
- the purchaser or their appointed inspection agency are planned to attend the works
- there are any problem areas identified.

803 An example of a typical audit report is shown in Appendix D

E 900 Visit reports

901 Visit reports are documentation/recording of attendance activity by DNV.

Guidance note:

Visit reports are and may be called by different names. Examples are Inspection Release Note, Survey Report, Inspection Certificate, Site Report, etc.

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902 A visit report will contain enough information to identify clearly the product or service that has been examined, the operating conditions or specifications to which it has been examined and the conclusion reached by DNV.

903 The visit report will be printed on the relevant form and will contain as much information as possible in accordance with the standard headings in the form. In addition, the report number shall be shown.

904 An example of a typical Visit Report is shown in Appendix D.

F. Use of Quality Management Systems

F 100 General

101 The assurance of pipeline integrity requires that gross errors during design, construction and operation be minimised. The likelihood of gross errors shall be reduced in a systematic manner by the operation of a quality management system adequate for the work being carried out. This is according to DNV-OS-F101 Sec.2 B500.

102 Quality management systems frequently are documented at three levels:

- the quality manual and related procedures document how the organisation, as a whole, manages the quality of all its products and services
- the quality plan documents the specific procedures related to a particular project
- the inspection and test plan documents how the quality control activities for a particular project shall be carried out and recorded.

F 200 Quality plans

201 The basic function of a quality plan is as an *aide mémoire* in the management of a project. In an organisation with many quality procedures for a variety of functions the quality plan states those that are applicable to that particular project. The quality plan acts as a route map through the complexities of management of the project and highlights those activities relevant to quality management.

202 The project quality plan normally consists of two parts; firstly, a narrative description of the means of controlling the project, and secondly, a tabular description of the inspections and tests to be carried out during the work.

203 The quality plan should address:

— organisational details of the project
— authorities and responsibilities of key personnel
— interfaces between, the client, contractors, sub-contractors and third parties
— quality assurance activities placed on sub-contractors
— cross references to existing company procedures.

204 The narrative part of the quality plan should include a description of:

— the applicable standards
— project organisation and responsibilities
— review of the contractual requirements
— project planning and progress reporting
— procedures for such activities as design control, purchasing, construction, installation, commissioning, interface control and auditing.

205 Additionally, the narrative part of the plan should describe the documentation requirements It should be specified:

— what documents are required
— at what stage these documents are required
— who is responsible for preparing the documents
— relevant parties to whom documents are submitted
— how any necessary approvals are acquired
— who has originals and who has copies
— if copies have to be certified copies
— the length of time documents are to be retained and by whom.

F 300 Inspection and test plans

301 The tabular description of the inspections and tests to be carried out during the work is frequently known as the inspection and test plan.

302 The following items should be checked for inclusion within the inspection and test plan:

— each inspection and test point and its relative location in the production cycle should be shown
— the characteristics to be inspected and tested at each point should be identified
— the use of sub-contractors should be indicated and details of how the verification of sub-contractor's quality shall be carried out should be shown
— hold points established by the constructor, the operator or a third party, where witness or review of the selected inspection or test is required, should be shown.

F 400 Review of quality management programme

401 The contractor's quality manual will be reviewed for compliance with ISO 9001 or 9002 as appropriate. The contractor's operations should be audited to establish compliance with the documented system.

402 If the contractor has a quality system certified by an accredited third party certification body, this may be taken as evidence of a satisfactory quality system *provided the certificate is relevant to the contractor's scope of work for the pipeline*. However, the last two years' periodical audit reports shall be reviewed to identify if any recurring non-conformities have been revealed.

403 Any weaknesses revealed during this audit, or review of periodical audit reports, shall be considered when planning the contractor monitoring activities.

404 Surveillance of the continuing acceptability of the contractor's quality management system is carried out by observing a selection of audits carried out by the contractor as part of its internal audit system. The audits to be observed should be selected over the length of the project at suitable intervals and should cover as wide a selection of activities as possible.

405 Contractors' inspection and test plans for the various activities undertaken during their scope of work for the pipeline shall be reviewed and accepted, if adequate.

G. Maintenance of Pipeline Certificate

G 100 General

101 During the operations phase, verification in order to maintain the pipeline certificate is optional.

102 Maintenance of the pipeline certificate may only take place if the original pipeline certificate is issued with maintenance conditions.

G 200 Certificate of conformity with maintenance conditions

201 In addition to the requirements in Section 3 E400, the pipeline certificate will contain:

— conditions of validity
— signature positions for confirmation of annual assessment.

G 300 Validity of certification documents

301 A prerequisite for the retention of validity of pipeline certificates in the operations phase is that an in-service contract has been established between the owner, or someone authorised to act on his behalf, and DNV.

302 The period of validity of a certificate subject to examination by DNV will not exceed 5 years. After that period the pipeline certificate may be reissued, provided a satisfactory overall condition assessment has been carried out.

303 The front page of pipeline certificates having a period of validity will have a specific area to be signed by DNV annually showing satisfactory completion of the annual assessments required to continue the certificate's validity. The pipeline certificate will become invalid if these signatures are not present

304 A verification report is issued after any modification or repair of the pipeline system. No new Certificate of Conformity is required.

G 400 Maintaining the certificate

401 Pipeline systems in operation will retain their pipeline certificate provided that:

— the pipeline system is operated within the specified limitations
— the owner provides adequate documentation from inspection and maintenance activities
— the owner maintains any installed systems for condition monitoring and carries out condition evaluations as applicable
— information about damages, repairs and modifications, which may affect the certification, is promptly reported to DNV

— non-conformance reports issued by DNV are acted upon within the specified time.

402 A verification report will be issued after any modification or repair of the pipeline system. No new Certificate of Conformity is required.

403 Pipeline systems that are temporarily out of service shall be subject to periodical inspections if the pipeline certificate is to be retained. The inspection requirements will be accepted by DNV.

404 The pipeline certificate can be withdrawn if the owner fails to:

— comply with the operational procedures for the pipeline system accepted by DNV
— carry out the regular in-service inspection and maintenance programme according to the procedures accepted by DNV
— comply with any non-conformance report issued by DNV.

405 Additionally, the pipeline certificate can be withdrawn if the pipeline system:

— is damaged, or is suspected of having been damaged, in a manner likely to impair its safety or integrity
— demonstrates signs of deterioration likely to impair its safety or integrity
— is subjected to any modifications or repairs, which will impair its safety or integrity
— is considered abandoned.

406 If the situation leading to withdrawal of the pipeline certificate no longer exists, the pipeline certificate may be reinstated. However, the pipeline system may be subject to special assessment or monitoring following the reinstating of the pipeline certificate.

G 500 Verification during operation

501 Verification during operation is carried out by audit or spot check of the work in sufficient detail to ensure that the specified requirements of the pipeline continue to be achieved.

502 Assessment of these activities will relate to the owner's, as well as any contractor's, work.

503 During operations, these assessments will consist of:

— review of operations processes:
  — review of operations management systems
  — audit of the quality management system, if necessary
— review of operations specifications and procedures:
  — confirmation of design assumptions
  — method statements
  — inspection plans
  — inspection methods
  — procedures for evaluation of inspection results
— attendance during operations activities:
  — attendance during inspections
— review of inspection records.

504 The documents that shall be produced in the project are given in DNV-OS-F101 Sec.3 F700.

505 Definition of certification of the operations phase will follow Table 3-8.

Table 3-8 Scope of work for certification of operations

Verification activity	Level		
	L	*M*	*H*
General review of the main document(s) to check compliance with applicable design documentation. Audit during repair and modification	x	x	x
Audit attendance during start-up of periodical survey, modification and repair activities. For critical aspects, as identified by the requirement for maintenance of certificate, audit attendance throughout the activities. Review of contractors' documentation of the survey/ modification.		x	x
Review of the main document(s) to check compliance with applicable codes and standards. Audit attendance during start-up and performance of periodical survey, modification and repair activities. For critical aspects, as identified by the requirement for maintenance of certificate, full attendance throughout the preparations of and the activities. Issuing of independent confirmation documentation of the survey/modification.			x

506 Verification during operations is carried out to confirm that the pipeline continues to meet the owner's specified requirements for the pipeline's integrity.

507 Annual assessments will be carried out to confirm that any deterioration of the pipeline system is within acceptable limits and that the pipeline continues to be fit for its intended purpose.

Guidance note:

Annual assessments do not necessarily involve annual inspections, which may not be required under a risk-based inspection strategy. Annual assessments involve the activities mention in G503 previously, and may involve only, for example, the review of records confirming that the pipeline has been operated within its design limits.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

508 Additional assessments shall be carried out to confirm that any damage, deterioration or modification to the pipeline system does not render the pipeline unsuitable for its intended purpose.

G 600 Obligations

601 Obligations similar to those given in section 2 C shall apply.

602 To maintain a Certificate of Conformity during the operational phase, DNV shall be kept informed about the condition of the pipeline. DNV shall have full access to information concerning operation, inspection and maintenance activities.

603 The owner shall notify DNV immediately if any of the events as listed below occur, and DNV will review the need for carrying out assessments:

— the pipeline system is damaged, or is suspected of having been damaged in a manner likely to impair its safety, reliability, strength or stability
— the pipeline system demonstrates signs of deterioration likely to impair its safety, reliability, strength or stability
— the pipeline system is to be subjected to any alterations, repairs or replacements.

604 DNV shall be:

— informed when inspections required to retain the Certificate of Conformity are to be carried out

— given timely notification of occasions when such parts of the pipeline system, as are not normally accessible for inspection, may be examined
— given timely advance notification of any pipeline repair activities.

605 The owner shall provide DNV with the necessary plans, specifications and procedures for acceptance. DNV acceptance is required for:

— operating and maintenance procedures and revisions to them
— inspection programmes and requirements both routine and special
— inspection scopes of work
— condition monitoring programmes
— condition monitoring report findings and inspection results.

606 Once a non-conformance report is issued formally, the validity of the Certificate of Conformity is conditional on successful completion of the required action within the specified time.

607 The owner shall notify DNV upon the fulfilment of a non-conformance correction, enabling DNV to carry out a verification of the work.

608 DNV is responsible for, in a timely manner:

— carrying out the agreed assessments
— issuing all reports and any necessary non-conformance report.

G 700 Documentation hierarchy

701 The certification documents for maintenance of certification are as follows:

— Certificate of Conformity
— verification report
— non-conformance reports.

G 800 Non-conformance report

801 Where, after assessment of the pipeline system during the operations phase, DNV does not consider that items examined meet the specified requirements, non-conformance reports are issued.

802 If no standard form is available, narrative reports containing all relevant information will be issued. This information shall enable precise identification of the area of DNV's concern.

803 No corrective action will be proposed by DNV, as this is the owner's responsibility.

APPENDIX A
SELECTION OF CERTIFICATION LEVEL

A. General

A 100 General principles

101 The selection of the level of certification depends on the criticality of each of the elements that have an impact on the management of risks to the pipeline system.

102 Certification shall direct greatest effort at those elements of the pipeline system where the risk is highest and whose failure or reduced performance will have the most significant impact on:

— safety risks
— environmental risks
— economic risks.

103 Suitable selection factors include, but are not limited to, the:

— Overall safety objectives for the pipeline system
— Assessment of the risks associated with the pipeline and the measures taken to reduce these risks
— Degree of technical innovation in the pipeline system
— Experience of the contractors in carrying out the work
— Quality management systems of the owner and its contractors.

104 Due to the diversity of various pipeline systems, their contents, their degree of innovation, the geographic location, et cetera, it is not possible to give precise guidelines on how to decide what level of certification is appropriate for each particular pipeline system.

105 Therefore, guidance is given as a series of questions that should be answered when deciding the appropriate level of certification for a pipeline system. This list is not exhaustive and other questions should be added to the list if appropriate for a particular pipeline system.

106 It must be emphasised that the contribution of each element should be judged qualitatively and/or quantitatively. Wherever possible quantified risk assessment data should use to provide a justifiable basis for any decisions made.

107 Depending of the stage of the project, the activities may not have taken place yet in which case the questions can also be posed in another form, i.e. “Is …. planned to be?”

B. Trigger Questions

B 100 Overall safety objective

— Does the safety objective address the main safety goals?
— Does the safety objective establish acceptance criteria for the level of risk acceptable to the owner?
— Is this risk (depending on the pipeline and its location) measured in terms of human injuries as well as environmental, economic and political consequences?

B 200 Assessment of risk

— Has a systematic review been carried out to identify and evaluate the probabilities and consequences of failures in the pipeline system?
— Has this review judged the contribution of each element qualitatively and quantitatively and used, where possible, quantified risk assessment data to provide a justifiable basis for any decisions made?|
— Does the extent of the review reflect the criticality of the pipeline system, the planned operation and previous experience with similar pipeline systems?
— Does this review identify the risk to the operation of the pipeline system and to the health and safety of personnel associated with it or in its vicinity?
— Has the extent of the identified risks been reduced to a level as low as reasonably practicable by means of one or both of:
  — reduction in the probability of failure
  — mitigation of the consequences of failure?
— Has the result of the systematic review of the risks been measured against the owner’s safety objective?
— Has the result of this review been used in the selection of the appropriate certification activity level?

B 300 Technical innovation

— Has the degree of technical innovation in the pipeline system been considered?
— Has it been considered that risks to the pipeline are likely to be greater with a high degree of technical innovation than with a pipeline designed, manufactured and installed to well-known criteria in well-known waters?
— Have factors been considered in the selection of the appropriate certification level such as:
  — degree of difficulty in achieving technical requirements
  — knowledge of similar pipelines
  — effect of the new pipeline on the surrounding area?

B 400 Contractors’ experience

— Has the degree of risk to the pipeline system been considered where design, construction or installation contractors are inexperienced?
— Has the degree of risk been considered where the contractors are experienced but not in similar work?
— Has the degree of risk been considered where the work schedule is tight?

B 500 Quality management systems

— Have all parties involved in the pipeline system implemented an adequate quality management system to ensure that gross errors in the work are limited?
— Do these parties include the:
  — owner
  — design contractor
  — construction contractors
  — installation contractor
  — operator?
— Do the factors being considered when evaluating the adequacy of the quality management system include:
  — whether or not an ISO 9000 or equivalent certified system is in place
  — results from external audits
  — results from internal audits
  — experience with contractors’ previous work
  — project work force familiarity with the quality management system?

APPENDIX B
LIST OF INSTANCES IN DNV-OS-F101 WHERE AGREEMENT OR ACCEPTANCE IS NECESSARY

A. General

A 100 Introduction

101 Table B1, Table C1, Table D1 and Table E1 give the instances where DNV-OS-F101 refers to acceptance or agreement. In those cases where DNV is providing a pipeline certificate, this acceptance and agreement shall be by DNV.

The table is subdivided into:

- design
- materials and components
- installation (including welding and non-destructive testing)
- operations.

B. Design

B 100 Instances of Acceptance or Agreement in DNV-OS-F101 - Design

Table B1 Instances of Acceptance or Agreement referenced in DNV-OS-F101 - Design	
	Description
Sec.2 B301	Acceptable damage to facilities or environment
Sec.3 B302	Acceptable operating limits
Sec.3 F103	Agreement on documents to be submitted
Sec.3 F 702	Agreement on documents to be submitted
Sec.5 B103	Acceptable damage caused by e.g. dropped objects
Sec.5 B105	Acceptable risk of failure leading to leak
Sec.5 B203	Waiving of system pressure test
Sec.5 B703	Acceptance of sudden leakage in relation to corrosion allowance
Sec.5 B 705	Waiving of minimum 3 mm corrosion allowance
Sec.5 C 201	Accepted principles for design analysis
Sec.5 C606	Displacement controlled buckling and acceptable displacements and cyclic effects

C. Materials and Components

C 100 Instances of Acceptance or Agreement in DNV-OS-F101 - Materials and Components

Table C1 Instances of Acceptance or Agreement referenced in DNV-OS-F101 - Materials and Components	
	Description
Sec.6 A103	Acceptable standards
Sec.6 A203	Agreement on content of Material Data Sheet
Sec.6 C201	Agreement to use C-Mn steel with SMYS higher than 555 MPa
Sec.6 C301	Accepted equivalent standard for Ferritic-austenitic (duplex) steel
Sec.6 C302	Agreement to modifications to Tab 1-5
Sec.6 C309	Agreement on testing to ASTM G 48
Sec.6 C503	Agreement on cladding and the lines material
Sec.6 C604	Agreement on weldability testing
Sec.6 C605	Agreement on weldability testing
Sec.6 C608	Acceptable ferrite/austenite ratio
Sec.6 C Table 6-1	Agreement to chemical compositions for wall thickness > 35 mm
Sec.6 C Table 6-1	Agreement on additional chemical elements other than deoxidation elements
Sec.6 Table 6-1	Agreement to 0.5 - 1.0 % Cr
Sec.6 C Table 6-1	Agreement needed to increase (Nb+V+Ti) $\%_{maximum}$ up to maximum 0.15 %
Sec.6 C Table 6-1	Agreement on Nb %-age up to 0.10 % for SMYS ≥ 485
Sec.6 C Table 6-1	Agreement on Boron content
Sec.6 C Table 6-2	Agreement to chemical compositions for wall thickness > 26 mm
Sec.6 C Table 6-2	Agreement on additional chemical elements other than deoxidation elements
Sec.6 C Table 6-2	Agreement to 0.5 - 1.0 % Cr
Sec.6 C Table 6-2	Agreement needed to increase (Nb+V+Ti) $\%_{maximum}$ up to maximum 0.15 %
Sec.6 C Table 6-2	Agreement on Boron content

Table C1 Instances of Acceptance or Agreement referenced in DNV-OS-F101 - Materials and Components (Continued)	
	Description
Sec.6 C Table 6-4	CVn test temperature to be agreed for t > 40 mm
Sec.6 C Table 6-5	Agreement on use of other alloying elements than specified in table
Sec.6 D201	Agreement on fracture arrest properties
Sec.6 D205	Agreement for concurrent sour service and fracture arrest properties
Sec.6 D302	Agreement on linepipe material for plastic deformation
Sec.6 D307	Agreement on higher yield strength of duplex steel pipes for use in umbilicals
Sec.6 D505	Acceptance of test unit
Sec.6 D Table 6-9	Agreement on fracture arrest properties for large thicknesses and diameters
Sec.6 E303	Agreement on the MPS
Sec.6 E310	Agreement of documentation for sour service for SMYS < 450 MPa
Sec.6 E401	Agreed variations
Sec.6 E501	Agreed variations
Sec.6 E502	Agreement on strip end welds
Sec.6 E507	Agreement of the use of automatic grinding
Sec.6 E601	Agreed variations
Sec.6 E610	Agreement of MPS: - bevelling method, - length of internal weld bead to be ground flush
Sec.6 E703	Agreement to elements in Tabs 6-1, 6-2 or 6-5
Sec.6 E804	Agreement for testing on materials other than those listed on Tab 6-11 and 6-13
Sec.6 E813	Agreement on testing on the same pipe if pipe fails to low CVN values in the HAZ
Sec.6 E905	Agreed testing
Sec.6 E1108	Agreement on omitting hydrostatic testing for UOE pipes
Sec.6 E1201	Agreement on testing for dimensional control
Sec.6 E1204	Agreed diameter tolerance
Sec.6 E1205	Agreed out of roundness tolerance
Sec.6 E1207	Agreement on dial type gauges
Sec.6 E Tab 6-11	See note 5
Sec.6 E Table 6-13	See note 3
Sec.6 F102	Agreement on type of marking
Sec.6 G101	Accepted equivalent to 3.1.B linepipe certificate
Sec.7 B401	Agreement on equivalent bolting standards
Sec.7 B402	Agreement on equivalent standards for bolts and nuts
Sec.7 D101	Acceptable standards
Sec.7 D105	Agreement on final chemical composition for sour service
Sec.7 D201	Agreement on materials with SMYS > 555MPa
Sec.7 D207	Agreement on chemical composition prior to start production
Sec.7 E101	Agreed hot forming procedure
Sec.7 E401	Agreement on heat treatment
Sec.7 F114	Agreement on the MPS
Sec.7 F305	Agreement on testing procedures
Sec.7 F505	Agreed procedures
Sec.7 F703	Agreement to use test pieces
Sec.7 F Table 7-1	See notes 1, 3, 5, 7 and 8
Sec.7 G302	Agreement on corrosion testing on mother pipe
Sec.7 G501	Agreed heat treatment
Sec.7 G505	Agreement on voiding stress relieving

Table C1 Instances of Acceptance or Agreement referenced in DNV-OS-F101 - Materials and Components (Continued)	
	Description
Sec.7 G602	Agreement on bending without post bending heat treatment
Sec.7 G1103	Agreement on grinding repair
Sec.7 H102	Agreement on specification prior to start of production
Sec.7 H303	Agreement on use of higher strength material
Sec.7 H404	Agreement on the MPS
Sec.7 H408	Agreement of procedure
Sec.7 H603	Agreed procedure
Sec.7 H705	Agreement on thin primer coating on welds
Sec.7 H709	Acceptance of effect of temperature effect on pressure test
Sec.7 H716	Acceptance of pressure variations during pressure test
Sec.7 H716	Acceptance of pressure test
Sec.7 I101	Accepted equivalent to 3.1.B certificate
Sec.8 C201	Acceptance by Purchaser of manufacturing qualification
Sec.8 C203	Acceptance by Purchaser of quality plan
Sec.8 F203	Agreed method of testing
Sec.8 F210	Agreement on repair procedures
Sec.8 F301	Acceptance by purchaser of quality plan
Sec.8 H108	Acceptance by purchaser of quality plan
App.B A102	Accepted equivalent for competence of test laboratory
App.B A301	Acceptable uncertainty of chemical analysis
App.B A702	Agreement of reduced DWTT specimens
App.B A804	Acceptance of modification to fracture toughness testing specimen geometry

D. Installation (Including Welding and Non-destructive Testing)

D 100 Instances of Acceptance or Agreement in DNV-OS-F101 - Installation (Including Welding and Non-destructive Testing)

Table D1 Instances of Acceptance or Agreement referenced in DNV-OS-F101 - Installation (Including Welding and Non-destructive Testing)

	Description
Sec.9 A505	Agreement on installation manuals
Sec.9 A705	Agreement on weld repair analysis
Sec.9 A807	Agreement on omitting radiographic and magnetic particle/liquid penetrant testing
Sec.9 A903	Agreement on omitting production testing
Sec.9 C303	Agreed computer program for mooring analysis
Sec.9 C502	Agreement on use of vessel with displacement > 5000 t within the installation 500 m zone
Sec.9 D401	Agreement on operating limits
Sec.9 D403	Agreement on operating limits based on defined sea states
Sec.9 D405	Agreement on postponed lay-down
Sec.9 D501	Agreement on installation procedures
Sec.9 D601	Agreement on contingency procedures
Sec.9 D703	Accepted heights and spacing
Sec.9 E201	Acceptance by purchaser of installation manual
Sec.9 E303	Agreement on ECA testing
Sec.9 E502	Acceptable redundancy
Sec.9 F103	Agreement on all aspects of surface tow
Sec.9 F104	Agreement on all aspects of bottom tow
Sec.9 F501	Agreement on installation procedures
Sec.9 F803	Acceptable weather conditions
Sec.9 G101	Agreement on other installation methods
Sec.9 G102	Agreement on installation of flexible pipes, bundles and multiple pipelines
Sec.9 H501	Agreement on installation procedures
Sec.9 H602	Acceptable cable tension limits
Sec.9 H804	Acceptable pulling tension limits
Sec.9 I102	Agreement on tie-in operations
Sec.9 I501	Agreement on tie-in procedures
Sec.9 I707	Accepted procedures
Sec.9 I802	Agreed procedure for diving and underwater operations
Sec.9 J201	Acceptable span lengths and heights
Sec.9 K301	Acceptable span lengths and heights
Sec.9 K409	Agreed time of trenching
Sec.9 M101	Agreed diving and underwater operation procedures
Sec.9 M102	Acceptance by Purchaser of use of bending shoe
Sec.9 M501	Acceptance of contingency procedures
Sec.9 M608	Acceptance of repair procedures
Sec.9 O301	Agreed procedures
Sec.9 O502	Acceptable weld quality
Sec.9 O510	Accepted correlation between temperature change and test pressure
Sec.9 O516	Agreement on shorter pressure hold period
Sec.9 O519	Acceptable pressure variations
Sec.9 O603	Acceptance of introduction of product
Sec.9 O701	Acceptance of procedures
App.C A203	Agreement on welding pre-qualification program
App.C B206	Agreement on partial qualification of welders
App.C B207	Agreement on premises used for welding qualification test

Table D1 Instances of Acceptance or Agreement referenced in DNV-OS-F101 - Installation (Including Welding and Non-destructive Testing) (Continued)

	Description
App.C B. Table C1	Agreement on bend test specimens
App.C B215	Agreement on position of test for renewal of qualification
App.C B502	Agreement on consumable storage and handling procedure
App.C D202	Acceptance of preliminary WPS
App.C D301	Agreement on welding procedure qualification record
App.C E201	Agreement on scope of repair weld qualification testing
App.C E204	Agreement on additional impact tests for qualification of repair welding
App.C E404	Acceptance of pre-qualification programme for mechanised welding
App.C E505	Acceptance of reduction in number of destructive tests
App.C E506	Agreement on pre-qualification program for mechanised welding
App.C E Table C5	Agreement on fracture toughness testing
App.C E801	Agreement on overlay welding methods
App.C F612	Agreement on requirements for corrosion testing
App.C F210	Agreement on welding of temporary attachments
App.C F215	Agreement on procedure for fillet welds with root gaps > 5mm
App.C G302	Acceptance of root repairs
App.C G401	Acceptance of CTOD values in as-welded condition
App.C G706	Acceptance of other underwater welding methods
App.C G708	Agreement on use of artificial resistance to simulate cable dimensions
App.C H105	Agreement on extent of testing and documentation of corrosion resistant welding consumables
App.D A405	Acceptance of equivalent NDT methods
App.D A502	Agreement on alternative codes and standards
App.D B201	Agreement on radiographic testing procedure
App.D B204	Agreement on alternative IQIs
App.D B206	Agreement on radiographic sensitivity for materials < 10mm thickness
App.D B210	Agreement on electronic storage of radiographic films
App.D B301	Agreement on ultrasonic testing procedure
App.D B304	Agreement on ultrasonic testing procedure
App.D B308	Acceptance of alternative materials for reference block
App.D B310	Agreement on alternative methods of calibration
App.D B401	Agreement on magnetic particle testing procedure
App.D B403	Agreement on magnetic particle testing procedure
App.D B501	Agreement on liquid penetrant testing procedure
App.D B503	Agreement on liquid penetrant testing procedure
App.D B603	Agreement on eddy current testing procedure
App.D E607	Acceptance of width of reference block slots
App.D B612	Agreement on reports of indications
App.D C101	Agreement on non-destructive testing procedures
App.D E104	Acceptance of limits for variation of welding parameters
App.D E104	Agreement on NDT used for verification of correlation between welding parameters and defects
App.D E105	Agreement on NDT methods and acceptance criteria

Table D1 Instances of Acceptance or Agreement referenced in DNV-OS-F101 - Installation (Including Welding and Non-destructive Testing) (Continued)	
	Description
App.D F103	Agreement on omitting tests for laminar imperfections
App.D F203	Agreement on acceptance criteria for imperfections
App.D G402	Agreement on length of pipe end for ultrasonic testing
App.D G503	Agreement on acceptance criteria for pipe body laminations
App.D G603	Agreement on use of TOFD probes
App.D G603	Agreement on ultrasonic testing equipment configuration
App.D G607	Agreement on ultrasonic testing equipment configuration
App.D G609	Agreement on acceptance criteria for pipe body laminations
App.D G705	Agreement on description of ultrasonic testing equipment
App.D G710	Agreement on type of reflectors
App.D G710	Agreement on use of mid-thickness notch
App.D G718	Agreement on use of “two lambda” method
App.D G727	Agreement on acceptance criteria for pipe body laminations
App.D I501	Agreement on acceptance criteria for machined surfaces
App.E B102	Agreement on examination zones > 3mm
App.E B410	Agreement on transducer changes
App.E B413	Agreement on alternative velocity and attenuation measurements
App.E B415	Acceptance of reflector dimensions and type
App.E B501	Agreement on order of output signals

Table D1 Instances of Acceptance or Agreement referenced in DNV-OS-F101 - Installation (Including Welding and Non-destructive Testing) (Continued)	
	Description
App.E B1201	Agreement on type and number of spares
App.E B1301	Agreement on use of slave monitors
App.E C104	Agreement on automated ultrasonic examination procedure
App.E C109	Agreement on reduction in frequency of calibration scans
App.E G303	Agreement on provision of software and hardware
App.E H104	Agreement on automated ultrasonic testing qualification program
App.E Ann.B B1	Agreement on equivalent methods of determining acoustic velocity

E. Operations

E 100 Instances of Acceptance or Agreement in DNV-OS-F101 - Operations

Table E1 Instances of Acceptance or Agreement in DNV-OS-F101 - Operations	
	Description
Sec.10 A402	Agreed intervals of safety equipment testing intervals
Sec.10 E102	Agreed repair specifications and procedures
Sec.10 E103	Agreed inspection methods and personnel
Sec.10 E109	Acceptance of temporary repair
Sec.10 E301	Agreed repair methods
Sec.10 E704	Acceptable safety in connection with repair while operating

APPENDIX C
GENERIC DESCRIPTION OF PROJECT SUB-PHASES

A. General

A 100 Introduction

101 A great deal of confusion can occur in projects over the precise meaning of the various project phases. The precise meanings are not, by themselves, important provided that everybody working on a particular project is consistent in the use and understanding of such meanings.

102 Some examples of descriptions of project sub-phases or milestones are given below. These descriptions are not intended to be precise definitions but are given as suggestions as to how particular project-specific definitions can look.

B. Initial Studies

B 100 Feasibility study

101 A feasibility study is a study directed at evaluation of the feasibility of one or more concepts.

102 The feasibility study is an evaluation of one or more proposed technical concepts against project cost and schedule. It should identify special technical problems and indicate the solution or solve these to the degree necessary to confirm the feasibility of the project cost and schedule.

103 The feasibility study shall address all essential cost and schedule aspects, and should conclude on what the most uncertain factors are and how they should be approached. It should preferably address aspects such as environmental impacts, special legislation etc. that are peripheral to pipeline integrity.

B 200 Concept study

201 A concept study is a design made to establish the main dimensions and data of the pipeline.

202 These include, for example, diameter, wall thickness, stability requirements, material type and corrosion protection philosophy. Other aspects include establishment of a route corridor and identification of possible needs for major intervention works and/or (additional) surveys. In short, the study has to establish the basic parameters for the work to be performed in the next stages of design and a means for more detailed cost estimation and possibly comparison of a number of concepts detailed to the same level.

203 It is expected only to indicate the preferred/possible methods or solutions of how to solve landfall zones, connection, installation, dropped object/trawl protection, expansion, major intervention etc. On this basis it is expected that the concept study documentation identifies how far the design has reach, what needs to be further detailed/investigated and how the designer foresees the use of the given information as part of the subsequent design.

C. Design

C 100 Basic design

101 Basic design is a design made to establish the main dimensions and data of the pipeline to a level where it is possible to make a detailed cost estimate and to place fabrication orders without taking any significant economic risk.

102 The following should be defined; final route, diameter, wall thickness, stability requirements (i.e. length of pipe with concrete coating and length of trenching and/or volume of rock dumping), insulation/cooling requirements, corrosion protection (i.e. number and type of anodes and type and thickness of ant-corrosion coating), material type and total length of required linepipe, type and number of buckle arrestors, number and depth of crossings, required seabed preparations, landfall design, dropped object/trawl protection requirements, number and type of tie-ins and installation requirement. In short, to establish a design for which only local details remain to be defined.

103 On this basis, it is expected that a large part of the basic design documentation will be the final design documentation and that it identifies what needs to be further detailed/investigated and how this shall be done by the designer.

C 200 Detail design

201 Detail design means the finalisation of design. It can entail all stages of design, as it does not necessarily have to be preceded by another distinct phase. It shall address all design issues for all items of the pipeline system and finalise all the specifications for the subsequent production phases.

D. Other Phases

D 100 General

101 Descriptions of other project phases, such as Construction (manufacturing, fabrication, installation, hook-up and commissioning) or Operations are not given, as there is rarely any confusion of their meaning or extent.

APPENDIX D
EXAMPLES OF CERTIFICATION DOCUMENTS

A. General

A 100 Introduction

101 This appendix includes example forms for use by DNV in the verification and certificate of pipeline systems.

102 The following forms are included:

- Certificate of Conformity
- Statement of Compliance
- Verification Comments Sheet
- Audit Report
- Visit Report

A 200 Certificate of Conformity

Certificate No.:
.....

DET NORSKE VERITAS

CERTIFICATE OF CONFORMITY

NAME OF OWNER: .....

NAME OF PIPELINE SYSTEM: .....

LOCATION: .....

DESCRIPTION: .....

OPERATIONAL LIMITATIONS:
PRESSURE: .....
TEMPERATURE: .....
SERVICE: .....

THIS IS TO CERTIFY THAT: The above mentioned pipeline system has been verified, by appropriate methods, to comply with the requirements of the DNV Offshore Standard OS-F101 Submarine Pipeline Systems 2000, for the operational limits stated above, with the exceptions noted in DNV Verification Report Number .....

CERTIFICATION INVOLVEMENT: The certification of the above mentioned pipeline system has been performed in accordance with DNV Offshore Service Specification OSS-301 Certification and Verification of Pipelines 2000 at Level ..... with the detailed scope of work described in DNV Verification Report Number .....

This certification level has been accepted by DNV to be satisfactory for the risk to the integrity of the pipeline system identified for its design and construction.

VALIDITY: This certificate is valid until ..... provided that there is satisfactory completion of annual assessments, as shown below.

REFERENCE DOCUMENTS: DNV Verification Report Number: .....

PLACE: _____ **DATE:** _____

_____
Regional Manager, Region .....

	1st ANNUAL ASSESSMENT	2nd ANNUAL ASSESSMENT	3rd ANNUAL ASSESSMENT	4th ANNUAL ASSESSMENT
Signature:				
Date:				

A 300 Statement of Compliance

Statement No.:
.....

DET NORSKE VERITAS

STATEMENT OF COMPLIANCE

NAME OF OWNER:	.....
NAME OF PIPELINE SYSTEM:	.....
LOCATION:	.....
DESCRIPTION:	.....
OPERATIONAL LIMITATIONS:	PRESSURE: ..... TEMPERATURE: ..... SERVICE: .....
THIS IS TO STATE THAT:	The above mentioned ..... has been verified, by appropriate methods, to comply with the requirements of the DNV Offshore Standard OS-F101 Submarine Pipeline Systems 2000, for the operational limits stated above, with the exceptions noted in DNV Verification Report Number .....
VERIFICATION INVOLVEMENT:	The verification of the above mentioned ..... has been performed in accordance with DNV Offshore Service Specification OSS-301 Certification and Verification of Pipelines 2000 at Level ..... with the detailed scope of work described in DNV Verification Report Number ..... This verification level has been accepted by DNV to be satisfactory for the risk to the integrity of the pipeline system identified for the above mentioned ..... .
REFERENCE DOCUMENTS:	DNV Verification Report Number: .....

PLACE: _____ **DATE:** _____

_____
Project Manager

A 400 Verification Comments Sheet

VERIFICATION COMMENTS SHEET				
Project Title:				DNV Project No.:
Document title:	Prepared by:	Date:	Sign:	Document No.:
	Verified by:	Date:	Sign:	Revision:
Have all previous comment to this document been satisfactory solved or repeated below?				YES / NO / N/A
VERIFICATION COMMENTS:				

VerCom. No.:	Description:	Category [1]	Status [2]
1.			
2.			
3.			
4.			
5.			
6.			
7.			
8.			
9.			
10.			

NOTES:

Category [1]

NC = Non-Conformance

The information contained in the document is not accepted as complying with the applicable requirements due to outstanding areas of concern.

TQ = Technical Query

The review of this document cannot be completed until the information requested is submitted.

A = Advice (reply not needed)
The information contained in the document is accepted as complying with the applicable requirements but DNV offers certain advice based on its experience

Status [2]

O = Open
C = Closed (requires a reference)

A 500 Audit Report

DNV Work Order No.:	Report No.:
Vendor:	Date of Visit:
Item:	Purchase Order No.:

This form is to be used as checklist and report for reviewing the quality system of companies supplying items subject to inspection by DNV. It should be appended to the first visit report.

1 Does the organisation have a documented quality system? Yes/No

Quality Manual: Ref..... Rev. No.....

Based upon: ISO 900.. /Other standard .....

2 Has the quality system been certified by an accredited Certification Body for the product (range) in question? Yes/No

Body.....

Certificate No..... Valid to date.....

Most recent periodical audit carried out on (date).....

N.B. If the answer to this question is YES go to item 5.

3 Based on reviews and checks, does the quality system cover the following quality assurance elements adequately for the product in question:

- Organisation Yes/No
- Authority/Responsibility Yes/No
- Job Descriptions for key persons Yes/No
- Internal Quality Audits Yes/No
- Documentation Change Control Yes/No
- Job Instructions/Procedures Yes/No
- Non-Conformance/Corrective Action Yes/No

For areas that are inadequate give brief details attached.

4 Are there adequate procedures for following activities as appropriate:

- Calibration of Equipment Yes/No
- Material Identification & Marking Yes/No
- Control of Special Processes like Welding, NDT, PWHT Yes/No
- Non-conformance Identification & Handling Yes/No
- Inspection Status Yes/No
- Final Inspection Yes/No
- Others - Specify Yes/No

For procedures found to be inadequate give brief details attached.

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5	Are organisation's facilities in general considered adequate for the scope of supply?	Yes/No
6	Has Quality Plan been prepared for the order concerned? Ref:.....rev.....	Yes/No
7	Are ..... or their appointed inspection agency in attendance? Which inspection agency?.....	Yes/No
8	Are any problem areas identified - Give details	

NAME: STATION:
SIGN: DATE:
Separate sheets attached Yes/No

page 2 of 2

A 600 Visit Report

DNV Work Order No.:	Report No.:
Vendor:	Date of Visit:
Item:	Purchase Order No.:

A visit report is to be prepared after every surveillance visit. It shall be faxed to DNV ..... within 3 days of the visit. If required, please give further details on separate sheet.

1 Are quality system procedures adhered to? Yes/No
If no, please give details.

2 Are fabrication/inspection requirements defined in vendor's quality plan being met
- By the vendor?
- By ..... or their appointed inspection agency?
- Other parties, if any (specify.....)

If no, please give details.

3 Is documentation being completed and collated as required?
If no, please give details.

4 Are there any outstanding non-conformances/corrective action required?
If yes, please give details.

5 Give brief details of completion status and purpose of visit:
Vendor Q-Plan reference: .....

6 Give brief details of work anticipated for next visit:
Vendor Q-Plan reference: .....

7 Indicate areas of concern or information requested from other parties not yet available:

NAME: STATION:
SIGN: DATE:
Separate sheets attached Yes/No

APPENDIX E
DETAILED SCOPE OF WORK
TABLES FOR CERTIFICATION AND VERIFICATION

A. General

A 100 Introduction

101 This appendix gives the format of the detailed scope of work tables that shall be made for each particular project.

102 The detailed project-specific scope of work tables for the chosen level of certification and verification shall be based on these tables. For pipeline project scenarios of components not covered in this Appendix similar tables, with the same degree of detail, shall be made.

103 If any of the activities are moved from one phase to another, then this must be identified clearly on the table where it is removed. Similarly, the detailed table for the phase to where it is moved shall be amended.

Guidance note:

Typically, contractual boundaries may give natural splits of activities between phases. However, then it is even more important to ensure that there is a traceability as to which phases what activity belong and that this is conveyed to the contractors also.

---e-n-d---of---G-u-i-d-a-n-c-e---n-o-t-e---

B. Description of Terms used in the Scope of Work Tables

B 100 General

101 The following abbreviations have been used. The definitions of which are given subsequently:

— A is audit
— S is surveillance
— H is Hold Point
— R is review

102 These abbreviations are DNV's preferred terms and will be used in DNV-generated documents. However, other terms, for example monitoring or witnessing, will be used by DNV if these are the terms commonly used in documents, such as Inspection and Test Plans, generated by others. In that case, it is expected that these other terms will be defined in these documents.

B 200 Audit

201 Systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives (ISO 8402:1994).

Guidance note:

This activity differs from the Surveillance by being focused on the adherence to and completeness and robustness of the procedures and not on the actual result of the procedure (although this is not ignored). Further, the audit is normally a 'one-off' activity as opposed to the continuity in monitoring.

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B 300 Surveillance

301 Continual monitoring and verification of the status of an entity and analysis of records to ensure that specified requirements are being fulfilled (ISO 8402:1994).

Guidance note:

Other commonly used terms for Surveillance are Monitoring or Witnessing.

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302 The amount of work involved in surveillance is not described in detail in the tables. This shall be part of the final contractual scope of work which shall define the frequency of surveillance based on the overall surveillance and the quality control performed by other parties as well as DNV's experience.

303 The following shall be used to describe the frequency if nothing else is specifically defined:

— S1 = Surveillance on a visit basis, e.g. once per week
— S2 = Surveillance frequency minimum once per day
— S3 = Surveillance frequency minimum once per shift.

Guidance note:

These surveillance frequencies may be modified to correspond with production work flow.

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B 400 Hold Point

401 A point, defined in an appropriate document, beyond which an activity must not proceed without the approval of a designated organization or authority (ISO 8402:1994).

B 500 Review

501 Systematic examination of reports and documentation. The depth of review will depend both on the type of document and the level of involvement.

502 The following shall be used to describe the extent of the review if nothing else is specifically defined:

— I = for information only
— R1 = review of principles and general aspects
— R2 = comprehensive review

Guidance note:

Review of production records does not guarantee their correctness. It is a confirmation to DNV that the manufacturer and/or sub-contractor has preformed the required activity and issued a report.

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503 Reports that are reviewed by DNV will, unless otherwise agreed, not be signed and stamped.

C. Overall Project Management

C 100 General

101 The project quality management documentation shall be available at the early stages of the project, preferably before design is underway, to ensure that the necessary controls are in place.

C 200 Detailed scope of work for overall project management

201 A detailed scope of work for the overall project management is given in Table C-1.

Table C-1 Overall Project Management

Item	*Description*	*Level*		
		Low	*Medium*	*High*
1	review of project quality management documentation	R1	R2	R2
2	audit of project quality management system	X	X	X
3	review of sub-contractor control	X	X	X
4	review of interface controls	X	X	X
5	review of methods of information flow			X

D. Design

D 100 General

101 For design verification a list similar to that given in Table D-1 and Table D-3 shall be made for the specifics of the minimum requirement to documentation for each pipeline system.

102 The documentation of the items under General in Table D-1 shall be available at the early stages of the design. Of the remainder of the documentation in Table D-1 and Table D-3, all shall be completed and be made available to DNV if requested, before the Statement of Compliance can be issued.

D 200 Design verification

201 DNV-OS-F101 specifies that the design and planning for a pipeline system shall cover all development phases including construction, operation and abandonment. (Sec 3 A410) and, further, that all documentation requirements shall be reflected in a document register (Section 3 F102). The documentation to be produced and issues to be covered during design are given in DNV-OS-F101 Section 3 F200.

202 For *certification* of pipeline systems, the document register shall be made available to DNV for identification of documents for submission for review for all project phases.

203 Table D-1 describes the issues to be verified and Table D-2 identifies the extent of independent analyses/calculations included in the three certification levels. Sections C300, C400 and C500 following, describe the verification for each of the levels.

204 Table D-3 and Table D-4 describe the issues to be verified in relation to flow assurance which, not being an integrity matter, is offered as an additional certification service.

D 300 Low level design verification

301 The initial *Low* level design verification consists of a detailed document review of the design basis, risk assessment/ analysis documentation, quality management documentation and (if they exist) method or design philosophy documents. The presumed critical aspects of the project shall be identified by DNV from the initial review and conveyed to the client and designer for discussion and agreement on correct understanding.

302 The subsequent verification consists of document review of the calculations/analysis methods used to conclude the critical aspects. Other design documents are used as information and a few will be spot checked for confirmation of the quality control.

303 Implementation of the transfer of conclusions from design calculations/reports into drawings and specifications is not included.

D 400 Medium level design verification

401 *Medium* level design verification consists of a review of all main design documents related to pipeline safety and integrity. Less critical aspects will be spot checked. The review will be detailed for all critical aspects and independent checks will be performed.

402 Implementation of the conclusions from design calculations/reports into drawings and specifications will be included on a spot check basis.

D 500 High level design verification

501 *High* level design verification consists of a full review of most of the produced documents related to pipeline integrity. The review will be detailed for all critical aspects and independent checks will be performed.

502 Implementation of the conclusions from design calculations/reports into drawings and specifications is included.

503 The main specifications are also checked for clearness and ambiguity.

D 600 Scope of work for design

601 Detailed scope of work for design is given in Table D-1, Table D-2, Table D-3 and Table D-4.

Table D-1 Pipeline integrity design

Item	*Description*	*Level*		
		Low	*Medium*	*High*
General				
1	Safety objective	I	I	I
2	Confirmation that the different contractors and sub-contractors' quality systems meet the requirements of ISO 9000	R2	R2	R2
3	Description of pipeline system and overall project organisation	I	I	R1
4	Risk assessment and identification of critical aspects	R2	R2	R2
5	Document register	I	R1	R2
Structural (main)				
6	Design basis	R1	R2	R2
7	Pipeline routing	I	R1	R2
8	Physical and chemical characteristics of fluid	I	I	R1
9	Materials selection including internal corrosion assessment (linepipe and pipeline components)	R1	R1	R2
10	Temperature/pressure profile (hydraulic/thermal analyses)	R1	R1	R2
11	Pressure containment (wall thickness calculations)	R1	R2	R2

Table D-1 Pipeline integrity design (Continued)				
Item	*Description*	*Level*		
		Low	*Medium*	*High* (Con-
12	Stability (including both temporary and permanent conditions)	R1	R2	R2
13	Pipeline expansion (if applicable)	R1	R1	R2
14	Free span assessment (if applicable)	R1	R2	R2
15	Upheaval buckling assessment (if applicable)	R1	R2	R2
16	Lateral snaking assessment (if applicable)	R1	R2	R2
17	Crossing design (if applicable)	R1	R2	R2
18	Tie-in design, expansion spool calculations (if applicable)	R1	R2	R2
19	Shore crossing assessment (if applicable)	R1	R2	R2
20	Trawl interaction (if applicable)	R1	R2	R2
21	Installation analyses	R1	R2	R2
22	Trenching assessment (if applicable)	-	I	R1
23	Fixed riser strength analyses (if applicable) (including both temporary and permanent conditions)	R1	R2	R2
24	Fixed riser supports design (if applicable) (including both temporary and permanent conditions)	-	I	R1
Structural (appurtenances)				
25	Pig launcher/receiver design (if applicable)	I	R1	R1
26	Flange calculations (if applicable)	I	R1	R2
27	T-joints, valves, etc. (if applicable)	I	R1	R2
Structural drawings				
28	Pipeline route drawings	I	R1	R1
29	Detailed pipeline crossing drawings	I	R1	R2
30	Platform layout drawings	I	R1	R2
31	Spool drawings	I	R1	R1
32	Pipeline protection drawings	I	R1	R2
33	Riser and riser clamp drawings	I	R1	R1
Linepipe and pipeline components (including welding)				
34	Linepipe specifications	R1	R1	R2
35	Welding specifications	I	R1	R2
36	Material take off/data sheets	-	I	R1
Corrosion control systems and weight coating				
37	Cathodic protection design report	R1	R1	R2
38	Anode manufacturing and installation specifications	I	R1	R1
39	Coating manufacturing specifications	I	R1	R1
40	Field joint coating specification(s)	I	R1	R1
41	Corrosion monitoring system specification	I	R1	R1
42	Material take off/data sheets	-	I	R1
Installation				
43	Failure Mode Effect Analysis (FMEA) and HAZOP studies	I	R1	R1
44	Installation and testing specifications and drawings	-	I	R1
45	ECA (if applicable)	-	R1	R2
46	Vessel evaluation and possible qualification testing specification	-	I	R1
Operation				
47	DFI resume	I	R1	R2
48	Inspection plan	I	R1	R1
Flow assurance, if not specified according to tables D-3 *and* D-4 *1)*				
49	Flow assurance (including internal corrosion assessment)	-	I	R1
1) Flow assurance verification is offered as an optional service for certification, see Table D-3 and Table D-4.				

Table D-2 Independent analyses/calculations for pipeline integrity design

Item	*Activity*	*Description*	*Level*		
			Low	*Medium*	*High*
1	Wall thickness	Simple calculations based on empirical formulas	x	x	x
2	Stability	Simple calculations based on empirical formulas covering wave loading according to Stokes 5th order theory and simple force equilibrium		x	(x)
3		Advanced calculations including the long term wave statistics			x
4	Expansion	Simple calculations based on empirical formulas	(x)	x	x
5		Advanced analyses with a fully non-linear FE program. (Note that these normally are not needed for straight-forward pipeline designs)		(x)	x
6	Upheaval buckling	Advanced analyses with a fully non-linear FE program accounting for the non-linear soil resistance.			
7	Free span	Simple calculations based on empirical formulas	(x)	x	x
8		Advanced analyses with a fully non-linear FE program accounting for the actual axial force distribution and the effect of multi-spans.			(x)
9	Fatigue	Simple calculations with an on-set criteria for cross flow vibrations		(x)	x
10		Advanced calculations accounting for the long term wave and current statistics, allowing for cross-flow vibrations			(x)
11	Trawling	Advanced non-linear FE calculations including the dynamic trawl loading			(x)
12	Lateral buckling	Simple calculations based on empirical formulas	(x)	x	x
13		Advanced FE calculations including non-linear material properties, soil interaction.			(x)
14	Laying	Simple calculations based on empirical formulas	(x)	x	x
15		Advanced static FE analysis with vessel geometry included			x
16		Advanced dynamic FE analysis with full vessel characteristics included			(x)
17	Spool	Advanced static FE analysis			(x)
18	Fixed Risers	Simplified static FE analysis		(x)	x
19		Advanced static FE analysis including environmental loading, platform movements and detailed support modelling (gaps)			(x)
20	Soil	Simplified axial, lateral soil friction (for expansion and/or stability calculations) and soil resistance to be used in upheaval buckling		(x)	x
21	Corrosion protection	Simple cathodic protection analysis	(x)	x	x
22		Anode temperature calculations		(x)	x
23	Internal corrosion	Simple internal corrosion analysis		(x)	(x)
25	Corroded/damaged pipelines	Simple calculations based on empirical formulas		(x)	(x)
26		Advanced non-linear FE calculations			(x)

x = analysis/check will be included in the scope of work (if relevant)

(x) = analysis/check should be included in the scope of work if the issue is identified as critical or highly utilised. Then final decision of inclusion in the scope of work will be a result of the document review of simple analysis.

Table D-3 Flow assurance design				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Design Basis				
1	Production profile	I	I	I
2	Hydrocarbon composition, water cut	I	I	I
3	Flowing well head pressure (FWHP) and flowing well head temperature (FWHT)	I	I	I
4	Pipe dimension	I	I	I
5	Operational requirements (arrival pressure and/or temperature, export pressure and/or temperature, cool-down time, slug sizes)	R1	R1	R1
6	Pipeline topography	I	I	I
7	Soil data	I	I	R1
8	Subsea templates/expansion loops	I	R1	R1
Steady State Thermo-hydraulic Report				
9	Pipeline model	I	R1	R1
10	Pipe dimension/capacity of pipeline	I	I	R1
11	Steady state pressure and temperature profiles	R1	R1	R1
12	Flow regimes/slugging	R1	R1	R1
13	Anode temperatures	I	R1	R2
14	Heating	R1	R1	R1
15	Pipeline insulation system	R1	R1	R2
16	Overall heat transfer coefficient	R1	R1	R2
17	Hydrate analysis	R1	R1	R1
18	Wax formation analysis	R1	R1	R1
19	Design of methanol/glycol injection system	R1	R1	R2
20	Effect of pipeline trenching and soil properties	R1	R1	R2
Other Aspects				
21	Sand accumulation	R1	R1	R1
22	Erosion in piping system	R1	R1	R1
23	Erosion of chokes and valves	R1	R1	R2
24	Internal corrosion	R1	R1	R1
Transient Thermo-hydraulic Report				
24	Terrain slugging	R1	R1	R2
25	Shut-down of pipeline	R1	R1	R1
26	Pressure surges/water hammer	R1	R1	R1
27	Cool-down time at shut-down	R1	R1	R2
28	Liquid hold-up during shut-down	R1	R1	R1
29	Start-up of pipeline	R1	R1	R1
30	Heating of pipeline	R1	R1	R2
31	Liquid surging at start-up	R1	R1	R1
32	High integrity pressure protection system (HIPPS)	I	R1	R2
33	Control system	I	R1	R1
34	Pipeline creep at shut-down/start-up	I	R1	R1
35	*Update of Steady State Report and Transient Report based As-laid Survey.*	I	R1	R2

Table D-4 Independent analyses/calculations for flow assurance

Item	*Activity*	*Description*	*Level*		
			Low	*Medium*	*High*
1	**Capacity/ pipe dimension**	Checking of input values, program system used and brief assessment of results	x	x	x
2		Simple calculations based on empirical formulae/spread-sheet models		x	x
3		Independent calculations with appropriate multi-phase program system			x
4	**Pressure/ temperature profiles** Anode temperature	Checking of input values, program system used and brief assessment of results	x	x	x
5		Simple calculations based on empirical formulae/spread-sheet models		x	x
6		Independent calculations with appropriate multi-phase program system			x
7	**Hydrate/ wax analysis**	Checking of input values, program system used and brief assessment of results	x	x	x
8		Independent calculations with appropriate process simulation and multi-phase program systems		(x)	x
9	**Insulation system** Over-all U-value, Effect of trenching	Checking of input values, program system used and brief assessment of results	x	x	x
10		Simple calculations based on empirical formulae/spread-sheet models		x	x
11		Independent calculations with appropriate multi-phase program system		(x)	x
12	**Corrosion assessment**	Independent calculations with appropriate multi-phase program system			(x)
13	**Erosion assessment** Piping system, Chokes	Independent calculations with appropriate program system			(x)
14	**Sand accumulation**	Independent calculations with appropriate multi-phase program system			(x)
15	**Transient analysis** Cool-down, Heating	Checking of input values, program system used and brief assessment of results	x	x	x
16		Independent calculations with appropriate transient multi-phase program system		(x)	x
17	**Transient analysis** Pressure surges, HIPPS	Checking of input values, program system used and brief assessment of results	(x)	(x)	x
18		Independent calculations with appropriate transient multi-phase program system			(x)
19	**Transient analysis** Terrain slugging, Liquid hold-up, Liquid surges	Checking of input values, program system used and brief assessment of results	x	x	x
20		Independent calculations with appropriate transient multi-phase program system		(x)	x

x = analysis/check will be included in the scope of work (if relevant

(x) = analysis/check should be included in the scope of work if the issue is identified as critical or highly utilised. Then final decision of inclusion in the scope of work will be a result of the document review of simple analysis.

E. Construction

E 100 General

101 Construction consists of a number of different site activities and their associated documentation.

102 Table E-1 and Table E-2 give summaries of the scope of work tables included in this section for various construction activities

103 For construction, verification lists similar those shown hereafter shall be made for the specifics of the particular project.

E 200 Construction verification

201 DNV-OS-F101 (Sec. 3 F300, F400 and F500) specifies the documentation to be submitted before, during and after construction.

202 For certification and verification of pipeline systems construction activities are considered as:

— initial activities
— inspection activities
— final activities.

203 The *initial activities* include the review of procedures, attendance during qualification of procedures (e.g. MPQT) and personnel (e.g. welders) and other start-up activities. The *inspection activities* are the site attendance and the *final activities* are the (continuous) review of production results/records and the completion of documentation and reports.

E 300 Low level construction verification

301 For *Low* level verification, the procedure review consists of a review of the construction management procedures and confirmation that the most important aspects of the main specifications have been included in the procedures. For the qualification of procedures and personnel DNV will not attend the actual qualification, but will review the results.

302 During the construction, DNV's verification will be performed during site visits. The verification will focus on the critical items/aspects identified in the detailed scope of work tables.

303 The subsequent verification of the final activities will be by spot-checks of the production records including non-conformance logs, and results from audits, both contractors internal audits or audits performed by other parties.

E 400 Medium level construction verification

401 For *Medium* level verification, the procedure review consists of a detailed review of construction management procedures. Other important procedures will be spot checked to confirm that the most important aspects of the specifications have been included.

402 For the qualification of procedures and personnel DNV will visit the main qualifications and review the results.

403 During construction, DNV's verification will be performed by full time attendance at the main sites. The verification will focus on the critical items/aspects as identified in the detailed scope of work tables.

404 Verification of the final activities will be by review of the production records including non-conformance logs, and results from audits, both contractor's internal audits or audits performed by other parties, from the main sites and spot checks of the same from other important sites.

E 500 High level construction verification

501 For *High* level verification, the procedure review consists of a detailed review of construction management procedures. Other procedures will be spot checked to confirmation that important aspects of the specifications have been included.

502 For qualification of procedures and personnel DNV will attend the main qualifications, visit other qualifications and review the results

503 During construction, DNV's verification will be performed by full time attendance at the main sites and by visits to the other important sites. Verification will focus on the critical items/aspects as identified in the detailed scope of work tables.

504 Verification of the final activities will be by detailed review of the production records including the non-conformance log, and results from audits, both contractors internal audits or audits performed by other parties, from the main sites and spot checks of the same from other important sites.

E 600 Verification of work in progress

601 The monitoring by the owner during construction relates to the activities of the contractor. The monitoring of these activities by DNV relates not only to the contractor's activities but also to the monitoring of these activities carried out by the owner.

602 The emphasis placed on the various activities in the verification plan varies depending on:

— any areas of concern revealed during design verification
— any areas of concern revealed during the audit of the owner's or contractor's quality management systems
— the progress of construction
— the findings of the contractor surveillance personnel.

603 Many contractors have adequate quality control systems and quality control departments, with competent personnel to perform, for example, inspection at mills and coating plants and specialist material engineers competent to review and verify the performance of mills.

604 In that case, all certification work need not be done by DNV personnel. Where applicable, the various inspections may be carried out by competent persons other than DNV personnel. In that situation DNV's certification activities can be confined to:

— reviewing the competence of the contractor's personnel
— auditing their working methods and their performance of that work
— reviewing the documents produced by them.

605 DNV personnel will spend more time in areas where problems have occurred, or are considered likely to occur. Conversely, less time is spent in areas where the likelihood of problems is considered lower.

E 700 DNV final report

701 All the scopes of work tables for construction end with a hold point entitled "Issue of DNV Visit Report". This item is not related to the production process as a normal hold point would be, reference Appendix E B400 previously. This item is intended as a reminder to the DNV (or others) inspection personnel that a final report of their verification activities is required to finish the work.

E 800 Detailed scope of work for construction

Table E-1 Construction Summary Table - Fabrication

Table No.	*Table Description*
E3	Steel making
E4	Plate rolling
E5	Linepipe production
E6	Buckle arrestor fabrication
E7	Loading and handling operations
E8	Coating application (internal or external)
E9	Insulating joint fabrication
E10	Fabrication of pressure containing components
E11	Fabrication of non-pressure containing components

Table E-2 Construction Summary Table - Installation

Table No.	*Table Description*
E-12	Pre-installation survey and preparation of pipeline route
E-13	Qualification of lay barge, marine spread and installation equipment
E-14	Qualification of equipment, consumables, procedures and personnel
E-15	Pipe storage yard
E-16	Double jointing (onshore or offshore)
E-17	Pipeline installation
E-18	As-laid survey
E-19	Trenching
E-20	Span rectification and pipeline protection
E-21	Gravel dumping
E-22	As-built survey
E-23	Commissioning

Table E-3 Steel making				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents.	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures.	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents.	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing.	R1	S1	H
Inspection activities				
6	Steel making and slab casting.	S1	S2	S3
7	Slab inspection macro, non-metallic inclusion verification.	-	S1	S2
8	Slab identifications heat number.	-	S1	S2
9	Chemical analysis (ladle).	-	S1	S2
Final activities				
10	Review of manufacturing and testing records.	R1	R2	R2
11	Issue of DNV visit report.	H	H	H

Table E-4 Plate rolling				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	R1	S1	H
Inspection activities				
6	Slab re-heating, rolling and accelerated cooling processes	S1	S2	S3
7	Automatic ultrasonic inspection Calibration of equipment	-	S1	S2
8	Automatic ultrasonic re-test inspection Manual ultrasonic inspection	-	S1	S2
9	Visual inspection	S1	S2	S3
10	Identification of test coupons	-	S1	S2
Final activities				
11	Review of manufacturing and testing records	R1	R2	R2
12	Issue of DNV visit report	H	H	H

Table E-5 Linepipe production

Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	-	S1	H
Inspection activities				
6	Material identification (pipe list) and tracking	S1	S2	S3
7	Check pipe-forming and bevel	S1	S2	S3
8	Welding and consumable handling	-	S1	S2
9	Weld repairs	-	S1	S2
10	View and interpret X-rays of repairs	S1	S2	S3
11	Expanding, review record of expansion ratio	-	S1	S2
12	Check calibration of gauge	R1	R2	R2
13	Hydrostatic test	S1	S2	S3
14	End facing and squareness	-	S1	S2
15	View and interpret X-rays of pipe ends	S1	S2	S3
16	Calibration of UT equipment	R1	R2	R2
17	Automatic ultrasonic on pipe (longitudinal and transverse)	S1	S2	S3
18	MPI - Equipment and sensitivity check	R1	R2	R2
19	MPI - For pipe ends	S1	S2	S3
20	MPI - After repair of pipe body by grinding	S1	S2	S3
21	Dye penetrant - Check procedures	R1	R2	R2
22	Dye penetrant - For pipe ends	S1	S2	S3
23	Dye penetrant - After repair of pipe body by grinding	S1	S2	S3
24	Wall thickness measurement after repair by grinding	S1	S2	S3
25	Manual ultrasonic of pipe ends - Calibration of equipment,	R1	R2	R2
26	Manual ultrasonic of pipe ends - Ultrasonic inspection of pipe-end (circumference). Both 90 ° and angle probes shall be used.	S1	S2	S3
27	Dimensional inspection as per specification.	S1	S2	S3
28	Visual external inspection, including cleanliness of inside pipe body	S1	S2	S3
29	Weighing of pipe	-	S1	S3
30	Bevel protectors (if required)	-	S1	S3
31	Marking - Check tracking records, Die stamp weld bevel, Paint mark internal, Colour code external	S1	S2	S3
32	Storage of finished pipes	-	S1	S2
33	Cutting and identification of test coupons	S	S1	S2
34	Mechanical testing of production test pieces	S1	S2	S3
35	Check chemical analysis	R1	R2	R2
Final activities				
36	Review of manufacturing and testing records	R1	R2	R2
37	Issue of DNV visit report	H	H	H

NOTE:

This table defines the scope of work for the verification of longitudinally welded linepipe production. However, it may be used for seamless linepipe production by simply omitting all items related to the welding of the longitudinal seam.

Table E-6 Buckle arrestor fabrication				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	R1	S1	H
Inspection activities				
6	Material identification (Pipe list)	R1	R2	R2
7	Check pipe- forming (forging), heat treatment (Q/T) and machining	S1	S2	S3
8	Welding and consumable handling	-	S1	S2
9	NDT	S1	S2	S3
10	Check calibration of gauge	R1	R2	R2
11	Hydrostatic test	S1	S2	S3
12	Dimensional inspection as per specification.	S1	S2	S3
13	Visual external inspection, including cleanliness of inside pipe body	S1	S2	S3
14	Weighing of buckle arrestors	-	S1	S2
15	Bevel protectors (if required)	-	S1	S2
16	Marking - Check tracking records, Die stamp weld bevel, Paint mark internal, Colour code external	-	S1	S2
17	Storage of finished buckle arrestors	-	S1	S2
18	Removal and identification of test coupons	S1	S2	S3
19	Mechanical testing of production test pieces	S1	S2	S3
20	Check chemical analysis	R1	R2	R2
Final activities				
21	Review of Fabrication Records	R1	R2	R2
22	Review of Testing Records	R1	R2	R2
23	Issue of DNV Visit Report	H	H	H

Table E-7 Loading and handling operations				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
Inspection activities				
4	Loading and handling operations at manufacturer	-	S1	S2
5	Loading operations in port	-	S1	S2
Final activities				
6	Review of manufacturing and testing records	R1	R2	R2
7	Issue of DNV visit report	H	H	H

Table E-8 Coating application (internal or external)				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of Specifications and Procedures	R1	R2	R2
4	Technical Meeting / Kick-off Meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the Procedure and Personnel Qualification Testing	R1	S1	H
Inspection activities				
6	Testing of coating materials	R1	R2	R2
7	Qualification test	S1	S2	S3
8	Examination of pipe prior to surface preparation	S1	S2	S3
9	Examination of grit	-	S1	S2
10	Pre-treatment - temperature, steel temperature humidity during pre-treatment, surface condition	-	S1	S2
11	Visual inspection after blast-cleaning for cleaning standard, roughness, surface imperfections, contamination as dust and chlorides, cleanliness, segregation, repair and re-instalment of rejected pipes	S1	S2	S3
12	Paining Application - temperature, steel temperature humidity during painting application, surface condition	-	S1	S2
13	Curing conditions	-	S1	S2
14	Paint thickness measurements	S1	S2	S3
15	Acceptance testing of panels	R1	R2	R3
16	Final inspection and marking of coated pipes	S1	S2	S3
17	Repairs to coating	S1	S2	S3
18	Storage and handling of coated pipes	-	S1	S2
Final activities				
19	Review of fabrication records	R1	R2	R2
20	Review of testing records	R1	R2	R2
21	Issue of DNV visit report	H	H	H

Table E-9 Insulating joint fabrication				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical Meeting / Kick-off Meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the Procedure and Personnel Qualification Testing	R1	S1	H
Inspection activities				
6	Selection of chemical composition for carbon steel, and other materials (if applicable)		S1	S2
7	Forging and heat treatment	S1	S2	S3
8	Machining	-	S1	S2
9	Welding and consumable handling	-	S1	S2
10	NDT	S1	S2	S3
11	Check calibration of gauge	R1	R2	R2
12	Hydrostatic test	S1	S2	S3
13	Hydraulic fatigue testing	-	S1	S2
14	Electrical resistant test	S1	S2	S3
15	Dielectric strength test	S1	S2	S3
16	Visual inspection	-	S1	S2
17	Dimensional inspection as per specification.	S1	S2	S3
18	Weighing of insulating joints	-	S1	S2
19	Marking	-	S1	S2
20	Storage of finished insulating joints	-	S1	S2
21	Removal and identification of test coupons	S1	S2	S3
22	Mechanical testing of production test specimen	S1	S2	S3
23	Check chemical analysis	S1	S2	S3
24	Insulating joint conservation and storage	-	S1	S2
Final activities				
25	Review of fabrication records	R1	R2	R2
26	Review of testing records	R1	R2	R2
27	Issue of DNV visit report	H	H	H

Table E-10 Fabrication of pressure containing components				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification Testing	R1	S1	H
Inspection activities				
6	Material identification (Material certificate)	S1	S2	S3
7	Check pipe- forming (forging), heat treatment (Q/T) and machining	S1	S2	S3
8	Welding and consumable handling	-	S1	S2
9	NDT	S1	S2	S3
10	Check calibration of gauge	R1	R2	R2
11	Hydrostatic test	S1	S2	S3
12	Dimensional inspection as per specification.	S1	S2	S3
13	Visual external inspection, including cleanliness of inside pipe body	S1	S2	S3
14	Weighing of final product	-	S1	S2
15	Bevel protectors (if required)	-	S1	S2
16	Marking - Check tracking records, Dye stamp weld bevel, Paint mark internal, colour code external etc.	-	S1	S2
17	Storage of final product	-	S1	S2
18	Cutting and identification of test coupons	S1	S2	S3
19	Mechanical testing of production test specimen	S1	S2	S3
20	Check chemical analysis	S1	S2	S3
Final activities				
21	Review of fabrication records	R1	R2	R2
22	Review of testing records	R1	R2	R2
23	Issue of DNV visit report	H	H	H

Table E-11 Fabrication of non-pressure containing components				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification Testing	R1	S1	H
Inspection activities				
6	Material identification (Material certificate)	S1	S2	S3
7	Welding and consumable handling	-	S1	S2
8	NDT	S1	S2	S3
9	Dimensional inspection as per specification.	S1	S2	S3
10	Visual external inspection, including cleanliness of inside pipe body	S1	S2	S3
11	Weighing of final product	-	S1	S2
12	Bevel protectors (if required)	-	S1	S2
13	Marking - Check tracking records, Dye stamp weld bevel, Paint mark internal, colour code external etc.	-	S1	S2
14	Storage of final product	-	S1	S2
15	Cutting and identification of test coupons	S1	S2	S3
16	Mechanical testing of production test specimen	S1	S2	S3
17	Check chemical analysis	S1	S2	S3
Final activities				
18	Review of fabrication records	R1	R2	R2
19	Review of testing records	R1	R2	R2
20	Issue of DNV visit report	H	H	H

Table E-12 Pre-installation survey and preparation of pipeline route				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R1	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	-	A
3	Review of specifications and procedures	R1	R1	R2
4	Technical meeting, kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification Testing	-	R1	H
Inspection activities				
6	Pre-installation survey: — pre-installation survey	-	S1	S1
7	Seabed preparations: — extent of preparation — preparation method and procedures — seabed preparations survey report	-	S1	S1
8	Crossings: — extent of preparation — preparation method and procedures — cable crossing preparations survey report	-	S1	S1
9	Preparations for shore approach: — extent of preparation — preparation method and procedures — seabed preparations survey report — Onshore preparations survey report	-	S1	S1
Final activities				
10	Review of survey reports	R1	R1	R2
11	Issue of DNV visit report	H	H	H

Table E-13 Qualification of lay barge, marine spread and installation equipment				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	R1	S1	H
Inspection activities				
6	DP Systems (Consequence Class II and III)	-	S1	S2
7	Anchoring System	-	S1	S2
8	Combined DP / anchoring system - tensioner tests (Pull-Stop):			
	— simulate barge pull and tensioner failures	-	S1	S2
	— miscellaneous other redundancy testing during barge pull	-	S1	S2
9	Tension system test/ calibration:			
	— calibration	R1	R2	R2
	— testing of combinations of tensioner testing of single tension failures when running two or three tensioners	-	S1	S2
	— testing redundancy for single tensioners (brakes, tension motors, squeeze pressure system)	-	S1	S2
	— simulate main power loss	-	S1	S2
	— simulate loss of signal power	-	S1	S2
10	Abandonment and retrieval winch test/calibration:			
	— calibration	R1	R2	R2
	— simulate to test fail safe action	-	S1	S2
	— simulate main power loss	-	S1	S2
	— simulate loss of signal power	-	S1	S2
11	Test of friction clamps:			
	— test fail safe actions	-	S1	S2
	— test clamps during barge pull	-	S1	S2
12	Test of remote operated buckle detector	-	S1	S2
13	Calibration of measuring devices used for configuration control	R1	R2	R2
14	Stinger configuration and control devices	R1	R2	R2
15	Welding machines	R1	R2	R2
16	Maintenance records of critical/essential equipment	R1	R2	R2
17	AUT equipment:			
	— qualification programme	R1	R2	R2
	— detailed system description and operation manual	R1	R2	R2
	— AUT procedure and reporting levels proposed for the qualification programme	-	S1	S2
	— sound velocity measurements (material from all plate mills)	-	S1	S2
	— calibration block(s) dimensions and tolerances	-	S1	S2
	— welding of test welds with defects and RT/UT to confirm presence of defects	-	S1	S2
	— scanning of SAW, GMAW and repair test welds	-	S1	S2
	— AUT report and selection of areas to be sectioned	-	S1	S2
	— sectioning and defect height/length/location determination	R1	R2	R2
	— statistical treatment of data and the defect sizing error determined	R1	R2	R2
	— proposed threshold levels	R1	R2	R2

Table E-13 Qualification of lay barge, marine spread and installation equipment (Continued)				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
18	Welding system:			
	— system description	R1	R2	R2
	— WPS	R1	R2	R2
	— bevelling and bevel shape	-	S1	S2
	— line-up and fit-up	-	S1	S2
	— welding consumables identification, re-cycling of welding flux, mixture of new and re-cycled welding flux	-	S1	S2
	— welding system instrumentation and control of welding parameters	-	S1	S2
	— removal of test pieces	-	S1	S2
	— mechanical testing	-	S1	S2
Final activities				
19	Review of reports and documentation	R1	R2	R2
20	Issue of DNV visit report	H	H	H

Table E-14 Qualification of equipment, consumables, procedures and personnel				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	R1	S1	H
Inspection activities				
6	Qualification of welding procedure (including repair):			
	— WPS + WPAR	R1	R2	R2
	— welding equipment type and identification	-	S1	S2
	— base material identification and certificates	R1	R2	R2
	— bevelling and bevel shape	-	S1	S2
	— line-up and fit-up	-	S1	S2
	— excavation and grinding of repair welds	-	S1	S2
	— welding consumables identification and certificates, re-cycling of welding flux, mixture of new and re-cycled welding flux	-	S1	S2
	— preheat and interpass temperatures	-	S1	S2
	— recording and control of welding parameters	-	S1	S2
	— NDT of test welds	S1	S2	S3
	— removal and identification of test pieces	S1	S2	S3
	— mechanical testing	S1	S2	S3
7	Review of NDT procedures:			
	— final AUT procedure	R1	R2	R2
	— manual UT procedures	R1	R2	R2
	— MPI procedures	R1	R2	R2
8	Qualification of field joint coating procedures:			
	— procedure	R1	R2	R2
	— identification of materials	-	S1	S2
	— surface preparation	-	S1	S2
	— application of coating	-	S1	S2
	— testing of coating	S1	S2	S3
9	Qualification of external coating repair procedure:			
	— procedure	R1	R2	R2
	— identification of materials	-	S1	S2
	— surface preparation	-	S1	S2
	— application of coating	-	S1	S2
	— testing of coating repair	S1	S2	S3
10	Qualification of internal coating repair procedure:			
	— procedure	R1	R2	R2
	— identification of materials	-	S1	S2
	— surface preparation	-	S1	S2
	— application of coating	-	S1	S2
	— testing of coating repair	S1	S2	S3
11	Welders' qualification/certification records	R1	R2	R2
12	Welding inspectors' qualification/certification records	R1	R2	R2
13	NDT operators qualification/ certification records	R1	R2	R2
14	Welding consumable batch qualification:			
	— bevelling and bevel shape	-	S1	S2
	— welding consumables identification and certificates	R1	R2	R2
	— re-cycling of welding flux, mixture of new and re-cycled welding flux	-	S1	S2
	— preheat and interpass temperatures	-	S1	S2
	— control of welding parameters	-	S1	S2
	— removal and identification of test pieces	S1	S2	S3
	— mechanical testing	S1	S2	S3

Table E-14 Qualification of equipment, consumables, procedures and personnel (Continued)				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
15	Fabrication of Abandonment and Repair and pulling heads:			
	— material and component certificates	R1	R2	R2
	— welding Procedure Qualification (WPQ)	R1	R2	R2
	— welder qualification	R1	R2	R2
	— machining	-	S1	S2
	— welding and consumable handling	-	S1	S2
	— NDT	R1	R2	R2
	— visual and dimensional inspection as per specification	-	S1	S2
	— testing	S1	S2	S3
	— marking	-	S1	S2
Final activities				
16	Review of reports and documentation	R1	R2	R2
17	Issue of DNV visit report	H	H	H

Table E-15 Pipe storage yard				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	R1	S1	H
Inspection activities				
6	Inspection of pipes and key products at assembly yards before load out for transportation:			
	— pipe stacking heights in accordance with specification	-	S1	S2
	— pipe ends for damage and end protectors	-	S1	S2
	— condition of coating, degradation and damage	-	S1	S2
	— pipe identification legible, complete and correct	-	S1	S2
	— marking and proper segregation/quarantine of rejected pipe	-	S1	S2
	— “repaired pipe” and “rejected pipe” records	R1	R2	R2
	— internal cleanliness of pipe during storage and prior to shipping	-	S1	S2
	— certification, documentation and status of pipes in tracking system	R1	R2	R2
	— identification and certification of key products and welding consumables	-	S1	S2
	— storage condition for key products and welding consumables	-	S1	S2
7	Cargo manifest, pipe tracking floppy disk and pipe prior to shipping:			
	— consistency between Cargo manifest and pipe tracking disk	-	S1	S2
	— no rejected or un-repaired pipes included	S1	S1	S2
	— pipe identification correct and legible	-	S1	S2
	— pipe quantity correct	-	S1	S2
	— conditions of pipes acceptable to specification	-	S1	S2
8	Receiving inspection of pipe returned from offshore:			
	— segregation of returned pipe	S1	S1	S2
	— confirmation of reported reason for rejection	-	S1	S2
	— inspection for any further damage	-	S1	S2
	— determine if pipe is repairable	-	S1	S2
	— marking of pipe as reject or repair	-	S1	S2
	— entry of rejected pipe in “rejected pipe” records and pipe tracking system	-	-	H
9	Storage of repairable pipe in storage area:			
	— storage in segregated area	-	S1	S2
	— storage conditions for pipe to be repaired	-	S1	S2
	— maintenance of “repair” marking	-	S1	S2
10	Repair of repairable pipe:			
	— repair according to accepted procedures	S1	S1	S2
	— documentation of repair	-	S1	S2
	— acceptability of repair	-	S1	S2
	— correction of “repair” marking	-	S1	S2
	— correction of status for repaired pipe in the pipe tracking system	-	-	H
Final activities				
11	Review of reports and documentation	R1	R2	R2
12	Issue of DNV visit report	H	H	H

Table E-16 Double jointing (onshore or offshore)				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	R1	S1	H
Inspection activities				
6	All major equipment is available and ready for use	R1	R2	R2
7	All procedures for use during DJ are accepted	R1	R2	R2
8	Valid certification for welding inspection and NDT personnel	R1	R2	R2
9	Pipe receiving inspection and storage:			
	— pipe identification legible, complete and correct	-	S1	S2
	— identification of pipe against certificates	-	S1	S2
	— identification of welding consumables	-	S1	S2
10	Receipt of welding consumables and key products:			
	— condition acceptable according to specification, packaging undamaged	-	S1	S2
	— identification and certification of welding consumables	-	S1	S2
	— storage conditions for welding consumables	-	S1	S2
11	Bevelling, cleaning, line-up and welding at welding stations:			
	— bevelling and bevel shape	-	S1	S2
	— internal cleaning	-	S1	S2
	— line-up and fit-up	-	S1	S2
	— welding consumables identification, re-cycling of welding flux, mixture of new and re-cycled welding flux	-	S1	S2
	— welding procedures, control of welding parameters	S1	S1	S2
	— sequence of anode pipe and buckle arrestors	-	S1	S2
	— pipe tracking system entries	-	-	S2
12	Non destructive testing:			
	— calibration blocks	-	S1	S2
	— equipment calibration	-	S1	S2
	— scanning	-	S1	S2
	— interpretation of indications	-	S1	S2
	— called repairs, location, defect type	S1	S1	S2
	— documentation filing	-	S1	S2
	— equipment maintenance	-	S1	S2
13	Excavation, welding and NDT of repairs:			
	— excavation length and depth, grinding	-	S1	S2
	— NDT of excavation	-	S1	S2
	— welding consumables identification	-	S1	S2
	— welding procedures, control of welding parameters	-	S1	S2
	— NDT of repairs	S1	S1	S2
14	Production tests:			
	— welding of production tests	-	S1	S2
	— NDT of production tests	-	S1	S2
	— marking and shipping	-	S1	S2
15	Field joint coating:			
	— material and procedure	-	S1	S2
	— testing of field joint coating	-	S1	S2
16	Pipe tracking – recording of data	-	-	H
Final activities				
17	Review of reports and documentation	R1	R2	R2
18	Issue of DNV visit report	H	H	H

Table E-17 Pipeline installation				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting or kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	R1	S1	H
Inspection activities				
6	All major equipment is available and ready for use	R1	R2	R2
7	All procedures for use during DJ are accepted	R1	R2	R2
8	Valid certification for welding inspection and NDT personnel	R1	R2	R2
9	Consistency between cargo manifest and pipe tracking floppy disk (prior to receipt of pipe)	-	-	H
10	Pipe unloading, receiving inspection and storage:			
	— pipe identification legible, complete and correct	-	S1	S2
	— identification of pipe against certificates	-	S1	S2
	— conditions of pipes acceptable according to specification, pipe ends undamaged and end protectors in place, coating without degradation and damage.	-	S1	S2
	— identification, marking, segregation and return onshore of pipe unacceptable to specification	-	S1	S2
	— pipe stacking heights in accordance with specification	-	S1	S2
	— identification of key products and welding consumables	R1	R2	R2
	— certification, documentation and status of pipes in contractor's tracking system	-	S1	S2
11	Receipt of welding consumables and key products:			
	— condition acceptable according to specification, packaging undamaged	-	S1	S2
	— identification and certification of welding consumables	-	S1	S2
	— storage conditions for welding consumables	-	S1	S2
12	Repairs of damage to external and internal coating	R1	R2	R2
	— correct repair procedure	R1	R2	R2
	— testing of coating repair	-	S1	S2
13	Bevelling, cleaning, line-up and welding at welding stations:			
	— bevelling and bevel shape	-	S1	S2
	— internal cleaning	-	S1	S2
	— line-up and fit-up	-	S1	S2
	— welding consumables identification, re-cycling of welding flux, mixture of new and re-cycled welding flux	-	S1	S2
	— welding procedures, control of welding parameters	S1	S1	S2
	— sequence of anode pipe and buckle arrestors	-	S1	S2
	— pipe tracking system entries	-	-	S2
14	Non destructive testing:			
	— calibration blocks	-	S1	S2
	— equipment calibration	-	S1	S2
	— scanning	-	S1	S2
	— interpretation of indications	-	S1	S2
	— called repairs, location, defect type	S1	S1	S2
	— documentation filing	-	S1	S2
	— equipment maintenance	-	S1	S2
15	Excavation, welding and NDT of repairs:			
	— excavation length and depth, grinding	-	S1	S2
	— NDT of excavation	-	S1	S2
	— welding consumables identification	-	S1	S2
	— welding procedures, control of welding parameters	-	S1	S2
	— NDT of repairs	S1	S1	S2
16	Production tests:			
	— welding of production tests	R2	S1	S2
	— NDT of production tests	R2	S1	S2
	— marking and shipping	-	S1	S2

Table E-17 Pipeline installation (Continued)				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
17	Field joint coating:			
	— material and procedure	-	S1	S2
	— testing of field joint coating	-	S1	S2
18	Buckle detector:			
	— pulling wire tension and length	R1	S1	S2
	— load chart readings	R1	S1	S2
19	Pipe tracking – recording of data	-	-	S2
20	Pipelaying activities:			
	— adherence to the specified requirements and accepted procedures for control, monitoring and data recording during pipelaying operations.	S1	S1	S2
21	Monitoring and recording of laying parameters:			
	— vessel position	-	S1	S2
	— move-up speed	-	S1	S2
	— anchor patterns	-	S1	S2
	— tension	S1	S1	S2
	— DP system operation	-	S1	S2
	— roller loads	-	S1	S2
	— vessel trim and draft	-	S1	S2
	— ramp configuration	-	S1	S2
	— water depth	-	S1	S2
	— suspended pipeline configuration	-	S1	S2
	— touch down point monitoring	-	S1	S2
	— curvature and stress/strain in overbend/sagbend	-	S1	S2
	— buckle detection	S1	S1	S2
	— operating limit condition parameters	-	S1	S2
22	Abandonment and recovery operations:			
	— removal of internal equipment	-	S1	S2
	— welding of A&R head	-	S1	S2
	— winch tension and wire length	-	S1	S2
	— inspection of pipeline prior to resuming laying	-	S1	S2
23	Shore pull:			
	— verify adequate seabed preparation	-	S1	S2
	— installation of pulling head	-	S1	S2
	— pulling force	-	S1	S2
	— tension and wire length	-	S1	S2
	— twisting	-	S1	S2
	— ROV monitoring	-	S1	S2
24	Tie-in operations:			
	— pre tie-in survey of seabed	-	S1	S2
	— winch tension and wire length during lifting and lowering	-	S1	S2
	— line-up and fit-up	-	S1	S2
	— welding, consumables identification, welding procedures, control of welding parameters	-	S1	S2
	— field joint coating	-	S1	S2
	— ROV survey on both sides of tie-in after lowering	-	S1	S2
	Final activities:			
25	Review of reports and documentation	R1	R2	R2
26	Issue of DNV visit report	H	H	H

Table E-18 As-laid survey				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	R1	S1	H
Inspection activities				
6	ROV observations of touch-down point	-	S1	S2
7	Plotting on alignment sheets	-	S1	S2
8	Identification of free spans exceeding specified length and gap height	-	S1	S2
9	Condition of corrosion protection system	-	S1	S2
10	Condition at cable crossings	-	S1	S2
11	Pipeline supports, foundation	-	S1	S2
Final activities				
12	Review of reports and documentation	R1	R2	R2
13	Issue of DNV visit report	H	H	H

Table E-19 Trenching				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	R1	S1	H
Inspection activities				
6	Trenching equipment monitoring system calibration	-	S1	S2
7	Underwater monitoring	-	S1	S2
8	Trenching operation parameters	-	S1	S2
Final activities				
9	Review of reports and documentation	R1	R2	R2
10	Issue of DNV visit report	H	H	H

Table E-20 Span rectification and pipeline protection				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	R1	S1	H
Inspection activities				
6	Proposal for areas to be rectified	R1	R2	R2
7	Rectification operations	-	S1	S2
8	Underwater monitoring	-	S1	S2
Final activities				
9	Review of reports and documentation	R1	R2	R2
10	Issue of DNV visit report	H	H	H

Table E-21 Gravel dumping				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	R1	S1	H
Inspection activities				
6	Gravel dumping schedule	R1	R2	R2
7	Gravel dumping operations	-	S1	S2
8	Gravel dumping survey	-	S1	S2
Final activities				
9	Review of reports and documentation	R1	R2	R2
10	Issue of DNV visit report	H	H	H

Table E-22 As-built survey				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activity				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	R1	S1	H
Inspection activities				
6	Survey operations	-	S1	S2
Final activities				
7	Review of reports and documentation	R1	R2	R2
8	Issue of DNV visit report	H	H	H

Table E-23 Commissioning				
Item	*Description*	*Level*		
		Low	*Medium*	*High*
Initial activities				
1	Review quality management system documents	R1	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers.	-	A	A
3	Review of specifications and procedures	R1	R2	R2
4	Technical meeting / kick-off meeting and review of manufacturing documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel qualification testing	R1	S1	H
Inspection activities				
6	Cleaning and gauging operations	-	S1	S2
7	System pressure test:			
	— water sampling	-	S1	S2
	— inhibitors	-	S1	S2
	— water filling	-	S1	S2
	— instrumentation and equipment calibration	R1	R2	R2
	— air contents measurements	-	S1	S2
	— pressurisation	-	S1	S2
	— pressure test / holding	-	S1	S2
	— depressurisation	-	S1	S2
	— dewatering and cleaning	-	S1	S2
8	Filling of product	-	S1	S2
9	Operational verification (start-up inspection):			
	— expansion	-	S1	S2
	— movement	-	S1	S2
	— lateral snaking	-	S1	S2
	— upheaval buckling	-	S1	S2
	— global buckling of free spans	-	S1	S2
	— wall thickness / metal loss	-	S1	S2
Final activities				
10	Review of reports and documentation	R1	R2	R2
11	Issue of DNV visit report	H	H	H

F. Operations

F 100 General

101 No tables are provided for the operation phase. The project specific tables will be based on the work performed leading up to the certificate and the contractual arrangement for the project.