

DIN EN ISO 19901-5

ICS 75.180.10

**Erdöl- und Erdgasindustrie –
Besondere Anforderungen an Offshore-Bauwerke –
Teil 5: Gewichtskontrolle während der Auslegung und Konstruktion
(ISO 19901-5:2003);
Englische Fassung EN ISO 19901-5:2003**

Petroleum and natural gas industries –
Specific requirements for offshore structures –
Part 5: Weight control during engineering and construction (ISO 19901-5:2003);
English version EN ISO 19901-5:2003

Industries du pétrole et du gaz naturel –
Exigences spécifiques relatives aux structures en mer –
Partie 5: Contrôles des poids durant la conception et la fabrication (ISO 19901-5:2003);
Version anglaise EN ISO 19901-5:2003

Gesamtumfang 58 Seiten

Normenausschuss Erdöl- und Erdgasgewinnung (NÖG) im DIN

Nationales Vorwort

Diese Europäische Norm wurde vom Technischen Komitee CEN/TC 12 „Materialien, Ausrüstungen und Offshore-Bauwerke für die Erdöl-, und Erdgasindustrie“ (Sekretariat: Frankreich) erstellt. Es handelt sich dabei um die unveränderte Übernahme von ISO 19901-5:2003, erarbeitet von ISO/TC 67 „Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries“, Subkomitee SC 7 „Offshore-Konstruktionen“ (Sekretariat: England).

Für Deutschland war der Normenausschuss Erdöl- und Erdgasgewinnung (NÖG), Arbeitsausschuss NÖG 7 „Offshore-Bauwerke“ an der Erarbeitung dieser Norm beteiligt.

Diese Europäische Norm enthält unter Berücksichtigung des DIN-Präsidialbeschlusses 13/1983 nur die englische Originalfassung der ISO-Norm.

English version

Petroleum and natural gas industries – Specific requirements for
offshore structures – Part 5: Weight control during engineering
and construction (ISO 19901-5:2003)

Industries du pétrole et du gaz naturel – Exigences
spécifiques relatives aux structures en mer – Partie 5:
Contrôles des poids durant la conception et la fabrication
(ISO 19901-5:2003)

Erdöl- und Erdgasindustrie – Besondere Anforderungen an
Offshore- Bauwerke – Teil 5: Gewichtskontrolle während
der Auslegung und Konstruktion (ISO 19901-5:2003)

This European Standard was approved by CEN on 10 July 2003.

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Foreword

This document (EN ISO 19901-5:2003) has been prepared by Technical Committee ISO/TC 67 "Materials, equipment and offshore structures for petroleum and natural gas industries" in collaboration with Technical Committee CEN/TC 12 "Materials, equipment and offshore structures for petroleum and natural gas industries", the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2004, and conflicting national standards shall be withdrawn at the latest by January 2004.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Luxembourg, Malta, Netherlands, Norway, Portugal, Slovakia, Spain, Sweden, Switzerland and the United Kingdom.

Endorsement notice

The text of ISO 19901-5:2003 has been approved by CEN as EN ISO 19901-5:2003 without any modifications.

Introduction

The offshore structures International Standards ISO 19900 to ISO 19906 constitute a common basis covering those aspects that address design requirements and assessments of all offshore structures used by the petroleum and natural gas industries worldwide. Through their application the intention is to achieve reliability levels appropriate for manned and unmanned offshore structures, whatever the type of structure and the nature of the materials used.

It is important to recognize that structural integrity is an overall concept comprising models for describing actions, structural analyses, design rules, safety elements, workmanship, quality control procedures and national requirements, all of which are mutually dependent. The modification of one aspect of design in isolation can disturb the balance of reliability inherent in the overall concept or structural system. The implications involved in modifications, therefore, need to be considered in relation to the overall reliability of all offshore structural systems.

The offshore structures International Standards are intended to provide a wide latitude in the choice of structural configurations, materials and techniques without hindering innovation. Sound engineering judgement is therefore necessary in the use of these International Standards.

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1 Scope

This part of ISO 19901 specifies requirements for controlling the weight and centre of gravity (CoG) by means of mass management during the engineering and construction of structures for the offshore environment. The provisions are applicable to offshore projects that include structures of all types and materials.

This part of ISO 19901 differentiates between projects where considerations with regard to weight and CoG have a high priority as a result of weight and/or CoG sensitivity, and projects where weight and CoG are of little consequence. This differentiation has been made by the introduction of three different classes of structure (Class A, Class B and Class C). Depending on the degree of control necessary, different clauses of this part of ISO 19901 will apply; Clause 4 provides guidelines for assigning one of these classes.

This part of ISO 19901

- specifies quality requirements for reporting of weights and centres of gravity,
- specifies requirements for weight reporting,
- provides a basis for overall project status reports or management reports for all classes,
- specifies requirements for weight and load budgets for offshore installations,
- specifies the methods and requirements for the weighing of major assemblies, and the determination of weight and centre of gravity,
- specifies requirements for weight information from suppliers, including weighing of equipment and bulk materials for offshore installations;

and may be used

- as a basis for planning and presentation of the contractor's weight-reporting system;
- as a basis for evaluation of the contractor's weight-reporting system;
- as a means of refining the structural analysis/model;
- as a contract reference between the ordering client and the contractor;
- as a basis for costing.

2 Normative references

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

Guide to the expression of uncertainty in measurement (GUM), BIPM, IEC, IFCC, ISO, IUPAC, IUPAP and OIML

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

3.1.1

assembly

designed and fabricated group of bulk and equipment items which form one unit

3.1.2

ballast

variable solid or fluid content used to trim a floating structure and/or keep a certain draft

3.1.3

base weight estimate

weight estimate used for budgeting purposes which does not include any unforeseen quantity growth, estimating errors or unnamed events

3.1.4

base weight contingency

weight addition, based on risk analysis or experience, used to transform a base weight estimate into a 50/50 weight estimate accounting for uncertainties

3.1.5

budget weight

weight reference figures as defined in the weight and load budget and related to the initial or changed design concept

3.1.6

bulk

component or arrangement of components defined as stock materials or of low complexity

NOTE Bulk items support the equipment items by providing infrastructure around and between them.

3.1.7

client weight reserve

weight addition with CoG (usually a fixed weight) controlled by the client and used to cater for any orders for variation to the contractual design concept

3.1.8

CoG envelope

defined constraint volume within which the CoG of an assembly must remain for design purposes

3.1.9

consumables

variable content, which is solid in stores and fluid in utility tanks

EXAMPLES Fuel, provisions, service/potable water, operating utilities.

3.1.10

contractor weight reserve

weight addition (usually a fixed weight) controlled by the contractor and used to cater for any design growth due to development of the initial design concept

3.1.11

deadweight

total carrying capacity of a floating structure

NOTE Includes weight of crude oil, deck cargo, temporaries, water, snow and ice accumulations, marine growth, ballast water, consumables, crew and their effects.

3.1.12

displacement

weight of the volume of water displaced by a floating structure, which is the sum of lightweight and deadweight

3.1.13**dry weight**

weight of a component, weight item or an assembly in its dry installed condition including permanent utilities

NOTE 1 Examples of permanent utilities are gearbox oil, hydraulic oil, filter sand, etc.

NOTE 2 Any content of operating fluid flowing through a component, weight item or an assembly is excluded.

3.1.14**equipment**

component, or arrangement of components, built for specific function(s)

NOTE The component/assembly normally has unique documentation due to its function and complexity.

3.1.15**first fill**

initial filling of liquid in equipment items, piping lines or tanks

NOTE First fill typically takes place towards the end of site construction, prior to tow-out and prior to filling for normal operations.

3.1.16**float-out**

loading condition in which a major assembly is transferred from a dry construction site to become self-floating

3.1.17**fluid content**

all fluids flowing through a component, weight item or an assembly

EXAMPLES Process gases, liquids, powders, etc.

3.1.18**future weight**

weight of a component or an assembly to be installed after the start of production

NOTE Start of production is also known as "first oil".

3.1.19**grillage**

temporary structural foundation assemblies for modules or sections during transportation

3.1.20**gross reported weight**

sum of the net weight and weight allowance

3.1.21**gross WTO****gross weight take-off**

sum of the net WTO and weight allowance

3.1.22**gross weight/WTO contingency**

difference between the gross reported weight and the gross WTO at any time during the project execution

3.1.23**hook-up**

installation and commissioning of components or assemblies after the modules have been installed in their final position

3.1.24

hook weight

sum of lift weight and lifting gear weight

3.1.25

lifting gear

rigging

equipment needed during a lifting operation

EXAMPLES Slings, spreader bars, lifting frames, shackles, etc.

3.1.26

lift weight

weight of a component, an assembly or a module at padeyes, including temporaries and residual fluid content but excluding lifting gear

3.1.27

lightweight

lightship

dry weight and utility systems required for a minimum operation of a floating structure

3.1.28

live load

load on a deck area according to its defined function

3.1.29

loading condition

defined event or operation during which loads occur

NOTE For each loading condition, all weight items and variable loads that are known or predicted to occur are identified, quantified and located.

3.1.30

load-out

loading condition in which a major assembly or a module is transferred from land onto a floating structure by horizontal movement

3.1.31

mating

loading condition in which a major assembly supported on vessel(s) is joined onto its temporary or permanent substructure

3.1.32

net weight

weight (excluding any allowances or contingencies) obtained either by estimation as estimated from early design documents or present sketches, calculated take-off from drawings or 3D model, or as given in vendor data-sheets or obtained by physical weighing

3.1.33

net WTO

net weight take-off

weight derived from calculated take-off or from 3D model, given in vendor data-sheets or weighed, excluding any allowances or contingencies

3.1.34

not-to-exceed weight

NTE weight

maximum acceptable weight

3.1.35**operating weight**

sum of the dry weight and the fluid content weight

3.1.36**project management**

dedicated management personnel with the task of implementing weight policy, objectives and procedures

3.1.37**residual fluid content**

fluid content remaining after testing or commissioning and present during the subsequent loading condition until the start of production

3.1.38**sea fastening**

items used for temporary fastening to keep movable items in position during transportation at sea

3.1.39**tagged equipment**

equipment tagged in accordance with the project coding manual

3.1.40**temporaries**, noun pl

components, assemblies or utility items which are temporarily installed during a specific loading condition and removed afterwards, either prior to or after installation

3.1.41**test weight**

sum of the dry weight plus the fluid content required to test the equipment and assembly

3.1.42**tow-out**

final towing of a complete floating structure to the offshore production field

3.1.43**transport**

loading condition in which a major assembly or a module is transferred from one inshore/at shore location to another location or to the offshore production field

3.1.44**weight allowance**

quantified weight addition accounting for definable components which could not be specified at the actual project stage

NOTE Weight allowance is expressed either as a percentage or as a lump sum.

3.1.45**weight contingency**

weight addition, based on risk analysis or experience, used to transform a base weight estimate to a 50/50 weight estimate accounting for uncertainties and/or definable components which could not be specified at the actual project stage

NOTE Weight contingency is expressed either as a percentage or as a lump sum.

3.1.46**weight item**

defined collection of bulk and/or equipment, design volume or assembly suitable for weight reporting purposes

3.1.47

weight installation code

computer code which verifies whether a component or a weight item is physically installed or not in an assembly or module

3.1.48

weight management

all planned and controlled activities which deal with the

- definition and publication of the project weight objective and policy,
- identification of, information about and evaluation of alternative design solutions,
- selection and implementation of an optimal design with respect to weight, CoG, volume, functionality, cost and progress.

NOTE The project management, the engineering disciplines and the weight control discipline are actively cooperating and taking part in and influencing the weight management process by means of adequate working methods and tools, to include weight optimization, weight consciousness and weight reductions.

3.1.49

weight objective

defined set of engineering goals necessary to fulfil the project contractual weight/CoG requirements and intentions in order to contribute to the correct design quality as defined by the management

3.1.50

weight phase code

computer code defining in which loading conditions a component or a weight item is present

3.1.51

weight policy

statement by the project management based on the weight objective and how it will be achieved

NOTE The statement should as a minimum describe

- the weight objective's importance to the project aims and results,
- the priority, profile and control at different levels in the project,
- a philosophy for responsibility and authority within and between project groups engaged in weight/CoG matters.

3.1.52

weight reporting

adequate and timely weight/CoG information reported with respect to content and presentation in order to fulfil expectations and requirements from/needs of organizations involved in the project

3.1.53

weight status code

computer code related to the weight item level of accuracy

3.1.54

50/50 weight estimate

value representing the median value in the probability distribution of weight estimates

NOTE The actual weight value is equally likely to be smaller or larger than the 50/50 weight estimate.

NOTE The 50/50 weight estimate is used as the basis for weight budgeting.

3.2 Abbreviated terms

CoG	centre of gravity
LCG	longitudinal centre of gravity
MEL	master equipment list
NTE	not to exceed
TCG	transverse centre of gravity
TLP	tension leg platform
WLB	weight and load budget
WTO	weight take-off

4 Weight control classes

4.1 General

In order to select the most appropriate level for weight control and weight reporting according to the degree of weight and/or CoG sensitivity of the project, three classes of weight control have been defined.

The tender documents and final contract shall specify the applicable weight control class, so that the contractor can allocate the required resources.

4.2 Class A: High definition of weight and CoG requirements

Class A shall apply if the project is weight- or CoG-sensitive for lifting and marine operations or during operation (with the addition of temporaries), or has many contractors with which to interface. Projects may also require this high definition if risk gives cause for concern.

Full traceability of weights shall be given for this class, commencing with all documented weight data from suppliers.

Recording of weight data for Class A requires the use of a relational-type database from the commencement of detail engineering, with suppliers' data, fabricators' data and data from physical weighings integrated into the system.

The theoretical weight and CoG of assemblies shall be verified by means of physical weighings. Three weighings are recommended and, as a minimum requirement, two weighings for each major assembly shall be carried out.

The weight data, at piecemark level, produced in the design phases in the form of weight dossiers (if applicable), shall be updated to "as-built" status during the fabrication stage.

4.3 Class B: Medium definition of weight and CoG requirements

Class B shall apply to projects where the focus on weight and CoG is less critical for lifting and marine operations than for projects where Class A is applicable. The requirements for the "as-built" status are relaxed and the number of physical weighings may be reduced.

The complexity of the project shall determine whether a relational-type database is necessary for recording of the weight data, or whether spreadsheet software can be used.

4.4 Class C: Low definition of weight and CoG requirements

Class C shall apply to projects where the requirements for weight and CoG data are not critical.

A final weighing should be performed which would constitute the “as-built” weight.

Supporting documentation consisting of equipment weights and summarized discipline weights by drawing shall be provided.

Spreadsheet software can be used.

4.5 Selection of weight control class

The design basis, NTE weight and CoG criteria, together with WLBs established at the close of the concept phase, are major factors to be considered when selecting the weight control class.

Potential weight and CoG problems whether for load-out, transportation, mating, inshore lift, float-out, tow-out, offshore lift or operating phase, also need to be assessed before selecting the weight control class. Even a module or structure significantly under projected weight could lead to a serious problem if not diagnosed before marine operations.

Class selection may be made from examination of Table 1, which is included as a guide for determining the required degree of weight and CoG control needed for a project.

Table 1 — Guidance criteria for weight control class selection

Description	Class A	Class B	Class C
Concept type	new	partly known	well known
Weight sensitivity	high	medium	low
CoG sensitivity	high	medium	low
Weight data processing requirement	high	medium	low
Contract requirement	detailed	general	none
Weight data external interfaces (other contractors)	> 6	4 to 6	1 to 3

5 Weight and load budget (WLB)

5.1 General

Class A	Class B	Class C
For all offshore installations, the total weight and load situations shall be controlled from the conceptual beginning. Budget weights including CoG constraints shall be worked out for the topsides, substructure and individual modules including temporaries (as appropriate) corresponding to the appropriate loading conditions, in cooperation with the structural and marine disciplines in addition to the management, and presented in WLBs as a comparison reference during an engineering and construction project. The main purposes of the WLBs are to act as a comparison reference for a) weight, load, and CoG control and reporting for the duration of the project through the engineering, construction, installation and operation phases; b) structural capacity requirements for individual sections or modules and for the total topsides or sub-structure; c) bearing capacity and stability of the total structure (temporary or permanent); d) overall cost and schedule control.	As Class A.	As Class A, except that d) is not required.

5.2 Requirements

Class A	Class B	Class C
Each participant in a project shall be allocated a separate WLB. Typically WLB's for the client, the contractor and the sub-contractors are allocated. The contractor WLBs shall be established either by the client, in which case they shall be included in the project contract, or by the project contractor. The project management/client shall hold overall responsibility for deciding the variations between the various WLBs. WLBs for subcontractors and vendors shall be established by the contractor. No revisions to WLBs shall take place under normal circumstances unless concept or major design changes to the design which impact on the weight, load or CoG, are implemented by the project management/client. All participants in the project shall be responsible for adherence to actual weight and CoG WLB figures. In the event that the project weight control and weight reporting detects the possibility of significant variations from the WLBs, corrective actions shall be initiated by the project management and the design disciplines and closely followed up in order that overruns do not occur or implications are minimized.	As Class A.	The contractor WLBs are established either by the client, and are included in the project contract, or by the project contractor. Unless specified by the client, the format and complexity is left to the discretion of the contractor.

5.3 Weight and load budget (WLB) content

5.3.1 General

Class A	Class B	Class C
The WLB consists of different types of weights, loads and associated CoGs, see Figure 1.	As Class A.	As Class A.