INTERNATIONAL STANDARD

ISO 19901-5

Second edition
2016-02-15

Petroleum and natural gas industries — Specific requirements for offshore structures —

Part 5: Weight control during engineering and construction

Industries du pétrole et du gaz naturel — Exigences spécifiques relatives aux structures en mer —

Partie 5: Contrôle des poids durant la conception et la fabrication

Reference number
ISO 19901-5:2016(E)

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Contents

Page

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 67, *Materials,equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 7, *Offshore structures*.

This second edition cancels and replaces the first edition (ISO 19901-5:2003), which has been technically revised.

ISO 19901 consists of the following parts, under the general title *Petroleum and natural gas industries — Specific requirements for offshore structures*:

— *Part 1: Metocean design and operating considerations*

— *Part 2: Seismic design procedures and criteria*

— *Part 3: Topsides structure*

— *Part 4: Geotechnical and foundation design considerations*

— *Part 5: Weight control during engineering and construction*

— *Part 6: Marine operations*

— *Part 7: Stationkeeping systems for floating offshore structures and mobile offshore units*

— *Part 8: Marine soil investigations*

The following parts are under preparation:

— *Part 9: Structural integrity management*

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0 Introduction

1.1 General

The International Standards ISO 19900 to ISO 19906 relating to offshore structures 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.

ISO 19900 to ISO 19906 relating to offshore structures 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.

1.2 Preface

It is proposed to canvass the TC 67/SC 7 member countries to widen the scope of this part of ISO 19901 for the third edition. As a consequence, the title might change.

— It is proposed to expand and re-structure this part of ISO 19901 to more comprehensively address topsides weight engineering principles, roles, responsibilities and objectives for a complete platform life cycle.

— It is proposed to re-format into a more traditional ISO document layout.

— The use of weight class A, B and C tables will be reviewed.

— There will be an outline of how to control topside weight, and of the aims and expectations of a Weight Review Panel (or similar).

— A common topside operating philosophy will be included with a matrix of coincident drilling loads, operating loads, and laydown / storage loads to be included in topside weight databases.

— It is proposed to give guidance on applied design contractor allowances during detailed design, plus the use of client operational and management reserves.

— The weight and CoG accuracy expected from weighings will be addressed.

— Separate clauses will be added to give clarity to specific requirements of floating structures and jackets

— The contents and terminology will be coordinated to interface with ISO 19902, *Design of offshore structures*, and the forthcoming ISO19901-9, *Structural integrity management* (due to be published in 2017).

It is proposed to give more guidance on a range of topics encountered during the phases of a platform life cycle, typically:

a) Weight control principles

Overview of principles, aims and objectives

Roles and responsibilities

Competency

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Software selection

Deliverables for each project phase

Weight report contents

b) Floating structures and jackets

Specific requirements for floating structures

c) Concept and feasibility phase

Use of historical volumetric weight norms

Use of area based weight calculations

Use of footprint ratios

d) Front end engineering design phase

Design parameters to be fixed prior to setting Not-to-Exceed weights

e) Detailed design phase

Control of weight using a Weight Review Panel or similar

Use of contractor allowances

Use of client reserves

Discipline reporting responsibilities

Coincident operating loads

Coincident drilling loads

Coincident laydown and storage loads

Laydown and storage drawings and area signage

Vendor weighing requirements

f) Fabrication phase

Fabricator responsibilities

Reporting of site run materials

Weighing requirements

Preparations for weighing

Expected weight and CoG accuracy from weighings

Predictions and witnessing of weighings

Post-weighing reconciliation and weighing corrections

g) Installation and hook-up phase

Reporting of hook-up weights

h) Operational phase

Control of weight and CoG for topside modifications

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Interfaces with ISO 19901-9 and ISO 19902

i) Decommissioning phase

Preparations for decommissioning

Some of the above proposed changes are outlined in Annex G of this document (informative).

It is proposed that preparation of the third edition of this part of ISO 19901 will begin immediately after the issue of this edition with a target publication date of 2017.

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Petroleum and natural gas industries — Specific requirements for offshore structures —

Part 5: Weight control during engineering and construction

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 (fixed and floating) and materials. These structures can be complete new installations or the modifications to existing installations. Maintaining the weight control of existing installations is not part of the main body of this part of ISO 19901, but some guidance on this is included in the Annex G.

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 weight reports or management reports for all weight control classes;

— specifies requirements for weight and load budgets;

— specifies the methods and requirements for the weighing and the determination of weight and CoG of major assemblies;

— specifies requirements for weight information from suppliers, including weighing of equipment and bulk materials for offshore installations.

It can be used:

— as a basis for planning, evaluating and presenting the client's, contractor's or fabricator's weight management and reporting system;

— as a means of refining the structural analysis or model;

— as a contract reference between client, contractor and suppliers;

— as a basis for costing, scheduling or determining suitable fabrication method(s) or location(s).

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.

ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)*

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3 Terms and definitions

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

3.1
assembly
designed and fabricated group of bulk and equipment items which form one unit

3.2
budget weight
weight reference figures as defined in the weight and load budget and related to the initial or changed design concept

3.3
bulk
component or arrangement of components defined as stock materials or of low complexity

Note 1 to entry: Bulk items support the equipment items by providing infrastructure around and between them.

3.4
centre of gravity
CoG
average location of the weight of an item

Note 1 to entry: For assemblies, modules or topsides, the aggregate CoG is the mathematical weighted average of the CoGs of the individual items (comprising the completed assembly, module or topsides) measured from a common reference point.

3.5
client
organisation for which a weight report is prepared

Note 1 to entry: This is the project owner (oil company/operator, fabricator, engineering sub-contractor, lift/transportation contractor, etc.).

3.6
client weight reserve
weight addition (usually a lump sum weight) controlled by the client and used to account for any orders for variation to the contractual design concept

3.7
CoG envelope
defined constraint volume within which the centre of gravity (CoG) of an assembly shall remain

3.8
consumables
variable content that does not remain at a constant level due to consumption during the operation of an offshore installation

EXAMPLE Potable/service water, diesel fuel, crew provisions, bulk drilling powders for creation of mud and/or cement.

3.9
contents
fluids or bulk powders held within bulks (piping or structural tanks) or equipment at their normal operating levels

Note 1 to entry: Typical contents are hydrocarbons, cooling and heating mediums, chemicals, fuels, condensates, seawater, fresh water, dry powders (drilling cement and mud additives), dry stores for workshops, sack stores, etc. Fluids that are expected to be continuously installed in an item of equipment (e.g. coolants and lubricating oils) are not to be considered as contents. See *dry weight* (3.16) for further explanation.

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3.10
contractor
organization tasked with constructing a portion of, or an overall project facility

3.11
contractor weight reserve
additional weight (either a lump sum weight or percentage of a total weight) at a specified CoG, controlled by the contactor and used to account for any design growth within their control

3.12
deadweight
total carrying capacity of a floating structure

Note 1 to entry: Includes weight of crude oil, deck cargo, temporaries, water, snow and ice accumulations, marine growth, ballast water, consumables, crew and their effects.

Note 2 to entry: See Annex D.

3.13
discipline
discrete branch of engineering reflecting a single aspect in the project

EXAMPLE Architectural, drilling, electrical, HVAC, instrumentation, loss control (safety), piping, structural and telecommunications.

3.14
discipline check list
document detailing the weight items that are within the discipline's control

3.15
displacement
weight of the volume of water displaced by a floating structure

Note 1 to entry: The sum of lightweight and deadweight including mooring system load, appendences and/or appurtenances e.g. structures outside the moulded hull

Note 2 to entry: See Annex D.

3.16
dry weight
weight of a component, weight item or an assembly in its dry installed condition including permanent utilities

Note 1 to entry: Examples of permanent utilities are gearbox oil, hydraulic oil, filter sand.

Note 2 to entry: Any content of operating fluid flowing through a component, weight item or an assembly is excluded.

3.17
equipment
component or arrangement of components, built for specific function(s)

Note 1 to entry: The component/assembly normally has unique documentation due to its function and complexity.

Note 2 to entry: Refer to *tagged equipment* (3.41) for further explanation.

3.18
estimated weight
weight determined based on previous experience

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3.19
first fill
initial filling of specific contents in items of equipment or piping prior to start of operation of an offshore facility

Note 1 to entry: First fill typically takes place towards the end of site construction, prior to tow-out and prior to filling for normal operations.

3.20
float-out
loading condition in which a major assembly is transferred from a dry construction site to become self-floating

3.21
future weight
weight of a component or an assembly to be installed after the start of production

3.22
grillage
steel structure, secured to the deck of a barge or vessel, designed to support the cargo and distribute the loads between the cargo and the barge or vessel

3.23
gross weight
sum of the net weight and weight allowances

3.24
hook-up
installation of components or assemblies after the modules have been installed in their final position, to connect to the existing installation

3.25
hook weight
sum of component, assembly or module lift weight and lifting gear

3.26
operating
<loading condition for an operating offshore facility> at the start of steady-state production

Note 1 to entry: All bulk and equipment items are present with contents at nominal operating levels.

3.27
lifting gear
equipment needed during a lifting operation

EXAMPLE Slings, spreader bars, lifting frames, shackles.

3.28
lift weight
weight of a component, assembly or a module, including temporaries and residual fluid content but excluding lifting gear

3.29
lightship weight
dry and invariable weight of a floating unit, including minimum utility content to secure a safe condition

Note 1 to entry: See Annex D.

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3.30
loading condition
defined event for which a weight and CoG need to be controlled

Note 1 to entry: For each loading condition, all weight items and variable loads that are known or predicted to occur are identified, quantified and located.

Note 2 to entry: Typical loading conditions are dry installed offshore, float-out at assembly site, future operating installed offshore, operating installed offshore, load-out to offshore transport vessel, transport to offshore field, etc.

3.31
load-out
transfer by way of horizontal movement of an assembly, module or topsides from its land-based fabrication site onto a floating or grounded transport barge or vessel

Note 1 to entry: The following are typical load-out operations:

— skidded: load-out using a combination of skid-ways, skid-shoes or runners, propelled by towing engines, jacks or winches;

— trailer: load-out using multi-axle trailers [self-propelled modular transporter (SPMT)].

3.32
master equipment list
MEL
project -specific database for control and management of technical data for tagged equipment

3.33
mating
transfer of a major assembly supported on barge(s) or vessel(s) to a temporary or permanent support structure

3.34
module
major assembly of items forming a major building block which needs to be controlled with respect to weight and CoG

3.35
net weight
calculated or estimated weight of an item excluding allowances

3.36
not-to-exceed weight
NTE weight
maximum acceptable weight for any given loading condition, with an associated limiting CoG envelope

3.37
operating weight
sum of the dry weight and the content weight

3.38
project management
<weight management> management personnel tasked with implementing weight policy, objectives and procedures

3.39
residual content
content in bulks and equipment remaining after testing or commissioning, and being present during the subsequent loading conditions up to the start of production

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3.40
sea fastening
items used for temporary fastening to keep all items in position during transportation at sea

3.41
tagged equipment
equipment identified and labelled in accordance with the project coding manual and tracked in MEL

3.42
temporary items
temporaries
items temporarily installed during a loading condition and removed afterwards

Note 1 to entry: Temporaries do not form part of a structure's permanent dry or operating weight.

3.43
test weight
sum of the dry weight plus the content required to test the equipment or assembly

3.44
tow-out
towing of a complete floating structure to the offshore installation site

3.45
transport
<loading condition> transfer of an assembly or module from one inshore or at shore location to another location, or to the offshore installation site

3.47
weight allowance
weight additions to account for expected general growth due to immaturity of the current project stage and/or components which are not estimated in detail at the current project stage

3.48
weight and load budget
WLB
document defining the weight and CoG limits for each loading condition, major assembly (and disciplines for the dry installed offshore load condition)

Note 1 to entry: The WLB 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 supporting structure;

c) temporary and permanent bearing capacity and stability of the total facility;

d) overall cost and schedule control.

3.49
weight item
item or collection of bulk and/or equipment, content or assembly identified for weight reporting purposes

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3.50
weight management
all planned and controlled activities which deal with:

— definition and publication of the project weight procedures, objectives and policies;

— 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;

— monitoring and reporting weight data throughout the complete life cycle of an installation to assess present and potential weight status

Note 1 to entry: Project management, engineering disciplines and weight control discipline shall cooperate and participate to influence the weight management process by means of adequate working methods and tools.

3.51
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

3.52
weight phase code
code used to identify the loading conditions in which a weight item is present

3.53
weight policy
statement from the project management, based on the weight objective, defining how the weight objective is to be achieved

Note 1 to entry: As a minimum, the policy should include:

— the importance of the weight objective to the project aims and results;

— the priority, profile and control of weights at different levels in the project;

— a philosophy for responsibility and authority within and between project groups engaged in weight matters

3.54
weight report
regularly issued project document that details the weight and CoG for required assemblies and load conditions based on best available information

Note 1 to entry: This document provides the basic load case for the project Structural Integrity models.

3.55
weight status code
code, based on the maturity of the design, used to identify the level of accuracy of the weight of a weight item

Note 1 to entry: The weight status code is often used to assess the value of the weight allowance applied. As a design matures, the weight status code will change so that an item's weight allowance is reduced.

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4 Abbreviated terms

CoG	Centre of Gravity
FEED	Front End Engineering Design
MEL	Master Equipment List
NTE	Not to Exceed
WLB	Weight and Load Budget
WTO	Weight Take-Off

5 Weight control classes

5.1 General

In order to select the most appropriate level for weight control and reporting according to the degree of weight and/or CoG sensitivity of the project, three classes of weight control have been defined. These classes may also be used to determine the level of effort required in the weight management activities for a project.

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

5.2 Class A: High definition of weight and CoG

Class A shall apply if the project is weight and/or CoG sensitive for any of the anticipated loading cases, or has many contractor interfaces.

Class A weight projects shall:

a) regardless of the source, have full traceability of all weight and CoG data;

b) record weight and CoG data using a relational database from the commencement of detail engineering, with integration of suppliers', fabricators' and weighing results into the system;

c) verify the calculated weight and CoG of assemblies, modules or topsides by means of physical weighings;

d) update weight data per weight item produced during the design phases to "as-built" status during the fabrication.

5.3 Class B: Medium definition of weight and CoG

Class B shall apply to projects where the focus on weight and CoG is less critical for any of the anticipated loading cases than for projects where Class A is applicable.

Class B weight projects shall:

a) based on the complexity of the project, determine whether a relational database or spread sheet software is required for recording of weight and CoG data;

b) verify the calculated weight and CoG of assemblies, modules or topsides by means of physical weighings;

c) have less stringent requirements for updating "as-built" status during fabrication.

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5.4 Class C: Low definition of weight and CoG

Class C shall apply to projects where requirements for updating "as-built" status during fabrication is not critical.

Class C weight projects shall:

a) as a minimum use a spread sheet software for recording weight and CoG data;

b) verify the calculated weight and CoG of assemblies, modules or topsides by means of physical weighings;

c) provide supporting weight and CoG documentation consisting of equipment weights and summarized bulk weights by drawing;

d) have no requirements for updating "as-built" status during fabrication.

5.5 Selection of class of weight control

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 class of weight control.

Potential weight and CoG problems, specific to the loading condition, also need to be assessed before selecting the class of weight control.

Class selection may be made from examination of Table 1, included as a guide for determining the required degree of weight and CoG control for a project. The class of weight control selected should be the highest class meeting any of the Project Parameters in Table 1.

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 to minimal
Weight data external interfaces (other contractors)	> 6	4 to 6	1 to 3
NOTE Weight sensitivity may be a result of constraints established by installation method (i.e. capacity of lifting device) or capacity of supporting structure (i.e. jacket, GBS, hull, etc.)			

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6 Weight and load budget (WLB)

6.1 General

Class A	Class B	Class C
For all offshore installations, weight and CoG information for all loading conditions shall be controlled from the start of conceptual design. Budget weights and CoG constraints shall be determined for the modules, topsides and supporting substructures (inclusive of temporaries required for the appropriate loading conditions). This shall be done in cooperation with the structural and marine disciplines as well as the project management. The budget weights and CoG constraints shall be presented in the project WLB as a reference point to be used during a project. The WLB is to be reference point for: a) weight, load, and CoG control and reporting during all phases of the project: engineering, construction, installation and operation; b) structural capacity requirements for assemblies, modules, topsides and supporting structures; c) bearing capacity and stability of the total installation (temporary or permanent); d) control of overall cost and schedule; e) ensuring that all loading conditions are within the anticipated capacities.	As Class A.	As Class A, except that d) is not required.

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6.2 Requirements

Class A	Class B	Class C
Each participant in a project (typically the client, contractor and sub-contractors) shall be allocated a separate WLB. The contractor WLBs shall be established by either the client or the contractor. If established by the client, the WLBs shall be included in the project contract documents. The project management or client shall hold overall responsibility for deciding the variations between the various WLBs. WLBs for subcontractors and vendors shall be established by the contractor. Under normal circumstances, revisions to WLBs shall not take place unless concept or major changes to the design - which impact the weight, load or CoG - are implemented by the project management/client. All participants in the project shall be responsible for adherence to established WLB values. In the event that the project weight management detects the possibility of a significant variation from the established WLBs, corrective actions shall be initiated by the project management in order that weight or CoG variations do not occur, or their impact is 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.

6.3 Content

6.3.1 General

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

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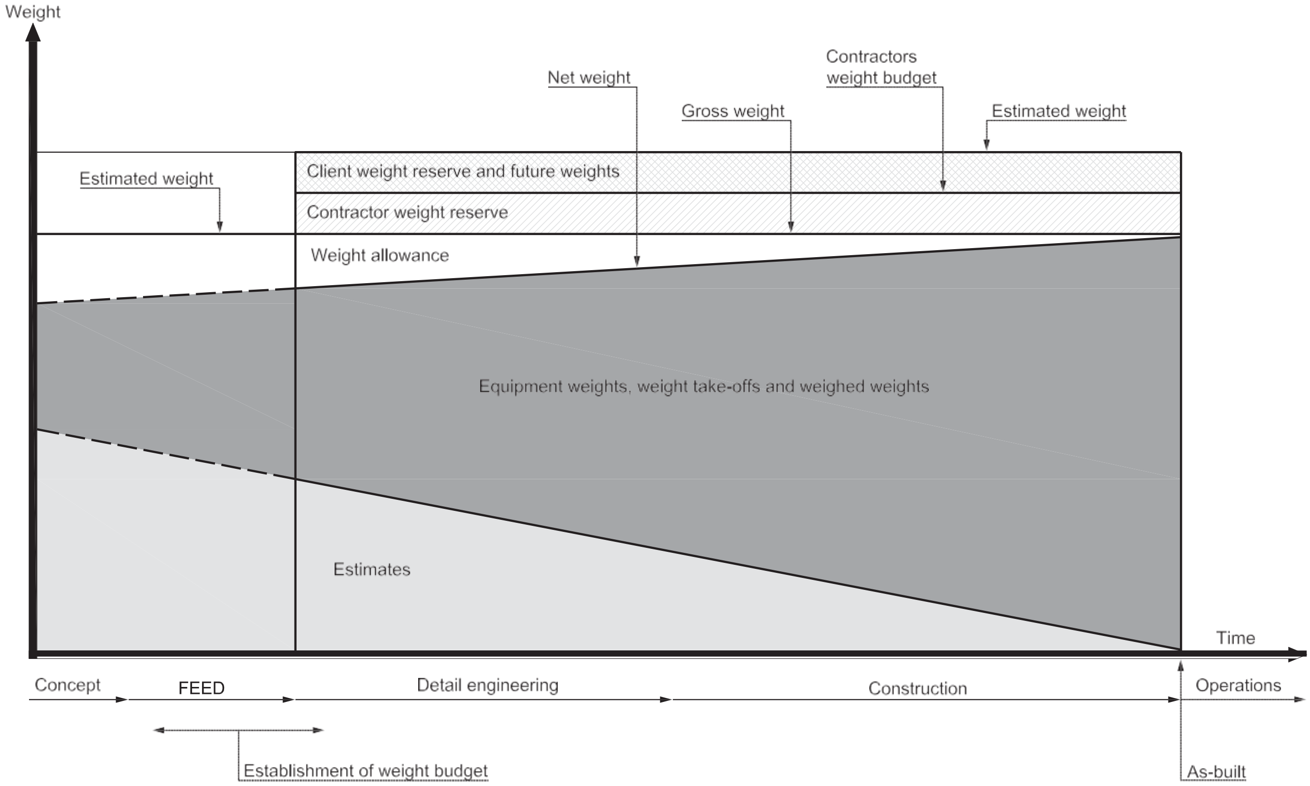

Figure 1 — Weights, loads and associated CoGs

6.3.2 Weight reserves

Class A	Class B	Class C
A contractor weight reserve including CoG may be added on top of the WLB estimated weight. In addition to the contractor weight reserve, the client may add a weight reserve including CoG. The value and location of the weight reserve will depend upon the concept type and the project weight policy. Any relevant variation orders issued by the client after the contract has been issued may affect the weight reserve and may necessitate a WLB revision. In special situations, if the chosen design concept is declared too heavy and thus subject to weight reductions, the weight reserve will be negative. This will result in a WLB weight below the current estimated or reported weight.	As Class A.	As Class A.

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6.3.3 Future weights and loads

Class A	Class B	Class C
Future weights and/or loads are not included in the weight reserve, but shall be identified separately in the WLBs.	As Class A.	As Class A.

6.3.4 Loading conditions and parameters

6.3.4.1 General

<table>
<tr><th>Class A</th><th>Class B</th><th>Class C</th></tr>
<tr><td>A set of relevant loading conditions and associated weight/load parameters shall be defined for weight control and weight reporting purposes.</td><td rowspan="3">As Class A.</td><td>As Class A.</td></tr>
<tr><td>Corresponding WLBs shall be provided. This shall be done in cooperation with the structural and marine disciplines as well as the project management.</td><td>Not required.</td></tr>
<tr><td>Agreement between the client and the contractor shall be reached for:
— the necessary weight reserves;
— the implication of free surface effects on the stability for floating conditions (either temporarily or permanently) installation;
— the variable loads, relevant maxima and associated positions.
Variable loads may include, but shall not be limited to:
— operating loads (stores, personnel etc.);</td><td>As Class A.</td></tr>
</table>

6.3.4.2 Loading condition selection

Class A	Class B	Class C
The necessary loading conditions shall be dependent on the nature of the structure as well as the fabrication and installation methods used.	As Class A.	As Class A.

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6.3.5 Formats and levels

6.3.5.1 General

Class A	Class B	Class C
The format of the WLBs shall depend on the selected weight control class. The WLB format shall, as a minimum requirement, present a maximum permissible weight and a CoG for each assembly, module or topsides. The format may be further developed in order to present a maximum permissible weight for each main weight contributor (e.g. structural steel, piping and equipment) and one common figure for the rest of the design. Individual values for both bulk and equipment for all disciplines may also be given. All values shall be recorded in the relational-type database. The weight report formats shall allow for the inclusion of necessary WLB values.	As Class A. All WLB values shall be recorded in the relational-type database/ spread sheet.	Not required.

6.3.5.2 Formats

Class A	Class B	Class C
An example of a WLB format is given in Annex C.	As Class A.	As Class A.

6.3.6 CoG envelopes

Class A	Class B	Class C
The WLB shall include CoG envelopes for weight control and weight reporting purposes. The CoG envelope shall be either two-dimensional or three-dimensional depending on the structure being controlled, i.e. for a fixed structure, where lifting operations are critical to the CoG, the CoG envelope shall be on two-dimensional, but for stability purposes of a floating structure, the CoG envelope shall be three-dimensional.	As Class A.	As Class A.

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7 Weight control procedure

Class A	Class B	Class C
A weight control procedure shall be issued to the client by the contractor's weight control discipline within 60 days of the contract award, or as stated in the contract. The procedure shall document the weight reporting responsibilities of the engineering disciplines and contractors. The procedure shall include requirements that: a) all personnel carrying out work of significance concerning weight shall have the necessary qualifications and background/experience of such work, b) the contractor or responsible organization shall establish and document a plan, which clearly shows how different tasks, responsibilities and authorities are distributed between disciplines,	As Class A.	As Class A.
c) the contractor or responsible organization shall produce weight documents to substantiate methods of obtaining the weight data at various stages of the project. This documentation shall, as a minimum, contain a description of: — the estimating methodology used at during the project phase(s) covered by the procedure; — the level of weight allowances/ contingencies applied at various project stages; — assessment of CoG for the loading conditions; — assessment of weights for hook-up scope material (if applicable); — assessment of loading conditions 1) weight management philosophies; 2) transfer of weight control responsibility through the various phases of the project (if applicable).	As Class A. Include weight plan to explain the use of weight allowances vs. design maturity.	Not required.
d) define the following: 1) input requirements; 2) global coordinate system; 3) area designation system; 4) loading conditions to be reported; 5) all codes (installation, status, weight allowance, etc.) utilized in the weight control system; 6) discipline checklist.	As Class A.	As Class A.

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8 Weight reporting

8.1 General

Class A	Class B	Class C
Project weight reporting shall be the result of systematic compilation and documentation. Results are presented in a project weight report. It shall be based upon agreed project procedures and work instructions, with the formal weight policy and weight objective defined and adhered to, forming the project weight-management activities, and requirements.	As Class A.	As Class A.
The frequency and type of report shall be dependent on the project requirements. As a minimum frequency, weight reporting every two months is recommended.	The frequency and type of report shall be dependent on the project requirements. As a minimum frequency, weight reporting every three-months is recommended.	The frequency and type of report shall be dependent on the project requirements. As a minimum frequency, weight reporting every four-months is recommended.

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8.2 Weight report requirements

The following text is the required content of a weight report.

Class A	Class B	Class C
EXECUTIVE SUMMARY Shall contain a short summary of project main focus areas (loading condition weights and CoGs) and brief descriptions of variations in weight and CoG and the WLB since the previous weight report. (See examples in Annex I)	As Class A.	As Class A.
1 Introduction 1.1 Purpose A description of the purpose of the weight report. 1.2 Scope A brief description of the scope of work for the project and the corresponding scope/content of the weight report. Include a description of the specific loading conditions that are reported. 1.3 Loading conditions A description of the loading conditions presented in the report.		
2 Report basis 2.1 Sources of information A listing of reference material used (i.e. layout drawings, plot plans, MEL, discipline input, etc. and issue dates) used to create the weight report. Include the cut-off date used for submission of the discipline weight data. 2.2 Report assumptions A list of the assumptions used to create the report. 2.2 Estimates A table showing weight data based on estimates (not detailed weight take-offs) and/or factored from weights determined by detailed weight take-offs.		

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Class A	Class B	Class C
3 Loading condition summaries Include tables showing weight and CoG summaries for assemblies, modules and entire topsides – as defined by project requirements. The tables shall present weight and CoG data for current and previous weight reports – along with mathematical differences between the two time frames. As a minimum, summary data shall be presented for the following loading conditions: 3.1 Dry installed loading condition. 3.2 Operating installed loading condition. 3.3 Other loading conditions summaries. 3.4 Weight summaries by discipline for assemblies, modules and topsides. Include tables of comparisons between current weights and CoGs and those established in the WLBs. 3.5 Description of dry and operating installed weight variations (since the previous weight report) for dry and operating loading conditions. 3.6 A list of possible weight risks (increases) and savings (reductions). List includes possible changes to scope and design that are to be processed through a management of change process before inclusion in the weight report.		
4 Weight and CoG trend graphs Weight and CoG trend graphs for all agreed loading conditions showing the weight development and CoG shift over time.		

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Class A	Class B	Class C
5 Attachments		
5.1 Definitions		
A table showing the definition of expressions used in the report.		
5.2 Abbreviations		
A table to explain the abbreviations used in the report.		
5.3 Area plan and global reference system		
Drawing or sketch indicating the main area codes and global coordinate system.		
5.4 Weight phase codes		
A table showing the relevant weight phase codes used in the weight database.		
5.5 Weight status codes		
A table showing the weight status code definitions.		
5.6 References		
A table showing the reference documents, standards, procedures and specifications etc. for the report.		
5.7 Report schedule		
A schedule indicating the planned cut-off and issued dates for the report.		
5.8 Design data		
A configuration of the principal design data for the project.		
5.9 Other		

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9 Requirements for suppliers' weight data and weighing of equipment and bulks

9.1 General

Class A	Class B	Class C
The supplier shall calculate the weight and CoG as accurately as possible. The supplier shall provide the following weight and CoG data for his delivery: — as-installed dry weight and CoG for each item as it will be installed, including any auxiliaries; — weight of the item's normal operating fluid content; — weight of the item in normal operating condition; — weight of any auxiliaries such as lubricants, hydraulic oil, etc.; — test weight; — transportation weight; — weighing certificate (see B.1).	As Class A.	As Class A.

9.2 Provision of weight information

Class A	Class B	Class C
The supplier shall provide weight and CoG information as follows: — as a part of the bid documents; — within one month after purchase order issue; — when the weight change exceeds the agreed project magnitude value; — within one week after weighing. The weighing certificate shall be attached. NOTE Annex A provides an example of a weight data sheet. Annex B provides an example of a weighing certificate. For purpose-designed items, the weight data sheet shall also include weight and CoG data based upon approved construction drawings.	As Class A.	As Class A.

9.3 Weighing requirements

Class A	Class B	Class C
The supplier shall perform weighing of all equipment weighing more than 10 kN (1 t). If there is identical equipment, only a representative sample shall be weighed. For items weighing less than 10 kN (1 t), catalogue data or supplier's detailed weight calculation is acceptable.	As Class A.	Weighing of equipment is optional.

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9.4 Weighing equipment

Class A	Class B	Class C
The weighing equipment shall have a maximum relative measurement uncertainty of ± 1 %.	The weighing equipment shall have a maximum relative measurement uncertainty of ± 2 %.	The weighing equipment shall have a maximum relative measurement uncertainty of ± 3 %.
The readout of the weighing results shall be easily accessible, and display the results with the same degree of accuracy as that of the weighing equipment.	As Class A.	As Class A.
For all equipment/bulk items weighing 100 kN (10 t) or above, electronic compression load cells or equivalent shall be used to establish the horizontal CoG.	For all equipment/bulk items weighing 150 kN (15 t) or above, electronic compression load cells or equivalent shall be used to establish the horizontal CoG.	For all equipment/bulk items weighing 200 kN (20 t) or above, electronic compression load cells or equivalent shall be used to establish the horizontal CoG.
The weighing shall be planned in such a way that the weighing equipment operates below 80 % and above 20 % of its rated capacity, to account for possible weight underestimation and safety aspects. Necessary spare parts shall be made readily available in order to minimize delays in the weighing operation as a result of faulty weighing equipment.	As Class A.	As Class A.

9.5 Weighing procedure

Class A	Class B	Class C
The supplier shall submit a weighing procedure (see Annex E) to the purchaser for approval within three months of purchase-order issue. The procedure shall include at least the following: — name and address of any subcontractor involved in the weighing; — description of weighing method; — make, type, range, and accuracy of weighing equipment; — name and address of calibration/verification body; — purchase order number.	As Class A.	As Class A.

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9.6 Notification and witnessing of weighing

Class A	Class B	Class C
The supplier shall notify the purchaser in writing of the planned date, time and location of the weighing operation at least 14 days in advance. The supplier shall notify the purchaser of the confirmed date, time and location of the weighing operation at least three working days in advance. All weighings of items weighing more than 100 kN (10 t) shall be witnessed by the client if not otherwise agreed.	As Class A.	As Class A.

9.7 Calibration of weighing equipment

Class A	Class B	Class C
The weighing equipment shall be calibrated for its full range. The calibration of the weighing equipment shall be carried out by a competent laboratory that can ensure traceability and adequate procedures, such as a laboratory that meets the requirements of ISO/IEC 17025 or is accredited by a national accreditation body. For weighings less than 100 kN (10 t), the weighing equipment shall have been calibrated within the last 12 months, and for 100 kN (10 t) and above within the last six months. The calibration certificate(s) shall be available for the purchaser's inspection prior to start of weighing.	The weighing equipment shall be calibrated for its full range. The calibration of the weighing equipment shall be carried out by a competent laboratory that can ensure traceability and adequate procedures, such as a laboratory that meets the requirements of ISO/IEC 17025 or is accredited by a national accreditation body. For weighings less than 150 kN (15 t), the weighing equipment shall have been calibrated within the last 12 months, and for 150 kN (15 t) and above within the last six months. The calibration certificate(s) shall be available for the purchaser's inspection prior to start of weighing.	The weighing equipment shall have a readout facility, which is traceable to a national standard, such as in the form of a production end control at the manufacturer or subsequent check at intervals not longer than four years.

9.8 Weighing operation

Class A	Class B	Class C
A minimum of three weighings shall be performed. Additional weighings shall be performed if one of the following problems has arisen: — inconsistent weighing results; — mechanical/electrical fault or breakdown; — overloading of the weighing equipment; — adverse environmental conditions. In these cases the contractor shall make provision to replace or interchange load cell positions if required.	As Class A.	As Class A.

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9.9 Temporaries during weighing

Class A	Class B	Class C
Temporaries shall be kept to a minimum during the weighing operation. The weighing shall be performed prior to the packing of the supplier's delivery. For temporaries weighing 10 kN (1 t) or less, the weight and CoG for all temporaries included in the weighing shall be calculated, specified and included on the weighing certificate. The weighing result shall be adjusted accordingly. Temporaries weighing above 10 kN (1 t) each shall be weighed separately.	As Class A.	As Class A.

9.10 Items not installed during weighing

Class A	Class B	Class C
The weight and CoG for all items not installed during weighing of the bulk/equipment items shall be obtained individually and separately by weighing or by detailed calculation, and included in the weighing certificate. Items excluded which are above 10 kN (1 t) each shall be weighed separately.	As Class A.	As Class A.

10 Requirements for weighing of major assemblies

10.1 Weighing procedure

Class A	Class B	Class C
The contractor shall, as part of his scope of work, prepare his own weighing procedure, which shall be subject to client approval. Refer to 10.3.2 for details.	As Class A.	As Class A.

10.2 Environmental conditions

10.2.1 Light

Class A	Class B	Class C
Whenever possible, the weighing should be performed during daylight. If this is not possible, the contractor shall provide lighting to give good visibility to all working and inspection areas where the weighing operation is carried out.	As Class A.	As Class A.

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10.2.2 Wind

Class A	Class B	Class C
If weighing take place at wind speed above 8 m/s the effects of wind shall be calculated.	If weighing take place at wind speed above 11 m/s the effects of wind shall be calculated.	If weighing take place at wind speed above 14 m/s the effects of wind shall be calculated.
Wind-measuring equipment shall be provided by the contractor.	As Class A.	As Class A.

10.2.3 Temperature and humidity

Class A	Class B	Class C
The acceptable range of temperature and humidity in which the assemblies/modules may be weighed shall be within the ranges specified for the specific weighing equipment. Measurement uncertainty specified in 10.3.5.4 shall be maintained.	As Class A.	As Class A.

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10.3 Weighing

10.3.1 Number and timing of weighing

Class A	Class B	Class C
Major assemblies shall be weighed twice. The first weighing should be performed when the assembly is 70 % to 85 % complete with respect to weight. The final weighing shall be performed immediately prior to load out. For simple structures, e.g. bridges or flare booms, only the final weighing is required.	Major assemblies shall be weighed once. The weighing shall be performed immediately prior to load out.	The necessity of weighing shall be considered depending on the assembly criticality. However, a final weighing is recommended.
The precise timing of each weighing shall be subject to approval by the client representative.	As Class A.	As Class A.

10.3.2 Weighing procedure

Class A	Class B	Class C
The contractor shall submit his proposed weighing procedure to the project for approval at least two months in advance of the planned weighing date. The weighing procedure documentation shall include at least the following: — name of subcontract weighing specialist, if applicable; — description of weighing equipment and method; — documentation of the accuracy of the weighing equipment; — list of spare parts readily available for weighing equipment; — calibration authority; — samples of calibration certificates; — dimensioned sketches of the arrangement and alignment of the assemblies for weighing; — expected load at each weighing point; — the contractor's organizing of the weighing operation.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A.

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10.3.3 Notification and witnessing of weighings

Class A	Class B	Class C
The contractor shall notify the client representative in writing of the planned date, time and location of the weighing operation 30 working days in advance. The contractor shall notify the client of the confirmed date, time and location of the weighing operation at least 10 working days in advance of the weighing operation. The client shall decide either to witness the weighing or to authorize the contractor to perform the weighing at the contractor's own discretion.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A

10.3.4 Preparation of the weighing

10.3.4.1 Weighing prediction report

Class A	Class B	Class C
The contractor shall produce a preliminary weighing prediction report prior to the weighing operation. This report shall be produced no later than 24 h prior to the weighing operation, with a final update immediately prior to the weighing. The report shall contain at least the following information: a) total theoretical weight and CoG for the assembly to be weighed; b) listings with weight and CoG summaries for all permanent items included in the weighing; c) listings with weight and CoG summaries for all temporary items. This can include, but shall not be limited to — scaffolding, — residual fluid content, — sea fastening, — lifting gear (rigging), — first fill.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A

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10.3.4.2 Temporaries during the weighing

Class A	Class B	Class C
Temporaries shall not exceed 10 % of the permanent weight for any intermediate weighings and shall not exceed 1 % of the permanent weight for the final weighing.	Temporaries shall not exceed 10 % of the permanent weight for any intermediate weighings and shall not exceed 2 % of the permanent weight for the final weighing.	If a final weighing is performed, temporaries shall not exceed 10 % of the permanent weight for any intermediate weighings and shall not exceed 3 % of the permanent weight for the final weighing.
At least the following items shall be removed/released from the assembly before the final weighing, and should preferably also be removed/released before any intermediate weighings: — all scrap containers; — all items that are no longer required for performing contractor's scope of work; — all water, snow and ice accumulations. If this is not practical, the amount of water, snow and ice accumulations present shall be determined and recorded in the prediction report; — all items that cause undetermined loads on the assembly; — all personnel not involved with the weighing operation; — all scaffolding material not in use during the weighing operation.	As Class A.	As Class A.

10.3.5 Weighing equipment

10.3.5.1 Load cells

Class A	Class B	Class C
The weighing system shall consist of electronic strain-gauge load cells. Other types of load cell may be used if approved by the client representative. The load cells shall be equipped with a spherical seating, or equivalent, in order to minimize horizontal forces and bending moments and to reduce the uncertainty of the coordinates for the reaction forces.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A

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10.3.5.2 Read-out equipment

Class A	Class B	Class C
The loads on each load cell shall be indicated on a digital display using a central console. Weights shall be reported with a resolution of one third of the measurement uncertainty or better, i.e. a resolution of 1 kN or better for a 600 kN load cell reading with 0,5 % uncertainty. For weighings where four or more cells are applied, a display for remote reading of each cell shall be used.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A

10.3.5.3 Jacking system

Class A	Class B	Class C
It is essential that the jacking system employed for the weighing operation be able to produce uniform vertical movement at all weighing points. When the load cells are positioned adjacent to the jacks, the assembly shall be lowered smoothly and uniformly on to the load cells. This method of jacking/weighing shall be used only for smaller assemblies. The assembly weight shall be applied directly to the load cells, either by jacking up and lowering onto the load cells (where the load cells are adjacent to the jacks) or by jacking the load cells up to the assembly and then lifting (where the load cells are on top of the jack or inside the hollow piston of the jacks).	As Class A.	If a final weighing is performed, the requirements shall be as for Class A.

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10.3.5.4 Accuracy of weighing system

Class A	Class B	Class C
Each individual load cell shall have a measurement uncertainty within ± 0,5 %, k = 2 of rated capacity. The measurement uncertainty shall be calculated and presented by the calibration authority in accordance with ISO/IEC Guide 98-3, *Uncertainty of measurement — Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)* or a document for determination of uncertainty in force measurements based on the GUM and issued by a member of International Laboratory Accreditation Cooperation (ILAC) or International Accreditation Forum, INC (IAF). The measurement uncertainty of the weighing system as a whole shall be within ± 1,0 %, k = 2 of actual weighed weight. The measurement uncertainty of the weighing result shall be calculated after principles given in the GUM. See Annex J for further information.	Each individual load cell shall have a measurement uncertainty within ± 1,0 %, k = 2 of rated capacity. The measurement uncertainty shall be calculated and presented by the calibration authority in accordance with the Guide to the expression of uncertainty in measurement (GUM) or a document for determination of uncertainty in force measurements based on the GUM and issued by a member of International Laboratory Accreditation Cooperation (ILAC) or International Accreditation Forum, INC (IAF). The measurement uncertainty of the weighing system as a whole shall be within ± 2,0 %, k = 2, of actual weighed weight. The measurement uncertainty of the weighing result shall be calculated after principles given in the GUM. See Annex J for further information.	If a final weighing shall be performed, the requirements are as follows. Each individual load cell shall have a measurement uncertainty within ± 2,0 %, k = 2 of rated capacity. The measurement uncertainty shall be calculated and presented by the calibration authority in accordance with the guide to the expression of uncertainty in measurement (GUM) or a document for determination of uncertainty in force measurements based on the GUM and issued by a member of International Laboratory Accreditation Cooperation (ILAC) or International Accreditation Forum, INC (IAF). The measurement uncertainty of the weighing system as a whole shall be within ± 3,0 %, k = 2, of actual weighed weight. The measurement uncertainty of the weighing result shall be calculated after principles given in the GUM. See Annex J for further information.

10.3.5.5 Load range

Class A	Class B	Class C
The weighing operation shall be planned in such a way that the load cells and jacking (lifting) equipment are operating within 20 % to 80 % of the rated capacity of the load cells as stated by the load cell manufacturer.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A

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10.3.6 Calibration of weighing system

Class A	Class B	Class C
The calibration of the weighing equipment shall be carried out by a competent laboratory that can ensure traceability and adequate procedures, i.e. a laboratory that meets the requirements of ISO/IEC 17025 or is accredited by a national accreditation body. The calibration shall be carried out over the full range of the capacity of equipment and documented in the calibration certificates.	As Class A.	If a final weighing shall be performed, the requirements shall be as follows. The calibration of the weighing equipment shall be carried out by a competent laboratory that can ensure traceability to a national standard and adequate procedure.
The calibration shall have been carried out within six months prior to the weighing operation. The client representative shall be notified in writing of the calibration date and location at least two weeks in advance.	The calibration shall be carried out within 12 months of the date of weighing.	The calibration shall be carried out within 18 months of the date of weighing.
The calibration shall be carried out in one of the following two ways, depending on the output of the read-out unit: a) If the output on the read-out unit is dependent on cable lengths, the whole weighing system, i.e. the load cells, cables, read-outs and amplifiers shall be calibrated as one system. b) If the output on the read-out unit is not dependent on the cable lengths, the load cells shall be calibrated mechanically, separately from the amplifiers, which shall be calibrated electrically by using a precision strain-gauge calibrator. Both the calibrator and its read-out unit shall have valid calibration certificates. Type, serial number, accuracy of measurement, and reference to the master load cell shall be included on the calibration certificates.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A.
Unless permitted by the project, calibrated load cells shall not be used for any other weighing.	As Class A.	

10.3.7 Weighing foundation and supports

Class A	Class B	Class C
The load cells and lifting equipment shall be positioned at approved weighing points. The contractor shall ensure that the foundations and supports are fully adequate and stable to account for all loadings that might occur during the weighing operation.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A.

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10.3.8 Structural integrity

Class A	Class B	Class C
The contractor shall ensure that the weighing causes no damage to the assembly being weighed. This shall be documented by the contractor. The contractor shall ensure that any local strengthening at load cell support points are undertaken prior to the weighting operation.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A.

10.3.9 Weighing operation

10.3.9.1 Number of lifts

Class A	Class B	Class C
Before commencing the weighing operation, a test weighing shall be performed. For each weighing operation, a minimum of three lifts/weighings/readings are required. A fourth and any subsequent weighings may be carried out at the discretion of the client representative.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A.
Following each lift/weighing, when readings have been noted and witnessed, the load cells shall be completely unloaded, the reading and display reset to zero for the next lift.	Following each lift, when readings have been noted and witnessed, the load cells shall be completely unloaded, the reading and display reset to zero.	If a final weighing is performed, the requirements shall be as for Class B.
The fourth and any subsequent lifts/weighings shall be performed if one of the following problems has arisen: — inconsistent weighing results; — mechanical/electrical fault or breakdown; — overloading of the weighing equipment; — adverse environmental conditions. In these cases, the contractor shall make provision to replace the load cells or interchange their positions if requested by the client representative.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A.

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10.3.9.2 Readings of load cells and level criteria

Class A	Class B	Class C
The assembly shall be lifted clear of all supports with a minimum air gap of 3 mm. An acceptable load distribution shall be maintained during the weighing operation. The load cell readings shall be taken simultaneously after the readings have stabilized, level checked and wind speeds taken. After the load has been removed from the load cells, any residual weights shown on display units shall be recorded and the weight result amended accordingly. In the event of the residual amount being excessive, the equipment shall be checked and previous results shall be disregarded by the project.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A.

10.3.9.3 Consistency of results

Class A	Class B	Class C
Discounting clearly inconsistent or erroneous results, the total weight of an assembly as measured for each of the lifts shall not vary from the average of the total weight by more than 0,5 %. The contractor may be required to perform the weighing again if the requirements in general are not met.	Discounting clearly inconsistent or erroneous results, the total weight of an assembly as measured for each of the lifts shall not vary from the average of the total weight by more than 1,0 %.	Discounting clearly inconsistent or erroneous results, the total weight of an assembly as measured for each of the lifts shall not vary from the average of the total weight by more than 2,0 %.
The contractor shall ensure that results are satisfactory to the client representative before demobilizing the weighing system.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A.

10.3.10 CoG calculations

Class A	Class B	Class C
The final CoG shall be calculated as an average, using the results from each weighing. The datum lines utilized for the calculations of the CoG locations shall be as agreed with the project management.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A.

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10.3.11 Weighing certificate

Class A	Class B	Class C
The results of the weighing operation shall be presented on a weighing certificate, and signed by the weighing contractor, contractor and client representative. An example weighing certificate is given in Annex B. The weighing certificate shall contain at least the following information: — project identification; — time, date and location of weighing; — temperature, wind speed and wind direction; — dimensional sketch of load cell position; — recorded total weight and CoG for the weighed assembly; — reference to the global coordinate system for the weighed assembly; — identification of weighing equipment and calibration.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A.

10.3.12 Weighing report

Class A	Class B	Class C
Within seven days of the weighing, the contractor shall submit a report of the weighing operation. The weighing report shall include: — units of measurement; — weighing results; — final weighing correction; — calculations of CoG; — weighing contractor; — weather conditions incl. wind speed; — client witness; — calibration certificates of weighing equipment; — weighing certificate (fully signed); — list and summary of temporary construction items (including their weight and CoG); — detailed list of installed items; — final prediction report; — any deviation from the approved procedure.	As Class A.	If a final weighing is performed, the requirements shall be as for Class A.

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11 Requirements for “as-built” weight documentation

Class A	Class B	Class C
a) An electronic copy of the weight database containing a complete set of designed quantities, including unit weights, CoG and specified attribute information and descriptions, shall be provided. If a 3D model is applied for the project, the quantities within the weight database shall be consistent with those in the model with corrections for non-modelled items. The database fields, their format as well as the coding, shall be in accordance with contractual requirements.	As Class A.	a) An electronic copy of the weight data, containing a complete set of weights with CoG and specified attribute information and descriptions, shall be provided.
b) A detailed hard-copy weight dossier which includes — an “as-built” weight and CoG report, — an “as-built” weight item list, — an “as-built” master equipment list (MEL), — tag-mark drawings correlating to the electronic database (if applicable).	b) A detailed hard-copy weight dossier which includes — an “as-built” weight and CoG report, — an “as-built” weight item list, — an “as-built” MEL.	b) No specific hard-copy “as-built” weight dossier is required. Thus, the “as-built” documentation shall include — the latest weight and CoG report, — the latest weight item list.
In order to provide the level of documentation required, a thorough weight control activity shall be maintained by all disciplines.	As Class A.	Not required.

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Annex A
(informative)

Weight data sheets — Tagged equipment

	Weight data sheet **Tagged equipment**		**Page 1 of 2**
Project:		Client:	
Package No.:	Doc. No.		Rev.

Tag No.:	Serial No.:	
Description:		
Vendor:	Layout drawing No.:	
Manufacturer:	P & ID No.:	
Model:	Area:	

Weight of complete unit (Unit:)		
Condition	**Weight**	**Remarks**
Dry weight delivered from vendor		
+ Fluid content normal operating		Filling (%):
= Operating weight		
Test weight (filled with fluid)		
Max. lift weightt at padeyes		
Largest removable item		

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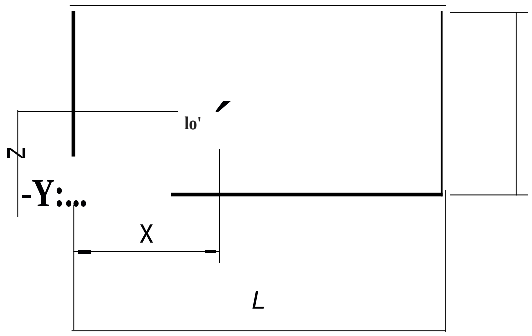
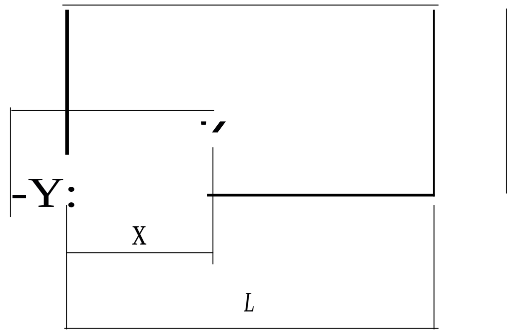
21 Overall sizes and positions of local centre of gravity (CoG) [mm]

Length (L):	Dry CoG X:
Width (W):	Dry CoG Y:
Height (H):	Dry CoG Z
Vendor drawing ref.:	Oper CoG X:
	Oper CoG Y:
Rev.: Date:	Oper CoG Z:

Weight/CoG status (by vendor), check as appropriate
D Estimate at bid D Confirmed after purchase order D Recalculated/catalogue data D Final calculated D Approved for construction D Weighed weight
Notes
Date Sign



Side view



Top view

0 Local datum point
E9 Local CoG

NOTE Sketch to be included showing overall dimensions, key features and orientation. Datum point to be shown in plan and elevation. CoG shall have reference to the datum point.

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Annex B
(informative)

Weighing certificates

B.1 Equipment and bulks weighing certificate

<table>
<tr><td colspan="5">Equipment and bulks weighing certificate
Page 1 of 2</td></tr>
<tr><td>Project:</td><td colspan="4">Client:</td></tr>
<tr><td>Item/tag No.:</td><td colspan="4">Bid package No.:</td></tr>
<tr><td colspan="5">Description:</td></tr>
<tr><td colspan="5">Purchase Order No.:</td></tr>
<tr><td colspan="5">Supplier:</td></tr>
<tr><td rowspan="2">Weighed components
or other items</td><td rowspan="2">Date</td><td colspan="3">Dry weight (Unit:)</td></tr>
<tr><td colspan="2">Calculated
(purchase order)</td><td>Recorded</td></tr>
<tr><td></td><td></td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">Total dry weight this item/Tag No.:</td><td colspan="2"></td><td></td></tr>
<tr><td colspan="2">Weighing equipment</td><td colspan="3" rowspan="3">NOTE CoG to be shown on sheet 2 if applicable.</td></tr>
<tr><td colspan="2">Make:</td></tr>
<tr><td colspan="2">Type:</td></tr>
<tr><td colspan="2">Range:</td><td>Approved:</td><td>Date:</td><td>Signature:</td></tr>
<tr><td colspan="2">Serial number:</td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Calibration date:</td><td>Supplier:</td><td></td><td></td></tr>
<tr><td colspan="2">Calibration authority:</td><td>Purchaser:</td><td></td><td></td></tr>
<tr><td colspan="5">Document number:</td></tr>
</table>

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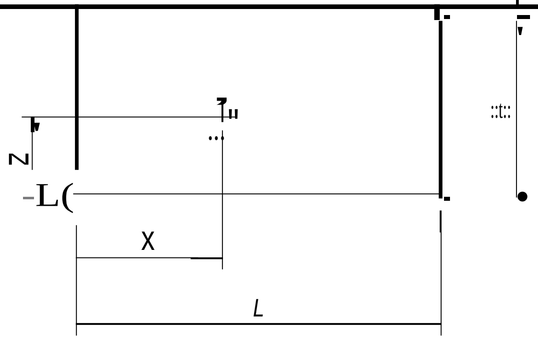
Equipment and bulks weighing certificate-CoG status

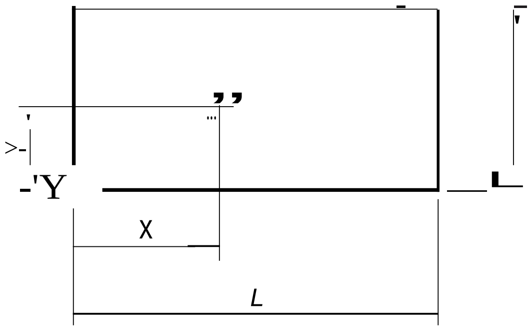
Page 2 of 2

Project:	Client:
Item/tag No.:	Bid package No.:
Description:	
Purchase order No.:	
Supplier	

Weighed components or other items	Date	Dry weight recorded (Unit:)	CoG		
			East (X)	North (Y)	Elevation (Z)
Total dry weight and CoG for skid, including items excluded during weighing:					



Side view



Top view

O Local datum point
EB Local CoG

Overall dimensions (mm):

L = *W* = *H* =

Local datum 12oint (mm), (if known):
East (X) =
North (Y) =
Elevation (Z) =

Local CoG (mm):
East (X) =
North (Y) =
Elevation (Z) =

Fluid content weight for operating condition:

Operating weight (dry + fluid

NOTE This sheet shall be completed vvhen measurement of CoG is necessary. Sketch to be included shovving overall dimensions, CoG data for skid in installed dry condition, key features and orientation. Datum point to be sho1M1 in plan and elevation. CoG shall have reference to the datum point

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B.2 Major assembly weighing certificate

Major assembly weighing certificate Page 1 of 2	
Project:	Client:
Assembly/Area:	Location of weighing:
Wind speed:	Temperature (°C):
Weighing operation time start/end:	Weighing operation date:

Load cell reference	Load cell reading at weighing (Unit:)				
	1st	2nd	3rd	4th (if required)	Average
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					

	Weighing results		
	Weight (Unit:)	East/LCG (m)	North/TCG (m)
Predicted			
1st			
2nd			
3rd			
4th			
Average			

Major assembly weighing certificate Page 2 of 2	
Project:	Client:
Assembly/Area:	Location of weighing:

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Load cell reference	Load cell serial number and coordinates at weighing					
	1st	2nd	3rd	4th(if required)	X	Y
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

Witnessed:	Signature:	Date:
Weighing contractor:		
Contractor:		
Project:		

A dimensional sketch showing the load cell positions, reference to the global coordinate system and wind direction shall be attached to this certificate.

Number of attachments:

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Annex C
(informative)

Weight and load budget (WLB) formats and levels

Table C.1 — Topsides operating weight budget

Area code	Platform area	Weight estimate (Unit: ...)	Contractor weight reserve (Unit: ...)	Client weight reserve (Unit: ...)	Content weight (Unit: ...)	Live, hook and set back load (Unit: ...)	Total weight (Unit: ...)	Centre of gravity		
								East	North	Elevation
A	Utilities area									
B	Mud module									
C	Derricksubstr./ derrick									
D	Flare boom									
E	Living quarters									
F	Process deck 1 and 2									
G	Process deck 3, 4, 5 and pipe-rack									
H	Well bay									
I	Hook-up									
J	Total									

CoG-envelope : East: ± ..... m
North: ± ..... m
Elevation: ± ..... m

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Annex D
(informative)

Major elements of the weight displacement

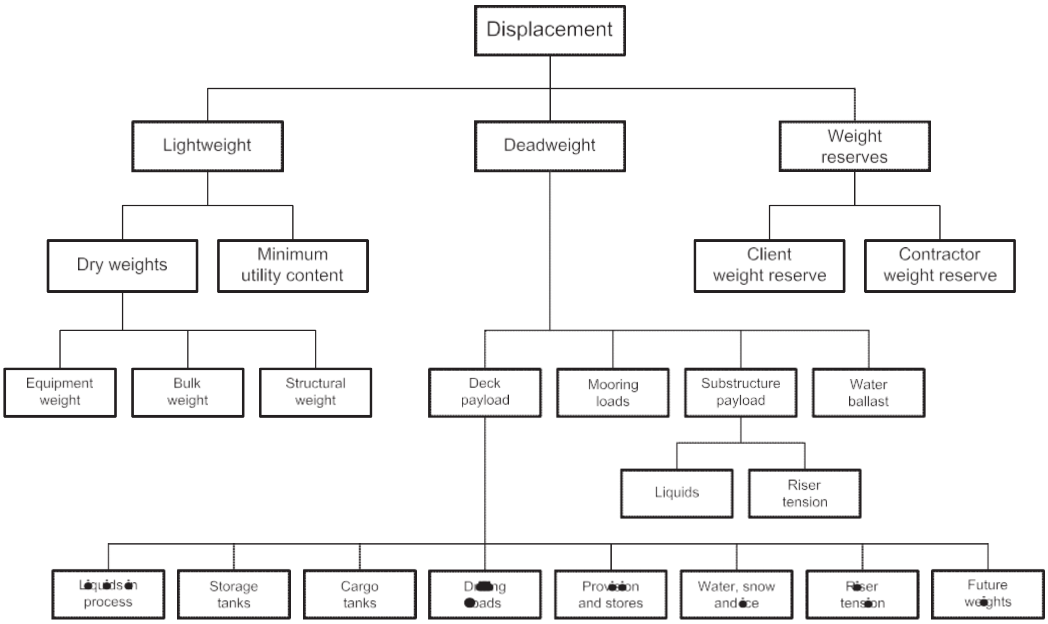

Figure D.1 — Weight displacement summary, design operating condition

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Annex E
(informative)

Supplier weighing procedure

Items/tag No. to be weighed		
Project:	Client:	
Purchase order No.:	Date:	
Supplier:	Author:	
Item/tag No.	**Description**	**Predicted weight (Unit:)**
Weighing subcontractor:		
Address of weighing subcontractor:		
Calibration authority:		
Address of calibration authority:		
Weighing equipment		
Make:		
Type:		
Range:	Accuracy: %	
Notes:		
Document No.:		

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Description of weighing method:
Description of CoG recording:

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Annex F
(informative)

Guidelines for displacement measurement of floaters

F.1 General

F.1.1 Procedure for displacement measurement

This part of ISO 19901 gives guidelines for the minimum requirements for a displacement measurement in order to provide reliable and accurate results for weight control purposes. When formal inclining experiments are performed, the individual requirements from the classification society in question should be followed.

Data obtained from the lightweight survey and inclining experiment applied for safety reasons by the classification society can be used by the weight discipline provided certain requirements are fulfilled.

This method gives a lower degree of accuracy as compared with weighing using load cells.

The contractor should prepare a displacement measurement procedure incorporating the classification society requirements in question. The contractor's procedure should be made available to the client representative at least one month in advance of the planned displacement measurement date.

F.1.2 Displacement measurement subcontractor

The displacement measurement should be conducted by the contractor and/or classification society in question. Both the client representative and the contractor should be present during the measurement.

F.2 Environmental conditions for displacement measurement

The following requirements should be implemented:

a) a sheltered location should be found in which the measurement can be carried out;

b) sufficient time, approximately 12 h, should be allowed for the measurement operation;

c) good weather should be forecast;

d) the wind speed should be below 5 m/s;

e) there should be no significant swell;

f) the maximum wave height should be 1,0 m and there should be no substantial current;

g) the floating structure should be free-floating;

h) time and location should be indicated, as well as water depth.

F.3 Displacement measurement

F.3.1 Displacement measurement procedure

The contractor should submit his proposed displacement measurement procedure for approval at least one month in advance of the planned measurement date.

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The displacement measurement procedure should cover at least the following subjects:

— description of equipment and method;

— assessment of measurement accuracy;

— dimensional sketches of the measurement arrangement;

— contractor's organization of the measurement operation.

F.3.2 Notification

The client representative should be notified in writing of planned displacement measurement dates 15 working days in advance.

F.3.3 Preparation of the displacement measurement

F.3.3.1 Displacement measurement prediction report

The contractor should make a preliminary displacement measurement prediction report prior to the measurement. This report should be presented to the project no later than 24 h prior to the measurement operation with a final update immediately prior to the displacement measurement.

The report should contain at least the following information:

— total theoretical weight and CoG for the assembly to be measured;

— expected draught on the measurement locations on both sides aft, forward and midships;

NOTE For semi-submersibles, the measured draught in the measurement locations should be at all columns.

— listings with weight and CoG summaries for all items included in the measurement;

— general arrangement plan "as-carried-out";

— draught-mark position survey;

— listing of weight of liquids in tanks, including CoG;

— listing of permanent items temporarily located;

— listing and summation of all temporary items including CoG, including any ballast and consumables.

F.3.3.2 Temporaries and foreign forces

The following requirements should be implemented:

— anchors should be raked and the floating structure, if necessary, assisted by tugs;

— floating structure should be free-floating;

— the minimum number of personnel should be on board during test;

— no fresh water should be consumed or produced during the measurement operation;

— the minimum number of cables and hoses, etc. should be connected; those hoses which are connected should be slack.

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F.3.4 Equipment for displacement measurement

Any equipment directly affecting readout of measurement results should be calibrated and have a known measurement uncertainty. This includes the following:

— hydrometers (densitometers) for measuring specific gravity of the water in which the floating structure is floating;

— thermometer for measuring seawater temperature;

— steel measuring tape or similar for checking draught marks and draught measurements;

— throttled transparent plastic tube or other suitable water-level measuring device for draught measurements;

— equipment for measuring wind velocity.

F.3.5 Displacement measurement operation

If an adequate draught-mark position survey is not available, the draught marks should be checked by measuring against a known datum level on the vessel.

Two sets of draught measurements should be executed at a minimum of six locations in sequence. A third set and any subsequent draught measurement sets may be needed if one of the following problems has arisen:

— inconsistent draught measurements;

— adverse environmental conditions.

The draught measurements are considered consistent if the total displacement based on each set of draught measurements does not vary from the average by more than 0,5 % and the horizontal shift in CoG is less than 0,3 % of the floating structure's dimension in the same direction. In case of inconsistent draught results, efforts should be made to identify any activity on board that might have caused movement of significant weights.

F.3.6 Displacement measurement certificate

The displacement measurement result should be presented on a displacement measurement certificate, and signed by a representative from the measurement contractor, contractor and client representative.

The displacement measurement certificate should contain at least the following information:

— floating structure identification

— time, date and location of measurement;

— temperature, wind speed and wind direction;

— water depth and estimated wave height;

— dimensional sketch of draught measurement locations;

— draught readings and time at which they were taken;

— specific gravity of water in which the floating structure is floating;

— recorded total weight and CoG for the measured assembly;

— reference to the global coordinate system for the measured assembly;

— identification of displacement measurement equipment used.

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F.3.7 Displacement measurement report

Within seven days of the displacement measurement operation, the contractor should submit a report of the measurement operation, which should include:

— measurement results;

— calculation of CoG;

— displacement measurement certificate (fully signed);

— detailed list of installed items;

— final prediction report;

— assessment of the accuracy of measurement results.

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Annex G
(informative)

Requirements for weight control during operations

G.1 Foreword

Annex G is a precursor for some of the topics that are proposed to be included in the next revision of ISO 19901-5.

Some of this informative information may tend to conflict with present normative text given elsewhere. However, these topics will be further discussed in the next edition and the informative may become the normative, if proposals to expand the scope of this part of ISO 19901-5 are accepted.

Once finalised, caveats will be added to this part of ISO 19901-5 where necessary to clarify the coincident operating loads on different types of facilities e.g. oil and gas producing, gas producing, not normally manned, drilling and work over by jack-up rigs, floaters.

G.2 Weight control during platform operational life

G.2.1 General requirements

The dry and operating weight and centre of gravity (CoG) of an offshore installation shall be controlled throughout its operational life. The output from a topside weight database shall be the prime document used by client structural engineers and Structural Integrity Management (SIM) engineers when conducting assessment or re-analyses of structures.

Regular assessment and re-analysis ensures local and global design parameters are not exceeded by the weight impact of the numerous projects and modifications a facility undergoes in its operational lifetime (often in excess of 2 000).

The dry and operating weight and CoG data stored in a facility's weight database may also be used for the following operational phase activities:

- provision of weight and CoG of equipment to assist deck crew with offshore movements and change-outs;
- provision of weight and CoG data for future decommissioning of the installation;
- provision of weight and CoG data for presentation to verification bodies and certifying authorities.

A high degree of confidence in the accuracy of a facility's topside operating weight and CoG is required; otherwise proposed load factors in ISO 19902, *Petroleum and natural gas industries — Fixed steel offshore structures* and ISO 19901-9, *Petroleum and natural gas industries —- Specific requirements for offshore structures — Part 9: Structural integrity management*, become inadequate. It is therefore critical that weight databases used in SIM models have:

- the complete topsides dry and operating weight, with drilling modules and in-line drilling equipment included;
- no significant dry and operating weight or CoG errors;
- no significant omissions;
- no consistent un-conservatism in the weight estimate of the items;

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- no consistent conservatism in the weight estimate of the items (for brownfield project viability);
- no operating practices on the platform that lead to significantly higher loads than those reported in the weight database".

ISO 19902:2007, A.9.1, states *"The partial action factors provided in Clause 9 are intended to cover variations in the intensity of direct actions from the specified representative values and as far as appropriate the uncertainties in predicting internal forces."*

Put another way, the load factors in ISO 19902 do not allow for any significant weight errors, or weight omissions (often referred to as known unknowns, and unknown unknowns).

ISO Interfaces

Recent studies show that in the past, a number of operating weights and drilling loads have been omitted from topside weight databases, and hence the SIM models.

To ensure these types of omissions do not recur, it is proposed that ISO 19901-5 includes a common operating philosophy with a prescriptive list of coincident operating weights that regularly occur on a facility. These shall then be included in topside weight databases and linked to the G1, G2, Q1, Q2 Load Factors listed in ISO 19902, to forge a link between these ISO standards.

The above measures will help prevent the selective weight reporting and SIM modelling that has been found in some quarters.

Recent study

Given the above focus on the accuracy of topside operating weight, it is interesting to note the results of a recent academic study of 10 UK sector platform weight databases. The sample included:

— a range of ages;

— a range of operators;

— a range of design contractors;

— a span of topside operating weights.

After applying the proposed common operating philosophy to each platform, the total platform operating weights **increased** by an average of 14 % with a CoG movement approaching 1,0 m. If these study findings prove typical, a concerted effort will be required to undertake weight health check audits to correct the c. 8 000 offshore platforms installed globally, and ensure SIM models are not deficient.

Weight update and SIM download

Discussions with ISO 19901-9 SIM committee show their preferred way forward is to have weight databases automatically downloaded into SIM models in future. This will require the weight database to be constantly updated throughout the platform lifecycle, as it will become the primary document for updating SIM models. It is understood that discussions with leading structural integrity software suppliers are well advanced to enable this.

G.2.2 Operational phase weight control procedure

An operational phase weight control procedure shall be produced that clearly defines the roles and responsibilities of the client; the modification design contractor; the SIM engineers; and the weight database custodian. It should include a simple weight control flow diagram showing implementation of a modification and its weight change from inception; to weight database update; to SIM model update; and final close-out.

Design contractor

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Weight and CoG changes resulting from modifications undertaken during the operational phase shall be recorded on weight control input sheets to be completed by the design contractor. These must be included in design work packs, and issued to the weight database custodian for review and input.

Weight database custodian

The topside weight database shall be maintained by the appointed weight database custodian, and kept regularly updated with all weight and CoG changes and modifications i.e. additions, relocations and removals. The custodian shall check to ensure the topside weight database includes all coincident drilling, laydown and operating loads, as shown in the common operating philosophy below.

The custodian shall keep the client and structural integrity management engineers regularly informed of all proposed weight and CoG changes. In addition, the custodian should issue an annual weight report to the client and SIM engineers for presentation to certifying authorities as part of the inspection regime.

SIM model

It is important that structural SIM models and topside weight databases are kept fully synchronised. To ensure this, one of the primary SIM model load cases shall exactly mirror the dry and operating weights and centre of gravity in the topside weight database.

G.2.3 References to operational weight control and SIM in other ISO standards

ISO 19902, *Petroleum and natural gas industries – Fixed steel offshore structures*

An up-to-date topside weight database is required in order to check whether the magnitude of weights and CoG changes have triggered the need for a SIM reassessment of the facility in accordance with ISO 19902:2007, Clause 24. A SIM system is recommended in ISO 19902:2007, 23.1.

ISO 19904 (all parts), *Petroleum and natural gas industries — Floating offshore structures*

ISO 19904-1:2006, 5.5.4 and 5.5.7 contain requirements for the update of the weight database for the structure's operational life.

ISO 19901-9, *Petroleum and natural gas industries —- Specific requirements for offshore structures — Part 9: Structural integrity management*

Weight control during a facility's operational life will also be addressed in ISO 19901-9.

G.3 Coincident operating weights

G.3.1 Common topside operating philosophy

All topside weight databases shall adopt a common topside operating philosophy as stated below.

The topside weight database shall comprise an inventory of the dry and operating weight and CoG of each component broken down by module and discipline. When summarized, these shall reflect a snapshot impression of the maximum topside operating weight and CoG that may be experienced under normal operational drilling conditions.

Movable items shall be located in logically fixed locations e.g. cranes in parked position, forklift in sack store, drilling derrick, substructure and skid base located over a corner drill slot, etc.

The maximum in-place operating condition shall be a summation of the dry weights, plus operating increases from men, equipment, bulks, fluids, powders, laydown areas, storage areas, setback area, and fully laden pipe rack applied simultaneously.

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The topside weight database shall not attempt to reflect the worst topside load case, as this requires the application of a number of variable factors and environmental forces to be added to the SIM model by the structural engineer e.g.

— stuck casing (hook load),

— drilling modules and moveable items in most onerous location,

— worst combination of environmental forces,

— worst combination of hydrotest,

— ice and snow accretion.

Likewise, transient live loads shall be omitted, as they will already be taken account of elsewhere i.e. men and luggage located in the accommodation module, and transient loads located on laydown and storage areas.

The maximum topside operating weight occurs when coincident maximums of mud, brine, powders, drill string, and the 9 5/8" casing are on board for drilling the longest well. At this time all laydown and storage areas are commonly coincidentally full, and shall be reflected as such.

NOTE A fact often overlooked is that the longest well (and maximum topside operating weight) may occur early in a platform life cycle. Studies show the operating philosophy and drilling matrix are often not updated. Hence, neither is the topside weight database, nor the structural SIM model. Failure to update these documents can jeopardize viable brownfield re-development proposals if the engineering is based on out-of-date drilling load combinations that cannot recur.

G.3.2 Common operating philosophy assumptions

The common operating philosophy reflects a common condition when operational drilling is underway. The topside operating assumptions for a manned, operational drilling oil and gas facility are listed below.

Drilling

- — Fully outfitted drilling substructure, derrick, skid base, and pipe bridge/cat walk shall be positioned over a well slot most onerous to the structural design (corner slot). These drilling modules should be reported separately, so they can be re-located over any well slot if required.
- — Moveable equipment such as hoists, gantry cranes, and forklift trucks shall be reflected in mid-range of normal operating locations. These are assumed unladen as transient loads are reflected on laydown and storage areas.
- — Pipe rack (longest 9 5/8" casing load + 5 % rejects), plus containers shall be assumed full. Approximately 80 % of hole length is normally cased with 9 5/8" casing. Refer to the Drilling Operations manual.
- — Setback area shall be assumed full (drill string + 5 % rejects with Bottom Hole Assembly for longest hole to be drilled). Refer to the Drilling Operations manual.
- — Hook load shall be zero (drill string and casing cannot be in two places at once).
- — Drill water and brine tanks shall be assumed full.
- — Active and reserve mud tanks shall be assumed full. Once drilling has commenced, and LP and HP piping and equipment are operationally full, the mud tanks are usually topped up.
- — Trip tank shall be assumed full.
- — Mud gutters shall be assumed full.
- — Mud in shakers and mud cleaning systems shall be assumed full.

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— Cuttings cleaning systems shall be assumed full.

— Cuttings re-injections system shall be assumed full.

— Poorboy degasser shall be assumed full.

— Drilling line reel shall be assumed full.

— Powder tanks (P-tanks) shall be full with worst case combination of powders and densities.

— P-tanks shall be full of aerated powder (not settled contents).

— Sack store shall be assumed full.

— Drilling risers and Christmas trees are supported directly from the seabed, and shall not be included.

Vessels

— Vessel trains including sand accumulation, plus oil and water shall be assumed full to normal operational levels.

Caissons

— Caissons supported from the topside structure shall be included.

Tanks

— Diesel tanks shall be assumed full.

— Main water tanks shall be assumed full.

— Potable water tank shall be assumed full.

— Chemical injection tanks shall be assumed full.

Laydown and storage

— Laydown and storage: all areas shall be assumed coincidentally full (single stacked containers).

— Stairs, walkways, escape routes and other free areas shall be unladen i.e. live loads shall not be included.

Cranes and forklifts

— Platform cranes shall be assumed unladen in parked position as laydown areas are full.

— Forklifts shall be assumed unladen as laydown areas are full.

Living quarters

— All personnel and baggage shall be assumed located in living quarters: POB × 0,20 tonnes per man.

— Fridges, freezers, stores and laundry shall be assumed full.

— Vegetable and cold stores shall be assumed full.

— Single helicopter (maximum take-off weight) shall be assumed on helideck.

— Lifeboats shall be unladen as men are in accommodation module.

Piping

— Wet process piping plus HP/LP drilling piping shall be assumed coincidentally full.

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— Dry gas and air piping shall be assumed empty.

— Foam systems shall be assumed full.

Scaffolding and paint store

— Scaffold and paint stores shall be assumed full.

— Operational scaffold shall be assumed deployed (there is normally 250 to 350 tonnes of scaffold on a 15 000 tonne operating topsides).

G.3.3 Coincident operating loads

The table below shows the coincident operating increases that shall be included in a topside weight database for a typical manned oil and gas producing installation with a single drilling rig facility.

Coincident operating loads	**ISO 19902:2007 Permanent actions (G1 and G2) and Variable actions (Q1 and Q2)**
DRILLING	
Setback load (for longest hole including Bottom Hole Assembly +5 % rejects)	Q1
Pipe rack load (9 5/8” casing string for longest hole, +5 % rejects)	Q1
Containers on pipe rack (normally 100 to 200 tonnes)	Q1
Loose drill floor tools (normally 10 tonnes)	G1
P-tank powder storage for cement, bentonite, and baryte (full - aerated)	Q1
Sack store (full)	Q1
Mud in tankage (active and reserve tanks full)	Q1
Drill water in brine tanks (full)	Q1
Completions fluid storage (full)	Q1
Mud in cuttings cleaning system (full)	Q1
Cutting slurry in cuttings reinjection system (full)	Q1
Mud in shakers and mud cleaning system (full)	Q1
Mud in Poorboy degasser	Q1
Mud in Trip tank	Q1
Schlumberger wireline and tools in tool house (full)	G1
LAYDOWN and STORAGE	
Laydown and storage areas all areas coincidentally full (single stacked containers)	Q1
Platform stores and spares (full)	Q1
Tote tank and IBC areas (full)	Q1
EQUIPMENT and PROCESS	
Diesel in storage tanks and day tanks	Q1
Potable water in storage tanks	Q1
Fluids in topside Equipment including Process separators, Test separator and KO drum full to normal operational levels (including sand accumulation)	Q1
Water in Coolers and Radiators (full)	Q1
Fluids in Degassers	Q1
Water in Fire pumps	Q1
Chemicals in injection package	Q1
AFFF in storage tanks	Q1

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Coincident operating loads	ISO 19902:2007 Permanent actions (G1 and G2) and Variable actions (Q1 and Q2)
DRILLING	
Methanol in methanol system	Q1
Fluids in deluge system	Q1
Hydraulic fluids in Power Packs and accumulators	Q1
Water in seawater system	Q1
Water in firewater system	Q1
Fluids in process piping and valves	Q1
Water in potable water system	Q1
Water in produced water system	Q1
Equipment inventory including gearbox fluids, lube oil, etc.	G1
CRANES AND FORKLIFTS	
Platform cranes shall be assumed unladen in parked position as laydown areas are full	Zero
Forklifts shall be assumed unladen as laydown areas are full	Zero
ACCOMMODATION MODULE	
Men and luggage (POB x 0.2te/man) located in Accommodation module(s)	Q1
Lifeboats shall be unladen as men are in Accommodation module	Zero
Contents of fridges, freezers and veg dry stores	Q1
Helicopter (max take-off weight)	Q1
Galley fluids and black drains	Q1
Sewage in macerator	Q1
SCAFFOLD	
Scaffold stores shall be assumed full Operational scaffold shall be assumed to be deployed (there is normally 250 to 350 tonnes of scaffold on a 15,000 tonne operating topsides)	Q1
TRANSIENT LIVE LOADS	
Transient live loads shall be omitted, as they will already be taken account of elsewhere i.e. men and luggage located in Accommodation module and containers on laydown and storage areas.	Zero
BRIDGE REACTIONS	
Bridge reaction (if applicable)	G1 + Q1

G.3.4 How weight database dry and operating weights interface with ISO 19902:2007 permanent actions (G1 and G2) and variable actions (Q1 and Q2)

9.2.1 Permanent action — G1 (dry weight)

G1 is the action imposed on the structure by the self-weight of the structure with associated equipment and other objects. G1 includes the following:

a) weight of the structure in air, including, where appropriate, the weight of piles, grout, and solid ballast;

b) weight of equipment and other objects permanently mounted on the structure that do not change with the mode of operation;

c) hydrostatic actions acting on the structure below the waterline, including internal and external pressure, and resulting buoyancy (not applicable to topside weight database items);

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d) the weight of water enclosed in the structure, whether permanently installed or temporary ballast (not applicable to topside weight database items).

The representative value of G1 is the value computed from nominal dimensions and mean values of densities.

9.2.2 Permanent action — G2 (dry weight)

G2 is the action imposed on the structure by the self-weight of equipment and other objects that remain constant for long periods of time, but which can change from one mode of operation to another or during a mode of operation. G2 includes the following:

a) weight of drilling and production equipment that can be added to or removed from the structure;

b) weight of living quarters, heliport and other life-support equipment, diving equipment, and utilities equipment, which can be added to or removed from the structure.

The representative value of G2 is the estimated lift weight of the object plus any field installed appurtenances.

9.2.3 Variable action — Q1 (operating weight)

Q1 is the action imposed on the structure by the weight of consumable supplies and fluids in pipes, tanks and stores, the weight of transportable vessels and containers used for delivering supplies, and the weight of personnel and their personal effects.

Where appropriate, the weight of marine fouling and ice shall be included in Q1 (not applicable to topside weight database items).

The weight of scaffolding or other temporary access systems used during operations and maintenance of the platform shall also be included in Q1.

The representative value of Q1 is computed from the nominal weight of the heaviest material and the largest personnel capacity under the mode of operation considered (typically mud and powder weights).

9.2.4 Variable action — Q2 (not applicable to weight database items)

Q2 is the short duration action imposed on the structure from operations, such as lifting of drill string, lifting by cranes, machine operations, vessel mooring, and helicopters. The additional weight of liquids used for testing of vessels and pipes is also included in Q2. The representative value of Q2 is computed from the rated maximum capacity of the equipment involved and includes dynamic and impact effects.

9.10-1 — Table of partial action factors for in-place situations

SIM engineers must check that G1, G2, Q1 and Q2 are the maximum values for each mode of operation.

G.4 Allocation of design allowances and reserves

G.4.1 Suggested design allowances

A design allowance is an overall allowance added to a dry weight to account for uncertainties. The following tables show the suggested range of design allowances to be applied to dry weights of different disciplines at the various stages of design development.

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It comprises a summation of the following three elements:

Item accuracy allowance

An allowance to account for inaccuracies in estimates, Weight take-off and vendor data that experience shows will be used during normal design development. It is dependent on assessed quality of available data - not project phase.

Design change allowance

An allowance to account for weight changes that experience shows will be used during normal design development.

Fabrication allowance

An allowance to account for fabrication tolerances and changes that experience shows will be used from material substitutions, site run materials, and site queries.

Operational Reserve

An additional allowance of operating weight expressed as an overall tonnage that is reserved over and above the management reserve to account for additional items added to a platform during its operational life. These would typically include the following.

- Minor modifications. History shows most platforms will have more than 2 000 in a 30-year operational lifetime. These can amount to increases in excess of 1 000 tonnes operating.
- Major projects (increases in power generation, produced water capability, tie-ins to new wells and facilities, etc.).
- Compliance with new regulations.
- Additional laydown and storage.
- Flowlines.

Management reserve

An additional allowance of operating weight expressed as an overall tonnage that shall be reserved over and above the factored operating weights to account for any changes made to original contract requirements by the client. The management reserve shall be released as appropriate by the project Weight Review Panel, or similar body.

Equipment

Design allowances	Preliminary estimate	Catalogue or preliminary vendor estimate	Vendor weight (or from previous project)	Final vendor weight	Weighed weight
Item accuracy	5 %–7 %	5 %–7 %	2 %–5 %	2 %	0 %
Design change	5 %	2 %	0 %	0 %	0 %
Fabrication	5 %	5 %	2 %	2 %	0 %–2 %
Total allowance	15 %–17 %	12 %–14 %	4 %–7 %	4 %	0 %–2 %

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Discipline bulks

Design allowances	Preliminary estimate	Preliminary MTO	Intermediate MTO	Final MTO	Weighed weight
Item accuracy	5 %–7 %	5 %–7 %	2 %–5 %	2 %	0 %
Design change	5 %	2 %	2 %	0 %	0 %
Fabrication	5 %	5 %	2 %–5 %	2 %–5 %	0 %–2 %
Total allowance	15 %–17 %	12 %–14 %	6 %–12 %	4 %–7 %	0 %–2 %

Structural

Design allowances	Preliminary estimate	Preliminary MTO	Intermediate MTO	Final MTO	Weighed weight
Item accuracy	5 %	3 %	2 %	0 %	0 %
Design change	5 %	2 %	0 %	0 %	0 %
Fabrication	5 %	5 %	2 %–5 %	2 %–5 %	0 %–2 %
Primary steel Total allowance	15 %	10 %	4 %–7 %	2 %–5 %	0 %–2 %
Item accuracy	10 %	5 %	2 %	0 %	0 %
Design change	5 %	5 %	3 %	0 %	0 %
Fabrication	5 %	5 %	5 %	2 %–5 %	0 %–2 %
Secondary steel Total allowance	20 %	15 %	10 %	2 %–5 %	0 %–2 %
Item accuracy	0 %	0 %	0 %	0 %	0 %
Design change	0 %	0 %	0 %	0 %	0 %
Fabrication	5 %	5 %	5 %	2 %–5 %	0 %–2 %
Deck plate and grating Total allowance	5 %	5 %	2 %–5 %	2 %	0 %–2 %

Structural

Structural steelwork typically represents between 40 % and 55 % of a module's dry weight, and rationalization of the allowances applied to each category (Primary, Secondary, Plate) can produce large savings.

Primary steel

Primary steelwork is usually reasonably well defined at an early stage of a project. A preliminary structural analysis is normally undertaken during the conceptual design to confirm member sizes. As such, lesser individual allowances are justified.

Secondary steel

Secondary steelwork is by its nature less well defined and is usually subject to change throughout FEED and detailed design due to revisions made by upstream disciplines. As such, higher individual allowances are recommended.

Deck plate and grating

Deck plate and grating usually contributes a high proportion of structural dry weight. However, once the area of deck to be plated has been defined and the plate thickness selected, it is normally only subject to weight change in respect of openings and cut-outs for penetrations. Consequently, only the Fabrication allowance is justified.

Guidance on design allowances

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Some of the individual design allowances shown above have been given an upper and lower value i.e. 10 % to 15 %. The value that shall be used is dependent upon:

— demonstrated accuracy of weight data previously provided by the design contractor;

— demonstrated accuracy of final weights achieved on previous projects.

Design allowances applied to individual items of weight shall not be dependent upon project phase, drawing, or data sheet revision. Rather, they shall be dependent upon the data's demonstrable accuracy at any given time. This principle gives flexibility to setting of design allowances, produces lower factors, and optimises the platform load carrying capacity at an early stage. It prevents weight conscious designs from being penalised and ensures that full utilization of the available topsides weight capacity is made at the earliest stages of design development.

It is important that the design allowance is understood to be a measure of accuracy of the base dry weight of an item, and not an allowance for omissions. The weight allowance should generally only be applied to the base dry weight of each item, not the contents, as all operating increases should be accurately defined early in the detailed design of a project.

Guidance on miscellaneous operating loads

By the start of detailed design the following operating increases should have a design allowance of zero (0 %), as these values should be accurately known.

— Pipe rack load (9 5/8" casing string + 5 % rejects) — maximum depth of hole to be drilled will be known, and the weight of the 9 5/8" casing string can be accurately calculated. Refer to the Drilling Operations manual.

— Setback load (drill string + 5 % rejects) — maximum depth of hole to be drilled will be known, and the weight of the drill string can be accurately calculated. Refer to the Drilling Operations manual.

— Laydown and helicopter (maximum take-off weight) — helicopter weight will be known.

— Fluids and powders in tanks and vessels (normal operating levels) — tank and equipment process data sheets should be available.

— Paint and weld — added as a percentage of dry weight.

— Slings and shackles — added as a percentage of lift weight.

— Environmental loads, e.g. wind, snow and ice accretion, should not be included in a topside weight database. They should be calculated and applied separately to the SI analysis by structural engineers.

— Likewise, local design live loads should not appear in a topside weight database, as these are transient and accounted for elsewhere, i.e. on laydown and storage areas, and in the living quarters.

— A drilling load combination matrix should be included in the weight report. One is attached below for information.

Guidance on CAD

There have been widely experienced problems with weight and CoG and extraction from CAD systems in the past. It should be remembered that if it is not modelled, the weight and CoG will not be calculated, e.g. stiffeners, handrail, drain boxes, piping specials, and separate manual weight estimates must be included for non-modelled items, while bearing in mind the status of the model.

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G.4.2 Allocation of topside allowances and reserves

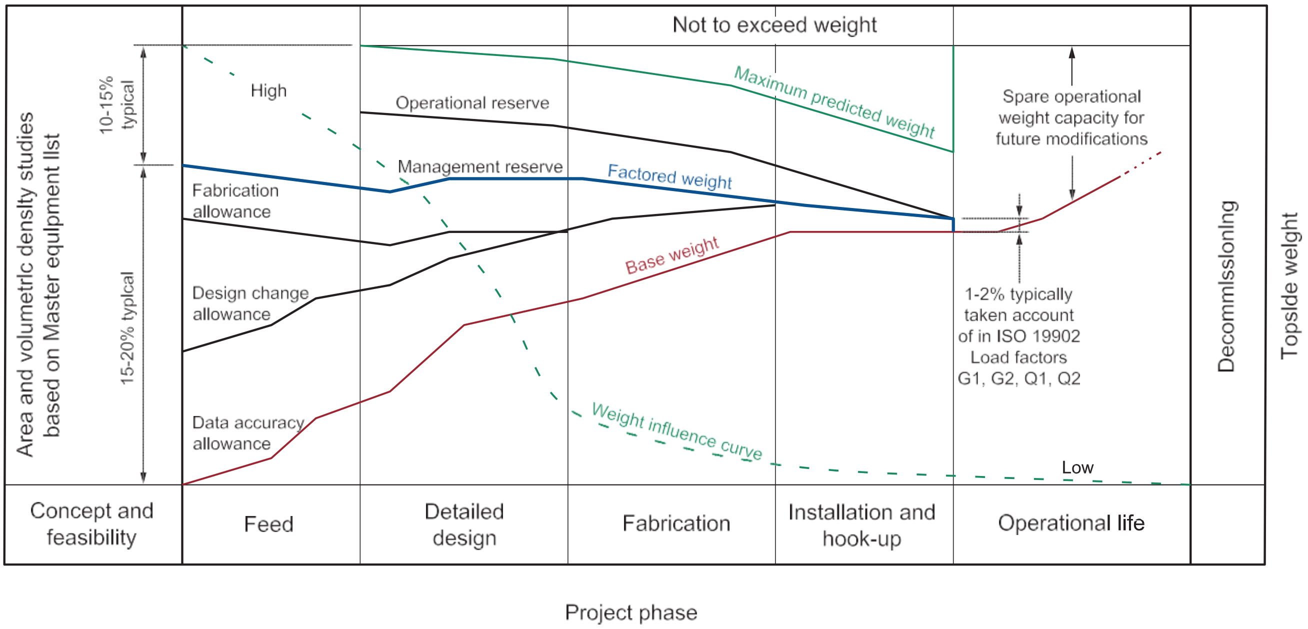

Figure G.1 — Allocation of topside allowances and reserves diagram

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G.5 Drilling load matrix

See G.3.3 for coincident loads to be reflected in the topside weight database.

	Drilling load and operating load combinations			
	A	B	C	D
	Full 9⅝" casing on pipe rack — Storm	Full 9⅝" casing on pipe rack — Operating	Stuck casing	Stuck drill string
Hook load (rated capacity of the derrick. not listed in weight report – applied by SI engineer)	Zero	Zero	X d	X d
Setback load (for longest hole including Bottom Hole Assembly +5 % rejects)	X acg	X ac	X ac	Zero f
Pipe rack load (9 5/8" casing string for longest hole, +5 % rejects)	X a	X a	X e	X a
Containers on pipe rack coincident with 9 5/8" casing load (normally 100 to 200 tonnes)	X b	X b	X b	X b
P-tank powder storage for cement, bentonite, and baryte (full- aerated)	X a	X a	X a	X a
Extreme wind (not listed in topside weight database – applied by SI engineer)	X h	X h	X h	X h
Operating wind (not listed in topside weight database – applied by SI engineer)	X h	X h	X h	X h
Snow and Ice accretion (not listed in topside weight database – applied by SI engineer)	X h	X h	X h	X h
Drill Water tanks (full)	X a	X a	X a	X a
Sack store (full)	X a	X a	X a	X a
Active and reserve mud tanks (HP and LP systems full)	X a	X a	X a	X a

NOTE 1 All other operating loads will be 100 % of those reported in the topside weight database.

NOTE 2 Attempts to rationalize drilling loads should be avoided, as these are common conditions.

NOTE 3 Full to normal operating level switches as shown on P&IDs.

NOTE 4 100 % full of the normal operating fluid flowing through it.

a 100 % of reported weight database loads

b 100 % of reported weight database load for supply containers and fixed containers e.g. tea shack, tool house, paint store, laboratory.

c Setback load represents the drill string for longest hole plus 5 % rejects, plus Bottom Hole Assembly. It is stacked in 90' stands (triples).

d The hook load for a typical derrick rating i.e. 1 000 000 lbs. = 454 te.

e Calculated for a full load of 9 ⅝" casing (approx. 80 % of hole length) plus 5 % rejects for the longest well. It is assumed 50 % of casing, plus supply and fixed containers remain on the pipe rack, while the remainder of the casing is hanging on the hook.

f Assumed zero, as the drill string will be hanging on the hook.

g If sufficient warning is received for an approaching 100-year return storm, it is possible the drill string in the setback area may be run down the hole to reduce wind load profile.

h These loads should not be listed in the weight database. They must be calculated and applied by the Structural Integrity engineer.

G.6 Laydown and storage

G.6.1 General

Topside weight reports shall include laydown and storage drawings for each deck level. The drawings shall include tabulated values for maximum global load, maximum local and concentrated load, and area in m^2. These values shall be consistent with the operating loads shown in the topside weight

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database. Permanent containerised offices, tea shacks, and stores shall not form part of the laydown storage loads. They shall be separately itemised, and reported in the weight database as such.

G.6.2 Signage

Laydown and storage drawings shall form the basis of the platform signage to be displayed at these areas offshore (see Figure G.2).

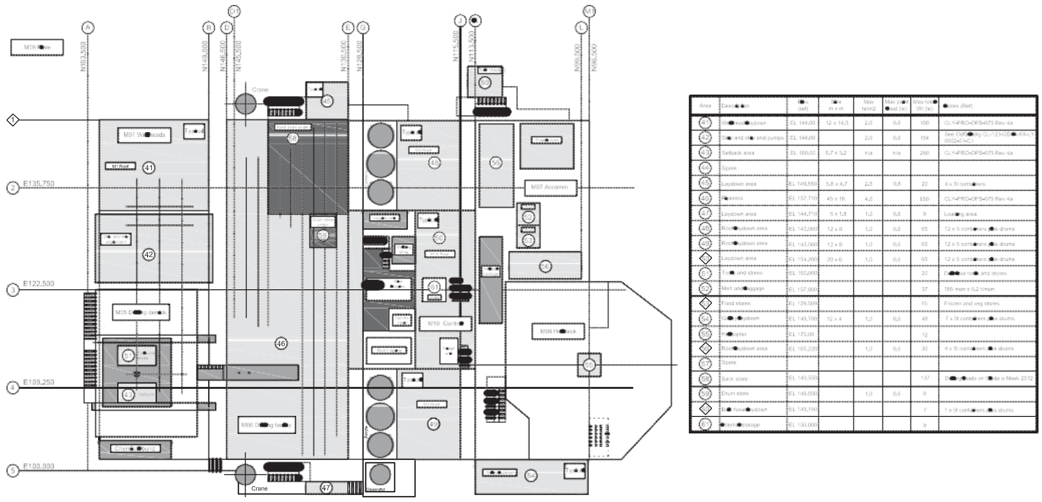

Figure G.2 — Example of laydown and storage drawing

G.7 Accuracy of weighing predictions

G.7.1 General

The accuracy of a module or assembly weighing result compared with its pre-weighing prediction should be within the following tolerances:

Predicted weight

The accuracy of the pre-weighing weight prediction shall be within the following tolerances:

Weighing	Accuracy
Preliminary weighing	±3 % of prediction
Intermediate weighing	±2 % of prediction
Final weighing	±1 % of prediction

Predicted CoG

The accuracy of a module CoG prediction shall be expected to fall within the following percentages of its length and breadth (measured centre to centre of trusses or legs):

Weighing	East	North
Preliminary weighing	±0,75 %	±0,75 %
Intermediate weighing	±0,50 %	±0,50 %
Final weighing	±0,50 %	±0,50 %

Example for final weighing of module 20,000 m long × 10,000 m wide

The longitudinal CoG should be within 20,000 m × 0,005 % = ± 100 mm

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The lateral CoG should be within 10,000 m × 0,005 % = ± 50 mm

G.7.2 Post weighing reconciliation

Any predicted values that fall outside the above weight and CoG accuracy ranges shall result in the design contractor undertaking a post-weighing reconciliation of the pre-weighing predictions. This shall begin immediately on completion of the weighing, and continue until the inaccuracies can be sufficiently explained and resolved to the client representative's satisfaction.

Once the post-weighing reconciliations have been satisfactorily concluded, the necessary weight and CoG corrections shall be added to the weight database in a separate discipline named "weighing corrections".

G.8 Competence

Broadly defined, competence is the combination of the qualifications, understanding, experience and skills needed by an engineer to be effective in their job.

The weight control process involves data gathering from many sources, including discipline weight input from the main contractor, the drilling contractor, the accommodation contractor and equipment vendors (see G.9). Generally, one individual does not have the time, background or skills to single-handedly manage the whole process. Usually, a team of people, with the requisite skills and background, is needed to implement an effective weight control facility. The engineer (or group of engineers) involved in the process should be:

— familiar with weight control principles and procedures;

— knowledgeable about multi-discipline weights;

— knowledgeable about CAD extractions and downloads;

— familiar with drilling techniques and loads;

— familiar with laydown and storage requirements;

— familiar with equipment and module weighing requirements;

— cognisant of requirements for difference design phases;

— familiar with weight control requirements of offshore structural engineers.

Further description of competencies for each aspect of the weight control process is provided elsewhere.

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G.9 Weight control information sources and flow diagram

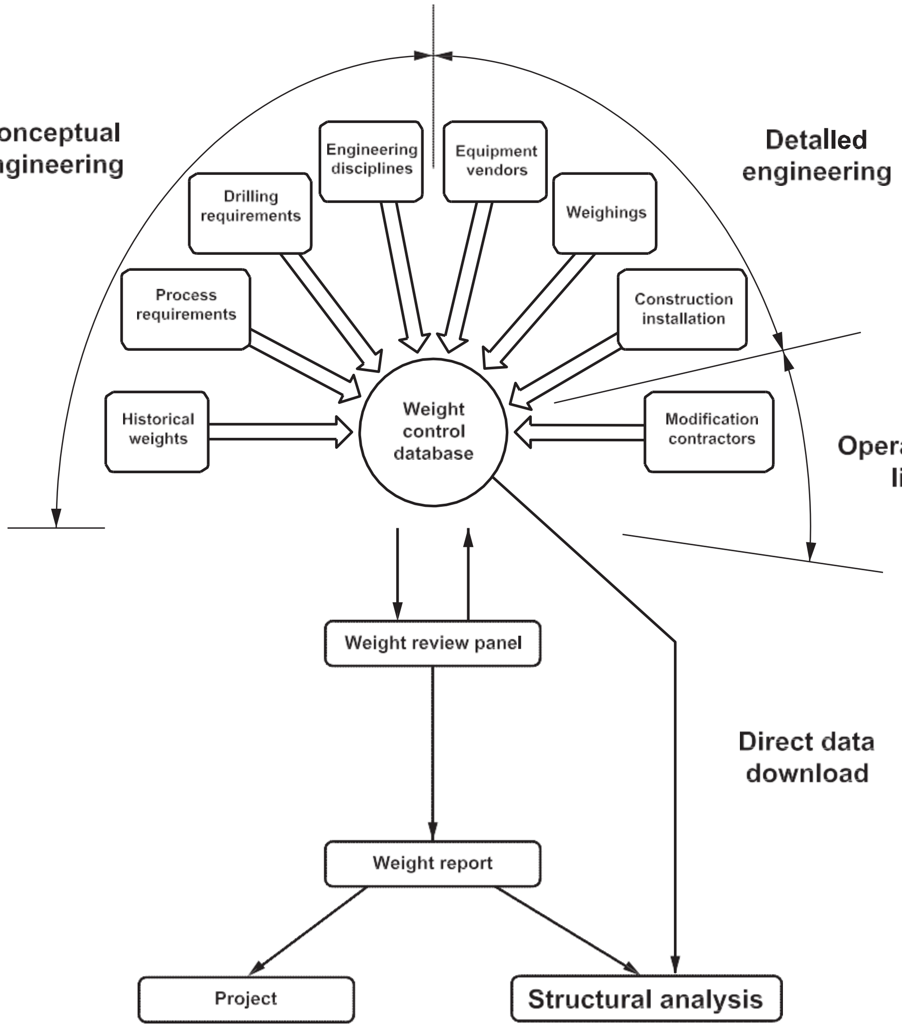

Figure G.3 — Flow diagram of information sources

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Annex H
(informative)

Requirements for topside weight estimation — New builds/ green field

H.1 General

Topside weight estimation is an important activity in early phase concept development for new offshore installations. Estimated weights for topside units are important input and basis for a number of activities:

1) weight information is one of the main input parameters for cost estimating and planning;

2) weight information is vital for transportation, lifting and installation analyses;

3) weight information is vital for analysis of substructure capacity;

4) weight information is vital for stability analysis, loading conditions and platform operations.

The objective for weight estimation is to predict, from an early stage in concept development, a topside weight as close to the final as-built weight as possible.

This annex describes weight estimation activities to take place in the early phase development of a project, covering screening/feasibility phase, concept selection phase and FEED phase prior to the detail engineering and construction phase.

H.2 Topside weight estimation methodology

All estimated weights shall be given as values covering both the identified elements, as well as the anticipated, but yet unidentified/unspecified elements, giving the assumed as-built weight for the chosen concept.

Weight estimates are established by use of different methods:

a) Simple analytical models calibrated against relevant previous projects are used in the early stages, especially in screening and feasibility phases. Weights are then estimated from assumed functions and capacities, and scaled based on earlier project experiences.

b) When there is sufficient knowledge about main equipment, normally after the first process simulations, the MEL will be used as basis for determining the weights of other disciplines by application of experience weight factors. This method is normally used in feasibility and concept phases, and also in FEED. Different ways to use the MEL information to establish weight estimates are given in 1) and 2).

    1) Based on MEL information, relevant topside area and volume requirements can be identified and layout drawings can be established. Based on the layout drawings, weight for bulk and structural can be estimated based on experience area/volume density factors.

    2) Based on MEL information, equipment weight per system can be established. Based on this, weight for bulk and structural can be estimated based on experience factors for bulk and structural per system.

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c) When the progress of engineering is sufficient for a Weight Take-Off (WTO) for certain disciplines, WTOs can be used for determining the weight for these disciplines. Weight allowance should then be added to account for items not yet identified. This method is applicable for some disciplines in FEED in combination with experience factors. Reported weights based on WTO must always be verified by experience factor estimates.

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H.3 Recommended weight estimation requirements

Class A	Class B	Class C
1. The equipment list and the equipment layout should be basis for the topside weight estimate. 2. Weights should be distributed on areas (construction units). 3. Weights in each area should be split in equipment, structural and bulk. 4. Bulk should be split on disciplines. 5. Structural should be split in primary, secondary and outfitting. 6. WTO for designed structure should be prepared, based on 3D models. 7. WTO for piping should be prepared, based on 3D models. Material grade should be given. 8. Weight allowance should be specified. 9. Split between topside and substructure should be clearly defined. Weights should be calculated for both substructure and topside and be given separately. 10. Centre of gravity should be calculated. 11. Lift weight for each lifting item should be prepared. 12. Source of weight data should be given (vendor information, calculated, reference project etc.). 13. Weight accuracy and confidence level for the established weight estimate should be given, based on the chosen estimating method and level of details (i.e. weight accuracy ± 10 % with a confidence level of 80 %). May be verified by statistical simulations. 14. Layout drawings and coordinate system should be given. 15. SI-units should be used.	1. The equipment list and the equipment layout should be basis for the topside weight estimate. 2. Weights should be distributed on areas (construction units). 3. Weights in each area should be split in equipment, structural and bulk. 4. Bulk should be split on disciplines. 5. Structural should be split in primary, secondary and outfitting. 6. If possible, piping material grades should be given. 7. Split between topside and substructure should be clearly defined. Weights should be calculated for both substructure and topside and be given separately. 8. Centre of gravity should be calculated. 9. Weight accuracy and confidence level for the established weight estimate should be given, based on the chosen estimating method and level of details (i.e. weight accuracy ± 15 % with a confidence level of 80 %). May be verified by statistical simulations. 10. Layout drawings and coordinate system should be given. 11. SI-units should be used.	1. Weight estimate to be based on experiences from earlier, comparable projects. 2. Weights should be split in equipment, structural and bulk. 3. Split between topside and substructure should be defined. Weights should be calculated for both substructure and topside and be given separately. 4. Weight accuracy and confidence level for the established weight estimate should be given, based on the chosen estimating method and level of details (i.e. weight accuracy ± 25 % with a confidence level of 80 %). May be verified by statistical simulations. 5. SI-units should be used.

H.4 Master Equipment List (MEL)

The MEL is of vital importance in weight estimation. Irrespective of chosen weight estimation method, MEL is the main input and basis for the weight estimate.

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Weight for each listed equipment item must be given. Weight allowances should be used and clearly stated in the equipment list. Weight allowance should be added based on concept development and maturity.

MEL must also include temporary equipment needed for any defined temporary operation. These items should be marked as temporary.

H.5 Weight allowance

When weight estimates are based on MEL and WTOs, a weight allowance should be added to the reported weights to account for inaccuracies and incompleteness in the definition of items. The amount of weight allowance should be determined based on experience, judgment of concept maturity and development of engineering. The amount of weight allowance added should always be specified.

When weights are estimated by comparative methods, scaling or by experience factor estimates, no weight allowance is needed as the basis for these methods are determined from existing, complete facilities, and the estimated weights are considered to be expected values.

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H.6 Recommended content for weight estimation report, feasibility and concept phase

Class A	Class B	Class C
WEIGHT ESTIMATES • **Topside weight estimate** • **Introduction** Purpose Scope • **Report Basis** Overall reporting basis Report assumptions • **Weight Summary** Dry installed weight Operating weight Other weight conditions if required • **Weight Estimation Method** Detailed description of methods used to establish the weight estimate • **Disciplines Scope of Work** Description of elements included in each technical discipline • **Dry installed and operating weight by discipline and area** Detailed weight matrix showing weight broken down by discipline, area etc. • **Estimate Accuracy** Evaluation and discussion regarding the weight estimate accuracy • **Benchmarks** • **Area Plan** Area plan showing coordinate system and area coding according to weight matrix breakdown – construction units, functional areas etc. • **Sub structure/hull weight estimate** Presentation of weight, estimating method etc. • **Attachments** Definitions Abbreviations References	As Class A	**WEIGHT ESTIMATES** • **Topside weight estimate** • **Introduction** Purpose Scope • **Report Basis** Overall reporting basis Report assumptions • **Weight Summary** Dry installed weight Operating weight Other weight conditions if required • **Weight Estimation Method** Description of methods used to establish the weight estimate • **Disciplines Scope of Work** Description of elements included in each technical discipline • **Dry installed and operating weight by discipline and area** Weight matrix showing weight broken down by discipline and area • **Estimate Accuracy** Evaluation and discussion regarding the weight estimate accuracy • **Benchmarks** • **Sub structure/hull weight estimate** Presentation of weight, estimating method etc. • **Attachments** Definitions Abbreviations References

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Annex I
(informative)

Executive summary description

I.1 General

The executive summary is a one page "dashboard" summary of the weight status and trends presented in the report. The executive summary varies from project to project depending on the risks and concerns for the project or customer. The summary should address 80 % to 90 % of the issues. A good executive summary will use 10-point font for all text and should be something that is posted on project status boards.

An example is shown in Figure I.3.

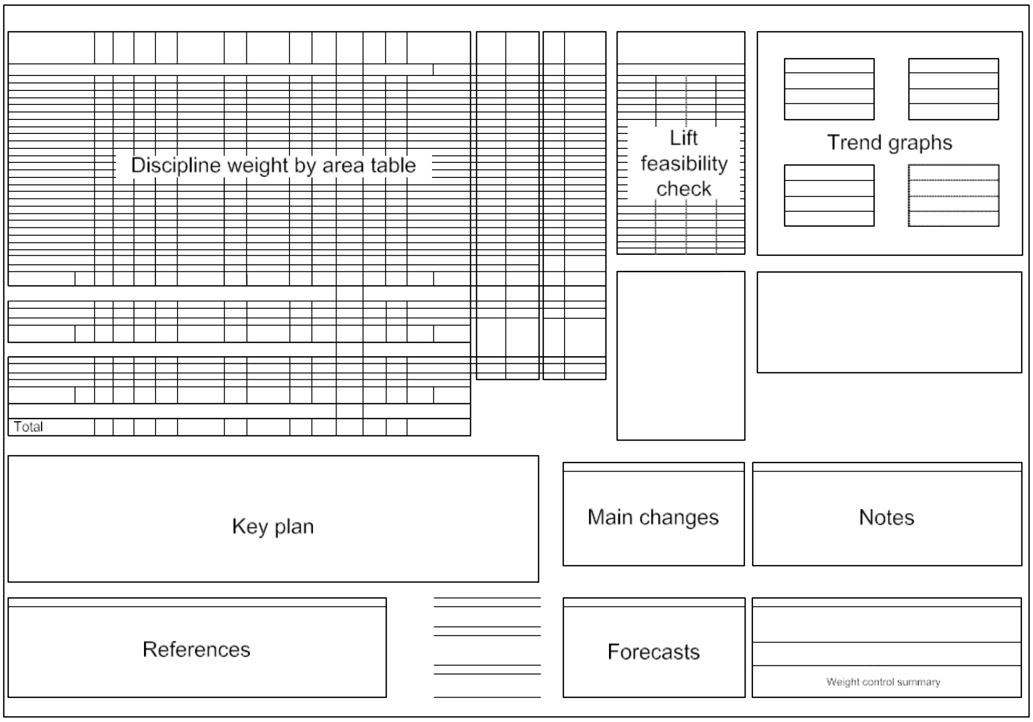

Figure I.3 — Example of an executive summary

I.2 Trend for weight and CoG

The trends are time-based trends of weight and CoG for the project. The CoG(s) that are plotted vary from project to project, based on the issues. For a module or topside the CoG envelope may be presented. For a ship or submersible hull the KG curve may be presented. Each trend chart should have a bold limiting curve or line, with one or two trend lines shown. A future weight and CoG point should be plotted for each trend line that shows the impact of the potential changes on the currently reported weight.

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I.3 Comparison to budget

This is a simple table that shows overall weight changes since the beginning of the project. It presents the weight budget by discipline (structure, piping, outfitting, equipment and electrical), current weight allowance, and current gross weight.

I.4 Loading conditions

I.4.1 General

This is a table of the loading conditions using the current weight and CoG. The loading conditions are a limited set of all the conditions developed by the naval architect. Typically the loading conditions used to establish the WLB, construction and extreme operating conditions are used. The construction conditions may include launch, integration, tow out, commissioning and inclining experiment. The extreme conditions are those that are close to the edge of the KG limit or CoG envelope.

I.4.2 Management reserve analysis

This is a table of the current values of net allowance, and gross weight along with the CoGs. It compares the gross weight to the not-to-exceed limits to determine the amount of management reserve.

I.4.3 Changes to this report

A list of the changes that is included in the report. A description, weight impact and CoG information should be provided for each change.

I.4.4 Potential changes for next report

A list of the potential changes that could impact the weight or CoG presented in the trend charts. Potentials include the impact of weight changes of drawing calculations that have not been completely checked, design changes that have not been completed, rumoured weight changes from vendors, etc.

I.5 Additional summaries (depending on project)

a) Additional loading conditions

b) Construction modules weight summaries

c) Lift weight summaries (including temporaries)

d) Cost account weight summaries

e) Material take-off weight summaries

f) Summary of the weight and CoG history over the life of the project

I.6 Discipline by Area (DA) weight summary

The DA summary is a table of the weight for each discipline and area. The disciplines are usually those identified on the organization chart or upon customer request by their definition of disciplines. These are not usually the same. The weight should be rounded to the nearest whole number.

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Annex J
(informative)

Weighing result uncertainty

According to the GUM (Clause 2) any measurement is disturbed by some random influence, called the measurement uncertainty. It is quantified by its standard deviation and its weight result uncertainty, called the standard uncertainty, denoted u.

As the GUM requires that the coverage factor is given together with the measurement uncertainty one can easily recalculate the expanded uncertainty to any wanted value of k. The two statements

W = 1 000 tonne ±1 %, k = 2

and

W = 1 000 tonne ±1,5 %, k = 3

in fact have the same quality as both have standard uncertainty u = 0,5 %.

For weighing complying to the ± 1 %, k = 2 requirement for the Class A weighing in this standard, it is reasonable to assume that the weighing result will not deviate more than 1 % from the true weight in 95 % of the weighings.

Calibration is a documented act of observing and documenting the output of a measuring device when it measures a physical quantity at a set of values having known uncertainty. The set of quantities should be large enough to enable reasonable assessment of the measurement uncertainty and should cover the whole range for which the measuring device is intended used.

Standard uncertainty is the standard deviation of the measurement uncertainty, denoted u.

Expanded uncertainty is the standard uncertainty multiplied by the coverage factor, denoted u. The result of the measurement ± u is expected to cover a large fraction of values that could reasonably be attributed to the measured quantity.

Coverage factor is the factor used to multiply the standard uncertainty to obtain the expanded uncertainty, denoted k.

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Annex K
(informative)

Weight control database structure

Class A	Class B	Class C
Each record in the weight control database shall as a minimum contain the following information in separate data fields:	Each record in the weight control database shall as a minimum contain the following information in separate data fields:	No specific requirements.
Discipline code: The discipline code according to the project's numbering system.	**Discipline code:** The discipline code according to the project's numbering system.	
System code: The system code according to the project's numbering system		
Area code: The area code according to the project's numbering system.	**Area code**: The area code according to the project's numbering system.	
Drawing number: The drawing number from which the weight has been identified or calculated.	**Drawing number:** The drawing number from which the weight has been identified or calculated.	
Drawing revision: The revision of the drawing from which the weight has been identified or calculated.	**Drawing revision:** The revision of the drawing from which the weight has been identified or calculated	
Piece number: The unique piece within a drawing number, e.g. plate girder M10–2356 shown on a structural deck drawing. The data field is a text field.	**Piece number:** The unique piece within a drawing number, e.g. plate girder M10–2356 shown on a structural deck drawing. The data field is a text field.	
Number off: Number of identical pieces. Only integer numbers shall be used.		
Size: The size of each piece, e.g. 2,350 m for the length of an HE200A beam.		
Dry weight: The dry weight of each piece in kg, that is the product of Number off × Size × Unit weight, e.g. 1 × 2,350 × 42, 3 = 99 kg for one HE200A with a length of 2,350 m.	**Dry weight:** The dry weight of each piece in kg.	
Content: The weight of the content in kg in a piping line, vessel, tank etc.	**Content:** The weight of the content in kg in a piping line, vessel, tank etc.	
Weight status code: A coding to identify the level of accuracy of the weight data of each piece number.	**Weight status code:** A coding to identify the level of accuracy of the weight data of each piece number.	
Weight phase code: A coding to identify during which phase a piece number will be installed and present.	**Weight phase code:** A coding to identify during which phase a piece number will be installed and present.	
Weight installation code: A coding to identify whether a piece is installed or not on a module/installation.	**Weight installation code:** A coding to identify whether a piece is installed or not on a module/installation.	

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Class A	Class B	Class C
Coordinates: The coordinates in the platform north direction, the platform east direction and elevation.	**Coordinates:** The coordinates in the platform north direction, the platform east direction and elevation.	
Originator code: The originator code according to the project's numbering system of the organization or contractor who have calculated or revised the weight data for a piece number.	**Originator code:** The originator code according to the project's numbering system of the organization or contractor who have calculated or revised the weight data for a piece number.	
Date: The date when a piece number was entered or revised in the weight control database.	**Date:** The date when a piece number was entered or revised in the weight control database.	

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1) Under preparation.

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