INTERNATIONAL STANDARD

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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: Contrôles des poids durant la conception et la fabrication

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 19901-5 was prepared by Technical Committee ISO/TC 67, *Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries*, Subcommittee SC 7, *Offshore structures*.

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

- *Part 4: Geotechnical and foundation design considerations*
- *Part 5: Weight control during engineering and construction*

The following parts of ISO 19901 are under preparation:

- *Part 1: Metocean design and operating considerations*
- *Part 2: Seismic design procedures and criteria*
- *Part 3: Topsides structure*
- *Part 6: Marine operations*
- *Part 7: Stationkeeping systems for floating offshore structures and mobile offshore units*

ISO 19901 is part of a series of standards for offshore structures. The full series consists of the following standards:

- ISO 19900, *Petroleum and natural gas industries — General requirements for offshore structures*
- ISO 19901 (all parts), *Petroleum and natural gas industries — Specific requirements for offshore structures*
- ISO 19902, *Petroleum and natural gas industries — Fixed steel offshore structures*
- ISO 19903, *Petroleum and natural gas industries — Fixed concrete offshore structures*
- ISO 19904, *Petroleum and natural gas industries — Floating offshore structures*

— ISO 19905-1, *Petroleum and natural gas industries — Site-specific assessment of mobile offshore units — Part 1: Jack-ups*

— ISO/TR 19905-2, *Petroleum and natural gas industries — Site-specific assessment of mobile offshore units — Part 2: Jack-ups commentary*

— ISO 19906, *Petroleum and natural gas industries — Arctic offshore structures*

Introduction

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

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

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

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 and materials.

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

This part of ISO 19901

— specifies quality requirements for reporting of weights and centres of gravity,

— specifies requirements for weight reporting,

— provides a basis for overall project status reports or management reports for all classes,

— specifies requirements for weight and load budgets for offshore installations,

— specifies the methods and requirements for the weighing of major assemblies, and the determination of weight and centre of gravity,

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

and may be used

— as a basis for planning and presentation of the contractor's weight-reporting system;

— as a basis for evaluation of the contractor's weight-reporting system;

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

— as a contract reference between the ordering client and the contractor;

— as a basis for costing.

2 Normative references

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

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

3 Terms, definitions and abbreviated terms

3.1 Terms and definitions

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

3.1.1
assembly
designed and fabricated group of bulk and equipment items which form one unit

3.1.2
ballast
variable solid or fluid content used to trim a floating structure and/or keep a certain draft

3.1.3
base weight estimate
weight estimate used for budgeting purposes which does not include any unforeseen quantity growth, estimating errors or unnamed events

3.1.4
base weight contingency
weight addition, based on risk analysis or experience, used to transform a base weight estimate into a 50/50 weight estimate accounting for uncertainties

3.1.5
budget weight
weight reference figures as defined in the weight and load budget and related to the initial or changed design concept

3.1.6
bulk
component or arrangement of components defined as stock materials or of low complexity

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

3.1.7
client weight reserve
weight addition with CoG (usually a fixed weight) controlled by the client and used to cater for any orders for variation to the contractual design concept

3.1.8
CoG envelope
defined constraint volume within which the CoG of an assembly must remain for design purposes

3.1.9
consumables
variable content, which is solid in stores and fluid in utility tanks

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

3.1.10
contractor weight reserve
weight addition (usually a fixed weight) controlled by the contractor and used to cater for any design growth due to development of the initial design concept

3.1.11
deadweight
total carrying capacity of a floating structure

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

3.1.12
displacement
weight of the volume of water displaced by a floating structure, which is the sum of lightweight and deadweight

3.1.13
dry weight
weight of a component, weight item or an assembly in its dry installed condition including permanent utilities

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

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

3.1.14
equipment
component, or arrangement of components, built for specific function(s)

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

3.1.15
first fill
initial filling of liquid in equipment items, piping lines or tanks

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

3.1.16
float-out
loading condition in which a major assembly is transferred from a dry construction site to become self-floating

3.1.17
fluid content
all fluids flowing through a component, weight item or an assembly

EXAMPLES Process gases, liquids, powders, etc.

3.1.18
future weight
weight of a component or an assembly to be installed after the start of production

NOTE Start of production is also known as “first oil”.

3.1.19
grillage
temporary structural foundation assemblies for modules or sections during transportation

3.1.20
gross reported weight
sum of the net weight and weight allowance

3.1.21
gross WTO
gross weight take-off
sum of the net WTO and weight allowance

3.1.22
gross weight/WTO contingency
difference between the gross reported weight and the gross WTO at any time during the project execution

3.1.23
hook-up
installation and commissioning of components or assemblies after the modules have been installed in their final position

3.1.24
hook weight
sum of lift weight and lifting gear weight

3.1.25
lifting gear
rigging
equipment needed during a lifting operation

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

3.1.26
lift weight
weight of a component, an assembly or a module at padeyes, including temporaries and residual fluid content but excluding lifting gear

3.1.27
lightweight
lightship
dry weight and utility systems required for a minimum operation of a floating structure

3.1.28
live load
load on a deck area according to its defined function

3.1.29
loading condition
defined event or operation during which loads occur

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

3.1.30
load-out
loading condition in which a major assembly or a module is transferred from land onto a floating structure by horizontal movement

3.1.31
mating
loading condition in which a major assembly supported on vessel(s) is joined onto its temporary or permanent substructure

3.1.32
net weight
weight (excluding any allowances or contingencies) obtained either by estimation as estimated from early design documents or present sketches, calculated take-off from drawings or 3D model, or as given in vendor data-sheets or obtained by physical weighing

3.1.33
net WTO
net weight take-off
weight derived from calculated take-off or from 3D model, given in vendor data-sheets or weighed, excluding any allowances or contingencies

3.1.34
not-to-exceed weight
NTE weight
maximum acceptable weight

3.1.35
operating weight
sum of the dry weight and the fluid content weight

3.1.36
project management
dedicated management personnel with the task of implementing weight policy, objectives and procedures

3.1.37
residual fluid content
fluid content remaining after testing or commissioning and present during the subsequent loading condition until the start of production

3.1.38
sea fastening
items used for temporary fastening to keep movable items in position during transportation at sea

3.1.39
tagged equipment
equipment tagged in accordance with the project coding manual

3.1.40
temporaries, noun pl
components, assemblies or utility items which are temporarily installed during a specific loading condition and removed afterwards, either prior to or after installation

3.1.41
test weight
sum of the dry weight plus the fluid content required to test the equipment and assembly

3.1.42
tow-out
final towing of a complete floating structure to the offshore production field

3.1.43
transport
loading condition in which a major assembly or a module is transferred from one inshore/at shore location to another location or to the offshore production field

3.1.44
weight allowance
quantified weight addition accounting for definable components which could not be specified at the actual project stage

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

3.1.45
weight contingency
weight addition, based on risk analysis or experience, used to transform a base weight estimate to a 50/50 weight estimate accounting for uncertainties and/or definable components which could not be specified at the actual project stage

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

3.1.46
weight item
defined collection of bulk and/or equipment, design volume or assembly suitable for weight reporting purposes

3.1.47
weight installation code
computer code which verifies whether a component or a weight item is physically installed or not in an assembly or module

3.1.48
weight management
all planned and controlled activities which deal with the

— definition and publication of the project weight objective and policy,

— identification of, information about and evaluation of alternative design solutions,

— selection and implementation of an optimal design with respect to weight, CoG, volume, functionality, cost and progress.

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

3.1.49
weight objective
defined set of engineering goals necessary to fulfil the project contractual weight/CoG requirements and intentions in order to contribute to the correct design quality as defined by the management

3.1.50
weight phase code
computer code defining in which loading conditions a component or a weight item is present

3.1.51
weight policy
statement by the project management based on the weight objective and how it will be achieved

NOTE The statement should as a minimum describe

— the weight objective's importance to the project aims and results,

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

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

3.1.52
weight reporting
adequate and timely weight/CoG information reported with respect to content and presentation in order to fulfil expectations and requirements from/needs of organizations involved in the project

3.1.53
weight status code
computer code related to the weight item level of accuracy

3.1.54
50/50 weight estimate
value representing the median value in the probability distribution of weight estimates

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

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

3.2 Abbreviated terms

CoG centre of gravity

LCG longitudinal centre of gravity

MEL master equipment list

NTE not to exceed

TCG transverse centre of gravity

TLP tension leg platform

WLB weight and load budget

WTO weight take-off

4 Weight control classes

4.1 General

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

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

4.2 Class A: High definition of weight and CoG requirements

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

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

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

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

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

4.3 Class B: Medium definition of weight and CoG requirements

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

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

4.4 Class C: Low definition of weight and CoG requirements

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

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

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

Spreadsheet software can be used.

4.5 Selection of weight control class

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

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

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

Table 1 — Guidance criteria for weight control class selection

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

5 Weight and load budget (WLB)

5.1 General

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

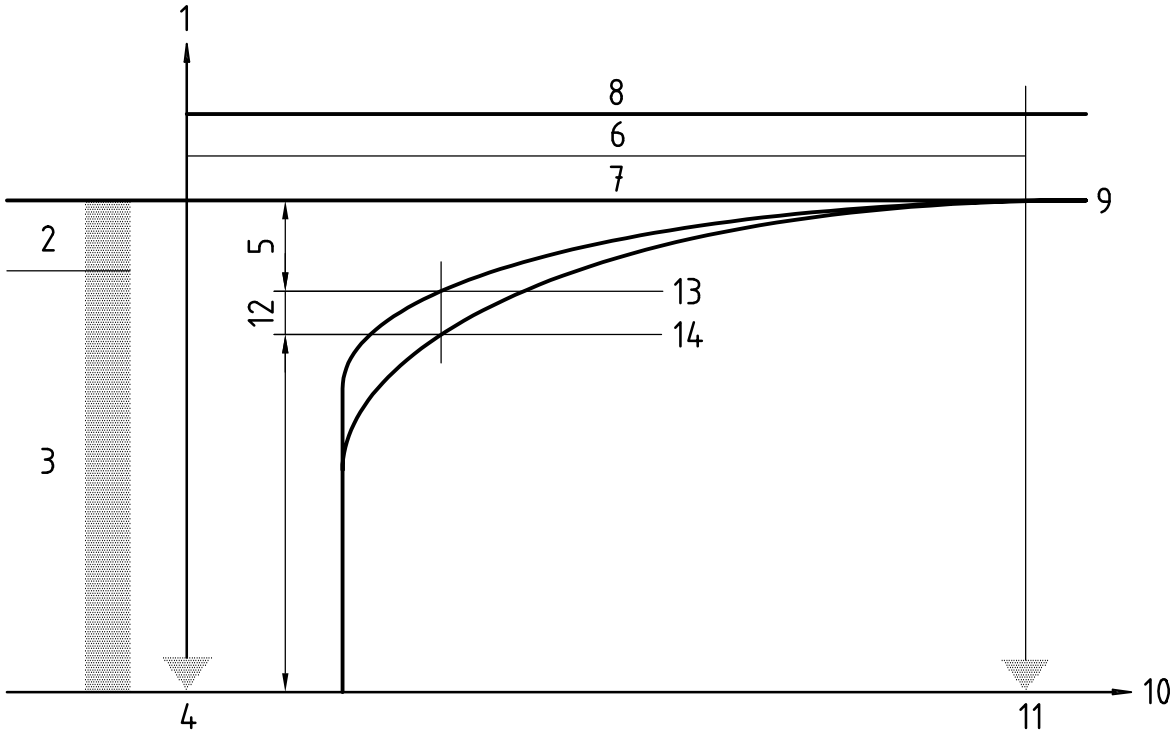
5.2 Requirements

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

5.3 Weight and load budget (WLB) content

5.3.1 General

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



Key

1 weight
2 base weight contingency
3 base weight estimate
4 contract award
5 gross weight contingency
6 future
7 reserves
8 not to exceed weight
9 50/50 weight estimate
10 time
11 as-built
12 weight allowance
13 gross WTO
14 net WTO

Figure 1 — General weight development figure

5.3.2 50/50 weight estimate

Class A	Class B	Class C
The primary basis for the WLB figures are the weight, load and CoG estimates for the chosen design concept, carried out either by the client or the contractor. If it is found necessary, the basis for the WLBs may be verified by re-estimation at the commencement of the engineering phase. Normally, the weight allowance and base weight contingency are included as a part of the estimated weight to determine the 50/50 weight estimate of the facility.	As Class A.	As Class A.

5.3.3 Weight reserves

Class A	Class B	Class C
A contractor weight reserve may be added on top of the WLB 50/50 weights. The design maturity and the project policy established by the project management with respect to design control and maximum tolerable design development have an influence on the weight reserve figure. In addition to the contractor weight reserve, the client may add its own client weight reserve. Any relevant variation orders issued by the client after the contract issue can affect the reserve figure and normally 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 might create a WLB weight below the current estimated or reported weight.	As Class A.	As Class A.

5.3.4 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.

5.3.5 Loading conditions and parameters

5.3.5.1 General

Class A	Class B	Class C
A set of relevant loading conditions and associated weight/load parameters shall be defined for weight control and weight reporting purposes during the fabrication, installation and operating phases of the project.	As Class A.	As Class A.
Corresponding WLBs shall be worked out for the actual loading conditions in cooperation with the structural and marine disciplines especially, in addition to the management.		Not required.
In addition to the dry and fluid content weights for the different WLBs, a joint agreement shall be reached for: — the necessary weight reserves; — the implication of free surface effects on the stability; — the variable loads, relevant maxima and associated positions. Variable loads may include, but shall not be limited to: — live loads; — water, snow and ice accumulations. A standardized practice shall be applied if possible. However, a floating structure includes more variable loads than a fixed one.		As Class A.

5.3.5.2 Loading condition selection

Class A	Class B	Class C
The necessary loading conditions shall be dependent on the nature of the floating structure as well as the fabrication and installation methods used. The following is a list of the different loading conditions which may be required, depending on the nature of the project: — start fabrication; — internal site transport; — load-out to module transport vessel; — transport to assembly site; — lift at assembly site; — float-out at assembly site; — mating at assembly site; — lift at inshore field; — load-out to offshore transport vessel; — inclination test; — transport to offshore field; — lift at offshore field; — dry, installed offshore; — operating, installed offshore; — future operating, installed offshore; — decommissioning.	As Class A.	As Class A.

5.3.6 Weight and load budget (WLB) formats and levels

5.3.6.1 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 total weight figure for each main area or module. The format may be further developed in order to present figures for each main weight contributor (e.g. structural steel, piping and equipment) and one common figure for the rest of the design. Individual figures for both bulk and equipment for all disciplines may also be given. All figures shall be recorded in the relational-type database. The weight report formats shall allow for the inclusion of necessary WLB figures.	As Class A. All figures shall be recorded in the relational-type database/spreadsheet.	Not required.

5.3.6.2 Example

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

5.3.7 CoG constraints

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

6 Weight reporting

6.1 General

Class A	Class B	Class C
The project weight reporting shall be systematically compiled and documented. 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 given in this part of ISO 19901.	As Class A.	As Class A.
The frequency and type of report shall depend on the project requirements. Two-month reporting intervals are recommended.	The frequency and type of report shall depend on the project requirements. Three-month reporting intervals are recommended.	The frequency and type of report shall depend on the project requirements. Four-month reporting intervals are recommended.

6.2 The weight control procedure

Class A	Class B	Class C
A weight control procedure shall be issued by the weight control discipline within 60 days of the contract award, or as stated in the contract. The weight control procedure shall document the responsibilities of the engineering disciplines as well as the contractors, with regard to weight reporting. The weight control 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 are distributed between disciplines, as well as the responsibility and authority assigned to these disciplines.	As Class A.	As Class A.
c) the contractor or responsible organization shall produce weight documents to substantiate: 1) 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 applied; — the level of applied allowances/ contingencies at various project stages; — assessment of CoG; — review of hook-up scope (if applicable); — assessment of extraordinary conditions at various project stages (e.g. crane and transportation barge limitations). 2) weight management philosophies; 3) transfer of weight control responsibility through the various phases of the project (if applicable).	As Class A.	Not required.
In addition to these requirements, the weight control procedure shall, as a minimum, include: — input requirements; — global coordinate system; — area designation system; — loading conditions to be reported; — all coding utilized in the weight control system; — discipline checklist.		As Class A.

6.3 Requirements to the weight report

6.3.1 Introduction to the report

Class A	Class B	Class C
All weight reports shall have an introduction giving information necessary to understand the content of and background to the report. The introduction shall, as a minimum, describe a) which major assemblies are included, b) the cut-off date, c) weight information provided by others, d) list of reported loading conditions, e) any discrepancies from the project standard procedures, definitions, etc.	As Class A.	As Class A.

6.3.2 Summary and conclusions to the report

6.3.2.1 Main summary

Class A	Class B	Class C
The main summary shall contain all current main-weight data, including CoG, and comparisons between those data and the WLB. The reported weights shall reflect all relevant loading conditions and all main assemblies. Any major problems that need to be highlighted shall also be included here. For floating structures, a block diagram showing all major elements of the displacement, lightweight and deadweight may be included. An example of such a block diagram is given in Annex D.	As Class A.	As Class A.

6.3.2.2 Weight and load budget (WLB)

Class A	Class B	Class C
Known changes to the WLB, if relevant (including reasons for them), shall be documented. Expected changes to the WLB and their potential consequences shall also be included.	As Class A.	As Class A.

6.3.2.3 Global CoG plots

Class A	Class B	Class C
Global CoG plots shall be included if applicable to the project. The global location shall be presented relative to the various CoG envelopes. Weight and CoG shall also be presented in relation to each other.	As Class A.	Not required.

6.3.2.4 Main variations from the previous report

Class A	Class B	Class C
Only the major changes in weight and CoG shall be included. A short explanation of why the changes occurred shall be given. If the changes relate to more than one phase in the project, the explanation shall give details of this.	As Class A.	Not required.

6.3.2.5 Weight forecast

6.3.2.5.1 General

Class A	Class B	Class C
The weight forecast shall be included in the report as an aid to weight management, and to give an early warning of weight trends. As a minimum, the following shall be included, where applicable: a) approved design changes not yet included in the reported weights; b) proposed design changes not yet approved; c) possible weight changes relating to any design change under review or any alternative to the design which has a potential weight impact.	As Class A.	Not required.

6.3.2.5.2 Main-trend graphs

Class A	Class B	Class C
Main-trend graphs shall be produced and presented for all relevant loading conditions. Trend graphs shall, as a minimum, contain reported weight and WLB data. Dry weight and operating weight shall be shown where applicable.	As Class A.	Not required.

6.3.2.6 Main weight printout summaries by area and discipline

Class A	Class B	Class C
The printout summaries shall, as a minimum, show the total assembly weight for all relevant loading conditions. CoGs shall also be included.	As Class A.	As Class A, but with a detail level as applicable to a smaller type of project.

6.3.2.7 As built/weighing data

Class A	Class B	Class C
Summaries of final weighing results shall be included where relevant.	As Class A.	As Class A, but with a detail level applicable to a smaller type of project.

6.3.3 Area/module reports

6.3.3.1 Variations from last report by area and discipline

Class A	Class B	Class C
The variations from the previous report shall describe the weight changes (and reasons for them) per discipline by area. Comparisons to the WLB may be included and various project loading conditions shall be reflected where relevant.	As Class A.	Not required.

6.3.3.2 Trend graphs by area

Class A	Class B	Class C
Trend graphs by area shall be included where relevant. These trend graphs shall contain reported weights, and the WLB shall be included if established. Trend graphs by discipline per area may also be included in this section.	As Class A.	Not required.

6.3.3.3 CoG plots

Class A	Class B	Class C
CoG plots by area may be included where relevant. The CoG location for a fixed structure shall be presented relative to the lifting control envelope, the lifting points, the support points or the axis, as appropriate. Weight and CoG coordinates shall also be presented. The inclusion of CoG plots for a floating structure is optional. Where included, they shall be presented relative to the requirements of the project.	As Class A.	Not required.

6.3.3.4 Area weight printouts

Class A	Class B	Class C
Area printouts shall be included for the relevant loading conditions. These printouts should, as a minimum, contain the WLB, reported weight and CoG by discipline, together with any variations from the previous report. Temporaries shall either be included on these printouts, or printed separately.	As Class A.	Not required.

6.3.4 Special reports (optional)

6.3.4.1 System reports (optional)

Class A	Class B	Class C
System summary reports may be included for the relevant loading conditions. These reports may include total weight per system and variations from the previous report. Detailed reports containing system weights per discipline and centres of gravity may be included where appropriate.	As Class A.	Not required.

6.3.4.2 Sub-area report or sub-assemblies report (optional)

Class A	Class B	Class C
Sub-area or sub-assemblies reports may have the same format as the area reports.	As Class A.	Not required.

6.3.4.3 Secondary lift report (optional)

Class A	Class B	Class C
The secondary lift report should, as a minimum provision, show lift weight summaries for identified separate lifts in the various project loading conditions. Hook weights are not normally presented. Detailed data per discipline, variation from previous report and CoG may be included as appropriate.	As Class A.	Not required.

6.3.5 Annexes to the report

6.3.5.1 Assumptions

Class A	Class B	Class C
The assumptions for the report shall be split into two main sections, one for general assumptions and one for discipline assumptions. The general assumptions shall include information concerning layout, construction philosophy, inclusions at various project loading conditions, temporaries for various phases, residual fluid content, any bridges to adjacent facilities, etc. The discipline assumptions shall include information about the basis for discipline work, any discrepancies according to general reporting instructions, any interdiscipline assumptions, any special hook-up assumptions, etc.	As Class A.	The general assumptions shall include information concerning layout, construction philosophy, inclusions at various project loading conditions, temporaries for various phases, residual fluid content, any bridges to adjacent facilities, etc.

6.3.5.2 Area designations and global origin

Class A	Class B	Class C
This report annex shall describe all project main areas/modules and sub-areas, including their location, size, code and name. The annex shall also show the location of global origin relative to axis and levels of the main structure.	As Class A.	As Class A.

6.3.5.3 Weight allowance and contingency

Class A	Class B	Class C
If weight allowances and contingencies are applied to the net weights, these shall be reported.	As Class A.	As Class A.

6.3.5.4 Report codes

Class A	Class B	Class C
All definitions, abbreviations and codes used in the report shall be fully explained. The codes used may include, but not be limited to: — weight installation codes; — weight phase codes; — weight status codes; — area codes.	As Class A.	Not required.

6.3.5.5 References

Class A	Class B	Class C
Reference shall be made to any documents that might be necessary for clarification of the content of the weight report.	As Class A.	As Class A.

6.3.5.6 Other descriptions

Class A	Class B	Class C
Listings of variation order, potential weight variation, assembly weighings, module weighings, etc., shall be included here.	As Class A.	Not required.

7 Requirements for weight data from suppliers and weighing of bulk and equipment

7.1 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: — 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.

7.2 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.

7.3 Requirements for weighing

Class A	Class B	Class C
The supplier shall perform weighing of all equipment and bulk items weighing more than 10 kN (1 t). If there are identical equipment and/or bulk items, 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.

7.4 Weighing equipment

Class A	Class B	Class C
The weighing equipment shall have a maximum relative measurement uncertainty of $\pm$ 1 %.	The weighing equipment shall have a maximum relative measurement uncertainty of $\pm$ 2 %.	The weighing equipment shall have a maximum relative measurement uncertainty of $\pm$ 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 % of its rated capacity, to account for possible weight underestimation and safety aspects. If weighing equipment is operated below 20 % of its rated capacity, the measurement uncertainty shall be documented to be within the requirements. 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.

7.5 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.

7.6 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.	As Class A.	As Class A.

7.7 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, i.e. a laboratory that meets the requirements of ISO/IEC 17025 [1] or is accreditated 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, i.e. a laboratory that meets the requirements of ISO/IEC 17025 [1] or is accreditated 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, i.e. in the form of a production end control at the manufacturer or subsequent checks at intervals not longer than four years.

7.8 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.

7.9 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.

7.10 Items excluded during weighing

Class A	Class B	Class C
The weight and CoG for all items excluded from the weighing of the bulk/equipment items shall be obtained individually and separately by weighing or by detailed calculation, and included in the weighing certificate. The total weight figure shall be adjusted accordingly. Items excluded which are above 10 kN (1 t) each shall be weighed separately.	As Class A.	As Class A.

8 Requirements for weighing of major assemblies

8.1 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 project approval.	As Class A.	As Class A.

8.2 Environmental conditions

8.2.1 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.

8.2.2 Wind

Class A	Class B	Class C
In the event that the wind velocity exceeds 8 m/s, conservative influences on the total weight and CoG due to wind actions shall be calculated as follows: $I_w = 0{,}0065 \times (A_h/m_t) \times v^2$ (1) $I_c = 0{,}013 \times [(A_v \times h)/(m_t \times l)] \times v^2$ (2) where I_w is the influence on total weight, in percent; A_h is the horizontal area of module, in square metres; m_t is the module mass, in tonnes; v is the wind velocity, in metres per second; I_c is the influence on CoG, in percent of module dimension; A_v is the vertical wind-exposed area, in square metres; h is the height of module, in metres; l is the length of module in direction of wind, in metres.	In the event that the wind velocity exceeds 11 m/s, conservative influences on the total weight and CoG due to wind actions shall be calculated as Class A.	In the event that the wind velocity exceeds 14 m/s, conservative influences on the total weight and CoG due to wind actions shall be calculated as Class A.
If both I_w and I_c, when calculated, are less than 0,2 %, the wind has no significant contribution to the weighing uncertainty and the weighing may be performed. If both I_w and I_c, when calculated, are above 0,2 %, the decision to accept any weighing results when wind speed exceeds 8 m/s is taken by project management/client and only after evaluation of results accounting for characteristics of the subject weighing as indicated above.	If both I_w and I_c, when calculated, are less than 0,4 %, the wind has no significant contribution to the weighing uncertainty and the weighing may be performed. If both I_w and I_c, when calculated, are above 0,4 %, the decision to accept any weighing results when wind speed exceeds 11 m/s is taken by project management/client and only after evaluation of results accounting for characteristics of the subject weighing as indicated above.	If both I_w and I_c, when calculated, are less than 0,6 %, the wind has no significant contribution to the weighing uncertainty and the weighing may be performed. If both I_w and I_c, when calculated, are above 0,6 %, the decision to accept any weighing results when wind speed exceeds 14 m/s is taken by project management/client and only after evaluation of results accounting for characteristics of the subject weighing as indicated above.
Wind-measuring equipment shall be provided by the contractor.	As Class A.	As Class A.

8.2.3 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 8.3.5.4 shall be maintained.	As Class A.	As Class A.

8.3 Weighing

8.3.1 Number and timing of weighings

Class A	Class B	Class C
There shall be a minimum of two weighings of a major assembly. However, three weighings are recommended at the following stages: — when the structural steelworks have been erected or when the assembly is structurally stable; — at any intermediate stage (optional); — immediately before load-out.	There shall be a minimum of one weighing of a major assembly. However, two weighings are recommended at the following stages: — when the structural steelworks have been erected or when the assembly is structurally stable; — immediately before 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.

8.3.2 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 shall be performed, the requirements are as for Class A.

8.3.3 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 15 working days in advance. 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 shall be performed, the requirements are as for Class A.

8.3.4 Preparation of the weighing

8.3.4.1 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, — grillage, — lifting gear (rigging), — first fill.	As Class A.	If a final weighing shall be performed, the requirements are as for Class A.

8.3.4.2 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.

8.3.5 Weighing equipment

8.3.5.1 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.	As Class A.	If a final weighing shall be performed, the requirements shall be as for Class A.

8.3.5.2 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 shall be performed, the requirements shall be as for Class A.

8.3.5.3 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 onto 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 shall be performed, the requirements shall be as for Class A.

8.3.5.4 Accuracy of weighing system

Class A	Class B	Class C
Each individual load cell shall have a measurement uncertainty within 0,5 % of rated capacity. The measurement uncertainty of the weighing system as a whole shall be within 1,0 % of actual weighed weight. The measurement uncertainty shall be calculated and presented by the calibration authority in accordance with the *Guide to the expression of uncertainty in measurement*.	Each individual load cell shall have a measurement uncertainty within 1,0 % of rated capacity. The measurement uncertainty of the weighing system as a whole shall be within 2,0 % of actual weighed weight. The measurement uncertainty shall be calculated and presented by the calibration authority in accordance with the *Guide to the expression of uncertainty in measurement*.	If a final weighing shall be performed, the requirements shall be as follows. Each individual load cell shall have a measurement uncertainty within 2,0 % of rated capacity. The measurement uncertainty of the weighing system as a whole shall be within 3,0 % of actual weighed weight. The measurement uncertainty shall be calculated and presented by the calibration authority in accordance with the *Guide to the expression of uncertainty in measurement*.

8.3.5.5 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 shall be performed, the requirements shall be as for Class A.

8.3.6 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 [1] or is accreditated 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 procedures.
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.

8.3.7 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 shall be performed, the requirements shall be as for Class A.

8.3.8 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.	As Class A.	If a final weighing shall be performed, the requirements shall be as for Class A.

8.3.9 Weighing operation

8.3.9.1 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 shall be 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, and the load cells shall be rotated through 120° around their vertical axis 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 shall be 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 shall be performed, the requirements shall be as for Class A.

8.3.9.2 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 shall be performed, the requirements shall be as for Class A.

8.3.9.3 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 shall be performed, the requirements shall be as for Class A.

8.3.10 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 shall be performed, the requirements shall be as for Class A.

8.3.11 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 of a weighing certificate is given in B.2. 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 co-ordinate system for the weighed assembly; — identification of weighing equipment and calibration.	As Class A.	If a final weighing shall be performed, the requirements shall be as for Class A.

8.3.12 Weighing report

Class A	Class B	Class C
Within seven days of the weighing operation, the contractor shall submit a report of the weighing operation. The weighing report shall include: — units of measurement; — weighing results; — calculations of CoG; — 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 shall be performed, the requirements shall be as for Class A.

9 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. The database fields, their format as well as the coding shall be in accordance with contractual requirements.	a) 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” master equipment list (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.

Annex A
(informative)

Weight data sheets — Tagged equipment

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

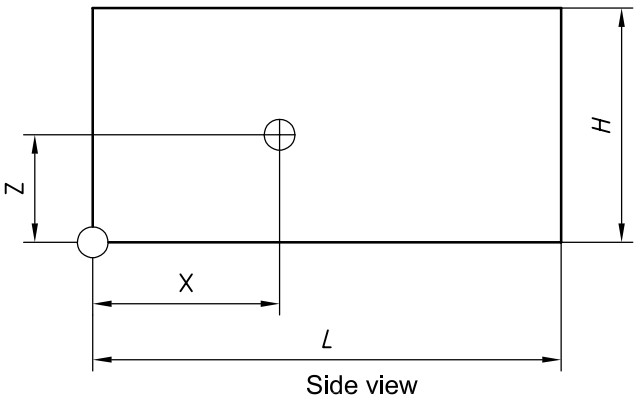
Tag No.:	Serial No.:	
Description:		
Vendor:	Layout drawing No.:	
Manufacturer:	P & ID No.:	
Model:	Area:	

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. lifting weight with padeyes		
Largest removable item		

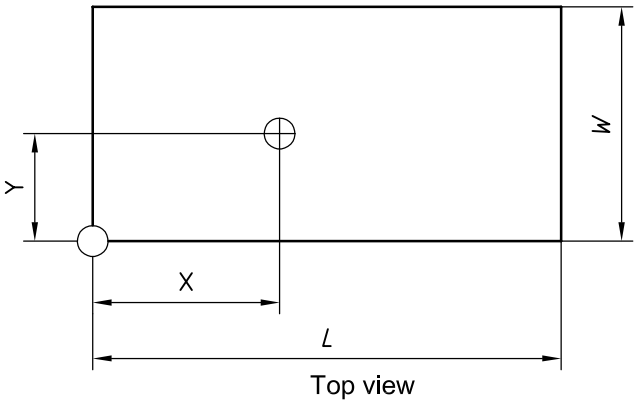
Overall sizes and positions of local centre of gravity (CoG) [mm]

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	
❒ Estimate at bid	
❒ Confirmed after purchase order	
❒ Recalculated/catalogue data	
❒ Final calculated	
❒ Approved for construction	
❒ Weighed weight	
Notes:	
Date:	Sign:



Side view



Top view

◯ Local datum point

⊕ 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.

Annex B
(informative)

Weighing certificates

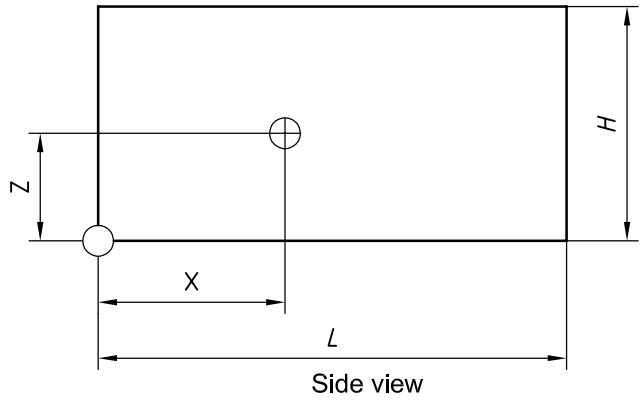
B.1 Bulk and equipment weighing certificate

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

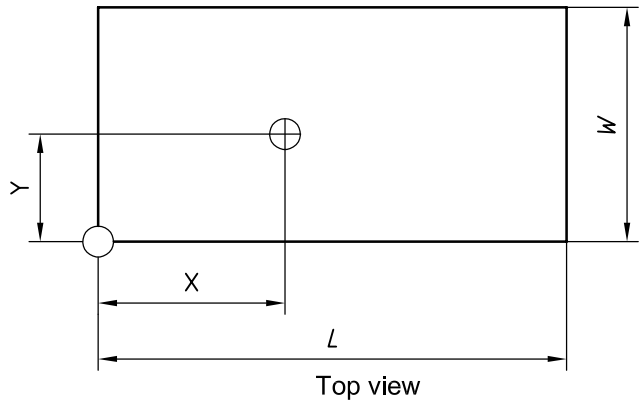
Bulk and equipment weighing certificate — CoG status

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

◯ Local datum point

⊕ Local CoG

Overall dimensions (mm):

L = W = H =

Local datum point (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 content):

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

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					
17					
18					
19					
20					
21					
22					
23					
24					
25					
26					
27					
28					
29					
30					
31					
32					

	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:

Load cell reference	Load cell serial number and coordinates at weighing					
	1st	2nd	3rd	4th(if required)	East/LCG	North/TCG
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						

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

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

Number of attachments:

Annex C
(informative)

Weight and load budget (WLB) formats and levels

Table C.1 — Topsides operating weight budget

Area code	Platform area	50/50 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	Derrick substr./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

Annex D
(informative)

Major elements of the weight displacement

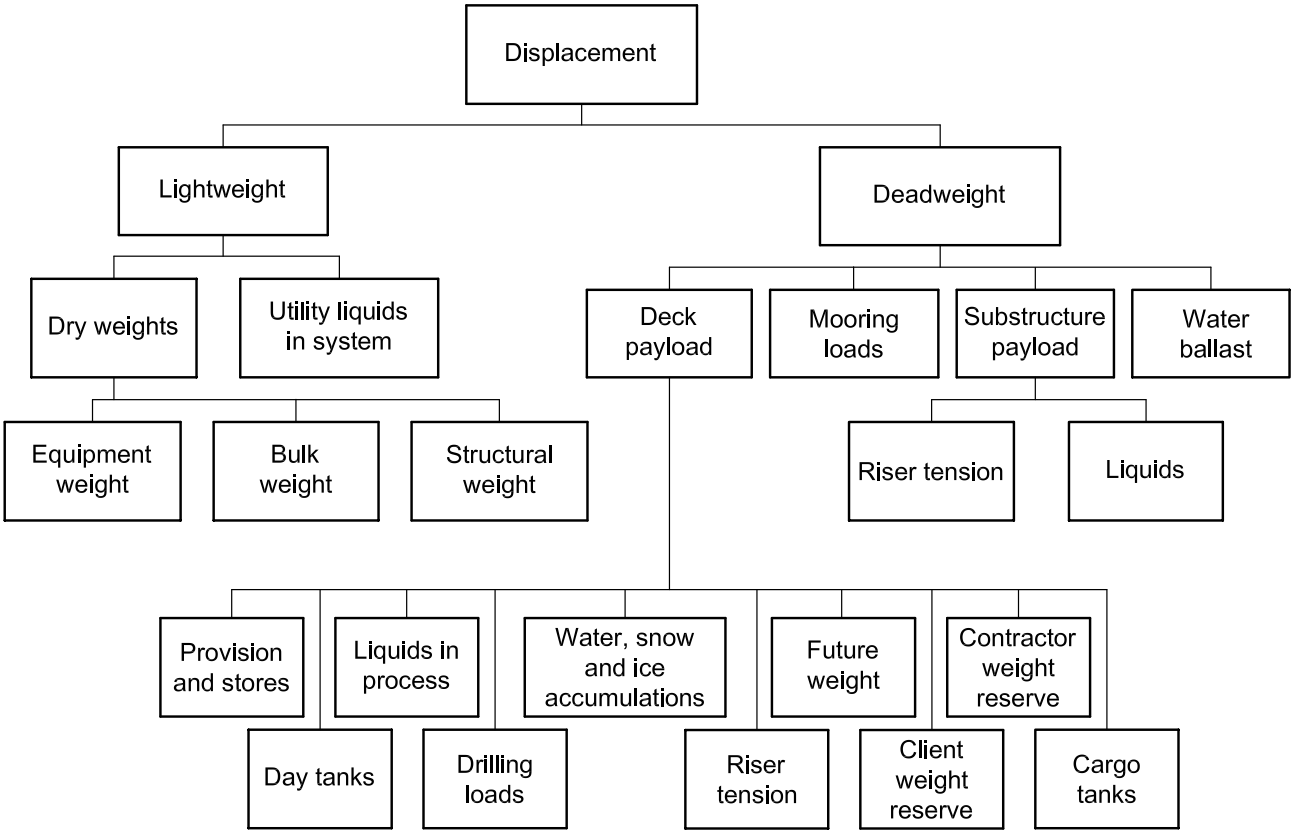


Figure D.1 — Weight displacement summary, design operating condition

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.:		

Description of weighing method:
Description of CoG recording:

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 shall be found in which the measurement can be carried out;

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

c) good weather shall be forecast;

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

e) there shall be no significant swell;

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

g) the floating structure shall be free-floating;

h) time and location shall 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.

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 shall be raked and the floating structure, if necessary, assisted by tugs;

— floating structure shall be free-floating;

— the minimum number of personnel shall be onboard during test;

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

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

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;

— hydrometers (densitometers) for measuring specific gravity of liquids in tanks;

— 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 onboard 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.

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);

— list of temporary items (weight and CoG);

— detailed list of installed items;

— final prediction report;

— assessment of the accuracy of measurement results.

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