



Exploration & Production

GENERAL SPECIFICATION

STRUCTURAL

GS EP STR 401

**Loadout, seafastening, transportation and
installation of offshore structures**

Rev.	Date	Notes
09	01/2011	§ 11.2.3.4, 11.2.4.1, 11.3.1, 11.3.2.4, 12.2.2 revised
08	10/2009	§ 2, 9.3.4, 11.2.2, 11.2.3.4, 11.2.4.1, 12, 12.1.1, 13.2.2.4 revised
07	10/2008	§ 9.2.1.2, 10.2.4.3, 10.7.2, 11.2, 12, 12.3, 12.7 revised
06	10/2007	§ 2, 3, 11.2.3.4, 11.2.5 revised and General revision of sections 8, 9 & 10
00	02/2001	First issue
Rev.	Date	Notes

Owner: EP/TDO/TEC

Managing entity: EP/TDO/TEC/STR



Contents

1. Scope	4
2. Reference documents.....	4
3. Definitions.....	6
4. Involved parties and responsibilities	7
4.1 Certification/Third Party authorities.....	7
4.2 Distribution of responsibilities	7
5. Safety and Health	11
6. Equipment and re-used steel components	12
6.1 General.....	12
6.2 Hydraulic jacking system	12
7. Load tests and test intervals.....	13
7.1 General.....	13
7.2 Crane used on Construction yards	13
7.3 Offshore cranes and crawler or telescopic cranes installed on a barge	13
7.4 Lifting ancillaries	15
8. Company reserve and budget weight.....	15
8.1 General.....	15
8.2 Pre-service conditions	16
9. Loadout	17
9.1 General.....	17
9.2 Structure, quay and soil	17
9.3 Systems and equipment	20
9.4 Loadout barge (or vessel).....	28
9.5 Loadout manual	29
9.6 Operational aspects.....	30
9.7 Loadout report	32
9.8 Special cases.....	32
10. Transportation and seafastening.....	32



10.1	General.....	32
10.2	Design and strength.....	32
10.3	Transportation barge (or vessel).....	37
10.4	Transportation and seafastening manual	38
10.5	Towing requirements	39
10.6	Towing manual	39
10.7	Operational aspects.....	40
10.8	Transportation report	40
11.	Installation studies.....	41
11.1	General.....	41
11.2	Lifting studies.....	41
11.3	Jacket launching studies.....	50
11.4	Jacket free float studies	53
11.5	Jacket upending and setting studies.....	53
12.	Installation operations	55
12.1	Procedure, preparation	56
12.2	Installation of the jacket	59
12.3	Installation of piles	61
12.4	Installation of the deck and other frames	61
12.5	Final steps	70
12.6	Tolerances	71
12.7	Limitation criteria for offshore installation	73
13.	Documents.....	74
13.1	Documents to be supplied by the Company to the Contractor	74
13.2	Documents to be submitted by the Contractor to the Company	74
14.	Other references	77
Appendix 1	Check list of information required for approval of loadout.....	78
Appendix 2	Loadout control and monitoring on quay/barge interface.....	82



1. Scope

This General Specification defines the conditions and methods which are required by Company for loadout, seafastening, transportation and installation of offshore fixed steel structures.

The specification applies to "conventional" fixed offshore structures, such as:

- 3, 4, 6 or 8 leg piled jackets installed by crane
- Launched 4 or 8 - legged piled jackets
- Decks (whether pre-equipped or not) installed by crane or barge ballasting
- Modules.

This specification does not cover the installation of self-launched components such as columns, jack-ups, gravity-base platforms, etc. If necessary, these will be covered by a particular specification.

For special transportation such as dry tows of hull, TLP, semi-submersible, jack-up, etc. general guidelines from Noble Denton shall be applicable unless otherwise specified in the Particular Project Specification.

This specification shall be read in conjunction with the Project Particular Specification.

Plastic design shall not be allowed.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated in the CONTRACT, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT. References to superseded standards that may occur on technical documents will not over-write this clause.

Standards

Reference	Title
ISO 19901-6	Specific requirements for offshore structures - Part 6: Marine operations

The document [ISO 19901-6](#) is nearing completion and formal issue.

The Company recognizes this document as a source of sound recommendations on good practice. However, in some cases the requirements of this International Standard do not comply with the requirements of the Company's General Specifications. Furthermore, there exists within this International Standard the requirement for the owner or operator to define certain parameters which may override suggested default values.

In general terms, the requirements of formally issued [ISO 19901-6](#) when available shall be applicable in context to the design of new structures for Company and to the insurance that marine operations are performed within defined and recognized safety/confidence levels where these requirements are additional to or are more onerous than the requirements stated in the Company's General Specifications and Project Particular Specifications. In this context, the default values of parameters are recommended by the International Standard shall apply, unless more onerous values are stipulated within the Contract documents.



Any other proposal based on the content of this International Standard shall be subject to Company approval.

Professional Documents

Reference	Title
API RP 2A	Recommended Practice for Planning and Constructing Fixed Offshore platforms
BV - NI183	Towage at sea of vessels or floating units
DNV	Rules for Planning and Execution of Marine Operations
LOC	Guidelines for marine operations
NDI Ltd - Report 0013/NDI	Guidelines for loadouts
NDI Ltd - Report 0021/NDI	Guidelines for the approval of towing vessels
NDI Ltd - Report 0027/NDI	Guidelines for lifting operations by floating crane vessels
NDI Ltd - Report 0028/NDI	Guidelines for the transportation and installation of steel jackets
NDI Ltd - Report 0030/NDI	General guidelines for marine transportations

Regulations

Reference	Title
I.A.L.A.	International Association of Lighthouse Authorities Regulations

Codes

Reference	Title
IMO A 749 (18)	Code on intact stability of all type of ships covered by IMO instruments

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
GS EP COR 350	External protection of offshore and coastal structures and equipment by painting
GS EP GEO 504	Comprehensive evaluation of metocean conditions
GS EP GEO 702	Requirements for design and installation of skirted foundations and suction anchors
GS EP LSO 201	Towing floating unit
GS EP POS 001	Offshore surface positioning works
GS EP STR 001	Weight monitoring and weighing offshore units
GS EP STR 005	Lifting appliances other than cranes and winches
GS EP STR 100	Offshore structures - General
GS EP STR 101	Design of offshore jackets and subsea structures
GS EP STR 102	Design of offshore topsides structure
GS EP STR 201	Materials for offshore steel structures
GS EP STR 202	Cast materials for steel structures
GS EP STR 203	Forged materials for steel structures
GS EP STR 301	Fabrication of offshore steel structures
GS EP STR 304	Fabrication of welded plate girders (W.P.G.)
GS EP STR 402	Anchorage for support vessel on an offshore site
GS EP STR 404	Marine aspects for load-out, transportation and installation of offshore structures
GS EP STR 431	Installation of piles for offshore steel structures - Driven piles
GS EP STR 432	Installation of piles for offshore steel structures - Drilled and grouted piles
GS EP STR 901	Design rules and construction standards for ancillary structures of offshore installations

3. Definitions

Barge	The floating vessel on which the object is transported. For this specification, the term 'barge' can be considered to include cargo barge, vessel or ship where appropriate.
Budget weight	Estimated object weight + Company reserve.
Link beam	The connecting beam between the quay and the barge.
MBL	Minimum Breaking Load.
MSF	Main Support Frame.



Object	The offshore structure to be successively loaded out, transported and installed.
Skidbeam	A system of steel structural beams on the barge, on which the object is loaded via the skidshoes.
Skidshoe	A bearing pad attached to the object that engages in the skidway and carries a share of the vertical zone.
Skidway	A system of structural beams (concrete and/or steel) or rails, on the quay, on which the object is loaded via the skidshoes.
SWL	Safe working load.
Trailer	A system of steerable wheels, connected to a central spine beam by hydraulic suspension which can be raised or lowered.

4. Involved parties and responsibilities

4.1 Certification/Third Party authorities

The Project Particular Specification will define the Marine Warranty Surveyor, the Third Party Authority and/or Certification Authority and their respective scope and responsibilities during the operations covered by this General Specification.

In particular, the following will be defined:

- The authority responsible for checking/certifying the design of structures
- The authority responsible for checking/certifying the construction
- The authority responsible for checking/certifying one or all of the following operations:
 - Loadout
 - Seafastening
 - Transportation.
- The authority responsible for checking/certifying lifting and installation operations
- Interface tables detailing the scope, the interfaces and the documents to be submitted and approved.

4.2 Distribution of responsibilities

- The distribution of responsibilities and the interfaces between:
 - The Company
 - The various Contractors in charge of design, construction, loadout, transportation and installation
 - The various Certification or Controlling Authorities

are defined in the following tables. These typical tables shall be used unless otherwise specified in the Project Particular Specification or in the Contract.



- In particular, for the loadout, seafastening, transportation and installation, the Marine Warranty Surveyor appointed by the Company shall be responsible for checking/surveying/certifying as relevant the following:
 - The design including but not limited to design criteria, barge strength, stability, motions analysis, dynamic analysis during installation, etc.
 - The procedures and operation manuals
 - The marine and installation operations
 - The marine equipment and support vessels (derrick barge, HLV, cargo barge, ship, tug, etc.)
 - The necessary equipment/aids used for the different operations (jacking system, pushing/pulling system, water pumps, slings/shackles, moorings, towing equipments, etc.)
 - The transportation route
 - The environmental conditions
 - The weather forecast.
- The compliance with this specification and Company Approval does not release the Contractors and the Authorities in charge of the work, inspection and/or the certification, from their own responsibility.

Distribution of responsibilities

- Contractors in charge of:
 - . E Design Study
 - . F Fabrication/Construction
 - . W Weighing
 - . L Loadout
 - . S Seafastening
 - . T Transportation
 - . I Installation
- Company C
- Marine Warranty Surveyor MWS
- Third Party/Control authority TP
- Certification Authority CA

A = Approval - P = Carries out or supplies - R = Review - W = Witness - H = Hold Point

(*) Responsibilities of TP shall be defined in the Project Particular Specification.

1 - Loadout	Contractors							TP	CA	MWS	C
	E	F	W	L	S	T	I				
1.1 Supply and acceptance of means of transport and transport at yard entrance	R	R		R		P		(*)		A	A
1.2 Berthing and mooring of barge		P		A		R		(*)		A	R
1.3 Weight and centre of gravity calculated	P							(*)	R		R
1.4 Weight and centre of gravity measured during fabrication	R	P						(*)			R
1.5 Weighing	R	P	P				W/R	(*)	W/R	W/A	W/A
1.6 Services defined in 9.6.1		P		P				(*)		R	R
1.7 Loadout procedure defined in 9.5	A	P		P		R		(*)	R	A	A
1.8 Loadout defined in 8		P		P		R		(*)		A	A
1.9 Loadout of accessories defined in 8		P		P		R		(*)		A	A
1.10 Loadout documents defined in 8		P		P				(*)	R	A	A
1.11 Loadout certificate defined in 13.2.3								(*)		P	

2 - Seafastening		Contractors							TP	CA	MWS	C
		E	F	W	L	S	T	I				
2.1	Barge grillage and sea-fastening documents defined in 10	P/R	P		R	P	A	R	(*)	A	A	A
2.2	Services defined in 10.2.5.4		P			P			(*)		R	R
2.3	Technical file for seafastening (see 10.4)								(*)			
	• Barge + packages	A				P	P		(*)	R	A	A
	• Packages on barge	A				P	P		(*)	R	A	A
	• Internal seafastening	P	P			P	R		(*)	A	A	A
2.4	Values to be taken into account for loading and sea-fastening calc. (see 10.2.3)	P					P		(*)	R	A	A
2.5	Barge internal reinforcement	A					P/R		(*)	A	A	R
2.6	Repair of areas damaged during loading and sea-fastening (see 10.2.5.4)	A	P			P	A		(*)		A	R

3 - Transportation		Contractors						TP	CA	MWS	C	
		E	F	W	L	S	T					I
3.1	Technical documents for transportation (sea-worthiness certificate, selected sea route, planning + personnel charts) see 13.2.2.4 and GS EP STR 404	P					P		(*)		A	A
3.2	Acceptance of transportation means						(*)		A		A	
3.3	Transportation documents (see 10)						P		(*)		A	A
3.4	Certificate of Sail Away (see 13.2.4)						(*)		P			

4 - Installation	Contractors							TP	CA	MWS	C
	E	F	W	L	S	T	I				
The list here below corresponds only to activities where responsibilities may lead to discussions between Contractors entrusted with studies, manufacturing and transportation, and Contractors entrusted with installation. For the rest see sections 11 and 12.											
4.1 Pile make up and driveability analysis (see GS EP STR 431)	P						A	(*)	A		A
4.2 Supply of slings and lifting shackles	R						P	(*)		A	R
4.3 Installation of slings and lifting shackles (see 12.1.2.2)		P					A	(*)		A	R
4.4 Supply and installation of temporary access ways to attachment areas		P					A	(*)		R	R
4.5 Fitting-out of cargo-barge, lifting barge						A	P	(*)		A	A
4.6 Mooring of cargo-barge, lifting barge						R	P	(*)		A	A
4.7 Cutting off of sea-fastening						R	P	(*)		A	R
4.8 Lifting operations							P	(*)		A	A
4.9 Return of cargo-barge						P		(*)		A	A

5. Safety and Health

In order to protect the personnel and all equipment, the Contractor shall take all the necessary and preventive actions to fulfil the safety requirements in particular for the use of Personnel Protective Equipment (P.P.E.), safety harness, scaffoldings correctly erected and in good order, correct lightning of working areas, safety buoys along quay side or cargo barge/ vessel side shells, a minimum of 150% life raft capacity with respect to the POB involved in the operation and additional visitors and workers to be identified, etc.

In particular, life vests shall be worn during the operations along the quay and on the vessel for the loadout, seafastening, transportation and installation.

For long duration operations of more than six hours, a safe rest area with sufficient number of tables, chairs, benches, lightning, camp beds, etc., shall be provided with sufficient drinks and meals. In addition, decent mobile chemical cabin toilets or equivalent in sufficient number (one cabin for 20 persons maximum) shall be provided for all the involved personnel.

Surfer/boat landings shall be provided to allow for a safe access on the cargo barge/vessel on both sides. Trial fitting and erection sequence shall be performed at yard before the sail away.



Air/electrical winches shall be used to facilitate and expedite the erection at site. Manual chain blocks will be avoided in particular for long pulling lengths/heights.

6. Equipment and re-used steel components

6.1 General

- All equipment and re-used steel components to be used shall be in good order.
- For loadout or lifting operation using strand jacks system or equivalent, all cables shall be brand-new and clean before the operation. At least one full spare strand jack unit with brand-new cables shall be provided.
- For critical operations such as a float-over, all the synthetic hawsers shall be brand-new with certificates including for all the tug ones.
- Prior to any re-use, all equipment or steel components such as, but not limited to, substructures, skid beams, barge grillage, spreader frames/beams, jacking/pulling systems, etc. shall be submitted to Company approval.
- An associated inspection program shall be submitted to Company approval. In particular, it shall be developed in line with, but not limited to, **GS EP STR 201** Table 4.1 and **GS EP STR 301** sections 10.2 and 15 requirements.
- Material certificates shall be supplied.
- Re-use of bolts is strictly prohibited.
- Equipment and jacking system maintenance, cocooning and protection during fabrication and transportation shall be performed by skilled qualified personnel, and in accordance with the schedules and instructions supplied by Manufacturers.
- Equipment and jacking system testing and inspections shall be carried out by appropriate skilled and qualified personnel.

6.2 Hydraulic jacking system

All the above requirements (see section 6.1) shall apply to hydraulic jacking systems, and particularly:

- Any re-used/not brand-new jack or hydraulic power unit (HPU) shall be completely refurbished with new gaskets and seals.
- At least one spare jack for each type and one spare HPU shall be provided and kept immediately available with sufficient spare oil quantity at fabricator site and at offshore site.
- In presence of MWS, of Company and a Certifying Authority appointed by the Contractor and approved by Company, performance and calibration tests shall be performed for all the jacks and HPUs with new and clean oil and lubricants.
- After tests, the used/contaminated oil shall be analysed and replaced by new oil compatible for the long storage and idle period.
- A long duration running test of at least 72 hours shall be performed to simulate the degradation of the oil quality and system performance with respect to the running time, oil



temperature, heavy jacking operating loads and relevant climatic conditions at fabricator and offshore sites.

- In case of use of the jacking system during the loadout, the used/contaminated oil shall be analysed and replaced if necessary by new oil for the final use on offshore site.
- A detailed testing, operating, maintenance and cocooning manual shall be provided with the relevant Failure Mode Analysis of the full hydraulic jacking system and control system.

7. Load tests and test intervals

Test intervals shall not exceed one year.

7.1 General

Any equipment used for personnel transfer shall be tested every six (6) months and baskets shall be tested every three (3) months.

A new test shall be made in case of major repair or replacement of an essential part, or in case of a modification or a reassembly.

Very particular care shall be taken for special handling using hired equipment which shall be tested in situ with its foundations and checked with respect to its design limitations (load, radius, wind, differential settlements, etc.).

Contractor shall demonstrate that such hired equipment is in good order, maintained and inspected according to the Manufacturer maintenance program, and properly insured with a clear definition of the responsibilities.

For jacking, lifting, pulling or pushing equipment, load tests shall be performed and witnessed by a Third Party Authority, the MWS and Company.

7.2 Crane used on Construction yards

Contractor has to comply with the National Regulation. But, in any case overload test shall not be older than one (1) year.

For a crane, the load test shall be performed with the maximum hook capacities at both maximum and minimum lifting radii in the same configuration (i.e. revolving, tie-back, etc.). This must be performed for all the hooks.

If the crane has been dismantled for transportation and re-assembled before entering one of our sites, the crane shall be load tested again (with overload).

If the crane configuration (boom length, fixed jib adjunction or fly-jib set-up) is modified in between our operations, the crane shall be load tested in that particular configuration.

All safety devices installed on the crane shall be in good working order. Safe Load Indicator, angle and radius indicators, anti-two-block device are required and shall be fitted up.

Hoist lines shall be fully and thoroughly inspected annually.

7.3 Offshore cranes and crawler or telescopic cranes installed on a barge

a - Crawler or telescopic cranes installed on barge

Crawler cranes and telescopic cranes on outriggers, temporary or permanently installed and used on barge shall be annually inspected and load tested according to 7.2. The standard load



charts of these cranes are not valid for this utilisation and specific load charts for offshore (crane mounted on floating vessel or barge) shall be provided by the crane manufacturer. On this load chart shall appear the Serial Number of the crane and the operating limitations.

b - Offshore cranes (Derrick barge, shear leg, etc.)

Contractor has to comply with:

- Case 1: Last load test with overload dated less than 1 year

No particular requirement from the Company with the exception that derrick cranes (on lifting barge) or offshore pedestal cranes shall be inspected by Company.

- Case 2: Last load test with overload dated more than 1 year and less than the 4 or 5 years regular time

Company requires a functional load test representative of and in similar conditions with the planned lifting to be performed for our project (lifted load taking into account the Dynamic Amplification Factor, radius, hook block to be used, crane rotation, etc.).

This test shall be witnessed by Company representative or appointed Third Party.

To be noted: the purpose of this test is to be sure that the crane is fit for purpose and ensure that all mechanisms and safety devices are well functioning. This test is not an overload test and the test load shall not be heavier than the Safe Working Load of the crane. Therefore it will never reduce the lifetime of the crane or increase the risk of deterioration by overload.

Derrick cranes on lifting barge, offshore pedestal cranes shall be inspected (thorough examination) by Company/appointed Third Party before the test.

If a similar lift has been safely done by the Contractor (lift representative to and in similar conditions with the planned lift to be performed for our project), within the last year, depending on the Contractor Quality Management Procedure and QA/QC documentation (maintenance log book, operation log book, preventive and scheduled maintenance, inspection...) and the results of the visual crane inspection by Company, Company may validate this lift as the required functional load test.

Furthermore for all cranes with an offshore use Company requires an NDT check scheduled on a yearly basis and random before any heavy lift:

- 100% of the welds of the boom done in 5 years with a 20% rate per year
- 5% of the most highly stressed nodes (boom, A-frame, central crane pivot...) by random check before any heavy lift
- Hook rams and body before any heavy lift.

For all cranes with an offshore use, hoist lines shall be fully and thoroughly inspected annually. A sample of wire running on the sheaves of the hook block shall be cut from the dead end and subject to destructive tensile test. Results shall be provided to Company.

If the crane hoisting lines are used for underwater lifting operations and the hooks are submerged, the maximum working life shall be less than 2 years. Without a specific cable maintenance procedure dedicated to subsea lifts and up to date log book, the hoisting lines shall be replaced.



7.4 Lifting ancillaries

Lifting ancillaries such as slings, shackles, spreader bars, lifting beams, etc. shall be tested every year and thoroughly examined/inspected by a competent surveyor/Third Party Inspector.

The applied load test shall be:

- For slings and shackles: 1.25 x SWL
- For spreader bars & lifting beams: 1.50 x SWL.

When the accurate knowledge of the slings length is required to reduce the skew load factor, the slings length shall be measured under tension with the intended factored load, as applied to the slings during lifting operation.

It is recommended not to use large diameters (> 114 mm diameter) hand spliced cable laid slings. The use of this type of slings may result in failure of rigging system components, crane hooks and even lift package attachment points. The use of this type of slings shall be avoided in favour of the grommets or multiple part braids with flemish eye connection.

Inspection certificates issued by a Third Party Authority of any lifting and handling equipment shall be no more than one year old unless otherwise required.

Slings should be marked with the following information:

- Sling number or Contractor internal reference number
- Sling manufacturer
- Sling diameter
- Sling length
- Sling SWL
- Date of the last load test.

8. Company reserve and budget weight

8.1 General

- The Company reserve is a weight reserve to secure the design against unknown development(s) which could be decided by Company and could have an adverse impact on the project schedule.
- The Company reserve shall be about 10% of the gross operating weight unless otherwise specified in the Project Particular Specification.
- The Company reserve shall be added to the gross pre-service weight of the object and applied in the calculation models at operating centre of gravity.
- The Company reserve shall be considered for loadout, transportation and installation of Topsides and selection of associated means (transportation barge, derrick barge, yard, substructures, etc.).
- The following table provides some guidance on the definition of the object pre-service budget weight, which includes the object gross pre-service weight and the Company reserve, unless otherwise specified in the Project Particular Specification.

How to define the object Pre-service Budget Weight				
	Basic engineering	Bidding phase	Detailed engineering until weighing	After weighing
Pre-service Budget Weight	Gross pre-service weight + Company reserve	Gross pre-service weight from end of Basic + Company reserve	Gross pre-service weight + Company reserve	Weighed weight, including a contingency factor when applicable (see section 9.2.1.1 and GS EP STR 001) + Agreed additional weights (e.g. temporary items or for hook up)

- A Not To Exceed weight shall be defined by Contractor for each pre-service phase and approved by Company at detailed engineering phase.

8.2 Pre-service conditions

8.2.1 Loadout

The following items shall be designed/checked for loadout conditions considering the object pre-service budget weight:

- Object to be loaded: primary and main bearing structure of the object (see section 9.2.1)
- Quay/foundations (see section 9.2.2.1)
- Skid ways, skid beams, skid shoes, link beams, barge grillage (see section 9.3.1)
- Push/pull system when applicable (see section 9.3.2)
- Trailers when applicable (see section 9.3.3)
- Barge (see sections 9.4).

8.2.2 Transportation and seafastening

The following items shall be designed/checked for transport conditions considering the object pre-service budget weight:

- Object to be transported: primary and main bearing structure of the object (see section 10.2.4)
- Seafastening and barge grillage (see section 10.2.5)
- Barge (see section 10.3).



8.2.3 Installation

The following items shall be designed/checked for installation conditions considering the object pre-service budget weight:

- Object to be installed: primary and main bearing/lifting structure of the object
- Lifting ancillaries
- Crane
- Substructures, guides and bumpers, etc.
- Barge.

9. Loadout

9.1 General

9.1.1 Loadout methods

This section defines the conditions and methods which are required by Company for the loadout of heavy items including offshore jackets, modules, bridges and components from the shore onto floating or grounded barges.

Due to the wide range of objects, loadout methods and transport barges, this section cannot cover all aspects of every loadout scheme. Alternative proposals and methods will be considered on their own merits and can be approved if they are documented to be in accordance with safe practice.

9.1.2 Applications

This section also applies to site moves. The object movement from the fabrication area to the quay side shall be considered as part of the loadout operation.

This section particularly applies to skidded and trailer-transported loadouts in tidal waters. Requirements for lifted and grounded loadouts are also included.

9.2 Structure, quay and soil

9.2.1 Structure to be loaded

The structure to be loaded, hereafter called the “object”, shall be designed to withstand the static and dynamic loads, support conditions (uneven support level for instance), environmental loads, uneven pulling/pushing loads and friction loads experienced during the loadout operation.

9.2.1.1 Weight and centre of gravity

- The loadout analysis shall be based on the best estimated object weight and centre of gravity, derived from the Weight Control Report. Final loadout analysis shall be assessed after object weighing.

The loadout analysis shall consider the following contingencies depending on the weight reference:

- The Pre-service Budget weight as defined in section 8, when applicable (i.e. for topsides)

- Same contingencies on the object weight as in the weight control report - which corresponds to the maximum expected weight - when the weight control report is the reference for the load cases
- A global contingency that corresponds to the weighing accuracy, with a minimum of 3% - when the weighed weight is the reference for the load cases
- The extremes of a CoG envelope centred on the calculated CoG, which corresponds to a rectangle whose sides are:
 - . 5% of the overall width and length for a jacket, a flare, a vent boom or a bridge
 - . 10% of the overall width and length, and not less than a 2 m x 2 m square for a deck.

Whenever the results of a weighing (if any) would show a weighed weight greater than the maximum expected weight and/or an excessive CoG shift, the loadout calculations shall be revised to consider the weighed weight and CoG, and the structures shall be reinforced accordingly if required.

- The weighing of the object shall be performed as specified in **GS EP STR 001** and/or as specified in the Project Particular Specification.

In case the weighing is performed with a jacking system, a contingency factor of not less than 1.10 shall be conservatively applied to the weighed weight.

In case the weighing is not possible, the weight and centre of gravity of the object shall be calculated with a great degree of accuracy prior to loadout and a contingency factor shall be conservatively applied to the calculated weight. This contingency factor, which depends on the accuracy of the Weight Control for all the loads (structural, equipment, etc.), shall not be less than 1.10, unless otherwise indicated in the Project Particular Specification.

- The loadout manual shall be updated after final object weighing, in particular to consolidate the ballast procedure.

9.2.1.2 Design cases

- The loadout scenario shall be documented in detail and all specific loads generated in the object during loadout operation shall be identified. A calculation note shall be presented to Company and MWS to demonstrate the acceptability of these loads and any corresponding reinforcement required for the object.

A loadout operation does not represent one well defined load case, but a sequence of different load cases. The loadout operation shall be considered step-by-step and the most critical load cases for each specific element shall be identified.

Intermediate stops or parking areas shall be considered and defined.

- When the loadout procedure is not known (at basic engineering stage for instance), the loadout analysis shall be performed considering the two following cases:
 - Normal case: a vertical displacement of ± 30 mm shall be imposed to each object support point. These elementary support point deflections shall then be combined to cover any situation that can be met during loadout. The member stresses resulting from this analysis shall be compared to basic allowable stresses without the one third (1/3) increase even in case of loss of contact.

- Extreme case: each object support shall be successively released (no support) or a maximum displacement of ± 60 mm shall be applied (three supports for a four point loadout arrangement and one row unsupported for a multipoint loadout arrangement). The member stresses resulting from this analysis shall be compared to the basic allowable stresses with the one third (1/3) increase.
- For a skidded jacket, as extreme cases, the structure stresses shall be checked and compared to basic allowable stresses with the one third (1/3) increase, for the following conditions as a minimum:
 - The forward end of the jacket is cantilevered off the end of the fabrication yard skidways and the barge is ballasted to an elevation lower than required. The critical position is when the centre of gravity of the jacket is just at the end of the yard skidways.
 - The forward end of the jacket is resting on the barge but the centre of gravity of the jacket is still not on the barge skidbeams, and the barge is ballasted to an elevation higher than required. This will lift the jacket forward end until the jacket is supported at the extreme ends of the jacket leg launch runner.
 - The forward end of the jacket is moved onto the barge until the jacket centre of gravity is just on the barge skidbeams and the barge is ballasted to an elevation higher than required. The jacket tailing end would be cantilevered off the end of the barge.
- The skew loads due to misalignment between the barge and the quay skidways or uneven ballasting or uneven jacking/pulling/pushing loads shall be considered. The values to be used for support out-of-level shall be indicated in the Project Particular Specification and subject to Company approval.

Longitudinal and transversal stability of the object shall be demonstrated with a minimum horizontal acceleration of 1 m/s^2 combined with the environmental loads and one damaged compartment.

For trailer loadouts, the reactions imposed onto the object by the trailer configuration shall be considered. The global stability shall be checked (bends, lateral loads, etc.)

- Stress levels shall be within those permitted by **API RP 2A**. One third (1/3) increase for allowable stresses shall not be allowed for the normal case considering a minimum vertical displacement of ± 30 mm between two adjacent supports. This value shall be documented by the Contractor taking into account the levelling control system and a reasonable achievable value. The details of the calculations shall be submitted to Company, MWS and Third Party if any for review/approval.
- Compatibility of support strength and elasticity against the support conditions used for analysis of the object shall be demonstrated.

Any intermediate supporting element between the object and the ground shall be checked according to above requirements, fabricated and inspected according to **GS EP STR 301** and classified in first category.

Consideration shall also be given to lifting off construction supports or onto seafastening supports when these operations form an integral part of the loadout operation taking into account re-distribution of forces and dynamic effects, sagging and hogging, tolerances, etc. during load transfer operations

9.2.2 Quay and soil

9.2.2.1 Foundations

The adequacy of the quay, quay approaches, wall and foundations for the loadout shall be demonstrated and documented (including calculation notes), based on the proposed loadout scenario, the load distribution along the skidways and the vertical and horizontal peak loads at quay wall.

Compatibility between quay strength/elasticity and the support conditions used for the analysis of the object shall be demonstrated.

The capacity of all mooring bollards, winches and other attachments to be used shall be demonstrated and documented.

9.2.2.2 Seabed

Bathymetric information for area covered or crossed by the barge during loadout, post-loadout and sail way shall be supplied.

The seabed in front of the loadout quay shall be inspected for obstacles by divers or by an adequate survey method if the barge underkeel clearance is considered as critical.

Underkeel clearance shall not be less than 1.0 meter during and after the loadout operation.

9.3 Systems and equipment

9.3.1 Skidways, skidbeams, skidshoes and link beams

9.3.1.1 Design of skidding equipment

- For each loadout scenario, loads to be experienced by the skidding equipment (skidways, skidbeams, skidshoes and link beams) shall be clearly identified and documented.

Adequate strength and stability of the skidding equipment and the load distribution in the object, the quay, the link beams, the barge and other loadout equipment, shall be demonstrated and documented considering all possible load combinations experienced during the loadout, such as - but not limited to:

- Differential settlement loads
- Uneven support level load
- Uneven horizontal push-pull load/effects of eccentricity of the push-pull loads
- Friction loads
- Wind loads
- Lateral loads
- Dynamic loads.

Longitudinal and transversal stability and integrity of the object to be loaded and the skidding equipment shall be demonstrated with a minimum horizontal acceleration of 1 m/s^2 combined with the environmental loads and one damaged compartment.

- Compatibility between strength and elasticity of the skidding equipment and the support conditions used for the loadout analysis of the object (see section 9.2.1) shall be

demonstrated. Local web stiffening of the skidding equipment shall be provided at the point loads to avoid any web buckling or crippling.

9.3.1.2 Link beams

In addition to the strength and stability requirements mentioned above, link beams shall be checked for loads induced by barge moorings, barge movements and pull/push on or pull/push back forces induced by loadout operation or emergency load off back to quay.

Tolerances on link beam movement shall be shown to be suitable for anticipated movements of the barge during the operation.

Alternative proposals and methods without link beams can be considered and can be approved if they are documented to comply with safe practice and all above requirements.

9.3.1.3 Sliding interface and friction coefficients

Particular attention shall be given to the design and fabrication of the sliding interface, which shall withstand the flatness defects of skid shoes and skid beams and their relative deformations.

Depending on the sliding surfaces, the following indicative coefficients of friction may be experienced during loadout. The loadout Contractor shall substantiate the choice of friction coefficient and lubrication used in the loadout calculations.

Level surfaces	Static			Moving		
	Min.	Typ.	Max.	Min.	Typ.	Max.
Sliding						
Steel/steel	0.15	0.20	0.35	0.10	0.15	0.25
Steel/grease/steel	0.10	0.15	0.30	0.08	0.12	0.20
Steel/Teflon	0.10	0.15	0.25	0.04	0.05	0.10
Stainless steel/Teflon	0.08	0.10	0.20	0.03	0.04	0.07
Teflon/grease/planed wood	0.08	0.14	0.25	0.03	0.06	0.08
Teflon/grease/wood	0.10	0.18	0.30	0.05	0.10	0.15
Steel/wood	0.20	0.40	0.60	0.15	0.30	0.40
Steel/grease/wood	0.15	0.30	0.40	0.10	0.15	0.20
Rubber tyres (locked)	0.20	0.35	0.50	-	-	-
Rolling						
Steel wheels/steel		0.01			0.01	
Rubber tyres/steel	0.01		0.02	0.01		0.02
Rubber tyres/gravel	0.02		0.06	0.02		0.04



9.3.1.4 Barge grillage and skidbeams

The grillage/skid beams on the barge shall be installed with the barge ballasted such that the deflected shape of the barge is the same as the static transportation condition.

The differential hogging or sagging of the barge due to different load/ballast arrangement at skid beams pre-installation stage shall be compensated by shimming. Longitudinal stability of the skidbeams on barge during the loadout operation shall be ensured by minimum welding. Final longitudinal welding of the skidbeam after the loadout operation shall be done when the barge is ballasted in the transport ballast configuration.

The area corresponding to the transport location shall be checked to ensure that the supports are at the nominal elevation with a tolerance of ± 5 mm. If not, shimming underneath the deck shall be required after loadout before setting down of the object on its final transportation supports.

9.3.2 Winches and jacking systems

9.3.2.1 General

- Mixing systems with jacks and winches is prohibited: only one system shall be used for moving the object to the final position on the barge, except for the break-out (i.e. start up) for which the assistance of additional pushing jacks is required.

The overall pushing jacks capacity shall be about 40% of the total required break-out load assuming a maximum static friction of 25% for a skidding operation.

A braking system capable of arresting object movement is required for all stages of the loadout.

- The capacity of the winching or jacking system shall take into account the slope, the sliding or rolling friction and losses in sheaves. Except for grounded loadouts, a barge inclination of 1.0% in addition to any planned inclination shall be accounted for.
- The winching system, when used, shall be capable of moving the object from fully on the shore to fully on the barge without re-rigging.

The nominal calculated load on winching systems shall not exceed 80% of the certified Safe Working Load (SWL), unless full capacity test has been performed, after allowance for splices, bending, sheave losses, wear and corrosion and after taking into account the requirements of sections above. If no certified SWL is available, the nominal computed load shall not exceed a quarter (1/4) of the breaking load of any part of the system and a load test of the system shall be performed at $1.25 \times \text{SWL}$ or $0.33 \times \text{MBL}$ prior to the operation.

The complete winching system and any part thereof, including pulling eyes, tie bars and link-plates, multi-sheaves pulley blocks, shackles, pins, pulling wires, etc...shall be designed and justified for the full pulling capacity of the winch, even if the friction is anticipated to be much less than the full pulling capacity. In case any winching or jacking system is capable of exerting a greater force than the capacity of any other part of the pulling system, the winching system shall be fitted with a cut-out to prevent the system from SWL being exceeded, and the winch operator shall be clearly and formally instructed in not exceeding the SWL of the system.

9.3.2.2 Redundancy and back-up capacity

- The winching or jacking system shall have a redundancy capacity such that the loadout can still proceed and be completed in the event of failure of any one mechanical component, hydraulic system, control system, power source.
- The back-up capacity for accidental conditions will be able either to complete the operation or to pull the object back to shore.

The pull back system, when needed, shall have the same capacity than the pulling system and shall be designed according to the above requirements (see section 9.3.2.1).

The loadout reversibility requirement can be forfeited provided that the loadout Contractor demonstrates that:

- The ballasting system has capacity to compensate for the maximum tide rise/fall through one complete tide cycle expected for the planned loadout month ± 1 month, with the object in any position.
- No damage is induced to the object when stopped in the most critical position. This situation is an extreme case where the one third (1/3) increase for allowable stresses is to be considered.
- The loadout equipment has sufficient redundancy capacity to complete the loadout operation.

These conditions shall be documented and subject to Company and MWS approval.

9.3.2.3 Quay - barge interface

For sensitive and critical loadout operations, vertical jacks and anti uplift jacks shall be provided at the quay to control/monitor the barge reactions at the stern or bow or side depending on the loadout type (longitudinal or transversal) during the loadout (see Appendix 2).

9.3.3 Trailers

The following shall apply when using trailers for loadout:

- Maximum axle loading shall be shown to be within the trailer Manufacturer's recommended limits.
- "Footprint" pressure on the quayside, link beam and barge deck shall be shown to be within the allowable values.
- Shear force and bending moment curves shall be prepared for the trailer spine structure, and maximum values shall be shown to be within the Manufacturer's allowable limits.
- Transverse stability of trailers and any intermediate structural piece between trailers and the object shall be analysed, especially if movements other than straight line route are planned for loadout operation.
- Longitudinal and transversal stability and integrity of the object to be loaded and the trailers shall be demonstrated with a minimum horizontal acceleration of 1 m/s^2 combined with the environmental loads and one damaged compartment.
- The trailer arrangement shall be compatible with the support assumptions considered in section 9.2 and with the barge grillage arrangement.



- When the trailers are winched onto the barge, then the requirements of section 9.3.2 shall apply.
- Where motive power is provided by tractors, or the trailers are self-propelled, then the requirements of section 9.3.2 shall be met and the reversibility of the motion shall be demonstrated.
- Adequate back up system shall be provided such that the loadout can still proceed in the event of failure of any one mechanical component, hydraulic system, control system, prime mover or power source.
- Particularly in case of multipoint loadout, special care shall be taken to ensure that the object will come and rest in contact with all supports when the trailers are lowered and removed. Appropriate barge deck level survey and supports levelling shall be performed prior to loadout and required shimming, if any, anticipated. Due consideration shall be given to barge deck deformation with barge ballasting such that the loadout supports are perfectly levelled in the transport condition. The trailers shall not be removed until satisfactory levelling has been achieved.

9.3.4 Lifted loadouts

The following shall apply when using shore-based or floating cranes for:

- Lifting the object, parts of the object or heavy equipment onto the barge
- Lifting parts of the object or heavy equipment on the yard during erection phase.
- An inshore or onshore dynamic factor shall be considered (see section 11.2.3.4).

For shore-based crane(s) when transit with the load is required, the lifting operation shall be within the certified crane load-radius curve, including a DAF of 1.25.

For shore-based crane(s) in a fixed position (no crane movement other than lifting, lowering or slewing), the lifting operation shall be within the certified crane load-radius curve, including a DAF of 1.1, unless otherwise agreed by Company.

For floating cranes, the intended hook load including DAF as per table given in section 11.2.3.4 shall be less than the maximum lift capacity of the proposed crane(s). If this calculated hook load including DAF is above 90% of the maximum lift capacity, the maximum lift capacity of the proposed crane shall be considered for the lifting analysis.
- Loads imposed by shore-based cranes on the quay shall be shown to be within allowable values.

All ground areas shall be carefully prepared with concrete pads and/or steel bearing mats to avoid any differential settlement and obstruction.
- Lifting forces for an object to be loaded out by direct lift onto the transportation barge shall be evaluated when lifting arrangement differs from the one to be used for installation. In that case, appropriate dynamic, skew and safety factors shall be defined considering the expected local conditions and the requirements of sections 11.2, 12.2.1 and 12.4.2 shall be satisfied.
- Certified SWL of slings and shackles shall be in accordance with section 11.2.5.
- When the offshore lifting points and spreader beams/frames are used for loadout, then 100% visual inspection and 100% NDT inspection (MPI and UT inspection or AFCM

inspection. This alternate non-destructive weld inspection method can be used through paint and coating. If a crack is detected with AFCM technique, near crack area shall be cleaned from any painting, complementary inspection performed - UT & MPI - and defect repaired with an approved procedure) of the lifting points, spreader bars/frames and their connections with the object shall be carried out before and after loadout operation.

- Means of preventing sway or rotation of the load during lifting and transit shall be provided.
- Slewing of the rear transporters shall be performed to check the preparation and capacity of its path.

Water level shall be installed on the crane or front transporter.

9.3.5 Grounded loadouts

- Survey of levels over the area covered by the bottom of the barge showing suitable support conditions for the barge shall be performed by Contractor and submitted to Company and MWS.

A diver or side-scan survey shall be made shortly before positioning the barge to ensure that no debris exists which could damage the barge bottom plating.

- If even support below the whole barge bottom plating cannot be achieved, then calculations shall be submitted showing that no overstress will occur.
- The barge shall be ballasted to provide sufficient ground reaction to withstand the 10-year return period storm loadings, in both pre- and post-loadout conditions, at mean high water spring tide and 10-year storm surge condition.
- The barge should be positioned and ballasted onto the pad several tides before the loadout operation, and pre-loading by ballasting shall be carried out, to allow for consolidation and settlement. Barge levels should be monitored during this time.
- Final skid way levels shall be compatible with assumptions used for structural analysis as in section 9.3.1.
- According to the nature of the sea-bottom, the installation of jetting or air-lifting devices in the area under the bottom of the barge may be needed prior to barge grounding to ensure the barge taking-off operation.
- The ballast shall be adjusted during loadout, if required, to avoid barge settlement or overstress.

9.3.6 Pumping and ballasting

9.3.6.1 Ballasting system

- The ballasting system shall be documented, as part of the ballast procedure, with:
 - Ballast manual of the barge when applicable
 - Arrangement drawings
 - Line diagram(s) for the ballast piping and/or distribution system
 - Line diagram(s) of the compressed air system when applicable