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|   | AREA:                                    |            |                               |        |        |        |        |        |          |   |    |    |
| SRGE  | <b>WEIGHT CONTROL PROCEDURES</b>         |            |                               |        |        |        |        |        | INTERNAL |   |    |    |
|   |  |            |                               |        |        |        |        | ESUP   |          |   |    |    |
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| A   | General Revision                         |            |                               |        |        |        |        |        |          |   |    |    |
| B   | Adjusting Document Cover and Header      |            |                               |        |        |        |        |        |          |   |    |    |
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TITLE:

**WEIGHT CONTROL PROCEDURES**

**INTERNAL**

**ESUP**

**SUMMARY**

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## 1. INTRODUCTION

The Purpose of this document is to explain how the activity "Weight Control" is supposed to be performed during the basic design and FEED (Front End Engineering Design) and to give to the CONTRACTOR the global directives, in order to proceed with the weight control during the detailed design and construction phases.

This document contains a generic description showing how several different systems are to be considered in the Weight Control.

The CONTRACTOR shall present his procedures based on the directives given herein and in the Annex III. This annex presents an example of a "CONTRACTOR's weight control procedure" to be issued for PETROBRAS approval.

The objective of the activity "Weight Control" is to control the weight evolution along design phases and subsequent phases, by grouping items with their weights and centers of gravity, totaling these data, identifying trends and determining corrections, in order to assure that the unit will achieve estimated stability and motions performance. It is also used for structural calculations.

Each item must have its origin specified according to the following parameters:

- Manufacturer data;
- Catalogue data;
- Weighing data;
- Estimate;
- Calculation Report;
- Database;
- 3D model;
- SPPID;
- Previous WCR (Weight Control Report);
- Others\*.

\* In this case, the leader of the discipline responsible for the item must inform its origin.

The transverse center of gravity (TCG) in relation to the center line shall not exceed 4% of the unit's breadth in order to avoid future fixed ballast compensations. Thus, the TCG is not supposed to divert to one side, or as usual, to the risers balcony. If the TCG surpasses the referred maximum, the RD (responsible for discipline) of the weight control shall contact the RD of the arrangement and/or the Design Coordinator to correct this impact in the design.

It is mandatory to define in the WCR what is considered Hull, Topside and Accommodation.

**Hull:** It is considered hull the floating structure, all equipment and systems located inside the hull and in the Main Deck and the upper and lower risers balcony.



**Topside:** Everything fixed on the stools or multipoint supports and the Flare System. It is important to say that during the lifting campaign some equipment placed on the upper part of a module can be removed due to the limited lifting capacity of the shipyard and thus their weights need to be subtracted for the weight calculations. Posteriorly they must be incorporated to the referred module after it is integrated to the unit.

### 1.1. LIFTING

Every equipment to be lifted with the module must belong to the referred module.

When a module is to be lifted, it is expected that all equipment that belong to that module will be lifted together with it.

The Weight Control Representative shall check, in the Design Bases, if there will be any weight restriction for the modules lifting. This should be foreseen due to the lifting of shipyards capacity.

### 2. RESPONSIBILITIES

A weight control responsible should be assigned for the whole unit. As the design comprehends –all design disciplines (structure, safety, mechanical, naval architecture, electrical, piping, instrumentation & automation, architecture, telecommunication, naval systems, HVAC, etc.), each discipline must have a person designated as responsible for the weight control of items related to that discipline. This person is called Responsible for the discipline (RD).



### 3. SUBDIVISION / CODING

. The Weight Control subdivision structure is divided in three levels as follows:

1º level: PARTS – Identified by Topside (composed by all equipment that are in modules, pipe rack, riser pipe rack and flare system); Hull (all equipment that are in its limits); Accommodation (composed by all equipment that are in its limits), and Areas (all equipments that are in its limits);

*It is necessary to define the Parts limits (Xmin, Xmax; Ymin, Ymax; Zmin, Zmax).*

2º level: MODULES, Pipe rack, riser balcony – Just like in the first level (Parts), it is necessary to define the Modules limits (Xmin, Xmax; Ymin, Ymax; Zmin, Zmax) and inform their names.

3º level: ITEMS – It is necessary to insert the data of each item according to the Responsible.

#### 4. DATA FOR PARTS, MODULES AND ITEMS

##### 4.1. PARTS

- Description of the Part according to chapter 1 (Introduction).

##### 4.2. MODULES

- Description of the Module according to chapter 1 (Introduction).

##### 4.3. ITEM

- 
- *Part* – Identification of the Part that the item is inserted. Example: Topside, Hull, Accommodation, etc.
- *Module* – Identification of the Module that the item is inserted.
- *Discipline* – Discipline responsible for the item.
- *Name* – Weight item description.
- *Weight* - weight of the complete item (see Annex I for item components considerations) for dry, operating and test condition.
- *Center of gravity (X, Y, Z)* - which defines the position of the item center of gravity.
- *Contingency factor* - percentage of uncertainty referring the weight of the item.
- *Fluids Contingency factor* - percentage of uncertainty referring the weight of fluids inside of item.
- *Dimensions of the items* – and their dimensions (Xmin, Xmax, Ymin, Ymax, Zmin, Zmax), with reference to the coordinate system indicated.
- *Responsible* - indicates the discipline responsible person according to the abbreviation glossary.
- *Revision*
- *Tag/Remark* - Identification number according to PETROBRAS Internal Rules N-1521/N-1522.
- *Change Date* - It indicates the date when an item is inserted or modified..
- *Item weight origin* – The discipline responsible person has to indicate the origin of the weight item according to chapter 1 (Introduction).
- *Optional Item Code* – Code according Annex II. The objective of this code is separate the items according the process or objective of item.

## 5. CONTINGENCY FACTOR

The contingency factor determines the margin (always positive) considered, due to the uncertainties in the weight estimate. This factor is to be updated (reduced) during the project phases as the uncertainties are being reduced.

This margin is set up for each item as a percentage of the given weight.

In the beginning of a Basic Design, the sum of the weight of an item with its contingency factor shall be the maximum value that this item should be weighed with its contingency factor at the end of the Detailed Design. It means that the possible increase of the weight of an item during the all phases of the Design shall be accompanied with the decrease of the contingency factor.

In Table 5.1 below it is shown the contingency level that normally is suggested in all design phases.

Table 5.1 - Contingency level of the weight considering all design phases

| Discipline \ STEP   | Conceptual Design |     |               |      |      |          |          |
|---------------------|-------------------|-----|---------------|------|------|----------|----------|
|                     | Basic Design      |     |               |      |      |          |          |
|                     |                   |     | Detail Design |      | AFC  | As-Built | Weighted |
| Primary Structure   | 20%               | 15% | 10%           | 7%   | 5%   | 3% ~ 1%  |          |
| Secondary Structure | 25%               | 20% | 12%           | 7%   | 5%   | 3% ~ 1%  |          |
| Hull Structure      | 20%               | 15% | 10%           | 5%   | 4%   | 3% ~ 1%  |          |
| Mechanical          | 25%               | 20% | 12%           | 7%   | 5%   | 3% ~ 1%  |          |
| Piping              | 25%               | 20% | 12%           | 7%   | 5%   | 3% ~ 1%  |          |
| Electrical          | 25%               | 20% | 15%           | 10%  | 5%   | 3% ~ 1%  |          |
| Instrumentation     | 25%               | 20% | 15%           | 10%  | 5%   | 3% ~ 1%  |          |
| Architectural       | 25%               | 20% | 15%           | 10%  | 5%   | 3% ~ 1%  |          |
| HVAC                | 25%               | 20% | 15%           | 10%  | 5%   | 3% ~ 1%  |          |
| Safety              | 25%               | 20% | 15%           | 10%  | 5%   | 3% ~ 1%  |          |
| Global (approx.)    |                   |     | 12%           | 6.5% | 4.5% | 3% ~ 1%  |          |

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## 6. COORDINATE SYSTEMS

The center of gravity of the Unit is given with reference to the global coordinate system, which shall follow right hand rule. The global coordinate system shall be clearly described in the Weight Control report.

## 7. REPORTS AND REVISIONS

For each Part and for the complete Unit, weights (with and without contingency factor) and the COG shall be presented at each report.

Revisions, at Basic Design, are supposed to be issued in conjunction with General Arrangement revisions or whenever major changes are detected. Revision of the weight control is designated by letters in sequence (A, B, C,...), starting with 0 (zero) for the original or PR for the preliminary report.





## 8. ANNEX I - CONSIDERATIONS ON WEIGHT CONTROL PROCEDURES

Basic design takes major decision on weight and weight control. Detailed design is the main responsible for weight control over steel works and material choice.

Early stage weight forecast cannot be limited to listed items. A great number of items not listed shall be attached to the unit during conversion or construction. Small items in great number shall add significant weight. These items shall be included as “miscellaneous”.

Early stages of the design cannot transfer responsibilities for missing items, or under evaluated weight and centers of gravity to later stages. Optimistic assumptions must be considered together with adequate amounts.

Structure and steel works must be carried out very carefully since early stages of the project, setting the best forecast for each listed item and margins for minor not listed items. Detailed design must be performed within defined weights. Very usual mistake is to relax weight control on dimensioning of auxiliary structures during detailing phase.

General arrangement must care for area and walk ways. Area expansion during assembling or detailing phase which is not accounted means enormous non predicted weight increase. Steel material specification during assembly is very important and must be in accordance to the predicted weight.

Excess weight on a single item is not a problem, because it can generally be compensated on other items, however such excess is to be treated like an exception and not accepted as a matter of rule.

At the completion of platform construction, CONTRACTOR shall perform an inclining test as required by Classification Society (CS) and International Maritime Organization Code (IMO-Code).

### 8.1. Weight Reduction

Steel is the major item of weight on a vessel, so every steel detail specification must be rigorously controlled.

Steel may be divided in major items:

- Hull structural steel: It is a consequence of the decisions taken in basic design, and control on scantlings is mandatory.
- Steel works and supports: Although this item represents a weight smaller than hull steel, it plays the major importance on deck load. Steel works include handrails, skid bases, ladders, working platforms, supports, pipe racks, riser hangers, hatches, pipe supports in general, helideck, crane pedestals, rails and reinforcements to the structure. Great efforts are generally dedicated to the optimization of hull structure, however little efforts are dedicated to the dimensioning of steel works, although they constitute a high center of gravity load. In terms of cost, steel works represent less than 5% of the cost of the Unit, so more expensive solutions, aiming weight reduction, may be used with insignificant impact to the overall cost.
- Pipes: Pipes are generally made of steel, and represent a small stake on the overall cost of the Unit, but a significant stake on deck load. Major decision on amount of pipe takes place during design phase, when systems and arrangements are defined. However, a precise evaluation of pipe amount during basic design phase is very difficult. Initially large margins are generally allocated for piping.

- Equipment: Heavy equipment, like turbo compressors, pumping units, turbo generators, represent a major stake on deck load. Lighter weight solutions, however, may have a significant impact on costs. Notwithstanding the previous sentence, it is to be kept in mind that skid bases and steel works on package units must have the same consideration as steel works, because they are very heavy, while representing little cost.

## STRUCTURE

The calculation of net steel weight may be based on nominal thickness of plate, profiles and include tolerance of plate fabrication and welds (approximately 1.9%).

Miscellaneous weight item may be considered (approximately 3% of steel weight) with the purpose of including small reinforcement plates not considered in the weight control calculation and other modifications generated in the detailed engineering.

The item "foundation for equipment" considers only local reinforcements in the equipment supporting region, to be included in the detailed engineering design. The weight of equipment skids is not to be included in the structural items, but in the equipment discipline.

It may be considered that the weight reductions due to openings, holes, doors, etc. will be compensated by the corresponding local reinforcements.

Structure weight considers only main ladders, handrails, platforms and railings of the hull. Therefore, similar items that belong to the equipment are included in the equipment weight calculation.

Only main pipe-racks in the general arrangement drawings are to be considered in the proper structural item.

## EQUIPMENT

*For weight distribution purposes, the following philosophy shall be adopted:*

- Pumps and compressors (driven by electric motors) comprises the pumps, compressors, motor, skids, instrumentation and accessories. The instrumentation mounted on the suction and discharge lines is not comprised.
- Fire pumps (driven by diesel engine) comprises pumps, gear and diesel engine (with accessories and instrumentation mounted on the same skid). Diesel tank, start-up air bottles and pipes are not comprised.
- Tanks, towers, filters, separators and heat transfer equipment comprises hull, internals, skid and eventually the access stairs and platforms. Instrumentation on the lines is not comprised.
- Crane - The crane pedestals and boom rest supports are not comprised.
- Package units (air compression units, helicopter refueling, desulfurization unit, etc...) comprise instrumentation, piping, cables and equipment mounted on the skid.
- Monorail comprises webs, trolleys and lift gear.
- Test burner comprises burner, boom pipes and cables.
- Flare comprises only the burner. Boom, pipes and cables are not comprised.
- Water heating comprises base, furnace, fans, panel and everything mounted on the skid.



. Gas compression unit comprises turbocompressor skid, process skid, local control room and pipes connecting the equipment to the process skid. The weight of the waste recovery heat exchange is to be divided between the two turbocompressors.

. Turbogenerator comprises the turbogenerator itself and the skid with the local accessories. The weight of the waste recovery heat exchange to be divided between the turbogenerators.

### **INSTRUMENTATION**

Instrumentation (including instrumentation cables) comprises cables and fittings necessary to their installation. The instrumentation weight is considered within the weight of the item (equipment or pipe) where it is installed.

Bilge system comprises the instrumentation and instrumentation cables within the hull.

### **VAC**

"Fans" comprises motor and base.

*"Ducts" comprises dampers, diffusers, air filters, insulation and fittings.*

*Condensing units comprise the unit itself, air coolers, electric motor, piping and base.*

### **PIPING**

Piping comprises pipes, support fittings and insulation.

### **ACCOMMODATION**

The weight of accessories and fixing devices of furniture, shelves, hooks, deck cover, etc... are considered within "miscellaneous".

## **8.2. Weight Control Report**

Weight Control Report shall be periodically (e.g.: in six weeks) issued and shall indicate all design conditions.

Weight Control Representative shall prepare a trend analysis plotting all totals from previous reports in a graphic showing evolution as a function of time. All variations (increases and decreases) shall be indicated for each part and for the totals. It's important to have such analysis for future scenarios, before reaching a point of non-return (i.e., managers are to be informed of consequences of planned actions before fabrication or purchase is turned into a fact).

Each weight evaluation sets a new forecasting of the final weight and new margins are established. As the construction and assembly trends to the end the forecast shall be closer to the final weight, independently if such final weight is acceptable or not.

*The Annex II is the itemization tree that help to remember some weight item that are mentioned in that tree.*

## 9. ANNEX II - ITEMIZATION TREE STRUCTURE

### 1 HULL

#### 11 HULL

- 111 Hull (Pontoons for semisubmersibles and TLP's)
- 112 Columns and braces (for semisubmersibles and TLP's)
- 113 Upper hull
- 114 Pull-in and offloading structure
- 115 Superstructure
- 116 Production plant deck
- 117 Machinery/Engine room
- 118 Vent/Flare
- 119 Helideck

#### 12 ANCHORING AND MOORING STRUCTURES

- 121 Turret
- 122 Fairlead or mooring porch (for semisubmersibles, SPAR Buoys and TLP's)
- 123 Hawser structure (for Turret and DICAS)

#### 13 MISCELLANEOUS STAIRS, LADDERS AND LIFTS

- 131 Railings, platforms, stairs and ladders, external
- 132 Stairs and ladders, internal (exc. mach. spaces)
- 133 Ladders in cargo holds and tanks
- 134 Lifts
- 135 Shore gangway, pilot lifts, accommodation ladders

#### 14 DOORS, WINDOWS AND HATCHCOVERS

- 141 Bunker and pilot ports, stores hatches etc.
- 142 Automatic doors
- 143 WT doors and other steel doors
- 144 Windows
- 145 Access hatches and manholes covers
- 146 Hydraulic piping for group 14

#### 15 MISCELLANEOUS EQUIPMENT AND PROTECTION

- 151 Deck coverings, external
- 152 Sun and wind shields, awning

#### 16 SERVICE SYSTEMS, VESSEL

- 161 Air and Sounding Pipes
- 162 Ballast Systems
- 163 Bilge System
- 164 Level Indicator System
- 165 Heating coils in bunker tanks
- 166 Deck drain, clean
- 167 Deck drain, contaminated
- 168 Hypochlorite system

**17 FIRE FIGHTING SYSTEMS AND EQUIPMENT**

- 171 CO2 firefighting systems
- 172 Foam firefighting systems
- 173 External firefighting systems
- 174 Fire and wash down system
- 175 Sprinkler system
- 176 Halon firefighting systems
- 177 Dry powder firefighting systems
- 178 Remaining firefighting systems
- 179 Emergency breathing system

**18 HEATING EQUIPMENT**

- 181 Water radiators, aero tempers and steam heating

**19 VENTILATION SYSTEM**

- 191 Ventilation of machinery spaces
- 193 Equipment for control of air conditioning
- 194 Air conditioning of accommodation
- 195 Ventilation of cargo hold
- 196 Equipment for control of cargo hold ventilation
- 197 Dehumidification system
- 198 Remote reading of cargo hold climate

## 2 DECK AND VESSEL EQUIPMENT

### 21 RIGGING EQUIPMENT

- 211 Masts, derrick posts, derricks and rigging
- 212 *Radar, signal and antenna masts*
- 213 *Provision and hose handling cranes, monorails (exc. such in machinery spaces)*

### 22 STEERING AND STABILIZING EQUIPMENT

- 221 *Rudder, complete*
- 222 *Steering gear*
- 223 *Side Thrusters*
- 224 *Fin stabilizers*
- 225 *Other stabilizers*

### 23 ANCHORING AND MOORING EQUIPMENT

- 231 *Windlasses, mooring winches, hose winches, anchors and chains, anchor wire ropes*
- 232 *Fixed mooring equipment*
- 233 *Loose mooring equipment*
- 234 *Towing gear for tugs*
- 235 *Turret equipment*
- 236 *Fair lead (Semi-sub, Spar, Turret, DICAS)*
- 237 *Hydraulic piping for group 23*

### 24 RISERS ACCESSORIES

- 241 *Bell mouths*
- 242 *Risers spools*
- 243 *Risers hang-off*
- 244 *Pull-in sheaves*
- 245 *Receptacles*

### 25 LIFE SAVING EQUIP

- 251 *Lifeboats, liferafts and davits*
- 252 *Other lifesaving equipment*
- 253 *Special lifesaving equipment and systems*

### 26 FURNISHING AND EQUIPMENT IN DECK STORES

- 261 *Furnishing in deck stores*
- 263 *Deck inventories and tools*
- 264 *Stowing arrangements for spare parts for Main groups 1 and 2*

### 27 OTHER DECK AND VESSEL EQUIPMENT

- 271 *Oil spill recovery equipment*
- 272 *Salvage equipment*
- 273 *Pile driving equipment*
- 274 *Equipment for helideck*
- 275 *External passive fire protection*
- 276 *Floating fenders equipment (for Turret and DICAS)*



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**28 DIVING EQUIPMENT**

- 281 Decompression chambers and diving bell*
- 282 Handling equipment*
- 283 Life support system*
- 284 HP gas system*
- 285 Hyperbaric lifesaving equipment*
- 286 Underwater tools and systems*
- 287 Hydraulic piping for group 29*
- 288 Surface diving system equipment*



### **3 ACCOMMODATION**

#### **31 ACCOMMODATION FOR CREW**

- 311 Insulation of bulkheads and ceilings*
- 312 Deck covering, floors and insulation*
- 313 Panels, bulkheads, ceilings and doors*
- 314 Furniture and inventories*
- 315 Accommodation containers (cabins, toilets, offices, etc.)*

#### **32 SANITARY SYSTEM**

- 321 Fresh water service systems*
- 322 Sea water service systems*
- 323 Sanitary discharge systems, gray water*
- 324 Sanitary discharge systems, black water*
- 325 Garbage shuts in galley and on deck*
- 326 Sanitary equipment*

#### **33 GALLEY, PROVISION STORES, LAUNDRY ETC.**

- 331 Furnishing and equipment in galley, pantry and scullery*
- 332 Refrigeration plant panels and outfitting for refrigerated provision stores*
- 333 Laundry equipment*





## 4 SURFACE AND TREATMENT AND CATHODIC PROTECTION

### 41 SANDBLASTING AND SHOP PRIMING

- 411 Sandblasting and shop priming, automatic
- 412 Sandblasting and shop priming of equipment manually

### 42 PAINTING AND CATHODIC PROTECTION, EXTERNAL

- 421 Painting of hull up to operational draught
- 422 Painting of hull above operational draught and of upper hull
- 423 Painting of main deck
- 424 Painting of deck equipment
- 425 Painting of deck houses incl. outfitting details
- 426 Cathodic protection, impressed current
- 427 Painting of legs and spudcans (jack-up rigs)

### 43 PAINTING AND CATHODIC PROTECTION, INTERNAL

- 431 Painting of cargo hold and tanks
- 432 Painting of clean ballast tanks
- 433 Painting of visible steel in refr. cargo rooms
- 434 Painting behind insulation in refr. cargo rooms
- 435 Painting of other tanks (e.g. fresh water tank)
- 436 Cathodic protection, internal
- 437 Chemical treatment of cargo tanks
- 438 Special surface treatment of cargo tanks

### 44 PAINTING AND CATHODIC PROTECTION, INTERNAL

- 441 Painting of machinery spaces
- 442 Painting of pipe tunnels, cofferdams and chain lockers
- 443 Painting of deck stores
- 444 Painting of steelworks behind panels and ceilings
- 445 Painting of visible steelworks in accommodation

### 45 SIGNS, DRAUGHT MARKS

- 451 Signs
- 452 Draught marks, name and port of registry



## 5 EQUIPMENT FOR CARGO

### 51 CARGO HANDLING EQUIP

- 511 Cargo hatchcovers on the weather deck
- 512 Cargo doors in the shell, bow and stern
- 513 Cargo hatchcovers in the tween decks
- 514 Elevator hatchcovers

### 52 CAR DECKS AND RAMPS

- 521 Car decks
- 522 Ramps
- 523 Car elevators
- 524 Hydraulic piping for group 52

### 53 CARGO HANDLING EQUIPMENT

- 531 Cargo cranes, fixed
- 532 Cargo cranes, traveling
- 533 Derrick posts and booms
- 534 Automatic cargo handling equipment
- 535 Cargo winches
- 536 Maneuvering winches
- 537 Hydraulic piping for group 53

### 54 EQUIPMENT FOR CONTAINER HANDLING

- 541 Stowing devices in cargo holds
- 542 Guide structures on hatch coaming
- 543 Stowing devices on deck
- 544 Platforms and railings in cargo holds

### 55 EQUIPMENT FOR CARGO STOWING, LASHING ETC.

- 551 Gratings on deck
- 552 Cargo battens at side
- 553 Cargo battens on bulkheads
- 554 Guides, lashings and fittings etc. in holds and deck

### 56 REFRIGERATION PLANT FOR CARGO

- 561 Refrigeration machinery
- 562 Piping for sub-group 561
- 563 Control and monitoring system
- 564 Ventilation system and ozone generator
- 565 Drainage system
- 566 Electrical sockets for refrigerated containers

### 57 REFRIGERATION PLANT FOR CARGO (cont'd)

- 571 Insulation and sheathing in holds
- 572 Gratings
- 573 Bins, loose bulkheads etc.
- 574 Insulation of tank top
- 575 Ducts, false bulkhead, etc. for refr. air distribution

## **6 OIL/GAS PRODUCTION SYSTEMS**

### **61 RECEIPT AND DISTRIBUTION OF OIL AND GAS**

- 611 Subsea installation (wellheads and/or prod. manifold)*
- 612 Subsea installation (oil/gas gathering system from remote wellheads)*
- 613 Flexible risers incl. control system*
- 614 Rigid risers incl. control system*
- 615 Wellhead assembly on vessel*
- 616 Production manifold on vessel*
- 617 Start-up/booster compressor system*
- 618 Gas lift system*
- 619 Kill system*

### **62 GAS SEPARATION**

- 621 Test separation*
- 622 Fuel gas separation and fuel gas system*
- 623 First stage separation crude oil*
- 624 Middle stage separation crude oil*
- 625 Separation system at normal pressure*
- 626 Coalescing*
- 627 Glycol treatment and regeneration system*
- 628 Desulfuration system*

### **63 IMPORT CRUDE OIL TREATMENT**

- 631 Crude oil cooling system*
- 632 Special crude oil treatment systems*
- 633 Crude oil transfer system upstream of storage manifold*
- 634 Pull-in equipment*

### **64 IMPORT GAS TREATMENT**

- 641 Gas cooling system*
- 642 Gas cleaning system (scrubbing)*
- 643 Gas compression system*
- 644 Stabilizing system*

### **65 EXPORT CRUDE OIL. HANDLING**

- 651 Crude oil storage transfer pumps*
- 652 Crude oil storage manifold*
- 653 Crude oil transfer system between storage manifold and storage tanks*
- 654 Crude oil export system (pipeline, offshore loading)*
- 655 Crude oil sampling from storage tanks*
- 656 Export crude oil metering*
- 657 Crude oil storage cleaning system*
- 658 Transfer system for emulsions and sludge from storage tanks*
- 659 Oil dehydration system*

**66 EXPORT GAS HANDLING**

- 661 Gas compression
- 662 Export gas compressor plant
- 663 Export gas metering
- 664 Export gas piping
- 665 Gas dehydration and export

**67 TREATMENT OF OILY WATER, EMULSIONS AND SLUDGE**

- 671 Open drain system (from trays etc.)
- 672 Closed drain system (from separators, heat exchangers...)
- 673 Cleaning plant for oil/water from drain systems
- 674 Treatment system for emulsions from production and storage tanks
- 675 Treatment system for solid wastes from production and storage systems

**68 GAS SYSTEM RELIEF SYSTEM, FLARING**

- 681 Gas gathering system between process and vents/flare incl. pipes and K.O
- 682 Vent/Flare system
- 683 Inert gas system

**69 GAS/WATER RE-INJECTION, CHEMICAL INJECTION**

- 691 Compressor plant for re-injection gas
- 692 Equipment for conditioning, cooling, drying and cleaning of re-injection gas incl. injection manifold
- 693 Piping for re-injection gas
- 694 Pumps for re-injection sea water
- 695 Conditioning of re-injection sea water
- 696 Piping for re-injection sea water
- 697 Chemical injection system
- 698 Sea water deaeration and injection

**7 DRILLING EQUIPMENT****71 EQUIPMENT ON DRILLFLOOR**

- 711 Derrick and equipment in derrick
- 712 Draw works
- 713 Rotary equipment
- 714 System for skidding of cantilevered drillfloor
- 715 Tensioners system
- 716 Hydraulic system for pipe racking
- 717 Hydraulic/pneumatic system for tensioners
- 718 Driller's house

**72 BLOWOUT PREVENTION SYSTEM**

- 721 BOP stack, lower marine riser, BOP control station, test station, diverter
- 722 BOP handling equipment

**73 RISER, DRILLPIPES, TOOLS ETC.**

- 731 Tools for drillpipes, riser and casings, fishing tools
- 732 Electric logging unit, wire line unit
- 733 Riser, drilling pipes and casings
- 734 Equipment for handling of drillpipes, riser and casings
- 735 Equipment for well testing incl. burner booms
- 736 Sub-sea TV system, remote controlled vehicle
- 737 Air hoists

**74 JACKING SYSTEM**

- 741 Jacking units
- 742 Racks
- 743 Jetting system

**75 MUD AND BULK SYSTEM**

- 751 HP cementing system and choke and kill system
- 752 LP mud system
- 753 Bulk system
- 754 HP mud system
- 755 Clean oil system for mud
- 756 Drill water system
- 757 Pipe supports group 75

## 8 MACHINERY

### 81 PROPULSION MACHINERY

- 811 *Propulsion machinery*
- 812 *Separate thrust bearings*

### 82 SHAFTING AND PROPELLERS ETC.

- 821 *Reduction gears, coupling etc.*
- 822 *Propeller shafts with bearings*
- 823 *Propeller stern tubes*
- 824 *Fixed propellers*
- 825 *Azimuthing thrusters*

### 83 DRIVERS FOR MAIN GENERATORS

- 831 *Diesel engines for main generators*
- 832 *Steam turbines for main generators*
- 833 *Gas turbines for main generators*
- 834 *Couplings and power transmissions for shaft generators*

### 84 AUX. SYSTEM FOR MACHINERY

- 841 *Fresh water cooling systems*
- 842 *Sea water lifting/cooling systems*
- 843 *Lub. oil systems*
- 844 *Fuel oil systems*
- 845 *Compressed air systems*
- 846 *Exhaust pipes, propulsion machinery*
- 847 *Exhaust pipes, auxiliary machinery*
- 848 *Heating system*
- 849 *Inert gas system*

### 85 HP STEAM SYSTEM

- 851 *HP system*
- 852 *Smoke uptakes for sub-group 851*
- 853 *Feed water and condensate system for group 85*
- 854 *Superheated steam system*
- 855 *Desuperheated steam system*
- 856 *Other HP systems, e. g. exhaust steam, counter pressure, blow-off systems etc.*

### 86 AUXILIARY SYSTEMS, LP STEAM, HOT WATER & OIL

- 861 *Auxiliary steam and exhaust gas boilers*
- 862 *Smoke uptakes for subgroup 861*
- 863 *Fresh water generators*
- 864 *Steam generators*
- 865 *Feed water, condensate and circulation system for group 86*
- 866 *LP steam, hot water and hot oil systems incl. drain piping*



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### **87 MISCELLANEOUS IN MACHINERY SPACES**

*871 Floors, ladders, platforms and railings*

*872 Sea chests*

*873 Lifting gear and transportation equipment*

*874 Tools, equipment and inventories for engineers*

*875 Tanks for various purposes (not integral with structures)*

*876 Incinerator and garbage shuts*

*877 High pressure cleaning equipment*

### **88 MISCELLANEOUS IN MACHINERY SPACES (cont'd)**

*881 Doors in machinery spaces*

*882 Heat, fire and sound insulation*

*883 Insulation of components in machinery spaces*

*884 Installation of spare parts for main group 8*

*885 Piping supports & racks*

### **89 BUNKER AND DOCK TRIALS**

*891 Bunkers for tests and trials*

*892 Tests and dock trials*



## 9 ELECTRICAL, NAVIGATION, COMMUNICATION AND CONTROL

### 91 ELECTRICAL POWER GENERATION AND DISTRIBUTION SYSTEMS

- 911 High voltage
- 912 Low voltage
- 913 DC-system
- 914 Emergency power supply
- 915 Cable trays and supports
- 916 Transformers
- 917 Lighting & small power/electrical heating
- 918 Uninterruptable power supplies (UPS)

### 92 INSTRUMENT AND CONTROL SYSTEM

- 921 Main control and supervision system
- 922 Control and instrument vessel
- 923 Control and instrument drilling
- 924 Control and instrument diving
- 925 Control and instrument process
- 926 Control and instrument subsea
- 927 Station keeping system
- 928 Environmental, meteorological and platform data acquisition system

### 93 LIGHTING AND ELECTRICAL HEATING SYSTEM

- 931 Lighting and small power
- 932 Electrical heating

### 94 NAVIGATION AID SYSTEM

- 941 Navigation equipment

### 95 COMMUNICATION SYSTEMS

- 951 Internal communication
- 952 Master clock
- 953 Entertainment
- 954 Radio plant
- 955 External communication
- 956 TV supervision and monitoring systems
- 957 Fire, gas detection and alarm systems

### 96 CABLES

- 961 Cables
- 962 Earthing

### 97 CABLE SUPPORTS AND STEELWORKS

- 971 Cable supports and penetrations
- 972 Electrical equipment seating and fastenings





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## 10 LIGHT SHIP DISTRIBUTION (ONLY FOR FPSO CONVERSION)

### 10.1 Light weight curve former

*10.11 Light ship distribution*

### 10.2 removed itens

*10.21 Removed itens from light ship distribution*

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## 10. ANNEX III - CONTRACTOR WEIGHT PROCEDURE (EXAMPLE)

### 1. INTENT

The intent of this manual is to explain in detail how the activity "Weight Control" is going to be performed during the detail engineering phase and the construction phase, up to delivery of the Unit.

This manual shall describe in detail the organizational structure for this activity, the personnel involved and their responsibilities, the procedures and all the documents required for the activity "Weight Control".

This Weight Control Manual shall serve as the lead document for all the activities concerning Weight Control. All guidelines set forth in this Manual are to be strictly adhered to and any amendments to the procedures must be authorized by the Weight Control Coordinator, who will document them as a new revision of this Manual. He will be responsible for circulating the amended manual to all concerned for information and action, if necessary.

## 2. WEIGHT CONTROL ORGANIZATION

### 2.1. Weight Control Organizational Structure

The Weight Control activity may be organized as shown in the work chart below:

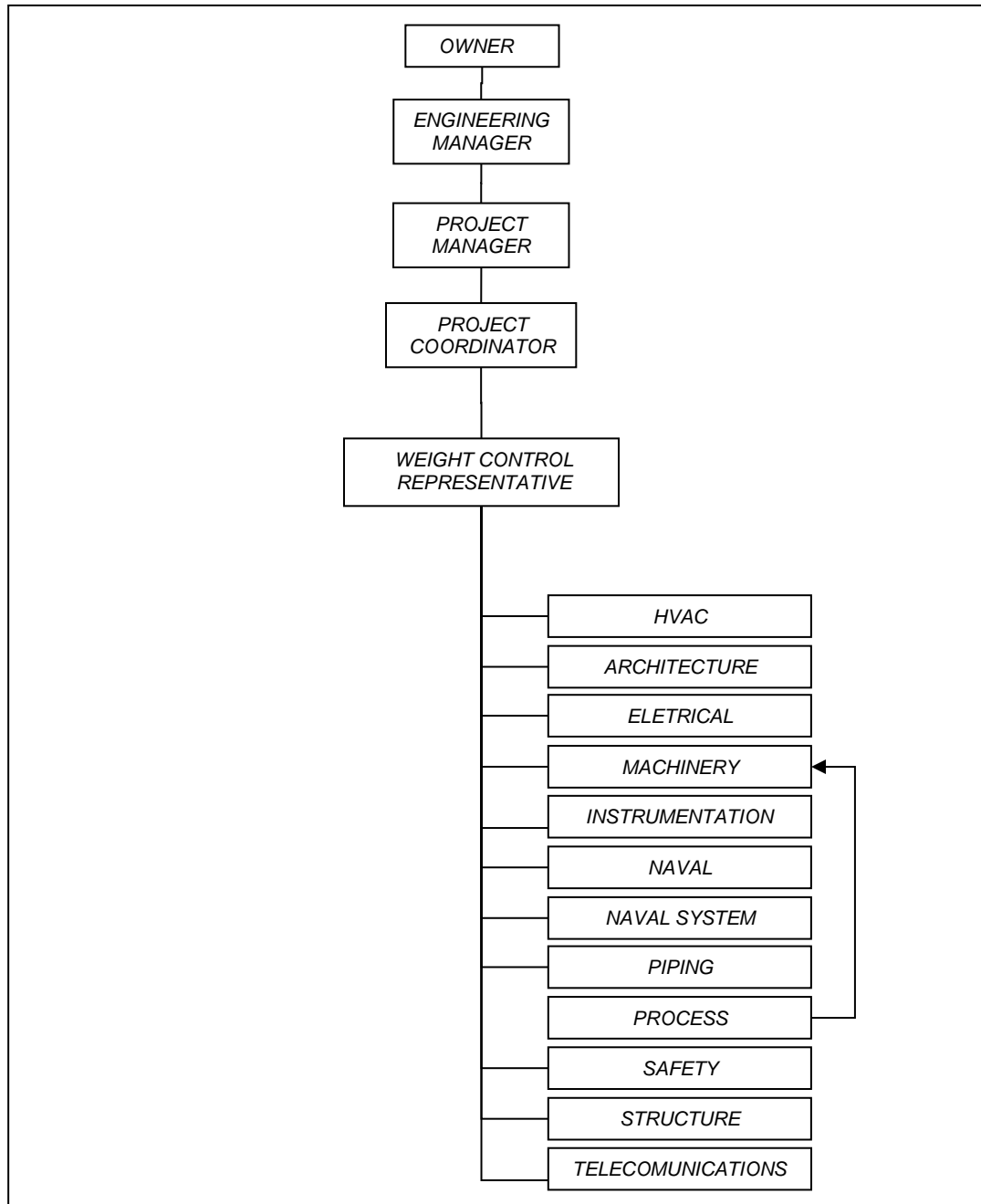


Figure 2.1 - Weight Control Organization Structure



## 2.2. Brief Description of Work Flow

### 2.2.1. Engineering

All disciplines of engineering in the course of their detail engineering work are to calculate to the best of their means the weight of items in their respective area of responsibility. Possible sources of information will be equipment certified drawings from vendors.

### 2.2.2. Project Weight Control Team

The Project Weight Control Team comprising of representatives from the different disciplines of Engineering will monitor control and update the weights.  
(See Section 3 for detail description)

### 2.2.3. Project Engineer, Project Manager and Engineering Manager

The Project Engineer, Project Manager and Engineering Manager will keep contact with OWNER Supervision Team on all matters of Weight Control that require OWNER endorsement.

The Project Engineer shall also ensure that all weight information in tender documents, quotations or purchase specifications be circulated to relevant discipline weight control representative.

## 3. WEIGHT CONTROL PROCEDURE

### 3.1. Scope

The scope of this procedure shall cover the following areas:

- a. the generation of weight data.
- b. the issue of the first Weight Control Report within "N" days of Contract Award in accordance with the provisions of Contract.
- c. the periodically updating of the Weight Control Report.
- d. the endorsement of the Weight Control Report.
- e. the issue of delivery loading condition.
- f. weighing procedures.

### 3.2. Basis

The basis of Weight Control shall be according to the items given in OWNER document Weight Control. The subdivision into subgroups and groups used in above document shall be retained.

### 3.3. Weight Control Procedures

### 3.3.1. Generation of Weight Data

As mentioned above, the basis of Weight Control shall be according to the items given in OWNER document "Weight Control Procedures ". All weight data shall be given on this same basis.

For the calculation of steel structures, the following guidelines should be adopted:

- *the actual S.G. (specific gravity) of steel material used shall be applied for weight computation of steel.*
- *nominal thickness of plates & profiles to be used for weight calculation.*
- *net steel weight will exclude welds.*
- *weight of weld shall be estimated based on empirical percentage of net steel weight. The percentage agreed upon is \_\_\_\_% of the steel weight. Weld CoG must be placed at steel structure CoG.*

*For the calculation of equipment weight:*

- *initial weight of equipment will be based on vendor initial quotations.*
- *the final weight of the item will be based on the information given in vendors final certified drawings.*
- *the C.O.G. of equipment shall also be based on certified drawing information.*

For the calculation of piping items :

- *a weight survey sheet must be prepared for each system (according to OWNER item classification). The line number will act as identified in the weight survey sheet for pipes. Only valves weighing more than 1.0 ton and all control valve shall be entered as separate item.*
- *the C.O.G. of each line will be determined by survey.*
- *the C.O.G of valves weighting more than 1.0 ton can be determined by localization (e.g: module 2 ) or area. For valves weighting less than 1.0 ton, their C.O.G can be assumed the same of the piping or determined by drawings.*
- *initial weight of piping will be in the form of estimates based on initial detail engineering work and to use the geometric center of the module to determinate the CG.*

For bulk items calculation (electrical, outfitting, mechanical etc.):

- *Drawings showing layout/locations of bulk items shall be used and tag marked into convenient sections for the split up of the bulk materials. (Such drawings shall be stamped "Weight Control" and be kept as supporting documents by discipline weight control representative after marking.)*
- *A Weight Input Form (See Appendix \_\_\_ ) will then be used to calculate the weight and C.O.G. of the bulk materials using the tag-marked sections as item.*

All weight data generated will then be submitted in a Weight Update Form supported by relevant documents discussed above. (Details of Update Form will be given in Section 5)



### 3.3.2. Issue of First Weight Control Report

In accordance with the provisions of GTS (General Technical Specification) paragraph \_\_\_ and Clause \_\_\_ of Contract a first Weight Control Report will be submitted within \_\_\_ days of Contract Award.

This first Weight Control Report will be based on all available information and generated in accordance with the guidelines laid down in paragraphs above.

All Weight Update Forms from the various disciplines are to be submitted to the Weight Control Team by the \_\_\_th day after Contract signing. The Weight Control Team will consolidate all the information and compile the first Weight Control Report by the \_\_\_th day after Contract Award.

In this report, all "over weight" omitted and "short counted" items will be highlighted.

The Constructor shall submit to OWNER the first Weight Control Report for endorsement. OWNER will have \_\_\_ calendar days to endorse it.

After endorsement, the Constructor will issue the first Weight Control Report to all concerned for information and the Contractual Loading Condition will be adjusted according to the new weight, if necessary.

### 3.3.3. Periodically Updating of Weight Control Report

The weight control of the platform will be coordinated by the Naval Architecture Section, that will monitor and update the lightweight and center of gravity of the Unit at every\_\_\_weeks in the form of the Weight Control Report.

All disciplines will submit on the \_\_\_th of each period all their update forms supported by relevant documents (see 3.3.1) to the Weight Control Team. Every discipline shall have a representative to submit the weight updates. All equipment weights are supplied by the respective vendors. These equipment weights are further checked and updated by the vendor certified drawing weight.

The Weight Control Team will consolidate all the information and submit to OWNER the Weight Report on the \_\_\_th of the subsequent period.

Constructor will highlight, among other things, all the updated items and its effects on the lightship weight.

### 3.3.4. Site Query on Weight Matters

All material substitution or any other changes requested by production that has impact on weight must be reviewed by the relevant discipline Weight Control representative. The Weight Control representative will prepare a site query in which the impact of weight and its consequences will be stated. This site query will then be submitted for OWNER approval.



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OWNER is to review and approve/reject site query within \_\_\_ calendar days. In the event that the site query is approved, the increase/decrease in weight will be updated in the following weight report. If OWNER rejects the site query, alternatives within the context as stated above must be given. If such alternatives are accepted by the Constructor, their impact on weight will be calculated and updated in the following weight report.

## 4. WEIGHT CONTROL TEAM AND RESPONSIBILITIES

### 4.1. Composition of Weight Control Team

The Weight Control Team shall consist of the following members as shown in figure below:

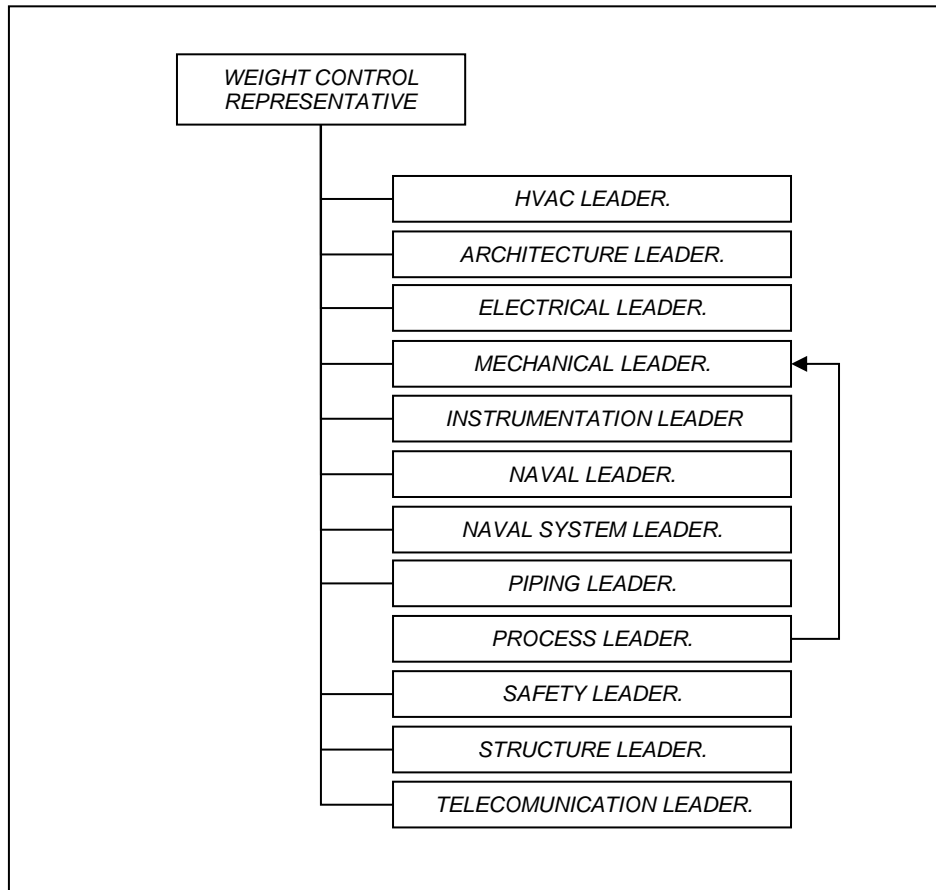


Figure 4.2 - Weight Control Team



## 4.2. Responsibilities

### 4.2.1. Weight Control Team

The Weight Control Team will coordinate all weight related information produced by and received from engineering, and incorporate it into a central information data base. The information in this central information data base will be the basis of the Weight Control Report.

The Weight Control Team will also document and OWNER representative shall witness the weighing of major blocks as stated in the Contract.

### 4.2.2. Weight Control Coordinator

The Weight Control Coordinator shall coordinate the activities of the Weight Control Team in accordance to the procedures set forth in Section 3. His duties shall cover but not limited to the following :

- to divide the Weight Control Report into the various disciplines area of responsibility.
- to ensure that all data generated are according to the procedures and all supporting documents are properly kept by the discipline representative.
- *to ensure the timely issue of the periodic weight report and endorsement by OWNER.*
- *to ensure that all Site Queries are properly documented and finally endorsed by OWNER.*
- to ensure that the weighing of the necessary major blocks are done according to procedures and witnessed by the OWNER representative.

### 4.2.3. Discipline Weight Control Representative

The discipline weight control representative is responsible for the monitoring and control of weight of items within the area of responsibility allocated by the Weight Control Coordinator. His duties include but not limited to following:

- to ensure that members of the discipline are aware of the items and weights in their area of responsibility.
- to ensure that all members of the discipline endeavor to achieve the weights given in the Weight Control Report in the course of their detail engineering work.
- to ensure that all weights update are properly done and accompanying documents are properly kept.
- *to ensure that all update forms, site queries are properly filled.*
- to review the Weight Control Report issued by the Weight Control Team and verify its content and impact on the discipline.
- *The Weight Control Team will also document and OWNER representative shall witness the weighing of major blocks as stated in the Contract.*

## 5. DISCIPLINES INFORMATIONS FOR THE WEIGHT CONTROL'S DISCIPLINE LEADER

The forms of delivery of weight items per discipline should follow a certain standard items, which may have small changes according to the particularity of the unit to be built, with the agreement of the leader of weight control discipline.

All disciplines must send the list of the weight of items of items in their respective discipline to the leader of the Weight Control Discipline with the following information:

- Dry weight, Test weight, operation weight, center of gravity in three dimension (X, Y, Z), contingency in percentage (%) for dry weight item, contingency in percentage (%) for weight liquid, dimensions of the weight item (Xmin, Xmax; Ymin, Ymax; Zmin, Zmax), localization (module, hull, some hull compartment, Accommodation or some area), Tag of the equipment, information origin (if through of: similar weight control reports, 3D model, data base of weight, manufactures data, calculation memory or estimated weight).

The contingency, in percentage of the weight item, is the uncertainly of the item weight and not to cover the item weight of items foreseen but not included. For example: welding, thermal insulation, screws and nuts, paint, etc..., this items must be estimated and included a relative item.

In order to avoid duplicity and / or forget to placing weight items, we describe below the form of delivery of the weights of each discipline and assign responsibility to their representatives

### 5.1. DISCIPLINES:

For this, we created a standard of select weight items for each discipline, as follows:

#### 5.1.1. STRUCTURE DISCIPLINE:

- Primary structure;
- Secondary structure;
- Outfitting (ladders, handrails, skid bases, hatches, etc);

Metal plates, excluding passive protection coating (items of responsibility of Architecture discipline);

- Structural supports, including supports requested by the Piping discipline. This weight items has an interface with the Piping discipline;
- Lifting beams for handling;
- Manufacturing tolerance;
- Paint: 1.5% (or the percentage that the discipline deems appropriate) of the value of the structural weight, referring to the weight of the structure of the module, hull, floors and etc., based on the area to be painted, coming from the model 3D
- Welding: 1.5% (or the percentage that the discipline deems appropriate) of the value of the structural;
- Equipment foundation (pumps, compressor, generators, vessels etc.);



- Risers balcony (including riser hangers);
- Bell mouths (of the riser balcony);
- Flare tower;
- Flare tower foundation;
- Telecom tower;
- Hull and accessories;
- Panama chocks and rollers;
- Bollards;
- Helideck structures;
- Crane pedestal;

#### 5.1.2. MECHANICAL DISCIPLINE:

- All mechanical equipment;
- All equipment referring to process discipline;
- All sets of equipment + drives (e.g.: generator + drives, pump + drives, compressor + drives, etc
- Set of skidded Equipment provided by vendors (packet);
- Handling equipment: mechanical and electrical hoists, power puller,
- Cranes + drives, davits (minus lifeboat davits);
- Spare equipment (make based estimate through previous designs report detailing phase, database, etc...) by location;
- Distillation system;
- FW system (pumps + drivers);
- All static equipment (pressure vessels, heat exchangers, filters, separators, deaerators, etc...)
- Flare tip;
- Equipment for mechanical and electrical workshop;

#### 5.1.3. INSTRUMENTATION AND INDUSTRIAL AUTOMATION DISCIPLINE:

- All instrumented valves for process plant and security;
- All instrumented valves for cargo and ballast system
- Instrumentation panel;
- All instrumentations that are not in the pipeline (outline);
- Cables for Instrumentation and automation, by location;
- Trays cables for instrumentation and automation, by location;
- Measuring skids (tax and appropriation);

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- Dampers of instrumented valves HVAC (interface with the HVAC discipline)
- Panels process analyzers;
- Instrumented valves for flare;
- Flare automation panel;
- IHMs (Interface Human Machinery);
- HPUs (Hydraulic Pressure Unit);
- Racks for hydraulic solenoids;
- Others automation skids (ex.: HIPPS);
- Hydraulics Instrument tubings

**5.1.4. ELETRIC DISCIPLINE:**

- All electrical equipment;
- Cathodic protection system by impressed current;
- Electrical panels, in general;
- Trays and supports for cabling by locations;
- Transformers;
- Rectifiers;
- Frequency converters;
- Electrical cables, by location;
- Electric switchboards, including the cargo and ballast system;
- Spare of electrical equipment, in store house; (to estimate by design reports similar in detailing phase, database, etc);
- Luminary, supports and posts, by locations;
- Batteries;
- Battery chargers;
- Electrical module or LER;
- Electrical system workstation (HMI);
- Panels for electrical and mechanical workshop;

**5.1.5. PIPING DISCIPLINE:**

- Pipes, flanges, pipe curves (90° e 45°), pipes "T", reductions, by diameter and specification for each location (pipe rack, module, hull, accommodation, areas, compartments, etc).



- Thermal insulation;
- Bracking: Supports, including clamps, cases, nuts, by location;
- Supports, clamps, screws, nuts, covers, case, etc, by location;
- Manual valves (if possible by diameter), by location;
- Piping and manual valves for flare;
- Painting in the pipe: 1.5% of the total weight of pipe, by location;
- Welding on pipe: 1% of the total weight of pipe, by location;
- Manual valves for cargo and ballast system;
- Piping for fire and foam system;

#### 5.1.6. NAVAL DISCIPLINE:

- Mooring winches;
- Chain stoppers;
- Chain locker system;
- Fairleads;
- Smit bracket and chock;
- Fenders;
- Main riser pull-in winch;
- Auxiliary riser pull-in winch;
- Offloading system (hose and reel);
- Offloading hydraulic unit;
- Pneumatic hoist;
- HPU mooring system;
- Riser spool;

OBS: Bell mouth (Structure discipline is responsible for this item weight);

#### 5.1.7. HSE DISCIPLINE:

- Inflatable liferaft + Davits;
- Rescue Boats + Davits;
- Lifeboats + Davits;
- CO2 cylinders and accessories;

- Water mist equipment;
- Emergency eyewash and safety shower station;
- Foam tanks and eductors;
- Foam pumps;
- Firefight Pumps;
- Proteção passiva (anteparas) de segregação de áreas de risco;
- Miscellaneous (Fire extinguishers, firefight cabinets, detectors, hydrants, life jackets, buoys, etc.)

**5.1.8. ARCHITECTURE DISCIPLINE:**

- Passive protective finishing in bulkheads and floors on laboratories, electrical modules and accommodation compartments, or all closed rooms;
- Furniture, utensils and partitions of the inhabited compartments (dining rooms, lodgings, offices, control rooms, kitchen, living rooms, etc.);
- Architectural coatings (for flooring, floating floor, covers, etc.)
- Floors systems in general, including elevated floors and all coverings, as wooden floors;
- Equipment for laboratory, kitchen, freezers room, dry provision, coffee shop, laundry, hospital, etc.;
- Doors of passage, scuttle and frames in general;
- Watertight doors in general (type watertight, weathertight, watertight sliding door, etc)

**5.1.9. HVAC DISCIPLINE (HEATING AND AIR CONDITIONING):**

- HVAC Systems;
- Chiller unit;
- HVAC panels;
- Ventilator and fan panels;
- Fans;
- Ventilators;
- Refrigerating system;
- Air conditioning ducts, by locality;
- Air conditioning system for CCR;

**5.1.10. TELECOMUNICATION DISCIPLINE (TELECOM):**

- Telecom panels;
- Telecom cables;
- Trays and supports for cabling for telecom;
- AC distribution board;
- DC distribution board;



- Fuse box;
- General telephone distributor;
- GMDSS console, operational radio console;
- Public address redundant system (5 racks);
- Public address main system (5 racks);
- Acoustic boot for public address;
- Loudspeakers / horns;
- Audio and video rack;
- Active repeater rack;
- Satellite TV antenna (C Band, KU band, VSAT, receiver);
- Distribution rack for LAN;
- Private branch exchange;
- VSAT system rack;
- Misc. for radio antennas;
- Videoconference system;

## 5.2. Schedule

The various disciplines will continually update the weights and C.O.G. during the construction. For the compilation of the periodic weight report, the disciplines will progressively submit their weights update according to the following schedule:

### Day of Month

### Activities

\_\_th

*Cut-off date for weight and COG update for the month.*

\_\_th to \_\_th

*Checking and compilation of periodic report and submission to OWNER for endorsement.*

\_\_th to \_\_th

*OWNER will review and endorse/propose alternatives.*

## 5.3. Content of Weight Control Report

*The periodic Weight Control Report shall contain the following information:*

- a) *Introduction*
- b) *Coordinate system*
- c) *Weights and centers evolution analyses*
- d) *Disciplines and responsible*
- e) *Definition of modules limits, when applicable*

- f) *Data analysis, including tables and graphics, for: Global weight, center of the gravity, global summary, etc and their evolutions*
- g) *Modules weight evolution (much used in lifting)*
- h) *Conclusion / Comments*
- i) *Appendix 1: Glossary of terms used*
- j) *Appendix 2: Tables*
- k) *Appendix 3: Items of modules and/or each main group*

### 5.3.1. Introduction

The introduction shall be the same for all issues of the periodic report, unless any relevant modification occurred during the design.

In this introduction, the general particulars of the Unit will be given and the basis of the weight and COG will be explained (e.g. the origin for the calculation of COG).

### 5.3.2. Summary

The summarized impact of Weight Control on the Unit and possible remedial actions shall be indicated in the Conclusion item.

The coordinate system shall have a drawing for better clarification.

Modules boundaries shall be defined, e.g: X (min, max); Y (min, max); Z (min, max), wrt global system.

Areas of concern will also be highlighted as a result of new weight information and if necessary possible remedial actions will be proposed and to be included in the Conclusion item.

### 5.3.3. Weights and centers evolution analyses

Analysis and graphics with the evolution of weights and centers of gravity shall be presented, issuing trends for Delivery condition.

### 5.3.4. Conclusion

The conclusion will comment on the trend of the weights updated so far and also the remaining margin available.

## 6. WEIGHING PROCEDURES





### 6.1. Purpose

The purpose of these procedures is to ensure that the weighing of the major blocks is done in a proper manner so as to achieve the highest accuracy possible with the existing means of the shipyard.

### 6.2. Personnel Involved

The Weight Control Team is responsible for organizing, notifying the relevant personnel and witnessing with OWNER representatives the weighing of major blocks as stated in the Contract.

*Personnel involved are:*

- *Project Superintendent*
- *QA representative*
- *Weight Control Team*
- *OWNER Weight Control Representative*
- *any other person deemed necessary by Project Manager*

### 6.3. Procedures

The following procedures should be adhered to for all weighing of major blocks:

#### 6.3.1. Preparation

When a block is ready for weighing, the Project Superintendent shall inform all concerned about the place, date and time of weighing at least 24 hours prior to the scheduled weighing.

QA/Weight Control Team shall reach all parties concerned to confirm the date, time and place of the weighing. Meanwhile, Project Superintendent shall ensure that the necessary crane/crew, lifting accessories and tension meter are available and ready at the stated time and place.

(Note : Project Engineer must have the lifting/weighing procedure and arrangement ready sufficiently early for production to prepare.)

*Preparation and recording of weighing forms will be the responsibility of the Weight Control Team.*

#### 6.3.2. Pre-Weighing Inspection

All personnel involved are to conduct a pre weighing inspection:

Project Supt. - to ensure that the lifting arrangement/accessories are according to lifting drawing produced by engineering.

QA - to ensure that the padeyes/lugs are according to those specified by engineering and are properly welded.



Weight Control Team - to ensure that all the equipment that are supposed to in the block are effectively in place and at the correct location. All temporary items like staging, brackets temporary reinforcement etc. shall be recorded. At the same time the weight of wire ropes, shackles etc. to be recorded.

### 6.3.3. Weighing

The actual weighing will be done by means of either the Asian Hercules or the gantry crane at the dry dock. Calibration of the respective cranes shall have a validity covering the period of the weighing.

The reading on the tension meter should only be taken when the load is freely suspended.

QA/Weight Control Team will fill the necessary information in the weighing forms.

After all parties have witnessed and signed all relevant forms, copies will be made and circulated as per distribution list on the form. The original shall be kept in the Weight Control File.

### 6.4. Remedial Actions

After the weight of the block is known, the weight difference between the expected and as weighed will be calculated by the Weight Control Team. The weighing is considered satisfactory if the weight difference found is within the margin of error (e.g., load cell error range). Otherwise, all respective weight control representatives shall be assigned at site to check every item. If the weight increase on the platform cannot be accounted for, the impact of the weight increase will be studied and remedial actions shall be submitted to OWNER.