

**Spheres quotation for Carbon Black &  
Delayed Coker Project  
Abu Dhabi Oil Refining Company (TAKREER)**



**FELGUERA-IHI REF: MA-5950**


**TECHNICAL PROPOSAL**

**July 31th, 2012**

## TECHNICAL BID

### INDEX

<i>Chapter 0</i>	<i>.- INTRODUCTION</i>
<i>Chapter 1</i>	<i>.- TECHNICAL SPECIFICATION</i>
<i>Chapter 2</i>	<i>.- SCOPE OF WORKS.</i>
<i>Chapter 3</i>	<i>.- TECHNICAL DATA SHEET.</i>
<i>Chapter 4</i>	<i>.- SPARE PART LIST.</i>
<i>Chapter 5</i>	<i>.- SUB SUPPLIERS LIST.</i>
<i>Chapter 6</i>	<i>.-. QUALITY AND HSE CERTIFICATIONS.</i>
<i>Chapter 7</i>	<i>.-.QUALITY PLAN AND INSPECTION.</i>
<i>Chapter 8</i>	<i>.-SHIPPING, ERECTION AND PWHT PROCEDURES</i>
<i>Chapter 9</i>	<i>.-MAN POWER, CONSTRUCTION EQUIPMENT AND REQUIRES UTILITIES</i>
<i>Chapter 10</i>	<i>.-SCHEDULE</i>
<i>Chapter 11</i>	<i>.-DEVIATION LIST</i>
<i>Chapter 12</i>	<i>.-. REFERENCE LIST.</i>
<i>Chapter 13</i>	<i>.-. FELGUERA-IHI BROCHURE.</i>


 <b>SAMSUNG ENGINEERING</b>	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

**Chapter 0 .- INTRODUCTION**

This offer has been prepared and quoted by the consortium FI-SHI, integrated by the companies FELGUERA-IHI and SHI Qatar. We are providing general and specific information of both companies, in order to let you know our technical capabilities and experiences in the sphere market.

FELGUERA-IHI is a Spanish company leader in the European sphere sector with more than 220 sphere references up to 10.000 m3. FELGUERA-IHI high experience and technology give the consortium the necessary support and reference.

SHI Qatar is a Qatar company with enormous experiences in the sphere market in Middle East and Gulf area. Shi has experience in the construction of similar equipments and has full knowledge of the local market and site condition.

 <b>SAMSUNG ENGINEERING</b>	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

## **1.- INTRODUCTION**

This specification aim is showing general criteria for design and fabrication of spherical Spheres under ASME code, section VIII Div.2 (alternative of EN 13445 ANEXO B)

## **2.- GENERAL**

- 2.1.** For spherical Spheres design applicable technical requirements have been considered.
- 2.2.** Felguera-I.H.I., S.A. will submit for your approval the most adequate welding procedure to be used for this type of spherical Spheres.
- 2.3.** Welders will be qualified as per ASME Secc. IX code, latest edition.  
Electrodes, previous to their use on field will be stored in stoves in order to store them at adequate temperature and perfectly dry.

## **3.- GENERAL DESCRIPTION**

- 3.1.** Spherical Spheres are mainly made up by to parts:

**3.2.** Spherical Shell

This part is made up by plates distributed between upper and bottom crowns and rings of variable thickness.

Plates will be pressed to achieve sphere's curvature radius and they will be assembled       butt welded.


Number and dimensions of plates will be as per Felguera-I.H.I. standards.

Central plates (superior and inferior) of crowns will be provided with sphere's nozzles.

Spherical shell will be designed to resist stresses dues to:

- Internal pressure (design and test).
- Presssure due to product and water during hydrotest.
- Seismic conditions.

Additionally, plates of equatorial ring will be checked by mean of "Free Body" theory (Membranes theory).

	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	



### 3.2. Support Columns

Spherical shell will be supported by means of supporting columns; number and dimensions of them will be according to Felguera-I.H.I. standards.

Supporting columns will be designed to resist following loads:

- Shell's weight, supporting columns and accessories.
- Wind and Seismic loads.
- Loads due to product and water during hydrotest.
- Additionally, and due to supporting columns design (articulated in their ends), horizontal forces generated because of wind and earthquake transmitted to foundation through the tie bars placed in "St. Andrew's Cross" form. Those tie bars are dimensioned according to Felguera-I.H.I. Standards.

## 4.- MATERIALS

Materials to be used in spherical Spheres as well as accessories are indicated in our technical sheets.

## 5.- FABRICATION

### 5.1. General

Fabrication and inspection will be done according to code, drawings and specifications applicable to the job.

Reinforcements of nozzles will be tested with pressured air and soap tested. No leak will be allowed. Minimum test pressure will be 1,0kg/cm<sup>2</sup>.

### 5.2. Plates Cutting


Plates shape for cutting is drawn on 3D-Shaped plates, and therefore at this time dimensional check is performed by means of checking the bevel position in the plate.

Bevels preparation of all plates will be performed by means of oxycutting, in a way that resulting surfaces are uniform and free of any lamination and slag accumulation before welding.

### 5.3. Shop Heat Treatment

Shop heat treatment will be performed in central plates of crowns with their corresponding connections, and also in equatorial plates-top column junction, according to technical requirements applicable.

### 5.4. Transport preparation

	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

Flanged connections will be protected against corrosion by means of protective film and covering them with a wooden disk or a steel plate, screwed, in order to protect faces during transportation. Those connections with permanent blinds or covers will be erected with gaskets and bolting ready to duty. In threaded connections a cap will be used.

Loading of all fabricated materials will be performed in order to avoid any damage during transportation.

## 6.- **INSTRUMENTATION AND ACCESSORIES**

Instrumentation and accessories considered are according your Material Requisition for Sphere, we summarize the following:

### Accessories:

- Helicoidally stairs
- Platforms
- All Internal, including vertical ladder, support ring, clips...
- Manhole
- Others indicated in Material Requisition

### Instrumentation:

- Not instrumentation has been considered.

## 7.- **FIRE PROOFING SYSTEM**

Out of the scope of supply


## 8.- **PAINTING**

Painting has been considered for external surface of the sphere and columns. The protective considered scheme is shop primer for transport protection and final application in site according client specification.


## 9.- **INSULATION**

Insulation has not been considered. Out of scope of supply.

## 10.- **JOB SITE WORKS**

	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	


In this project, job site works are included in Felguera-I.H.I. scope of work according chapter 2.

 <b>SAMSUNG ENGINEERING</b>	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	


**Chapter 2 .- SCOPE OF WORKS.**

In order to give you our best competitive proposal, we indicate the scope of works for our quotation:


<b>1.1. Scope of supply</b>		<b>FI/SHI</b>	<b>Client</b>
<b>1.1.1. Material procurement</b>			
- Sphere proper and accessory		X	
- Bracing and its accessories for column supports		X	
- Internal dip pipe, stilling well and its supports		X	
- Internal ladder and its supports		X	
- Stud bolt, nut and gasket for blind flange and manhole		X	
- Bolt and nut		X	
- Vortex breaker		X	
- Spiral stairway with intermediate / top platform & ladder (galvanized)		X	
- Fire detection system piping and supports		X	
- Spare Parts for Construction, Pre-commissioning, Commissioning and Start-up		X	
- Inside hand grips and ladder rungs		X	
- Earth lugs		X	
- Name plate (stainless steel 304) with bracket		X	
- Paint material		X	
- Welding consumable		X	
- Other necessary material and consumable for Erection, Testing and painting work		X	
- Vent device			X
- Valves and Pumps if any			X
- Junction box and cabling between instrument / Junction box.			X
- Piping / Nozzles up to first flange of the Sphere.			X
- Local Temperature Indicator			X
- Local Level Indicator			X
- Level Switch & Level Transmitter			X
- Cathodic Protection materials			X
- Tools and jigs for field assembling		X	
- Blind flange with bolts and nuts for hydrostatic test		X	
- Insulation materials			X
- Spare Parts		X	
- Other accessories necessary for site assembling			X
<b>1.1.2. Construction aid</b>			
- Direct temporary equipment and materials		X	
- Construction equipment and tools		X	
- Inspection and test equipment, tools and consumable		X	
- Safety equipment and material		X	

	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

- Consumable materials required at site for construction work, including welding rods, gouging rods and painting consumables	X	
- Test plates for welder and/or welding operator performance qualification and production testing	X	
- Tools and erection jigs for site assembling for each Sphere	X	
<b>1.1.3. Temporary facilities for construction</b>		
- Field office	X	
- Warehouse for equipment and materials	X	
- Sanitary facilities	X	
- Water for hydro testing (FI will provide necessary pumps and piping)		X
<b>1.1.4. Accommodation</b>		
- Housing	X	
- Catering service	X	
- Necessary telecommunication facilities	X	
- Security guard	X	
- Telecom, Electricity, Water to operate site office & canteen	X	
<b>1.2. Scope of work</b>		
<b>1.2.1. Design</b>		
- Strength calculation and detail design for the mechanical part	X	
- Related engineering documentation	X	
<b>1.2.2. Construction permit</b>		
- Engineering documentation support for construction permit	X	
- Acquisition of government approval		X
<b>1.2.3. Prefabrication work at shop</b>		
- Manufacturing of articles and/or equipment prefabrication	X	
- Welding procedure qualification test	X	
- Welder and/or welding operator performance qualification test	X	
- Inspection and test at shop	X	
- Rust prevention at shop after fabrication	X	
- Post weld heat treatment, if required by code	X	
- Nozzles and manholes welding to the sphere	X	
- Upper part columns welding to the equatorial plates	X	
<b>1.2.4. Transportation</b>		
- Transportation of all material up to FOB position in Spain (Gijón)	X	
- Transportation of all material to Takreer site location	X	
- Unloading from truck at site for the same	X	
<b>1.2.5. Storekeeping</b>		
- Storekeeping with the necessary protection for the equipment and materials after arrival at site		X
<b>1.2.6. Construction work</b>		
<b>1.2.6.1. Management</b>		
- Planning and scheduling	X	

	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

- Coordination and supervising	X	
- Manpower and quality control	X	
- Reports	X	
- Acquisition of permits for the mobilized manpower	X	
<b>1.2.6.2. Construction execution</b>		
- Civil and foundation works		X
- Sphere erection work	X	
- Sphere accessories installation,	X	
- Construction aid such as preparation, mobilization and maintenance.	X	
- Temporary work for construction	X	
- Dimensional check	X	
- Painting work including surface treatment for Sphere proper.	X	
- Qualification test for welder and welding operator	X	
- Welding procedure qualification test	X	
- Radiographic inspecton	X	
- Hydropneumatic test	X	
- Stress Reliving / PWHT	X	
- Insulation works		X
- Calibration	X	
- Fire proofing Columns		X
- Installation of electric and instrumentation		X
- Installation of cathodic protection		X
- Sweep cleaning and flushing	X	
<b>1.2.6.3. Field office operation (materials, construction and management)</b>		
- Installation of telecommunication equipment	X	
- Transportation of personnel	X	
- Medical care of personnel	X	
- Fuel	X	
- Maintenance and repair expense for office facility and equipment	X	
- Security expense	X	
- Printing	X	
<b>1.2.6.4. Insurance</b>		
- Workman's compensation and employer's liability insurance	X	
- Automobile insurance including liability and physical damage itself	X	
- Ocean, marine and cargo insurance for the materials and equipment	X	
- Insurance for construction tools and equipment	X	
- All risk insurance for the whole project	X	
<b>1.2.6.5. Third party inspection</b>		X
<b>1.2.7. Technical Meeting</b>		
- One (1) Kick off meeting in Takreer	X	
- Two (2) Technical clarification meeting in Client Offices	X	

	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	




- Any Technical clarification or pre-inspection meeting in Spain	X	
- More Technical clarification meeting in Client Offices		X

Nevertheless, we are available to modify this proposal if you require it.

Not included in our prices:

- Any civil works, stating that our company will provide all loads data necessary to design the foundations by others.
- Control and inspection expenses of any official or private party ordered from your side, in mill shop or in our shops as well as all necessary means to do it.
- Any connection with the administration, particularly the project development and satisfaction rates for the same visa. Nevertheless we providing the technical information necessary for prepare the draft and submit it to the appropriate authorities.
- Supply of the instruments and accessories not listed in our technical proposal.


Nevertheless, we are available to modify this offer if necessary changes in the scope of it.

	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

Attachment finds Felguera-IHI technical data sheet for the project. We include a technical data sheet for a base proposal with design of the spheres according to ASME VIII Div. 2 and material A-516 Gr.65N.

Alternative, we propose you several optional designs of the spheres in accordance to:

- Alternative 1: Code: ASME VIII Div. 2<sup>a</sup> ; Material A-516Gr70N
- Alternative 2: Code: ASME VIII Div. 2<sup>a</sup> ; Material A-537 Cl.2
- Alternative 3 : Code EN 13445 ANEXO B ; Material P 355 NL (European)

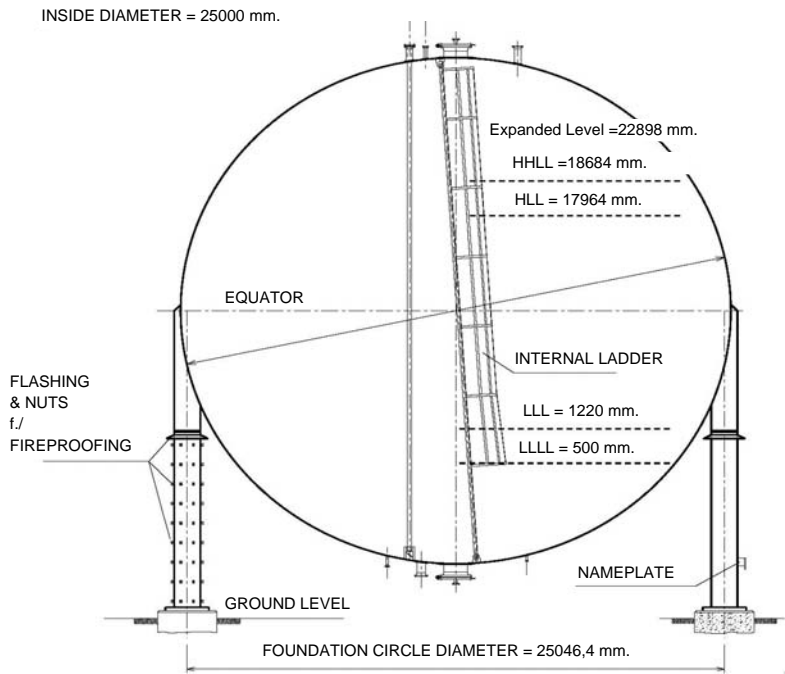
 <b>SAMSUNG ENGINEERING</b>	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
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**TECHNICAL DATA SHEET SPHERE**

**ITEM No. :2041-D-001/2/3/4/5**

**BASE**

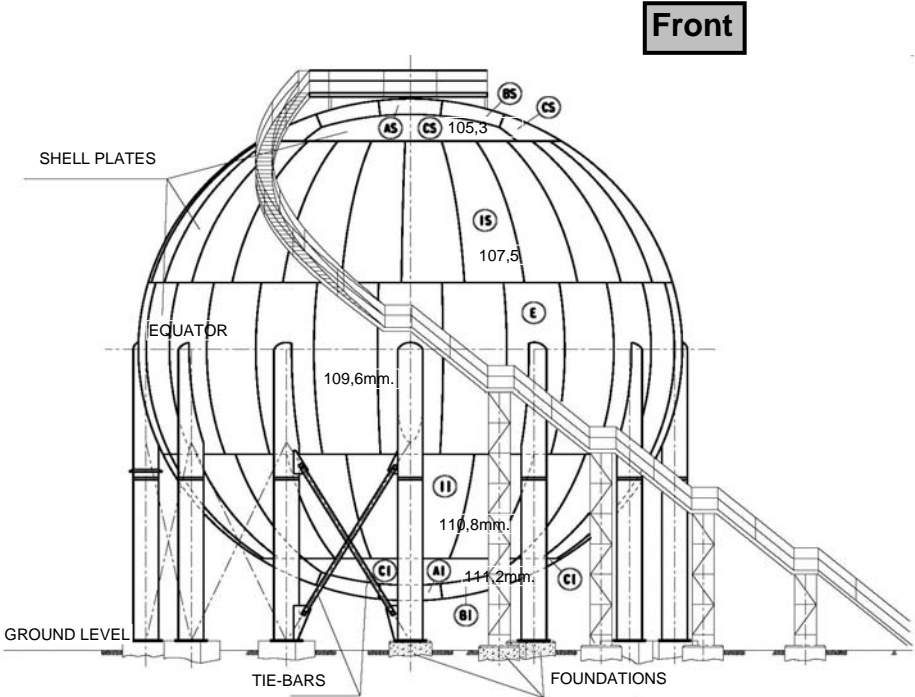
**Schematic view**



**DESIGN DATA**

Spherical Tank Code:	ASME Code Sec.VIII Div.2
Columns Code:	A.I.S.C. / F.I.
Number of Columns:	14
Product:	Propylene
Specific Gravity (g/cm <sup>3</sup> ):	0,540
Internal Desing Pressure (Kg/cm <sup>2</sup> ):	24,30
Pneumatic Desing Pressure (Kg/cm <sup>2</sup> ):	34,75
Design Temperature (°C):	-47,4/87
Wind (Km/h):	160
Earthquake:	IBC-2009-C. L=1, R=3
Corrosion Allowance (mm):	3,0
Shell Type:	Partial Football
Coefficient Efficiency Soudures:	1
Storage Ability Ratio:	90 % f./calculation
Nominal Capacity (m <sup>3</sup> ):	8.181 m <sup>3</sup>
PWHT at Shop:	Yes(Nozzles)
PWHT at Site:	Yes
Insulation:	No
Fireproofing:	Yes
Max. Allowable Stress f./Design (Kg/cm <sup>2</sup> ):	1487,83
Max. Allowable Stress f./Test (Kg/cm <sup>2</sup> ):	2202,59
Shell Material Tensible Strenght (Kg/cm <sup>2</sup> ):	4588,72
Shell Material Yield Strenght (Kg/cm <sup>2</sup> ):	2447,32
Temperature (C.E.T.) f./Impact Test:	Acc./ Code

**Configuration**



**SHELL PLATES NOMENCLATURE**

POS.	THK.	DESIGNATION	MATERIAL
AS	105,3	Upper Head (# Central Plate)	<b>SA-516 Gr. 65 N</b>
BS	105,3	Upper Head (# Lateral Plates)	
CS	105,3	Upper Head (# Border Plates)	
IS	107,5	Upper Intermediate Plates	
E	109,6	Equatorial Plates	
II	110,8	Lower Intermediate Plates	
CI	111,2	Lower Head (# Central Plate)	
BI	111,2	Lower Head (# Lateral Plates)	
AI	111,2	Lower Head (# Border Plates)	

LENGTH OF WELDS	WEIGHT	Nº PLATES
1037 m.	~ 1.935.000 Kg	96

**MATERIAL QUALITY**

Plates	Spherical Shell:	SA-516 Gr 65 N
	Columns (Upper Part.):	SA-516 Gr 65 N
	Columns (Lower Part.):	A131 EH36
	Columns (Base Plate):	A131 EH36
	Shell Reinforcement:	N/A
Others	Structurals Shapes:	SA-516 Gr 65 N / SA-283 GR. C
	Pipes:	SA-516 Gr 65 N / SA-283 GR. C
	Forging:	SA-350 Gr. L F 2
	Elbows, Tees & Reducers:	SA-420 WPL 6

**BILL OF NOZZLES**

Mark	Qty.	Size	Type/Rating	Service
A1	1	8"	300#	Liquid inlet
A2	1	8"(Hold)	600#	Min. Flow Recirculation
B	1	12"	300#	Liquid Outlet
M	1	24"	300#	Manhole
S	1	6"	300#	Spare
V	1	4"	300#	Vent to Flare
L1	1	6"	300#	Level Transmitter
L2	1	6"	300#	Level Transmitter
P1	1	2"	300#	Pressure Transmitter
P2	1	2"	300#	Pressure Transmitter
T	1	2"	300#	Temperature Indicator
W	1	8"(Hold)	300#	Relief Valve
L3	1	6"	300#	Level Transmitter

**ACCES & OTHERS**

- EXTERNAL SPIRAL STAIRWAY	- STILLING WELLS AND INTERNAL
- INTERNAL LADDER	- CLIP AND SUPPORTS
- NAMEPLATE	- PIPING & NOZZLES
- GROUND LIGHTNING PROTECTION	- WATER SPRAY SYSTEM
- NUTS f./FIREPROOFING OF COLUMNS	- ANCHORS,BOLTS,NUTS AND WASHERS

Client	Site	Ref.	Rev.	Date
Samsung	Ruwais, U.A.E.	Ma-5990	0	18.07.2012

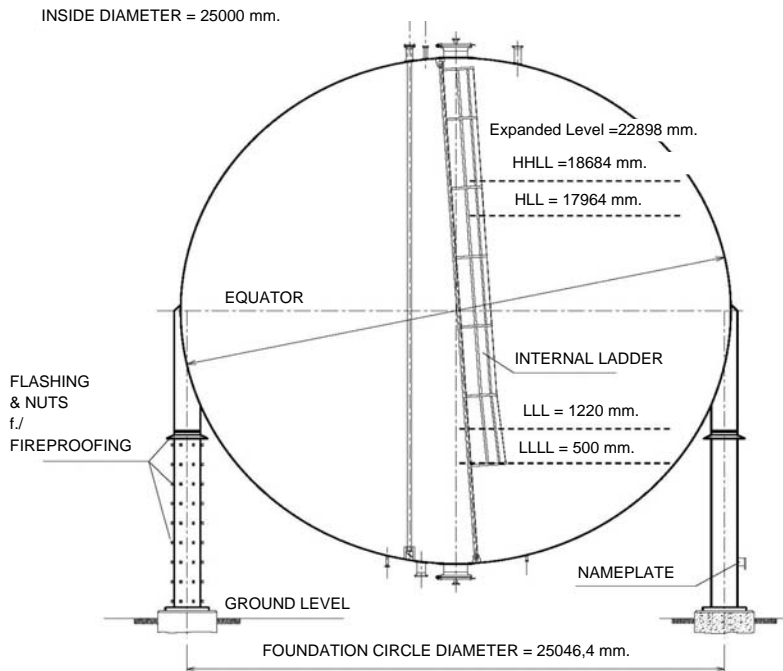
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**TECHNICAL DATA SHEET SPHERE**

**ITEM No. :2041-D-001/2/3/4/5**

**ALTERNATIVE-1**

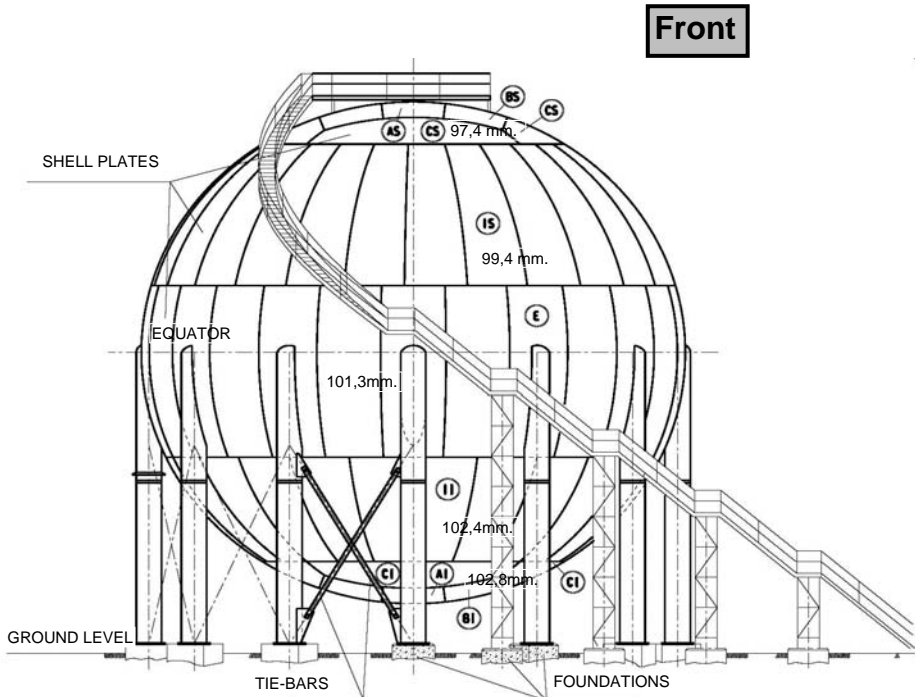
**Schematic view**



**DESIGN DATA**

Spherical Tank Code:	ASME Code Sec.VIII Div.2
Columns Code:	A.I.S.C. / F.I.
Number of Columns:	14
Product:	Propylene
Specific Gravity (g/cm <sup>3</sup> ):	0,540
Internal Desing Pressure (Kg/cm <sup>2</sup> ):	24,30
Pneumatic Desing Pressure (Kg/cm <sup>2</sup> ):	34,75
Design Temperature (°C):	-47,4/87
Wind (Km/h):	160
Earthquake:	IBC-2009-C. L=1, R=3
Corrosion Allowance (mm):	3,0
Shell Type:	Partial Football
Coefficient Efficiency Soudures:	1
Storage Ability Ratio:	90 % f./calculation
Nominal Capacity (m <sup>3</sup> ):	8.181 m <sup>3</sup>
PWHT at Shop:	Yes(Nozzles)
PWHT at Site:	Yes
Insulation:	No
Fireproofing:	Yes
Max. Allowable Stress f./Design (Kg/cm <sup>2</sup> ):	1487,83
Max. Allowable Stress f./Test (Kg/cm <sup>2</sup> ):	2202,59
Shell Material Tensible Strenght (Kg/cm <sup>2</sup> ):	4588,72
Shell Material Yield Strenght (Kg/cm <sup>2</sup> ):	2447,32
Temperature (C.E.T.) f./Impact Test:	Acc./ Code

**Configuration**



**Front**

**SHELL PLATES NOMENCLATURE**

POS.	THK.	DESIGNATION	MATERIAL
AS	97,4	Upper Head (# Central Plate)	<b>SA-516 Gr. 70 N</b>
BS	97,4	Upper Head (# Lateral Plates)	
CS	97,4	Upper Head (# Border Plates)	
IS	99,4	Upper Intermediate Plates	
E	101,3	Equatorial Plates	
II	102,4	Lower Intermediate Plates	
CI	102,8	Lower Head (# Central Plate)	
BI	102,8	Lower Head (# Lateral Plates)	
AI	102,8	Lower Head (# Border Plates)	

LENGTH OF WELDS	WEIGHT	Nº PLATES
1037 m.	~ 1.797.000 Kg	96

**MATERIAL QUALITY**

Plates	Spherical Shell:	SA-516 Gr 70 N
	Columns (Upper Part.):	SA-516 Gr 70 N
	Columns (Lower Part.):	A131 EH36
	Columns (Base Plate):	A131 EH36
	Shell Reinforcement:	N/A
Others	Structurals Shapes:	SA-516 Gr 70 N / SA-283 GR. C
	Pipes:	SA-516 Gr 70 N / SA-283 GR. C
	Forging:	SA-350 Gr. L F 2
	Elbows, Tees & Reducers:	SA-420 WPL 6

**BILL OF NOZZLES**

Mark	Qty.	Size	Type/Rating	Service
A1	1	8"	300#	Liquid inlet
A2	1	8"(Hold)	600#	Min. Flow Recirculation
B	1	12"	300#	Liquid Outlet
M	1	24"	300#	Manhole
S	1	6"	300#	Spare
V	1	4"	300#	Vent to Flare
L1	1	6"	300#	Level Transmitter
L2	1	6"	300#	Level Transmitter
P1	1	2"	300#	Pressure Transmitter
P2	1	2"	300#	Pressure Transmitter
T	1	2"	300#	Temperature Indicator
W	1	8"(Hold)	300#	Relief Valve
L3	1	6"	300#	Level Transmitter

**ACCES & OTHERS**

- EXTERNAL SPIRAL STAIRWAY
- INTERNAL LADDER
- NAMEPLATE
- GROUND LIGHTNING PROTECTION
- NUTS f./FIREPROOFING OF COLUMNS
- STILLING WELLS AND INTERNAL
- CLIP AND SUPPORTS
- PIPING & NOZZLES
- WATER SPRAY SYSTEM
- ANCHORS,BOLTS,NUTS AND WASHERS

Client	Site	Ref.	Rev.	Date
Samsung	Ruwais, U.A.E.	Ma-5990	0	18.07.2012

Edition
Issued for Bid

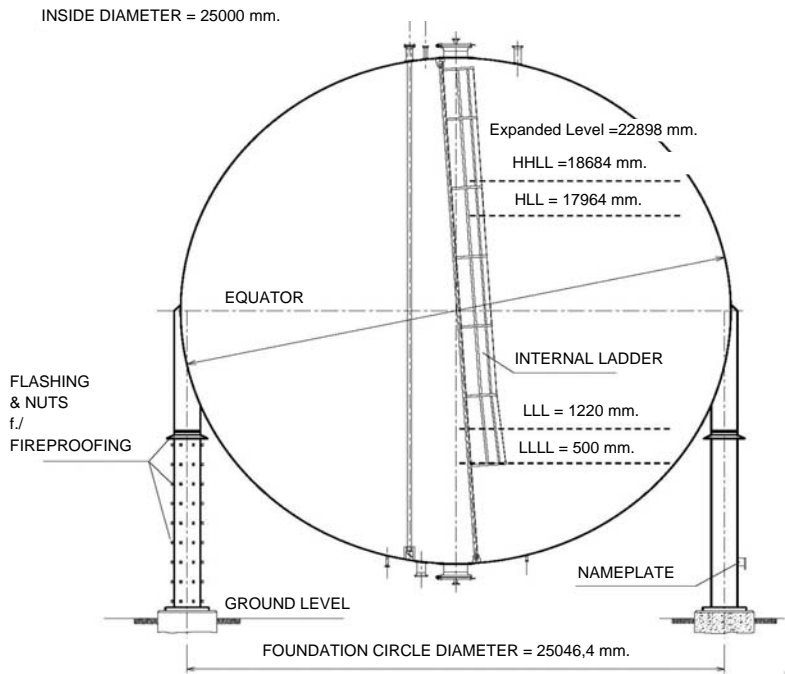


**TECHNICAL DATA SHEET SPHERE**

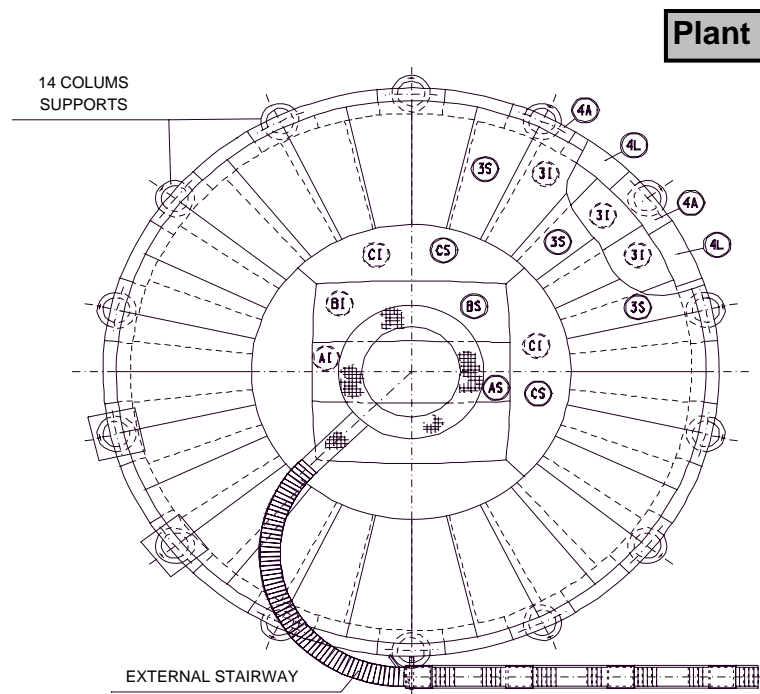
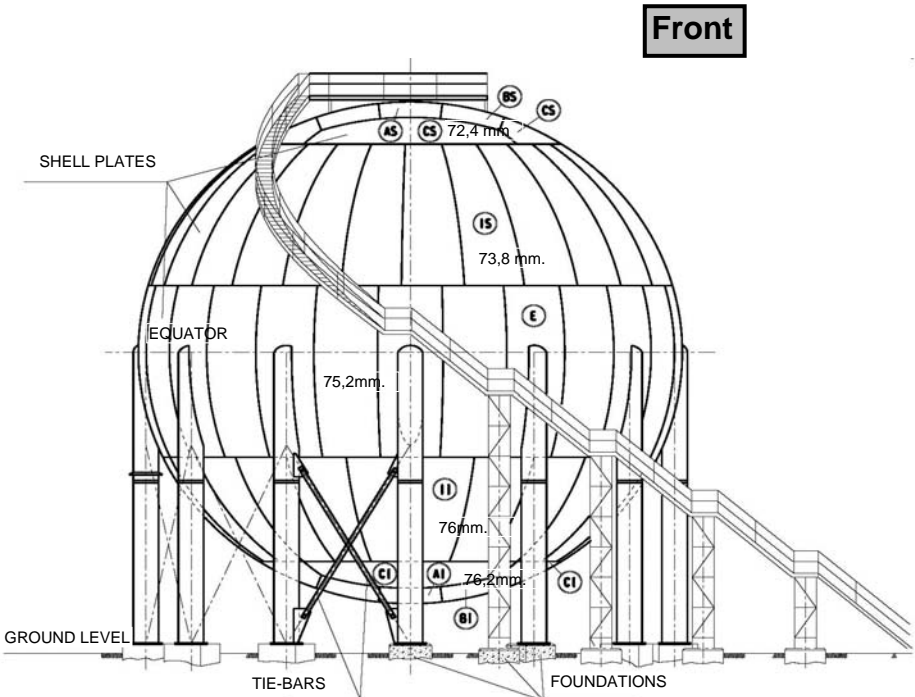
**ITEM No. :2041-D-001/2/3/4/5**

**ALTERNATIVE-2**

**Schematic view**



**Configuration**



**DESIGN DATA**

Spherical Tank Code:	ASME Code Sec.VIII Div.2
Columns Code:	A.I.S.C. / F.I.
Number of Columns:	14
Product:	Propylene
Specific Gravity (g/cm³):	0,540
Internal Desing Pressure (Kg/cm²):	24,30
Pneumatic Desing Pressure (Kg/cm²):	34,75
Design Temperature (°C):	-47,4/87
Wind (Km/h):	160
Earthquake:	IBC-2009-C. L=1, R=3
Corrosion Allowance (mm):	3,0
Shell Type:	Partial Football
Coefficient Efficiency Soudures:	1
Storage Ability Ratio:	90 % f./calculation
Nominal Capacity (m³):	8.181 m³
PWHT at Shop:	Yes(Nozzles)
PWHT at Site:	Yes
Insulation:	No
Fireproofing:	Yes
Max. Allowable Stress f./Design (Kg/cm²):	1487,83
Max. Allowable Stress f./Test (Kg/cm²):	2202,59
Shell Material Tensible Strenght (Kg/cm²):	4588,72
Shell Material Yield Strenght (Kg/cm²):	2447,32
Temperature (C.E.T.) f./Impact Test:	Acc./ Code

**SHELL PLATES NOMENCLATURE**

POS.	THK.	DESIGNATION	MATERIAL
AS	72,4	Upper Head (# Central Plate)	<b>SA-537 C1.2</b>
BS	72,4	Upper Head (# Lateral Plates)	
CS	72,4	Upper Head (# Border Plates)	
IS	73,8	Upper Intermediate Plates	
E	75,2	Equatorial Plates	
II	76	Lower Intermediate Plates	
CI	76,2	Lower Head (# Central Plate)	
BI	76,2	Lower Head (# Lateral Plates)	
AI	76,2	Lower Head (# Border Plates)	

LENGTH OF WELDS	WEIGHT	Nº PLATES
1037 m.	~ 1.395.000 Kg	96

**MATERIAL QUALITY**

Plates	Spherical Shell:	SA-537 C1.2
	Columns (Upper Part.):	SA-537 C1.2
	Columns (Lower Part.):	A131 EH36
	Columns (Base Plate):	A131 EH36
	Shell Reinforcement:	N/A
Others	Structurals Shapes:	SA-537 C1.2 / SA-283 GR. C
	Pipes:	SA-537 C1.2 / SA-283 GR. C
	Forging:	SA-350 Gr. L F 2
	Elbows, Tees & Reducers:	SA-420 WPL 6

**BILL OF NOZZLES**

Mark	Qty.	Size	Type/Rating	Service
A1	1	8"	300#	Liquid inlet
A2	1	8"(Hold)	600#	Min. Flow Recirculation
B	1	12"	300#	Liquid Outlet
M	1	24"	300#	Manhole
S	1	6"	300#	Spare
V	1	4"	300#	Vent to Flare
L1	1	6"	300#	Level Transmitter
L2	1	6"	300#	Level Transmitter
P1	1	2"	300#	Pressure Transmitter
P2	1	2"	300#	Pressure Transmitter
T	1	2"	300#	Temperature Indicator
W	1	8"(Hold)	300#	Relief Valve
L3	1	6"	300#	Level Transmitter

**ACCES & OTHERS**

- EXTERNAL SPIRAL STAIRWAY	- STILLING WELLS AND INTERNAL
- INTERNAL LADDER	- CLIP AND SUPPORTS
- NAMEPLATE	- PIPING & NOZZLES
- GROUND LIGHTNING PROTECTION	- WATER SPRAY SYSTEM
- NUTS f./FIREPROOFING OF COLUMNS	- ANCHORS,BOLTS,NUTS AND WASHERS

Client	Site	Ref.	Rev.	Date
Samsung	Ruwais, U.A.E.	Ma-5990	0	18.07.2012

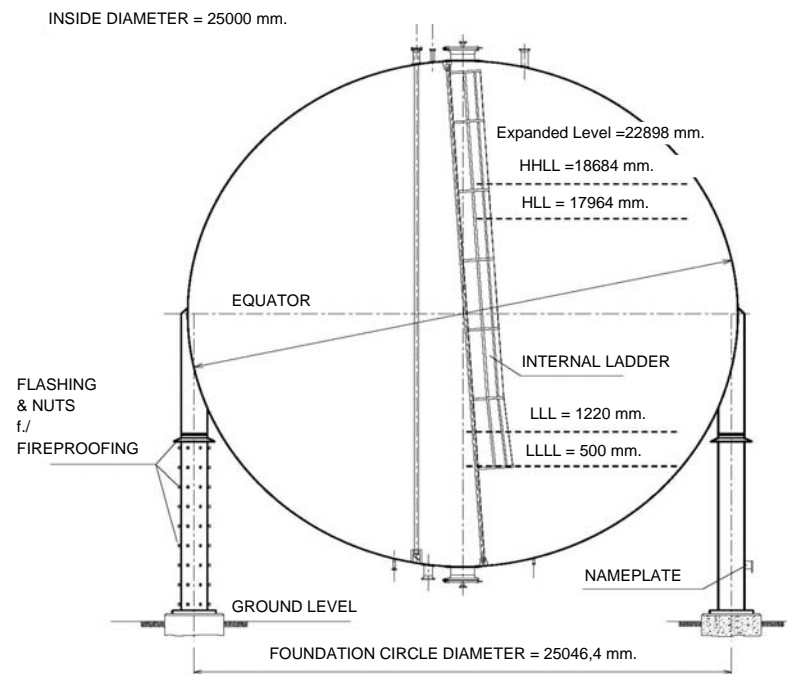
Edition
Issued for Bid

# **TECHNICAL DATA SHEET SPHERE**

**ITEM No. :2041-D-001/2/3/4/5**

**ALTERNATIVE-3**

## **Schematic view**

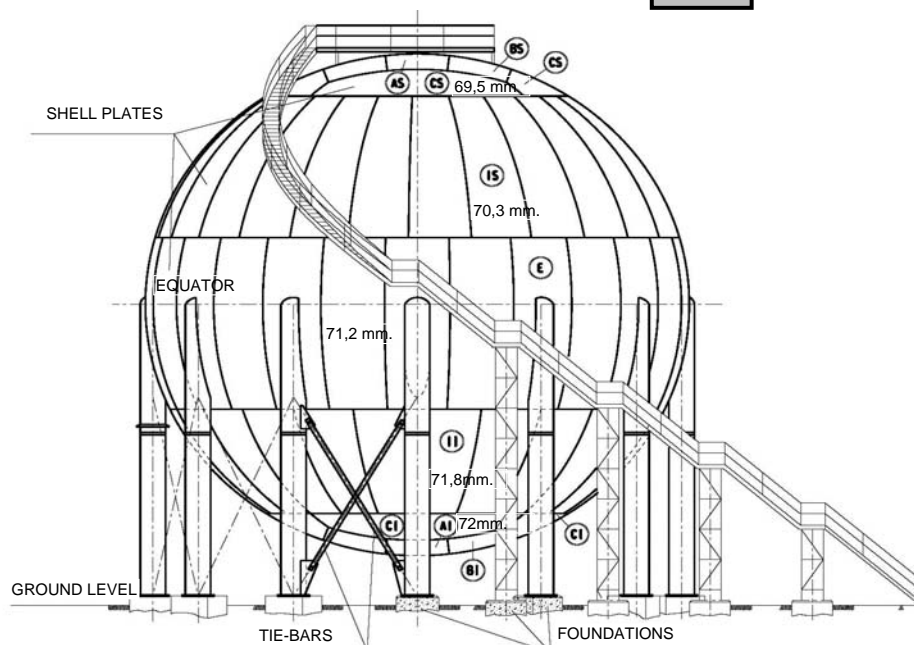


## **DESIGN DATA**

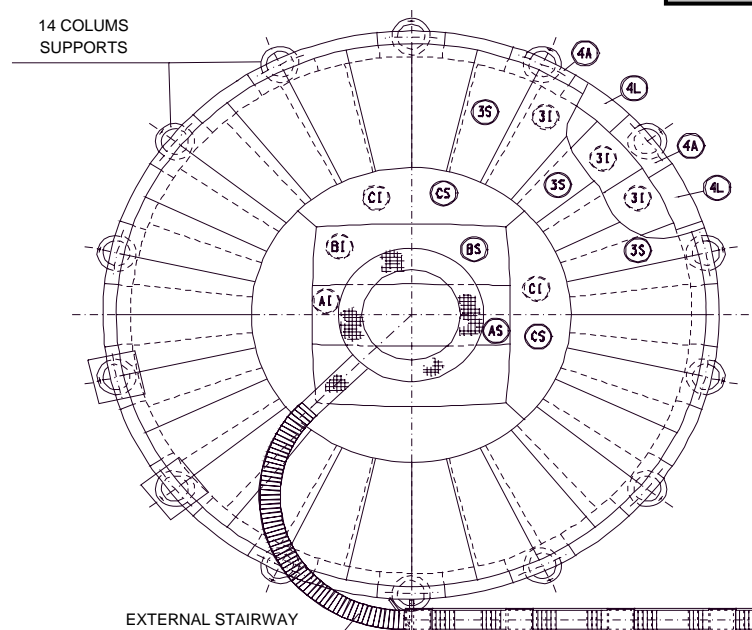
Spherical Tank Code:	EN 13445-3 2010 ANNEX B
Columns Code:	A.I.S.C. / F.I.
Number of Columns:	14
Product:	Propylene
Specific Gravity (g/cm³):	0,540
Internal Desing Pressure (Kg/cm²):	24,30
Pneumatic Desing Pressure (Kg/cm²):	34,75
Design Temperature (°C):	-47,4/87
Wind (Km/h):	160
Earthquake:	IBC-2009-C. L=1, R=3
Corrosion Allowance (mm):	3,0
Shell Type:	Partial Football
Coefficient Efficiency Soudures:	1
Storage Ability Ratio:	90 % f./calculation
Nominal Capacity (m³):	8.181 m³
PWHT at Shop:	Yes(Nozzles)
PWHT at Site:	Yes
Insulation:	No
Fireproofing:	Yes
Max. Allowable Stress f./Design (Kg/cm²):	1487,83
Max. Allowable Stress f./Test (Kg/cm²):	2202,59
Shell Material Tensible Strenght (Kg/cm²):	4588,72
Shell Material Yield Strenght (Kg/cm²):	2447,32
Temperature (C.E.T.) f./Impact Test:	Acc./ Code

## **Configuration**

### **Front**



### **Plant**



## **SHELL PLATES NOMENCLATURE**

POS.	THK.	DESIGNATION	MATERIAL
AS	69,5	Upper Head (# Central Plate)	<b>P 355 NL</b>
BS	69,5	Upper Head (# Lateral Plates)	
CS	69,5	Upper Head (# Border Plates)	
IS	70,3	Upper Intermediate Plates	
E	71,2	Equatorial Plates	
II	71,8	Lower Intermediate Plates	
CI	72	Lower Head (# Central Plate)	
BI	72	Lower Head (# Lateral Plates)	
AI	72	Lower Head (# Border Plates)	

LENGTH OF WELDS	WEIGHT	Nº PLATES
1037 m.	~ 1.350.000 Kg	96

## **MATERIAL QUALITY**

Plates	Spherical Shell:	P 355 NL
	Columns (Upper Part.):	P 355 NL
	Columns (Lower Part.):	A131 EH36
	Columns (Base Plate):	A131 EH36
	Shell Reinforcement:	N/A
Others	Structurals Shapes:	P 355 NL / SA-283 GR. C
	Pipes:	P 355 NL / SA-283 GR. C
	Forging:	SA-350 Gr. L F 2
	Elbows, Tees & Reducers:	SA-420 WPL 6

## **BILL OF NOZZLES**

Mark	Qty.	Size	Type/Rating	Service
A1	1	8"	300#	Liquid inlet
A2	1	8"(Hold)	600#	Min. Flow Recirculation
B	1	12"	300#	Liquid Outlet
M	1	24"	300#	Manhole
S	1	6"	300#	Spare
V	1	4"	300#	Vent to Flare
L1	1	6"	300#	Level Transmitter
L2	1	6"	300#	Level Transmitter
P1	1	2"	300#	Pressure Transmitter
P2	1	2"	300#	Pressure Transmitter
T	1	2"	300#	Temperature Indicator
W	1	8"(Hold)	300#	Relief Valve
L3	1	6"	300#	Level Transmitter

## **ACCES & OTHERS**


- EXTERNAL SPIRAL STAIRWAY	- STILLING WELLS AND INTERNAL
- INTERNAL LADDER	- CLIP AND SUPPORTS
- NAMEPLATE	- PIPING & NOZZLES
- GROUND LIGHTNING PROTECTION	- WATER SPRAY SYSTEM
- NUTS f./FIREPROOFING OF COLUMNS	- ANCHORS,BOLTS,NUTS AND WASHERS

Client	Site	Ref.	Rev.	Date	Edition
Samsung	Ruwais, U.A.E.	Ma-5990	0	18.07.2012	Issued for Bid



**Chapter 4 .- SPARE PART LIST.**

Find enclosed spare part list for commissioning and 2 years operation

 <b>SAMSUNG ENGINEERING</b>	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

# SPARE PARTS LIST FOR CONSTRUCTION & PRE-COMMISSIONING

Project Name : Carbon Black & Delayed Cpk Project

Project No. : Ma-6059 - SHIQ-001

Vendor Name : Felguera-IHI. S.A - SHI Qatar

Item No.	Part Name	Drawing Part No.	Quantity (Unit)			Material Spec.	Size & Description	Remarks
			Installed Per One set	Supply as Spare Parts/Unit	Total Supply as Spare Parts for 5 Units			
2041-D-001/2/3/4/5 PROPYLENE SPHERE								
1)	8" Liquid Inlet	A1						
	- Gasket		1	1	5	Non Asbestos	8" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10	A193-B7/A194-2H	U7/8" - 10UNC x 145 L	
2)	8" Min. Flow Recirculation	A2						
	- Gasket		1	1	5	Non Asbestos	8" ANSI 600# RF x 4.5 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10	A193-B7/A194-2H	U1 1/8" - 10UNC x 200 L	
3)	12" Liquid Outlet	B						
	- Gasket		1	1	5	Non Asbestos	12" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		16	2	10	A193-B7/A194-2H	U1 1/8" - 10UNC x 180 L	
4)	24" Manhole	M						
	- Gasket		1	1	5	Non Asbestos	24" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		24	2	10	A193-B7/A194-2H	U1 1/2" - 10UNC x 240 L	
5)	6" Spare Nozzle	S						
	- Gasket		1	1	5	Non Asbestos	6" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10	A193-B7/A194-2H	U3/4" - 10UNC x 130 L	
6)	4" Vent to Flare	V						
	- Gasket		1	1	5	Non Asbestos	4" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		8	2	10	A193-B7/A194-2H	U3/4" - 10UNC x 120 L	
7)	6" Level Transmitter	L1						
	- Gasket		1	1	5	Non Asbestos	6" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10	A193-B7/A194-2H	U3/4" - 10UNC x 130 L	
8)	6" Level Transmitter	L2						
	- Gasket		1	1	5	Non Asbestos	6" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10	A193-B7/A194-2H	U3/4" - 10UNC x 130 L	

# SPARE PARTS LIST FOR CONSTRUCTION & PRE-COMMISSIONING

Project Name : Carbon Black & Delayed Cpk Project

Project No. : Ma-6059 - SHIQ-001

Vendor Name : Felguera-IHI. S.A - SHI Qatar

Item No.	Part Name	Drawing Part No.	Quantity (Unit)			Material Spec.	Size & Description	Remarks
			Installed Per One set	Supply as Spare Parts/Unit	Total Supply as Spare Parts for 5 Units			
9)	2" Pressure Transmitter - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	P1	1 8	1 2	5 10	Non Asbestos A193-B7/A194-2H	2" ANSI 300# RF x 3.0 t U5/8" - 10UNC x 95 L	
10)	2" Pressure Transmitter - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	P2	1 8	1 2	5 10	Non Asbestos A193-B7/A194-2H	2" ANSI 300# RF x 3.0 t U5/8" - 10UNC x 95 L	
11)	2" Temperature Indicator - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	T	1 8	1 2	5 10	Non Asbestos A193-B7/A194-2H	2" ANSI 300# RF x 3.0 t U5/8" - 10UNC x 95 L	
12)	8" Relief Valve - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	A1	1 12	1 2	5 10	Non Asbestos A193-B7/A194-2H	8" ANSI 300# RF x 3.0 t U7/8" - 10UNC x 145 L	
8)	6" Level Transmitter - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	L3	1 12	1 2	5 10	Non Asbestos A193-B7/A194-2H	6" ANSI 300# RF x 3.0 t U3/4" - 10UNC x 130 L	

<b>SPARE PARTS LIST FOR COMMISSIONING &amp; START UP</b>	Project Name : Carbon Black & Delayed Cpker Project Project No. : Ma-6059 - SHIQ-001 Vendor Name : Felguera-IHI. S.A - SHI Qatar
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Item  No.	Part Name	Drawing  Part No.	Quantity (Unit)			Material  Spec.	Size & Description	Remarks
			Installed Per One set	Supply as Spare Parts/Unit	Total Supply as Spare Parts for 5 Units			
2041-D-001/2/3/4/5 PROPYLENE SPHERE								
1)	8" Liquid Inlet	A1				Non Asbestos A193-B7/A194-2H	8" ANSI 300# RF x 3.0 t U7/8" - 10UNC x 145 L	
	- Gasket		1	1	5			
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10			
	2)	8" Min. Flow Recirculation	A2				Non Asbestos A193-B7/A194-2H	8" ANSI 600# RF x 4.5 t U1 1/8" - 10UNC x 200 L
- Gasket		1		1	5			
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10			
	3)	12" Liquid Outlet	B				Non Asbestos A193-B7/A194-2H	12" ANSI 300# RF x 3.0 t U1 1/8" - 10UNC x 180 L
- Gasket		1		1	5			
	- Stud Bolt & 2-Hex. Heavy Nuts		16	2	10			
	4)	24" Manhole	M				Non Asbestos A193-B7/A194-2H	24" ANSI 300# RF x 3.0 t U1 1/2" - 10UNC x 240 L
- Gasket		1		1	5			
	- Stud Bolt & 2-Hex. Heavy Nuts		24	2	10			
	5)	6" Spare Nozzle	S				Non Asbestos A193-B7/A194-2H	6" ANSI 300# RF x 3.0 t U3/4" - 10UNC x 130 L
- Gasket		1		1	5			
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10			
	6)	4" Vent to Flare	V				Non Asbestos A193-B7/A194-2H	4" ANSI 300# RF x 3.0 t U3/4" - 10UNC x 120 L
- Gasket		1		1	5			
	- Stud Bolt & 2-Hex. Heavy Nuts		8	2	10			
	7)	6" Level Transmitter	L1				Non Asbestos A193-B7/A194-2H	6" ANSI 300# RF x 3.0 t U3/4" - 10UNC x 130 L
- Gasket		1		1	5			
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10			
	8)	6" Level Transmitter	L2				Non Asbestos A193-B7/A194-2H	6" ANSI 300# RF x 3.0 t U3/4" - 10UNC x 130 L
- Gasket		1		1	5			
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10			

<p align="center"><b>SPARE PARTS LIST FOR COMMISSIONING &amp; START UP</b></p>	<p>Project Name : Carbon Black &amp; Delayed Cpk Project  Project No. : Ma-6059 - SHIQ-001  Vendor Name : Felguera-IHI. S.A - SHI Qatar</p>
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Item No.	Part Name	Drawing Part No.	Quantity (Unit)			Material Spec.	Size & Description	Remarks
			Installed Per One set	Supply as Spare Parts/Unit	Total Supply as Spare Parts for 5 Units			
9)	2" Pressure Transmitter - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	P1	1 8	1 2	5 10	Non Asbestos A193-B7/A194-2H	2" ANSI 300# RF x 3.0 t U5/8" - 10UNC x 95 L	
10)	2" Pressure Transmitter - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	P2	1 8	1 2	5 10	Non Asbestos A193-B7/A194-2H	2" ANSI 300# RF x 3.0 t U5/8" - 10UNC x 95 L	
11)	2" Temprature Indicator - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	T	1 8	1 2	5 10	Non Asbestos A193-B7/A194-2H	2" ANSI 300# RF x 3.0 t U5/8" - 10UNC x 95 L	
12)	8" Relief Valve - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	A1	1 12	1 2	5 10	Non Asbestos A193-B7/A194-2H	8" ANSI 300# RF x 3.0 t U7/8" - 10UNC x 145 L	
8)	6" Level Transmitter - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	L3	1 12	1 2	5 10	Non Asbestos A193-B7/A194-2H	6" ANSI 300# RF x 3.0 t U3/4" - 10UNC x 130 L	

<p align="center"><b>SPARE PARTS LIST FOR 2 YEARS OPERATION</b></p>	<p>Project Name : Carbon Black &amp; Delayed Cpk Project  Project No. : Ma-6059 - SHIQ-001  Vendor Name : Felguera-IHI. S.A - SHI Qatar</p>
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Item No.	Part Name	Drawing Part No.	Quantity (Unit)			Material Spec.	Size & Description	Remarks
			Installed Per One set	Supply as Spare Parts/Unit	Total Supply as Spare Parts for 5 Units			
2041-D-001/2/3/4/5 PROPYLENE SPHERE								
1)	8" Liquid Inlet	A1						
	- Gasket		1	2	10	Non Asbestos	8" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10	A193-B7/A194-2H	U7/8" - 10UNC x 145 L	
2)	8" Min. Flow Recirculation	A2						
	- Gasket		1	2	10	Non Asbestos	8" ANSI 600# RF x 4.5 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10	A193-B7/A194-2H	U1 1/8" - 10UNC x 200 L	
3)	12" Liquid Outlet	B						
	- Gasket		1	2	10	Non Asbestos	12" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		16	2	10	A193-B7/A194-2H	U1 1/8" - 10UNC x 180 L	
4)	24" Manhole	M						
	- Gasket		1	2	10	Non Asbestos	24" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		24	3	15	A193-B7/A194-2H	U1 1/2" - 10UNC x 240 L	
5)	6" Spare Nozzle	S						
	- Gasket		1	2	10	Non Asbestos	6" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10	A193-B7/A194-2H	U3/4" - 10UNC x 130 L	
6)	4" Vent to Flare	V						
	- Gasket		1	2	10	Non Asbestos	4" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		8	2	10	A193-B7/A194-2H	U3/4" - 10UNC x 120 L	
7)	6" Level Transmitter	L1						
	- Gasket		1	2	10	Non Asbestos	6" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10	A193-B7/A194-2H	U3/4" - 10UNC x 130 L	
8)	6" Level Transmitter	L2						
	- Gasket		1	2	10	Non Asbestos	6" ANSI 300# RF x 3.0 t	
	- Stud Bolt & 2-Hex. Heavy Nuts		12	2	10	A193-B7/A194-2H	U3/4" - 10UNC x 130 L	



<p align="center"><b>SPARE PARTS LIST FOR 2 YEARS OPERATION</b></p>	<p>Project Name : Carbon Black &amp; Delayed Cpker Project  Project No. : Ma-6059 - SHIQ-001  Vendor Name : Felguera-IHI. S.A - SHI Qatar</p>
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Item No.	Part Name	Drawing Part No.	Quantity (Unit)			Material Spec.	Size & Description	Remarks
			Installed Per One set	Supply as Spare Parts/Unit	Total Supply as Spare Parts for 5 Units			
9)	2" Pressure Transmitter - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	P1	1 8	2 2	10 10	Non Asbestos A193-B7/A194-2H	2" ANSI 300# RF x 3.0 t U5/8" - 10UNC x 95 L	
10)	2" Pressure Transmitter - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	P2	1 8	2 2	10 10	Non Asbestos A193-B7/A194-2H	2" ANSI 300# RF x 3.0 t U5/8" - 10UNC x 95 L	
11)	2" Temprature Indicator - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	T	1 8	2 2	10 10	Non Asbestos A193-B7/A194-2H	2" ANSI 300# RF x 3.0 t U5/8" - 10UNC x 95 L	
12)	8" Relief Valve - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	A1	1 12	2 2	10 10	Non Asbestos A193-B7/A194-2H	8" ANSI 300# RF x 3.0 t U7/8" - 10UNC x 145 L	
8)	6" Level Transmitter - Gasket - Stud Bolt & 2-Hex. Heavy Nuts	L3	1 12	2 2	10 10	Non Asbestos A193-B7/A194-2H	6" ANSI 300# RF x 3.0 t U3/4" - 10UNC x 130 L	

**Chapter 5 .- SUB-SUPPLIERS.**

We propose you a list of the main subcontractors of Felguera-IHI:

**FELGUERA-IHI:**

Steel mill plates:

- Arcelor Mittal
- Ruukki
- Corus Group
- Norsider

Steel distributors plates:

- Gonvarri
- Thyssen Ros
- Arcelor Iberia
- AG Asturias
- Hiasa

Prefabricated SHOP


We usually work with Felguera Calderería Pesada, company owned by Duro Felguera, for the prefabrication of the spheres plates. It is located in Asturias, Spain.

Painting:

- Sem
- Depisa
- Julio Crespo
- Pinsur

NDT'S


- SGS
- Qualicontrol
- Local companies

	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

**Chapter 6    .-. QUALITY AND HSE CERTIFICATIONS.**

Attachment finds Felguera-IHI certifications in the following normative:

- ISO 9001
- ISO 14001
- OSHAS 18001
- ASME U/U2 Stamp

 <b>SAMSUNG ENGINEERING</b>	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	



## CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

**FELGUERA - I.H.I., S.A.**  
**Las Rozas, Madrid**  
**Spain**

has been approved by Lloyd's Register Quality Assurance  
to the following Quality Management System Standards:

**ISO 9001:2008**

The Quality Management System is applicable to:

**Design, management of fabrication, installation and  
assembly, repair and starting up of equipment for storage  
of liquids, gases and liquified gases.**

Approval  
Certificate No: SGI 2199520

Original Approval: 23 February 2000

Current Certificate: 1 January 2010

Certificate Expiry: 31 December 2012

Issued by: LRQA, Ltd. Operaciones España



001

This document is subject to the provision on the reverse  
71 Fenchurch Street, London EC3M 4BS United Kingdom. Registration number 1879370  
This approval is carried out in accordance with the LRQA assessment and certification procedures and monitored by LRQA.  
The use of the UKAS Accreditation Mark indicates Accreditation in respect of those activities covered by the Accreditation Certificate Number 001  
Macro Revision 13

## CERTIFICATE OF APPROVAL

This is to certify that the Environmental Management System of:

**FELGUERA IHI, S.A.**  
**Las Rozas, Madrid**  
**Spain**

has been approved by Lloyd's Register Quality Assurance  
to the following Environmental Management System Standard:

**ISO 14001:2004**

The Environmental Management System is applicable to:

**Design, installation, assembly and repair of equipment for  
storage of liquids, gases and liquified gases.**

Approval  
Certificate No: SGI 6010832

Original Approval: 06 May 2011

Current Certificate: 06 May 2011

Certificate Expiry: 05 May 2014



Issued by: LRE, S.A.  
On behalf of Lloyd's Register Quality Assurance Limited



001



# CERTIFICATE

AUDITORES DEL NOROESTE, S.L. certifies that the  
Occupational Health and Safety Management System of

**FELGUERA-IHI, S.A.**

(LAS ROZAS, MADRID, SPAIN)

complies with the requirements of OHSAS 18001:2007

*Scope: Design, management of fabrication, installation and  
assembly, repair and starting up of equipment for storage  
liquids, gases and liquified gases.*

Certificate Registration No: SGSSL 081113

Issue Date: December 11, 2008

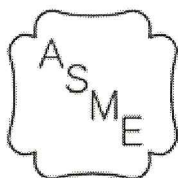
Renewal Date: December 10, 2011



**Auditores del Noroeste 2000, S.L.**, authorized company as a specializing entity in OH&S Management  
Systems Audit, with nationwide scope, according to 6/11/2002 resolution of Work and Employment  
Promotion Ministry of the Government of Asturias (SPAIN), and authorization number 33/0003/01.







U2

# CERTIFICATE OF AUTHORIZATION

The named company is authorized by the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the certification mark and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this certification mark shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:

Felguera-I.H.I, s.a.  
Poligono Industrial Riu Clar, c/Mercuri Nave 166A  
Tarragona 43006  
Spain

SCOPE:

Manufacture of pressure vessels at the above location and field sites controlled by  
the above location

AUTHORIZED: March 30, 2012

EXPIRES: March 30, 2015

CERTIFICATE NUMBER: 42,213

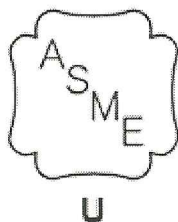
Vice President, Conformity Assessment

Director, Conformity Assessment









# CERTIFICATE OF AUTHORIZATION

The named company is authorized by the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the certification mark and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this certification mark shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

**COMPANY:**

**Felguera-I.H.I, s.a.  
Poligono Industrial Riu Clar, c/Mercuri Nave 166A  
Tarragona 43006  
Spain**

**SCOPE:**

**Manufacture of pressure vessels at the above location and field sites controlled by the above location (This authorization does not cover impregnated graphite)**

**AUTHORIZED: March 30, 2012**

**EXPIRES: March 30, 2015**

**CERTIFICATE NUMBER: 42,212**

A handwritten signature in black ink, appearing to read 'Sullivan J. P. ...'.

Vice President, Conformity Assessment


A handwritten signature in black ink, appearing to read 'David A. ...'.

Director, Conformity Assessment



Find enclosed an example of the quality documents of:

- Quality inspection plan (shop and site)
- Job quality plan

 <b>SAMSUNG ENGINEERING</b>	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

<b>PPI RECOMENDED</b>				<b>PROGRAMA DE PUNTOS DE INSPECCIÓN EN OBRA</b> <i>Inspection and Testing Plan at Site</i>						Ref.: XXX-PPI-01-At Site		Ed.: 3			
										Pág. 1 of 6		Fecha: 20-10-11 Date			
Cliente: xxxxxxxxxxxxxxxx <i>Client</i> Ingeniería: xxxxxxxx <i>Engineering</i>				xxxxxxxxxxxxx PROJECT				Centro de trabajo: OBRA / SITE <i>Work place</i> Localidad: xxxxxxxxxxxx <i>Locality</i>							
Actividad: <i>Activity</i>				ERECTION OF SPHERES				Constructor <i>Manufacturer</i>		Cliente <i>Client</i>		Tercera Inspección <i>Third party inspection</i>		Observaciones <i>Observations</i>	
Item Nº	Descripción de la operación de Inspección o Prueba <i>Inspection and or testing description</i>	Extensión <i>Extent</i>	Procedimiento Especificación, Plano <i>Procedure, Spec., Drw.</i>	Registro <i>Record</i>	Símbolo <i>Symbol</i>	Fecha y firma <i>Date and sign</i>	Símbolo <i>Symbol</i>	Fecha y firma <i>Date and sign</i>	Símbolo <i>Symbol</i>	Fecha y firma <i>Date and sign</i>					
1	ERECTION IN SITE														
1.1	PROCEDURES														
1.1.1	WPS	100	ASME SECC. IX	YES	R		R								
1.1.2	PQR	100	ASME SECC. IX	YES	R		R								
1.1.3	WPQ	100	ASME SECC. IX	YES	R		R								
1.1.4	Non destructive test	100	ASME SECC.V	YES	R		R								
1.1.5	Others procedures ( blasting, painting, Etc.)	100	S.N.A.	YES	R		R								
1.2	BASE RECEPTION.														
1.2.1	Base Leveling	100	AS DRAWING	YES	O		O								
1.2.2	Dimensional control	100	AS DRAWING	YES	O		O								
1.3	MATERIAL RECEPTIONS IN SITE														
1.3.1	BASE MATERIALS RECEPTIONS														
1.3.1. 1	Visual inspection of each plate or piece. To verify absence of damages. To Check marks identification.	100	-----	YES	A		A								

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1.3.1. 2	Documentation Review: To check invoices. To check SHIPMENT AUTHORIZATION	100	-----	YES	A		A							
1.3.2	SPHERE FILLER METALS RECEPTION													
1.3.2. 1	Visual control, marks Identification	100	EN 10204	NO	A		A							
1.3.2. 2	Material Certification	100	3.1.B/ EN 10204	NO	A		A							
1.3.3	UPPER SIDE COLUMNS FABRICATION													
1.3.3. 1	Fit up, Upper side columns with shell plate Dimensional Control	100	AS DRAWING	NO	A		A							
1.3.3. 2	Weld Upper side columns with shell plate Humid magnetic Particles control	100	AS PROCEDURE	YES	A		A							
1.3.4	CUT PLATES HOLES AND REINFORCEMENTS HOLES													
1.3.4. 1	Cut holes and edge finishing Dimensional Control	100	AS DRAWING	NO	A		A							
1.3.4. 2	Cut holes and edge finishing 80 mm wide Ultrasonic test, Minimum	100	AS PROCEDURE	YES	A		A							
1.3.4. 3	Cut holes and edge finishing Humid magnetic Particles control	100	AS PROCEDURE	YES	A		A							

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1.4	COLUMNS ERECTIONS											
1.4.1	Dimensional Control	100	AS DRAWING	NO	A		A					
1.5	SPHERICAL SHELL ERECTION											
1.5.1	Shell Erection: Dimensional Control.	100	AS DRAWING	NO	A		A					
1.5.2	Joint fit-up. Dimensional Control. Alignment and gaps	100	AS DRAWING	NO	O		O					
1.5.3	Checking cleaning edges before welding	100	-----	NO	A		A					
1.6	WELDING JOINT											
1.6.1	First weld beam, Visual Control	100	AS PROCEDURE	NO	A		A					
1.6.2	Root Gauging, Visual control.	100	AS PROCEDURE	NO	A		A					
1.6.3	Root Gauging. Humid magnetic Particles control	100	AS PROCEDURE	YES	A		A					
1.6.4	Root weld, Visual control.	100	AS PROCEDURE	YES	A		A					
1.6.5	All butt weld of spherical shell Radiographic test (Quality: Structurix D-4 or same)	100	AS PROCEDURE	YES	O		O					

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1.6.6	All butt weld spherical shell Ultrasonic control.	100	AS PROCEDURE	YES	O		O						
1.6.7	Humid magnetic particles Control of all welds carried out in the inner side of the sphere	100	AS PROCEDURE	YES	O		O						
1.6.8	Removed temporal erection welding by grinding. Visual control	100	AS PROCEDURE	YES	O		O						
1.6.9	Removed temporal erection welding by grinding, Humid magnetic particles Control	100	AS PROCEDURE	YES	O		O						
1.6. 10	Production test in 1G, 2G and 4G positions	100	S/ASME IX	YES	O		O						
1.6. 11	Mechanical test of Production test, Tensile, Bend, Charpy V Notch and Hardness test.	100	S/ASME IX	YES	O		O						
1.6. 12	Columns, Verticality controls.	100	AS PROCEDURE	YES	O		O						
1.6. 13	Column welds Upper to bottom side, Visual control.	100	AS PROCEDURE	YES	O		O						
1.6. 14	Record welding drawing	100	AS PROCEDURE	YES	A		A						
1.7	ERECTION AND WELDING OF NOZZLES AND REINFORCEMENT												
1.7.1	Nozzles erection on spherical shell Dimensional Control	100	AS DRAWING	NO	A		A						
1.7.2	Nozzles weld on spherical shell. Both side visual control.	100	AS PROCEDURE	YES	A		A						

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1.7.3	Nozzles weld on spherical shell. Root Gauging Humid magnetic particles Control	100	AS PROCEDURE	YES	O		O						
1.7.4	Nozzles weld on spherical shell. Both side Humid magnetic particles Control	100	AS PROCEDURE	YES	O		O						
1.7.5	Nozzles weld on spherical shell. Ultrasonic test	100	AS PROCEDURE	YES	O		O						
1.7.6	Reinforcements weld zones. 50 mm wide ultrasonic test. Minimum	100	AS PROCEDURE	YES	O		O						
1.7.7	Reinforcements weld – Plates Humid magnetic particles Control	100	AS PROCEDURE	YES	O		O						
1.7.8	Reinforcements weld. Pneumatic test at 1.4 Kg / cm <sup>2</sup>	100	AS PROCEDURE	YES	A		A						
1.8	ACCESSORIES												
1.8.1	Erections. Dimensional Control.	100	AS PROCEDURE	NO	A		A						
1.8.2	Accessories welded. (Suspenders, Stairway, platform, Etc. ). Visual control	100	AS PROCEDURE	NO	A		A						
1.8.3	Supports, reinforcement and lugs welded out side of spherical shell. Humid Magnetic Particles test.	100	AS PROCEDURE	NO	O		O						
1.9	HEAT TREATMENT OF THE SPHERICAL SHELL	100	AS PROCEDURE	YES	O		O						
1.10	CONTROLS AFTER HEAT TREATMENT OF SPHERICAL SHELL												


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1.10.1	ALL BUTT WELDS OF SPHERICAL SHELL AND WELDED NOZZLES TO SPHERICAL SHELL. Ultrasonic Control. After heat Treatment.	100	AS PROCEDURE	YES	O		O						
1.10.2	ALL BUTT WELDS OF SPHERICAL SHELL AND ALL BUT WELD OF NOZZLES. Radiographic test (Quality: Structurix D-4 or same ), After heat Treatment.	100	AS PROCEDURE	YES	O		O						
1.10.3	ALL BUTT WELDS OF SPHERICAL SHELL, ALL BUT WELD OF NOZZLES, WELDED NOZZLES TO SPHERICAL SHELL AND TEMPORAL WELDED ZONES. Humid Magnetic Particles control. After Thermal Treatment.	100	AS PROCEDURE	YES	O		O						
2	INNER VISUAL CONTROL.	100		YES	A		A						
3	OUTER VISUAL CONTROL	100		YES	A		A						
4	FINAL DIMENSIONAL CONTROL	100		YES	O		O						
5	CARRIED OUT OF HYDRAULICS TEST	100	AS PROCEDURE	YES	O		O						
6	PAINTING	100	AS PROCEDURE	YES	O		O						
7	INSULATION	100	AS PROCEDURE	YES	-		-						
8	FINAL CERTIFICATION												
9	DOCUMENTATION REVIEW	100		YES	O		O						
10	FINAL DOSSIER OF WORKS	100		YES	O		O						


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			<b>PROGRAMA DE PUNTOS DE INSPECCIÓN EN FABRICACIÓN</b> <i>Inspection and Testing Plan in Fabrication</i>					Ref.: XXXX-PPI-01		Ed.: 4			
Cliente: xxxxxxxx <i>Client</i> Ingeniería: xxxxxxxxxxxx <i>Engineering</i>			xxxxxxxxxxxx PROJECT					Centro de trabajo: TALLER / SHOP <i>Work place</i> Localidad: GIJÓN - SPAIN <i>Locality</i>					
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1	MATERIALS RECEPTION												
1.1	SUBJECTED TO PRESSURE MATERIALS												
1.1.1	BASE METALS PLATES												
1.1.1.1	Dimensional / Visual Control	100	AS DRAWING	NO	A		A						
1.1.1.2	Marks Identification / Traceability	100	AS DRAWING	NO	A		A						
1.1.1.3	Materials Certification, Identification, Chemical Composition and Mechanical Test, Review.	100	3.1.B / EN 10204	NO	R		R						
1.1.1.4	100 mm. Squares scan. Ultrasonic test..	100	S/ ASTM A-435	YES	O		A						
1.1.2	FORGES												
1.1.2.1	Dimensional / Visual control. Including holes numbers, diameter and position.	100	AS DRAWING	NO	A		A						
1.1.2.2	Marks Identification / Traceability	100	AS DRAWING	NO	A		A						
1.1.2.3	Materials Certification, Identification, Chemical Composition and Mechanical Test, Review.	100	3.1.B / EN10204	NO	R		R						
1.1.2.4	Forges Ultrasonic Test, 30 mm thickness or bigger than.	100	S / ASTM A-388	YES	O		A						
1.1.2.5	Forges Humid Magnetic Particles test, 30 mm thickness or bigger than. after mechanized.	100	A / SA-350	YES	O		A						


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1.1.2. 6	Hardness Test	100	A / SA-350	YES	O		A						
1.1.2. 7	Visual Inspection of The Flanges Faces	100	A / SA-350	YES	A		A						
1.1.3	PIPE												
1.1.3. 1	Dimensional / Visual control. Diameter, Thickness, Roundness and Inner finishing, Checking:.	100	AS DRAWING	NO	A		A						
1.1.3. 2	Impact test of one pipe per unit of equipment, chosen at radom	1	Acc./3.3.2 of SPC-EQ-1003	YES	A		A						
1.1.3. 3	Marks Identification / Traceability	100	AS DRAWING	NO	A		A						
1.1.3. 4	Materials Certification, Identification, Chemical Composition and Mechanical Test, Review.	100	3.1.B /EN 10204	NO	R		R						
1.1.4	JOINTS, SCREWS AND NUTS.												
1.1.4. 1	Dimensional / Visual Control To Check : Type, Dimensions and piece number	100	AS DRAWING	NO	A		A						
1.1.4. 2	Materials Certification. To Check: Identifications, Dimensions and quality	100	2.2/EN10204	NO	R		R						
1.1.5	FILLER METALS TO WELD SPHERE												


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1.1.5.1	Visual control, marks Identification.	100	EN 10204	NO	A		A						
1.1.5.2	Materials Certifications	100	3.1.B / EN 10204	NO	R		R						
1.2	NOT SUBJECTED TO PRESSURE MATERIALS.												
1.2.1	BASE METALS												
1.2.1.1	Dimensional Control	100	AS DRAWING		A		A						
1.2.1.2	Marks Identification / Traceability	100	AS DRAWING		A		A						
1.2.1.3	Materials Certification. To Check: Identification, Dimensions and Quality	100	2.2./ EN 10204	NO	R		R						
1.2.2	FILLER METALS, TO WELD NOT SUBJECTED TO PRESSURE MATERIALS.												
1.2.2.1	Visual control, Marks Identification	100	EN 10204	NO	A		A						
1.2.2.2	Materials Certification	100	2.2./ EN 10204	NO	R		R						
2	SHOP PREFABRICATION												
2.1	SPHERICAL SHELL												


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		<b>PROGRAMA DE PUNTOS DE INSPECCIÓN EN FABRICACIÓN</b> <i>Inspection and Testing Plan in Fabrication</i>						Ref.: XXXX-PPI-01		Ed.: 4			
Cliente: xxxxxxxx <i>Client</i> Ingeniería: xxxxxxxxxxxx <i>Engineering</i>		xxxxxxxxxxxx PROJECT						Centro de trabajo: TALLER / SHOP <i>Work place</i> Localidad: GIJÓN - SPAIN <i>Locality</i>					
Actividad: <i>Activity</i>		<b>ERECTION OF SPHERES</b>				Constructor <i>Manufacturer</i>		Cliente <i>Client</i>		Tercera Inspección <i>Third party inspection</i>		Observaciones <i>Observations</i>	
Item Nº	Descripción de la operación de Inspección o Prueba <i>Inspection and or testing description</i>	Extensión <i>Extent</i>	Procedimiento Especificación, Plan o Procedure, Spec., Drw.	Registro <i>Record</i>	Símbolo <i>Symbol</i>	Fecha y firma <i>Date and sign</i>	Símbolo <i>Symbol</i>	Fecha y firma <i>Date and sign</i>	Símbolo <i>Symbol</i>	Fecha y firma <i>Date and sign</i>			
2.1.1	SHELL PLATES												
2.1.1.1	Marks Identification / Traceability	100	AS DRAWING	NO	A		A						
2.1.1.2	Forming: bend control	100	AS DRAWING	NO	A		A						
2.1.1.3	Cut: dimensional control	100	AS DRAWING	NO	A		A						
2.1.1.4	Beveling: dimensional control	100	AS DRAWING	NO	A		A						
2.1.1.5	Beveling: visual Inspection	100	AS DRAWING	NO	A		A						
2.1.1.6	Beveling: 80mm wide Ultrasonic Edge Control. Minimum	100	AS PROCEDURE FCP-RI-0-01-Re0	YES	O		A						
2.1.1.7	Beveling: Humid Magnetic Particles Edge Inspection	100	AS PROCEDURE FCP-PM.0.01Re0	YES	O		A						
2.2	NOZZLES, REINFORCEMENTS AND PIPES												
2.2.1	Marks Control / Traceability	100	AS DRAWING	NO	A		A						
2.2.2	Rolling: Bend Control.	100	AS DRAWING	NO	A		A						
2.2.3	Cut. Dimensional Control	100	AS DRAWING	NO	A		A						
2.2.4	Nozzles, Reinforcements and forges Beveling: Dimensional Control.	100	AS DRAWING	NO	A		A						

Leyenda de símbolos:  
*Symbols legend*


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Actividad: <i>Activity</i>		<b>ERECTION OF SPHERES</b>				Constructor <i>Manufacturer</i>		Cliente <i>Client</i>		Tercera Inspección <i>Third party inspection</i>		Observaciones <i>Observations</i>	
Item Nº	Descripción de la operación de Inspección o Prueba <i>Inspection and or testing description</i>	Extensión <i>Extent</i>	Procedimiento Especificación, Plan o Procedure, Spec., Drw.	Registro <i>Record</i>	Símbolo <i>Symbol</i>	Fecha y firma <i>Date and sign</i>	Símbolo <i>Symbol</i>	Fecha y firma <i>Date and sign</i>	Símbolo <i>Symbol</i>	Fecha y firma <i>Date and sign</i>			
2.2.5	Reinforcement Beveling: Humid Magnetic Particles test.	100	AS PROCEDURE FCP-PM.0.01Re0	YES	A		A						
2.2.6	Reinforcement Beveling: 80mm wide Ultrasonic test. Minimum.	100	AS PROCEDURE FCP-US-0-04Re1	YES	A		A						
2.3	COLUMNS ( Upper and bottom side)												
2.3.1	Marks Control / Traceability.	100	AS DRAWING	NO	A		A						
2.3.2	Rolling: Bend control	100	AS DRAWING	NO	A		A						
2.3.3	Cut. Dimensional Control	100	AS DRAWING	NO	A		A						
2.3.4	Beveling: dimensional control and visual control	100	AS DRAWING	NO	A		A						
2.4	OTHER ELEMENTS (SUSPENDERS, PLATFORM, STAIRWAY, SUPPORTS, ETC.)												
2.4.1	Marks Control./ Traceability.	100	AS DRAWING	NO	A		A						
2.4.2	Dimensional Control	100	AS DRAWING	NO	A		A						
3	SHOP FABRICATION												
3.1	UPPER SIDE COLUMNS												

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Cliente: xxxxxxxx <i>Client</i> Ingeniería: xxxxxxxxxxxx <i>Engineering</i>			xxxxxxxxxxxx PROJECT				Centro de trabajo: TALLER / SHOP <i>Work place</i> Localidad: GIJÓN - SPAIN <i>Locality</i>					
Actividad: <i>Activity</i>			<b>ERECTION OF SPHERES</b>		Constructor <i>Manufacturer</i>		Cliente <i>Client</i>		Tercera Inspección <i>Third party inspection</i>		Observaciones <i>Observations</i>	
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3.1.1.	Dimensional control	100	AS DRAWING	NO	A		A					
3.1.2	Weld visual control.	100	AS PROCEDURE FCP-EV-0-01Re0	NO	A		A					
3.2	COLUMNS BOTTON SIDE, STAIRWAY, PLATFORM, HANDRAIL, Etc.											
3.2.1	Dimensional control	100	AS DRAWING	NO	A		A					
3.2.2	Weld visual control	100	AS PROCEDURE FCP-EV-0-01Re0	NO	A		A					
3.3	NOZZLES WELDS											
3.3.1	Pipe-Flange and Pipe-Forges welds. Radiographic test	100	AS PROCEDURE FCP-RI-0-01-Re0	YES	A		A					
3.3.2	Pipe-Flange and Pipe-Forges welds. Humid Magnetic Particles Control	100	AS PROCEDURE FCP-PM-0-01Re0	YES	A		A					
3.4	PAINTING											
3.4.1	Visual Inspection / Thickness Control	100	AS PROCEDURE OF PAINTING	YES	A		A					
3.5	SHOP SHIPMENT TO SITE											
3.5.1	To Check: correct Identification of invoices.	100	AS DRAWING	YES	A		A					

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Actividad: ERECTION OF SPHERES <i>Activity</i>				Constructor <i>Manufacturer</i>		Cliente <i>Client</i>		Tercera Inspección <i>Third party inspection</i>		Observaciones <i>Observations</i>	
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3.5.2	Quality documentation review.	100		YES	O		A				
3.5.3	PACKING AND MARKING	100	AS PROCEDURE OF P. AND M.	YES	A		A				
3.5.4	SHIPMENT AUTHORIZATION Emission	100		YES	O		O				

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	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
Sphere Tank		Hoja 2 de 18	Rev.: 2

## INDEX

1.	INTRODUCTION .....	3
2.	ORGANIZATION AND RESPONSIBILITIES .....	3
2.1.	Responsibilities .....	3
2.2.	Project Coordination .....	5
2.3.	Human Resources and Infrastructure .....	5
3.	CONTROL AND PROJECT MANAGEMENT .....	6
3.1.	Review and amendment of the Contract .....	6
3.2.	Project Scheduling .....	6
3.3.	Project Administration .....	6
4.	ENGINEERING.....	7
4.1.	Responsibilities .....	7
4.2.	Design Control .....	7
4.3.	Engineering Documentation .....	7
5.	PURCHASING .....	7
5.1.	Responsibilities .....	8
5.2.	Supplier Approval.....	8
5.3.	Purchasing Control.....	8
5.4.	Inspections at the reception .....	9
6.	IDENTIFICATION AND TRACEABILITY .....	9
6.1.	Materials and Equipment .....	9
6.2.	Inspection and Testing .....	9
7.	CONSTRUCTION.....	10
7.1.	Responsibilities .....	10
7.2.	Components of the Site.....	10
7.3.	Subcontractors.....	10
7.4.	Erection .....	11
7.5.	Special Processes .....	11
8.	QUALITY CONTROL .....	11
8.1.	Inspections and Tests at the Reception.....	11
8.2.	Inspections and Tests in the Manufacturing .....	11
8.3.	Quality Control Procedures .....	12
8.4.	Measurement and Testing Equipment .....	12
9.	PRESERVATION OF THE PRODUCT AND OF THE SUPPLIES OF THE CLIENT .....	12
10.	INTERNAL AUDIT QUALITY .....	13
11.	NON CONFORMITIES, CORRECTIVE AND PREVENTIVE ACTIONS .....	13
12.	PROJECT QUALITY RECORDS .....	13
13.	FINAL DELIVERY .....	13
14.	ANNEXES.....	14

	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 3 de 18</b>	<b>Rev.: 2</b>

## 1. INTRODUCTION

Felguera-IHI, S.A. establishes this Quality Plan to describe the organization, structure and the procedures to be adopted in the execution of XXX SPHERES FOR XXXXXXXXXXXXXXXX PROJECT.

This Project located at XXXXXXXX, XXXXXXXX, for "XXXXXXX", comprises engineering, supply, manufacturing, construction, erection, and delivery of three spheres tanks. These phases apply to XXXX spheres tanks of XXXX. Felguera-IHI will perform the following project activities:

- Engineering and supply
- Construction activities (Manufacturing, welding, handling, storage, erection and delivery)
- Inspection and testing
- Painting

For drafting this Plan, has been taken into account the Customer specifications and the Customer's quality requirements and content of ISO 9001: 2008.

Felguera IHI, S.A. is accredited to ISO 9001:2008, for the following activities: design, management of fabrication, installation and assembly, repair and starting up of the equipment for storage liquids, gases and liquefied gases. This Quality Plan includes procedures of Felguera IHI's Quality System.

Quality Plan is issued by Felguera-IHI Quality Department and it is approved by Project Manager.

## 2. ORGANIZATION AND RESPONSIBILITIES

Functional organization and responsible of the Project is attached as annex 1: Organization Chart.

### 2.1. Responsibilities

#### Quality Assurance, Safety and Environment

It is responsible for the preparation, implementation and maintenance of the Project Quality System and it must be in permanent communication to Project Management to resolve any Quality deviation.

	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 4 de 18</b>	<b>Rev.: 2</b>

#### Project Manager

The Project Manager is responsible of:

- To review design and of the preparation of alternatives, if appropriate, taken into account codes, rules, regulations as applicable, as well as the specifications of the Project.
- To verify that the suppliers' designs meet specifications of the Project.
- Preparation of drawings.
- Preparation of Project documentation in Spanish or English language.
- Preparation of Final Quality Dossier.
- The material control and accounting, when applicable.
- Preparation of schedules for inspection of materials and equipment; activation of the delivery of equipment, materials and manufacturing.
- The requests of purchase.

#### Field Manager

The Field Manager is responsible of:

- Performance of the Site under the Contract, performance the program of Site, and quality requirements.
- To coordinate and manage of human and material resources.
- He/she supervises the documentation available at Site.
- Manage the purchases, and to realize the control and accounting of the orders emitted by the Site.
- He/she coordinates and supervises, on time and quality, the accomplishment of the subcontracted service.
- Completing the Site progress reports.
- Verifies compliance with plans and procedures.
- Presence test equipment.

#### Field Quality Control

The Field Quality Control is responsible of:

- Establishing quality management in accordance with the requirements of the Project and the Quality System.
- The quality of construction will be verified by a team of quality inspectors, who will be under your control. This team has the responsibility to verify, to review and witness the inspection activities.
- Maintaining quality documentation of the Site, including documentation related to the ITP's.
- Caring for the Customer Inspectors.

	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 5 de 18</b>	<b>Rev.: 2</b>

### Safety Health and Environment Control (SHE)

Is responsible of:

- Ensure knowledge of safety at Site of all staff.
- Ensure the methods and procedures are safe.
- Ensure the methods and procedures comply with all laws, regulations and other legal provisions available and applicable to personal safety and the environment.
- Analyze the effects of construction on the environment and take preventive measures necessary to comply with existing legislation.

## **2.2. Project Coordination**

### Communication between the Client and the Company

The disclosure of documents was done by a computer program.

## **2.3. Human Resources and Infrastructure**

The Engineering Manager assigns personnel to the Project Manager. During the execution of the Project, can be necessary specific actions for formation. Human Resources shall provide all documentation in the form of codes, standards, regulations, Quality System documents and publications applicable, as well as the specifications of the Project.

Applicable documentation is contained in Annex 2: List of applicable documents.

This List consists of the following paragraphs:

- a) Customer Contract or Order.
- b) Codes, rules or regulations.
- c) Drawings and Customer's specifications.
- d) Documents of the Quality Plan (FI)
- e) Documents of the Quality Plan (Subcontractors).

Documents issued by Subcontractors will be added later to paragraph *e) Documents of the Quality Plan (Subcontractors)*

Project staff must be suitably qualified to develop the work for which it has been required. So that:

- All NDT personnel shall be qualified as per a widely recognized Standard (ASNT, AEND, etc)
- All welders shall be qualified as per ASME IX or European Standard EN 287. The welders' qualifications must be approved by Notified Body or Independent Organization.

It will be made (or it will be required to the subcontractors) a list of tooling, machinery, welding equipment, transport facilities, lifting equipment and safety equipment. All this

	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 6 de 18</b>	<b>Rev.: 2</b>

material and equipment must meet the requirements of the Industrial Safety legislation in force.

The legalization of the workplace is not applicable in this project.

### 3. CONTROL AND PROJECT MANAGEMENT

It consists in the description of the General Methods for the control and the administration at Project in an economically way. It is considered the following points:

- Review and amendment of the Contract,
- Project Scheduling,
- Project Administration.

#### 3.1. Review and amendment of the Contract

Prior to the development of technical documentation of the Project, contract documents should be reviewed. Any omission or error that is detected must be communicated to Customer.

Meetings will take place with the participation of those responsible for project management with the target to review progress and ensure that goals are achieved, also to consider new proposals and any impacts of the Project. Customer's requirements must be incorporated at the Project. Representatives of the Customer can attend.

#### Modification of Contract or Project.

Any change or modification to the Contract should be reviewed to verify compliance with the Project Schedule and assess any impact on the Project cost.

#### 3.2. Project Scheduling

Project Scheduling is performed using accredited software. The results of these programs are filed. The dates of term of activities must get up-to-date in the successive reviews of the planning.

The initial Project Scheduling is detailed in:

Planning (on hold)

#### 3.3. Project Administration

The administrative control of the project is run by the Engineering Department in collaboration with the Project Manager. The criteria of administration of the project are based on the analysis of the current schedule, the cost report, and budget. It will take into



	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 7 de 18</b>	<b>Rev.: 2</b>

account the changes in the Contract. The Project Manager will take appropriate action as a result of the analysis the progress of the Project and the economic result of the project.

#### **4. ENGINEERING**

Project Manager is responsible for the development of engineering of the Project; he/she will coordinate the external engineering resources, if applicable. The following sections describe the methods to coordinate and manage the Project.

##### **4.1. Responsibilities**

The Director of the Engineering Department is responsible for designing the project, including external engineering, if applicable, as well as supervision and control of construction requirements and specifications of materials and equipment. The Project Manager is responsible for coordinating the various teams of engineers and designers involved in design development and programming to meet the Project.

##### **4.2. Design Control**

Felguera-IHI has a procedure on the control design is applicable to the Engineering Project.

The Engineering Department verifies the review, verification and validation of Engineering design developed by outside subcontractors, if any.

##### **4.3. Engineering Documentation**

All project documentation will be identified and monitored so as to enable the easy location of it. Documents must be in its latest version. The following procedures are developed to win control of the documents, taking into account the requirements of the Contract and Project.

##### **List of Documents of the Engineering**

Felguera has a procedure for document control which should consider the following methods:

- Emission, review and approval
- Modifications and changes
- File, control and conservation

#### **5. PURCHASING**

This section includes securing the control of the purchases in accordance with the specifications, Adjudication of the offer of supply of materials, equipment, manufacturing and services, until the verification of purchased product. Also, this paragraph is applicable to

	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 8 de 18</b>	<b>Rev.: 2</b>

activities of persons or organizations involved in procurement, which may affect the quality of materials, equipment and services.

### 5.1. Responsibilities

The Project manager issues the Request of purchase, later, the Unit of Purchases realizes the tabulations according to the different suppliers approved (suppliers), awarding the order to one of them in agreement with the transmitted requisitions.

### 5.2. Supplier Approval

In general the suppliers are selected of the List of FI's Approved Suppliers after overcoming the process of homologation.

There will remain excluded from this initial homologation those suppliers imposed by the client and that have punctual character for a certain project. This will not prevent the follow-up of these suppliers along the project. This type of suppliers will be considered to be authorized by historical evaluation, after three supplies or consecutive satisfactory services.

Also there remain excluded from the homologation the suppliers of punctual purchases motivated by situations of urgency and that have sporadic character and the subsidiaries of Duro Felguera.

The selection of suppliers will be based on the evaluation of his aptitude to supply the products / services, in agreement with the requirements of purchase specified.

The homologation of the suppliers will be realized depending on the type of supplies and the possibilities of evaluation, of the following forms:

- For historical evaluation.
- For sending of questionnaire.
- For certification.

When it proceeds external audits will be realized to suppliers, in order that they report of his quality and capacity.

All suppliers are in the "Approved Suppliers List".

### 5.3. Purchasing Control

The Scheduling of the Project, will be updating similar advance the project, bearing in mind dates foreseen of collections of materials in workshops and other information, all this in order to assure that the supplies should realize in the foreseen period.

Furthermore, it will track the order materials, equipment, manufacturing and services to complete the scheduling requirements of the Project.

	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 9 de 18</b>	<b>Rev.: 2</b>

#### 5.4. Inspections at the reception

On receipt of the material requested, to ensure the quality of materials, equipment, manufacturing and services have been requested from the supplier, it will check for documentation, visual inspections and the necessary controls according to specifications and standards.

The inspection activities at the reception will be detailed at ITP's. Verification of these activities is documented, or is witnessed by inspectors FIHI.

Likewise Felguera-IHI has developed an instruction to output the materials once inspected.

### 6. IDENTIFICATION AND TRACEABILITY

As far as possible, or from the Customer's needs, it should be identified the product throughout the execution of the work.

The identification and traceability is applicable to materials and equipment which are erected at Project, and is applicable to the inspections and tests performed.

#### 6.1. Materials and Equipment

In receiving the materials and equipment for the Project, it must be identified the marks, labels or sheets according to specifications. The quality records of materials and accessories must be kept, to have documented the history of manufacturing and quality of the tank, before, during and after tank construction.

Material Certification consists on certificates of their respective holders.

The identification and traceability of materials, equipment, non-conforming products, welded joints, and inspection records, tests and trials, it is described principally in the Felguera's procedures.

#### 6.2. Inspection and Testing

It is necessary to evaluate the advance of the inspections and testing of components of project, to be able to control and improve the corresponding processes.

Manufacturing Supervisor and the Field Manager are responsible for filling the boxes included in the ITP's, as well as checking that has been done similarly in the IPP of subcontractors and vendors. Also verify that the client (or his representative), the Manufacturer or Subcontractor, and the Third Party, if any, have duly completed the ITP.

On completion of each activity of the ITP, is completed and signed by each manager, stating the date.

	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 10 de 18</b>	<b>Rev.: 2</b>

## 7. CONSTRUCTION

This section establishes the method to ensure control of all construction activities and when they apply, their accessories, ancillary facilities, insulation and paint.

### 7.1. Responsibilities

The Field Manager is responsible for the management and organization of construction activities in the Work, to complete the work within the deadline, while maintaining quality and security required

The Field Manager is responsible for establishing, promoting and maintaining the safety of construction activities of the Site in accordance with the requirements and criteria established deadlines, costs and quality.

It has the authority and means to identify the technical and safety problems and, therefore, to recommend and provide solutions. Must ensure that the necessary safety equipment is available at Work in the quantity and quality. The Field Manager must ensure that the necessary safety equipment is available in site in the quantity and quality.

Promote staff training in security issues and ensure that working methods are in accordance with the laws and regulations of Security.

### 7.2. Components of the Site

The Site consists of different components, some of which may be subcontracted, in whole or in part.

The project includes construction supervision, monitoring is done by specialized subcontractors.

The following lists the components of the Site:

- Three spheres Storage Tanks

### 7.3. Subcontractors

The Subcontractor shall submit before the start of work on site, the procedures that are deemed appropriate and, necessarily, Points Test Plan (ITP).

The ITP's made by the subcontractor carrying out the work must be duly approved by FI.

FI supervision of the work performed by subcontractors is done by verifying compliance with the applicable procedures and programs for Inspection Points (ITP).

	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 11 de 18</b>	<b>Rev.: 2</b>

#### 7.4. Erection

The erection of these storage tanks, and its associated facilities if applicable, must meet the requirements and specifications of the Work Project.

To ensure the effective execution of construction work, there is a procedure of assembly of the equipments in question, although not exclusive, and additional ones may be prepared as required.

#### 7.5. Special Processes

The following special procedures shall be carried out by qualified personnel:

- Welding
- Nondestructive testing (NDTs)

The special process controls are executed in accordance with welding procedure specifications are developed, and non-destructive testing is to be applied, the latter issued by the subcontractors who will perform the tests and others Felguera IHI when it's run.

The acceptance criteria for non-destructive testing are in accordance with codes and standards applicable to the Site.

### 8. QUALITY CONTROL

This section establishes the quality control methods during manufacturing activities and construction to ensure they remain the quality requirements according to the required standards.

#### 8.1. Inspections and Tests at the Reception

Felguera has procedures for inspection methods and process control for quality assurance processes and suppliers.

#### 8.2. Inspections and Tests in the Manufacturing and Erection

All construction activities are subject to inspections and tests to assure that erection works can continue.

The scope of these inspections and tests includes from the inspections of the material in workshop up to the inspections of ending Site.

Inspections and tests may be witnessed by the Customer. After the test with satisfactory results will be issued the corresponding certificate signed by the client, a copy of the certificate is for the customer.

	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 12 de 18</b>	<b>Rev.: 2</b>

Generated reports and certificates shall be kept by the Field Quality Control facilitating access to them at any time by Customer.

The activities of inspection for the manufacture and the construction are controlled and identified by means of inspection and test plan (ITP), which indicate the phase in which an inspection or test is needed, and the type of test to realizing.

Since the completion of engineering documentation, develop inspection test plan (ITP's), which define the quality control in the workshop and field phases and for each tank.

The acceptance criteria for non-destructive testing will be required in the codes and rules for implementing the Project.

### **8.3. Quality Control Procedures**

In the plans of inspections and testing, identifies quality procedures which are required, including procedures for subcontractors.

### **8.4. Measurement and Testing Equipment**

In the manufacturing stage, the Inspector of Supply is responsible for verifying that the inspection teams, measurement and testing used by the subcontractor are properly identified and calibrated in a state of validity. The subcontractor must provide copies of calibration certificates.

When applying the assembly phase, will proceed the same way, and be the Field Manager or the quality technical site responsible for checking the correct identification and validity of the measuring equipment.

## **9. PRESERVATION OF THE PRODUCT AND OF THE SUPPLIES OF THE CLIENT**

Felguera has documents detailing the procedure for handling, packing, storage and delivery control, and treatment of supplies of the Customer.

	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 13 de 18</b>	<b>Rev.: 2</b>

## 10. INTERNAL AUDIT QUALITY

The internal quality audits are conducted as appropriate to verify the effective implementation of FIHI's Quality System.

## 11. NON CONFORMITIES, CORRECTIVE AND PREVENTIVE ACTIONS

Non-compliance shall be clearly documented and identified its cause and take appropriate corrective action to eliminate the nonconformity.

When feasible, preventive actions are implemented to avoid potential nonconformities.

The treatment of non-compliance, subsequent corrective action and possible preventive actions are detailed in Felguera procedures.

The Field Quality Control, with knowledge of the Quality Department is responsible for managing the treatment of non-conformance and corrective actions and responsible for communication with the customer.

## 12. PROJECT QUALITY RECORDS

This section summarizes the measures to ensure control of quality records, have checked the documents and facilitate access to them.

Quality records shall be legible, be conveniently stored, preserving them from possible damage and must be identified clearly.

Quality records will be stored in any medium, such as paper or electronic media.

The minimum file all records will be, if another term is not required in contract specifications or legal requirements, in three years. **For this Project, the storage time is 5 years.**

The records that are generated are integrated into the Final Dossier; those not included in it will be archived on the department responsible for the preparation of such records.

## 13. FINAL DELIVERY

The control the Final Delivery of the Site is done to ensure that:

a) Both parties are aware of the scope of the work, and the action limit in the same at the time of Final Delivery.

	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 14 de 18</b>	<b>Rev.: 2</b>

b) It will be fixed a date for the Final Delivery of the Work that will be adapted for both.

c) The documentation and all the information of the dossier of the Work will be realized by the formats and of the form resolved.

Quality Assurance must verify that the following documentation is complete according to contract:

- Final drawings, records and specifications required.
- Availability of full documentation from suppliers.

#### **14. ANNEXES**

ANNEX 1: ORGANIZATION CHART

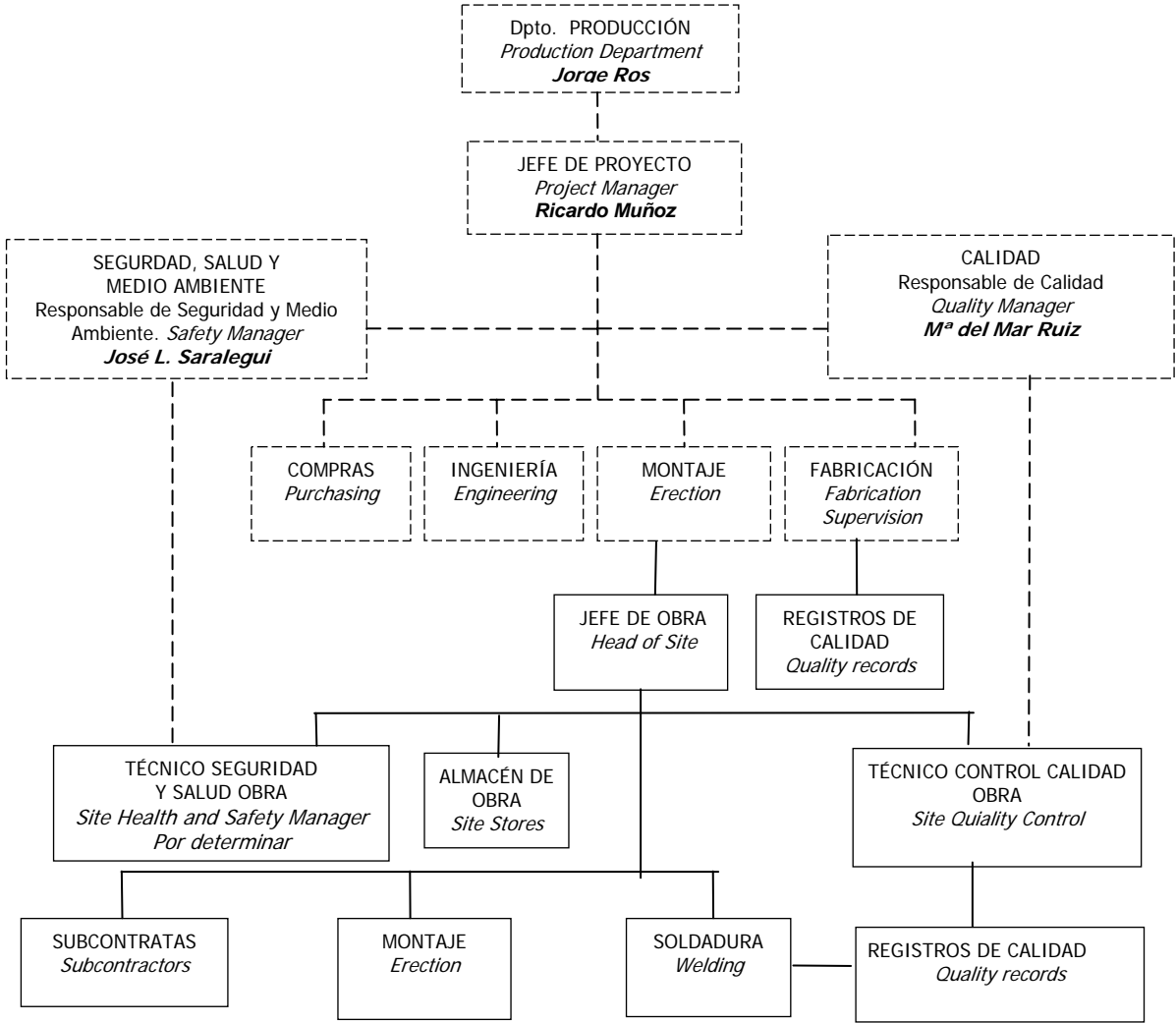
ANNEX 2. LIST OF DOCUMENTS APPLICABLE



	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
		<b>Hoja 15 de 18</b>	<b>Rev.: 2</b>

Sphere Tank

ANNEX 1. ORGANIZATION CHART



Office staff

Personal field

	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 16 de 18</b>	<b>Rev.: 2</b>

## ANNEX 2. LIST OF DOCUMENTS APPLICABLE

### a) Contract

Purchase order No.:

Customer: "Saudi Aramco"

### b) Codes, Rules and Regulations

AD: AD 2000 Regelwerk Technical rules for pressure vessels

AISC: Code of standard practice for steel buildings and bridges

ANSI/ASME: B31.3 Process piping

API RP:

\* 520 Part 1 Sizing, selection and installation of pressure relieving devices in refineries. Part I: Sizing and selection

\* 2003 Protection against ignitions arising out of static, lightning, and stray currents.

API Std:

\* 620 Design and construction of large, welded, low-pressure storage tanks

\* 650 Welded Steel tanks for oil storage

\* 2000 Venting atmospheric and low-pressure storage tanks. Non refrigerated and refrigerated.

ASCE: 7 Minimum design loads for buildings and other structures

ASME II:

\* Part A Materials. Ferrous material specifications

\* Part B Materials. Nonferrous material specifications

\* Part C Materials. Specifications for welding rods, electrodes, and filler metals

\* Part D Materials. Properties (Metric)

ASME IX Welding and brazing qualifications

ASME V Non destructive examination

ASME VIII Div.1 Rules for construction of pressure vessels.

ASME VIII Div.2 Rules for construction of pressure vessels. Alternative rules.

BS: 7777. 3. Flat-bottomed, vertical, cylindrical, storage tanks for low temperature service. Recommendations for the design and construction of prestressed and reinforced concrete tanks and tank foundations, and for the design and installation of tank insulation, tank liners and tank coatings. Issues BSI.



	<b>PROJECT:</b>  XXXXXXXXXXXXX PROJECT	<b>QUALITY PLAN</b>	
		<b>PLAN DE CALIDAD</b>	
<b>Sphere Tank</b>		<b>Hoja 18 de 18</b>	<b>Rev.: 2</b>


**e) Documents of the Quality Plan (Subcontractors)**

Document No.	Title
	RADIOGRAPHIC INSPECTION FOR WELDS
	MAGNETIC PARTICLES EXAMINATION PROCEDURE
	PENETRAN LIQUID TEST PROCEDURE
	PAINTING PROCEDURE
	THERMAL TRATMENT PROCEDURE

**Chapter 8 .-SHIPPING, ERECTION AND PWHT PROCEDURES**

Find enclosed *our the following procedure for spheres.*

- *Shipping procedure (by FI)*
- *Erection procedure (editable format by SHI)*
- *PWHT Procedure (editable format by SHI)*

 <b>SAMSUNG ENGINEERING</b>	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

# **TRANSPORTATION** **PROCEDURE**

**(SPHERES)**

## **CONTENTS**

- 1.0 SCOPE.
- 2.0 APPLICABILITY.
- 3.0 PACKING AND MARKING.
- 4.0 HANDLING.
- 5.0 TRANSPORT.
  - 5.1 LAND
  - 5.2 SEA
- 6.0 FIELD STORING

## **1.0 SCOPE.**

This specification covers handling, transportation and storage requirements for proper transport of prefabricated items relevant to Site

Transport will be from Felguera Caldereria Pesada workshop in Gijón, SPAIN.

## **2.0 APPLICABILITY.**

Requirements set forth herein shall be adhered to for proper conservation of the following items:

- Shell plates.
- Support columns.
- Tie plates.
- Stairways.
- Accessories, bolting and the like.

## **3.0 PACKING AND MARKING.**

All plates belonging to the spherical shell shall be marked on a corner with corresponding identification:

POS  
DRAWING  
ITEM

In addition to this, packing list item will be shown on the plates.

Columns and all structural elements will be recorded with corresponding position and drawing and also showing packing list item.

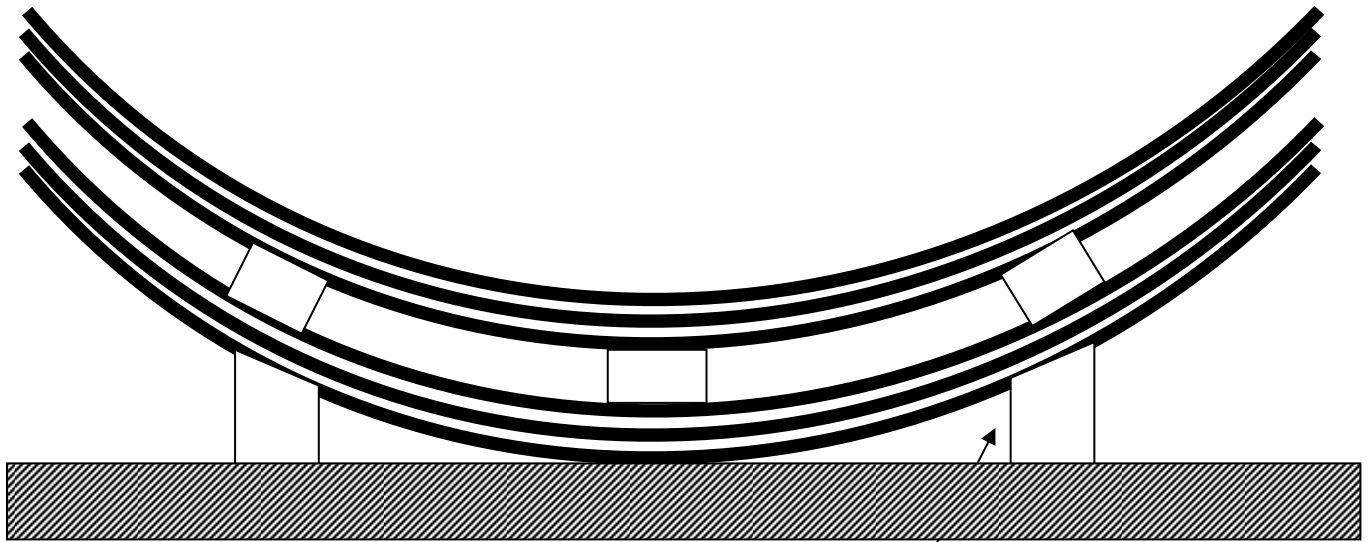
Shell plates will be piled up as per sketch 1.

Correct bending will be ensured by means of wood pieces (sketch 1).

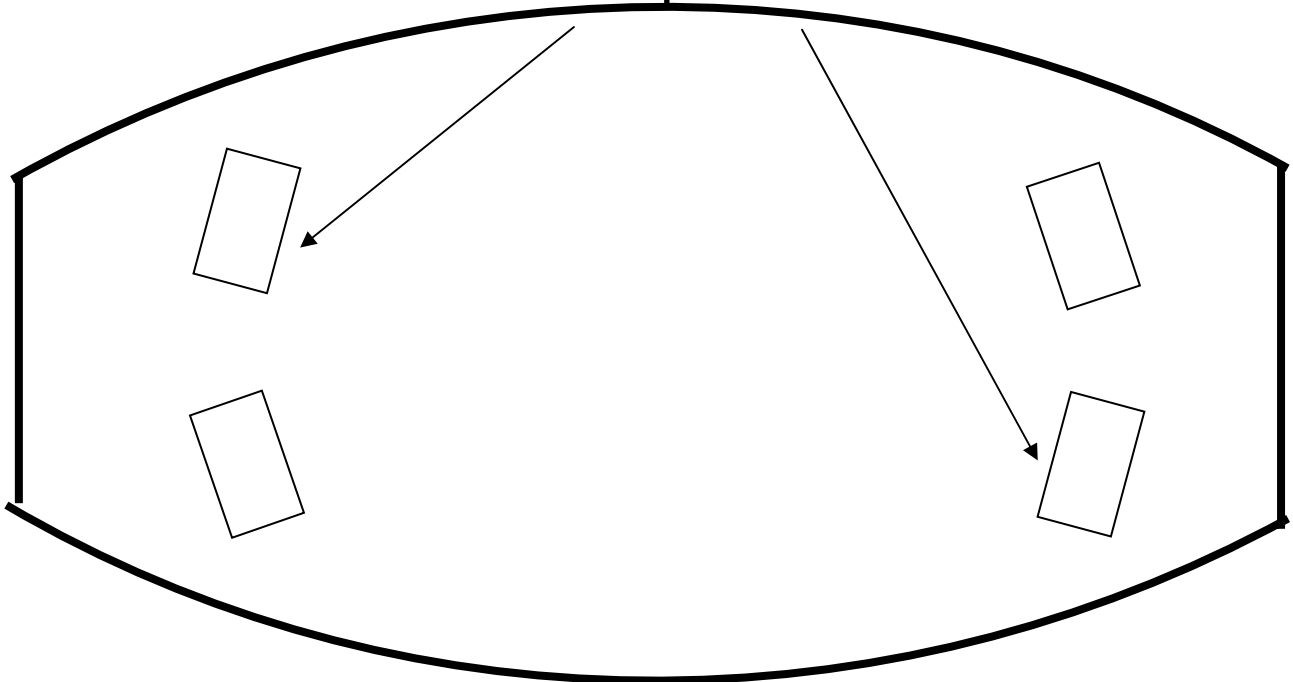
In order to make loading and unloading process easier, four wood pieces will be placed between each set of plates. Approximate weight of each set: 24 tons.

A set of wedges will be fitted in order to avoid columns movement. (Sketch 2)





Wood pieces



Structural elements such as stairways, tie plates and all those materials that cannot be properly packed in wooden boxes, shall be packed in bundles. Marking will be done by means of an engraved aluminium plate (sketch 3).

Special boxes or crates with proper identification (in two different sides) will store gaskets, bolts, loose nozzles, small pieces and spare parts. The contents shall be protected by waterproof and strong plastic foil which shall be sealed. Identification of the package will be placed on two sides of the box by means of stickers (sketch 4 and 5).

Marking of the different packages will be done as per client packing & marking specification.

#### **4.0 HANDLING.**

For protected surfaces (e.g. nozzles), pieces shall be handled in such a way as to prevent any damage to coated and machined surfaces.

Shell plates (dispatched individually) may be put into a pile. Such pile's weight will not exceed 50 tm. Nevertheless, handling of those plates will be done individually for each plate by means of two or more canvas sling with appropriate strength (enough for safe handling of 10 tm pieces each) and minimum width 60mm.

Direct contact shall be avoided between steel ropes, chains or hooks, and coated surfaces; for this scope sheathed steel ropes may be used, or pads may be inserted.

#### **5.0 TRANSPORT.**

##### **5.1 LAND TRANSPORT.**

From workshop to sea port plates will be carried by trucks. Plates position shall be the same than specified in point 3. Each truck will transport no more than 24 tons approx. Same kind of wood pieces employed at storage and ship transportation will be used for trucks. (Sketch 1).

Loading and unloading will be carried away by means of proper canvas slings in order to avoid any damage to the plate edges.

Plates will be unloaded at port over wood pieces and in homogeneous groups.

## **5.2 SEA TRANSPORT.**

From Spain to Site material will be shipped. It is essential to store materials in ship in a way that makes as easier as possible unloading stage and following general rules given on points 3 & 4.

As in all the transportation process, wood pieces will be placed in order to ensure correct bending and to separate different groups of plates. Total height of each group of plates is to be finally decided by ship captain.

Columns shall be stored in a way that no movement is allowed.

Ecuatorial plates with column attached and upper and lower plates will be stored in opposite position than the rest of the plates and no plate shall be placed over them.

## **6.0 FIELD STORING**

The materials to be transported have the adequate protection against the bad weather for two years.

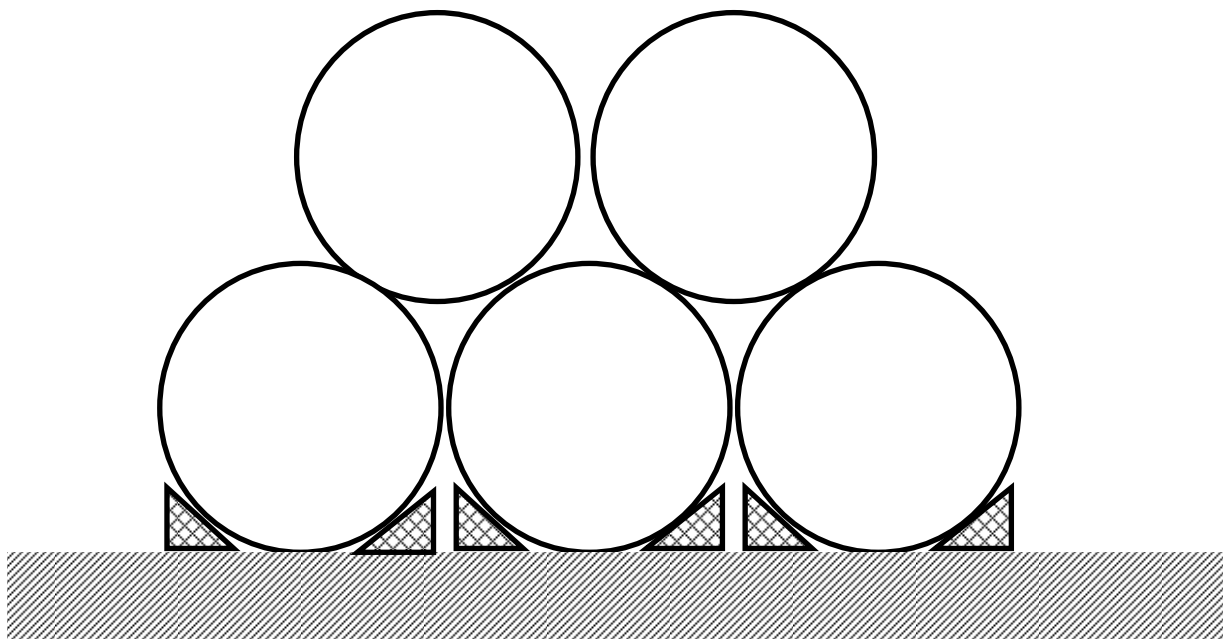
The store procedure will be similar to the transport procedure methods, using the same supports and distance pieces.

The size of the material stacks would be only limited by the allowable space and foundation conditions in the store place. The material weight has to be supported by the intermediate distance pieces and their corresponding supports.

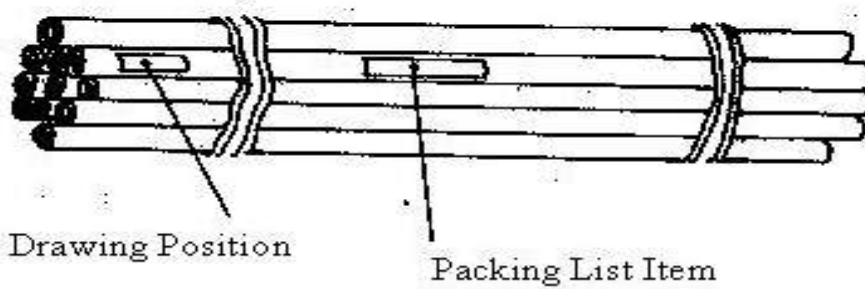
In the event of water presence, it is recommended to cover the materials with canvas in order to avoid the accumulation of water over the material surface. It is strongly recommended to store materials in a place with roof.

The storing area took up by the materials will be conveniently indicated and protected to avoid any damage to the stored material

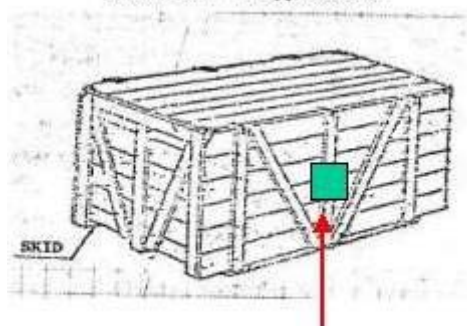
Sketch N°2



SKETCH N° 3: Typical Bundle

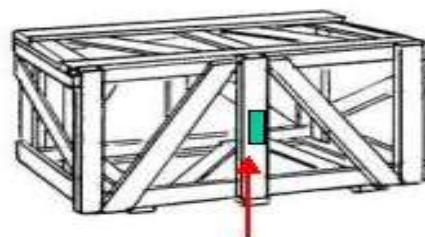


SKETCH N° 4: Typical Box



Packing List Item. (2 opposite sides)

SKETCH N° 5: Typical Crate



Packing List Item.  
(2 opposite sides)



## CONTENTS

	PAGE
1. Scope_____	3
2. Applicable code & specification_____	3
3. General sequence of work_____	3
4. Foundation_____	5
5. Equipment_____	5
6. Sphere erection_____	5
7. Inspection_____	7
8. PWHT_____	7
9. Hydrostatic Testing_____	7
10. Safety_____	7

## 1. Scope

1.1 This procedure covers the construction procedure for field erection of Spherical tanks for UAE Carbon Black & Delayed Coker Project.

1.2 Item to be supplied

Item No.	Description	Q'TY
2041-D-001 / 1~5	Propylene Spherical tank	5

## 2. Applicable code & Specification

Unless otherwise specified the following shall be applied.

2.1 ASME Sec. VIII Div. 1 1998 Edition up to 2000 Addenda.

2.2 Applicable procedure

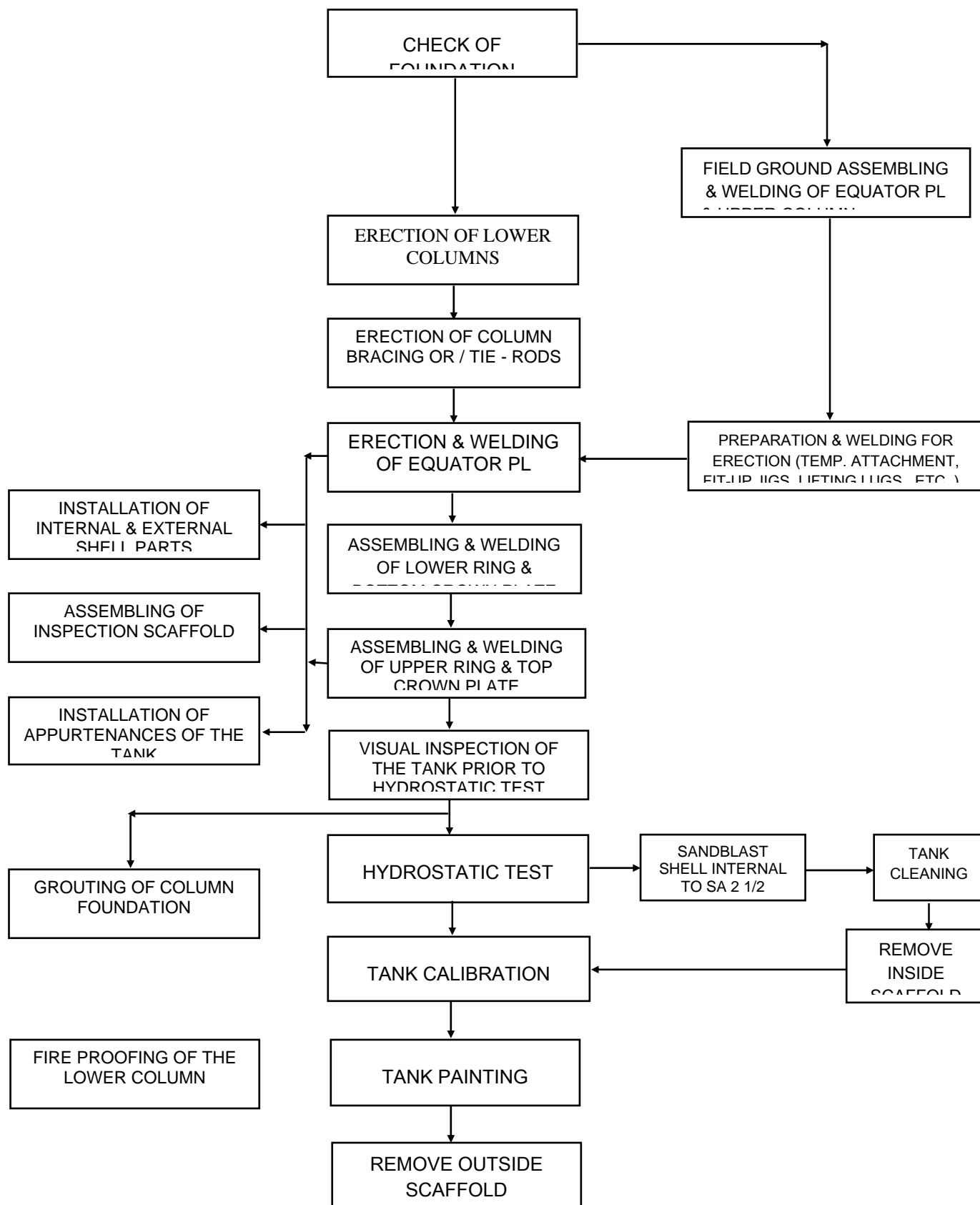
- WPS W/PQR at field
- ITP at field
- Hydrotest procedure
- General safety plan
- Painting procedure

## 3. General sequence of work

Deliveries of fabricated materials are schedule to satisfy the erection sequence, mobilization of facilities & equipment and mobilization of manpower.



Sequence of work



#### 4. Foundation Inspection

Following items of foundation shall be checked prior to erection work of the tank. Tolerance shall be in accordance with site inspection procedure.

- 4.1 Intervals between anchor bolts.
- 4.2 Measurement of the distance between individual column foundation centers.
- 4.3 Measurement of foundation level.
- 4.4 Measurement of the bolt projection length.

#### 5. Equipment :

The construction equipment shall be mobilized prior to the erection of each sphere or group of spheres. Power generation equipment, welding machines and compressors will be located centrally to satisfy the needs of each sphere.

Major equipment categories involved in the execution of this project include :

- Power Distribution Panels
- Electric Welding Machine
- Electric Compressors
- Cranes for Sphere Erection and Material Handling
- Scaffolding both Fixed and Movable
- Vehicles for both Personnel, Material & Equipment Transportation
- Patented Key and Fit up Equipment
- Container Dark Room
- NDE and Testing Equipment
- Office and Tools Container
- Personnel and Construction Safety Equipment



#### 6. Sphere erection :

Sphere construction will commence with the fitting and welding of the equator plate with upper column to equator plate ( ground assembly ) followed by erection of the assemblies. The following is a summary of the construction steps involved.

Steps in sphere erection includes the following :

##### 6.1 Sphere center line and orientation-

Arrange with contractor to provide temporary centerline and center reference stakes for each sphere which will establish the orientations required by the construction drawing. These will be the reference used for the layout of the fittings and accessories.

	<p>FIELD ERECTION PROCEDURE</p>	 PAGE 5 OF 7
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#### 6.2 Foundation Survey-

Survey and measure the completed foundation to ensure level, dimensional, and orientations are in accordance with the construction drawings, All survey data will be recorded and any discrepancies will be brought to contractor attention. Upon confirmation that the piers and anchorage embedments are within the tolerances, TREL will then formally accept the foundation from contractor so sphere erection work can begin.

#### 6.3 Group Assemblies-

The equator / post plates are fit and welded on the ground, number of plates assembled depends on the crane lifting capacity, soil bearing capacity, schedule, equipment and work area availability, etc.

Install and welding temporary attachments (lifting lugs, erection nuts, fit-up jigs and etc.) to the assembly parts prior to erection.

#### 6.4 Columns-

- Set the shim plate and the lower columns assemblies in position.
- Install the column scaffolding before handing any shell plates.
- Weld column splices anytime after the equator course if fit and welded, splices must be welded before the hydrotest of the sphere.
- Install column tie rods immediately after erection of lower columns for safety purposes.

#### 6.5 Erection-

Hang the first equator plate with upper column (single plate) assembly and guy it securely, Continue to hang & fit the assemblies until the entire equator course is complete. Weld the vertical seams in accordance with the approved WPS.



Hang, fit & weld the lower ring plates and then the upper ring plates.

Hang, fit & weld the bottom crown plates. The bottom center crown plate may be left out for ventilation purposes.

Erect the inspection scaffold inside the sphere or outside the spheres and set it in the sphere.

Erect the upper course assemblies, guy and support as necessary until the entire course is completely hung. Fit and weld all seams in accordance with the approved WPS.

Raise and install the inspection scaffold.

	<p>FIELD ERECTION PROCEDURE</p>	 PAGE 6 OF 7
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Hang, fit and weld the top head plates and bottom head plate. All welding in accordance with the approved WPS.

Erect and weld all accessories, such as the stairways, platform, pipe supports, etc.

Note :        1)    Do not hammer off in removing temporary attachments. Lugs, etc. Use grinder arc air gouging.

## 7. Inspection :

7.1 All NDE inspection to be carried out in accordance with the field inspection procedure and the approved NDE procedure.

7.2 Dimensional inspection also to be carried out in accordance with the Project specification and code requirements.

## 8. Hydrostatic test

The tank will be filled with test water as a hydrostatic test to verify the load supporting capability of the foundation, tank structural integrity, and leak tightness.

## 9. Insulation

Refer to approved insulation procedure for installation of Tank.

## 10. Safety

Refer to approved Safety Procedure.

TABLE OF CONTENTS

SECTION	1.	FOR SPECIFICATION
SECTION	2.	SPECIFICATION OF THE HEAT TREATMENT
SECTION	3.	HEAT TREATMENT EQUIPMENT
SECTION	4.	THERMOCOUPLE AND RECORDER REQUIREMENTS
SECTION	5.	INSULATION DETAILS AND SUPPORTS
SECTION	6.	DOCUMENTATION AND ABNORMAL PROCEDURE
SECTION	7.	GENERAL SITE PREPARATION
SECTION	8.	THERMOCOUPLE LOCATION
SECTION	9.	METHOD OF MOVEMENT
SECTION	10.	RECORD / REPORT REQUIREMENTS
SECTION	11.	INSPECTION

# Reference Only

## SECTION 1. FOR SPECIFICATION

This procedure describes the general requirements of post weld heat treatment as a whole for Spherical tanks of ROC Ethylene Project in Thailand.

1.1 The procedure relates to be post weld heat treatment by internal firing using a high velocity gas burner.

1.2 The post weld treat applies to vessel shell, nozzle to shell welds and support columns to the shell welds.

1.2.1 PWHT shall be performed after completion of welding for shell plate, supporting structure ( columns, bracing, etc. ) and attachments welded to pressure parts directly. Internal and external accessories such as stairway platform, piping and instruments shall be installed after PWHT. The cover plate of manhole shall be taken off during PWHT.

1.3 Type of vessel

1.3.1 TK1201A / B

1.3.1.1	Material of shell	:	ASME SA 537 CL.2
1.3.1.2	Sphere inside diameter	:	18300mm.
1.3.1.3	Shell thickness	:	51 - 52.5mm.
1.3.1.4	Empty weight of tank	:	500.2 tons
1.3.1.5	Number of Support Column	:	10 sets
1.3.1.6	Number of Nozzle	:	See Drawing
1.3.1.7	Type of Tank	:	Spherical Tank
1.3.1.8	Applicable Standard and Code	:	ASME SEC. VIII DIV.2 (1995 Edit & Include 1995 Addenda)

1.3.2 TK1300A / B / C

1.3.2.1	Material of shell	:	ASME CA 537 CL.2
1.3.2.2	Sphere inside diameter	:	20270mm.
1.3.2.3	Shell thickness	:	56.3 - 58.5mm.
1.3.2.4	Empty weight of tank	:	688.6 tons
1.3.2.5	Number of Support Column	:	10 sets
1.3.2.6	Number of Nozzle	:	See Drawing
1.3.2.7	Type of tank	:	Spherical tank 1300 A / B / C
1.3.2.8	Applicable Standard and Code	:	ASME SEC. VIII DIV.2 (1995 Edit & Include 1995 Addenda)

# Reference Only

## SECTION 2. SPECIFICATION OF THE HEAT TREATMENT

The heat treatment program shall be as follows :

( Refer to Table AF 402.1 & AF 402.2, purchase specification of ASME SA 537 Cl.2 )

### 2.1 TK1201 A/B

- 2.1.1 Heating Rate : Max. 110 °C/Hr. ( above 427°C )
- 2.1.2 Holding Temperature : Min. 567°C , Max. 605°C  
Do Not Exceed Tempering Temperature ( 615°C )
- 2.1.3 Holding Time : Min. 150 minutes
- 2.1.4 Cooling Rate : Max. 135°C/Hr. ( above 427°C )

### 2.2 TK1300 A/B/C

- 2.2.1 Heating Rate : Max. 100 °C/Hr. ( above 427°C )
- 2.2.2 Holding Temperature : Min. 567°C , Max. 605°C  
Do Not Exceed Tempering Temperature ( 615°C )
- 2.2.3 Holding Time : Min. 150 minutes
- 2.2.4 Cooling Rate : Max. 120°C/Hr. ( above 427°C )

### 2.3 Maximum Temperature difference is as follows :

- 2.3.1 Above 427°C during heating and cooling : Max. 138°C within 4.5m ( 15 ft. ) of interval.
- 2.3.2 During the holding period : 55°C between the highest and lowest temperature throughout the portion of the sphere to be heated.

## SECTION 3. HEAT TREATMENT EQUIPMENT

- 3.1 The vessel shall be heat - treated by internal firing with external insulation cladding.
- 3.2 A high velocity gas burner shall be used. This is manually controlled throughout the firing with constant reference being made to the temperature recording instruments.
- 3.3 The gas burner is designed to be used with blown air from a centrifugal fan and gas supplied to the train 3 - 4 psi suitably regulated from a gas tanker .
- 3.4 The gas burner is of short flame type. The hot gases of combustion are exhausted at a very high velocity which promotes a high degree of turbulence giving good heat transfer to the tank, and uniformity of temperature distribution.
- 3.5 An ultraviolet flame detection unit is fitted and flame failure will immediately and



automatically cut off the gas supply using two safety shut - off valves.

- 3.6 Rain protection shall be installed

#### SECTION 4. THERMOCOUPLE AND RECORDER REQUIREMENTS

- 4.1 Calibrated temperature recorder shall be used.
- 4.2 The thermocouple wire shall be used the nickel chrom/ nickel aluminum ( K-type ) directly capacitance discharge welded to the workpiece.
- 4.3 Each temperature of all thermocouples shall be recorded by automatic time temperature recorder.
- 4.4 Minimum holding time shall be considered as a period when all thermocouples recorded the required holding temperature.
- 4.5 Failure of recording shall not be exceeded 5% of the total number of thermocouples.

#### SECTION 5. INSULATION DETAIL AND SUPPORTS ( see page 8 of 11 )

- 5.1 The insulating material shall be of 75 mm. mineral wool .
- 5.2 The insulating material is to be held in position by steel wire supported by steel ring.
- 5.3 Supporting legs and nozzles shall be insulated in accordance with enclosed diagrams giving an extra thickness of insulation on strengthening plates.
- 5.4 Support column for the vessel must be free to move to allow for expansion and contraction.

This is particularly important for the legs of a sphere which should be jacked in and out at the bottom of the legs every hundred degrees according to the reference tables. The legs should be built on greased sliding plates and temporary guides, Gauges shall be affixed prior to commencement of PWHT.

Reference Table

Temperature	TK 1201 A / B	TK 1300 A / B / C
100 °C	7.43mm per each side	8.23mm per each side
200 °C	19.15mm per each side	21.21mm per each side
300 °C	32.05mm per each side	35.51mm per each side
400 °C	46.24mm per each side	51.22mm per each side
500 °C	61.38mm per each side	67.99mm per each side
600 °C	76.90mm per each side	85.18mm per each side

#### SECTION 6. DOCUMENTATION AND ABNORMAL PROCEDURES

- 6.1 DOCUMENTATION

Documentation ( application form ) consisting of specification of heat treatment is to be

submitted to client prior to starting of the heat treatment.

- 6.2 The site supervisor shall be responsible for all document information, and ensuring compliance with all procedure and regulations.

Documentation shall includes :

- Recorder calibration certificate
- Thermocouple conformance certificate
- Operators resumes
- Thermocouple location sketch
- Temperature recorder charts

# Reference Only

## 6.3 ABNORMAL PROCEDURE

- 6.3.1 In case of power failure, PWHT shall be started in accordance with applicable procedure from begining after resumption of power supply immediately.
- 6.3.2 In the event of power failure, the burner will fail safely with safety shut - off valves closing in less than a second. This fail safe system shall be checked and demonstrated prior to commencement of PWHT.
- 6.3.3 The heat treatment specialist will do all in his power to reduce the ill effects of any power failure, this will include any or all of the following.
- 6.3.3) 1. Close fuel damper.
- 6.3.3) 2. Close pilot and control gas valves on gas train.
- 6.3.3) 3. Close gas supply valve from gas tank
- 6.3.3) 4. Romove burner from vessel and seal the hole. ( If required )
- 6.3.4 On resumption of power supply, the temperature recorder charts shall be checked for spread of temperature. If the spread is still within specification, temperature is to be maintained for 30 minutes, then heat treatment may continue. If the spread is outside specification, the burner is to be used to bring temperature back into the band of temperatures recorded until they are once more within specification. This condition is to be held for a further 30 minutes before continuing heat treatment.

## 6.4 MISCELLANEOUS

- 6.4.1 A weather forecast for the anticipated heat treatment period shall be obtained prior to starting heat treatment.
- 6.4.2 If bad weather is expected, the insulation should be protected with sheeting, and firing postponed till such time as a suitable weather forecast is obtained.
- 6.4.3 If unexpected bad weather occurs during the heat treatment, the heat treatment specialist may continue with the work at this decision provided that this does not constitute a danger to tank or to personnel, and the heat treatment remains within specification.

- 6.4.4 If unexpected bad weather is so severe as to constitute a danger to personnel or the vessel, then the heat treatment may be put into a hold condition, or in extreme cases and after due consultation with clients, the temperature of the vessel may be reduced in a controlled manner.
- 6.4.5 If during the course of heat treatment the insulation becomes saturated with rainwater, the vessel shall be placed in a hold situation untill the insulation has dried out.
- 6.4.6 If the insulation is damaged, the tank shall be placed in a hold situation untill the damage has been repaired.

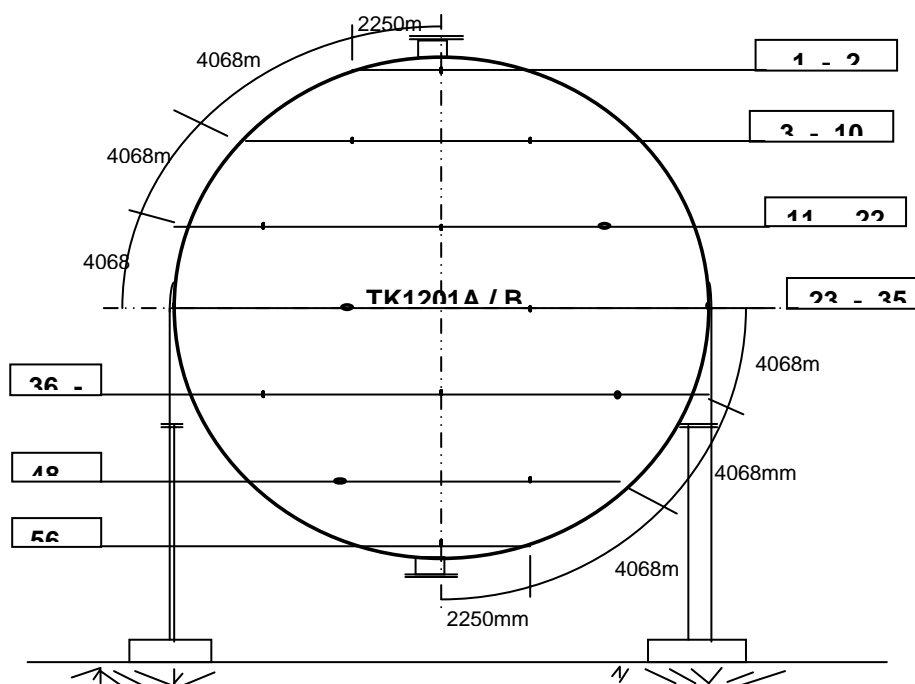
## SECTION 7. GENERAL SITE PREPARATION

### 7.1 GENERAL

- 7.1.1 Scaffolding supports shall be made of steel.
- 7.1.2 There should be adequate distance between scaffolding planks and vessel to allow for the placing of insulation onto the tank, its fixing, and the adjustment of these fixings during firing.
- 7.1.3 There shall be adequate access to each and every thermocouple for the purposes of fixing and checking during the firing.

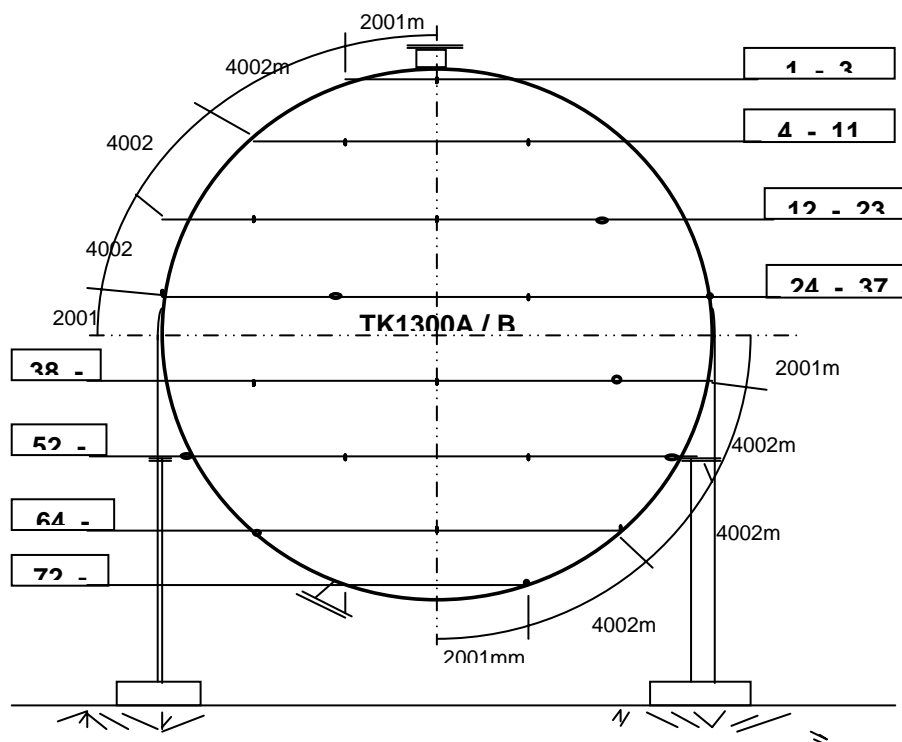
## SECTION 8. THERMOCOUPLE LOCATION AND INSULATION

The distance of thermocouple shall be max. 4500mm to each other .

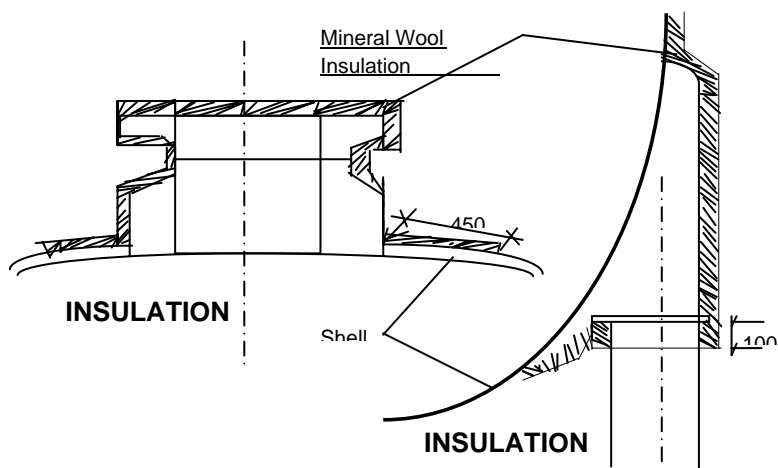


# Reference Only

## THERMOCOUPLE LOCATION



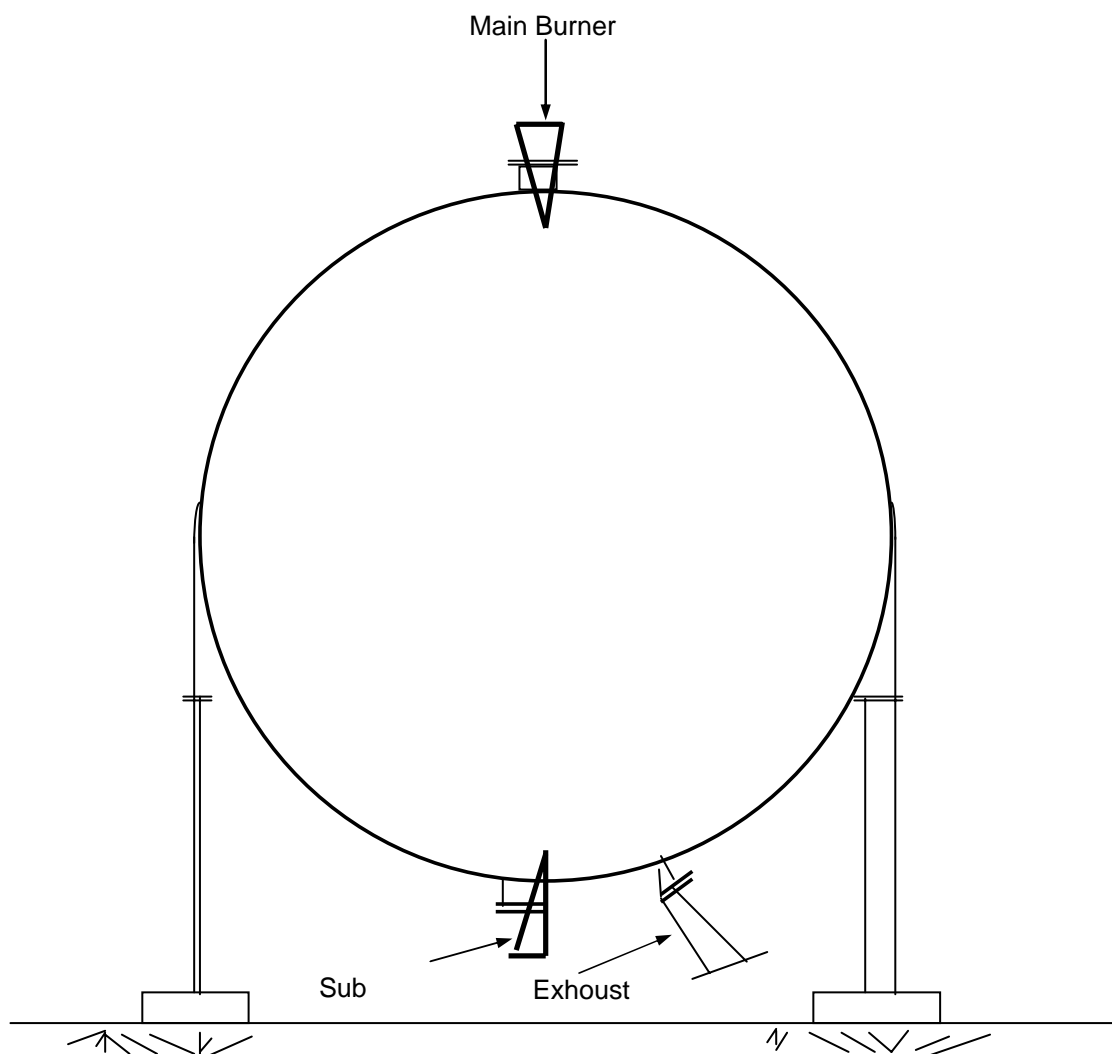
## INSULATION



## SECTION 9. METHOD MOVEMENT

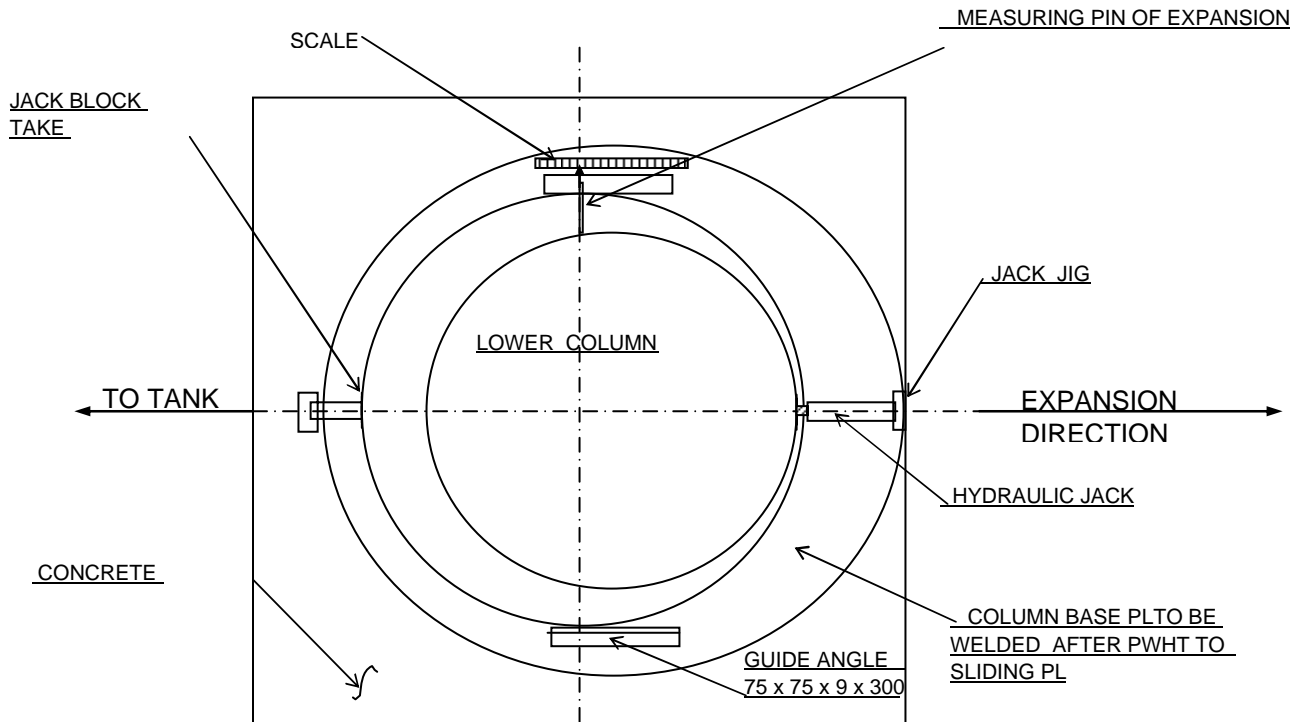
The columns of sphere shall be free from expansion and contraction caused by PWHT by the following method ( see illustration on the next page ) .

- 1) The columns of sphere will be slid for expansion and contraction by using jacks for smooth slide toward to the radius line.
- 2) Before installation of columns on the sliding plates, greased will be lubricated on the top side of sliding plates. While, the back side of base plates will be clean up and free from any dust, scale and other foreign matter.
- 3) The reference point of column movement will be checked and marked by white paint on the guide angles. ( After PWHT, the contraction point of columns will be adjusted by the reference point.) - See illustration on the next page

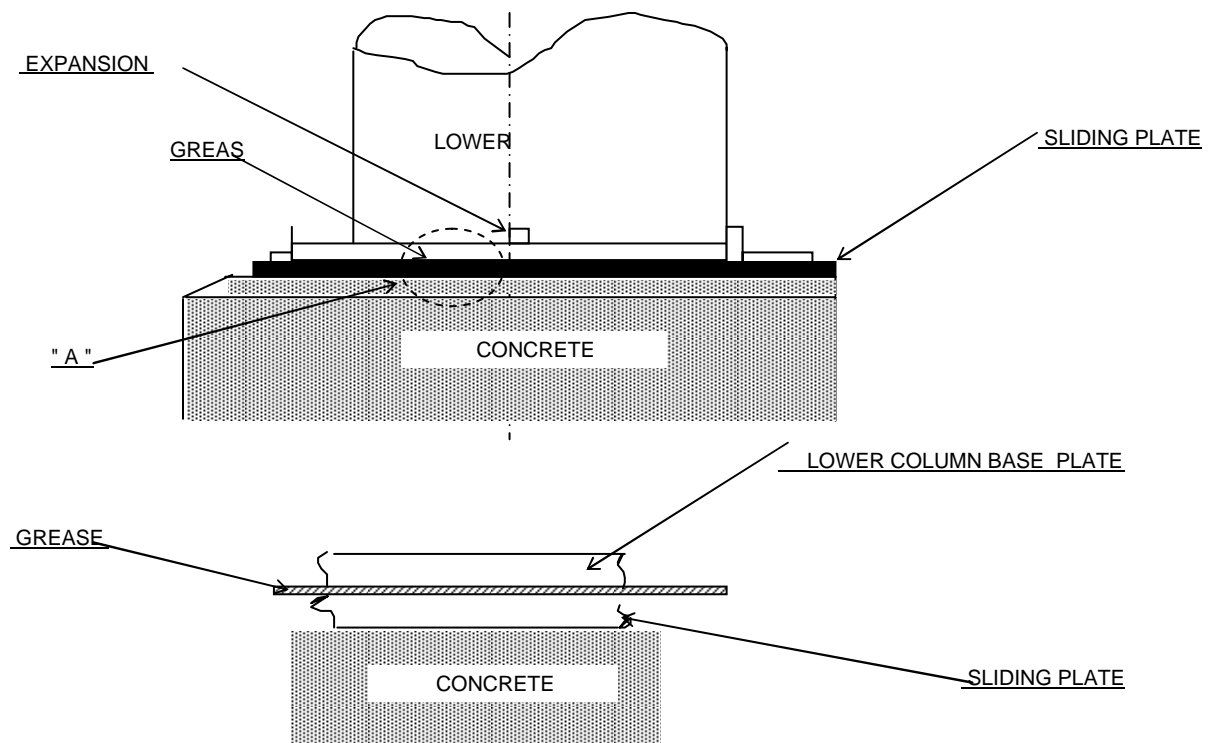


P.W.H.T. Equipment  
Arrangement DWG.

**ILLUSTRATION**



**SHOW EXPECTED DIAMETRIC EXPANSION VALUE & AVERAGE LEG MOVEMENT**



## SECTION 10. RECORD / REPORT REQUIREMENTS

- 10.1 The record and / or report of post weld heat treatment result shall include the following information.
  - 10.1.1 The data performed post weld heat treatment.
  - 10.1.2 Facility type and equipment No. of PWHT.
  - 10.1.3 Time - temperature record No.
  - 10.1.4 Number and placement of thermocouples.
  - 10.1.5 Heating and Cooling rates.
  - 10.1.6 Holding time and temperature.
- 10.2 The record and / or report shall be written in English.

## SECTION 11. INSPECTION

The inspector representing purchaser, customer and / or customers appointed third party shall have free entry at all times, to all facilities and equipments of the vendor's works that concern the operation of the Post Weld Heat Treatment.




**Chapter 9 .-MAN POWER, CONSTRUCTION EQUIPMENT AND REQUIRES UTILITIES**

Find enclosed *our the man power schedule and construction equipments schedule for the construction of the spheres.*

- *Man power Shedule*
- *Construction Equipment Schedule*

In addition the required utilities and facilities for site fabrication provided by Samsung should be according the following plot plan:

 <b>SAMSUNG ENGINEERING</b>	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

# INDIRECT MANPOWER MOBILIZATION PLAN

Job / Proposal No. :

Project : Carbon Black & Delayed Coker Project

Client : Samsung

Contractor : Felguera-IHI and SHI-Qatar Company W. L. L.

Occupational Category	Year	2011												2012				Remarks	
	Month	0	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		4
Indirect Manpower																			
1. Project Manager			1	1	1	1	1	1	1	1	1	1	1	1	1				
2. Project Engineer			1	1	1	1	1	1	1	1	1	1	1	1	1				
3. QA/QC Manager																			
4. QA/QC Engineer				1	2	3	3	3	3	3	3	3	3	2	1				
5. Material Control Engineer																			
6. Material Coordinator			1	1	1	1	1	1	1	1	1	1	1	1	1				
7. Welding Engineer																			
8. Safety Supervisor			1	1	1	1	1	1	1	1	1	1	1	1	1				
9. Admin Supervisor			1	1	1	1	1	1	1	1	1	1	1	1	1				
10. Payroll			1	1	1	1	1	1	1	1	1	1	1	1	1				
1. Construction Manager			1	1	1	1	1	1	1	1	1	1	1	1					
2. Project. Superintendent			1	1	1	1	1	1	1	1	1	1	1	1	1				
3. Tank Superintendent			1	1	2	3	4	5	5	5	5	4	3	2	1				
4. Welding Supervisor				1	1	1	1	1	1	1									
5. Field Engineer			1	1	1	1	1	1	1	1	1	1	1	1	1				
6. Storeman			1	1	1	1	1	1	1	1	1	1	1	1	1				
7. Driver			1	1	1	1	1	1	1	1	1	1	1	1	1				
8. Mechanic			1	1	1	1	1	1	1	1	1	1	1	1	1				
9. Electrical/Instrument Engineer																			
10. Electrician			1	1	1	1	1	1	1	1	1	1	1	1					
11																			
Total Indirect Manpower		0	14	16	18	20	21	22	22	22	21	20	19	17	13	0	0	0	

# DIRECT MANPOWER MOBILIZATION PLAN

Job / Proposal No. :

Project : Carbon Black & Delayed Coker Project

Client : Samsung

Contractor : Felguera-IHI and SHI-Qatar Company W. L. L.

Occupational Category	Year	2011												2011				Remarks	
	Month	0	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		4
Direct Manpower																			
1. Erection Forman			1	1	2	3	4	5	5	5	5	4	3	2	1				
2. Welding Foreman				1	2	3	4	5	4	3	2	1							
3. NDE Foreman				1	1	1	1	1	1	1	1	1							
4. NDE Techician				1	2	3	4	4	4	3	2	1							
5. AGW Operator																			
6. AVW Operator																			
7. LT7 Operator																			
8. Welder				12	24	36	48	60	48	36	24	12	6						
9. Rigger			1	2	4	6	8	10	10	10	10	8	6	4	2				
10. Fitter			1	2	4	6	8	10	10	10	10	8	6	4	2				
11. Grinder / Helper			1	2	4	6	8	10	10	10	10	8	6	4	2				
12. Crane Operator			1	1	2	3	4	5	4	3	2	2	2	1	1				
13. Forklift Operator			1	1	1	1	1	1	1	1	1	1	1	1	1				
14. Drivers			1	1	1	1	2	2	2	2	2	1	1	1	1				
15																			
Total Indirect Manpower		0	7	25	47	69	92	113	99	84	69	47	31	17	10	0	0	0	
Direct Manpower Painting																			
Occupational Category	Year	2011												2011				Remarks	
	Month	0	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3		4
Direct Manpower Painting																			
1. Painting Forman										1	2	3	4	5	1				
2. Painter										4	6	8	8	6	4				
3. Blaster										4	6	8	8	6	4				
4. Grinder / Helper										6	8	8	8	8	6				
5																			
Total Indirect Manpower		0	0	0	0	0	0	0	0	15	22	27	28	25	15	0	0	0	

## MAJOR CONSTRUCTION EQUIPMENT MOBILIZATION PLAN

Job / Proposal No. :

Project : Carbon Black & Delayed Coker Project

Rev. : 0

Client : Samsung

Contractor : Felguera-IHI and SHI-Qatar Company W. L. L.

Equipment		Year Month	2011												2012					Remarks
			1	2	3	4	5	6	7	8	9	10	11	12	13	1	2	3	4	
Erection Equipment																				
1	Generator (350-400KVA)				2	2														
2	Generator (125-250 KVA)	1	2	3	4	5	5	5	4	3										
3	Compressor (600 CFM)			1	1	1	1	1	1	1	1	1								
4	Compressor (260 CFM)	1	2	2	2	2	2	2	2	2										
5	Welding Machine (400-500 Amp) DC OR / AC	0	12	24	36	48	60	48	36	24	12	6								
6	Crane (250 Ton)	1	1	1	1	1	1	1	1	1										
7	Crane (50 Ton)	1	1	2	3	3	3	3	3	3										
8	Crane (25 Ton)		1	1	1	1	1	1	1	1	1	1	1	1						
9	AGW																			
10	Ginding Machine 4"	0	12	24	36	48	60	48	36	24	12	6								
11	Ginding Machine 7"	0	12	24	36	48	60	48	36	24	12	6								
12	Portable Oven 5kg	0	12	24	36	48	60	48	36	24	12	6								
13	Gouging Machine (600 Amp)		4	4	6	6	6	6	6	4	2	2								
14	Dry Oven (Backing Oven) Electrode & Flux		1	1	1	1	1	1	1	1										
15	Fan Blower		5	5	5	5	5	5	5	5	5	5								
16	Spray Paint Pump																			
Total Erection Equipment			4		116	170	219	265	217	168	117	57	33	1	1	0	0	0	0	
Total Painting Equipment																				
Transportation																				
1	Pick-up	1	2	2	2	2	2	2	2	2	2	2								
2	Mini Bus		1	1	1	1	1	1	1	1	1	1								
3	Trailer	1	1	1	1	1	1	1	1	1	1	1								
4	2.5 Ton Truck	1	1	1	1	1	1	1	1	1	1	1								
5	Bus	1	1	2	3	3	3	3	3	3	2	1								
Total Transport			4		7	8	8	8	8	8	8	7	6	0	0	0	0	0	0	
Grand Total Equipment			8		123	178	227	273	225	176	125	64	39	1	1	0	0	0	0	





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**Chapter 10 .-SCHEDULE**

Find enclosed *our the preliminary schedule for the engineering, prefabrication, construction and commissioning of the spheres*

 <b>SAMSUNG ENGINEERING</b>	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

Id	Nombre de tarea	Duración	M-1	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22
1	 PURCHASER ORDER	1 d?																							
2	ENGINEERING	190 d																							
3	SPHERES DESIGN	190 d																							
4	DOCUMENTATION LIST AND SCHEDULE	100 d																							
5	INTERNAL ACCESORIES	80 d																							
6	EXTERNAL STRUCTURES AND ACCESORIE:	130 d																							
7	DRAWINGS AND PROCEDURES	75 d																							
8	PURCHASING	135 d																							
9	MAIN STEEL PLATES	120 d																							
10	STEEL ACCESORIES	80 d																							
11	OTHERS	60 d																							
12	PREFABRICATION AT SHOP	163 d																							
13	FABRICATION MAIN STEEL (SPAIN)	150 d																							
14	FABRICATION ACCESSORIES	43 d																							
15	Internal piping and Ladder	19 d																							
16	Platform, walk way and handrail	11 d																							
17	Others	13 d																							
18	PAINTING	163 d																							
19	Plates shop primer	120 d																							
20	Structure primer	40 d																							
21	TRANSPORTATION UP TO RUWAIS	185 d																							
22	MARINE TRANSPORTATION UP TO SAINT P	175 d																							
23	SHIPPING 1	25 d																							
24	SHIPPING 2	25 d																							
25	SHIPPING 3	25 d																							
26	INLAND TRANSPORTATION UP TO SITE	160 d																							
27	SHIPPING 1	10 d																							
28	SHIPPING 2	10 d																							
29	SHIPPING 3	10 d																							
30	CONSTRUCTION	296,4 d																							
31	MOBILIZATION	225 d																							
32	Mobilization / Temp. Facilities	30 d																							
33	Receiving Materials Delivery	200 d																							
34	ERECTION OF SPHERES	266,4 d																							
35	SPHERE 2041-D-001	186,4 d																							
36	ASSEMBLY	184 d																							
37	Foundation reception	0 d																							
38	Columns legs	6,4 d																							
39	Ecuador	20 d																							
40	Lower cap	4 d																							
41	Scaffolding	8 d																							
42	Upper intermediate	16 d																							
43	Over cap	4 d																							
44	Upper closure plate	4 d																							
45	Still-pipes	3,2 d																							
46	Lower closure plate	4 d																							
47	Removing internal scaffolding	6,4 d																							
48	Removing external scaffolding	4 d																							


Id		Nombre de tarea	Duración	M-1	M1	M2	M3	M4	M5	M6	M7	M8	M9	M10	M11	M12	M13	M14	M15	M16	M17	M18	M19	M20	M21	M22
49		External staircase and platform	4 d																							
50		Fire Fighting system	8 d																							
51		WELDING	124 d																							
52		Ecuador	36 d																							
53		Lower cap	16 d																							
54		Upper intermediate	36 d																							
55		Over cap	16 d																							
56		Upper closure plate	8 d																							
57		Lower closure plate	8 d																							
58		Columns legs	8 d																							
59		Heat treatment	12 d																							
60		END	8 d																							
61		HYDRAULIC TEST	11,2 d																							
62		Water filling	4 d																							
63		Pressurization	3,2 d																							
64		Emptying	4 d																							
65		Painting	16 d																							
66		SPHERE 2041-D-002	186,4 d																							
67		ASSEMBLY	184 d																							
68		Foundation reception	0 d																							
69		Columns legs	6,4 d																							
70		Ecuador	20 d																							
71		Lower cap	4 d																							
72		Scaffolding	8 d																							
73		Upper intermediate	16 d																							
74		Over cap	4 d																							
75		Upper closure plate	4 d																							
76		Still-pipes	3,2 d																							
77		Lower closure plate	4 d																							
78		Removing internal scaffolding	6,4 d																							
79		Removing external scaffolding	4 d																							
80		External staircase and platform	4 d																							
81		Fire Fighting system	8 d																							
82		WELDING	124 d																							
83		Ecuador	36 d																							
84		Lower cap	16 d																							
85		Upper intermediate	36 d																							
86		Over cap	16 d																							
87		Upper closure plate	8 d																							
88		Lower closure plate	8 d																							
89		Columns legs	8 d																							
90		Heat treatment	12 d																							
91		END	8 d																							
92		HYDRAULIC TEST	11,2 d																							
93		Water filling	4 d																							
94		Pressurization	3,2 d																							
95		Emptying	4 d																							
96		Painting	16 d																							



## PLANNING 5 SPHERES


## PLANNING 5 SPHERES

No main deviation list different to this technical offer

 <b>SAMSUNG ENGINEERING</b>	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

**Chapter 12 .-. REFERENCE LIST.**

Attachment find Felguera-IHI and SHI reference list with more than 220 spheres up to 10.000m<sup>3</sup>.

 <b>SAMSUNG ENGINEERING</b>	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	

### SPHERICAL TANKS

Units No	VOLUME (m³)	DESIGN PRESSURE (kg/cm²)	AVERAGE THICKNESS (mm.)	NOTES	MATERIAL	STORED PRODUCT	CLIENT	LOCATION
1	650	19,52	40,0		EH-36.K	Propane	Enpetrol	Puertollano
2	1.150	13,05	20,0		EH-36.K	Propane	Enpetrol	Puertollano
2	650	19,25	40,0		EH-36.K	Propane	Enpetrol	Puertollano
2	1.850	6,75	24,0		EH-36.K	Butane	Enpetrol	Puertollano
1	420	22,00	43,0		EH-36.K	Etilene	Enpetrol	Puertollano
3	400	22,00	40,0		EH-36.K	Propilene	Enpetrol	Puertollano
7	1.640	15,10	32,0		EH-36.K	City Gas	Gas Madrid	Madrid
1	1.645	5,25	16,0		EH-36.K	Butano	Petromed	Castellón
1	1.645	15,40	37,0		EH-36.K	Propane	Petromed	Castellón
1	2.480	14,50	42,0		EH-36.K	Butane	Petromed	Castellón
1	1.850	0,00	0,0		-	V.C.M.	P.Q. Esso	Castellón
1	2.000	6,00	22,0		EH-36.K	Butane	I.Q.A.	Tarragona
1	4.000	2,81	17,0		F-52	Ammonia	Enpetrol	Cartagena
1	7.000	5,00	25,0		52-N	Butane	Enpetrol	Cartagena
1	4.500	5,00	21,1		52-N	Propane	Enpetrol	Cartagena
2	2.200	4,60	25,5		A-285 Gr.C	Ammonia	Enpetrol	Cartagena
2	560	16,83	24,5		SP-52.R	Propane	Petroliber	La Coruña
1	3.180	7,73	30,6		SP-52.R	Butane	Petroliber	La Coruña
1	3.000	0,00	0,0		-	Ammonia	Enpetrol	Tarragona
1	2.000	10,00	25,0		ST-50/36.P	Butane	Butano	Madrid
1	2.000	10,00	25,0		ST-50/36.P	Butane	Butano	La Coruña
1	2.000	10,00	25,0		ST-50/36.P	Butane	Butano	Gijón
1	2.000	10,00	25,0		ST-50/36.P	Butane	Butano	Logroño
1	2.000	10,00	25,0		ST-50/36.P	Butane	Butano	Castellón
1	4.500	0,00	0,0		-	Propane	Enpetrol	Cartagena
1	4.000	0,00	0,0		-	Butane	Enpetrol	Cartagena
2	6.000	0,00	0,0		-	Propilene	Montoro	Puertollano
1	6.000	7,50	27,5		ST-50/36.P	Butane	Butano	Castellón
1	6.000	7,50	27,5		ST-50/36.P	Butane	Butano	Gibraltar
1	6.000	7,50	27,5		ST-50/36.P	Butane	Butano	Tarragona
2	4.000	10,00	31,5		ST-50/36.P	Butane	Butano	Granada
1	4.000	10,00	31,5		ST-50/36.P	Butane	Butano	Huesca
1	7.000	4,00	20,0		ST-50/36.PF	Ammonia	Enpetrol	Tarragona
2	1.500	16,50	29,0		ST-50/36.P	Propane	Enpetrol	Puertollano
2	2.800	6,60	26,7		ST-50/36.P	Butane	Enpetrol	Puertollano
5	1.640	15,10	32,0		EH-36.K	City Gas	Gas Madrid	Madrid
1	4.000	10,00	31,5		ST-50/36.P	Butane	Butano	Huesca
1	4.000	10,00	31,5		ST-50/36.P	Butane	Butano	Alcudia
2	2.000	10,00	24,5		ST-50/36.P	Butane	Butano	Huesca
1	2.000	10,00	24,5		ST-50/36.P	Butane	Butano	León
1	2.000	10,00	24,5		ST-50/36.P	Butane	Butano	Salamanca
1	4.050	9,80	32,0		ST-50/36.P	Isobutane	Pritchard Rhodes	Jordania
2	1.640	15,10	32,0		EH-36.K	City Gas	Gas Madrid	Madrid
10	500	1,20	8,0		A-240 Tip.304	Beer	El Aguila	Madrid
1	750	6,80	12,5		ST-52/36.P	V.C.M.	Monsanto Iber.	Huesca
3	3.500	6,00	20,5		ST-52/36.P	Propane	Enpetrol	Tarragona
2	1.437	23,80	43,0	(2)	ST-52/36.P	Ammonia	Enfersa	La Coruña
8	500	1,20	8,0		A-240 Tip.304	Beer	El Aguila	Valencia
3	6.000	10,00	30,0		ST-50/36.P	Butane	Butano	Gijón
2	6.000	10,00	30,0		ST-50/36.P	Butane	Butano	Logroño
1	6.000	10,00	30,0		ST-50/36.P	Butane	Butano	Castellón
1	6.000	10,00	30,0		ST-50/36.P	Butane	Butano	Algeciras
1	4.000	10,00	24,0		ST-50/36	Butane	Butano	Huelva

### SPHERICAL TANKS


Units No	VOLUME (m³)	DESIGN PRESSURE (kg/cm²)	AVERAGE THICKNESS (mm.)	NOTES	MATERIAL	STORED PRODUCT	CLIENT	LOCATION
2	4.500	6,00	22,5		ST-52/36.P	Propilene	Enpetrol	Tarragona
1	3.500	0,00	0,0			V.C.M.	Monsanto Iberi.	Tarragona
1	3.700	6,80	23,0		ST-50/36	V.C.M.	Monsanto Iberi.	Tarragona
1	4.900	6,00	24,0		ST-52/36.P	Vinyl Chloride	Terquimsa	Barcelona
1	1.000	9,20	30,0		ST-52/36.P	Acetaldehyde	I.Q.A.	Tarragona
2	1.500	16,00	35,0		ST-52/36.P	Ammonia	S.A. Cros	Sevilla
2	1.300	17,60	38,5	(2)	ST-52/36.P	Ammonia	Paular	Tarragona
1	4.500	6,90	25,0		ST-52/36.P	Propilene	Paular	Tarragona
2	6.000	10,00	30,0		ST-52/36	Butane	Butano	Puertollano
1	6.600	7,00	29,2		BS-1501-224-32A	Propilene	Ertisa	Huelva
1	6.000	10,00	30,0		ST-50/36	Butane	Butano	Gijón
1	4.000	10,00	24,0		ST-50/36	Butane	Butano	Santander
1	4.000	4,90	22,5		ST-52/36.P10	Butane	E.N.A.P.	Maipú (CHILE)
1	3.500	10,55	27,6		ST-54/38.U20	Ethane	I.M.P. /PEMEX	Candua (MEXICO)
1	302	Atmosf.	8,0	(1)		Water	I.H.I.	Arabia Saudí
2	700	3,50	10,0		ST-52/36.P10	Methane	Cadagua	Madrid
12	1.111	16,00	35,7	(2)	A-516 Gr.70	L.P.G.	IHI /Sonatrach	Arzew (ARGELIA)
4	556	22,00	36,9	(2)	A-516 Gr.70	L.P.G.	IHI /Sonatrach	Arzew (ARGELIA)
1	556	4,80	12,0		A-516 Gr.70	Pentane	IHI /Sonatrach	Arzew (ARGELIA)
2	4.189	11,60	39,5	(2)	A-516 Gr.70	L.P.G.	Petroliber	La Coruña
2	3.058	11,60	39,5	(2)	A-516 Gr.70	L.P.G.	Petroliber	La Coruña
3	2.144	18,10	47,3	(2)	A-516 Gr.70	Propane	Petroliber	La Coruña
1	4.000	10,00	24,0		ST-50/36	Butane	Butano	Cartagena
4	4.003	11,00	47,9	(2)	A-299	L.P.G.	H.A.R.	GRECIA
3	4.000	10,00	24,0		ST-50/36	Butane	Butano	Zaragoza
2	1.000	18,70	36,0		s/Cliente	Propane	Enpetrol	Puertollano
3	2.600	6,60	20,0		s/Cliente	Butane	Enpetrol	Puertollano
1	2.500	5,25	20,0		A-516 Gr.65	Butane	Petromed	Castellón
2	3.600	7,40	30,0		s/Cliente	Propilene	Petronor	Somorrostro
1	4.500	6,30	23,0		s/Cliente	Propilene	Dow Chemical	Tarragona
2	1.000	10,00	16,3		ST-52/36	L.P.G.	Butano	Vigo
2	1.629	21,40	64,5	(2)	A-738	Propilene	H.A.R.	GRECIA
4	1.300	30,00	50,0	(2)	ST-52/36	Oxygen	Ensidesa	Avilés
3	900	7,00	14,0		ST-52/36	Nitrogen	Ensidesa	Avilés
1	2.500	20,50	41,5	(2)	ST-52/36	Propane	Petromed	Castellón
1	300	31,00	23,7		WSTE- 47	Hidrogen	Influisa	Barcelona
3	2.200	17,70	34,5	(2)	TSTE-355	Propane	Petrogal	PORTUGAL
1	2.200	18,00	34,5	(2)	TSTE-355	Propane	B.P.Portuguesa	PORTUGAL
1	8.000	6,70	29,9		A-537 Cl.1	Propane	Dow Chemical	Tarragona
3	1.200	19,60	36,7		A-537 Cl.2	Etilene	Tianjin	CHINA
1	500	9,85	10,6		A-516 Gr.60	Butane	D.I.S.A.	Fuerteventura
1	450	18,05	27,1		A-516 Gr.70	Propane	D.I.S.A.	Tenerife
2	1.000	6,12	13,0		A-516 Gr.70	Butane	D.I.S.A.	Tenerife
3	6.000	10,00	29,4		TSTE-355	G.L.P.	Repsol Butano	Huelva
2	1.000	6,12	13,0		A-516 Gr.70	Butane	D.I.S.A.	Tenerife
1	800	18,05	33,0		A-516 Gr.70	Propane	D.I.S.A.	Tenerife
4	1.111	16,00	35,7	(2)	A-516 Gr.70	L.P.G.	IHI /Sonatrach	Arzew (ARGELIA)
1	268	16,06	22,6		A-516 Gr.70	Propane	D.I.S.A.	Lanzarote
2	3.262	18,30	51,1		TSTE-355	Propilene	ERTISA	Huelva
1	3.262	17,50	49,0		TSTE-355	Propane	ERTISA	Huelva
1	2.400	17,50	47,2		A-516 Gr.70	Propane	PETROJET	Alexandria
1	2.400	6,20	18,5		A-516 Gr.70	Butane	PETROJET	Alexandria
3	2.400	9,80	27,5		A-516 Gr.70	G.L.P.	PETROJET	Alexandria

### SPHERICAL TANKS

Units No	VOLUME (m³)	DESIGN PRESSURE (kg/cm²)	AVERAGE THICKNESS (mm.)	NOTES	MATERIAL	STORED PRODUCT	CLIENT	LOCATION
1	4.000	9,00	32,5		A-516 Gr.70	Propylene	Hellenic Petroleum	GREECE
1	3.500	6,00	24,5		A-516 Gr.60	Isopentane	REPSOL	Tarragona
1	1.400	7,00	27,0		A-516 Gr.70	Methane	EDAR "La China"	Madrid
1	4.500	3,80	29,1		A-516 Gr.70	LPG	Amir Kabir	Iran
2	120	3,80	13,5		A-516 Gr.70	LPG	Amir Kabir	Iran
3	100	3,80	11,4		A-516 Gr.70	LPG	Amir Kabir	Iran
1	10.500	4,00	28,0		SA-516-Gr 70 N	NH3	UBE Europe	Castellón
1	4.000	7,20	25,0		SA-516-Gr 70	LPG	Cepsa	Huelva
2	600	7,00	13,0		P-355 NL1	Methane	LF	Barcelona
1	600	18,60	42,3		SA-537 Cl.1	Propane	N.P.C.	Irán
1	2.500	21,70	62,0		SA-537 Cl.1	Propylene	N.P.C.	Irán
3	4.800	9,00	26,9		P-355 NL1	Butan./Propan.	Cepsa	Huelva
1	1.176	18,06	26,7		TStE 355	Propane	DISA	Gran Canaria
1	4.500	5,00	21,7		SA-516 Gr.60	Propane	REPSOL	Cartagena
1	7.000	5,00	25,5		SA-516 Gr.60	Butane	REPSOL	Cartagena
1	4.000	10,54	41,6		SA-516 Gr.70	NGL	OHL	Peru
1	4.000	14,07	48,0		SA-516 Gr.70	Propane	Recope	Costa Rica

**Chapter 13    .-. TECHNICAL BROCHURE.**

We send you Felguera-IHI and SHI Qatar Brochure for more information of us.

 <b>SAMSUNG ENGINEERING</b>	Spheres for Carbon Black & Delayed Coker Project	31/07/2012
	Job N° SO-2542	
	Abu Dhabi Oil Refining Company (TAKREER)	



**Fi** felguera-I.H.I., s.a.

STORAGE PLANTS

**F****i**felguera-I.H.I.,s.a.



Presentación / Overview ..... 4

ÁREAS DE NEGOCIO / BUSINESS AREAS

Almacenamiento de Gas Natural Licuado  
LNG Storage Tanks ..... 9

Tanques de Almacenamiento Verticales y Esféricos  
Vertical and Spherical Storage Tanks ..... 11

Plantas de Almacenamiento de Hidrocarburos  
Hydrocarbon Storage Plants ..... 17

Recursos Humanos y Materiales  
Human and Material Resources ..... 20





*Felguera-IHI is a company specialised in fuel storage and is jointly owned by the Spanish group Duro Felguera and the Japanese IHI Corporation*

With over 45 years experience in the market, Felguera-IHI is part of the Duro Felguera Industrial Plants business segment. Duro Felguera is an industrial group of companies which has been in existence since the middle of the 19th century in Asturias (Northern Spain). It currently executes major turnkey projects in the industrial and power sectors and also provides construction, maintenance, commissioning and operation services for industrial installations. The company also has several workshops to manufacture industrial equipment. Duro Felguera, whose shares are traded on the Madrid Stock Exchange, has wide experience in constructing power generation installations and port mineral handling facilities abroad. The group is currently working on projects in various countries in Latin America, Europe and Asia.

IHI Corporation is an industrial and technological Japanese conglomerate which is present on the five continents working in the fields of energy, aerospace, physical distribution systems, shipbuilding, development of infrastructures, rotating equipment, industrial machinery and systems, offshore operations and engineering, among others.

**Felguera-IHI es una compañía especializada en el almacenamiento de combustibles que está participada por la española Duro Felguera y la japonesa IHI Corporation**

Con más de 45 años de experiencia en el mercado, Felguera-IHI forma parte del segmento de negocio de Plantas Industriales de Duro Felguera, grupo industrial constituido a mediados del siglo XIX en Asturias –Norte de España- y que en la actualidad ejecuta grandes proyectos «llave en mano» para los sectores energético e industrial, a los que presta también servicios de montaje, mantenimiento, puesta en marcha y operación de instalaciones. Asimismo, cuenta con talleres de fabricación de bienes de equipo. Duro Felguera, empresa cotizada en la Bolsa de Madrid, tiene una amplia experiencia internacional en la construcción de centrales de generación eléctrica e instalaciones y terminales portuarias para el manejo de minerales. El grupo ejecuta proyectos en numerosos países de Latinoamérica, Europa y Asia.

IHI Corporation es un conglomerado industrial y tecnológico japonés presente en los cinco continentes y que trabaja en las áreas energética, aeroespacial, logística, construcción naval, desarrollo de infraestructuras, equipos rotativos, maquinaria y sistemas industriales, offshore e ingeniería, entre otros.

2. **F felguera-I.H.I., s.a.**



*Felguera-IHI is the Spanish leading company in providing storage for a multiple variety of liquid and gas fuels*

*LNG storage tanks, turnkey construction of fuel storage plants and storage equipment (spherical, refrigerated, semi-refrigerated and high temperature pressure vessels).*

*Founded in 1962 as Felguera Stockage, initially to meet the demands of the Spanish storage market but with an ever-growing focus on the international, Felguera-IHI makes the most of the alliance between Duro Felguera and IHI Corporation, and is at the forefront in engineering, design, manufacturing and construction of complete plants and individual storage equipment (vertical or spherical).*

*The company has consolidated newly developed business such as cryogenic tanks for LNG, high temperature tanks for solar powered plants and the construction of «turnkey» storage installations.*

*Felguera-IHI has carried out projects for the major oil companies in countries such as Turkey, Chile, Mexico, Greek, Iran, Libya and Algeria.*

**Felguera-IHI es la compañía española líder en el almacenamiento de combustibles, tanto líquidos como gases, en sus múltiples variedades**

Tanques de almacenamiento de LNG, construcción «llave en mano» de plantas de almacenamiento de combustibles y equipos de almacenamiento (depósitos esféricos, tanques refrigerados, semi-refrigerados y de alta temperatura).

Fundada en 1962 como Felguera Stockage para atender el mercado de almacenamiento español, aunque con una creciente vocación internacional, Felguera-IHI aprovecha las sinergías de Duro Felguera e IHI Corporation y está a la vanguardia tecnológica en ingeniería, diseño, fabricación y montaje de plantas completas y equipos de almacenamiento individuales (verticales o esféricos).

La compañía ha consolidado negocios de nuevo desarrollo como son los tanques criogénicos para LNG, los tanques de alta temperatura para plantas termosolares y la construcción de plantas de almacenamiento en la modalidad «llave en mano».

Felguera-IHI ha desarrollado proyectos en países como Turquía, Perú, Irán, Libia y Argelia, trabajando para las grandes compañías petroleras.





### 3. Almacenamiento de Gas Natural Licuado *LNG Storage Tanks*



*The turnkey construction of Liquefied Natural Gas tanks consolidates Felguera-IHI's leadership in the storage field. These EPC projects, which include connection of the tanks with the rest of the installation (transfer from LNG carriers and regasification process), require the most advanced designs to assure total containment of the product to be stored under the most unfavourable conditions.*

*Felguera-IHI carries out the conceptual design of the equipment as regards basic materials to be used and geometric configuration. The company also performs a detailed study which analyses critical zones with maximum technical precision, using state-of-the-art methods and calculation programmes to develop engineering. This gives the construction project a definite shape with which to back up the commissioning of the equipment, guarantee performance and assure that boil-off does not go above the maximum levels established in the design.*

La construcción «llave en mano» de tanques de Gas Natural Licuado consolida el liderazgo de Felguera-IHI en el campo del almacenamiento. Estos proyectos EPC, que incluyen la conexión de los tanques con el resto de las instalaciones (*descarga metaneros y proceso de regasificación*), exigen la utilización de los más avanzados diseños para asegurar la contención total del producto almacenado en las condiciones más desfavorables.

Felguera-IHI realiza el diseño conceptual del equipo en cuanto a materiales básicos utilizados o configuración geométrica, así como un estudio detallado analizando zonas críticas con el máximo rigor técnico y haciendo uso de métodos y programas de cálculo vanguardistas. De esta manera, la compañía desarrolla la ingeniería y da forma definitiva al proyecto constructivo que respaldará la puesta en servicio del equipo con todas las garantías de funcionamiento, asegurando así que las pérdidas por evaporación (*Boil-off*) no superen el máximo establecido en el diseño.





## 4. Tanques de Almacenamiento Verticales y Esféricos

### Vertical and Spherical Storage Tanks



#### 4.1 Vertical Storage Tanks

Felguera-IHI designs, supplies and constructs any kind of vertical storage tanks existing in the market, adapting the design to the required capacity and to the specifications of the product to be stored.

Depending on the product to be stored, we supply the following tanks:

- *Conventional fixed-roof tanks.* There are two types of construction depending on the roof of the tank: spherical or conical. These tanks are the most varied due to the range of volumes to be stored. Felguera-IHI has several references of large capacity fixed-roof tanks for diesel and fuel oils ranging from 60,000 to 80,000 m<sup>3</sup>.
- *Internal Floating Roof Tanks.* Without varying the basic design, these tanks have an internal cover which floats on the product thereby decreasing evaporation. This system is used to store volatile products (ethanol, MTBE, naphtha, gasoline).

#### 4.1 Tanques Verticales de Almacenamiento

Felguera-IHI diseña, suministra y construye toda la variedad de tanques verticales de almacenamiento existentes en el mercado, adaptando el diseño a las capacidades requeridas y las especificaciones del producto a almacenar.

En función de los productos que vayan a contener, se suministran los siguientes tanques:

- **Tanques convencionales de techo fijo.** Hay dos modalidades de construcción del tanque según la configuración del techo: esférica o cónica. Este tipo de tanques es el más variado en cuanto a capacidades. Felguera-IHI cuenta entre sus referencias con tanques de techo fijo de grandes capacidades para almacenamiento de gasóleo y fuel, que oscilan entre 60.000 y 80.000 m<sup>3</sup>.
- **Tanques de techo fijo con pantalla flotante.** Sin variación del diseño básico, van provistos de una pantalla interna metálica que flota sobre el producto disminuyendo su evaporación. Se emplea este sistema para almacenamiento de productos volátiles (etanol, MTBE, naftas, gasolinas).

Given the particular characteristics of this equipment, development of the project on site requires continuously changing work methods to meet Project Planning coordination needs, among which are:

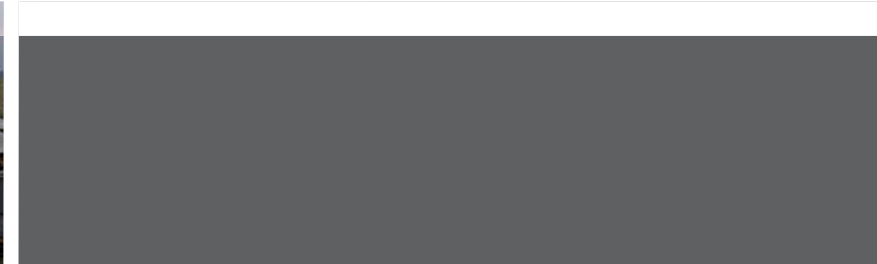
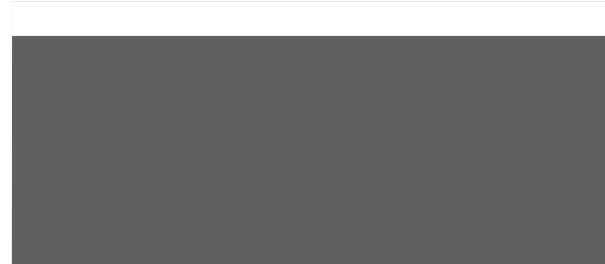
- Placement of large modules inside concrete tanks to assemble the steel dome.
- Raising the dome with air.
- Organisation of assembly systems for the internal tank shell.

Felguera-IHI integrates a detailed study of procedures in the construction system itself which includes rigorous safety measures for each step of the process.

Debido a las peculiares características de estos equipos, el desarrollo de la obra en campo requiere el uso de métodos de trabajo en continua evolución para adaptarse a las necesidades de coordinación exigidas por la planificación del proyecto, entre otros:

- Introducción de grandes módulos en el interior del tanque de hormigón para el ensamblado de la cúpula metálica.
- Izado de la cúpula con aire.
- Racionalización del sistema de montaje de la envolvente del tanque interior.

Felguera-IHI integra en el propio sistema constructivo un estudio detallado de los procedimientos en el que se reflejan las medidas preventivas de seguridad que deben aplicarse en cada momento con el máximo nivel de exigencia.



• *External Floating Roof Tanks.* These constitute one of the specialised technologies in storing volatile products, mainly large capacities of crude oil, the roof being a dynamic structure which floats on the product, acting as a physical screen and impeding evaporation. There are various types depending on the design of the roof and the diameter of the tank: single pontoon, double pontoon or double deck. Felguera-IHI has ample references in all of these among which are the largest tanks ever constructed in the world with capacities reaching up to 150,000 m<sup>3</sup>.

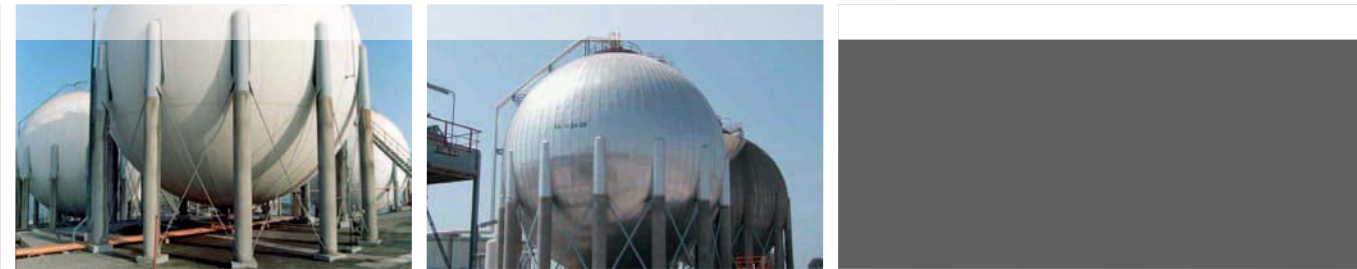
• *Refrigerated and cryogenic tanks.* These are used for storing large volumes of liquefied gases and require total containment designs using double shells and insulation systems to guarantee specified evaporation rates. Apart from LNG, the liquefied gases that are usually stored at low temperature are petroleum derived products (ethylene, propylene, LPG), ammonia and air gases (oxygen, nitrogen).



• *Tanques de techo flotante.* Constituyen una de las tecnologías especializadas del almacenamiento de productos volátiles, principalmente de crudo en grandes capacidades, siendo el techo un elemento dinámico que flota sobre el producto, haciendo de pantalla física e impidiendo la evaporación. Se pueden distinguir varios tipos en función del diseño del techo y dependiendo del diámetro del tanque: Simple pontón, Doble pontón o Doble cubierta. Felguera-IHI cuenta con amplias referencias en todos ellos, entre las que se encuentran los mayores tanques construidos en el mundo, con capacidades que llegan hasta 150.000 m<sup>3</sup>.

• *Tanques refrigerados y criogénicos.* Se destinan al almacenamiento de gases licuados en grandes volúmenes y requieren diseños de contención total, dotados con doble pared y los sistemas de aislamiento que garantizan la tasa de evaporación especificada. Al margen del GNL, los gases licuados que se almacenan habitualmente a bajas temperaturas son los derivados de la destilación del petróleo (etileno, propileno, GLP), amoníaco y gases del aire (oxígeno, nitrógeno).





**4.2 Spherical Storage Vessels**

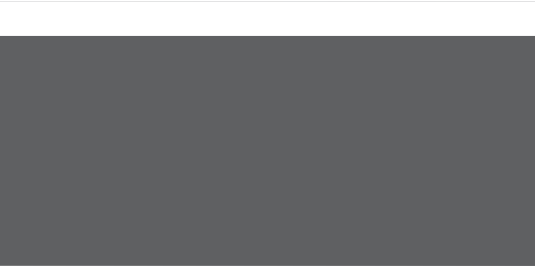
*When liquefied gas is destined for processing or distribution which implies relatively small volumes, the storage container used is a spherical pressure vessel. Felguera-IHI is specialised in developing the engineering, design and construction of this type of equipment and offers a wide range of products, capacities, pressures and temperatures.*

*Depending on the storage temperature, there are two types of spheres: room temperature or semi-refrigerated. The choice between the two will depend on the balance between the steam pressure of the product and the volume of the sphere. The mechanical design is thereby optimised by limiting the thickness of the steel shell.*

**4.2 Tanques Esféricos de Almacenamiento**

Cuando las características del almacenamiento de gases licuados responden a necesidades de proceso o de distribución que requieren capacidades relativamente pequeñas, el recipiente que se utiliza es el tanque esférico a presión. Felguera-IHI está especializada en el desarrollo de la ingeniería, el diseño y la construcción de este tipo de equipos, contando entre sus referencias con una amplia gama de productos, capacidades, presiones y temperaturas.

En función de la temperatura de almacenamiento se distinguen dos tipos de esferas: a temperatura ambiente o semirrefrigeradas. La elección de una u otra dependerá del balance de la presión de vapor del producto y el volumen de la esfera. Se trata así de optimizar el diseño mecánico limitando los espesores de la envolvente de acero.



5. Plantas de Almacenamiento de Hidrocarburos  
*Hydrocarbon Storage Plants*



*By applying the maximum technical precision that storage in pressure vessels of this type requires, Felguera-IHI offers the following services:*

- *Selection of materials for the primary components of the equipment.*
- *Advanced design, minimising welding lengths to be carried out.*
- *Rigorous quality control system.*

*The company also has references for liquefied gas stored in spheres whose capacities are among the largest in the world, reaching up to 10,000 m<sup>3</sup>.*

Aplicando el máximo rigor técnico que requiere el almacenamiento en recipientes a presión de estas características, Felguera-IHI ofrece los servicios de:

- Selección de los materiales de los componentes primarios del equipo.
- Avanzado diseño, minimizando la longitud de soldadura a llevar a cabo en la obra.
- Riguroso sistema de control de calidad.

La compañía cuenta también en esta disciplina con referencias que amparan el almacenamiento de gases licuados en esferas de capacidades que están entre las mayores del mundo, llegando hasta 10.000 m<sup>3</sup>.

*Thanks to its long-standing experience in designing and constructing storage equipment, Felguera-IHI has been able to develop the necessary engineering to provide storage plants for petroleum derived products on a turnkey basis, offering a complete service which goes from product offload to final transfer.*

*The company constructs three types of installations:*

- *Crude Oil Storage Plants for processing the product or storing strategic reserves, including the whole operation system.*
- *Hydrocarbon Storage Plants (diesels and gasolines), from offload to transfer of final product.*
- *LPG Storage Plants, from product offload to transfer onto trucks or bottling plant.*

Gracias a su larga experiencia en el diseño y construcción de equipos de almacenamiento, Felguera-IHI ha sido capaz de desarrollar la ingeniería necesaria para el almacenamiento integral de productos derivados del petróleo en la modalidad «llave en mano», ofreciendo así un servicio completo que abarca desde la descarga de los productos hasta su expedición.

**La compañía ejecuta tres tipos de instalaciones:**

- Parques de almacenamiento de crudo para el envío a proceso o reservas estratégicas, incluyendo todo el sistema de operación.
- Plantas de almacenamiento de hidrocarburos (gasóleos y gasolinas), incluyendo desde la descarga del producto hasta su expedición al detalle.
- Plantas de almacenamiento de LPG, incluyendo la descarga del producto y su expedición a camiones cisterna o planta embotelladora.





**Scope of the Projects:**

- Collaboration in selecting optimum plant location and preparing documentation required for permits, licenses and official approval by local governing bodies.
- Development of engineering systems to assure correct functioning of the plant (pumping stations, fire-fighting systems, access routes, site conditioning, buildings, etc.).
- Supply of all elements required to construct the plant.
- Construction, testing and commissioning of the plant.
- Management and overall coordination of the project up to delivery to final customer after the operational tests.

**Alcance de los proyectos:**

- Colaboración en la selección de la localización óptima de la planta y en la preparación de la documentación necesaria para la obtención de permisos, licencias y legalización.
- Ingeniería básica y de detalle.
- Desarrollo de sistemas e ingeniería para asegurar el correcto funcionamiento de la planta (estación de bombeo, sistema contraincendios, accesos, urbanización, edificios, etc.).
- Suministro de todos los elementos necesarios para la construcción de la planta.
- Construcción, pruebas y puesta en marcha de la instalación.
- Dirección y coordinación global de todo el proyecto hasta su entrega tras las pruebas operacionales.

6.

Recursos Humanos  
y Materiales

Human and Material Resources



*Felguera-IHI is conscious that to complete the contracts subscribed with its customers successfully, it is of the utmost importance to have a specialised group of professionals capable of implementing with the highest level of efficiency and quality all the stages within a project, from the start-up to the commissioning.*

*In order to respond to this ambitious objective, Felguera-IHI counts on an engineering team and other professionals who assist in all the disciplines required by the storage projects, so that final delivery is guaranteed to schedule with the quality standards required.*

*In the engineering phase Felguera-IHI carries out a technical study with maximum technical precision using state-of-the-art methods and calculation programmes.*

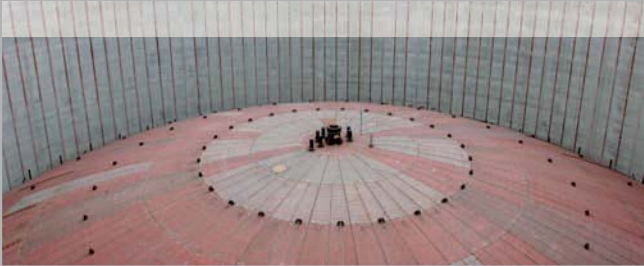


Felguera-IHI es consciente de que para ejecutar con éxito los compromisos adquiridos en los contratos suscritos con sus clientes es imprescindible contar con un equipo de profesionales especializados, capaces de implementar con el máximo nivel de calidad y eficacia todas las fases que componen el desarrollo integral de los proyectos, desde sus inicios hasta la puesta en marcha de los mismos.

Para responder a este ambicioso objetivo, Felguera-IHI cuenta con un amplio equipo de ingenieros, así como otros profesionales especializados en todas las disciplinas que requieren los proyectos de almacenamiento. De esta forma se garantiza la entrega final al cliente dentro de los plazos previstos con el estándar de calidad exigido.

En la fase de ingeniería, Felguera-IHI realiza un estudio detallado con el máximo rigor técnico haciendo uso de métodos y programas de cálculo vanguardistas.





Some of the calculation tools used are as follows:

- Finite element method (FEM): Ansys V.12
- Structural calculations: Risa3D & CivilFem.
- Electronic mock-ups: Cadworkx
- Drawings: Microstation & Autocad

In the same manner, Felguera-IHI requires that the assigned specialised site management uses the appropriate material resources, i.e. the company's own specific tools and means, integrating the necessary elements within the construction system itself to guarantee that the work is carried out to the highest standards of safety and environmental protection.

MATERIAL RESOURCES

With over 400 lifting devices and its own assembly means, Felguera-IHI leads the Spanish storage tank construction market.

Algunas de las herramientas de cálculo empleadas son:

- Elementos finitos (FEM): Ansys V.12
- Cálculo estructuras: Risa3D y CivilFem.
- Maquetas electrónicas: Cadworkx
- Delineación: Microstation y Autocad

Igualmente, a la hora de desarrollar los trabajos en obra, Felguera-IHI requiere que la dirección facultativa designada utilice los recursos materiales adecuados, contando con herramientas específicas y medios propios, integrando en el propio sistema de montaje los elementos necesarios que garanticen el desarrollo de la obra dentro de los estándares de seguridad y protección del medio ambiente más elevados.

MEDIOS MATERIALES

Con más de 400 gatos y medios propios para el montaje de tanques, Felguera-IHI es líder en el mercado español en el montaje de tanques de almacenamiento.

PRINCIPALES REFERENCIAS/ MAJOR PROJECTS

Proyecto Project	Cliente Customer	Localización Location
12 Tanques de Almacenamiento de 25.000 m³ de Capacidad Total Twelve (12) Storage Tanks with a total capacity of 25,000 m³	Kawasaki Kawasaki	Mary (Turkmenistán) Mary (Turkmenistan)
1 Tanque de Almacenamiento de para Amoniaco de 9.000 m³ de Capacidad One (1) Storage Tank for Ammonia with a total capacity of 9,000 m³	Kawasaki Kawasaki	Mary (Turkmenistán) Mary (Turkmenistan)
4 Tanques de Almacenamiento de Hidrocarburos de 160.000 m³ de Capacidad Total Four (4) Storage Tanks for Hydrocarbons with a total capacity of 160,000 m³	Terquimsa Terquimsa	Barcelona (España) Barcelona (Spain)
2 Tanques de Almacenamiento de LNG de 150.000 m³ de Capacidad Unitaria Two (2) LNG Storage Tanks with a unit capacity of 150,000 m³	Enagás Enagás	Gijón (España) Gijón (Spain)
2 Tanques de Almacenamiento de Sales Fundidas de 32.000 m³ de Capacidad Total  Two (2) Molten Salts Storage Tanks with a total capacity of 32,000 m³	Man Solar Millennium / Duro Felguera Energía Man Solar Millennium / Duro Felguera Energía	Granada (España)  Granada (Spain)
2 Esferas de Almacenamiento de Butano / Propano de 11.500 m³ de Capacidad Total Two (2) Butane / Propane Storage Spheres with a total capacity of 11,500 m³	Repsol Repsol	Cartagena (España) Cartagena (Spain)
2 Tanques de Almacenamiento de LNG de 150.000 m³ de Capacidad Unitaria Two (2) LNG Storage Tanks with a unit capacity of 150,000 m³	Enagás Enagás	Barcelona (España) Barcelona (Spain)
3 Esferas de Almacenamiento de Propano / Butano de 14.400 m³ de Capacidad Total Three (3) Butane / Propane Storage Spheres with a total capacity of 14,400 m³	Cepsa Cepsa	Huelva (España) Huelva (Spain)
4 Tanques de Almacenamiento de Hidrocarburos de 166.000 m³ de Capacidad Total Four (4) Storage Tanks for Hydrocarbons with a total capacity of 166,000 m³	Cepsa Cepsa	Huelva (España) Huelva (Spain)
1 Tanque de Almacenamiento de LNG de 150.000 m³ de Capacidad Unitaria One (1) LNG Storage Tank with a unit capacity of 150,000 m³	Enagás Enagás	Cartagena (España) Cartagena (Spain)
1 Planta de Almacenamiento de 200.000 m³ de hidrocarburos líquidos 200,000 m³ Storage Plant for Liquid Hydrocarbons	Cores/Repsol Cores/Repsol	Puertollano (España) Puertollano (Spain)
1 Planta de Almacenamiento de 200.000 m³ de hidrocarburos líquidos 200,000 m³ Storage Plant for Liquid Hydrocarbons	Cores/Repsol Cores/Repsol	Cartagena (España) Cartagena (Spain)
2 Tanques de Almacenamiento de LNG de 150.000 m³ de Capacidad Unitaria Two (2) LNG Storage Tanks with a unit capacity of 150,000 m³	Enagás Enagás	Barcelona (España) Barcelona (Spain)
1 Esfera de Almacenamiento de Amoniaco de 10.000 m³ de Capacidad One (1) Storage Sphere for Ammonia with a unit capacity of 10,000 m³	UBE Chemical UBE Chemical	Castellón (España) Castellón (Spain)



**F** felguera-I.H.I., s.a.

**df** duro  
felguera

[www.durofelguera.com](http://www.durofelguera.com)



SHI-QATAR CO., W.L.L.





# CONTENTS

1. Company Introduction
2. Company History
3. Commercial Registration
4. Major Construction Equipment
5. Company Organization
6. Engineer's Certificate
7. Reference
8. EPC Projects Performance
9. Overseas Project Investors Gathering
10. Contact



# 1. Company Introduction



## About **SHI-QATAR COMPANY W.L.L.**

Is taking advantages of manufacturing numerous storage tanks, steel structures and other related equipment from the boom of petrochemical, refinery, gas storage plant and power plant project. Special knowledge of Product & Blending Silo and Pneumatic Conveying system in domestic and overseas.

## 2. Company History

AUG 04.1995 Established Capital : 200,000,000 (Korean Won)

JAN 15. 1996 Increased of Capital : 120,000,000 (Korean Won)

MAY 16.1996 Registered as Company for Construction & Eng. : GYEONGBOOK 11-95

AUG 29.1997 Increased of Capital : 260,000,000 (Korean Won)

JAN 16.1998 Construction License for Piping & Equipment : ULSAN 99-12-01

AUG 20.1998 Purchased on 20 Aug 1998 Merged with Manufacturing  
Factory: DAEDONG ENTERPRISE CO., LTD

MAR 01.2000 Increased of Capital :360,000,000(Korean Won)

APR 10.2001 Construction License for Gas Treatment Equipment : ULSAN 2001-27-1-07

OCT 16.2001 Construction License for Under Water Project : ULSAN 2001-17-02

NOV 14.2001 Provided Management and Operation for  
SAMSUNG HEAVY INDUSTRIES (THAILAND) CO.,LTD

DEC 13.2001 SAMSUNG HEAVY INDUSTRIES (THAILAND) CO.,LTD  
Changed Name to SHI-ASIA COMPANY LIMITED

AUG 15.2004 Established SHI-Qatar Co., WLL in QATAR

OCT 14.2005 Achieved of : ISO KS A 14001:2004 / ISO 14001:2004  
: ISO KS A 9001:2001 / ISO 9001:2000

JUN 16. 2006 Increased of Capital : 410,000,000(Korea Won)

JUL 04. 2006 Construction License for Demolition Factory : Yeosu 2006-07- 01


Sep 24. 2006 SHI-Qatar Salwa Fabrication Shop Registration

Sep 26. 2006 Ministry of Municipal Affairs and Agriculture  
Computer Number

Jan 07. 2007 Membership Certificate from  
Qatar Chamber of Commerce & Industry



### 3. Commercial Registration (Cont'd)



Certificate No : REM0417

## Environmental Management System Certificate

This is to certify that  
the environmental management system of

**SAM HYOUN INDUSTRIES CO.,LTD.**

at

#914-3, Bongdu-ri, Sora-myeon, Yeosu-si, Jeonnam, Korea

has been found to conform to the Environmental Management System Standards:




*KS A ISO 14001:2004 / ISO 14001:2004*


This Certificate is valid for the following product or service ranges:



*Design, Production and Servicing of Storage of Tank, Plant Project*

Issue Date  
Sep. 29. 2008

Certification Date : Oct. 14. 2008      Valid Date : Oct. 13. 2011



Authorized By   
Ki Ho Park, President

-  Mark indicates that KMAR is accredited by the KAB (No. KAB-EC-17)
-  Mark indicates that KMAR is accredited by the member of the International Accreditation Forum Multilateral Recognition Arrangement
- KS/C CODE :172-2812/ Initial certification date: Oct. 14. 2005

KMAR/ 1dong, 12F, Ace High Tech City, #55-20, Mullae-dong, 3-ga, Yeongdeungpo-gu, Seoul, 150-972, Korea

### 3. Commercial Registration (Cont'd)

<b>Qatar Chamber of Commerce &amp; Industry</b> P.O. Box 402, Doha, Qatar, Tel: 4559111, Fax: 4661697 E-mail: info@qcci.org, Website: www.qcci.org		<b>غرفة تجارة وصناعة قطر</b> ص.ب ٤٠٢، الدوحة، قطر، تليفون ٤٥٥٩١١١، فاكس ٤٦٦١٦٩٧ البريد الإلكتروني: info@qcci.org، الموقع على الإنترنت: www.qcci.org
<b>شهادة عضوية</b> <b>MEMBERSHIP CERTIFICATE</b> Year : 2009		
<b>Qatar Chamber Of Commerce &amp; Industry certify that</b> <b>SHI - QATAR CO.</b> is a member of QCCI under Membership No 01/08833 and has ( 1 ) branches		
	Date: 05/03/2009	 <b>Management</b>
<p>Note : This certificate is valid until: 01/03/2010</p> <p>* Any alterations , overwriting or amendments to this certificate shall annul it.</p> <p>* Please see important notices on the back side</p>		

<b>Qatar Chamber of Commerce &amp; Industry</b> P.O. Box 402, Doha, Qatar, Tel: 4559111, Fax: 4661697 E-mail: info@qcci.org, Website: www.qcci.org		<b>غرفة تجارة وصناعة قطر</b> ص.ب ٤٠٢، الدوحة، قطر، تليفون ٤٥٥٩١١١، فاكس ٤٦٦١٦٩٧ البريد الإلكتروني: info@qcci.org، الموقع على الإنترنت: www.qcci.org
<b>شهادة عضوية</b> <b>MEMBERSHIP CERTIFICATE</b> عام : ٢٠٠٩		
<b>تشهد غرفة تجارة وصناعة قطر</b> <b>بأن السادة اس اتش اي قطر</b> <b>عضو منتسب لدى الغرفة برقم عضوية ٠١/٠٨٨٣٣ ولديهم عدد ( ١ ) فرعاً</b>		
	 <b>الإدارة</b>	<b>التاريخ: ٢٠٠٩/٠٣/٠٥</b> <b>الرجاء النظر خلف الشهادة</b> <b>ملاحظة : هذه الشهادة سارية المفعول حتى ٢٠١٠/٠٣/٠١</b> <b>أي كشط أو تعديل بهذه الشهادة تعتبر لا غية</b>

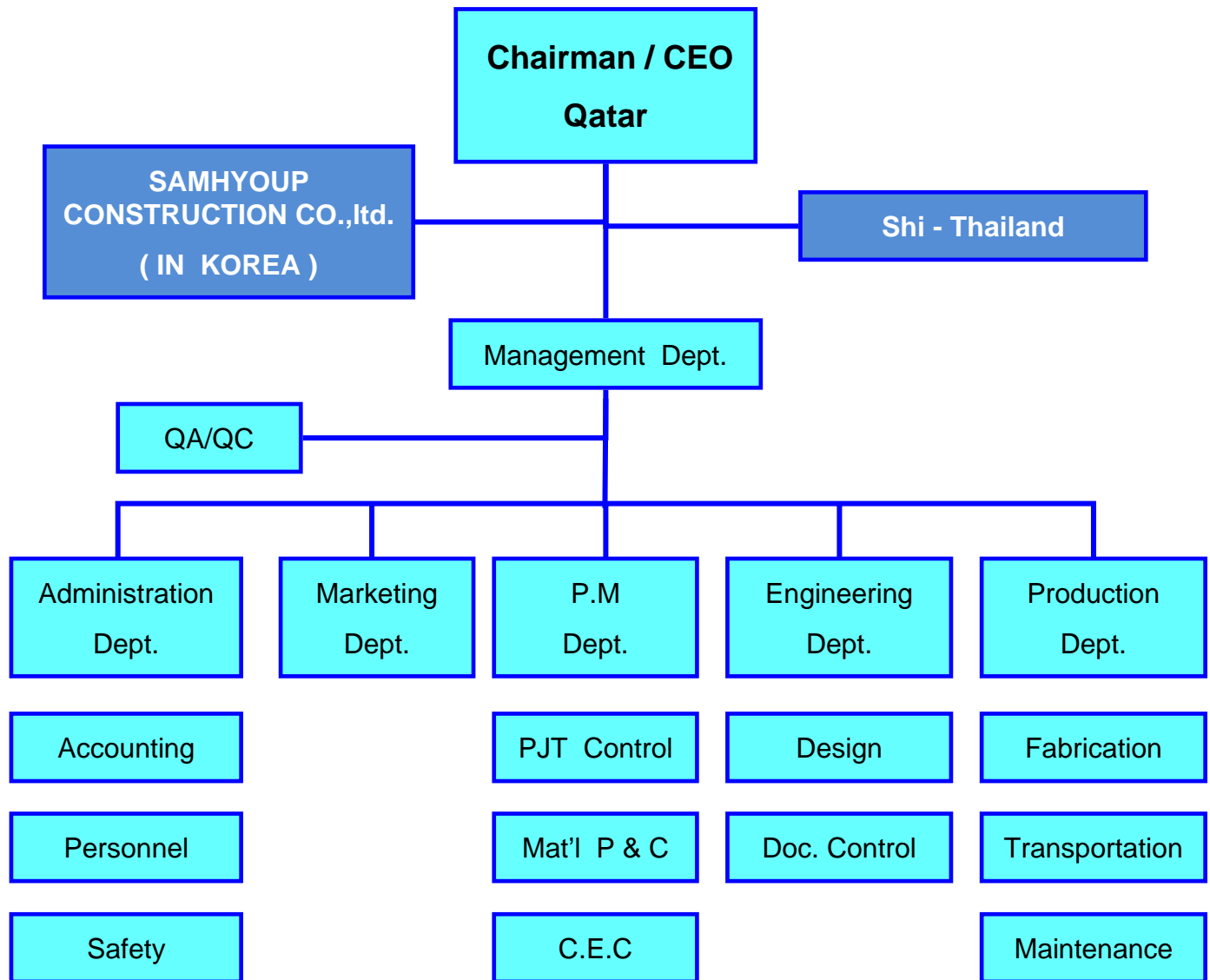




## 4. Major Construction Equipment

No	Description	Capacity	Q'ty	No	Description	Capacity	Q'ty
1	Kobelco 2500 Crawler Crane	250 Tons	1	32	Grinder	7"	30
2	Hitachi CX2000 Crawler Crane	200 Tons	1	33	Grinder	4"	200
3	Excavator Hyundai – Korea	29 Tons	15	34	Baby Grinder	-	30
4	Concrete Pump Car Junjin - Korea	43 M	2	35	Cutting Machine	YK300	5
5	Concrete Pump Car Junjin - Korea	37 M	3	36	Cutting Machine	YK150	3
6	Tadano RT500 Mobile Crane	50 Tons	5	37	Gouging Machine	600A	1
7	Tadano RT250 Mobile Crane	25 Tons	3	38	Gouging Machine	1000A	3
8	Mantis Rubber Crawler Crane	18 tons	1	39	Gouging Machine	800A	1
9	Ganty Crane		1	40	Gouging Machine	600A	1
10	Fork Lift	7 Tons	1	41	Auto Blasting machine	SA 2.5 x 45cm/min.	1
11	Fork Lift	5 Tons	1	42	Plate Bending Roller	50mm x 3200mm	1
12	Fork Lift	3 Tons	1	43	Plate Bending Roller	35mm x 4300mm	1
13	Generator	500 KVA	3	44	Blower for Air Raising	SAH-600	12
14	Generator	430 KVA	1	45	Dry Oven	400KG	1
15	Generator	360 KVA	2	46	Flux Dry Oven	100KG	1
16	Generator	275 KVA	2	47	Flux Dry Oven	200KG	1
17	Generator	250 KVA	2	48	Portable Dry Oven	5 KG	200
18	Generator	200 KVA	2	49	Hydraulic Jack	30TON	10
19	Generator	227 KVA	4	50	Hydraulic Jack	50TON	15
20	Generator	100 KVA	2	51	Chain Block	3 Tons	10
21	Generator	15 KVA	1	52	Chain Block	2 Tons	75
22	Air Compressor	15H	4	53	Impact Wrench	-	10
23	Air Compressor	10H	1	54	Trailer	30 Tons	2
24	Air Compressor Diesel	265CFM	5	55	Trailer Lowbed	35 Ton	1
25	Air Compressor Diesel	825CFM	1	56	Truck	5 Tons	1
26	AGW (Auto Girth Welder )	1000 A	7	57	Truck	3 tons	1
27	AVW (Auto Vertical Welder)	1000 A	3	58	Passenger Bus	60 seater	5
28	Stud Welding Machine		2	59	Passenger Bus	28 Seats	2
29	CO2 Welding Machine	500 A	6	60	Container	20 ft	17
30	AC Welding Machine	400 A	100	61	DC Welding Machine	1000 A	13
31	AC Welding Machine	500 A	30	62	LT-7 (Down Flat Welder)	1000 A	4

## 5. Company Organization





## 6. Engineer's Certificate

Name	Identification	Description		Position
		Issue Date	Certification No	
C.K.NAM	#304,Hana-APT, Samjeong-Li , Ulsan	Construction & M/C Engineer 2 <sup>nd</sup> Grade	94202030705Q	Construction Dept Asst. Manager
	700818-1114119	Jun. 20.1994		
M.S.CHUN	#305, Daiheong-API, Sineong-Dong, Nam-Ku, Ulsan	Piping Construction Engineer	1988-26-117-001	Administration Dept Executive Director
	461213-1851011	Jul.15.1998		
J.H.LEE	#1235-4,Mung-Dong, Nam-Ku, Ulsan	Piping Construction Engineer	1988-26-117-002	Construction Dept Engineering Manager
	591117-1105837	Jul.15.1998		
S.W.KIM	6B5N, Yacksa-Dong, Jung-Ku, Ulsan	Special Welding Engineer	9740803431T	Construction Dept Control Manager
	640605-110113	Jan.06.1998		
B.I.JEONG	#102-503,Jugong-API, Mung-Dong, Nam-Ku, Ulsan	Construction Engineer	G00176095	Construction Dept Project Manager
	560702-1930618	Jul.28.2000		
H.S.PARK	#101-503, Jugong-API, Mung-Dong, Nam-Ku, Ulsan	Construction Engineer	G00176444	Construction Dept QA/QC Manager
	591123-1850717	Aug.01.2000		

## 7. Reference (Cont'd)

No	Project Name	Contractor	Location	Description	Weight (ton)	Period
1	SK Oil Co., CDU Tank Farm	SHI	Ulsan Korea	FRT 750,000BBL=4 Tanks	10,000	96.01.01-96.05.30
2	SK Oil Co., 750,000BBL Tank	SHI	Ulsan Korea	FRT 750,000BBL=2 Tanks	5,500	96.01.01-96.05.30
3	Samsung General Petrochemical UT Complex Tank	SHI	Daesan Korea	FRT 500,000BBL=4 Tanks DRT 500,000BBL=4 Tanks Misc Tank * 15 Tanks	12,400	96.04.15-97.04.30
4	Samsung General Petrochemical UT Complex Tank	SHI	Daesan Korea	Spherical tank 2000 M3 = 1 Tank	650	96.04.15-97.04.30
5	SK Oil Co., Storage Tank	SHI	Ulsan Korea	FRT 750,000BBL=2 Tanks	4,100	96.04.15-96.10.30
6	SK Oil Co., Production Storage Tank	SHI	Ulsan Korea	Spherical tank 2000 M3 = 1 Tank	520	96.08.01-96.09.30
7	SK Oil Co., Storage Tank	SHI	Ulsan Korea	FRT 750,000BBL=1 Tank	2,050	96.08.25-96.10.30
8	SK Oil Co., Storage Tank	SHI	Ulsan Korea	FRT 750,000BBL=1 Tank	2,050	97.02.11-97.07.15
9	SK Oil Co., Storage Tank	SHI	Ulsan Korea	CRT 100,000BBL=6 Tanks	6,800	97.05.01-97.05.30
10	SK Oil Co., Production Storage Tank	SHI	Ulsan Korea	CRT 100,000BBL=6 Tanks CRT 200,000BBL=6 Tanks	6,700	97.11.01-96.02.28
11	FORMOSA Tank Farm Project of 21,000,000T/Y Refinery Plant	SHI	Yun Lin County Taiwan	DDFRT820,000BBL=4Tanks IFRT 320,000BBL= 8 Tanks CRT 320,000BBL= 10Tanks IFRT 190,000BBL= 4 Tanks	34,000	98.04.01-99.09.30
12	FORMOSA Tank Farm Project of 21,000,000T/Y Refinery Plant	SHI	Yun Lin County Taiwan	DDFRT820,000BBL=8Tanks IFRT 320,000BBL= 8 Tanks	24,700	99.07.01-00.09.30
13	FORMOSA Tank Farm Project of Loading Unit of Refinery Plant	SHI	Yun Lin County Taiwan	CRT Misc Tank= 10 Tanks	7,800	98.07.01-00.09.30
14	FORMOSA Tank Farm Project of Loading Unit of Refinery Plant	SHI	Yun Lin County Taiwan	Processing Piping Steel Structure	85,000 3,800	98.07.01-00.09.30
15	FORMOSA Tank Farm Project of Refrigerated LPG Plant	SHI TGE	Yun Lin County Taiwan	Low Temperature Double Wall Tank 8,000 M3=3 Tanks	7,000	99.09.01-01.04.30
16	SK Chemical CP-2 2Y Water Purifying Plant	SK Chemical	Ulsan Korea	Maintenance	-	99.10.15-99.11.01
17	SK Chemical CP-2 Modify Processing Plant	SK Chemical	Ulsan Korea	Modified & Replace Processing Pipe Line	-	99.10.18-99.11.04
18	SK Chemical 1HH-#5 Duct Expansion & Maintenance	SK Chemical	Ulsan Korea	Boiler & Duct Replacement	-	99.11.03-99.11.08
19	S-Oil PX / BZ Tank	S-Oil Co	Onsan Korea	CRT 100,000BBL=1Tank	750	00.02.08-00.04.27
20	PX BZ Tank	S-Oil Co	Onsan Korea	Piping Construction	25,000	00.04.01-00.05.31
21	S-Oil Rainy Water Tank	S-Oil Co	Onsan Korea	CRT 50,000 = 1Tank	175	00.06.08-00.08.06

## 7. Reference

No	Project Name	Contractor	Location	Description	Weight (ton)	Period
22	S-Oil New Crude Oil Storage Tank	SHI	Onsan Korea	FRT 750,000 = 12Tanks	24,000	99.08.14-00.07.30
23	S-Oil Processed Oil Storage Tank Farm	SHI	Onsan Korea	FRT 750,000 = 1Tank CRT 600,000BBL=1Tank CRT 300,000BBL=2Tanks	5,350	99.08.14-00.07.31
24	S-Oil Spherical Tank (21.5M DIA)	SHI	Onsan Korea	Spherical Tank 30,000 M3 = 4 Tanks	2,547	01.01.08-01.07.20
25	TDF Epension Project (Basf)	JungJin Const'	Yeosu Korea	Tank Farm Project for construction work only CRT 7units	1400	02.04.02 02.11.28
26	LG MMA Expension Project	SungJin	Yeosu Korea	Spherical Tank 1500 m3 = 1 Tank	180	02. 05.01 02. 11.15
27	Samsung Jeil Petrochemical Expension Project	Hantech	Yeosu Korea	Spherial Tank 1800 m3 = 1 Tank	230	03. 01.03 03. 04.22
28	Maintenance Work for LG MMA	LG MMA	Yeosu Korea	Waste Water Tank 1 unit (Stainless Steel)	250	03. 09.19 04. 01.21
29	BPA Project (NEW)	LGPC	Yeosu Korea	(Stainless Steel) Prilling Tower = 1 unit Product Silo = 4 units Product Tank = 1 units Conveying Duct = 1 units	250 200 58 76	04. 01.14 04.10.15
30	LGPC YP-2 Project (NEW)	LG E & C	Yeosu Korea	Product Silo (4units) Product Tank (5 units)	130 86	04. 10.01 05. 04.30
31	LGPC YP-2 Project (NEW)	MORITANI	Yeosu Korea	Blending Silo = 1 unit	76	04. 10.26 05. 04.30
32	DOLPIN Project Upstream and Compression Facilities	TKK	Qatar	Tank Construction work only For 36 units	7,800	04. 12.01 06. 04.30
33	Maintenance Work for YNCC	JungJin	Yeosu Korea	Product Tank = 1 unit	350	05. 06.10 05. 09.15
34	BPA Expansion Project for LGPC	LGPC	Yeosu Korea	(Stainless Steel) Storage Silo = 2 units	110	05. 08.19 05. 12.31
35	Qatar Gas-II LNG Project	IHI	Qatar	LNG Storage Tank = 5 units	16,250	05. 08.01 07. 06.16 08. 12.31
36	LG MMA-3 Expansion Project	LGMMA	Yeosu Korea	Spherical Tank = 1 unit DRT = 8 units CRT= 6 Units	1550	06.06.22 07. 04.30
37	Polycarbonate Train-II Project LG-DOW	Coperion	Yeosu Korea	(Stainless Steel) Silo & Hoppers with Blender = 22 units	450	06. 04.26 06. 12.30
38	PRIVATISATION OF CLEANING SERVICES AND WASTE TREATMENT FACILITIES.	KEPPEL SEGHERS	QATAR	Starter legs, Inlaid Parts, Journal Shaft, Hoppers, Absorber	1500	07-12-07 08-Ongoing
39	PRIVATISATION OF CLEANING SERVICES AND WASTE TREATMENT FACILITIES.	KEPPEL SEGHERS	QATAR	Incineration plant, Dano Drum Turbine Hall, Water treatment plant.	2483	07-12-07 08-Ongoing

## 8. EPC Projects Performance (Cont'd)

### Qatar Gas-II LNG Project

Contractor : IHI  
Location : Raslaffan, Qatar  
Description : 5 Units of Double Wall LNG Tanks  
Capacity : 140,000 m3  
Weight(ton) : 24,000  
Period : 1<sup>st</sup>. Aug 2005 ~ 31<sup>st</sup>. Aug 2008



IHI

CTN



Ammico

KETTANEH

SHI-QATAR

JEL

KAEFER

CAPE

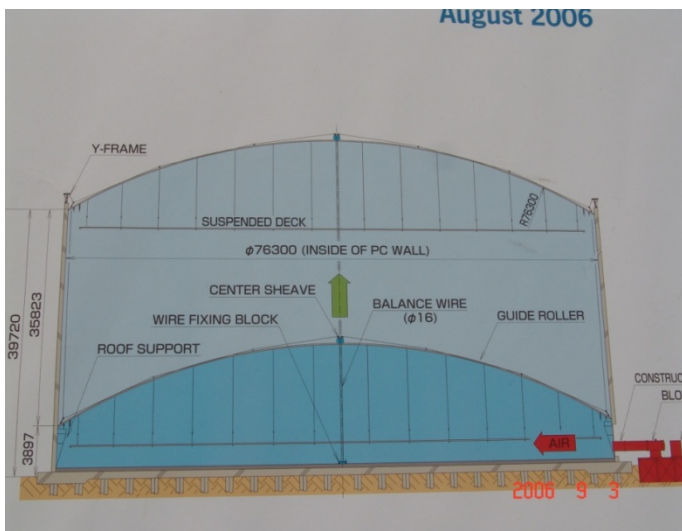
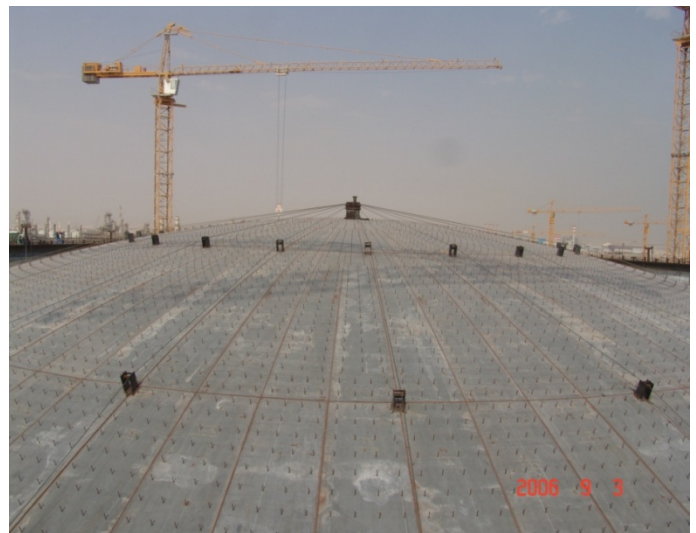
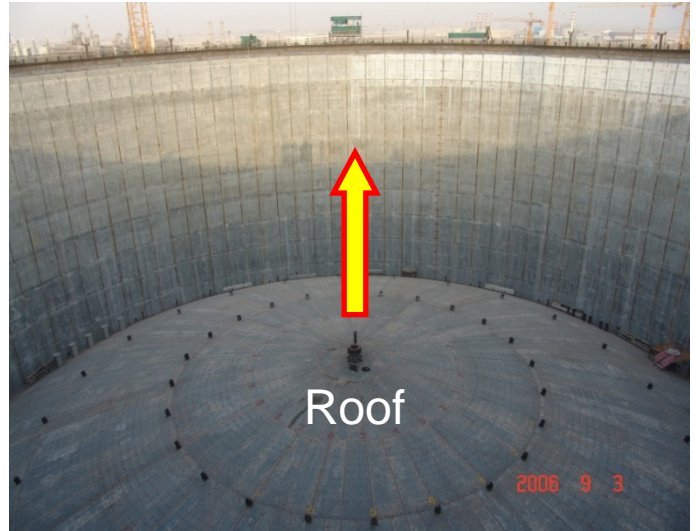
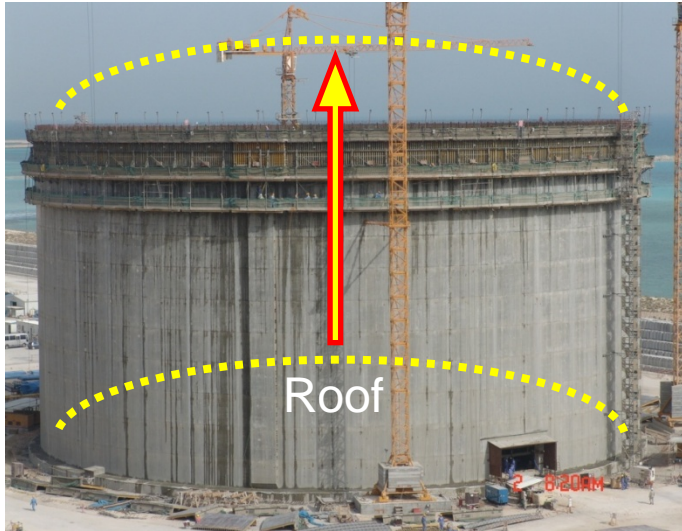




## 8. EPC Projects Performance (Cont'd)

### Qatar Gas-II LNG Project

#### Roof Air Lifting System



#### AIR LIFTING SPECIFICATION

PC WALL INSIDE DIAMETER	76,300mm
LIFTING WEIGHT	APPROX. 520 Tons
LIFTING LEVEL	35,823mm
LIFTING AIR PRESSURE	128mmAq
AIR CONSUMPTION	AVE. 1200m <sup>3</sup> /min
LIFTING SPEED	AVE. 200mm/min
OPERATION TIME	APPROX. 3 Hours

2006 9 3

## 8. EPC Projects Performance (Cont'd)

### DOLPIN Project Upstream and Compression Facilities



Contractor : TKK  
Location : Qatar  
Description : Tank Construction work For 36 units of Misc.Tanks  
Weight(ton) : 7,800  
Period : 1<sup>st</sup>. Dec. 2004 ~ 30<sup>th</sup>. Apr. 2007



Contractor : Samsung Construction Co.,Ltd.  
Location : Meassied,Qatar  
Description : 3 units of Double Wall LPG Tanks  
Capacity : 100,000 m3  
Weight(ton) : 13,500  
Period : 12<sup>th</sup>. July 2002 ~ 30<sup>th</sup>. June 2004



## 8. EPC Projects Performance (Cont'd)

### TAIWAN & THAILAND PROJECT



Qatar Gas PROJECT



## 8. EPC Projects Performance

### SPHERICAL TANKS (Gas or Liquid)





## 8. EPC Projects Performance (Cont'd)

### PIPING & STRUCTURE INSTALLATION



## 8. EPC Projects Performance (Cont'd)

### PRILL TOWER & SILOS





## 8. EPC Projects Performance (Cont'd)

### PRIVATISATION OF CLEANING SERVICES AND WASTE TREATMENT FACILITIES.



## 8. EPC Projects Performance (Cont'd)

### PRIVATISATION OF CLEANING SERVICES AND WASTE TREATMENT FACILITIES.





## 9. Overseas Projects Investors Gathering

OVERSEAS INVESTORS BEST PERFORMANCE AWARD CEROMONY WITH  
KOREAN PRESIDENT



### **Qatar**

**Company Name :** SHI-QATAR COMPANY W.L.L.

**Address :** P.O. Box 23603

Doha, Qatar

**TEL :** +974-478-1608

**FAX :** +974-479-5639

**Homepage :** <http://www.shiqatar.com>

### **Korea**

**Company Name :** SamHyoup Industries Co.,Ltd.

**Address :** 914-3, Bongdo-Ri, Sora Myeon, Yeosu City,  
Jeonnam, Korea

**TEL :** +82-61-691-5977~8

**FAX :** +82-61-691-5962

**Homepage :** <http://www.shikorea.com>

### **Thailand**

**Company Name :** SHI-THAILAND COMPANY W.L.L.

**Address :** 171 Moo 5 Samnaktorn Banchang Rayoung  
21130 Tax ID No. 3032292863, THAILAND

**TEL :** +66-3869-5262

**FAX :** +66-3869-5263.

**E-mail :** [asdang@shi-thai.com](mailto:asdang@shi-thai.com)