

SOW for Erect New Crud Oil–Floating Roof Storage Tanks in Banyas area

Technical Specifications for the Construction of Steel Floating Roof Tanks for Oil Storage with Associated Piping Works for Syrian Petroleum Company (Banyas, Tartous) on Turnkey Basis

1- Introduction:

The Syrian Company for Oil Transport wishes to construct steel tanks for storing oil with a single deck pontoon floating roof, with nominal capacities of (20,000 – 30,000 – 40,000 – 90,000) cubic meters.

The tanks will be constructed in the company's tank farm in Banyas and Tartous. The new tank piping network will be connected to the existing company piping network (loading and transfer) in Banyas and Tartous.

2- Scope of Work:

Contractor to provide company during 10 days of contract signing a project execution plan (for engineering, procurement & commissioning), company to submit comment to contractor after 7 days then contractor to provide final plan 7 days later.

2-1- Piping Network: tanks will be connected to the company's piping network as follows:

2-1-1 Inlet lines:

- Banyas: inlet nozzles of new tanks will be connected to the main existing inlet header including all necessary valves and accessories (valve at tank side and valve at header side as clarified by red color on attached Banyas tank drawing).
- Tartous: Inlet nozzles of new tanks at Tartous terminal site (near administration offices) will be connected to the existing two sea lines to load oil from VLCC tankers, along with all necessary valves, accessories, and pipes. While tank's inlet nozzles for the mountainous tanks will be connected to inlet header of existing tanks as clarified by blue color on attached Tartous tanks drawing.

2-1-2- Outlet line:

- Banyas: New tanks outlet nozzles will be connected to the existing outlet headers, including all necessary valves and accessories (valve at tank side and two valves at headers side as clarified by blue color on attached Banyas tank drawing).
- Tartous: The outlet nozzles of new tanks at Tartous terminal site (near administration offices) will be connected to new pumps, and from the pumps to the existing sea lines for loading oil from new shore tanks to VLCC tankers, with all necessary valves, accessories, pipes, and pumps. While outlet nozzles of new mountain tanks will be connected to the existing loading lines, in addition to construct a new line with approximately /600/ meters length for oil transferring from low-level mountain tanks,

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with all necessary pipes, valves, and accessories, tacking in consideration that the right-of-way for the mentioned line from the lowest tank to the existing loading lines near the Maghawir tie -n point need to be acquisitioned (company responsibility), as clarified by red color on attached drawing of Tartous tanks.

The work includes, but is not limited to **the following**:

- Supply and installation of piping:
Buried pipes must be coated, while above-ground pipes must be painted by the same painting as an external painting of tank.
- Supply and installation of all accessories.
- Supply and installation of valves.
- Supply and installation of the necessary pumps.
- Construction of a new line for transferring oil from low-level tanks with an approximate length of /600/ meters length.

2-2- Tanks:

The work includes construction of above-ground atmospheric storage tanks with a single floating roof and integrated peripheral pontoons, in accordance with API 650 standard, for storing crude oil in the Banyas & Tartous tank farm, under the following conditions:

- Climatic Conditions:

- Ambient air temperature ranges between -5°C and +45°C.
- Temperature under direct sunlight +82°C.
- Humidity ranges between 30% and 100%.
- Air pressure: (940-970) millibar.
- Snowfall is rare according to meteorological regulations for the Tartous and Banyas region.
- Maximum rainfall rate is 45 mm/h or as per meteorological regulations for the Tartous and Banyas region.
- Prevailing wind direction in the Tartous and Banyas region is from the Southwest towards the Northeast.
- Design wind speed: 160 Km/h.
- Seismic Zone: The Tartous and Banyas region is classified as Zone 4 according to API 650 Appendix E.
- Salty atmosphere, Mediterranean coast, strong winter storms, high frequent of lightning.

- Design Conditions:

- Nominal tank capacity: (20,000 – 30,000 – 40,000 – 90,000) cubic meters as follow:
 - a) Banyas: 4 tanks with 30000 m³ capacity for each, and 3 tanks with 20000 m³ capacity for each.
 - b) Tartous mountain site: 4 tanks with 90000 m³ capacity for each, 6 tanks with 40000 m³ capacity for each, and one tank with 2000 m³ capacity.

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c) Tartous shore site (near administration offices): 5 tanks with 40000 m³ capacity for each.

- Maximum shell height as per design, not exceeding 18 meters.
- Approximate internal diameter as per design.
- Shell plate width as per design, not less than 2 meters.
- Corrosion allowance: (Bottom and shell plates = 3mm), (Floating roof plates and structural steel = 1.5 mm).
- Design specific gravity: 1000 kg/m³.
- Specific gravity of stored material: 850 kg/m³.
- Vapor pressure of stored material: 0.7 bar.
- Aromatic content: 50%.
- withdrawal rate from the tank: 2400 m³/hour.
- inflow rate to the tank: 4800 m³/hour

- Tank design related standards:

- API Standard 650: Welded steel tanks for oil (Latest edition).
- API 2000: Venting atmospheric and low-pressure storage tanks.
- IS: 2007: Method for calibration of Vertical Oil Storage tanks.
- IS: 2008: Method for computation of capacity tables for Vertical Oil Storage tanks.
- API RP 2003: Protection against ignitions arising out of static, lightning and stray currents.
- ASME Sect IX: Welding.
- NFPA: Firefighting protection.
- Etc.

The scope includes, but is not limited to, the following:

- The contractor shall supply all consumable and non-consumable materials necessary for the optimal construction of the tanks, whether mentioned in the technical specifications or not.
- Supply of welding rods, structural steel, scaffolding, bending and cutting equipment, oxygen, acetylene, grease, oil, labor, etc.
- Supply of required plates for tank construction (bottom, shell, floating roof, stiffeners, etc.).
- Supply of structural steel required for (Circumferential stairways and rolling ladders – wind girders – walkways – beams for walkway support – platforms – handrails – foam and cooling pipe supports – etc.).
- Supply of stiffeners for pontoons.
- Supply of Seamless pipes for (Nozzle necks, inlet/outlet fittings, floating roof supports, vent valves, rainwater drain hose connection, etc.).
- Supply of accessories (pipes, valves, flanges, blind flanges, etc.).

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- Preparation of steel plates and beams for tank construction (bottom, shell, floating roof, ladders, wind girders, etc.).
- Design, supply, and installation of all nozzles, flanges, elbows, etc.
- Design, supply, and installation of Circumferential stairways and rolling ladders, walkways, handrails, top curb angle, etc.
- Design, supply, and installation of an impressed current cathodic protection system.
- Design, supply, and installation of rising and annular cooling pipes and spray nozzles (in two or three rows) above and below the wind girders.
- Design, supply, and installation of a foam fire fighting system (rising and annular pipes – foam generators, etc.).
- Supply and installation of a radar type transmitter according to the specifications below.
- Supply and installation of all electrical equipment (panels, cables, tank earthing, lightning protection for tanks, lighting poles and fixtures, (lighting fixtures must be (Exx) in hazardous areas, etc.).
- Submission work procedure for non-destructive testing and inspection, X-ray tests, visual inspection, and necessary measurements (procedures must be approved by company) then to execute the mentioned inspection & tests.
- Submission job safety analysis for all critical work.
- Performance of hydro-static, pneumatic, and vacuum testing, etc.
- Tank calibration and prepare calibration tables.
- Design, supply, and installation of tank accessories (openings, vents, hatches, earthing, etc.).
- Design, supply, and installation of rainwater drainage hose with accessories.
- Design, supply, and installation of primary and secondary seals with accessories.
- Supply and installation of a gauge well sleeve and copper plate.
- Supply and installation of all bolts and nuts required for the project.
- Supply required paints and execute painting according to the technical specifications below.
- Design and execution of tank foundation based on API 650 Appendix B, Section B.4.2 Concrete Ring Wall, and execution of the tank basin, bun wall, and walkways, etc.
- Completion of any other work required to make the tank ready for commissioning tests.
- Design, preparation, and submission of all general and detailed drawings for all project components.
- Provision of labor, tools, machinery, materials, cranes, and everything necessary to complete the project.

2-2-1- Design and Drawing Preparation:

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Immediately after contract signing, the contractor shall, within a short period (specified in the contractor's work plan), start design phase for the tanks, pumps, building, electrical, communication and instrument & control systems (calculations notes, design calculations for tank foundations and bun wall, preparation of general and detailed drawings for the tanks, civil drawings, drawings for connecting tanks to the company's piping network showing insulation gasket locations, complete electrical drawings (earthing, power supply, control, lighting, etc.), pumping systems design (data sheet, drawing, calculations, protections,..etc), and specifying locations of electrical panels, drawings for cathodic protection system for tanks and piping, drawing for radar level transmitter, etc.).

All design calculations and drawings shall be submitted to company for review and prior approval (before material procurement and final invoice approval).

Contractor to provide company with all engineering deliverables consisting of but not limited to:

- Basic engineering design.
- HAZID & HAZOP reports.
- Hydraulic study.
- Calculation notes.
- Detailed engineering drawings (foundation, building, structures, electrical, instrument, communication, piping & tanks).
- MTO's.
- Equipment data sheets.
- As-built drawings.
- Etc.

Nots:

- 1- Any discrepancy between hereunder tender requirement and API 650 requirement, the strict requirement to be followed (prior company's approval is required).
- 2- Contractor could use a sealing system (between floating roof and tank shell) other than hereunder mentioned system (must be according to API 650 requirement and prior company's approval is required).
- 3- Contractor could use a roof supporting system other than hereunder mentioned system (must be according to API 650 requirement and prior company's approval is required).
- 4- 40 years project design life to be considered.

2-2-2- Fabrication and Erection:

- Tank Shell:

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- Shell plates shall be made of ASTM 516 Gr.70 steel or equivalent. All plates shall be manufactured and hot formed for butt-welded joints.
- Based on the tank shell design study, the plates of the top course of the tank shell, and possibly the one below it, may be made of ASTM A283 Gr C.
This shall be discussed with the company during the design and drawing preparation phase.
- The contractor shall submit calculation notes based on API 650 standard for:
 - Shell design thickness calculation.
 - Top curb angle calculation.
 - Wind girder, Intermediate wind girder.
 - Overturning Stability against wind load.
 - Seismic design.
 - Anchorage design.
 - Fitting and accessories design.
- All vertical and horizontal joints shall be full penetration and full fusion welded.
- Joints shall be double welded butt joints.
- Single-side welding is rejected.
- The curb angle of the tank shell shall be lap welded to the top course.
- The tank height specified in technical specifications is nominal; the actual height may vary to match the erection.
- The stiffening ring shall be welded to the tank shell using support and stiffeners. The welding shall be of the same quality as the tank shell welding. The primary stiffening ring shall be used as a walkway with a handrail ring. The horizontal section of the stiffening rings shall be provided with appropriately spaced 25 mm holes to prevent rainwater from moving towards the tank shell.
- Welded joints of the curb angle and wind girders shall not be aligned (on the same line) with the vertical seam of the tank shell. These joints shall be spaced at least one meter apart.
- The vertical seam of the first course of the tank shell shall be at least 360 mm away from the annular plate weld or the bottom weld.
- The vertical seam of the tank shell shall be at a distance from the weld of openings or stiffener plates as per API 650 standard.
- The vertical seam of the next course of the tank shell shall be at a distance of one-third of the plate length from the vertical seam of the preceding course.
- No holes shall be made in the tank shell for erection purposes.
- The internal face of the shell plates shall be aligned.

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- The internal butt joints of the tank surface shall be aligned and smooth to allow for proper floating roof movement without damaging the seal.
- The first course of shell plates shall be fixed in place using metal clips or other means attached to the tank bottom. The verticality and roundness of the course shall be checked before welding or tack welding. Shrinkage shall also be considered when welding vertical joints.
- Before commencing final welding of the first course of shell plates, the alignment of the plates and the gap between them shall be verified. Any inaccuracy after welding must be within the tolerances specified in API 650 standard. If clearances are large, plates shall be realigned before final welding.
- Shell plates shall be continuously welded on both the inside and outside to the annular plates before commencing the welding of the bottom plates.
- After completing the welding of the first course, the radius shall be measured horizontally from the tank center to any point on the inner face of the shell. The deviation from the nominal radius shall not exceed the allowable limit in API 650 standard.
- Shell openings and accessories for each tank:
 - One flush-type cleaning door, open model, not less than 36x48 inches.
 - Two 30-inch Class 150 manholes with blind flanges.
 - One 24-inch Class 150 outlet nozzle, raised face RF or as per design.
 - One 20-inch Class 150 inlet nozzle, raised face RF.
 - One 10-inch Class 150 spare nozzle with blind flange, RF face.
 - One nozzle with two flanges and a valve for rainwater drainage (size as per design).
 - Two 6-inch Class 150 nozzles with pipes for draining water from the sump.
 - One 2-inch Class 150 nozzle, RF face with blind flange for pressure transmitter (PT).
 - One Circumferential stairway from ground to the top of the shell with a specified slope (as per API 650 requirement).
 - Foam pourers and generators and rising pipes compatible with the tank size and design to ensure proper foam usage for dealing with tank fires.
- A tank cooling system consisting of horizontal, rising, and annular pipes (two or three rings depending on wind girders numbers) with water spray nozzles above and below the wind girders.
- The tank shall be provided with a suitable earthing system, and this system must be connected to the company's earthing system.
- ...etc., any other necessary accessories as per design.
- The number and size of the above-mentioned openings may be modified if design calculations show they are not suitable for design and operating purposes. The contractor shall provide justifications for any such modifications.

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- Floating Roof:

- The floating roof shall be a single deck in the center with peripheral pontoons. The floating roof shall include a metal sealing system, a primary flexible seal, a secondary seal with stainless steel pressure plates, and a foam dam with a height of 1 meter.
- The material for the floating roof plates shall be ASTM A283-Gr C.
- The single deck pontoon roof shall have adequate rigidity.
- The inner and outer rim plates shall be designed by the contractor, and the calculations shall be submitted to the Company for review and approval.
- The roof plate thickness shall be as specified in API 650 standard, plus 1.5 mm corrosion allowance.
- The floating roof shall be designed to prevent any vapor mixture from accumulating underneath.
- The floating roof shall have an adequate slope towards the center to prevent rainwater accumulation.
- When the floating roof is at its highest position, the tank shall be at its design capacity.
- Floating roof plates shall be welded from the top with lap joints.
- Floating roof plates shall be welded from the bottom with intermittent welds of 50 mm length every 400 mm. Corners shall be fully welded, especially in overlap areas and where bending is expected near support or attachments, full welding according to API 650 Appendix C must be followed.
- The contractor shall submit to Company the following calculation notes used to determine plate thicknesses and verify the proper functioning of the floating roof:
 - Deck deflection and stress to be calculated for live and dead load.
 - Pontoon structure sizing according to live and dead load.
 - Structure design for anti-rotation.
 - Deck pole design for buckling and other loadings.
 - Gross and local buckling of pontoon.
 - Hydraulic design.
 - Buoyancy calculations.
 - Anti-rotation calculation.
 - Elastic stability against "gross out of plane" buckling and "local" buckling of the outer pontoon due to the radial load imposed by deflection of the center deck.
- The radial load shall be determined from the maximum expected rainfall loading condition or punctured center deck loading condition, whichever governs.
- **Roof nozzles and accessories for each tank:**
 - Two main access manholes, 600-750 mm size.
 - One pontoon manhole per pontoon, 500 mm size.

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- Automatic bleeder vent, size and number as per design.
- Rim vent valves, size and number as per design.
- One 8-inch nozzle next to the gauge well.
- One opening for installing the gauge well.
- One rolling ladder with self-adjusting steps according to the roof position, to access the floating roof, with a guide rail.
- A suitable rainwater drainage system for the roof with all its equipment.
- One galvanized metal sealing system with a primary seal.
- One secondary seal.
- One 12-inch gauge hatch (center of the deck).
- One nozzle for installing a multi-point temperature measurement device.
- One galvanized foam dam, 1 meter high and 3 mm thick.
- A suitable gauge hatch suitable for the level recorder and signal transmitter to the control room.
- ...etc., any other necessary accessories as per design.
- The floating roof shall be grounded to the shell by at least two flexible cables. The floating roof shall ensure good contact with the stored product.
- A roof drain sump and a check valve for the sump, and a rainwater filter made of non-oxidizing material shall be used. The rolling ladder and its steps and all its parts shall be earthed.
- **Floating Roof Supports:**
 - The number of legs supports shall be sufficient to ensure that the floating roof and tank bottom are not deformed when the floating roof rests on the supports. The contractor shall submit a calculation memo to define the number and specifications of the required support.
 - Supports shall be equipped with holes in their upper section and provided with a suitable working Cotter pin made of stainless steel.
 - Two operating positions shall be at heights of 1.2 meters and 2 meters from the tank bottom plates:
 - The lower position allows the floating roof to rest at a height of 1.2 meters above the tank bottom plates without affecting internal tank accessories, including the seal mechanism.
 - The upper position (for cleaning and maintenance) allows the floating roof to rest at a height of 2 meters above the tank bottom plates.
 - Fixed pipe sleeves shall extend sufficiently above the floating roof, considering water immersion (flooding) conditions above the floating roof, and extend below the floating roof to prevent vapor leakage (at least 200 mm).

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- Roof Drain:

- The floating roof shall be sloped towards the rainwater drainage sump.
- The rainwater drainage system shall be designed to drain rainwater at the maximum rainfall rate. The contractor shall submit a calculation memo including the specifications of the rainwater drainage system.
- The rainwater drainage sump shall be equipped with a swing check valve to prevent stored material from flowing onto the floating roof in case of damage to the drainage hose or pipe, if any.
- The rainwater drainage hose shall be manufactured of flexible type and equipped with all its accessories as per the manufacturer's recommendations and as specified in the technical specifications for flexible hoses below.
- If a pipe is required between the drainage sump and the flexible hose, its thickness shall be according to Sch 40 and it shall be well supported from the underside of the floating roof.
- Internal parts of the check valve (disc & seat) shall be made of copper or bronze.
- All bolts and nuts used in the rainwater drainage system shall be made of stainless steel.
- Gaskets and seals shall be made of a material suitable for oil and petroleum derivatives.

- Roof Vents:

- The floating roof shall be equipped with the vents specified below. The contractor shall submit a calculation memo to determine the specifications and number of vents according to, which must be according to API 2000.
- Automatic bleeder vent: The automatic bleeder vent system opens before the floating roof reaches its lowest position and closes when the floating roof rises above that point.
- Rim seal vent: Used to vent the area between the pontoons and the tank shell under the primary seal. The vents release excess air or non-condensed vapors that have entered the tank from the filling line.
- Pressure/Vacuum vent if needed.
- The number and specifications of the vents shall be determined through the tank design study.

- Gauge Hatch:

- The floating roof shall be equipped with two-gauge hatches with diameters of 8 and 12 inches, as specifications determined by the tank design study.
- The gauge hatch shall be made of spark-resistant material and equipped with a quick-opening cover.

- Gauge Well:

- The tank shall be equipped with a perforated gauge well extending from the top of the tank platform to the bottom of tank, installed on the side of the rolling ladder.

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- The top of the gauge well shall be equipped with a suitable flange for installing the radar gauging device.
- The gauge well shall be installed vertically.
- The diameter of the measuring column used for radar gauge is /200/ mm of Seamless Sch 40 pipe, or according to design.
- The pontoons shall be equipped with a 350 mm diameter sleeve and a 20 mm thick copper flange through which the gauge well passes.
- The gauge well and flange shall be used as an anti-rotation device. The contractor shall submit the calculation memo for it.
- **Roof Manholes:**
 - Each pontoon shall be equipped with a 500 mm nozzle.
 - The single deck of the roof shall be equipped with a 750 mm nozzle, equipped with a ladder for entering the tank when the floating roof is at its lowest position.
 - The single deck of the roof shall be equipped with a 600 mm nozzle.
 - The two manholes in the single deck of the floating roof shall be located diametrically opposite each other.
- **Rim Seals:**
 - The floating roof shall be equipped with a primary and secondary seal to reduce vapor loss, protect the environment, and prevent rainwater from entering the tank. It consists of a primary seal and a secondary seal:
 - Mechanical shoe seal (Scissor type) and a flexible seal according to the technical specifications below.
 - Secondary seal composed of pressure plates according to the technical specifications below.
- **Tank Bottom:**
 - The material for the bottom plates shall be ASTM A 283 Gr C steel, and the material for the annular plates shall be ASTM 516 Gr 70, or as per the design.
 - The contractor shall submit a calculation memo to determine the thickness of the bottom and annular plates.
 - The thickness of the bottom and annular plates shall be in accordance with API 650, plus 3 mm corrosion allowance.
 - The external (underside) face of the bottom plates shall be blast cleaned to Sa 2 1/2 degree and coated with two layers of bitumen paint to a minimum dry film thickness of 500 microns.
 - The external face of the bottom plates shall be protected by cathodic protection.
 - The bottom plates shall have a slope of 1/100 towards the outside (from center to outside).

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- The tank bottom slope shall be achieved during the construction of the tank's foundation itself, before laying the plates.
- Before laying the plates, the flatness of the tank foundation shall be checked, not exceeding ± 3 mm in any 3 meters and ± 13 mm over the entire circumference.
- Bottom plates shall be laid starting from the center plate and overlapping outwards.
- The welding sequence shall be shown on the drawings, which shall be followed to minimize plate shrinkage and distortion as much as possible.
- Central bottom plates shall be lap welded, with the overlap not less than five times the plate thickness.
- The overlap of bottom plates with annular plates shall be as shown in API 650 standard.
- Annular plates shall be butt welded using a backing strip with dimensions of 10 mm thickness and 150 mm width, made of the same metal as the annular plates.
- Datum plates for calibration and material level measurement in the tank shall be welded horizontally directly below the gauge well.
- Rest plates for Floating roof support shall be welded to the bottom with continuous fillet welds of 600x600x10 mm dimensions, with rounded corners, and shall be made of the same metal as the bottom.
- Welds of the annular butt-welded joints shall be subjected to NDT according to the percentage specified in API 650.
- The tank bottom shall be equipped with two drainage sumps (or as per design) of appropriate dimensions and according to the design requirement, diametrically opposite each other, made of the same bottom material.
- **Circumferential stairway and rolling Ladder:**
- Stairways (Circumferential): Each tank shall be equipped with a ladder with handrails and a platform to access the floating roof, with a slope of not more than 45 degrees to the horizon. Each step shall be designed according to the honeycomb pattern.
- The platform shall be elevated and of suitable dimensions, extending to allow easy access to the radar level gauge for installation and maintenance.
- Rolling Roof Ladders: Self-adjusting ladders according to the floating roof position, to access the floating roof from the platform. The wheel rail is fixed on the floating roof, allowing free movement of the ladder. Wheels shall be made of copper or any spark-free material. As mentioned above, each step is designed according to the honeycomb pattern.
- **Manholes and Nozzles:**
- All manholes and nozzles in the shell and floating roof shall be designed according to API 650 standard.

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- The number, type, and size of openings in the floating roof and shell are specified above and can be modified if there is conflict with design calculations. The contractor shall provide justifications.
- The external side of inlet and outlet nozzles shall be equipped with slip-on flanges to facilitate the installation of the gate valve.
- The position and orientation of the nozzles shall be such that they facilitate connection to the existing piping network.
- Inlet and outlet nozzle flanges shall be Class 150 and designed according to ANSI B 16.5 standard.
- Nozzles shall be welded to the tank shell with the same quality as the welding rods used for welding the tank shell.
- Internal Filling and Emptying piping Network: Each tank will be equipped with an internal network for filling and emptying purposes – the diameters of the pipes used are according to the design.

2-2-3- Fire Fighting Systems:

The firefighting system provided by the contractor shall be according to NFPA standards.

The fire extinguishing system shall include, but not be limited to, **the following:**

- Foam extinguishing system.
- Water cooling system.

2-2-3-1- Foam Extinguishing System:

- The contractor shall provide all necessary requirements for installing an extinguishing system for liquid petroleum product storage tanks suitable for temperatures not exceeding 100°C. This system shall include, but not be limited to:
 - A steel pipe extending from existing main firefighting network to each tank (at bottom level), equipped with a fire hydrant on the roadside and supported by appropriate concrete supports for each location (Banyas & Tartous).
 - A rising steel pipe fixed to the tank shell by suitable welded supports.
 - A circumferential steel pipe at the top (above the walkway).
 - Foam generators.
 - Foam pourers.
 - ...etc.
- The diameter of the pipes, and the size and number of foam generators and pourers shall be designed based on the solution flow rate required for each tank.
- The solution requirements for each tank shall be determined in accordance with the codes and standards mentioned above, ensuring that the fire is extinguished in the shortest possible time.

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- The contractor shall submit the calculation memo to determine the number and specifications of the above-mentioned firefighting equipment, pipe diameters, and specifications, and technical data sheets & catalogs. The contractor shall also provide the necessary installation drawings.

2-2-3-2- Water Cooling System:

- The tank shall be equipped with a cooling system based on water spraying through a main circumferential ring. There may be more than one ring in case of multiple wind girders, for spraying above and below the wind girders.
- The rising pipe and the main ring shall be fixed by suitable supports welded to the tank shell.
- Sprinklers shall spray water at an appropriate angle, with overlapping with adjacent sprinklers.
- Sprinklers shall be made of an appropriate, non-corrosive metal and fixed to the main ring via an internally threaded connection.
- A pipe is extended from the main cooling system to each tank (at bottom level), supported by concrete structures.
- Water pressure in the existing firefighting network is approximately 10 bars.
- The contractor shall submit a calculation note to select the diameters of the various pipes, their specifications, and the specifications of the Sprinklers, in accordance with relevant international standards. The contractor shall also provide the necessary installation drawings showing dimensions, etc.
- The contractor shall blast clean and paint the firefighting and cooling networks in the same manner as the external tank shell. The final color for the foam and cooling network shall be as per international practice: yellow for the foam network and red for the cooling network.

Notes:

Note (1): The new firefighting piping network shall be connected to the existing firefighting network for each of mountain tanks at Tartous & Banyas tanks.

- Ensure the compatibility of the existing firefighting network with the requirements of the new firefighting and cooling system for the new tanks (in each of Banyas site and Tartous mountain site).

Note (2): Supply and installation of new comprehensive cooling & firefighting system for tank farm at Tartous terminal (shore tanks near administrative offices). Including but not limited to (Water tank or water basin according to design requirements – foam tank - jockey pumps - Main pumps – Cooling & Foam piping network, spray nozzle, pourers & generators, structures & supports, instrument and control system, power supply etc.)

2-2-4- Welding Works in Tanks:

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- All welding works, including weld repairs, shall be performed in accordance with API 650, API 653, and ASME IX standards.
- The contractor shall submit welding procedure specifications (WPS) to the company, including all necessary information, for approval.
- After obtaining WPS approval, a procedure qualification test (PQR) shall be conducted under the supervision of a qualified and authorized third party. The contractor shall provide company with a copy of their qualifications.
- Upon WPS approval, the third party shall issue a PQR certificate including welding parameters, observations related to the welding procedure, and tests such as tensile and bend tests, weld test results, etc.
- Welder qualification tests shall be performed by a qualified and authorized third party according to the WPS. The third party shall issue WPQ certificates for successful welders, accompanied by radiographic images of the weld performed by each welder.
- WPS, PQR, and WPQ works shall be in accordance with ASME SEC IX standard.
- Samples for WPQ and PQR shall be prepared by the contractor.
- All welding activity for PQR and WPQ shall be performed at the company's site in Banyas in the presence of the supervision committee.
- The contractor shall pay all costs of WPS, PQR, and WPQ works.
- No welder shall be employed on the project unless they have passed the welding test and get a certificate.
- Before commencing erection works, the contractor shall submit the erection sequence and welding sequence to the company for approval by the supervision committee.
- Tack welds used in vertical and horizontal joints of the tank shell shall be removed.
- Tack welds in the bottom, shell-to-bottom joints, floating roof, and automatic welding of horizontal shell joints and other joints do not require removal.
- Tack welding shall be performed with the same welding rod that will be used for the first pass welding.
- Each weld pass shall be cleaned of slag and other deposits before commencing the next pass. The final weld shall also be cleaned of slag before inspection.

2-2-5- Inspection and Testing:

- The contractor shall perform inspection and testing in accordance with API 650 standard. For this purpose, the contractor shall submit a detailed procedure for inspection and testing to company for approval before commencing inspection and testing works. Inspection and testing include, but are not limited to, the following:
 - Radiographic inspection of butt welds and annular plate welds.
 - Vacuum testing (vacuum box) for bottom and roof welds.
 - Visual inspection of all welds.

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- Hydrostatic testing – the company will provide the necessary water for testing.
- Penetrant testing and other non-destructive tests where necessary.
- Dimensional testing.
- The person nominated to perform non-destructive tests must hold at least a Level II certificate. The contractor shall provide company with a copy of the certificates, which must be issued by an approved entity.
- All non-destructive tests shall be performed in accordance with API 650 and ASME Sec V standards.
- The contractor shall perform all tests at their own expense, either on-site or through laboratories.
- The work shall be subject to continuous monitoring and inspection by the supervision committee. The contractor shall follow the instructions given during inspection and ensure that the work is performed according to the technical specifications and relevant international standards.
- Any work not conforming to execution drawings, technical specifications, or relevant international standards shall be immediately rejected. The contractor shall correct the error at their own expense.
- Inspection and test results shall be recorded in inspection and test logs, etc., which shall be certified by the supervision committee. These logs shall form part of the project completion documents.
- Inspection and acceptance of works do not release the contractor from his responsibilities according to the contract.

2-2-6- Painting:

2-2-6-1- Surface Preparation for Painting:

- All metal surfaces shall be free of oil and grease. If oil, grease, etc., are present, they must be removed using suitable solutions, steam cleaning, cleaning solutions, or high-pressure water.
- Weld spatter and sharp edges such as (Plate Lamination - Weld Spatter - Sharp Edge) must be removed using appropriate methods.
- blast cleaning to Sa2 1/2 degree according to the Swedish Institute, using suitable abrasive materials (approved by the supervision committee), to remove mill scale (if any), rust, paint layers, and foreign materials.
- No traces of coloring residues shall appear on the blasted surface, except for slight smudges in the form of spots or scratches.
- Materials used for blasting shall be in accordance with the recommendations in international standards for such works (ISO 8501, SIS O5 5900, SSPC) or according to the manufacturers' recommendations for each type of paint used.

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- Blasting materials shall be completely removed from the blasted surface using a vacuum cleaner, clean compressed air, or brushes.
- The roughness of the blasted surface shall be between 50-75 microns and shall not exceed 100 microns under any circumstances.

2-2-6-2- Blasting Equipment:

- The contractor shall be aware that they are working within an oil tank farm, and therefore, all cleaning and blasting equipment must be safe for use. The supervision committee has the right to reject any equipment that does not comply with the usage conditions.
- Compressed air used must be free of water and oil. Air compressors must be equipped with suitable traps and separators.
- The used air temperature for blasting shall not exceed 110°C.

2-2-6-3- Painting Specifications:

- Since newly blasted surfaces are susceptible to corrosion, especially in tank farms with high humidity and salty atmosphere, blasted surfaces must be painted immediately at the end of the workday and according to painting manufacturer data sheet.
- If the contractor delays painting the blasted surfaces and signs of metal redness appear, the contractor must re-blast the surface.
- Painting shall not be performed under the following conditions:
 - Ambient temperature below 5°C.
 - Humidity above 85%.
 - Metal surface temperature is higher than the ambient dew point by less than 3°C.
 - Surface temperature to be painted above 40°C.
 - In other atmospheric conditions such as strong winds, dust in the air, etc.
- Before supplying paint to the work site, the contractor shall provide the company with the following information for approval:
 - Specification Number
 - Color Reference Number
 - Method of Application
 - Batch Number
 - Date of Manufacturing
 - Shelf Life and Expiry Date
 - Manufacturer Name
- The company has the right to take a sample from each batch at any time and test it in a private or public laboratory at the contractor's expense. If the sample test results are found uncomeatable with technical specifications, the entire batch shall be rejected.
- Each coat shall be inspected before applying the next coat. The contractor shall repair defects or repaint.

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- Each paint coat shall be free of defects. The final appearance of the coat shall be free from viscosity after drying, cracks, bubbles, wrinkles, etc.
- Painting method: Airless Spray or Conventional Spray, according to the paint manufacturer's recommendations.
- Thinning: The type and quantity of thinner shall be according to the paint manufacturer's recommendations and shall be added during mixing just before painting, in the presence of the supervision committee.
- Supervision committee shall supervise the following tests on the paint, which must meet acceptance criteria of thickness, porosity, and adhesion. If there are deviation, the paint shall be rejected and redone until the acceptance criteria achieved:
 - Thickness check tests.
 - Porosity check for internal paint.
 - Adhesion check.
- The contractor shall adhere to international safety standards and safety data sheet of painting manufacturer.
- The contractor shall supply paint materials from international companies such as Ameron, Sigma, Hempel, Verna, and Jotun.
- The contractor shall provide all necessary equipment for painting works, including compressors, blasting materials, equipment, and tools, etc.

2-2-6-4- Painting of Tank Bottom, One and a Half Meter Height (from the first and last course), and Underside of Floating Roof:

- Painting shall be performed in three coats with a total dry film thickness of 300 microns, 100 microns per coat, using Epoxy Phenolic material with the following specifications:
- Epoxy Phenolic: Cross-linked epoxy phenolic with alkaline curing agent. Pigment titanium dioxide, inert, tinting colors, and special abrasion resistance pigments. (4/5 mils) 100/125 microns dry film thickness each coat. Volume solids percentage of 48-52%. Curing in accordance with manufacturing recommendation. Temperature resistance 120°C.
- The contractor shall lift all floating roof supports for painting underneath them alternately. They shall not be lowered until the paint reaches the required hardness (according to painting specifications).
- Before laying the bottom plates, the contractor shall underside paint them with suitable bitumen with a dry film thickness of 500 microns.

2-2-6-5- Painting external surfaces of floating roof & shell and external painting of new constructed piping & fitting ... etc.

- The external surfaces shall be painted with epoxy in three coats with a total dry film thickness of 240 microns, according to the following sequence:

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- Primer coat: A primer coat shall be applied with Inorganic Zinc Rich Primer, with a dry film thickness of 75 microns.
Inorganic Zinc Rich Primer: One coat of two-pack inorganic zinc silicate (self-curing) pigmented with zinc dust plus trace colorant. Solvent used: alcohol, glycol ether (no organic binders). Volume solids approximately 45%. Minimum zinc level 80% pure zinc by weight, leaving a minimum of 85% metallic zinc by weight in dry film. Minimum dry film thickness 75 microns. Temperature resistance up to 400°C.
- Intermediate coat: The intermediate coat shall be applied with High Build Epoxy Polyamide, with a dry film thickness of 125 microns.
High Build Epoxy Polyamide: Epoxy resin and polyamide curing agent. Pigmented with inert light-fast non-toxic pigments. Volume solids approximately 55-66%. Minimum dry film thickness 125 microns per one coat. Temperature resistance up to 120°C.
- Final coat: The final coat shall be applied with Aliphatic Polyurethane topcoat, with a dry film thickness of 40 microns.
Aliphatic Polyurethane topcoat: Aliphatic acrylic polyurethane and agent. Pigment: inert light-fast pigment. Volume solids approximately 48-56%. Minimum dry film thickness 40 microns. Temperature resistance up to 90°C. Minimum pot life 4 hours at 20°C.

2-3- Piping, Valves, and Accessories:

The work includes, but is not limited to, the following:

- Supply of all materials for the new piping network, valves, and necessary accessories to the work site.
- Prepare piping network route, taking into consideration that the route of the new lines will be crossed with main asphalt roads, rainwater drainage channels within the company's tank farm, electrical and control cables, and special lines for water and oil.
- Laying the new piping sections and welding it alongside the proposed route.
- Excavation pipe trench alongside the proposed route.
- Trench cleaning & pipe lowering.
- Tie-in welding.
- Hydrostatically testing the new line according to American standard API 1110, using fresh water.
- The contractor shall submit test reports signed by contractor and Company representative.
- The line shall be drained of water by the contractor.
- Backfilling the line, re-leveling the roads, and restoring the area to its previous condition.

The contractor shall also consider the following:

- Pipe welding shall be performed according to American standard API 1104 for all welding activities, including welding radiography, interpretation of images, and repairs.

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- The contractor shall submit a WPS to company for approval before commencing welding works, in accordance with API 1104 and ASME IX standards. This procedure shall include welding rod specifications and diameters, number of weld passes, current value, welding speed, welding method, etc.
- The submitted welding procedure shall be qualified under the supervision of a qualified and authorized third party. The contractor shall provide company with a copy of their qualifications.
- Upon WPS approval, the third party shall issue a PQR certificate including welding parameters, observations, and tests such as tensile and bend tests, weld test results, etc.
- Welder qualification tests shall be performed by a qualified and authorized third party according to the WPS. The third party shall issue WPQ certificates for successful welders, accompanied by radiographic films of the welding joints for each welder.
- The contractor shall provide all necessary requirements for conducting the tests, including providing and preparing the required joints, welding rods, welding machines, and radiography of the joints, etc. These joints shall be radiographed by the contractor using gamma rays, and only welders who pass the test shall be accepted.
- The contractor shall use skilled workers specialized in pipe installation and holding certificates proving their prior experience in such work.
- The contractor shall adhere to the installation principles mentioned in ASME B31.4 & ASME B31.3, the longitudinal welding seam to be on the top side during installation. The distance between adjacent pipes shall not be less than 20 cm. Appropriate clamps shall be used and remain until the completion of the first pass. Pipes shall be cold bent at appropriate angles according to standards, ensuring that the ends of bended pipes are straight. Hammers shall not be used for bending.
- The contractor shall support the pipes with suitable metal supports during welding. The pipe shall not be moved during the first and second welding passes.
- Welding shall be performed by two welders starting and finishing simultaneously, except for small diameter pipes where one welder may be used.
- All weld passes shall be performed continuously without delay. Welding shall start from the first pass and continue until all passes are completed without interruption.
- The contractor shall number the joints and indicate the weld number and contract number.
- The contractor shall use E6010 and E7010 welding rods from international brands such as Böhler, Lincoln, or ESAB, or equivalent (Contractor to get company approval for welding rod manufacturer).
- The contractor shall clean the weld joint areas by grit blasting, then paint these joints with epoxy to a minimum dry film thickness of 400 microns in two coats (contractor to

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get company approval for the type and manufacturer of used epoxy painting). The contractor shall provide all necessary materials for proper coating of the weld joints.

- The contractor shall repair any damaged coating on the pipe (if present) in the appropriate manner.
- The contractor shall ensure that the old pipe coating and the new welded section's coating are in good condition, especially at the connection points of the old pipe to the new section. If any damage is found, the contractor shall repair it appropriately.
- After completing the welding work, the contractor shall radiograph 100% of the weld joints using gamma rays.
- The contractor shall apply appropriate marking to identify the location of the joint in the film, the contract number, and the welder number, which shall be printed on the image itself, not written on it after radiography.
- The contractor shall submit a report on the status of the films, accepted ones, and the type of defect according to API 1104 standard, signed by an authorized specialist from an approved entity.
- In case of defects, the contractor shall perform repairs and re-radiograph until the weld is accepted.
- The contractor, with the assistance of the supervision committee, shall accurately determine the location of the proposed route.
- Excavation shall be carried out by excavator, Jack hammer, compressor, or manual labor, depending on the nature of each area and the risk of excavation. The depth shall be according to the pipe diameter, ensuring a minimum cover layer of 1.2 meters above the pipe, depending on the site situation.
- During excavation, the contractor must be aware of the possible presence of various pipes (oil, derivatives, water), electrical lines, telephone lines, etc. Excavation must be carried out with caution. The contractor shall be responsible for any damage caused during excavation.
- The contractor shall prepare the trench section lowering. The contractor shall remove all solid blocks and stones, then level the excavation to a uniform level with slopes matching the natural ground.
- The contractor shall manually spread salt-free sand or fine soil free of gravel and stones, 20 cm high, to lay the new section on.
- After leveling the sand, contractor shall, with the assistance of appropriate machinery, lower the pre-prepared section smoothly without causing stress within the pipe. To achieve that, the contractor shall use three machines for lowering the pipe, preferably cranes and backhoe.

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- After the contractor completes all required works for lowering each section individually, the contractor shall spread salt-free sand (or fine soil free of gravel and stones) around and above the pipes to a depth of 20 cm, then backfill the trench with fine local backfill, followed by backfilling from the excavated soil.
- The contractor shall ensure that the pipe does not contact with solid or rocky blocks.
- The contractor shall restore the site to its original condition and remove all rubbish from the work site, including leaked oil and other debris.
- Pipes laid above ground shall be supported on suitable supports and painted in the same manner as the external tank shell, as described above.
- International standards shall be followed for installing manual, electric, and check valves, with suitable supports if needed.
- All facilities and roads, including asphalt, that were removed due to the works shall be restored to their original condition before commencing work.
- All pipes, elbows, flanges, valves, and other piping network requirements shall be in accordance with the latest edition of the respective standard.
- Tank accessories (flanges, necks, bolts, etc.) shall be in accordance with the materials recommended in API 650 standard.
- The type and materials of valves shall be suitable for the required service, as specified later.
- The contractor shall provide all necessary cranes, welding machines, machinery, equipment, rollers, welding labor, welding materials, etc.

2-4- Material Specifications:

2-4-1- Plate Specifications:

- All types of plates mentioned above shall be manufactured according to the technical specifications defined in API 650 standard.
- The contractor shall provide all manufacturing tests, including, but not limited to, chemical analysis and mechanical tests.
- Plates shall be coated with iron oxide paint for protection against rust during transport.
- Plates shall be heat-stamped.
- Plate width shall be a minimum of 2 meters. Plate length shall be determined according to the design.

2-4-2- Structural Steel Specifications:

- Steel used for the construction of circumferential and rolling ladders, handrails, etc., shall be ASTM A36 steel.

2-4-3- Piping and Accessories Specifications:

2-4-3-1- Pipe Specifications:

- API 5L Gr B, Seamless, PSL II, Bevel End, STD.

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- Length about 12 m each line pipe.
- Pipes diameter 24", 20", 12", 8", 4", 3" etc.
- For buried line pipe, it shall be externally polyethylene coated by fusion/extrusion wrapping process or equivalent, with a polyethylene coating thickness of 3.5 mm.
- Pipe ends shall be protected against shipment.
- The contractor shall issue the following certificates for pipes and coating:
 - Pipes: Chemical Composition and Mechanical Properties Testing, Hydrostatic test, Dimensional and Visual Inspection, Also Nondestructive Inspection and other Mill tests.
 - Coating: Visual Inspection, Thickness, Porosity, Adhesion, Impact test, Electric Resistance and other Mill Tests.

2-4-3-2- Accessories Specifications:

- Flange: Weld neck and slip-on flange shall be carbon steel, ASTM A105, ASME B16.5, Class 150, RF, SCH STD.
- Elbow: 45° & 90° shall be carbon steel, ASTM A234-WPB Type S, ASME B16.9, BE, SCH STD.
- Reducer: Concentric or eccentric shall be carbon steel, ASTM A234-WPB Type S, ASME B16.9, SCH STD.
- Tees: Tees shall be carbon steel, ASTM A234-WPB Type S, ASME B16.9, SCH STD.
- Gaskets: 4.5mm THK, Spiral Wound, SS 316, Centering Ring: CS, ASME B16.20, Class 150, RF.

2-4-4- Valve Specifications:

First - Tank Nozzle Valves (inlet and outlet):

- a- Manual Gear Operated Gate Valves, carbon steel, 20-inch diameter (1 unit) and 24-inch diameter (1 unit), Class 150, for each tank or as per design, equipped with ASME B 16.34 raised face flanges, strictly manufactured and tested according to API 6D and API 598 standards.
- b- Materials:
 - Bonnet and Body: Cast Carbon Steel ASTM A216WCB.
 - Stem: F6 (13% Cr).
 - Gate and Seats: F6 (13% Cr).
 - Bolts and Nuts: Carbon Steel ASTM A193 Gr B7 / 194 Gr 2H.
 - The contractor shall provide company with mill material test certificates for (Body, Bonnet, Trim, Bolts and Nuts).
 - All materials shall be free of defects, repairs, and replaced parts, and shall be new and not refurbished.
- c- Operating Conditions:

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- Valves shall be suitable for petroleum derivatives.
- Operating temperature from -29°C to +38°C.
- Valves shall be installed either above or below ground.
- d- Testing: The valve manufacturer shall perform essential valve tests according to API 6D or Std 598, including:
 - Hydrostatic test for body and seat seal test.
 - Visual inspection.
 - Fire test.
- e- Painting: Valves shall be painted externally with epoxy suitable for underground use, with a dry film thickness of not less than 250 microns.
- f- Valves shall be equipped with an "Open-Close" position indicator and be lockable with a using a chain in both fully open and fully closed positions.
- g- Installation: Horizontal, stem vertical, external thread, and stem protection against weather conditions.
- h- Drawings: The contractor shall provide company with three copies of final drawings showing dimensions and a complete bill of materials and their manufacturing materials.
- I- Documents: contractor shall provide company with three copies of the following documents, one of which must be original:
 - Mechanical test certificate and chemical analysis for materials used in valve manufacturing (Body, Bonnet, Trim, Bolts and Nuts).
 - Complete hydro-static test reports with recorded time and pressure for each test.
 - Fire test certificate.
 - Three copies of operation and maintenance manuals.
 - All documents shall be in English.

Second - Check Valves:

- a- One 3-inch carbon steel check valve for each tank for rainwater drainage.
- b- All check valves shall be Swing Check type, horizontal, equipped with ASME B 16.34 raised face flanges. Body: Cast Steel, strictly manufactured according to API 6D standard or equivalent, and tested according to API 6D and Std 598.
- c- Materials:
 - Bonnet and Body: Cast Carbon Steel ASTM A216 WCB.
 - Disc and Seat: F6 (13% Cr).
 - Bolts and Nuts: Carbon Steel ASTM A193 B7 / A194 2H.
 - Seal: Metal/Metal.
 - Leakage is not permitted.

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- d-The contractor shall provide company with certificates for materials used in manufacturing (Body, Bonnet, Trim, Bolts and Nuts).
- e- All materials shall be free of defects, repairs, and replaced parts, and shall be new and not refurbished.
- f- Operating conditions, painting, drawings, testing, and documents shall be as specified for the gate valves mentioned above.

Third - Electric Ball Valves:

- a- Two electric ball valves, 24-inch diameter, for connection to outlet lines, and one 20-inch valve diameter for connection to the inlet line, Class 150 or as per design.
- b- All valves shall be equipped with ASME B-16.34 raised face flanges.
- c- All valves shall be manufactured strictly according to API 6D standard and tested according to API 598.
- d- Materials:
 - Trunnion mounted Ball valves.
 - Body and cover: carbon steel ASTM A 216 WCB.
 - Trim: 304/PTFE.
 - Bolts and Nuts: Carbon Steel ASTM A193 B7 / A194 2H.
- e- The contractor shall provide company with certificates for materials used in manufacturing (Body, Bonnet, Trim, Bolts & Nuts).
- f- All materials shall be free of defects, repairs, and replaced parts, and shall be new and not refurbished.
- g- Operating conditions, painting, drawings, testing, and documents shall be as specified for the gate valves mentioned above.
- h- Valves shall be equipped with an "Open-Close" position indicator and be lockable with a chain in both fully open and fully closed positions.

2-4-5- Seal Specifications:

- a- Mechanical and Primary Seal:
 - Mechanical Scissor Hanger type seal, manufactured from Galvanized Steel, shall remain in constant contact with the tank shell, allow for expansion and contraction, and be suitable for oil.
 - Primary seal shall be made of Primary Vapor Barrier Fabric and made of PTFE Laminated Fluoropolymer.

Note: Liquid filled resilient seal is prohibited.

- b- Secondary Seal: A secondary seal shall be installed above the primary seal and consists of:

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- A wall scraper made of Nitrile/PVC with permanent and continuous adhesion to the tank shell.
- compressive Stainless steel plates fixed to the upper edge of the external side of pontoons, provided with a continuous fabric vapor barrier membrane under plates
- Minimum thickness of pressure plates: 1.2 mm.
- The secondary seal shall be equipped with a static shunt made of stainless steel for dissipating static electricity.
- All secondary seal fasteners shall be made of stainless steel.
- foam dam with one meter height ,2.5—3 mm thickness of galvanized plates with all accessories

2-4-6- Rainwater Drainage Hose:

A flexible rainwater drainage hose of suitable length for installation inside the tank, according to the following specifications:

- Applications: Flexible hose assemblies for immersion inside storage tanks to drain rainwater from the floating roof. Specially compounded covers are used to resist immersion in high aromatic or corrosive liquids.
- Lining: Smooth bore, mandrel built, Nitrile (NBR).
- Reinforcement: Textile cord reinforcement with a high tensile wire helix to resist collapsing by external pressure when immersed.
- Pressure: Although these hoses must be tested to 10 bar with water and vacuum testing to -0.85 bar at least.
- Covering: Smooth wrapped finish in the following materials: PVC/Nitrile or VITON (suitable for aromatics not less than 50%).
- Lead ballast and branding: Each hose assembly incorporates a permanently attached lead covered stainless steel cable to prevent the hose from floating in the stored product. A longitudinal white stripe is permanently branded on the cover of each hose to ensure correct alignment. All hoses are supplied electrically continuously.
- Clamps and chains for roof attachment.
- Flanges: Generally mild steel nipples with fixed ASA150 R/F flanges are supplied.
- The ballast connection is a stainless-steel threaded section permanently welded to the hose nipple. The ballast is secured with two threaded stainless-steel nuts.

2-4-7- Specifications of materials to be installed on tanks are shown in the attached table.

2-5- Supply and installation of the necessary pumps at the Banyas and Tartous terminal.

2-5-1- Banyas terminal: Due to the fact that the required elevation for the existing oil pumps in Banyas is not enough, it is necessary to supply and install new electric pumps on the new low-level tanks (the tanks located west of tank (302) east of (T1, T2, T3)) to

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discharge 4800 cubic meters per hour, number of operational pumps to be according to design in addition to one standby pump (N+1), that suction header of the pumps will be connected to the outlet nozzles of low level tanks and the discharge header to the existing loading transfer lines at Banyas terminal, along with all necessary pipes, valves, filters, accessories, etc. Dimeters of suction and discharge lines to be specified through design.

2-5-1-1- Pump specifications:

- The flow rate according to the design is to discharge 4800 m³ per hour.
- NPSHA to be defined by design tacking in consideration the lowest oil design level of the lowest tank level.
- Suction pressure: calculated by design and taking into consideration the lowest oil design level of the lowest tank level.
- Discharge head: about 80 meters.
- Installation: OUTDOOR.
- Pump orientation: horizontal or vertical, as per design.
- Seals: single mechanical seals or as per manufacturer recommendation.
- Connection: the motor is connected to pump via a flexible coupling joint.
- The pump to be manufactured from materials suitable for oil applications, in accordance with API 610.

2-5-1-2- Required Electrical Works in Banyas:

2-5-1-2-1 Electrical supply:

The new pumps shall be supplied from a 66/6.6 kV power supply, from the existing 2 × 10 MVA electrical substation, which is located approximately 400 meters from the site where the pumps are to be installed. The contractor shall use a one feeder at the transformer substation and shall supply and connect the appropriate cable following approval of the study.

2-5-1-2-2 Electrical supply requirements:

The contractor shall carry out the civil works for the electrical equipment building, which comprises three main sections: the first section is for medium-voltage switchgear breakers and pump motor starter cubicles, the second section is for low-voltage distribution, and the third section is for services.

- a) Medium-Voltage Section: This section shall include the medium-voltage switchgear and the starter cells required for the pump motors. These cells must be capable of being expanded to an appropriate extent within the building, and the building must have sufficient space for the future addition cells to be used for oil pumps.

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- b) Low-Voltage Section: This section shall contain the low-voltage switchgear and LV distribution for (lighting, sockets, DC system, UPS system, air conditioning, ventilation system, etc.). There shall also be a battery room equipped with an internal door and external doors. additional 10% of the main feeders shall be provided for future expansion, and this section shall include 40% empty space of the room's area.
- c) Services section: This section must contain an appropriate size office room, a storage room, as well as other facilities as specified in the civil section.
- contractor shall provide all the required materials & equipment and perform all electrical and civil construction works to the highest technical specifications and quality. All electrical equipment (Transformer, MV/LV switchgear, circuit breaker, cubical and distribution panels shall be supplied in accordance with IEC.
- The contractor shall supply and install two power factor correction capacitor banks capable of automatically adjusting the power factor, equipped with a control panel and all necessary components for proper operation.

2-5-1-2-3 Cables and Accessories:

The Contractor shall provide and install power/control cables (copper cables), cable accessories, cable ducts, cable trays, etc. All materials/equipment and installation shall be performed in accordance with IEC standard.

2-5-1-2-4- 6.6 kV Medium-Voltage Switchgear and Motor Starter Cubicles:

The contractor shall assess the electrical loads and supply 6.6 kV MV switchgear cubicles, including motor starters, tow 6.6/0.4 kV transformer cubicle with a capacity of at least 400 kVA, and a spare cubicle, along with all necessary equipment for operation, inspection, maintenance, monitoring, and related requirements.

- 6.6 kV switchgear shall be METAL-CLAD with vacuum type with drawable circuit breaker, nominal current not less than 630 A, short-circuit current not less than 31.5 KA.
- Each motor's starting cell consists of a circuit breaker cell and a cell containing the starting device, along with all necessary protection for the circuit breaker and the electric motor.

2-5-1-2-5- Electric Motors:

The contractor shall study and supply electric motors suitable for operating the pumps in terms of power and environmental conditions – and compatible with 6.6KV starting cells, the starting method to be determined by the bidder (in technical offer).

- Specifications of the electric motor for pumps / in Banyas:

Motor design (construction - assembly – winding – testing... etc.) according to the latest edition of the following international standards and norms:

IEC 60034, IEC 60072, IEC 60079, IEC 60085.

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In hazardous areas, IEC 60079 in addition to following European standards standard may be used:

EN 50014 - EN 50016 - EN 50018 - EN 50019 - EN 50020.

other standards such as API - NFPA is subject to management approval.

The motor power must be suitable for operating the pumps under various operating conditions to get the required pressure and flow.

- Class Class (S1).
- Operating voltage 6600 Volts.
- Frequency 50 Hz $\pm$ 2%.
- Power factor Not less than 90%.
- Motor starting Does not cause a voltage drop of more than 15% of the nominal voltage.
- The motor shall withstand an overload of not less than 10% of its nominal power without damage.
- The motor shall withstand three cold starts within one hour.
- The motor shall be capable of operating at $\pm$ 15% of the nominal voltage without damage for a time period determined by the manufacturer.
- Protection degree EEXd IIBT3 IP 55.
- Insulation class CLASS F.
- Temperature rating CLASS B.
- Bearings equipped with temperature sensors.
- The junction box is made of the same material as the motor and has the same protection degree.
- The windings are equipped with sensors to measure temperature.
- The fans are made of non-rusting material and do not produce sparks.
- Installation and calibration of the required electrical protections for the motors, which are:
- Over Current - Under Voltage - Earth Fault - Negative Sequence
- Locked Rotor - Thermal Overload - Phase Unbalance- Number of Starts

2-5-1-2-6 Low Voltage System 400VAC and Lighting System:

The contractor shall study, supply, and install all electrical requirements for the building, electrical valves, chargers, electrical panels, circuit breakers, electrical cables, and lighting equipment including lighting points, supply panels, wires, breakers, sockets, cable gland, civil works related to the electrical installation, etc. This is to complete the low voltage system and the internal and external lighting system. The lighting equipment above the motors and pumps shall be explosion-proof and provide good lighting.

2-5-1-2-7- Grounding and Lightning Protection:

The contractor shall study, supply, and install the necessary equipment and accessories such as grounding rods, cables and their accessories, grounding spikes, insulators, etc., to complete the grounding system and the lightning protection system.

2-5-1-2-8- DC System and uninterruptible AC Power Supply System UPS:

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The contractor shall study, supply, and install the necessary equipment to ensure the operation of the UPS System, including two battery chargers each capable of charging the batteries at 100%, in addition to two battery sets each with a capacity of 50% of the required capacity, and the batteries shall be of good quality. The system also includes two inverters, a static transfer switch, a BY-PASS transformer, and a distribution panel. This system shall be designed according to IEC international standards.

2-5-1-2-9 Cathodic Protection System:

The contractor shall design, supply, and install all necessary equipment and for cathodic protection system such as grounding pits, cables and installation accessories, resistors, resistor control boxes, insulating flanges & kit, etc., to protect all buried metallic structures, pipes, and pipe accessories, etc. It is noted that the cathodic protection system must be designed according to IEC standards or NACE.

2-5-1-2-10- Work Completion and Site Tests:

The contractor shall perform pre-commissioning and commissioning tests and provide the FAT test carried out by the manufacturer for both medium voltage circuit breaker cell equipment and medium voltage motors, and all equipment.

2-5-1-2-11- Designs and Engineering Study:

The contractor shall provide engineering study for the electrical system. He must submit this study to the company to obtain approval at least 60 days before the date of supply of materials and equipment, Design and study shall be in accordance with the international IEC standard. The study must include the following tables, reports, and drawings:

- Electrical Power System Study
- Short Circuit Study
- Cable Cross-Section Study
- Lighting System Study
- Grounding System Study
- DC Power Supply System Study
- Stable AC Power Supply System (UPS) Study
- Cathodic Protection System Study
- Electrical Cable Schedule
- Cable routing tables
- Control cable tables and their connection tables
- Electrical load schedule
- Motor schedule
- Protection and alarm system schedule
- Hazardous areas schedule
- Electrical equipment and cable duct layout drawing.
- Cathodic protection system lay out drawing.
- Hazardous area classification drawing

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- external lighting equipment layout drawings.
- external outlets layout drawings.
- layout drawings of lighting for the pump room
- layout drawings of internal lighting for the electrical and control building
- layout drawings for socket outlets
- layout drawings of external earthing/grounding
- layout drawings of the grounding and lightning protection system for the electrical and control building
- Cable arrangement drawings.

2-5-1-2-12- Execution of Electrical Works:

- The contractor must commit, during the execution of the works, to use suitable and designated tools for carrying out electrical works with a high level of accuracy and quality. Works shall be executed by Skilled workers.
- The contractor shall execute the electrical works according to the international IEC specifications.

2-5-1-2-13- Spare Parts:

The contractor shall provide company with 5 years spare parts, especially medium voltage breakers, starting devices, protections (one of each type), measuring devices, and voltage testing.

Protection and flag relay 20%

Time relay 20%

Lamps 40%

Space heaters 20%

LV fuses 10%

Terminal blocks 20%

Aux. Relays 20%

Contactors 20%

Metering 20%

CT 30%

VT 30%

MCB 10%

Diode 20%

Signaling Lamps 20%

Trolley for vacuum CB (2)

Digital indicator 30%

Multi-Function Meter 30%

2-5-2- Tartous Terminal:

- Supply and installation of electric pumps for transferring oil from tanks in the administration area (shore tanks) and from mountain tanks:

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In order to transfer oil ~~empty~~ from the tanks in the administration area and from the mountain tanks to VLCC tankers, it is necessary to supply and install suitable pumps to pump a quantity of /4800/ cubic meters per hour, that the required number of ~~required~~ pumps are /N+1/, where the pump suction header will be connected to the loading transfer lines to load the VLCC tankers, while the pump discharge header will be connected to the sea lines for transferring oil from existing and new tanks to VLCC tankers. The contractor shall determine the necessary pipe diameters for pumps.

2-5-2-1- Specifications of the booster pumps:

Same specifications as Banyas pumps.

2-5-2-2- Electrical works required at Tartous Terminal:

2-5-2-2-1- Electrical power supply:

The new pumps to be installed at Tartous Terminal will be fed from a new transformer substation that will be built later, and the contractor shall determine the required loads for the establishment of the transformer substation by the company.

- Medium voltage power capacitors for power factor correction up to a value of $0.95 \pm 2\%$.

2-5-2-2-2- Medium Voltage Cells 6.6 KV and Starter Cells:

In addition to same Banyas requirement the contractor shall provide and install transformer cells 6.6/0.4 KV with a capacity of not less than 400KVA or as per design for each transformer

All other electrical installation shall be the same as Banyas requirement.

2-6- Tank Calibration:

- The contractor shall provide what is necessary for tank calibration. Calibration shall be performed by an internationally approved third party (company prior approved is required). The contractor shall ensure that calibration is performed in the presence of company supervisor, company must be informed through calibration technicians of the measurements and methods used, then submitting a copy to the company.

- Calibration shall be performed using the laser method.

The calibration tables shall include the following features:

- Measurement units according to the SI system.
- Units in liters based on millimeters. Calibration tables shall be prepared based on a temperature of 15°C.
- Mention to the base point elevation.
- Mention the weight of the floating roof after testing.
- Mention the formula for calculating the volume displaced by the floating roof weight.
- Mention the recorded density and temperature during calibration.
- Any useful information in tank measurement.

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- Results shall be presented in 5 computer-generated daily use calibration tables.
- Calibration results shall be approved by the company (in case there are no comments on).

2-7- Electrical Section (for tanks):

2-7-1- General Description and Objectives:

The electrical works will be prepared to supply the required electrical power and protection to the tanks according to work requirements. These works include but not limited to the following:

- Earthing of steel storage tanks.
- Cable network for supplying the new hut, motorized valves, tank level gauges, etc.
- A hut to accommodate the switchboard and termination panel, as well as all necessary trenches for the cable network.
- Distribution switchboard 230/400 V A.C 50 Hz connected to existing substations (maximum distance to substations is approximately 100 meters).

2-7-2- Scope of Work Summary:

The contractor shall be responsible for the supply, construction, and connection to the relevant existing facility of all equipment, civil works materials, including testing and commissioning required to complete and operate each installation. The work shall be performed in accordance with IEC standards or equivalent and practical electrical work regulations.

2-7-3- Electrical Installations:

The contractor shall be responsible for the supply, construction, testing, and successful commissioning of all electrical equipment, and for all materials and accessories required for the safe and proper operation of all electrical work for the tanks. This includes, but is not limited to:

2-7-3-1- Tank Earthing:

- The Earthing system shall comply with API-RP450 procedures. The equipment ground and the existing Earthing system shall be connected to a single common point at each voltage level. Common Earthing conductors shall not be from the common point to the earthing electrodes.
- Earthing resistance shall not exceed 1 ohm.
- Earthing cables shall not be laid with other cables type in the same trench.
- Where cables appear, they shall be mechanically protected by steel conduits.
- The main earthing ring shall consist of a 40x40 GT steel strip.

2-7-3-2- Low Voltage Switchboards and Control Panel:

For operating motorized valves and site lighting, the contractor shall supply, construct, test, and commission the 230/400 V A.C 50 Hz distribution switchboard. Low voltage distribution switchboards shall be dustproof (IP55) and equipped with a latching front door.

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The switchboard shall be installed on a stable location. connection, and maintenance access shall be from the front side. The termination at panel shall be with threaded terminals on both sides and provided with incoming and outgoing cables with cable glands including all accessories for installation. All distribution switchboards shall be equipped with two main molded case circuit breakers, 50 Hz, 3PH, 4P, two units for feeding both sides.

2-7-3-3- Cable Network:

Supply, laying, connection, testing, and commissioning of all 230/400 V A.C cables with required connection and termination accessories from the old TF panels and new switchboards to storage tanks and motorized valves shall be performed in accordance with IEC standard.

- Voltage rating: Cables shall be suitable for AC 50Hz or DC operation with the following voltage ratings: 1KV for LV cables operating up to 600 volts, 100V for LV cables operating up to 50 volts.
- Cable type: multi-conductor cables (XLPE) for all. Concrete trenches shall be used for steel-armored cables. Single conductor LV cables shall be laid in conduits for lighting installations or used for switchboards. Outdoor cable shall be insulated with PVC and have a minimum cross-section of 2.5 mm². All cable conductors shall be made of pure copper. Cable shielding shall be galvanized steel wire. Since the cables will be laid in an environment potentially contaminated with oil, the cables shall have the following properties: Flow retardant to IEC 332.
- International Standards: relevant IEC standards, latest edition shall be confirmed with.

2-7-3-4- Lighting:

The contractor shall supply, construct, and connect steel lighting poles (shall be earthed) for floodlighting the tanks.

2-7-3-5- Civil Works (for Electrical Works):

- Cable trenches and earthing network: The contractor shall supply, construct, implement, and lay clean sand with a thickness of 10 cm under and above the cables, and backfill the trenches for buried cables and the Earthing network in accordance with detailed offer specifications and requirements for proper cable laying in trenches.
- All cables crossing roads shall be laid within galvanized steel conduits, high-pressure PVC, or reinforced cement pipes of appropriate diameter.
- Cables laid above ground shall be installed on galvanized cable trays of suitable dimensions and in accordance with international best practices.

2-7-3-6- Lightning Protection System:

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The lightning protection system shall be equipped with air terminal rods in accordance with the Franklin method (resistance less than one ohm) and shall comply with the international standard for lightning protection (BS EN IEC 62305).

2-8- Instrumentation & communication

Banias & Tartous Instrumentation & communication requirements are:

- 1- Field instrumentation, measurement and control
- 2- Communication and control
- 3- Operation systems and HMI

2-8-1- Field Instrumentation Requirements:

- All instrument devices (pressure, temperature, flow and level) gauges, switches and transmitters shall be certified to be used in Hazardous area classification according to Standard such as ATEX or IECEx ,ESD system:
- Vibration Monitoring: a vibration monitoring system and devices shall be installed to measure, monitor and analyses the vibration which produced by the machines components (bearings, shaft, fans, motors).
- Temperature Monitoring readings shall be transferred to the control system.
- Vibration and temperature readings and data shall be transferred to control and shutdown system with the required action accordingly.
- All field instruments shall have ingress protection suitable for the project.

2-8-2- Control & Safeguarding & Communication System Requirements

System Architecture:

- The scope of work includes basic and detailed engineering of comprehensive new Control and Safety System called ICSS.
- The ICSS consists of PLC/DCS based control system, SCADA system, Emergency Shut Down system, Fire system, Alarm Management System.
- The emergency Shutdown signals shall be an independent individual of main control system.
- The emergency Shutdown system for safety purposes; shall give direct action (as stopping pumps, open closing SDV...) in case of the emergency (LL level, LL pressure, HH level and HH pressure, vibration, temperature.... etc)
- The central control room in Baniyas can monitor status of tank farms in tartous.
- If the distance between sites is large, remote terminal units (RTUs) are installed at the pump sites and tank sites to gather data from field devices and send it to the main control room.

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- Supervisory control and data acquisition (SCADA) shall be provided for monitoring, controlling the process and generating alarms in case of process upsets
- Upgradable system, free capacities and redundancy considerations.
- All signals to / from the central control room shall be electric /electronic.
- Analog signals shall be standard 4-20 mA DC signals (24V DC, two-wire system) of which smart HART communication shall be applied
- Instrument devices supply 24VDC.

2-8-2-1- Pumps/Motor:

Each pump/ motor protection shall be equipped with:

- VSD system to control speed of pumps regarding operating requirement.
- Recommended protection devices for the pump / motor, drive / non drive end, switches as suction and discharge pressure, lubrication oil protection, vibration, and temperature... etc.
- Recommended protection signals with control system in the control room to monitor and protect the pump/motor.
- Anti-Cavitation Protection: Protect pumps from low pressures on suction lines.

2-8-2-2- Tanks: Each oil tank shall be equipped with the following:

- High-precision radar level gauge with a local level display that can be easily accessed.
- TSM tank side monitor device
- Multipoint temperature measurement transmitter
- Pressure measurement transmitter
- Pressure gauges as required
- Level, pressure and temperature readings considering the set points for alarm and tripping actions as H/HH, L/LL setting.

2-8-2-3- Fire & Gas System: Linking the control system with smoke, heat, and gas detectors at the station to automatically shut down the facility in emergency situations.

2-8-2-4- Back Pressure Control: Due to the large elevation difference (from the mountain to shore at Tartous site), the control system must control the high-pressure situation on the discharge line. This may require precise control of pressure relief valves or control valves to avoid water hammer and surge.

2-8-2-5- Communication Network:

- Basic (Redundant Fiber Optic): It is preferable to use fiber optic cable to connect all sites, to ensure high-speed and reliable data transmission and immunity to electromagnetic interference.....
- All devices and control systems must be supported by standard and open protocols to ensure compatibility, ease of integration, maintenance and communication

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- Professional mobile radio / VHF: a complete system hardware and software installation for personnel communication in each station and with other stations via VHF radio system and devices.
- Internal/ external telephone lines system in each station and in the building/housing.

2-8-3- Operating system and operator interface.

- Interactive display screens (HMI + SCADA) reflect the live operation conditions, status, data and parameter, diagrams, graphics of the station.
- The Operator has ability to remotely start and stop pumps, open and close valves, and change set points for control systems.
- Trending graphs: Display graphical charts (curves) of important variables over time, analyze station performance and troubleshoot.
- Alarming: Advanced Alarm Management System to show clear colored, classified alarms by priorities and criticality.

2-8-4- Instrumentation specification:

2-8-4-1- Level transmitter:

A radar level transmitter is required for each tank, suitable for operation using digital signal processing technology, based on FMCW technology with the following specifications:

- Measurement range from 0 to 20 meters.
- High accuracy not exceeding ± 0.5 mm or better.
- Output: 4-20 mA.
- Operating voltage: 24 V DC.
- Protection rating: IP 65.
- Explosion-proof EEXIIBT3 and lightning protection.
- Local reading with an LCD screen for level display next to the tank (easily accessible).
- Sensor material: MFR.STD SS 316.
- Device body according to manufacturer's standards.
- Flanges: ASTM A105, with all necessary accessories for installation.

2-8-4-2- Temperature Transmitter:

A temperature transmitter for measuring the liquid temperature in the tanks at multiple levels (multi-point measurement temperature transmitter) with an easily accessible local reading near the tank, operating on 24 V DC, providing a 4-20 mA output, IP65 protection rating, and EEXIIBT3 explosion-proof.

2-8-4-3- Pressure Transmitter:

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A pressure transmitter for measuring the liquid pressure in the tanks (pressure transmitter) with an easily accessible local reading near the tank, operating on 24 V DC, providing a 4-20 mA output, IP65 protection rating, and EEXIAlIBT3 explosion-proof.

Notes:

- The provided devices (temperature, pressure, and level) shall be connectable to the existing system from ENRAF or should be independent system .
- Alternatively, a new, completely independent measurement system (level, temperature, and pressure) from the ENRAF system shall be provided, with all its requirements, including all accessories and system requirements (software, special calibration devices, cables, etc.), with readings displayed in the main control room.
- Ambient temperature: -10°C to +45°C.
- Sensors shall be made of materials suitable for the measured substance.
- Instrumentation cables shall comply with international standards and be laid on cable trays.

2-8-4-4- Electric Valve Actuators:

1. Motor squirrel cage
2. Operating voltage/frequency: 400Vac / 3 PHASE / 50HZ
3. Action on power failure: in last position
4. Actuator space heater
5. Manual/auto levers
6. Position indicator: local/remote
7. Lamp indication: open/intermediate/close
8. Limit switches enclosure: EEx xia || BT4
9. Enclosure: IP 65
10. Actuator type: conventional
11. Mode of operation: by PB open local
12. Mode of operation: by PB close local
13. Mode of operation: by PB stop local
14. Torque switch (open-close)/adjustable
15. Double sealed terminal box
16. Monitor phase protection
17. Insulation class
18. Local; Remote position switches
19. Cable gland for (power + control + ESD)

Electric valve actuators shall meet the following minimum specifications:

1. Valve operation shall be controlled remotely via a PLC-based control system.

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2. The valve control system shall be linked to the existing system (PLC & SCADA from PHOENIX company) after its upgrade.
3. Control voltage for valves: 24 Volts.
4. Control circuits shall be explosion-proof.
5. Control cables (number of pairs - wire diameter - SHIELDED) shall be suitable for valve operation.
6. Exposed control cables shall be laid in trench and supported on cable trays for protection, and buried cables shall be laid according to the Syrian Arab Code for cable laying.

2-8-4-5- Cables: all instrumentation cables, accessories, Junction boxes, cable glands required, tagging, and colors for laying cable in separated cable trays to meet the cable standards

- Free capacity for future upgrades to be considered
- The Ex hazardous area classification and certificates to be considered.

2-8-5- Drawings and documents: All required documents and drawing, As-built documentation, P&ID, C&E, wiring diagrams, loop diagrams including test documentation, data sheets and certificates, operating and maintenance manuals.

2-8-6- Standards: implementation of the control system must comply with international standards, most notably:

- IEC 61131-3: An international standard defining unified programming languages for programmable logic controllers (PLC).
- ISA-5.1: Standard for symbols and diagrams used in the design of measurement and control systems.
- PI RP 14C: Recommended safety system analysis and protective devices in facilities and pumping stations.
- ISA-S5.3: Graphic Symbols for Distributed Control
- ISA-SP84: Programmable electronic systems use in safer applications

2-9- Cathodic Protection Section:

- All materials for the cathodic protection system shall comply with relevant cathodic protection system standards. The system to be applied to the tanks and piping network shall be comprehensive to achieve the protection specified in the standards.
- The specifications below provide the basic requirements for the cathodic protection system. The contractor shall consider all necessary parameters to provide engineering design for cathodic protection system based on impressive current technology.

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- The components of the cathodic protection system and the specifications of the materials to be supplied and installed are as follows:

2-9-1- Transformer Rectifier Unit, Quantity: 7, or as per design.

- Oil-immersed, natural cooling transformer/rectifier, suitable for outdoor use in marine environment.
- Power supply: 200/230 V single phase 50 Hz.
- The output current is controlled by an autotransformer feeding a power transformer, which feeds a full-wave bridge rectifier (diodes). The autotransformer modifies the voltage via two coarse and fine switches to control the number of turns.
- Number of stages: minimum 4 courses, 4 fines.
- Maximum output voltage: 80 V DC.
- Maximum output current: 80 A DC.
- The device shall include all necessary accessories, such as voltmeter, ammeter, over-voltage protection fuses, moisture absorber (silica gel), thermometer, etc.
- Ambient temperature for the device shall not be less than 45°C.
- Spare parts for continuous operation for five years shall be provided.
- A technical data sheet containing device specifications and manufacturer's name and country of origin shall be provided.

2-9-2- Anodes: Quantity: 260, or as per design.

Anodes are made of carbon or chrome-silicon (HSCI). The weight of each anode shall not be less than 25 kg. Each anode shall be equipped with a double-insulated copper cable with a cross-section of 16 mm² and a length of 50 to 70 meters, properly attached to the center of the anode. Current density is approximately 10 A/m².

Note: Anode specifications are subject to change in size and type depending on availability. The contractor shall inform company of new specifications for approval before purchase.

2-9-3- Carbonaceous Backfill:

- Quantity: 28 tons, or as per design.
- The backfill shall consist of carbonaceous granules with dimensions ranging in size 1.8 to 12 mm.
- Carbon content shall not be less than 90%.
- Resistance is less than 50 ohm/cm.
- Free of calcium hydroxide.
- Packed in high-quality bags, each weighing not more than 25 kg.

2-9-4- Cables:

- Insulated single core copper cable insulated copper cable, 50 mm² cross-section, red color, suitable length.
- Insulated single core copper cable, 50 mm² cross-section, black color, suitable length.

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- cables, 16 mm² cross-section, double insulated XLPE/PVC, suitable length.
- salt in sufficient quantity for all tanks.

2-9-5- Test Station/Box:

- Quantity: 14, or as per design.
- Box made of aluminum alloy or stainless steel, thickness 2 mm, dimensions length x width x depth = 20 x 15 x 10 cm. It must be fire and weather resistant and suitable for outdoor installation in hazardous areas.
- Inside the box, there shall be a row of 6 connectors suitable for single core cables with a 16 mm² cross-section.
- The box shall be mounted on two galvanized pipes (each 70 cm long and 1 inch diameter) at a height of 30 cm above ground level. The pipes shall be fixed with a concrete base measuring 40x40x40 cm buried in the ground. Two insulated cables shall enter through these pipes.

2-9-6- Anode Junction Box Cables:

- Boxes made of aluminum alloy or stainless-steel minimum IP 55. And it shall be explosion-proof type if installed in hazardous areas.
- Quantity shall be according to the number of wells agreed upon and the company's standard model for connecting anode cables, with a maximum of 50 boxes.

2-8-7- Permanent Reference Cells:

- These are permanent reference measurement cells of the type: Cu/Cu SO₄ permanent reference electrode, 5m cable, double coat XLPE/PVC, 16mm/cm.

2-8-8- Insulating Flanges:

Insulating flanges shall be installed to achieve electrical isolation between buried pipes and above-ground pipes, as well as for pipes entering and exiting tanks.

Insulating flange kits shall be according to the ANSI standard and each kit **shall consist of:**

- A flat gasket, 3 mm thick, F or E type, covering the raised face of the metal flange and located between the flange bolts.
- Insulating sleeves for flange bolts, 0.8 mm thick.
- Two insulating washers, 3 mm thick, for each flange bolt.
- Insulating flange parts shall be made of reinforced phenolic material with a neoprene surface layer.

2-9-9- Installation:

- Five wells shall be drilled with a diameter of 10 inches and a depth of 20 meters (number of wells to be determined by design). Plastic pipes of polyethylene or PVC shall be used as casing to prevent collapse.
- The anode shall be surrounded by fine carbonaceous backfill on all sides uniformly, at a rate of 100 kg per anode, with sufficient salt at a rate of 20 kg per anode.

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- A plastic pipe for ventilation, 2 inches in diameter, shall be placed above each anode, extending into the fine backfill and rising 30 cm above ground level.
- Each well shall be back-filled with soil.
- Cables (for all anodes) shall be connected to a main junction box installed next to the well (number to be determined by the number of wells). A main cable (red color) with a cross-section of 50 mm², the positive cable connected to the rectifier, shall exit the box. It shall be extended through a trench at least 60 cm depth, surrounded by fine sand on all sides, and a suitable warning tape (company shall be consulted for a drawing of the cable connection method and junction box model).
- The negative cable with a cross-section of 50 mm² (black) shall be welded to the pipe or tank to be protected using Cad Weld, and the weld area shall be sealed with molten tin, then insulated with suitable insulating materials. The cable shall be run through a trench at least 60 cm deep, surrounded by fine sand on all sides, and a suitable warning tape to connect to the rectifier.
- Potential difference measurement points shall be established at a rate of 4 boxes per tank and 4 boxes for pipes. A cable with a cross-section of 16 mm² copper, insulated (insulation as per the previous paragraph), shall be welded to the pipe (or tank). This cable shall be connected to a suitable junction box (according to the company's model), this junction box is fixed in the ground near the pipe route (or tank). Inside the box cables shall be connected via cable connectors for potential difference measurement.
- Permanent reference cells shall be buried next to the pipe or tank bottom. Cables shall be run in a standard trench to the reference cell potential difference measurement box.
- The main positive cable shall be connected to the anode junction box, and the main negative cable (connected to the pipes or tank) shall be connected to the rectifier. The rectifier is then activated, and the protection system is calibrated according to the resulting potential difference readings.
- Warning signs are placed to indicate the start and end of the cables.

2-10- Civil Section:

2-10-1- Survey Works:

- Topographic survey for tank sites / (Tartous terminal & mountain site, Banyas)
- Marking of tank and basin locations on existing company drawings.
- Performance of any other work required by the company.
- Issue Drawing for tanks sites (plot plan - contour lines - etc.) with all related data (tank basins - tanks - buildings (MCC and control room– transfer pumps and firefighting pumps – workshop - rainwater channels - roads, ...etc.).

2-10-2- New Tank Foundation:

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- The tank foundation shall be constructed according to the model in API 650 Appendix B, Section B4.2, named Concrete Ring Wall.
- The attached figure and the executed foundation in the company shall be used as a basis for designing the foundation of the planned tank according to its new design dimensions.
- The contractor shall submit a calculation memo for the tank foundation design, and issue new drawings showing specifications and dimensions according to the design of the new tank.
- Backfill inside the Concrete Ring Wall, with a note that the final layer shall be fine asphalt.
- Construction of two diametrically opposite rainwater drainage sumps within the Concrete Ring Wall before laying and compacting the backfill.
- Before executing the asphalt works for the final layer within the Concrete Ring Wall, the reference cells for the cathodic protection system shall be installed, and cables extended outside the Concrete Ring Wall.
- Backfill in the tank foundation shall be of fine gravel.
- When installing the reinforcement steel for the Concrete Ring Wall and before commencing concrete pouring, the following shall be considered:
 - Installation of galvanized pipes, 2 inches in diameter, diametrically opposite, for detecting leaks in the tank bottom, if any.
 - Installation of galvanized pipes, 1 inch in diameter, for the exit of reference cell cables from the Concrete Ring Wall.
- If the design study for the new tank requires installation of anchor bolts for the tank, their locations shall be determined and fixed with the reinforcement steel.

2-10-3- Excavation Works (of any type):

- The term "excavation" wherever used shall include all types of soil, regardless of its nature. Excavation shall be performed by mechanical or manual means. The contractor shall take all necessary measures for water drainage. Excavation works shall be strictly according to drawings and required levels, and according to the instructions of the supervision authority. The contractor shall not exceed excavation levels except with written approval from the company. Otherwise, the contractor shall rectify the situation by pouring ordinary concrete with a strength of 250 kg/m³ to reach the required level without claiming any compensation. The contractor shall remove excavated material from the site. The bottom of trench shall not be exposed to weather conditions for a long period before pouring. The contractor shall also support the sides of excavations, when necessary, at their own expense.
- The contractor shall take necessary precautions during excavation and pay attention to the possibility of presence of utility networks (electricity, oil pipelines, water, etc.) at the

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excavation site. No damage shall be caused to them, and the contractor shall be solely responsible.

2-10-4- Backfilling Works:

This consists of a mixture of gravel and natural sand (river sand) or basaltic residues, with specified thicknesses in the drawings. It shall be spread, watered, and compacted to meet these specifications and the longitudinal and transverse slopes shown in the drawings. The materials must be clean and free of impurities and clayey foreign materials. The maximum particle size shall not exceed 63.5 mm.

Large materials shall be excluded by separation or crushing and reuse.

The materials shall meet gradation No. 1 and No. 2 of the following table:

% Passing by Weight		Sieve Size	
Gradation /2/	Gradation /1/	mm	inch
-	100	62.5	2.5
100	100-90	50	2
100-90	-	37.5	1.5
85-55	-	25	1
80-50	-	19	0.75
70-40	-	9.52	0.375
60-30	70-35	4.75	Number 4
50-20	-	2.54	Number 10
30-10	-	0.425	Number 40

The materials in the above table shall meet the following requirements:

- Sand equivalent shall not be less than 25%.
- Los Angeles abrasion loss shall not exceed 50% (upper limit).
- California Bearing Ratio (CBR) shall not be less than 50%.
- Materials shall be placed and spread in layers of 25 cm thickness per layer, watered, and compacted to achieve 98% of modified Proctor density.
- Analysis tests shall be conducted in approved laboratories.
- Syrian Arab Code shall be followed regarding backfill works and their specifications.
- All backfills not meeting the specification shall be removed within 24 hours in the presence of the supervision committee.

2-10-5- Construction Works:

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- The contractor shall conduct a soil mechanics study at the required sites by specialized and approved laboratories.
- Design will depend on and take into consideration the output of soil mechanics report and contractor will provide company with a detailed design.
- All drawings, designs, and studies shall be approved by the company.
The contractor shall comply with all modifications requested by the company and redraw the drawings according to the new modifications.
- Final "As-built" drawings shall be submitted at the end of the works.

2-10-6 Concrete Works:

Description: The materials used for concrete mixes, concrete consistency, and their strength shall meet the required concrete resistance limits. Therefore, careful monitoring of these materials is required to ensure compliance with specifications for a durable and safe structure. The concrete mix shall consist of the following materials:

2-10-6-1- Cement:

- The cement used shall meet the mechanical, physical, and chemical requirements according to Article 1-2-1-2 of the Technical Specifications issued by the Ministry of Construction and Reconstruction (Volume One - Civil Works), pages 51-52. The cement class shall not be less than 38, the initial setting time not less than 60 minutes, and the volume stability not exceeding 10 mm.
- Portland cement (black) shall be used, supplied in 50 kg bags. It must be ensured that the bag has not been exposed to moisture. Cement that has formed lumps due to moisture shall be rejected and immediately removed from the site. Cement shall not be stored in the open area.

Cement bags shall be placed on wooden racks raised at least 20 cm from the ground.

Hot, freshly manufactured cement shall not be used.

The shelf life is three months from the date of production.

2-10-6-2- Gravel and Sand:

According to Article 2-2 and Article 2-2-1-5 of the Technical Specifications for Roads and Bridges issued by the Ministry of Transport in 2002.

These two materials must be carefully selected for their granular composition and cleanliness.

River sand and gravel are usually used in concrete mixes. However, crushed stone and sand resulting from the crushing of hard limestone can be used provided that the Los Angeles abrasion value of the crushed stone does not exceed 40% and that of the fine material does not exceed 10% in special crushers. The stones used for crushing must be solid and hard. The elongation of aggregates shall be tested according to BS812 PART105.2, and

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aggregates shall be shaped according to BS812 PART105.1, such that they are not affected by air, water, and frost. Basalt gravel resulting from crushing hard basalt rock can also be used, that its grains shall be cubical or spherical.

Both gravel and sand must be clean (free) from anything that could reduce the cohesion and durability of the concrete or affect the steel of reinforcement.

They must be free from voids, veins, soft spots, organic matter, soil, and adhesive materials. They shall be tested according to ASTM C142 and the gradation of gravel and sand shall conform to the required gradation for the total aggregate mix for concrete according to the Syrian Arab Code. Foreign bodies such as coal pieces, wood, sulfurous materials, and chlorides according to BS812 PART117 & 118. They shall not contain very fine materials like powder.

Gravel with fine dust that prevents cement adhesion to the gravel must be washed.

The contractor shall supply gravel and sand sorted separately for use in different concrete types according to the proportions determined by company.

If laboratory tests for any supplied quantity of these two materials are unacceptable, the contractor shall change the source of these materials.

2-10-6-3- Reinforcing steel:

The specifications for steel mentioned in Chapter (2-5) of the Technical Specifications for Roads and Bridges issued by the Ministry of Transport in 2002, Part Five, page 53, shall be adhered to. The company has the right to conduct necessary tests to ensure that the supplied steel conforms to all specifications.

Steel shall be according to the dimensions specified on the drawings and accurately distributed in the designated locations.

Reinforcement bars shall be clean and free from rust, cracks, iron scales, paint, oily and greasy materials, asphalt, and anything that prevents the bonding of concrete to steel.

During steel installation, it shall be separated from the formwork by precast concrete cubes with a thickness of at least 2 cm to ensure adequate concrete cover for the reinforcement steel. reinforcement steel shall be made in a way that prevents horizontal or vertical movement of the steel during pouring and vibration.

The contractor shall provide scaffolding and walkways of appropriate width for walking during pouring to avoid movement or deformation of the steel.

Soft steel wire shall be used to tie the reinforcement steel at close intervals to ensure strong binding necessary to maintain its distribution according to the drawings.

Steel weights shall be calculated according to their cross-sections and standard tables.

Bar diameters shall be verified at the workshop, as some steel may be supplied in non-standard diameters, and such supplied types shall be rejected.

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If some bars cannot be procured, written approval from the supervising engineer shall be obtained for their replacement with equivalent diameters.

Any excess weight in such cases shall be on contractor' own cost. Written approvals for reinforcement works shall be obtained before commencing pouring.

2-10-6-4- Water:

The water used in all types of concrete shall be clean and free of salt, soil, and organic matter.

The company engineer shall conduct necessary laboratory tests on water from unfamiliar sources.

Natural drinking water, which is odorless and tasteless, is suitable for concrete works.

The contractor shall provide water in the required quantities and at the required times for mixing and curing concrete in all cast parts. The chemical content of mixing water shall not exceed the following:

- Dissolved solids: 2 g/liter.
- Carbonates and bicarbonates (alkaline): 1 g/liter.
- Chlorides: 0.75 g/liter.
- Sulfates: 0.3 g/liter.
- Alkalinity: 0.6 g/liter.
- Hydrogen ion concentration: minimum 4.

2-10-6-5- Form-work:

Form-work for concrete pouring shall meet the following conditions:

- It must be strong, stable, and safe to withstand all static and dynamic loads resulting from movement, pouring, vibration, etc. It must be tight and free of holes and cracks to prevent mortar leakage. The wood thickness shall not be less than 2.5 cm.
- It must consist of sound and flat pieces and be installed regularly.
- Columns and supporting beams shall be connected with strong, crossed ties to resist stresses and movements during pouring.
- Form-work levels shall be precisely adjusted before pouring.
- It must be easy to dismantle without causing deformation of the poured concrete during dismantling.
- Form-work shall be sprayed with water before commencing pouring.

2-10-6-6- Concrete Mixing:

Concrete mixing shall not commence without written permission from the supervising engineer at central batching plants (approved by the supervision staff of the company). Concrete batching plants must have special water measurement capabilities, allowing monitoring of water quantity used. The water-to-cement ratio in concrete shall not exceed

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45% and not be less than 38% to provide good protection for reinforcement materials against corrosion. If this is not available, an effective means of monitoring this shall be provided.

2-10-6-7- Concrete Transportation:

Concrete shall be transported from the batcher to the pouring location as quickly as possible and placed in its final position within a maximum of thirty minutes, provided it has not lost its consistency or begun to set.

Any concrete deviation shall be rejected.

2-10-6-8- Concrete Testing:

At least six metal cylinders, 15-30 cm in diameter, shall be prepared to determine the required strength according to the drawings. The potential characteristic cylindrical compressive strength f'_c after 28 days of casting shall not be less than 250 Kg/cm² for the quality grade of the cylinder C25. As for the pre-stressed concrete beam, the potential characteristic cylindrical strength f'_c should not be less than 350 Kg/cm² / quality grade for the cylinder of C35.

The strength of the cylinder after 28 days of pouring shall not be less than 250 kg/cm².

For pre-stressed beams, it shall not be less than 352 kg/cm². Cylinders shall be continuously cleaned after use.

A sample of concrete shall be taken, molds filled, dated, and immersed in water for 28 days. Then, it shall be tested for compression and compared with the required strength.

If the results are less than required, the cast element shall not be accepted.

A special logbook shall be maintained, recording sequentially the dates of sample preparation, their numbers, test results, and corresponding structural elements.

Tests indicate that strength after seven days is approximately 60% of the strength after 28 days.

However, results after seven days shall not be relied upon, as actual results after 28 days may differ from initial expectations.

2-10-6-9- Deal with Concrete After Pouring:

Concrete to be hardened and get the required strength the following conditions must be noted:

Maintaining the concrete in a moist state by continuously spraying it with water except during freezing times.

Protecting the concrete from harmful weather fluctuations such as wind, sunlight, rain, and frost. For this purpose, slabs are covered after hardening with a layer of burlap or matting or a 2 cm thick layer of sand, which is continuously sprayed with water.

Avoiding any load or walking on the concrete after 15 minutes from pouring, and if necessary, taking the necessary procedures to allow without damaging the poured

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concrete.

Prevent any loading on the concrete with any additional weights, determined duration by the supervision authority according to the weather conditions and the type of concrete.

2-10-6-10- Openings and Holes:

The contractor shall take all measures to create openings, holes, projections, voids, etc. All pipes, iron pieces, or other materials to be embedded or fixed in the concrete shall be installed and fixed according to the safety instructions deemed necessary by the engineer. Pouring shall not be permitted until all parts to be installed are executed.

2-10-6-11- 250 kg/m³ lean concrete shall be used under foundation bases and wherever indicated in the drawings. Lean concrete is generally specified as follows:

- Considering that the maximum allowed gravel size is 4 mm.

2-10-6-12- 350 kg/m³ Reinforced concrete: the used 350 kg/m³ Reinforced concrete will be with a reinforcement ratio as per design requirement for each of concrete walkways, rainwater drainage channels, concrete supports for cooling & firefighting lines & other piping, and concrete beam (in case of suggested & approved by design) for tanks in accordance with the requirements of the Syrian Arab Code and mentioned requirement hereunder.

2-10-6-13- 400 kg/m³ reinforced Concrete the used 400 kg/m³ Reinforced concrete will be with a reinforcement ratio as per design requirement for foundations & beams related to (tanks and buildings) and dike concrete (if required in the design). shall be used for walls and columns.

Sand and gravel proportions shall be determined based on Article 2-2-1-5 and Article 3-2-2-1-5 of the Ministry of Transport's Technical Specifications for Roads and Bridges and based on laboratory tests conducted either by the contractor's laboratory on-site or at any laboratory chosen by the company on samples of the sand and gravel intended for use.

The contractor shall submit, well in advance before starting the concrete pouring, the quantities of sand and gravel intended for use, with each quantity not less than a truckload. Samples shall be taken from each using standard laboratory sieves, and tables and graphs shall be prepared.

Final proportions for the mix shall be determined by comparing with standard graphs.

Concrete samples shall be made according to the determined proportions and tested for strength after seven and 28 days. If the results are acceptable within the prescribed limits, the final proportions shall be adopted and adhered to as long as the quality of materials supplied to the site does not change.

If any change occurs, tests must be repeated.

Water in concrete shall be at the required level to ensure work-ability. If this is not possible, admixtures shall be used to improve the work-ability of the concrete mix. The

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specifications of the water to be used with the cement shall be the same as those stated in Article 5-1-2-3 of the technical conditions and specifications of the Ministry of Transport. The amount of water required is determined by the ratio of the weight of water to the weight of cement so that the water-to-cement ratio in the concrete does not exceed 45% and is not less than 38%. This determination is the result of testing several small batches and monitoring their appearance, degree of cohesion, viscosity, and strength. After determining the preferred ratios, adherence to them is required, taking into account air humidity at the time of use and the moisture content of the aggregates and sand. If the working conditions in some locations, due to limited space or congestion of reinforcement bars, require the concrete to be fluid, the cement content must be increased so that the water ratio remains within the limits, or plasticizers should be used to improve the workability of the concrete mix while keeping the amount of water constant and in accordance with Syrian Standard Specification No. 1632

- The surface of the cast concrete for the floors and ceilings of the electrical and control building and the workshop building is polished using helicopter troweling machines. These are used after one to four hours, representing the initial setting time, with the addition of hardener materials to the cast concrete surface. They are used to provide greater durability and service life, as they are sprayed on the concrete surfaces before using the troweling machine.

Three coats of asphaltic waterproofing shall be applied to buried parts for moisture insulation by applying asphaltic material with the following specifications:

- Specific gravity at 25°C: 1.01 to 1.06.
- Flash point (open cup): 200°C.
- Penetration at 20/10: 2 cm.
- Softening point at 25°C: 2 cm.
- Solubility in carbon dioxide solution: 90%.
- Before painting, the surfaces to be insulated (surfaces of the concrete mat in contact with the soil) shall be cleaned. The asphalt shall be heated to 60°C and applied to the surfaces using manual metal brushes at least 10 cm long, ensuring all voids and gaps are filled. The second and third coats shall not be applied before the first coat is dry. Asphalt is considered dry if it does not stick to a wet hand. The application rate shall not be less than 2 kg/m².

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Concrete Mix Grades Used:

Application Area	Concrete grade kg/m ³
Works of concrete beams, foundations, reinforced walls, and all parts buried within the soil (ring wall-buildings - pump foundations), dike concrete (if required in the design)	400
Concrete walkways, rainwater drainage, pipe supports, concrete supports for cooling & firefighting pipes (in case of suggested and approved by the design)	350
All types of lean concrete works.	250

- **concrete beams wall (dike concrete):** shall be constructed according to reinforced concrete specifications. Tank beams (barrier wall) drawings shall be submitted for approval before commencing execution.

2-10-7- bund wall surrounding tank basin: The storage volume for the proposed tank basin shall be calculated to be equal to the volume of stored material plus 10%. Then, surrounding bund wall shall be proposed for the tanks according to importance:

2-10-8- Rainwater Drainage: Rainwater shall be drained into water drainage channels like those existing in the company, as follows:

1. Rainwater channels and associated sumps shall be studied and calculated. A complete study of the channels and their sumps shall be submitted, including a mechanism for separating rainwater from accompanying oil in case of leaks or tank drainage. This study shall be submitted to company for prior approval.
2. Rainwater channels shall be made of cast concrete (350 kg/m³) with surface water drainage openings.
3. Culverts shall be constructed at intersections or walkways with public roads.

2-10-9- Roads and Walkways and their Accessories: Roads between tanks and main roads shall be studied and designed. The complete study with associated drawings shall be

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submitted to company for prior approval. Backfill shall be of good quality and conform to the technical specifications for roads and bridges issued by the Ministry of Transport in 2002. Backfill shall be spread in layers of 25 cm each, watered, and compacted to achieve 98% density. The final layer shall be of quarry residue (crushed stone) with compaction. An asphaltic layer shall be spread with a width of not less than 6 meters from the main road into the tank basin, with a thickness of 7 cm for the base layer and 5 cm for the cover layer. Compaction shall be done with rollers to achieve good density.

2-10-10 MCC and Control rooms + Workshop (Tartous terminal, Banyas):

The contractor is committed to constructing the following buildings on a turnkey basis as follows:

- MCC and Control rooms + Workshop Building (Tartous terminal).
- MCC and Control rooms (Banyas).
- The contractor is committed to provide all structural, architectural, electrical drawings etc. with all drawings, detail designs, and calculation notes to be approved by company. The contractor must comply with all modifications requested by the company and redraw the drawings and design documents according to the suggested modifications.
- The area of mentioned buildings must be proportional to the design dimensions required for the equipment (according to design requirement), including service offices, a small buffet, restrooms, etc.
- The control and MCC buildings at the Banyas and Tartous terminal sites include all related requirement such as concrete and metal trenches necessary for power & control cables, etc.
- All finishing materials necessary for the above-mentioned buildings must be of good quality and available in local markets (cement blocks of various sizes + plaster works + tiles + acrylic paint + wooden doors + metal doors + aluminum windows + sanitary plaster with accessories, along with electrical equipment such as switches and lighting points, etc.) on a turnkey basis and in compliance with the Syrian Arab code requirements. It shall be taken into account that the buildings meet future expansion requirements.
- **Provide and install metallic shelter with 0.7 mm thickness corrugated steel sheets equipped with an overhead crane:**

The contractor is committed to providing the necessary design for metallic shelter with an overhead crane (for the pump buildings and fire pumps at each of Tartous terminal-Banyas sites). The design must include providing calculation notes attached with the required drawings, taking into account dead loads from the weight of the structure and roof, wind loads, earthquake loads, in addition to additional dynamic loads resulting from the movement and operation of the overhead crane to ensure smooth and safe crane

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movement.... The following points must be considered by design:

- The dimensions and height of the metallic shelter must be proportional to the design dimensions of the provided pumps (transfer pumps - firefighting pumps, etc.) taking into account that the load capacity of the overhead crane is suitable for the pumps.
- The contractor is committed to supply and install a metal structure including columns, H & I beam, angles, etc., taking into account preparing the runway beams for an overhead crane whose design load capacity matches provided pumps according to the above mentioned design, with the necessary electric motor and all associated electrical equipment for operating and moving of the crane, covering all crane operation requirement. The electric motor must comply with IEC standards with an accessible control system using a pendant cable or a wireless remote-control device.
- The overhead crane operates on wheels that move on metallic rails.
- The crane is equipped with LIMIT SWITCHES along with an overload protection system and emergency brakes, etc., achieving safety operating requirement (for operators & equipment).
- The (RUNWAY BEAMS) must be high rigidity to prevent deflection.
- The bracing system shall use X-bracing on the side walls and roof to ensure the stability of the structure according to the submitted design.
- All components of the metal structure must comply with ASTM A36/A572 for angles & bars, ASTM A992 for primary structural beams, ASTM F3125 (Grade A325) for structural bolts, AISC 360 for metallic joints, and ASTM A653/A653M for galvanized steel sheets used for the roof and part of the walls (for fire pumps and both main and booster pumps at the Tartous terminal and Banyas sites). Additional space for future expansion and maintenance works shall be considered that the design must be submitted for prior company approval.
- Main Beams supporting the structural members must be fixed to reinforced concrete foundations with anchor bolts compliant with ASTM F1554.
- All metal members must be coated with epoxy coating paints to protect structure from corrosion effects.
- The two RUNWAY BEAMS must be perfectly parallel with a deviation not exceeding millimeters within the tolerance limits according to international standards to ensure smooth movement of the overhead crane for safe operation.
- Welding to be carried out by certified welders, and all critical welds are subject to non-destructive testing (NDT) such as ultrasonic testing (UT) or radiographic testing as specified in design and according to international standard.
- Fabrication activities must comply with the ISO 9001 quality management system, and all structural metal elements (columns, beams, braces, etc.) must test (bending, tension, etc.)

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according to the requirements of the Syrian Arab Code.

3- Spare Parts:

The contractor shall supply spare parts for instrumentation, electric motors, seals, and drainage hoses for five years of operation.

4- Third Party:

The contractor shall nominate third party company for the following supplies:

- Steel plates.
- Primary and secondary seals.
- Rainwater drainage hose.
- Cathodic protection equipment.
- Pipes.
- Valves.
- Firefighting equipment.
- Radar level transmission and temperature and pressure transmitters.

The third-party company's responsibilities include, but are not limited to:

- Attending all factory tests.
- Verifying manufactured materials against technical specifications.
- Checking specifications and dimensions.
- Conducting any tests deemed necessary to verify specifications.

5- Bidder's Duties:

- The bidder shall attach to his offer the basic tank data sheet as specified in API 650 Appendix L.
- The bidder shall attach with his offer preliminary tank drawings (tank shell showing opening & nozzles & stairway, floating roof showing opening & nozzles & rolling ladder, bottom showing dimensions & thickness & material specifications, shell showing dimensions & thickness & material specifications, tanks foundation) to demonstrate the bidder's understanding of tank construction.
- Bidder shall attach to his offer preliminary building drawings for MCC & control & communications building (including area & architectural design).
- The bidder shall define in his offer, preliminary sealing specifications, preliminary data sheet for oil transfer pumps & preliminary data sheet for overhead cranes.

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- The bidder shall submit (as part of his offer) a brief of cooling and firefighting system which will be used in Tartous terminal site (shore tanks site near to administration offices) including preliminary operating philosophy of the offered system.
- Specify the country of origin & manufacturer for all project equipment (plates, primary and secondary seals, rainwater drainage hose, pumps, cooling & firefighting equipment, foam material, pipes and accessories, valves, cathodic protection system equipment, cables, transformers, level & pressure & temperature gauges & transmitters, radar level device, TSM, PLC/DCS & SCADA system equipment, telephone exchange station, VHF devices).
- Specify the offered project life.
- Bidder shall nominate list of suggested third party companies.
- The bidder shall attach to his offer documents proving execution and final acceptance of similar works for all project systems.
- The bidder shall attach to his offer a price analysis table for quantities, which shall be considered final for the turnkey project execution. **Prices shall reflect their true proportions, and prices shall not be shifted from one item to another, otherwise the offer will be rejected.**
- Before submitting his offer, the bidder shall visit the work site and inquire about anything deemed necessary. Once submission of the offer, the bidder will be considered to make this important visit.

6- Contractor's Duties:

- Before final invoice approval for project equipment, the contractor shall submit the following to company:
 - Three copies of the following documents and drawings:
 - Basic engineering documents.
 - HAZID & HAZOP reports.
 - Hydraulic study.
 - General and detailed drawings of tanks (Layout and general arrangement drawings), tank orientation drawing with cross-sections, design parameters, tank opening and nozzles orientation drawings and their sizes, etc.
 - Detailed drawings of the shell, bottom, floating roof, pontoons, floating roof supports, Circumferential stairway and rolling ladders, openings and nozzles, gauge well, wind girders, walkways, rainwater drainage system, seals, cooling and foam system, vents, etc., showing dimensions, weight, and specifications.
 - Design calculations mentioned above: Tank data sheet for plate thickness and tank stability, etc. (according to standards), wind girders, inner and outer rim plates of the floating roof, design calculations for the floating roof and rainwater drainage system,

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design calculations for vent openings, design calculations for floating roof supports mentioned above, etc.

- Detailed drawings for tank foundation & ring wall and all concrete foundations for (pumps, supports, walkways, basin, beam (barrier wall), etc.).
- Detailed drawings for buildings (MCC, control, etc.).
- Detailed drawings for structures (walkways, shelters, etc.).
- Detailed (drawings & calculation notes) for piping network (3D drawing, GA & Isometric, heat and material balance, thickness, etc.).
- Detailed (drawings & calculation notes) for power electrical system, lightning & earthing system, instrument & control system, ESD system and communication system.
- Submission of a schedule showing timelines for all project works such as design and drawing preparation, procurement, manufacturing, construction & erection, and pre-commissioning & commissioning & start-up phase, etc.
- Submission of welding procedure and welder qualification procedure.
- Submission of a weekly progress report for all project work.
- Submission of five hard copies and electronic copies (Auto-cad for drawings) including **as minimum but not limited to the following documents for all project equipment:**
 - Test certificates and inspection reports (leak tests, pneumatic tests, painting tests, etc.).
 - Calibration certificates for tanks.
 - Calibration certificates for instrument devices.
 - Material test certificates.
 - FAT & SAT for PLC/DCS & SCADA equipment.
 - FAT & SAT for oil & fire pumps.
 - MTO's for all project components.
 - Welding MAP's.
 - Radiography films with inspection reports.
 - Final "As-built"/final data/documents.
- Data sheet & operation and maintenance manuals for the cathodic protection system, manual & control & electrical valves, radar level device, FSM, level & pressure & temperature transmitters, pumps, hydrants & pourers & foam generators & extinguishers & all firefighting equipment, telephone line exchanger, VHF devices, power & instrument cables, electrical transformers, valve actuators, etc.

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- Pre-commissioning, Commissioning and testing reports for Cathodic protection system, ESD system, control & communication system, cooling & firefighting system, etc.
- The contractor shall, at his own expense, provide all necessary construction equipment, testing equipment, power generation units, heat treatment (when necessary), transportation, storage facilities, cranes, welding machines, welding and radiography tools, welding rods, grinding tools & all consumables, labor, and shall provide security and firefighting equipment, etc., and everything necessary for the execution of the works. The company may provide electrical power and water; in this case the contractor shall compensate the cost according to legal rates.
- The contractor shall, at his own expense, supply all material and handle customs clearance.
- The contractor shall provide necessary safety equipment such as ropes, helmets, etc., and safety devices.
- The contractor shall provide portable fire extinguishers and a hose reel connected directly to the nearest fire hydrant for emergencies.
- The contractor shall be aware that they are working within an oil tank farm and must take all precautions. Their machinery shall be equipped with spark arrest, and all electrical cables used in the project must be safe and well-insulated, including distribution panels.
- The contractor shall take all safety precautions for hot work after getting a hot work permit from the site in coordination with the supervision committee.
- The contractor shall provide the necessary electrical power for the project through diesel generators.
- The contractor shall clean the site periodically to facilitate site access and safety issues. The site shall be maintained clean, clear, and shall be always accepted to supervision committee.
- The presence of company representatives on-site to supervise work execution does not release the contractor from their responsibilities for correct & safe execution. Therefore, any noted issues during the execution or warranty period shall be rectified by the contractor at their own expense according to the instructions and acceptance of the supervision members.
- The contractor shall be aware that all works will be carried out within an oil tank area and must strictly adhere to and closely monitor their personnel to ensure the application of all applicable safety and security regulations in the company and other international oil companies. Smoking is prohibited within the tank farm. No ignition or fire sources shall be permitted without prior written approval from the company by getting approved work permit from the company.

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- The contractor shall submit a list of all their workers and employees, along with their job titles, for company prior approval for allowing them to be present at the tanks site.
- The contractor shall submit a list of successful welders in qualification tests and qualified painters for such work who have previously worked on similar projects, along with certificates to prove this. Otherwise, they will be prevented from working, regardless of their technical level.
- The contractor shall return surplus materials to the company's warehouses.
- The contractor shall complete all necessary works for the safe operation of the project, whether mentioned in technical specifications or not.

7- Execution Period:

- The execution period for all works shall be // days from the date of the order to commence or site handover, whichever is later.
- A workshop logbook shall be used for the works.
- The execution period will be extended by the stoppages caused by company works. Stoppages due to rain shall not be considered justified. The workshop logbook shall be used to determine justified days due to company work, if any.

8- Modify Contract value:

The company has the right to increase or decrease the contract value by 25% of the contract value.

9- Payment Method:

- / / Payment shall be paid for the value of supplied materials upon their arrival at the work site in good technical condition and conforming to specifications, along with the required documents.
- / / Payment shall be paid for the value of provisional acceptance of materials supplied by the company.
- Payment shall be made for the value of executed works based on the unit of work, executed work statements, and the bidder's proposed and contracted price schedule.

10- Warranty Period:

One full Gregorian year from the date of provisional acceptance.

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Materials for Floating Roof Tank

Design Data		Material Specification	
Design Code	API 650	Shell & Annular	ASTM A 516 Gr70/EQVT
Design pressure	Atmospheric	Bottom & Roof	ASTM A283 Gr C /EQVT
Operating Pressure	Atmospheric	Roof Manholes Neck, flanges, covers	ASTM A283 Gr C/ EQVT
Design Temperature	> 50 Fº	Shell Manholes Neck, flanges, covers	ASTM A516 Gr70/EQVT
Operating Temperature	Ambient	Nozzle Necks	A 516 Gr70/A 106 Gr B/EQVT.
Wind Pressure	153.6 kg/m3	Nozzle Flanges	SA – 105/EQVT.
Seismic Data	Zone 4	Gaskets	Flexible Graphite with Tangent Insert
Corrosion Allowance	3 mm for bottom and Shell/1.5 mm for roof	Bolting for structure	IS- 1363 or equivalent
Radiography	As per API 650	Bolting for nozzles, Manholes etc.	ASTM A193 Gr B7/ 194 Gr 2H.
Stored product		Steel Structure	ASTM A36.
Capacity	30000 cu m 20000 cu m 40000 cu m 90000 cu m	Gauge Well	A 106 Gr B/ A 53 Gr A, B - seamless.
Type	Single Deck FR	Gussets on shell	ASTM A516 Gr 70 /EQVT
Test Pressure	Hydrostatic	Reinforcement plate on the shell	ASTM A516 Gr 70 /EQVT
		Reinforcement plate on the roof	ASTM A283 Gr C /EQVT
		Gussets on roof	ASTM A283 Gr C /EQVT
		Roof drainpipe	A 106 Gr B seamless.
		Bleeder (pipe-sleeve)	A 106 Gr B/ A 53 Gr A, B - seamless.

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		Curb-angle/wind girder/intermediate wind girder.	ASTM A516 Gr 70/ EQVT
		Stairway/platforms/ Handrail.	ASTM A36/EQVT.
		Fire water & Foam pipes	A53/A106 Gr B/API 5LGr B Seamless.
		Roof Supports /legs and sleeves.	A106 Gr B/API 5L GrB Seamless Sch 80.
		Auto Bleeder vent pipe & sleeve	A 106 Gr B seamless.
		Fittings	A – 234 Gr. WPB.

Technical Evaluation Criteria

Evaluation Items	Percentage	Evaluation Criteria
Engineering Studies	5%	
Previously executed engineering design for floating roof tanks with their accessories.	1%	Execution of similar studies for floating tanks of not less than 20,000 m ³ for each (at least five studies).
Engineering design deliverables.	4%	Commitment to provide a HAZID & HAZOP report and all basic & detailed design deliverables.
Material Specifications	20%	
Type of used material	8%	Carbon steel plates ASTM A516 Gr.70 type of material used

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Origin of valves, instrumentation, seals, firefighting equipment, and all tank accessories	5%	Western European, American, Japanese, Australian, or Canadian origin
Origin of pipes and their accessories	2%	Western European, American, Japanese, Australian, or Canadian origin
Technical specifications of valves, instrumentation, seals, firefighting equipment, and all tank accessories	5%	Specifications of Al-Furat Oil Company – Deir Ezzor Oil – Conoco, and in case of adopting different company specifications, (approval must be obtained from the Syrian Petroleum Company before submitting the technical offer)
Execution	75%	
Execution of similar works for floating tanks	40%	Providing proof of execution of similar works for floating roof tanks and their accessories not less than 20,000 m ³ capacity (five projects)
Commitment to safety standards.	10%	Commitment to safety standards, providing the bidder's safety manual.
Experience	10%	Not less five years
performing all final project tests (commissioning)	5%	performing all final project tests (commissioning)
Commitment to submitting the final dossier	10%	Commitment to submitting the final dossier including all general arrangement drawings, structure drawings, foundation drawings, layout, instrument and electrical wiring diagram, MTO's, isometric drawings, 3D drawings, inspection reports, procedures, tests, calibration certificates, studies, calculation notes, data sheets, specifications, etc

Notes:

SOW for Erect New Crud Oil–Floating Roof Storage Tanks in Banyas area

- 1- The bidder has the right to add any item they deem necessary.
- 2- The contractor will be paid based on the actual quantities, lengths and weights executed.

Bidder's Name:

Address:

Date: