5.3 Offshore Platforms

5.3.1 Overview

The Phase 3 offshore platforms will consist of a DUQ platform bridge linked to the PCWU platform (Figure 5.4). Together, the two installations will provide the necessary facilities for the production and partial processing of hydrocarbon products prior to its export to shore, in addition to drilling and water injection requirements. The following sections summarise the platform facility design/layout, the fabrication/construction and onshore pre-commissioning activities, plus the load-out and offshore installation, hook-up and commissioning activities. Operational activities of the platforms are described in Section 5.5.

Figure 5.4 Phase 3 Offshore Platforms (Drilling derrick equipment set (DES) and drilling support module (DSM) not shown)

5.3.2 Design and Layout

5.3.2.1 Drilling Template

The Phase 3 drilling template will be of similar design as for the Phase 1 and Phase 2 templates (Figure 5.5). It will provide 12 well slots for the pre-drill programme. Pin Piles shall be used for the docking guides for the installation of the DUQ jacket. The template will be constructed from high-grade marine steel, with corrosion protection provided by anti-corrosion / anti-fouling paint and zinc-aluminium sacrificial anodes.

Figure 5.5 ACG Phase 1 Pre-Drilling Template

5.3.2.2 Jackets
The Phase 3 jackets will be similar in design to the Phase 1 and 2 jackets. They will be eight-leg, braced, steel structures that will support the topsides structures and will be designed for installation over a pre-installed drilling template. Each jacket will be approximately 190 m tall and will extend from the seabed (175 m deep) up to 14.3 m above the sea surface. The top of the jacket structures will be a “twin tower” configuration so as to allow “float-over” installation of the topsides deck. The design of the base of the jackets incorporates three pile sleeves at each corner to accommodate the twelve piles required to anchor it to the seafloor at the offshore location. The Phase 3 jacket design is illustrated in Figure 5.6.

The Phase 3 jackets shall use pin piles for foundation support. This differs from the Phase 1 and 2 jackets, which used mud mats to obtain the foundation support. The use of pin piles eliminates the need for mud mats, and saves approximately 1000 tonnes of fabricated steelwork per jacket.

Figure 5.6 ACG Phase 3 Jacket Design

5.3.2.3 DUQ Topsides

The DUQ topsides will be a two level facility providing equipment for power generation, drilling, hydrocarbon, separation, utilities and accommodation for platform personnel.

The upper (weather) deck of the DUQ drilling facilities will consist of:

- Centrally located derrick equipment set (DES) that operates over 48 well slots. The DES contains the drilling derrick, drill floor equipment, drilling fluid solids control system and the well control equipment.
- A fixed drilling support module (DSM) containing a mud storage and mixing area, mud pumps and cement system.
- Two identical process trains, including a high-pressure (HP) and a low-pressure (LP) separator each
- A single power generation package
- A produced water treatment package
- A living quarters module capable of supporting 200 persons onboard (POB) during normal operation and up to 300 POB (as may be required during commissioning and shutdowns activities).
- A helideck and two cranes

The lower (cellar) deck facilities will contain:
• The production tree and production manifolds, where wells will be completed (including tied-back pre-drill wells) and hydrocarbon will be received and passed to the process trains.
• Sand separation package and general utilities
• Four lifeboat stations located directly beneath the living quarters.

Platform utilities will be located on both the upper deck and cellar deck levels and will include workshops, a Rolls Royce RB211 duel fuel power generation turbine, switchgear room, seawater lift pumps and a seawater system, firewater pumps, sewage treatment and storage facilities. In addition, eight (8) diesel generators will be temporarily located on the DUQ for back-up power supply during the period of drilling operations that will take place prior to the installation of the PCWU platform.\textsuperscript{1}

The proposed layout of the DUQ topsides is shown in Figure 5.7.

\textbf{Figure 5.7} DUQ Topsides Layout

\textsuperscript{1} It is planned that the diesel generators will be removed once the PCWU platform has been installed and fuel gas becomes available to power the RB211 generators on the DUQ and PCWU platforms.
5.3.2.4 PCWU Topsides

The PCWU topsides will also be a two level facility that will provide equipment for power generation, seawater lift, treatment and injection, plus gas compression and export.

The upper deck will house:

- Four RB211 dual fuel turbine generators;
- Two electrostatic coalescers
- The water injection system, driven by three RB211s; and
- Two export gas compressors and ancillaries.

The cellar deck will house:

- The seawater lift pumps;
- The gas dehydration system and glycol regeneration boilers;
- The fuel gas system;
- The main oil line pumps; and
- The cooling water medium system.

The proposed layout of the PCWU topsides is shown in Figure 5.8.

Figure 5.8 PCWU Topsides Deck Layout
5.3.2.5 Flare Boom

The flare boom enables the transfer of hydrocarbons from the DUQ and PCWU processes to the flare burner tip for combustion under non-routine operating conditions. The flare will be fitted with a pilot light that will be continuously lit. The flare will be a 110 m long structure, fixed at an angle of $60^\circ$ to the PCWU topsides on the opposite side to the bridge link.

5.3.2.6 Bridge Link

The bridge link between the DUQ and PCWU platforms will be 70 m long, 4.5 m wide and 7 m tall and will provide personnel access and service support between the two platforms. It will be constructed of a steel lattice structure with service supports and cable rack to support pipework, cabling and connections required for the transfer of oil, gas, cooling water / medium, electricity and air between the two topsides.

5.3.3 Offshore Facility Fabrication/Construction and Pre-Commissioning

5.3.3.1 In-country/Out-country Fabrication

The offshore facilities described in the previous sections will either be fabricated within Azerbaijan or, where this is not possible, sourced internationally and transported to the region for assembly. In-country fabrication will, where possible, utilise existing national fabrication yards, as previously used for ACG Phase 1 and 2 (Azeri Project), for the fabrication, construction and onshore pre-commissioning of Phase 3 offshore platform and jacket facilities. The principal in-country yards under consideration are the Shelfprojectsroi (SPS) yard and the Amec-Tekfen-Azfen (ATA) yard located to the south of Baku. At the time of writing, fabrication/construction contracts had not been awarded and therefore, a final selection of yard or yards has not been made.

Topsides components and modules fabricated outside of Azerbaijan will be imported into Azerbaijan by road, rail and sea using the transportation routes established for the previous Azeri Project construction programmes. The main proven routes are the Russian Federation canal system and road and rail networks through Turkey/Georgia and Iran depending on the point of origin of each component.

5.3.3.2 Drilling Template

The drilling template will be constructed of high-grade marine steel, and will be cathodically protected by means of zinc-aluminium sacrificial anodes, and will be coated with an anti-corrosion/anti-fouling paint. Individual components will be manufactured before being welded together. The template will be inspected and all weld joints will be integrity tested using a Non Destructive Test (NDT) methods, such as radiographic and ultrasonic tests, prior to load-out onto the installation vessel.

5.3.3.3 Jackets (and Piles)

The DUQ and PCWU jackets are of similar design to the ACG Phase 1 jackets and will be constructed using largely the same methods established for Phase 1. The timeline for construction of the jackets is a critical task in the schedule of the Phase 3 project. Due to the schedule it will be necessary to initiate construction of the inner lattice of the second jacket before the first jacket is completed.

The jackets will be made of tubular rolled steel. The fabrication yards in Azerbaijan have the ability to roll locally provided sheet steel to a limited thickness, and fabrication of the majority of the jacket members will be conducted onsite. Large diameter / heavy wall steel tubulars for the jackets and piles will be supplied from international manufacturing facilities if the particular tubular member exceeds the in-country rolling capability.
Steel plate and tubes received at the fabrication yard will be cut and shaped as required and then welded together to form the various sectional pieces of the jackets. Once welding has been completed, each section will be subject to NDT to check section integrity and weld joints, and will be grit blasted in preparation for painting. Once these tests have been completed, each section will be painted with an anti-corrosion paint. Cathodic protection will also be provided by zinc-aluminium sacrificial anodes. The sections will be then transferred to the skidway where they will be crane lifted into position and welded to other jacket sections to form the complete structure. NDT will be performed on all final weld joints as required.

The seabed piles (each about 140 m in length) will be transported to the yard in pre-fabricated sections for assembly, grit blasting, inspection, testing and painting.

The jacket construction method is illustrated in Figure 5.9.

**Figure 5.9  Jacket Construction Method**
5.3.3.4 Topsides

The design, general construction and onshore commissioning methods for the Phase 3 topsides will be essentially the same as that employed for the Phase 1 facilities, as illustrated in Figure 5.10. Pre-fabricated components and modules will be imported from international fabrication yards and transported to fabrication yards in sections for assembly. These will include the living quarters module, helideck and the drilling modules\(^2\) on the DUQ deck. All pre-fabricated equipment will be tested at the point of manufacture prior to arrival but will be re-tested and pre-commissioned once integrated with the topsides structure. Where possible, selected components required for the topsides will be fabricated at the local yards where the specification and quality of materials can be assured from a local supplier.

For the topsides deck frames, steel plate will be supplied to the fabrication yards where it will be cut, shaped and subsequently welded to form box girders, plate girders and tubular supports. The sections will then be grit blasted in a workshop and then painted with anti-corrosion paint in a ventilated paint facility. Pre-fabricated utility and process equipment will be installed into the structural frame, secured in place and be outfitted with power and piping connections as required. A single flare boom structure for the offshore complex will be attached to the PCWU integrated deck prior to load out. All deck frame and component weld joints will be tested using NDT methods.

5.3.3.5 Integrity and Hydrotesting

Approximately 95% of the process equipment and utilities on each of the platform topsides will be pre-commissioned onshore, following the installation of the utility and process equipment onto the deck. Pre-commissioning will include pressure testing with water or gas. Hydrotesting will be performed using either potable water wherever possible, or seawater dosed with a sterilising agent. Where seawater is used it will be dosed with sodium hypochlorite at a concentration of 2 mg/l. On completion of the pressure test the waters will be removed and reused where possible. Discharge of the hydrotest waters will be either to the municipal drains (not for seawater), or through a discharge point to the harbour. Prior to discharge any dosed seawater will be dechlorinated using sodium thiosulphate, a chemical with very low toxicity, which poses no environmental risks.

Testing will be carried out as follows:

- **Cooling Water System**: Seawater will be abstracted from the harbour, and discharged back to the harbour at a rate of 500 m\(^3\)/hour for up to 10 hours per day for up to 8 weeks. Disinfectant and neutralising chemicals (sodium hypochlorite and sodium thiosulphate as described above) will be dosed for one hour per day during testing.
- **Living Quarters**: Fresh water will be used for the living quarters hydrotest. This test is a static test with a total volume of around 120m\(^3\). It too will be dosed with sodium hypochlorite and dechlorinated using sodium thiosulphate. The discharge will take place over a period of 3 – 4 hours at a rate of approximately 10 litres per second: this will permit a high rate of dilution, and will ensure that salinity in the harbour is not affected at a distance of more than 1m from the point of discharge.

\(^2\) At the time of writing, the option of constructing the drilling module in-country was still being assessed. If a suitable facility including appropriately skilled workers is identified, construction will be undertaken in-country.
5.3.3.6 Bridge Link

The 70 m bridge that will link the PCWU and DUQ facilities will be constructed at one of the main fabrication yards in Azerbaijan and will be loaded out with the PCWU deck. Pipe work and cabling will be fitted into the bridge and these components will be hydro- and electrically tested respectively prior to load-out of the facility. Weld joints will be subject to NDT methods.

5.3.3.7 Flare boom

The flare boom will be constructed of a steel lattice frame structure in a piece-small manner similar to that described for the jacket construction. The flare boom will be installed and tested on the PCWU platform topsides at the onshore construction yard prior to load-out of the facility.

5.3.3.8 Onshore first fill

Offshore facilities such as the topsides require consumables such as fuel and chemicals for operation. Where these are supplied by independent contained storage tanks they will be filled onshore following commissioning of the tanks. This reduces the need for and minimises the risks associated with filling the tanks offshore.

5.3.4 Load-out and Transportation

The completed and pre-commissioned offshore facilities will be loaded onto barges for transportation to the proposed installation site at DWG. Two vessels will be used for the transportation of the offshore facilities, the Derrick Barge Azerbaijan (DBA) for transportation of the drilling template and the STB-1 barge for the jacket structures and topsides. Figure
5.11 shows the completed Phase 1 CA jacket, ready for float-out, after load-out onto the installation barge. Figure 5.12 shows the DBA vessel.

**Figure 5.11** Completed CA Jacket on the Installation Barge

![Completed CA Jacket on the Installation Barge](image1)

**Figure 5.12** DBA Vessel

![DBA Vessel](image2)

The offshore jackets and topsides will be sea-fastened by welding and bolting the load-out frame to the barge and the barge will be ballasted and trimmed to sea-tow condition in readiness for transfer to the offshore location. Each transportation barge will be assisted by three attendant tugs during sail-away. The jacket piles will be transported to site by “wet float”; that is, towed in the water behind a tug or supply vessel.
5.3.5 Offshore Installation

The following sections present details with regards to the offshore installation of the offshore platform facilities.

5.3.5.1 Drilling Template and Pin Piles

Once at the drilling site, the drilling template will be lifted into position by the DBA and lowered onto the seabed. Once on the seabed, the template will be levelled using a hydraulic system. The template will then be anchored to the seabed by piles that will be driven into place by a hydraulic hammer operated from the DBA.

After installation of the template, two steel lattice frames will be set on the seabed and used to index the installation position of four pin piles per jacket. The frame pair are used at each jacket location to position the pin piles, and after pin pile installation, the frames are recovered for transport back to the onshore fabrication quayside, as they do not form a part of the permanent works.

5.3.5.2 Jackets

Installation of the Phase 3 jackets will follow similar methods as employed for the Azeri project. Once the jackets are at the proposed location, the barge will be anchored in place and the jacket load-out frame sea-fastenings will be removed. The barge will then be ballasted such that the stern end becomes submerged and the jacket can be slid off into the water as illustrated in Figure 5.13.

Figure 5.13 Platform Jacket Installation
The jacket will be fitted with flotation tanks to provide the buoyancy required to manoeuvre the structure into position following jacket launch off the STB-01. The jacket legs will then be flooded with seawater, dosed with biocide, corrosion inhibitor and oxygen scavenger, so that the structure ‘rolls’ into a vertical position for lowering onto the seabed. The seawater will remain in the jacket legs for the lifetime of the facility.

At the seabed the jackets will be docked onto the pin piles with the assistance of the DBA crane and progressive flooding of the buoyancy tanks. The operation will include the presence of support vessels. The pin piles dock into receptacle sleeves located inside the four main corner jacket legs, and once the pin piles are safely inside the sleeves, they become securely connected through a hydraulic pile gripper system. After docking the jacket onto the pin piles, the buoyancy tanks are completely flooded and removed by the DBA. The tanks are then towed back to the onshore fabrication yard for use on the next jacket to be installed. After removal of the buoyancy tanks, the jacket is secured in place by hydraulically hammering the jacket foundation piles through the base plates. Minor leaks of hydraulic fluid may result from this operation if there is a hammer failure, however the probability of this occurring is very low. The foundation piles will, once hammered into position, be grouted to the jacket pile sleeves. Grout will be supplied via flexible hoses from the DBA to the grout manifold panel located on the side of jacket from where it will be pumped down into the annulus between pile and pile sleeve via grout hoses mounted on the side of the jacket. The base of the pile sleeve will be fitted with rubber bladders to stop grout from passing through the sleeve to the seabed.

Any previous cuttings pile from the pre-drill programme will be surveyed by ROV and if it poses a problem to installation of the jacket, it will be jetted with water to disperse the cuttings.

5.3.5.3 Topsides

The topsides are designed for the “float-over” method of installation, as employed for the Phase 1 project topsides. The barge is manoeuvred between the two jacket support towers such that the topsides are positioned above their intended installation position on the jacket as illustrated in Figure 5.15. The transportation barge is then ballasted down until the topsides mating legs reach and mate with the jacket support tower structure. Approximately 32 m$^3$ of clean sand in total will be released from the eight sand jacks during this process.
5.3.5.4 Bridge Link

Once the PCWU and DUQ topsides are installed offshore, the bridge will be lifted into position between the two platforms where it will be secured into place. The DBA crane barge will lift and manoeuvre the bridge into the final installed location on the platform bridge landing areas where it will be secured at both ends. Once bridge installation has been completed, the process/utility pipework and the power and process control cables will be hooked up and commissioned.

5.3.6 Offshore Hook-up and Commissioning

5.3.6.1 Tie-back and testing

A number of hook-up and commissioning (HUC) activities will need to be completed offshore prior to start-up. These include, but are not limited to, tie-in to the pre-laid subsea export and water injection pipelines, the subsea umbilicals, and tie-back of pre-drilled wells to the platform facilities (production and water injection). These HUC activities will require a number of personnel to be offshore and an additional three heavy-duty tugs to be on station. Additionally, the DBA will remain on station to provide accommodation support during hook-up and commissioning activities and it is also likely that the dive support vessel (DSV) “Tofik Ismailov” will be used to assist in tie-in operations between the offshore facilities and the interfield pipeline systems and in subsea umbilical pull-in operations (Section 5.6.4.3).

The offshore commissioning activities will require installation of temporary test equipment (e.g. pumping unit, test cabin, several quads of \( \text{N}_2 \)) on the platform. The pipe work will be pressurised to test the integrity of all joints and connections with nitrogen with a 1% helium trace. Once the system test pressure is reached, the flanged joints will be examined and checked for leaks against pre-determined test criteria. The tests will be repeated for all relevant systems until all joints have been successfully tested. Pipe work between the two offshore platforms will be hydrotested to ensure technical integrity of interface systems between DUQ and PCWU. This will occur prior to \( \text{N}_2 \) gas leak testing to strength test the connections at either end of the bridge link. The hydrotest water will be potable water supplied from onshore and no chemicals will be added. At the completion of testing the water will be discharged to sea.

5.3.6.2 Offshore first fill
Once all facilities have been connected and tested and all equipment and facilities are connected together for the first time, the offshore equipment that could not be filled onshore will be subject to a first fill to provide all tanks, flowlines and equipment. All inventories of fuel, chemicals and other consumables will be supplied from the support vessels using closed connectors and hose links under careful management.

### 5.3.7 Emissions, Discharges and Wastes

Emissions, discharges and wastes that will be generated during the offshore facility fabrication/construction, pre-commissioning, installation and offshore HUC are quantified in Section 5.10. These will be managed in accordance with the provisions of the A2BU Waste Management Strategy and the ACG Project Waste Management Plans (i.e. Contractor Control Plans and Contractor Implementation Plans and Procedures).

Typical wastes during the onshore construction phase will include paint tins, solvent tins, oily rags, grit from sandblasting, cardboard, wood and packaging materials, scrap metal and wiring, hydro-test water, nitrogen gas (vented) and sewage. Wastes generated during the offshore facilities’ installation, hook-up and commissioning activities will primarily relate to installation vessel operations and any final leak testing (hydrotest and/or gas pressure test) that needs to be completed offshore. Wastes will be segregated in skips and brought back to shore for appropriate disposal.
This page is intentionally blank.