# AIOC Platform Project

An order for the supply of Bondstrand® GRE (Glassfiber Reinforced Epoxy) pipes and fittings for several platforms for the (Azeri, Chirag, Guneshli) (ACG) full field development project in the Caspian Sea Azerbaijan was received by NOV Fiber Glass Systems (FGS) in 2001. The order was negotiated and finalised with British Petroleum (BP) acting on behalf of Azerbiajan International Operating Company (AIOC) .

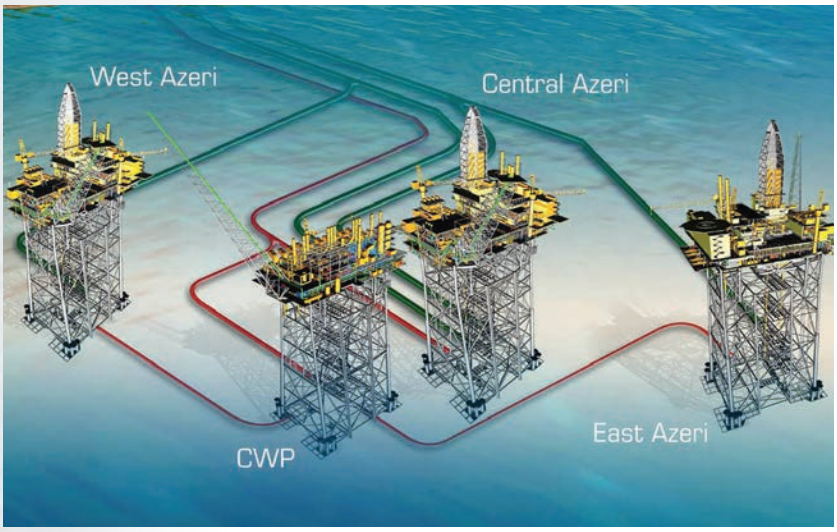
Kellogg, Brown and Root (KBR), London (UK)) was responsible for the technical evaluation of the bidding process and FGS was awarded the contract. The ACG full field development project comprised three phases during which a total of six platforms were built between 2002 and 2007. FGS also received the order for the supply of the three km 24 inch water disposal line at the Sangachal oil terminal.

The total order value exceeded $10 million, making it one of the larger offshore projects ever obtained by FGS.

Project development leading to the actual booking of the order began in September 1994 with the signing of a Production Sharing Agreement (PSA) in Azerbaijan between the State Oil Company of the Azerbaijan Republic S(CAR) and AIOC. This PSA grants the consortium the rights to develop and manage the hydrocarbon reserved found in the ACG field termed the “Contract Area” for a period of 30 years.

In July 1999, BP was appointed operator for the PSA on behalf of the AIOC member companies. Part of the objective was to produce the recoverable reserves in the central part of the Azeri Field. The project required offshore drilling and production facilities and a means of transferring the produced hydrocarbons to shore. There were estimated oil reserves of 4.6 million barrels and 3.5 trillion cubic feet of natural gas.

The contract to provide design and procurement for the full field development of the ACG offshore fields was awarded to KBR. J. Ray McDermott won the contract for fabrication, assembly, hook up and commissioning of the Central Azeri (CA), West Azerii (WA), East Azeri (EA) and Deep Water Guneshli (DWQ) platforms. The Azfen/Tekfen/Amec (ATA) consortium was awarded C&WP and PCWU topsides fabrication within the ACG FFD.




## Project

ACG Full Field Development Project
Baku, Azerbaijan

## Client

Azerbaijan International Operating Company (AIOC)
Operated by BP

## Pipe system

Bondstrand Series 7000 and 3416 Conductive Pipe and Fittings with Quick Lock and Taper/Taper Adhesive-Bonded Joints
Diameters: 25-750 mm (1-30 inch)

## Operating conditions

Firewater:
Diameter: 2-10 inch
Working Pressure: 15 bar
Test Pressure: 24 bar
Seawater:
Diameter: 1-12 inch
Working Pressure: 15 bar
Test Pressure: 24 bar
Cooling Water:
Diameter: 2-30 inch
Working Pressure: 4-8 bar
Test Pressure: 24 bar
Sewage and Non-Hazardous Open Drains:
Diameter: 1-8 Inch
Working Pressure: Atmospheric
Test Pressure: Leak Test
Design Temperature: 40°C (104°F) all systems except cooling water at 65°C (149°C)

## Installation date

2001-2008

NOV Fiber Glass Systems


Azerbaijan, the oldest known oil producing region in the world, experienced an oil boom at the beginning of the 20th Century served as a major refining centre in the former Soviet Union. Oil production peaked at about 500,000 barrels per day during World War II and then fell significantly after the 1950's as the Soviet Union re-directed exploration resources elsewhere. Azerbaijan had 1.2 billion barrels of proven oil reserves, as well as enormous potential reserves in (yet) undeveloped off-shore fields in the Caspian Sea.

The platform manufacturing project was carried out in two manufacturing sites located at the coast of the Caspian Sea, near Baku, capital of Azerbaijan. One yard was 15 km from Baku, operated by ATA (joint venture ATA site) and the other site was situated 30 km from Baku, operated by McDermott (SPS site).

Two platforms were manufactured on the ATA site: one for C&WP and the other for PCWU, respectively compression,water injection and power, and process compression and water utilities. At the SPS yard, four platforms were manufactured for production, drilling and living quarters and were positioned in the four locations: CA, WA, EA, and DWG.

After completion, the platforms were shipped 120 km from the Azeri coast to their final destinations. Once in production, oil was conveyed to Sangachal oil terminal outside of Baku. From that location, the oil was transported to Europe via the 1760 km Baku-Tbilisi-Ceyhan pipeline. This pipeline has a capacity of one million barrels a day and had the capacity for 10 million barrels of oil. In July 2006, the first Caspian oil arrived at Ceyhan at the Black Sea.

C&WP Platform in Production

## Azeri Project Platforms

The pipe work scope of supply for this multi-million dollar project included the following platforms:

- Seawater
- Cooling Water
- Non-hazardous Open Drains
- Firewater
- Sewage
- Atmospheric Vent

Bondstrand Series 7000G (Quick Lock joint) was used for lines up to 4" (100 mm). This product can be used for pressure ratings up to 16 bar.

Bondstrand Series 3416C (Taper joint) was used for lines from 6" to 30" (150 mm to 750 mm) with a pressure rating of 16 bar.

Both pipe series are electrically conductive and limit static electricity by connecting it to the ground. In explosive danger areas, such as platforms, this is an important safety concern.

All pipe work was designed to the ISO 14692 specification. The firewater piping is L3 fire rated (wet piping). The dry deluge pipe work in the process area containing L3 plus 5 minutes dry, Jet Fire rated.

Installation of Bondstrand Seawater Line

12" Bondstrand Firewater Ring Line

Bondstrand Cooling Water Lines in Service

This project spanned the change of seasons. During hot summer days, the pipe fitters were trained to be aware of the relative short pot life of the adhesive. During wet and cold winter days, the pipe fitters were required to preheat the bonding surface before beginning the bonding process.

The workshop for pipe fabrication of spools was an enclosed, conditioned area so no temperature or moisture influence affected the bonding of joints. The adhesive resin and hardener were stored in a conditioned room with a temperature varying between 18 and 24°C.

## Pipe Systems

To fulfill the demand of the dry deluge piping, Favuseal® mat was applied to the Bondstrand pipes. The spools were pressure tested to detect any leaks then the spools were overwrapped in the following manner:

- 1 layer of Combimat (glass)
- 2 layers of Favuseal sheet
- 1 layer of boat tape (glass)
- The top layer was impregnated with a cold curing, two component epoxy resin.

An extensive test program was executed to prove the quality of the Bondstrand products for each platform. Numerous pipes and fittings were pressure tested according to ASTM D-1599. All tests were witnessed by Bureau Veritas. The total project was comprised of 30,000 meters of Bondstrand pipe with diameters in sizes 2”-30” (50-750 mm) and approximately 32,000 fittings and more than 4,000 pipe spools were prefabricated.

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Field Joint of Pipe Spools

Over-wrapping of Fire Protected Spool with Boat Tape

**Traceability** - All pipe fitters were required to complete the following information on a form related to joints and materials:

- Pipe fitters badge number
- Joints on spool drawings were numbered and the number of the joint was recorded on the traceability form.
- Joints on the spool drawings were numbered and the number of the joint was recorded on the traceability form.
- Batch number of the adhesive was noted on the form.
- The unique FGS pipe and fitting ID codes were noted on the spool drawing and traceability form.


Flanges to Connect to Steel Piping

Spool manufacturing was a major part of this project. The GRE piping systems for the first platform (Central Azeri) were completely prefabricated in the Netherlands by Amerplastics BV in Termeuzen. These pipe spools were transported to the site in wooden crates with the first Bondstrand spools arriving in Baku in 2003.

The spools for other five platforms were prefabricated in a workshop set up locally in Baku. The main advantages of setting up spool prefabrication on site were related to the ability to modify spools to site requirements and implement design changes that weren't in the original layout of the project. This lowered the cost of transporting the spools and improved the flexibility overall of work and planning.

The workshop consisted of the following areas:

- An area for cutting and shaving, keeping noise and dust away from the main work area,
- An area for bonding and applying Favuseal to the spools,
- A testing area for spools,
- A climate-controlled area for storing adhesive, resin, hardener, keys and O-rings,
- An office for administration and drawing storage.

Installation of Spool

Spool Building

## Joining Systems

Quick-Lock adhesive bonded joints are used for pressure ratings up to 16 bar. Available pipe diameters are 1”-16” (25-400 mm). Spigots (male end) are cylindrical; bell ends (female end) are slightly conical with a pipe stop inside.

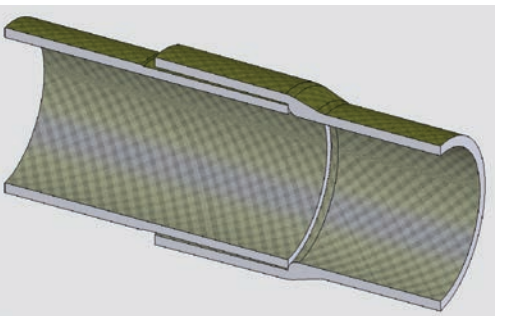
For the ACG project the Quick-Lock joint was used for pipe sizes 2-4 inch (50-100 mm). For larger diameters the Taper joint was preferred as this joint withstands dynamic loadings like pressure surges much better.

Taper/Taper adhesive bonded joints are used for pressure ratings up to 75 bar (depending on wall thickness and pipe size). Available pipe sizes are 2-40 inch (50 mm-1000 mm). Both the spigots and the bell ends are tapered.

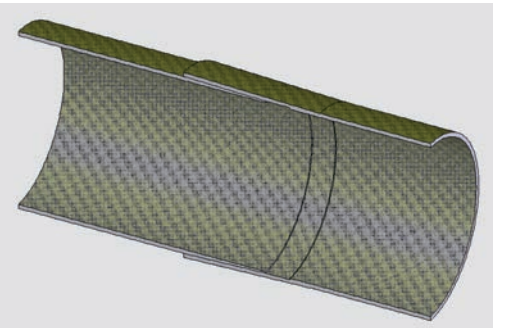
For the ACG project the Taper/Taper joint was used for pipe sizes 6-30 inch (150-750 mm).

Flanged joints are used to connect pipelines to pumps, valves, tanks and other equipment. Flanges are available in both Quick-Lock and Taper/Taper configuration.

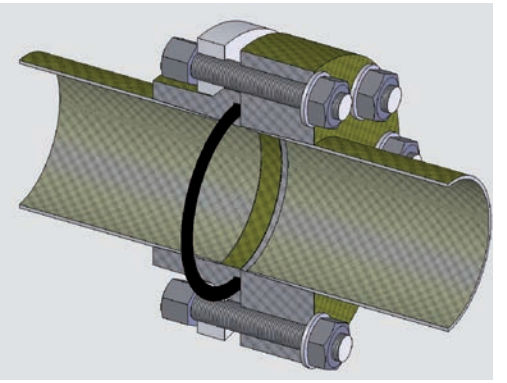
For the ACG project only Van Stone (stub-end) flanges were used. These flanges have the advantage of a loose steel flange ring enabling easy installation.



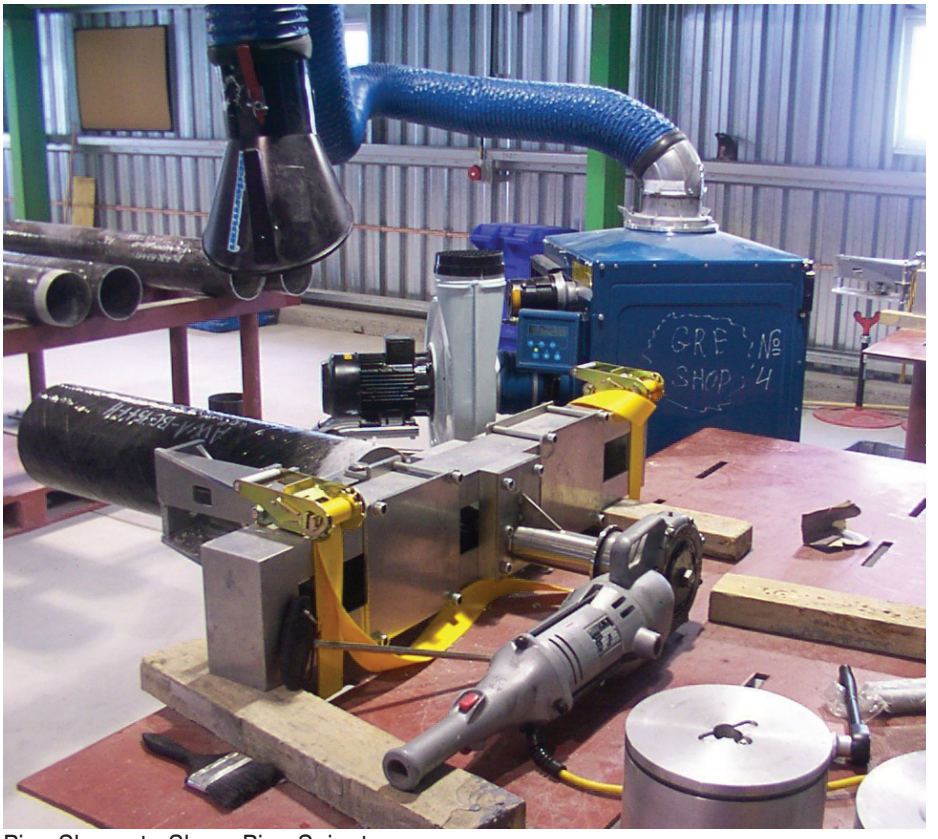
Quick-Lock Joint



Taper Joint



Flanged Joint




Pipe Shaver to Shave Pipe Spigot

Crossing of Several Pipe Systems

# Bondstrand Advantages for the Project

The following design aspects had to be considered during material selection of the pipe systems:

- The platforms are designed for a minimum lifetime of 25 years,
- The air in the Caspian area is relatively salty,
- No build-up of electricity is allowed inside the pipe systems, as explosive gases could be present.

Bondstrand pipe systems were selected because of the following advantages:

- Easy to handle resulting in low installed costs,
- Designed for a minimum lifetime of 25 years service,
- Non-corrosive,
- Maintenance free,
- Conductive, no static electricity is built up.

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# Special Thanks

PIPEX -(FGS distributor for the United Kingdom)

- Supported FGS in securing the project;
- Wrote the project specification, which is now the KBR GRE project standard;
- Reviewed the isometrics for fabrication, testing and fire protection;
- Tracked the isometrics drawings from KBR to MCCI and following the Pipex review, final isometrics were issued to FGS (Amerplastics).

AMERPLASTICS (FGS distributor for the Benelux)

- Received free issue material from FGS to prefabricate spools for the CA platform;
- Produced spool shop drawings and prefabricated the spools;
- Hydrotested and conductivity tested the spools;
- Applied Favuseal to the spools (fire protection);
- Prepared the spools for shipment.



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