

# EXPLOSION PROTECTION IN THE OFFSHORE INDUSTRY

## OFFSHORE INDUSTRY IN NORWAY

by N. Weppler \*



Figure 1: View of the „FPSO JOTUN“ on the terrain of KVÆRNER Oil & Gas in the harbour of Stavanger

The Norwegian Offshore Industry endeavours constantly to develop creative and flexible solutions as well as to achieve a continual adjustment to the market. Focussed research and development is determined essentially by the market conditions for oil and gas prices in addition the natural changes and the resulting pollution control are also decisive. In search of new economical and environmentally acceptable designs especially for smaller oil deposits improved solutions are found.

The tendency of developing drilling systems results from various requirements and applications. These systems should be able to perform additional tasks like process control engineering during production next

to the crude oil winning for example. An easy transport of installation parts must additionally be guaranteed to render and facilitate recycling (for example after the exhausting of an oil- and gas-spring). For this reason the so-called „floating production systems“ arise due to the development of the subsea and deepwater production.

More than one dozen new floating production systems are scheduled in the British and the Norwegian oil and gas sectors during the next two years. Therefore the North West of Europe can boast of having 30% of 200 floating production systems worldwide in use. This forward-looking concept was taken as a basis for the development of the oil field „JOTUN“.

### The JOTUN oil field

The Norwegian oil field JOTUN is located 200 km west of Stavanger between the BALDER and HEIMDAL field. The average water depth in this area of nearly 20 km<sup>2</sup>, is 126 meter.

The main owners are ESSO and ENTERPRISE, while CONOCO, STATOIL and AMERADA HESS own smaller parts of the field. ESSO is responsible for the management.

The aspects of safety, quality costs and schedule efficiency are the main and basic characteristics of the JOTUN concept. ESSO would like to extend proven and reliable technologies as well as optimised standard solutions. This type of procedure will be supported by intensive cooperation in teams. They consist of competent and experienced companies, who cooperate as license and working partners (partly with customers). Redesigns as well as long testing phases and maintenance are thus avoided.

The JOTUN will be developed with the help of a wellhead drilling platform, a production vessel FPSO, shuttle tankers, flowlines and risers as well as fibre optic communication. The risers and flowlines ensure the transport of different fluids, oils and gases.

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Therefore the fluid/oil respectively gas produced is routed via risers and flowlines from the drilling rig to production pipelines and then to the production vessel (FPSO). The crude oil will be processed on the FPSO. After this the processed oil is then stored into the tanks of the FPSO and will later be offloaded to shuttle tankers.

It is interesting that the JOTUN field, consisting of the three areas, „Elli“, „Elli South“ and „Tau West“, can be completely developed with this structure. All the equipment required for exploitation of an oilfield is designed for a life cycle of 20 years.

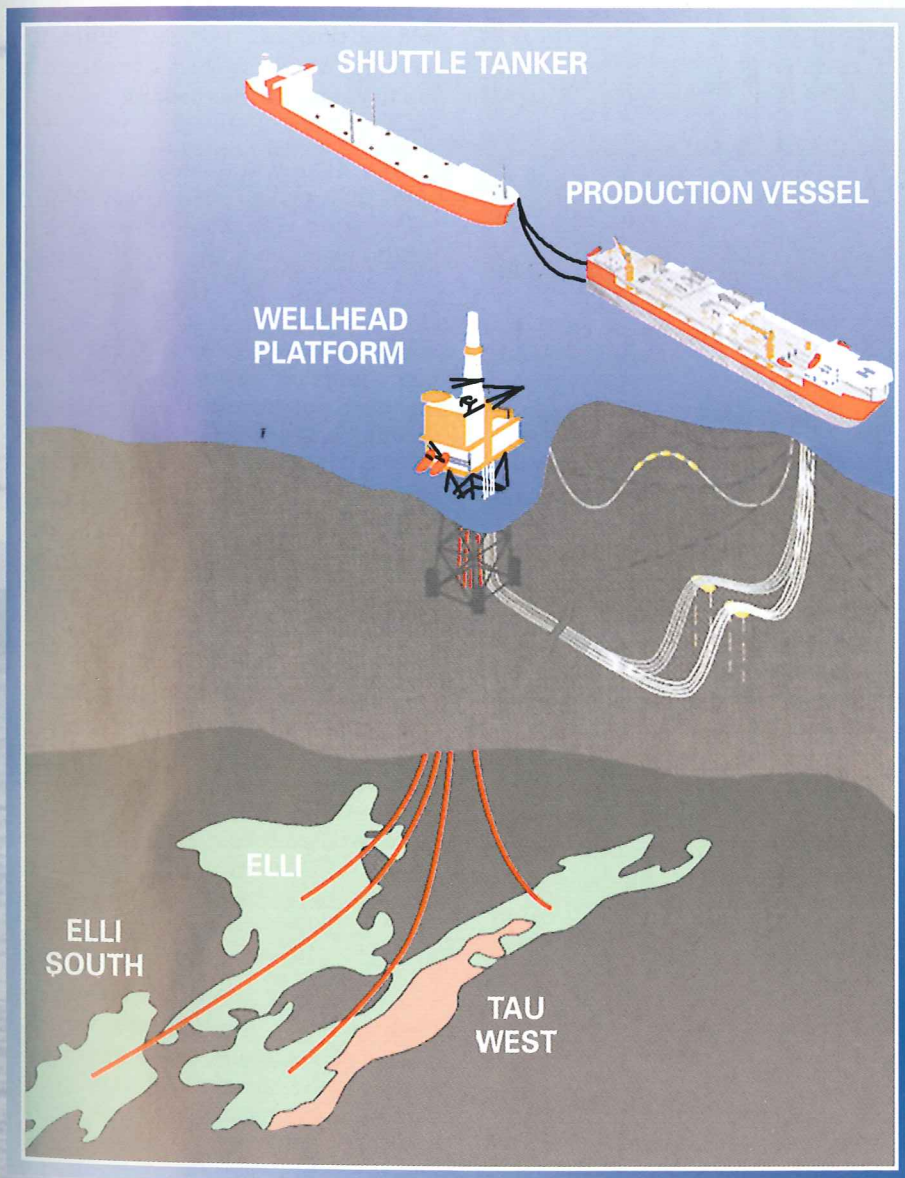


Figure 2: Schematic of the JOTUN oil field and its offshore components (ESSO NORGE AS)

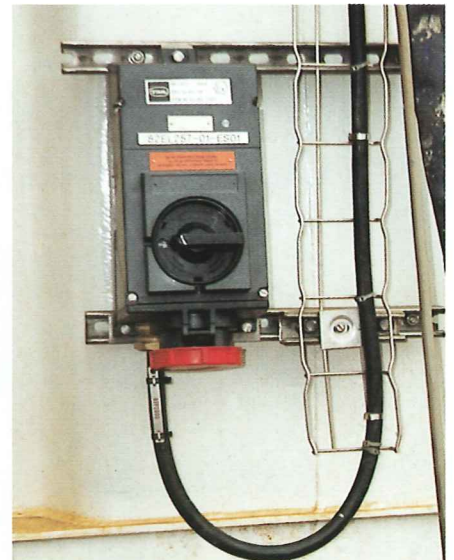


Figure 3: Explosion protected plug and socket system on the outside of the FPSO near the heliport

### What is the meaning of FPSO?

The basic functions of an FPSO are

- ◆ Floating Production
- ◆ Storage and
- ◆ Offloading

The FPSO itself is a production vessel. It appears from this that all the different parts of the control engineering concerning production are installed on a hull.

The production vessel consists mainly of the following areas:

- ◆ heliport
- ◆ living quarters with process monitoring
- ◆ absorption of crude oil routed over risers and flowlines which are connected directly to the turret

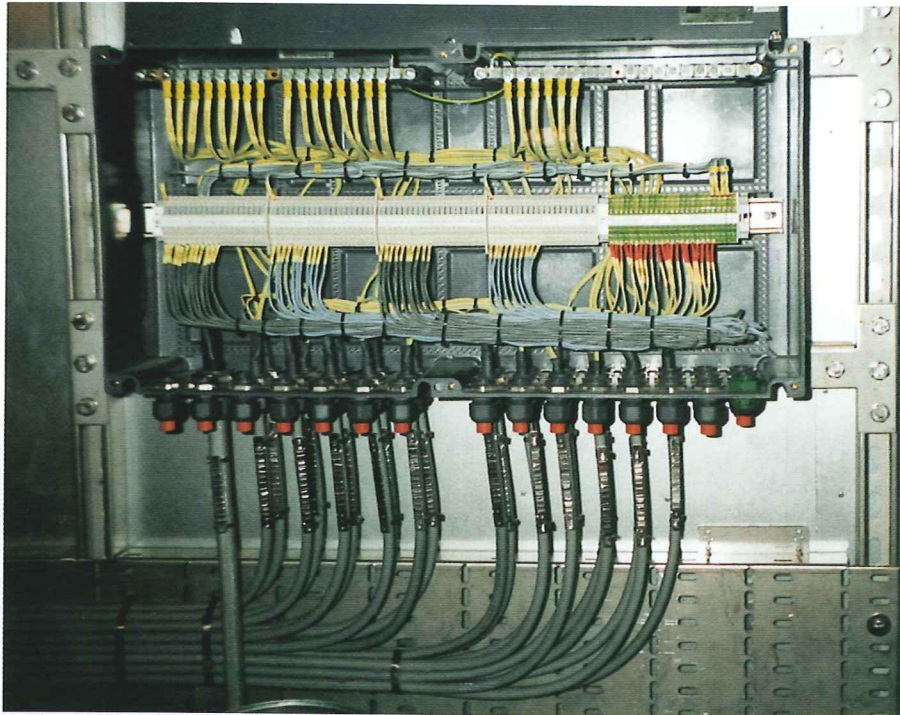


Figure 4: EEx e distribution box in the process area of the FPSO

systems and the seven flexible risers are connected. The risers, flowlines and mooring lines are also directly connected with the wellhead platform. The FPSO has the possibility to align with wind, waves and currents because of the rotatable turret. A rotation of about 10 times 360° in one direction will be possible before it will be necessary to turn the FPSO into the opposite direction.

Twelve mooring lines reaching from the centre of the turret to the anchors ensure that the vessel will retain its position. The SSIV (Sub Sea Isolating Valve) is also connected to the turret for safety reasons.

The safe and reliable swivel system also serves for transporting or transferring well stream fluid/gas, injection water and gas, signals and power between the turret and the vessel.

This causes a flexible and continual junction between FPSO and wellhead platform; the process of winning and processing crude oil.

Processing facilities have a maximum capacity of approximately 90.000 barrels of crude oil per day (One Barrel is nearly equivalent to 160 l).

The FPSO includes a storage capacity of about 6 days of crude oil production dependent on the standard flow rate. When the shuttle tankers cannot to be at the FPSO in time because of bad weather or traffic conditions, the times of not-offloading can be spanned without a production stop.

Gas for gas export and gas lift is compressed in three stages. Oil production wells are equipped with a gas lift, while water wells are provided with submersible electrical pumps. To meet the required product specifications the gas is processed to a higher level than is necessary for heating or lift gas.

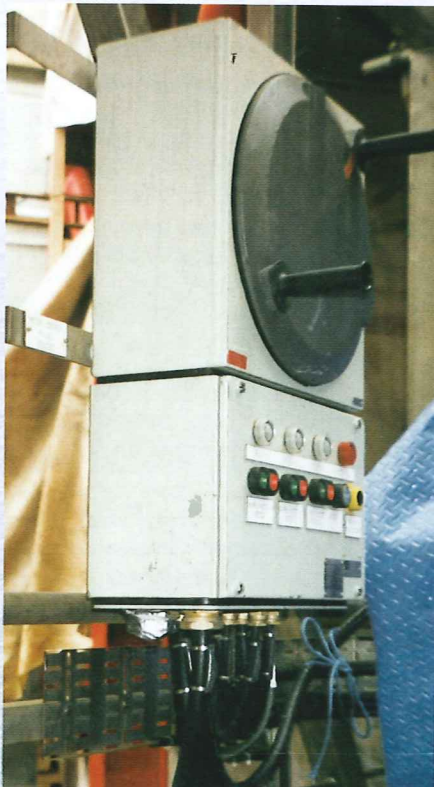


Figure 5: Flameproof control unit with connection chamber in EEx ed IIC T4 near the turret of the FPSO

- ◆ production process for cleaning and processing crude oil as well as gas
- ◆ storage of oil and LNG (Liquid Natural Gas) for later offloading to shuttle tankers
- ◆ power generation as well as the storage of diesel, drinking water and other essential substances

The hull was produced in Finland, the turret with the area next to it in The Netherlands and the living quarters in Scotland. The project design and also the production of the remaining areas of the FPSO was carried out in Norway.

The living quarters have beds for 60 persons. It also contains offices like central control rooms, safety stations as well as recreation rooms.

The production vessel rotates around the turret, where the mooring