

## Dunbar Field Life extended using Sulzer Multiphase Pumps

**“The advent of high power multiphase pumps is changing the world of oil production, in particular by allowing the exploitation of fields nearing the end of their useful lives. This revolutionary technique has been operated since Autumn 1999 on the Dunbar platform, in the British segment of the North Sea”**

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### Sulzer Multiphase Pumps

- The Sulzer MPP range of pumps are of the helico-axial design originally developed from the Poseidon research programme.
- Pumps of this design are particularly well suited to high capacities. Current installations include pumps with a total capacity of over 500,000 bpd

### The role of Multiphase Pumping

Multiphase Pumping is essentially a means of adding energy to the unprocessed effluent which enables gas/liquid mixtures to be transported over longer distances without the need for prior phase separation. This also enables the wells to produce at a lower WHFP (Wellhead Flowing Pressure) and so consequently :

- The production from existing fields and weak wells is increased
- Ultimate recovery is increased
- Life of a field can be extended.
- Development costs are reduced

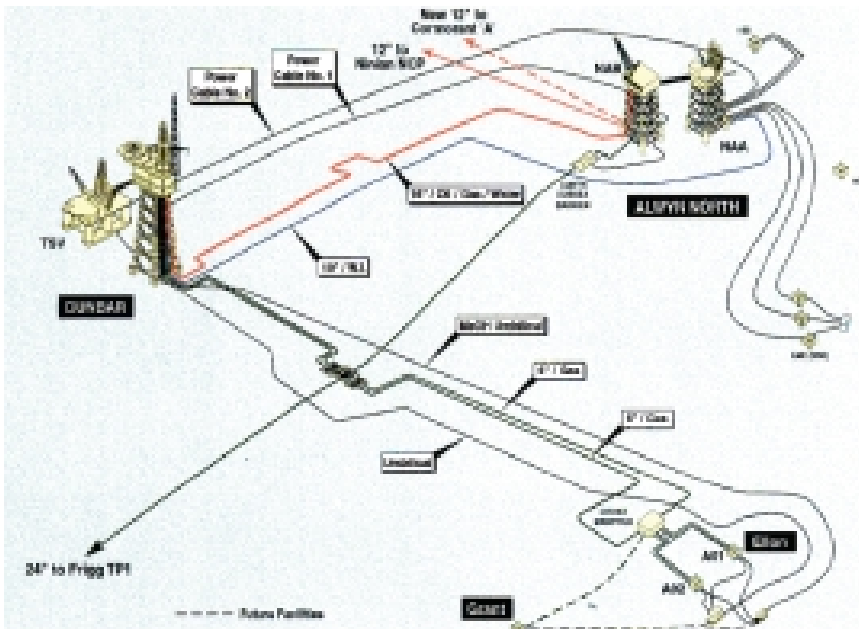
The Dunbar development is an example which demonstrates how these benefits have been realised in the field.

### The Dunbar Field

The Dunbar field is located 120 km North East of the Shetland Islands and 440 km from Aberdeen. Dunbar is a wellhead platform which is operated as a satellite of the Alwyn North Platform located 22 km to the North East.

In the first phase of production the wellhead pressure was sufficient for the effluent to flow naturally from Dunbar fields along a 16" multiphase pipeline to the Alwyn platform.

The introduction of multiphase pumps on Dunbar for the second phase has enabled production to continue in the face of declining wellhead pressure.



The Dunbar field

## Why multiphase pumps

The two main alternatives considered for the second production phase were :

Firstly a conventional system comprising a separator operated at low pressure with the liquids pumped and the gas compressed upstream of the multiphase pipeline

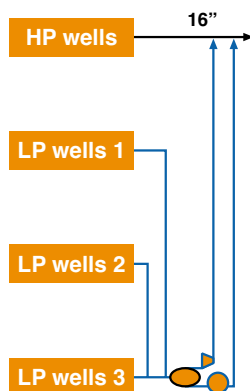
Secondly an innovative system using multiphase pumps to boost the low pressure wells directly into the multiphase pipeline.

Multiphase pumps were selected in preference to a separator based solution because :

- There would be no need to modify the existing facilities or process operating conditions
- They provide a more cost effective solution
- A module incorporating multiphase pumps would be over 30% lighter
- Vertically installed pumps minimised space requirements
- Weight and space reductions would facilitate the design of the proposed cantilevered module extension

Operational flexibility maximised by implementing a well segregation scheme using multiphase pumps

### Conventional concept



## Well segregation scheme

This scheme makes maximum use of the natural energy of the wells which means that electrical power requirements are minimised.

There are three independent lines

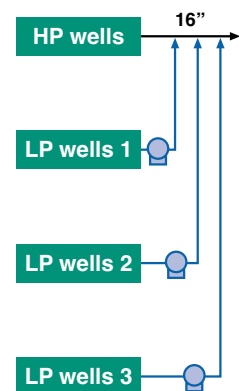
- High pressure wells bypass the pumps
- LP wells will be boosted from approx 70 to 125 bar.g via an 8 stage pump

Note : Both pumps are identical although the pump in this line is destaged to 8 stages

- LLP wells will be boosted from approx 50 to 125 bar.g via a 12 stage pump
- There is also provision for a third pump for even lower pressure wells (20-30 bar.g)

This system therefore matches pumping requirements to evolving and fluctuating production requirements

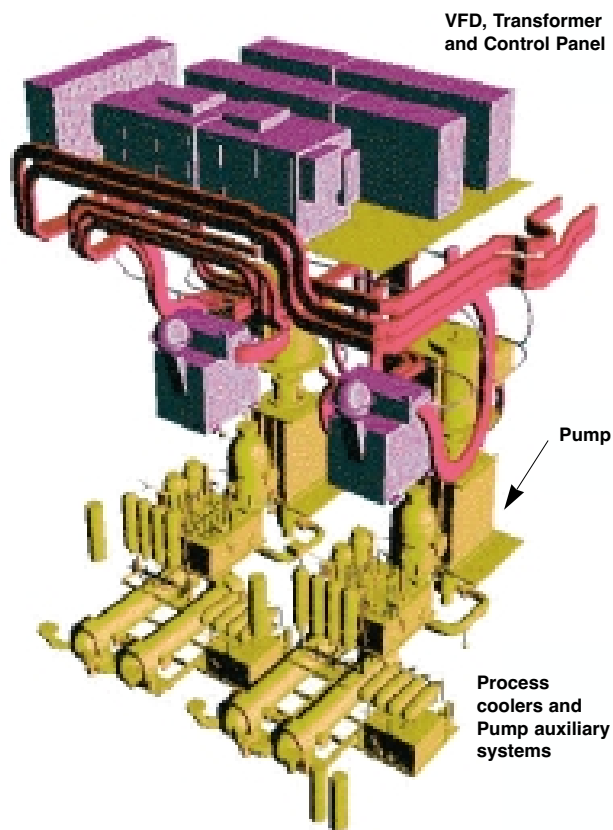
TotalFina Elf estimate that by 2004, approximately 84% of the oil production will be boosted



## Well segregation scheme

The pumpset packages were supplied by a consortium between Sulzer and ABB (who were responsible for the electrical equipment). Each pumpset comprises the following main items

- Process Cooler (by TotalFinaElf)
- Buffer tank at pump suction
- Multiphase Pump
- Epicyclic gearbox
- Lube oil and seal oil systems
- Electric motor
- Frequency converter
- Transformer
- Anti-harmonic filters



**Main Pumpset Components**

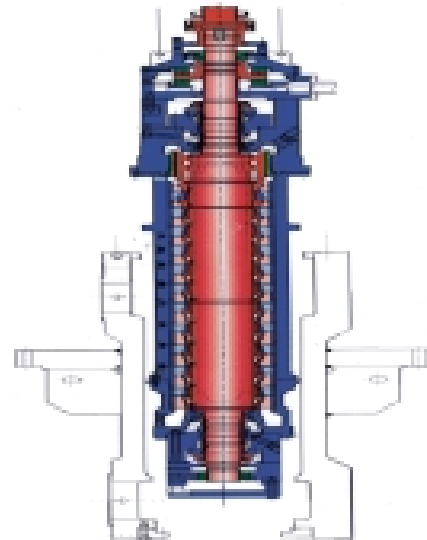
## Pump Description

Total Capacity	<b>180,000 bpd</b>
GVF	<b>30 – 90%</b>
Suction Pressure	<b>50 – 70 Bar.g</b>
Discharge Pressure	<b>125 Bar.g</b>
Speed Range	<b>3,500 to 6,000 rpm</b>
Motor Rating	<b>4500 kW</b>

### Pump design features include:

- Vertical barrel installation
- Axially split inner casing
- Twistlock design
- Tilting pad bearings
- Balance piston

These are the largest multi-phase pumps installed offshore world wide.



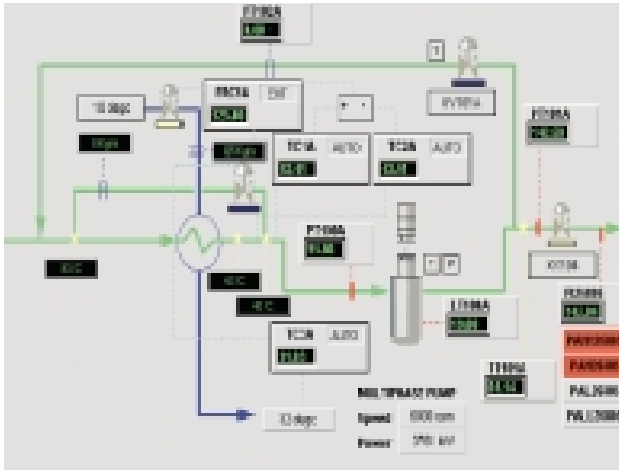
## Cartridge replacement

- Twistlock casing design facilitates cartridge withdrawal.
- Cartridges of different hydraulic design or stage combinations can be fitted to suit evolving production requirements



## Pumpset Control

- The pump speed is adjusted via the frequency converter to suit process and export requirements.
- The pump is designed for use on an unmanned installation. Pump monitoring and speed control can be effected remotely from Alwyn



## Installation

The pump was incorporated into the module at the fabrication yard. The module measures 12m x 7.5m x 19m high and weighs 650 tonnes. The module was installed on the platform in the summer of 1999 and the pumps commissioned in November of the same year.

Since the pumps were commissioned, the pressure in certain wells has declined further. To compensate for this, the pump in the LP line has since been updated to 12 stages.

## Field Reserves significantly increased

The importance of this multiphase pump installation is demonstrated by TotalFinaElf's estimate that the impact on production from the Dunbar field will be as follows :

### “Key Figures :

- Estimated Reserves in 1986 : 435 million bep
- Reserves re-assesses in 1994 at 700 bep
- Estimated reserves in 2001 owing to multiphase pumps; 1.2 billion bep”

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