THE CHALLENGE OF DESIGN AND OPTIMISATION OF CENTRIFUGAL COMPRESSORS FOR THE UK'S LARGEST PRODUCING OFFSHORE GAS FIELD

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Abstract

The South Morecambe Field, owned and operated by Hydrocarbon Resources Ltd (a wholly owned subsidiary of Centrica PLC), has proved and probable reserves of 5.3 tcf and is located offshore in the East Irish Sea. With a plateau production rate of 1800mmscfd, the field delivered up to 20% of the UK peak gas demand.

The field has been operating for over 15 years, initially free-flowing, later with two 26 MW gas turbine driven offshore compressor trains. The reservoir pressures have since declined and two additional 30 MW gas turbine driven compressor trains have been installed onshore to boost gas delivery pressures.

Output from the South Morecambe field must react readily to fluctuations in national gas demand. Production from the facility varies considerably between summer and winter months. This presented a major problem in the design of the centrifugal compressors since suction and discharge pressures were are not constrained, but vary on a monthly, weekly, and daily basis.

Conventional methods of gas compressor specification failed to provide a practical design, which could operate over the wide variety of flow and total head requirements of the field. In order to determine the operating conditions of the compressors on a year-by-year basis, a computer model was built of the entire gas field including the reservoir, wells, gathering system, processing equipment, and sub-sea pipelines. The model allowed flow and reservoir pressures during future years production to be simulated.

CASE STUDY

This paper presents a case study for the optimisation of centrifugal compressor design, and definition of performance envelopes, which most closely meet production requirements. It describes how the compressor performance maps were optimised using the integrated model of the gas field, allowing a full range of operating scenarios to be investigated. This ensured that the operating points stayed within the efficient range of the compressor map and did not move deeply into stonewall or operate in recycle, irrespective of the flow demand and train availability.

The centrifugal compressor trains designed using this method have been operating successfully since October 2001, and have met the full range of production conditions specified by the operating company.

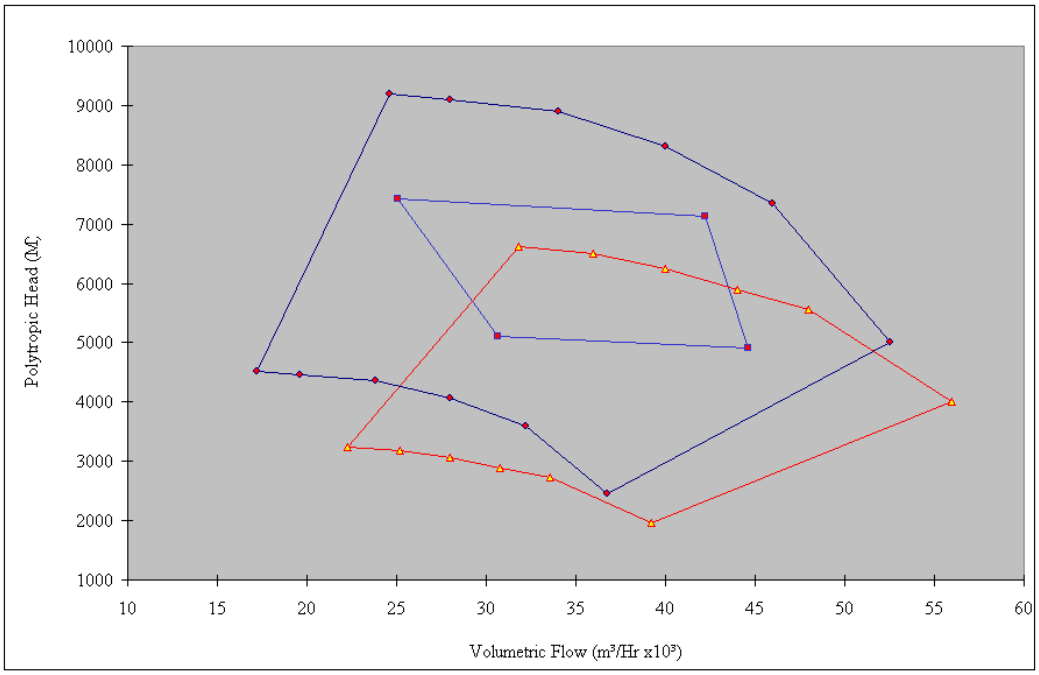

Figure 1

Vendors Revised Compressor Design LP Compressor Compared to Original Tender

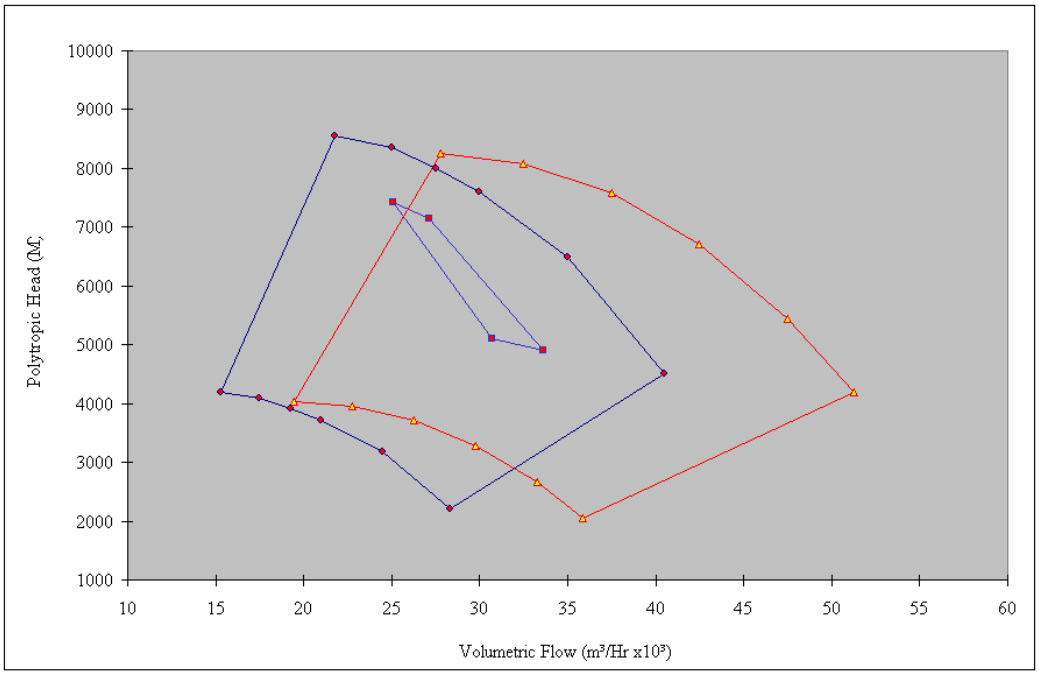

Figure 2

Vendors Revised Compressor Design HP Compressor Compared to Original Tender

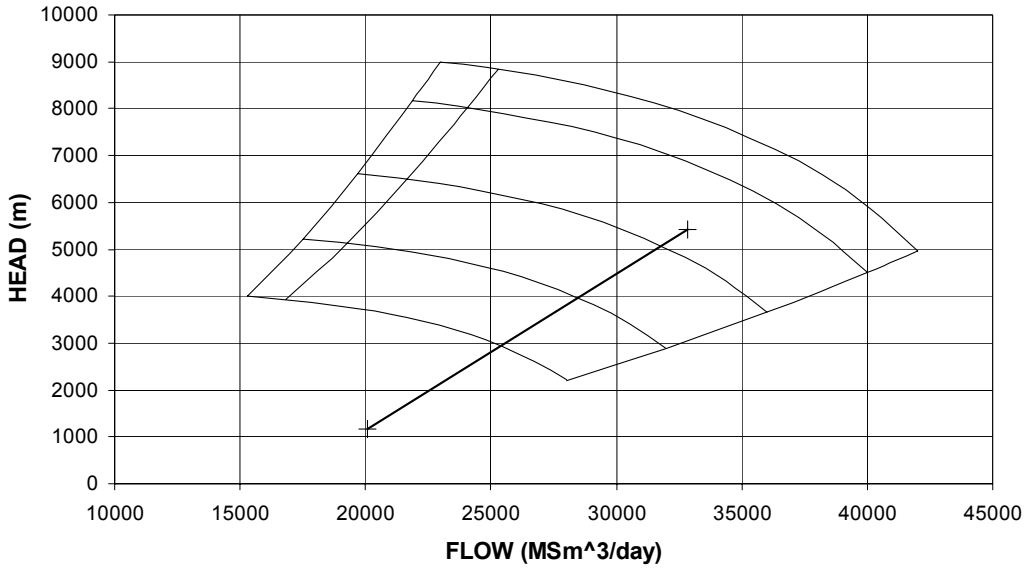

Figure 3

Variation in Operating Point Using Established Procedures

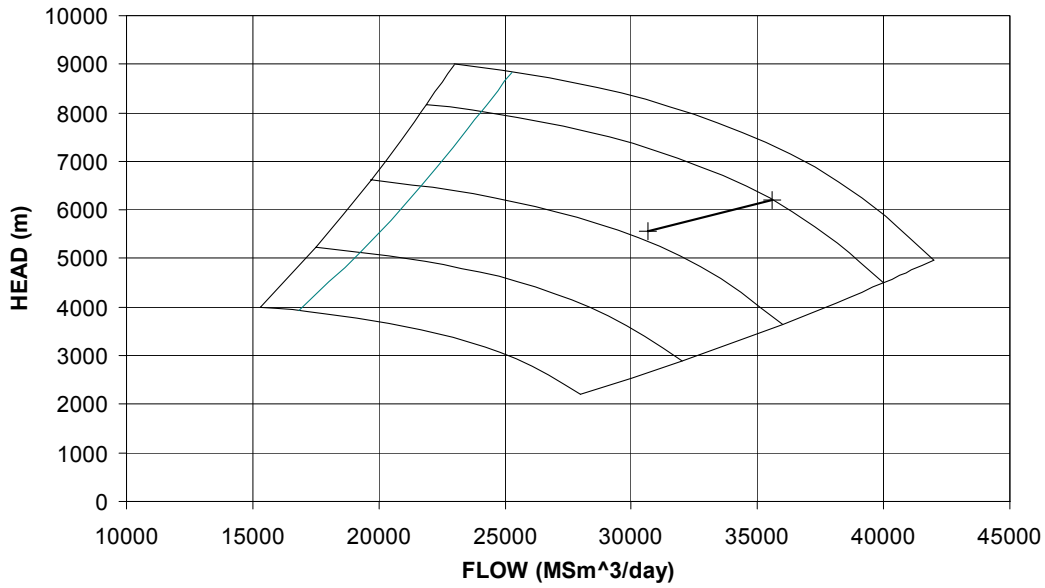

Figure 4

Variation in Operating Point Using Regime Determined by the GASMAN Model