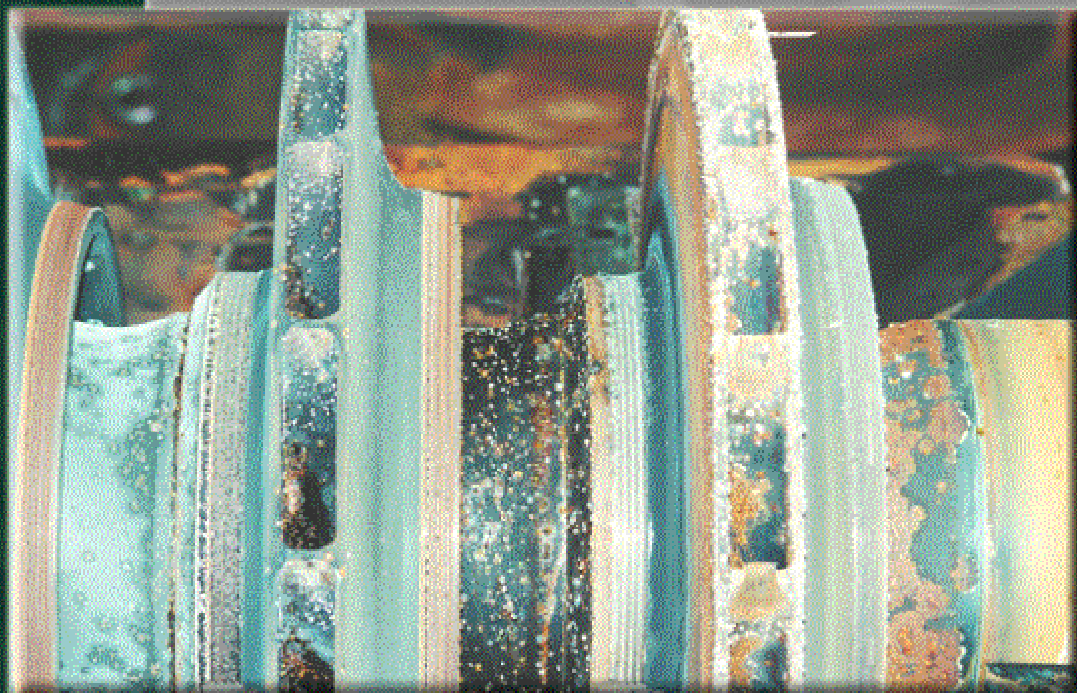


JOINT INDUSTRY PROJECT

**Pointing to the Optimum Centrifugal Compressor
For Hydrocarbon Gas Service**





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For Hydrocarbon Gas Service

Participating Companies



BACKGROUND

Compressor fouling and deterioration causes production losses on many major platforms and disrupts strategic supply sources for gas around the UK. Yet many other installations operate very successfully without suffering fouling. Up to today, expensive refurbishments have provided the only realistic way of countering fouling, but this frequently perpetuates problems, and recurrent production losses are experienced in subsequent operation.

Getting on top of compressor performance is central to production. Yet what goes on inside centrifugal compressors in the field is a mystery to most, including the manufacturers.

So how can a company be sure its equipment is working optimally? And how does that performance compare with others in the same industry? For a field producing \$500,000 a day, a 15% loss in performance matters.

This thinking led to MSE (Consultants) Ltd setting up the first ever Joint Industry Project (JIP) for optimum centrifugal compressor performance in the hydrocarbon gas industry. The JIP '*Pointing to the Optimum Centrifugal Compressor for Hydrocarbon Gas Service*' was launched by MSE in the UK to:

- Decipher the factors that characterise fouling in compressors, derived by the evidence provided by analysis of the combined experience of a wide population of compressors used in hydrocarbon gas compression service.
- Evaluate the performance losses experienced by centrifugal compressors, which so often lead to loss of production and equipment failure.
- Choose examples of compressors operated on major production platforms where performance loss in production is experienced, and quantify the efficiency losses.
- Choose examples of compressors with good performance retention in production applications and quantify their performance.
- Make an analysis of the population of compressors; isolate the effects of process conditions, operational usage characteristics and process system designs.
- Isolate the effects of seal wear, balance piston wear, diffuser fouling, blade fouling, internal recycle.
- Analyse differences in centrifugal compressor design criteria and isolate connections to fouling effects.

The outcome would be a blueprint for the optimum centrifugal compressor, resistant to fouling, and with maximum performance retention.

JIP: PHASE 1

This was the 'what'. It involved collecting operating data from some 50 compressors, constructing a database to enable the machines to be benchmarked and conducting an initial performance analysis. MSE quantified head and efficiency losses and produced initial population trends. They found:

- Up to 25% head loss and efficiency loss (compared with manufacturers' data)
- Power discrepancies between absorption and delivery
- Certain compressor designs may be more susceptible to performance loss than others

JIP: PHASE 2

Second phase was the 'why'. MSE showed:

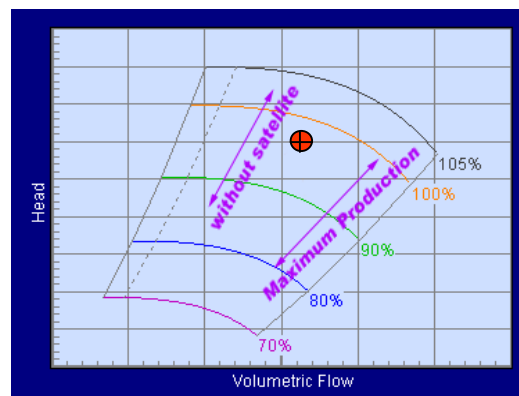
- The effects of four key performance loss mechanisms
- Sensible design decisions lead to performance retention
- Even a low level of liquid carry-over leads to sustained performance loss

Now each JIP member can view, online via a secure password, the performance of their own machines and how they compare, in detail, with various trends exhibited by anonymous data from the other members of the JIP.

JIP: PHASE 3

The third Phase linked performance loss mechanisms to compressor design attributes and produced a series of invaluable design guidelines, which have been validated against extensive field data collected during the project, for operators.

It was concluded with a September workshop and seminar for compressors users with the theme: '*Regain Performance to Recover Production*'. The stand-alone seminar was also open to non-JIP members.



TECHNOLOGY

Under this Joint Industry Project MSE has developed:

- 12 design guidelines for optimum design of centrifugal compressors
- The database of over 50 centrifugal compressor designs and real performance characteristics
- The Loss Mechanism Test - for diagnosing causes of compressor degradation from performance measurements
- The Health Index - for calculating the risk of exposure to performance losses of a new design

Design Guidelines for Optimum Centrifugal Compressors

By analysis of the design and operational characteristics of over 50 compression trains, twelve centrifugal compressor design guidelines have been derived. The guidelines direct engineers and designers in correct machine selection, ensuring peak performance and robust design to protect against performance losses due to service related problems.

Industry Wide Machine Data-Base

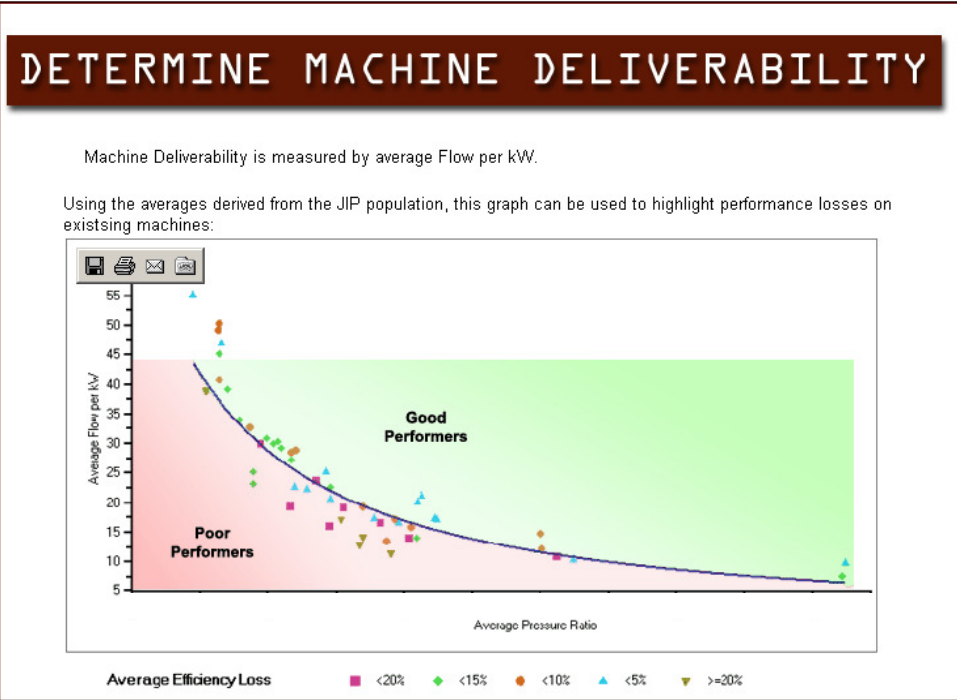
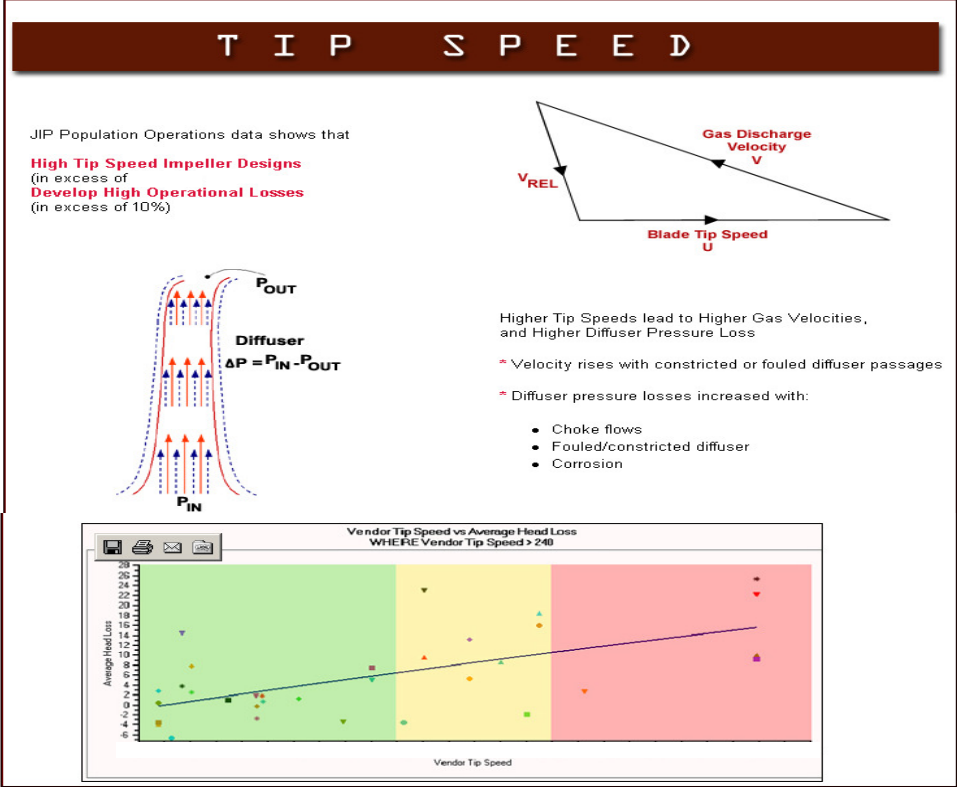
An Industry wide Machine Data-base (currently over 50 machines) supported on the internet, is now accessed by the five oil companies to evaluate their designs with the accumulated experience of the growing population. Designers may determine the optimum impeller geometry, speeds, and impeller diameters. The database identifies machine geometry for peak efficiency. It identifies the machines that show the greatest fall in efficiency with use.

Loss Mechanism Test

The Loss Mechanism Test diagnoses causes of performance losses to direct engineers about how to provide optimum maintenance of compressors. Machine performances are improved to deliver higher production flows.

Health Index

A Health Index for compressors has been invented. It is based on impeller geometry, compressor speed, and other selection criteria, and compared with the process demands for which it has been derived. The Health Index identifies by a numerical value, the suitability of the design for the duty. It also enables technical comparison of alternative proposals to be evaluated and compared in order that the optimum is selected.



WHAT HAS BEEN ACHIEVED

MSE developed a large database of compressors and drivers and performed a rigorous analysis of the operating data.

The results of MSE analysis were presented in three separate workshops that were organised at the culmination of each Phase of the JIP project.

The workshop enabled full interaction with the engineers of the participating companies and results of their machines were discussed in full during the workshop.

JIP MILESTONES

MSE met all the JIP milestones and delivered to the participating companies:

- **British Gas (HRL)**
- **BP**
- **ConocoPhillips**
- **BG Group**
- **ENI Lasmio**

All the participating companies were satisfied with the outcome of the JIP. All of them requested that the data collection and analysis of the machines be extended for a further 12 month period to enable additional data to be collected and analysed to provide further input to the database.

The more machines in the database, the greater is its effectiveness in identifying best designs and rooting out operational problems.

For further information, please contact:

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