Guidelines for the life extension for safe operation of ageing rotating equipment on offshore petroleum installations: Centrifugal compressors
Guidelines for the life extension for safe operation of ageing rotating equipment on offshore petroleum installations:
Centrifugal compressors
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FOREWORD

The centrifugal compressor is one of a series of rotating machinery types that operators may seek to deploy beyond design life. This document aims to provide those involved in operation and maintenance of such equipment; including managers, designers, equipment manufacturers, and integrity and maintenance engineers, with good practice guidance on how to ensure that the integrity of centrifugal compressor equipment is retained when operated beyond its designed operational life.

This document was written and compiled under the direction of a joint industry Steering Group (SG) comprising personnel from a cross-section of UK offshore operators, original equipment manufacturers (OEM), relevant service companies, and Lloyd’s Register EMEA. The SG members provided input to the development via discussion at meetings, correspondence, individual contributions and with provision of industry experience and other selected information.

Although instigated by, and produced for, the UK offshore petroleum industry, guidance provided herein is regarded as being applicable to similar industries throughout the world. It may also be useful to those involved in related onshore terminal and process plants.

Note: In several places throughout, use has been made of examples which have been provided by members of the SG. Where these have been cited, it is implicit there are alternative ways and methods that other users may use to meet the same objective that may also constitute good practice. Therefore, these examples are provided for guidance only and should not be regarded as a recommendation or a standard.

This publication has been compiled for guidance only and while every reasonable care has been taken to ensure the accuracy and relevance of its contents, the Energy Institute, its sponsoring companies, the document writer and the Steering Group members listed in the Acknowledgements who have contributed to its preparation, cannot accept any responsibility for any action taken, or not taken, on the basis of this information. The Energy Institute shall not be liable to any person for any loss or damage which may arise from the use of any of the information contained in any of its publications.

These guidelines may be reviewed from time to time and it would be of considerable assistance for any future revision if users would send comments or suggestions for improvements to:

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1 INTRODUCTION

1.1 GENERAL

These guidelines have been compiled to assist the operators of centrifugal gas compressor equipment with assessment of integrity to confirm fitness for purpose when required for service beyond its design life. This is consistent with a UK offshore oil and gas industry initiative in support of the findings of the UK BERR Report of the PILOT 2004 Brownfields Studies Maximising economic recovery of the UK’s oil and gas reserves.

This was an implicit recognition that the UK offshore infrastructure, which is approaching or has already reached, the end of its original design life, will either have to be replaced or procedures established and implemented to safely extend its operating life to the end of viable production. Hence there is the need for such critical equipment, especially on reaching the end of its original design life, to be subject to inspection programmes to ensure continued safe operation to the end of field production. Where deployed for offshore and coastal applications (i.e. in harsh marine environments), this issue has even greater importance.

Centrifugal compressors for hydrocarbon services are generally designed in accordance with API 617. This standard places expectations on manufacturers regarding minimum design life of equipment as follows:

‘The equipment (including auxiliaries) covered by this standard shall be designed and constructed for a minimum service life of 20 years and at least five years of uninterrupted operation. Note: It is recognized that this is a design criterion.’

It is also important to note that other design criteria, such as the need for mechanical rigidity, result in most compressors having a service life expectation which is much more than 20 years and also that machines which are exposed to particularly harsh operating conditions may require replacement or significant repair before 20 years have elapsed.

1.2 HYDROCARBON RELEASES FROM COMPRESSORS

Recent hydrocarbon releases data for the UK offshore industry are given in the HSE Research report RR672. The data are based on all recorded hydrocarbon releases between 1992/1993 and 2006/2007 and as such, are able to provide a reliable basis for their number, types and sources. Figure 1 shows the total number of releases including those that ignited during the same period. The graph shows that there has been a downward trend in total releases but the number of releases ignited per year has remained somewhat constant.

The leak data presented in Table 1 for gas compression system reflect leaks from the whole gas compression system, including small bore tubing assemblies and the equipment defined in Annex D as well as process pipework and equipment that is outwith the scope of this document.