



“Testing Excellence”



**Testing Facility at Mill Close
Officially Opened by Lord Coe
on the 6th October 2003**

The AESSEAL[®] Group
of Companies

Designers and
Manufacturers of
Mechanical Seals and
Engineered Seal
Support Systems



AESSEAL® Testing Facilities

Introduction

The new AESSEAL® Testing Facility represents AESSEAL's huge commitment to the research and development of mechanical seals and seal support systems. With an investment of more than £1,000,000 (\$1,800,000/€1,500,000) in the building and considerably more in the facilities within, AESSEAL® believe it is the most advanced facility of its kind in the world. This document is designed to give a brief guide to the new test facility outlining how it will evolve as more test rigs are built to meet the companies need to develop new products and enhance its product range further. This will ensure AESSEAL® continue to have the latest technology available to develop and test mechanical seals for the whole spectrum of duties found throughout the world today.



In 2002 the previous smaller test facility was replaced by a new larger self contained building with numerous test rooms, offices, central logging rooms and emergency de-contamination facilities. There is also a wide corridor for fork lift truck access to all test rooms and a separate area to the rear of the building housing all test rig services, test equipment components and test fluid storage. This new building was also designed so that future expansion could take place to the rear of the building by the addition of further internal test rooms without having to resort to major reconstruction work. In reality what has actually taken place is that the new test facility has been built around / over the original building so that product development testing could be carried out right up to the final changeover with eventually only the API 2 test rig remaining which was finally integrated into the new building.



AESSEAL® Seals and Systems are ATEX compliant.



Test Support Facilities



Each new test room is fully equipped to test a particular group of fluids or specific type applications as the need arises. Each test room accommodates a standard test rig main frame designed to accept interchangeable sub frames each with their own particular rig configuration i.e. motor (FLP or non-FLP), coupling, bearing housing and respective shaft size. This gives great flexibility since test rigs can simply be interchanged as and when required using the fork lift truck. In fact the whole of the facility has been designed with sufficient clearances for safe fork truck operation.

The testing facilities currently house a total of 14 different test rigs throughout the various rooms. All services are available for each rig and are fed from the service area as follows:

1. Chilled water at 2°C (36°F)
2. Pumped water (closed loop with return tank cooling coil).
3. Direct water feed from high level gravity tank.
4. Nitrogen gas at a pressure range of 0 - 100 barg (0-1500psig) . All bottles are housed in a purpose designed storage area and each test rig feed line incorporates system over pressurisation protection.
5. Steam services for test rigs employed on oil testing.



The test facility is also equipped with the latest health and safety features including emergency showers at appropriate locations throughout the facility to enable instantaneous action in the event of personnel contact with a dangerous test fluid such as Sodium Hydroxide or similar.

Workbench facilities are also provided in the service area along with racking for test equipment and test fluid storage. The test fluids are stored in purpose designed trolleys to prevent spillage of fluids and consequential environmental contamination.



The whole site has also been awarded the ISO 9001 Quality Assurance Management System, the ISO 14001 Certificate of Approval from Lloyds

Register Quality Assurance for its own Environmental Management System and in July 2004 all AESSEAL® systems were approved to the OHSAS 18001 Health and Safety Standard.

Future expansion of the test facility will be into this area with the option to construct further purpose designed test rigs as the company continues to expand its product range.

On the latest design of test rig AESSEAL® have moved from part manual / part automatic operation (similar to the original API 2 test rig), to fully automatic testing where test parameters are input via a virtual control panel and all aspects of the test / data collection are carried out automatically. This allows more time for other duties since the cyclic phase of API 682 pre-qualification testing is very time consuming due to the need to continually adjust the test conditions in accordance with the above test criteria. The high temperature and pressure test rig is AESSEAL's first fully automatic test rig and it is envisaged that all future large test rigs will utilise this method of test rig control / data handling.





AESSEAL® Testing Facilities

Facilities

Working from one end of the building to the other the test facilities comprise:

API 1 Test Room

It is intended that a Propane test rig will be built in this room. Until that happens this test room is used to allow small ad hoc tests to be carried out as the need arises.

In the longer term we will be building a new test rig designed to enable API 682 Second Edition low temperature hydrocarbons (Propane / low temperature oil) to be tested. In this room windows are removable since propane has to be tested in an “untented” area. Floor channels are also incorporated for housing the Propane detectors that will safely shut down the test in the event of any serious leakage. All electrics within the test rig area will be FLP (flameproof) design.



The main electrical panels (non-FLP) will be housed in the adjacent control room with all cable entries to room sealed gas tight.



Development Rig Room

This is a test area that is used for cool / non-hazardous product testing and is used for small experimental tests. Rig arrangements are continually adapted to suit the nature of the test which can vary from product development testing, replication of customers site duty,

troubleshooting, customer witness tests or simply product enhancement testing. The room is equipped with power outlets for small inverters and motor cooling fans, cooling outlets, nitrogen outlets and networked Fluke loggers / laptops for data collection.

Within this area we have the ability to run 3 test rigs (up to 7.5 kW per rig) concurrently with the option for a 4th test rig as the demand on our resources grows.

Recent developments tested in this area include dry running reactor seals (shown right).

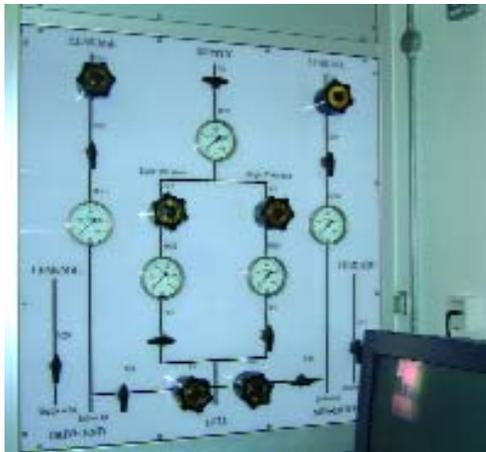


350 barg (5000 psig) 45,000rpm Test Facilities



High Speed / High Pressure Dry Gas Seal Test Room

In anticipation of Testing requirements AESSEAL plc in partnership with Corac Group PLC have created a modular test facility which will allow High Pressure Dry Gas seals, from 50mm to 280mm, to be tested. Both single and double seal configurations can be tested in the new facility that uses state of the art control and logging software and hardware from National Instruments together with precision instruments including mass gas flowmeters which measure gas consumption.



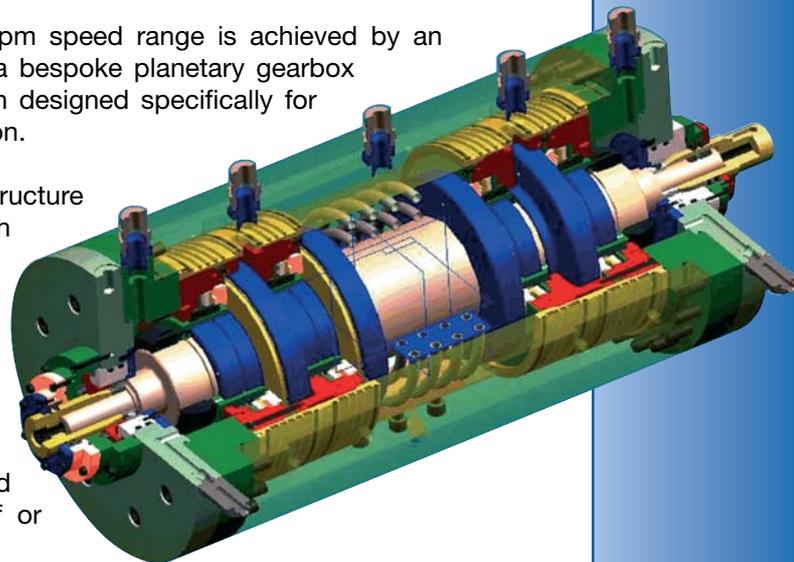
We have the ability to test seals at pressures up to 350 barg (5000 psig) and at shaft speeds of 45,000 rpm. For this facility AESSEAL® has purchased a compressor to generate the necessary compressed air.

The air pressure during the test is controlled with a specially designed gas panel that can cope with the full range of pressures.

The 45,000 rpm speed range is achieved by an inverter and a bespoke planetary gearbox that has been designed specifically for this application.

The test room as a whole required additional infrastructure putting in place including a large water cooling unit which has been piped to the test room to provide temperature control to the seal vessel and an overhead crane to install the test vessel.

The result of the investment is that AESSEAL® now has a fully capable, modular test room which can be used to test the full size range of gas compressor seals across the full performance range. Tests are computer controlled and all relevant parameters are also logged for proof or reference.



This installation has departed from our previous equipment in terms of shaft speed, pressure and working fluid (now compressed air) and has required an investment of over £290,000 (€435,000 / \$522,000).



It is expected that each of the Dry Gas Seals that we sell may require a witness test and this investment represents a substantial commitment to this market.



AESSEAL® Wet Testing Facilities

High Temperature & Pressure (HTP) Test Room- Tests to 100 barg (1,500 psig) and 260°C (500°F)

This test rig is capable of operating with product (oil or water) within the temperature range of 20 - 260°C (68 - 500°F) and pressures up to 100 barg (1,500 psig) with variable speed control. The rig is arranged so that 2 seals are fitted and they are able to operate with cooled Barrier Fluids up to 40 barg (600psig).

It is also very different from the adjacent API 2 Test rig in that all aspects of test rig operation, control and data collection are fully automatic via a National Instruments FieldPoint unit which is also connected to the local area network (Ethernet). The FieldPoint is initially programmed local to the main control panel by means of a Laptop since it is easier to check whether the equipment is functioning properly when local to the test rig. The specially



compiled test software, based around NI Labview Version 7, offers the user either manual or fully automatic mode of testing. In the automatic mode, which is based upon a typical API 682 dynamic / cyclic phase test, all aspects of the test such as operating parameters, sequences, equipment in circuit and associated safety circuits etc are pre-programmed. The FieldPoint unit then controls all aspects of the test and transmits data packets via the local area network to the PC situated in the centralised data logging room adjacent to our office. At certain points within the test, the programme waits for user input i.e. leakage measurement which is difficult to measure automatically, before moving on to the next stage of the test. The manual mode allows test parameters such as speed and pressure to be input but does not stop / start the rig automatically or follow any particular test procedure.



The FieldPoint also allows remote user access and observation / amendment of test parameters from remote locations via the internet using a unique password for this access. The basic product circuit comprises high temperature / high pressure circulation pump, 20 kW heater, high temperature / high pressure inline cooler and inline heat exchangers and high temperature / high pressure flexible hoses and isolation valves. Incorporated into this circuit is a flush control system to both seals and dead legs incorporating system control and safety features. Chilled and cooling water services are also fed to the inline cooler and inline heat exchanger automatically controlled by the Fieldpoint unit via motorised proportioning valves. Barrier fluid systems incorporating automatic control and safety features are also incorporated to both test and slave seals. Expenditure on this particular test rig is currently in excess of £100,000 (\$180,000 / €150,000).





API 2 Test Room

This is the original API 682 hot oil test rig which is the only test rig remaining from the original building. It is now serviced from the new service area as previously described. The test rig is designed to test hot oil up to 260°C (500°F) and 40 barg (600 psig). This rig is semi-automatic but requires personal presence at certain times during the API 682 cyclic phases, which on the high temperature tests can take approximately 5 working days to complete.

API 3 Test Room

This area is currently being used for running additional small test rigs on cool tests such as further MagTecta™ bearing isolator enhancements, improvements to pumping seal performance, seal face comparison torque tests, ATEX product evaluation etc.

In the longer term this test room will house a further API 682 test rig designed to test hot water or Caustic Soda. Again as in the high temperature / high pressure rig it is envisaged that it will be fully automatic.



Central Logging / Post Test Seal Inspection Room

This area houses the centralised PC that collects and stores data from the automatic high temperature / high pressure test rig within the test facility. It also serves as a “clean” area for pre / post test analysis of seal components. Within this area there is equipment to check seal face flatness, magnification equipment to closely scrutinise seal face condition and other equipment used to examine mechanical seals. Seal face wear measurements and seal face surface finish are measured in the Inspection Department situated within the main building.





ENVIRONMENTAL TECHNOLOGY

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sealed with
engineered
excellence

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Due to continuously fluctuating exchange rates this document assumes that UK £1 is equal to US\$ 1.8 /€1.5.