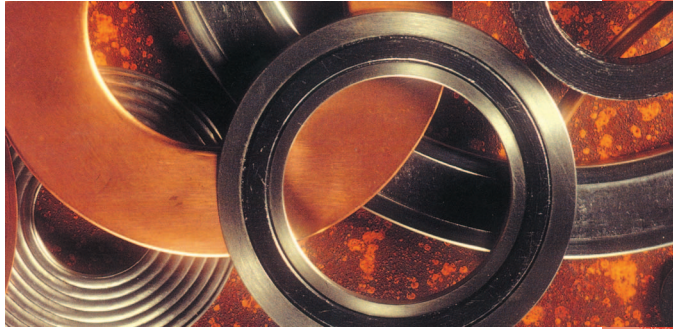


Products and Services

amtec



ASTM, EN 13555,

**ADVANCED**

DIN 28090, DIN 28091,

**GASKET**

DIN 52913, DIN 3535, and

**TESTING**

User Defined Procedures

amtec

Advanced Tools and Comprehensive Services for  
the Reduction of Fugitive Emissions



To a high degree, the correct function of a gasketed joint depends on the behavior of the gasket. Typical gasket characteristics can be expressed in gasket factors. Such gasket factors are important for the selection of a suitable gasket for a specific application; they are also necessary for

## Gasket Factors for Selection, Analysis and Quality Assurance

tightness and stress analysis purposes (including the calculation to determine the prestress value or tightening torque). Gasket factors are also important for gasket manufacturers, e.g. for quality assurance purposes.

Regarding the choice of a gasket, the long term behavior with a given medium and at given environmental parameters are of interest.

Tightness or a certain tightness class can only be achieved if there is a good seating of the gasket during assembly and if there is a minimum required gasket stress during every relevant state of operation. Both stress values depend on the given medium and on the internal pressure. They characterize the tightening behavior of the gasket material.

**LONG TERM BEHAVIOR**  
**TIGHTENING CHARACTERISTICS**  
**DEFORMATION CHARACTERISTICS**



If the real behavior of a flanged joint has to be described (e.g. by calculation), the elastic recovery and the elastic-plastic behavior of the gasket have to be considered. Additionally, the upper limits of the gasket during assembly and in operation have to be known. These gasket factors characterize the deformation behavior.



In the U.S.A., generic gasket factors are defined in ASME pressure vessel design standards. However, their use is restricted to design purposes. In several PVRC projects new gasket factors were defined including the related test procedures; these gasket factors characterize both the deformation behavior and the sealing behavior. This experience is summarized in ASTM standards.

Additionally, there are several ASTM standards that give procedures regarding the determination of deformation and sealing behavior as well as the long term behavior of gasket materials. ■■■■■■■■■■

In Europe, gasket factors that characterize both the deformation behavior and the sealing behavior are defined in the European standard EN 13555. This standard also includes guidelines for the determination of the factors in special laboratory tests.

These gasket factors are used in standards for flange calculation (e.g. EN 1591).

EN 14772 and DIN 28091 are test procedures regarding quality assurance of the gasket manufacturing process. Further tests that are familiar to certain applications are included in DIN 52913 and in DIN 3535.

Additionally, there are special test procedures provided by gasket manufacturers and by major end users (e.g. chemical and petrochemical industry) regarding qualification/screening of gaskets and quality control purposes.

- ASTM-TESTS**
- PVRC PROCEDURES**
- EN 13555**
- DIN 28090/91**
- DIN 52913**
- DIN 3535**
- USER DEFINED PROCEDURES**
- FIRE SAFE TESTS**
- PROCEDURES DEFINED BY INDUSTRY**



- COMPRESSION TESTS**
- LEAK RATE TESTS**
- CREEP TESTS**
- CREEP-/RELAXATION TESTS**

Although there are a lot of demands on the determination of gasket characteristics, only a few types of tests are required. Compression tests, leakage tests and creep relaxation tests are the most common ones.

For the determination of these gasket factors **amtec** developed a set of test rigs.



## Universal Test Rig

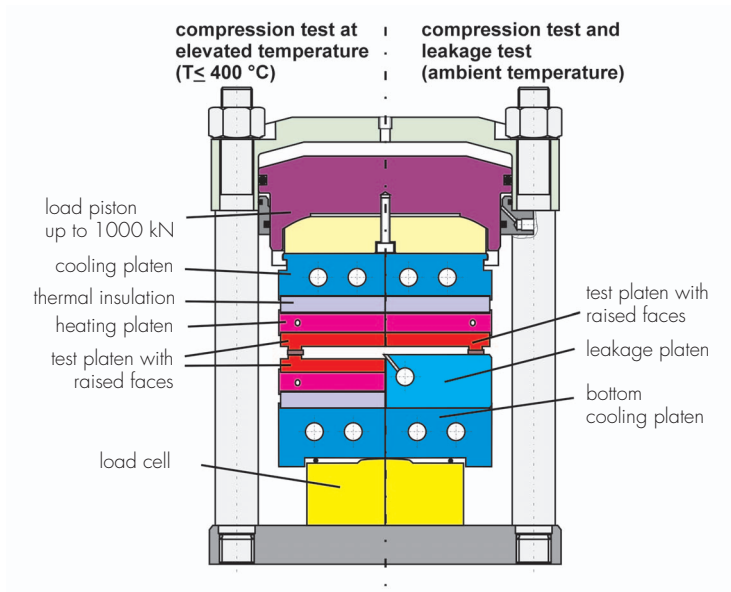
**TEMES™**  
*fl.ai1*

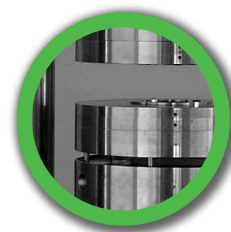
The test rig **TEMES fl.ai1** provides the possibility to perform compression tests, leakage tests as well as compression creep tests and creep relaxation tests. Compression tests and leakage tests can be made with steadily increasing load or with constant load. During compression creep tests, the initial stress (after mounting) decreases due to plastic deformations of the gasket.

Basically **TEMES fl.ai1** is a servo-hydraulic press. The test rig consists of different modules, i.e. different components can be assembled depending on the intended type of test. Especially the insulating, cooling and heating platens can be exchanged, but also the gasket platens for tests of different gasket designs (e.g. gaskets for floating type or metal-to-metal type joints).

The force acting on the gasket is measured using a load cell mounted on the bottom of the test rig. Gasket deformation is measured using displacement transducers. The temperature profile of the test rig is controlled using several temperature measurement points across the test rig.

Data logging, graphical and numerical display and data storage is controlled by a user friendly software. The tests can completely be performed under control of this specially developed software, thus tests according to standards (e.g. ASTM, CEN and DIN) are possible as well as tests according to a user defined specification.

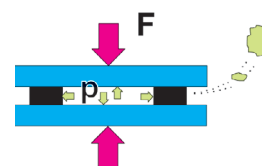
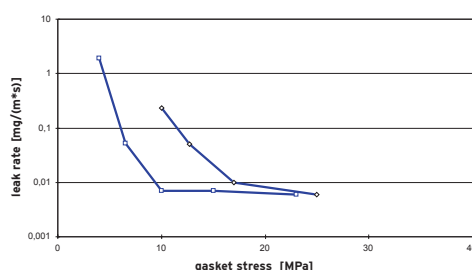
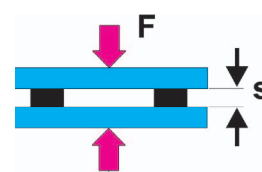
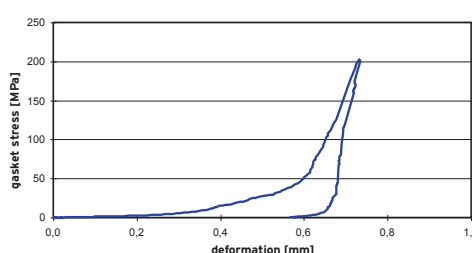




The standard method to measure leak rate is the pressure decay method. Every necessary valve is switched under computer-control allowing a fully automated procedure. As an option, the leak rate measurement can be made using a Helium leak detector. Thus, a wide range of leak rates can be covered.

Usually, leakage tests are performed with constant internal pressure and different steps of gasket stress. As the filling with medium and the application of pressure are done by computer-control, leak rate measurements at different levels of internal pressure are possible, too. The single steps of gasket stress are applied automatically and kept constant during the state of the test. Thus, loading and unloading curves can be determined. Leakage tests are performed automatically (device can be manually operated, too).

**TEMES™**  
*fl.ai1*



- 1 Mechanical Press
- 2 Leak Rate Measurement Equipment (Pressure Decay)
- 3 Computer and Monitor
- 4 Control Unit
- 5 Leak Rate Measurement Equipment (Helium Leak Detector)
- 6 Cooling Device
- 7 Hydraulic Pump



## Technical Details Test Rig

**TEMES™**  
*fl.ai1*

- ■ ■ **Modular Design**  
the test rig can be configured individually for compression tests, leak rate tests, creep / relaxation tests
- ■ ■ **Gasket Dimensions**  
outer diameter up to 160 mm / 6.5 inches, i.e. all important ASME/ASTM sizes as well as all DIN and EN – dimensions can be tested  
» other sizes on demand
- ■ ■ **Gasket Types**  
gasket for floating type flanges and gaskets for metal-to-metal type flanged joints (test platens can easily be exchanged)
- ■ ■ **max. Force 1,000 kN / 225,000 lbf**  
constant gasket stress can be adjusted and controlled by hydraulics
- ■ ■ **Internal Pressure**  
max. up to 200 bar / 2,900 psi » higher values on demand
- ■ ■ **Temperature**  
room temperature, elevated temperature (up to 400 °C / 750 °F standard) by use of integrated heating platens » higher/lower temperatures on demand
- ■ ■ **Medium**  
e.g. N<sub>2</sub>, He » CH<sub>4</sub> on demand
- ■ ■ **Leakage Rate**  
standard: pressure decay method, a good insulation guarantees isothermal conditions  
optional: Helium leak detector » other methods on demand

### Compression Tests - Measured Parameters:

- ■ ■ **Load**  
The gasket stress is determined using a high precision load cell.
- ■ ■ **Deformation**  
The gasket deformation is measured by means of accurate displacement transducers (multiple points along the circumference).
- ■ ■ **Temperature**  
Measurement and control of temperature during the test period.

### Leakage Tests - Measured Parameters:

- ■ ■ **Load**  
The gasket stress is determined using a high precision load cell.
- ■ ■ **Deformation**  
The gasket deformation is measured by means of accurate displacement transducers.
- ■ ■ **Differential Pressure (standard)**  
The pressure difference between a measurement volume and a reference volume is measured. This combines a high resolution (in terms of pressure decay) and short measurement periods.
- ■ ■ **Temperature of Medium**  
Medium temperature is controlled continuously during the tests. Thus temperature changes can be considered and corrected, if necessary.

### Creep Relaxation Tests - Measured Parameters:

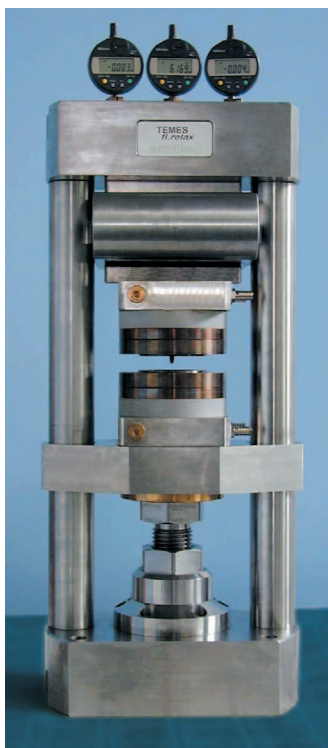
- ■ ■ **Load**  
The gasket stress is determined using a high precision load cell.
- ■ ■ **Deformation**  
The gasket deformation is measured by means of accurate displacement transducers.
- ■ ■ **Temperature**  
Measurement and control of temperature during the test period.

### Monitoring:

- ■ ■ **Computer Controlled online Monitoring**  
A computer controlled system provides permanent reliable data logging. Online graphics (including alphanumerics) give an overview over every stage of the test. Data storage is performed in a EXCEL-compatible format; thus user specific evaluations are easily implemented.

### Control and Operation:

- ■ ■ **Manual Control**  
Every function of the test rig can be controlled manually.
- ■ ■ **Completely Computer Controlled**  
Tests can be performed totally computer controlled. Thus even long term tests become cost effective.



In those cases in which a creep of the gasket could lead to an unloading of the flanged joint, gasket factors from creep relaxation tests are of interest. Influencing parameters can be stiffness, temperature, temperature changes, time etc. It is necessary to perform a lot of tests and most of them are of long term nature.

This is the reason why **amtec** developed an additional test rig especially for creep relaxation tests. These tests can be performed in **TEMES fl.ai1**, too, but as there are a lot of tests, a mechanical test rig seemed to be more convenient. With this test rig, called **TEMES fl.relax**, tests can be made in a more cost effective manner, several test rigs can be used, if necessary.

**TEMES fl.relax** basically consists of two platens with high stiffness; the gasket is compressed between these platens.

It is possible to heat the platens using heating platens similar to those of **TEMES fl.ai1**. The device is loaded mechanically.

The stiffness of the test rig can be modified by exchanging a specially designed stiffness-module. In the standard version, the maximum load is 300 kN (67,500 lbf), the maximum gasket diameter that can be tested is 100 mm (4 inches).

## Test Rig for Creep Relaxation Tests

**TEMES™**  
*fl.relax*

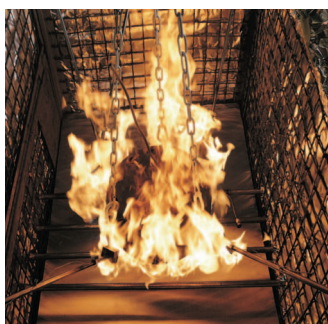
### Technical Details Test Rig TEMES *fl.relax*

- ■ ■ **Modular Design**  
the test rig configuration can be made to suit different gasket dimensions and different values of stiffness
- ■ ■ **Gasket Dimensions**  
outer diameter up to 100 mm / 4 inches  
» other dimensions on demand
- ■ ■ **max. Force 300 kN / 67,500 lbf**  
controlled loading of the gasket
- ■ ■ **Temperature**  
standard up to 400 °C / 750 °F (integrated heating platens)
- ■ ■ **Stiffness**  
different stiffness levels can be applied by exchange of stiffness module
- ■ ■ **Measured Parameters**  
gasket stress, gasket deformation, temperature; outputs for data logging systems available

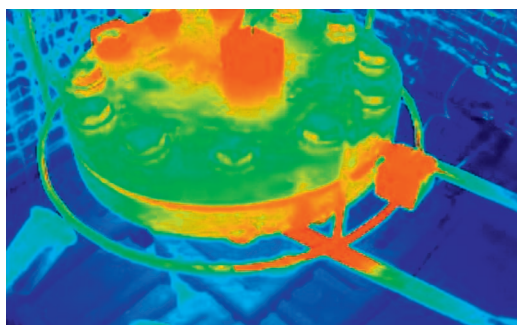
In addition to the test rigs described above there are several other commonly

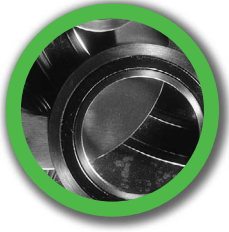
accepted applications/qualification tests.

One example is a test rig for fire safe tests. **amtec** developed this test rig to complete its scope of services and products.



## Test Rig for Fire Safe Tests





amtec provides a comprehensive set of products and services in the field of tightening joints (flanged joints and stuffing box packings), e.g. determination of gasket factors (as a service or test rigs), monitoring



- GASKET FACTORS**
- TEST EQUIPMENT**
- MONITORING**
- CALCULATIONS**
- MOUNTING**
- TRAINING**
- CONSULTING**

of the real loads and external environment, calculation of flanged joints and mounting of tightening joints.

Regarding flanged joints and stuffing box packings engineers of amtec offer comprehensive consulting services. Based on many years of experience in this field amtec provides practical, state of the art guidance of highest quality.

amtec offers a variety of training courses, too. Training and workshops include detailed background information as well as hands on training. Courses can be held at amtec or at customers' offices. Visit our website for news and the latest dates.



**PROTECT ENVIRONMENT**



**MINIMIZE EMISSIONS**



amtec provides advanced tools and services for:

- gasketed flanged joints
- stuffing box packings
- valve integrity
- integrity analysis of piping systems and vessels



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