ASME, CEN, DIN, FEA,
CALCULATION
Stress Analysis, Fatigue Analysis,
OF FLANGED
Tightness Analysis
JOINTS

Advanced Tools and Comprehensive Services for
the Reduction of Fugitive Emissions
Environmental legislation and regulations have become more stringent in recent years. “Best available technology” is demanded to minimize emissions. On this background the demands on correct function of flanged joints have been specified in greater details in all parts of industry.

Correct function of a flanged joint is given if it is tight and its integrity is guaranteed for the entire period of operation. Integrity usually is achieved by limiting the stresses in the components (safety against failure). Tightness means, the emissions of the joint are limited.

According to the amtec philosophy the “best available technology” to minimize emissions is to apply an integral procedure, similar to a quality improvement circle. The analysis steps in this circle should be passed preventively and iteratively, if necessary. As part of the analysis it is necessary to know the relevant loads (during assembly and in operation) in detail, the design of the joint as well as of the gasket must meet the demands, the necessary gasket factors have to be determined, these gasket factors have to be used in stress and tightness analysis and last but not least the mounting procedure has to be reliable and related to the demands.
One central point of the analysis of flanged joints is a reliable calculation. Flanged joint calculations can be performed either analytically (ASME, CEN, DIN etc.) or detailed using Finite Element Analysis (FEA), for example. It is necessary that both flanged joints with the gasket floating between the flange platens and flanged joints with metal-to-metal contact of the flange platens can be analyzed.

The first task of a calculation is to determine the assembly stress level (tightening torque) of the joint. An assembly stress value is necessary for every flanged joint, therefore, this part of the calculation has to be done in each case.

The second task of a calculation is a stress analysis (prevent destruction); if there are cyclic loads, a fatigue analysis has to be performed, too. Finally, the third task is a tightness analysis (to control emissions, i.e. to maintain a demanded tightness class).

For reliable calculation results it is necessary that all parts of the assembly (i.e. flanges, bolts and gasket) and their interaction are regarded.

Regarding the calculation of flanged joints, amtec offers the software package TEMES, that incorporates the most relevant analytical codes. amtec provides flange calculation services, too.
For users that work frequently on the field of flanged joints, the flange calculation software package **TEMES_fl.cal** is a reliable tool, based on the state of the art and which is TÜV certified. It incorporates the most relevant analytical codes.

**Software for the Calculation of Flanged Joints**

- **Calculation codes and standards**
  - Calculation according
    - ASME standards
    - EN 1591
      (using gasket factors as defined in EN 13555)
    - EN 13445

- **Database for geometry and materials**
  - It is possible to put in user defined data for geometry and materials; additionally, the implemented standard database for geometry and materials (for bolts, flanges and gasket) can be used.

- **Load cases**
  - The behavior of the tightening joint is analyzed in pre-defined load steps (input of temperatures, internal pressure, external forces and moments for each step).
Calculation
User defined demands regarding assembly stress, tightness class and tightening procedure are part of the analysis.

Assessment of the results
As results, e.g., the stresses in the bolts and in the flanges, the gasket stress, the flange rotation and the tightness class are given for every load case.

Documentation
The results can be printed on paper, saved on hard disk or transferred to other Windows® applications.
Those users who run into flanged joint calculation needs only every once and a while might prefer the comprehensive amtec flange calculation service. It is tailored to the real needs, performed by experienced engineers.

Flange Calculation as a Service

We use our own software if analytical approaches are convenient. Especially in the case of special designs that are not covered by analytical methods, additionally, we perform calculations using Finite Element Analysis (FEA).

CALCULATIONS ACCORDING TO
- ASME
- CEN
- DIN

CALCULATIONS USING THE
- FINITE ELEMENT ANALYSIS (FEA)

STRESS ANALYSIS
FATIGUE ANALYSIS
TIGHTNESS ANALYSIS
As said above, it is necessary to perform an integral analysis; this analysis has to cover every parameter that can be of influence to integrity and tightness of a flanged joint. Only on this basis an assessment can be reliable. **amtec** offers comprehensive tools and advanced services for every aspect of this analysis:

### Loads

Loads like internal pressure, temperature and their transients (even dynamic loads) are input data to every flange calculation. Therefore, **amtec** offers services regarding monitoring of the real loads.

### Gasket factors

**amtec** manufactures test equipment for gaskets. Therefore, **amtec** is the first choice for services regarding determination of gasket characteristics. This makes the selection of the most effective gasket easier.

### Calculation

Calculations are performed following analytical approaches as well as using the Finite Element Analysis (FEA). Realistic boundary conditions and gasket factors are used.

### Assembly and tightening

Consulting according assembly and tightening of flanged joints, tools for controlled assembly and tightening of joints (like hydraulic spanners), tightening of joints as service.

### Flanged joint database

Database tools for joint integrity management systems.
amtec has many years of field experience regarding tightening joints. On this base amtec is following an integral philosophy to realize reliable function of flanged joints. Competent consulting is one of our services.

Training, Consulting

amtec provides workshops on flange calculation. Visit our website for actual dates of training courses and workshops.

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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