1 General
This technical information describes the requirements for boiler installation rooms and contains notes on the installation of boilers and boiler house components for steam, superheated steam, warm and hot water boiler systems. It is intended to provide assistance to planners of installation rooms and buildings. All the relevant national and local regulations and applicable standards should also be followed.

2 Basic requirements for the installation room
The following basically requirements for the boiler room must be met:

- The boiler system may only be installed in a room that meets the local regulations for the installation of boiler systems.
- The installation room must be kept clean and free from dust and dripping water. The inside temperature must be between 5°C and 40°C.
  If the air contains salt (proximity to the sea), the maintenance intervals of the boiler system may be shortened.
- Unauthorised persons must be forbidden to access the boiler room through permanent, clearly visible notices.
- Depending on the boiler parameters (water content, pressure, capacity), less strict installation or supervisory regulations may be applicable, depending on the national regulations.
- Sound insulation requirements must be met in accordance with local regulations.
- The control cabinets must be installed in such a way that no vibrations or shaking of the system components can be transmitted to the control cabinets. Installation must be carried out in areas which protect the control cabinets against excessive radiated heat and which safely allow access in situations which could be dangerous.
- Free access to inspection openings on boilers and plant components must be ensured.

2.1 Requirements on the building
The following requirements on the building must be met:

- The place of installation must be designed in such a way, in terms of construction, that vibrations caused by the process cannot cause any damage to buildings or neighbouring systems.
- The structural loading of the building shell must be taken into consideration for all fixings.
- Every boiler installation room must have n external wall or ceiling surface that is if possible continuous and clear, totalling at least 1/10 of the ground surface area (or in accordance with local requirements) which, in the event of excess pressure in the boiler installation room, will give much more easily than the other enclosing walls.
- The opening for brining equipment into the boiler installation must be made in accordance with the dimensions of the individual components. Suitable lifting equipment must be provided in the boiler installation room for moving heavy equipment.
- The clear height and width of all surfaces that can be walked on must be sufficient. Access to the system must be guaranteed in accordance with the local regulations. If the clear height of the installation room is smaller than the required height, for construction reasons, the minimum height must be agreed with the local authorities.
- Suitable, clearly marked emergency rescue routes must be provided.
- The boiler installation room, especially in the area of the valves and safety equipment, and the emergency rescue routes must be well lit.
- The parts of the system that are to be operated must be easily accessed and there must be sufficient space to open doors (including inspection openings).
2.2 Requirements on the foundation

The following requirements on the foundation must be met:

- Care should be taken to ensure that the floor in the installation room is completely level (evenness tolerance: in accordance with DIN 18202) and of a sufficient loadbearing capacity.
- Possibly existing ground ducts must be covered and equipped with drainage systems.
- In calculating the loadbearing capacity of the foundation, the maximum operating weight of the relevant components must be taken into account. In determining the operating weight, additional attachments (e.g. control cabinet, burners, sound attenuators, flue gas pipes, etc.) must also be taken into account and their weights included. The operating weight corresponds to the weight of the components when filled.
- The operating weight of boilers must be taken by the foundations in the area of the front and back feet. Care should be taken to ensure that the rear boiler foot (seen from the burner side) is designed as the fixed point on the longitudinal beam. The front boiler foot is designed as a loose bearing point, i.e. the boiler expands forwards when it heats up.
- Each component must be levelled when it is installed.
- If a separation between the installation surface and the system is required due to structure-borne sound, sound insulation strips must be positioned under the system before it is installed.
- If boiler or plant components are to be installed on a bearing structure, suitable spring systems should be used for bearing and absorption of vibrations.

2.3 Aeration and vent openings

Incoming air must be free from foreign bodies; it may not contain dust or corrosive elements, such as solvents or coolants, for example.

2.3.1 Layout of openings

The aeration openings should ideally be located at the back of the boiler. If this is not possible, for structural reasons, deflector plates or metal ducts must be installed within the boiler installation room to divert the intake air. When planning the aeration openings, the position of system components that are sensitive to frost (e.g. water treatment systems) must be taken into account to ensure that they are not installed directly in the flow of incoming air. In addition, the aeration openings must be installed in the boiler installation room in such a way that the flow of incoming air does not pass across boiler doors or reversing chambers (to avoid condensation).

Vent openings must also be provided. Aeration openings should be 500 mm above the boiler room floor and vent openings should be located at the highest point in the installation room. Cross ventilation must also be provided.

2.3.2 Determination of size

Aeration and vent openings must be designed in such a way that the pressure in the boiler room is ± 0 mbar. We provide the following calculation formulae as a non-binding recommendation. It is essential that the system installer obtains the agreement of the competent planning or building authority. Additional incoming air consumption units (e.g. compressors) must be taken into consideration when determining the size of the openings.

<table>
<thead>
<tr>
<th>Group classification by thermal capacity:</th>
<th>Aeration opening cross-section:</th>
</tr>
</thead>
<tbody>
<tr>
<td>GR 1 ≤ 2000 kW</td>
<td>$A_{GR \ 1} = 300 + [(Q - 50) \times 2.50]$</td>
</tr>
<tr>
<td>GR 2 &gt; 2000, ≤ 20000 kW</td>
<td>$A_{GR \ 2} = 5175 + [(Q - 2000) \times 1.75]$</td>
</tr>
<tr>
<td>GR 3 &gt; 20000 kW</td>
<td>$A_{GR \ 3} = 36675 + [(Q - 2000) \times 0.88]$</td>
</tr>
</tbody>
</table>
Explanation of symbols:

\[ A_{GR} = \text{Clear cross-section in } cm^2 \]
\[ Q = \text{Thermal capacity in } kW \]

Ratio between sides maximum 1 : 2
Vent cross-sections are always 60% of aeration cross-sections.
The cross-sections are net cross-sections.

If the combustion air is transported to the burner via air intake channels, aerodynamic flow and sufficient dimensioning with regard to pressure loss must be ensured.

2.3.3 Frost protection

If there is a risk of low outside temperatures or in the case of boiler installation rooms in which the full insulation of all system components and fittings only allows minimum radiation of heat and thus no heating of the boiler house, it is necessary to take steps to pre-warm the incoming air (e.g. using heating registers in the aeration opening) and to prevent frost.

2.3.4 Electrical integration

With adjustable aeration flaps, firing may only start if the aeration flap is completely open (potential-free feedback to the boiler control via safety limit switches). Aeration flap controls must be provided.

2.4 Special requirements for open air installation

If boilers are installed in the open air, the following additional requirements must be met:

- All the components and parts of the system must be suitable for external installation (i.e. suitable material, necessary protection category, paint / protective coating, etc.).
- Sensitive components (burner system, control cabinet, measurement and control equipment, motors, pumps, etc.) must be protected by a roof against rain and sunshine.
- Thermal insulation must be provided in accordance with the conditions in situ.
- Cable material and wiring must be suitable for external installation.
- If there is a risk of frost, the system components, pipes, pumps and fittings must be provided with background heating.
- An effective lightning conductor system must be provided.

3 Transport of the boiler system

For floor-level boiler transport, means of transport under the base frame may exclusively be placed below the boiler feet. The use of "tank steel rollers" under the base frame is inadmissible for floor-level transport. Danger of base frame deflexion!

4 Burner system

Technical Information TI030 – Requirements for a burner system provided by the customer or a burner system provided by the customer with boiler control provided by the customer for the operation of oil-, gas- and dual-fired steam, heating and hot water boilers – must be complied with. When attaching the burner system and burner components (e.g. silencer hood, oil circulation module, etc.), care should be taken to ensure that it is easy to open the front reversing chamber door and/or boiler door and to swivel the burner without any problems. Oil hoses, cables, etc. should be laid accordingly, and the burner fittings should project at the side. The compensator in the gas regulating line must be installed in the longitudinal direction of the boiler in order to absorb the axial expansion of the boiler.
4.1 Combustion air
The combustion air must be free of dust and corrosive components (e.g. solvents containing chlorine). The maximum relative humidity is 80% (without condensation).

Air should be supplied to the burner system from the boiler installation room in order to allow for fluctuations in the outside temperature. The maximum temperature fluctuation may not exceed 30 K.

Combustion air temperature: minimum: + 5°C or in accordance with burner manufacturer's instructions
maximum: + 40 °C or in accordance with burner manufacturer's instructions

Keep the area (1 m) around the suction cross-section of the burner blower free.

4.2 Fuels
Facilities for the storage, preparation and supply of fuels must be design and made in such a way that they can be used without danger and meet the national and local regulations and relevant standards.

For commissioning the burner system it must be possible to measure fuel quantities for each burner and fuel type.

4.2.1 Fuel oil
The storage and distribution of fuel must be carried out in accordance with safety requirements. If the fuel supplied is EL fuel oil, the storage and transport temperature should not be less than 5°C; with medium and heavy oils, higher temperatures are necessary, depending on the viscosity, in order to guarantee that the oil can still be pumped. If necessary, background heating must be provided for the tank and pipe system.

4.2.2 Gas
A device for safe drainage under pressure must be installed upstream of the gas regulation module.

Liquid gas must be available in vapour form at the gas regulating module. The safeguard pressure at the transfer station may not be greater than the maximum permitted gauge pressure at the gas regulating module.

5 Flue gas system
The following paragraphs contain recommendations for the design of flue gas systems to ensure trouble-free operation of combustion systems. In case of non-observance of these regulations, serious operating troubles up to deflagration can occur during firing operation. These are often acoustic faults, impairment of combustion stability, excessive vibration of components or their components respectively. Low NOx firing systems must be assessed as critical with regard to these operating troubles due to their combustion control. Thus, planning and construction of the flue gas system requires particular technical elaboration.

The flue gas system usually consists of a connection piece between heat generator and the vertical part of the flue gas system and the vertical flue gas system itself (chimney).

The following requirements must be met when designing and constructing the flue gas system:

- Flue gas systems must be designed in accordance with the national and local regulations as well as the applicable standards. General requirements on flue gas systems at and inside of buildings are specified in the DIN EN 1443 standard. The design of the flue gas systems must comply with the locally applicable building laws as well as the DIN V 18160 standard. For freestanding chimneys, the DIN 1056, DIN 4133 and DIN EN 13084-1 standards are applicable besides the building laws. Specifications for fluidic dimensioning must be gathered from the DIN EN 13384 standard for flue gas systems at and inside of buildings or DIN EN 13084-0 for freestanding chimneys.

- Flue gas ducts must be made from non-flammable building materials and must be resistant to the effects of flue gas and heat. The material for the flue gas system must be suitable for temperatures up to 350°C.

- When determining the material of the flue gas system, the composition of the combustion gases must be taken into account in order to prevent damage or soil ing of the system components in contact with flue gases.
• The flue gases must be directed directly towards the chimney in a gas flow-optimizing way (e.g. on a short and rising path with little deviations).

   Each boiler must be equipped with a separate chimney pass. The flue gas line and the chimney are dimensioned according to details provided by expert companies and refer to a pressure of +0/-1 mbar (for boilers with thermal capacity \( \leq 2 \) MW: +0/- 0.5 mbar) at the boiler or flue gas heat exchanger flue gas connection. The system's heat expansion must be taken into account.

   If the residual manometric pressure remaining at the burner needs to be taken into consideration in the design of the chimney system, then a detailed agreement about this has to be reached between the manufacturers of the boiler, the burner and the flue gas system (including the chimney).

• Diversions in connection pieces must be executed in a favourable fluidic way by means of bends or guiding plates. Connection pieces with multiple diversions should be avoided as they might have a negative influence on airborne and structure-borne sound as well as the start-up pressure impulse. Sharp-edged transitions between rectangular connection flanges and the connection pipe should be avoided. The transition angle on any required reductions / extensions should not exceed 30°.

• The flue gas line downstream of the boiler must have the option of performing a flue gas measurement. The closeable measurement opening must always be attached in the connector between the heat generator and the chimney behind the last heat exchanger. The measurement opening should be attached at a distance of approximately double the diameter of the connector behind the flue gas nozzle of the boiler / heat exchanger. The diameter of the measurement opening must be at least 15 mm.

• Several fireplaces may only be connected to a common flue gas system (chimney, flue gas pipe) if their design ensures that they are suitable for this operating mode and meet the following requirements:
  - The system is dimensioned for proper flue gas discharge in any operating mode.
  - The entry of flue gases in switched-off fireplaces in overpressure operation (e.g. by tightly closed flue gas flaps) is prevented.
  - The furnace pressure conditions remain constant in all connected heat generators in all operating modes.
  - The minimum flue gas velocity \( W_{\text{min}} \) acc. to the DIN EN 13084-1 standard is taken into account or, simplified, \( W_{\text{min}} = 0.5 \text{ m/s} \).

   If possible, merging of flue gas streams should be avoided as it causes a slight negative pressure in the chimney if only a small portion of the chimney capacity is used (e.g. when only one heat generator is operated). In that case the flue gases do not fill the chimney completely any more and cold air can enter the chimney. The resulting cooling of flue gases can bring about soot formation, chimney fouling and fire hazard in the chimney. However, if the merging of flue gas streams cannot be avoided, the flue gas streams must be guided in parallel and insulated from each other by an insulating plate in a short section of the flue gas system in order to avoid interaction of the flue gas streams.

   The following heating appliances must not be connected to flue gas systems serving several heating appliances:
  - Furnaces operated with liquid gas
  - Fireplaces with fans unless all the fireplaces are installed in the same room

• If possible, connection pieces must be inserted upwards in the chimney in a way which optimises the gas flow (at an angle of 45°). Should the chimney serve several heating appliances, connections located opposite or on the same level must be avoided. Possibly existing caps on chimney outlets must ensure free discharge of the flue gases into the free airflow.

• Any occurring condensates must be discharged without any obstructions along the complete length, in accordance with the local regulations (e.g. ATV (Sewage Technology Association) Bulletin No. 251) and disposed of in accordance with the local regulations.

• The chimney must be equipped with cleaning openings acc. to the local regulations (e.g. DIN 18160-1 and DIN 18160-5 standards, IVS (Industrial Association for Steel Chimneys) Guideline No. 105), possibly in co-ordination with the responsible chimney sweeper or chimney sweeper master craftsman.

• The chimney may be positioned directly on the flue gas heat exchanger if the load and the horizontal forces (e.g. wind forces) do not have any effect on the heat exchanger. A separate support for the chimney must be provided. In order to stop rain from entering and thus to prevent corrosion in the flue gas heat exchanger, the chimney must be provided in this case with a cover.
The chimney (e.g. with compensator) must be separated from the boiler/flue gas heat exchanger system in order to prevent any structure-borne sound.

In the event of a standstill and minus temperatures outside, the danger of frost damage must be prevented.

If a flue gas valve is incorporated into the flue gas system, it is essential that a safety limit switch "OPEN" is incorporated into the boiler control. It must only be possible for firing to start if the limit switch reports that the flue gas valve is completely open. Due to the setting time of the flap drives, pressure or temperature drop in the boiler is possible. The "SHUT" position at the flue gas valve must be set in such a way that the flue gas valve never completely closes. This will prevent any damage from accumulated heat at the attached burner. To ensure that any accumulated heat can be safely removed, it is essential that there should be a sufficient vacuum behind the flue gas valve (on the chimney side) as soon as the assigned burner switches off. Alternatively, if the flue gas valve closes tightly, an opening to remove the accumulated heat should be provided in the direction of flow to the flue gas valve.

Observe that the heat exchanger bundles of double-flue boilers with single-flame tube operation and down-line economizers or flue gas condensers are separated on the flue gas side in such a way that the flue gases are well directed to the flue gas system. If the two flue gas lines from the double-flue boiler are connected, the pressure at this point must amount to + 0 / - 1 mbar (at full-load with single-flame operation). If this is not the case, sealing air blowers will be necessary for each burner.

6 Piping

6.1 Piping design

- Pipes must be laid in accordance with the national and local regulations and relevant standards, taking into account the pressure losses and flow speeds.
- Suitable materials (for the max. permissible temperatures (safety temperatures) of the system components) and accessories (e.g. piping supports) must be used.
- When installing a flue gas condenser, the downstream flue gas system must be suitable for condensation operation (stainless steel design).

6.2 Piping installation

- All supply and discharge lines must be laid in accordance with the regional applicable regulations as well as the recognised engineering rules.
- The thermal expansion of pipes and system components (boiler, flue gas heat exchanger) must be taken into account for piping installation.
- Lines must be laid in a stress-free way and they must not apply any forces or moments on the system components.
- Hot pipes must be marked and surrounded by an effective touch guard so that injuries by touching the hot pipes are excluded.
- Discharge into pump sumps, drain channels etc. must be designed in such a way that the discharged water can be controlled.

6.3 Vent and drainage pipes

- Pipes must be installed over the shortest route and with drainage facilities at the lowest point and vent facilities at the highest point.
- Drainage and desalting, emptying and blow-down pipes must be laid separately and sloping to the blow-down, expansion and cooling device. The waste water must be cooled before passing into the sewage network in accordance with local regulations.
• If the blow-down pipe is taken more than 1 m upwards, the blow-down pipe must be drained at the lowest point before every blow-down procedure. It is recommended that stainless steel pipes are used as the material for the blow-down pipe because of the higher load on the pipes.

• Observe that blow-down lines of low-pressure boilers are pulled upwards max. 2 m from the boiler connection (drain).

• Pressure safeguard blow-down pipes or vent pipes at the blow-down, expansion and cooling device must be taken so that they open safely into the open air, must be protected against the penetration of rainwater and dirt and drained at their lowest point. In the case of warm and hot water boiler systems, an expansion vessel at the pressure safeguard blow-down pipe is necessary in order to separate the water-steam mixture.

• Pressure safeguard blow-off lines may only be brought together with other lines in exceptional cases and with the corresponding calculated evidence.

• Drainage connections on the flue gas side of boilers (e.g. flue gas chambers) and plant components must be equipped with a water pocket of approx. 10 cm to avoid flue gas emission. The drainage pipes (stainless steel) must be guided via a neutralisation. In order to prevent accidental backflow it is prohibited to combine them with pipes conveying other media.

• The starting line for the boiler must be incorporated into the pipeline network in such a way that each boiler can safely emit steam into the open air via the steam shutoff valve during the start-up procedure.

7 Installation of fittings and system components

When installing fittings and system components, the following requirements must be met:

• Fittings must be installed without tension. Installation mistakes may not be rectified by violently tightening the flange screws.

• Flange seals must be checked for cleanliness and proper fit.

• Fittings must be drained if necessary to prevent water impact.

• When fitting the individual system components and fittings, make sure that they can be operated and that the direction of flow is as indicated.

• The feed water pipework must be direct and suitable for the water flow. The feed pumps must be located right by the feed water container. When erecting the feed pumps, the minimum positive suction head of the pump must be maintained.

• In the case of condensing boilers, sufficiently dimensioned neutralisation systems must be used in accordance with the valid local regulations.

• Screws and nuts for flange connections must be designed for the max. gauge pressures and temperatures that might occur and they must be made of suitable material acc. to international, national or local regulations (e.g. material No. 5.6 for screws or material No. 5.2 for nuts).

• In multi-boiler steam plants hydraulic decoupling of the individual boilers via non-return valves (e.g. at the steam distributor) is mandatory to avoid interaction of the boilers (pressure charging).
8 Assembly of Measurement and Control Technology

The following requirements must be observed when installing measurement and control technology components:

- Observe the mounting position and conditions (e.g. max. ambient temperature) and the necessary inlet and outlet paths of the sensors (observe the operating instructions of the respective devices for this).

- When installing sensors in flue gas lines observe that they must be mounted in pipes that are constantly ascending or running vertically up (mandatory with limiter devices). Possibly occurring condensate must be discharged without any obstructions.

- If any water seals are installed upstream of sensors they must be filled with distilled water.

- Observe during installation that sensors must accessible for commissioning and maintenance.