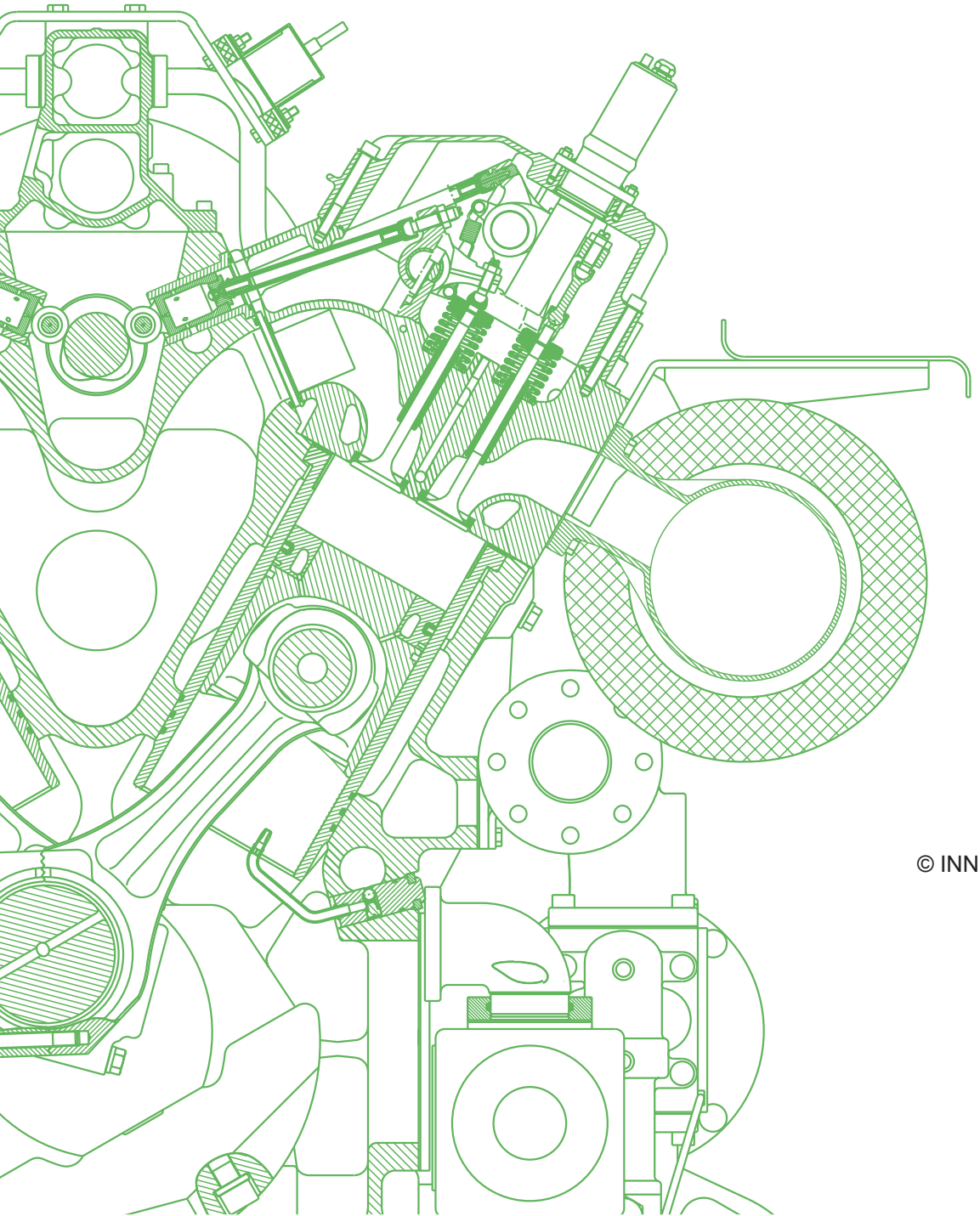
JENBACHER

# TA 1100-0111

Technical Instruction

## General Conditions - operation & maintenance

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**NOTE**

**Observance of the conditions of this Technical Instruction and performance of the activities described therein is the basis of safe and efficient plant operation.**

Non-observance of the conditions of this Technical Instruction and/or non-performance of the prescribed activities or any departure from the prescribed activities may result in the loss of guarantee rights.

The activities and conditions defined in this Technical Instruction shall be performed and/or observed by the plant operator. This shall not apply if this Technical Instruction is expressly allocated to the area of responsibility of INNIO Jenbacher GmbH & Co OG or a contractual agreement between the operator and INNIO Jenbacher GmbH & Co OGprovides for a different arrangement.

**The target recipients of this document are:**

Prospective Customers, Customers, Distribution Partners, Service Partners, Commissioning Partners, Subsidiaries/ Branches, Location Jenbach

## 1 Scope

This Technical Instruction (TA) applies to the following Jenbacher Gas Engines:

- Type 2 engines
- Type 3 engines
- Type 4 engines
- Type 6 engines
- Type 9 engines

and special products, unless an updated version of this document is issued.

## 2 Purpose

This Technical Instruction (TA) contains basic information regarding the operation and maintenance of Jenbacher modules and refers to other applicable TAs.

## 3 Additional information

A glossary and list of abbreviations can be found in TA 1100-0010.

**Relevant documents:**

**IW 0309 M0** – Spark plugs

**TA 1000-0099B** – Limit levels for used oil in Jenbacher gas engines

**TA 1100-0105** – Engine shut-down

**TA 1100-0110** – Boundary conditions for Jenbacher gas engines

**TA 2102-0020** – Check list for engine repairs and overhauls

**TA 2300-0001** – Employee protection

**TA 2300-0005** – Safety instruction

**TA 2300-0010** – Guidelines for using the LOTO kit

## 4 Boundary conditions

The boundary conditions for Jenbacher Gas Engines as specified in TA 1100-0110 must be observed. The work specified in the maintenance plan must be carried out and tracked in the operational data sheet. All specified maintenance work must be performed regularly, expertly and on schedule. Knock-free operation must be guaranteed.

## 5 Cooler/heat exchanger (Jenbacher scope of supply)

When integrated into the hot water system, appropriate measures must be taken to prevent dirt or sediment building up in the relevant components on the water side.

Refer to the Technical Diagram and Technical Instructions for the relevant specifications.

## 6 Connection points

The specified conditions at the connection points must be observed, and must comply at all times with the applicable specifications laid down in the Technical Diagram and/or Technical Description, circuit diagram, interface list and control technical specifications. Failure to comply with these requirements may have an adverse effect on the characteristics of the product and on its reliability of operation and, in the end, restrict or invalidate warranty claims.

## 7 Maintenance staff

Work on the plant may only be carried out by specialist staff who have received relevant electrical and mechanical training. It is possible to conclude service contracts with INNIO Jenbacher GmbH & Co OG, INNIO Jenbacher GmbH & Co OG subsidiaries or authorised specialist contractors.

## 8 Safety regulations

The safety instructions in Description, Operation and Maintenance must be observed. Statutory safety and accident prevention regulations in force must be observed. Before performing any maintenance work on the plant, the customer must make sure that the relevant safety instructions are being followed.

See also:

**TA 2300-0001** – Employee protection

**TA 2300-0005** – Safety instruction

For work which may only be carried out when the engine has been shut down, the system must be shut down as specified in TA 1100-0105 and measures must be taken to ensure that it cannot be started accidentally.

See also:

**TA 1100-0105** – ⇨ General Conditions - operation & maintenance

**TA 2300-0010** – Guidelines for using the LOTO kit

The customer is responsible for ensuring that the workplaces provided for service and maintenance work are adequately lit. Additional mobile lighting must be provided if necessary.

## 9 Cleanliness when working on Jenbacher plants

- When working on Jenbacher Gas Engines, installations and components, always adhere to the strictest standards of cleanliness.
- Thoroughly clean the working area before opening any engine components or parts, and remove all dirt and deposits on the outside of the engine before opening the engine.
- Avoid the ingress of dirt from either outside or inside whenever any servicing or maintenance work is carried out, e.g.
  - deposits inside the engine or other plant components. any gasket residues or deposits on engine components must be thoroughly removed using suitable means.
  - Dirty tools:
    tools must be cleaned before use.
- Rotating metal brushes may not be used inside the engine room.
- Only clean, approved and undamaged tools may be used.
- Components for use or installation on or in the engine should not be cleaned until immediately before fitting.
- Make sure to select the right covers and means of protection for properly carrying out the work.
- When fitting components, ensure that all covers on the outside and inside of components and lines are removed.

- Observe check-list TA 2102-0020 when carrying out maintenance work or overhauling engines.

**⚠ DANGER**

**Personal injury and severe damage to components or systems**

Loose bolts, foreign bodies or dirt in systems can lead to personal injury and severe damage to components or systems on commissioning.

➢ Ensure that before recommissioning all systems are free of foreign bodies, dirt and loose bolts or tools.

## 10 Risk assessment

The customer is responsible for observing and enforcing safety instructions to ensure the availability and safe use of the plant and equipment. To this end, a risk assessment of conditions on site, applicable standards and safety regulations must be carried out in accordance with local laws, regulations and guidelines.

The customer must take the necessary measures to ensure that employees at the plant are only provided with equipment which is suitable for the conditions pertaining at the workplace and guarantees their health and safety if used properly.

The risk assessment will cover approval, planning, assembly, commissioning, operation, maintenance, servicing, decommissioning and disposal.

The risk assessment of the plant to be performed by the customer in accordance with local conditions and pursuant to local laws and guidelines may give rise to acceptance tests, inspections and maintenance operations which are not included in the Maintenance Plan. The customer is responsible for implementing and enforcing these additional measures.

## 11 Start-up conditions

All Jenbacher Gas Engines engines are fitted with a preheating system for the engine cooling water.

**NOTE**

**Damage to the engine**

If an engine that has not been preheated is started, loaded and run up to full load, there is a danger of engine damage.

➢ Do not start or load engines or operate them at full-load unless they have been preheated to a cooling water temperature of >55° C.

## 12 Failures

### General

When the installation is operational, the engine management system will control the engine and also perform engine-failure management. The engine-failure management system checks all relevant system variables. If a defined set value is exceeded or not reached, a warning message will be issued or the module will be shut down.

**⚠ DANGER**

**Potential hazardous conditions due to engine damage**

If the cause of a tripping or warning fault is not rectified, severe damage can be caused to the plant and/or the engine room (container) and hazardous conditions may result both for the operator on site and for the environment.

- **The cause of a tripping fault must be rectified before the plant is restarted.**
- **The cause of a warning fault must be rectified before the warning is reset.**

**NOTE**

**Engine damage and invalidation of any warranty claim**

If the cause of a tripping or warning fault is not rectified, severe damage can be caused to the plant and also result in any warranty claim being invalidated.

- **The cause of a tripping fault must be rectified before the plant is restarted.**
- **The cause of a warning fault must be rectified before the warning is reset.**

**⚠ WARNING**

**Danger from unauthorised restarting**

Serious injuries such as cutting, crushing, severing or shearing of body parts due to unintentional contact with rotating or moving machine parts.

- Shut down the engine as described in TA 1100-0105.
- Secure the engine against unauthorised restarting in accordance with TA 2300-0010.

### Critical messages

If the system shuts down with a critical message, the cause of the failure must be rectified before the failure is reset. If any of the following error messages appears, inform INNIO Jenbacher GmbH & Co OG or a respective service partner without delay.

**Particularly critical - Category I:**

| | | |
|---|---|---|
| | 2308 | IMEP-based friction monitor |
| | 3368 | Ramp-down time too short |

**Critical - Category II:**

| | | |
|---|---|---|
| | 1017 | Oil pressure minimum |

| | | |
|---|---|---|
|  | 1019 | Cooling water pressure minimum |
|  | 1022 | Overspeed (relay) |
|  | 1023 | Start-up failure |
|  | 1048 | Knocking |
|  | 1049 | Cylinder exhaust gas temperature high excess over absolute value |
|  | 1050 | Cooling water pressure maximum |
|  | 1051 | Engine oil level high |
|  | 1060 | Pre-lube pressure low |
|  | 1064 | Overspeed (RPS-control system) |
|  | 1080 | LEANOX deviation exceeded |
|  | 1094 | Backfire prevention |
|  | 1105 | Charge temperature fluctuation speed maximum |
|  | 1130 | Charge cooling water pressure low |
|  | 2117 | Charge cooling water pressure low |
|  | 2228 | Main bearing temperature maximum |
|  | 2230 | Conrod bearing temperature maximum |
|  | 2262 | Maximum cylinder peak pressure |
|  | 2281 | Cylinder pressure sensor membrane burst |
|  | 2285 | Main bearing temperature – positive deviation from average value |
|  | 2286 | Big-end bearing temperature – positive deviation from average value |
|  | 2293 | Lambda-based friction loss monitoring: potential fault detected. |
|  | 2299 | Cylinder pressure sensor saturation |
|  | 3322 | Crank case pressure maximum |

| | | |
|---|---|---|
|  | 3335 | SAFI shutdown due to overspeed |
|  | 3339 | Knocking |
|  | 3341 | Maximum valve noise |
|  | 3406 | Cooling water pressure maximum |
|  | 3416 | Oil filter clogged - engine will not start |
|  | 3507 | Oil pressure high |

**Remote acknowledgement of tripping failures**

Based on the risk category selected by the customer (0-4), tripping failures can be acknowledged using remote access to the display system (max. 5 times every 6 hours' running under load).

| Failures: | Failure number: | National restrictions | Risk category |
|---|---|---|---|
| MISFIRING | 1047, 3005 - 3024 | | 0 |
| COOLING WATER TEMPERATURE MAXIMUM | 1021 | 1) | 0 |
| ENGINE ROOM TEMPERATURE HIGH | 1135 | 1) | 0 |
| FAILURE OF AUXILIARY EQUIPMENT | 1129 | | 0 |
| SYNCHRONISING FAILURE | 1039 | | 0 |
| SUPPLY WATER TEMPERATURE MAXIMUM | 1063 | | 0 |
| MISSING ENGINE RUNNING CONDITIONS | 1025 | | 1 |
| START UP FAILURE | 1023 | 1) | 1 |
| GAS PRESSURE MINIMUM CONTROLLED GAS SYSTEM 1 | 1028 | 1) | 1 |
| GAS PRESSURE MINIMUM CONTROLLED GAS SYSTEM 2 | 1030 | 1) | 1 |
| MIXTURE TEMPERATURE MAXIMUM | 1040 | | |
| OIL TEMPERATURE MAXIMUM | 1043 | | 1 |
| ADMISSIBLE CONTROL DEVIATION OF LEANOX CONTROLLER EXCEEDED | 1080 | | 1 |
| ENGINE COOLING WATER PUMP FAILURE | 1090 | | 1 |
| GENERATOR FREQUENCY TOO LOW | 1110 | | 1 |
| ACTUAL VALUE MEASURING SIGNAL FAILURE | 1113 | | 1 |
| ENGINE SPEED MEASURING SIGNAL FAILURE | 1120 | | 1 |
| TECJET GAS QUANTITY JUMP | 3099 | | 1 |
| ENGINE OIL LEVEL LOW | 1018 | | 2 |
| GENERATOR REVERSE POWER | 1038 | | 2 |
| CYLINDER EXHAUST GAS TEMPERATURE DEVIATION FROM MAXIMUM AVERAGE VALUE | 1044 | | 2 |
| CYLINDER EXHAUST GAS TEMPERATURE HIGH EXCESS OVER ABSOLUTE VALUE | 1049 | | 2 |

| Failures: | Failure number: | National restrictions | Risk category |
|---|---|---|---|
| COOLING WATER PRESSURE MAXIMUM | 1050 | | 2 |
| MIXTURE TEMPERATURE FLUCTUATION SPEED MAXIMUM | 1105 | | 2 |
| GENERATOR EXCITER FAILURE | 1109 | | 2 |
| NEUTRAL CURRENT MAXIMUM | 1112 | | 2 |
| CYLINDER EXHAUST GAS TEMPERATURE HIGH EXCESS OVER ABSOLUTE VALUE | 1049, 2001 – 2020 | | 2 |
| COOLING WATER PRESSURE MAXIMUM | 1050 | | 2 |
| CYLINDER 1 MAXIMUM EXCESS OVER ABSOLUTE VALUE | 2001 | | 2 |
| CYLINDER X DEVIATION FROM AVERAGE VALUE, MAXIMUM POSITIVE DEVIATION | 2021 – 2040 | | 2 |
| CYLINDER X DEVIATION FROM AVERAGE VALUE, MAXIMUM NEGATIVE DEVIATION | 2041 – 2060 | | 2 |
| GAS PROPORTIONING VALVE CAN LINK FAILED | 3093 | | 2 |
| OIL PRESSURE MINIMUM | 1017 | | 3 |
| MISSING POWER SIGNAL | 1041 | | 3 |
| OIL FILTER DIFFERENTIAL PRESSURE HIGH | 1059 | | 3 |
| GAS MIXER CONTROL FAULTY | 1083 | | 3 |
| BACKFIRE PROTECTION | 1128 | | 3 |
| ALL OTHER FAILURES NOT LISTED IN RISK CATEGORIES 0 – 3. | | | 4 |

[1)] Due to national restrictions, faults listed in category 0 and 1 may be promoted to category 4 risks.

Single or multiple resetting of all other trip-generating failures without remedying the cause first will result in a considerable potential risk of injury or damage. The customer (or the party responsible for the remote acknowledgement) will be entirely liable for such injury or damage.

## 13 Recording operational data, maintenance record sheet

It is mandatory for all operational data to be recorded and all out-of-the-ordinary events to be described.

**Interpretation and plausibility of data:**

It is not enough merely to record the facts in writing. The data should be compared with the commissioning data and its plausibility verified. In case of deviations, abnormal noises etc. the cause must be investigated and rectified. If you cannot find the cause, INNIO Jenbacher GmbH & Co OG or a relevant service partner should be notified immediately.

It is in the customer's own interests to maintain and record operational data (maintenance record sheet, operational data journal). Properly maintained operational data journals and data record sheets are important data, which allow and support the appropriate analyses and remedial measures in the event of failures. Moreover, this data is also important when deciding on warranty claims. The operational data should preferably be recorded daily electronically in the myPlant* logbook function. The paper form provided for the purpose can be used as an alternative.

## 14 Spare parts

Only original spare parts from INNIO Jenbacher GmbH & Co OG (caution: e.g. oil filters!) should be used. Warranty claims in respect of defects and damage will be invalidated by the use of non-original spare parts.

In order to avoid unscheduled downtimes due to maintenance work, it is strongly recommended that a stock of spare parts be held.

## 15 Lubricating oil

INNIO Jenbacher GmbH & Co OG does not issue any guaranteed fixed oil change intervals. The lubricating oil in Jenbacher Gas Engines must be changed depending on its condition. It is the customer's responsibility to take all necessary measures to ensure the protection and safe operation of the plant and guarantee the plant's availability.

The oil service life (depending on gas quality, mean pressure, engine type, oil consumption, oil temperature and oil type) can be prolonged by fitting an additional oil tank. If premature wear is claimed, the results of the lubricating oil analysis, subject to observing the limit levels laid down in TA 1000-0099B, must be presented in full, even after the warranty period has expired.

## 16 Spark plugs

No specific maintenance interval is specified for spark plugs. IW 0309 M0 describes the inspection and maintenance procedure.

Spark plug service life depends on the boundary conditions of the plant (e. g. type of spark plugs, gas type, mean pressure, gas mixing temperature, ignition system, emission limits). It is the customer's responsibility to take all necessary measures to ensure the protection and safe operation of the plant and guarantee the plant's availability.

## 17 Elastomer components

Elastomer components age and become brittle, even when engines are not operational. That is why the service life of these components does not depend solely on the length of time for which the module has been in service, the cooling water temperature and pressure, etc. With a normal running time of 5,000-6,000 Oh annually and a maximum cooling water temperature of 90 °C, all elastomer components are replaced at the intervals specified in the maintenance schedule. If this number of operating hours is not reached, the elastomer components (e.g. O-rings at cylinder liners, elastic couplings etc.) should still be replaced as a precautionary measure after a maximum of 5 years.

## 18 Decommissioning the plant

When prolonged scheduled or unscheduled downtimes occur, such as after the heating season in power plants, the engine systems must be prepared (preserve, change old lubricating oil, close off the flue-gas connection, etc.) for their downtime according to their geographical location (climate, proximity to the sea, gas type, etc.)

As conditions can vary enormously, we recommend that you consult a suitable specialist firm concerning the measures to be taken or contract it to carry out the work.

Before recommissioning the plant, you must make sure that it has been restored to its normal operational condition.

## 19 Welding work on the module

**NOTE**

**Damage to the ignition rail as a result of welding work**

Welding work on the module can result in damage to the ignition rail.

- Remove the ignition rail before any welding work on the generating set.
- The ignition rail must not be refitted and correctly connected until the welding work has been completed.

Always make sure to attach the negative pole as close as possible to the weld location when carrying out welding work on the module – not on the ground connection (earth cable) though.

Only specifically qualified technical staff may perform welding work (regional regulations must be observed). Furthermore, additional requirements and regulations must be observed for the welding of gas lines.

## 20 Components coming into contact with exhaust gas

All parts that come into contact with exhaust gas are state-of-the-art materials with a specified service life. Due to the different operating modes and different fuel gas contents (including traces of harmful substances), no binding guarantee can be given on the service life of components such as the exhaust manifold, etc. Where silencers are situated in the open air without external heat insulation, condensate (acid, water) can occur even in installations without heat exchangers (hot exhaust gases) and shorten the service life. This also applies to silencers with internal insulation, where the temperature in the rock wool insulation can fall below the dew point.

## 21 Consumables

The service life and safe operation of the plant depend to a considerable extent on the operating materials used. Only use operating materials such as fuel gas, engine cooling water, warm water, anti-freeze agent, anti-corrosive agent, lubricating oil, etc. as specified in the respective INNIO Jenbacher GmbH & Co OG Technical Instructions.

## 22 Fuel gas quality

The customer is obliged to check the quality of the fuel gas in terms its thermal value, methane number and content of harmful substances at regular intervals. If these values differ from the values stipulated in the contract, immediate measures must be taken by agreement with INNIO Jenbacher GmbH & Co OG or a relevant service partner. If the content of harmful substances increases (e.g. sewage gas, landfill gas) the lubricating oil can become heavily acidified within a fraction of the normal oil change interval and acute or irreparable damage and increased wear occur all of a sudden, for example on cylinder liners and bearings and/or oil consumption increases.

If the methane number fluctuates downwards (within the range stipulated in the contract) the engine is protected against harmful knock operation by the engine management system (automatic ignition point adjustment, power reduction).

During the commissioning process the engine is adjusted to the optimum setting for the methane number given at that time.

If the methane number increases after commissioning (for a prolonged period or a major part of the plant's operating time) the engine setting should be adjusted so as to optimise operational efficiency. This task must be carried out solely by INNIO Jenbacher GmbH & Co OG by or a relevant service partner.

## 23 J624 TSTC turbocharger unit

Safety cannot be assured in the event of improper use.

This pressure equipment is part of the generating set and may only be used in the intended manner. The entire engine and generating set documentation therefore applies in addition to these Instructions and must be taken into account as well.

Use of the pressure equipment is only permissible if the stated limits are observed.

**Information for use:**

- The customer must arrange for recurrent tests in accordance with local conditions and pursuant to local laws and guidelines.
- The introduction of additional loads (lifting, pushing) is prohibited.
- No welding, heat treatment or metal-cutting machining may be carried out on the cast parts.
- The bolted joints between the cast parts must never be touched in any way, unless instructed in the maintenance instructions.

Since these are open pressure equipment items, static overpressures are not possible. However, to avoid exceeding the design pressures during engine operation, bypass valves and pressure sensors must be fitted. They must be fully functional.

## 24 Maintenance Intervals

The intervals stated in the maintenance schedule are average empirical values. Where there is a lack of proper operation and maintenance (such as poor oil management, large accumulations of dust or other problematic external influences), the intervals specified in the maintenance schedule may not be reached and have to be carried out at much shorter intervals.

The customer is solely responsible for judging this. If irregularities are found during the daily inspection,especially during the warranty period (abnormal sounds or noises, etc.), the operator must take action to minimise any risk of damage (e.g. by immediately switching off the engine, investigating the cause of the irregularity and rectifying it, and/or notifying the GE Jenbacher customer service department).

**Scheduling of maintenance work:**

Upcoming maintenance work must be carried out before the maintenance interval is reached. Maintenance work must be scheduled in advance and if necessary carried out before the maintenance interval is reached to achieve fault-free operation or to avoid interruptions in operation, for example, during the heating season.

Maintenance intervals may not be extended to avoid downtime during the heating season.

## 25 Documents from original equipment manufacturers

The customer documentation from INNIO Jenbacher GmbH & Co OG contains documents from the original equipment manufacturers for certain bought-in parts in addition to INNIO Jenbacher GmbH & Co OG documents.

The following must be observed in relation to this:

- The appropriate information and documents from the original equipment manufacturer are taken into account when drawing up INNIO Jenbacher GmbH & Co OG documentation.

- In the event of discrepancies between INNIO Jenbacher GmbH & Co OG documents and enclosed documentation from the original equipment manufacturer, the documentation from INNIO Jenbacher GmbH & Co OG shall take priority (including any appropriate Technical Instructions, maintenance plans and maintenance etc.)
- Any documents from the original equipment manufacturer that are provided are supplementary to the INNIO Jenbacher GmbH & Co OG documentation and should be observed in addition to this.

## 26 Revision code

**Revision history**

| Index | Date | Description / Revision summary | Expert<br>*Auditor* |
|---|---|---|---|
| 11 | 11.06.2019 | Ergänzung von kritischen Störmeldungen für Baureihe 9 in Kapitel 12 / Addition of critical error messages for type 9 in chapter 12 | **Fuerhapter M.**<br>*Mayer M.* |
| | | Sicherheitshinweis in Kapitel 12 ergänzt / Safety information in chapter 12 added | **Stefano R.**<br>*Mayer M.* |
| | | Anpassungen in Kapitel 13 / Adaptions in chapter 13 | **Coll M.**<br>*Mayer M.* |
| 10 | 28.02.2019 | Ergänzung von kritischen Störmeldungen in Kapitel 12 / Addition of critical error messages in chapter 12 | **Hirzinger J.**<br>*Mayer M.* |
| 9 | 27.05.2015 | Ergänzung „Klassifizierung – Potenzieller Kunde“ / Additional „Classification - Prospective Customers“ | **Bilek**<br>*Kelly* |
| 8 | 30.04.2015 | Grundlegende überarbeitung zur anpassung an TA 1100-0110 / Fundamental Reworl to align with TA 1100-0110 | **Provin/Rocha**<br>*Mayer* |
| 7 | 16.10.2013 | Punkt 1.6 überarbeitet / Point 1.6 revised | **Provin**<br>*Mayer* |
| 6 | 19.03.2013 | Punkt 1.22 neu / Point 1.22 new | **Bilek, Provin**<br>*Mayer* |
| 5 | 06.09.2012 | Ergänzung rechtlicher Hinweis/ legal notice added | **Provin**<br>*Spieker* |