DRAFT AMENDMENT ISO 3977-3:2002/DAmd 1

ISO/TC **192**

Secretariat: **ANSI**

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Gas turbines — Procurement —

Part 3:
Design requirements

AMENDMENT 1

Turbines à gaz — Spécifications pour l'acquisition —

Partie 3: Exigences de conception

AMENDEMENT 1

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ICS 27.040

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Foreword

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International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 3977 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

Technical Corrigendum to International Standard ISO 3977-3:2002 was prepared by Technical Committee ISO/TC 192, *Gas Turbines*, JWG 4, *Gas turbine use*.

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ISO 3977 consists of the following parts, under the general title *Gas turbines — Procurement*:

— *Part 1: General introduction and definitions*

— *Part 2: Standard reference conditions and ratings*

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— *Part 3: Design requirements*

— *Part 4: Fuels and environment*

— *Part 5: Applications for petroleum and natural gas industries*

— *Part 7: Technical information*

— *Part 8: Inspection, testing, installation and commissioning*

— *Part 9: Reliability, availability, maintainability and safety*

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Gas turbines — Procurement — Part 3: Design requirements

1 Scope

This Technical Corrigendum is issued to correct technical errors and ambiguities in ISO 3977-3:2002 in order to avoid incorrect and unsafe application of the standard.

Page 1

2 Normative references

ISO 11342 has to be referenced under 2 "Normative references" and not in the "Bibliography"

Change the title of ISO 10816-1 to read: "Mechanical vibration - Evaluation of machine vibration by measurements on non-rotating parts - Part 1: General guidelines

ANSI B31.3 to be replaced by ISO 15649 "Petroleum and natural gas industries – Piping"

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3.25 lower explosion level

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Replace existing text by:

3.25
lower explosion limit
the concentration of flammable gas or vapour in air, below which the gas atmosphere is not explosive

Page 10

4.4.2 Responsibility for the unit

Replace existing text by:

The packager shall be responsible for the gas turbine package performance and mechanical integrity provided the package is operated and maintained as per the packagers instructions.

Page 11

4.5.1 Coupling and guards

Delete "and guards" from the title

Page 13

4.6.4 Motor and electrical

Replace existing text by:

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N/A

Motors, electrical components, and electrical installations within hazardous zones shall meet the requirements of the relevant parts of IEC 60079. Area classification shall be carried out by the supplier, or packager, in respect of all potential sources of release that are likely to create an explosive atmosphere in accordance with IEC 60079-10.

NOTE If effective and reliable isolation of flammable substances is provided, it may be possible to demonstrate that an installation is safe when shut down and that unprotected electrical equipment may be used at such times.

Page 13

4.6.6 Dry low emissions combustion

Replace existing text by:

When specified by the purchaser the gas turbine shall be equipped with dry low emissions combustion (DLE) to control NO_x and CO emissions. On request, the packager shall demonstrate to the purchaser that the likelihood of a damaging thermal acoustic and flashback phenomena occurring from the combustion system is acceptably improbable.

Page 13

4.7.1 General

Delete the Note. Last paragraph to be replaced by:

Generally the packager is responsible for the lateral and torsional vibration analysis of the entire system. All shaft critical speeds, pertinent modes of exciting frequencies of the driver and driven equipment throughout the startup and operating speed range, and any external exciting forces, as defined by the purchaser, shall provide specified separation margins to prevent excitation of one by another. All these modes shall provide for ample frequency ranges within which the supporting foundation's natural frequencies can be designed. This analysis shall be performed before the package installation design.

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4.7.3.1 General

Delete the title

Replace existing text by:

The packager shall carry out an analysis of the torsional vibration characteristics of the complete system. A minimum separation margin of 10 % is recommended between each torsional eigenfrequency and any possible torsional excitation frequency. If this cannot be fulfilled, a torsional response calculation shall be performed. For all generator drives a response calculation for excitation by mal-synchronisation and by short-circuit shall be done. The torsional response calculations shall demonstrate that all stress responses remain in safe limits.

NOTE 1 Torsional excitation sources can include, but are not limited to, the following.

– For trains with generators or electric motors, one and two times the rotation speed should be considered as excitation frequencies. If electronic frequency converters are used, other integer multiples of the speed can excite torsional modes too.

– Gear unbalance or pitch line runout.

– Hydraulic governor control-loop resonance.

Note 2 For generator disturbance response calculations, no widely accepted standard is available. The packager may apply an appropriate internal standard.

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4.7.3.2 Forbidden speed ranges

Delete title and text

4.7.3.3 Critical speeds

Delete title and text

4.7.3.3.1 Lateral critical speeds

Delete title and text

4.7.3.3.2 Torsional critical speeds

Delete title and text

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5.1.4 Welding

Replace “ANSI B 31.3” by “ ISO 15649”

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5.2.3.4 Ventilation and purging

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Replace the last paragraph by:

If cool-down ventilation is required to prevent damage to the gas turbine major auxiliary or instrumentation systems within the enclosure, a separate back-up fan shall be provided.

Page 38

6.4.4.3 Emergency shutdown

Replace existing text by:

Emergency shutdown may be manually initiated but shall occur automatically on operation of applicable gas turbine/process plant protection devices as agreed with the purchaser. The system shall operate directly on the fuel shut-off valve to stop the gas turbine fuel supply.

Following emergency shutdown, normal turning and shutdown sequences, as appropriate, shall subsequently take place. An automatic restart shall not be possible without a manual reset unless mutually agreed between the packager and purchaser and supported by the package safety assessment.

Page 38

6.4.5 Fire and gas shutdown

Replace existing text by:

6.4.5 Fire, gas detection and ventilation failure shutdown

Should a serious fault be detected, such as fire, gas leakage at trip level, or ventilation failure, shutdown shall occur automatically as a result of the function of automatic detection devices. The system shall operate directly on the

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fuel shut off and vent valves. The gas turbine shall be shut down immediately without ramping to minimum load or cooling period.

In the case of gas detection at an enclosure ventilation outlet (but not the inlet), the ventilation fans shall be retained on to purge remaining gas from the enclosure.

If an unacceptable level of explosive atmosphere is detected at a ventilation inlet, the ventilation fans shall be tripped where applicable as the source is most probably external to the enclosure, and shutdown of the gas turbine shall occur.

Page 38

6.5.1 Turbine enclosure

Replace existing text by:

Ventilation air movement should be monitored and interlocked with the automatic start sequence. Only after a satisfactory purge of the enclosure where no unacceptable level of explosive atmosphere has been detected shall the automatic start sequence continue. Unless national regulations state otherwise, the purging cycle shall displace normally at least three times the volume of the enclosure before the starting sequence is allowed to proceed.

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6.10.7 Fire detection and protection

Replace existing text by:

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Where the gas turbine is installed in an enclosure, suitable means shall be provided to monitor for the outbreak of fire within the enclosure. The fire suppression system and fire detection system shall be designed

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a) to satisfy the national or regional requirements, and

b) in accordance with the mutual agreement between the purchaser and packager.

Rate-compensated thermal detection shall be considered the minimum level of detection. Additional levels of detection, such as optical (ultraviolet, infrared) or smoke, shall be specified by the purchaser.

All fire suppression and detection devices utilized within the enclosure shall be designed to operate throughout the entire range of operational service conditions encountered within the enclosure.

Halon or other ozone-depleting agents shall not be used for fire suppression.

The shutdown sequence shall be treated as in 6.4.5 unless otherwise agreed between the purchaser and packager. The shutdown sequence shall include the isolation of the ventilation fans, closing of fire dampers and the release of extinguishant to bring the fire under control.

The fire extinguishant shall be automatically released unless agreed otherwise between the purchaser and packager. In the case of automatic release, a delay may be necessary after an alarm to warn personnel of the situation. When CO_2 is used as a fire extinguishant a warning and a delay is required.

A means shall be provided to safely isolate the release during maintenance and entry into the enclosure.

NOTE 1 Isolation for entry may not be required if non-toxic or non-asphyxiant extinguishant is used.

A manual actuation system shall be provided. A manual release station shall be located externally on each side of the enclosure.

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Following a fire in the enclosure the extinguishant shall be sustained at an adequate level for a period of time to allow cool down of the gas turbine to a level below self ignition of any flammable fluid that may be present in the enclosure. For large heavy duty gas turbines this is not possible due to excessive need of extinguishant. In these cases the sufficient extinguishant level shall be kept until the engine is at low speed (typically 15...30 minutes). Other measures like supervision and foam application have to be prepared to prevent reignition.

NOTE 2 An agreement with the local fire marshal or authorities is recommended.

NOTE 3 The purchaser may specify any special design considerations to be included in the suppression system, including the specific fire suppression medium.

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6.10.8 Gas detection

Replace existing text by:

A gas detection system shall be provided where

a) the gas turbine is gas fuelled, and/or

b) when the gas turbine package is operating in a hazardous area.

NOTE Additional fire explosion risks relating to the driven unit should be considered and properly addressed

Suitable means shall be provided to monitor for gas leaks entering or within the enclosure, and for alarm and shutdown at appropriate concentrations. The shutdown shall be treated as in 6.4.4.

In an environment where gas can occur in the atmosphere (gas plants, LPG plants, etc.) a gas detector should be placed at the air intake of the gas turbine.

The philosophy of initiation and warning and shutdown levels for the gas detector(s) shall either

c) satisfy local or national regulations, or

d) be agreed between the purchaser and packager.

Gas detectors shall monitor for gas leakage and shall be arranged so that their efficiency is not impaired by adverse air flow, i.e. by a high air demand for heat removal. When the gas alarm system detects a specified percentage [typically in the range of 5 % to 10 % at the vent outlet of the lower explosive limit (LEL)], it shall give an alarm. When the gas alarm system detects a specified higher percentage (typically in the range of 10 % to 25 % of the LEL at the vent outlet), the gas turbine should trip, as described in 6.4.5.

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6.10.10 Exhaust temperature loading

Replace existing text by:

An array of temperature detectors shall be provided to monitor the temperature of the gas turbine exhaust or the temperature before a separate power turbine. Sufficient detectors shall be provided to detect asymmetric failure or deterioration of the combustion system or turbine nozzles. An alarm shall be initiated if an abnormal temperature deviation is detected. When higher deviation is specified, deloading, shutdown or trip shall occur.

Appropriate action should be taken in accordance with 6.4.4.

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