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Turbocompressors — Performance test code — Simplified acceptance test

Turbocompresseurs — Code d'essais des performances — Essai de réception simplifié

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 118, *Compressors and pneumatic tools, machines and equipment*, Subcommittee SC 6, *Air compressors and compressed air systems*.

Introduction

ISO 5389 is the primary International Standard for performance statements of dynamic compressors of all types.

For electrically driven packaged air compressors of standard types, which are constructed to specifications determined by the manufacturer, and which are sold against performance data published in the manufacturer's sales documentation, ISO 5389 provides for demanding conditions to be met for such standard packages.

To allow performance statements to be made for standard types, this simplified code has been developed where the performance statement can be given based on specified test conditions (see Table 1), where the key measured variables are maintained within identified test limitations (see Table 2).

The performance statement is valid, provided it is within the identified acceptance allowances (see Table 3) for volume flow rate, specific power consumption, and unloaded power consumption.

Whereas ISO 5389 addresses any type of dynamic compressor, this simplified International Standard addresses centrifugal compressors only which are of the fixed speed type and are electrically driven packaged air compressors. It is envisaged that at a later date, variable speed types will also be included.

This International Standard will ultimately become an annex of ISO 5389 once sufficient experience has been gained from its use in the field. In its current form, it complements ISO 5389 for standard packages, but where acceptance tests are required to demonstrate fulfilment of the order conditions and guarantees specified by the client in a supply contract, then ISO 5389 is still the primary reference International Standard.

Turbocompressors — Performance test code — Simplified acceptance test

1 Scope

This International Standard applies to any fixed (constant) speed, liquid cooled, packaged centrifugal air compressor which incorporates a centrifugal compression element of any type driven by an electric motor.

This International Standard defines and describes acceptance tests for electrically driven packaged air compressors of standard types which are constructed to specifications determined by the manufacturer and which are sold against performance data published in the manufacturer's sales documentation.

NOTE Items supplied shipped loose for installation at site are not considered to be a part of the compressor package.

Such compressors are designed to draw in atmospheric air from their immediate surroundings and the performance data offered by the manufacturer usually relates to a normal ambient air inlet pressure.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1217, *Displacement compressors — Acceptance tests*

ISO 3857-1, *Compressors, pneumatic tools and machines — Vocabulary — Part 1: General*

ISO 3857-2, *Compressors, pneumatic tools and machines — Vocabulary — Part 2: Compressors*

ISO 5167-1, *Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full — Part 1: General principles and requirements*

ISO 9300, *Measurement of gas flow by means of critical flow Venturi nozzles*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3857-1, ISO 3857-2, ISO 1217 and the following apply.

3.1
ambient pressure
absolute pressure of the atmospheric air measured in the vicinity of the compressor

3.2
ambient temperature
total temperature of the atmospheric air in the vicinity of the compressor but unaffected by it

3.3
centrifugal air compressor
comprise machines in which inlet, compression, and discharge are continuous flow processes

Note 1 to entry: The gas is conveyed and compressed in impellers and decelerated with further increase in pressure in fixed vaned or vaneless stators.

3.4
external coolant
liquid medium externally supplied to the compressor to which the compression heat is finally rejected

3.5
packaged compressor
compressor unit, fully piped and wired and generally includes all ancillary items necessary for their effective operation as a complete self-contained air compressor installation

3.6
packaged compressor (electrical) power input
sum of the electrical power inputs to the prime mover and all other ancillary and auxiliary items included in the standard package

Note 1 to entry: The total given is at the specified electrical supply conditions (voltage, phase and frequency) stated by the manufacturer in his sales data at loaded test conditions.

3.7
pressure ratio
discharge pressure divided by the inlet pressure

3.8
specific power consumption
packaged compressor input power (3.6) per unit of compressor actual *volume flow rate* (3.12)

3.9
standard discharge point (package)
terminal discharge point of the compressor, typically at the discharge flange of the package

3.10
standard inlet point (package)
point at which ambient air enters the package

Note 1 to entry: Unless otherwise indicated by the manufacturer.

Note 2 to entry: If filter is not included, refer to Table 1.

[SOURCE: ISO 1217:2009, 3.1.24, Note 2 to entry — modified]

3.11
unloaded power consumption
sum of the electrical power inputs to the prime mover and all other ancillary and auxiliary items included in the standard package

Note 1 to entry: The total given is at the specified electrical supply conditions (voltage, phase, and frequency) stated by the manufacturer in his sales data at unloaded test conditions.

3.12
volume flow rate
3.12.1
measured
volume flow rate of air, compressed and delivered at the *standard discharge point* (3.9), referred to conditions of total temperature, total pressure and composition prevailing at the standard inlet point

3.12.2
corrected
volume flow rate of air, compressed and delivered at the *standard discharge point* (3.9), corrected for machine behaviour at specified test conditions

Note 1 to entry: The specified test conditions are given in Table 1.

4 Symbols

4.1 Symbols and units

Symbol	Term	SI unit	Other practical units
f	Correction factor	—	—
f_1	Correction factor for influence of speed, temperatures, pressures, and humidity	—	—
f_2	Correction factor for condensed water vapour at the specified free air condition	—	—
f_4	Correction factor for inlet pressure	—	—
f_5	Correction factor for pressure ratio	—	—
f_6	Correction factor for cooling water temperature	—	—
$\dot{m}$	Mass flow	kg/s	—
N	Rotational frequency (shaft speed)	s^{-1}	min^{-1}
p	Pressure	Pa	MPa, bar, mbar
P	Power	W	MW, kW
Π	Pressure ratio	1	—
R	Specified gas constant	J/(kg·K)	—
SPC	Specific power consumption	—	—
T	Thermodynamic temperature	K	—
$\dot{V}$	Volume flow	m^3/s	m^3/h, m^3/min, L/s

4.2 Subscripts

Subscript	Term	Remarks
a	Absolute	
amb	Ambient	Air, temperature
cond	Condensate	
corr	Corrected	
g	Guarantee	
m	Mass	Characterizes the mass specific rates of flow, energies, and volumes
pk	Package	
R	Reading	Indicates the quantities read during the test or predetermined as test conditions
vap	Vapour	
W	Coolant	

5 Test conditions, limitations and allowances

5.1 General

The test conditions shall be as close as is reasonably possible to the conditions specified in Table 1.