

GENERAL SPECIFICATION

HVAC

GS EP HVA 410

HVAC Equipment FACTORY COMPLIANCE TESTS
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1. Scope

The present specification defines the reference documents and the procedures for *HVAC* equipment *FACTORY COMPLIANCE TESTS (FCT)*.

These procedures are only applicable to *HVAC* equipment listed in the present specification. For *HVAC* equipment (or piece of equipment) which is not listed in this specification but which is submitted to *FCT*, *CONTRACTOR* is in charge to develop and to submit a dedicated procedure to Company.

The words and expressions in CAPITAL characters and *italic* are defined inside the general specification **GS EP HVA 801**.

When other words require a definition only to be used in the present document, then the definition is given in a dedicated paragraph of the present document and the defined word, when used, is marked in small and *italic* letters.

2. Reference documents

The reference documents listed below form an integral part of this General Specification. Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the EFFECTIVE DATE of the CONTRACT.

Equipment and installations shall be in accordance with (by order of precedence):

1. The country local regulations where equipment and/or installations shall be operated
2. Total General Specifications as listed in **GS EP HVA 000**
3. The International Standards
4. The French Regulation (when Country local regulation does not exist).

International System of Units (SI) shall be used.

Notes:

- In case of discrepancy between documents the more stringent requirements shall apply.
- The *HVAC VENDOR* or *CONTRACTOR* may propose proven improvements to the reference documents but shall obtain written approval of the Company prior to implementation.
- An International Standard is a good "engineering practice" which shall be recognized and taken into consideration by *VENDOR*, *SUPPLIER*, *MANUFACTURER* and/or *CONTRACTOR*. If required, the translation of the standards shall be included into HVAC scope.
- The latest revision of standards, codes, regulations and the published errata if any shall be used and applied by *VENDOR*, *SUPPLIER*, *MANUFACTURER* and *CONTRACTOR*.

Some documents listed hereafter are issued from the French Government and are applicable to the basic engineering, detailed engineering and construction. *ENGINEERING*, *CONTRACTOR* are in charge to translate or to entrust the translation to specialist.

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External Documents

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published at the effective date of this document.

Reference	Title
AICVF Codes	Association des Ingénieurs de Chauffage, Ventilation Français (All codes in accordance with equipment or part of <i>HVAC</i> installation designed)
ARI	Air Conditioning and Refrigeration Institute (All documents in accordance with equipment or part of <i>HVAC</i> installation designed)
ASHRAE	American Society of Heating, Refrigeration and Air Conditioning Engineers (All documents in accordance with equipment or part of <i>HVAC</i> installation designed)
Directive 2004/108/EC dated 15 December 2004	Directive 2004/108/EC of the European Parliament and of the Council of 15 December 2004 on the approximation of the laws of the Member States relating to electromagnetic compatibility and repealing Directive 89/336/EEC Text with EEA relevance
Directive 2006/42/EC dated 17 May 2006	Directive 2006/42/EC of the European parliament and of the council on machinery, and amending Directive 95/16/EC
Directive 2006/95 dated 12 December 2006	Directive 2006/95/EC of the European Parliament and of the Council of 12 December 2006 on the harmonisation of the laws of Member States relating to electrical equipment designed for use within certain voltage limits
Directive 94/9/EC, referred to a ATEX 100a / 95	Directive of the European parliament and the council on the approximation of the laws of the member states concerning equipment and protective systems intended for use in potentially explosives atmospheres
Directive 97/23/EC dated 29 May 1997	Directive 97/23/EC of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment
Directive 98/37/EC dated 27 June 1988	Directive 98/37/EC of the European Parliament and of the Council of 22 June 1998 on the approximation of the laws of the Member States relating to machinery
EN 13053	Ventilation for buildings - <i>AIR HANDLING UNITS</i> - Rating and performance for units, components and sections
ISO 17025	General requirements for the competence of testing and calibration laboratories
ISO 5725-1	Accuracy (trueness and precision) of measurement methods and results. Part 1: General principles and definitions

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Reference	Title
ISO 5725-2	Accuracy (trueness and precision) of measurement methods and results. Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method
ISO 5725-3	Accuracy (trueness and precision) of measurement methods and results. Part 3: Intermediate measures of the precision of a standard measurement method
ISO 5725-4	Accuracy (trueness and precision) of measurement methods and results. Part 4: Basic methods for the determination of the trueness of a standard measurement method
ISO 5725-5	Accuracy (trueness and precision) of measurement methods and results. Part 5: Alternative methods for the determination of the precision of a standard measurement method
ISO 5725-6	Accuracy (trueness and precision) of measurement methods and results. Part 6: Use in practice of accuracy values
EN 14511-1	Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling - Part 1: Terms and definitions
EN 14511-2	Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling - Part 2: Test conditions
EN 14511-3	Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling - Part 3: Test methods
EN 14511-4	Air conditioners, liquid chilling packages and heat pumps with electrically driven compressors for space heating and cooling - Part 4: Requirements
NF EN 1886	Ventilation for buildings - <i>AIR HANDLING UNITS</i> -Mechanical performance

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Total General Specifications

Unless otherwise stipulated, the applicable version of these documents, including relevant appendices and supplements, is the latest revision published in the applicable yearly collection.

Reference	Title
GS EP HVA 000	List of HVAC specifications
GS EP HVA 231	Chilled water unit(s) (Water Cooled - Screw compressors)
GS EP HVA 801	Terminology, definitions, abbreviations

The Company General Specifications, other than "GS EP HVA XXX" **shall not be used** for the purpose of *FCT* of HVAC equipment.

3. Definitions

The following definitions have to be used in *FCT* report produced by the *MANUFACTURER*.

Measuring interval: set of values of quantities of the same kind that can be measured by a given measuring instrument or measuring system with specified instrumental uncertainty, under defined conditions.

Measurand: quantity intended to be measured.

Measured quantity value: quantity value representing a measurement result.

Measurement result: set of *quantity values* being attributed to a *measurand* together with any other available relevant information.

Quantity value: number and reference together expressing magnitude of a quantity.

4. Tools and spare parts lists

The tools and spare parts lists, for equipment start-up and 2 years maintenance have to be submitted before *FCT*, for the following item:

- *CHILLED WATER UNITS*.

5. Generalities

For equipment, or each piece of equipment, submitted to *FCT*, the *CONTRACTOR* is in charge of the *FCT* organization.

The necessary period to realize the *FCT* has to be taken into account during detailed engineering period in order that the *MANUFACTURER* deliver the equipment or piece of equipment in time, according to the detailed engineering, procurement, construction, pre-COMMISSIONING and COMMISSIONING project schedule.

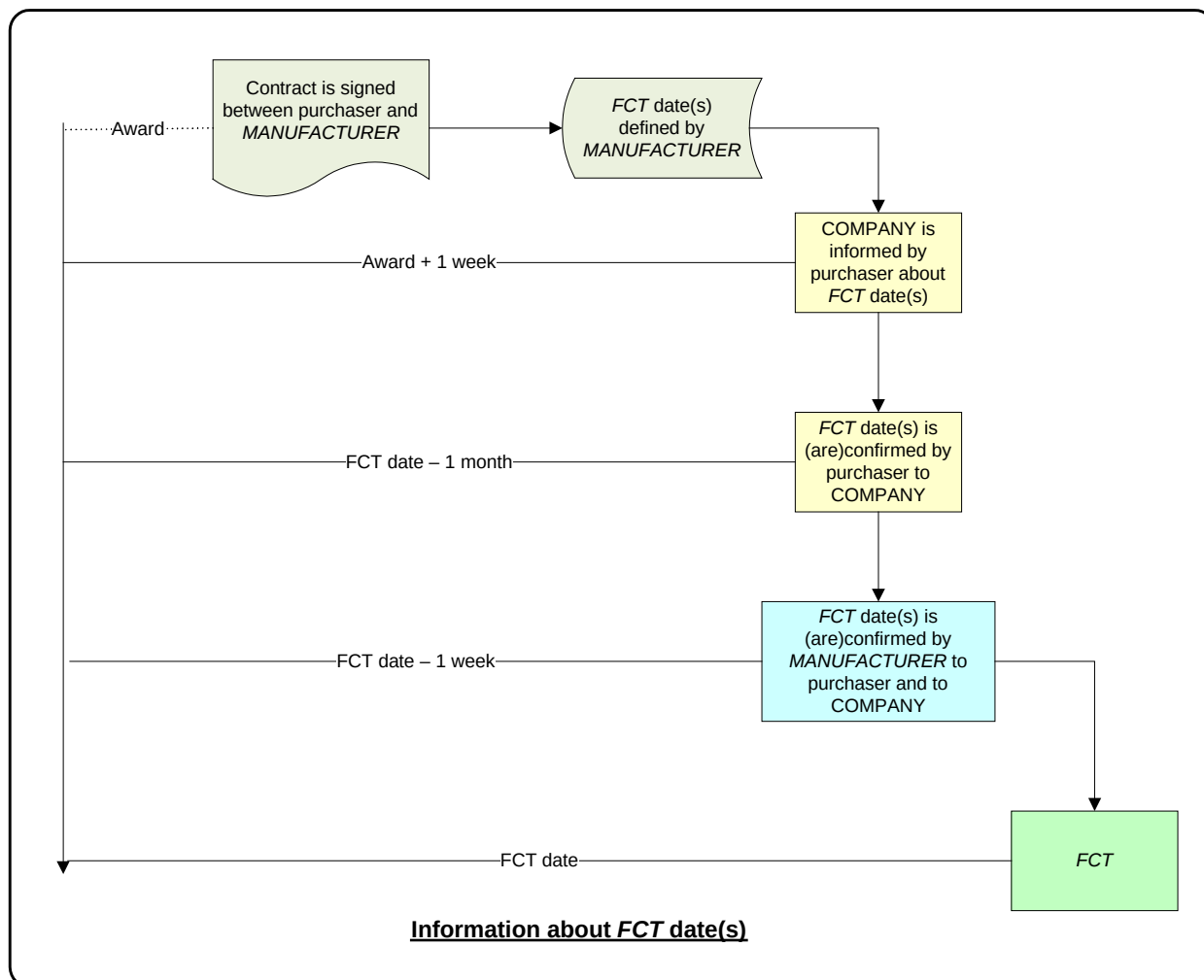
The *FCT* date(s) has (have) to be defined by *MANUFACTURER* when sales contract is signed between purchaser and *MANUFACTURER*. This information shall be transmitted by *MANUFACTURER* to purchaser **and** to Company as per the following figure. Respect of this requirement is mandatory.

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5.1 Information to be issued to *MANUFACTURER*

The issue of the following documents, by *HVAC CONTRACTOR*, to the *MANUFACTURER* is mandatory:

- Purchase Order Specification, attached documents, documents indicated for reference
- The present specification
- The measurement conditions which correspond to the design data for the concerned equipment, as per project calculation notes, General Specifications, etc. It is paramount to note that the measurement conditions shall include the over-design (as an example, the air flow rate to be considered for *AHUs*, includes the over-design on this data).

The address of project Company *HVAC SPECIALIST* has to be indicated in the Purchase Order Specification. A dedicated paragraph, in this Purchase Order Specification, shall refer to the present specification in order to remind the requirements regarding *FCT*.

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5.2 Document to be transmitted to purchaser

In order to guarantee success of *FCT*, the *MANUFACTURER* shall issue the following documents to the *CONTRACTOR* within 4 weeks after award:

- P&ID and/or *D&ID* of tests arrangement indicating all instruments for measurements. Equipment arrangement, instruments for measurement shall be indicated on these documents. Instruments tag numbers (as per calibration sheets) shall be indicated
- Calculation method(s) for capacity calculations
- Tolerance calculations and results of tolerance to be applied on results issued from capacity calculations
- Certification of laboratory procedures according to [ISO 17025](#) or identity of certifying authority covering the tests
- List of equipment tests and procedure for each test (this item include performance measurements and operation and/or functional tests)
- Tests and performance results forms
- Documentation of purchased equipment (PDF files and DWG files for drawings).

These documents shall be submitted to purchaser for approval and to Company for comment. This dossier is included in the *HVAC* Master Document Register under "Tests procedures for xxxx *FCT*" (where xxxx correspond to the equipment designation).

It shall be issued one dossier per equipment or per group of equipment. A set of chilled water units, for example, is a group of equipment.

Documents to be issued by *MANUFACTURER* to purchaser, not later than five weeks before the *FCT* date:

- The final documentation issued to purchaser approval (above listed documents to be issued four weeks after award)
- Equipment or piece of equipment user manual.

It has to be noted by *CONTRACTOR* and *MANUFACTURER* that these documents shall be transmitted to Company three weeks before *FCT* date, at least. The *FCT* date(s) shall be automatically postponed in case of the supply of these documents is delayed.

Instruments (sensors) calibration certificates (pdf files) shall be issued by *MANUFACTURER* to purchaser, during the *FCT*. The period of validity of certificate(s) shall cover the period of equipment, or piece of equipment, *FCT*.

6. Inspection of equipment during FCT

The punch list(s) shall be issued by the purchaser and signed by the purchaser, the *MANUFACTURER* and Company.

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The items of the punch list shall be classified in two categories:

- Category A: the item has to be cleared by the *MANUFACTURER* at the Factory,
- Category B: the item can be cleared by the *MANUFACTURER*, at the Factory or on the construction plant site.

6.1 Compliance with specifications

Compliance of equipment design, procurement and construction with project specifications (*HVAC* basis of design, General Specifications, etc) has to be checked.

6.2 Compliance with "documents approved for construction"

The compliance with the documents approved for construction (approval from Company) has to be checked. These documents are:

- Deviation(s) granted by Company
- General arrangement drawings
- Dimensions of equipment
- Position of battery limits (piping, cabling, etc.)
- Position of fixation points
- Lifting points
- Detailed drawings.

6.3 Certificates examination

The master certificates, issued from *MANUFACTURER* and/or from Notified Body(ies) shall be submitted to purchaser and to Company. They shall be marked by purchaser with written indication "Master certificate produced on (date) to purchaser". A copy of each marked certificate shall be attached to the *FACTORY COMPLIANCE TEST* report by the *MANUFACTURER*.

Certificates shall be provided for:

- Metallurgy
- Pressure tests
- Compliance with Directives, ATEX certification
- NOTIFIED Body certificates, when required
- Etc.

6.4 Labels

Installation of the following labels must be checked:

- Safety labels
- Name plates

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- Lifting labels
- Etc.

7. LIQUID CHILLING PACKAGE (water cooled) FCT

Note: The following restriction "Installations used for heating and/or cooling of industrial processes are not within the scope of this standard" mentioned within [EN 14511-1](#), [EN 14511-2](#), is not applicable for the equipment considered in the present specification.

This paragraph is applicable to *LIQUID CHILLING PACKAGE*(s) equipped with a water cooled condenser.

The following sections prevail over [EN 14511-2](#).

7.1 Preparation of FCT

The following documents shall be provided to Company (one paper copy, one set of native files, one set of PDF files) by purchaser the day of *FCT*:

- Purchase Order Specification (POS)
- Projects documents listed in POS
- P&ID of unit
- Data sheets
- Weight and center of gravity documentation
- Drawings with dimensions for operation and maintenance
- Request(s) for deviation, granted and signed by Company
- Documentation provided by *MANUFACTURER* (as built documents, Users Manual, wiring diagrams, spare parts list for start-up, spare parts list for 2 years operation, etc.)
- Test certificates issued by *MANUFACTURER* during equipment manufacturing
- Certificates issued from Notified Body(ies)
- Calibration certificates for measurement devices and measurement standards (etalons) according to [ISO 17025](#).

The delivery of above documents, taking into account the last comments issued by Company, is a preliminary condition to realize the *FCT*. It means that Company can decide to delay the *FCT* in case of one or several of above listed documents is (are) not provided to Company.

7.2 Compliance with specifications

Refer to "Inspection of equipment during *FCT*" section.

7.3 Compliance with "documents approved for construction"

Refer to "Inspection of equipment during *FCT*" section.

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7.4 Certificates examination

The master certificates, issued from *MANUFACTURER* and/or from Notified Body(ies) shall be submitted to purchaser and to Company. They shall be marked by purchaser with written indication "Master Certificate produced on (date) to purchaser". A copy of each marked certificate shall be attached to *FACTORY COMPLIANCE TEST* report by the *MANUFACTURER*.

7.5 Test conditions

7.5.1 Environmental conditions and electrical power supply requirements

The tests shall be carried out under the environmental conditions hereafter indicated, depending on the location of the unit:

- Ambient temperature: $24^{\circ}\text{C} \pm 1,5^{\circ}\text{C}$
- Ambient *RELATIVE HUMIDITY*: 60% to 70% or surface temperature measurement on cooled parts of unit. The measured surface temperature(s) has (have) to be higher than $18,1^{\circ}\text{C}$.

Electrical power voltage and frequency shall be within the range of design data indicated in technical specification / data sheet.

7.5.2 Test conditions

The appropriate test conditions defined for the project shall be applied. These conditions have to be defined within the Purchase Order Specification (POS) of project.

These conditions are:

- Temperature at evaporator outlet (water or brine)
- Water mass flow rate through evaporator
- Temperature at condenser inlet (water or seawater)
- Water or seawater mass flow rate through condenser
- Refrigerant saturated vapour temperature on condenser or bubble point temperature (the bubble point is defined from the pressure measured at the discharge of the compressor)
- Refrigerant liquid temperature (including sub-cooling).

7.6 Measure of cooling capacity

The cooling capacity shall be determined in accordance with the direct method at the water or brine heat exchanger, by determination of the volume flow of the heat transfer medium and the inlet and outlet temperatures, taking into consideration the specific heat capacity and density of the heat transfer medium.

The cooling capacity (measured on evaporator) and heat rejection capacity (measured on condenser) shall be calculated using the following formula:

$$P_C = q \times \rho \times c_p \times \Delta t$$

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where:

P_c is the capacity, in Watt

q is the volume flow rate, in cubic metre per second

ρ is the density, in kilogram per cubic metre

c_p is the specific heat at constant pressure, in Joule per kilogram and Kelvin

Δt is the difference between exchanger inlet temperature and outlet temperature, in Kelvin.

The uncertainties of measurement shall not exceed the limits specified hereafter:

<i>Measured quantity value</i>	Unit	Uncertainty of measurement regarding <i>measured quantity value</i>
Inlet / outlet water temperature	°C	± 0,1 K
Mass flow	kg/s	± 1 %
Pressure difference	kPa	± 5 %
Pressure at compressor discharge	kPa	± 1 %
Temperature of refrigerant	°C	± 0,5 K
Heat transfer medium concentration (brine)	%	± 2 % of the water mass
Electrical absorbed power	W	± 1 %
Power supply voltage	V	± 0,5 %
Absorbed current	A	± 0,5 %
Energy consumption	kWh	± 1 %
Compressor rotational speed (when open compressor)	min ⁻¹	± 0,5 %

Calibration certificates shall be provided by the *MANUFACTURER*, for each of the measurement devices. The certificates shall be dated less of six months, referred to the *FCT* date.

7.7 Measurement of performance

7.7.1 Steady state conditions

The required conditions to start the measurements are considered obtained and maintained when all the *measured quantities values* remain constant without having to alter the set values, for a minimum duration of 35 minutes, with respect to the tolerances given in the following table. Periodic fluctuations of *measured quantities values* caused by the operation of regulation and control devices are allowed, if the mean value of such fluctuations does not exceed the permissible deviations listed in the same table:

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<i>Measured quantity value</i>	Permissible deviation of the arithmetic mean values from set values	Permissible deviations of individual <i>measured quantity values</i> from set values
Ambient dry bulb temperature	0,5 K	± 1 K
Ambient <i>RELATIVE HUMIDITY</i>	2 %	3%
Inlet water temperature	± 0,2 K	± 0,5 K
Outlet water temperature	± 0,3 K	± 0,6 K
Volume flow	± 2%	± 5 %
Pressure difference	-	± 10 %
Temperature of refrigerant	± 1 K	± 2 K
Saturated vapour temperature	± 0,5 K	± 1 K
Power supply voltage	± 4 %	± 4 %
Absorbed current	± 5 %	± 5 %

7.7.2 Measurement recording

The following data shall be measured:

<i>Measured quantity value</i>	Unit
Ambient temperature	°C
Ambient <i>RELATIVE HUMIDITY</i>	%
Evaporator water (brine) inlet temperature	°C
Evaporator water (brine) outlet temperature	°C
Volume through evaporator	m ³ /s
Pressure difference on evaporator	kPa
Condenser water inlet temperature	°C
Condenser water outlet temperature	°C
Volume through condenser	m ³ /s
Pressure difference on condenser	kPa
Heat transfer medium concentration (when brine)	%
Heat transfer medium specific heat	J/ kg.K
Refrigerant compressor discharge pressure	bar abs.
Compressor rotational speed of open type	min ⁻¹

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<i>Measured quantity value</i>	Unit
Absorbed power	W
Power supply voltage	V
Absorbed current	A

For EER₇₅ measurement, different data collecting periods shall be realized, taking into account the required capacity reduction. Medium flows shall be maintained at nominal project values for condenser and evaporator.

7.7.3 Manual measurements

<i>Measured quantity value</i>	Frequency	Unit
Starting current (only for "measure 4" – Refer to "Measurement parameters" paragraph)		A
Lowest surface temperature (on piping, exchanger, etc.)		°C

7.7.4 Measured physical properties

The following properties of medium(s) shall be measured before testing:

Property	Unit
Heat transfer medium concentration (when brine)	%
Heat transfer medium density (measurement from a sample)	kg/m ³

7.7.5 Intermediate calculated values

The following value, to be used for performance calculations, shall be calculated:

Value	Unit
Saturated vapour temperature	°C

7.7.6 Parameters to be used for measurement

The performance has to be measured for the following conditions:

- Measure 1: design conditions for operations (worst conditions for operations):
Parameters to be considered are:
 - Evaporator nominal leaving temperature
 - Evaporator nominal water flow rate

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- Maximum condenser entering water temperature (ETC_{Max}) on operation site (highest value of condensing temperature range, as per *HVAC* Basis of Design)
- Condenser nominal water flow rate
- Main power nominal voltage
- Main power supply frequency
- Capacity reduction: 0%.
- Measure 2: conditions for towing (when equipment has to be used during tow):
Parameters to be considered are:
 - Evaporator leaving temperature
 - Evaporator nominal water flow rate
 - Maximum condenser entering water temperature (water or air), during tow (highest value of condensing temperature range, as per *HVAC* Basis of Design)
 - Condenser nominal water flow rate
 - Main power nominal voltage
 - Main power supply frequency
 - Capacity reduction: 0%.
- Measure 3: design conditions for operations and minimum refrigerating capacity:
Parameters to be considered are:
 - Evaporator nominal leaving temperature
 - Evaporator nominal water flow rate
 - Condenser entering water temperature: lowest of the following temperatures:
 - . Minimum condenser entering water temperature, during tow (lowest value of condensing temperature range, as per *HVAC* Basis of Design)
 - . Minimum condenser entering water temperature on operation site (lowest value of condensing temperature range, as per *HVAC* Basis of Design).
 - Condenser nominal water flow rate
 - Main power nominal voltage
 - Main power supply frequency
 - Capacity reduction: maximum.
- Measure 4: starting current:
Peak starting current has to be measured on unit under automatic control.

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- Measure 5 to 8: measurements for EER calculations (refer to **GS EP HVA 231**):

Parameters to be considered are:

- Evaporator nominal leaving temperature: 6,7°C
- Evaporator nominal water flow rate
- Condenser inlet temperature according to the load ratio 100%, 75%, 50%, 25% (refer to Energy efficiency ratio paragraph – **GS EP HVA 231**)

ETC_{Max} = Maximum water entering temperature on condenser (nominal project conditions).

ETC_{Min} = Minimum water entering temperature on condenser (nominal project conditions).

$$\Delta T = ETC_{Max} - ETC_{Min}$$

- Condenser nominal water flow rate
- Main power nominal voltage
- Main power supply frequency.

7.8 Functional tests

In order to guarantee the correct design and construction of units, the following tests have to be performed:

Start-up test in normal conditions:

Test conditions	Action	Result to be checked
Remote On / Off switch is open	Operator tries to start the unit	Unit does not start
Remote On / Off switch is closed	Operator tries to start the unit	Unit starts

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Start-up test in ab-normal conditions:

Test conditions ¹	Action	Result to be checked
Chilled water outlet temperature sensor is disconnected from terminals in control cabinet	Operator tries to start the unit	- Unit does not start - Fault is indicated on chilled water unit fault contact
Compressors suction pressure sensors is disconnected (one by one) from terminals in control cabinet		

Automation (in normal operation) tests:

Test conditions	Action	Result to be checked
Water flow through evaporator is progressively reduced	Unit is started before flow reduction	Unit stops Flow switch setting point has to be reported
Temperature at chilled water inlet is progressively reduced from nominal chilled water inlet temperature to nominal chilled water outlet temperature	Unit is started before test	Refrigerating capacity is progressively reduced by temperature controller
Compressors discharge pressure sensor is disconnected (one by one) from terminals in control cabinet	Unit is in operation	Unit stops

7.9 Test report

The *FCT* report shall be issued by the *MANUFACTURER* within one week after the *FCT* date. The tested unit shall not leave the Factory if *FCT* report has not been signed by *MANUFACTURER*, purchaser and Company *HVAC SPECIALIST*.

The test report dossier shall include:

- Documents to be provided by *MANUFACTURER* (refer to paragraph "Documents to be transmitted to purchaser")
- Tests and performance results

¹ When device exist on tested unit.

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- Functional tests
- Punch list.

7.9.1 Performance results

The performance results, of the “35 minutes of measurement tests”, shall be indicated in the following table, for each test (one table per test).

The tolerance on performance result shall be calculated for each test. A detailed calculation note (theoretical calculation) shall be provided indicating the calculations to realize for tolerance calculation for performance results.

Data	Mean value	Tolerance on result	Unit
Evaporator entering temperature			°C
Evaporator leaving temperature			°C
Evaporator water flow rate			m ³ /s
Condenser entering temperature			°C
Condenser leaving temperature			°C
Condenser water flow rate			m ³ /s
Refrigerating capacity			kW
Heat rejection capacity			kW
Absorbed power			kW
Starting current (measure n°4)			A

7.9.2 Operating tests results

The following tables shall be produced in report:

Start-up test in normal conditions:

Test conditions	Action	Result to be checked	Result
Remote On / Off switch is open	Operator tries to start the unit	Unit does not start	
Remote On / Off switch is closed	Operator tries to start the unit	Unit starts	

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Start-up test in ab-normal conditions:

Test conditions ²	Action	Result to be checked	Result
Chilled water outlet temperature sensor has to be disconnected from terminals in control cabinet	Operator tries to start the unit	- Unit does not start - Fault is indicated on chilled water unit fault contact	
Compressors suction pressure sensors have to be disconnected (one by one) from terminals in control cabinet			

Automation (in normal operation) tests:

Test conditions	Action	Result to be checked	Result
Water flow through evaporator is reduced	Unit is started before flow reducing	- Unit stops - Flow switch setting point has to be reported	
Temperature at chilled water inlet is progressively reduced from nominal chilled water inlet temperature to nominal chilled water outlet temperature	Unit is started before test	Refrigerating capacity is progressively reduced by temperature controller	
Compressors discharge pressure sensor have to be disconnected (one by one) from terminals in control cabinet	Unit is in operation	Unit stops	

² When device exist on tested unit.

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8. Other references

Following documents are applicable:

- AICVF Codes, ARI, ASHRAE, Directive 94/9/EC, referred to a ATEX 100a/95, Directive 97/23/EC dated 29 May 1997, Directive 98/37/EC dated 27 June 1988, Directive 2004/108/EC dated 15 December 2004, Directive 2006/42/EC dated 17 May 2006, Directive 2006/95 dated 12 December 2006, EN 13053, ISO 5725-1, ISO 5725-2, ISO 5725-3, ISO 5725-4, ISO 5725-5, ISO 5725-6, EN 14511-3, EN 14511-4