



Exploration & Production

GENERAL SPECIFICATION

ROTATING MACHINERY

GS MEC 101

Design and Power Margin

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1. Scope

1.1 Purpose of the specification

- To define the position of the design point of a machine with respect to the specified operating points.
- To define the minimum power margin between the driven equipment power requirements and the drive machine available power at site conditions.

1.2 Limits of application

This specification applies to the following driven machines, whether or not covered by a standard, a professional document or a code:

- Centrifugal compressors,
- Axial compressors,
- Volumetric compressors,
- Centrifugal or axial or helico-axial pumps,
- Volumetric pumps,
- Electric generators.

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.

Standards

Reference	Title
Not applicable	

Professional Documents

Reference	Title
API 610	Centrifugal pumps for general refinery service
API 611	General purpose steam turbines for refinery service
API 612	Special purpose steam turbines for refinery service
API 616	Combustion gas turbines for general refinery service
API 617	Centrifugal compressors for general refinery service
API 618	Reciprocating compressors for general refinery service
API 619	Rotary type positive displacement compressors for general refinery service

Reference	Title
API 7B11C	Internal combustion reciprocating engines for oil field service
API 11 P	Packaged high speed separable engine driven reciprocating gas compressors
ISO 5199	Technical Specifications for Centrifugal Pumps Class II

Regulations

Reference	Title
Not applicable	

Codes

Reference	Title
Not applicable	

Other documents

Reference	Title
Not applicable	

Total General Specifications

Reference	Title
Not applicable	

3. Definitions

- **Operating point:** Complete set of operating characteristics (power, flow, pressure, temperature, speed, liquid and/ or gas composition, etc.) of a machine or section or stage of a machine in service.
- **Design point** (of a machine or section or stage of a machine): Complete set of operating characteristics used as a basis for the design of the machine or section or stage of a machine, for which the efficiency is maximum.
- **Specified point:** Any operating point indicated in the specifications.
- **Guaranteed point:** Any specified operating point to be guaranteed.

Remarks:

- The design point may not correspond to a specified operating point.
- The guaranteed point may differ from the design point.
- Several guaranteed points may be required.

4. Driven Machines

4.1 Centrifugal compressors

The following clause complete the latest edition of **API 617**:

When a single point is specified, the design point of each stage (inlet guide vanes, impeller, diffuser and return channel) shall correspond to an actual suction volume flow between 100 and 105% of the specified operating point volume flow.

For compressors with variable inlet guide vanes, the specified point may be obtained by setting the guide vanes within plus or minus 10° from the position corresponding to pure axial flow.

4.2 Axial compressors

The compressor overall curve shall be taken into account. The suction volume flow of the compressor design point must be between 100% and 105% of the specified point suction volume flow.

The specified point may be obtained by setting the variable guide vanes between plus 5° and minus 10° from the setting corresponding to the design point.

4.3 Volumetric compressors

The volumetric compressors shall be designed for continuous operation at the discharge pressure equal to the pressure safety valve set point and the minimum specified suction pressure.

The actual net flow capacity of a volumetric compressor, taking into consideration the volumetric efficiency and all losses, shall be at least:

- 120% of the maximum specified flow for instrument air applications.
- 110% of the maximum specified flow for process applications.

4.4 Centrifugal or axial or helico-axial pumps

The design point of a centrifugal or axial pump shall correspond to a flow between 100% and 110% of the specified operating point flow.

4.5 Volumetric pumps

The volumetric pumps shall be designed for continuous operation at the discharge pressure equal to the pressure safety valve set point and the minimum specified suction pressure.

In these conditions, the actual net flow capacity of a volumetric pump shall be at least 110% of the maximum specified flow.

4.6 Electric generators

The electric generator power versus site temperature curve shall always be 5% minimum above the driver power versus site temperature curve within the specified range of the site conditions.

5. Power margin

5.1 General rules

In all cases listed below, the power absorbed by the driven machine shall include losses resulting from transmission, coupling, gears and shaft driven accessories.

5.1.1 Driven machines other than electric generators

The driving machine shall be able to deliver continuously a shaft power, at site conditions, and at the driven machine speed of any specified operating point, fulfilling both conditions hereafter, whichever is greater:

- Ten percent (10%) over the power corresponding to the maximum power of the guaranteed operating points with no positive tolerances (therefore including any API allowances or any other allowances for equipment not covered by a standard or a code).
- Five percent (5%) over the maximum power with no positive tolerances that can be absorbed at any specified operating point.

5.1.2 Electric generators

At specified site conditions, the driving machine shall have at least a power margin of 10% above the net output shaft power of the driving machine required to produce the specified electric power.

5.1.3 Small power motors applications

Motors shall have power ratings including the service factor, if any, at least equal to the percentages of power at rated conditions, as follows:

Motor nameplate rating	Percentage of guaranteed absorbed power
<22 kW	125%
22 to 55 kW	115%
>55 kW	As per §5.1.1

5.2 Special rules

5.2.1 Start-up conditions

Start-up of a rotating machines train shall be possible without any depressurization.

For electric motors, the calculation of the acceleration time of the shaft line shall be submitted to COMPANY for approval.

5.2.2 Gas turbine

In all cases, the maximum inlet turbine temperature corresponding to continuous operation of the gas turbine shall never be exceeded either for any operating point or to fulfill the above indicated power margin.