

GENERAL SPECIFICATION

ROTATING MACHINERY

GS EP MEC 253

Anti Surge System for Centrifugal and Axial Compressors
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1. Scope

1.1 Purpose of the specification

The intention of this document is to provide an overview of how the compressor anti-surge system should work, with the following points:

- Function and minimum requirement definition
- Responsibility of the Vendor for the whole system, as defined in this document.

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 as per [API Std 617](#) or [API Std 672](#)
- Axial compressors

applicable for either process gas or air.

1.3 Responsibility

The compressor Manufacturer shall assume the full responsibility for the design, the supply and the tuning of the Anti Surge System. In addition, compressor Manufacturer shall review and comment the sizing of the complete anti surge loop.

The equipment including all auxiliaries shall be suitable for operation under the environmental conditions specified by the Company.

2. Reference documents

The reference documents listed below form an integral part of this General Specification.

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
API Std 617	Axial and Centrifugal Compressors and Expander-compressors for Petroleum, Chemical and Gas Industry Services
API Std 672	Package Integrally Geared Centrifugal air Compressor for Petroleum, Chemical and Gas Industry Services
ASME PTC 10	Performance Test Code on Compressors and Exhausters
FCI 70-2	Control Valve Seat Leakage

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Reference	Title
ISA Guide	Control Valves, Practical Guide for Measurement and Control
ISO 5167 (All parts)	Measurement of fluid flow by means of pressure differential devices - All parts

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 INS 101	Instrumentation engineering, supply and construction general requirements
GS EP INS 120	Control and Choke Valves
GS EP INS 137	On/off valve control panels and actuators functional and construction requirements
GS EP INS 900	Instrument hook-up diagrams
GS EP MEC 292	Rotating Machines Packages Installation Requirements
GS EP PVV 102	Piping Hook-up Standards
GS EP PVV 112	Piping material classes
GS EP PVV 142	Valves

3. Definitions

- **Surge Flow:** The volume flow capacity below which a dynamic compressor starts to surge.
- **Surge Line:** A line composed of dedicated points where for each speed, the actual surge occurs when the flow is reduced.
- **Surge Control Line:** A parallel line to the surge line where the anti surge valve is operated to keep minimum flow through the compressor without surging.
- **Surge Protection Line:** Called also Safety Line, a line between the surge line and the control line where the anti-surge valve is ordered to be fully open.

4. System Overview

A dynamic compressor requires a recycle loop to control the flow and avoid surge by keeping a specified minimum flow through the compressor. Surge is a non-steady state condition with flow reversal inside the impellers and can cause severe damages to the machine, particularly to the impellers, the thrust bearings and the seals. It can also affect the suction and discharge piping.

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To prevent surge conditions, an anti-surge system is employed. This system continuously checks the process conditions and adjusts the flow through the anti-surge valve in order that at least the minimum flow is maintained. It attempts to anticipate surge through the field instruments and takes pre-emptive action, by opening the anti-surge valve before any surge occurs. If surge is detected then the anti-surge valve trips open and the compressor is tripped.

The anti-surge system is designed for control and asset protection. It is not designed as a safety system.

The compressor anti surge protection loop(s) shall be free of any isolation or check valve.

The flow measurement shall be installed on the suction line.

The anti-surge system shall consist as a minimum of:

- Compressor suction flow measuring device
- Compressor suction flow transmitter
- Compressor suction and discharge pressure transmitters
- Compressor suction temperature transmitter if required for flow compensation
- Anti-surge valve and associated accessories (refer below)
- Anti surge control system based on PLC technology.

In case of side stream, such as for refrigeration compressors, each compressor section shall have its own anti-surge protection system including dedicated anti surge valve, instrumentation and controller.

In case of a multistage compressor with or without intermediate gas refrigeration, each compressor section shall have its own anti-surge protection system including dedicated anti surge valve, instrumentation and controller.

4.1 Field Instrumentation

Refer to the anti-surge control system schematic attached in Appendix 1. Anti Surge instrumentation shall be fully dedicated to the anti-surge system and provided by compressor Manufacturer. The instruments are installed on the suction and discharge pipe work of the compressor by Contractor. These field instruments to be provided by compressor Manufacturer include:

- 1 x suction flow differential pressure transmitter coupled to a flow nozzle measuring device located at the compressor suction side and installed according to [ISO 5167](#) with all necessary straight lengths of upstream and downstream pipe. If the rangeability of the Anti Surge control PDT is not enough to measure the maximum flow of the compressor, a second PDT, called "wide range PDT", shall be supplied and wired to the PLC. The information shall also be sent to the DCS.
- 1 x suction pressure transmitter
- 1 x suction temperature transmitter, if required for flow compensation