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## Compressed air system basic standards

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## 1. General information

This document summarises the key guidelines with respect to the compressed air systems in the SOLARIS synchrotron.

## 2. Technical description

### 2.1 Synchrotron technology in connection with the compressed air system

#### 2.1.1 Storage ring (SR)

The compressed air system in the storage ring includes the following elements – main pipeline with (for each ring sector):

1. Main connections for the straight section front end components: supply with the cut off valves,
2. Main connections for the magnet section front end components: supply with the cut off valves,
3. Main connections for the aluminium chambers of the insertion device: supply system including cut off valves,

#### 2.1.2 Experimental hall (EH)

The compressed air system in the experimental hall is provided with the following elements:

1. main connections for the beamline infrastructure: supply system with cut off valves,
2. infrastructure – backbone/frame construction with sectoral infrastructure for beamlines

### 2.2 Compressed air installations for the synchrotron technology

#### 2.2.1 Compressed air technological parameters

Compressed air is used as a purifying and driving medium, as well as the controlling medium of the synchrotron components and devices.

The compressed air in the main pipeline has the following parameters:

- 1) Working pressure: 6.0 bar
- 2) Minimum pressure: 4.5 bar
- 3) Air quality: class 2.2.1 as per PN-ISO-8573-1, i.e.:
  - a. Number of particulates in 1m<sup>3</sup> (after decompressing) – particles ≤ 1µm – not more than 1 mg/m<sup>3</sup>,
  - b. Dew point temperature: -40°C
  - c. Oil max. 0.01mg/m<sup>3</sup>, after application of the carbon filter max. 0.003mg/m<sup>3</sup>

#### 2.2.2 Materials and fittings used in backbone/frame infrastructure installations and compressed air supply manifolds

The following materials have been used in the synchrotron technology.

1. Main pipelines including connections were made from the double-side galvanized steel and mounted in the Geberit Mapress C-Stahl clamped system.
2. The connections were provided with the following (Festo standard):
  - connections dedicated for the devices (single ending, connection pieces): cut off valve with the threaded internal nest 1/4", which will enable connection/use of suitable adapters or endings of the same type as in the devices with the clamped pneumatic hose.
  - working connections (two endings, two connection pieces):
    - Cut off valve with a threaded internal nest 1/4" to be provided with CK-1/4-PK-4 ending
    - Cut off valve with the internal threaded nest 1/4" to be provided with KD4-1/4-I quick connector for KS4-CK-6 ending

3. The Client gives in Table 1. the standards currently used for fittings with their producer/supplier:

Tabel 1: Standards for fittings of compressed air

No.	Item	Type/Model	Producer/Supplier
1.	Quick connector	CK-1/4-PK-4	Festo
2.	Quick connector	KD4-1/4-I	Festo
3.	Quick connector	for KS4-CK-6	Festo

### 2.2.3 Materials and fittings used in the Vacuum Components that require compressed air (front end and beamline)

1. SOLARIS does not define exactly which type of materials should be used in front end components, insertion device and beamline. The applied materials must be suitable for under and above specified compressed air conditions and material used in SOLARIS backbone/frame infrastructure.
2. The Contractor takes full responsibility for realization of internal compressed air system for every component that requires compressed air.
3. Below, SOLARIS provides pins for connectors and sockets for components using compressed air.
  - a. pins on component: male
  - b. pins on connector: female
  - a. connector type: Amphenol-Tuchel Electronics
  - b. model: C016 30G006 100 12 (6+PE)
  - c. connection plan:

Pin	Item
1	Open / Out
2	Open / Out
3	Coil +
4	Coil -
5	Close / In
6	Close / In
7	n/a

4. SOLARIS requires that each connection between the backbone connection and the supply manifold (Pic. 1.) be equipped with an air preparation set consisting of, at a minimum, a regulator pressure gauge, shut-off valve and silencer (Pic. 2).
5. Where components using compressed air are grouped together in a single front end or beamline area, the Contractor shall:
  - a. install a buffer tank of up to 3 litres capacity with a check valve on the tank supply between the backbone connection or supply manifold, or air preparation set (Pic. 3)
  - b. after the buffer tank - install a local manifold with the number of spigots at least equal to the number of connections on the components; a minimum of one spare spigot is required (Pic. 3).



Pic. 1. Connection between a backbone connection and a supply manifold



Pic. 2. Air preparation set



Pic. 3. Buffer tank with a check valve and a local manifold

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## 2.2.4 Storage ring

### Scope of works and delivery

#### 1. The Contractor:

- a. delivers the executive design of the compressed air distribution system of the front end components including fittings specified by SOLARIS.
- b. based on the executive design of the Contractor, selects, provides and installs: supply separator/splitter, buffer tanks, local manifolds including the front end compressed air system fittings; prefabricates all necessary connections between supply splitter connection piece and the connection pieces of the front end individual components; where necessary – parallel connection and/or serial connection between the connection pieces of the same component and between the other components. If the Contractor provides components together with dedicated compressed air preparation sets – connections between those sets and connection pieces of the component. The selected fittings, materials and connections as well as all other elements not defined but necessary for proper assembly and operation of the front end compressed air system should be used at the factory acceptance test (FAT) and delivered to SOLARIS in a reconstituted state and assembled or ready for reassembly by SOLARIS at the installation stage
- c. if necessary – provides schematic diagram (executive design is not needed) of compressed air supply manifold for the insertion devices components, including the fittings specified by the Client, containing detailed specification of connections.
- d. execute the connections between supply manifold and the individual component connection pieces of the insertion device (usually by using flexible hoses, that will be provided by SOLARIS during the installation phase); where necessary, parallel connection and/or serial connection between the connection pieces of the same component and between the components. If the Contractor provides components together with dedicated compressed air preparation sets, buffer tanks and local manifolds – connections between those sets and local manifolds, and connection pieces of the component.

#### 2. SOLARIS:

- a. based on the executive design, it selects, provides and installs: single connection (usually by using flexible hoses) between main pipeline, through the air preparation sets, and supply manifold for the front end compressed air system,
- b. based on the executive design, mounts during the installation phase: supply manifold for the front end compressed air system; in case the supply manifold will be subdivided into several components, SOLARIS installs parallel connection and/or serial connection between all sections of the manifold,
- c. in case of delivery by the Contractor of all defined necessary materials and connections, based on the executive design, installs all necessary connections between supply manifold and the connection pieces of the individual front end components; where necessary – the adjoining and/or parallel and/or serial connection between the connection pieces of the same component and between the components,
- d. if necessary – based on schematic diagram, provides executive design and selects, provides and installs: supply manifold for the insertion device compressed air system (incl. fittings),

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- e. based on the executive design, it selects, provides and installs: single connection (usually by using flexible hoses) between main pipeline and supply manifold for insertion device compressed air system.

## 2.2.5 Experimental hall

### Scope of works and deliveries

#### 1. The Contractor:

- a. provides schematic diagram (executive design is not needed) of beamline components compressed air system, including the fittings specified by SOLARIS. And, where necessary – local compressed air supply manifolds for the individual or group beamline components, including suitable fittings.
- b. in case of necessity to use local manifolds – make connections between local supply manifolds and the connection pieces of the individual beamline components (usually by using flexible hoses, that will be provided by SOLARIS during the installation phase).
- c. where necessary – make parallel and/or serial connections between the connection pieces for the same component and between the components

#### 2. SOLARIS:

- a. provides an executive design of the compressed air backbone/frame installation, including the necessary fittings and diagnostics,
- b. based on the executive design, SOLARIS selects, provides and installs the backbone/frame infrastructure including fittings, diagnostics and connection pieces for the compressed air supply for components and local distributors of the beamline components. If the Contractor provides components together with dedicated compressed air preparation sets – makes connections between those sets and backbone/frame infrastructure.
- c. make the connections between supply manifold (backbone/frame infrastructure) and the connection pieces of the individual beamline components (usually by using flexible hoses, that will be provided by SOLARIS during the installation phase).
- d. make the connection between backbone/frame infrastructure and local manifolds of the beamline components (incl. fittings)

## 2.3 Industry guidelines

### 2.3.1 Compressed air system

SOLARIS requires meeting the following requirements to avoid the use of adapters, reduction, non-standard compressed air elements, etc .:

1. diameters and types of connection spigots on the supply manifold should be the same as the diameters and types of connection spigots on the main distribution pipeline; no requirement is defined for an identical type of connection: external or internal,
2. diameters and types of connection spigots of fittings elements mounted on the supply manifold or other parts of the installation, should be the same as diameters and types of connecting spigots on the front end components and beamline; no requirement is defined for an identical type of connection: external or internal

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3. In any other case, the Contractor will provide appropriate adapters, reductions, non-standard elements that ensure compliance with the aforementioned requirements.

### 2.3.2 Installation take-over

During the installation works, the Contractor is obligated to carry out detailed documentation of work progress, covering such subjects as pipeline connections, pressure tests, leak detections and repairs.