

Note 1 : It is important you let the Makerfigt organizer know if you intend to bring a robot with pneumatics as soon as possible, preferably when you register your robot. If no robot with pneumatics is registered, we can't ensure that we will have the necessary material to perform the tech check of a pneumatic robot. The risk being that we will not be able to allow you to compete.

Note 2 : In order to improve the compatibility of Makerfigt's ruleset with other European events, this appendix is inspired from the following document : Fighting Robot Association – Build Rules International Build Rules and Regulations 2022 Edition. However it is not an exact translation, so we strongly advise you to read it all.

Chapitre 9, Pneumatics

1 : Allowed Gases

Pneumatic systems must use Carbon Dioxide [CO₂]

2 : Maximum Pressure

The maximum pressure at any point within a pneumatics system must not exceed (68bar).

3 : Cylinders

The compressed gas must be stored in a commercially manufactured gas cylinder of appropriate design, specification and certification. Except where the maximum storage pressure is less than 3.4bar.

4: Burst Disc

The gas cylinder must incorporate a burst disc rated below the maximum test pressure of the bottle. Except where the storage pressure is less than 3.4bar)

5: Manual Isolation Valve

Gas cylinders charged to pressures of greater than 3.4 bars must incorporate a manual isolation valve that can be operated from outside of the robot.

6: Remote Isolation Valve

Where the manual isolation valve is not integral to the gas cylinder (for example: the gas is normally released as soon as the cylinder is screwed into the mating pneumatic connection) must have an additional remote isolation valve accessible from outside of the robot

6:1: Position

Any remote isolation valve must be positioned to minimise the pipe length between it and the cylinder. This pipe length must fully vent before the cylinder is fully unscrewed from the pneumatic connection.

7: Rating and marking

All industrial pneumatic components used with pressures greater than 3.4 bars must be rated and marked by the manufacturer, or tested to at least the maximum pressure available in that part of the system. You may be required to provide documentation or certification to support this.

7:1: Custom Components

Custom made components, non-industrial components, and parts operating above the suppliers maximum working pressure, must be independently tested and certified at 120% of the maximum system pressure available at that point. You may be required to provide documentation or certification to support this.

7:2 Hydraulic Components

Components originally designed for hydraulics use will be de-rated by 50% for pneumatics use.

8 : Pressure Relief Device

A pressure relief device must be installed in each part of the pneumatics system where a different operating pressure is used.

8:1: Rating

Pressure relief devices must have a rating of 68 bars or 110% of the pneumatic component with the lowest 'maximum working pressure' rating protected by that particular pressure relief device, whichever is the lower.

8:2: Low Pressure Systems

Pneumatic systems employing pressures less than 3.4 bars or systems employing air compressors that have a maximum output pressure lower than the pneumatic component with the lowest 'maximum working pressure' do not require a pressure relief device. The pressure relief device(s) dictate the maximum pressure available in that part of the pneumatics system. The pressure relief device(s) must have a flow rate capacity that exceeds the maximum flow rate that can be expected under 'over pressure' conditions. Any attempt to falsify the pressure settings of pressure relief device(s) will be considered as gross misconduct by the organizer and may result in expulsion.

8:3: Full Pressure Systems

Non-regulated pneumatic systems or pneumatic systems where the regulator is not directly attached to the gas cylinder require that a 68 bars pressure relief device is fitted.

8:4: Regulated Systems

Regulated pneumatic systems that operate at less than 16 bars and where the regulator is directly attached to the gas cylinder do not require a 68 bars pressure relief device before the regulator. The regulator must be rated to 120% of the gas bottle burst disc pressure. The burst disc pressure must be integrated between the gas cylinder and the regulator. After the regulator, a pressure relief device is required down-stream of the regulator rated at 110% of the component with the lowest 'maximum working pressure' rating.

9 : Pressure Relief Devices

Pressure relief devices must be readily accessible and must be removable for testing purposes.

10 : Mounting

All pneumatic components must be securely mounted and adequately protected within the body shell. Any component storing gas (i.e. gas cylinders, buffer tanks etc.) must be secured in such a way as it cannot escape the robot even if suffering a rupture.

11 : Test points

Within every different pressure zone there must be a test point where we can easily connect a pressure gauge for testing purposes. The test points can be removed after the tech check, in that case a visual check of the modifications will be necessary. The competitor will have to provide the necessary connectors required to make the test points available.

12 : Vannes de purge

All pneumatic systems must incorporate one or several pressure dump valve accessible from outside of the robot. This dump valves will quickly and reliably exhaust all gas downstream of the gas cylinder isolation valve (including if one way valves or any other type of component is fitted).

12.1 : Normally Open

The dump valve must be left open at all times when the robot is not in the arena or testing areas.

13 : Removable Cylinders and Filling

Gas cylinders must be readily removable for inspection and refilling. You will have to bring all the necessary material for filling up - including gas.

14 : Heaters and Boosters

Pneumatic systems using heaters or pressure boosters are not permitted.