

# TECHNICAL ARTICLE

# AIR

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**Synonyms:** *Atmospheric air, the atmosphere of the earth, compressed air.*

**Molecular Weight:** 28.975

**Density:** 0.7493 LB/ft<sup>3</sup> (at 1 atmosphere)

**Specific Gravity:** 1.00 (at 1 atmosphere)

**Description:** A compressible gas which is, by nature, invisible and tasteless, non-corrosive and non-toxic. Man has devised many uses for air and most involve some kind of preparation of the gas. Among these treatments we can list pressurization, filtration, and distribution. Once the air has been enhanced in some way it is no longer regarded to be in a natural state and more so considered as a Process Air.

The natural makeup of air includes mostly Nitrogen at 78% and Oxygen at 21%. The constituent balance is trace gases like Carbon Dioxide, Hydrogen, Helium, Neon, Argon, Krypton, and Xenon. Particles and vaporized water also inhabit the mixture dependent on local weather and environmental conditions.

Intentional or not, additives introduced through the processing of air further modify the gas for its intended application. The ingredients you might find added, by intent, include higher proportions of Oxygen and Helium, water vapor and odorants. Processing events, like compressing, put in condensable and particulate matter. Industrial pollutants unavoidably find their way into the mix too. Some common ones; Nitrogen Oxide and Dioxide, Hydrogen Solvents, Acetylene, Sulfur and various Hydrocarbons. These are sometimes undesirable and must be removed by purification.

**Classification:** Non-Flammable Gas. As a compressed gas, air falls under the federal regulatory eye of the Department of Transportation (DOT) and their provisions for handling, containing, labeling and transporting. The DOT acts over and in cooperation with the Association of American Railroads (AAR) and the Bureau of Explosives, the Federal Highway, Railroad and Aviation Administrations, and the US Coast Guard. This means that the DOT rulings apply evenly across all state lines and by all means of land, air and water transportation. They apply to rail transportation in Canada, as well. International air transportation of compressed air comes under the focus of the International Air Transportation Association (IATA).

If you desire to learn more about the DOT and other regulations, publications are available from each organization. I suggest that you obtain, first, the "Code of Federal Regulations" from the Superintendent of Documents, US Govt. Printing Office, Washington DC 20402 (for interstate, Title 49-Part 170 to 179; for water, Title 46-Part 146; for air Title 14-Part 103)

How does Diving Air fit into the regulated fanfare of the DOT? . . . Code of Federal Regulations (CFR), Title 49-Part 173.34. This covers procedures and regulation for safe handling, marking and transportation of Hazardous Materials. Yes, this means that pressurized diving air is considered hazardous.

**Containerizing:** Air can be put into any order of container from a balloon to a sport shoe lining. At the pressures used in diving (upwards of 3500 psi) the container must be designed to withstand both the pressure and handling. Air released from these elevated pressures can be quite violent. Even deadly. The cylinders (bottles) and associated compressing equipment easily turn into deadly shrapnel and projectiles during a failure. With cylinders, potential for hazards are enhanced by dropping and rough handling. Also, dragging will cause excessive wear on the cylinder walls which diminishes the safety factor. Never put yourself in the possible trajectory of a failed cylinder of charging whip during the filling process. Do not stand in front of or bend over a charging cylinder.

According to general rules, compressed air cylinders (diving air included) should be filled only with the owner's consent and in accordance with DOT regulations. The cylinder must bear proper markings for the gas contained therein. In the case of diving air, the most common in service are 3AA, E9791, 3AL, SP6498 and SP6576 types. The gases in a cylinder should not be intermixed and cylinders should be filled from an empty (or near empty) state.

It is common to find oil residue, passed on by the oil lubricated air compressor and which filtration may not catch, in the piping and charging apparatus of an air system. It is dangerous to put Oxygen into diving cylinders normally used for air. This poses an extreme hazard for explosion.

**Breathing Grades:** As detailed by the Compressed Gas Association (pamphlet G-7.1), air for breathing must be free of excessive oil and water condensable, poisonous gases and substances of any health hazard. This is particularly important in diving air since the action of partial pressures will amplify the effects of those detrimental substances. Water vapors, once condensed out, also pose threats of equipment corrosion and blockages. Carbon Monoxide, induced by burning of compressor lubricants and ambient pollution, is the greatest and most potentially dangerous threat.

The CGA grade for recreational diving is "E". Procedures must be instituted to ensure constant production of safe breathing air grades. A quality program, which includes monitoring and periodic analysis is indicated.

**Motto:** Stay healthy. Be "Air Aware".

