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## Air Liquide innovation and technology at the service of CERN for the LHC

*press release*

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### Air Liquide's world firsts at CERN

- An **ultra low temperature of  $-271^{\circ}\text{C}$** , close to **absolute zero\***
- This temperature is maintained along the whole length of a **27 km underground ring**
- Circulation of **superfluid helium** at a **reduced pressure** of 0.02 bar
- **3,000 components**, designed, manufactured and assembled to make up the 27 km cryogenic system
- **300 connection points** between the **Air Liquide cryogenic system** and the **LHC magnets**.

\* **Absolute zero:** the lowest temperature we can approach, corresponding to 0K on the Kelvin temperature scale or  $-273.15^{\circ}\text{C}$  on the Celsius temperature scale.

0 Kelvin is the temperature at which the movements of atoms and particles should be "fixed" and at which heat would no longer be produced by the atoms.

The **largest and most complex scientific instrument ever built** will be officially inaugurated at **CERN**, European Centre for Nuclear Research, on **October 21, 2008** by government representatives from the CERN member states, and many other dignitaries. On September 10th, the Large Hadron Collider (LHC) was successfully started, emitted its first beam of protons and is currently stopped until next Spring.

The **LHC**, the world's most powerful particle accelerator, **will break new ground in terms of knowledge of particle physics** and will therefore advance fundamental physics research into matter and the birth of the universe.

Since 1995, Air Liquide has contributed to this exceptional project, developing the "**largest refrigerator in the world**": a complex and innovative system of liquid helium distribution and cooling.

Placed in a tunnel 100 meters below ground, on the French-Swiss border, the **cryogenic system designed and installed by Air Liquide** distributes superfluid liquid helium in a ring measuring 27 km in circumference. The LHC's 1,700 superconducting magnets must be maintained at a temperature of 1.8K ( $-271^{\circ}\text{C}$ ), a cryogenic temperature very close to "absolute zero". Air Liquide also developed and supplied CERN with the **liquefiers** required to cool the helium. The Group's **operation and maintenance teams** provide CERN with their **know-how and skill** on a daily basis, in the fields of cryogenics.

**François Darchis**, member of the Air Liquide Executive Committee, in charge of Advanced Technologies, declared: "*The exceptional dimension of the LHC and the expected level of performance presented Air Liquide teams with a technological challenge that was met successfully. We are delighted with the first beam generations and continue to support CERN in order to open up the field of knowledge in fundamental physics. Air Liquide is proud to be contributing in this way to scientific projects that require total mastery of cryogenics at ultra low temperature.*"



With more than **40,000 employees** in **75 countries**, Air Liquide is the **world leader** in industrial and medical gases and related services. The Group offers **innovative solutions** based on constantly enhanced **technologies** and produces **air gases (oxygen, nitrogen, argon, rare gases...)** and **many other gases including hydrogen**. The Group contributes to the manufacturing of **many everyday products**: bubbles in sparkling beverages, protective atmosphere for packed foods, oxygen for hospitals and homecare patients, ultra-pure gases for the semiconductor industry, hydrogen to desulfurize fuels...

Air Liquide is committed to **sustainable development** and helps to **protect life**. Founded in 1902, Air Liquide has successfully developed a long-term relationship with its shareholders built on **trust** and **transparency** and guided by the principles of **corporate governance**. Since the publication of its first consolidated financial statements in 1971, Air Liquide has posted **strong and steady earnings growth**. Sales in 2007 totaled **11,801 million euros**, with sales outside France accounting for almost 80%. Air Liquide is listed on the Paris stock exchange and is a component of the CAC 40 and Eurostoxx 50 indices (ISIN code FR 0000120073).