



MADRID, SPAIN, CNG

EMT Sanchinarro Operation Center: "Record Station"

Galileo has designed and built the largest and fastest CNG station in Europe, equipping it with CNG Microcore® MSP330 Compressors and EMB® Dispensers.

Background

Madrid City Council has chosen the field of mobility and transport as one of the main areas to develop its environmental policy, which is aimed at substantial improvements in the quality of the air and the citizens' life.

Consequently, in 2010, Madrid's Municipal Transport Company (EMT) decided to reduce the environmental impact of its bus fleet with the progressive replacement of diesel vehicles by modern models, driven by Compressed Natural Gas (CNG).

The adoption of CNG was intended to reduce emissions of nitrogen oxides by 108 thousand pounds (lbs) (54 tons) approximately, and to lower particulates by an estimate of 8,000 lbs (4 tons) and CO₂ emissions between 15 and 20%.

Galileo Technology

The significant change the city of Madrid and EMT pursued involved the construction of the necessary public infrastructure to ensure the daily performance of the new vehicles.

The challenge was taken by Galileo along with its distributor in Spain, HAM. Both companies were selected to equip and mount the CNG refueling station of EMT Sanchinarro Operation Center, located in northern Madrid.

Inaugurated on November 17, 2010, this service area designed by Galileo is Europe's largest CNG refueling station, and the fastest by international standards. These unparalleled features led the press to refer to this station as the "record station".

Its magnitude can be seen in the 59,201 square feet (sqft) [5,500 square meters (sqm)] refueling area, divided into nine streets with refueling capacity to supply a total of 150 to 180 buses per hour. Therefore, the 400 buses, which it was conceived for, can fill their tanks in less than three and a half hours. Due to its refueling speed, Sanchinarro is considered the fastest CNG station worldwide.

Each of its nine refueling streets is equipped with a CNG Microcore® packaged compressor to provide a total compression capacity of 7,000 gasoline gallon equivalents per hour (GGE/hour) [25,000 normal cubic meters per hour (Nm³/h)]. Thanks to the unique Common Manifold® direct refuelling technology, this compression capacity results in the simultaneous operation of nine EMB® Dispensers of ultrafast flow.

This structure designed by Galileo enables an average filling time of approximately 3 minutes per bus or fuel tank of 6,354 standard cubic feet (scf) [50.8 gasoline gallon equivalent (GGE) - 180 standard cubic meters (Sm³)], in addition to a longer vehicle autonomy.

As refueled buses must cover a large area of the city,

Record Station

including the districts of Barajas, Hortaleza, Fuencarral, Chamartin, Centro, Salamanca, Ciudad Lineal and San Blas -it was central to achieve their maximum autonomy as one of the goals of the project.

To achieve this goal, each Microcore® compresses the natural gas at a pressure of up to 4,350 psi (300 bar) and lowers its temperature below 59 °F (15 °C) by applying the Coldbox® Technology. Both processes allow for a bigger CNG load per tank and contribute to the speed of the operation.

Another objective was to keep this station working 24 hours a day. With this purpose in mind, a central control system manages the start-ups and shutdowns of the Microcore®, optimizing their hours of operation and ensuring a steady supply of CNG.



Furthermore, as the fueling station had to contribute to optimizing the energy consumption of the entire Operation Center, the Microcore® has an intelligent speed control, called Enersave®. This control system controls and adjusts the compression capacity according to the demand of CNG. This ensures the availability of CNG flow as required, as well as the saving of energy by reducing the number of the equipment start-ups and shutdowns.

The environmental efficiency of Galileo technology is also shown in the installation of an innovative gas recovery system which completely eliminates methane emissions into the atmosphere.

Simultaneously, the full capacity of the station control is monitored via internet through the SCADA system (Supervisory Control and Data Acquisition) of Galileo.

The use of this tool facilitates the work of technical supervision and increases system reliability thanks to the permanent monitoring of the facility.

Part of a Major Project

It is worth highlighting that the CNG refueling station is part of an operation center which occupies an area of 635 thousand sqft (59,000 sqm) and serves nearly one-fifth of the EMT bus fleets.

Sanchinarro has an operation concept similar to the ongoing process of an automotive factory operation and the CNG refueling station was designed to run accordingly. Buses are identified automatically upon arrival at the service station; quickly and efficiently, all the services such as fueling, lubricating, adjusting tire pressure, and cleaning are provided for optimal functioning.

Sanchinarro intends to be an example of sustainability in the full sense of the word. Apart from the benefits of its CNG station, it features a photovoltaic plant for the production of hot clean water and a recycling plant for its own waste. It also has sound barriers and 3,000 plant species that minimize impact on urban environment.

The construction of this operation center required an investment of 47 million euros. In Mayor Alberto Ruiz Gallardón's words, the global objective of the project is "to make Madrid one of the most committed cities in the use of alternative and cleaner fuels."

"The completion of this work will reduce emissions of carbon dioxide and nitrogen oxides, one of the biggest problems of Madrid, as well as the consequent emission



In the opening ceremony, Mayor Alberto Ruiz Gallardón said in his speech that "the conversion of EMT to natural gas and the subsequent investment in fueling stations and related infrastructure makes sense environmentally, politically and economically."

"The purpose of this change," Gallardón said, "is to accompany Madrid and its citizens on their way to a more sustainable future, with greater opportunities for progress and a better life quality".



Summary

Galileo Technology

• CNG Microcore® MSP330 Packaged Compressors	9 Units	Total compression capacity of 7,000 GGE/hour (25,000 Nm ³ /h).
• EMB® Dispensers	9 Units	Ultra fast flow
• Common Manifold®		Direct filling and simultaneous operation of all dispensers
• Coldbox®		Bigger refueling volume for greater bus autonomy
• Enersave®		Energy saving due to a low number of equipment starts and stops
• Galileo SCADA®		Remote monitoring and management via internet

Operational Capacity and Efficiency

- The biggest CNG refueling station: 59,201 sqft (5,500 sqm) refueling area
- Operational flow through 9 refilling streets
- Capacity to supply 400 buses with CNG in less than three hours and a half, nearly one fifth of Madrid's buses

The Fastest NGV Refueling Station Worldwide

- 150 to 180 buses per hour
- 3 minutes average filling time per bus for an average volume of 6,354 scf (180 Sm³)

Galileo

Since 1983, Galileo has been a global reference in modular technologies for both CNG and LNG production and transportation. Its portfolio includes the widest range of compressors and pumps for vehicles and vessels; pipeline boosters and wellhead compressors; and the Virtual Pipeline® system, for gas distribution by road, which can reach remote communities and industries without pipeline network connection. Based in Buenos Aires, Argentina, with a Service and Training Hub in Los Angeles, USA, Galileo exports and provides ongoing assistance to customers in 65 countries in Latin America, USA, Europe, Africa and Asia.