

Doha Metro - Qatar Rail

Case study



Borri is privileged to have taken part in this prestigious project to supply more than 300 AC and DC UPSs and batteries for the colossal new Doha Metro project, powering safety, emergency systems and operations. "We have excelled in our technical and production capabilities meeting the difficult project challenges".



Key players

Main Contractor

Mitsubishi Heavy Industries (MHI) Group delivers innovative and integrated solutions across a wide range of industries from commercial aviation and transportation to power plants and gas turbines, and from machinery and infrastructure to integrated defence and space systems.

MHI, and Consortium partners, were awarded the Doha Metro system package by the Qatar Railways Company on 14 June 2015. The Doha Metro is the first metro system to be constructed in the State of Qatar and is one of the world's largest projects for a single metro system. MHI, the leader of the Consortium, supplied the power distribution system, platform screen doors, trackwork, tunnel ventilation system, and undertook overall project management and system integration.

End User

Following its establishment in 2011, Qatar Railways Company (Qatar Rail) is leading one of the largest rail projects in the region to meet the demands of Qatar's dynamic and growing population. The company is responsible for the design, construction, commissioning, operation and maintenance of the entire network and systems.

The state-of-the-art railway network consists of Doha Metro, a rapid transit system connecting communities within Doha and its suburbs and Lusail Tram, a service for convenient travel within the new city of Lusail.

The Challenge

Borri was selected for one of the largest projects in the Middle East for the emergency power backup, supplying over 300 units of AC and DC Uninterruptible Power Systems for the prestigious Doha Metro Project.

The systems are used to power the line signalisation, emergency lighting and fire system, substation protection and other critical loads needed to insure safe and proper operations under any power conditions.

Doha Metro is one of the most prominent and visible projects in Doha and runs throughout the city by three interconnecting lines - Red, Green, Gold - covering a total operational distance of 76 kilometres and 37 stations (Phase 1). The new metro system connects the main areas of Doha including the Hamad International Airport, the Old City, and newly developing inner city areas such as West Bay and Lusail. These lines opened to the public on 10 December 2019.

Borri was chosen for its technical solutions and manufacturing capability to meet the stringent project schedule and special design needed for this strategic transportation project.



On the left:
Borri AC UPS E3001.igbt 200 kW

Results

Doha Metro is one of the biggest ever Metro projects in the Middle East. Borri proved to be able to meet the stringent project specifications as well as high-volume and tight-schedule demands, maintaining at the same time high-quality manufacturing standards and a complete project support. Borri's Research and Development Team's expertise played a key role in the project. Borri's R&D engineers developed a strong and highly reliable UPS parallel control algorithm for long distance, guaranteeing high reliable operation even in electrically noisy environment.

No less important was the availability to support the customer during all installation and commissioning activities, with specialised staff and technical service on site, confirming Borri's capability to handle professionally and successfully technically complicated Power Backup mega projects.



On the right: Borri RTB 110 Vdc System.

Our solutions

All AC UPS units are based on the proven reliability of Borri's industrial UPS series E3001.igbt technology, which is characterised by input power factor correction achieving unity power factor and harmonic current distortion less than 3%.

System customisations were necessary to fulfil the customer's stringent requirements.

The main challenge was to parallel the UPS systems in different UPS rooms approx. 150 m apart; due to special long distance between the UPS's and the very long parallel control cable distance a special algorithm was implemented to allow the connection of parallel communication lines via fibre optic.

The hardware includes physical redundancy on the synchronisation signals by means of 2x individual fibre optic cables, resulting in an exceptional

system tolerance.

A special operating firmware was also developed to guarantee the parallel operation with unsynchronised bypass lines; the algorithm allows synchronisation of both UPS's with the priority line and automatic switch to the other one in case of failure, allowing for second fault tolerance.

The DC UPS systems are based on the Borri RTB series of industrial battery chargers in parallel redundant configuration, providing two independent lines inclusive of battery and DC dropping diodes for the supply of the DC loads. An integrated switch-over system at distribution level increases the overall availability of the supply, allowing for the automatic transfer to the healthy supply in case of failure of one of the chargers.

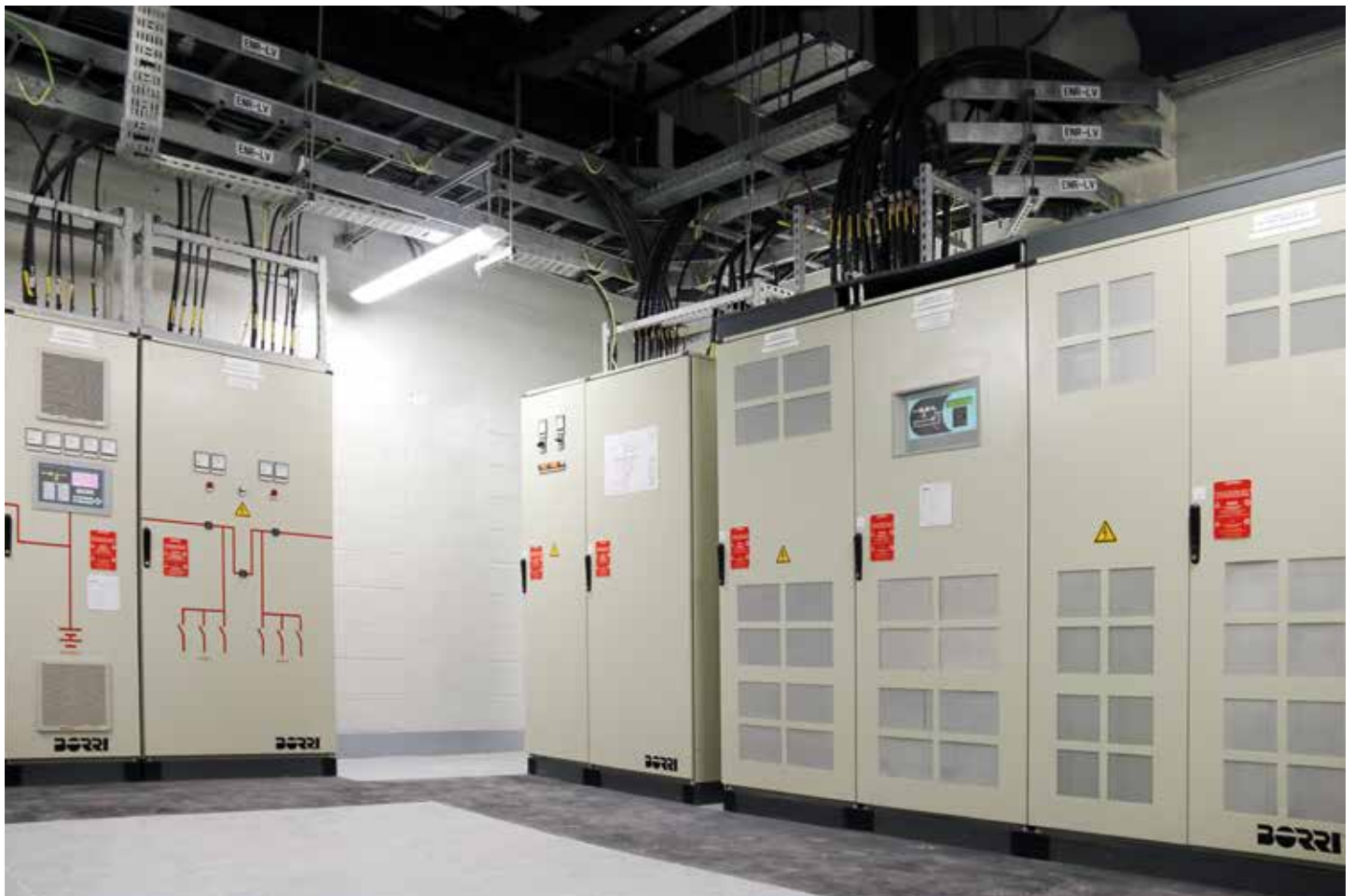
Such tailored solutions guarantee optimal system performance and reliability

thanks to the rugged state-of-the-art technology.

Integrity of parallel transmitted data on AC UPS's is guaranteed by the robustness of the fibre optic communication line and increased operation reliability is achieved thanks to the second fault tolerant algorithm.

Below:

Left Borri RTB 110 Vdc System,
Right Borri AC UPS E3001.IGBT 200 kW.



The system

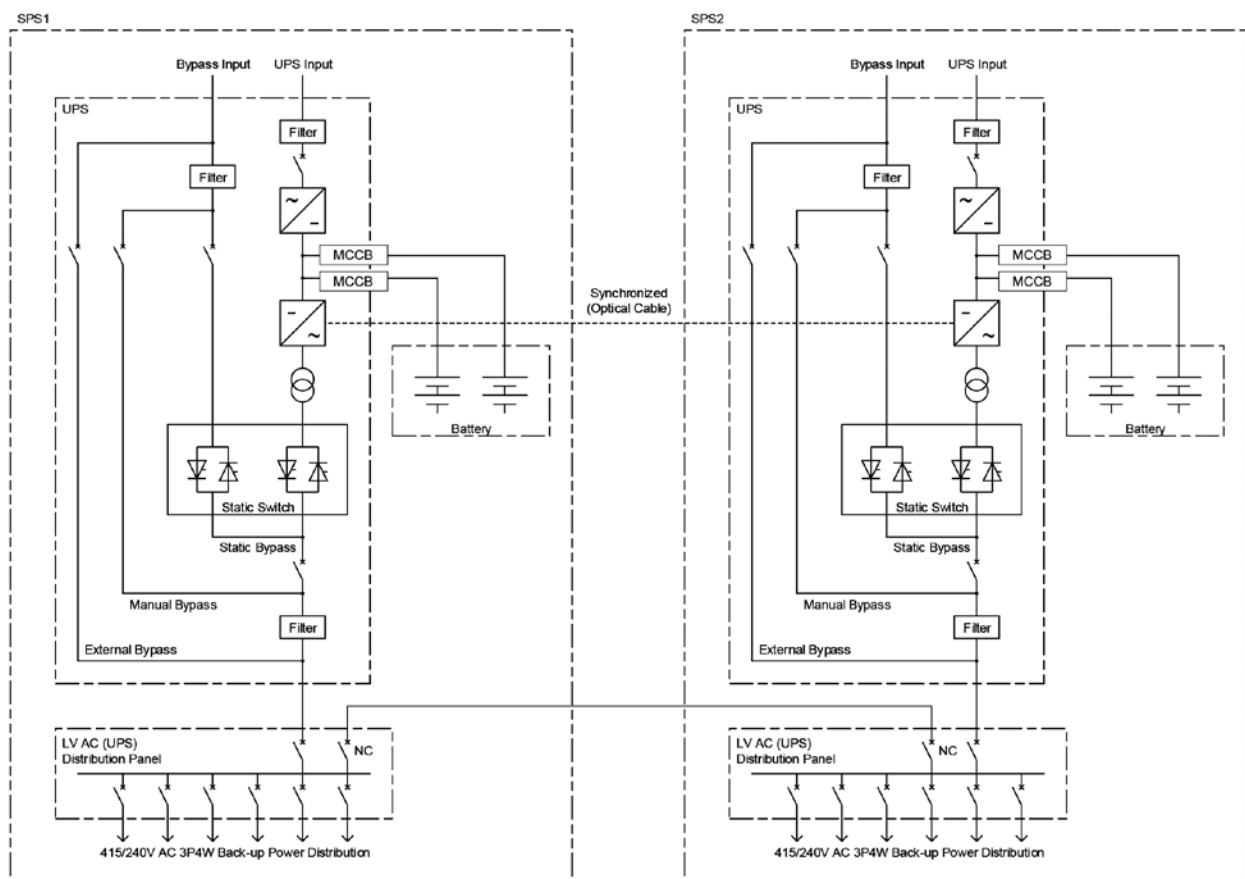
Starting at the end of 2016 until mid-2018 140 AC UPS and 190 DC UPS were tested and delivered, the installation started in sequence according to the project development plan. Each DC system is formed by two rectifiers in duplicate configuration, each one with its own battery providing 8 hours autonomy at actual load. DC UPS's supply all control, protection and auxiliary devices of the LV and MV switchgears. Each set of parallel UPS system, with power ratings ranging from 20 kVA up to 300 kVA, is formed by two units. The UPS rooms are generally approx. 150 m apart. The AC distributions are paralleled by power cables and the UPS parallel operation is controlled via fibre optic connection to handle long distance between the paralleled UPS. Each UPS unit is equipped with its own

Nickel Cadmium battery providing 4 hours autonomy at actual load. Borri UPS's protect all critical loads such as SCADA system, signalling and communication devices, emergency and escape routes lighting.

Validation tests

Compliance to EN 50171 (Central Power Supply Systems) was required for all AC UPS's. Certification was released by the IMQ institute according to type tests performed at Borri premises and witnessed by MHI engineers. Complete on-site functional tests to ascertain full system functionality were also carried out on each delivered system, according to Site Acceptance Test Procedure.

UPS single line diagram



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Who we are

Borri Group is a global provider of power electronics systems and solutions for harsh industrial and demanding commercial and ICT secure power requirements merging over eighty years of experience in developing, manufacturing and supplying uninterruptible power systems and solutions.

The Research and Development Team's expertise combines AC and DC power technologies spanning the worlds of both conventional and renewable energy, to provide innovative solutions for tomorrow's problems.

The company is comprised of three business units: Industrial Power, Critical Power and Renewable Power, headquartered in Bibbiena, Italy. Borri's latest products, based on Green Conversion operation, guarantee the best PUE for green data centres: proof of the ongoing company commitment to innovation.

Thanks to its highly skilled custom engineers Borri controls in-house the entire process: from feed studies to design, production and after-sales service guaranteeing state-of-the-art solutions.

Based in Italy with over 20,000 m² production area and a large high power test field, Borri can depend on its more than 80 years of experience and multidisciplinary research and development to serve our customers best.

For more information,
visit our website: www.borri.it