WB Power Services (WBPS) was first established in 1983 and since then we have grown significantly in size and service capability. Today, we provide critical power services to some of the UK's most important businesses and organisations, ensuring essential services are protected. We proud to retain our family values on a national scale as we strive to be the biggest and the best power generation company in the UK.

CASE STUDY

WB E-POD DATA CENTRE MODULAR POWER SOLUTION

Over many years, WB Power Services have worked very closely with a number of global Data Centre builders and operators to support them in the design, supply, installation and commissioning of a range of high quality and cost-effective standby generator packages of various ratings and configurations. Today we are one of the leading suppliers of standby power to the UK Data Centre market with an installed or in work base of over 500MW of standby generation. Using our significant experience and market insight WB have designed and built a full plug and play standby power package for the Data Centre market; This case study looks at the WB E-POD packages produced for one specific global hyperscale Data Centre client.

The offsite built and tested solution includes transformer, switchgear, generator, UPS, cooling, gantry, all interconnections between containers and fully site commissioning making this a true plug and play solution.

The solution outlined in this document has been designed by WB working in conjunction with the client, the clients' consultant and construction contractor. Right from the time of project conception WB worked with the design team, offering full electrical and mechanical design support to ensure the clients full range of requirements are catered for. The design process was undertaken with support from trusted partners and also vendors preferred by the client. The equipment has been packaged at our own newly equipped facilities in Leicestershire, manned by our own specialist mechanical and electrical teams all of which is over seen by a production manager.

DETAIL OF WORKS

SYSTEM OVERVIEW

This package includes a:
- Kohler KD3500 3500kVA / 2800kW 400V 50Hz DCC rated generating set
- Generator housed in a 65dBA @1m FFC container complete with o Selective Catalytic Reduction (SCR) system

A 48-hour capacity fuel system comprising:
- 35,000l (useable) bunded structural belly tank
- End mounted fuel fill point cabinet

MV/LV Power POD 14m x 4.0m x 4.0m which includes:
- 11kV Ring Main Unit Ringmaster
- 11kV/415V Cast Resin Transformer
- Main LV Switchboard
- Manual Transfer Switchboards
- Tripping Batteries

UPS power pod which includes:
- 1200kW UPS and 10min (end of life) VRLA Batteries
- 30kVA / 15kVA Static UPS & Batteries
- POD CRAC Units to flange ends mounted on the POD wall
- Static Transfer switch for power management of internal essential services

- Power POD Busbar Trunking to cable connection boxes on the POD wall
- Electrical Fit out of the POD
- POD Fire Suppression and Fire Alarm to match site requirements Access steps
- Commissioning and SAT
- Full site Installation

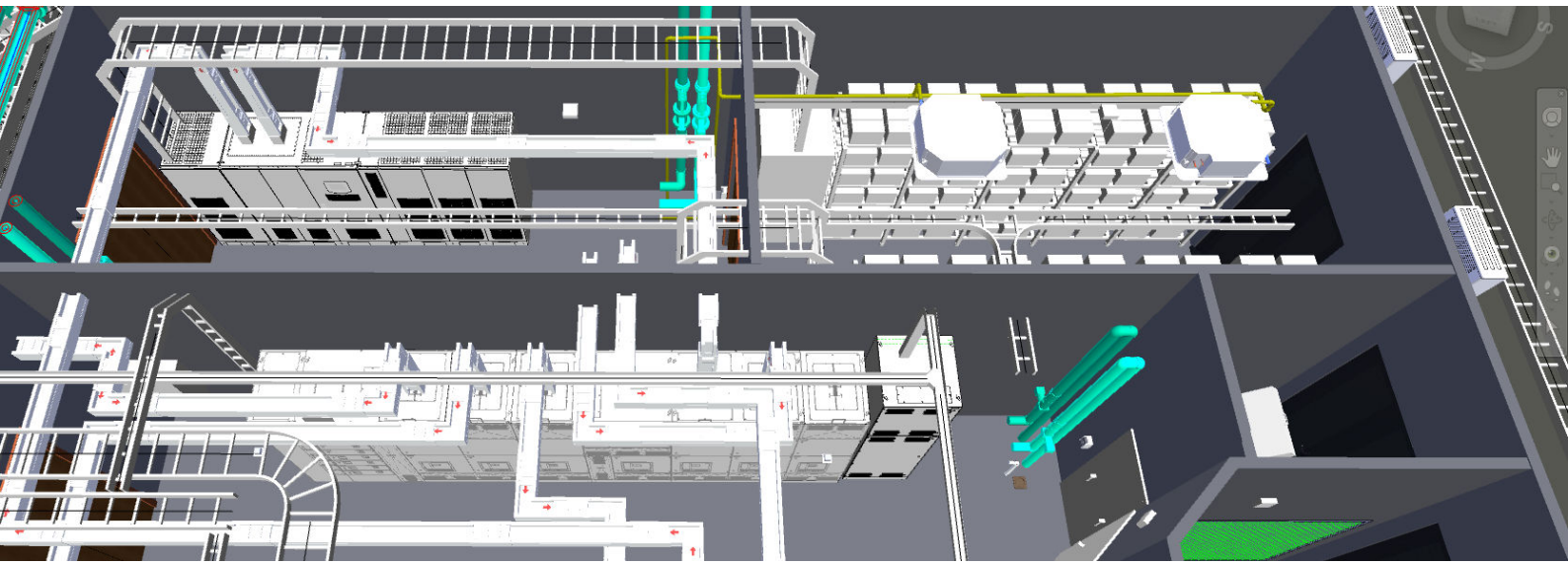


Fig 1 - Internal layout of UPS and Switchgear modules

DETAIL OF WORKS

SYSTEM OVERVIEW

To ensure quality and consistency of production each container is constructed throughout by utilising standard rolled steel sections. Other features include:

- Design and construction generally in accordance with relevant EuroCodes
- All structural member joints and abutments are fully welded.
- Structure Welds associated directly with lift points to be non-destructive tested (NDT) using a Magnetic Particle Inspection method.
- Wall construction is a rolled section structural framework made from Zintec cladded sheets with sandwiching mineral wool thermal insulation. The internal skin (1.6mm) and external skin (2mm) sheets are stitch welded and mastic sealed. This will give a nominally flat external wall appearance.
- Roof construction will comprise rolled section structural framework, with internal and external Zintec/mild steel cladding sheets sandwiched with mineral wool thermal insulation.
- Containers will have a shallow sloped roof to discourage rainwater ponding on the roof
- Internal floors to be 5-6mm thick steel plate welded to floor beams at regular intervals
- The under floor area to be under-drawn with 1.8mm Zintec steel sheet welded and sealed in position to retain the under floor mineral wool insulation. (100mm Thick)
- Each POD is split into rooms internally by 50mm thick partition wall comprising Zintec sheets, stitch welded and mastic sealed, sandwiched with mineral wool insulation
- Access doors
- All external fixings to be stainless steel and anti-vandal, e.g. snake eye screws or similar.
- Paint Finish - Module exterior walls and roof painted in Bradgate 2 pack acrylic paint system to give a durability of high (15 years) in a C3 environment to ISO12944. External finish to a BS / RAL colour of customers choice. Internal finish is our standard white. Internal floor painted in black floor paint with the under-base painted in a bitumen based underseal.

Fig 2 - e-Pod Containers in place on the assembly line

Fig 3 - e-Pod Container craned into Loughborough production facility

DETAIL OF WORKS

WB E-POD SYSTEM INTERNAL SERVICES

Each PODs comes fully serviced with:-
- Internal small power services delivered via Local distribution boards by Schneider Acti 9 LED luminaires
- Multiple MK power sockets and light switches etc Cable basket, tray etc by legrand
- Door furniture from the Metador defender range
- Low smoke cable in accordance with BS EN50267-1 is used throughout
- Fire detection and suppression (type is POD dependant)

THE GENERATOR PACKAGE

The generating set deployed is the Kohler model KD3500-E 3500 kVA 2800 kWe 415 V 50 Hz 1500 rpm DCP rated generating set which is complete with set mounted radiator and embedded APM802 control panel all designed for operating at 10 deg C / +40 deg C ambient and 1000 masl without derating.

The Kohler KD3500 KD83V16 5CES engine is Emissions Optimized and is rated to deliver 3500kVA / 2800 kWe DCP @ 40°C. The set is designed to meet performance class ISO8523G3. The engine is matched with the Leroy Somer alternator type LSA 54.2 L14 415 V 50 Hz which is a single bearing, Brushless, Synchronous unit rated at IP23, Class H / Temperature Rise Class F insulation and complete with a Leroy Somer D550 Digital AVR which is located in Terminal Box. The alternator amongst other things also includes alternator pre-heating, AREP + PMI Excitation, Thermal Protection on the Stator Windings and 6x 3 Wire PT100 RTD.

The engine cooling system is a set mounted, dual circuit vertical radiator using an engine driven cooling fan. The engine is complete with
- Coolant heater
- Dual 24VDC electrical starter motor, starting batteries using the Optima Red Top RTS 4.2 batteries and dual battery chargers
- Lubrication oil make up system

Fig 4 - Kohler KD3500-E (cooling package fitted separately)

DETAIL OF WORKS

GENERATOR CONTROL PANEL

The generating set deploys the immensely capable Kohler APM802 which has been designed to be user-friendly, ergonomic and offers autonomous operation of multiple generator sets and power plants. It is an intuitive system to use with navigation via its 12-inch colour touch screen. The system is:

Touch screen and 100% usable without the need for an external computer The APM802 manages:

- Control of the genset and/or the power plant in both manual and automatic mode, as well as tests off load or on load
- Mechanical and electrical measurement displays
- Status and time stamped event displays (up to 1000 events)
- Adjustment of parameters accessible to the customer (timers, etc.) The APM802 comes with built-in:
- Software, accessible from an external computer, a tablet or smartphone, used for modifying certain parameters and displaying the APM802 data
- Configuration of site-specific functions

The APM802 is designed for operation under the following conditions:

- Operating temperature 20°C to + 60°C Humidity: 93% at 40°C
- The APM802 is able to integrate fully with a BMS/EMS system via multiple communication options including ethernet & fibre

Fig 5 - APM802 Screen Views

e-POD CONTAINER

The generating set is housed in a container rated to achieve a noise level of 65dBA @1m FFC. Each generating sets container is made using a 100mm thick preformed construction, comprising of a 3.0mm thick (10SWG) “Zintec”, Zinc coated steel outer skin and a 0.7mm (22SWG) perforated steel inner skin, with intervening space packed with high density mineral wool. The container has fully welded, bunded and sealed base area designed to accommodate the fluid capacity of the engine and radiator.

Additionally, it has:

- An outward opening door on each side
- External finish: 2-pack acrylic paint system suitable for an inland environment RAL colour to client choice
- Internal finish: Semi-gloss white Water mist fire suppression system

Fig 6 - A newly delivered e-Pod Container in place on the Lougborough production facility assembly line

Fig 7 - A newly delivered e-Pod Containers in place on the client site gantry

FUEL SYSTEM

The Generating set is fed from a 48 hour, 35,000l capacity bunded structural belly tank which sits below the generator container. Each belly tank is filled via a fill point cabinet located at the front of the tank. Flexible Fuel Lines from the belly tank terminate at the generator base frame. A fuel safety system is also installed which comprises a Landon Kingsway Free-Fall Fire Valve complete with tilt switch.

Fig 8 - An 8 hour, 35,000l capacity bunded structural belly tank, set below the generator container

SCR SYSTEM

The Kohler engine offers low levels of NOx emissions, but these emissions are further reduced by the addition of a roof mounted Selective Catalytic Reduction (SCR) system enabling the NOx levels to meet the most stringent of planning requirements. The AdBlue tank is located at the front of the container (adjacent to the fuel fill point) for ease of filling.

Fig 9 - SCR system installed on generator canopy

UPS POD

Each "UPS POD" includes a 1200kVA/1200kW UPS package complete with a 10 year design life battery which has 240 x Hoppecke Xtreme VR125100 stand mounted batteries offering a full 10-minute end of life autonomy. The battery system also includes a battery circuit breaker and string isolation.

The UPS selected is the Eaton 9395P-1200(1200) model which offers an extremely high level of double conversion efficiency (96.3%) resulting in reduced energy consumption even at low levels of load. The 9395P completely isolates output power from all input power anomalies, and delivers 100% conditioned, perfect sine-wave output, even during severe power disturbance. The Variable Module Management System (VMMS) can optimise the load levels of power modules in a single UPS or in parallel UPS systems, by suspending extra UPS capacity. This means not only greater efficiency at lower load levels, but optimum efficiency at all load levels.

The UPS is matched to open stand mounted Hoppecke Xtreme VR batteries 240 x VR 125100 10 mins at end of 10 years. Ancillary services within the WB e-Pods are supported by an Eaton 30kVA UPS type 93PS-30 with integral bypass, battery circuit breaker and 10 minute battery system.

Fig 10 - UPS Pod interior

UPS OUTPUT SWITCHBOARD

The UPS output switchboard is a 4000A IP31 welded sheet steel multi-compartment floor standing cubicle meeting form 4 Type 6 with aluminum and mild top entry and exit steel gland plates. The board features an inboard maintenance bypass with quick connect load bank connections all designed to enable load testing of the UPS modules whilst maintaining a live out going critical load. The switchboard is complete with Thermographic Via Mesh Screens and finished in light grey RAL 7035. The board is complete with an in-bound maintenance bypass with quick connect load bank connections all designed to enable load testing of the UPS modules whilst maintaining a live out going critical load.

BATTERY ROOM DX COOLING

Cooling within the UPS pod is provided by an Airdale smart cool four stage dual circuit unit suitably rated to meet the cooling requirements of the plant withing the POD. The battery is installed within its own room cooled by a suitably rated DX unit.

SWITCHGEAR POD

Transformer and RMU area of the Switchboard POD has fan assisted cooling with weather louvers. The ventilation system for the RMU and transformer space is via two suitably sized double louvered doors at a size of 1.4m x 2.5m, to ensure that there is sufficient makeup air into the space to meet the cooling requirements. Air is extracted via a single 0.65m x 3m louvre. Access is via the double doors which are interlocked for safety.

TRANSFORMER

The transformer is a 3150kVA, ANAN 11kV/415V aluminium wound Energy Efficient Cast Resin Transformer which has an 11% impedance, tappings for +/- 2 x 2.5%, a temperature Relay and PT100 sensors and extended aluminium LV bars. The transformer is in full compliance to IEC 60076-11 / EU 548 Environmental Class - Climatic - Fire Comp. E3-C2-F1 Seismic resistance class < 0.2g (light earthquakes) Nominal frequency fr [Hz] 50 THDv [%]

Fig 11 - 11kV / 400V transformer

RING MAINS UNIT

The switchgear pod also includes a no extendable 630A Ringmaster fault make/ load break, spring assisted switches. The unit also includes a Circuit Breaker Castell Lock, Close Coupled MU6D-N17/21, 2 x Cable Boxes, Power Quality Analyser with Ethernet and Modbus communications.

Fig 12 - RMU Housed adjacent to the transformer and accessed via double doors

TRIPPING BATTERIES

The package includes tripping batteries for the MV switchgear.

LV SWITCHBOARD

There are two LV distribution boards housed in the package with internal power connections made using suitably rated busbar. The combined distribution boards have at their heart the mains / generator change over switchgear with outgoing feeds to the essential mechanical and data hall auxiliary services plus supplies to the dual UPS system and maintenance bypass.

MAIN LV SWITCHBOARD 1&2

The main LV switchboards are an IP31 welded sheet steel multi-compartment floor standing cubicle meeting form 4 Type 6 with aluminium and mild steel top cable and exit gland plates, Thermographic Via Mesh Screens and finished in light grey RAL 7035.

The main busbars are 5000A, 4-Pole, air Insulated, 100kA for 1 second, ASTA/KEMA certified with riser busbar rated at 2500A 4-Pole air insulated, 100kA for 1 second, ASTA/KEMA certified.

The Earth Bar is 60mm x10mm plain copper earth bar 100kA/1 Sec fault rated. All breakers will be manufactured by Schneider Electric, mains/transformer and generator incomer will be withdrawable pattern ACBs. The switchboard also includes elements such as Restricted earth fault relay, Neutral earth device, surge protection, Generator HMI along with multiple outgoing ways to



Fig 13 - Switchgear POD interior

GANTRY

Integral to the whole package is the WB E-Pod support gantry on which all of the PODs are located. The final design of this important element was honed to marry with the building structure and site-specific requirements. The gantry is designed to facilitate a fully integrated plant replacement strategy as well as clear and safe personnel access to all plant and equipment.

Fig 14 - On-site gantry

FACTORY ACCEPTANCE TESTING

All of the equipment was fully tested prior to leaving the manufacturers' various factory locations. Each system was pre commissioned and FAT tested prior to dispatch from our packaging facility. The scope and duration of the testing was extensive and tailored to meet specific requirements of this client.

Fig 15 - e-Pod factory acceptance testing setup

SITE MANAGEMENT & INSTALLATION

On project award we will appoint a WB Construction manager and Project manager who coordinate with and worked alongside our design team and all key stakeholders right through until the project completion. Once delivered to site the WB team took on the responsibility of offloading and positioning all plant and equipment. Once in place all interconnections between the modules be it cable or busbar was installed by our on site team. The fire alarm and suppression system was designed to match the site wide systems and was taken to marshalling points within the POD for connection to BMS outstations, and security system etc.

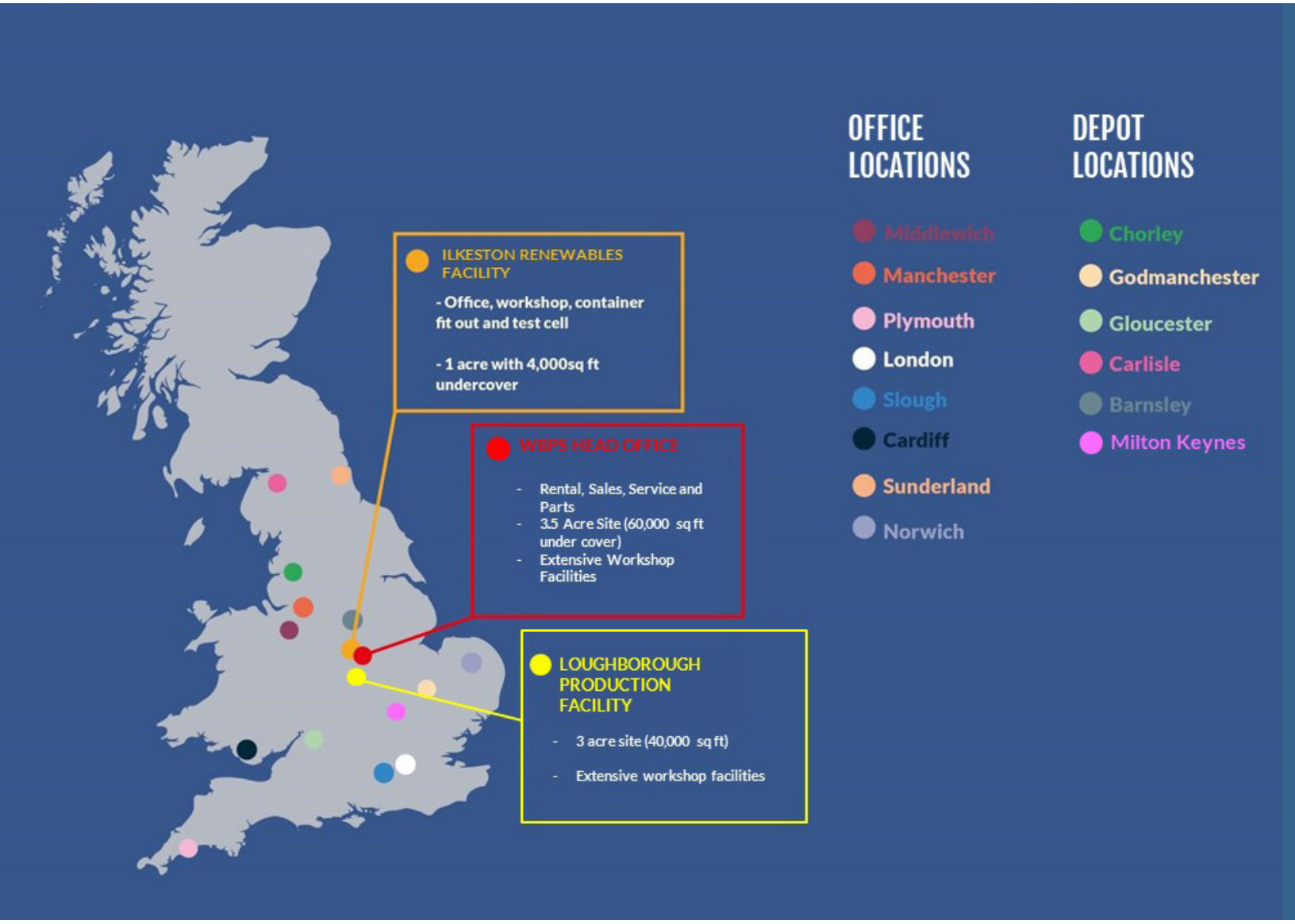
Fig 16 - e-Pod is lifted into position on top of the gantry, on-site

COMMISSIONING

During the construction and installation phases of work our project delivery team, which includes the commissioning manager, worked closely with the client and nominated specialists to finalise the commissioning plan and programme. Once both the mechanical and electrical installations had been completed the commissioning manager and his team set to work to commission and test all aspects of the installation. This culminated in a full site acceptance test (SAT) including load testing fully coordinated with all other services providers working on the project.

THROUGH LIFE MAINTENANCE

With eight fully operational depots and over 90 field-based engineers based throughout the UK WB are uniquely placed to offer a full and comprehensive preventative maintenance and four hour emergency response to any client site. The WB E-Pod packages contain a wide range of electrical equipment provided by our long-standing specialist partners who we work with to provide all necessary specialist maintenance and emergency support on their unique products. WB were able to offer this client a seamless maintenance and support package on all equipment provided.



WB Power Services Ltd, Heanor Gate Road, Heanor Gate Industrial Estate, Heanor, Derbyshire DE75 7RJ
sales@wbpsltd.co.uk | 0115 9444 422 | www.wbpsltd.co.uk