Best Available Technique Assessment - DP3107LF

Colt Powergate Data Centre

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1.0 INTRODUCTION

This Best Available Technique (BAT) assessment has been prepared by HDR on behalf of the operator Colt Data Centre Services Limited (Colt) in support of the application for a new bespoke Environmental Permit (ref DP3107LF) for the Colt Powergate Data Centre located at Unit 9-13, Volt Avenue, Powergate Business Park, North Acton, NW10 6PN.

Colt as the legal operator is required to apply to the Environment Agency (EA) for an Environmental Permit because the total thermal capacity of the emergency back-up combustion plant exceeds the 50MW threshold stipulated in the regulations1

At the time of writing the installation is operating below 50MWth. Only once the new generators are commissioned will the combustion plant exceed 50MWth pending receipt of the Environmental Permit, or permission to operate from the EA.

For a detailed description of the Data Centre and surrounding area, please refer to the Non-technical Summary submitted as part of the application for a permit.

1.1 Purpose of this report

It is a requirement that the operator demonstrates how they comply with the indicative BAT requirements, with assessment to be completed as part of the application for an environmental permit. 'Techniques' include both the technology used and the way the installation is designed, built, maintained, operated and decommissioned.

At the time of writing there are no relevant published BAT reference documents (BREF notes) for Data Centres. The previous guidance document: 'Combustion Activities (EPR 1.01)' was withdrawn in August 2018. To replace this, the EA have produced a working draft BAT guidance document specifically for Data Centres: 'Data Centre FAQ Headline Approach v11' (May 2020). This BAT assessment is structured using this guidance document and seeks to provide evidence of BAT or justification where the requirements have not been met.

Note: Each individual Emergency Standby Generator (ESG) is significantly below the threshold of 15MWth for large combustion plant. Therefore, the BAT requirements for large combustion plant are not relevant for this installation.

[1] The Environmental Permitting (England and Wales) Regulations 2016 (as amended)

2.0 SITE SUMMARY

We have presented a high-level summary below. Please refer to the Non-technical Summary (NTS) document submitted with the application for a non-technical introduction to the installation and the application for a permit.

Powergate, has been operating as a Data Centre since 2001 and as with other Data Centres it utilises ESGs to provide emergency power in the event of grid electrical failure. Recent expansion works will see x6 no additional ESGs installed and commissioned which will result in the total thermal capacity exceeding 50MWth for the first time in the sites history.

All of the ESGs due to be commissioned are over 1MWth and are classed as 'Medium Combustion Plant' (MCP). Details of the existing and new MCPs are in Table 2.1 below with more details in Figure 2.1 and in the thermal schedule in APPENDIX A.

Table 2.1 Summary of MCP details

MCP type	No. of ESGs	Thermal capacity	Install date
Existing	7	~30MWth	Pre 2010
New	6	~32MWth	2023
Total after expansion	13*	~62MWth	-

**As part of the expansion works, 4no. existing ESGs have been decommissioned and replaced with 2no. new temporary ESGs. These temporary ESGs will be removed once the new ESGs have been commissioned and therefore have not been included in the application.*

The ESGs are "excluded MCPs" as they are purely standby plant and there is no capacity agreement in place. Excluded MCPs are not required to comply with the emission limits set out in Schedule 25A of the applicable environmental permitting legislation. As such, operation of the generators is likely to be limited to monthly/annual maintenance and testing of approximately 13 hours/year/generator.

The Directly Associated Activities (DAA) include the fuel storage tanks, associated pipework and the drainage network.

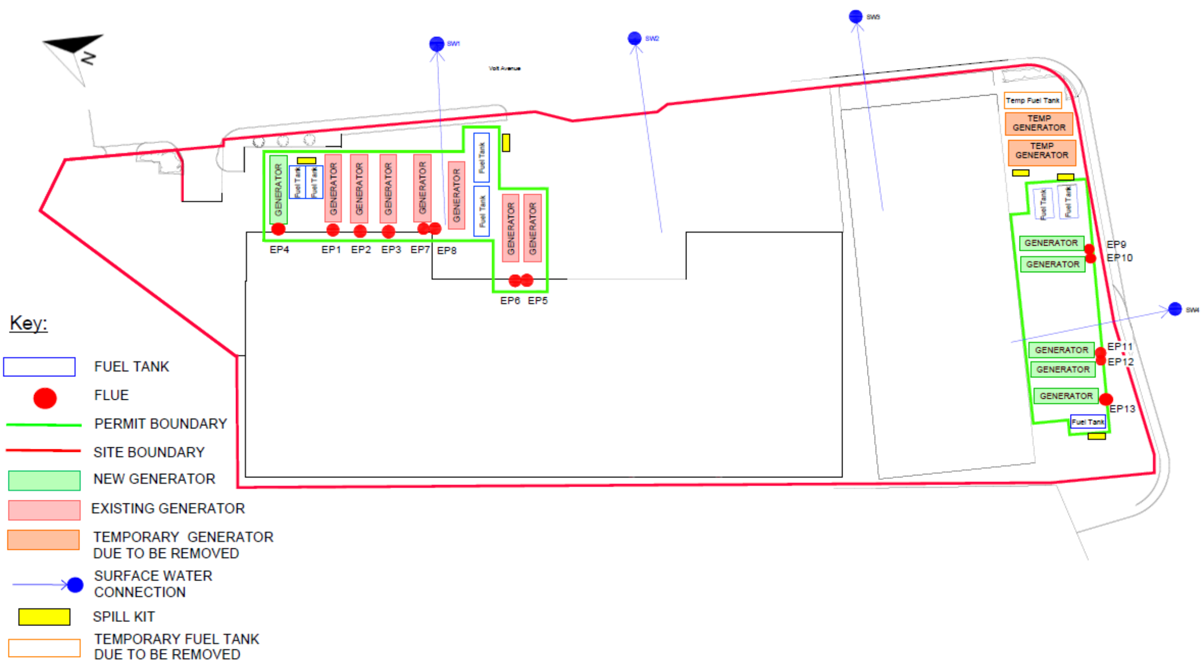


Figure 2.1 - Installation boundary and emission points

3.0 DATA CENTRE DESIGN

3.1 Uninterruptible power provision

The Data Centre functions by renting out data halls to customers to fill with various servers and associated IT equipment. This equipment requires a stable and constant supply of electricity to operate.

'Uptime' or power availability is a term used to explain how reliable a power source is. Data Centres require a high level of uptime or uninterruptible power provision and being supplied by the national grid brings a risk of a mains failure events (black out) or fluctuations outside of acceptable limits (brown outs). Downtime i.e. power failures or voltage drops, even momentarily, may mean loss of service to customers e.g. banks. This could have significant negative implications to site services, both in terms of direct financial costs and indirectly through reputational damage. Therefore, an uninterruptible power supply is critical to a Data Centre's ability to operate.

The Uptime Institute's Tier classification and performance standard[2] provides an objective basis for comparing the one sites infrastructure vs another. The differing tiers are summarised below.

	Tier I	Tier II	Tier III	Tier IV
Active Capacity Components to Support IT Load	N	N+1	N+1	N after any failure
Distribution Paths	1	1	1 active and 1 alternate	2 simultaneously active
Concurrently Maintainable	No	No	Yes	Yes
Fault Tolerance (single event)	No	No	No	Yes
Compartmentalization	No	No	No	Yes
Continuous Cooling*	load density dependent	load density dependent	load density dependent	Yes (Class A)

Figure 3.1 - Uptime Institute's Tier classifications

Uptime is calculated based on the amount of downtime a site experiences as a % of the year. I.e. 99% or 'two 9's' corresponds to about 7 hours and 12 minutes of downtime per month. As the "nines" uptime increases – to three (99.9%), four (99.99%) and five (99.999%) the downtime decreases. In general, five nines are considered a reasonably high reliability. With six nines, or 99.9999%, an average customer would experience about 2.6 seconds of downtime per month, or less than 32 seconds per year.

The Powergate site uptime is split per set of infrastructure below:

- ISC: Tier III: Concurrently maintainable site infrastructure 99.98% availability
- FDC: Tier IV Fault tolerant 99.99 % availability
- IDC4 & Node: Tier III: Concurrently maintainable site infrastructure 99.98% availability
- IDC 5,6,7: Tier III: Concurrently maintainable site infrastructure 99.98% availability

The National Grid produce an annual report of performance The below is a statement from the National Grid report for 2020/21[3].

> *"We are committed to delivering a reliable network and have consistently exceeded our reliability targets over the RIIO-T1 period, concluding with 0MWh of 'Energy Not Supplied' in 2020/21. The 8-year average of incentivised events is 32.64MWh against the incentive neutral point of 316MWh which equates to an 8-year average network reliability of 99.99995%, which our stakeholders tell us continues to be so important to them. We have also continued to invest in the network for the benefit of future consumers and customers, exceeding our overall network risk target to maintain longer-term system reliability."*

[2] https://uptimeinstitute.com/tiers

[3] https://www.nationalgrid.com/electricity-transmission/document/137766/download

3.2 Onsite electrical infrastructure

For resilience reasons, it is preferable to have numerous power supplies to the site; this provides an alternate route to switch to, should one supply be compromised during an outage. This can be provided in several ways, but the common option is to have separate supply routes within one substation, or to have multiple substations onsite. If one supply route fails, the Data Dentre can switch to an alternate supply that is unaffected. A process known as "bus coupling". This ability to switch to an unaffected supply route reduces the duration for which the generators operate in the event of an outage.

The site electrical infrastructure is presented in APPENDIX C with a summary below.

- x2 Canal Bank 11KV supplies – Sub-station 'A' and 'B'
- Onsite high voltage (HV) sub-station –'A' and 'B 'supplies and x4 feeders

The substation powering the installation has two feeds (A & B). Each feed can support the full site load, meaning that if one feed was to fail, electrical provision to the installation would not be compromised. A site wide failure is considered extremely rare as it would require a catastrophic regional failure on the grid, or at the supplying power station, and would likely impact not only the site but the surrounding London area.

Given the risk of downtime via brown/black outs, the installation has installed ESGs to provide an electrical supply to the Data Centre.

The installation has incorporated redundancy / resilience as a risk measure to help ensure that power provision is not interrupted even in the event of a mains failure. The number and size of the generators that are selected are based on the likely maximum electrical demand by prospective customers. The generators can provide more than the maximum amount of power that the Data Centre could ever require.

The redundancy arrangement for the generators is stated below where 'N' is the number of generators required to carry the maximum electrical load.

- ISC – N+1 (current system utilisation approx. 38.6%)
- FDC – N+N (current system utilisation approx. 37.1%)
- IDC 5-7 – N+1 (build in progress)

In the event of grid failure, the generators will start up, but they will not be able to take the electrical load immediately. Power is initially provided by the site's Uninterruptible Power Supply (UPS) (arrangement of batteries) until the generators start to take the site's electrical load. The generators start from 'cold' to take on the load from the UPS (typically within 30-60 seconds). The backup generators then provide ongoing power until a stable mains electrical supply is restored. Each group of generators has a different redundancy arrangement to safeguard power to their dedicated data hall.

3.3 Grid outage scenario

Major power outages are rare. In the last 8 years the Powergate site has had high levels of grid reliability, only experiencing micro-outages or 'blips' that last less than 0.1 second.

In a major outage where the installation loses both A & B grid supplies, all generators will start. If a single side outage occurs (either A or B) then the following would occur:

- **ISC** – The main LV switchboard would bus couple until power to the affected side is restored. Generators should only run in the event of a total A & B outage. No generator should operate in this single side utility outage scenario.
- **FDC** – During a Side A outage, the A side generators will operate. If there is a B Side outage, then the B side generators will operate. There should only ever be 2 out of 4 generators operating under this scenario.
- **IDC 5-7** – The system would bus-couple. Generators will only run in the event of a total A&B outage. No generators will operate under this scenario.

If a micro / momentary power outage occurs, the generators would follow the below:

- **ISC** – The UPS would support the load and the generators would not start. The system is capable of supporting the site on batteries for 5 minutes. Load will transfer from UPS batteries to utility when power is restored.
- **FDC** – The generators will start and should run until mains power is restored. After power is restored for 15 minutes, the load will be transferred back to utility.
- **IDC 5-7** – The UPS will support the load and the generators will not start. Similar to the ISC infrastructure, the UPS batteries can support the load for 5 minutes until utility is restored.

After the outage has occurred, the generators will automatically return to mains power as a primary source.

3.4 Technology selected to provide emergency power

ESGs have been selected to provide emergency power to the installation in the event of grid failure. A BAT assessment considering alternative technologies and why ESGs are considered BAT is presented below.

There are currently no BAT reference documents or BREF notes that have been made available by the European Commission for the specific provision of backup power in the Data Centre industry. We are therefore proposing an alternative which is based on the guidance in the EAs "*Data Centre FAQ Headline Approach v11*".

The key criteria used in the selection of the BAT to fulfil the backup power requirements are split into two categories:

- Operational requirements
- Environmental risks

The criteria for both categories have been chosen based on the main risks posed and in accordance with the risk assessment guidance for bespoke permits.

3.4.1 Operational requirements

Table 3.1 - Operational requirements

Criteria	Considerations	Weighting
Cost benefit analysis	The initial capital cost of the technology being considered, and the potential cost of potential mitigation measures need to be considered to ensure they are not disproportionately high compared to the environmental benefits. Otherwise, the operator will cease to be competitive.	High – impacts competitiveness
Proven as a reliable technology	The resilience requirements of Data Centres are such that the key operational criterion is for the technology used to be a proven and reliable technology. An indication of reliability of a technology can be taken from the number of instances that the technology in question has been successfully utilised in the industry, i.e. whether this is a tried and tested technology or is it new and emerging. The technology also needs to suit the prevailing model of the industry.	High – if technology is not proven it presents a risk to the operator
Cold start capability	The technology will need to have the ability to start operating quickly in the event of a sudden loss of power. A warm start configuration would necessitate 24/7 operation of generators at the site: creating unnecessary fuel costs and environmental impacts. A slow start technology would necessitate additional energy storage UPS capacity (in the form of batteries or flywheels), taking up additional space and creating additional cost.	High – the ability to provide instant power is critical to business functions
Space requirements	Space requirements are relevant as an environmental consideration as a technology that requires excessive use of space (in the form of generator units, energy storage UPS capacity, and fuel storage) will reduce the amount of space available at the Data Centre for the IT equipment it is designed to host. This will necessitate a larger site area or construction of additional sites to provide the same level of service.	High / Medium – space limitations often dictate the technologies that can be considered

Criteria	Considerations	Weighting
Fuel suitability	The fuel used needs to be capable of being stored / transported to and across the site without excessive risks to operations e.g. low risk of combusting.	Medium – low volatility and low risk is vital
Lifetime of stored fuel	The fuel will need to be stored onsite potentially over a long period of time as mains failure events are rare and as such the generators are not routinely operated, other than for maintenance and testing purposes. The fuel stored onsite may remain unused for a long period of time and should therefore be of a type that will remain useable under these conditions – rather than becoming a waste product in need of disposal.	Medium to low – whilst an added cost it is not top priority

3.4.2 Environmental risks

Table 3.2 - Environmental risks

Criteria	Considerations	Weighting
Air quality impact	Local air quality impacts from exhaust of combustion gases when operating the technology in combination with the fuel being combusted.	High – internal combustion engines perform poorly but they are run infrequently
Noise / odour	The technology should not incite regular Odour / Noise complaints from nearest sensitive receptors e.g. residences.	Low – complaints are unlikely due to infrequent operation
Global warming impact	The global warming impact of the fuel being combusted should compare favourably against the electrical output of the technology.	Medium – impact is high but combustion of fuel is infrequent
Release to water (fuel spillage)	The risk of fuel escaping to the environment, e.g. local river course / ground should be low.	Low – fuel use is low due to infrequent operation
Fugitive emissions (leak of gaseous fuel)	The risk of fuel escaping to the air, e.g. gaseous escape should be low.	Low – fuel use is low due to infrequent operation

The following technologies were considered for the provision of emergency power to the Data Centre:

- Diesel Generators (includes operation on HVO / alternative liquid fuels)
- Diesel rotary uninterruptible power supply engines (DRUPS)
- Natural Gas (piped) Fuelled Generator – Spark Ignition Engine
- Natural Gas (piped) Fuelled Generator – Gas Turbine (CCGT or OCGT)
- Liquid Petroleum Gas (LPG) Fuelled Generator – Spark Ignition Engine
- Hydrogen Fuel Cell Technology: Polymer Electrolyte Membrane (PEM) Fuel Cells
- Hydrogen Fuel Cell Technology
- Standby Gas turbine Technology

The conclusion of the assessment was that Gas and Diesel generators are the preferred method for back up electricity generation at this site. Colt have decided to install Diesel generators at this installation as they outperform Gas generators when comparing their cold start capability and their reliability in providing an uninterruptible power supply, due to the reliance of an off-site supply of natural gas.

Emissions optimised generators were chosen previously for the existing data halls and have been selected again as BAT for this installation. The following are reasons to support the selection of the generators and are in line with EA guidance on BAT for Data Centres:

- Proven technology for providing reliable power supply
- Start-up time & cold start capability
- Space requirements
- Capital expenditure
- Environmental impact
- Fuel storage

3.5 Generator emissions performance

The generator engine and emissions datasheets for the existing and new ESGs can be found in APPENDIX B.

The EA guidance for new generators is that they, as a minimum achieve the following standards:

> *"TA-Luft 2g' or Tier II USEPA with guaranteed emissions: this has requirements for 2000mg/m^3 NOx; 650 mg/m^3 for CO; particulates and dust 130 mg/m^3 and 150 mg/m^3 for hydrocarbons (all at reference conditions and 5% O_2)."*

The 6no. new ESGs that have been selected to support the site expansion are emissions optimised and achieve the TA-Luft 2g' (2,000mg/Nm^3 @ 5%O_2 @100% load) as well as the Tier II US EPA standard.

The 7no. existing generators are legacy sets which were commissioned in 2001.

The generator emissions rates used in the Air Quality Dispersion Modelling Assessment (AQDMA)(See Section 0), are presented in the table below.

Table 3.3 – Mass Emissions rates

Stack Reference	Generator make and model	Pollutant	Emission Maximum (mg/Nm^3)[a]	Emission Maximum (mg/m^3)[b]	Emission Rate (g/s)
ISC gens 1-3 (EP 1-3)	FG Wilson P2000	NO_x	2158.00	527.43	3.402
		CO	283.00	283.00	283.00
		PM	80.00	19.55	0.126
		HC	64.00	15.64	0.101
ISC gens 1-3 (EP 4)	SDMO X2200K	NO_x	1846.00	449.41	0.826
		CO	185.90	45.26	0.083
		PM	35.50	8.64	0.016
		HC	72.20	17.58	0.032
FDC gens 1-4 (EP 5-8)	MTU DS1400	NO_x	2000.00	478.21	2.869
		CO	650.00	155.42	0.933
		PM	130.00	31.08	0.187
		HC	150.00	35.87	0.215
IDC gens 1-5 (EP 9-13)	Kohler SDMO KD3100-E	NO_x	1475.00	334.23	2.020
		CO	521.00	118.06	0.713
		PM	33.00	7.48	0.045
		HC	140.00	31.72	0.192

3.6 Generator noise attenuation

Since operations commenced in the early 2000’s there have been no noise complaints associated with the operation of the generators. The generators are located within an individual generator enclosure which provides added noise attenuation to achieve an acoustic pressure level of 75dB(A) (100% load) @ 1m around the perimeter of the container under standard test conditions.

Attenuation is achieved by lining the sheet steel roof and walls with soundproofing panels comprising a 50mm thick layer of high-density mineral wool sandwiched between a steel sheet outer skin and a perforated steel inner skin. Additional heavy mass layers will be added as required to achieve the required level of sound attenuation.

For more information on noise impacts, please refer to the noise impact assessment submitted with the application (‘Noise Impact Assessment’).

3.7 Generator flue design

Each generator set has a dedicated flue / ‘stack’ (see Figure 3.2, Figure 3.3 & Figure 3.4 below). Existing flues have an elevation of approx. 10.5m, while the new IDC 5-7 generators will have flues with an elevation of approx.13.63m.

Dispersion of pollutants has been considered when designing the flues for the generators. As a result, all existing and new build generator flues are unimpeded by flaps/cowls and have been orientated vertically, exiting above the height of the building. The design of the flues is therefore considered to be BAT for this application.

During the design process consideration was given to implementing a common windshield to group stacks as this is understood to improve dispersion in certain situations. Common windshields require additional support structure and the space constraints for the new generators could not support this. Additionally, if the common windshield was compromised for any reason the Data Centre’s requirement for redundancy could be compromised also. During normal operation, generators are tested individually to minimise air quality and noise impacts. Thus, a combined flue arrangement would have little impact on emissions.

Figure 3.2 – Existing Generator Flues

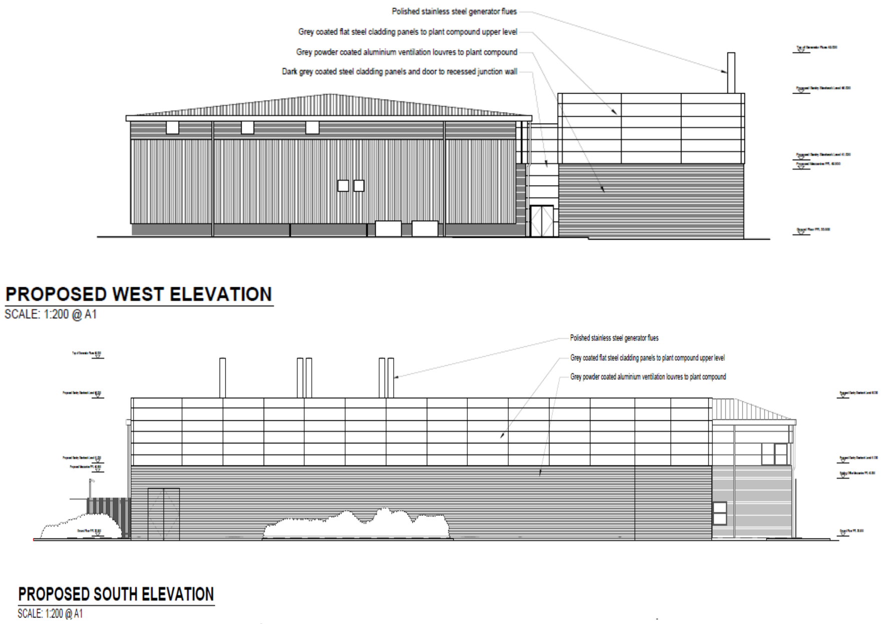


Figure 3.3 – Flue elevations for new generators

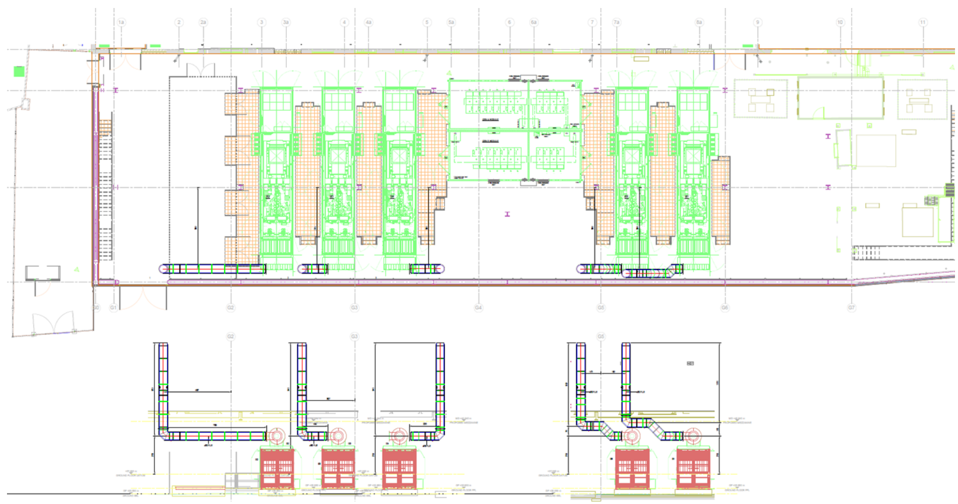


Figure 3.4 – Flue design for new generators

3.8 Fuel storage

The ESGs are capable of operating on diesel or biodiesel such as 'HVO' or Hydrogenated Vegetable Oil. Fuel for the ESGs is held in various bulk and day tanks across the site (see Figure 2.1).

The sites ESGs required adequate fuel storage to allow the generators to operate during a grid failure. The generators are fed from day tanks or receiver tanks which are in turn fed from larger bulk tanks. Their locations can be seen in Figure 2.1. Details of the tanks and associated activities are covered in the following sections.

Onsite storage capacity

The site stores enough fuel to operate in the event of Grid failure. This is based on a worst-case scenario where the data halls are at capacity requiring the generators to run at 100% load which is highly unlikely as Halls are rarely above 50-75% of their design capacity. The current fuel storage is as follows:

- Existing generators (ISC &FDC) – 72 hours
- New Generators (IDC5-7) – 48 hours

Fuel is stored in bulk fuel tanks which are located externally, above ground on cement plinths. To help prevent accidental release of fuel, leak detection and overfill alarms are in place. Bulk tank specifications differ for ISC, FDC and IDC 5-7 and are detailed below.

Table 3.3 Bulk Fuel tanks

Description	Location	Serves	Tank capacity (litres)
ISC bulk tank 1	Adjacent to ISC generators	3no. ISC generators	33,000 litre useable (36,000 brim-full)
ISC bulk tank 2	Adjacent to ISC generators	3no. ISC generators	33,000 litre useable (36,000 brim-full)
FDC bulk tank 1	Adjacent FDC generators	4no. FDC generators	66,400 litre (nominal)
FDC bulk tank 2	Adjacent FDC generators	4no. FDC generators	66,400 litre (nominal)
IDC5-7 bulk tank 1	Adjacent to IDC5-7 generators	5no. IDC5-7 generators	56,474 litre useable (58,970 litre brim-full)
IDC5-7 bulk tank 2	Adjacent to IDC5-7 generators	5no. IDC5-7 generators	56,474 litre useable (58,970 litre brim-full)
IDC5-7 bulk tank 3	Adjacent to IDC5-7 generators	5no. IDC5-7 generators	56,474 litre useable (58,970 litre brim-full)

Each bulk tank is fitted with a digital OLE electronic gauge which can be read at the tank or remotely via the BMS. These will produce an alert in the event of overfill or leakage.

The FDC tanks are bunded to 110%. These tanks conform to BS 799 pat 5 type J 2010 and are manufactured with steel conforming to BS 4360 43A.

The new IDC5-7 bulk tanks are to be integrally bunded to 110% as per the oil storage regulations. Overfill Prevention Valves (OPV) are to be fitted to the tank fill line to help prevent overfilling. Leak detect float switches will be provided within tank bunds should the primary tank become compromised (see Figure 3.5).

The existing ISC and FDC bulk tanks are refuelled via connections in independent fill point cabinets The fill points are located within lockable cabinets and are accessed from the pavement on Volt Avenue. Drip trays are present to capture minor spills. Within the fill cabinet there are pneumatic gauges to measure tank levels as well as tank overfill prevention controls/alarms, which are connected to the BMS.

The new IDC 5-7 bulk tanks will be refuelled by 1 no. independent fill point cabinet with 3 no. manual level operated fill valves. The cabinet is lockable and there is a drip tray to capture minor spills. A forecourt separator is to be installed near the bulk tanks which will capture fuel spills that manage to enter the surface water drains. A drawing of the current design is presented in APPENDIX E.

The larger bulk tanks feed individual day tanks for each of the ID5-7 generators. As a result, there will be 5 no. bunded and double skinned day tanks fitted within the new generator enclosures. Each tank will be fitted with an OLE gauge to provide detailed fuel level information. The tank bund shall incorporate a leak detect float switch to alarm if a leak is detected. There are no receiver/day tanks for existing ISC and FDC generators.

For more information on the bulk tanks, see the bulk tank diagrams submitted in support of this application.

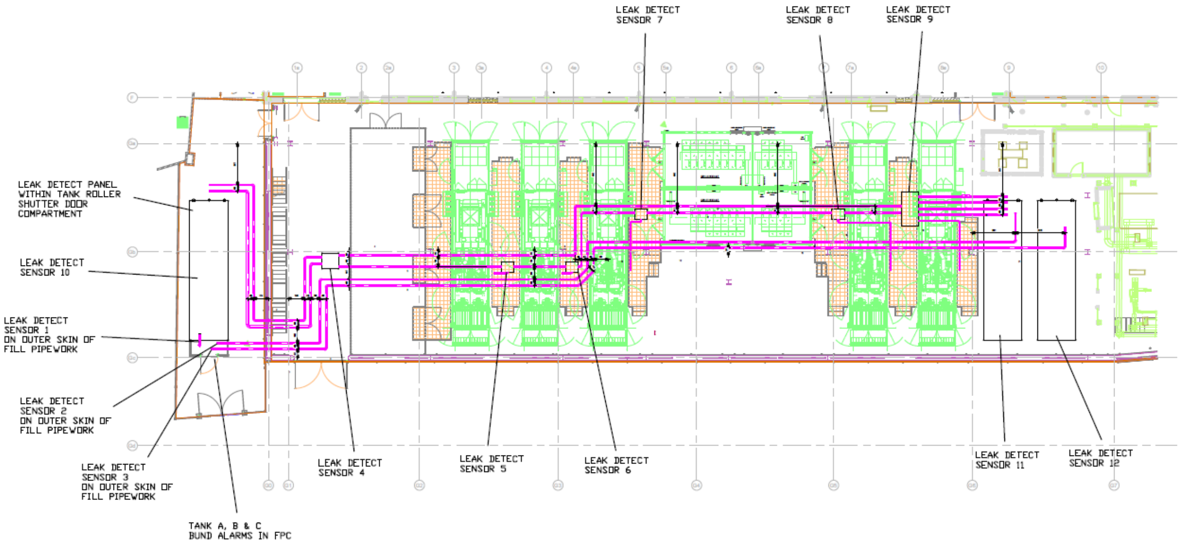


Figure 3.5 – Fuel schematic for new IDC5-7 generators

Fuel management procedures and security

Fuel consumption is low this installation due to the plant being used for emergency back-up power generation only. As such, fuel deliveries are on average less than once per year. When required, refuelling is carried out by trained fuel tanker drivers, and supervised by a trained member of the site engineering team.

A standard operating procedure (SOP) is in place to facilitate refuelling activities. This SOP is intended to help reduce the risk of a spillage during refuelling. These are supplemented by additional supplier procedures for fuel deliveries. In addition to this, additional controls are in place to help reduce the risk of an incident including an SOP for spill response and spill kits.

The sites PPM regime includes periodic visual checks for leaks / spills and checks for suitably stocked spill kits, are located within close proximity of fuel storage tanks and fill points (see Figure 2.1).

Drain covers have been purchased to help prevent spilt fuel from entering the drainage network, during refuelling or in an emergency.

The fuel storage procedures and infrastructure mentioned above have been designed to achieve BAT in accordance with EA guidance.

The Data Centre is currently manned 365 days a year with monitoring by security staff located within a security office, using an extensive CCTV and alarm system. Entry and exit to the site are tightly controlled via a security gate and turnstiles. The site is bounded by a palisade security fence that acts as an impenetrable perimeter to prevent unauthorised access to the site.

Future site expansion

There are currently no plans to expand the installation following the commissioning of the 6no. new generators. The Operator is aware of the requirement to vary the permit if additional plant is added to the installation which wasn't included in the original permit application.

4.0 OPERATING TECHNIQUES

4.1 Generator operation

The generators are to be used purely as standby plant to provide emergency standby power in the event of grid failure. There is no capacity agreement in place or elective operation of the plant for generating revenue (e.g. STOR, Triad avoidance, Demand Side Response, Peak Demand etc.). As such operation of the generators is likely to be limited to monthly maintenance and testing of approx. 13 hours/year/generator.

4.2 Maintenance & Testing

The maintenance schedule for the generators is based on manufacturer guidelines. These guidelines help to prolong the life of the equipment, reduce the use of raw materials (e.g. replacement parts, oil changes) and ensure the engines perform efficiently to prevent increases in pollutant levels or black smoke.

Testing regimes for monthly and annual testing are detailed below. The AQDMA in Section 10.3 has not identified significant impacts to short term Air Quality from the proposed test regime. Each generator is expected to run for 13 hours per annum and is considered to be BAT.

Table 4.1 Annual operational hours per generator

Generator Test Frequency	Description	Load Profile	Duration	Total hours per generator
Monthly test	Each data hall is tested monthly on separate weeks. ISC - all generators tested at current load (approx. 1450 kW) for one hour. FDC – Side A tested at current load (approx..650kW) for one hour, followed by Side B at the same current load. IDC5-7 – all generators tested at current load (TBC) for one hour.	Current site load	1 hour	**12**
Annual test	Testing each generator separately beginning at 10am on a Saturday in December	Current site load	1 hour	**1**
Total hours of operation per generator				**13**

5.0 F-GAS

Fluorinated gases or ‘F-gasses’ will not be used in the permitted activities e.g. generators and associated fuel storage.

There is potential that F-gases will be used in the chiller plant and or air conditioning units. This plant is to be maintained in accordance with manufacturer specifications and recommendations with relevant documentation retained. The site has an environmental management system (EMS) that is certified to ISO 14001 and in order to comply with these records of F-gasses are retained. This includes details such as plant make, model and serial, the type and volume of refrigerant, and maintenance history. Any significant releases or leaks are to be recorded and, where significant, notified to the EA as soon as possible.

6.0 ENERGY EFFICIENCY

6.1 General energy management

As energy prices rise and customers demand more of their Data Centre providers, there is increasing attention on energy efficiency and better energy management. The most prominent indicator of a Data Centre's energy efficiency is PUE (Power Usage Effectiveness), and this is often reported as a metric to customers. PUE is the ratio of the total energy delivered to the site compared with the energy used by just the IT equipment. A PUE of 2 means that 50% of the power delivered to the site is used to run the IT equipment. The closer the PUE is to 1, the more efficient the Data Centre is. Most efficient Data Centres are seeking to achieve a PUE of approx. 1-1.2. The annualised / seasonally adjusted PUE at 100% IT load for the Data Centre is likely to be approx. 1.16.

Colt are in the process of developing an Energy Management System (EnMS). A key focus of this will be improving energy efficiency particularly for high energy consuming activities such as cooling.

6.2 UK ETS

The site has participated in the UK ETS scheme since its 2021 when the scheme replaced the EU version which the site also participated in since 2013. This is required as the installation's combustion plant is in excess of 20MWth[4].

Participating in these schemes requires the site to record and maintain detailed records of generator operational hours and fuel consumption to determine annual CO_2 emissions.

6.3 EED

The Energy Efficiency Directive (EED) provides an exemption for emergency back-up plant operating under 1500 hours per year. The current testing and maintenance plans (13 generators x 13 hours each = 169 hours) do not exceed this limit and therefore EED requirements are not deemed to be applicable.

6.4 ESOS

The UK's Energy Savings Opportunities Scheme (ESOS) is a mandatory energy assessment scheme for organisations in the UK that meet the qualification criteria. At the time of writing these criteria are any company that either:

- employs 250 or more people
- has an annual turnover in excess of £44 million, and an annual balance sheet total in excess of £38 million

Colt meets the above criteria and has participated in ESOS in the past by completing extensive energy audits of various Data Centres and offices including Powergate.

6.5 CCA

A Climate Change Agreement (CCA) agreement is a voluntary agreement made between UK industry and the EA to reduce energy use and CO_2 emissions. Colt entered into a CCA in August 2021. Energy management techniques are employed at Colt Powergate to monitor, record and track power usage effectiveness (PUE) within the Data Centre.

6.6 Measures to improve energy efficiency

The electricity efficiency of the generators ranges from 30-40%. Heat recovery on generators is not a viable option since the generators are backup plant that operate infrequently (approx. <20 hours per year). To ensure the generators operate as efficiently as possible, the site follow a periodic preventative maintenance (PPM) regime. This involves regular checks of the generators to help ensure each generator is operating efficiently.

[4] https://www.gov.uk/government/publications/participating-in-the-uk-ets/participating-in-the-uk-ets#free-allocation

7.0 EFFICIENT USE OF RAW MATERIALS

The main raw materials that will be used within the permitted installation are as follows.

7.1 Diesel / HVO

The installation will store enough diesel / Hydrogenated Vegetable Oil (HVO) to provide ISC and FDC with 72 hours' worth of electricity when running at 100% continuous rated load and IDC with 48 hours' worth. Due to the highly reliable grid supply, it is unlikely that large volumes of fuel will be consumed by this installation. Fuel use will mostly be limited to maintenance running of the generators. The PPM regime in place will help seek efficient fuel use by the generators.

As per Section 4.2, each generator is tested for 13 hours per year. The generator datasheets provide fuel consumption at 50, 75 and 100% load. Using 50% load, the total estimated fuel consumption for each generator can be seen below. These are highly conservative given the monthly tests are at approx.25% load.

- ISC – 2,769 litres
- FDC – 2,795 litres
- IDC 5-7 – 3,003 litres

A conservative estimate gives an annual site consumption of 37,271 litres, based on the above. Over the last 3 years, the site's average annual consumption has been approx. 23,000 litres, which is roughly 40% lower than the conservative estimate given here.

Diesel / HVO has been selected due to the ability to store sufficient volumes to ensure security of supply. Other fuels have been considered but do not currently provide the same level of security. Natural gas could not be stored in sufficient volumes and would be reliant on the National Transmission System. A contract for an uninterruptable supply would be excessively costly given the infrequency of use. Further reasons for fuel selection are present within Section 3.4.2. Due to the limited hours of operation, any potential benefits from the lower impacts associated with emissions from natural gas are reduced.

7.2 Lubrication oils

The engines require lubrication oil to reduce wear and tear through friction. Periodic replacement of this oil is required. Waste oils are to be stored and disposed of responsibly and in accordance with applicable legislation.

8.0 AVOIDANCE, RECOVERY AND DISPOSAL OF WASTES

8.1 Waste

Waste streams arise as a result of operation and maintenance of the combustion plant. Maintenance extends the life of the plant and resolves issues in a timely manner, reducing waste associated oils, lubricants & replacement parts. The installation does not produce significant amounts of waste due to the standby nature of the generators.

A licenced third-party maintenance contractor is responsible for removing waste produced as a result of generator maintenance. Colt retains Duty of Care information including waste carriers' licences and transfer notes.

Waste streams arising from this installation can include:

- Lubrication oils used in maintenance and servicing (minimal)
- Air and fuel filters (minimal)
- Fuel that has reached end of life (infrequent)
- Used spill kits (emergency only, unlikely)
- Decommissioned plant (end of life only)

Colt aims to minimise waste generation through efficient use of raw materials including diesel, filters, and lubrication oils.

For example, the need to dispose of waste fuel is reduced / minimised by conducting routine fuel polishing. Colt hires and external provider to conduct fuel polishing for each tank at the installation. The aim is to help maintain the fuel to a usable standard, preventing early degradation and ultimately extending the life of the fuel.

9.0 GENERAL MANAGEMENT

9.1 Management Standards

The following management standards are currently held by Colt and are applicable at Colt – Powergate:

- ISO 14001:2015 – specifies the requirements for an environmental management system that an organization can use to enhance its environmental performance.
- ISO/IEC 27001:2013 – specifies the requirements for establishing, implementing, maintaining, and continually improving an information security management system within the context of the organisation. It also includes requirements for the assessment and treatment of information security risks tailored to the needs of the organisation. The requirements set out in ISO/IEC 27001:2013 are generic and are intended to be applicable to all organisations, regardless of type, size or nature.
- ISO9001:2015 – specifies the requirements for establishing, implementing, monitoring, managing, and improving quality throughout the organisation.

9.2 Environmental Management System

Colt has implemented an effective Environmental Management System (EMS) that is accredited to the internationally recognised ISO 14001:2015 standard. The EMS focusses on ensuring continual improvement and includes information on policies, management principles, organisational structure, responsibilities, standards / procedures, process controls and resources in place to manage environmental protection across the permitted activities at the installation. It also includes Colt's commitment to protect the natural environment through set objectives that comply with relevant legislation.

The EMS places a specific focus on the following:

- Reducing risks to the environment to a level that is as low as reasonably practicable using best available techniques
- Integrating EMS responsibilities within line management
- A commitment to personnel environmental awareness and competence
- The ongoing monitoring and review of environmental performance
- A commitment to working to achieve continuous improvement in environmental performance.
- Integral to the EMS will be an overarching environmental policy. This will seek to underpin the EMS and help ensure uptake by each staff with sufficient training provided as required.

It is a requirement of the EMS that Colt maintains relevant records. These records are to be stored for the appropriate duration on a backed-up system and updated in line with the management system's policies. Records include:

- Organisational procedures
- EMS manual
- Aspect register
- Compliance register
- Monitoring documents
- Accident, prevention, and control procedures
- Training records
- Review and audit records
- Environmental risk assessments

10.0 EMISSIONS

There will be no point source emissions to water, air or land, except from the sources and emission points identified in Section 2.0, Figure 2.1.

Emissions identified as significant have been further expanded in the following sections.

10.1 Noise emissions

A noise impact assessment was completed in support of the application for an environmental permit. This report identifies sensitive receptors and potential sources of noise from the installation. The primary noise sources are the sites generators.

The impact assessment concluded that "*noise levels are predicted to achieve the noise limits at the nearest noise sensitive properties and therefore noise impacts are not considered to be significant.".* Further information can be seen in the 'Noise Impact Assessment' submitted as part of this application.

10.2 Point source emissions to sewer / surface water

The sites drainage system is split into separate foul and surface water networks as shown in APPENDIX D. The site is largely covered in good quality hard standing. As per Section 10.2, discharges to sewer are not anticipated. The EA are to be notified where incidents occur that have the potential to cause pollution / environmental harm. Site drainage exits into the drainage network for the entire industrial estate. Thames Water are the sewerage provider and CBRE are responsible for the estate network.

Indicative locations for where the sites surface water drainage system enters the local network is identified in Figure 2.1 as SW1, SW2 and SW3. Discharges are expected to be limited to surface water run-off, which is not anticipated to contain spilt fuel due to the mitigation measures in place (described below).

The surface water drainage system around the IDC 5-7 data hall is connected to a forecourt separator prior to discharging to the local network. Current plans for this can be found in APPENDIX E. This will be fitted with an automatic sensor / shut off valve that will close upon detecting the presence of spilt fuel. This will help ensure that contaminated runoff does not exit the site by isolating the system.

The sites drainage system and interceptor will be subject to periodic visual inspections and integrity testing as part of the PPM regime. The tank will be emptied periodically or in the event of a spillage with contaminated liquids disposed of appropriately as hazardous waste.

10.3 Point source emissions to air

Emissions to air will occur from the operation of the generators. Due to the Data Centre's high levels of resiliency, it is expected that operation will be limited to maintenance and testing only, with no elective operation as detailed in Section 4.1.

An Air Quality Dispersion Modelling Assessment was completed in support of the permit application to predict the impacts of operating the generators on short- and long-term air quality. A summary of the findings is below, with further information in the 'Air Quality Dispersion Modelling Assessment'.

Testing and maintenance (Testing Scenario 1)

Plans are for each generator to be tested at site load (assumed 50%) for 1 hour every month and 1 hour annually. Each generator will operate concurrently. This totals 13 hours per generator per annum.

Emergency power outage: (Testing Scenario 2)

As per EA requirements, the model accounted for a 72-hour grid failure event, with all 13 generators running concurrently at site load, assumed 50% load. In a typical outage, only generators required to carry the building load would operate, meaning this scenario is conservative. This scenario is not regarded to be representative of typical site operations and therefore should not be used to determine significance of impacts of the Data Centre.

The conclusion of the assessment is as follows, with further details, in the AQDMA:

> *"Predicted impacts at all human and ecological sensitive receptors for all pollutant concentrations and both annual mean nitrogen and acid deposition rates, with the exception of 1-hour nitrogen dioxide and 24-hour oxides of nitrogen concentrations, associated with normal operation of the site (Scenario 1) can be considered* ***not significant****."*
>
> *"Scenario 2 is representative of a power outage (1 in every 10 years) and only the generators required to meet the electrical load will operate for a maximum of 72 hours. Therefore, the modelling results indicated above cannot determine the significance of impacts of the Data Centre."*

The ESGs are "excluded MCPs" as they are purely standby plant operating for less than 500 hours per annum and there is no capacity agreement in place. As excluded MCPs, the ESGs will not be subject to Emissions Limit Values (ELVs) for the substances listed in Annex V of Directive 2010/75/EU on industrial emissions (Industrial Emissions Directive, IED).

10.4 Air Quality Management Plan

The AQ assessment identified that there is potential that the short-term standard for NO_2 and NO_x may be exceeded. BAT is therefore to develop an Air Quality Management Plan (AQMP) to be implemented in the event of a prolonged outage.

As part of the application for a permit, a draft AQMP has been drafted as a basis for identifying which receptors may be affected and if notification is required. Following commissioning of IDC 5-7, the AQMP will be updated to include more information on the following:

- Outage occurrence – e.g. date, time, season, meteorologic factors
- Receptors – e.g. AQ model receptors, general public
- Outage situation – e.g. likely duration, how receptors are affected

The plan is to be developed in conjunction with the Local Authority and its Local Air Quality Management (LAQM) process. Once the AQMP is finalised, it shall be submitted to the EA for final approval.

11.0 MONITORING

11.1 Emissions limits & flue gas monitoring

The generators are classed as Medium Combustion Plant (MCP). Operational hours are unlikely to exceed 50 hours per year and thus the plant is classed as ‘excluded MCP which are exempt from meeting the new plant BAT emissions limit values (ELVs).

Monitoring of flue gas emissions is to be completed in accordance with EA requirements. Flue gas sampling ports, designed to meet BS EN 15259, will be installed on the flues of the x6 no new IDC 5-7 generators and on 2 no existing generators. This will allow for NO_x and CO monitoring when required by the permit. Any testing is to be undertaken by an MCERTS accredited supplier.

Total mass emissions for NO_x, SO_x, PM and CO are to be reported to the EA annually.

11.2 Generator operation

Generator operational hours and fuel consumption for maintenance, testing and during an outage, are currently monitored and reported to the EA annually for ISC and FDC data halls. Monitoring and reporting is to be undertaken for the new IDC 5-7 generators once commissioning is complete. This will follow the monitoring practices for the existing generators. In addition to the annual report, outages are to be notified to the EA within 24 hours of emergency operation commencing.

12.0 CONCLUSION

We have set out the proposed design and operating techniques for this installation and these are considered to meet the EA's BAT requirements for this Data Centre.

APPENDIX A.

THERMAL SCHEDULE

Thermal Schedule & Emission Points - Colt, Powergate

Emission Point Ref	MCP Description	MCP type	Manufacturer	Model	output rating (kVA)	Output rating (kWe)	Max fuel (litres)	Calculated Efficiency	Thermal Capacity (MW)	Comments
EP1	ISC gen 1	Existing	F G Wilson	P2000	2000	1,600	426	38%	**4.17**	
EP2	ISC gen 2	Existing	F G Wilson	P2000	2000	1,600	426	38%	**4.17**	
EP3	ISC gen 3	Existing	F G Wilson	P2000	2000	1,600	426	38%	**4.17**	
EP4	ISC gen 4	New	MTU	DS1400	1250	1,000	300	35%	**2.86**	New in 2022/23
EP5	FDC1 GA1 - gen 1	Existing	SDMO	X2200K	2000	1,600	436	37%	**4.27**	
EP6	FDC1 GA2 - gen 2	Existing	SDMO	X2200K	2000	1,600	436	37%	**4.27**	
EP7	FDC1 GB1 - gen 1	Existing	SDMO	X2200K	2000	1,600	436	37%	**4.27**	
EP8	FDC1 GB2 - gen 2	Existing	SDMO	X2200K	2000	1,600	436	37%	**4.3**	
EP9	IDC5-7 - Gen 1	New	Kohler - SDMO	KD3100-E	2812	2,250	604	38%	**5.9**	New in 2022/23
EP10	IDC5-7 - Gen 2	New	Kohler - SDMO	KD3100-E	2812	2,250	604	38%	**5.9**	New in 2022/23
EP11	IDC5-7 - Gen 3	New	Kohler - SDMO	KD3100-E	2812	2,250	604	38%	**5.9**	New in 2022/23
EP12	IDC5-7 - Gen 4	New	Kohler - SDMO	KD3100-E	2812	2,250	604	38%	**5.9**	New in 2022/23
EP13	IDC5-7 - Gen 5	New	Kohler - SDMO	KD3100-E	2812	2,250	604	38%	**5.9**	New in 2022/23
								Total NET thermal input capacity	**66.57**	

NCV (GJ/tonne)	42.56881	Source: National Factors 2021
Density (litres/tonne)	1,184	Source: DUKES 2021

Max fuel	604.00	
MK	500.11	MK = max fuel x0.828
Hu	42.57	Hu = calorific value
Pth	5913.66	Pth = MK x Hu / 3.6

APPENDIX B.

GENERATOR ENGINE & EMISSIONS DATASHEETS

Technical Engine Data

16V4000G61
Water charge air cooling (external);
50 Hz - 1.500/min
exhaust optimized (TA-Luft)

Operating method	Four stroke Diesel	**Flywheel housing flange**	SAE 00
Combustion system	Direct Injection	**Flywheel interface**	21"
Charging method	Exhaust turbo charger and Water charge air cooling (external);	**Starter ring-gear teeth no.**	182
		Injection system	Common Rail System with electronically controlled high-pressure injection through singel injector pumps
Bore / Stroke	165 / 190 mm		
Displacement, total	65.0 Liter		
Number of cylinders	16	**Control / Monitoring**	Electronic engine management system "MDEC"
Cylinder configuration	V - 90°	**Number of turbo chargers**	4
Compression ratio	15.5 : 1	**Number of intercooler**	1
Direction of rotation (viewed from flywheel side)	left		

MTU-Application group				3D (ICFN)	3C (ICXN)	3B (ICXN)	3A (ICXN)
Power (ISO 3046)		kW	A	#NV	1760	1760	#NV
Mean piston speed		m/s	A	#NV	9.5	9.5	#NV
Mean effective pressure		bar	A	#NV	21.7	21.7	#NV
Engine weight (Engine in basic execution)	dry	kg	R	#NV	6950	6950	#NV
	wet	kg	R	#NV	7435	7435	#NV
Dimensions (Engine only)	length	mm	R	#NV	2900	2900	#NV
	height	mm	R	#NV	1350	1350	#NV
	width	mm	R	#NV	1710	1710	#NV
Consumption							
Specific fuel consumption (be)	100% CP	g/kWh	G	#NV	210	210	#NV
(Tolerance +5% according to ISO 3046/1)	75% CP	g/kWh	R	#NV	213	213	#NV
	50% CP	g/kWh	R	#NV	215	215	#NV
Lube oil consumption (after run-in)			R	#NV	0.5	0.5	#NV
Capacity							
Engine oil capacity, initial filling (standard oil system)	total	Liter	R	#NV	290	290	#NV
	Oil pan capacity, dipstick mark min.	Liter	L	#NV	160	160	#NV
	Oil pan capacity, dipstick mark max.	Liter	L	#NV	230	230	#NV
Engine coolant capacity (without cooling equipment)		Liter	R	#NV	175	175	#NV
Intercooler coolant capacity		Liter	R	#NV	40	40	#NV
Heat dissipation							
Engine coolant dissipation	100% load	kW	R	#NV	740	740	#NV
Charge-air heat dissipation	100% load	kW	R	#NV	440	440	#NV
Radiation and convection heat, engine		kW	R	#NV	90	90	#NV
Starter system							
Electrical Starter (make Delco)							
Starter, rated voltage		V	R	#NV	24	24	#NV
Starter, rated power		kW	R	#NV	2X9.0	2X9.0	#NV
Starter, power requirement max.		A	R	#NV	2600	2600	#NV
Starter, power requirement at firing speed		A	R	#NV	1000	1000	#NV
Recommended battery capacity	Lead-acid	Ah/20h	R	#NV	450	450	#NV
	NiCd	Ah/5h	R	#NV	240	240	#NV
Firing speed		1/min	R	#NV	80 - 120	80 - 120	#NV
Coolant pre-heating							
Preheating temperature (min.)		°C	R	#NV	32	32	#NV
Heater performance		kW	R	#NV	9.0	9.0	#NV

Technical Engine Data

16V4000G61
Water charge air cooling (external);
50 Hz - 1.500/min
exhaust optimized (TA-Luft)

MTU-Application group			3D (ICFN)	3C (ICXN)	3B (ICXN)	3A (ICXN)
Coolant system, Engine coolant circuit						
Coolant temperature (at engine outlet to cooling equipment)	°C	A	#NV	95	95	#NV
Coolant temperature after engine, alarm	°C	R	#NV	97	97	#NV
Coolant temperature after engine, shutdown	°C	L	#NV	99	99	#NV
Coolant antifreeze content, max. permissible	%	L	#NV	50	50	#NV
Cooling equipment: coolant flow rate	m^3/h	A	#NV	62	62	#NV
Coolant pump: inlet pressure, min.	bar	L	#NV	0.4	0.4	#NV
Coolant pump: inlet pressure, max.	bar	L	#NV	1.5	1.5	#NV
Pressure loss in off-engine cooling system, max. permissible	bar	L	#NV	0.7	0.7	#NV
Cooling equipment: height above engine max. permissible	m	L	#NV	15.2	15.2	#NV
Cooling equipment: design pressure	bar	A	#NV	2.5	2.5	#NV
Coolant system, Charge-air coolant circuit						
Coolant temperature before intercooler (engine inlet)	°C	A	#NV	55	55	#NV
Coolant antifreeze content, max. permissible	%	L	#NV	50	50	#NV
Cooling equipment: coolant flow rate	m^3/h	A	#NV	19	19	#NV
Pressure loss in off-engine cooling system max. permissible	bar	L	#NV	0.7	0.7	#NV
Cooling equipment: height above engine max. permissible	m	L	#NV	10	10	#NV
Cooling equipment: design pressure max. permissible	bar	A	#NV	2.5	2.5	#NV
Combustion air						
Combustion air volume flow	m³/s	R	#NV	2.3	2.3	#NV
Intake air depression new filter	mbar	A	#NV	30	30	#NV
limit value	mbar	L	#NV	50	50	#NV
Fuel system						
Fuel supply flow, max.	l/min	R	#NV	20.0	20.0	#NV
Fuel temperature, max.	°C	L	#NV	-	-	#NV
Fuel pressure at supply connection on engine, max. admissible	bar	L	#NV	1.5	1.5	#NV
Fuel pressure at supply connection on engine, min. admissible	bar	L	#NV	-0.1	-0.1	#NV
Exhaust system						
Exhaust volume flow	m³/s	R	#NV	5.8	5.8	#NV
Exhaust temperature after turbocharger	°C	R	#NV	490	490	#NV
Exhaust backpressure limit value	mbar	L	#NV	51	51	#NV
General operating data						
Recommended minimum continuous load	%	R	#NV	20	20	#NV
Engine mass moment of inertia, with standard flywheel	kgm²	R	#NV	15.88	15.88	#NV
Noise emission						
(Free-field sound pressure level, 1m distance)						
Engine surface noise	dB(A)	R	#NV	107	107	#NV
Exhaust noise, unsilenced	dB(A)	R	#NV	116	116	#NV

A = Design value; G = Guarenteed value; R = Guideline value
L = Limit value, up to which the engine can be operated w/o change
#NV - Data not available

Reference conditions

	Standard	Power available up to
Intake air temperature	25°C	40°C
Site altitude above sea level	100 m	400 m
Charge-air coolant temperature	55°C	55°C

MTU Friedrichshafen GmbH
88040 Friedrichshafen
Phone: (07541) 90 87 73
Fax: (07541) 90 81 11

E-Mail: powergen@mtu-online.com
Internet: www.mtu-friedrichshafen.com

X2200K DIESEL GENSET

MODEL	X2200K
Stand-by Power @ 50Hz	*1760kW / 2200 kVA*
Prime Power @ 50Hz	*1600 kW / 2000 kVA*

Standard Features

General features :

- Engine (MTU , 16V4000G61E)
- Charge alternator 24 V , Governor: Elec
- Alternator (LEROY SOMER , LSA51.2M60)
- Single bearing alternator IP 23 , insulation class H /H
- Radiator 40°C [104°F]°C max. T° air inlet with coolant cap
- Skid and vibration isolators
- Dry type air filter
- Main line circuit breaker
- Microprocessor control panel
- User manual

Generator Ratings

Voltage	HZ	Phase	P.F	Standby Amps	Standby Ratings kW/kVA	Prime Ratings kW/kVA
415/240	50	3	0.8	3061	1760 / 2200	1600 / 2000
400/230	50	3	0.8	3176	1760 / 2200	1600 / 2000
380/220	50	3	0.8	3343	1760 / 2200	1600 / 2000

PRP : Prime Power is available for an unlimited number of annual operating hours in variable load applications, in accordance with ISO 8528-1. A 10% overload capability is available for a period of 1 hour within 12-hour period of operation, in accordance with ISO 3046-1
ESP : The standby power rating is applicable for supplying emergency power in variable load applications in accordance with ISO 8528-1. Overload is not allowed.

Conditions of sale

- SDMO provides a full line of products with high quality recognized engines and alternators.
- Service and parts are available from SDMO distributors as a single source of responsibility.
- Electronic governor MDEC is available on all models from the XS range.
- Each and every units is factory tested. All generator sets are also prototype tested.
- Warranty according to our standard conditions. Five years extended also available

ENGINE DATA

Manufacturer / Model	MTU 16V4000G61E , 4-cycle, Turbo , Air/Water DC
Cylinder Arrangement	16 X V
Displacement	65.00L [3966.5C.I.]
Bore and Stroke	165mm [6.5in.] X 190mm [7.5in.]
Compression ratio	16.6 : 1
Rated RPM	1500 Rpm
Piston Speed	9.5m/s [31.2ft./s]
Max. stand by Power at rated RPM*	1940kW [2600BHP]*
Frequency regulation, steady state	+/-0. 5%
BMEP	21.66bar [314psi]
Governor : type	Elec
Exhaust System	
Exhaust gas flow	6000L/s [12715cfm]
Exhaust temperature	510°C [950°F]
Max back pressure	300mm CE [12in. WG]
Fuel System	
110% (Stand By power)	484L/h [127.9gal/hr]
100% (of the Prime Power)	436L/h [115.2gal/hr]
75% (of the Prime Power)	324L/h [85.6gal/hr]
50% (of the Prime Power)	213L/h [56.3gal/hr]
Total fuel flow	1320L/h [348.7gal/hr]
Oil System	
Total oil capacity w/filters	290L [76.6gal]
Oil Pressure low idle	3bar [43.5psi]
Oil Pressure rated RPM	5.5bar [79.7psi]
Oil consumption 100% load	2.34L/h [0.6gal/hr]
Oil capacity carter	230L [60.8gal]
Thermal balance 100% load	
Heat rejection to exhaust	1302kW [74032Btu/mn]
Radiated heat to ambiant	90kW [5117Btu/mn]
Heat rejection to coolant	N/A
Air intake	
Max. intake restriction	150mm CE [6in. WG]
Engine air flow	2500L/s [5298cfm]
Coolant System	
Radiator & engine capacity	N/A
Max water temperature	97°C [207°F]
Outlet water temperature	93°C [199°F]
Fan power	N/A
Fan air flow	33.3m3/s [70566cfm]
Available restriction on air flow	19mm CE [0.7in. WG]
Type of coolant	Coolelf mdx
Thermostat	79/-- °C
Emissions	
HC	150 mg/Nm3
CO	650 mg/Nm3
Nox	2000 mg/Nm3
PM	130 mg/Nm3

* For the 2000 series engines, the powers expressed are the net engine powers (cooling system as standard)
For the 4000 series engines, the powers expressed are the gross engine powers (cooling system optional, compact version)

ALTERNATOR SPECIFICATIONS

GENERAL DATA

- Compliance with NEMA MG21, UTE NF C51.111, VDE 0530, BS 4999, CSA standards.
- Vacuum-impregnated windings with epoxy varnish.
- IP21 drip proof.

ALTERNATOR DATA

Manufacturer / Type	LEROY SOMER LSA51.2M60
Number of phase	3
Power factor (Cos Phi)	0.8
Altitude	< 1000 m
Overspeed	2250 rpm
Pole : number	4
Exciter type	AREP
Insulation : class, temperature rise	H / H
Voltage regulator	R449
Sustained short circuit current	3 IN = 10s
Total harmonics (TGH/THC)	< 4 %
Wave form : NEMA = TIF – TGH/THC	< 50
Wave form : CEI = FHT – TGH/THC	< 2 %
Bearing : number	1
Coupling	Direct
Voltage regulation 0 to 100% load	+/- 1%
Recovery time (20% Volt dip) ms	< 700 ms
SkVA with 90 % of nominal sustained voltage (at 0.4 PF)	5500

OTHER ALTERNATOR DATA

Continuous nominal rating @ 40°C	2460 kVA
Standby rating @ 27°C	2640 kVA
Efficiencies @ 4/4 load	95.4 %
Air flow	2.5m3/s [5297.18cfm]
Short circuit ratio;50 (Kcc)	0.29
Direct axis synchro reactance unsaturated (Xd)	389 %
Quadra axis synchro reactance unsaturated (Xq)	233 %
Open circuit time constant;50 (T'do)	2800 ms
Direct axis transient reactance saturated (X'd)	34.4 %
Short circuit transient time constant (T'd)	250 ms
Direct axis subtransient reactance saturated (X''d)	15.2 %
Subtransient time constant (T''d)	23 ms
Quadra axis subtransient reactance saturated (X''q)	19 %
Zero sequence reactance unsaturated (Xo)	3.6 %
Negative sequence reactance saturated (X2)	17.1 %
Armature time constant (Ta)	41 ms
No load excitation current (io)	1.5 A
Full load excitation current (ic)	5.9 A
Full load excitation voltage (uc)	62 V
Recovery time (Delta U = 20% transitoire)	< 700 ms
Motor start (Delta = 20% perm. Or 50% trans.)	4800 kVA
Transient dip (4/4 charge) – PF : 1.8 AR	12 %
No load losses	30.1 kW
Heat rejection	88.3 kW

Control Panels

TELYS

Specifications :

Frequency meter, Ammeter, Voltmeter

Alarms and faults Oil pressure, water temperature, No start-up, Overspeed, Min/max alternator, Min/max battery voltage, Low fuel level, Emergency stop

Engine parameters Hours counter, Oil pressure, Water temperature, Engine speed, Battery voltage, Fuel level

KERYS

Specifications :

Frequency meter, Ammeter, Voltmeter

Alarms and faults Oil pressure, water temperature, No start-up, Overspeed, Min/max alternator, Min/max battery voltage, Low fuel level, Emergency stop

Engine parameters Hours counter, Oil pressure, Water temperature, Engine speed, Battery voltage, Fuel level

Additional specifications Website, Troubleshooting, Assistance and Maintenance, Plotting and logging, Load impact, 8 configurations available, Compliance with international standards...

M80

Specifications :

Tachometer, Emergency stop button, client connection terminal strip, EC certified

Engine parameters :

Hours counter, Oil pressure gauge, Water temperature indicator, Oil pressure indicator

Options

Engine and Radiator

- Heat shield protection
- Oil drain extension
- Heavy duty air filter
- Lube oil drain pump
- Radiator core guard
- Battery charger
- Block heater

Alternator

- Anti condensation heater
- Enforced impregnation
- Oversized alternator

Exhaust

- Residential silencer
- Critical silencer
- Flexible exhaust conn.

Control panel

- NFPA 110 level 1
- Paralleling system
- Remote annunciator
- Oil temperature shutdown
- Key start panel

Literature

- Parts
- Maintenance

Fuel

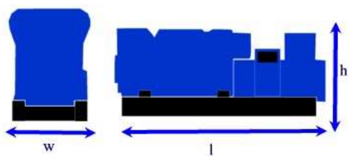
- Day tank
- Subbase fuel tanks UL
- Water separator fuel filter

Contenergy

- **EUR40SI**
- Silent 75 db @ 7m [23 Ft] (stby)

Weight and Dimensions

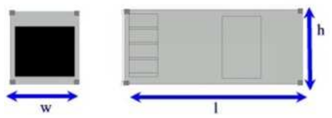
Open Model Excluding option



Overall size l x w x h :
4420mm [174in] x 1835mm [72in] x 2210mm [87in]

Weight :
12022kg [26496lbs] Net 12498kg [27546lbs] Brut

With Optional Enclosure



Overall size l x w x h :
12192mm [480in] x 2438mm [96in] x 2896mm [114in]

Weight :
21430kg [47232lbs] Net 22394kg [49356lbs] Brut

SDMO industries - Head Office – 12bis, rue de la Villeneuve – CS 92848 - 29228 BREST cedex 2 - FRANCE - www.sdmo.com

KOHLER®

KD3100

50 Hz. Diesel Generator Set
EMISSION OPTIMIZED DATA SHEET
TIER 2 COMPLIANT

ENGINE INFORMATION

Model:	KD83V16	Bore:	175 mm (6.89 in.)
Type:	4-Cycle, 16-V Cylinder	Stroke:	215 mm (8.46 in.)
Aspiration:	Turbocharged, Intercooled	Displacement:	83 L (5048 cu. in.)
Compression ratio:	16:0:1		
Emission Control Device:	Direct Diesel Injection, Engine Control Module, Turbocharger, Charge Air Cooler		

EXHAUST EMISSION DATA:	**EPA D2 Cycle 5-mode weighted**
HC	0.47 g/kWh
NO_x (Oxides of Nitrogen as NO_2)	5.66 g/kWh
CO (Carbon Monoxide)	1.04 g/kWh
PM (Particular Matter)	0.08 g/kWh

EMISSION DATA

Cycle point	100% ESP		100% PRP		75% ESP		75% PRP		50% PRP	
Power [kW]	2663		2421		1997		1816		1211	
Speed [rpm]	1500		1500		1500		1500		1500	
NO_X [g/kWh]	6.2		6.2		5.8		5.6		5.1	
CO [g/kWh]	0.4		0.3		0.4		0.5		1.8	
HC [g/kWh]	0.27		0.32		0.37		0.39		0.48	
PM [g/kWh]	0.02		0.02		0.02		0.02		0.12	
	@ 5% O_2	@ 15% O_2	@ 5% O_2	@ 15% O_2	@ 5% O_2	@ 15% O_2	@ 5% O_2	@ 15% O_2	@ 5% O_2	@ 15% O_2
HC [mg/Nm^3]	86	36	101	38	121	45	125	47	140	52
NOx [mg/Nm^3]	1976	741	1983	744	1880	705	1783	669	1475	553
CO [mg/Nm^3]	113	43	95	36	128	48	165	62	521	196
PM [mg/Nm^3]	7	3	6	2	6	2	7	3	33	13

TEST METHODS AND CONDITIONS

Test Methods:
Steady-State emissions recorded per ISO8178-1 during operation at rated engine speed (+/-2%) and stated constant load (+/2%) with engine temperatures, pressures and emission rated stabilized.

Fuel Specification:
EN590 Diesel Fuel

Reference Conditions:
25°C (77 °F) Air Inlet Temperature, 40°C (104 °F) Fuel Inlet Temperature, 100 kPa (29.53 in Hg) Barometric Pressure; 10.7 g/kg (75 grains H2O/lb) of dry air Humidity. Intake Restriction set to maximum allowable limit for clean filter; Exhaust Back pressure set to maximum allowable limit.

Data was taken from a single engine test according to the test methods, fuel specification and reference conditions stated above and is subjected to instrumentation and engine-to-engine variability. Test conducted with alternate test methods, instrumentation, fuel or reference conditions can yield different results.

Data and specifications subject to change without notice.

Industrial Diesel Generator Set – KD3100-E
50 Hz - Emission Optimized – EPA Tier 2 Compliant

RATINGS 400 V - 50 Hz		
Standby	kVA	3100
	kWe	2480
Data Center / Mission Critical	kVA	3100
	kWe	2480
Prime	kVA	2818
	kWe	2254

Benefits & features

KOHLER premium quality

- KOHLER provides **one source responsibility** for the generating set and accessories
- The generator set, its components and a wide range of options have been **fully developed, prototype tested, factory built**, and production-tested
- The generator sets are designed in accordance to ISO8528-5 performance **class G3** and accepts rated load in one step
- Approved for use with HVO (Hydrotreated Vegetable Oil) according to EN15940

KOHLER premium performances

Engines

- Low fuel consumption thanks to a high technology common rail injection engine
- A smaller footprint thanks to a high power density
- Low temperature starting capability
- Long maintenance interval

Alternator

- Provide industry leading motor starting capability
- Excitation system to permit sustained overcurrent > 300% In, during 10 sec
- Built with a class H insulation and IP23

Cooling

- A flexible solution using an electrical driven radiator fan
- High temperature and altitude product capacity available

Control Panel

- The KOHLER wide controller range provide the reliability and performances you expect from your equipment. You can program, manage and diagnose it easily and in an efficient way

KOHLER worldwide support

- A standard three-year or 1000-hour limited warranty for standby applications.
- A standard two-year or 8700-hour limited warranty for prime power applications.
- A worldwide product support

GENERAL SPECIFICATIONS	
Engine brand	KOHLER KD Series
Alternator commercial brand	KOHLER
Voltage (V)	400/230
Standard Control Panel	M80-D
Optional control panel	APM403
Optional Control Panel	APM802
Consumption @ 100% load ESP (L/h) *	667
Consumption @ 100% load PRP (L/h) *	599
Emission level	Emission optimization - EPA Tier 2 Compliant
Type of Cooling	Electrical driven fan
Performance class	G3
One step load acceptance (out of ISO criteria)	100%

GENERATOR SETS RATINGS

	Standby			Data Center / Mission Critical		Prime	
Voltage	kWe	kVA	Amps	kWe	kVA	kWe	kVA
415/240	2480	3100	4313	2480	3100	2254	2818
400/230	2480	3100	4475	2480	3100	2254	2818
380/220	2472	3090	4695	2472	3090	2247	2809

DIMENSIONS COMPACT VERSION	
Length (mm)	5319
Width (mm)	1960
Height (mm)	2482
Tank capacity (L)	0
Dry weight (kg)	19750

DIMENSIONS SOUNDPROOFED VERSION	
Type soundproofing	NOT AVAILABLE
Length (mm)	16826
Width (mm)	4000
Height (mm)	4000
Dry weight (kg)	44200
Acoustic pressure level @1m in dB(A) 50Hz (75% PRP)	85

* Volumetric Fuel consumption is up to 4% higher when using HVO than Diesel Fuel

Reference Conditions: 25°C Air Inlet Temperature, 40°C Fuel Inlet Temperature, 100 kPa Barometric Pressure; 10.7 g/kg of dry air Humidity. Intake Restriction set to maximum allowable limit for clean filter; Exhaust Back pressure set to maximum allowable limit.
Data was taken from a single engine test according to the test methods, fuel specification and reference conditions stated above and is subjected to instrumentation and engine-to-engine variability. Test conducted with alternate test methods, instrumentation, fuel or reference conditions can yield different results. Data and specifications subject to change without notice.

Industrial Diesel Generator Set – KD3100-E
50 Hz - Emission Optimized – EPA Tier 2 Compliant

Engine

General	
Engine brand	KOHLER KD Series
Engine ref.	KD83V16-5AES *
Air inlet system	Turbo
Fuel	Diesel Fuel/HVO
Emission level	Emission optimization - EPA Tier 2 Compliant
Cylinder configuration	V
Number of cylinders	16
Displacement (l)	82,74
Bore (mm) * Stroke (mm)	175 * 215
Compression ratio	16 : 1
Speed 50Hz (RPM)	1500
Maximum stand-by power at rated RPM (kW)	2663
Piston type & material	Forged Steel
Charge Air coolant	Air/Water
Frequency regulation, steady state (%)	+/- 0.25%
Injection Type	Direct
Governor type	Electronic
Air cleaner type, models	Dry

Fuel system	
Maximum fuel pump flow (l/h)	1070
Fuel Inlet Minimum recommended size (mm)	33,70
Fuel Outlet Minimum recommended size (mm)	33,70
Max head on fuel return line (m fuel)	3,50
Maximum allowed inlet fuel temperature (°C)	70

Consumption with cooling system	**PRP**	**ESP**
Consumption @ 100% load (g/kW.h)	212	214
Consumption @ 75% load (g/kW.h)	213	210
Consumption @ 50% load (g/kW.h)	231	227
Consumption @ 25% load (g/kW.h)	268	261

* Engine reference may be partially modified depending on genset application, options selected by the customer and lead time required.

Lubrication System	
Oil system capacity including filters (l)	560
Min. oil pressure (bar)	3,70
Max. oil pressure (bar)	
Oil sump capacity (l)	460
Oil consumption 100% ESP 50Hz (l/h)	1,25

Air Intake system	
Max. intake restriction (mm H2O)	510
Combustion air flow (l/s)	3702,30

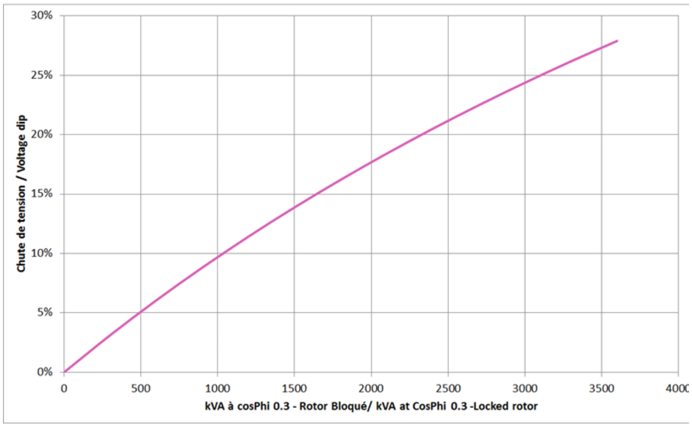
Exhaust system	**PRP**	**ESP**
Heat rejection to exhaust (kW)		2050
Exhaust gas temperature (°C)		500
Exhaust gas flow (L/s)	8153	10072
Max. exhaust back pressure (mm H2O)	867	

Optional cooling system (HT/LT)	
Type of coolant	GENCOOL
Radiated heat to ambiant (kW)	125
Heat rejection to coolant HT (kW)	990
HT circuit flow rate (l/min)	1980
Outlet coolant temperature (°C)	85
Coolant capacity HT, engine only (l)	270
Max coolant temperature, Shutdown (°C)	105
Restriction pressure drop off engine – HT circuit (mbar)	700
Minimal pressure before HT pump (mbar)	400
Max. pressure at inlet of HT water pump (mbar)	2500
Thermostat begin of opening HT (°C)	71
Thermostat end of opening HT (°C)	81
HT Standard pressure cap setting (kPa)	100
Heat rejection to coolant LT (kW)	750
LT circuit flow rate (l/min)	620
Temperature of inlet to LT engine water circuit (°C)	55
Coolant capacity LT, engine only (l)	105
Restriction pressure drop off engine – LT circuit (mbar)	700
Minimal pressure before LT pump (mbar)	400
Max. pressure at inlet of LT water pump (mbar)	2500
LT Standard pressure cap setting (kPa)	100

Reference Conditions: 25°C Air Inlet Temperature, 40°C Fuel Inlet Temperature, 100 kPa Barometric Pressure; 10.7 g/kg of dry air Humidity. Intake Restriction set to maximum allowable limit for clean filter; Exhaust Back pressure set to maximum allowable limit.
Data was taken from a single engine test according to the test methods, fuel specification and reference conditions stated above and is subjected to instrumentation and engine-to-engine variability. Test conducted with alternate test methods, instrumentation, fuel or reference conditions can yield different results. Data and specifications subject to change without notice.

Alternator Specifications	
Alternator commercial brand	KOHLER
Kohler Alternator description	KH06550T
Number of pole	4
Number of bearing	Single Bearing
Technology	Brushless
Indication of protection	IP23
Insulation class	H
Number of wires	06
AVR Regulation	Yes
Coupling	Direct
Capacity for maintaining short circuit at 3 In for 10 s	Yes
Application data	
Overspeed (rpm)	2250
Power factor (Cos Phi)	0,80
Voltage regulation at established rating (+/- %)	0,50
Wave form : NEMA=TIF	<50
Wave form : CEI=FHT	<2
Total Harmonic Distortion in no-load DHT (%)	<3.5
Total Harmonic Distortion, on linear load DHT (%)	<3.5
Recovery time (Delta U = 20% transcient) (ms)	500
Performance datas	
Continuous Nominal Rating 40°C (kVA)	3000
Unbalanced load acceptance ratio (%)	8

Peak motor starting (kVA) based on x% voltage dip power factor at 0.3



Alternator Standard Features

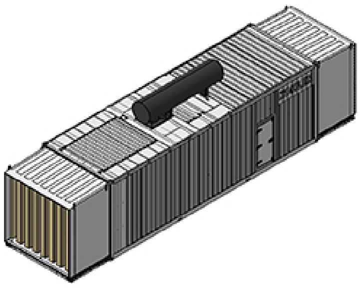
- All models are brushless, rotating-field alternators
- NEMA MG1, IEEE, and ANSI standards compliance for temperature rise and motor starting
- The AVR voltage regulator provides superior short circuit capability
- Self-ventilated and dip proof construction
- Sustained short-circuit current of up to 300% of the rated current for up to 10 seconds
- Superior voltage waveform

Note: See Alternator Data Sheets for alternator application data and ratings, efficiency curves, voltage dip with motor starting curves, and short circuit decrement curves.

Dimensions compact version

Length (mm) * Width (mm) * Height (mm)	5319 * 1960 * 2482
Dry weight (kg)	19750
Tank capacity (L)	0

Container dimensions WIC 85 dB



Length (mm) * Width (mm) * Height (mm)	16826 * 4000 * 4000
Dry weight (kg)	44200
Acoustic pressure level @1m in dB(A) 50Hz (75% PRP)	85

Container dimensions WIC 75 dB

Length (mm) * Width (mm) * Height (mm)	17509 * 4000 * 6058
Dry weight (kg)	47550
Acoustic pressure level @1m in dB(A) 50Hz (75% PRP)	75

* dimensions and weight without options

M80-D

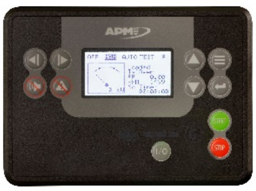
The M80-D can be used as a basic terminal block for connecting a control unit and as an instrument panel with a highly intuitive LCD screen giving an overview of your generating set's basic parameters:

- Oil gauge
- Coolant temperature
- Oil temperature
- Engine speed
- Battery voltage
- Charge air temperature
- Fuel consumption
- etc.

The engine main functions can be controlled and events are recorded to facilitate diagnostics:

- Starting
- Speed adjustment
- Stopping
- Droop
- etc.

APM403



BASIC GENERATING SET AND POWER PLANT CONTROL

The APM403 is a versatile control unit which allows operation in manual or automatic mode

- Measurements : voltage and current
- kW/kWh/kVA power meters
- Standard specifications: Voltmeter, Frequency meter.
- Optional : Battery ammeter.
- J1939 CAN ECU engine control
- Alarms and faults: Oil pressure, Coolant temperature, Overspeed, Start-up failure, alternator min/max, Emergency stop button.
- Engine parameters: Fuel level, hour counter, battery voltage.
- Optional (standard at 24V): Oil pressure, water temperature.
- Event log/ Management of the last 300 genset events.
- Mains and genset protection
- Clock management
- USB connections, USB Host and PC,
- Communications : RS485 INTERFACE
- ModBUS protocol /SNMP
- Optional : Ethernet, GPRS, remote control, 3G, 4G,
- Websupervisor, SMS, E-mails

APM802

ADVANCED POWER PLANT MANAGEMENT CONTROL

Dedicated to power plant management APM802 provides advanced control, system monitoring, and system diagnostics for optimum performance and compatibility

- Graphic display with touchscreen
- User language selectable
- Specially researched ergonomics
- High level of equipment availability
- USB and Ethernet ports
- Modbus protocol
- Making it easy to extend the installation
- Complies with the international standard IEC 61131-3

STANDARD SCOPE OF SUPPLY

All our KD Series gensets are fitted with:

- Industrial water cooled DIESEL engine
- Electric starter & charge alternator 24 V D.C
- Electronic governor
- Standard air filter
- Single bearing alternator IP 23 T° rise/ insulation to class H/H
- Welded steel base frame with 85% vibration attenuation mounts
- M80-D control panel
- Flexible fuel lines & lub oil drain pump
- Fuel water separator filter
- Exhaust outlet with flexible and flanges
- User's manual (1 copy)
- Packing under plastic film
- Delivered with oil

CODES AND STANDARDS

Engine-generators set is designed and manufactured in facilities certified to standards ISO9001:2015 & ISO14001:2015. The generator sets and its components are prototype-tested, factory built and production tested and are in compliance with the relevant standards:

- Machinery Directive 2006/42/EC of May 17th 2006
- EMC Directive2014/30/UE
- Safety objectives set out in the Low Voltage Directive 2014/35/UE
- EN ISO 8528-13, EN 60034-1, EN 61000-6-1, EN 61000-6-2, EN 61000-6-3, EN 55011, EN 1679-1 et EN 60204-1

POWER RATINGS DEFINITION according to ISO8528-1 (2018-02 edition) and ISO-3046-1

Emergency Standby Power (ESP): The standby rating is applicable to varying loads for the duration of a power outage. There is no overload capability for this rating. Average load factor per 24 hours of operation is <85%.

Prime Power (PRP): At varying load, the number of generator set operating hours is unlimited. A 10% overload capacity is available for one hour within 12 hour of operation. Average load factor per 24 hours of operation is <75%.

Data Center Mission Critical (DCP): Data Center Mission Critical power is defined as being the maximum power which a generating set is capable of delivering while supplying a variable or continuous electrical load and during unlimited run hours. Depending on the sites to supply and the availability of reliable utility, the generating set manufacturer is responsible to define what power level is able to supply to fulfil that requirement including hardware or software or maintenance plan adaptation.

TERMS OF USE

According to the standard, the nominal power assigned by the genset is given for 25°C Air Intlet Temperature, of a barometric pressure of 100 kPA (100 m A.S.L), and 30% relative humidity. For particular conditions in your installation, refer to the derating table.

WARRANTY INFORMATIONS

Standard Warranty Period:

- for Products in "back-up" service
    - 30 months from the date the Product leaves the plant, **extended to 42 months for KD series**
    - 24 months from the Product's commissioning date, **extended to 36 months for KD series**
    - 1,000 running hours

  The warranty expires when one of the above conditions is met.

- for Products in "continuous" service (continuous supply of electricity, either in the absence of any normal electricity grid or to complement the grid),
    - 18 months from the date the Product leaves the plant, **extended to 30 months for KD series**
    - 12 months from the Product's commissioning date, **extended to 24 months for KD series**
    - 2,500 running hours, **extended to 8700 running hours for KD series**

  The warranty expires when one of the above conditions is met.

For more details regarding conditions of application and scope of the warranty please refer to our General "terms & conditions of sales".

4000 Series Diesel Engine Emissions
Standard Spill Timing - None Emissions Compliant

Prime Nett Power Rated @ 1500rpm

Emission level in mg/Nm^3 corrected to 5% oxygen in the exhaust

Engine Type	Timing BTDC	Prime Power Gross kWb	Fuel Input <3MW	Fuel Input >3MW	NOx mg/Nm^3	CO mg/Nm^3	HC mg/Nm^3	PM mg/Nm^3	Comments
4006-23TAG2A	17.5°	658	*		3300	310	120	<80	
4006-23TAG3A	17.5°	705	*		3100	320	100	<80	
4008TAG1A	16°	805	*		2585	242	88	<80	
4008TAG2A	16°	899	*		2378	254	75	<80	
4008-30TAG1	18°	808	*		3471	438	140	<80	
4008-30TAG2	16°	892	*		3227	326	143	<80	
4008-30TAG3	14°	997	*		3092	245	144	<80	
4012-46TWG2A	22°	1113	*		5400	350	130	<50	
4012-46TWG3A	22°	1207	*		5100	410	120	<50	
4012-46TWG4A	22°	1308		*	4600	400	108	<50	
4012-46TAG0A	16°	1117	*		3950	250	120	40	
4012-46TAG1A	18°	1212	*		3700	240	120	37	
4012-46TAG2A	18°	1331		*	3280	240	90	48	
4012-46TAG3A	18°	1500		*	2990	480	90	47	
4016TAG	18°	1502		*	3457	537	226	<80	
4016TAG1A	16°	1588		*	2380	177	100	<80	
4016TAG2A	16°	1766		*	2158	283	64	<80	
4016-61TRG1	18°	1648		*	3447	296	116	22.5	
4016-61TRG2	16°	1774		*	2743	309	138	27.5	
4016-61TRG3	14°	1975		*	2341	215	143	30.4	

Typical emissions levels for 4000 Series diesel engines. Data may be subject to variation if the engine is not maintained according to Perkins Service and Maintenance Manuals. Data is valid on date of issue only.

Issue 6 - 13/10/2015

www.FGWilson.com

P2000/P2250E

Image for illustration purposes only.

Output Ratings

Voltage, Frequency	Prime	Standby
380-415V,50Hz	2000.0 kVA / 1600.0 kW	2249.2 kVA / 1799.4 kW
	- / -	- / -

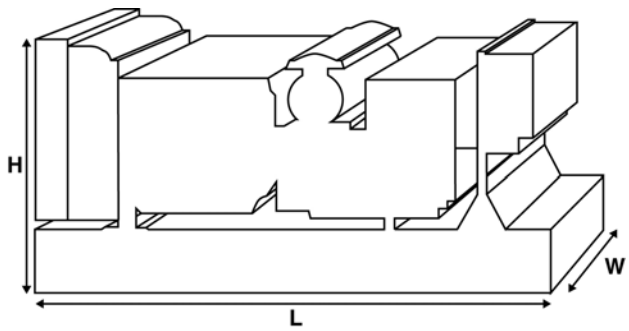
Ratings at 0.8 power factor.

Please refer to the output ratings technical data section for specific generator set outputs per voltage.

Prime Rating
These ratings are applicable for supplying continuous electrical power (at variable load) in lieu of commercially purchased power. There is no limitation to the annual hours of operation and this model can supply 10% overload power for 1 hour in 12 hours.

Standby Rating
These ratings are applicable for supplying continuous electrical power (at variable load) in the event of a utility power failure. No overload is permitted on these ratings. The alternator on this model is peak continuous rated (as defined in ISO 8528-3).

Standard Reference Conditions
Note: Standard reference conditions 25°C (77°F) Air Inlet Temp, 100m (328 ft) A.S.L. 30% relative humidity.
Fuel consumption data at full load with diesel fuel with specific gravity of 0.85 and conforming to BS2869: 1998, Class A2.



Ratings and Performance Data

Engine Make & Model:	Perkins® 4016TAG2A	
Alternator manufactured for FG Wilson by:	Leroy Somer	
Alternator Model:	LL9224H	
Control Panel:	PowerWizard 1.1+	
Base Frame:	Heavy Duty Fabricated Steel	
Circuit Breaker Type:	3 Pole ACB – Option	
Frequency:	**50 Hz**	**60 Hz**
Engine Speed: RPM	1500	-
Fuel Tank Capacity: litres (US gal)	-	
Fuel Consumption: l/hr (US gal/hr)		
(100% Load) **- Prime**	425.7 (112.5)	-
- Standby	486.8 (128.6)	-

Available Options

FG Wilson offer a range of optional features to tailor our generator sets to meet your power needs. Options include:

- Upgrade to CE Certification
- A wide range of Sound Attenuated Enclosures
- A variety of generator set control and synchronising panels
- Additional alarms and shutdowns
- A selection of exhaust silencer noise levels

For further information on all of the standard and optional features accompanying this product please contact your local Dealer or visit: www.FGWilson.com

Dimensions and Weights

Length (L) mm (in)	**Width** (W) mm (in)	**Height** (H) mm (in)	**Dry** kg (lb)	**Wet** kg (lb)
5852 (230.4)	2300 (90.6)	3020 (118.9)	15364 (33872)	15680 (34568)

Dry = With Lube Oil   Wet = With Lube Oil and Coolant

Ratings in accordance with ISO 8528, ISO 3046, IEC 60034, BS5000 and NEMA MG-1.22.
Generator set pictured may include optional accessories.

Engine Technical Data

No. of Cylinders / Alignment:	16 / Vee
Cycle:	4 Stroke
Bore / Stroke: mm (in)	160.0 (6.3)/190.0 (7.5)
Induction:	Turbocharged Air To Air Charge Cooled
Cooling Method:	Water
Governing Type:	Electronic
Governing Class:	ISO 8528 G2
Compression Ratio:	13.6:1
Displacement: l (cu. in)	61.1 (3730.0)
Moment of Inertia: kg m² (lb/in²)	20.72 (70803)
Engine Electrical System:	
- Voltage / Ground	24/Negative
- Battery Charger Amps	40
Weight: kg (lb) **- Dry**	5570 (12280)
- Wet	5847 (12890)

Performance

Performance	50 Hz	60 Hz
Engine Speed: rpm	1500	-
Gross Engine Power: kW (hp)		
- Prime	1766.0 (2368.2)	-
- Standby	1937.0 (2597.6)	-
BMEP: kPa (psi)		
- Prime	2311.1 (335.2)	-
- Standby	2535.2 (367.7)	-

Fuel System

Fuel Filter Type:	Replaceable Element
Recommended Fuel:	Class A2 Diesel or BSEN590

Fuel Consumption: l/hr (US gal/hr)

Prime	110% Load	100% Load	75% Load	50% Load
50 Hz	486.8 (128.6)	425.7 (112.5)	313.1 (82.7)	213.0 (56.3)
60 Hz	-	-	-	-

Standby	100% Load	75% Load	50% Load
50 Hz	486.8 (128.6)	353.9 (93.5)	236.8 (62.6)
60 Hz	-	-	-

(Based on diesel fuel with a specific gravity of 0.85 and conforming to BS2869, Class A2)

Air Systems

Air Systems	50 Hz	60 Hz
Air Filter Type:	Replaceable Element	
Combustion Air Flow: m³/min (cfm)		
- Prime	137.0 (4838)	-
- Standby	145.0 (5121)	-
Max. Combustion Air Intake Restriction: kPa (in H_2O)	3.7 (14.9)	-

Cooling System

Cooling System	50 Hz	60 Hz
Cooling System Capacity: l (US gal)	316.0 (83.5)	-
Water Pump Type:	Centrifugal	
Heat Rejected to Water & Lube Oil:		
kW (Btu/min) **- Prime**	660.0 (37534)	-
- Standby	721.0 (41003)	-
Heat Radiation to Room: Heat radiated from engine and alternator		
kW (Btu/min) **- Prime**	202.9 (11539)	-
- Standby	236.6 (13455)	-
Radiator Fan Load: kW (hp)	63.5 (85.2)	-
Radiator Cooling Airflow: m³/min (cfm)	2058.0 (72678)	-
External Restriction to Cooling Airflow: Pa (in H_2O)	250 (1.0)	-

Designed to operate in ambient conditions up to 50°C (122°F).
Contact your local FG Wilson Dealer for power ratings at specific site conditions.

Lubrication System

Oil Filter Type:	Spin-On, Full Flow
Total Oil Capacity: l (US gal)	238.0 (62.9)
Oil Pan: l (US gal)	214.0 (56.5)
Oil Type:	API CG4 15W-40
Oil Cooling Method:	Water

Exhaust System

Exhaust System	50 Hz	60 Hz
Silencer Type:	Industrial	
Silencer Model & Quantity:	IND-Option (1)	
Pressure Drop Across Silencer System: kPa (in Hg)	-	-
Silencer Noise Reduction Level: dB	17	-
Maximum Allowable Back Pressure: kPa (in Hg)	6.6 (1.9)	-
Exhaust Gas Flow: m³/min (cfm)		
- Prime	387.0 (13667)	-
- Standby	387.0 (13667)	-
Exhaust Gas Temperature: °C (°F)		
- Prime	493 (919)	-
- Standby	493 (919)	-

Alternator Physical Data	
Manufactured for FG Wilson by:	Leroy Somer
Model:	LL9224H
No. of Bearings:	1
Insulation Class:	H
Winding Pitch Code:	2/3 - 6S
Wires:	6
Ingress Protection Rating:	IP23
Excitation System:	AREP
AVR Model:	R449

Alternator Operating Data	
Overspeed: rpm	2250
Voltage Regulation: (Steady state)	+/- 0.5%
Wave Form NEMA = TIF:	50
Wave Form IEC = THF:	2.0%
Total Harmonic content LL/LN:	3.5%
Radio Interference:	Suppression is in line with European Standard EN61000-6
Radiant Heat: kW (Btu/min)	
- 50 Hz	86.6 (4925)
- 60 Hz	-

Alternator Performance Data:	50 Hz			60 Hz
Data Item	415/240V	400/230V	380/220V	
Motor Starting Capability* kVA	6986	6509	5897	
Short Circuit Capacity %**	300	300	300	
Reactances: Per Unit				
Xd	3.174	3.416	3.785	
X'd	0.243	0.261	0.289	
X"d	0.126	0.136	0.151	

Reactances shown are applicable to prime ratings.
*Based on 30% voltage dip at 0.4 power factor.
**With optional permanent magnet generator.

Output Ratings Technical Data 50 Hz				
Voltage	Prime:		Standby:	
	kVA	kW	kVA	kW
415/240V	2000.0	1600.0	2250.0	1800.0
400/230V	2000.0	1600.0	2249.2	1799.4
380/220V	2000.0	1600.0	2244.6	1795.7

Output Ratings Technical Data 60 Hz				
Voltage	Prime:		Standby:	
	kVA	kW	kVA	kW

Documentation

A full set of operation and maintenance manuals and circuit wiring diagrams.

Generator Set Standards

The equipment meets the following standards: BS5000, ISO 8528, ISO 3046, IEC 60034, NEMA MG-1.22.

FG Wilson is a fully accredited ISO 9001 company.

Warranty

All prime equipment carries a one year manufacturer's warranty. Standby equipment, limited to 500 running hours per year, has a two year manufacturer's warranty. For details on warranty cover please contact your local Dealer, or visit our website: FGWilson.com.

Dealer contact details:

FG Wilson manufactures product in the following locations:

Northern Ireland • Brazil • China • India • USA

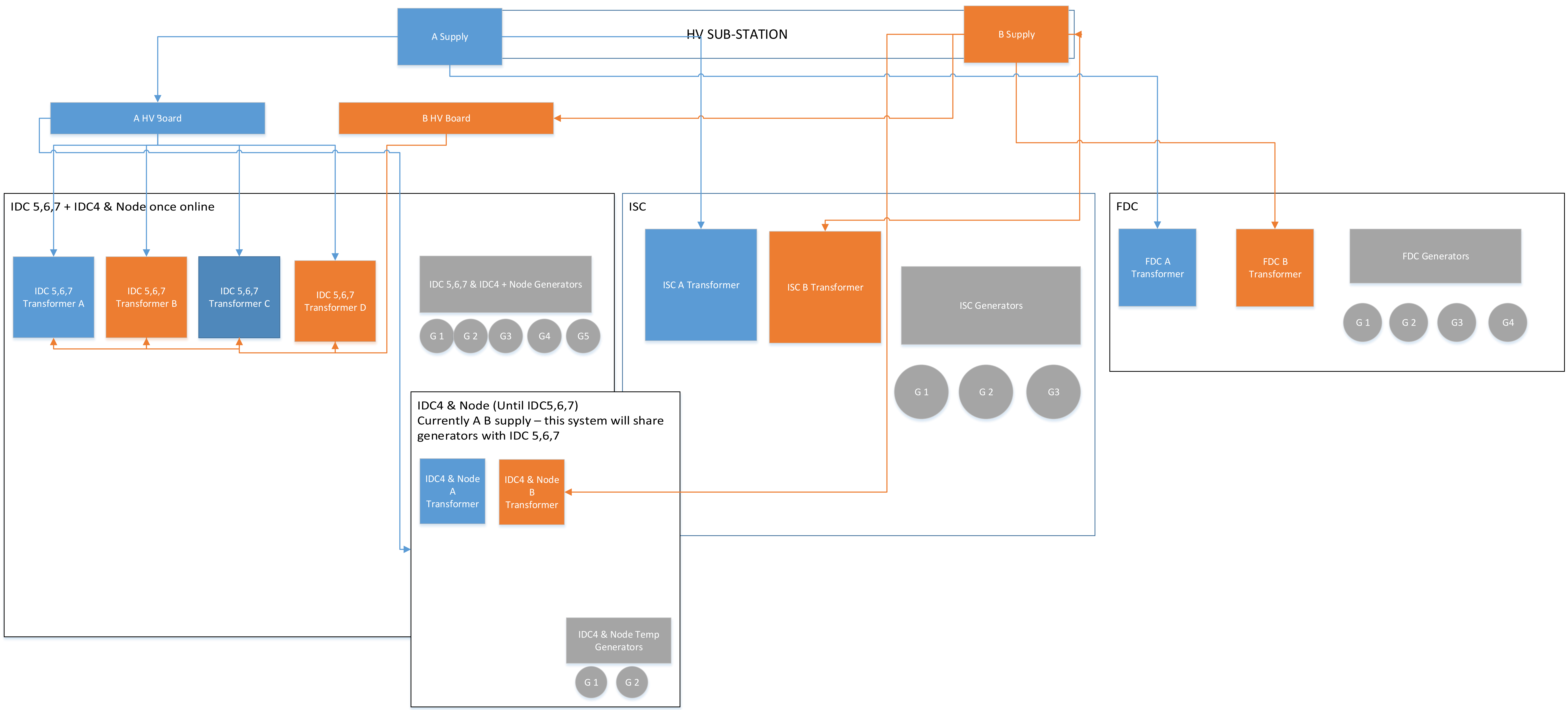
With headquarters in Northern Ireland, FG Wilson operates through a Global Dealer Network.
To contact your local Sales Office please visit the FG Wilson website at www.FGWilson.com.

FG Wilson is a trading name of Caterpillar (NI) Limited.

In line with our policy of continuous product development, we reserve the right to change specification without notice.

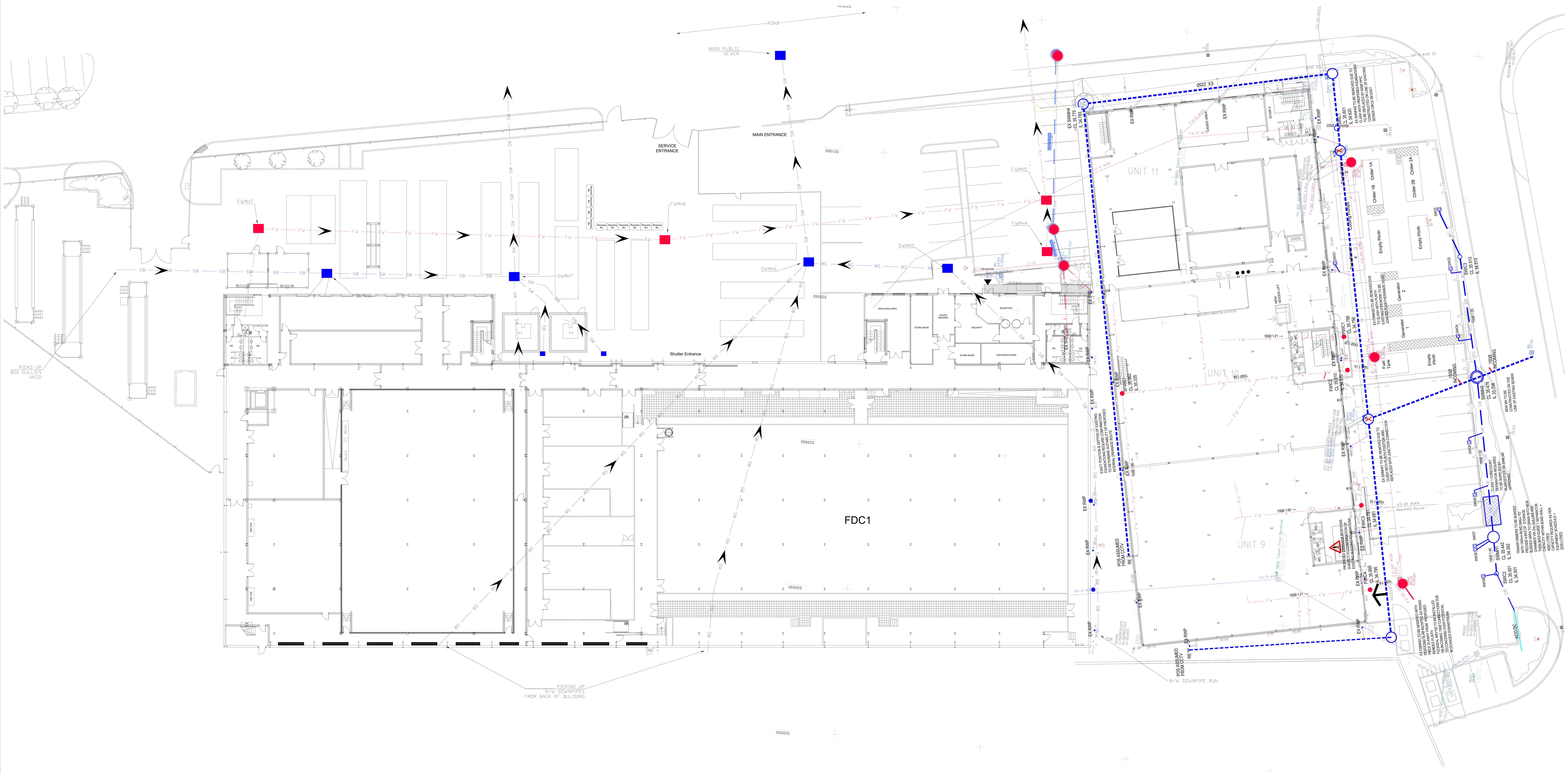
APPENDIX C.

SITE ELECTRICAL INFRASTRUCTURE


HV SUB-STATION
A Supply
B Supply
A HV Board
B HV Board
IDC 5,6,7 + IDC4 & Node once online
IDC 5,6,7 Transformer A
IDC 5,6,7 Transformer B
IDC 5,6,7 Transformer C
IDC 5,6,7 Transformer D
IDC 5,6,7 & IDC4 + Node Generators
G 1
G 2
G3
G4
G5
ISC
ISC A Transformer
ISC B Transformer
ISC Generators
G 1
G 2
G3
FDC
FDC A Transformer
FDC B Transformer
FDC Generators
G 1
G 2
G3
G4
IDC4 & Node (Until IDC5,6,7)
Currently A B supply – this system will share generators with IDC 5,6,7
IDC4 & Node A Transformer
IDC4 & Node B Transformer
IDC4 & Node Temp Generators
G 1
G 2

APPENDIX D.

SITE DRAINAGE PLAN



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NOTES:

1. THIS DRAWING MUST NOT BE USED FOR CONSTRUCTION OR INSTALLATION PURPOSES UNLESS EXPRESSLY STATED.
2. DO NOT SCALE OFF THIS DRAWING. ALWAYS WORK TO NOTED DIMENSIONS.
3. ALL DIMENSIONS MUST BE VERIFIED ON SITE BEFORE COMPLETING SHOP DRAWINGS OR SETTING OUT THE WORKS.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE SCOPE OF WORKS AS PREPARED BY HDR .
5. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL ARCHITECTURAL AND STRUCTURAL ENGINEER'S DRAWINGS AND ASSOCIATED HDR DRAWINGS.

LEGEND

SURFACE WATER

FOUL WATER

Rev	Description	Date
P1	FOR PERMIT APPLICATION	29.04.22

Drawing Status: PERMIT APPLICATION

Suitability:

240 BLACKFRIARS ROAD
LONDON.
SE1 8NW
UNITED KINGDOM

t: +44 (0) 20 7429 3333
e: info@hdrinc.com
w: www.hdrinc.com

Client: COLT DATA CENTRE SERVICES

Architect:

Project: COLT POWERGATE EPR APP

Title: COLT POWERGATE DRAINAGE LAYOUT

HDR Project Number: 10290863

Cad File Name: COLT PG-P-DRAIN

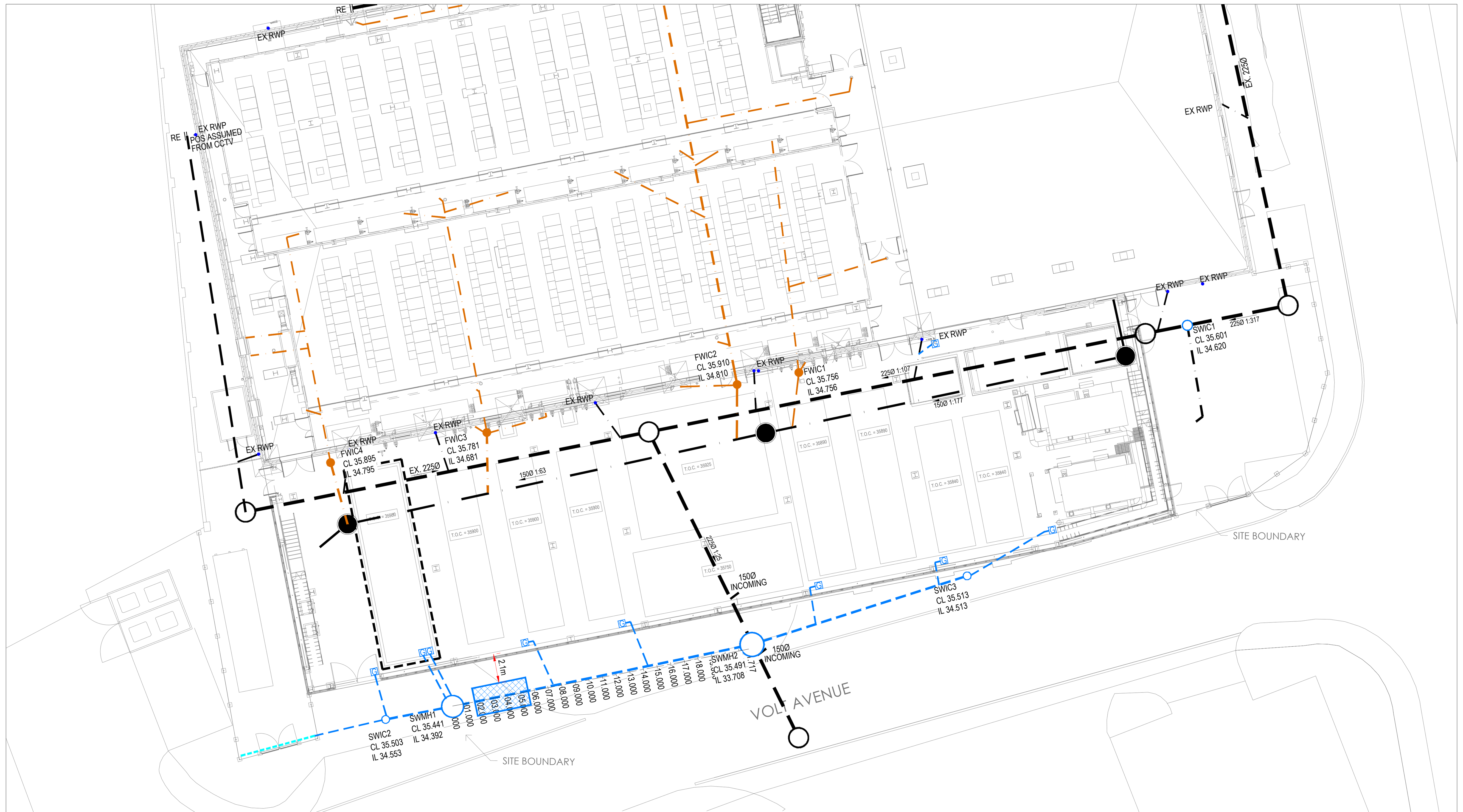
Drawn:	Chkd/Appd:	Date:	Scale @ A0:
JT	OF/NS	29.04.22	1:200

Drawing Number: COLT PG-P-DRAIN

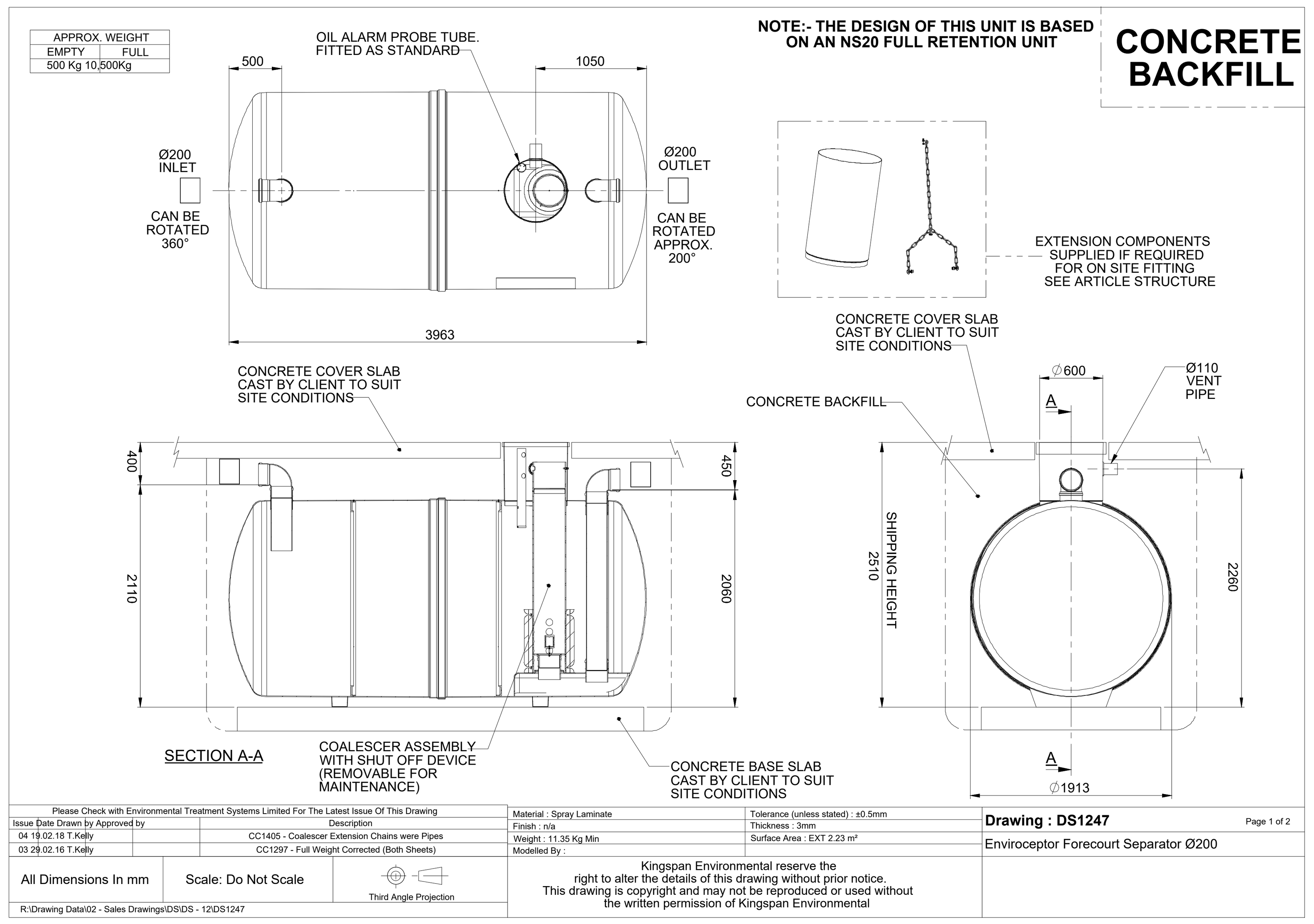
Revision: P1

APPENDIX E.

FORECOURT SEPARATOR DRAWING



PLAN VIEW ON SECTION THROUGH INTERCEPTOR
SCALE 1:250



MANUFACTURERS SEPARATOR INFORMATION
SCALE: NTS

GENERAL SAFETY NOTES:

1. WHERE THE BASE (ROAD BASE) HAS BEEN USED AS A TEMPORARY RUNNING SURFACE DURING THE CONTRACT IT SHALL BE THOROUGHLY CLEANED AND POWER WASHED AS NECESSARY. AFTER DRYING AND IMMEDIATELY BEFORE THE BINDER COURSE IS LAID A TACK COAT OF BITUMEN EMULSION CLASS A1-40 OR K1-40 TO BS434 SHALL BE APPLIED AT A RATE OF 0.35-0.55 LITRES/SQ METER.
2. ALL RADIUS KERBS WITH A RADIUS OF 12m OR LESS SHALL BE FORMED WITH PROPRIETARY RADIUS KERBS.

HEALTH & SAFETY:

1. CONTRACTOR SHOULD BE AWARE OF GENERAL CONSTRUCTION RISKS TO PREVENT SLIPS, TRIPS AND FALLS AND TAKE NECESSARY PRECAUTIONS WITHOUT SPECIAL INSTRUCTION.

ROADS & DRAINAGE

2. CONTRACTOR TO PROVIDE TRENCH SUPPORTS AS APPROPRIATE AND ENSURE THAT PLANT REMAINS A SAFE DISTANCE FROM TRENCHES PRIOR TO INSTALLING DRAINAGE
3. THE TIME THAT EXCAVATIONS ARE OPEN ON SITE SHOULD BE KEPT TO A MINIMUM AND ALL TRENCHES SHOULD BE SURROUNDED BY A BARRIER.
4. CONNECTIONS TO EXISTING SEWERS TO BE MADE BY APPROVED CONTRACTOR ONLY.
5. CONTRACTOR TO MAKE OPERATIVES AWARE OF ASSOCIATED DANGERS TO HEALTH SUCH AS LEPTOSPIROSIS (WEILS DISEASE) AND RECOMMENDED PRECAUTIONS. ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING TO BE PROVIDED AS REQUIRED.
6. UNFINISHED MANHOLES MUST BE COVERED WITH LOAD BEARING MATERIALS AND SURROUNDED WITH BARRIER.

PIPES & CABLES

7. CONTRACTOR TO OBTAIN ALL SERVICE RECORDS PRIOR TO WORKS COMMENCING.
8. SERVICE RECORDS TO BE REFERRED TO PRIOR TO WORK COMMENCING. CONTRACTOR TO PROCEED WITH CAUTION AND SERVICES TO BE LOCATED BY HAND DIG AND PROTECTED ACCORDINGLY.

EXCAVATION/FILL

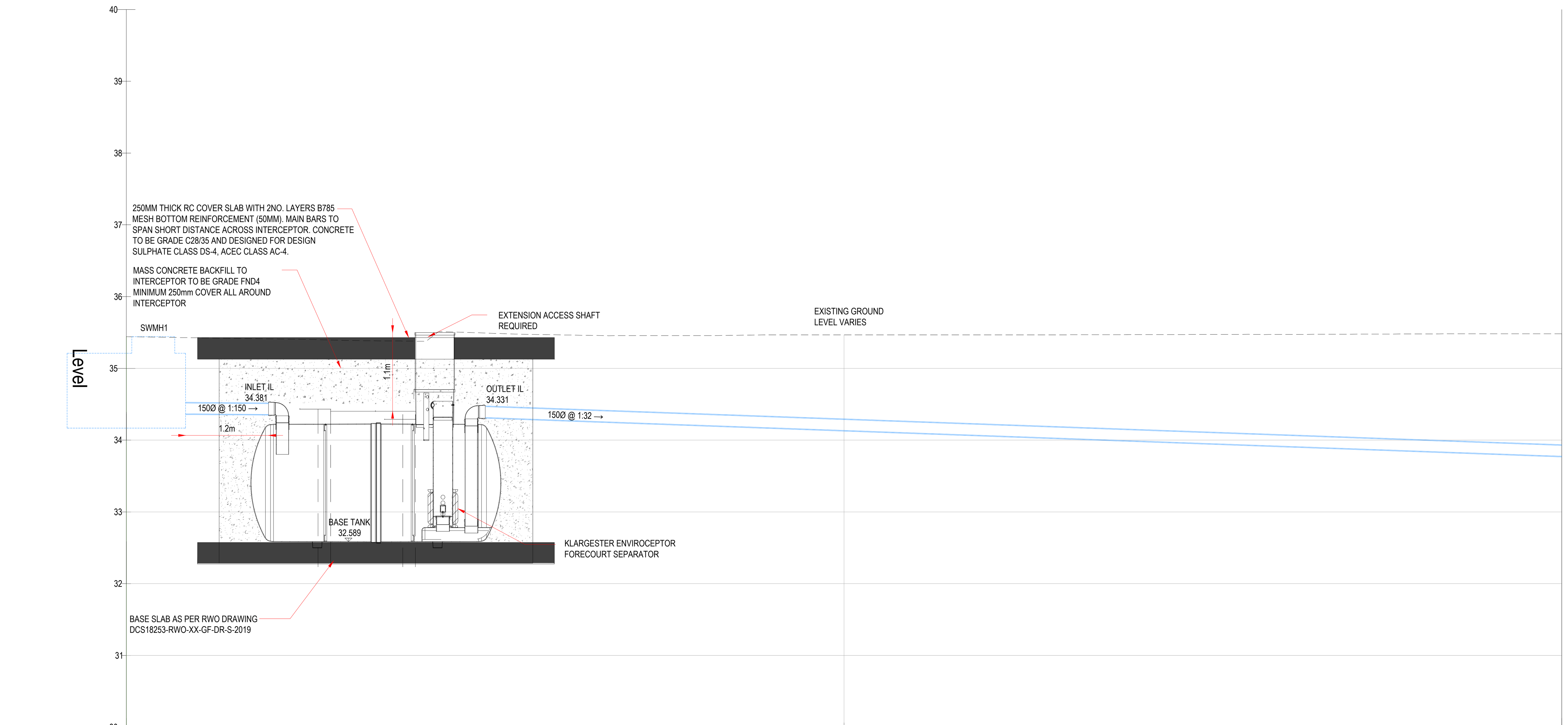
9. CONTRACTOR TO ENSURE RELEVANT MEASURES ARE TAKEN TO KEEP PLANT AND PEOPLE A SAFE DISTANCE FROM STEEP SLOPES DURING THE WORKS.
10. CONTRACTOR TO ENSURE THAT PROCEDURES ARE IN PLACE TO KEEP PEOPLE A SAFE DISTANCE FROM WORKING PLANT WHERE NECESSARY.
11. CONTRACTOR TO REFER TO GROUND INVESTIGATION REPORT FOR CONTAMINATION TESTS AND TO PROVIDE ADEQUATE WELFARE FACILITIES AND PROTECTIVE CLOTHING AS REQUIRED.

DESIGN NOTES:

1. ALL WORKS TO COMPLY WITH CURRENT VERSION OF THE FOLLOWING DOCUMENTS:
- DESIGN MANUAL FOR ROADS AND BRIDGES (DMRB)
- SPECIFICATION FOR HIGHWAY WORKS (SHW)
- LOCAL AUTHORITY DESIGN GUIDE AND SPECIFICATION
2. PRIOR TO COMMENCING WORKS THE CONTRACTOR SHOULD INVESTIGATE AND LOCATE AS NECESSARY ANY STATUTORY UNDERTAKERS EQUIPMENT WITHIN THE NEW ACCESS AND DISCUSS REQUIREMENTS FOR LOWERING/DIVERSION AND PROTECTION WITH THE RELEVANT UNDERTAKER.
3. ALL WORKS WITHIN THE PUBLIC HIGHWAY TO MEET LOCAL AUTHORITY REQUIREMENTS. CONTRACTOR TO APPLY FOR ROAD OPENING NOTICES ETC AS REQUIRED.
4. CBR VALUE NOT AVAILABLE. ROAD CONSTRUCTION DETAIL SUBJECT TO CONFIRMATION OF CBR VALUES. CONTRACTOR TO ALLOW FOR LAB TESTS TO BE UNDERTAKEN IN AGREEMENT WITH LOCAL AUTHORITY HIGHWAY ENGINEER PRIOR TO WORKS COMMENCING.
5. PROPOSED LEVELS HAVE BEEN BASED ON THE EXISTING TOPOGRAPHICAL SURVEY SUPPLIED BY METNOR BY
6. PROPOSED DRAWING BASED ON INFORMATION SUPPLIED BY ARUP
7. SLOPES GREATER THAN 1 IN 6 MAY REQUIRE STABILISATION. GEOTECHNICAL ENGINEER TO BE CONTACTED TO CONFIRM REQUIREMENTS
8. SEVERAL EXISTING UTILITIES AND SERVICES CROSS THE SITE OF WHICH SOME WILL REQUIRE DIVERSION.
9. **ALL NAMED PRODUCTS TO BE INSTALLED IN LINE WITH MANUFACTURERS SPECIFICATION & INSTALLATION DETAILS**
10. **DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT RWO & THIRD PARTY INFORMATION**

DRAINAGE NOTES:

1. ALL PIPES 100Ø UNLESS OTHERWISE STATED.
2. ALL PRIVATE TO ADOPTABLE CONNECTIONS 150Ø UNLESS OTHERWISE STATED.
3. ALL PPIC'S IN TRAFFICKED AREAS TO HAVE D400 COVERS & CONCRETE SURROUND.
4. ALL INTERNAL DRAINAGE REQUIRES CONFIRMATION PRIOR TO CONSTRUCTION.
5. CONTRACTOR TO CONFIRM MH COVER & INVERT LEVEL OF PROPOSED CONNECTION POINT PRIOR TO CONSTRUCTION. ANY VARIATION TO BE REPORTED TO ENGINEER.
6. THE INVERT LEVEL OF THE EXISTING SEWERS ARE TO BE VERIFIED PRIOR TO COMMENCEMENT OF ANY DRAINAGE WORKS. ANY DISCREPANCY MUST BE NOTIFIED TO THE ENGINEER.
7. EXISTING MANHOLES TO BE MODIFIED TO ACCOMMODATE THE PROPOSED LATERAL CONNECTIONS. CONTRACTOR TO APPLY TO THE WATER AUTHORITY FOR THE SECTION 106 APPROVAL TO MAKE THE CONNECTIONS. PIPES ARE TO BE LAID WITH COMMON INVERT LEVELS.
8. ALL STUB PIPES ARE TO BE CAPPED.
9. ALL PIPES CONNECTIONS TO BE SOFFIT TO SOFFIT UNLESS STATED OTHERWISE. REFER TO MANHOLE SCHEDULE FOR FURTHER INFORMATION.



Chainage	00.000	01.000	02.000	03.000	04.000	05.000	06.000	07.000	08.000	09.000	10.000	11.000	12.000	13.000	14.000	15.000	16.000	17.000	18.000	19.000	20.000
Existing Levels	35.441	35.426	35.411	35.391	35.379	35.492	35.467	35.455	35.456	35.468	35.467	35.466	35.466	35.467	35.470	35.472	35.472	35.476	35.479	35.482	35.481

SECTION THROUGH INTERCEPTOR
SCALE: H 1:50,V 1:50. DATUM: 30.000

KEY

EXISTING GROUND PROFILE

Date	Revisions	Drawn	Checked	Rev
04.04.22	COVER SLAB & BACKFILL SPEC REVISED	RL	RWO	2
18.03.22	FIRST ISSUE	RL	RWO	1

Dwg Status: CONSTRUCTION

RWO
CONSULTING ENGINEERS

NORTH EAST
0191 2585632

YORKSHIRE
0113 535 3500

WWW.RWO.GROUP
INFO@RWO.GROUP

Client: COLT TECHNOLOGY SERVICES

Project: POWERGATE BUSINESS PARK
LONDON, NW10 6PW

Title: FORECOURT INTERCEPTOR INFORMATION

DO NOT SCALE	Scale @ A1: SCALE	Drawn RL	Checked RWO	Date 11.02.22
Job No 20221	Dwg No DCS18253-RWO-XX-BG-DR-C-4004			Rev 2