Network Rail Infrastructure Projects

Network Rail Intake Substation

Euston Substation – Lighting Assessment

E100-ARP-REP-EG-000006

First Issue | 13 November 2015

Job number 233394-02

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ARUP

Document Verification

ARUP

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			Prepared by	Checked by	Approved by
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1 Introduction - Requirements

This report has been produced by Arup for the Network Rail Planning Submission to present the proposed substation external lighting review.

The agreed designed documentation for external lighting for Network Rail utilised the Railtrack Engineering Policy for Lighting of Railway Premises, reference number RT/ENGP/06/22, April 2002. The required average illuminance for authorised external walking ways is 10 lux.

Different consideration needs to be taken though for the small staircase located in the backside of the planning layout. As the previous documentation does not have any reference for external staircases, BS EN 12464-2 for external workplaces are utilised. An average of 50 lux with 0.4 uniformity is required.

2 Lighting Assessment

For the purpose of this assessment, LED Luminaires have been used from Design Plan, Talos Wall Max, 15W.

The total number of used luminaires is fourteen, twelve of which are located in the perimeter of the substation building, mounted in the wall at 3m height. One is located near the back stairs mounted in a special dedicated post at 2.5m height, and one at the exit door near the PSP building also mounted in a post at 2.5m height. For further clarifications please refer to sketch NREW-SK-E-099, Appendix A.

The average illuminance that has been achieved is 22 lux with 0.27 uniformity at the general yard outside the building area. For the staircase 54 lux average illuminance has been achieved with 0.74 uniformity.

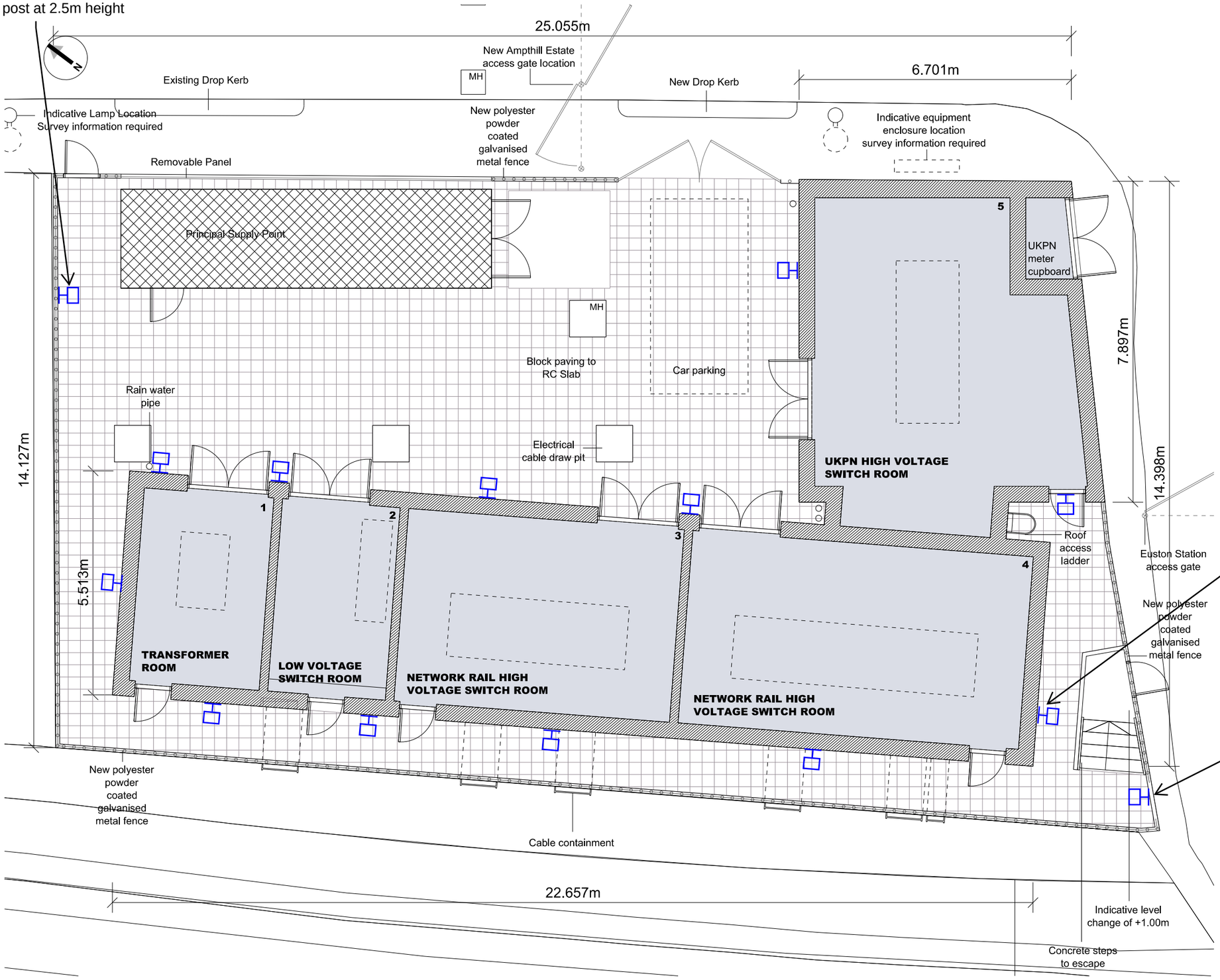
For the calculation results and the luminaire datasheet please refer to Appendix B.

Appendix A – Sketches

Sketches included:

1. NREW-SK-E-099 – External Lighting Luminaire Arrangement

Luminaire located in the left side of the PSP mounted in a dedicated post at 2.5m height



Legend:

Design Plan, Talos Wall Max luminaire, LED, 15W

Notes:

1. 14 luminaires used in total
2. 12 of them are located in the perimeter of the building mounted on the wall at 3m height, 1 in the back stairs and 1 near the PSP exit, mounted at 2.5m height

Luminaires located in the perimeter of the building are wall mounted at 3 m height

Luminaire located in the stairs mounted in a dedicated post at 2.5m height

1:100 @ A3

ARUP

Job No	233394-00
Job Title	Network Rail Intake Substation

Sketch title: External Lighting Luminaire arrangement

Sketch number: **NREW-SK-E-099**

Issue	Date	By	Chkd	Appd
01	12/11/15	AM	SK	SH

Appendix B

Included information:

1. Luminaire Datasheet
2. Dialux Calculation Results

Cus. Sec. Hou. Tra. Urb.

Talos Wall Max

IK16 IP65

- Attractive LED specific fitting with >75 lumens per watt.
- Minimal upward light.
- 5 year guarantee on driver and LEDs.
- Die cast aluminium body finished in titanium polyester powder coat.
- Opal or frosted polycarbonate diffuser held against gasket by tamperproof screws.
- Electronic control gear on removable tray with fused plug & socket connector block.
- Optional photocell.
- Provision for conduit entry in back, gaskets provided.

Finishes

TITANIUM C49

MATT SILVER C48

MATT WHITE C46

LAMP OPTIONS

OPAL DIFFUSER

LED	Lamps	Rating	Temp	Load	Lum/lms	Efficacy	Weight
TLSWM/1400NW/XC49	LED Array	1400lm	4000K	15W	1125lm	75lm/W	4.5KG
TLSWM/1900NW/XC49	LED Array	1900lm	4000K	20W	1400lms	70lm/W	4.5KG

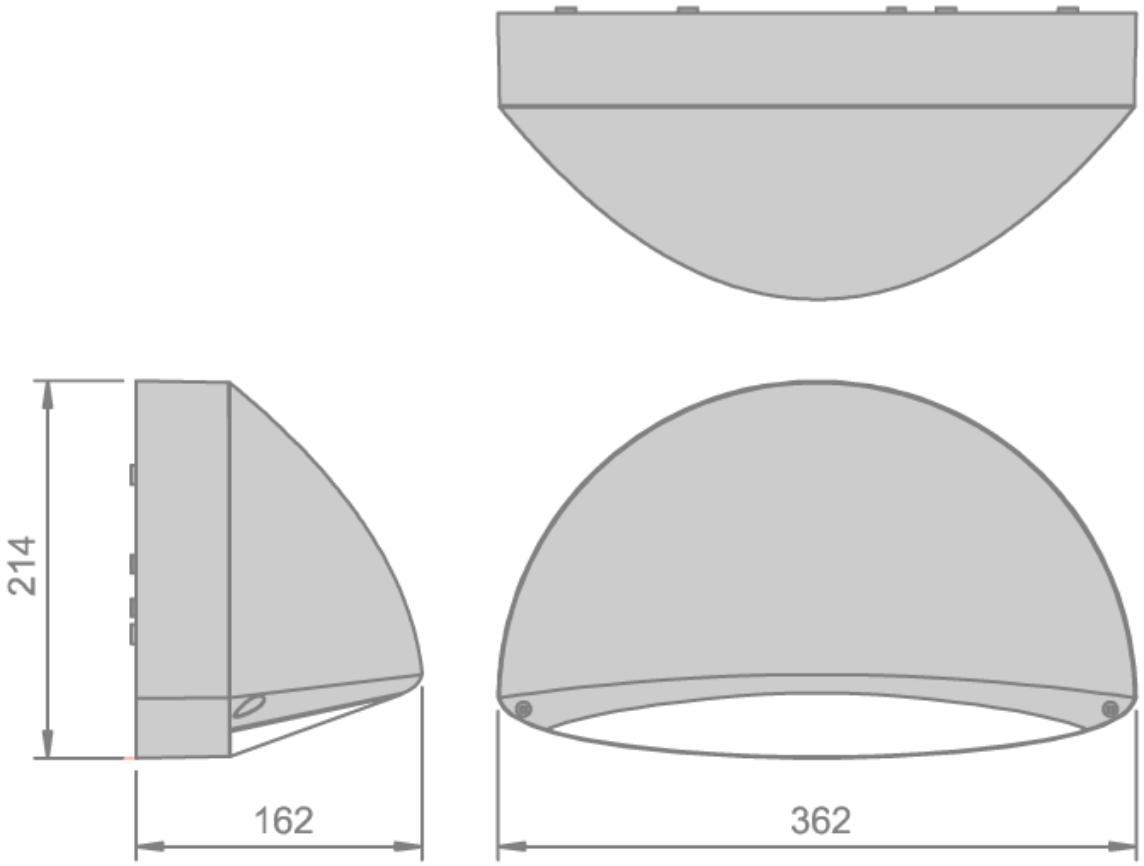
FROSTED DIFFUSER

LED	Lamps	Rating	Temp	Load	Lum/lms	Efficacy	Weight
TLSWM/2500NW/FC49	LED Array	2500lm	4000K	18W	1675lms	93lm/W	4.5KG
TLSWM/3500NW/FC49	LED Array	3500lm	4000K	26W	2345lms	90lm/W	4.5KG
TLSWM/4500NW/FC49	LED Array	4500lm	4000K	36W	3015lms	84lm/W	4.5KG

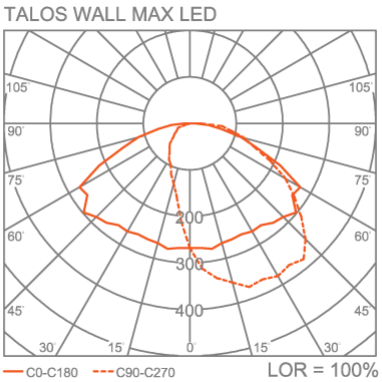
FITTING OPTIONS

Matt silver finish	replace C49 with C48
Matt white finish	replace C49 with C46
Intergal 3 hour duration emergency	add suffix /EM3
DALI dimming/monitoring	add suffix /DALI
Photocell	add suffix /PEC
Side entry	Add suffix /HH
Top entry	Add suffix /TH

Section drawings

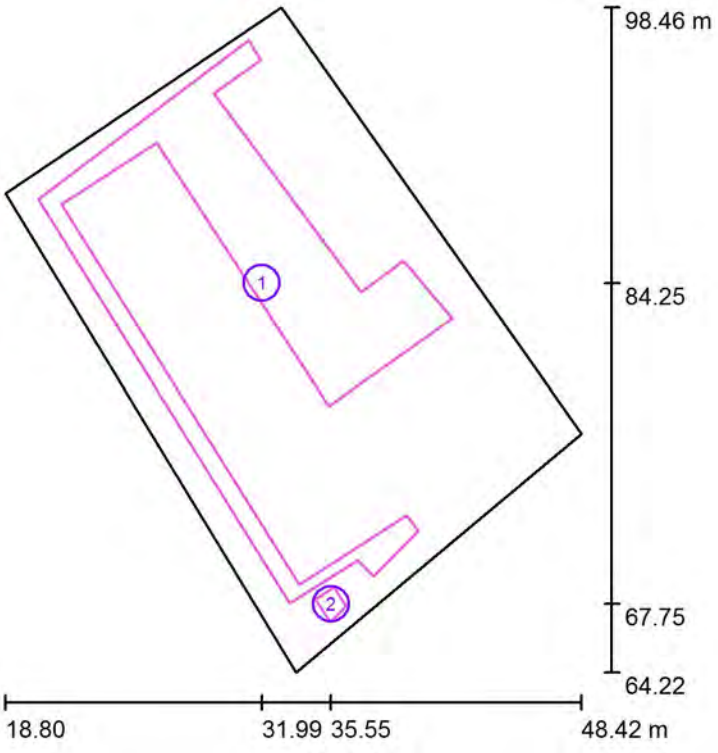


Polar curves



Operator
Telephone
Fax
e-Mail

NR Intake Substation / Calculation surfaces (results overview)



Scale 1 : 390

Calculation Surface List

No.	Designation	Type	Grid	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0	E_{min} / E_{max}
1	Calculation Surface 1	perpendicular	128 x 128	22	5.97	47	0.268	0.128
2	Calculation Surface 2	perpendicular	64 x 64	54	40	59	0.739	0.672

Summary of Results

Type	Quantity	Average [lx]	Min [lx]	Max [lx]	u0	E_{min} / E_{max}
perpendicular	2	23	5.97	59	0.26	0.10

Network Rail Infrastructure Projects

Network Rail Intake Substation

Euston Substation – Noise and Vibration Assessment

E100-ARP-ASS-EG-000001

First Issue | 13 November 2015

Job number 233394-02

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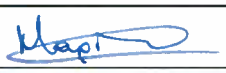
		Name	Athanasia Marinou	Irina Popova	Simon King
		Signature			
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Appendix A - Sketches

Appendix B

1 Introduction - Requirements

This report has been produced by Arup for the Network Rail Planning Submission to present the substation noise and vibration assessment.

The new built Euston substation is going to be located in close proximity of urban – residential areas and as a result careful consideration should be taken for the emitted acoustic levels in its vicinity. In the United Kingdom a representative outdoor noise level for city and town centre areas is 60dB(A) for peak daytime hours.

2 Noise and Vibration Assessment

The two major pieces of equipment generating noise in the designed substation are the transformer and the generator set.

The transformer, located within the main building in separate dedicated room, has been sized according to the substation requirements and demands. It is a 500kVA cast resin transformer creating noise levels of 48dB(A) at 1m distance from the source. At the boundary of the substation approximately 8.5m distance from the source towards the street, the noise level reaches the 29dB(A). Taking into account the transformer is located within a room, it is considered that the noise level will not create an issue for the surrounding area.

The generator set is located outside the main building, within the substation yard. It has been sized at 100kVA to comply with Network Rail operational requirements. A dedicated sound attenuated enclosure with integrated silencers and air attenuators, shall be provided, for the purpose of noise reduction.

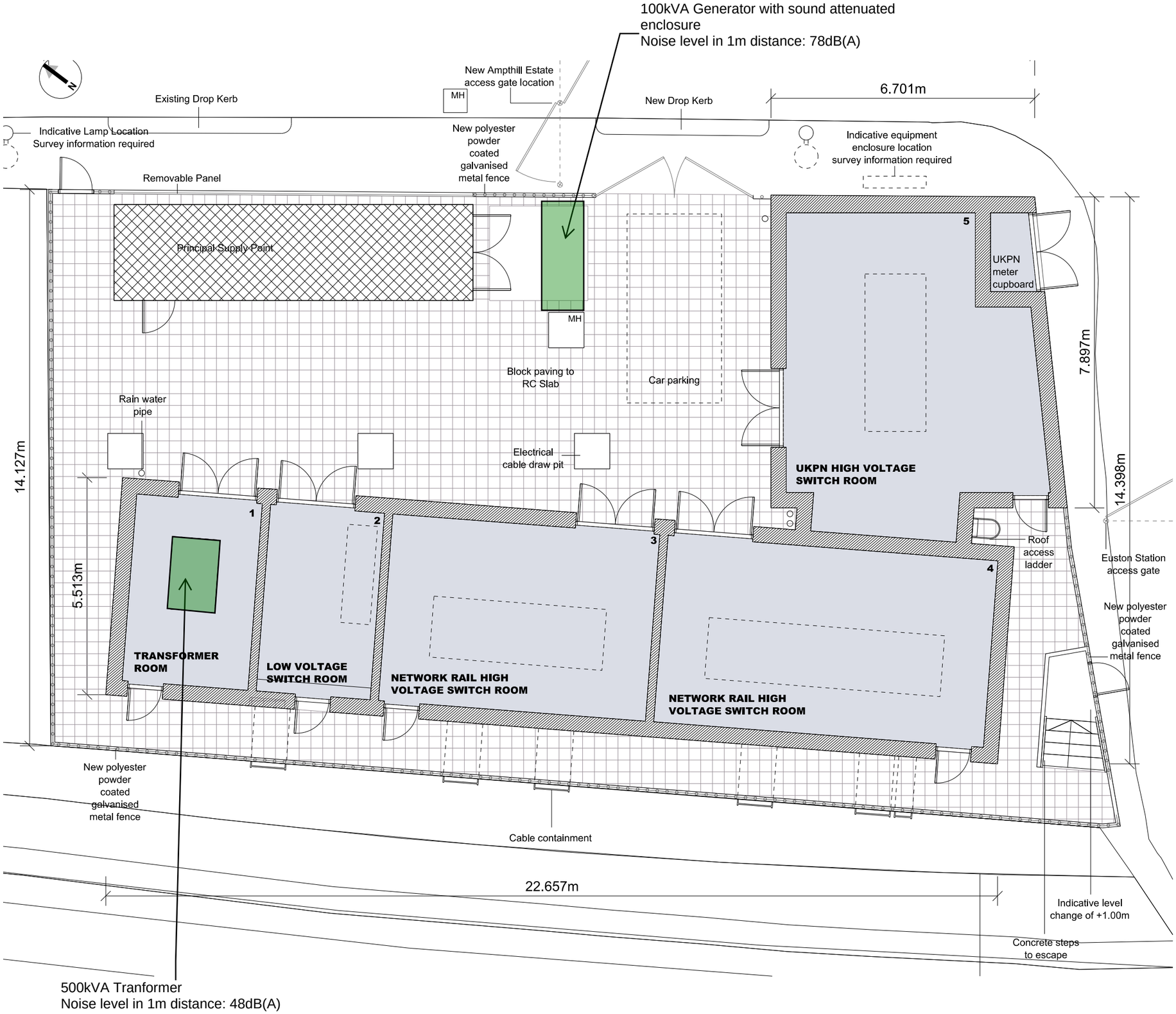
The ambient noise level from the generator set at 1 m from the enclosure is 78dB(A). The loads however from the generator set are essential and already had a dual supply serving them. As a result the generator set will be operational only under emergency conditions, when both of the permanent have been lost.

Anti-vibrations pads, vibration isolators and attenuated enclosures could be provided to reduce the noise level even further.

Appendix A - Sketches

Sketches included:

1. NREW-SK-E-100 – Noise levels Assessment



Notes:

1. Equipment generating noise: Transformer and Generator
2. Acceptance noise level 60dB(A) for city and town centre areas.

1:100 @ A3

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Job No	233394-00
Job Title	Network Rail Intake Substation
Sketch title	Noise levels Assessment
Sketch number	NREW-SK-E-100

Issue	Date	By	Chkd	Appd
01	12/11/15	AM	SK	SH

Appendix B

Equipment Datasheet:

1. Schneider Trihal HE Cast Resin Transformer, 500kVA
2. Broadcrown Generator, 100kVA

TRIHAL HE

UP TO 3150 KVA, 12 KV, LOSSES A_0 A_k

PM102308

Trihal HE - C3* E3 F1 5pC
High Efficiency Cast Resin Transformer

Standard

These transformers comply with standards:

- IEC 60076-11 and IEC 60076-16
- NF EN 50541-1

Schneider Electric guarantees that its transformers are silicone free and certified:

- C3* Climatic class
- E3 Environment class according to IEC 60076-16
- F1 Fire behaviour class
- Almost partial discharge free - Acceptance level:

- ≤ 10 pC Routine Test
- ≤ 5 pC Special Test according to IEC 60076 standard

* C2 Thermal shock test carried out at -50°C

Description

Cast resin, 50 Hz, three-phased distribution transformers with the following characteristics:

- Indoor use / Outdoor use with properly designed enclosure
- Thermal class F - Temperature rise 100 K
- Ambient ≤ 40°C, altitude ≤ 1000 m
- MV windings encapsulated in cast resin
- Pre-impregnated LV windings
- Natural air cooling system (AN type)
- Core and frame covered with protective coating
- Anti-corrosion surface treatment : corrosivity category class C2, “Medium” durability (according to ISO 12944-2)

Standard fittings

Trihal without enclosure (IP00):

- HV voltage variation by off circuit tapping links
- 4 bi-directional flat rollers
- 4 lifting holes
- 4 haulage holes on the underbase
- 2 earthing points
- 1 rating plate (on HV side)

Trihal with IP31 metal enclosure:

- Trihal IP00 as above
- IP31 metal enclosure (except the bottom: IP21):

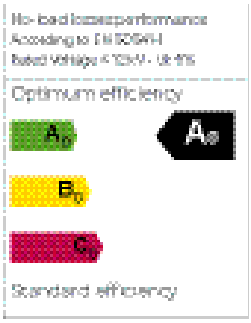
- 2 lifting lugs for transformer and enclosure assembly
- 1 earthing point on enclosure
- access to HV tapping by removing a bolted panel
- enclosure final colour RAL9002

Optional fittings

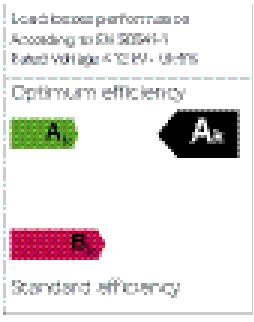
- Temperature sensors located in the e LV windings
- Electronic temperature monitor
- (Z converter or T digital thermometer)
- + 40 % AF cooling system with fans
- Custom enclosures with special paint colors, IP level (up to IP44) or anti-corrosion treatment
- Earthing balls, Surge arrestors, Antivibrations pads
- 3 HV plug-in bushings (IP00 or IP31)
- Locking device for plug-in bushings (lock in option)
- 3 mobile connectors for plug-in bushings straight or elbow (cable characteristics must be specified)

The above descriptions / options concern usual cases and are not restrictive. For any other requests (special site conditions, temperature rise, housing design, etc..), please consult us.

SM100141



SM100142



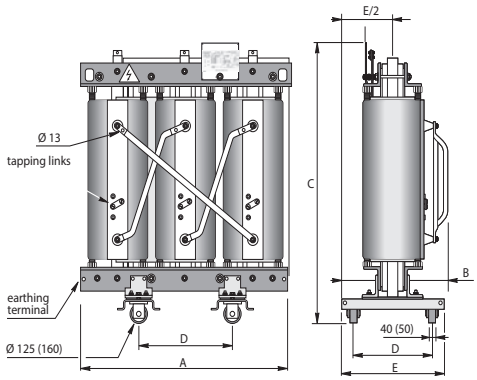
Schneider Electric

Electrical characteristics

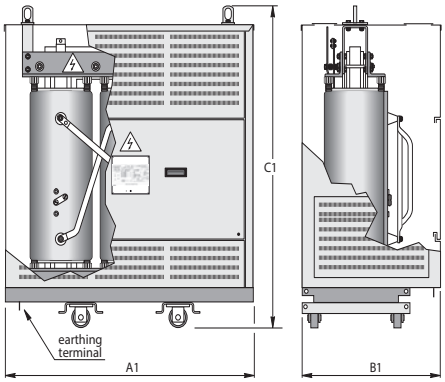
Power kVA	160	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
Primary voltage Secondary voltage	10 kV 400V												
Isolation level	12kV												
HV Tapping range	± 5 %												
Vector group	Dyn 11, Dyn 5, Dyn 1 (other vector groups upon request)												
No-load losses (w) Load losses at 75°C (w) load losses at 120°C (w)	350 2270 2600	500 2970 3400	590 3400 3900	700 3920 4500	830 4920 5650	1000 6180 7100	1100 6960 8000	1300 7830 9000	1500 9570 11000	1800 11310 13000	2200 13480 15500	2600 16090 18500	3150 19140 22000
Impedance voltage (%)	6	6	6		6		6	6	6	6	6	6	6
Acoustic Level dB(A): - power LWA - pressure LPA (1m)	 54 43	 57 45	 59 47	 60 48	 61 48	 62 49	 64 50	 65 51	 67 53	 68 54	 70 55	 71 56	 74 59

Dimensions and weights

Without enclosure (IP00)



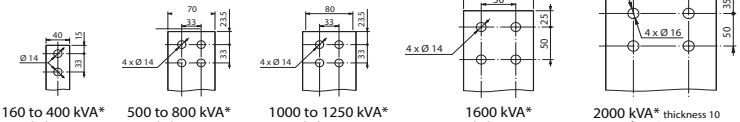
With IP31 metal enclosure



Rated power (kVA)		160	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150
Without enclosure IP00														
Dimensions (mm)	-A	1080	1190	1220	1300	1300	1380	1540	1580	1640	1680	1800	1800	1960
	-B	650	660	800	800	800	800	800	950	950	950	1200	1200	1200
	-C	1280	1300	1390	1410	1620	1660	1860	1880	1940	2070	2220	2170	2360
	-D	520	520	670	670	670	670	670	820	820	820	1070	1070	1070
	-E	715	715	795	795	795	795	795	945	945	945	1195	1195	1195
Masse totale (kg)		800	1020	1160	1360	1540	1900	2640	2820	3360	3760	4900	5160	6580
With IP31 metal enclosure														
Dimensions (mm)	-A1	1650	1650	1700	1700	1900	1700	1900	2000	2000	2000	2330	2330	2260
	-B1	950	950	1020	1020	1100	1020	1100	1170	1170	1170	1270	1270	1020
	-C1	1750	1750	1900	1900	2300	1900	2300	2400	2400	2400	2650	2650	2760
Weight enclosure (kg)		180	180	200	200	240	200	240	240	240	280	350	360	420
Total weight (kg)		980	1200	1360	1560	1780	2100	2880	3060	3600	4040	5250	5520	7000

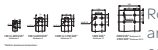
Terminations

LV Terminations



*Valid for aluminium terminations.

HV Terminations - EN 50180



Routine fittings such as bar and cable supports, flexible connectors, etc. will be supplied by the contractor, who will ensure that the transformer terminals are not subject to mechanical stresses.

Schneider Electric Industries SAS

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02-2014

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Technical Data

April 2008

John Deere 4045 HFU79	Newage Stamford UCI 274	Generator Model:	BCJD 110-50 E2

50 Hz	3-Phase	Power Factor Cos Φ = 0.8	Emissions Certification Euro Stage 2

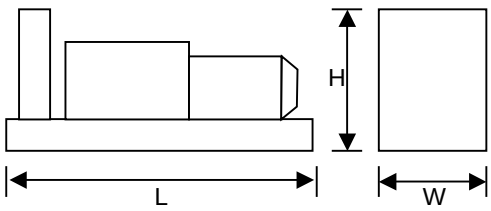
RATINGS	PRIME POWER (PRP)		STANDBY POWER (LTP)		
Voltage	**kVA**	kWe	kVA	kWe	Amps
415/240	**100**	80	110	88	153
400/230	**100**	80	110	88	159
380/220	**100**	80	110	88	167

Definition of Ratings & Reference Conditions

Prime Power (PRP) is the nominal output continuously available, where the average load (variable) does not exceed 70% of the prime power rating. 10% overload is available for a maximum of 1 hour in 12 hours of operation.
Standby Power (LTP) is the maximum output available, for up to 500 hours per year, where the average load (variable) does not exceed 70% of the standby power rating. No overload is available.
Standard Reference Conditions: air temperature 25°C (77°F), barometric pressure 99kPa, [110m(361ft) altitude], 30% relative humidity.
Note: The above ratings may be subject to derate at different operating conditions. Please see the Derate Guidelines on the Broadcrown Website.
All power ratings and reference conditions in accordance with ISO 8528-1 and ISO 3046-1.

Key Features:

- Water cooled John Deere Diesel engine with ECU/CANBus
- Single bearing Newage Stamford alternator
- Radiator with pressure cap and drain point
- Fully guarded engine-driven fan
- Fully welded steel skid base with fork lift pockets
- Integral fuel tank with filler cap and gauge
- Heavy duty rubber anti-vibration mountings
- 12V starter battery and connecting cables
- Separate engine-driven battery charging alternator
- Spin on oil and fuel filters and dry type air filter element
- Industrial silencer (15dBA reduction) supplied loose
- Auto Start control system with digital instrumentation
- Main line circuit breaker
- Factory Test Certificate
- Operation & Maintenance Manual
- Wide range of optional extra features available



Overall Dimensions & Weights - Open Set

Length (L) = 2260mm
Width (W) = 850mm
Height (H) = 1560mm

Dry Weight (inc oil) = 1090kg
Operating Weight = 1285kg

	Typical Open Generator Sound Pressure Level at 1m, Free Field (dB)							
Overall dBA	63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
98	84	88	90	92	93	93	86	82

BROADCROWN

BCJD 110-50 E2

ENGINE & COOLING SYSTEM — *JOHN DEERE 4045 HFU79*

		SI Units	PRIME	STANDBY
Performance	Engine Speed	r/min	1500	
	Gross Power	kWm	94	103
	Fan Power	kWm	6.0	6.0
	Net Power	kWm	88	97
	Emissions Certification		EU Stage 2	
	Altitude Capability	m	3050	2300
General	Cylinders / Type		4 cyl / inline / 4-stroke / HPCR	
	Aspiration / Charge Cooling		Turbo-charged / None	
	Governing / Engine Management		Electronic Governor / ECU / CANBus	
	Bore / Stroke	mm	106 / 127	
	Cubic Capacity	litres	4.5	
	BMEP	kPa	1677	1838
Fuel	Fuel Consumption at 100% Power	litres/h	23.8	26.4
	Fuel Consumption at 75% Power	litres/h	17.7	19.7
	Fuel Consumption at 50% Power	litres/h	12.2	13.5
	Total fuel flow	litres/h	63	
	Standard Fuel Tank Capacity	litres	225	
Air	Engine Air Flow	m³/s	0.107	0.115
	Maximum Air Intake Restriction (used filter)	kPa	6.25	
Exhaust	Exhaust Gas Flow	m³/s	0.287	0.312
	Exhaust Gas Temperature	°C	533	556
	Maximum Exhaust Back Pressure	kPa	7.5	
	Typical Exhaust Pipe Diameter	mm	100	
Cooling	Radiator Cooling Air Flow	m³/s	1.0	
	Max Restriction to Cooling Air Flow	Pa	200	
	Max Radiator Air-On Temperature	°C	50	
	Maximum Coolant Temperature	°C	105	
	Coolant Capacity - Engine Only	litres	12	
	Total Coolant Capacity	litres	25	
Oil	Total Oil Capacity incl Filters	litres	12	
	Typical Oil Pressure at Rated Speed	kPa	260	
	Typical Oil Consumption (>250hrs Operation)	litres/h	0.06	
Thermal	Heat Rejection to Engine Cooling Water	kW	51	55
	Heat Rejection to Charge Cooler	kW	12	15
	Heat Radiated From Engine (Typical)	kW	11.8	12.9
Elec	Electrical System Voltage	V	12	
	Battery Type		1 X 643	
	Battery Capacity SAE CCA	A	660	

ALTERNATOR — NEWAGE STAMFORD UCDI 274

		SI Units	PRIME	STANDBY
General Data	Manufacturer		NEWAGE STAMFORD	
	Model (may vary with voltage)		UCI 274 C	UCI 274 C
	Operating Temperature	°C	40	27
	Coupling / No. of Bearings		Direct / Single Bearing	
	Phase / Poles / Winding Type		3-Phase / 4-Pole / Winding 311	
	Power Factor		Cos Φ = 0.8	
	Excitation		Self Exciting	
	Insulation System		Class H	
	AVR Type		SX 460	
	Voltage Regulation		± 1.5%	

BROADCROWN

BCJD 110-50 E2

STANDARD CONTROL SYSTEM — *BC 5310 Digital Auto Start*

The standard control system for this model is **BC 5310** (photo), based on the Deep Sea Electronics DSE5310 Digital Auto Start controller.

This provides for the manual and automatic remote start of the generator, together with full CANBus implementation for the control and protection of the engine via the ECU. LCD digital display of :

- Coolant temperature with high temperature alarm and shutdown
- Oil pressure with low pressure alarm and shutdown
- Oil temperature, engine operating hours, battery charge volts and amps
- Volts, with Under/Over Volts protection
- Amps, with Over Current protection
- Frequency, kW, kVA, Power Factor

Also featuring :

- Full RS485 Telemetry implementation
- Automatic cool-down timer function
- Emergency Stop button
- Ample auxillary inputs/outputs for optional features
- Optional (shown) - battery charger and door mounted illuminated switch.

The panel is constructed in 1.5mm steel, powder coated to RAL9001 for a high quality, durable finish.

CONTROL SYSTEM OPTIONS

The **BC 5320** control system (just the DSE5320 module is shown here) has an identical feature set to the BC 5310 but with the addition of full AMF functionality with integrated mains monitoring.

Finally, **BC 5510** & **BC 5520** control systems provide the same features as BC 5310 & BC 5320 respectively, plus :

- BC 5510 - Set-to-Set Synchronisation
- BC 5520 - Single Set-to-Mains Supply Synchronisation with integrated mains monitoring

For Multi Set-to-Mains synchronisation, each set requires BC 5510 with the addition of one mains monitoring panel **BC 5560** (not illustrated).
See the Synchronisation Guidelines for further details.

OPTIONAL ACOUSTIC ENCLOSURE *Canopy 2*

The optional acoustic enclosure for this model is **Canopy 2**, suitable for operation in harsh outdoor environmments whilst providing excellent security and acoustic performance. All steel canopy components are pre-treated and polyester powder coated (to a typical thickness of 70-80µm) in RAL9001 white and the baseframe is finished in RAL9005 black.

Acoustically, the canopy is designed to meet the requirements of EU Legislation 2000/14/EC, achieved by extensive use of fire-retardant polyurethane foam together with efficient management of cooling air. Exhaust noise is minimised by internally mounted high performance exhaust silencers.

A steel fuel tank with filler, gauge and accessory points, is integrated within the baseframe. Alernatively, a bund with separate fuel tank can be provided where this is required.

Other key features include :

- Gull-wing doors with gas struts for good service access
- Panel/breaker access door with viewing window
- Heavy duty locks on all doors for total security
- Weather cap on exhaust discharge
- Emergency Stop button relocated to canopy exterior
- Lifting and holding down points
- Fork Lift pockets
- Optional single roof lifting point.

Dimensions (mm) L x W x H	Additional Weight (kg) ✻	Typical Sound Pressure Level at 75% of Prime Power		Fuel Tank Capacity (Litres)		Single Point Lift
		dB(A) at 1m	dB(A) at 7m	Integral	Bunded	
2800 x 1110 x 1790	450	78	68	240	200	Optional

✻ Indicative weight of canopy *additional* to open set

Typical SPL is a mean level, measured in free field conditions, with no contributory background noise.

KEY MECHANICAL OPTIONS (Open Set)

Engine & Cooling :

- Electronic governor
- Oil and coolants drains extended to edge of baseframe
- Manual lub oil drain pump
- Coolant heater
- Medium duty air cleaner
- Exhaust manifold guards

Alternator :

- Anti-condensation heater
- Quadrature droop kit
- Alternative AVR
- Thermistor probes and controls

Fuel System :

- Baseframe with integral bund and drop-in fuel tank
- Fuel filter/separator
- Low fuel level switch (single point)
- Fuel level switch (four point)
- Manual fuel transfer pump
- Pumped/gravity fuel transfer system

Exhaust System :

- Residential silencer
- Critical silencer
- Flange/connection kit

Please refer to Broadcrown Sales Department for full details of these and other options