P1500P3_P1650E3

Dealer Contact Details

Documentation

Operation and maintenance manual including circuit wiring diagrams.

Generator Set Standards

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

Warranty

6.8 – 750 kVA electric power generation products in prime applications the warranty period is 12 months from date of start-up, unlimited hours (8760). For standby applications the warranty period is 24 months from date of start-up, limited to 500 hours per year.

730 – 2500 kVA electric power generation products in prime applications the warranty period is 12 months from date of start-up, unlimited hours (8760 hours) or 24 months from date of start-up, limited to 6000 hours. For standby applications the warranty period is 36 months from date of start-up, limited to 500 hours per year.

FG Wilson manufactures product in the following locations:
Northern Ireland • Brazil • China • India
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.

Technical Data

4000 Series

Diesel Engine - ElectropaK

4012-46TAG1A
4012-46TAG2A

Basic technical data

Number of cylinders . ... .12
Cylinder arrangement ... ...Vee, 60°
Cycle. ... ... 4 stroke
Induction system... ... ... Turbocharged
Combustion system .. .. direct injection
Compression ratio 13:1
Bore .. .. 160 mm
Stroke .. .. 190 mm
Cubic capacity .. .. 45·842 litres
Direction of rotation .. .. clockwise, viewed on flywheel
Firing order ... ...1^A,6^B,5^A,2^B,3^A,4^B,6^A,1^B,2^A,5^B,4^A,3^B
Cylinder 1 . ...furthest from flywheel
Note: Cylinders designated 'A' are on the right hand side of the engine when viewed from the flywheel end

Total weight of ElectropaK

Temperate or Tropical (approximate)
-engine.. ... ... 4400 kg
-electropak dry .. .. 6000 kg
-electropak wet . ... 6400 kg

Overall dimensions of ElectropaK

	Unit	Tropical	Temperate
Height	mm	2260	2230
Length	mm	3971	3951
Width	mm	2192	1777

Moment of inertia

Engine .. .. .9,73 kgm²
Flywheel ... ... .9,57 kgm²

Cyclic irregularity for engine/flywheel maximum

4012-46TAG1A. 1:714
4012-46TAG2A. 1:669

Ratings

Steady state speed stability at constant load. ... ... ± 0·25%
Electrical rating are based on average alternator efficiency and are for guidance only (0.8 power factor being used).

Operating point

Engine speed ... ...1500 rev/min
Static injection timing . ... see engine number plate
Cooling water exit temperature .. .. < 98 °C

Fuel data ... ... to conform to BS2869 class A2 or BS EN590

Performance

All data based on operation to ISO 3046/1, BS 5514 and DIN 6271 standard reference conditions.

Noise

Estimated sound pressure level at 1 metre
-1500 rev/min . ... 111 dB(A)

For engines operating in ambient conditions other than the standard reference conditions stated below, a suitable de-rate must be applied. De-rate tables for increased ambient temperature and/or altitude are available, please contact Perkins Applications Department.

Test conditions

Air temperature. . ... 25 °C
Barometric pressure... ... ... 100 kPa
Relative humidity 30%
Air inlet restriction at maximum power (nominal)... ... ... 2,5 kPa
Exhaust back pressure at maximum pressure (nominal)... ... ... 3,0 kPa
Fuel temperature (inlet pump) ... ... 58 °C maximum
For test conditions relevant to data on load acceptance, refer to page 18 of this document

General installation

4012-~~46TAG1A - Temperate~~

~~Designation~~	~~Units~~	~~Type of operation and application~~		
		~~Spill Timing 18°~~		
		~~Baseload power~~	~~Prime power~~	~~Standby power~~
		~~50 Hz 1500 rev/min~~		
~~Gross engine power~~	~~kWm~~	~~951~~	~~1191~~	~~1306~~
~~Fan and battery charging alternator power~~	~~kW~~	~~42~~		
~~Nett engine power~~	~~kWm~~	~~909~~	~~1148~~	~~1263~~
~~Brake mean effective pressure (gross)~~	~~kPa~~	~~1656~~	~~2073~~	~~2273~~
~~Combustion air flow at ISO conditions~~	~~m³/min~~	~~92~~	~~112~~	~~120~~
~~Exhaust gas temperature (max) after turbo~~	~~°C~~	~~N/A~~	~~N/A~~	~~470~~
~~Exhaust gas flow (max) at atmospheric pressure~~	~~m³/min~~	~~N/A~~	~~N/A~~	~~277~~
~~Boost pressure ratio~~	~~-~~	~~2,60~~	~~2,93~~	~~3,20~~
~~Mechanical efficiency~~	~~%~~	~~89~~	~~91~~	~~92~~
~~Overall thermal efficiency (nett)~~	~~%~~	~~41,0~~	~~41,5~~	~~41,0~~
~~Friction power and pumping losses~~	~~kWm~~	~~120~~		
~~Mean piston speed~~	~~m/s~~	~~9,5~~		
~~Engine coolant flow~~	~~l/s~~	~~1020~~		
~~Typical Genset electrical output (0.8pf)~~	~~kVA~~	~~1080~~	~~1364~~	~~1500~~
	~~kWe~~	~~864~~	~~1091~~	~~1200~~
~~Assumed alternator efficiency~~	~~%~~	~~95~~		

General installation

4012-46TAG1A - Tropical

Designation	Units	Type of operation and application		
		Spill Timing 18°		
		Baseload power	Prime power	Standby power
		50 Hz 1500 rev/min		
Gross engine power	kWm	973	1212	1327
Fan and battery charging alternator power	kW	64		
Nett engine power	kWm	909	1148	1263
Brake mean effective pressure (gross)	kPa	1694	2110	2309
Combustion air flow at ISO conditions	m³/min	92	112	120
Exhaust gas temperature (max) after turbo	°C	N/A	N/A	425
Exhaust gas flow (max) at atmospheric pressure	m³/min	N/A	N/A	280
Boost pressure ratio	-	2,60	2,93	3,20
Mechanical efficiency	%	89	91	92
Overall thermal efficiency (nett)	%	41,0	41,5	41,0
Friction power and pumping losses	kWm	120		
Mean piston speed	m/s	9,5		
Engine coolant flow	l/s	1020		
Typical Genset electrical output (0.8pf)	kVA	1080	1364	1500
	kWe	864	1091	1200
Assumed alternator efficiency	%	95		

4012-46TAG2A - Temperate

Designation	Units	Type of operation and application		
		Spill Timing 18°		
		Baseload power	Prime power	Standby power
		50 Hz 1500 rev/min		
Gross engine power	kWm	1047	1309	1437
Fan and battery charging alternator power	kW	42		
Nett engine power	kWm	1005	1267	1395
Brake mean effective pressure (gross)	kPa	1822	2278	2500
Combustion air flow at ISO conditions	m³/min	100	120	128
Exhaust gas temperature (max) after turbo	°C	N/A	N/A	450
Exhaust gas flow (max) at atmospheric pressure	m³/min	N/A	N/A	315
Boost pressure ratio	-	2,8	3,1	3,4
Mechanical efficiency	%	89	91	92
Overall thermal efficiency (nett)	%	41,0	41,5	41,0
Friction power and pumping losses	kWm	120		
Mean piston speed	m/s	9,5		
Engine coolant flow	l/s	1020		
Typical Genset electrical output (0.8pf)	kVA	1194	1505	1656
	kWe	955	1204	1325
Assumed alternator efficiency	%	95		

General installation

4012-46TAG2A - Tropical

Designation	Units	Type of operation and application		
		Spill Timing 18°		
		Baseload power	Prime power	Standby power
		50 Hz 1500 rev/min		
Gross engine power	kWm	1069	1331	1459
Fan and battery charging alternator power	kW	64		
Nett engine power	kWm	1005	1267	1395
Brake mean effective pressure (gross)	kPa	1861	2317	2538
Combustion air flow at ISO conditions	m³/min	100	120	128
Exhaust gas temperature (max) after turbo	°C	N/A	N/A	455
Exhaust gas flow (max) at atmospheric pressure	m³/min	N/A	N/A	320
Boost pressure ratio	-	2,8	3,1	3,4
Mechanical efficiency	%	89	91	92
Overall thermal efficiency (nett)	%	41,0	41,5	41,0
Friction power and pumping losses	kWm	120		
Mean piston speed	m/s	9,5		
Engine coolant flow	l/s	1020		
Typical Genset electrical output (0.8pf)	kVA	1194	1505	1656
	kWe	955	1204	1325
Assumed alternator efficiency	%	95		

Note: All quoted gross engine powers include an allowance of 1.5% for installation variances. Not to be used for combined heat and power (CHP) design purposes (indicative figures only). Consult Perkins Engines Stafford Limited. Assumes complete combustion.

Rating definitions

Baseload power

Unlimited hours usage with an average load factor of 100% of the published baseload power rating.

Prime power

Variable load. Unlimited hours usage with an average load factor of 80% of the published Prime Power over each 24 hour period. A 10% overload is available for 1 hour in every 12 hours.

Standby power

Limited to 500 hours annual usage with an average load factor of 80% of the published Standby Power rating over each 24 hour period.Up to 300 hours of annual usage may be run continuously. No overload is permitted on Standby Power.

Emissions capability

All 4012-46TAG ratings are optimised to the ‘best fuel consumption’ and do not comply to Harmonised International Regulation Emission Limits. More information on these statements can be obtained by contacting the Applications Department at Perkins Engines Company Limited.

Energy balance

4012-46TAG1A - Temperate

Designation	Units	50 Hz 1500 rev/min		
		Baseload power	Prime power	Standby power
Energy in fuel	kW	2200	2800	3120
Energy in power output (gross)	kW	951	1190	1305
Energy to cooling fan	kW		42	
Energy in power output (nett)	kW	909	1148	1263
Energy to exhaust	kW	750	900	1010
Energy to coolant and oil	kW	258	376	441
Energy to radiation	kW	66	84	94
Energy to charge coolers	kW	175	250	270

4012-46TAG1A - Tropical

Designation	Units	50 Hz 1500 rev/min		
		Baseload power	Prime power	Standby power
Energy in fuel	kW	2217	2817	3137
Energy in power output (gross)	kW	973	1212	1327
Energy to cooling fan	kW		64	
Energy in power output (nett)	kW	909	1148	1263
Energy to exhaust	kW	750	900	1010
Energy to coolant and oil	kW	252	370	406
Energy to radiation	kW	67	85	94
Energy to charge coolers	kW	175	250	300

4012-46TAG2A - Temperate

Designation	Units	50 Hz 1500 rev/min		
		Baseload power	Prime power	Standby power
Energy in fuel	kW	2400	3137	3500
Energy in power output (gross)	kW	1047	1309	1437
Energy to cooling fan	kW		42	
Energy in power output (nett)	kW	1005	1267	1395
Energy to exhaust	kW	800	1010	1050
Energy to coolant and oil	kW	271	428	485
Energy to radiation	kW	72	90	105
Energy to charge coolers	kW	210	300	423

4012-46TAG2A - Tropical

Designation	Units	50 Hz 1500 rev/min		
		Baseload power	Prime power	Standby power
Energy in fuel	kW	2450	3200	3570
Energy in power output (gross)	kW	1069	1331	1459
Energy to cooling fan	kW		64	
Energy in power output (nett)	kW	1005	1267	1395
Energy to exhaust	kW	805	1015	1080
Energy to coolant and oil	kW	288	457	501
Energy to radiation	kW	74	96	107
Energy to charge coolers	kW	214	301	423

Note: Not to be used for combined heat and power (CHP) purposes (indicative figures only). If necessary, please consult Perkins Engines Company Limited.

Cooling system

Recommended coolant: 50% inhibited ethylene glycol or 50% inhibited propylene glycol and 50% clean fresh water. For combined heat and power systems (CHP) and where there is no likelihood of ambient temperature below 10 °C, then clean 'soft' water may be used, treated with 1% by volume of Perkins inhibitor in the cooling system. The inhibitor is available in 1 litre bottles from Perkins under part number 21825 735.

Maximum pressure in crankcase water jacket ... ... 170 kPa
Maximum top tank temperature (standby) . ... 98 °C
Maximum static pressure head on pump ... ... 7 m

Total coolant capacity

Electrounit (engine only) ... ... 73 litres
Electropak (engine and radiator):
-temperate.. ... ... 207 litres
-tropical .. .. 210 litres
Maximum permissible restriction to coolant pump flow.. ... . 20 kPa
Thermostat operating range... ... ... 71 - 85 °C
Ambient cooling clearance (standby power) based on air temperature at fan 6 °C above ambient.
Temperature rise across the engines (standby power) with inhibited coolant @ 1500 rev/min . ... 8 °C
Coolant temperature shutdown switch setting ... ... 101 °C rising
Coolant immersion heater capacity (2 off) . ... 4 kWe each

Radiator

Temperate

Radiator face area . ... 2,57 m²
Material and number of rows:
-charge air and water jacket... ... ... .copper, 4 rows
Fins per inch and material:
-charge air and water jacket... ... ... brass, 12 rows
Width of matrix ... ... 1,608 m
Height of matrix.. ... ... 1,601 m
Weight of radiator... ... ... 1117 kg
Pressure cap setting (min) . ... 70 kPa

Tropical

Radiator face area . ... 3,46 m²
Material and number of rows:
-charge air and water jacket... ... ... .copper, 4 rows
Fins per inch and material:
-charge air and water jacket... ... ... brass, 12 rows
Width of matrix ... ... 2,10 m
Height of matrix.. ... ... 1,65 m
Weight of radiator... ... ... 1620 kg
Pressure cap setting (min) . ... 70 kPa

Water jacket cooling data

Temperate and Tropical @ 1500 rev/min

-coolant flow... ... ... 1020 litres/min
-coolant exit temperature (max) . ... 98 °C
-coolant inlet temperature (min) . ... thermostatic control
-coolant inlet temperature (max) ... ... 90 °C

Coolant pump

Speed. ... ... 1.4 x e rev/min
Method of drive .. .. gear

Fan

Type ... ... axial flow
Diameter
-Temperate ... ... 1530 mm
-Tropical . ... 1600 mm
Number of blades... 12
Material .. .. Aluminium
Drive ratio... ... ... 0·93:1

4012-46TAG1A - Temperate, Standby power

Maximum additional restriction (duct allowance) to cooling airflow and resultant minimum airflow		
Ambient clearance: 50% Glycol	Duct allowance (Pa)	Min airflow (m³/sec)
1500 rev/min		
35 °C	250	20,2

4012-46TAG1A - Tropical, Standby power

Maximum additional restriction (duct allowance) to cooling airflow and resultant minimum airflow		
Ambient clearance: 50% Glycol	Duct allowance (Pa)	Min airflow (m³/sec)
1500 rev/min		
50 °C	200	32,4

4012-46TAG2A - Temperate, Standby power

Maximum additional restriction (duct allowance) to cooling airflow and resultant minimum airflow		
Ambient clearance: 50% Glycol	Duct allowance (Pa)	Min airflow (m³/sec)
1500 rev/min		
35 °C	250	20,2

4012-46TAG2A - Tropical, Standby power

Maximum additional restriction (duct allowance) to cooling airflow and resultant minimum airflow		
Ambient clearance: 50% Glycol	Duct allowance (Pa)	Min airflow (m³/sec)
1500 rev/min		
50 °C	200	32,4

Lubrication system

Recommended SAE viscosity: A multigrade oil conforming to the following must be used: API CH4 15W/40.
Note: For additional notes on lubricating oil specifications, please refer to the Operation and Maintenance Manual (OMM)

Lubricating oil capacity

-total system capacity ... ... 177 litres
-sump maximum ... ...159 litres
-sump minimum. ... ...136 litres
-oil temperature at normal operating conditions to bearings 105 °C

Lubrication oil pressure

-at rated speed.. ... ... 400 kPa
-minimum at 80 °C ... ... 340 kPa
-oil relief values open ... ... 400 kPa
-oil filter spacing ... ... 20 microns
-sump drain plug tapping size G1
-oil pump speed. ... ... 2100 rev/min
-method of drive ... ... gear
-shutdown switch pressure setting (where fitted) .. . 193 kPa falling

Oil pump flow

-1500 rev/min ... ... 6,0 litres/sec

Normal operating angles

Front and rear ... ...5°
Side tilt .. .. 10°

Oil consumption

Prime power	Units	1500 rev/min
After running in (typically after 250 hours)	g/kWhr	0,52
Oil flow rate from pump	litres/sec	6

Electrical system

Type .. .. insulated return
Alternator voltage .. .. 24 volts with integral regulator
Alternator output:
... ...40 amps at a stabilised output, 28 volts at 20 °C ambient
Starter type ... ... axial
Starter motor voltage. ... ... 24 volts
Starter motor power .. .. 16,4 kW
Number of teeth on flywheel 156
Number of teeth on starter pinion.. 12
Minimum cranking speed .. .. 120 rev/min
Pull in current of starter motor
solenoid @ -25 °C max [1] . ...30 amps at 24 volts
Hold in current of starter motor
solenoid @ -25 °C max [1] . ... 9 amps at 24 volts
Stop solenoid hold-in current ... ... 1,1 amps at 24 volts
Engine stop solenoid. ... ... .24 volts
1. All leads to rated at 10 amps minimum

Fuel system

Recommended fuel to conform to:
BS2869 1998 Class A2 or BS EN590
Injection system.. ... ... direct
Fuel injection pump and injector type. ... ... .combined unit injector
Injector pressure. ... ... 140 MPa
Lift pump type. ... ... Tuthill TCH 1-089

Delivery

-4012-46TAG1A . ...1020 litres/hour
-4012-46TAG2A . ...1020 litres/hour
Heat retained in fuel to tank ... ... 8 kW
Fuel inlet temperature to be less than ... ... 58 °C
Delivery pressure ... ... 300 kPa
Maximum suction head at pump inlet. ... ... 2,5 m
Maximum static pressure head .. .. 3 m
Fuel filter spacing ... ...10 microns
Governor type. ... ... electronic
Governing toISO 8528-12 CLASS 3 and 4; ISO 8528-5 CLASS G2
Tolerance on fuel consumption 5%

Fuel consumption

Ratings	g/kW/hr	litres/hr
	1500 rev/min	
~~4012-46TAG1A, Temperate~~		
~~Standby~~	~~199~~	~~308,2~~
~~Prime~~	~~198~~	~~281,0~~
~~Baseload~~	~~196~~	~~224,8~~
~~75% Prime~~	~~198~~	~~212,8~~
~~50% Prime~~	~~210~~	~~154,2~~
~~4012-46TAG1A, Tropical~~		
~~Standby~~	~~199~~	~~310~~
~~Prime~~	~~196~~	~~282~~
~~Baseload~~	~~196~~	~~226~~
~~75% Prime~~	~~195~~	~~214~~
~~50% Prime~~	~~204~~	~~160~~
4012-46TAG2A, Temperate		
~~Standby~~	~~202~~	~~334~~
~~Prime~~	~~200~~	~~300~~
~~Baseload~~	~~200~~	~~240~~
~~75% Prime~~	~~201~~	~~230~~
~~50% Prime~~	~~203~~	~~160~~
~~4012-46TAG2A, Tropical~~		
~~Standby~~	~~202~~	~~335~~
~~Prime~~	~~201~~	~~301~~
~~Baseload~~	~~201~~	~~242~~
~~75% Prime~~	~~202~~	~~231~~
~~50% Prime~~	~~203~~	~~162~~

Note: Fuel consumption calculated on gross rated powers.

Induction system

Maximum air intake restriction of engine:
-clean filter. ... ... 2 kPa
-dirty filter .. .. 4 kPa
-air filter type . ... paper element

Exhaust system

Exhaust outlet size (internal). ... ... 2 x 254 mm Table D flanges
Exhaust outlet flange size . ... 2 x 254 mm Table D flanges
Back pressure for total system at standby power . ... 5 kPa
For recommended pipe sizes, please refer to the Installation Manual.

Cold start recommendations

Temperature range		
5 °C down to -10 °C (41 °F to 14 °F)	Oil:	15W40 CH4
	Starter:	2 x 24 volts
	Battery:	4 x 12V 286 Ah
	Max breakaway current:	1600 amps
	Cranking current:	810 amps
	Aids:	block heaters
	Min mean cranking speed:	120 rev/min

Notes:

- The battery capacity is defined by the 20 hour rate
- The oil specification should be for the minimum ambient temperature as the oil will not be warmed by the immersion heater
- Breakaway current is dependant on battery capacity available. Cables should be capable of handling the transient current which may be up to double the steady cranking current.

Engine mounting

Maximum static bending moment at rear face of block. .. 1356 Nm
Maximum additional load applied to flywheel
due to all rotating components.. ... ... 850 kg

Centre of gravity

Bare engine, dry
-forward of the rear face of the cylinder block... ... ... 771 mm
-above the crankshaft centre line.. ... ... 32 mm
ElectropaK, dry
-forward of the rear face of the cylinder block... ... ... 1176 mm
-above the crankshaft centre line.. ... ... 32 mm

Typical load acceptance (cold)

At 1500 rev/min

	Initial Load Acceptance When engine reaches rated speed (15 seconds maximum after engine starts to crank)				2nd Load Application Immediately after engine has recovered to rated speed (5 seconds after initial load application)			
Engine type	**Prime Power%**	**Load kWe Nett**	**Transient Frequency Deviation %**	**Frequency recovery time seconds**	**Prime Power%**	**Load kWm Nett**	**Transient Frequency Deviation %**	**Frequency recovery time seconds**
~~4012-46TAG1A~~	~~73~~	~~800~~	~~≤ 10~~	~~5~~	~~27~~	~~291~~	~~≤ 10~~	~~5~~
4012-46TAG2A	71	860	≤ 10	5	29	344	≤ 10	5

The above figures were obtained under test conditions as follows:
Engine block temperature ... 40 °C
Ambient temperature ... 25 °C
Governing mode ... Isochronous
Alternator inertia ... 50 kgm²
Under frequency roll off (UFRO) point set to ... 49,5
UFRO rate set to ... 16 v/hz
LAM on / off ... on

All tests were conducted using an engine installed and serviced to Perkins Engines Company Limited recommendations.

Applied load is a percentage of generator electrical output efficiency as published in the general installation section of this data sheet.

The information given on this Technical Data Sheet is for standard engines, and for guidance only. For ratings other than those shown contact Perkins Engines Company Limited, Stafford.

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All information in the document is substantially correct at the time of printing but may be subsequently altered by the company.

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Publication No. TPD1586E, Issue 3. April 2007 © Perkins Engines Company Limited.

FRAME 8224N WINDING 6S

MODELS LL8224N / LL8234N

REF: F8204NW6S-2 JULY 2010

WINDING DETAILS

Code	6S	Insulation class	H
Phase	3	Leads	6
Pole number	4	Pitch	2/3

MECHANICAL DETAILS

Standard protection		IP23
Overspeed	rpm	2250
Air flow 50Hz/60Hz	m^3/s	1.80 / 2.20

EXCITATION DETAILS

Excitation system	**AREP/PMG**
AVR model	R450M
Sustained short-circuit current	300%:10s
Steady state voltage regulation	±0.5%

WAVEFORM

Line voltage on no load or balanced linear rated load

Total harmonic content THC	<3.5%
Telephone influence factor TIF (NEMA)	<50
Telephone harmonic factor THF (IEC)	<2%

LINE VOLTAGE

No overvoltage tolerance for 440V 50Hz excitation level

Frequency / speed		**50Hz / 1500rpm**				**60Hz / 1800rpm**					
Star	**V**	**380**	**400**	**415**	**440**	**380**	**400**	**416**	**440**	**460**	**480**
Delta	V	220	230	240		220	230	240			

RATING

Power factor 0.8, Altitude <=1000m

Class H rise BR	**125/40**	**kVA**	**1500**	**1500**	**1500**	**1345**	**1485**	**1560**	**1625**	**1720**	**1795**	**1875**
		kW	*1200*	*1200*	*1200*	*1076*	*1188*	*1248*	*1300*	*1376*	*1436*	*1500*
Class H rise PR	**150/40**	**kVA**	**1590**	**1590**	**1590**	**1426**	**1574**	**1654**	**1723**	**1823**	**1903**	**1988**
		kW	*1272*	*1272*	*1272*	*1141*	*1259*	*1323*	*1378*	*1459*	*1522*	*1590*
Class H rise PR	**163/27**	**kVA**	**1650**	**1650**	**1650**	**1480**	**1634**	**1716**	**1788**	**1892**	**1975**	**2063**
		kW	*1320*	*1320*	*1320*	*1184*	*1307*	*1373*	*1430*	*1514*	*1580*	*1650*
Class F rise BR	**105/40**	**kVA**	**1365**	**1365**	**1365**	**1224**	**1351**	**1420**	**1479**	**1565**	**1633**	**1706**
		kW	*1092*	*1092*	*1092*	*979*	*1081*	*1136*	*1183*	*1252*	*1307*	*1365*

EFFICIENCIES

Power factor 0.8

110%	Class H BR	%	94.9	95.2	95.3	95.5	94.5	94.7	94.8	95.0	95.1	95.2
100%	Class H BR	%	95.2	95.4	95.5	95.6	94.7	94.9	95.0	95.1	95.2	95.3
75%	Class H BR	%	95.7	95.8	95.8	95.7	95.1	95.2	95.3	95.4	95.5	95.6
50%	Class H BR	%	95.8	95.8	95.7	95.2	95.0	95.1	95.2	95.3	95.3	95.3
25%	Class H BR	%	94.5	94.3	94.0	92.8	93.1	93.2	93.3	93.3	93.3	93.3

CHARACTERISTIC PARAMETERS

Reactance base class H BR rating

K_c	Short-circuit ratio		0.29	0.32	0.39	0.53	0.21	0.22	0.23	0.26	0.28	0.31
X_d	D-Axis synchronous reactance (unsaturated)	pu	4.19	3.78	3.51	2.80	4.97	4.72	4.54	4.30	4.10	3.94
X'_d	D-Axis transient reactance (saturated)	pu	0.27	0.24	0.23	0.18	0.32	0.30	0.29	0.28	0.26	0.25
X''_d	D-Axis sub-transient reactance (saturated)	pu	0.151	0.136	0.126	0.101	0.179	0.170	0.163	0.155	0.148	0.142
X_q	Q-Axis synchronous reactance (unsaturated)	pu	2.51	2.27	2.11	1.68	2.99	2.83	2.73	2.58	2.46	2.36
X''_q	Q-Axis sub-transient reactance (saturated)	pu	0.170	0.154	0.143	0.114	0.202	0.192	0.185	0.175	0.167	0.160
X_2	Negative-sequence reactance (saturated)	pu	0.161	0.145	0.135	0.108	0.191	0.181	0.175	0.165	0.158	0.151
X_0	Zero-sequence reactance (independent)	pu	0.036	0.033	0.030	0.024	0.043	0.041	0.039	0.037	0.036	0.034
T'_d	D-Axis transient time constant	ms			180				180			
T''_d	D-Axis sub-transient time constant	ms			18				18			
T'_{do}	D-Axis open-circuit time constant	ms			2779				2779			
T_a	Armature time constant	ms			27				27			
T_r	Voltage recovery time	ms			< 500				< 500			

EXCITATION VOLTAGE AND CURRENT

No load excitation voltage	V	9.1	10.2	11.3	13.9	6.8	7.3	7.7	8.5	9.2	10.2
No load excitation current	A	0.83	0.93	1.03	1.26	0.62	0.66	0.70	0.77	0.84	0.93
Class H BR excitation voltage	V	43.8	43.3	43.8	41.9	39.8	40.4	40.9	41.9	42.9	44.4
Class H BR excitation current	A	3.98	3.94	3.98	3.81	3.62	3.67	3.72	3.81	3.90	4.04

WINDING RESISTANCE

At 20° C

Stator line-to-line (series star)	Ω	0.0025	Exciter field	Ω 11.00
Main field	Ω	0.506		

According to: IEC 60034, UTE NFC51.111, VDE 0530, BS 4999/5000, NEMA MG 1-33

Values quoted are typical. In line with our policy of continuous improvement, we reserve the right to change specification without notice.

FRAME **8224N** **WINDING** **6S**

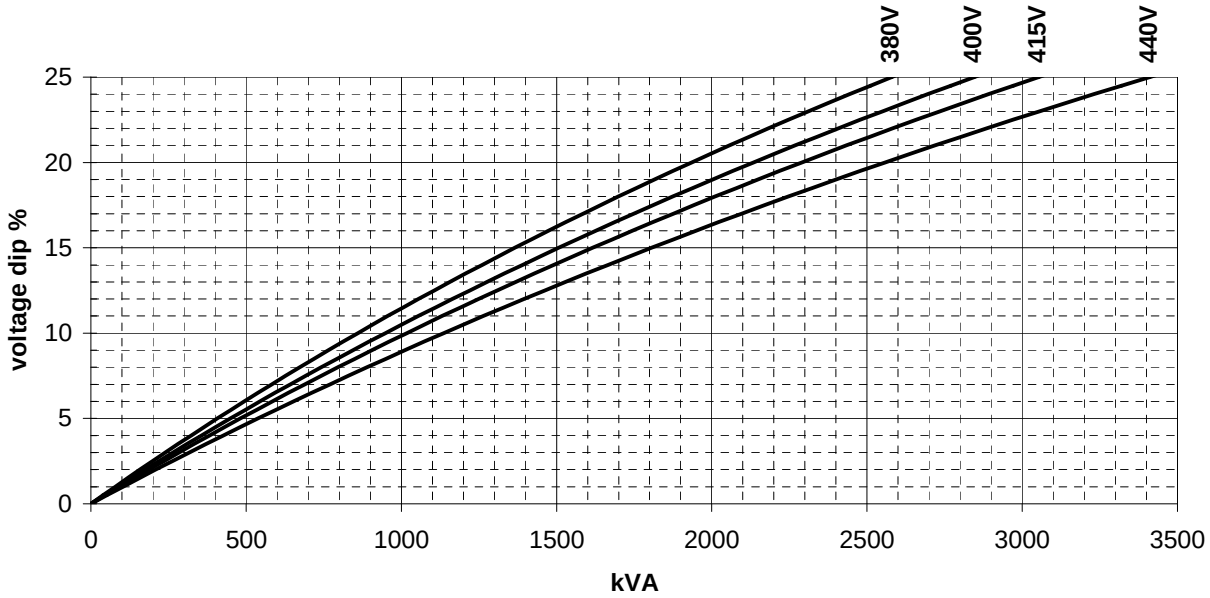
MODELS **LL8224N / LL8234N**

REF: F8204NW6S-2 JULY 2010

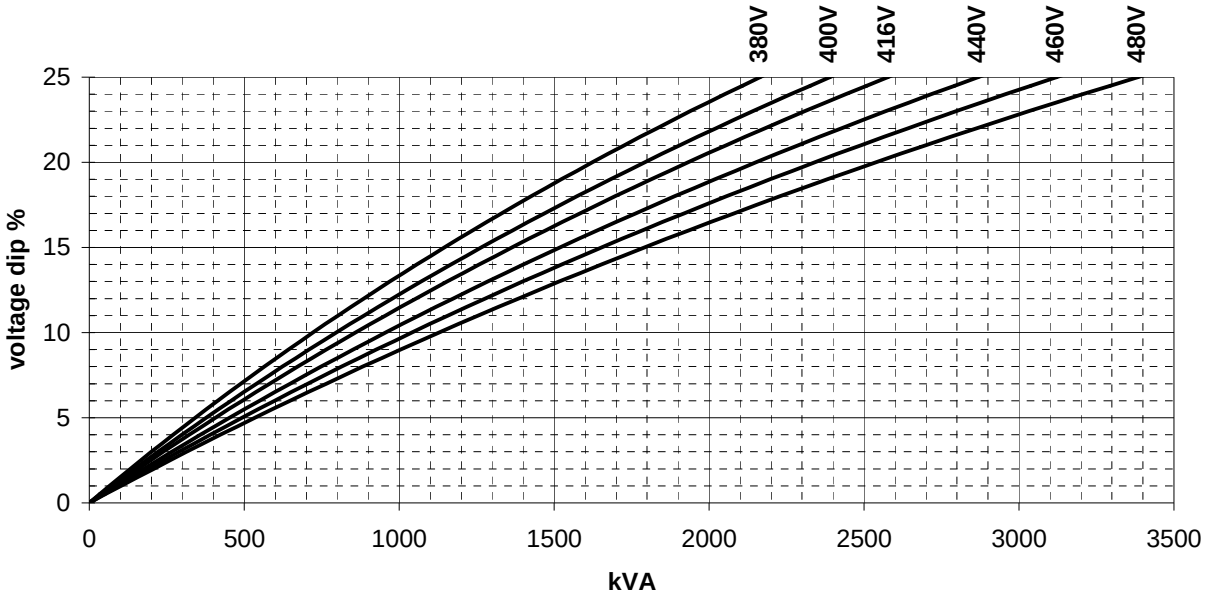
LOCKED ROTOR MOTOR STARTING CURVES

Power factor 0.4

50 Hz AREP / PMG



60 Hz AREP / PMG



According to: IEC 60034, UTE NFC51.111, VDE 0530, BS 4999/5000, NEMA MG 1-33

Values quoted are typical. In line with our policy of continuous improvement, we reserve the right to change specification without notice.

FRAME 8224N WINDING 6S

MODELS LL8224N / LL8234N

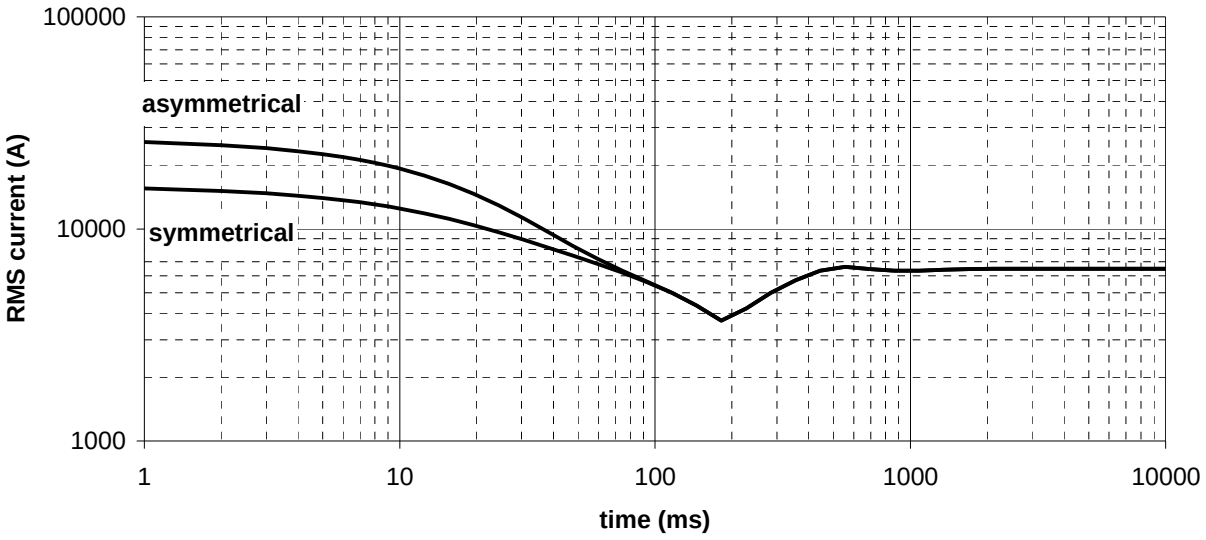
REF: F8204NW6S-2 JULY 2010

THREE-PHASE SHORT-CIRCUIT DECREMENT CURVES

No-load excitation at rated speed

400V 50Hz, 480V 60Hz

Star



Multiplication Factors

50Hz Voltages	380	400	415	440
Multiplication Factor	0.95	1.00	1.04	1.10

Apply factor up to 2xT'd, remainder of curve unchanged

60Hz Voltages	380	400	416	440	460	480
Multiplication Factor	0.79	0.83	0.87	0.92	0.96	1.00

Apply factor up to 2xT'd, remainder of curve unchanged

Winding Connection	Star	Delta
Multiplication Factor	1.00	1.73

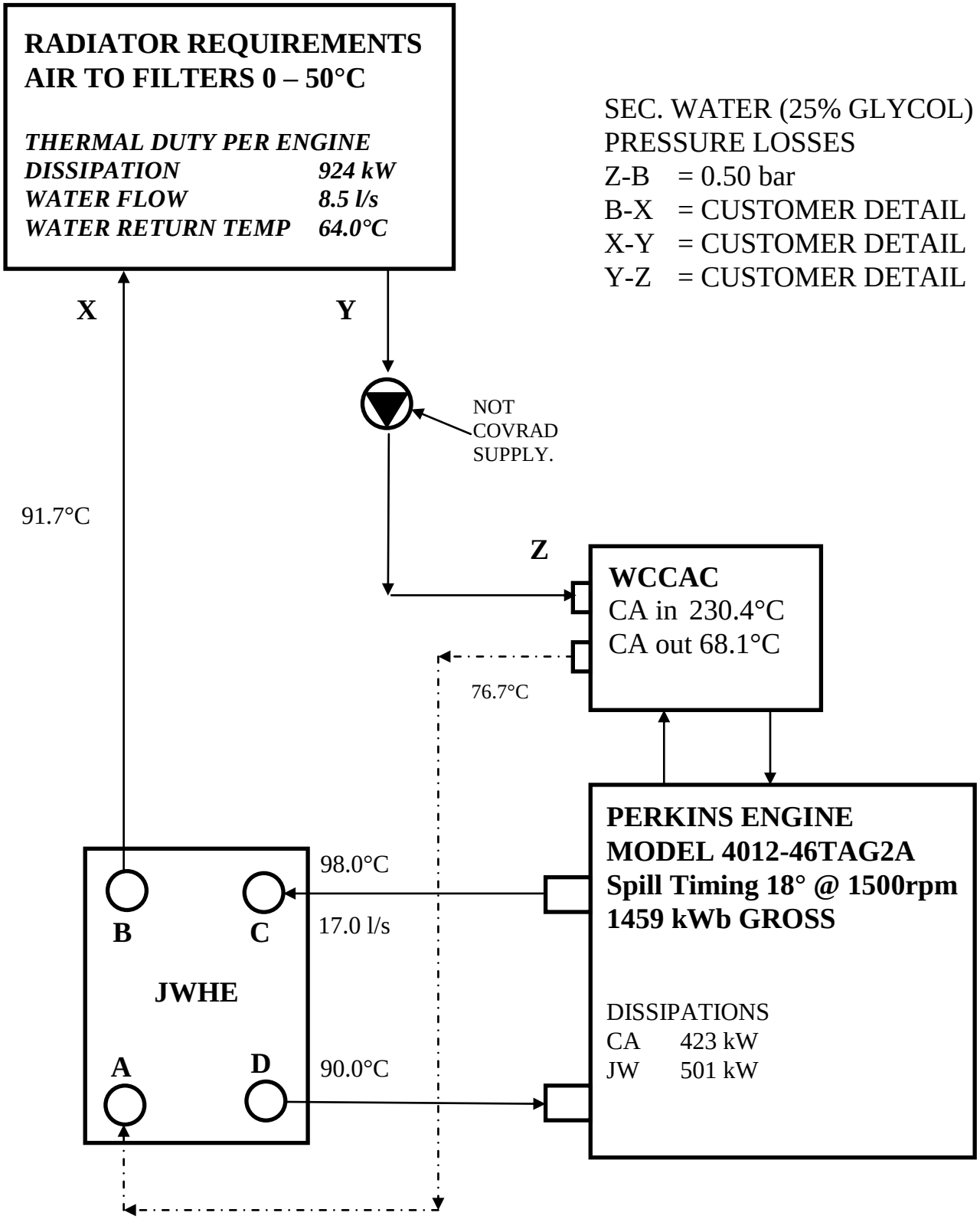
Apply factor to the complete curve

According to: IEC 60034, UTE NFC51.111, VDE 0530, BS 4999/5000, NEMA MG 1-33

Values quoted are typical. In line with our policy of continuous improvement, we reserve the right to change specification without notice.

REMOTE COOLING KIT
CRDA1648-B4 (CAT NI 128-501)
TECHNICAL DATA

Covrad GT
An API Heat Transfer Company



C Round
(Standard remote kits)
Issue 1
Date: March 2013

InteliGen^{NT}

GENERAL PURPOSE HIGH-END GEN-SET CONTROLLER

Description

InteliGen^{NT} is a comprehensive controller for both single and multiple gen-sets operating in standby or parallel modes. Compact construction is optimized for these purposes and various HW modifications allow customers to select the optimum type for a particular application.

A built-in synchronizer and digital isochronous load sharer allow a total integrated solution for gen-sets in standby, island parallel or mains parallel. Native cooperation of up to 32 gen-sets is a standard feature.

InteliGen^{NT} supports many standard ECU types and is specially designed to easily integrate new ones.

A powerful graphic display with user-friendly controls allows any user whatever their ability to find the information they need.

ComAp is able to offer customized firmware solutions.

Benefits

- Support of engines with ECU (Electronic Control Unit)
- Excellent configurability to match customers' needs exactly
- Complete integrated gen-set solution and signal sharing via CAN bus – minimum external components needed
- Many communication options – easy remote supervising and servicing
- Perfect price/performance ratio
- Gen-set performance log for easy problem tracing

ComAp is a member of AMPS (The Association of Manufacturers of Power generating Systems).

ComAp products meet the highest standards, with every stage of production undertaken in accordance with the ISO certification obtained in 1998.

The product has the UL Certification.

Features

InteliGen^{NT}

- Support of engines with ECU (J1939, Modbus and other proprietary interfaces); alarm codes displayed in text form
- AMF function
- Automatic synchronizing and power control (via speed governor or ECU)
- Baseload, Import/Export
- Peak shaving
- Voltage and PF control (AVR)
- Generator measurement: U, I, Hz, kW, kVAr, kVA, PF, kWh, kVAhr
- Mains measurement: U, I, Hz, kW, kVAr, PF
- Inputs and outputs configurable for various customer needs
- Controller redundancy
- RS232/RS485 interface with Modbus support; Analog/GSM/ISDN/CDMA modem support; SMS messages; ECU Modbus interface
- Event-based history (up to 500 records) with customer-selectable list of stored values; RTC; statistic values
- Integrated PLC programmable functions
- Interface to remote display unit (IG-Display LT GC)
- Dimensions 180×120 mm (front panel)
- Sealed to IP65

InteliGen^{NTC} – All items from InteliGen^{NT} plus:

- Selectable measurement ranges for AC voltages and currents – 120/277 V, 0–1/0–5 A
- Secondary isolated RS232/RS485 interface
- USB 2.0 slave interface

Integrated fixed and configurable protections

- 3 phase integrated generator protections (U + f)
- IDMT overcurrent + Shortcurrent protection
- Overload protection
- Reverse power protection
- Earth fault protection
- 3 phase integrated mains protections (U + f)
- Vector shift protection
- All binary/analog inputs free configurable for various protection types: HistRecOnly / Alarm Only / Alarm + History indication / Warning / Off load / Slow stop / BreakerOpen&Cooldown / Shutdown / Shutdown override / Mains protect / Sensor fail
- Phase rotation and phase sequence protection
- Additional 160 programmable protections configurable for any measured value to create customer-specific protections
- Application security

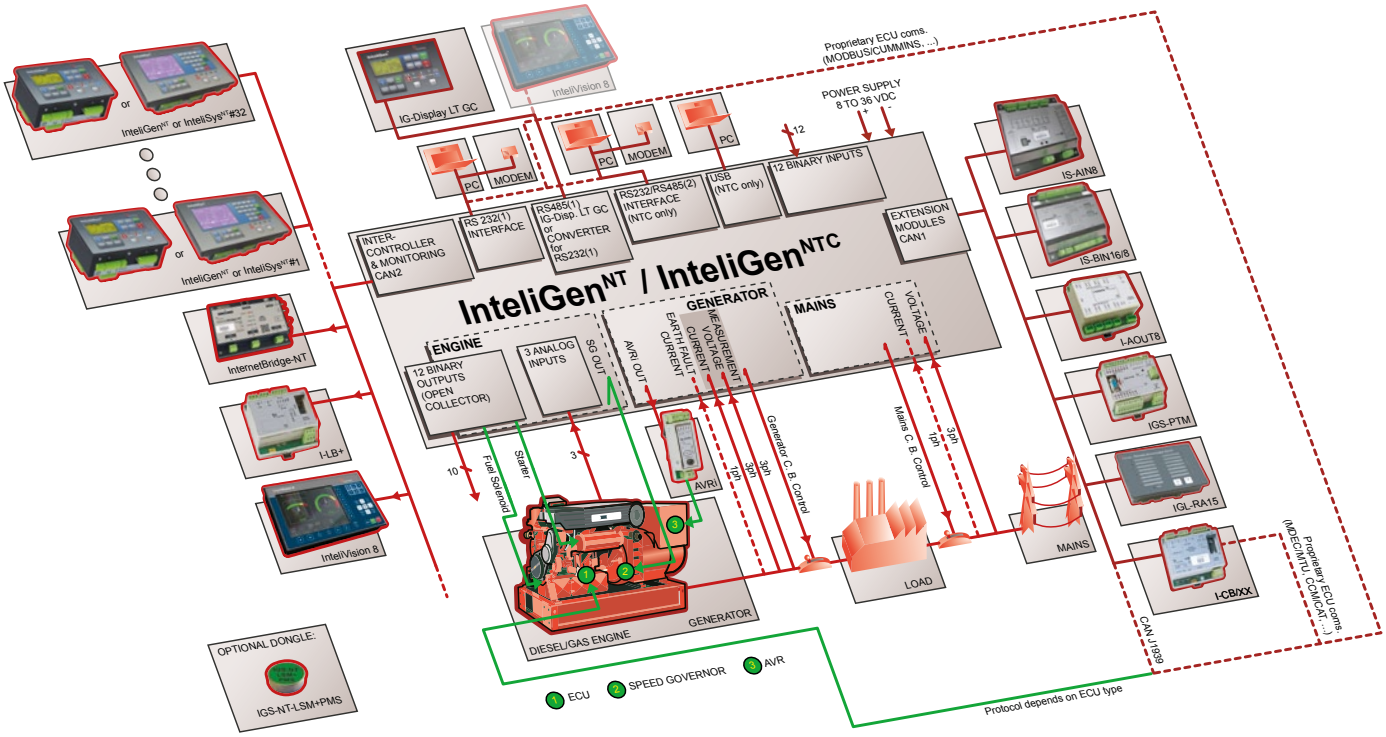
ANSI CODES

ANSI code	Protection
59	Overvoltage
27	Undervoltage
47	Voltage asymmetry
81H	Overfrequency
81L	Underfrequency
81R	ROCOF
78	Vectorshift
50+51	Overcurrent
46	Current unbalance

ANSI code	Protection
32	Overload
51N+64	Earth
32R	Reverse power
25	Synchronism check
47	Phase rotation
37	Undercurrent*
55	Power factor*
71	Gas (fuel) level

* can be created using universal protections

Schematic diagram



ComAp

Communication modules and PC tools

- **I-CR** – CAN repeater module
- **InternetBridge-NT** – Internet bridge module with wireless connection
- **I-LB+** – Local bridge
- **I-CB** – ECU communication bridge
- **InteliMonitor** – PC monitoring tool
- **InteliSupervisor** – PC tool for Gen-set or machines fleet management
- **WinScope** – Special graphical controllers' monitoring software
- **GenConfig** – PC configuration tool

Upgrade kit

- **IGS-NT-LSM+PMS dongle:**
  - Enables Multiple isolated parallel or multiple parallel with mains
  - Power management operation (with CAN bus)
  - Digital Load Sharing
  - Digital VAr Sharing

Extension modules and remote displays

- up to 4× **I-AOUT8** – Analog output extension module
- **IGL-RA15** – Remote annunciator
- up to 4× **IGS-PTM** – Analog/binary input/output module
- up to 10× **IS-AIN8** – Analog input module
- up to 10× **IS-AIN8TC** – Analogue input module for thermocouples
- up to 6× **IS-BIN16/8** – Binary input/output module
- **IG-Display LT GC** – Additional remote display
- up to 2× **InteliVision 5** – Controller 5.7" colour display unit
- up to 5× **InteliVision 8** – Controller 8" colour display unit
- **InteliVision 17Touch** – Site 17" colour display unit

Order codes

Controller	Order code
InteliGen^{NT}	IG-NT GC
InteliGen^{NT} LT	IG-NT LT GC
InteliGen^{NTC}	IG-NTC GC
InteliGen^{NTC} LT	IG-NTC LT GC

Typical application

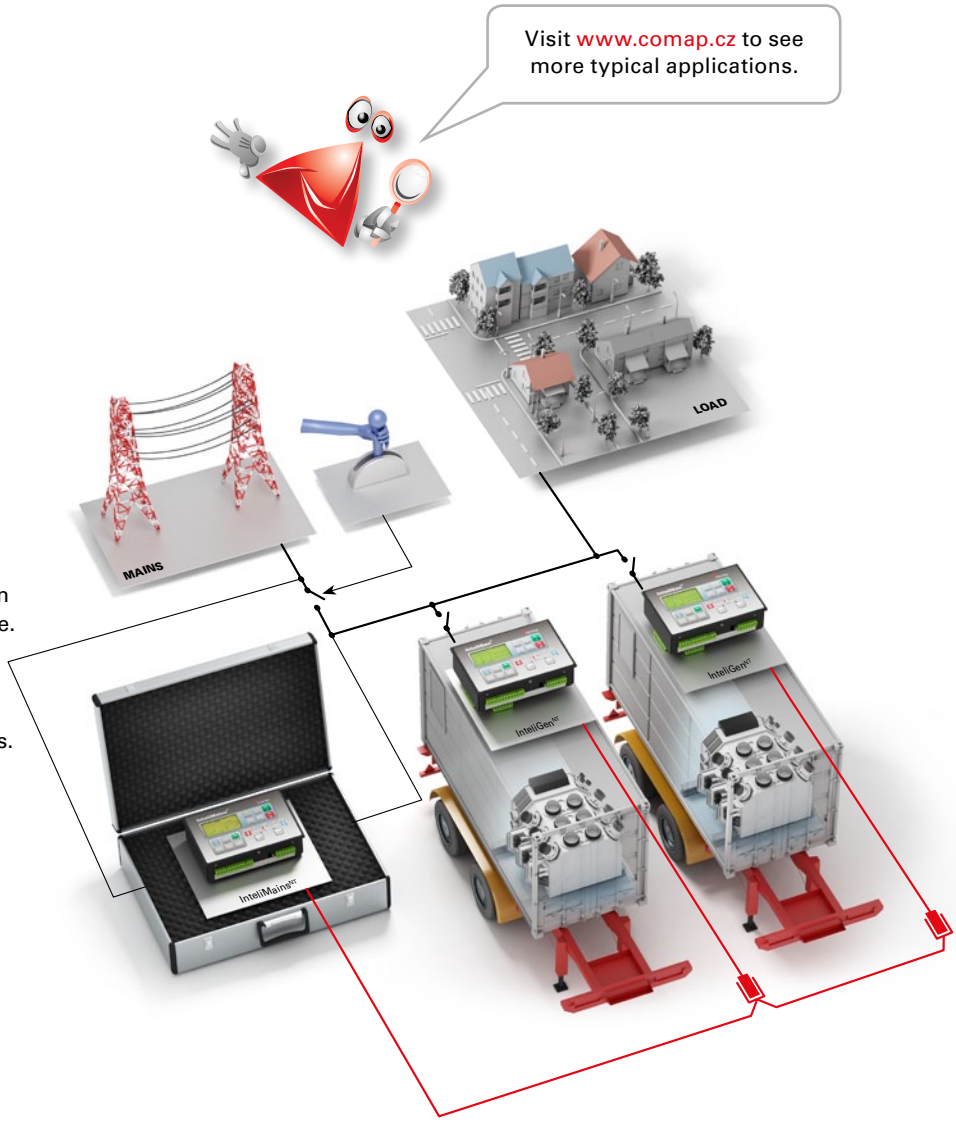
RENTAL SETS

Description:

- Containerized rental gen-sets can be used for maintenance of power lines without interruption of power delivery to end consumer.
- Gen-sets are connected one-by-one to mains at the consumer's end and manually loaded. Power line is then manually disconnected and consumer is powered from generators running in parallel.
- The group of gen-sets is reverse synchronized to mains after finalization of maintenance on power line. InteliMains^{NT} keeps generators and mains in synchronism enabling manual reconnection to power line.
- InteliMains^{NT} is built in a small shock proof suitcase.
- Interconnection of containers is done by color coded not-interchangeable connectors.
- Each gen-set can be used in Stand-by, Single parallel to mains and Multiple parallel modes according to the position of Mode selector switch.
- Frequency selector enables switching between 50Hz/230V and 60Hz/277V mains.

Scope of supply:

- 2× InteliGen^{NT}
- 2× IGS-NT-LSM+PMS dongle
- 2× IG-AVRi
- 2× IG-AVRi-TRANS/LV
- 1× InteliMains^{NT}



Functions chart

Controller	InteliGen^{NT}	InteliGen^{NT} BaseBox	InteliGen^{NTC} BaseBox	InteliSys^{NTC} BaseBox
Order code	IG-NT	IG-NT-BB	IG-NTC-BB	IS-NTC-BB
Binary Inputs / Outputs	12/12 (108/108) [1]	12/12 (108/108) [1]	12/12 (108/108) [1]	16/16 (112/112) [1]
Analog Inputs/Outputs	3/0 (83/32) [1] (configurable as tristate)	3/0 (83/32) [1] (configurable as tristate)	3/0 (83/32) [1] (configurable as tristate)	4/1 (84/33) [1] (configurable as tristate)
AMF function	●	●	●	●
GCB control with feedback	●	●	●	●
Integrated PLC	Standard	Standard	Standard	Extended
Input configuration	●	●	●	●
Output configuration	●	●	●	●
Voltage measurement Gen / Mains (bus)	3 ph / 3 ph 277V	3 ph / 3 ph 277V	3 ph / 3 ph 120V / 277V	3 ph / 3 ph 120V / 277V
Current measurement	3ph + 1 / 6w IDMT overcurrent 5A	3ph + 1 / 6w IDMT overcurrent 5A	3ph + 1 / 6w IDMT overcurrent 1A / 5A	3ph + 1 / 6w IDMT overcurrent 1A / 5A
kW / kWh / kVA measurement	● / ● / ●	● / ● / ●	● / ● / ●	● / ● / ●
Communication interfaces	CAN1, CAN2, RS232, RS485, Ethernet [2], Modbus	CAN1, CAN2, RS232, RS485, Ethernet [2], Modbus	CAN1, CAN2, RS232, 2× RS485, USB, Ethernet, Modbus, ModbusTCP, AirGate, Web server	CAN1, CAN2, RS232, 2× RS485, USB, Ethernet, Modbus, ModbusTCP, AirGate, Web server
ECU support	●	●	●	●
Active call / SMS support	●	●	●	●
Forward / Reverse synchronizing / Mains parallel operation	● / ● / ●	● / ● / ●	● / ● / ●	● / ● / ●
Multiple operation / Power Management System	● [3]	● [3]	● [3]	● [3]
Display	LCD 128×64	External	External	External
History (max records) [4]	500	1000	1000	4000

KEY

● included
CAN1 for peripheral modules and ECU (J1939)
CAN2 intercontroller can; monitoring

[1] with IS-AIN8, IS-AIN8TC, IS-BIN16/8, I-OUT8 or IGS-PTM
[2] with communication modules
[3] with IGS-NT-LSM+PMS dongle
[4] depends on number of values in history record

Customer feedback

"Regarding the parallel application, we only use ComAp controllers for many reasons – the most advanced technology, the fantastic policy of ComAp in providing the software upgrades via Internet without costs, the constant evolution of software and the easy way of use. This special modern way of working (open and wide information) gives ComAp the leadership in their business."

João Capelão
owner
Portugal
www.neoenergia.pt

ComAp

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LOCAL DISTRIBUTOR / PARTNER:

Customer satisfaction is our mission. We continuously develop the best people to succeed in our mission.

© ComAp. Features and specification are subject to change without prior notice.

AVM Technical Submittal
UCL ION/DRI

Bells Power Solutions Ltd
70 Clifton Street
London
EC2A 4HB

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www.bellspowersolutions.co.uk

MECHANICAL DATA CALCULATIONS **2-Mar-2021**

Isolation of P1500P3 Generator Set - UCL ION/DRI

INPUT DATA

	Component	Mass (kg)	Co-ordinates (mm) X	Y	Z
1	P1500P3	10024.00	0.00	3000.00	770.00

TOTAL MASS = 10024.00

MOUNTING SELECTION & POSITIONS RELATIVE TO THE ORIGIN

	Mounting Type	Co-ordinates X(mm)	Y(mm)	Z(mm)	Load (kg)	Defl. (mm)
1	ECS25/1200/B	-639.00	560.00	0.00	1002.4	20.9
2	ECS25/1200/B	-639.00	2090.00	0.00	1002.4	20.9
3	ECS25/1200/B	-639.00	3310.00	0.00	1002.4	20.9
4	ECS25/1200/B	-639.00	4220.00	0.00	1002.4	20.9
5	ECS25/1200/B	-639.00	4820.00	0.00	1002.4	20.9
6	ECS25/1200/B	639.00	560.00	0.00	1002.4	20.9
7	ECS25/1200/B	639.00	2090.00	0.00	1002.4	20.9
8	ECS25/1200/B	639.00	3310.00	0.00	1002.4	20.9
9	ECS25/1200/B	639.00	4220.00	0.00	1002.4	20.9
10	ECS25/1200/B	639.00	4820.00	0.00	1002.4	20.9

Slowest running speed of machine = 1500.0 r.p.m.
Average deflection = 20.9 mm
Vertical Natural Frequency = 206.9 c.p.m. (3.45 Hz)

VERTICAL ISOLATION EFFICIENCY = 98.06 %

Enclosed Spring Mountings

Type ES - Enclosed Spring and ECS - Enclosed Captive Spring Mounting

A unique range of mountings designed primarily for building services applications where the control of low frequency vibration and noise emanating from mechanical plant is of paramount importance.

The benefits of a combined rubber and steel housing for the spring have helped establish the ES and ECS mountings as industry standards accepted by specifiers, equipment manufacturers and mechanical services installers alike.

DESIGN FEATURES

- Nitrile rubber (oil resistant) lower spring housing eliminates the possibility of metallic continuity and ensures excellent acoustic performance. Steel reinforced on ECS range.
- Full enclosed captive assembly protects the spring and controls transient motion.
- All steel components are zinc plated.
- Nominal 15, 20, 25 & 50 mm deflection colour coded helical steel springs to BS1726 Class B, laterally stable with 50% overload capacity.
- Simple single screw height adjustment.
- 6 mm thick ribbed rubber seating pads available for ES25 and ECS ranges.
- Colour coded labels for easy identification.
- Stainless Steel variants available.

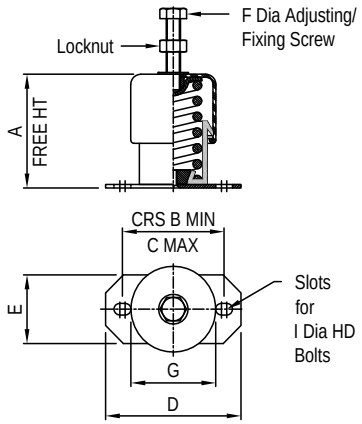
TYPICAL APPLICATIONS

- Axial and Centrifugal Fans.
- Air Handling Units.
- Chillers and Cooling Towers.
- Rotary and Multi Cylinder Compressors.
- Diesel Generating Sets (ECS only).
- Mechanical Test Rigs.
- Isolation of Sensitive Equipment.

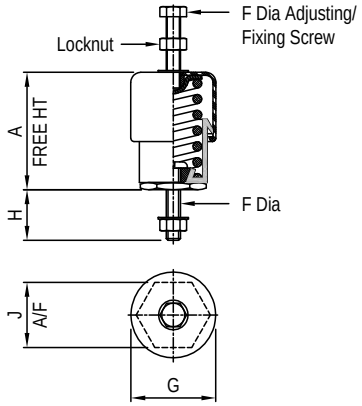
CHRISTIE & GREY Vibration & Shock Control

PL004/1 - SEPTEMBER 2018 - Rev. F

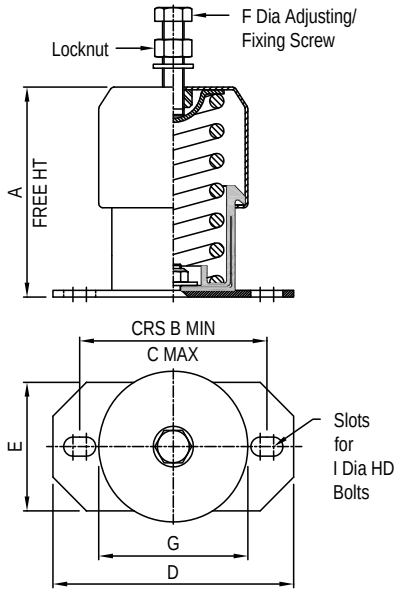
TYPE ES



TYPE ESB



TYPE ECS



TYPE ES, ESB, ES25, ECS25 & ECS50 MOUNTINGS

PART No.	COLOUR CODE	RATED LOAD (kg)	DEFLECTION AT RATED LOAD (mm)	DIMENSIONS (mm)										WT (kg) MAX
				A	B	C	D	E	F	G	H	I	J	
ES20/10	PURPLE	10	20	63	54	60	76	38	M8	48	-	M6	-	0.25
ES20/15	YELLOW	15	20											
ES20/20	GREY	20	20											
ES20/40	GREEN	40	20											
ES20/70	RED	70	20											
ES15/100	BLUE	100	15											
ESB20/10	PURPLE	10	20	65	-	-	-	-	M8	48	26	-	36	0.25
ESB20/15	YELLOW	15	20											
ESB20/20	GREY	20	20											
ESB20/40	GREEN	40	20											
ESB20/70	RED	70	20											
ESB15/100	BLUE	100	15											
ES25/30	YELLOW	30	25	88	85	90	110	70	M10	78	-	M8	-	1.0
ES25/60	GREEN	60	30											
ES25/100	BLUE	100	25											
ES25/160	WHITE	160	25											
ES25/250	RED	250	25											
ECS25/100	WHITE/YELLOW	100	25	127	130	150	180	95	M16	111	-	M12	-	3.0
ECS25/200	WHITE/RED	200	25											
ECS25/300	WHITE/PURPLE	300	25											
ECS25/400	WHITE/GREY	400	25											
ECS25/500	WHITE/ORANGE	500	25											
ECS25/600	WHITE/BROWN	600	25											
ECS25/700	WHITE/BLACK*	700	25											
ECS25/800	WHITE/GOLD	800	25											
ECS25/1000	WHITE/1000	1000	25											
ECS25/1200	WHITE/1200*	1200	25											
ECS25/1400	WHITE/1400*	1400	25											
ECS50/100	BLACK/YELLOW	100	50	155	130	150	180	95	M16	111	-	M12	-	2.8
ECS50/200	BLACK/GREEN	200	50											
ECS50/300	BLACK/BLUE	300	50											
ECS50/400	BLACK/WHITE	400	50											
ECS50/500	BLACK/RED	500	50											

* Internal nested spring.

Seating Pads

Ribbed rubber seating pads can now be fitted as standard, suffix Pt. No. /B e.g. ES25/100/B.

Stainless Steel.

This option is available across the entire range for external and other hostile environments.

When ordering the Pt. No. should be suffixed with /S for Stainless Steel or if fitted with a seating pad /SB e.g. ECS25/500/S or ECS25/500/SB.

ISOLATION EFFICIENCY AT TYPICAL MACHINE SPEEDS

MACHINE SPEEDS (rpm)	EFFICIENCY %		
	15 mm DEFL.	25 mm DEFL.	50 mm DEFL.
300	DO NOT USE	34.0	75.2
500	68.7	83.3	92.3
750	88.1	93.2	96.7
1000	93.7	96.3	98.2
1200	95.7	97.4	98.7
1500	97.3	98.4	99.2
1750	98.0	98.8	99.4
2000	98.5	99.1	99.5

The above figures are theoretical values only based on the vertical natural frequency of the sprung system assuming infinitely stiff structural supports.
The effects of high frequency spring coil resonances on low frequency performance are also ignored.

Spring Deflection

Spring stiffness is linear over its working range therefore the actual deflection for a given load can be calculated as follows:-

$$\text{Actual Deflection (mm)} = \frac{\text{Actual Load (kg)}}{\text{Rated Load (kg)}} \times \text{Rated Deflection (mm)}$$

For full installation instructions please refer to our data sheet DS026.
For more detailed information and technical assistance please contact our Technical Department.

In the interests of continual development, the Company reserves the right to make modifications to these details without notice.

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PL004/2 - SEPTEMBER 2018 - Rev. F

TECHNICAL DATA SHEET
DS 026

NON CONTROLLED UNLESS STATED OTHERWISE

PAGE	1 of 2
ISSUE	7
DATE	15 May 2019
APPROVED	A.N.M

TITLE. Instructions for Installation of Spring Isolators Type ES and ECS.

Details of isolators as Leaflet PL004

Each type of isolator is made in a range of sizes which are identified by colour coded labels.

Although these isolators have excellent finishes they are not usually suitable for prolonged use in adverse outdoor locations or corrosive atmospheres without further protection. (Please consult our application engineers about problem installation areas).

The isolators should be installed generally in accordance with the following procedure:

1. The structure beneath the machine should be constructed to form a rigid and reasonably level seating for each group of isolators.

2. The isolators should be examined to ensure they are of the correct size, and if appropriate, the positions for different sizes should be located in accordance with our recommendations or drawings.

3. After the isolators are in position, the machine base should be levelled and supported just clear of the isolator tops using jacks or block, ensuring alignment between isolator and machine fixing holes.

   At this stage, hold down bolts can be loosely fitted to maintain isolator positions during final lowering of machine base, but it is important these do not strain the isolator in any direction (HD bolts are supplied by others).

4. After removal of blocks the machine base can be carefully lowered evenly across supported area transferring full weight to the isolators. Adjusting screws should then be located through machine base into isolator tops, ensuring sufficient length for adjustment.

5. Tighten the adjustment screw after initial deflection to raise the upper spring cover until desired height of isolator is achieved or the machine is level. See Figure 1.

DO NOT adjust by more than the original deflection obtained when the load was applied to the mounting.

IF NO adjustment is required, adjusting screw must be wound down sufficiently so that the spring pressure is felt before tightening the locknut.

TECHNICAL DATA SHEET
DS 026

NON CONTROLLED UNLESS STATED OTHERWISE

PAGE	2 of 2
ISSUE	7
DATE	15 May 2019
APPROVED	A.N.M

TITLE. Instructions for Installation of Spring Isolators Type ES and ECS.

Where upward movement of equipment must be restrained during drawing down etc, the adjusting screw must be used to set the mounting to a maximum height of:

ES 20 range - 60 mm
ES 25 range - 85 mm
ECS range - 125 mm

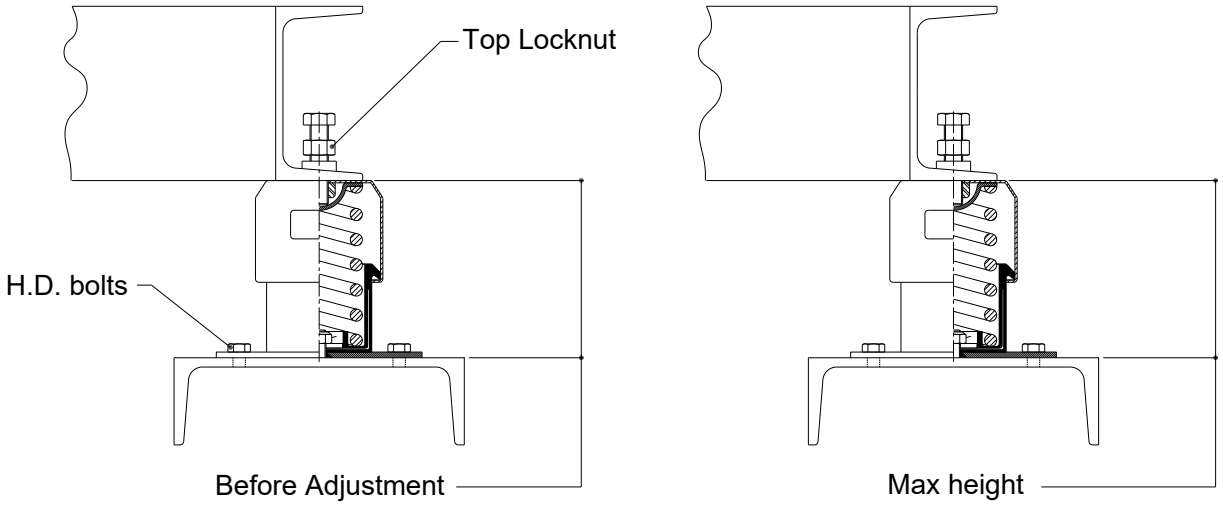

Figure 1.

6. Isolator HD bolts and top locknuts should now be fully tightened.

7. Ribbed rubber seating pads should always be used when the mounting is seated on concrete or other rough surfaces.

8. Note: Isolators are not designed to accommodate angular misalignment, excessive horizontal or tensile forces and must not be used for tensile or shear loading applications.

9. The efficiency of an isolator system can be seriously impaired if the system is connected to rigid pipes, electrical conduits, ducts or shafts. It is essential that such external connections be as flexible as possible, not only to prevent transmission of vibration through the connections and allow the system freedom of movement, but also to avoid possible failure of the connections.

Please contact our Technical Department at the address below if you have any problems relating to installation or selection.

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CERTIFIED ISO 9001 UKAS MANAGEMENT SYSTEMS 001

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BELLS THE STANDBY POWER SPECIALISTS	TECHNICAL SUBMITTAL SHEET TS No: 003 R2 Project: UCL ION/DRI Date: 22nd November 2021 Job No: Q4105	MJL MICHAEL J.LONSDALE *Creating the right environment*

To: Adrian Wells	From: James Murphy
Company: M J Lonsdale	Technical Enclosures: Acoustic Solution
Date answer is required:	Date answer was received:

SUBJECT:

Please find attached for approval technical information for the Acoustic Solution: -

Acoustic Equipment Specification

Allayway Acoustic Attenuation Datasheets & Performance Calculations

Exhaust Calculations & Datasheets

Fan Datasheet

Fire Drop Curtain Datasheet

Generator Room GA Layout

RESPONSE / STATUS	A	B	C

COMMENTS: