mecc alte

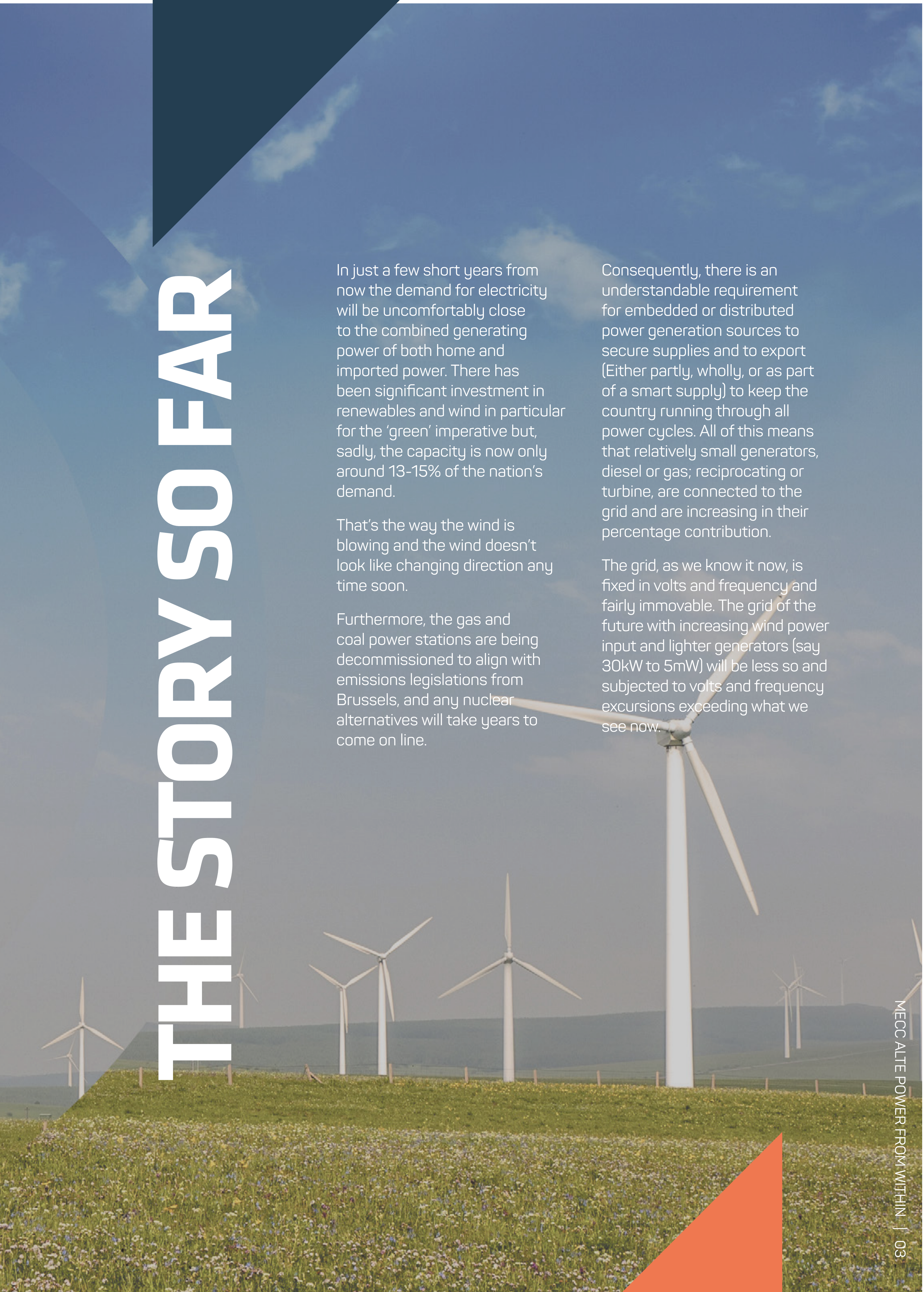
POWER FROM WITHIN

EUROPEAN GRID CODES

TECHNICAL GUIDE

GUIDA TECNICA

CODICI DI RETE EUROPEI



THE STORY SO FAR

In just a few short years from now the demand for electricity will be uncomfortably close to the combined generating power of both home and imported power. There has been significant investment in renewables and wind in particular for the 'green' imperative but, sadly, the capacity is now only around 13-15% of the nation's demand.

That's the way the wind is blowing and the wind doesn't look like changing direction any time soon.

Furthermore, the gas and coal power stations are being decommissioned to align with emissions legislations from Brussels, and any nuclear alternatives will take years to come on line.

Consequently, there is an understandable requirement for embedded or distributed power generation sources to secure supplies and to export (Either partly, wholly, or as part of a smart supply) to keep the country running through all power cycles. All of this means that relatively small generators, diesel or gas; reciprocating or turbine, are connected to the grid and are increasing in their percentage contribution.

The grid, as we know it now, is fixed in volts and frequency and fairly immovable. The grid of the future with increasing wind power input and lighter generators (say 30kW to 5mW) will be less so and subjected to volts and frequency excursions exceeding what we see now.

THE WAY FORWARD

It is with all of this in mind that Transmission System Operators (TSO) and Distribution System Operators (DSO) in their own countries are applying their technical requirements for such connected generators. These are called the Grid Codes and their purpose is to ensure the stability of power supply.

For example, if a fault occurs in a very high voltage part of the network, and shuts down a particular region, the transient effects in the transmission line should not cause a daisy chain of smaller generators disconnecting from the grid thus exacerbating the power loss of the original fault.

The problem is European wide and even further, and there are moves to standardise on what the Grid Codes should be, although in all likelihood there will remain differences as it seems too difficult to align all of the requirements. The need for the codes is nevertheless vital to secure reliable power supplies in the future.

Static state

The static requirements in terms of voltage, frequency, power factor and kVA are quite straight forward, but it is the dynamic requirements where special attention is necessary. Looking below at the original generator requirements of EN60034- 1 and then EN50160 you can see that the operating window of voltage / frequency has widened significantly.

In the main the conditions are:

- Voltage within -15% +10%
- Frequency within -5% +3%
- Lagging & Leading power factor

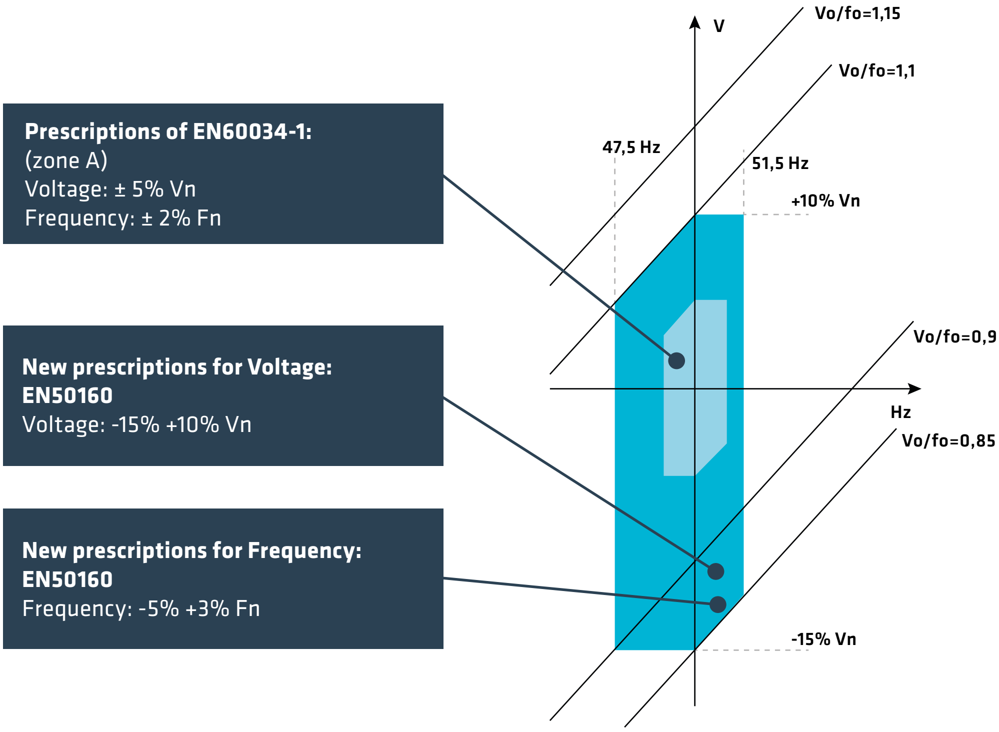
The genset and alternator specifically must consider this in its design and size selection.

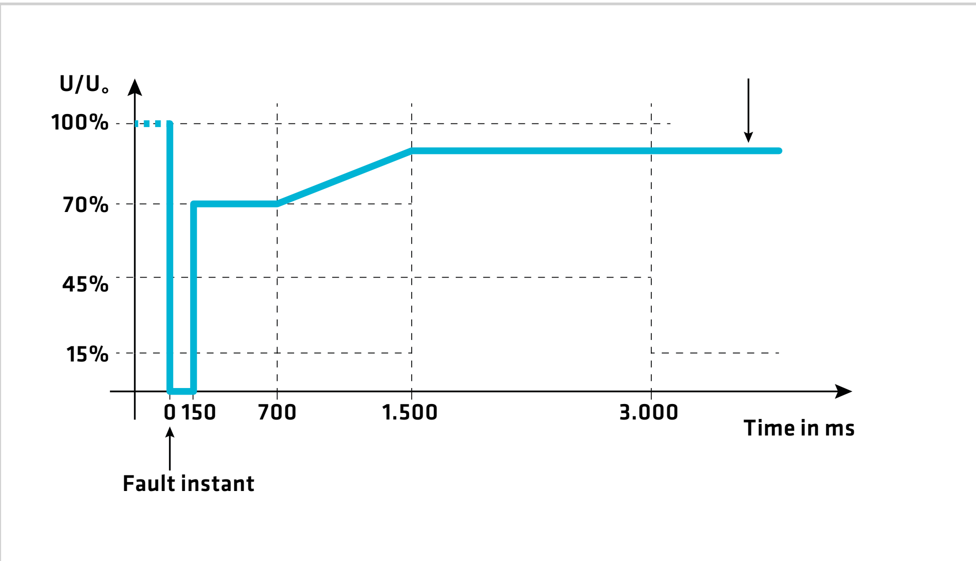
Dynamic State

In extreme conditions the generator
is required to NOT disconnect from
the grid... even if the grid happens to disappear.

We are talking of short periods and while Grid Codes are not yet agreeing, the standard referred to here is a period of 150ms. After the grid returns the realigning of generator to grid can impart significant stress, if not catastrophic failure to the alternator and even the engine. This event is called a Fault Ride Through (FRT) or Low Voltage Ride Through (LVRT). Again the alternator design and selection is key.

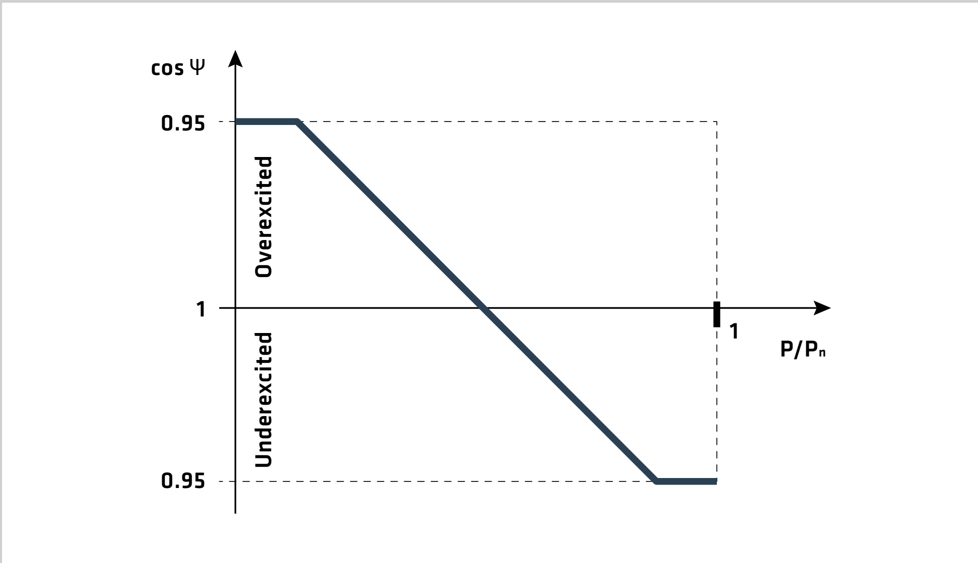
THE WAY FORWARD





For type-1 generating unit, synchronous generator directly connected to the network (only through the generator transformer), the power station shall not disconnect even in the conditions shown in the pictures

TYPICAL DEMANDS FOR ALTERNATORS



The reactive power of the generating plant must be adjustable. Any reactive power value resulting from the characteristic must automatically adapt within 10 seconds for inductive load and adjustable between 10 and 60 seconds for capacitive load

Alternators operating to these requirements must either satisfy the demands within the standard design of the machine or be redesigned to comply. The latter does have an effect on cost, availability and stock flexibility. This does appear to be a route taken by a number of manufacturers.

But, with Mecc Alte the standard design can withstand the rigours the standards as we now understand them.

There are specific conditions to address during a LVRT event. In the 1st instance the voltage at the point of generator connection drops and the load is effectively lost onto the alternator. The driver unit will likely overspeed can cause pole slip, but this will depend on the inertia of the genset and the reactance values of the chosen alternator. In the 2nd instance the fault clears and the genset – still connected to the grid, must instantaneously realign to grid frequency and voltage. This, following a LVRT 'speed up' creates tremendous mechanical and electrical forces on both engine and alternator.

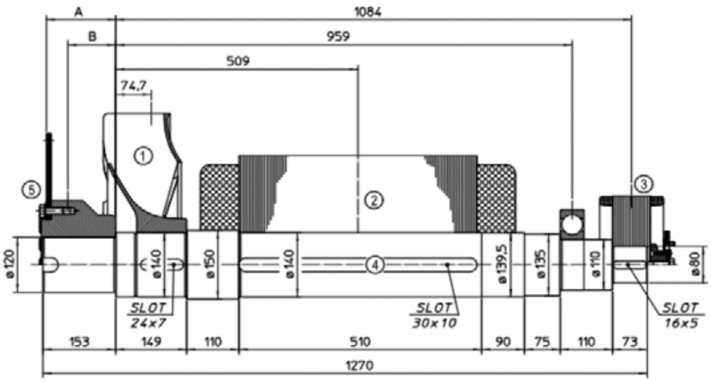
Mecc Alte... Leading the Way

Typically the design aspects of the Mecc Alte alternators for the frame, the shaft and disc hubs, are more robust than for the competitors.

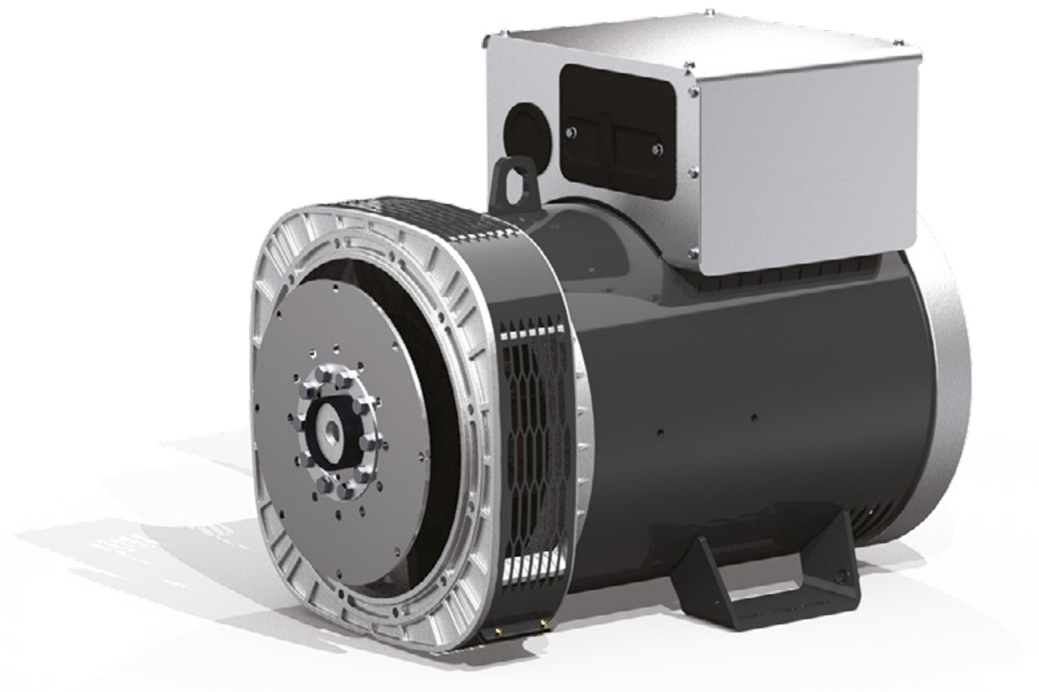
In machine selection (refer to the chart below) the machines inertia constant must be specifically designed or fundamentally able to resist speed changed associated with pole slip in LVRT.

The copper headers are low profile with mechanical spacing between phases to enhance cooling but to also resist the magnetic forces seen in fault conditions or re-sync with the grid. Tests of up to 100 consecutive short circuits have passed without failure to the integrity of the windings, and also the robustness of the mechanical design.

TYPICAL DEMANDS FOR ALTERNATORS



A Grid Code compliant generator must comply with both static and dynamic requirements of the appropriate Grid Code. In dynamic response the connection must remain while the Low Voltage Ride Through (LVRT) occurs, and survive the huge forces trying to change the concentric alignment of the stator.



SPECIFYING ALTERNATORS

From 6kVA to 2380kVA (50Hz), the Mecc Alte products will satisfy the requirements of EN50160-A70 Terna and (UE) 2016/631. There is a 15% ÷ 30% derate to the usual published powers which is derived from the combination of undervoltage up to -15%, overfrequency at +1.5Hz and leading power factor at 0.95.
A full list of the powers available are shown below:

4 POLE ALTERNATORS

Generator Type	400V @ 50Hz - 125/40°C (H)		
	Industrial Rating kVA	Derating	Grid Code Rating kVA
ECP28 1VS4 C	7,5	20%	**6**
ECP28 2VS4 C	10	20%	**8**
ECP28 1S4 C	12,5	20%	**10**
ECP28 2S4 C	15	20%	**12**
ECP28 3S4 C	17,5	20%	**14**
ECP28 M4 C	20	20%	**16**
ECP28 VL4 C	30	20%	**24**
ECP30 1M4 C	20	20%	**16**
ECP30 2M4 C	25	20%	**20**
ECP30 3M4 C	30	20%	**24**
ECP30 1L4 C	35	20%	**28**
ECP30 2L4 C	40	20%	**32**
ECP32 1S4 C	37,5	20%	**30**
ECP32 2S4 C	45	20%	**36**
ECP32 1M4 C	50	20%	**40**
ECP32 2M4 C	62,5	20%	**50**
ECP32 1L4 C	75	20%	**60**
ECP32 2L4 C	82,5	20%	**66**
ECP34 1S4 C	87,5	15%	**74**
ECP34 2S4 C	100	15%	**85**
ECP34 1M4 C	125	15%	**106**
ECP34 2M4 C	135	15%	**115**
ECP34 1L4 C	150	15%	**128**
ECP34 2L4 C	165	15%	**140**
ECO38 1S4 C	180	15%	**153**
ECO38 2S4 C	200	15%	**170**
ECO38 1M4 C	225	15%	**191**
ECO38 2M4 C	250	15%	**213**
ECO38 1L4 C	300	15%	**255**
ECO38 2L4 C	350	15%	**298**
ECO38 VL4 C	370	15%	**315**

Generator Type	400V @ 50Hz - 125/40°C (H)		
	Industrial Rating kVA	Derating	Grid Code Rating kVA
ECO40 1S4 C	400	15%	**340**
ECO40 2S4 C	450	15%	**383**
ECO40 3S4 C	500	15%	**425**
ECO40 1L4 C	550	15%	**468**
ECO40 2L4 C	625	15%	**531**
ECO40 3L4 C	680	15%	**578**
ECO40 VL4 C	750	30%	**525**
ECO43 1S4 A	820	15%	**697**
ECO43 2S4 A	930	15%	**791**
ECO43 1M4 A	1025	30%	**718**
ECO43 2M4 A	1150	30%	**805**
ECO43 2L4 A	1300	30%	**910**
ECO43 VL4 A	1400	15%	**1190**
ECO46 1S4 A	1500	15%	**1275**
ECO46 1.5S4 A	1650	15%	**1403**
ECO46 2S4 A	1800	15%	**1530**
ECO46 1L4 A	2100	15%	**1785**
ECO46 1.5L4 A	2300	15%	**1955**
ECO46 2L4 A	2500	15%	**2125**
ECO46 VL4 A	2800	15%	**2380**

For applications with Class F temperature rise, refer to the following additional derating factors to apply to the Grid Code Rating column:

- **5%** when in Class H we apply 15%
- **10%** when in Class H we apply 20%
- **15%** when in Class H we apply 30%

SPECIFYING ALTERNATORS

2 POLE ALTERNATORS

Generator Type	400V @ 50Hz - 125/40°C (H)		
	Industrial Rating kVA	Derating	Grid Code Rating kVA
ECP28 M2 C	22	30%	**15**
ECP28 1L2 C	27	30%	**19**
ECP28 2L2 C	31.5	30%	**22**
ECP28 VL2 C	40	30%	**28**
ECP32 1S2 C	44	30%	**31**
ECP32 2S2 C	50	30%	**35**
ECP32 M2 C	66	30%	**46**
ECP32 L2 C	82	30%	**57**

Generator Type	400V @ 50Hz - 125/40°C (H)		
	Industrial Rating kVA	Derating	Grid Code Rating kVA
ECP34 1S2 A	100	30%	**70**
ECP34 2S2 A	125	30%	**88**
ECP34 1L2 A	156	30%	**109**
ECP34 2L2 A	170	30%	**119**
ECO38 1S2 A	158	30%	**111**
ECO38 1L2 A	208	30%	**146**
ECO38 2L2 A	300	30%	**210**

For applications with Class F temperature rise, refer to the following additional derating factors to apply to the Grid Code Rating column:

- **5%** when in Class H we apply 15%
- **10%** when in Class H we apply 20%
- **15%** when in Class H we apply 30%

Compliant And Ready

With the above range to be extended upwards over the next few years, Mecc Alte is your perfect independent partner for grid power alternators, totally focussed on the needs of OEM's to fulfil their obligations now and for the future.

MECC ALTE SPA (HQ)

Via Roma
20 – 36051 Creazzo
Vicenza – ITALY

T: +39 0444 396111
E: info@meccalte.it
aftersales@meccalte.it

MECC ALTE PORTABLE

Via A. Volta
1 - 37038 Soave
Verona – ITALY

T: +39 0456 173411
E: info@meccalte.it
aftersales@meccalte.it

MECC ALTE POWER PRODUCTS

Via Melaro
2 – 36075 Montecchio
Maggiore (VI) – ITALY

T: +39 0444 1831295
E: info@meccalte.it
aftersales@meccalte.it

ZANARDI ALTERNATORI

Via Dei Laghi
48/B – 36077 Altavilla
Vicenza – ITALY

T: +39 0444 370799
E: info@zanardialternatori.it

UNITED KINGDOM

Mecc Alte U.K. LTD
6 - Lands' End Way
Oakham
Rutland LE15 6RF

T: +44 (0) 1572 771160
E: info@meccalte.co.uk

SPAIN

Mecc Alte España S.A.
2 - C/ Rio Taibilla
Polig. Ind. Los Valeros
03178 Benijofar (Alicante)

T: +34 (0) 96 6702152
E: info@meccalte.es

CHINA

Mecc Alte Alternator Haimen
LTD
755 - Nanhai East Rd
Jiangsu HEDZ 226100 PRC

T: +86 (0) 513 82325758
E: info@meccalte.cn

INDIA

Mecc Alte India PVT LTD
Plot NO: 1, Sanaswadi
Talegaon
Dhamdhere Road Taluka:
Shirur, District:
Pune - 412208
Maharashtra, India

T: +91 2137 673200
E: info@meccalte.in

U.S.A. AND CANADA

Mecc Alte Inc.
1229 - Adams Drive
McHenry, IL, 60051

T: +1 815 344 0530
E: info@meccalte.us

GERMANY

Mecc Alte Generatoren GmbH
2 - Bucher Hang
D-87448 Waltenhofen Köln

T: +49 (0) 831 540755 0
E: info@meccalte.de

AUSTRALIA

Mecc Alte Alternators PTY LTD
10 Duncan Road, PO Box 1046
Dry Creek, 5094, South
Australia

T: +61 (0) 8 8349 8422
E: info@meccalte.com.au

FRANCE

Mecc Alte International S.A.
Z.E. la Gagnerie
16330 St. Amant de Boixe

T: +33 (0) 545 397562
E: info@meccalte.fr

FAR EAST

Mecc Alte (F.E.) PTE LTD
10V Enterprise Road, Enterprise
10
Singapore 627679

T: +65 62 657122
E: info@meccalte.com.sg

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