

GRID CODE COMPLIANCE ISSUES GROUP DISCUSSION

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FREQUENCY AND POWER

- New Gird Code requirements

	MINIMUM OPERATING DURATION	REDUCTION OF POWER max %
Between 49.5 Hz to 49 Hz.	5 hours	10
Between 49 Hz to 48 Hz.	3 minutes	10
Between 48 Hz to 47.5 Hz.	3 minutes	15
Between 47.5 to 47 Hz.	20 seconds	20
Between 50,5 Hz to 51 Hz	60 minutes	10
Between 51 Hz to 51.5 Hz.	15 minutes	According to "2"
Between 51.5 Hz to 52 Hz.	20 seconds	According to "2"

- Other limits apply in some countries eg. UK 95% power at 47Hz
- Manufacturers nominal capability:
 - 47.5Hz for 95% power (Issues Blade stresses and increased firing temp)
 - Siemens, RR and Solar can accept
 - Issues for engines with knocking on lower quality fuels.
 - ◆ Can be compensated by reducing power, 92% proposed
 - 52Hz. Need to verify acceptable duration for Solar products
 - ◆ Not considered a problem for engines

VOLTAGE

- Fault Ride Through
 - Different requirements in individual countries
- $U = 0v$ presents major issue for small/medium size generators
- Issues:
 - Shape of fault curve in the specific fault condition (curves only show worst case under which generator must remain connected)
 - Dynamics of the Grid
 - Machine and control system dynamics
 - Difficult to simulate the prescribed fault response.
 - Third party certification required
 - ◆ Is this necessary?
 - ◆ No currently capable competent body.
 - ◆ Potential costs to achieve this, type testing impractical
 - ◆ Project based equipment design
 - ◆ Cost of simulation or test is out of proportion to equipment cost

FAULT RIDE THROUGH

- Stability studies required to determine specific machine capability
 - Manufacturers can provide data to enable study to be executed
 - Which Grid?
 - ◆ Country?
 - ◆ Project?
 - ◆ Today, Future?
 - Manufacturers conduct studies independently?
 - Consider joint approach and cost sharing across industry??
 - ◆ Jacob to make proposal on the modelling required.

POWER FACTOR

- Requirement for 0.95 Lag / 1.0 / 0.95 Lead
 - ◆ Under-excitation giving large load angle and risk of losing synchronism
 - ◆ This requirement should be site specific not generic
 - Dictated by the voltage control scenario of the local grid
 - ◆ Applicable for Wind generation and larger units.
- Operating value can be dictated by network operator
- Manufacturers typical capability
 - ◆ Leading power factor operation should only be provided for specific applications

DROOP MODE OPERATION

- Active power control in 10% steps to 0% dependant on system frequency or on instruction from network operator.
 - ◆ This issue is subject to further study.
 - ◆ Emissions compliance can be an issue at reduced load for some machines
 - ◆ No common protocol for telecommunications
 - ◆ Could have adverse effect on project commercial operation
- Requirement to deliver full power immediately following system fault clearance
 - ◆ Machine time constants and loading capability must be taken into consideration.

REMOTE CONTROL

- Requirement for control of the equipment to be “included in the network operators control scheme”
 - GCB control
 - Active power limitation
 - Reactive power control
- These can all be accommodated if required by Network operator

PROTECTION

- Requirement for more sophisticated protection systems?
 - Cost is disproportionate to project value.

ISLAND OPERATION

- Many industrial Customers plan to disconnect in the case of grid disturbance in order to maintain plant operation during grid loss events.