Electric Power Generation

Presented by Jack Youssef
EPG Factory's

- **Americas**: 24 Sales Representatives
- **EMEA**: 88 Sales Representatives
- **India**: 18 Sales Representatives

- **MANKATO (USA)**: M&HV Alternators, 499 Employees
- **LEXINGTON (USA)**: LV Alternators, 1,014 Employees
- **REYNOSA (MX)**: LV Alternators, 1,014 Employees
- **ORLEANS (FR)**: LV Alternators, 810 Employees
- **SILLAC (FR)**: LV Alternators, 1,062 Employees
- **OLOMOUC (CZ)**: M&HV Alternators, 416 Employees
- **FUZHOU (CN)**: LV / M&HV Alternators, WTG, 650 Employees
- **HUBLI (IN)**: LV Alternators, WTG, 802 Employees
- **BANGALORE (IN)**: LV Alternators, WTG, 802 Employees

Asia Pacific: 44 Sales Representatives
Global OEM customers
Petroleum & Drilling Companies

We have been a power generation solution provider for Oil and Gas applications for over 40 Years with over 10,000 units sold worldwide.
“When you are on a rig like this, the generators are ‘everything’. They are more than very important; they are the ‘lifeblood’ of the rig. If you have no generators, you have no power”.

Drilling Rig Offshore Installation Manager
We Understand What’s Important to You

- Design options
- Reliability
- SAFETY
- Durability
- Service & Support
We Understand What’s Important to You

RELIABILITY

“Downtime = lost profits”
Reliability

Dependable Product for All Types of Environments

- Vacuum Pressure Impregnation (VPI) rotor and stator insulation systems to provide better and more consistent protection in harsh environments over traditional bake varnish insulation methods.

- Precisely layered insulating tape to ensure maximum insulation properties and optimum fit in the coil slot to reduce premature failure in severe conditions.

- IP56 mechanical protection (either TEAAC or TEWAC)

- Performance load impact management (LAM or U/F features)

- Ability to test to specifications and demonstrate compliance

Drilling rigs operate in very harsh environments with wide ambient temperature and humidity swings as well as salty air.

These conditions coupled with heavy, continuous duty challenges often test a generator’s mettle to the limit.
Reliability

Vacuum Pressure Impregnation
- A polyester or epoxy resin is applied to windings.
- Vacuum and pressure reduce voids in the insulation, which can cause partial discharge and lead to winding failure.
- Provides mechanical strength, heat transfer, dielectric strength and environmental protection.

Precisely layered insulating tape
- The insulating tape is applied precisely to the copper wire with manual or automated equipment.
- Protects the stator windings in harsh conditions which can help avoid critical failures and unplanned downtime.
Reliability

IEC IP56 / NEMA Compliance

• Electrical enclosure standard developed by the International Electro-technical Commission (IEC) and is a worldwide standard. In the U.S., the National Electrical Manufacturers Association (NEMA) sets similar standards for mechanical protection.

• IP56 enclosure is protected against dust (and other small particles) and is watertight against jetting water from any direction.

Voltage Regulation

• Digital regulator provides high accuracy of regulation +/-0.5%

• In case of important impact, AVR will secure the operation, avoiding to stall the prime mover.

• Efficient load management (LAM or U/F)

• The frequency drop is reduced to remain within ISO criteria.
Reliability

Comprehensive Testing and Certification

- Material traceability / process controls / documentation / formal test reports aligning the tests with specific areas of the specifications and confirming compliance

- Utilize formal process for witness testing and accommodations for multiple personnel simultaneously.

- Test facilities are available that have been designed and constructed around very stringent vibration requirements from the petroleum industry with (3) seismic bases to attain performance repeatability from our test floor to the OEM’s package setup.
We Understand What’s Important to You

DURABILITY

“Want it to last”

Flux, saturation

Thermal analysis

Air flow analysis

Emerson
**Durability**

**Long Life Cycle / Low Maintenance**

- Generator cores built to minimize core loss and heating.
- Copper damper windings to lessen heating caused by non-linear loads.
- Mica turn-taped copper wire in the stator coils to provide nearly twice the instantaneous surge withstand capacity over glass-covered copper wire. Turn insulation rated for 10,000v impulse (Surge or Spike).
- Anti-friction, grease lubricated, wide race designed bearings allowing a long life span
- When needed, opposite-drive end bracket insulator between the sleeve and bearing to avoid shaft currents flowing through the bearing which can damage the bearing surfaces.
- Full factory and field testing and “aging” process for all new product designs.

Oil and Gas operations running offshore or remotely with no grid or poor grid access depend on reliable, lasting on-site electrical power supply with lower maintenance requirements.

Our solution is designed with this critical need in mind. Our machines are built and tested to provide power that lasts.
Durability

Solid Rotor
- In specific turbine applications we can offer solid rotor in order to have an optimized behavior in terms of thermal losses, vibration and rigidity.

Mica Turn Taped Form Coils
- Mica turn tape is applied over enamel copper wire to provide significant dielectric margin to meet the surge/impulse requirements of industry specifications such as IEEE 522 and IEC 34-15.
- The mica turn tape is applied precisely to the copper wire with automated equipment.
- Mica over enamel is a better insulator than glass over enamel.
Durability

High Grade Magnetic Steel to Increase Efficiency
- Hysteresis and eddy-current losses reduced by low loss silicon steel

Damper Windings Provide Longer Life
- For critical applications, copper bars that run through the pole faces and are shorted together by the end plates.
- Option of a fully-connected cage to obtain maximum effect.
- Helps during parallel operation and load-induced harmonics (non-linear loads).
- Necessary to prevent torsional oscillation and instability on engine-driven generator sets.
Durability

Ball Bearing
- Economical yet durable
- Grease lubricated for easy maintenance
- Thrust capable
- Wide race (ring width) for better durability
- Long maintenance cycle (~2000 hours)
- Good for black start as no pre-lube is required

Sleeve Bearing
- Low maintenance cycle, infinite lifetime.

Bracket Insulator
- Prevents bearing fluting caused by shaft currents, which would cause:
  - Vibration
  - Bearing damage
  - Shaft damage
We Understand What’s Important to You

Design options

“Square meters on a platform are very expensive. Compact dependable solution is very much appreciated”
Design options

Global and Custom Solution Design

• Global standard designs or highly customizable options.
• IP Protection: IP23-IP44-IP54-IP55-IP56
• Various cooling options – WPII, ODP, TEWAC, TEAAC
• AREP, PMG and SHUNT options based on end application.
• Class B, F and H temperature rise / insulation
• Optimized fault current characteristics according to specification
• Can build to various standards and certifications including but not limited to:
  • NEMA MG1 / MG-1-22, 40
  • API-546
  • CSA Ex
  • ATEX according to IEC 60079-15
  • IEEE
  • IEC 60034
  • Shipping: ABS, DNV, RINA, NKK, Bureau Veritas, GL,

Over the years, rigs and other offshore vessels have added more motors, more control systems and electrical circuits increasing operation complexity. Our ability to create custom power for unique applications and standardized global designs for ease of replacement cater to these needs.
**Design options**

State of the art and patented innovative excitation systems

<table>
<thead>
<tr>
<th></th>
<th>SHUNT</th>
<th>AREP (PMI)</th>
<th>PMG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor Starting Capacity</td>
<td>Basic</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Short-Circuit Capability</td>
<td>No</td>
<td>300%/10s</td>
<td>300%/10s</td>
</tr>
<tr>
<td>Susceptibility to non-linear loads</td>
<td>Maximum</td>
<td>Minimal</td>
<td>Minimal</td>
</tr>
<tr>
<td>Possibility of Conversion</td>
<td>Yes (PMG)</td>
<td>Yes (PMG)</td>
<td>Yes (Shunt)</td>
</tr>
<tr>
<td>Alternator Length</td>
<td>Basic</td>
<td>Basic</td>
<td>Longer</td>
</tr>
<tr>
<td>Voltage Build Up</td>
<td>Residual Magnetism</td>
<td>Residual Magnetism</td>
<td>Permanent Magnets</td>
</tr>
<tr>
<td>Stator Design</td>
<td>Standard</td>
<td>Special</td>
<td>Standard</td>
</tr>
</tbody>
</table>

**Emerson**
# Design options

<table>
<thead>
<tr>
<th>Axial (traditional)</th>
<th>Axial &amp; Radial</th>
<th>Dual ventilation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple &amp; efficient</td>
<td>Improving cooling</td>
<td>Need cooling balancing</td>
</tr>
<tr>
<td>For small &amp; medium size and short core length</td>
<td>For large machine and long core length</td>
<td>For large and long machines high speed (4P)</td>
</tr>
<tr>
<td>- Improved stator &amp; rotor cooling</td>
<td>- Improved stator &amp; rotor cooling</td>
<td>- Improved stator &amp; rotor cooling</td>
</tr>
<tr>
<td></td>
<td>- Noise reduction</td>
<td>- Noise reduction</td>
</tr>
<tr>
<td></td>
<td>- Higher efficiency</td>
<td>- Higher efficiency</td>
</tr>
</tbody>
</table>
Design options

State of the art cooling systems

**ODP**
- IC01
- Water circulation

**TEWAC**
- IC8 A1 W7

**TEAAC**
- IC6 A1 A1
- Air outlet

**Warm Air**

**Cold Air**

EMERSON
We Understand What’s Important to You

Service & Support

“Expect on-site support”

“Wants partner able to support us”
What We Offer: Service and Support

Service Workshops
- Bearing Replacement
- Rotor or Stator Rewinding
- Winding Impregnation using VPI Process
- Painting
- Load Testing

Field Service
- Inspection & Repair
- Alternator Cleaning & Drying
- Preventive & Corrective Maintenance

Predictive Maintenance
- Vibration Analysis
- Partial Discharge Measurements
- Laser Alignment
- Thermo graphics
- Lubricant Analysis
- Investigation
- Remote Monitoring

Specific Services
- Installation
- Commissioning
- Service Contracts
- Extended Warranty
- Parts Distribution

Consultancy Service
- Energy Efficiency Audits
- High-Efficiency Solution
- Variable Speed Conversion
- Installed Base Management
- Training on Alternators & Regulators
We Understand What’s Important to You

SAFETY
Lives are at stake
Global and Custom Solution Design

- High protection
  Membrane in Terminal box to avoid its explosion in presence of default (valve effect)

- Brushless excitation system
  By standardizing rotating diodes and not using brush systems we avoid arching risk which is critical in hazardous environments

- Redundant diode bridges
Each project looks standard but has its constraints

Our teams are dedicated to helping you on the specificity of each project.

One base generator, five different customer solutions

Our products offer a solution to standard projects.
Thank you

Our global customer knowledge sharing event and technology exhibition.

300+ papers and workshops.

Thank You for Attending!
Enjoy the rest of the conference.