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CUTTING-EDGE INSIGHT **DELIVERED BY EXPERTS** AND **THOUGHT LEADERS** INCLUDING:

Our programs are diligently researched and curated in partnership with the Automotive Manufacturing community, to **ensure they address the most pertinent current challenges and key investment areas.** This level of detail is part of our pioneering approach to content and ensures that we attract the highest level of attendees.

Bob Galyen
Conference Chair: Retired Chief Technical Officer | CATL

Samaneh Sadri
Staff Engineer, HV Multiphysics Thermal, | Lucid Motors

Dr.Sankar Nallapati
Advanced Battery Module Engineer | General Motors

Nathan Saliga
Chief Engineer | One | Our Nex Energy

Michael Kaas
EV Applications Engineer | ATF Inc.

Gérard Quoirin
Product Engineer Battery Fluids | TotalEnergies Lubrifiant S.A.

James Herbison
Head of Battery Research | Elantas PDG, Inc.

Sarah Fezzey
E-Mobility Project Leader | SIKA

Brian Engle
Business Development Manager | Amphenol Sensors

Dr Yan Shao
Technical Marketing Manager | Wacker

Elliot Sedlecky
Business Development Manager | tesa

Fabian Brockmeyer
Lab Manager | tesa

Nico Eddelbuettel
Market Segment Manager | tesa

Tom Corrigan
Technology Development Manager | Lubrizol

Brett Trimmer
Applications Engineering Manager | NeoGraf Solutions, LLCs

Jason Blume
Product Marketing Manager | TDK Electronics Inc

Tom Stellmach
Head of New Body Products Business Unit | Mubea, North America

John Timmermann
Principal Scientist | Henkel

Wim Dexters
Sales Engineering Director, Americas | bdtronic Americas

Thomas Schwoerer
President | Zeltwanger

Daigo Masumoto
Manager, New Business Development | AdvanTech International

Kevin Hales
Automotive Innovation Mngr, Powder Coatings | AkzoNobel

Mekiyah Bailey
Field Application Engineer II | Parker Lord

Ishant Dudhwal
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THURSDAY 11TH MAY 2023 I
CROWN PLAZA, PALO ALTO, CA

CONFERENCE&EXPO I SERIES

JOIN NAs LARGEST ANNUAL EVENT FOR xEV BATTERY THERMAL MANAGEMENT EXPERTS

Directly Addressing The Key Challenges, Technology Strategies, Engineering, Material And System Solutions To Optimises Battery Life, Safety & Range

Beyond The Material: Reducing Cost & Complexity At System Level

Battery Thermal Management Innovation USA is the #1 conference & exhibition to match OEM and Battery Manufacturer requirements with expert material, solution, and technology providers.

Following the success over the past 4 annual events, this unique Californian meeting has grown exponentially becoming known as the industry best-in-class technical summit and foremost communication network for BTM practitioners, and in particular Battery Manufacturers and OEMs.

BTM Innovation USA is North America's exclusive forum for battery engineers, technologists and experts to collectively address the key challenges and industry innovations surrounding advanced BTMS, materials, technologies, solutions and system integrations; to increase efficiency, range, health, optimise solutions for increasingly demanding and ever advancing battery requirements, whilst reducing complexity and cost.

Curated through intensive research with the OEM community to ensure your learning objectives are met -the conference analyses the most crucial and up to date challenges and benchmarks strategic imperatives such as cost and mass production for next-generation BEV advancement. Attendance will provide you with an unbeatable platform for networking and knowledge sharing, and offer a way to generate new business, or ideas, through the power of information exchange with key decision makers and engineers with a shared purpose.

We welcome you to join over 400 xEV experts gathering this May for North America's largest technical conference for battery thermal management professionals; and foremost communication network for OEMs, technology and solutions providers alike.

KEY TOPICS

- Optimal Design Of Thermal Management Systems At System Level
- Next-Gen Cylindrical Cells: Thermal Management Challenges & Solutions
- Immersion Cooling For Thermal Management of Lithium-ion Batteries
- Cooling Strategies For/ Managing The Impact Of Fast Charging On Thermal Management Of Battery Pack
- BMS, Cooling Innovations, Different Cooling Circuit Layouts
- Heat Sink Optimization
- Evaluating Difference Platforms And Architectures For Battery Integration
- Future Of Battery Pack Design & Integration
- Optimal Battery Pack Design & Modularity
- Integrating Electronic Components Into The Battery Pack
- Breakthroughs & Innovations In Thermal Efficiency: Balancing Performance Of The System Battery Pack Design And Material Selection
- Simulation And Modelling For BEV Safety Optimization: Predicting Thermal Performance And State Of Health Of Battery Pack
- Robust Early Detection Of Thermal Runaway
- Thermal Adhesive, Sealant & Bonding Solutions: Disruptive Solutions For Battery Applications
- Improving Energy Density And Performance Of EV Battery Packs With Thermal Management Materials & Coatings
- The Role of Thermal Interface Materials in Battery Systems (TIMs)

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CATL NAATBatt INTERNATIONAL

SPEAKER
BOB GALYEN
RT. CTO CATL, CHAIRMAN NAATBATT

PROGRAM 2023

07:15

Registration | Morning Reception

Breakfast Buffet – Continental Breakfast

08:30

Chairs Opening Remarks | Optimizing The Whole Vehicle Architecture At A System Level

Bob Galyen, CTO NAATBatt, Retired CTO – **CATL**

- System integration optimization issues at a whole vehicle level
- What are the emerging design philosophies for different classes of BEV?
- How does this impact the design philosophy for the overall vehicle, including battery pack integration and thermal optimization?
- How do you incorporate cost optimization into your whole vehicle design concept to reduce the price of the vehicle?
- Battery pack integration/attachment, thermal optimization and multi-function component integration

08:50

What Can You Do At System Level To Reduce Cost And Reduce Complexity

Nathan Saliga, Chief Engineer, **ONE | Our Next Energy**

- Improving energy efficiency, balancing thermal performance and weight reduction
- Beyond just the material – deep diving into the whole system
- Reducing the total system cost when looking at the big picture
- How to reduce complexity
- Minimizing wasted energy and optimizing the battery pack for weight reduction

09:10

Assessing and Overcoming Abrasion During Meter-Mix-Dispense of Highly-Filled Thermal Interface Materials

Mekiyah Bailey, Field Application Engineer II, **Parker Lord**

Thermally conductive, liquid-dispensed gap fillers and adhesives (TIMs) are used widely in high-volume assembly of battery packs. TIMs form a crucial interface between the battery cells and the cooling structure of the battery packs or modules, to rapidly remove heat from the batteries and maximize battery lifetime and charge rates.

TIMs generally comprise of a liquid phase that is highly filled with thermally conductive particles, typically oxides or nitrides of aluminium or boron, which are abrasive by nature.

High-volume manufacturing requires movement of a large amount of material quickly using automated meter-mix-dispense (MMD) equipment, and fast movement of an abrasive material can create challenges for MMD suppliers.

This presentation will describe fast tests for evaluating material abrasion in the laboratory, and we will use the results of these tests to illuminate the factors of the material formulation that can affect inherent abrasiveness. We will then describe testing of selected materials in commercial MMD equipment to assess abrasiveness in practice.

- A fast abrasion test can rapidly assess relative abrasiveness between different formulations and
- can be used to understand material properties that affect abrasiveness, such as filler particle shape, size, and hardness, as well as total filler loading and material viscosity
- MMD equipment design parameters, such as construction materials and fluid flow design improvements, can also affect the amount of abrasion observed
- With a proper combination of material and MMD design properties, high-volume dispensing of filled thermal interface materials can meet the needs of automotive EV manufacturers

09:40

Fastener Evolution For Permanent Electrical Contact In Battery Joints With High Thermal And Dynamic Loads

Michael Kaas, EV Sales Engineer, **ATF Inc**.

Battery joints, where multiple components are interconnected, need to maintain permanent electrical contact under extreme conditions, including high thermal and dynamic loads. In this session, we will explore the evolution of fasteners for battery joints to meet the increasing demands of modern battery systems.

- Integration of traditional spring elements into one component, creating a built-in "clamp load sensor" that enables for immediate controllable clamp load for known input torque
- Higher clamp load retention after being subject to thermal and dynamic loads
- Creates permanent electrical contact in joints with low surface pressures

10:00

Immersion Cooling: Safe, Fast & Cool

Gérard Quoirin, PhD, Product Engineer Battery Fluids, **TotalEnergies**

- The immersion cooling concept is a real technological leap in lithium batteries
- Challenges in Immersion Cooling for EV Battery Thermal Management
- Opportunities and Benefits of Immersion Cooling for EV Battery Thermal Management
- Testing, Validation, and Safety Considerations in Immersion Cooling for EV Battery Thermal Management
- Immersive Cooling as the solution for achieving ultra-fast charging
- A dielectric fluid able to avoid any fire and thermal runaway propagation
- Design and process simplification for a lower cost and weight

10:20

Optimum Thermal Management: A Key Contribution to Battery Safety During Fast Charging Situations

John Timmerman, Principal Scientist, **Henkel**

- Current solutions using liquid GapFillers and GapPads as the key thermal interface between cells, modules, and the cooling system
- Next-Gen batteries will become part of the structural integrity of electric vehicles as high performance thermally conductive adhesives are developed
- Thermal interface material selection and processing for the unique challenges of battery applications
- What are the material design blocks beyond thermal conductivity and lap shear strength? What needs to considered for the processing of a highly filled abrasive material?
- The presentation will show the material supplier development building blocks, selection considerations, and process functionality to help understand the thermal material value chain

- **Key take aways:**

- Selection Criteria for a multi-functional Thermal Interface Materials
- New Thermal Conductive Adhesives for Cell2Pack and Cell2Car designs
- Relevant process technology for dispensing abrasive filled materials

10:40 ELANTAS

Thermal Management & Bonding Of Lithium Battery Cells & Modules

James Herbison, Head of Research, **Elantas**

- Thermal Management Strategies for Lithium Battery Cells & Modules
- Bonding Techniques for Lithium Battery Cells & Modules
- Challenges and Opportunities in Thermal Management & Bonding of Lithium Battery Cells & Modules
- Bonding the battery cell/modules to form packs (to the heat sink, individual packs, or the modules to each other)
- Gap filling between the modules
- Thermal management materials taking heat from the modules or packs through to the heat sink
- Sealing of the module or box that the batteries are packed into
- Safety Considerations and Future Directions

11:00

Morning Networking Break -

Breakfasts Burritos

11:40

Enabling Simplicity In Battery Systems, From Concept To Assembly

Sarah Fezzey, E-Mobilty Project Leader, SIKA

Electric vehicle (EV) battery systems are complex assemblies that require careful design, manufacturing, and assembly processes to ensure optimal performance, safety, and reliability.

In this session, we will explore the challenges and opportunities in simplifying the entire lifecycle of EV battery systems, from concept development to assembly processes, with the goal of achieving efficient, cost-effective, and scalable battery systems for the growing EV market.

- Streamlining Battery System Design and Integration
- Simplifying Battery System Manufacturing Processes
- Enabling Efficient Battery System Assembly
- Challenges and Opportunities in Simplifying EV Battery Systems
- Thermal Interface Material solutions for management of thermal transfer improved performance, efficiency and longevity of batteries in both manufacture and service
- Circular economy as a driver of innovation; for better battery design, manufacturing, upcycling, recycling and reuse of batteries
- Concept to assembly, whether a small pilot line or large scale Gigafactory – development and scalability for mass manufacture

12:00

Robust Early Detection Of Thermal Runaway: Sensor Design And Optimization For xEV, EVSE & ESS Thermal Management

Brian Engle, Business Development Manager, **Amphenol Advanced Sensors**

- How to quickly identify initial cell vent-fast detection enables rapid countermeasures
- New sensor technology to detect thermal runaway
- Stressed Li-ion batteries can undergo failure through a variety of factors – resulting in an internal reaction that generates heat and causes chemical decomposition of the cell, which can rapidly accelerate into thermal runaway
- The evolution of new combined thermal management systems for xEV applications
- Design considerations for measuring critical control parameters for heat pump and heat exchange systems
- Measurement challenges for thermal management control
- Sensor design and packaging for harsh environment HP/HX measurement

12:20

Formulated Heat Transfer Fluids for Immersion Cooling

Tom Corrigan, Technology Development Manager, **Lubrizol**

- Enabling efficient performance and durability of batteries and electronics prone to high temperatures degradation
- Benefits of immersion cooling for battery thermal management
- Selecting a thermal management fluid by balancing coolant thermal performance and safety in battery thermal runaway scenarios
- Differentiation between base oils and formulated fluids
- EVOGENTM Battery Thermal Management Fluids

12:40

EV Thermal Management For Faster Charging, Extended Range, And Propagation Prevention

Bret Trimmer, Application Engineering Manager, **Neograf Solutions**

- Thermal management is a critical aspect of electric vehicle battery systems, with significant implications for faster charging, extended range, and propagation prevention. This conference session aims to provide a comprehensive overview of the challenges and opportunities in EV thermal management, exploring advancements in technologies, strategies, and best practices to optimize thermal performance in EVs.
- Five factors control how fast EVs can be charged. Only one is controllable by the pack designer
- EV driving range is influenced by the thermal management materials used there are four primary methods of controlling thermal runaway, with benefits and drawbacks
- Cell Cycle Lifetime is strongly influenced by your thermal management method

13:00

Optimizing EV Battery Design And Thermal Performance With Adhesive Tapes

Elliot Sedlecky, Business Dev Manager
Fabian Brockmeyer, PhD, Lab Manager
Nico Eddelbuettel, Market Segment Manager
tesa tape

- Adhesive tapes enabling battery lid protection
- Lamination of thermal insulation materials with pressure sensitive adhesive tapes
- Encapsulation of fibrous thermal insulation materials for improved cleanliness
- Mounting of various sheets, foams and other materials in the battery pack
- Saving weight and space in battery packs with adhesive tape based venting solutions

13:40

Powder Coating Solutions For BEV Components

Kevin Hales, Automotive Innovation Manager, **Powder Coatings, Akzonobel**

Powder coating can play a critical role in protecting and enhancing the performance of various components. This session will focus on the latest developments, applications, and challenges of powder coating solutions for BEV components.

- Advancements, Applications, Performance and Environmental Benefits of Powder Coating in BEV Components
- Challenges and Considerations in Powder Coating for BEV Components
- Future Trends and Opportunities in Powder Coating for BEV Components
- Analysing the protective properties for the battery pack to insulate electrical systems and prevent the build-up of heat in batteries to ensure they perform safely at the optimum level.
- Looking at cell to cell electrical insulation for even the most intricate designs. Be it a cylindrical and prismatic cell surface, it provides high dielectric strength property, extraordinary adhesion performance and exceptional thermal shocking resistance.

13:40 AkzoNobel

Networking Lunch Break

14:40

Adaptable Cure Silicone Adhesive And Battery Safety Silicones

Dr. Yan Shao, Technical Marketing Manager, Wacker Chemie

This session will focus on the latest advancements, applications, and safety considerations of adaptable cure silicone adhesives and battery safety silicones for EVs.

- Adaptable Cure Silicone Adhesives for Battery Assembly
- Battery Safety Silicones for Thermal Management
- Applications of Adaptable Cure Silicone Adhesives and Battery Safety Silicones in EVs
- Safety Considerations and Performance Evaluation of Adaptable Cure Silicone Adhesives and Battery Safety Silicones
- Future Trends and Opportunities in Adaptable Cure Silicone Adhesives and Battery Safety Silicones
- Basic process and chemistry of silicone materials
- New adaptable cure silicone adhesive and it's advanced properties at high temperature
- Designed materials for battery safety applications in thermal events

15:00

Heat Everywhere! The Expanded Application Demands for EV Thermal Management

Jason Blume, Product Marketing Manager, **TDK Electronic Inc.**

- How to measure temperature in the battery pack, E-motor, and Battery Disconnect Unit
- What are the key challenges in Heat Pump and Battery Cooling system in the primary and secondary loop
- Discover TDK sensor solutions for EV applications.
- Understand the key requirements in EV applications

15:20

Rollbonding For Battery Cooling Plate Applications

Tom Stellmach, Head of New Body Products, **MUBEA North America**

Rollbonding is a widely used manufacturing process for producing battery cooling plates with improved thermal conductivity, mechanical properties, and durability. This session will focus on the latest advancements, challenges, and opportunities in the field of rollbonding for battery cooling plate applications in EVs.

- Rollbonding Process for Battery Cooling Plates
- Material Selection and Design Considerations for Battery Cooling Plates
- Performance Evaluation and Testing of Battery Cooling Plates
- Advances and Innovations in Rollbonding for Battery Cooling Plates
- Challenges and Opportunities in Rollbonding for Battery Cooling Plates
- Explore alternative joining enabled by rollbonding
- Review architectures enabled by formable plates
- Discuss benefits of single alloy recyclability

15:40

Improved Methods For Leak Testing Lithium-Ion Batteries

Thomas Schwoerer, President, **Zeltwanger**

Leak testing is a critical step in the manufacturing process to identify potential leaks in battery enclosures or cells that could result in performance degradation or safety risks. This session will focus on the latest advancements in leak testing methods for lithium-ion EV batteries, including novel techniques, equipment, and approaches that offer improved accuracy, efficiency, and reliability.

- An introduction to battery leak testing outlining the key challenges
- Challenges and Requirements of Leak Testing Lithium-Ion Batteries
- State-of-the-Art Leak Testing Methods for Lithium-Ion Batteries
- Novel Techniques and Approaches for Leak Testing Lithium-Ion Batteries
- Benefits and Advantages of Improved Leak Testing Methods
- Comparing testing with air vs tracer gases
- Identifying different measurements methods and parameters
- System applications for air and tracer gases

16:00

Converted Thermal Management Solutions: Single SKU, Multiple Performance Benefits

Todd Wright, CEO, **JBC Technologies**

Where and how custom converted performance materials can be used in and around the EV Battery Pack to:

- Maintain consistent operating temperatures
- Improve driver experience by enabling faster charge & increased range
- Enhance occupant safety by blocking heat transfer & mitigating thermal runaway
- Support vehicle lightweighting

- Materials that can be used to spread, shield, and isolate heat
- How to use specialty adhesives to fabricate multilayer laminated solutions
- Flexible material conversion technologies that enable JBC to convert specialty materials, each with its own performance attributes, into single, lightweight, economical, easily-installable components with multiple end-use contributions – and a single SKU!

16:20

New Process Solutions For Battery Systems Manufacturing

Wim Dexters, Sales Engineering Director, bdtronic, Americas

- The manufacturing processes for batteries and where our technologies can be applied;
- Challenges of dispensing thermal materials, volume shot sizes, etc.
- The importance of surface pre-treatment in battery application
- Heat staking and the need to have good process control to achieve consistency and strong rivets

16:40

What Methods Are Used for Thermal Management of EV Batteries?

Kris Hanson, Account Manager, Polymer Science, INC

- Thermal Management Solutions: Less is more from Gap Fillers
- Gap Filler Materials and Properties
- Gap Filler Design Considerations
- Performance Evaluation and Testing of Gap Fillers
- Advances and Innovations in Gap Filler Technology
- Challenges and Opportunities in Gap Fillers for Battery Thermal Management
- So what is a two-part dispensable gap-filler?
- Pro's and con's of a two-part dispensable gap-filler
- How to choose: Functional properties, considering the cure point

17:00

Networking Break

17:40

Cell To Vehicle Optimization Loop For Battery Thermal Management

Samaneh Sadri, Staff Engineer, HV Multiphysics Thermal, **LUCID Motors**

This session will focus on the concept of a "Cell to Vehicle Optimization Loop" approach for battery thermal management, which considers the integration of thermal management strategies at the cell, module, and vehicle levels to achieve optimal performance, safety, and reliability.

- Vehicle level: How the battery thermal management affects overall vehicle performance
- Pack/module level: How the cooling strategy affects the battery pack design and packaging
- Cell level: How various cell types and cooling strategies affect cell performance
- Battery systems level: How to close this loop to design an optimized cooling system

18:00

Virtual Twins For Battery Engineering

Ishant Dudhwal, Portfolio Development Executive, **Siemens Digital Industries Software**

Virtual twins, also known as digital twins, are virtual representations of physical systems that can simulate and predict their behavior in real-time. This session will focus on the applications, benefits, and challenges of virtual twins in the context of EV battery engineering. We will explore how virtual twins can be used to accelerate battery development, improve performance, and enhance safety in EVs.

- Understanding Virtual Twins for Battery Engineering
- Applications of Virtual Twins in Battery Development
- Benefits of Virtual Twins for Battery Engineering
- Challenges and Future Directions of Virtual Twins for Battery Engineering
- Digital Twins to optimize battery performances over a wide range of operating conditions while preventing safety issues and reducing battery cost
- Exploring end-to-end solutions that capture all scales: From chemistry to cell engineering, to module and pack engineering and full vehicle integration
- From electro-chemistry modelling, to optimally designed battery materials for aging, system simulation for cells, modules and packs

18:20

xEV Cold Plate Optimization

Janine Powell, Senior Manager, NA/EU Vehicle Components Div. , **AdvanTech International**

Cold plates are critical components in the thermal management of battery electric vehicles (BEVs) and other xEVs, as they are responsible for removing heat from the battery pack during charging and discharging operations. This session will focus on the latest advancements in cold plate optimization for xEVs, including design considerations, performance benefits, and emerging technologies. We will explore the challenges and opportunities in this field, discussing how optimized cold plate designs can improve the thermal performance, efficiency, and reliability of xEV battery systems.

- Understanding Cold Plate Design and Performance
- Optimization Strategies for xEV Cold Plates
- Performance Benefits of Optimized Cold Plates for xEVs
- Emerging Technologies in xEV Cold Plate Optimization
- Real-world Applications and Case Studies of Cold Plate Optimization in xEVs
- How efficient and accurate cooling of an electric vehicle batter cold plate is ensuring optimum performance, better reliability and lifecycle return on investment

18:40

Engineering Single-Phase Immersion Cooling For Thermal Management Of Lithium-Ion Batteries

Gary Testa, President & CEO **Engineered Fluids Inc.**

- Understanding Formulated Heat Transfer Fluids for EV Immersion Cooling
- Performance Benefits of Formulated Heat Transfer Fluids for EV Immersion Cooling
- Safety Considerations in Formulated Heat Transfer Fluids for EV Immersion Cooling
- Applications and Case Studies of Formulated Heat Transfer Fluids in EV Immersion Cooling
- Future Directions and Emerging Technologies in Formulated Heat Transfer Fluids for EV Immersion Cooling
- Exploring coolants compatibility with materials used in Battery Management Systems
- Demonstration of how immersion Cooling with AmpCool extends battery life
- How to prevent fire propagation between battery cells using AmpCool Coolant

19:00 - 19:20

Chairs Closing Remarks

All Attendee Drinks Reception

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JOB TITLES CROSS SECTION 2022

Chief Engineer, Chief Scientists, **Head of Research,** Thermal Management – Battery Systems, **Vice President Battery Cell Process & Manufacturing Engineering,** Electrochemist, Advanced Battery Cell Engineering, **Materials and Manufacturing,** Battery Module Thermal Management, **Simulation engineer/ HV Battery thermal management,** Director High Voltage Battery Systems, **Battery Management Systems Engineer,** Director Battery Pack Design and Thermal Management, **Chief Engineer,** Battery Systems Management Engineer, Sr. Adv. Battery Modeling Engineer, **Sr. Staff Battery Cell Engineer,** Senior Project Manager, **Battery Cell ManufacturingFluids and Thermal Management,** R&D Engineers, **Thermal Management Lead Engineers,** Electrified Powertrains, Battery Research and Systems Engineers, **HV Battery Design and Testing,** Chief Engineer, **Thermal Management HV Components, Thermal Management Modules Battery Electrical Vehicles,** Battery Management Systems (BMS) Designer, **Battery Management Systems (BMS) Engineer,** Chief Technology Officer, Senior Mechanical Engineer, **Materials Engineer,** Powertrain Project Management, **Senior Thermal Multi-Physics Engineer,** Energy Storage Systems (ESS) Safety Engineer, **Technical Specialist,** Hardware Engineering, Director Product Manager, **Director of Advanced Thermal Systems and Technology,** Battery Safety Engineer, **Senior Battery Technology Engineer,** Director – Manufacturing Engineering, **Senior Cell Engineer,** Lead Engineer Thermal Management System, **Thermal Management Research Engineer,** Projecthouse Thermal Management Modules, **Head of EV Battery Systems,** Thermal CFD Engineer, Predictive Thermal Management High-Voltage Battery, **Senior Engineer – Virtual Design Development and Verification, Electrification Battery Thermal, Technical Lead – Thermal Management,** Analyst – Battery Thermal Management, **Team Leader – Battery Modeling and Diagnostic,** R&D (Battery Thermal System), Thermal Management CAE Engineer, **Senior Manager- Battery Thermal Simulations,** Battery Packs – Electrical, **Mechanical Thermal components Team Leader,** HV Battery Cell Vent Management Supervisor, Senior Director, **Battery Storage,** Platform Battery Thermal Management Process engineering, **Director Thermal Management HV-Battery,** Director Battery System Product & Platform Management, **EV-Battery Production and Production Planning,** Thermal Systems Architecture Engineering, **Thermal Simulation Lead,** Director of Battery Cell and Module Technology

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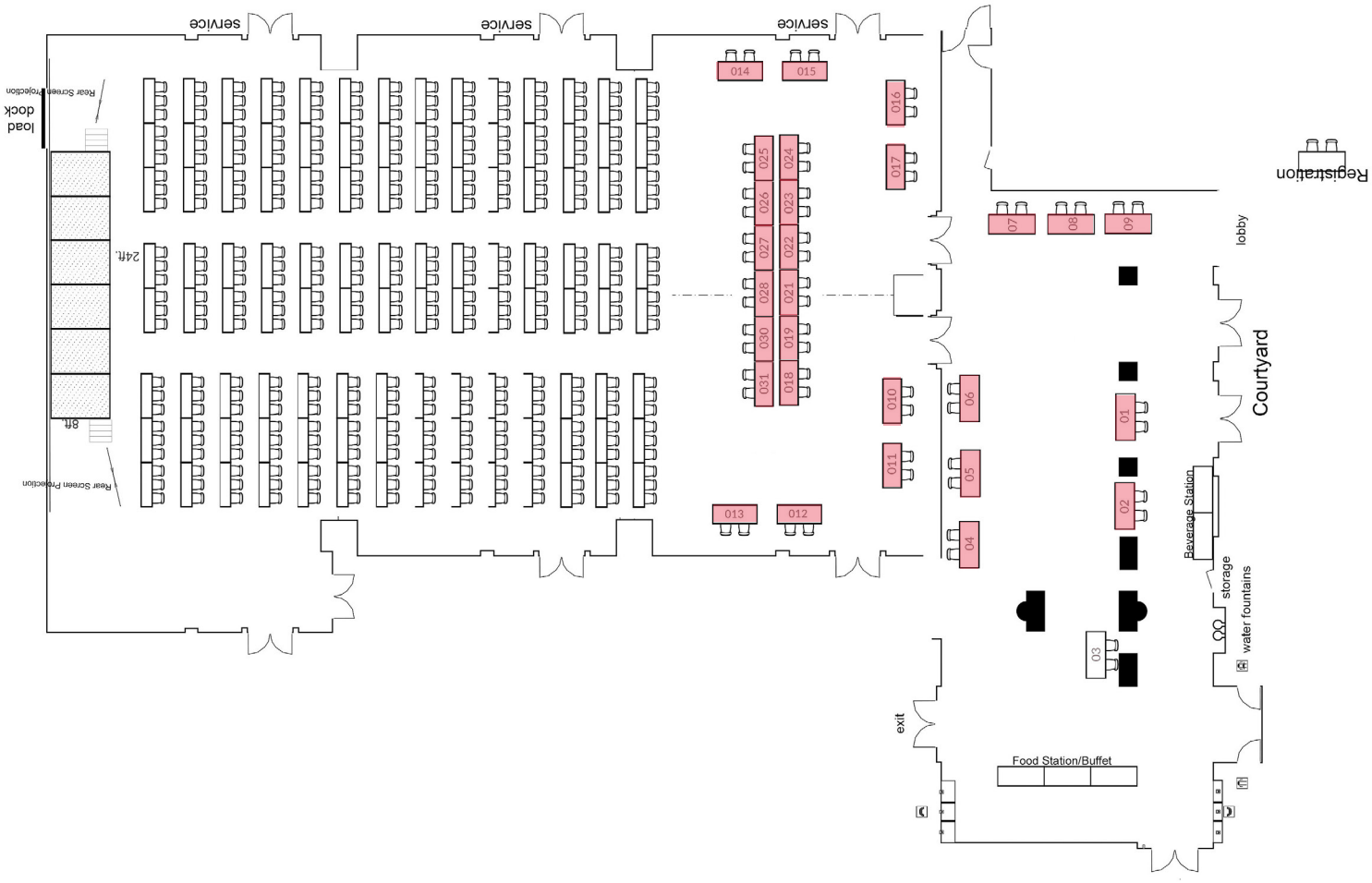

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2	NEOGRAF SOLUTIONS	8	CALGY	14	Parker Lord	21	Henkel	27	JOYSON SAFETY SYSTEMS
3		9	ELANTAS	15	Parker Lord	22	bdtronic	28	ZELTWANGER
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