CURTIS
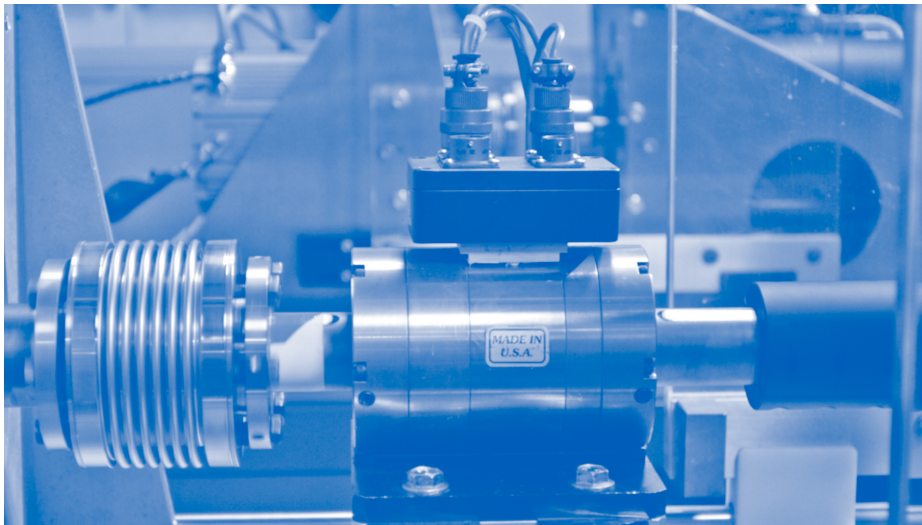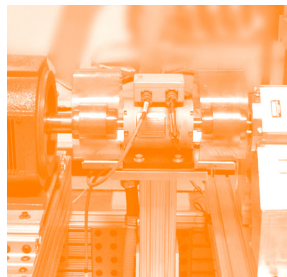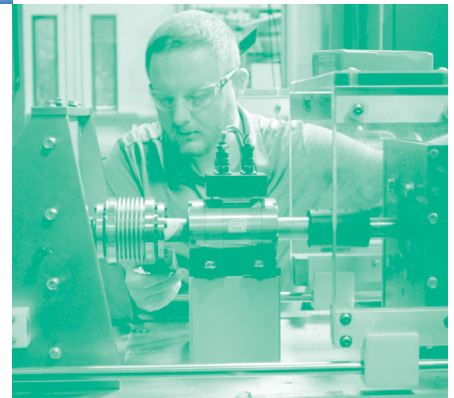
Curtis Dynamometer Services

PMAC Motor Analysis

Motor/Controller Matching

Performance Measurements

Extended Performance Measurements
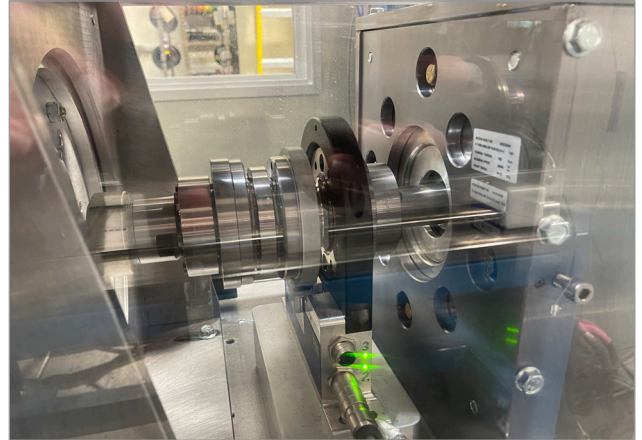
Curtis Dynamometer Services

Curtis Instruments provides a comprehensive set of expert dynamometer services to motor speed controller/ inverter customers, in-house in our major engineering centers. OEM customers can rely on Curtis EV specialists to perform these critical services quickly, efficiently, and accurately. EV motor and vehicle manufacturers benefit from decades of Curtis EV expertise.

The Curtis California R&D Center in Livermore, for example, has full-time, dedicated staff for dynamometer services and a complete set of state-of-the-art equipment, including:

- Himmelstein and HBM high precision torquemeters.
- Yokogawa WT5000 three phase power analyzers.
- Regulated power supplies allow stiff voltage control or battery emulation.
- LEM current sensors.
- Seven dynamometers.
  – Max torque ratings from 10 Nm to 550 Nm, optimized per motor size.
  – Max speeds to 15000 rpm.
  – 12V to 400V DC bus voltage.
- Liquid or air motor and controller cooling.

CURTIS DYNAMOMETER SERVICES INCLUDE:

Stage 1: Motor/Controller Matching

For PMAC motors and 1222 steering motors, this service is required for operation with Curtis controllers. For ACIM motors, we offer the option of autocharacterization.

The key advantages are:

- Ease of installation with Motor_Type ™ assigned.
- Higher efficiency operation (more torque, lower current).
- Torque estimate (safer operation, enables controller feature not available otherwise).
- Less torque ripple at high speeds.
- Enables controller features otherwise unavailable.
- May be necessary for some regulatory standards compliance.

Stage 1 includes:

- Motor/controller matching to enable optimized operation with any Curtis E or F series controllers.
- A Motor_Type will be created for each motor characterized and entered in the firmware database, permitting simple setup in the field.
- The Motor_Type generates a real-time torque estimate, useful for various controller features and customer monitoring.
- Beta software for development work, including the Motor_Type, will be created upon completion of the dyno work.
- Released software for production, including the Motor_Type, will be created within one month.

Curtis Dynamometer Services
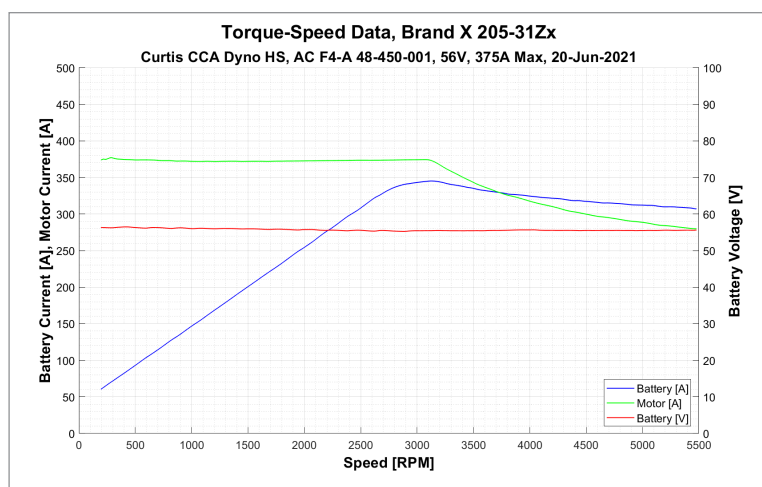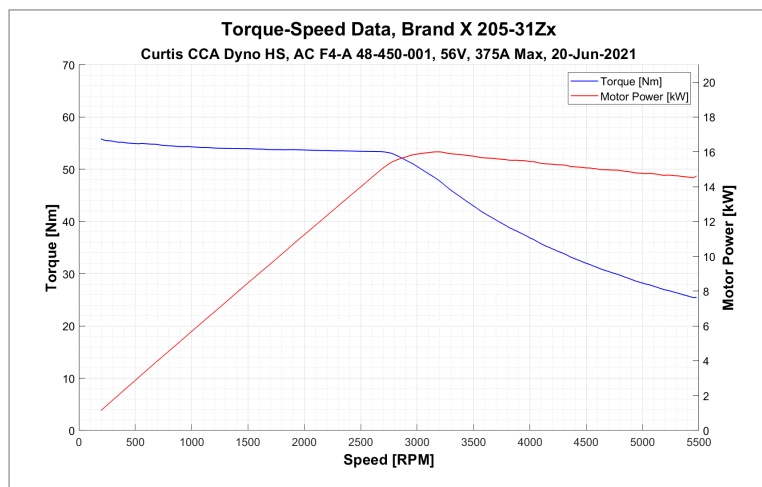
CURTIS DYNAMOMETER SERVICES continued:

Stage 2: Performance Measurements (Torque-Speed Curves)

Curtis uses the controller of customer's choice for the application and provides a torque-speed curve at one current and voltage.

- Optionally, Curtis can take measurements at different currents and/or voltages. For example, this test could indicate how the same motor/controller combination performs with a 56V bus versus a 48V bus, or the effect of a higher current controller.

Stage 2 includes:

- Stage 1 services.
- Torque-speed curves measured at the performance envelope given the voltage, max current, and maximum speed requested by the customer.
- Plots indicating motor torque, motor power, bus current, bus voltage, system efficiency, and motor current.

    (The underlying data are provided to the customer in Excel and MATLAB format).

Torque-Speed Data, Brand X 205-31Zx
Curtis CCA Dyno HS, AC F4-A 48-450-001, 56V, 375A Max, 20-Jun-2021

Torque-Speed Data, Brand X 205-31Zx
Curtis CCA Dyno HS, AC F4-A 48-450-001, 56V, 375A Max, 20-Jun-2021
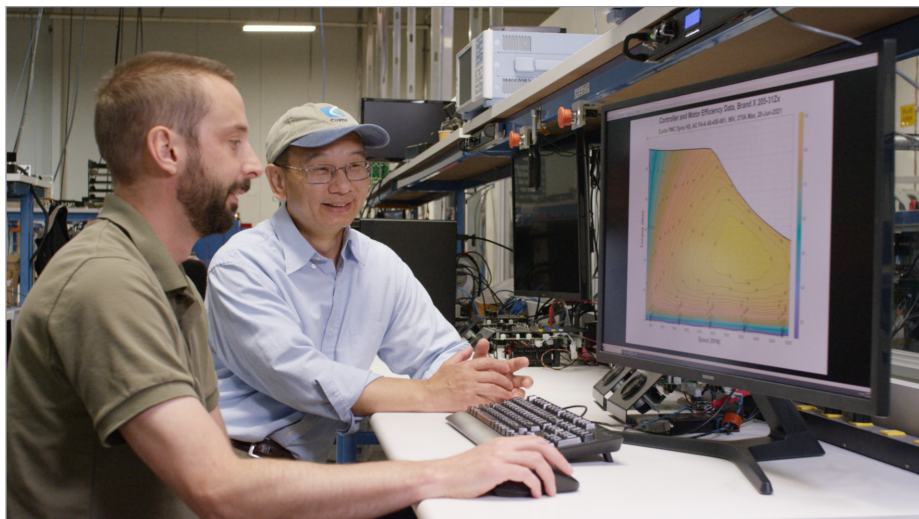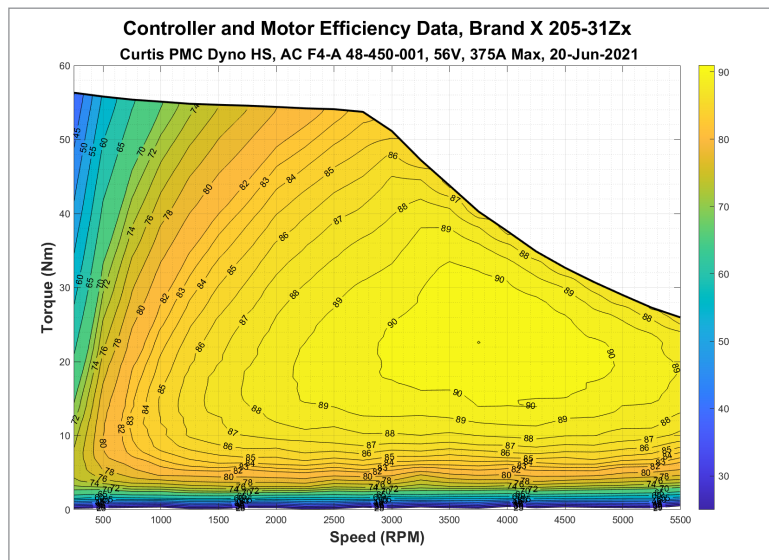
Curtis Dynamometer Services

Stage 3: Extended Performance Measurements (Efficiency Contour Curves)

These services will be advantageous to any customer simulating range/energy usage over a drive cycle, thermal performance, etc.

Stage 3 includes:

- Stages 1 and 2 services.
- System Efficiency contour plots showing the combined motor and controller efficiency over the entire torque-speed area.

  (The underlying data are provided to the customer in Excel and MATLAB format).

Controller and Motor Efficiency Data, Brand X 205-31Zx
Curtis PMC Dyno HS, AC F4-A 48-450-001, 56V, 375A Max, 20-Jun-2021

Curtis Dynamometer Services

CURTIS DYNAMOMETER SERVICES continued:

Stage 4: PMAC Motor Analysis

Only for PMAC motors, this stage includes all services of stages 1, 2, and 3. Motor manufacturers and OEMs who design their own motors benefit from the ability to correlate their simulated FEA data with real world measurements.

Full PMAC motor model identification is provided.

Stage 4 includes:

- Rs stator resistance.
- Short circuit current vs speed, short circuit torque vs speed.
- Ld saturation map.
- Lq saturation map.
- Magnet flux linkage.
- Optimized max torque per amp (MTPA) map.
- Optimized max torque per volt (MTPV) map.
- Id-Iq plane results.

Additional Services

OEM manufacturers are also able to add:

- Drive cycle testing. Monitoring energy usage and motor thermal performance over a customer-provided drive cycle.
- IEC duty cycles, e.g. S1 continuous, S2 short term, S3 intermittent etc.
- Position sensor performance analysis.
- Torque ripple analysis.
- (NVH) Vibrational harmonic analysis, order analysis.
- BEMF harmonic analysis.

We're ready to help you.

Please contact your local Curtis sales representative for pricing and to arrange a consultation.