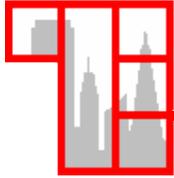


## DOCKETED

<b>Docket Number:</b>	15-MISC-03
<b>Project Title:</b>	Proposed Compliance Option for Data Centers Using a Refrigerant Economizer
<b>TN #:</b>	205666
<b>Document Title:</b>	Taylor Engineering Comments on Title 24 - 2013
<b>Description:</b>	N/A
<b>Filer:</b>	Mark Hydeman
<b>Organization:</b>	Taylor Engineering, LLC
<b>Submitter Role:</b>	Other Interested Person
<b>Submission Date:</b>	8/10/2015 12:29:12 PM
<b>Docketed Date:</b>	8/10/2015



August 10, 2015

California Energy Commission

Dockets Office, MS-4

Re: Docket No. 15-MISC-03, Proposed Compliance Option for Data Centers using a Refrigerant Economizer

1516 Ninth Street

Sacramento, CA 95814-5512

docket@energy.ca.gov

Subject: Comments on Title 24 2013 Docket No. 15-MISC-03, Proposed Compliance Option for Data Centers using a Refrigerant Economizer

Dear Sir or Madam:

My company, Taylor Engineering, LLC, was retained by the PG&E Codes and Standards Team through a Sub-Contract to Energy Solutions to review the Emerson Proposed Compliance Option for Data Centers using a Refrigerant Economizer, Docket No. 15-MISC-03.

We performed a thorough review of all of the material posted on the CEC website for this Docket, and similar material provided to the ASHRAE SSPC 90.1 as a code change proposal. We found that the procedures documented were not fully described in the Docket filing. We corresponded with the Docket authors on our concerns, and convened a net meeting with the authors of this proposal, members of the PG&E Codes and Standards team and others on July 31<sup>st</sup>, 2015 (see attendance list below). After reviewing all of that material and participating in the net meeting, **I have concluded that the proposed energy savings calculations are reasonable. I have also concluded that the materials provided to the public for review are lacking in both scope and clarity.** My recommendations for additions to and corrections for the materials in docket are detailed below. I have already reviewed most of these with Emerson and they have agreed to provide the data.

## Docket Document Review Comments

### *Excel WorkBooks*

The docket contains two sets of Excel Workbooks:

- Files with “Performance Data from Emerson” in the file name (e.g., the file, “Liebert DSE DA080 Performance Data - From Emerson.xlsx”) which document the generation of the performance curves from data generated by the Liebert Rating System Program (aka “LRS”).
- Files with “Regression Analysis” in the file name (e.g., the file, “Liebert DSE DA080 – Regression Analysis.xlsx”) which document the conversion of the performance curve data into the EnergyPlus capacity (CAPF\*) and energy (EIR\*) functions.



In all there are 5 sets of spreadsheets (10 total) that describe 5 capacities of Liebert DSE products: DA080, DA085, DA125, DA150, and DA165.

### **Excel Workbook Review Comments**

1. The Excel Workbooks have multiple worksheets. These sheet names should each be clearly labeled based on their function. For example, the file, “Liebert DSE DA080 Performance Data - From Emerson.xlsx” has 5 work sheets called *Sheet1*, *Sheet2* and so on. Sheet 1 depicts the DSE system power as a function of outside air dry-bulb and wet-bulb. This sheet should be labeled something like “*Pwr Fn(OATdb, OATwb)*.” Similarly *Sheet2* has the data for power as a function of evaporator airflow. It should be named something like *Pwr Fn(EvapLPS)*.
2. Whenever a temperature is listed it should be labeled as either outside (condenser) or inside (evaporator) conditions using standard abbreviations like OATdb or EvapLATdb.
3. All graphs should have titles on the Axes and keys for graphs with multiple lines. For example, in Sheet1 of the same workbook there is a graph of unit gross total cooling capacity in kW as a function of outside air dry- and wet-bulb temperatures. It needs a horizontal axis label like, “*GTCC(kW)*”; a vertical axis label like “*Ambient OA(F)*”; and a key with each of the coincident wet-bulb lines identified by its color (the teal line at the top is 75F Twb).
4. Terms that are not clearly defined in a definitive publication like an ARI standard or the ASHRAE Handbook of Fundamentals (HOF) Definitions Chapter must be labeled. For example, GTCC(kW) in Sheet1, Cell A1 is not defined. Nor is NTCC in Sheet 1, Cell A28. Add a sheet called something like, “*Abbreviations*” to identify non-standard terms. In general you should avoid using non-standard terms. Also all terms and abbreviations should be in a glossary.
5. Formulas should use named ranges for clarity. For example, cell E2 on Sheet1 in the file, “Liebert DSE DA080 Performance Data - From Emerson.xlsx,” contains the formula. “A2/\$A15.” This is not clear. A2 is the current gross total cooling capacity in kW and A15 is the nominal gross total cooling capacity in kW at a standardized condition. The cells A1 to A26 on Sheet1 should be named “*GTCC(kW)*” using a named range. Similarly Cell A15 should be named something like, “*RatedGTCC(kW)*.” Cell E2 would then read, “*GTCC(kW)/ RatedGTCC(kW)*” which is far more transparent. This same philosophy should be applied to all of the spreadsheets.

### ***Liebert DSE Modelling Input Data.PDF***

The File, “Liebert DSE Modelling Input Data.PDF,” documents the nominal rating conditions, and the performance curves, CAPF\* and EIRF\* generated in the spreadsheets with “Performance Data from Emerson” in the file name.



**Liebert DSE Modelling Input Data.PDF Review Comments**

1. This document should refer back to the appropriate workbook(s) and worksheet(s) where each of the data are generated.

***Additional Information Needed for This Docket***

The following additional information is needed in the docket for public review:

1. A listing of all of the documents provided in the docket with a brief description of what the purpose of that document is. Groups of similar documents like spreadsheets named “*Liebert DSE DA080 Performance Data – From Emerson.xlsx*” *et. al.* could be grouped together.
2. An overall process flow diagram or detailed description that goes from the physical equipment testing through the generation of the EnergyPlus performance curves. This should include references to each of the files in the docket as appropriate.
3. A copy of the slides provided in our 7/31/2015 net meeting (the file named, “*Emerson-Liebert Summary for PG&E 31-July-2015 final.PDF*”). These should be annotated as appropriate for public review.
4. A description of the Emerson test facility for both the interior and exterior chambers. This should include a list of standards adhered to in these tests and certifications for the facilities. This should also include the details of instrumentation accuracy and calibration or the Standards to which this instrumentation is held.
5. An overview of the procedures that were used to validate the LRS program. This is the program that generated the performance data from which the Energy Plus capacity and power functions were generated.

Sincerely,

Taylor Engineering LLC

Mark Hydeman, P.E.

Principal



**Attendee List for our Net Meeting on July 31<sup>st</sup> 2015**

Mark Hydeman, Taylor Engineering, LLC, Principal

Steve Taylor, Taylor Engineering, LLC, Principal

Jeff Stein, Taylor Engineering, LLC, Principal

Heidi Hauenstein, Energy Solutions

Marshall Hunt PG&E, Codes and Standards

Stuart Tartaglia, PG&E, Codes and Standards

Ben Dolcich, Emerson, Engineering Director

Steve Madera, Emerson, VP of Global Sales

John Boggs, Emerson, Application Engineering Manager

Greg Haig, Emerson, Product Manager for DSE

Shelin Lin Liebert, Emerson, Advanced Development Group.

Christian Hurd, AlaJor Engineering, Inc

Dave Kelly of Emerson has retired and was not part of this meeting. John Boggs and Ben Dolcich are the new key contacts at Emerson for this proposal.