Round Robin for Converters (RR'C) – short overview

November 2019

Introduction

After a decade of experience with electric motor testing standards and efficiency classification, now the efficiency of converters is at stake. They become more important within the motor driven unit when variable load operation is required. Converter losses in full and partial load need to be better understood when operated in combination with induction motors and advanced motor technologies.

In 2017, the IEC 61800-9-2, edition 1, was published. It includes a first concept of simulation and testing of converter losses and gives a table of reference losses and IE-classification for converters between 0.12 and 1000 kW. Since its publication, many independent testing laboratories have doubted the practicality, the accuracy and the repeatability of the proposed physical efficiency testing method. Also, the reference losses were seen as too high without incentive for industry to improve the efficiency of the products. While the European Commission published on 25 October 2019 the revision of the minimum energy performance standards (MEPS) for motors establishing MEPS for converters as well (Commission Regulation (EU) 2019/1781), the issue is becoming critical in the global electric motor community.

Goal

In order to be ready to present a reliable testing method for converter losses and to review the currently defined reference losses and efficiency classes, EMSA in cooperation with IEC has launched an international Round Robin testing program for converters losses (RR'C). EMSA serves as the organizer and some EMSA member countries participate actively by providing funding for independent testing laboratories in Australia, Denmark, Switzerland and USA. IEC SC22G WG18 will be instrumental in accumulating and integrating the new evidence for the planned revision of IEC 61800-9-2, edition 2.

Organization

The RR'C is staged in two phases:

Phase 1: November 2017 to February 2019: Definition of a Uniform Testing Protocol (UTP) and start with pilot testing.

Phase 2: March 2019 to October 2020: Enlarged set of testing laboratories and a wider selection of converters for test. The results will be used for statistical evidence of revised reference losses and efficiency classification.

The following four independent laboratories were engaged in phase 1 of the RR'C:

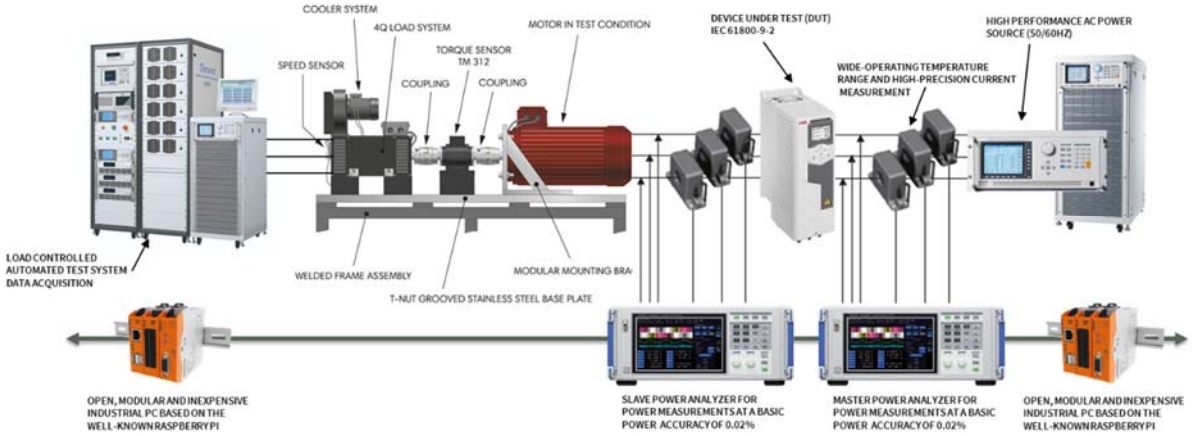
- Australia: CalTest, Port Elliot,
- Denmark: Danish Technological Institute (DTI), Taastrup,
- Switzerland: University of Applied Sciences (BFH), Berne,
- USA: Advanced Energy, Raleigh.

The following institutions are currently participating additionally in RR'C phase 2:

- Germany: Karlsruhe Institute of Technology, Karlsruhe,
- China: China National Center for Quality Supervision and Test of Electrical Control and Distribution Equipment, Tianjin City,
- Japan Fuji Electric Co., Ltd., Tokyo
- Denmark Danfoss Drives, Graasten
- Finland ABB, Helsinki
- USA Rockwell Automation, Wisconsin
- Belgium Ghent University, Kortrijk

Large converters will be tested in industry laboratories according to the UTP without having them shipped around the globe.

All converters are tested at each laboratory, using their available motors. After the tests the converters are shipped to the next laboratory. In each test sequence the converter and motor are run through a defined series of operating points with the motor running at full and partial torque and speed. Input and output of the converter are measured with highly precise instruments. The input/output losses are recorded, the converter efficiencies are calculated and recorded in a Standard Reporting Format which is used for the overall statistical analysis.



Automated efficiency testing test bench. In addition to conventional motor tests involving the test object, load machine and torque measurement, standard efficiency testing requires a high-quality power source, a winding ohmmeter, a power analyzer and a test automation system.

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