CIGRE Study Committee B4

PROPOSAL FOR THE CREATION OF A NEW WORKING GROUP

WG [1]N° B4.83	**Name of Convenor:** Babak Badrzadeh (AUSTRALIA) **E-mail address**: babak.badrzadeh@aemo.com.au
Technical Issues #[2]: 1,3,5	**Strategic Directions #[3]: 1,2**
The WG applies to distribution networks[4]: Yes	
Potential Benefit of WG work #[5]: 3,5	

Flexible AC Transmission Systems (FACTS) controllers' commissioning, compliance testing and model validation tests

Scope, deliverables and proposed time schedule of the WG:

Background:

The purpose of commissioning and compliance testing is to establish that the installed FACTS controller performs as expected and complies with the specified performance requirements, culminating with Grid Compliance testing. Successful completion of the commissioning tests is generally a pre-requisite for unrestricted operation.

Commissioning require testing of the plant, starting from individual equipment items, sub-systems and up to the entire integrated system. The commissioning tests will also validate respective power system models and data by comparison of test results with model responses. Accurate modelling of the FACTS controller is fundamental to ensuring that future power system studies adequately demonstrate the network behaviour, including the FACTS controller.

This working group will discuss the entire suite of commissioning tests conducted as part of commissioning a new or upgraded FACTS controller. The working group will present best practices for commissioning and compliance testing of different types of FACTS controllers. A four-stage process comprising equipment, sub-system, system commissioning and grid compliance tests will be discussed as applied to all FACTS controllers. These tests will include some tests conducted by the FACTS controller manufacturer at the factory, and all those required by the Owners or system operator before the FACTS controller is permitted to operate unrestricted. Therefore, the factory acceptance tests (FAT) should be used to validate EMT models for the FACTS controller to be integrated into the grid.

The working group will discuss and provide several practical examples of commissioning tests for Static Var Compensators (SVCs), Static Synchronous Compensators (STATCOMs), Unified Power Flow Controllers (UPFCs), and Thyristor Controlled Series Capacitors (TCSCs) and Static Synchronous Series Compensators (SSSCs). These cover a variety of approaches and requirements in different countries. Finally, the working group will present examples of model validation analysis by comparing measured and simulated responses of FACTS controllers.

The Green Book chapter "Commissioning of FACTS Controllers", which was led by the proposed convenor will provide significant input to the WG activities.

The proposed scope of the working group is as follows:

1. Introduction

2. General requirements
- 2.1. General principles
- 2.2. Documentation
- 2.3. Measurement systems
- 2.4. Role of power system modelling and simulation

3. Four stage commissioning tests for FACTS controllers
- 3.1. Checks on Equipment Prior to Commencement of Commissioning
- 3.2. On Site Equipment tests
- 3.3. Sub-system tests
- 3.4. System commissioning tests
- 3.5. Grid compliance tests

4. Typical commissioning tests for SVCs
- 4.1. System commissioning tests
- 4.2. Grid compliance tests

5. Typical commissioning tests for STATCOMS
- 5.1. System commissioning tests
- 5.2. Grid compliance tests
- 5.3. Practical experience

6. Typical commissioning tests for UPFCs
- 6.1. System Commissioning Tests
- 6.2. Grid compliance tests
- 6.3 Practical experience

7. Typical **commissioning rests for TCSC systems**
- 6.1. System Commissioning Tests
- 6.2. Grid compliance tests
- 6.3 Practical experience

8. Typical **commissioning of SSSC systems**
- 6.1. System Commissioning Tests
- 6.2. Grid compliance tests
- 6.3 Practical experience

9. Model validation tests
- 9.1. SVCs
- 9.2. STATCOMs
- 9.3 Other FACTS controllers

Deliverables:

☒ Technical Brochure and Executive Summary in Electra

☒ Electra Report

☒ Tutorial[6]

☒ Webinar[6]

Time Schedule: start: February 2020 **Final Report**: July 2021

Approval by Technical Council Chair:

Date: December 1st, 2019

Notes: [1] Working Group (WG) or Joint WG (JWG), [2] See attached Table 1, [3]See attached Table 2, [4] Delete as appropriate, [5] See attached Table 3,
[6] Presentation of the work done by the WG

Table 1: Technical Issues for creation of a new WG

1	Active Distribution Networks resulting in bidirectional power and data flows within distribution levels up to higher voltage networks
2	Digitalization of the Electric Power Units (EPU): Real-time data acquisition includes advanced metering, processing large data sets (Big Data), emerging technologies such as Internet of Things (IoT), 3D, virtual and augmented reality, secure and efficient telecommunication network
3	The growth of direct current (DC) and power electronics (PE) at all voltage levels and its impact on power quality, system control, system operation, system security, and standardisation
4	The need for the development and significant installation of energy storage systems, and electric transportation, considering the impact they can have on the power system development, operation and performance
5	New concepts for system operation, control and planning to take account of active customer interactions, and different generation types, and new technology solutions for active and reactive power flow control
6	New concepts for protection to respond to the developing grid and different generation characteristics
7	New concepts in all aspects of power systems to take into account increasing environmental constraints and to address relevant sustainable development goals.
8	New tools for system technical performance assessment, because of new Customer, Generator and Network characteristics
9	Increase of right of way capacity through the use of overhead, underground and submarine infrastructure, and its consequence on the technical performance and reliability of the network
10	An increasing need for keeping Stakeholders and Regulators aware of the technical and commercial consequences and keeping them engaged during the development of their future network

Table 2: Strategic directions of the Technical Council

1	The electrical power system of the future: respond to speed of changes in the industry
2	Making the best use of the existing systems
3	Focus on the environment and sustainability
4	Preparation of material readable for non-technical audience

Table 3: Potential benefit of work

1	Commercial, business, social and economic benefits for industry or the community can be identified as a direct result of this work
2	Existing or future high interest in the work from a wide range of stakeholders
3	Work is likely to contribute to new or revised industry standards or with other long term interest for the Electric Power Industry
4	State-of-the-art or innovative solutions or new technical directions
5	Guide or survey related to existing techniques; or an update on past work or previous Technical Brochures
6	Work likely to contribute to improved safety.
7	Work addressing environmental requirements and sustainable development goals.