NATO STANDARD

AEP-4819

NATO INTEROPERABLE DISMOUNTED BATTERY CHARGING INTERFACE

Edition A, Version 1

DATE
FINAL DRAFT

NORTH ATLANTIC TREATY ORGANIZATION

ALLIED ENGINEERING PUBLICATION

Published by the
NATO STANDARDIZATION OFFICE (NSO)

INTENTIONALLY BLANK

NORTH ATLANTIC TREATY ORGANIZATION (NATO)

NATO STANDARDIZATION OFFICE (NSO)

NATO LETTER OF PROMULGATION

date

1. The enclosed Allied Engineering Publication AEP-4819, Edition A, Version 1, NATO INTEROPERABLE DISMOUNTED BATTERY CHARGING INTERFACE, which has been approved by the nations in the NATO ARMY ARMAMENTS GROUP, is promulgated herewith. The agreement of nations to use this publication is recorded in STANREC 4819.

2. AEP-4819, Edition A, Version 1, is effective upon receipt.

3. This NATO standardization document is issued by NATO. In case of reproduction, NATO is to be acknowledged. NATO does not charge any fee for its standardization documents at any stage, which are not intended to be sold. They can be retrieved from the NATO Standardization Document Database (https://nso.nato.int/nso/) or through your national standardization authorities.

4. This publication shall be handled in accordance with C-M(2002)60.

Dimitrios SIGOULAKIS
Lieutenant General, GRC (A)
Director, NATO Standardization Office

INTENTIONALLY BLANK

RESERVED FOR NATIONAL LETTER OF PROMULGATION

INTENTIONALLY BLANK

RECORD OF RESERVATIONS

CHAPTER	RECORD OF RESERVATION BY NATIONS

Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.

INTENTIONALLY BLANK

RECORD OF SPECIFIC RESERVATIONS

[nation]	[detail of reservation]
Note: The reservations listed on this page include only those that were recorded at time of promulgation and may not be complete. Refer to the NATO Standardization Document Database for the complete list of existing reservations.	

INTENTIONALLY BLANK

TABLE OF CONTENTS

INTENTIONALLY BLANK

CHAPTER 1 INTRODUCTION

The Allied Engineering Publication AEP-4819 defines the NATO interfaces and requirements to allow one Nation's dismounted soldier batteries to be charged on another Nation's battery charger.

These requirements are based on using the same physical connector that is found in NATO STANAG 4695 SOLDIER POWER CONNECTOR - ELECTRICAL CONNECTIVITY STANDARDS BETWEEN NATO POWER SOURCES AND DISMOUNTED SOLDIER SYSTEMS (DSS) Edition B, Version 1 or later.

.

INTENTIONALLY BLANK

CHAPTER 2. DEFINITIONS

Smart Charger	Provides chemistry independent charging to a Smart battery. Can be Level 2 or Level 3 see Smart Battery Charger (SBC) Specification, Revision 1.1, December 11, 1998.
SMBus	SMBus. The System Management Bus (abbreviated to SMBus or SMB) is a specific implementation of an Inter-Integrated Circuit that provides data protocols, device addresses and additional electrical requirements that are designed to physically transport commands and information between the Smart Battery, Power Manager, Smart Battery Charger and other Smart Devices. (Smart Battery Data Specification (SBS) rev 1.1).
Smart Battery	A battery equipped with specialized hardware that provides present state, calculated and predicted information to its System Host under software control and allows for chemistry-independent charging (Smart Battery Data Specification rev 1.1).
Cell	The most basic component of a battery that converts electrochemical energy into electricity. A single cell (such as the “D” cell used in flashlights) is sometimes referred to as a battery.
Battery	A collection of two or more cells wired together to produce electricity.
Battery Charger Adapter	The device that provides a mechanical and electrical interface between a battery and a battery charger. This interface has not previously been standardized between Nations.
STANAG 4695 Interface	The DSS standardised power source interface.
STANAG 4851	The DSS standardized data (and power) interface
STANREC 4819 Interface	The implementation of SMBus smart battery technology and the associated mechanical connection to enable DSS Power Sources to be charged on another Nations smart charger.
Non-Smart Battery	By definition any battery that does not comply with SBS.

Host Nation	The host Nation is defined as having the battery charger.
Guest Nation	The Nation who has a requirement to charge their battery.
Power Manager	A Power Manager is a device that takes power from a source and has the capability to distribute it to multiple end items simultaneously. Some power managers may also provide power conditioning and DC/DC conversion. Some power managers have the capability to function as a Level 2 or Level 3 battery charger and if so they might be capable of meeting the electrical and physical requirements of this STANREC.
Energy scavenging	The ad-hoc transfer of energy from one energy source to another. A typical example is taking energy from a partially spent battery of one format and using it to charge a battery of another format.
Energy Harvesting	The use of energy from an alternative energy source to either power a device or to charge a battery (or other energy store). Typical examples of energy harvesting are the energy transformation from renewable sources (e.g. solar, wind and kinetic energy).
RMS voltage	The root mean squared voltage. It is the effective DC voltage that would provide the same amount of heat generation in a resistor as the AC voltage would if applied to that same resistor.

CHAPTER 3. RELATED MILITARY AND COMMERCIAL STANDARDS

a) STANAG 4695 SOLDIER POWER CONNECTOR - ELECTRICAL CONNECTIVITY STANDARDS BETWEEN NATO POWER SOURCES AND DISMOUNTED SOLDIER SYSTEMS (DSS) – AEP-4695

b) STANAG 4851 COMBINED POWER AND DATA ACCESSORY CONNECTOR FOR DISMOUNTED SOLDIER SYSTEMS (DSS) – AEP-4851

c) Smart Battery Charger (SBC) Specification, Revision 1.1, December 11, 1998.

d) SBS Smart Battery Data Specification rev 1.1 Dec 11 1998.

e) Smart Battery Data Accuracy Testing Guidelines Rev 2.0 20 march, 2001.

INTENTIONALLY BLANK

CHAPTER 4. Aim

To provide the necessary requirements (mechanical/electrical/etc.) for battery to battery charger interoperability between Nations.

This document only addresses the physical, electrical interfaces and minimum data transfer requirements that will allow one Nation to charge their National battery(ies) on the battery charger of another Nation.

The implementation of this STANREC with energy harvesting and or scavenging techniques requires the use of a power manager or other device/circuitry that can act as a Level 2 or Level 3 battery charger as defined below.

The Scope is limited to smart batteries and smart chargers.

INTENTIONALLY BLANK

CHAPTER 5. Background

For dismounted soldiers, fighting side by side, it was identified that there would be operational benefit in being able to charge the batteries used by one Nation's soldiers on the battery charger of another Nation. This STANREC outlines the minimum requirements for both batteries and battery chargers to enable one Nation (Guest Nation) to charge their battery(ies) on the battery charger of the Host Nation.

Individual Nations have historically developed their battery portfolio to match their respective equipment and use requirements, which has led to a proliferation of types, chemistries and interfaces resulting in a range of non-standardised batteries.

Different batteries have different charging requirements. This is due primarily to the chemistry of the battery and the number of cells contained within it. For safety reasons and to maximize battery lifetimes they must be charged according to their required charging profile. This and the physical configuration of the battery (in terms of connectors and charging interfaces) make interoperable charging very difficult.

The Smart Battery Charger Specification addresses the concerns of battery chemistry and the number of cells by providing a standard protocol that allows battery chargers to adjust their outputs to the battery-dependent charge profiles that are dictated by the smart batteries themselves.

Originally, each new military battery was issued with its own dedicated charger. The charger had the batteries' charging regime programmed into it and could only charge a limited range of batteries. Such chargers are still widely used successfully today but their use has led to a proliferation of dedicated chargers, which complicates the logistics issues.

Instances have been identified in which batteries of the same format may not be charged with chargers produced by a different manufacturer, presumably for safety concerns.
Recently there has been a trend for chargers to become more flexible by the use of adapter trays. This allows one charger to be reconfigured for multiple different types of batteries by using different battery trays. This gives a Nation flexibility in that it can buy battery chargers and then upgrade them to charge new batteries when required by buying new battery trays and possible firmware upgrades. The charger knows which battery charge profile to use by recognising the specific battery tray or battery cable.

Such chargers provide a degree of flexibility but do not help with interoperability between Nations during a combined exercise. This is because the Guest Nation would have to have their soldiers equipped with a battery adapter tray to act as an interface between the Guest Nation's battery and the charger interface on the Host Nation's charger. Normal practice has been for each Nation to provide their own charger solutions, independent of the needs of coalition partners.

These issues can be overcome by use of a Level 2 or Level 3 smart charger and smart batteries that adhere to the Smart Battery Specifications.

CHAPTER 6. REQUIREMENTS

6.1 Overview

A STANREC 4819 compliant system is one in which a smart battery is terminated with STANAG 4695 connector and which communicates battery information using the protocols defined below.

The requirements for the NATO Dismounted Soldier power connector are defined in the STANAG and AEP 4695 (referred to as the STANAG 4695 plug and receptacle), which is the reference. For illustration an outline is shown in Figure 1, the receptacle is shown on the left, plug in the centre and pin layout on the right.

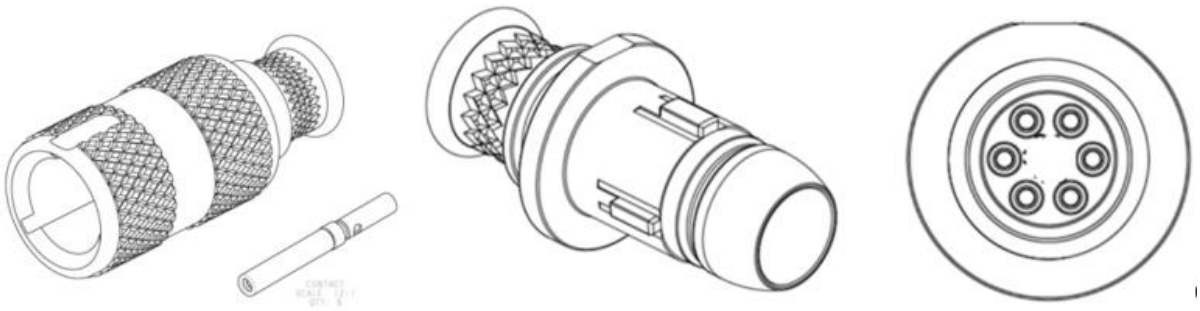

Figure 1 AEP 4695 Plug and Receptacle Connector Detail

It is noted that the intent of a STANREC 4819 compliant system can be met by either a battery with the appropriate connector or a non STANREC 4819 complaint battery can become compliant through the provision of an appropriate adapter.

6.2 Generic Requirements

a. In order for a charger to recognize the battery charging requirements, certain communications are required. This STANREC stipulates SBS battery protocols communicated by SMBus.

b. STANREC compliant batteries and chargers shall provide a communications interface meeting Smart Battery Data Specification rev 1.1.

c. The data fields that are required to be utilized are those defined by Smart Battery Charging Specification.

d. It is the responsibility of each Nation to ensure that the battery charger, batteries and any adapters/interfaces meet that Nation's own safety and performance requirements.

e. It is recommended that STANREC compliant chargers and batteries be so marked with STANREC 4819 in addition to national marking requirements.

f. EMC/EMI. Any adapter lead/connector should be built with EMC/EMI best practices. Any adaptor shall meet the same EMC/EMI characteristics as the nation's charger or battery.

6.3 Charger Requirements

a. To meet the requirements of this STANREC, a charger must be a SBS level 2 or level 3 charger.

b. The 4819 charger must be able to provide charging current with an output voltage from 8-20 V.

c. The charger must accept all batteries, which supply the necessary SBS data. i.e. the charger would not be compliant if it only charged batteries from a limited number of manufacturers.

d. The charger or charger adapter must be terminated in or provide a connector that complies with STANAG 4695. This shall be the plug with pins.

e. The minimum cable length shall be 10 cm to ensure that there is sufficient space to connect batteries with embedded connectors. The required length can also be provided by an extension cable.

f. The maximum length of the cable is not defined but it must preserve signal integrity compliant with the SBS.

g. Charging voltage shall not deviate from the requested value by the battery by more than -2%/+0.5% within its specified temperature range.

h. Charging current shall not exceed the requested values by the battery by more than -2%/+0.5% within its specified temperature range.

i. The RMS voltage such as that due to ripple and noise shall not deviate from the requested voltage by more than +/- 2% within its specified temperature range.

j. Leakage current as per SBC Specification revision 1.1 shall not exceed 100 uA.

k. Charger float voltage as per SBC Specification revision 1.1 shall not exceed 100 mV.

l. Charging current provided by compliant chargers shall not exceed 5 A on the 4819 charging circuit.

6.4 Battery System Requirements

a. All battery systems to be charged must be compliant to the SBS battery specification. This may be achieved by the addition of adapter circuitry if necessary.

b. All batteries systems shall contain protection circuitry to prevent any safety related incidents should there be an error in the charging protocol or the charging process itself.

c. The battery systems must either have the STANAG 4695 receptacle with sockets or utilize an adapter cable from the national battery connector to a STANAG 4695 receptacle with sockets.

d. For soldier batteries without a safety pin exposed on their interface the adaptor should connect the 4695-connector pin 6 to ground. [Ref Smart Battery Charger (SBC) Specification, Revision 1.1 Section Safety signal ranges.] (This allows a single wake up charge and SMBus based charging according to SBC.)

e. If an adaptor cable is used then its maximum length is not defined but it must preserve signal integrity compliant with the SBS.

f. Compliant battery systems shall tolerate a variation of -2%/+0.5% of their specified charging voltage within its specified temperature range.

g. Compliant battery systems shall tolerate a current that may exceed their requested values by not more than -2%/+0.5% within its specified temperature range.

h. Compliant battery systems shall tolerate a RMS voltage such as that caused by ripple or noise of +/- 2% of the requested voltage within its specified temperature range.

The notional illustration of the ability to connect a Nation specific battery to another Nation's charger is as shown in Figure 2.

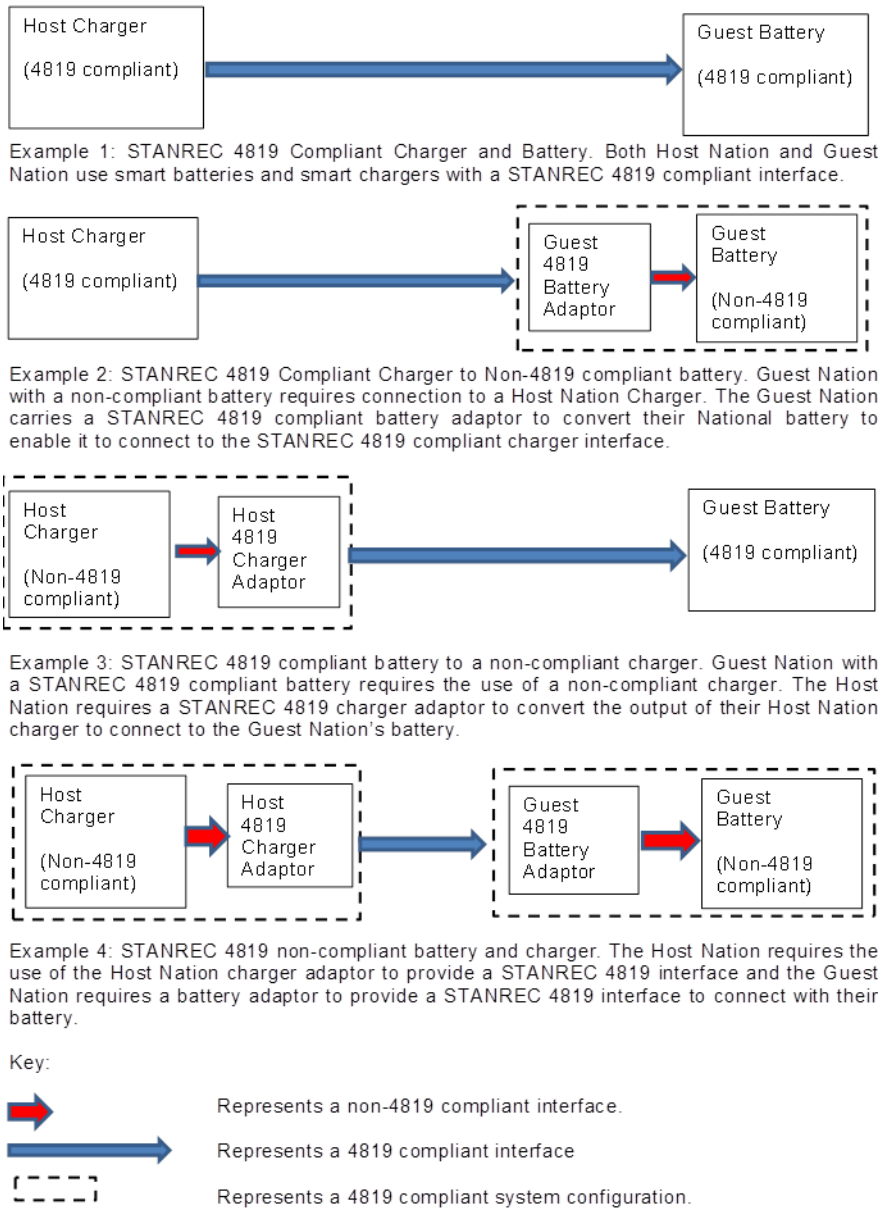

Figure 2 Schematic of interoperability scenarios with National chargers and batteries

CHAPTER 7. Assumptions, Exclusions and Recommendations

7.1 Assumptions and Exclusions

a. This STANREC is focused only on the interoperable charging of batteries used by the dismounted soldier, for equipment worn or carried.

b. To be compliant a charger may either have the necessary STANREC 4819 interface compliant connector built into the charger or provide a cable that terminates in a STANREC 4819 interface compliant connector. The use of this cable will allow for a host Nation's charger to become compliant without having to redesign the charger itself.

c. To facilitate charge acceptance additional components may be required in the charger lead to enable the charger to charge the battery.

d. If a national battery does not include a STANREC 4819 compliant interface, that Nation must provide an adapter for the national battery that terminates in a STANREC 4819 compliant interface.

e. If a host Nation's charger does not include a STANREC 4819 compliant interface, the host Nation must provide an adapter for the charger that terminates in a STANREC 4819 compliant interface.

f. It is the responsibility of each Nation to ensure that the battery charger, batteries and any adapters/interfaces meet that Nation's own safety and performance requirements.

i) Safety considerations have been addressed by referencing to the Safety protocols defined in SBS Battery Data Specification rev 1.1 Dec 11 1998.

j) This STANREC is to allow opportunistic charging of batteries using the connector and pin assignments described in STANAG 4695 and AEP 4695. It is noted that the soldier data connector as described in STANAG 4851 is the same physical connector as STANAG 4695 but with different pin assignment. This STANREC 4819 is not intended to enable the connection of electronic peripherals to chargers to receive power via their data interface. No harm will come to peripherals if they connect to a charger using the connector and adapter described in this STANREC 4819 (connector 4695). However, they will not be powered or charge and this is not recommended.

7.2 Implementation/Recommendations

a) Where practical it would be good practice to undertake assessment to ensure own Nation batteries and chargers are compatible with other Nation systems.

b) Smart Battery Data Accuracy Testing Guidelines Rev 2.0, March 2001 can be used to demonstrate adherence to the requirements of this STANREC.

c) To charge the popular BB-2590 this would need to be charged via an adaptor consisting of two 4819 connectors (with individual SMBus and charging circuits) into the single BB-2590 receptacle since the BB-2590 consists of two electrically separate battery strings.

INTENTIONALLY BLANK

AEP-4819(A)(1)