



EUROPEAN  
DEFENCE  
AGENCY

# **Expert Group 06 Electrical Interfaces**

## **Final Report**

**Brussels,  
25<sup>th</sup> of November 2021**

# Recommendations on best practice standards for Electrical Interfaces

## Record of changes

Date	Issue	Changes
2011-06-30	V1	First Final Report after CEN WS10
2021-11-25	V2	Update for EDSTAR

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## 1. Introduction

The European Commission requested the European Committee for Standardization to establish Workshop 10 (CEN/WS10) to improve the efficiency and enhance the competitiveness of European Defence Industry. The European Handbook for Defence Procurement (EHDP) has been prepared by Experts Groups and reporting to CEN Workshop 10. This document is a guide designed as a tool for anyone involved in the European defence procurement contractual negotiations. The primary target audiences for the Handbook are:

- The staff in the ministries of defence who are producing procurement specifications and invitations to tender;
- The staff in defence companies who are responding to those requirements;
- The EHDP is designed by the CEN Workshop 10 to provide Defence Procurement Agencies and Defence;
- Industries with a preferential list of selected recommended standards qualified as best practice ones to be included in armament contracts together with concise recommendations for an optimum use of those standards in such a Defence Procurement context.;
- Those types of resulting informative data could be used in the acquisition process by ministries of defence (MoD) and in the development process by Industry such that system will be built faster, better and cheaper.

The aim of a recommendation is to develop good practices in the domain addressed by the Expert Group and to assist the final user in using recommended best practices standards in the best cost-effective way:

- Increasing the controlled use of existing standardization, a necessity to harmonise European practices used by defence procurement stakeholders;
- The objective is to deploy a common approach through Nations Procurement agencies about an optimized utilization of standards: civil ones and military ones, the possible limitations of civilian standards with respect to military applications... to provide a useful guide to all stakeholders involved in defence procurement process;
- Description of how to implement standard s successfully in armament contracts;
- The overall result will be a better use of standards in armament contracts.

In 2012 the EHDP became the European Defence Standardization Reference (EDSTAR) under responsibilities of the European Defence Agency (EDA) which have to manage the work of experts' groups selection in order to maintain the EDSTAR database updated and continuously make it as close as possible to the need of the users. The EDSTAR public website contain the entire document selected as European best practices recommendations. It is designed to allow the final users to be provided with the right information for timely and quickly acquiring the best control in writing procurement's clauses related to the European defence project.

EG 06 has reviewed the CEN/WS 010/EG 06 Final Report dd. 30 June 2011 based on the situation in 2021 within the member states of the European Union. This document aims at providing recommendations on the best use of this best practice standard in armament contracts. The best practices and standards (BPS) listed, presented, commented as far as the reasons for its selection and the way of implementing it in contracts by a tailored approach.

## 2. **References and Terminology**

- IEC or International Electrotechnical Vocabulary is the standard IEC 60050. An online version is available on: <https://www.electropedia.org/>.
- EN 16341:2012 "Selection of standards and standard-like documents for defence products and services — Order of preference" is a preferred document in the choice of BPS in EDSTAR.

## 3. **Scope**

The task of EG 06 is to develop the Best Practices and Standards for EDSTAR database for defence applications regarding Electrical Interfaces, Hardware applications, such as:

- Mechanical: dimensions, material, resistance, surface;
- Electrical: voltage/current levels, data rate;
- Electrical and Optical connectors, and other components of electrical use.

The focus of the expert group is to provide, when possible, dual standards (civilian and military) across all domains (land, air, maritime and cyber), respecting the priorities of choice given by EDA.

## 4. **Rationale for selecting a standard/standards-like document as "Best Practice"**

In the scope of the work of this expert group, has been followed the EDSTAR Expert Group Terms of Reference. And as such, the experts involved considered and reviewed the best practices and standards of the given scope, these steps:

- Identify all known standards that are of relevance for the given technical domain as the initial basic list for their selecting work.
- Review the substance of the identified Standards.
- Benchmark the identified documents by applying the selection basic criteria mentioned under paragraph 2, that's to say comparing the identified standards with respect to their practical importance including: technical excellence (stability and maturity), broadest audience, frequency of usage, availability, economic impact on European defence business, influence on interoperability. Their scope shall reflect the "state of the art" of knowledge and best practices in the service of European defence interests.
- Select the Best Practice Standards by consensus between the Experts Groups members.
- Include the rationale for the selection together with necessary advice for the application of the selected standard into the best practice's recommendations included in the reports by the expert group when delivering their final contributions.
- Propose way ahead for filling gaps identified during the expertise work.

Starting the work for this expert group, there were around 1200 BPS listed for Electrical Interfaces in the EDSTAR database. In the process of reducing the number of BPS, we have now 616 documents considered as best practices or standards.

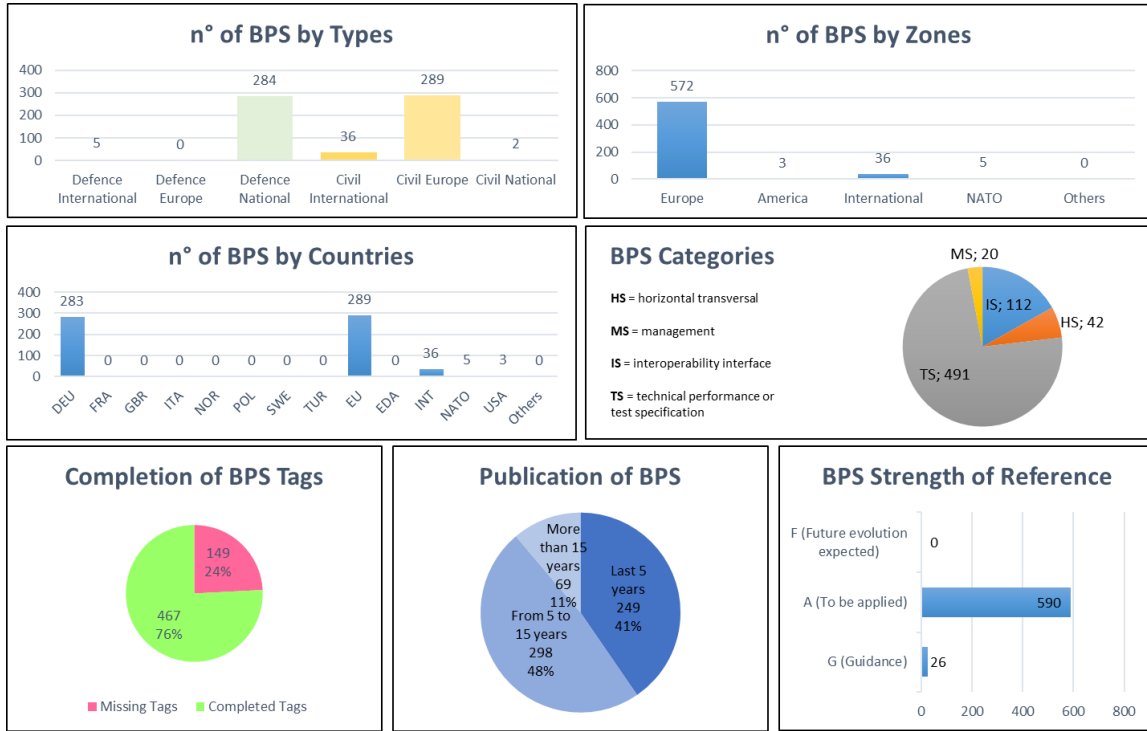
One of the major decisions was to remove all British BPS listed, mainly Def Stan standards, as UK left the European Union.

In the process of revising the scope, it has been decided to remove BPS which weren't compliant anymore (EN 2591, EN 3475, ...).

## 5. Recommendations on application and tailoring of a standard

### 5.1 List of Best practices selected

Here is an overview of the BPS selected in EG06. There are a total number of 616 BPS listed for this expert group.



### 5.2 Details about best practices standards selected

All VG standards are applied standards. They are used by at least 3 MoDs (Germany, Switzerland and the Netherlands) and various industries. In most cases there is no suitable counterpart in EN, MIL, STANAG, etc. Therefore, VG standards fill in the gaps of other standardization systems.

In addition to this, since 2010, all VG standards are being published in the European Defence Standardization Information System (EDSIS) to enable all pMS of EDA to get actively involved in developing common standards.

As part of the work in EG06 and to ease the work, were defined 4 categories (and a fifth for unfitting BPS), as follows:

- Cables;
- Connectors;
- Tubes;
- Electrical Components;
- Others.

#### 5.2.1 Cables

These are the 93 BPS that were selected and implemented in EDSTAR:

EN 2083	EN 2346-005	EN 2714-009	VG 95218-10/A1	VG 95218-26
EN 2084	EN 2713-002	EN 2714-010	VG 95218-1008	VG 95218-27
EN 2234	EN 2713-003	EN 2714-011	VG 95218-101	VG 95218-28

EN 2235	EN 2713-004	EN 2714-012	VG 95218-11	VG 95218-28/A1
EN 2266-002	EN 2713-005	EN 2714-013	VG 95218-13	VG 95218-29
EN 2266-003	EN 2713-006	EN 2714-014	VG 95218-14	VG 95218-60
EN 2266-005	EN 2713-007	EN 2812	VG 95218-14/A1	VG 95218-60/A1
EN 2266-007	EN 2713-008	EN 2853	VG 95218-2	VG 95218-61
EN 2267-002	EN 2713-009	EN 2854-002	VG 95218-2/A1	VG 95218-61/A1
EN 2267-003	EN 2713-010	EN 2854-003	VG 95218-20	VG 95218-62
EN 2267-005	EN 2713-011	EN 3838	VG 95218-21	VG 95218-63
EN 2267-007	EN 2714-002	EN 4049-001	VG 95218-21/A2	VG 95218-64
EN 2267-008	EN 2714-003	EN 4049-002	VG 95218-22	VG 95218-65
EN 2267-009	EN 2714-004	EN 4049-003	VG 95218-22/A1	VG 95218-66
EN 2267-010	EN 2714-005	EN 4049-004	VG 95218-23	VG 95218-7
EN 2346-002	EN 2714-006	EN 4604-006/AC	VG 95218-23/A1	VG 95218-8
EN 2346-003	EN 2714-007	EN 4604-007/AC	VG 95218-24	VG 95218-9
EN 2346-004	EN 2714-008	VG 95218-10	VG 95218-25	VG 95218-11/A1
VG 95218-13/A1	VG 95218-26 BERICHTIGUNG 1			

40 VG standards have been listed in the category of cables, which are all best practice standards to be applied. The user should choose the most appropriate standard for his particular application, depending on the requirements selected for the specific technology, process, etc. and the domain (air/sea/land) they will be used in.

## 5.2.2 Connectors

These are the 370 BPS that were selected and implemented in EDSTAR:

AEP-100(A)(1)	EN 3155-070	EN 3660-014	EN 4165-026	VG 95319-1007
EN 2997-001	EN 3155-071	EN 3660-015	EN 4434	VG 95319-1008
EN 2997-002	EN 3155-074	EN 3660-016	EN 4531-001	VG 95319-1009
EN 2997-003	EN 3155-075	EN 3660-017	EN 4531-002	VG 95319-101
EN 2997-004	EN 3155-076	EN 3660-018	EN 4531-003	VG 95319-1010
EN 2997-005	EN 3155-077	EN 3660-019	EN 4531-004	VG 95319-1011
EN 2997-006	EN 3218-001	EN 3660-020	EN 4531-005	VG 95319-1012
EN 2997-007	EN 3218-002	EN 3660-021	EN 4531-101	VG 95319-1013
EN 2997-008	EN 3218-005	EN 3660-022	EN 4604-001	VG 95319-1014
EN 2997-009	EN 3218-006	EN 3660-023	EN 4604-002	VG 95319-1015
EN 2997-010	EN 3218-007	EN 3660-024	EN 4604-003	VG 95319-1016
EN 2997-011	EN 3218-008	EN 3660-025	EN 4604-004	VG 95319-1017
EN 2997-012	EN 3218-009	EN 3660-026	EN 4604-006	VG 95319-1018
EN 2997-013	EN 3218-010	EN 3660-027	EN 4604-007	VG 95319-102
EN 2997-014	EN 3218-011	EN 3660-036	EN 4604-008	VG 95319-2
EN 2997-015	EN 3372-001	EN 3660-037	EN 4604-009	VG 95319-2 Beiblatt 1
EN 2997-016	EN 3372-003	EN 3660-038	EN 4604-010	VG 95319-2/A1
EN 3155-001	EN 3372-005	EN 3660-062	EN 4608-001	VG 95328-1
EN 3155-002	EN 3372-006	EN 3660-063	IEC 60169-1	VG 95328-1/A1
EN 3155-003	EN 3372-007	EN 3660-064	IEC 60169-1/A1	VG 95328-2
EN 3155-004	EN 3372-008	EN 3660-065	IEC 60169-10	VG 95328-4
EN 3155-005	EN 3372-009	EN 3682-001	IEC 60169-10/A1	VG 95328-5
EN 3155-005/AC	EN 3372-011	EN 3682-002	IEC 60169-10/A2	VG 95328-6
EN 3155-008	EN 3373-001	EN 3682-003	IEC 60169-1-1	VG 95328-7
EN 3155-009	EN 3545-001	EN 3682-004	IEC 60169-11	VG 95351-1
EN 3155-012	EN 3545-002	EN 3682-005	IEC 60169-12	VG 95351-2
EN 3155-013	EN 3545-003	EN 3682-006	IEC 60169-13	VG 95351-4
EN 3155-014	EN 3545-004	EN 3682-007	IEC 60169-1-3	VG 95351-5
EN 3155-015	EN 3545-005	EN 3682-008	IEC 60169-13/A1	VG 96912-1
EN 3155-016	EN 3545-006	EN 3682-009	IEC 60169-1-3/A1	VG 96912-1/A1
EN 3155-017	EN 3545-007	EN 3719	IEC 60169-17	VG 96912-2
EN 3155-018	EN 3545-008	EN 3733-002	IEC 60169-17/A1	VG 96912-4
EN 3155-019	EN 3545-009	EN 3733-003	IEC 60169-20	VG 96912-5
EN 3155-022	EN 3645-001	EN 3733-004	IEC 60169-21	VG 96912-6
EN 3155-023	EN 3645-002	EN 3733-005	IEC 60169-21/A1	VG 96917-1
EN 3155-024	EN 3645-003	EN 3733-007	IEC 60169-22	VG 96917-2
EN 3155-025	EN 3645-004	EN 3733-008	IEC 60169-23	VG 96917-3
EN 3155-026	EN 3645-005	EN 3733-009	IEC 60169-24/AC1	VG 96918-1
EN 3155-027	EN 3645-006	EN 3733-101	IEC 60169-25	VG 96918-2

EN 3155-028	EN 3645-007	EN 3733-103	IEC 60169-27	VG 96918-4
EN 3155-029	EN 3645-008	EN 3733-104	IEC 60169-28	VG 96918-5
EN 3155-031	EN 3645-009	EN 3733-105	IEC 60169-5	VG 96918-6
EN 3155-032	EN 3645-010	EN 3733-106	IEC 60169-5/AC1	VG 96919-1
EN 3155-033	EN 3645-011	EN 3733-108	IEC 60169-6	VG 96919-2
EN 3155-034	EN 3645-012	EN 4165-001	IEC 60169-7	VG 96919-3
EN 3155-035	EN 3645-013	EN 4165-001/AC	IEC 60169-7/A1	VG 96921-1
EN 3155-039	EN 3646-001	EN 4165-002	IEC 60169-9	VG 96921-2
EN 3155-040	EN 3646-002	EN 4165-002/AC	IEC 60169-9/A1	VG 96921-3
EN 3155-041	EN 3646-003	EN 4165-003	ISO 461-1	VG 96923-1
EN 3155-042	EN 3646-004	EN 4165-004	ISO 461-2	VG 96923-2
EN 3155-043	EN 3646-005	EN 4165-005	ISO 8843	VG 96923-3
EN 3155-044	EN 3646-006	EN 4165-006	ISO 8843/A1	VG 96926-1
EN 3155-046	EN 3646-007	EN 4165-007	MIL-STD-1760 E	VG 96926-2
EN 3155-047	EN 3646-008	EN 4165-008	STANAG 3347(6)	VG 96926-3
EN 3155-052	EN 3646-009	EN 4165-009	STANAG 3660(2)(8)	VG 96926-4
EN 3155-053	EN 3646-010	EN 4165-010	STANAG 3837(6)	VG 96929-1
EN 3155-054	EN 3646-011	EN 4165-011	STANAG 4007(2)	VG 96929-2
EN 3155-055	EN 3660-001	EN 4165-012	VG 88623	VG 96929-3
EN 3155-056	EN 3660-002	EN 4165-013	VG 88868	VG 96929-4
EN 3155-057	EN 3660-003	EN 4165-014	VG 88877-2	VG 96934-1
EN 3155-058	EN 3660-004+AC	EN 4165-015	VG 95234-1	VG 96934-2
EN 3155-059	EN 3660-005+AC	EN 4165-016	VG 95234-1/A1	VG 96934-3
EN 3155-060	EN 3660-006	EN 4165-017	VG 95234-2	VG 96934-4
EN 3155-061	EN 3660-007	EN 4165-018	VG 95234-4	VG 96938-1
EN 3155-063	EN 3660-008	EN 4165-020	VG 95234-5	VG 96938-2
EN 3155-064	EN 3660-009	EN 4165-021	VG 95234-6	VG 96938-3
EN 3155-065	EN 3660-010	EN 4165-022	VG 95234-7	VG 96938-4
EN 3155-067	EN 3660-011	EN 4165-023	VG 95319-1	VG 96966-1
EN 3155-068	EN 3660-012	EN 4165-024	VG 95319-100	VG 96966-3
EN 3155-069	EN 3660-013	EN 4165-025	VG 95319-1006	VG 95324-10
VG 96513-1	VG 96513-2	VG 96513-3	VG 96513-4	VG 96513-5
VG 96942-1	VG 96942-2	VG 96942-3	VG 96942-4	VG 96944-1
VG 96944-2	VG 96944-3	VG 96944-4	VG 96944-5	VG 96955-1
VG 96955-2	VG 96955-3	VG 96955-4	VG 96969-1	VG 96969-3

103 VG standards have been listed in the category of connectors, which are all best practice standards to be applied. The user should choose the most appropriate standard for his particular application, depending on the requirements selected for the specific technology, process, etc. and the domain (air/sea/land) they will be used in.

### 5.2.3 Tubes

These are the 28 BPS that were selected and implemented in EDSTAR:

EN 6049-002	VG 95343-12	VG 95343-19	VG 95343-29	VG 95343-9
EN 6049-003	VG 95343-13	VG 95343-2	VG 95343-30	VG 96936-10
EN 6049-006	VG 95343-14	VG 95343-22	VG 95343-5	VG 96936-2
EN 6049-007	VG 95343-15	VG 95343-24	VG 95343-7	VG 96936-6
EN 6049-008	VG 95343-18	VG 95343-25	VG 95343-8	VG 96936-8
VG 95343-1	VG 96967-5			

23 VG standards have been listed in the category of tubes, which are all best practice standards to be applied. The user should choose the most appropriate standard for his particular application, depending on the requirements selected for the specific technology, process, etc. and the domain (air/sea/land) they will be used in.

In addition to these 5 international standards have been listed, which are to be applied in the field of aerospace.

### 5.2.4 Electrical Components

These are the 70 BPS that were selected and implemented in EDSTAR:



EN 3567-001	VG 95236-19	VG 95345-17	VG 96928-23	VG 96933-13
EN 3567-003	VG 95236-21	VG 95345-18	VG 96928-3	VG 96933-14
EN 3567-004	VG 95236-25	VG 95345-19	VG 96928-31	VG 96933-2
VG 88711-1	VG 95236-27	VG 95345-2	VG 96928-32	VG 96933-20
VG 88711-2	VG 95236-4	VG 95345-20	VG 96928-33	VG 96940-6
VG 88711-3	VG 95236-6	VG 95345-21	VG 96928-34	VG 96945-2
VG 88773	VG 95318-14	VG 95345-23	VG 96928-4	VG 96933-12
VG 88812	VG 95318-15	VG 95345-24	VG 96928-5	VG 96928-22
VG 95236-1	VG 95318-6	VG 95345-25	VG 96928-6	VG 95345-15
VG 95236-11	VG 95343-28	VG 95345-6	VG 96928-7	VG 95236-18
VG 95236-12	VG 95343-6	VG 95345-9	VG 96928-8	VG 96933-11
VG 95236-13	VG 95345-1	VG 96928-1	VG 96928-9	VG 96928-21
VG 95236-14	VG 95345-10	VG 96928-2	VG 96933-10	VG 95345-14
VG 95236-16	VG 95345-11	VG 96928-20	VG 96933-105	VG 95236-17

67 VG standards have been listed in the category of electrical components, which are all best practice standards to be applied. The user should choose the most appropriate standard for his particular application, depending on the requirements selected for the specific technology, process, etc. and the domain (air/sea/land) they will be used in.

In addition to that 3 international standards have been listed, which are to be applied in the field of aerospace.

### 5.2.5 Other listed BPS

These are the 57 BPS that were selected and implemented in EDSTAR:

ARINC 600-20	VG 96950-12	VG 96950-9	VG 96953-5	VG 95387-1
ARINC 609	VG 96950-2	VG 96951-4	VG 96953-6	VG 95387-106
EN 3155-030	VG 96950-3	VG 96951-5	VG 96953-7	VG 96957-1
EN 3197	VG 96950-5	VG 96951-6	VG 96953-8	VG 96957-2
VG 96950-1	VG 96950-6	VG 96953-10	VG 96953-9	VG 95387-2
VG 96950-10	VG 96950-7	VG 96953-12	VG 95447-1	VG 95387-3
VG 96950-11	VG 96950-8	VG 96953-2	VG 95447-2	VG 95387-4
VG 95447-4	VG 95447-8	VG 96927-11	VG 95387-7	VG 95387-5
VG 96927-12	VG 96927-13	VG 96927-14	VG 96927-15	VG 96927-16
VG 96927-17	VG 96927-2	VG 96927-4	VG 96927-20	VG 96927-22
VG 96927-25	VG 96927-3	VG 96927-5	VG 96927-5 Bbl 1	VG 96927-5 Beiblatt 2
VG 96927-9	VG 96927-99			

53 VG standards have been listed in other categories, which are all best practice standards to be applied. The user should choose the most appropriate standard for his particular application, depending on the requirements selected for the specific technology, process, etc. and the domain (air/sea/land) they will be used in.

## 6. Conclusion

The main accomplishment for the group was the important reduction of BPS listed, this work enabling more coordinated and compliant armament contracts.

On top of that, the share on national BPS decreased from 90% to 50% of the BPS listed. This is a search of using more internationally recognised BPS (European, NATO...).

Annex A – List of Best practice standards references associated to the domain and presented in the spreadsheet template to be filled