

ICS 29.200; 29.240
CCS K 46



**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

GB/T 35702.2-2017

**Power losses in voltage sourced converter (VSC) valves for
high-voltage direct current (HVDC) systems -- Part 2: Modular
multilevel converters**

高压直流系统用电压源换流器阀损耗 第2部分：模块化多电平换流器
(English Translation)

Issued on: December 29, 2017

Implemented on: July 1, 2018

**Issued by: General Administration of Quality Supervision, Inspection and
Quarantine of the People's Republic of China, Standardization
Administration of the People's Republic of China**

Table of Contents

Foreword	
1 Scope	
2 Normative references	
3 Terms and Definitions, Symbols and Abbreviations	
3.1 Terms and definitions	
3.2 Symbols and Abbreviations	
4 Common conditions	
4.1 General	
4.2 Loss determination principle	
4.3 Valve loss classification	
4.4 Loss calculation method	
4.5 Input Parameters	
5 On-state loss	
5.1 Overview	
5.2 IGB T on-state loss	
5.3 Diode on-state loss	
5.4 Other on-state loss	
6 DC voltage-related losses	
7 DC capacitor loss of valve	
8 Switching loss	
8.1 Overview	
8.2 IGB T Switching Loss	
8.3 Diode switching losses	
9 Other losses	
Damping Circuit Loss	
9.2 Valve electronic circuit power loss	
Total loss of valve in HVDC converter station	
Appendix A (informative) MMC valve loss principle description	
References	

Foreword

GB/T 35702 "HVDC system voltage source converter valve loss" is divided into the following two parts.

- Part 1. General requirements;
- Part 2. Modular multi-level converter.

This section GB/T 35702 Part 2.

This section drafted in accordance with GB/T 1.1-2009 given rules.

This section uses the translation method identical with IEC 62751-2:2014 "high voltage DC system voltage source converter valve loss Part 2.

Modular multi-level converter. " the documents of our country that are consistent with the corresponding international documents that are normative references in this section are as follows.

- GB/T 13498-2017 HVDC terms (IEC 60633:2015, MOD)
- GB/T 34118-2017 voltage source converter for high voltage direct current system terminology (IEC 62747:2014, IDT) this section made the following editorial changes.
- According to our habit to change the text "R0" to "r0" (see 3.2.2,4.5.4,5.2,5.3, A.3.2.1 and A.3.2.2).

This standard proposed by the China Electrical Equipment Industry Association.

This standard by the National Standardization Technical Committee power electronic systems and equipment (SAC/TC60) centralized.

This standard was drafted unit. Xi'an West Power System Co., Ltd., China Southern Power Grid Institute of Science and Technology Co., Ltd. State Grid Beijing economy Technology Research Institute, Xi'an High Voltage Apparatus Research Institute Co., Ltd., Global Energy Internet Research Institute, China Southern Power Grid Co., Ltd.

EHV Transmission and Maintenance Testing Center, Monternet Rongxin Technology Group Co., Ltd.

1 Scope

This section GB/T 35702 gives based on the modular multi-level converter (MMC) high voltage direct current (HVDC) system converter valve Detailed calculation of power loss, each valve in the converter consists of a number of independent, double-ended controllable voltage source in series. This section does not Only applicable to the case where the submodule uses only one semiconductor device that can be turned off at each switch cell,

the OFF cells are made up of a plurality of turn-off semiconductor devices connected in series (this topology is also referred to as a cascaded two-level inverter). This section gives the main formula for a two-level "half-bridge" structure is given, and in Appendix A, how to generalize the result to determine other types of MMC Guidelines for standard components.

This section is mainly for the insulated gate bipolar transistor (IGBT) consisting of inverters can also be used as other types of turn-off semiconductors Guide for the use of inverters made of body components.

In addition to the converter valve, the power loss of other equipment in the HVDC converter station is outside the scope of this standard.

This section does not apply to the commutation converter in the HVDC system commutation converter.

2 Normative references

The following documents for the application of this document is essential. For dated references, only the dated version applies to this article Pieces. For undated references, the latest edition (including all amendments) applies to this document.

Voltage source converters for high voltage direct current systems - Valve losses - Part 1. General requirements (IEC 62751-1.

2014, IDT)

IEC 60633 HVDC Terminology for high-voltage direct current (HVDC) transmission] IEC 62747 HVDC system voltage source converter terminology
[Terminology for voltage-sourced converters (VSC) for high-voltage direct current (HVDC) systems] ISO/IEC Guide 98-3 Measurement Uncertainty Part 3. Measurement Uncertainty Indicators [Uncertainty of measurement-Part 3: Guide to the expression of uncertainty in measurement (GUM:1995)]

3.1 Terms and definitions

GB/T 35702.1-2017, IEC 60633 and IEC 62747 define the following terms and definitions apply to this document.

3.1.1

Modular multi-level converter; MMC each voltage source converter valve consists of a series of multilevel converters consisting of a number of modular multilevel converter standard components.

3.1.2

Modular multilevel converter standard component MMC building block MMC standard

components Composed of an independently controllable voltage source with two terminals and a DC capacitor and an auxiliary unit directly underneath,