ICS 03.120.10
CCS C 00

GROUP STANDARD

T/SHPPA 010(E)—2025
Replace T/SHPPA 010-2021

# Technical requirements for digital quality assurance in pharmaceutical production

# 药品生产数字化质量保证技术要求

*(English Translation)*



Issue date: 2025-06-16 Implementation date: 2025-06-28

Issued by Shanghai Pharmaceutical Profession Association

# Contents

# Foreword

the Shanghai Pharmaceutical Profession Association is in charge of this English translation. In case of any doubt about the contents of English translation, the Chinese original shall be considered authoritative.

This document is drafted in accordance with the rules given in the GB/T 1.1-2020 *Directives for standardization - Part 1: Rules for the structure and drafting of standardizing documents*.

This document replaces the T/SHPPA 010-2021 Technical requirements for digital quality assurance in pharmaceutical production in whole. In addition to a number of editorial changes, the following technicaldeviations have been made with respect to the T/SHPPA 010-2021:

a) Increased provisions for access to critical traceability data (see 4.3.1.7);

b) Increased provisions for integration of artificial intelligence technology (see 4.5.7);

c) Increased provisions for storage and backup (see 4.5.8).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. The issuing body of this document shall not be held responsible for identifying any or all such patent rights.

This document was proposed by the Shanghai Center for Drug Evaluation.

This document was prepared by the Shanghai Pharmaceutical Profession Association.

This document was drafted by: Shanghai Drug Evaluation and Verification Center and Shanghai Pharmaceutical Profession Association.

The main drafters of this document: Cao Meng, Ge Yuanyuan,, Han Bin, Wang Chong, Zhang Jingchen, Chen Guiliang,, Ge Yuqing, Zhang Jinwei, Yang Qing, Yi Zhengyu, Wu Yaowei and Zhu Beifen.

The initial implementing entities of this document are Shanghai Fosun Kairos Biotechnology Co., Ltd., Merck & Co. (Jiangsu) Co., Ltd., Shanghai Danrui Biomedical Technology Co., Ltd., Sanofi (Hangzhou) Pharmaceutical Co., Ltd., Shanghai Sibiman Biotechnology Co., Ltd., Shenzhen Sanofi Pasteur Biological Co., Ltd., Shanghai institute of Microsystem and information Technology Chinese Academy of Sciences, Shanghai Knowhub Technologie Co., Ltd., Shanghai Mianyi

Biopharmaceutical Co., Ltd., OBiO Technology(Shanghai) Corp.,Ltd., Nanjing IASO Medical Technology Co.,Ltd.and WuXi XDC Co., Ltd..

The release status of previous versions of this document and the documents it replaces is as follows:

—— First released in 2021 as T/SHPPA 010-2021;

—— This is the first revision.

# Introduction

The high-quality development of the pharmaceutical industry is a crucial task for advancing new industrialization and building a manufacturing powerhouse, and it is a key support for the Healthy China strategy. To expedite the implementation of the High-Quality Development Action Plan for the Pharmaceutical Industry (2023-2025), the Action Plan for the Digital Transformation of Manufacturing, and the Opinions on Comprehensively Deepening the Reform of Drug and Medical Device Regulation to Promote the High-Quality Development of the Pharmaceutical Industry, ensuring the reliability, authenticity, completeness, and consistency of drug production data is essential. Implementing digitalization in drug production is of great significance in this field.

The implementation of the Technical Requirements for Digital Quality Assurance in Pharmaceutical Production (T/SHPPA 010-2021) has been nearly four years. The implementation of the standard has promoted the deep integration of the pharmaceutical industry chain with the new generation of information technology, accelerated the cultivation and development of new quality productivity, and at the same time, with the application of new technologies and new methods, the requirements for digital quality assurance in pharmaceutical production need to be constantly updated.

In light of this, the Technical Requirements for Digital Quality Assurance in Pharmaceutical Production (T/SHPPA 010-2021) has been revised to include new requirements for data acquisition in the production of personalized drugs such as cell therapy, and integration with artificial intelligence technology. This revision aims to enhance the reliability, compliance, coordination, and precision of pharmaceutical quality assurance, thereby supporting the high-quality development of the pharmaceutical industry.

# Technical requirements for digital quality assurance in pharmaceutical production

## 1 Scope

This document specifies the technical requirements for digital quality assurance in pharmaceutical production, including basic requirements, application functions, data acquisition for pharmaceutical production, compliance management and early warning, implementation, risk management, data format and interface requirements.

This document applies to the digital design and practice of quality assurance related activities in the process of drug production.

## 2 Normative references

The following documents, cited through normative references, constitute essential provisions of this document. Only the versions corresponding to the dates provided apply; for documents without dates, the latest versions (including all amendments) apply.

GB/T 37393 *General technical requirements for digital workshop*

NMPAB/T 1003 *Basic technical requirements for pharmaceutical traceability system*

NMPAB/T 1004 *Basic data set for vaccine traceability*

NMPAB/T 1005 *Basic technical requirements for vaccine traceability data exchange*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
digital quality assurance, DQA

a series of procedures, modules, functions, algorithms or components that are used to regulate and monitor the life cycle of drugs by means of digital approaches

3.2
standard operating procedure, SOP

a general-purpose document approved to guide equipment operation, maintenance and cleaning,

as well as pharmaceutical production activities such as validation, environmental control, sampling and inspection

3.3
computerized system validation, CSV

adopt appropriate principles, methods and life cycle actions to establish documentation that demonstrates that the development of a computerized system conforms to quality engineering principles, provides functionality that meets user needs, and provides a process that can work stably over a long period of time

3.4
pharmaceutical production process

the whole chain process from starting material to release of finished product carried out by pharmaceutical manufacturers according to the approved process

Note: The drug production process usually includes manufacturing, test/assay and other activities that need to comply with the Good Manufacturing Practice

3.5
process signature

a visual representation of all characteristic information generated per unit time (usually milliseconds) for a particular manufacturing process

Note: In a compliant and controlled state, each process has its own unique, repeatable characteristic information, or digital "fingerprint"

3.6
critical Quality Attribute CQA

properties or characteristics of physics, chemistry, biology or microbiology

3.7
critical process parameter, CPP

variable parameters that affect key quality attributes

3.8
data

information reflecting the performance of activities generated in drug production activities

Note: Data generally includes numbers, symbols, images, audio, pictures, spectra, bar codes, etc

## 4 Technical requirements

### 4.1 Basic requirements for DQA construction

#### 4.1.1 Accessibility

Facilitate secure access to data related to drug production. The installed information system should have or allow the development of relevant access functions

#### 4.1.2 Traceability

Based on quality system evaluation and actual needs, the basic data generated in the drug production process can be interconnected and associated for retrieval, and the supporting information technology architecture can facilitate DQA to carry out key data traceability and compliance supervision .

#### 4.1.3 Controllability

The installation of DQA related components/systems on existing systems in production should be fully risk assessed to ensure that the installation does not adversely affect process or product quality. The risk-based scientific approach can be used to demonstrate that DQA is at least equivalent to or superior to non-digital quality assurance methods.

#### 4.1.4. Easy to analyze

The ability to analyze isolated data, track key process signature, especially indicators of quality attributes determined based on process understanding, and identify and evaluate relative differences before and during production should also be available.

#### 4.1.5 General and standardization

A series of key technical documents, particularly those related to the conversion of regulatory logic into computer logic, should be reviewed according to the requirements of ASTM International D6299-02. For process analytical technology systems used for validation, continuous quality assurance must be provided to the system being validated; for continuous manufacturing, the relevant requirements of ICH Q13 must be met.

### 4.2 Application functions of DQA

The application functions of DQA include at least:

—— Monitor the stability and consistency of drug production process;

—— Monitor the accuracy and accuracy of drug production data;

—— Periodic evaluation of the operation of the drug production management system, with special attention to the discovery, treatment and prevention of deviations;

—— Review the application cycle and test the quality assurance capability level through quality assessment methods;

—— Periodic and independent reconfirmation/revalidation of confirmed/validated systems.

4.3 Acquisition of pharmaceutical production data

4.3.1 Data acquisition

4.3.1.1 Data related to key quality attributes

The data related to critical quality attributes shall be evaluated and determined according to product characteristics, process characteristics and approved documents, and shall be specified in written documents. The critical quality attributes obtained include but are not limited to identification, purity, content, potency, safety and factors affecting stability (if applicable) of key intermediates and products.

4.3.1.2 Key process parameter data

Key process parameter data shall be evaluated and determined according to the control parameters, range limits, design space and approval documents in the process, and shall be specified in written documents. Key process parameters to be obtained include but are not limited to feed quantity, temperature, duration, humidity, pressure, flow rate and rotational speed (if applicable).

4.3.1.3 Key material data

Obtain information on key materials related to production, such as active pharmaceutical ingredients/ raw materials, excipients, and packaging materials that come into direct contact with drugs, including but not limited to batch number, supplier, expiration date, storage and transportation conditions (if applicable).

4.3.1.4 Deviation data

Obtain deviation and its investigation records, including but not limited to the time, place and scope of influence (batch impact, production step impact, etc.) of the deviation, investigation process and conclusion (if applicable).

4.3.1.5 Release of operational data

Obtain relevant information about the release activity, including but not limited to batch, condition, key person and action time (if applicable).

4.3.1.6 Key authorization data

Obtain key authorization information, including but not limited to authorization operations for key systems (such as DQA, production batch release system, quality management system, etc.) and key data, as well as application and authorizer, applicant qualification, application and grant date, application and authorization content, etc.

4.3.1.7 Key traceability data

Data such as donor materials for individualized drugs such as cell therapy, clinical test reports, collection records, unique identification codes, transportation conditions, and infusion records were obtained.

4.3.1.8 Other data

According to the quality system evaluation and actual needs, obtaining other elements required by the regulations and documents such as the Good Manufacturing Practice, for example, obtaining relevant information about facilities and equipment.

4.3.2 Data timeliness

4.3.2.1 Basic requirements for timeliness

The timeliness of data acquisition should be consistent with its related risk level, and the relevant information system or electronic data should be entered in time to ensure the authenticity, integrity and traceability of relevant data.

4.3.2.2 Real-time transmission of data

Data can be obtained as soon as it is generated. The scope of real-time data transmission should be determined according to the quality system evaluation and actual needs, including key values and abnormal values.

4.3.2.3 Periodic transmission of data

Data is obtained at a certain interval frequency after it is generated. The periodic transmission range and interval frequency of data should be determined according to the quality system evaluation and actual needs, including monitoring or recording data.

4.3.2.4 Delayed data transmission

Data shall be obtained within a certain time limit through manual intervention, including but not limited to manual input, scanning, data transfer, etc. The scope of delayed transmission data and the time limit for obtaining data shall be determined according to the quality system evaluation and actual needs, including:

—— Data on individual paper records;

—— Data generated by devices without transmission function;

—— Data generated by devices not connected to the local area network.

4.4 DQA compliance management and early warning

4.4.1 Restrict illegal operations

In the event of any of the following, further operations should be restricted through DQA to avoid the expansion of harm or further violations.

—— Ignore important alarms. Fail to record and/or investigate abnormal alarms that may affect product quality in time.

—— Unauthorized operation. Attempting to perform unauthorized operation, or using another persons account without authorization, or violating the key steps of SOP during operation.

—— The release is too lax. When deviations in the production process, inspection results exceed the standard, trend or expectation occur, the release is attempted without investigation according to regulations.

—— Personnel qualification is not confirmed. Without confirmation of personnel qualification and without training, or beyond the scope of their own work, they carry out key operations such as testing and manufacturing without authorization

—— Overdue or timeout. Occurrences that exceed the expiration date or normal time limit, such as:

- The registration approval, production license or other filing documents have expired;
- Reagents, materials, intermediates or finished products have been stored beyond their expiration date;
- The retest of the reference product or the calibration of the measuring equipment has exceeded the expiration date;
- The qualification of relevant personnel for on-the-job training has expired;
- The system has timed out in response to a specific request.

4.4.2 Indicating quality risks

In the following cases, timely risk alerts shall be sent to the relevant personnel through DQA.

—— Exceeds the warning line or trend. Data from the production process, inspection process, or environmental monitoring exceeds the warning line, or exceeds the trend (as applicable).

—— The process is not complete. Key steps are missing, or key data is not submitted, or electronic signature is not signed, etc

—— Data integrity measures are challenged. Controls to ensure data integrity are not implemented in accordance with quality system assessments and/or regulatory and industry specifications (such as PIC/S GMP/GDP).

4.4.3 Evaluate the quality system

At certain periodic intervals, a review can be carried out through DQA to evaluate the quality system and report on situations that require further attention. These include, but are not limited to:

—— Qualification. Facilities and equipment have been confirmed, measuring instruments have been calibrated, and personnel have been trained;

—— Process. Including the conformity of process regulations and operations, the standardization of inspection operations, the standardization of release approval, and the standardization of deviation handling, etc;

—— Results. Reliability of raw data, especially metadata, accuracy of reported results, etc;

—— Evidence. Audit trace data, qualification and verification data, quality assurance data integrity, etc.

4.5 Implementation of DQA

4.5.1 Determine scope and requirements

Based on the risk assessment method, determine the scope of DQA to be carried out in the current implementation stage. According to the product quality standards and process characteristics, determine the requirements that the quality assurance content involved in 4.3 and 4.4 should meet.

4.5.2 Establishment and implementation procedures

Establish relevant documents or regulations for the implementation of DQA under the framework of quality system.

4.5.3 Communication and training

The various activities involved in the DQA life cycle require close cooperation between personnel in the relevant functional departments. The responsibilities and authorities of all DQA personnel to use and manage them should be defined and appropriate training should be conducted.

4.5.4 Deployment

The DQA procedure shall be formally deployed after communication and training by the relevant functional personnel. The deployment shall be carried out in accordance with the relevant plan and evaluated for effectiveness.

4.5.5 Verification

The life cycle management of components/systems involved in DQA shall be conducted in accordance with the relevant requirements for computerized systems in the Good Manufacturing Practice.

Conduct a systematic review or validation of the DQA or its components, including but not limited to initial release and changes, based on the risk assessment approach.

Verification shall be performed in accordance with the requirements of ISPE/GAMP5.

4.5.6 Monitoring and adjustment

4.5.6.1 Continuous improvement

After implementing, it is essential to monitor the operation of DQA. Quality assurance personnel should ensure that DQA operates effectively and continuously as intended, and collect user feedback during its operation. By accumulating data and compliance management and early warning knowledge, DQA can continuously support the operation of the digital twin system in GMP factories, including using machine learning and other technologies to train and optimize the models of virtual entities.

4.5.6.2 Maintain the verification status

Periodic review of DQA to ensure that it remains in a validated state and within a controlled range.

4.5.6.3 Change management

All adjustments during the life cycle shall comply with the requirements of quality system change management.

4.5.6.4 Iteration, replacement or decommissioning

For the iteration, replacement or decommissioning of DQA system, corresponding plans should be formulated and implemented in a scheduled way. Data migration or archiving should meet the requirements of data reliability.

4.5.7 Integration of artificial intelligence technology

A risk-based credibility assessment framework should be established to determine the risk level of AI models based on the degree of influence and consequences of decisions made by Artificial Intelligence (AI) models.

The design of AI models requires appropriate interpretability and the data used should be of high quality and representative.

4.5.8 Storage and backup

Software application and data storage should be secured against malfunction, failure, loss, damage, or unauthorized access. Electronic data should be stored on a stable server or host

with a secure network environment.

A regular backup mechanism should be in place and disaster recovery capability should be available. The backup and recovery process should be validated.

4.6 Risk management

4.6.1 Risk management principles

Risk management should run through the DQA life cycle and be consistent with the life cycle risk management of drugs. It shall be implemented in accordance with ICH Q9.

4.6.2 Key links

For the general links of DQA life cycle, risk management should be carried out according to quality system evaluation and actual needs. For the following key links, risk identification, evaluation and control should be carried out:

—— Determine the scope and requirements of DQA;

—— Analyze the effectiveness of DQA;

—— Evaluate the potential impact of the implementation of DQA on existing processes;

—— Change management of DQA.

4.7 Data format and interface

4.7.1 The data format of DQA shall comply with the requirements of NMPAB/T 1003 and NMPAB/T 1004.

4.7.2 The data interface of DQA shall comply with GB/T 37393 and NMPAB/T 1005 requirements.

# Bibliography

[1] ISO/IEC 27001 *Information security, cybersecurity and privacy protection - Information security management systems - Requirements*

[2] ISO/IEC 38505-1 *Information technology - Governance of IT - Governance of data - Part 1: Application of ISO/IEC 38500 to the governance of data ISO/IEC 38500 Information technology - Governance of IT for the organization*

[3] IEEE 730-2014 *IEEE Standard for software quality assurance processes*

[4] IEEE 802.3-2018 *IEEE Standard for ethernet*

[5] IEEE 802.1X-2020 *IEEE Standard for Local and metropolitan area networks-port-based network access control*

[6] EDQM *Validation of computerised systems core document*

[7] FDA *Part 11 of title 21 of the code of federal regulations: electronic records; electronic signatures*

[8] FDA *Guidance for industry: PAT—A Framework for innovative pharmaceutical development, manufacturing, and quality assurance*

[9] ICH Q8 *Pharmaceutical development*

[10] MHRA *GXP Data integrity guidance and definitions*

[11] PDA *Elements of a code of conduct for data integrity*

[12] WHO *Guideline on data integrity: 4.Good data and record management practices*

[13] WHO *Supplementary guidelines on good manufacturing practices (GMP): validation*

[14] ICH Q9 *Quality risk management*

[15] ICH Q13 *Continuous manufacturing*

[16] PIC/S GMP/GDP *Good practices for data management and integrity in regulated GMP/GDP environment*

[17] ISPE/GAMP5 *Good automated manufacturing practice 5*

[18] ASTM International D6299-02 *Standard practice for applying statistical quality assurance techniques to evaluate analytical measurement system performance*

[19] *Good Manufacturing Practice for Pharmaceutical Products (2010 Revision)*

[20] *Annex to the Good Manufacturing Practice for Pharmaceutical Products: Confirmation and Validation (No.54,2015)*

[21] *Annex to the Good Manufacturing Practice for Pharmaceutical Products: Annex to the Computerized System (No.54,2015)*

[22] *Requirements for Drug Record and Data Management (Trial) (No.74,2020)*

[23] Cao Meng, Ge Yuanyuan, Zhang Jingchen, Chen Guiliang. Application of new drug analysis technology in pharmaceutical science supervision. China Pharmaceutical Affairs. 2021,35(6):614-623