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Prequalification Team Inspection services
WHO PUBLIC INSPECTION REPORT
of the Quality Control laboratory
(WHOPIR)

Part 1	**General information**		
Laboratory Details			
Name of the laboratory	Drugs Testing Laboratory, Rawalpindi, (hereafter DTL, Rawalpindi)		
Address of inspected laboratory	Dhamial Road, Hayal Sharif Rawalpindi, Punjab 46500 Pakistan		
GPS Coordinates	33.54187° N 73.01377° E		
Address of corporate office, telephone number and fax number	Primary & Secondary Healthcare Department, Government of Punjab Dhamial Road, Hayal Sharif, Rawalpindi Punjab 46500, Pakistan Tel: +92-51-9334398-9 Email: qmsm.dtlrwp@gmail.com director.technical.dtlrwp@gmail.com		
Dates of inspection	25-26 July 2022		
Type of inspection	Follow-up inspection		
Introduction			
Brief description of testing activities	*Type of analysis*	*Finished products*	*Active pharmaceutical ingredients*
	Physical/ Chemical analysis	Genera Appearance, Weight Variation, Volume (i.e. Deliverable, Extractable), pH, Conductivity, Friability, Hardness, Thickness, Diameter. Physical Tests of Cotton products (Wefts, Warps, sinking time, water holding capacity, weight per unit area etc.), Drug Release Profile of the solid Dosage Form (Disintegration Testing, Dissolution Testing)	General appearance, pH.
	Identification	Qualitative Analysis by HPLC/ UHPLC (PDA,	Qualitative Analysis by HPLC/ UHPLC (PDA,

		FLR, IR, UV/Visible, ECD), FTIR, UV spectrophotometry, TLC.	FLR, IR, UV/Visible, ECD), FTIR, UV spectrophotometry, TLC.
	Assay	Quantitative Analysis by HPLC/ UHPLC (PDA, FLR, IR, UV Visible, ECD), UV-Visible spectrophotometry, AAS and Titration.	Quantitative Analysis by HPLC/ UHPLC (PDA, FLR, IR, UV Visible, ECD), UV-Visible spectrophotometry, TLC and Titration
General information	The Drugs Testing Laboratory Rawalpindi is a regulatory laboratory established under section 15 of the Drugs Act 1976 in 2016. The Laboratory started its activities in February 2016. It provides pharmaceutical testing of drug samples to the Directorate of Drugs Control, Government of the Punjab, Primary & Secondary Healthcare Department, through its subsets; collected by the drug inspectors or any public sector forwarding authority like public healthcare facilities. The provincial Quality Control Board (internal customer of the Laboratory) is the designated body in the Directorate of Drugs Control of the Department, which has technical capabilities and legal functions to scrutinize test reports, audit, and suggest improvements in the Drugs Testing Laboratories.		
History	The Laboratory was inspected by WHO in April 2021. After review of the respective CAPA plan, it was concluded that the implementation of the corrective and preventive actions should be verified. After the last WHO inspection, the Laboratory was accredited by PNAC in accordance with ISO 17025:2017 requirements.		
Brief report of inspection activities undertaken – Scope and limitations			
Areas inspected	The inspection's target was to verify the implementation of the CAPA plan related to the Quality Management System, Personnel, Documentation and Records, Equipment *v*alidation – qualification – calibration, Reference standards, and Validation of computerized systems.		
Restrictions	N/A		
Out of Scope	N/A		
Abbreviations	**Meaning**		
ALCOA	Attributable, legible, contemporaneous, original and accurate		
API	Active pharmaceutical ingredient		
CoA	Certificate of analysis		
CAPA	Corrective action & Preventive action		
DQ	Design qualification		
FPP	Finished pharmaceutical product		
FTIR	Fourier transform infrared spectrophotometry or spectrophotometer		

GC	Gas chromatography or Gas chromatography equipment
GMP	Good manufacturing practices
HPLC	High-performance liquid chromatography (or high-performance liquid chromatography equipment)
ILC	Inter laboratory control
IQ	Installation qualification
IR	Infrared spectrophotometry
KF	Karl Fisher titration
LIMS	Laboratory information management system
MB	Microbiology
MR	Management review
N	Normality
NC	Non-conformity
NCA	National control authority
NCL	National control laboratory
NRA	National regulatory agency
OOS	Out-of-specifications test result
OQ	Operation qualification
Ph.Eur.	European Pharmacopoeia
PM	Preventive maintenance
PQ	Performance qualification
PQR	Product quality review
PQS	Pharmaceutical quality system
PT	Proficiency testing
PTS	Proficiency testing scheme
PW	Purified water
QA	Quality assurance
QC	Quality control
QCL	Quality control laboratory
QM	Quality manual
QMS	Quality management system
QRM	Quality risk management
RA	Risk assessment
RCA	Root cause analysis
SOP	Standard operating procedure
TLC	Thin layer chromatography
TOC	Total organic carbon
URS	User requirements specifications
USP	United Stated Pharmacopoeia
UV	Ultraviolet-visible spectrophotometry or spectrophotometer
VMP	Validation master plan
VS	Volumetric solution

Part 2	Summary of findings and recommendations

1. Organization and management

The Laboratory Director provided a presentation detailing the Laboratory's activities.

The organizational chart depicting the organization and management structure of the laboratory was updated on 5 Jul 2022, including information about the personnel's responsibility, authority, and interrelationship. The DTL was a part of the Primary & Secondary Healthcare Department, Govt of The Punjab, under the supervision of the Secretary Primary & Secondary Healthcare Department. The total number of staff accounted to 38 at the time of inspection. The laboratory was headed by Mr Ijaz Alvi (Director DTL Rawalpindi) & Mr. Zohaib Abbas Khan (Director Technical) and comprised of the following departments:

- QMS Management
- Technical Management
    - AAS & GC-MS Lab
    - Microbiology Lab
    - Hi-Tech Lab & ID/Assay Lab
    - Physical Lab
    - Release Lab
- Admin Management

The Laboratory had arrangements to ensure that its management and personnel were not subject to commercial, political, financial, and other pressures or conflicts of interest that might adversely affect the quality of their work. The Laboratory had the policy to ensure the confidentiality of information contained in marketing authorizations and test reports.

The direct and indirect customers of DTL Rawalpindi were the following organizations:

- Provincial Quality Control Board Govt. of Punjab
- Directorate of Drugs Control Govt. of Punjab
- Federal Inspectors of Drugs
- Provincial Inspectors of Drugs
- Tertiary Care, THQ, and DHQ hospitals of Rawalpindi Division, Sargodha Division, and ICT Islamabad

The observation concerning the Management and organization was adequately addressed in the respective CAPA plan.

2. Quality management system

A quality manual defining the quality management system was available.

The management review (MR) took place in accordance with SOP for Control of management review meeting following a management review plan. The last MR was carried out on 15 Dec 2021. The meeting agenda, the attendee list, and the MR report were reviewed and discussed. The MR report consisted of the agenda items, discussions, outcomes, decisions & actions to be taken, and communication on requirements and suggestions. According to the report, all the activities were carried out following the applicable plan, and there were no outstanding issues.

A quality assurance plan was provided on the respective template. The frequency of different QA activities, including participation in ILC and PT testing, was indicated on that plan. PT testing was planned to be performed in June, July, and September based on a procurement request issued on 1 Nov 2021. The name and testing specifications to be completed during 2022 were specified in the list. The testing activities were performed according to the order from the PT organizer, i.e., LGC proficiency testing. The sample results were uploaded to LGC proficiency testing portal and the respective evaluation was received on the same portal. The printout was provided as evidence of the execution of the tests.

Change control activities, and the trend analysis were executed in accordance with the applicable SOPs. The activities were verified by the review of change control documentation requested on 28 May 2022 to relocate FTIR equipment due to purchasing a new GC/MS system.

The trend analysis consisted of the various performance of activities, e.g., daily verification of equipment, temperature and humidity data, number of samples, non-conformity, OOS, customer feedback, etc.

Observations concerning the QMS were adequately addressed in the respective CAPA plan.

3. Control of documentation

The control of documentation was discussed through review of the procedures and their implementation.

4. Records

Records of analytical tests, including calculation and derived data, method validations/verifications, instrument use, calibrations and maintenance, and sample receipt, were verified through review of sample analyses and the respective analytical worksheets.

5. Data processing equipment

An inventory of computerized systems was available with information about equipment ID, PC no., name of the software, the software's ID, storage location, category, the purpose of the software, validation date, validation due, related documents, and contact person.

Validation report, together with installation, operation, and performance qualification of the randomly selected computerized systems were reviewed:

- The software systems used for the following activities within the sample management:
    - Receipt of sample
    - Distribution of samples to the analyst
    - Issuance of certificate of analysis
- Empower associated with HPLC instruments
- WinLab version 7 associated with UV visible instrument.

The roles and specifications for each software were defined in SOP for Access Privilege of Computerized Systems. Also, the Laboratory had an access control matrix of computerized systems to link each right to the respective role according to the organogram and list of staff.

New documentation regarding the policy on password management was provided during the inspection. It included implementing a password management policy to ensure a strong password for adequate protection of the users' accounts.

SOP for Control of records was available to manage the backup and restoration procedures. Electronic data was backed up at regular intervals. Transferring data from computerized systems to the server was automated, and the verification was performed in a logbook. The restoration activities were also documented in a logbook.

The URS for Empower software system was provided through a process managed by the Head Quarter and applicable at the time of purchase, i.e., 2016-2017. The Laboratory was required to meet the FDA CFR 21 Part 11 Compliance requirements with compatibility with multiple vendors.

A risk assessment for Empower software system with information about the impact of risk, severity, detection, RPN, and risk level was available. There was an SOP for Verification of software login and security functions. This document was serving as PQ protocol.

The qualification documentation of Empower software system, provided by the vendor was reviewed. Nevertheless, a verification report with a list of required tests was provided for the software login and security functionalities by the Laboratory. However, the requirements were not adequately challenged, e.g., it was not challenged whether the metadata on the audit trail could be modified/deleted or whether the audit trail could be deactivated without leaving any trace. The Empower associated with HPLC was investigated. The Laboratory managed to demonstrate that the audit trail functionality could be disabled. The record of the activity was available on the instrument audit trail, hence; it did not compromise the data integrity.

The URS documentation for UV-Visible was also available on a template for bulk purchase. This was related to a request to accord permission for procurement signed by the DTL Rawalpindi Director on 25 Feb 2019. The software must be CFR 21 compliant.

The qualification reports of UV WinLab V 7.0.0.61 of PerkinElmer were reviewed. The system was challenged during OQ and PQ and qualified on 4 Dec 2020. The audit trail of WinLab was configurated to provide three options:

- Admin audit trail with information about admin log in
- Login history
- Task with information about the analysis activities

The act of logging into the sample management software system was challenged and documented in the validation report. The Drugs Testing Laboratories of the Punjab primary and secondary healthcare department provided the validation report. The software developer, QMS manager, deputy director HISDU, Director DTL Lahore, and Additional Secretary Drugs control approved the document. According to the validation report, a reconciliation module was added to the system with a cut-off date of 19 Jul 2022.

The Laboratory had a practice of printing out the projects' audit trail and keeping the paper records with the rest of the documentation and analytical worksheets. However, the Laboratory intends to move toward paperless archiving and replace paper records with electronic metadata due to environmental reasons. The practice was discussed during the inspection, and the Laboratory was assured that the paper records could be replaced by electronic records as long as the computerized systems were regulatory compliant. Organizations are encouraged to opt for environmentally friendly solutions in their process and activities.

Observations related to the Data processing equipment were adequately discussed in the respective CAPA plan.

6. Personnel

The Laboratory had personnel with the necessary education, training, technical knowledge, and experiences for their assigned functions. The Laboratory maintained current job descriptions for all personnel involved in tests and/or calibrations, validations, and verifications. The Laboratory also maintained records of all technical personnel, describing their qualifications, training, and experience. Staff undergoing training was assessed on completion of the training.

Training in good data and record management in evaluating the configuration settings and reviewing electronic data and metadata, such as audit trails, for individual computerized systems used in generating, processing, and reporting data was performed.

Randomly selected job descriptions, CVs, and training documentation were reviewed and verified.

Observation concerning the Personnel was adequately addressed in the respective CAPA plan.

7. Premises

Some parts of the Laboratory facilities were revisited during the inspection to verify the equipment qualification.

8. Equipment, instrument and other devices

Refer to section 12.

9. Contracts

This section was covered during the precious inspection.

10. Reagents

This section was covered during the precious inspection.

11. Reference substances and reference materials

A Standard Procedure was in place for the Management and Analysis of Reference & Working Standards.

The standard materials were recorded on the respective master list upon their receipt and assigned a unique ID number:

- List of Working Standards
- List of Reference Standards

The record of usage was captured in the Analytical Balance Utilization Log and the analyst workbook of the respective analyst.

The Reference Standards Utilization Logbook was maintained for primary and secondary reference standards only.

The CoAs of the standards were available.

Observations related to the Reference standards were adequately discussed in the respective CAPA plan.

12. Calibration, verification of performance and qualification of equipment, instruments and other devices

Calibration and qualification of equipment were carried out in accordance with the respective SOP:

- To ensure all equipment and instruments used in Drugs Testing Laboratory, Rawalpindi were calibrated
- To define the frequency of calibration and prepare a calibration calendar according to the specifications of the instruments
- To define and lay down a procedure for the process of calibration
- To ensure the proper relevant, and necessary records of the process

- To describe the procedure for calibration/qualification of equipment. This document set the protocols and parameters for calibrating various equipment internally or through external bodies.

The verification documentation of the periodic performance and maintenance documentation of the following equipment was reviewed to verify the equipment suitable design and proper functionality:
- Dissolution Apparatus with Autosampler (ERWEKA, Germany)
- Disintegration Apparatus (Pharmatest, Germany)
- Friability Tester (Pharmatest, Germany) installed
- HPLC with PDA & ECD (Waters, USA)
- HPLC with PDA & RI, (Waters, USA)
- UV/Visible Spectrophotometer (PerkinElmer, USA)

An observation in relation to the Qualification of equipment was identified. The observation was adequately addressed.

13. Traceability

This section was covered during the previous inspection. However, the requirements were reverified during review of analytical worksheets.

14. Incoming samples

Drugs Testing Laboratory Rawalpindi was responsible for analysing drug samples received under the Punjab Drugs (amendment) act 2017, and no other activities were carried out other than drug analysis. The samples were received on Form-6 and distributed according to the SOP for Receiving, Distribution, Handling, Storage and Transportation of Test items. After completion of the analysis, the results were reported on Form-7 by Govt. Analyst according to SOP for Reporting of Result.

Provincial governments were responsible for Post Marketing Surveillance of supply chains and distribution networks in the provinces that deliver medicines to the point of use. Inspectors from the Provincial government visited wholesale dealers and pharmacy outlets. During these inspections, they took samples that were sent to the Laboratory for analysis. Medicine supplied to the government institution were also analysed by the DTLs before use.

The Laboratory received two categories of samples from all of its following districts:
- Inspectors of drugs took field samples (Post Marketing Surveillance) from their E-designated area.
- Government supply (e.g., DHQs, THQs, or tertiary care hospitals), District Rawalpindi

Samples were registered in the sample management database upon their receipt. The system was reviewed together with the sample custodian.

Observation related to the Incoming samples was adequately addressed in the respective CAPA plan.

15. Analytical worksheet

The documentation related to the randomly selected samples was reviewed and discussed: (For more details, refer to section 18; "Sample analysis and OOS investigation")

16. Validation of analytical procedures

The Laboratory did not perform any method validation. The procedures employed for testing were suitable for the intended use, as demonstrated by verification.

A method verification consisted of suitability, specificity, recovery, and precision tests in accordance with the applicable SOP.

Appropriate system suitability tests were employed prior to the analytical tests to verify pharmacopeial methods and/or validated analytical procedures.

The protocol related to verification of identification and assay of Acetaminophen tablet by HPLC with was reviewed and discussed.

An observation related to method verification was adequately addressed in the respective CAPA plan.

17. Testing

This section was covered during the previous inspection and reverified through revision of sample analysis documentation.

18. Evaluation of test results and OOS investigation

An SOP was in place describing the conduct of investigations of OOS test results. When a doubtful result (suspected OOS result) was identified, the supervisor and the analyst undertook a review of the procedures applied during the testing process. The SOP was implemented in April 2022, and the OOS results were investigated in accordance with this version since then. OOS investigations which took place after this date were selected to be reviewed and discussed during the inspection.

Doubtful results were rejected only if an error could be identified.

If the investigation was inconclusive, the SOP gave guidance on the number of retests allowed based on statistical principles. Once an error was identified, corrective and preventive measures were recorded and implemented. All individual results (all test data) with acceptance criteria were reported. The repeat of tests was done by a second analyst, at least as experienced and competent as the first one.

The Laboratory issued analytical test reports based on information recorded in analytical worksheets.

The test reports further included the following information.

- the background and the purpose of the testing;
- reference to the specifications and methods used;
- the results of all tests performed (or numerical result with the SD of all tests performed);
- the statement whether the sample complies with the requirements.

Observations in relation to the OOS investigation were adequately addressed in the respective CAPA plan.

19. Certificate of analysis

A certificate of analysis / Test report was generated through the sample management software system and contained series of information, among others:

- the results of the tests performed with the prescribe limits and
- a conclusion as to whether the sample was found to be within the limits of the specification.
- The date on which the tests were completed.

20. Retained samples

This section was covered during the previous inspection.

21. Safety

This section was covered during the previous inspection.

Miscellaneous	
Assessment of the Laboratory Information File	Laboratory Information File, approved on 10 Feb 2022 was submitted. The document was updated in procedural activities e.g., data backup process, document revision process, qualification requirements and in annexures.
Annexes attached	N/A

Part 3	**Conclusion / Inspection outcome**

Based on the areas inspected, the people met, and the documents reviewed, including the CAPA plan provided for the observations listed in the Inspection Report, ***Drugs Testing Laboratory, Rawalpindi***, located at ***Dhamial Road, Hayal Sharif, Rawalpindi, Punjab, 46500; Pakistan*** is considered to be operating at an acceptable level of compliance with WHO GPPQCL Guidelines.

All the non-compliances observed during the inspection that were listed in the full report as well as those reflected in the WHOPIR, were addressed by the Laboratory, to a satisfactory level, prior to the publication of the WHOPIR.

This WHOPIR will remain valid for 3 years, provided that the outcome of any inspection conducted during this period is positive.

Part 4	List of WHO Guidelines referenced in the inspection report

.1. WHO Good Practices for Pharmaceutical Quality Control Laboratories. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fourth Report. Geneva, World Health Organization, 2010 (WHO Technical Report Series, No. 957), Annex 1.
Short name: WHO GPPQCL Guidelines or ***TRS No. 957, Annex 1***
https://www.who.int/publications/m/item/who-good-practices-for-pharmaceutical-quality-control-laboratories---trs-957---annex-1

2. WHO good practices for pharmaceutical microbiology laboratories. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fifth Report Geneva, World Health Organization, 2011 (WHO Technical Report Series, No. 961), Annex 2.
Short name: WHO TRS No. 961, Annex 2
http://whqlibdoc.who.int/trs/WHO_TRS_961_eng.pdf?ua=1

3. WHO good manufacturing practices: water for pharmaceutical use. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fourth-sixth Report. Geneva, World Health Organization, 2012 (WHO Technical Report Series, No. 970), Annex 2.
Short name: WHO TRS No. 970, Annex 2

4. WHO guidelines for sampling of pharmaceutical products and related materials. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Thirty-ninth Report. Geneva, World Health Organization, 2005 (WHO Technical Report Series, No. 929), Annex 4.
Short name: WHO TRS No. 929, Annex 4
http://whqlibdoc.who.int/trs/WHO_TRS_929_eng.pdf?ua=1

5. Guideline on data integrity. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifty-fifth Report Geneva, World Health Organization, 2021 (WHO Technical Report Series, No. 1033), Annex 4.
Short name: WHO TRS No. 1033, Annex 4
https://www.who.int/publications/i/item/55th-report-of-the-who-expert-committee-on-specifications-for-pharmaceutical-preparations

6. WHO good manufacturing practices for pharmaceutical products: main principles. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-eighth Report Geneva, World Health Organization, 2014 (WHO Technical Report Series, No. 986), Annex 2. ***Short name: WHO GMP guidelines*** or ***TRS No. 986, Annex 2***

7. WHO good manufacturing practices for active pharmaceutical ingredients. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fourth Report. Geneva, World Health Organization, 2010 (WHO Technical Report Series, No. 957), Annex 2. ***Short name: WHO TRS No. 957, Annex 2***

8. WHO Good Practices for Pharmaceutical Products Containing Hazardous Substances. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fourth Report. Geneva, World Health Organization, 2010 (WHO Technical Report Series, No. 957), Annex 3.
   Short name: WHO TRS No. 957, Annex 3

9. WHO good manufacturing practices for sterile pharmaceutical products. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fifth Report Geneva, World Health Organization, 2011 (WHO Technical Report Series, No. 961), Annex 6.
   Short name: WHO TRS No. 961, Annex 6
   http://whqlibdoc.who.int/trs/WHO_TRS_961_eng.pdf?ua=1

10. WHO guidelines on transfer of technology in pharmaceutical manufacturing WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fifth Report Geneva, World Health Organization, 2011 (WHO Technical Report Series, No. 961), Annex 7.
    Short name: WHO TRS No. 961, Annex 7
    http://whqlibdoc.who.int/trs/WHO_TRS_961_eng.pdf?ua=1

11. Model guidance for the storage and transport of time-and temperature-sensitive pharmaceutical products. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fifth Report Geneva, World Health Organization, 2011 (WHO Technical Report Series, No. 961), Annex 9. ***Short name: WHO TRS No. 961, Annex 9***
    http://whqlibdoc.who.int/trs/WHO_TRS_961_eng.pdf?ua=1

12. General guidelines for the establishment maintenance and distribution of chemical reference substances. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-first Report Geneva, World Health Organization 2007 (WHO Technical Report Series, No.943) Annex 3. ***Short name: WHO TRS No. 943, Annex 3***
    http://whqlibdoc.who.int/trs/WHO_TRS_943_eng.pdf?ua=1

13. Guidelines on heating, ventilation and air-conditioning systems for non-sterile pharmaceutical products. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifty-second Report Geneva, World Health Organization, 2018 (WHO Technical Report Series, No. 1010), Annex 8. **Short name: WHO TRS No. 1010, Annex 8**

14. WHO guidelines on quality risk management. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-seventh Report Geneva, World Health Organization, 2013 (WHO Technical Report Series, No. 981), Annex 2. ***Short name: WHO TRS No. 981, Annex 2***

15. WHO guidelines on variation to a prequalified product. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-seventh Report Geneva, World Health Organization, 2013 (WHO Technical Report Series, No. 981), Annex 3. ***Short name: WHO TRS No. 981, Annex 3***

16. WHO guidelines for drafting a site master file. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-fifth Report Geneva, World Health Organization, 2011 (WHO Technical Report Series, No. 961), Annex 14. ***Short name: WHO TRS No. 961, Annex 14***
http://whqlibdoc.who.int/trs/WHO_TRS_961_eng.pdf?ua=1

17. WHO Guidelines on good manufacturing practices: validation, Appendix 7: non-sterile process validation. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-ninth Report Geneva, World Health Organization, 2015 (WHO Technical Report Series, No. 992), Annex 3. ***Short name: WHO TRS No. 992, Annex 3***

18. WHO General guidance on hold-time studies WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-ninth Report Geneva, World Health Organization, 2015 (WHO Technical Report Series, No. 992), Annex 4. ***Short name: WHO TRS No. 992, Annex 4***

19. WHO Technical supplements to Model Guidance for storage and transport of time – and temperature – sensitive pharmaceutical products. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Forty-ninth Report Geneva, World Health Organization, 2015 (WHO Technical Report Series, No. 992), Annex 5. ***Short name: WHO TRS No. 992, Annex 5***

21. Supplementary guidelines on good manufacturing practices: validation. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fortieth Report. Geneva, World Health Organization, 2006 (WHO Technical Report Series, No. 937), Annex 4.
Short name: WHO TRS No. 937, Annex 4
http://whqlibdoc.who.int/trs/WHO_TRS_937_eng.pdf?ua=1

22. Stability testing of active pharmaceutical ingredients and finished pharmaceutical products. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fifty-second Report Geneva, World Health Organization, 2018 (WHO Technical Report Series, No. 1010), Annex 10.
Short name: WHO TRS No. 1010, Annex 10
https://apps.who.int/iris/bitstream/handle/10665/272452/9789241210195-eng.pdf?ua=1

23. Guidance for organizations performing in vivo bioequivalence studies. WHO Expert Committee on Specifications for Pharmaceutical Preparations. Fiftieth Report Geneva, World Health Organization, 2016 (WHO Technical Report Series, No. 996), Annex 9.
Short name: WHO BE guidance or TRS996 Annex 9

24. Guidance for Good chromatography practices. WHO Expert Committee on Specifications for Pharmaceutical Preparations Fifty-fourth report, (WHO Technical Report Series, No. 1025, 2020), Annex 4.
Short name: WHO TRS No. 1025, Annex 4
https://cdn.who.int/media/docs/default-source/medicines/who-technical-report-series-who-expert-committee-on-specifications-for-pharmaceutical-preparations/trs1025-annex4.pdf?sfvrsn=53f56dbc_4&download=true

25. Good Manufacturing Practices, Annex 3; Guidelines on validation Appendix 5. Validation of computerized systems (adopted, subject to the changes discussed by the Expert Committee - WHO Technical Report Series, No. 1019, 2019)
Short name: WHO TRS No. 1019, Appendix 5
chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://cdn.who.int/media/docs/default-source/medicines/norms-and-standards/guidelines/production/who-good-manufacturing-practices-guidelines-on-validation.pdf?sfvrsn=9440a5c_0&download=true