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Requirements for qualification of components for space application

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Requirements for qualification of components for space application

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FOREWORD

The standard is translated from the Chinese version of Standard on GB/T 29074-2012 released by Standardization Administration of China (SAC) under the management of State General Administration of Quality Supervision and Inspection and Quarantine. TC 425 is responsible for the translation. In case of any doubt about the contents of English version, the Chinese original shall be considered authoritative.

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

This standard is proposed by China Aerospace Science and Technology Corporation.

This standard is under the jurisdiction of National Technical Committee on Space Technology and Operation of Standardization Administration of China (SAC/TC 425).

INTRODUCTION

This standard belongs to the National Standard System of China Space. The National Standard System of China Space is applicable to the formulation, revision, and management of national standards in the field of space, covering three sectors of space management, space technology, and space application and services and serving as the basis for guiding spacecraft and launch vehicle project management, engineering, space launch services, and in-orbit satellite applications.

The optimization of space electronic system performance is based on improvement of component performance index. The determination of quality grade and long-term steady supply of space electronic system is the top priority of space component management. Along with the ever-changing development of components technology, highly integrated, high-performance and high-index components emerge constantly. However, qualification should be conducted in accordance with relevant rules to check whether the components are in compliance with the requirements of space application. Meanwhile, in face of increasingly extensive international space cooperation, standardized and unified qualification rules are required in terms of certification and selection of component. This standard is hereby formulated to further guide and standardize qualification of space components and ensure the product quality.

Requirements for qualification of components for space application

1 Scope

This standard specifies the management and technical requirements of qualification cases, evaluation and test of components for space application.

This standard is applicable to the qualification of space components by qualification departments. When it is needed to qualify the components for other application, this standard can be referred.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- | | | |
|------------|---|-----------------------------|
| GB/T 19000 | Quality management system | Fundamentals and vocabulary |
| GB/T 19001 | Quality management system | Requirements |
| GB/T 19011 | Audit guide of quality and (or) environmental management system | |

3 Terms and definitions

For the purposes of this document, the terms and definitions given in GB/T 19000 and the following apply.

3.1

process identification document

all documents related to production process control of particular components, including:

- a) Production flow chart;
- b) Process specification;
- c) Inspection procedures;
- d) Construction of components (including drawings);
- e) Testing procedures;
- f) Quality management documents relating to the manufacturer.

3.2

non-conformance

deviation from certain feature in the documents applicable to the components.

4 Abbreviation

The following abbreviations are applicable to this standard.

CA—— construction analysis;
DPA—— destructive physical analysis;
PID—— process identification document;
QDSC—— qualification department for space components;
QPLS——qualified parts lists for space.

5 General requirements for qualification

5.1 Cases for qualification

Qualification shall be performed as follows:

- a) New technology components;
- b) Components that have been not manufactured for over 2 years (including 2 years) in the QPLS;
- c) Components with major changes of design, process and construction;
- d) Components with lots failure due to inherent reasons;
- e) Other conditions needed to be qualified.

5.2 Qualification procedure

To select the space required components, qualification must be carried out based on the procedure specified herein in 3 phases:

- a) Preliminary evaluation phase, including the application of manufacturer, documents review and CA by QDSC;
- b) detail evaluation phase, including the evaluation of manufacturer, verification and evaluation of components by QDSC;
- c) Qualification test phase, including the production of qualification samples by the components manufacturer and implementation of qualification test.

The qualification process refers to Figure 1. The procedure about the acquisition of initial qualification refers to Figure 2. The qualification maintains flows refer to Figure 3. The procedure about the renewal after the lapse refers to Figure 4.

6 Preliminary evaluation

6.1 Qualification application

Qualification shall be executed by QDSC after the submission of formal application. The application can be submitted by specific users, component manufacturers or QDSC.

6.2 Requirements of application

Application shall contain the information about organizations of manufacturer, components, production and quality control methods, applicable general specifications and detail specifications for the components, key process and technology, important production and testing activities, product flows, quality assurance programs, the PID, etc.

Manufacturers shall provide the evidence about the application experiences of users to prove that the manufacturers have a certain time of producing components. Farther more, manufactures shall provide the written commitment about evaluation, qualification and related actives which are willing to be performed by this standard.

6.3 Application review

QDSC shall review the application and relevant documents. The manufacturers shall supply the documents and information and supports for the site survey by QDSC when necessary.

6.4 Construction analysis (CA)

After the review of application, QDSC shall perform a CA of the samples provided by the manufacturers. The manufacturer may be requested to provide further samples and documents.

6.5 Preliminary evaluation conclusion

When CA result meets the QDSC requirements, preliminary review will be agreed and the detail evaluation will be carried out based on the requirements in Chapter 7.

7 detail evaluation

7.1 Evaluation of manufacturer

Manufacturer shall be audited by QDSC in accordance with GB/T 19001, GB/T 19011, the PID of components and requirements of other documents. Such evaluation shall include, but not necessarily be limited to the following aspects:

- a) The overall manufacturing facility and its organization and management;
- b) The manufacturer's quality management system;
- c) The manufacturer's system for manufacturing control;
- d) The production line used for the component to be qualified.

7.2 Verification and validation of components

Verification and validation shall be completed by the manufacturer under the arrangement of QDSC. Such verification and validation shall include, but not necessarily be limited to the following aspects:

- a) Establishment of the verification and validation program for components;

- b) Execute the verification and validation test;
- c) Manufacturer should analyze the results of verification and validation test, improve design or production process control;
- d) Manufacturer should accomplish the PID.

7.3 Improvement of manufacturer

The manufacturer shall make a corrective plan according to the evaluation results, then take the corrective actions that may be required and their implementation, take necessary corrective measures, review and the finalization of information to be contained in the PID for the component.

7.4 Evaluation conclusion

QDSC shall review the results of corrective actions and confirm the PID. When evaluation conclusion meets the QDSC requirements, Evaluation will be passed and the Qualification test will be carried out based on the requirements in Chapter 8.

8 Qualification test

8.1 Preparation of samples for qualification

The components required for qualification testing shall be produced strictly in accordance with the PID. The production plan shall be provided by the manufacture. The contents shall include all critical procedures and process of production and testing, the date of commencement for the important production and test activities. The QDSC shall supervise the manufacture of these process. The samples of components required for qualification testing shall pass the screening and final test.

8.2 Qualification testing

Qualification testing of the component shall be carried out in accordance with the requirements of the relevant general specification. Qualification testing may be carried out by QDSC, or by the manufacturer under the supervision of QDSC, or by a national third-party test agency certified by QDSC.

8.3 Conclusion of qualification testing

8.3.1 The executor of the qualification test will analyze the qualification test report and any other reports or results, finish the qualification testing report and provide the qualification testing conclusion.

8.3.2 If the qualification testing failed, the manufacturer shall analyze the reasons, and adopt necessary corrective actions. After the confirmed result by the QDSC, the requalification test according to the requirements in 8.1 and 8.2 should be executed.

9 Approval of the initial qualification

QDSC shall review the qualification testing report or other reports and documents formed during the

qualification. If the requirements are fully satisfied, QDSC will approve the qualification, list the qualified components in the QPLS and certify the approval of qualification. The period of validity for the qualification is 2 years, starting from the formal approval of qualification. The initial qualification refers to the Figure 2.

10 Maintenance of qualification

10.1 Maintenance requirements

The manufacturer shall maintain the qualification in accordance with this standard and the applicable general specifications. Any information that may affect the qualification effectiveness shall be reported to the QDSC. Non-conformance during the maintenance shall be dealt with by the manufacturer according to the applicable documents. Maintenance requirements of qualification are as following:

- a) Execute the PID;
 - b) The manufacturer shall make records for each production lot;
 - c) Non-conformance with the PID shall be handled by the manufacturer according to the applicable documents;
 - d) On receipt of an Alert from the user concerning the qualified product, the manufacturer shall carry out the necessary investigation and supply suggested corrective actions as soon as possible.
- If there are changes of the PID, it shall be reported to QDSC.

10.2 Approval for the extension of qualification validity

The manufacturer shall submit the record files 3 months before the expiry of qualification period, including the test report on the quality conformance inspection based on the PID, non-conformance report, to prove that it has executed the PID and satisfied the requirements in 10.1 during the qualification validity. After the review passed, QDSC will approve the extension of qualification for the manufacturer formally, and issue the new qualification certification and update the QPLS correspond. The extension of qualification validity refers to Figure 3. New qualification certificate will utilize the form of sequence number of original certificate plus letter, such as A (which means the update for the first time) or B (which means the update for the second time). But, I, O and X shall not be used.

11 Termination of qualification

11.1 Termination conditions of qualification

If the extension of qualification certificate is not approved, qualification will be terminated from the expiry of period of validity of the existing certificate.

11.2 Notification after the termination of qualification

11.2.1 Within 6 months after the termination of qualification, QPLS shall be updated in time and that shall be explained by QDSC. Such explanation shall at least include the type of product for which qualification is terminated and the date of termination.

11.2.2 Within 12 months after the termination of qualification, QDSC will inspect and decide whether to extension the qualification or execute the qualification again or not.

11.2.3 If the qualification is terminated for over 18 months, the component will be moved out from the QPLS by QDSC.

11.3 Approval for the resumption of qualification

11.3.1 After the termination of qualification, such qualification may be resumed within the period specified in 11.2. The manufacturer shall provide reports to prove that original evaluation of components is still valid and effective, and then conform the DPA, review the report of manufacturer evaluation and the testing records during the period of termination. If the review succeeds, QDSC will renewal its qualification certification. If DPA fails, it is necessary to execute the quality conformance inspection based on the requirements of the general specification.

11.3.2 If the review and evaluation mentioned above failed, the manufacturer shall carry out the initial qualification again based on this standard.

11.3.3 The resumption of qualification after the termination of qualification shall refer to Figure 4.

11.4 Loss of qualification

When the manufacturer fails to meet the requirements of initial qualification or the following conditions occur, loss of qualification will occur:

- a) The manufacturer has not manufactured qualified components for 2 years;
- b) Major Changes of design, process and construction are not approved by QDSC;
- c) Within the period of validity of qualification, products already delivered to users have serious failure or lots failure due to inherent reasons during the application.

12 Qualification of a series of components

A series of components mean some components that adopt the same design, technology and assembly procedure and are performed as different circuits. For qualification, a series of components may be evaluated according to relevant generic specification and detail specification, typical components shall be sampled and qualification test shall be performed for them, finally the series of components will pass the qualification if typical sample components pass the qualification test.

13 Requirements of qualification certificate

Qualification certificate of qualified components shall be released in a timely manner to prove the manufacture that has the supplying capacity. Qualification certificate shall include the following information:

- a) Company name;
- b) Product type;
- c) Outline of main technical parameters;
- d) Quality grade;
- e) General and detail specification code and issue code;
- f) The PID code and issue code;
- g) Issuance date and period of validity of certificate;
- h) Issuance unit and seal on the certificate.

14 Requirements about documents and records

14.1 Documents

14.1.1 The PID of components for qualification shall be compiled and approved by the manufacturer, confirmed by QDSC. The compilation of such document shall conform to the requirements specified in the corresponding document.

14.1.2 All accompanied documents of product must be fully frozen before the samples for qualification are put into production, confirmed by QDSC.

14.2 Records

14.2.1 The manufacturer shall keep all records of qualified components, especially relevant records related to defective components discovered during test. When necessary, the manufacturer shall make necessary failure analysis to find out the cause for failure and taken corrective action accordingly.

14.2.2 Report and data of screening test, quality conformity or routine test, X-ray film, DPA report, data of samples and other particular tests shall be kept by the manufacturer for at least 20 years.

15 Requirements for information notification

15.1 An information exchange channel between the manufacturer and QDSC shall be established to guarantee timely exchange of product quality information.

15.2 If any circumstance that may influence the initial qualification state of product occurs during design, material preparation, production, test or process control or any failure is repeated during production of product, the manufacturer shall make an investigation and take necessary action immediately, and notify QDSC of such problem and relevant action; otherwise the manufacturer's qualification will be cancelled.

15.3 After any non-conformance occurs, the manufacturer shall start the non-conformance control procedure according to requirements specified in related documents.

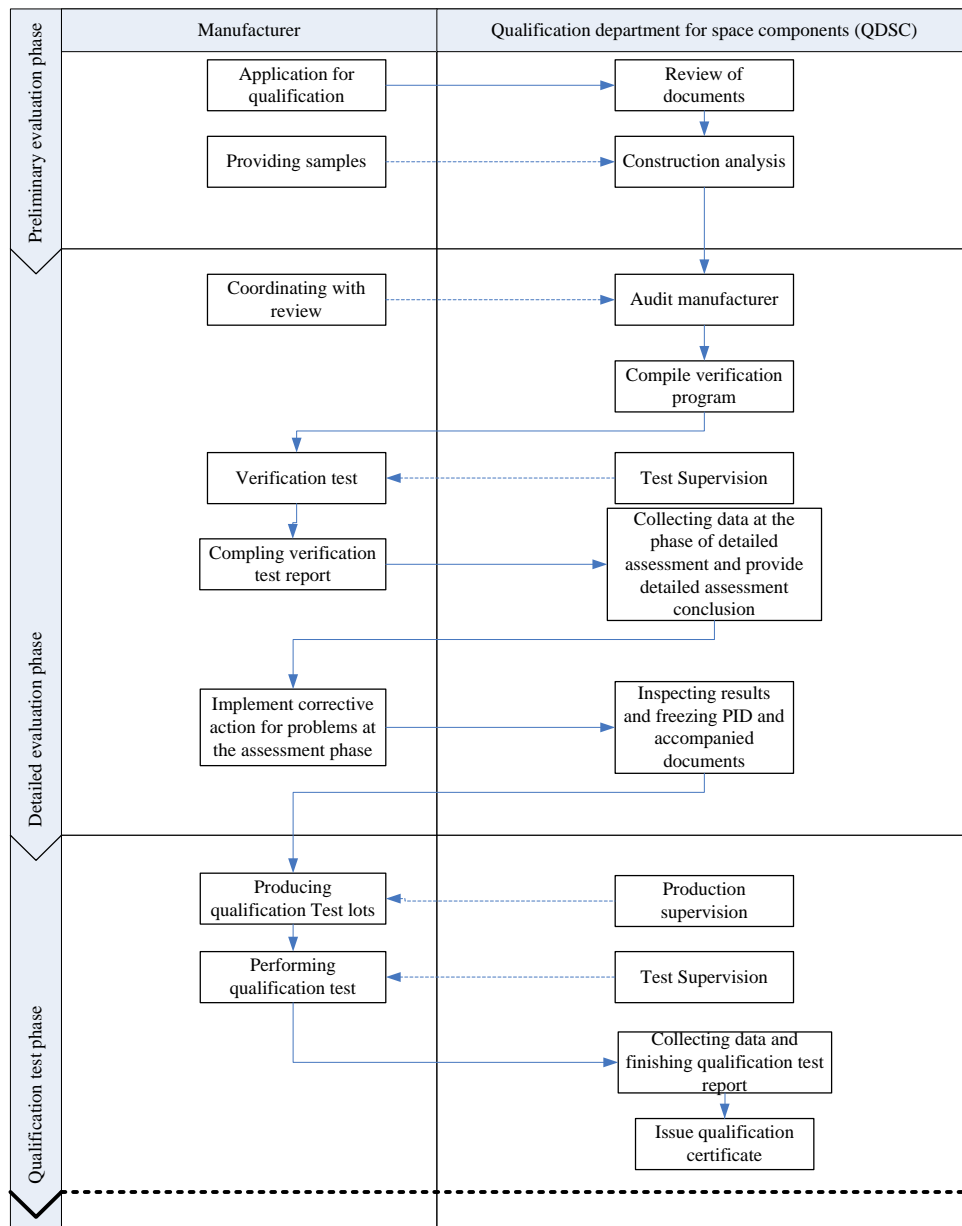


Figure 1 Qualification procedure

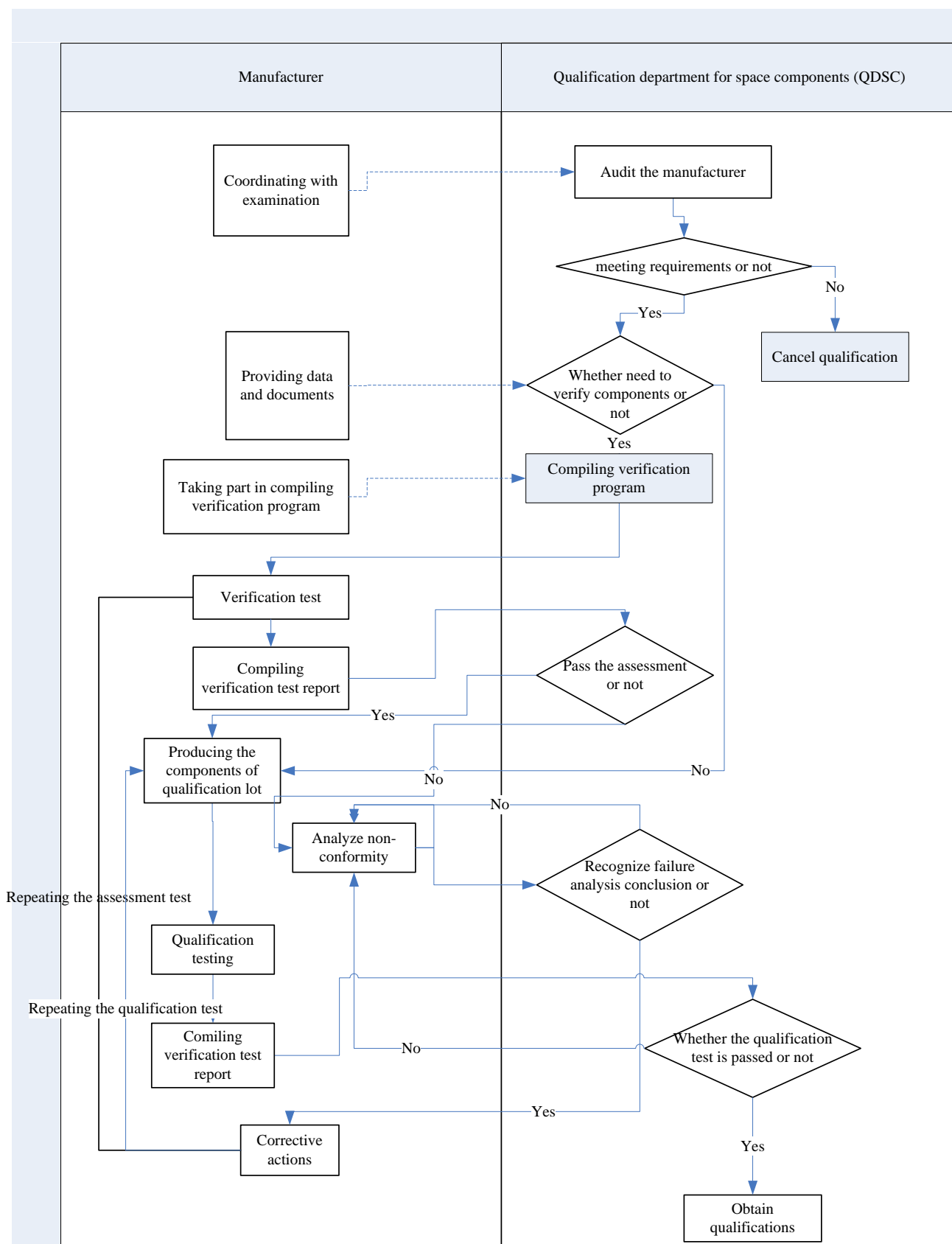


Figure 2 Procedure about the acquisition of initial qualification

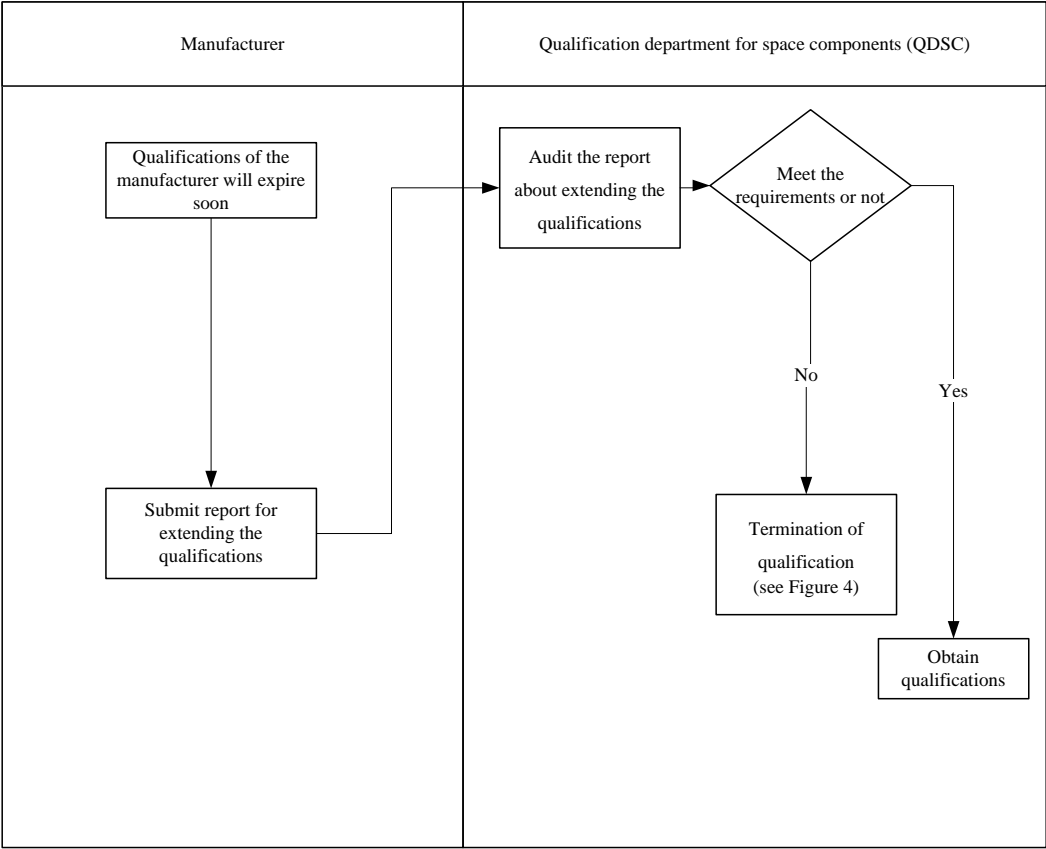


Figure 3 Procedure about the extension of qualification

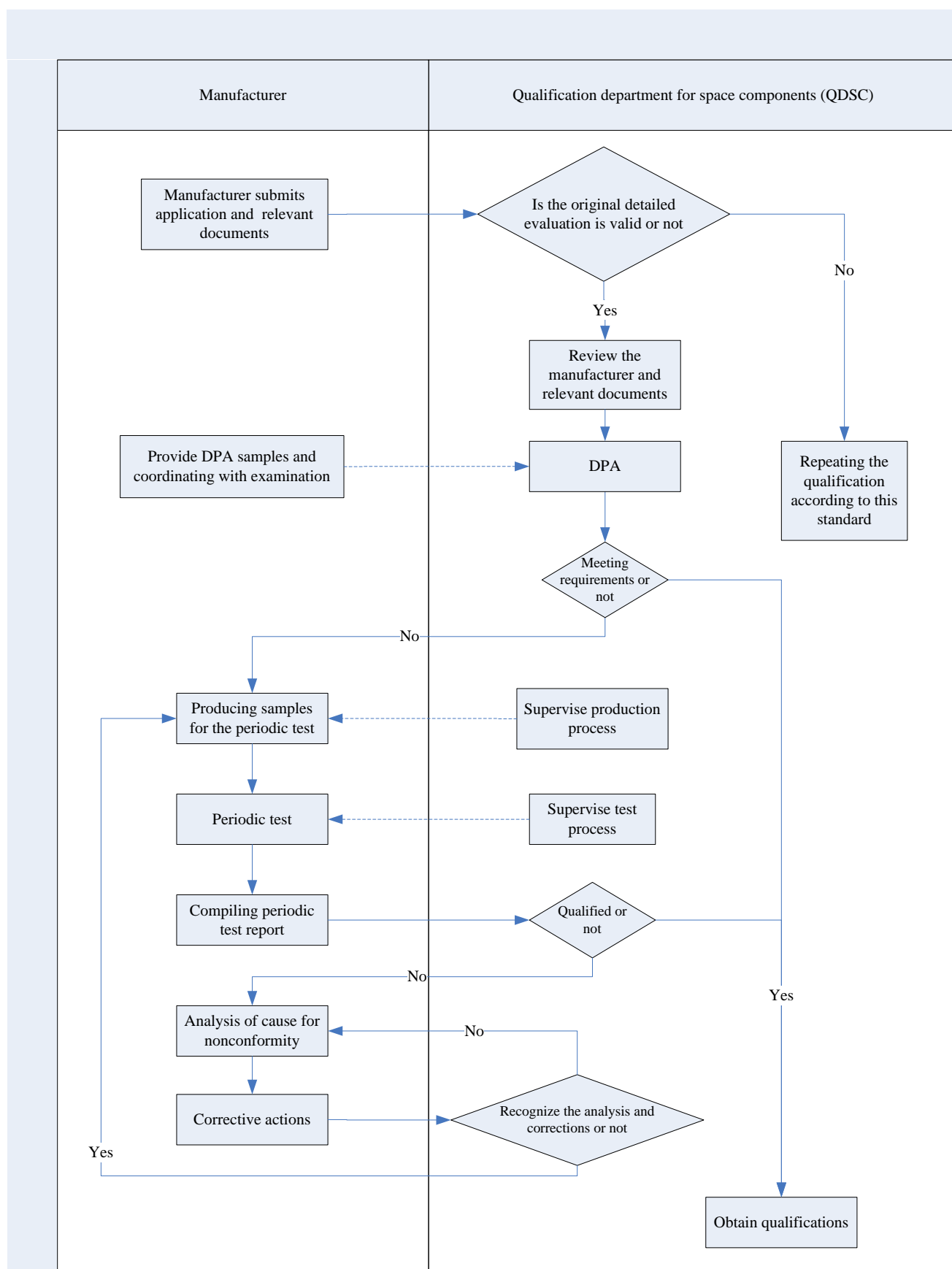


Figure 4 Procedure about the resumption after the termination of qualification