

## **Important Note for EPRI Report NP-5652**

EPRI NP-5652 was conditionally endorsed by the U.S. Nuclear Regulatory Commission (NRC) in Generic Letter 89-02.

It is important to note that the NRC revised 10CFR, Part 21 after EPRI published both NP-5652 and EPRI TR-102260 (Supplemental Guidance for the Application of EPRI Report NP-5652 on the Utilization of Commercial Grade Items). This revision included definitions that are different than the definitions included in EPRI NP-5652.

Please refer to 10CFR, Part 21 (available at [www.nrc.gov](http://www.nrc.gov)) for current regulatory definitions. Of particular note are the definitions for “dedication,” “commercial grade item” and “critical characteristic.”

Additional information, including the NRC’s emphasis on failure modes and effects analysis to determine critical characteristics, may be found in NRC IP 43003 and IP 38703 (also available at [www.nrc.gov](http://www.nrc.gov)).



Topics:  
Commercial grade items  
Dedication of parts  
Replacement of parts  
Critical characteristics

EPRI NP-5652  
Project Q101-7  
Final Report  
June 1988

# **Guideline for the Utilization of Commercial Grade Items in Nuclear Safety Related Applications (NCIG-07)**

Prepared by  
Gilbert/Commonwealth, Inc.  
Reading, Pennsylvania



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# R E P O R T S U M M A R Y

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SUBJECTS	Nuclear plant operations and maintenance / Quality engineering/construction / Nuclear plant life extension / Nuclear safety analysis center	
TOPICS	Commercial grade items Dedication of parts	Replacement of parts Critical characteristics
AUDIENCE	Utility design engineers / Plant operations, procurement, and quality assurance personnel	

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## **Guideline for the Utilization of Commercial Grade Items in Nuclear Safety Related Applications (NCIG-07)**

The reduced availability of spare and replacement parts designed specifically for nuclear safety related components has made it necessary for utilities to purchase commercial grade parts. This study, the seventh in a series cosponsored by the Nuclear Construction Issues Group (NCIG), outlines an acceptance procedure for ensuring that commercial grade items conform with requirements for their use in safety related applications.

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BACKGROUND	Most U.S. nuclear plants are now operational and frequently require replacement of parts, as well as complete components. Reductions in new nuclear power plant construction have prompted some suppliers to discontinue 10 CFR 50, Appendix B quality assurance programs, which had provided guidance on the design, manufacture, and application of safety related components. Utilities now must procure qualified replacement items from alternative suppliers or purchase replacement parts as commercial grade and dedicate them for safety related use. With the increased use of commercial grade items, a guideline is needed to ensure their conformance to regulatory requirements.
OBJECTIVE	To provide a guideline for procuring and using commercial grade items in safety related nuclear power plant applications.
APPROACH	A joint EPRI-NCIG committee reviewed documents related to the use of commercial grade items in safety related applications, including NRC codes, standards, regulations, and inspection reports, as well as industry publications. A survey of participating NCIG utilities and visits to a representative sample of nuclear power plants provided data on utility practices and procedures related to the procurement and use of these items. The group also visited a representative sample of suppliers of commercial grade items. Using this information, they developed this guideline and coordinated its dissemination to utilities, regulatory forums, and industry organizations.
RESULTS	The guideline contains a generic procedure for acceptance of commercial grade items, as well as four alternative acceptance methods—special tests

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and inspections, surveys of vendors supplying commercial grade components, source verification, and the recording of acceptable supplier/item performance—to provide flexibility. The report describes the implementation of each method and reviews examples of situations where it could be beneficial to use more than one acceptance method.

Appendixes and exhibits provide additional detail on selected subjects presented in the guideline and examples that can assist the user in employing the acceptance methods.

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**EPRI PERSPECTIVE**

The need to ensure availability of quality replacement parts for today's operating nuclear power plants in a timely manner is a concern of the industry. Since numerous replacement parts are now being purchased as commercial grade items, increased attention has been focused on their procurement and use. This guideline is intended to alleviate these and other difficulties, such as lack of consistent controls in procurement practices, regulatory inspection findings against utility control of commercial grade items, and lack of qualified replacement parts due to discontinuation of 10 CFR 50, Appendix B quality assurance programs. It facilitates industry uniformity in procuring and using commercial grade items.

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**PROJECT**

RPQ101-7  
EPRI Project Manager: Warren J. Bilanin  
Nuclear Construction Issues Group / Nuclear Power Division  
Contractor: Gilbert/Commonwealth, Inc.

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Items in Nuclear Safety Related Applications  
(NCIG-07)**

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**NP-5652  
Research Project Q101-7**

Final Report, June 1988

Prepared by

GILBERT/COMMONWEALTH, INC.  
Post Office Box 1498  
Reading, Pennsylvania 19603-1498

Principal Investigators  
M. P. Tulay  
F. J. Yurich  
F. M. Schremser, Jr.

NUCLEAR CONSTRUCTION ISSUES GROUP  
Commercial Grade Items Task Group

Prepared for

Nuclear Construction Issues Group

and

Electric Power Research Institute  
3412 Hillview Avenue  
Palo Alto, California 94304

EPRI Project Manager  
W. J. Bilanin  
Nuclear Power Division

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ORGANIZATION(S) THAT PREPARED THIS REPORT:

**Gilbert/Commonwealth, Inc.**  
**Reading, Pennsylvania**

## EPRI FOREWORD

The Nuclear Construction Issues Group (NCIG), with the support of the Electric Power Research Institute (EPRI), has prepared this guideline to provide specific direction on the utilization of commercial grade items intended for safety-related applications. This document provides methods that will reasonably assure commercial grade items are acceptable for their intended safety-related application. Although this document concentrates on spare/replacement commercial grade items, the same practices are applicable to commercial grade items intended for new construction or plant modifications, as well as for commercial grade services.

The NCIG Commercial Grade Items Task Group responsible for developing this guideline was composed of utility and consulting personnel with experience in the procurement, engineering, and quality assurance disciplines. Extensive data were collected prior to developing the guideline to establish a meaningful document.

The first step was to develop a current and concise summary of those documents that govern or provide guidance on the use of commercial grade items in safety-related applications. This research included a review of the following documents:

- Requirements set forth in U. S. Nuclear Regulatory Commission (USNRC) Regulations.
- Other regulatory type documents, including applicable USNRC Inspection Reports.
- Industry publications such as consensus documents, position papers, and white papers.

The more significant and applicable of these documents are listed in the reference and bibliography sections of this guideline.

The next step involved investigation of a sampling of utility practices and procedures related to the procurement and use of commercial grade items. This

included questionnaire responses from utilities and visits to a representative sample of nuclear power plants.

The final step was to visit a representative sample of suppliers that furnish commercial grade items used in nuclear power plants. The purpose of these visits was to examine suppliers' commercial quality controls and assure that suppliers would be receptive to surveys of their practices and source verifications at their facilities.

From these activities, the NCIG Commercial Grade Items Task Group developed, reviewed, and agreed upon a generic process for the acceptance of commercial grade items for use in safety-related applications. The process resulted in this document, which provides guidance and suggestions for implementation.

Warren Bilanin, Project Manager  
Nuclear Power Division

## ACKNOWLEDGMENTS

The following individuals were ongoing members of the Nuclear Construction Issues Group's Commercial Grade Items Task Group. As such, they made significant contributions to the development of this guideline by attending meetings, reviewing/commenting on various drafts, and writing portions of the document.

William E. Craig, Chairman	Arizona Public Service Co.
John D. Duffin	Bechtel Corp.
Walter J. Shewski	Commonwealth Edison Co.
William J. Razlaff	Cygn Energy Services
Warren J. Bilanin	Electric Power Research Institute
Tom J. Mulford	Electric Power Research Institute
Michael P. Tulay	Gilbert/Commonwealth, Inc.
Robert B. Stafford	Gulf States Utilities
Alan H. Miller	Impell Corp.
Kenneth E. Peveler	Iowa Electric Light & Power Co.
Larry Templeton	Northern States Power Co.
Steven M. Skidmore	Pacific Gas & Electric Co.
Dennis M. O'Rourke	Philadelphia Electric Co.
Robert M. Tjernlund	Sargent & Lundy Engineers
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## GLOSSARY OF TERMS AND DEFINITIONS

The terms presented below are referenced in various sections of this guideline and are used within the context of these definitions.

Acceptable Supplier/Item Performance Record - A record of acceptable performance of a supplier's commercial grade item which provides justification for a purchaser to accept the item for safety-related use.

Acceptance - The employment of methods to produce objective evidence which provides reasonable assurance that a commercial grade item received is the item specified.

Basic Component - An item procured either as a safety-related item or as a commercial grade item which has been accepted and dedicated for safety-related application. This term is synonymous with "safety-related component".

Certificate of Conformance - A written statement, signed by a qualified party, certifying that the items or services comply with specific requirements (definition from ANSI N45.2.10-1973).

Certification - The action of determining, verifying, and documenting that specified requirements are met.

Commercial Grade Item - An item satisfying all three of the following criteria:

1. Not subject to design or specification requirements that are unique to nuclear facilities; and
2. Used in applications other than nuclear facilities; and
3. Is to be ordered from the manufacturer/supplier on the basis of specifications set forth in the manufacturer's published product description (for example, a catalog) (definition from ANSI/ASME NQA-1-1986).

Commercial Grade Survey - Activities conducted by the purchaser or its agent to verify that a supplier of commercial grade items controls, through quality activities, the critical characteristics of specifically designated commercial grade items, as a method to accept those items for safety-related use.

Commodity Item - An item having a generic application throughout a nuclear unit, which lends itself to bulk procurement (e.g, nuts, bolts, materials, O-rings, gaskets, indicator lights, fuses, relays, resistors, etc.).

Conditioning - Any additional work or process imposed upon an item that makes it different from nominally similar items (definition from ANSI/IEEE STD 934-1987).

Conditioning may include calibration, adjustment, tuning, selection testing, "burn-in", heat treatment, machining, and similar processes.

Critical Characteristics - Identifiable and measurable attributes/ variables of a commercial grade item, which once selected to be verified, provide reasonable assurance that the item received is the item specified.

Dedication - The point in time after which a commercial grade item is accepted for a safety-related application and deficiency reporting becomes the responsibility of the party performing the acceptance.

Equivalency Evaluation - A technical evaluation performed to confirm that an alternative item, not identical to the original item, will satisfactorily perform its intended function once in service. This term is synonymous with "Equal-to-or-Better-Than Evaluation".

Item - Any level of unit assembly, including structures, systems, subsystems, subassembly, component, part, or material (definition from ANSI N45.2.10-1973).

Like-for-Like Replacement - The replacement of an item with an item that is identical.

Nonsafety-Related Item - An item which does not perform a safety-related function.

Part Number - A supplier's assigned identifier for a commercial grade item. Part number as used herein can also include identifiers such as model number, material type, grade, catalog reference number, etc.

Post-Installation Tests - Activities conducted after installation of a commercial grade item to verify required critical characteristics prior to placement in operation. An element of the "Special Tests and Inspection" method to accept an item for safety-related use.

Safety-Related Component - A plant structure, system, component or part thereof, necessary to assure:

1. The integrity of the reactor coolant pressure boundary,
2. The capability to shut down the reactor and maintain it in a safe shutdown condition, or
3. The capability to prevent or mitigate the consequences of accidents which could result in potential offsite radiation exposures comparable to those referred to in 10CFR Part 100.11 (definition also applies to a basic component per 10CFR21).

Source Verification - Activities witnessed at the supplier's facilities by the purchaser or its agent for specific items to verify that a supplier of a commercial grade item controls the critical characteristics of that item, as a method to accept the item.

Special Tests and Inspections - Activities conducted after receipt of a commercial grade item to verify one or more critical characteristics as a method to accept the item for safety-related use.

Standard Receipt Inspection - Activities conducted upon receipt of items, including commercial grade items, in accordance with ANSI N45.2.2-1978 or ANSI/ASME NQA-1-1986 and NQA-2-1986 to check such elements as the quantity received, part number, general condition of items, and damage.

Supplier - The organization furnishing a commercial grade item or basic component. This could include an original equipment manufacturer, part manufacturer, or distributor.

Technical Evaluation - An evaluation performed to assure that the correct requirements for an item are specified in a procurement document.



## ACRONYMS

Acronyms and their meanings may not be generally known to the reader of this document and as such, are provided as a convenience. Acronyms may have other meanings in the nuclear industry. However, the meanings as given herein are as used in this document.

<u>Acronym</u>	<u>Meaning</u>
AFBMA	Anti-Friction Bearing Manufacturers Association
AISI	American Iron and Steel Institute
AMS	Aerospace Material Specification
ANS	American Nuclear Society
ANSI	American National Standards Institute
API	American Petroleum Institute
ASL	Approved Suppliers List
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
CFR	Code of Federal Regulations
CG	Commercial Grade
CGI	Commercial Grade Item
DOD	Department of Defense
EPRI	Electric Power Research Institute
EQAG	Equipment Qualification Advisory Group
EQDB	Equipment Qualification Data Bank
IE	Inspection and Enforcement, Office of
IEEE	Institute of Electrical and Electronics Engineers
INPO NPRDS	Institute of Nuclear Power Operations Nuclear Plant Reliability Data Summary
MIL-STD	Military Standard
NCIG	Nuclear Construction Issues Group
NEMA	National Electrical Manufacturers Association
NP	Nuclear Power
NQA	Nuclear Quality Assurance
NSSS	Nuclear Steam Supply System

Acronym	Meaning
NUGEQ	Nuclear Utilities Group on Equipment Qualification
NUREG	Nuclear Regulation
NUS	Nuclear Utilities Service Corp.
PO	purchase order
QA	Quality Assurance
QC	Quality Control
QPL	Qualified Product List
SAE	Society of Automotive Engineers
SQUG	Seismic Qualification Utilities Group
UL	Underwriters Laboratories, Inc.
USNRC	U. S. Nuclear Regulatory Commission
USI	unresolved safety issue

## SUMMARY

This guideline provides direction for the procurement and use of Commercial Grade Items (CGI) in safety-related applications. It is divided into five major sections. A glossary of terms and definitions, an acronym listing, and seven appendices have also been included.

The glossary defines terms used in this guideline. In certain instances, the definitions may be unique to this guideline. Identification of acronyms utilized in this guideline is also provided.

Section 1 provides a background of the commercial grade item issues facing the nuclear industry. It provides a historical perspective of commercial grade item issues. The basic processes being addressed in this document are reviewed. Section 1 also summarizes the basic premises of this guideline.

Section 2 discusses the generic process for the acceptance of a commercial grade item for safety-related use. The benefits of evaluating the safety function of a part in a safety-related component are discussed. The need to confirm whether an item is commercial grade is addressed, as well as the need to establish critical characteristics of a part prior to acceptance of a commercial grade item. The selection of acceptance methods is briefly discussed.

Section 3 defines the four distinct methods used to accept commercial grade items for safety-related applications. Each acceptance method is discussed in detail and guidance is given on how to implement each method. The situation where it is beneficial to use more than one acceptance method is also reviewed with examples of using two or more methods in combination.

Section 4 lists specific references that are identified in this guideline.

Section 5 is a bibliography of documents that were considered in developing this guideline, but were not directly referenced in the document.

The seven appendices elaborate on certain subjects addressed in this document. Appendices B through G are intended for optional use. Four exhibits are included which provide illustrative examples to assist the user in employing the acceptance methodologies.

**Section 1**  
**BACKGROUND AND DOCUMENT BASIS**

**1.1 BACKGROUND**

**1.1.1 Issue**

A challenge the nuclear industry faces is to establish a consistent guideline for the utilization of commercial grade items. The lack of specific implementation direction in existing documents has resulted in inconsistent interpretation, implementation, and enforcement.

This guideline has been prepared to satisfy the following current nuclear industry needs:

- An acceptance process which provides reasonable assurance that a commercial grade item received is the item specified.
- Alternatives which provide flexibility in the selection of the most prudent acceptance method on a case-by-case basis.
- Acceptance methods which are definitive to minimize misinterpretations.
- Acceptance methods which are consistent with regulatory requirements.

Factors contributing to the need for this document include:

- Most nuclear plants in the United States are now in an operational phase. In this phase, spare and replacement parts for components, as well as complete components, are being purchased. A significant number of these items are commercial grade items.
- Because of the reduction in new nuclear power plant construction, some suppliers are discontinuing existing nuclear quality programs. In certain instances, spare and replacement items can only be procured as commercial grade items.

### 1.1.2 History

When 10CFR50, Appendix B was issued, it did not specifically address the subject of commercial grade items. This regulation establishes baseline programmatic requirements to assure the quality of safety-related items. The introduction to 10CFR50, Appendix B states:

"As used in this appendix, 'quality assurance' comprises all those planned and systematic actions necessary to provide adequate confidence that a structure, system, or component will perform satisfactorily in service." (1)

Criteria III and VII of 10CFR50, Appendix B establish controls to assure the correct safety-related items are specified and accepted. These controls are also applicable to commercial grade items intended for safety-related use.

ANSI N18.7-1976 (2), as endorsed by USNRC Regulatory Guide 1.33 (3), was the first nuclear standard to specifically address commercially "off the shelf" items. This standard states that spare and replacement parts found to be commercial "off the shelf" may be similarly procured as the original item or part, but care must be exercised to assure at least equivalent performance. The care needed to be exercised is left to the purchaser's discretion.

The USNRC issued 10CFR21 on June 6, 1977 (4). This document gives instructions on the reporting of defects and noncompliances that could create substantial safety hazards. As originally written, 10CFR21 reporting requirements applied to all parties in the procurement process, including suppliers providing commercial grade items. Each party in the procurement process was required to impose 10CFR21 on its purchase orders to subtier suppliers. As purchase orders were issued invoking 10CFR21, many subtier suppliers began to reject these purchase orders.

The October 1978 revision to 10CFR21 exempted suppliers of commercial grade items from 10CFR21 reporting responsibilities. Despite the reporting exemption, regulatory requirements still require commercial grade items used in safety-related applications to be addressed in the purchaser's 10CFR50, Appendix B quality assurance program.

The action taken to utilize a commercial grade item in a safety-related application has commonly been called dedication by the nuclear industry. The October 1978 revision to 10CFR21 required an item to be dedicated before it could

be used as a basic component. The term dedication defines the point in time when the commercial grade item becomes subject to 10CFR21 reporting requirements. Increased attention has been focused on commercial grade item procurement practices in the nuclear industry in recent years. Reasons for this emphasis include:

- Shift in procurement activity from original equipment to spare parts and replacement items.
- Lack of consistent controls in commercial grade item procurement practices.
- Inspection findings against utility control of commercial grade items.
- Difficulties encountered buying items due to suppliers discontinuing 10CFR50, Appendix B quality assurance programs.

### 1.1.3 Commercial Grade Items

Nuclear power plants are constructed of components designated either safety-related or nonsafety-related. A safety-related component is subject to 10CFR50, Appendix B quality assurance program requirements which mandates planned and systematic actions to control the quality of safety-related components. These controls are achieved in the nuclear industry through utility and supplier quality assurance programs.

Safety-related items need not be procured from suppliers that maintain a 10CFR50, Appendix B quality assurance program, provided that the items meet the commercial grade item definition. The definition of a commercial grade item is an item:

- Not subject to design or specification requirements that are unique to nuclear facilities, and
- Used in applications other than nuclear facilities, and
- Is to be ordered from the manufacturer/supplier on the basis of specifications set forth in the manufacturer's published product description (for example, a catalog).

Examples of typical commercial grade products used in the nuclear industry are as listed in Table 1-1.

Table 1-1

TYPICAL COMMERCIAL GRADE PRODUCTS USED IN THE NUCLEAR INDUSTRY

Anchor Bolt	Limit Switch	Shaft Coupling
Ball Bearing	Lubricating Grease/Oil	Solenoid Valve
Bolting	Material (e.g. plate, angle)	Spiral Wound Gasket
Control Switch	Motor	Spring
Cotter Pin	Non-Metallic Diaphragm	Temperature Switch
Crane Wheel Axle	O-ring	Terminal Block
Drive Belt	Pinion Gear	Terminal Connector
Filter Regulator Assembly	Pressure Switch	Torque Switch
Framing Device	Pump Impeller	Transistor
Fuel Oil	Pump Mechanical Seal Assembly	Transmitter
Fuse	Relay	Valve Packing Gland
Impeller Key	Resistor	Valve Seal Ring
Integrated Circuit	Roller Bearing	Valve Stem

Commercial grade items used in safety-related applications can be shown to be equivalent in quality to a safety-related item purchased as a basic component. For example, many commercial suppliers have excellent quality programs that satisfactorily control their products. Other suppliers have satisfactory undocumented controls that assure a conforming product is supplied. Original equipment manufacturers select suppliers based on a variety of factors including demonstrated performance and reliability.

## 1.2 UTILIZATION OF COMMERCIAL GRADE ITEMS

The utilization of commercial grade items intended for safety-related applications involves two distinct processes:

- A technical evaluation to assure that requirements for an acceptable item are specified in the procurement document.
- Acceptance methods to reasonably assure the item received is the item which was specified.

The technical evaluation process provides a means to specify the correct requirements for an item in a procurement document. If a supplier can furnish a like-for-like replacement, only a minimal technical evaluation may be required in developing procurement specifications. Reliance is placed on the engineering performed by the original equipment manufacturer during the initial design. Identification by the part number and descriptive nomenclature is normally adequate to ensure that the correct item is specified. If a supplier can only offer an alternative item, a technical evaluation should be conducted to assure equivalency. A detailed discussion of this technical evaluation process is provided in Appendix A of this document.

The acceptance methods for commercial grade items provide reasonable assurance that the item received is the item which was specified. This guideline concentrates on the acceptance process consisting of measures that assure the correct item has been supplied. The selection of the appropriate acceptance method and its application will vary based upon many factors which will be discussed throughout this guideline.

To utilize a commercial grade item in a safety-related application, reasonable actions must be taken to assure the item is appropriate for its intended application. The technical evaluation in combination with an appropriate acceptance process provides the assurance that the specified item is adequate to meet 10CFR50, Appendix B requirements. This concept is depicted in Figure 1-1.

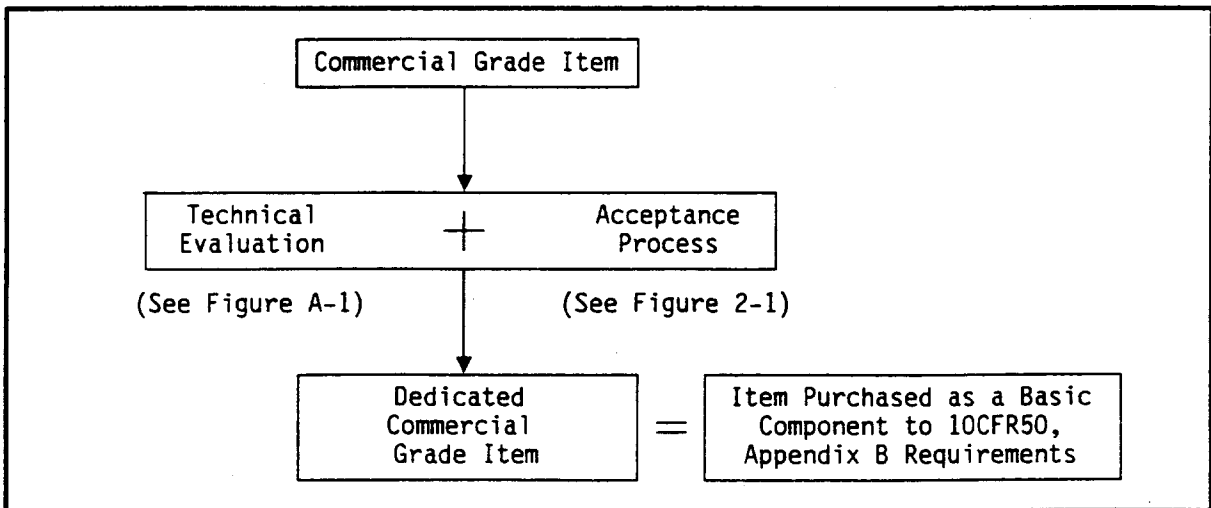


Figure 1-1. Utilization of Commercial Grade Items

### **1.3 BASIC PREMISES OF THE GUIDELINE**

#### **1.3.1 Design of Commercial Grade Items**

This guideline assumes that the design requirements of the item have been satisfactorily translated into specification requirements as reflected in the procurement document. The purpose of the technical evaluation is to assure that the specification requirements are correct. The acceptance process reasonably assures that an item received is the item which was specified in the procurement document.

#### **1.3.2 Equivalent Performance**

Equivalent performance is confirmed by conducting the technical evaluation to ensure the item specified meets design requirements. Acceptance assures that the item received is the item which was specified in the procurement document. The combination of the two activities, therefore, assures that the item received and accepted will perform in an equivalent fashion to the item being replaced. Neither activity need be conducted with the intention of improving the expected performance of a replacement commercial grade item.

#### **1.3.3 Part Number Verification**

Part number verification is an integral step in the acceptance of commercial grade items and is included in each of the four acceptance methods. Verification of a part number and the utilization of the acceptance methods in this guideline provide assurance of acceptability.

Since suppliers furnish commercial grade items for general industrial use, they may change the product design or the manufacturing process, and not the part number. These actions are taken without concern for the nuclear end user's design requirements. The methods described in this guideline provide various means to accept a commercial grade item without sole reliance upon part number verification.

#### **1.3.4 Guideline Consistency with Regulatory Requirements**

The methods in the guideline are in conformance with existing regulatory requirements. The methods for accepting commercial grade items are consistent with the provisions of Criterion VII of Appendix B to 10CFR50 which states:

"Measures shall be established to assure that purchased material, equipment, and services, whether purchased directly or through

contractors and subcontractors, conform to the procurement documents. These measures shall include provisions, as appropriate, for source evaluation and selection [Method 2], objective evidence of quality furnished by the contractor or subcontractor [Method 4], inspection at the contractor or subcontractor source [Method 3], and examination of products upon delivery [Method 1]." (1)

Each acceptance method in this guideline is depicted in brackets after the specific regulatory justification for that method. The acceptance methods provided in the guideline are:

- Method 1 - Special Tests and Inspections
- Method 2 - Commercial Grade Survey of Supplier
- Method 3 - Source Verification
- Method 4 - Acceptable Supplier/Item Performance Record

#### **1.3.5 Uniformity and Flexibility**

This guideline provides the detailed guidance that will permit the establishment and implementation of uniform nuclear industry practices for the acceptance of commercial grade items. The guideline permits flexibility in the selection of the most appropriate method or combination of methods to accept commercial grade items. This flexibility allows utilities to incorporate this guideline into their individual procurement, quality assurance, and engineering practices.

#### **1.3.6 Acceptance Documentation**

This guideline emphasizes that the acceptance process and the acceptance of an item must be documented. The flow diagrams (see Section 3) for each acceptance method designate when acceptance documentation should be developed.



## Section 2

### GENERIC PROCESS

The generic process for acceptance of commercial grade items contains four alternate methods. Figure 2-1 depicts, in flowchart form, the generic process for accepting a commercial grade item for installation in safety-related applications. Before the appropriate acceptance method can be selected for a particular replacement/stock item, the following three fundamental issues should be addressed:

- Determine the safety function of item.
- Confirm the item is commercial grade.
- Identify critical characteristics.

Although Figure 2-1 shows these fundamental issues as part of the acceptance process, the purchaser may choose to address them during the technical evaluation. If this is accomplished, the issues need not be addressed again during the acceptance process.

#### 2.1 DETERMINING SAFETY FUNCTION OF ITEM

The first step is to perform an evaluation to determine if an item is safety-related based on its function. This evaluation is optional and need not be performed if it is assumed that the component or all items within the component are safety-related. Appendix B of this document provides additional guidance on determining the safety function of an item.

By implementing the process discussed in Appendix B of this document, many items installed in safety-related components can be shown to have a nonsafety-related function.

#### 2.2 CONFIRMING ITEM MEETS DEFINITION OF COMMERCIAL GRADE

The second step is to confirm that the item meets the criteria set forth in the commercial grade item definition. If the item does not meet the criteria stated in the definition, it must be procured as a basic component or by other means not

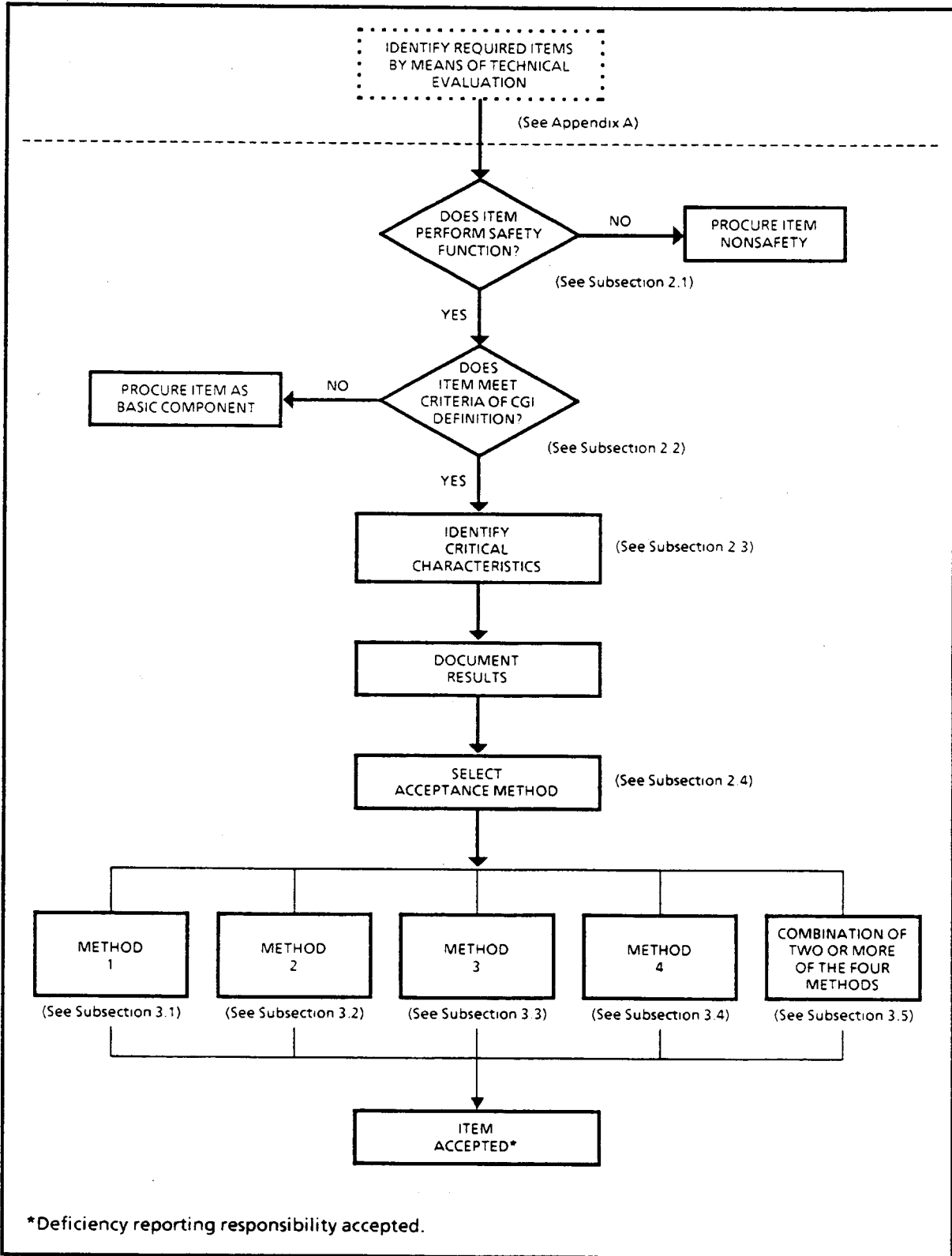


Figure 2-1. Generic Process for Acceptance of Commercial Grade Items Used in Safety-Related Applications

addressed by this guideline. Appendix C of this document provides additional guidance for classifying items as commercial grade.

## **2.3 IDENTIFICATION OF CRITICAL CHARACTERISTICS**

The third step is the identification of the critical characteristics to be verified. Critical characteristics are identifiable and measurable attributes/variables of a commercial grade item which once verified, provide reasonable assurance that the item received is the item specified.

Based on the performance and design basis for an item, a variety of characteristics can be identified that are critical for satisfactory performance. However, for purposes of establishing critical characteristics for acceptance, only certain of these must be verified to provide reasonable assurance that the item specified is the item received.

Commercial grade items which perform safety functions inherently have one or more characteristics critical to assuring equivalency to the item it is intended to replace. The item's part number by definition is a critical characteristic. Verification of a part number and the acceptance methods in this guideline provide assurance of acceptability. The acceptance methods in this guideline provide additional assurance of acceptability without sole reliance on the part number.

### **2.3.1 Types of Critical Characteristics**

Critical characteristics that could be identified, in addition to the part number, are physical characteristics of an item, identification markings, or performance characteristics of the item. A general listing of typical critical characteristics is provided in Table 2-1.

### **2.3.2 Selection of Critical Characteristics**

The selected critical characteristics are based upon the complexity, intended safety function, and performance of the commercial grade item. A listing of typical commercial grade items, their intended application, and potential critical characteristics is provided in Tables 2-2 and 2-3. The potential critical characteristics associated with the items in Tables 2-1, 2-2, and 2-3 are provided for illustration only to instruct the user of this guideline. These lists are not intended to be all inclusive or exclusive of critical characteristics which may be deemed important by the purchaser to specific applications. It is only necessary to identify and verify the appropriate critical characteristics which provide reasonable assurance that the item received is the item specified.

Table 2-1

GENERAL LISTING OF TYPICAL CRITICAL CHARACTERISTICS

<b><u>Product Identification</u></b>		
Color coding		Industry standard markings
Display type (scale, graduations)		Nameplate data
Enclosure type		Part number/unique identifier
<b><u>Physical Characteristics</u></b>		
Balance	Drop point	Oil/water separation
Capacitance	Ductility	Permeability
Cloud point	Durometer hardness	Plating
Coating	Elasticity	Polarity
Color	Fatigue resistance	Pour point
Composite material	Flammability	Purity
hardness	Flash point	Resilience
Concentration	General configuration	Resistance
Conductivity	or shape	Solubility
Continuity	Homogeneity	Spring constant
Density/specific	Inductance	Surface finish
gravity	Leachable halogen	Surface hardness
Dielectric strength	content	Tensile strength
Dimensions (to within	Luminescence	Torque
manufacturer's	Material of	Viscosity
tolerance)	construction	Weight
<b><u>Performance Characteristics</u></b>		
Accuracy	Leakage	Pressure drop
Burn-in endurance	Load rating	Pressure rating
Chatter	Open/closure time	Repeatability
Current rating	Operability (fail	Ride out
Cycle time	open/close, stroke)	Rotational direction
Deadband width	Operating range	Set point stability
Flow rate	Performance during	(no drift)
Gain	under voltage	Speed
Horsepower	conditions	Time/current response
Input/output voltage	Pick-up/Drop-out	Voltage rating
Interrupt rating	voltage	
Interrupting current	Power rating	

Table 2-2

POTENTIAL CGI CRITICAL CHARACTERISTICS FOR GENERIC APPLICATION ITEMS

Commercial Grade Item	Critical Characteristics <sup>(a)</sup>
Bearing	Configuration, dimensions, load rating, material, model number
Bolting	Configuration, dimensions, pitch, material, tensile strength, hardness, plating
O-ring	Dimensions, material, durometer hardness, elongation, leachable halogens
Terminal Block	Configuration, voltage rating, current rating, materials, dielectric strength
Crimped Terminal Connector	Configuration, material, dimensions (wire size, ring tong size), voltage rating, continuity, tensile pullout strength, color
Relay	Configuration, pick-up/drop-out voltage, voltage rating, current rating, chatter, response time
Fuse	Configuration, current rating, interrupt rating, time/current response, dimensions
Resistor	Configuration, markings, resistance, power rating
Drive Belt	Dimensions, cross-sectional shape, rideout, fatigue resistance, load rating, material, tensile strength
Spiral Wound Gasket	Configuration, dimensions, markings, style number, materials (filler and windings), pressure rating, leachable halogens, spiral density
Cotter Pin	Configuration (point type), dimensions, material, finish, hardness
Pressure Switch	Configuration, dimensions, material (pressure retaining parts), voltage rating, response time, accuracy, nameplate data, pressure range, wire rating, enclosure type, dielectric strength (insulation), deadband width
Temperature Switch	Configuration, dimensions, material, voltage rating, response time, accuracy, nameplate data, temperature range, wire rating, enclosure type dielectric strength (insulation), deadband width
Lubricating Grease/Oil	Color, specific gravity, viscosity, drop point, cone penetration, pour point, chemical composition, cloud point
Fuel Oil	Density, flash point, cloud point, pour point, kinematic viscosity, chemical composition, Btu rating
Framing Device	Configuration, shape, dimensions, material, tensile strength, coating
Material (e.g., Plate, Angle)	Dimensions, shape, material, tensile strength, hardness, ductility, markings, coating

(a) Part number is a critical characteristic for each item.

**Notes:**

1. These potential critical characteristics are provided for illustration only.
2. The lists are not intended to be all inclusive or exclusive of critical characteristics which may be deemed important by the purchaser.

Table 2-3

## POTENTIAL CGI CRITICAL CHARACTERISTICS FOR SPECIFIC APPLICATION ITEMS

Commercial Grade Item (Application)(a)	Critical Characteristics(b)
Valve Stem (Active, low pressure cooling system globe valve, seismically and environmentally qualified)	Configuration, dimensions, material, tensile strength, ductility, finish, markings, hardness
Pump Impeller (Make-up Water Transfer Pump)	Configuration, dimensions, material, hardness, balance, flow rate
Motor (Cooling Room Fan)	Nameplate data (horsepower, speed), insulation class, frame size, materials, weight, shaft type, coupling type, bearing types
Nonmetallic Diaphragm (Air operator for a globe valve, seismically and environmentally qualified)	Configuration, dimensions, material, durometer hardness, reinforcement material
Solenoid Valve (Torus vacuum breaker)	Configuration, size, pressure rating, materials, voltage rating, current rating, coil class, open/closure time
Limit Switch (Electric motor operator for a gate valve, seismically and environmentally qualified)	Configuration, dimensions, materials (metallic and nonmetallic), markings, operability, voltage rating, current rating
Impeller Key (Auxiliary Feedwater Pump)	Configuration, dimensions, material, hardness
Spring (Pressure relief valve, seismically qualified)	Configuration, dimensions (free length, coil diameter), spring rate, finish
Valve Packing Gland (Active control valve, seismically qualified)	Configuration, dimensions, material, tensile strength, hardness, finish
Filter Regulator Assembly (High Pressure Control Valve, seismically qualified)	Configuration, dimensions, materials, flow rate, pressure range, pressure rating, temperature rating, filter micron size
Pinion Gear (Spent Fuel Bridge Crane Hoist)	Configuration, dimensions, material, hardness, pitch
Crane Wheel Axle (Spent Fuel Bridge Crane)	Configuration, dimensions, material, tensile strength, hardness, finish
Shaft Coupling (Diesel Generator)	Configuration, dimensions, materials, hardness
Anchor Bolt (Seismically Qualified Concrete Anchor)	Configuration, dimensions, material, wedge hardness, pitch
Torque Switch (Operator for globe valve, seismically and environmentally qualified)	Configuration, dimensions, materials (metallic and nonmetallic), operability
Pump Mechanical Seal Assembly (Service Water Booster Pump)	Configuration (completeness of assembly), materials, finish, leakage, leachable halogen content, dimensions

Table 2-3

## POTENTIAL CGI CRITICAL CHARACTERISTICS FOR SPECIFIC APPLICATION ITEMS

Commercial Grade Item (Application) <sup>(a)</sup>	Critical Characteristics <sup>(b)</sup>
Valve Seal Ring (Emergency Closed Cooling System Globe Valve)	Configuration, material, dimensions, finish, leakage
Integrated Circuit (Reactor Protection System)	Configuration, gain, input/output impedance, frequency responses, operability
Pressure Transmitter (Main Steam Isolation Valve Air Accumulator)	Configuration, voltage rating, current output, pressure rating, materials, accuracy
Control Switch (Reactor Building Sump Reset)	General configuration, contact configuration, voltage rating, current rating, materials, dimensions, operability
Transistor (Uninterrupted Power Supply)	Markings, gain, input/output impedance, current rating, voltage rating, operability

(a) Seismic and environmental qualification pertain to the parent component.

(b) Part number is a critical characteristic for each item.

**Notes:**

1. These potential critical characteristics are provided for illustration only.
2. The lists are not intended to be all inclusive or exclusive of critical characteristics which may be deemed important by the purchaser.

Commercial grade items intended for installation in seismically or environmentally qualified applications require critical characteristics necessary to assure that the original qualification of the parent component is maintained. A discussion on maintaining seismic and environmental qualification is provided in Appendix F of this document.

Commercial grade items intended for generic safety-related applications rather than for installation in specific applications require special consideration when selecting critical characteristics. Critical characteristics should be selected based on the most severe conditions encountered in the generic application unless controls are in place to prevent inappropriate use. These controls should be sufficient to ensure that commercial grade items are not used in applications for which they have not been evaluated and accepted. A discussion regarding generic and specific applications is provided in Appendix G of this document.

## **2.4 SELECTING APPROPRIATE ACCEPTANCE METHOD**

The four methods that can be used to accept commercial grade items are:

- Method 1 - Special Tests and Inspections
- Method 2 - Commercial Grade Survey of Supplier
- Method 3 - Source Verification
- Method 4 - Acceptable Supplier/Item Performance Record.

Table 2-4 provides an overview of the four acceptance methods. It depicts the activities the purchaser and the supplier perform when employing each acceptance method.

The four acceptance methods provide, either individually or in combinations, a means to reasonably assure that a commercial grade item which is received meets the requirements of the item specified. The results of employing each method should be documented by the purchaser.

The selection of a method or combination of methods for a given commercial grade item should be based on factors such as: (1) selected critical characteristics, (2) available supplier information, (3) quality history, and (4) degree of standardization.

## **2.5 ACCEPTANCE DELEGATION**

This document is intended for organizations responsible for accepting commercial grade items for safety-related use. This includes utilities as well as suppliers that are delegated the acceptance responsibility. In either case, the party responsible for acceptance of the commercial grade item must include the acceptance process within its 10CFR50, Appendix B program. Figure 2-2 depicts this point.

## **2.6 REPORTABILITY AND TRACEABILITY**

The reportability and traceability of commercial grade items accepted for use in safety-related applications should be controlled in accordance with the purchaser's reportability and traceability programs applicable to other safety-related items.

Table 2-4

ACCEPTANCE METHODS AND UTILITY/SUPPLIER ACTIVITIES

Acceptance Method	Specific Utility Activities	Specific Supplier Activities
<p>Method 1 Special Tests and Inspections</p>	<ul style="list-style-type: none"> <li>● Determine sample size.</li> <li>● Determine post-installation testing requirements.</li> <li>● Determine special receipt tests and inspections.</li> <li>● Accept item via special receipt inspections.</li> <li>● Accept item via post-installation testing.</li> </ul>	<ul style="list-style-type: none"> <li>● Furnish technical design information to enable utility to verify critical characteristics.</li> </ul>
<p>Method 2 Commercial Grade Survey of Supplier</p>	<ul style="list-style-type: none"> <li>● Conduct survey of CG program.</li> <li>● Require the supplier to invoke the controls necessary to verify critical characteristics.</li> <li>● Accept item based on supplier Certificate of Conformance verified by CG survey.</li> </ul>	<ul style="list-style-type: none"> <li>● Implement controls necessary to verify critical characteristics.</li> <li>● Provide utility with a Certificate of Conformance (as requested).</li> </ul>
<p>Method 3 Source Verification</p>	<ul style="list-style-type: none"> <li>● Conduct source verification.</li> <li>● Accept item based on documented source verification results.</li> </ul>	<ul style="list-style-type: none"> <li>● Implement item-specific design, fabrication, assembly, manufacturing, testing, or inspection controls substantiated by the source verification for a particular commercial grade item.</li> <li>● Allow utility access to facilities to conduct source verification.</li> </ul>
<p>Method 4 Acceptable Supplier/Item Performance Record</p>	<ul style="list-style-type: none"> <li>● Establish documented performance record.</li> <li>● Monitor performance of item.</li> <li>● Confirm applicability of independent product test results, INPO NPRDS, commercial program audits/surveys conducted by industry groups, utilization of national codes and standards, supplier responses to CG program controls, results of periodic maintenance surveillance, results of successfully employing other acceptance methods.</li> <li>● Accept item by issuing certification which is based on supplier/item performance record.</li> </ul>	<ul style="list-style-type: none"> <li>● Respond to CG Program Controls Questionnaire. (See Subsection 3.4.3, Item 3.e.)</li> <li>● Ensure item complies with national codes and standards, if applicable.</li> </ul>

#### UTILITY PERFORMS ACCEPTANCE

- Item procured by utility as a commercial grade item.
- Acceptance performed by utility using Methods 1 through 4 described in Section 3.
- Acceptance controlled under utility's 10CFR50, Appendix B program.

#### UTILITY DELEGATES ACCEPTANCE

- Acceptance performed by suppliers using Methods 1 through 4.
- Acceptance controlled under supplier's 10CFR50, Appendix B program.
- Item procured by utility as a basic component.

Figure 2-2. Acceptance Delegation

Section 3  
ACCEPTANCE METHODS

**3.1 METHOD 1 - SPECIAL TESTS AND INSPECTIONS**

**3.1.1 Explanation of Method 1**

Figure 3-1 is a schematic logic diagram for accepting a commercial grade item by conducting special tests and inspections. The special tests and inspections should be conducted during or after receipt of an item to verify selected critical characteristics. The special tests and inspections may include post-installation tests. Although the part number is considered to be a critical characteristic, this guideline provides the purchaser the flexibility to verify it during their standard receipt inspection.

**3.1.2 Application of Method 1**

Method 1 should be used when the purchaser desires to verify critical characteristics after the item is received. The purchaser can apply this method to all commercial grade items when sufficient data exists to perform appropriate inspections and tests. However, Method 1 is most appropriate for:

1. Items furnished from multiple suppliers,
2. Items that are relatively simple in nature, and
3. Items on which post-installation tests can be conducted to verify critical characteristics.

The critical characteristics data is generally available in existing documents such as specifications, drawings, instruction manuals, bills of material, and catalogs. **Interface with the supplier may be necessary to obtain the required data.** Where sufficient data to utilize Method 1 cannot be obtained from suppliers because of proprietary considerations, other methods of acceptance must be considered.

In summary, Method 1 is valuable because the purchaser controls the verification of selected critical characteristics utilizing special tests and inspections. Method 1 should be used if the technical data are known, test facilities are

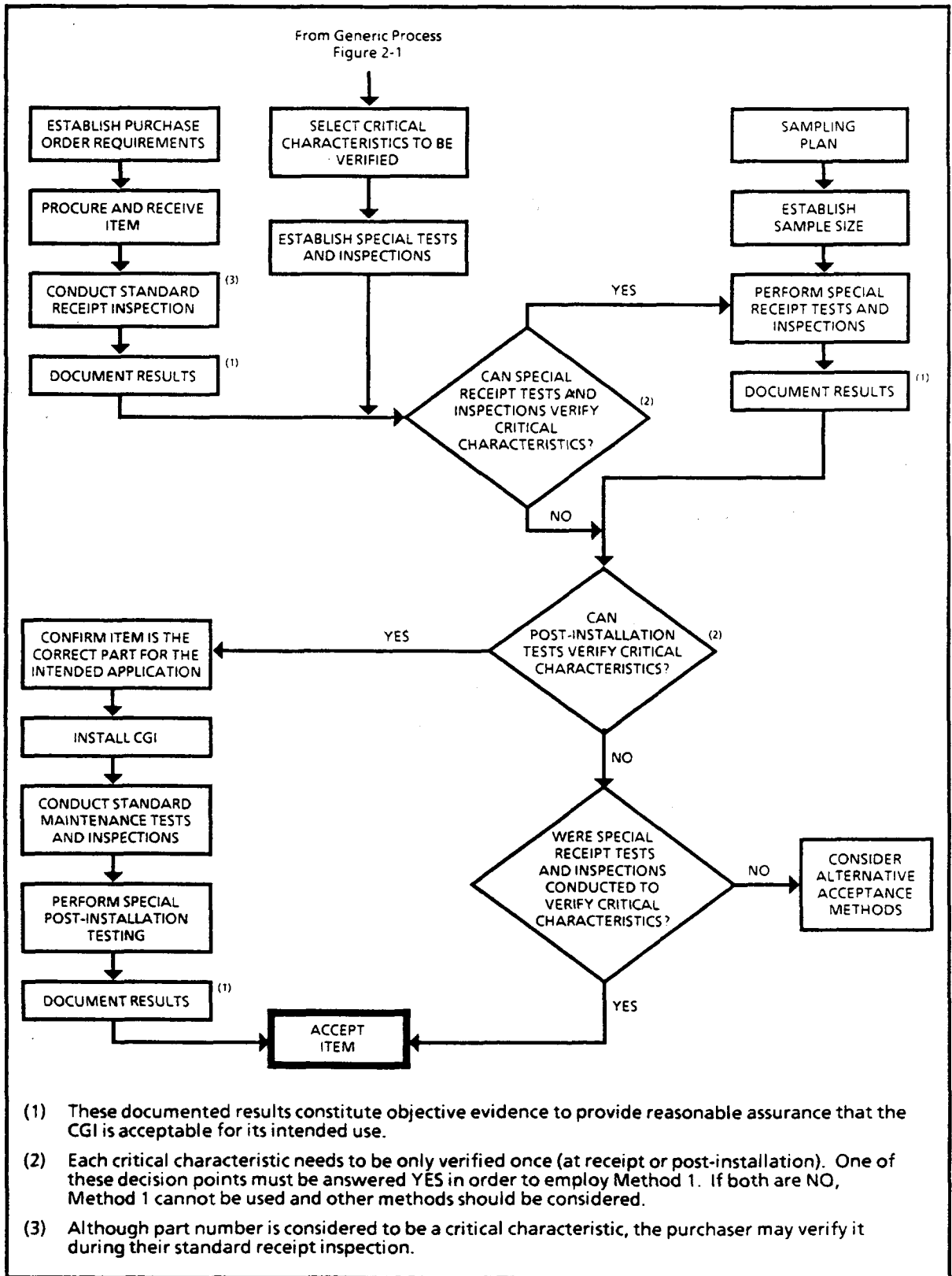


Figure 3-1. Method 1 - Special Tests and Inspections

available, and the items are such that inspection and tests upon receipt are adequate to verify critical characteristics. Method 1 may also be used in combination with other acceptance methods. Combining acceptance methods is discussed in Subsection 3.5.

### **3.1.3 Employment of Method 1**

Critical characteristics must be verified either via special receipt inspections and tests, or post-installation tests. These inspections and tests should be performed in addition to, or in conjunction with, the standard receipt inspection.

To employ Method 1, critical characteristics should be verified by developing a documented plan or checklist. This plan/checklist should include:

1. Tests and inspections to be performed.
2. Test methods and inspection techniques to be utilized (documented test and inspection procedures may be required as appropriate).
3. Acceptance criteria previously derived from the technical evaluation (see Appendix A) specific to the characteristics being verified.
4. Documentation requirements for inspection and test results.

The test and inspections may be performed utilizing a sampling plan when appropriate.

Post-installation tests may be performed as a part of standard maintenance tests if appropriate.

The purchaser may subcontract the special inspections and tests by utilizing the services of a purchaser approved test facility.

Once the critical characteristics are verified via special tests and inspections, the purchaser may accept the item for use in safety-related applications. Documenting the results of the special tests and inspections constitute objective evidence.

A valve stem is an example of an item for which special tests and inspections could be used to accept this item. The critical characteristics to be verified for this item would be material of construction, dimensions, material hardness,

and part number. These critical characteristics could be verified with the following special tests and inspections:

1. **Material of Construction:** Verify utilizing a spectrographic alloy analyzer.
2. **Dimensions:** If the dimensions are known, verify utilizing calibrated measuring devices. If the dimensions are not known, verify dimensions by confirming the valve stem's fit with a post-installation test by stroking the valve.
3. **Material Hardness:** Verify utilizing a hardness tester.
4. **Part Number:** Verify during the standard receipt inspection.
5. **Configuration:** Verify against supplier's drawing.

### 3.2 METHOD 2 - COMMERCIAL GRADE SURVEY OF SUPPLIER

#### 3.2.1 Explanation of Method 2

Figure 3-2 is a schematic logic diagram for accepting a commercial grade item by conducting a commercial grade survey of a supplier. The survey is a means by which the purchaser can take credit for the commercial controls that the supplier exercises on a given item or line of replacement items.

#### 3.2.2 Application of Method 2

Method 2 should be used when the purchaser desires to accept commercial grade items based on the merits of a supplier's commercial quality controls. These controls may constitute quality programs, procedures, or practices. The supplier may either be:

1. An approved nuclear supplier maintaining both a commercial program and a 10CFR50, Appendix B Quality Assurance program, or
2. A commercial grade supplier without a 10CFR50, Appendix B Quality Assurance program.

Commercial grade surveys can be conducted of suppliers who are:

1. NSSS suppliers,
2. Original equipment manufacturers,
3. Original part manufacturers, or
4. Distributors.

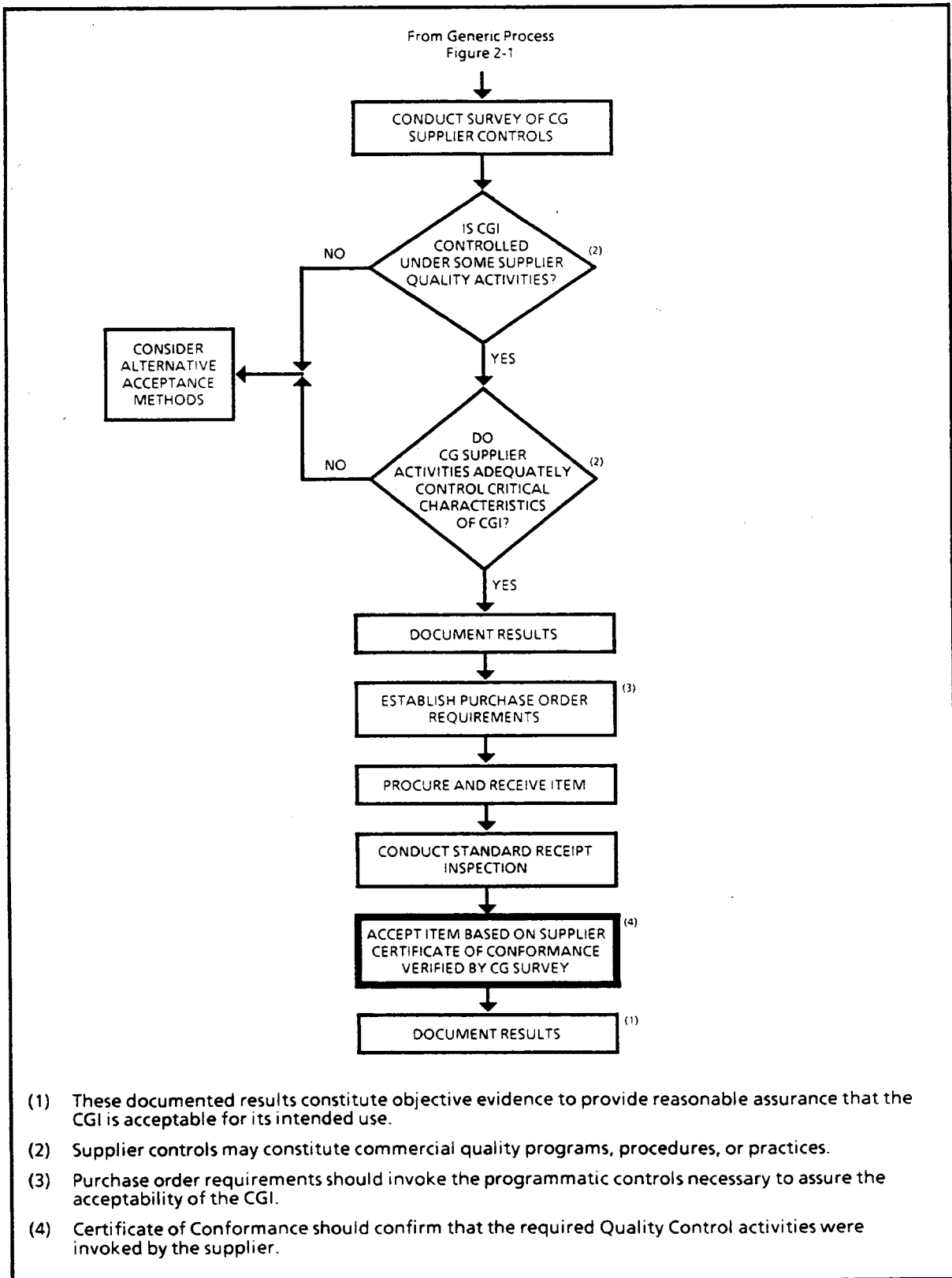


Figure 3-2. Method 2 - Commercial Grade Survey of Supplier

A commercial grade survey can be used to accept simple or complex items. The method is most appropriate in the following situations:

1. A single supplier of the commercial grade item is being used.
2. Required technical information cannot be obtained from the supplier.
3. A large group of items are repeatedly procured from a supplier for an entire line of components.
4. The commercial grade item is an assembly of many parts.
5. The purchaser cannot easily verify critical characteristics by inspections or tests.

Significant technical and quality information about a supplier's line of replacement items can be obtained during the survey. This information can subsequently be used in other acceptance scenarios as necessary.

Where a supplier demonstrates adequate controls, only verification of the part number and the supplier's Certificate of Conformance is required during the standard receipt inspection to complete item acceptance. Maximizing reliance on the supplier's controls will minimize the need to augment acceptance with Method 1 upon receipt.

### **3.2.3 Employment of Method 2**

Two basic criteria must be met when conducting a commercial grade survey. The purchaser must confirm that the selected commercial grade item's critical characteristics are controlled under the scope of commercial quality system activities. The purchaser must also be reasonably assured that the commercial supplier's activities adequately control the commercial grade items supplied.

The survey criteria and the supplier controls will vary from item to item. The survey criteria and necessary supplier controls should be determined by the purchaser and will depend on the number and type of critical characteristics. The survey should be specific to the scope of the particular commercial grade item(s) being purchased. When many items are purchased from a supplier, a survey of representative groups of commercial grade items can be sufficient to demonstrate that adequate controls exist. For each item, appropriate quality controls should be confirmed as being exercised and properly documented.

Table 3-1 provides general guidance on the types of supplier controls that should be surveyed to assure typical critical characteristics are being controlled.

Table 3-1

TYPICAL SUPPLIER CONTROLS THAT SHOULD BE SURVEYED USING METHOD 2

Design Control (if the design is not fixed by a national code or standard)
Procurement
Material Control
Fabrication
Assembly
Calibration
Tests
Inspections
Other controls may be necessary as they relate to the critical characteristics being verified.

The results of commercial grade surveys should be documented in an approved survey plan/checklist which include:

1. Item or items included within the scope of the survey.
2. Critical characteristics to be controlled by the supplier.
3. Supplier controls to be verified specific to the critical characteristics.
4. Survey methods or verification activities performed with results obtained.
5. Conclusions attesting to the adequacy of the supplier controls.

Deficiencies identified during the commercial grade survey may be corrected by the supplier instituting additional controls, or by utilizing other acceptance methods in this guideline to verify adequacy.

Once a supplier's controls have been deemed to be adequate, the purchaser should invoke or reference the observed commercial or quality controls as a part of the purchase order requirements for the commercial grade item. Care should be taken not to impose any nuclear unique standards on purchase orders for commercial grade items. Supplier compliance to purchase order requirements should be documented by a Certificate of Conformance. Acceptance of the item will be completed by

performing a standard receipt inspection with the accompanying supplier's Certificate of Conformance.

The purchaser should assess the frequency for which survey information needs to be reconfirmed based on supplier performance, item complexity, standard receipt inspection results, frequency of procurements, etc.

An example of a like-for-like replacement of a complex item for which a survey could be used to accept the item, is a commercial grade volume booster assembly for a diaphragm control valve. A volume booster is comprised of approximately 20 piece-parts ranging from brass and aluminum items to elastomers. The critical characteristics to be controlled are materials of construction, dimensions, operability, leakage, pressure rating, and part number. A survey for this item would be conducted as follows:

1. **Design Control:** Review the design documents to determine if the manufacturer has made any modifications to the design of the item that was originally qualified and supplied. Design changes should be addressed. Documentation should be available to demonstrate that the supplier performed an equivalency evaluation. If there were modifications, a review should verify the adequacy of the changes for the purchaser's specific application.
2. **Procurement:** Review the procurement controls the supplier exercises both on raw materials to be utilized in-house and on procured finished parts. Receipt inspection practices or procedures should be reviewed to verify that the supplier is assuring that the correct material and items are being received.
3. **Material Control:** Examine the supplier's material controls in the receiving, storage, and production areas to assure the proper parts are available for assembly and installation.
4. **Assembly:** Review assembly practices to determine if changes have been made.
5. **Calibration:** Assure the supplier calibrates applicable measuring and testing equipment.
6. **Inspections and Tests:** Investigate the types and frequency of inspections and bench tests that are performed. A bench test would confirm that the assembly was complete and the piece-parts were of the correct dimensions.

An impeller key is an example of a simple like-for-like replacement for which a commercial grade survey could be used to accept the item. The critical characteristics to be controlled for this item would be dimensions, material, and part number. A survey for this item would be conducted as follows:

1. **Design Control:** Review the detailed design/fabrication drawing to determine if the manufacturer has made any modifications to the item's dimensions or material of construction.
2. **Procurement:** Review the procurement controls the supplier exercises on the raw materials to be utilized in-house. Receipt inspection practices or procedures should be reviewed to verify the supplier is assuring that the correct materials are being received.
3. **Material Control:** Examine the supplier's material controls in the receipt and machining areas.
4. **Calibration:** Verify that the supplier calibrates applicable measuring and testing equipment.
5. **Inspection and Tests:** Confirm the types and frequency of inspections and tests that are performed.

In summary, by reviewing the commercial controls in several areas, reasonable assurance can be gained that the supplier's commercial grade items are subject to adequate quality activities and that the supplier controls those features or characteristics deemed critical by the purchaser.

### **3.3 METHOD 3 - SOURCE VERIFICATION**

#### **3.3.1 Explanation of Method 3**

Figure 3-3 is a schematic logic diagram for accepting a commercial grade item by conducting a source verification of a supplier. Method 3 involves the verification of critical characteristics by witnessing quality activities before releasing the item for shipment. The supplier may either be:

1. An approved nuclear supplier maintaining both a commercial program and a 10CFR50, Appendix B Quality Assurance program, or
2. A commercial grade item supplier without a 10CFR50, Appendix B Quality Assurance program.

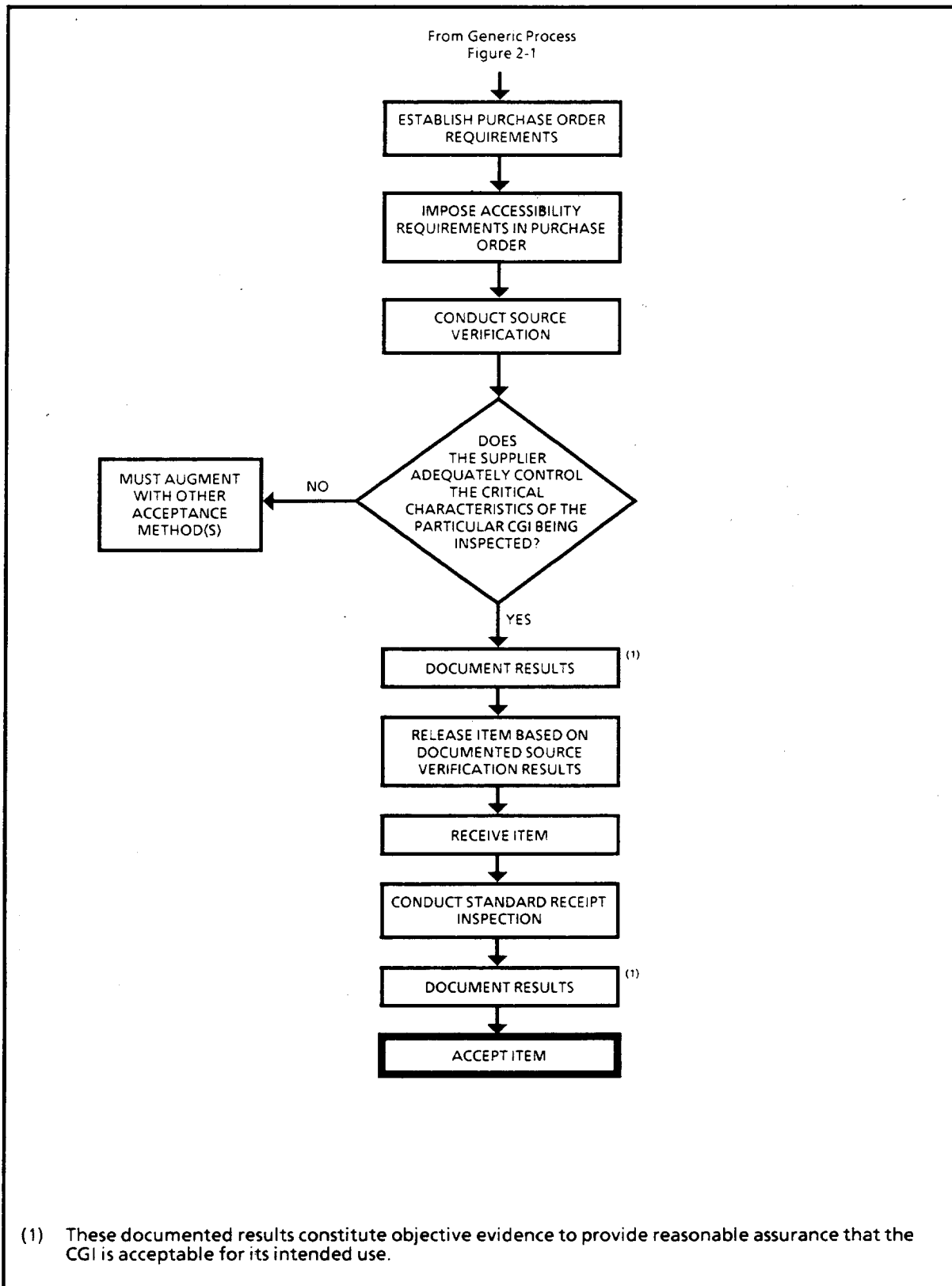


Figure 3-3. Method 3 - Source Verification

### 3.3.2. Application of Method 3

The source verification is best applied to a single item or shipment of items. Although a commercial grade survey (Method 2) is intended to qualify a supplier's entire scope of commercial grade Quality Control activities, a source verification is more suited for items procured on an infrequent or expedited basis.

When it is confirmed during a source verification that the supplier adequately controls the critical characteristics, only verification of the part number is required upon receipt. The item is accepted upon completion of the standard receipt inspection and documentation of the source verification results.

### 3.3.3 Employment of Method 3

The basic purpose of conducting a source verification is to confirm that the selected commercial grade items critical characteristics are satisfactorily controlled by the supplier.

The actual controls required to be witnessed by the purchaser will vary from item to item and should be dependent upon the number and type of critical characteristics. The scope of the surveillance may include witnessing fabrication and assembly processes, nondestructive examinations, performance tests, or final inspections. It may also include confirmation of the supplier's design, procurement, calibration, and material control methods employed for the particular commercial grade item being purchased.

The results of the source verification should be documented in an approved surveillance plan/checklist which include:

1. Item or items included within the scope of the surveillance.
2. Critical characteristics to be controlled by the supplier.
3. Supplier controls to be verified specific to the critical characteristics.
4. Surveillance methods or verification activities performed with results obtained.
5. Evaluation of the adequacy of the supplier controls.

Deficiencies identified during the source verification may be corrected by the supplier instituting additional controls, or by utilizing other acceptance methods in this guideline to verify adequacy.

Deficiencies identified during the source verification may be corrected by the supplier instituting additional controls, or by utilizing other acceptance methods in this guideline to verify adequacy.

This documentation constitutes objective evidence that control of specific critical characteristics was observed. Acceptance of the item is then completed by the standard receipt inspection.

A pump shaft is an example of an item for which source verification could be used to accept the item. The critical characteristics to be controlled are material of construction, hardness, surface discontinuities, dimensions, and part number. The source verification for this item would be conducted as follows:

1. **Material of Construction:** Review the supplier's procurement, receipt inspection, and material controls applicable to this item.
2. **Hardness:** Witness a hardness test of the item. Alternatively, review the applicable heat treatment procedure, heat treatment chart, and furnace calibration records.
3. **Surface Discontinuities:** Witness a liquid penetrant test of the shaft. Verify the test personnel are qualified, the procedure is followed, and no relevant surface indications are accepted.
4. **Dimensions:** Witness a dimensional inspection of critical dimensions shown on the pump shaft drawing. Verify no dimensional changes have been made to the part drawing that would affect part interchangeability.
5. **Part Number:** Verify during the standard receipt inspection.

### **3.4 METHOD 4 - ACCEPTABLE SUPPLIER/ITEM PERFORMANCE RECORD**

#### **3.4.1 Explanation of Method 4**

Figure 3-4 is a schematic logic diagram for accepting a commercial grade item by relying upon a documented acceptable supplier/item performance record. In essence, Method 4 allows the purchaser to accept commercial grade items based upon a confidence in the supplied item achieved through proven performance of the item. It also allows the purchaser to take credit for item performance based upon historical verification gained from the successful utilization of Methods 1, 2, or 3 or pertinent industry-wide performance data. Method 4 can be applied to many commercial grade items.

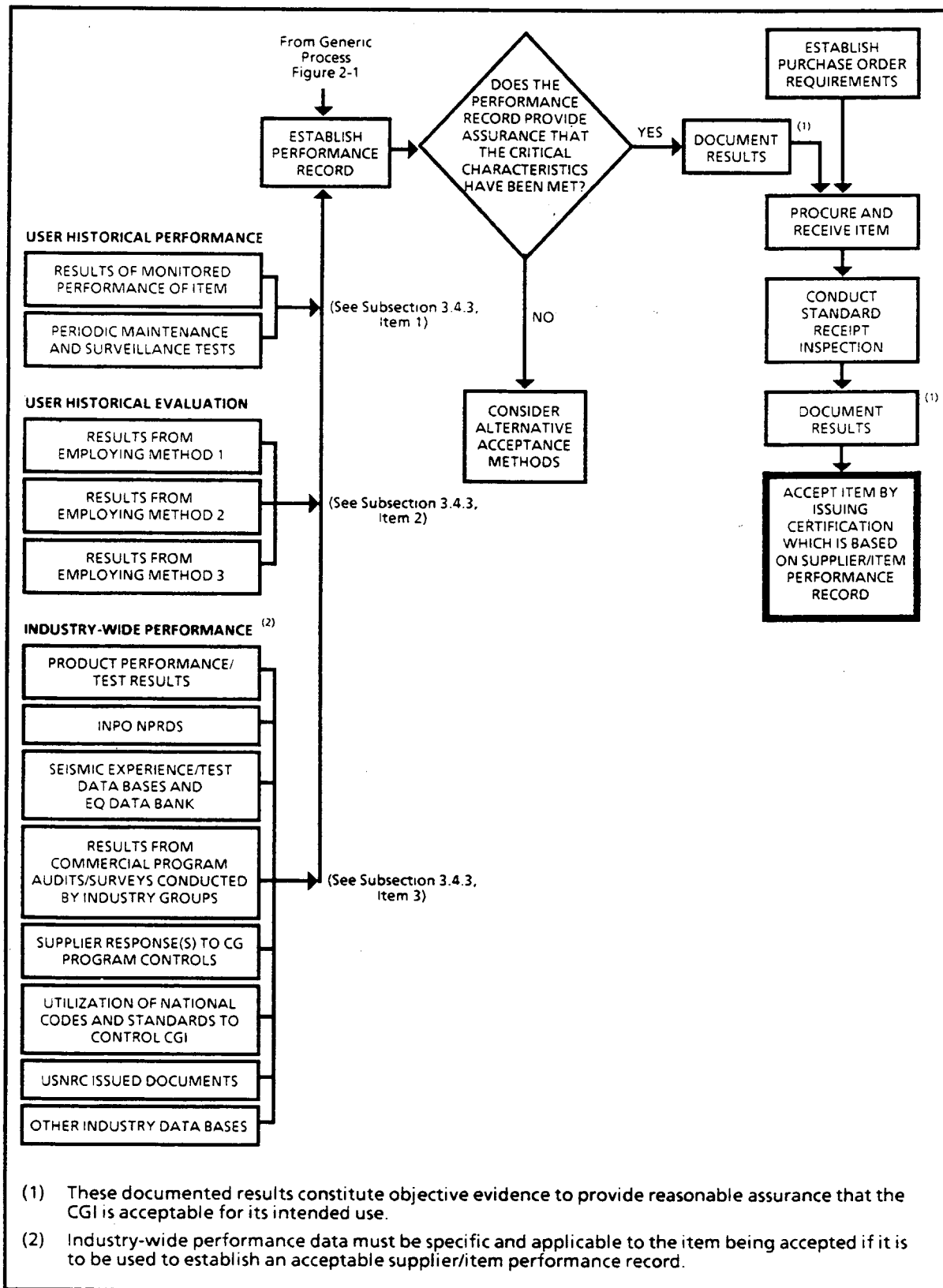


Figure 3-4. Method 4 - Acceptable Supplier/Item Performance Record

### **3.4.2 Application of Method 4**

Method 4 is best suited for commercial grade items where results of historical performance can be compiled utilizing:

1. Monitored performance of the item.
2. Industry product tests.
3. National codes and standards (not specific to the nuclear industry).
4. Other industry data bases (military, aerospace, etc. - see Figure 3-4).

Method 4 is a valuable means to accept commercial grade items because it relies on proven historical performance. It negates the need for costly and time consuming activities which do not add to the quality or performance of the item in service. Care should be utilized in application of this method to ensure that performance data used is directly applicable to the verification of the critical characteristics specific to the intended application.

### **3.4.3 Employment of Method 4**

The purchaser can establish a documented supplier/item performance record using the following sources of information (Note: Individual sources of information are not intended to stand alone as the sole means of demonstrating satisfactory performance of the item.):

1. User Historical Performance
  - a. Results of Monitored Performance

An item's performance record should be determined primarily by monitoring the performance of an item which was purchased from a particular supplier and by monitoring the performance of the parent component in which the item was installed.

This performance data is normally available from maintenance records. Once documented, this data provides an excellent source for establishing a performance record for a given commercial grade item. The objective basis to support the satisfactory performance of the commercial grade item in service will vary with the application, but could simply be the lack of failures during the in service period.

Failure, in this sense, refers to a failure caused by some inherent defect in the item which prevents it from performing its safety-related function. It is not intended to mean:

- 1) Failure of a part because of misuse or normal wearout, and
- 2) Failure resulting from failures of other items.

b. Conducting Periodic Maintenance and Surveillance Tests

The purchaser should have documented records of maintenance and surveillance tests. These tests should demonstrate that the item satisfactorily performed its intended design function for the specified length of time between surveillances.

2. User Historical Verification

The successful acceptance of an item using Methods 1, 2, or 3 over a period of time provides assurance that the supplier has been providing the item specified.

3. Industry-Wide Performance

Industry-wide performance data must be specific and applicable to the item being accepted if it is to be used to establish an acceptable supplier/item performance record.

a. Product/Performance Test Results

The supplier may test or send its product out to an independent test laboratory periodically. The results of these tests may be utilized to verify certain critical characteristics. Information such as reliability data from operating nuclear plants, suppliers, or industrial users which support performance history of the item may also be considered.

b. INPO NPRDS

The INPO NPRDS Summaries of Component Failures in Nuclear Power Plants provide data on component failure history. Within the component failure narratives, specific items that have failed may be identified.

c. Seismic Experience/Test Data Bases and Equipment Qualification Data Bank

The nuclear industry as a result of empirical studies of earthquake induced failures, has developed a seismic experience data base (5, 6).

Similarity by item, category, or general type should be established to demonstrate an item's inherent seismic sensitivity or ruggedness.

EPRI has established the Equipment Qualification Data Bank (EQDB) as a remotely accessible, computerized system containing several libraries of information related to qualification. One library lists summarized equipment qualification parameters for Class 1E equipment in operating plants. Other libraries contain seismic qualification data. Another library has thermal and radiation properties of nonmetallic materials commonly appearing in electrical and mechanical equipment. The EQDB is administered by a commercial organization under license to EPRI, with operating costs funded by subscriber fees (7).

Care should be exercised to ensure that the use of these data bases is acceptable under plant specific conditions.

d. Commercial Program Audits/Surveys Conducted by Industry Groups

To take credit for this type of information, the purchaser should assure that the audit/survey addressed the supplier quality controls applicable to the specific commercial grade item in question, and that those quality controls are still being employed by the supplier.

e. Supplier Response(s) to Commercial Grade Program Controls Questionnaire

The purchaser may determine by a questionnaire, those controls established by the supplier that reasonably assure the commercial grade item furnished is equivalent to the commercial grade item supplied with the original equipment. The most important information to be obtained is:

- 1) Changes that would result in a part number change,
- 2) Material changes, and
- 3) Changes to the manufacturing processes.

f. Utilization of National Codes and Standards

When taking credit for an item being manufactured to a national code or standard, the purchaser should assure that the item was manufactured in accordance with the code or standard. This assurance can be obtained by:

- 1) Referencing the national code or standard in the purchase order,
- 2) Receiving certification from the supplier, or

- 3) Researching and documenting that it is standard industry practice to manufacture the product to this national code or standard.
- 4) Verifying manufacturer testing or independent testing with certification.

Examples on the utilization of national codes or standards are provided in Appendix E of the document.

g. USNRC Issued Documents

Inspection and Enforcement Bulletins/Notices and Licensee Event Reports identify significant item failures and should be considered.

To utilize Method 4, the purchaser should perform an evaluation of the supplier/item performance record which includes the following:

1. Supplier/item being evaluated.
2. Previously established critical characteristics specific to the item or supplier.
3. Identification of utility/industry data examined to evaluate the supplier/item.
4. Basis for determining that industry data substantiates acceptability of the supplier/item.
5. Statement by the purchaser attesting to the acceptability of the supplier/item.

If the performance record provides reasonable assurance that the critical characteristics have been met, Method 4 can be used. After the establishment of an acceptable performance record, acceptance of the item utilizing Method 4 should be completed by performing a standard receipt inspection.

The supporting information should be periodically updated and reviewed to assure the supplier/item maintains an acceptable performance record.

### **3.5 COMBINATION OF TWO OR MORE METHODS**

#### **3.5.1 Explanation of Combining Two or More Methods**

The acceptance methods may be used in combinations to effectively verify critical characteristics and produce the objective evidence necessary to provide reasonable assurance of acceptability. In summary, Method 1 should be used to verify

critical characteristics by performing tests or inspections upon or after receipt of an item. Methods 2 and 3 should be used to take credit for the controls exercised by the supplier by conducting, respectively, a supplier survey or source verification of the supplier. Method 4, once established and documented, should be used to take credit for the proven historical performance of the supplier/item.

### **3.5.2 Application Example**

An example of combining Method 1 with Method 2 follows. The purchaser regularly procures a commercial grade replacement item for a line of similar components. The item has been determined to have a safety function. The mechanical component in which it is installed is active. The critical characteristics of the item were determined to be material of construction, dimensions, and part number. The supplier only exercises commercial controls on this item. The supplier machines the item and will not release the fabrication drawings to enable the purchaser to verify dimensional conformance upon receipt. The purchaser decides to survey the supplier to verify that the item is machined to within tolerances specified on the detailed design drawing. The survey confirms this, and credit can be given to the supplier for adequately controlling dimensions.

The survey also indicates that the supplier does not adequately control the material, nor is the supplier willing to upgrade his controls. The purchaser is provided the material of construction. By testing the item upon receipt with an alloy analyzer, assurance is achieved that the item is constructed of the material specified. Method 2 is used to verify dimensions and Method 1 to verify material. The part number is verified during the standard receipt inspection.

## Section 4

### REFERENCES

The references listed have been reviewed during the course of the study and have contributed to the preparation and content of this document. Many of these references are applicable to more than one of the various subsections of this document and would have necessitated their being repeated.

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2. Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants. ANSI N18.7/ANS 3.2-1976.
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4. Reporting of Defects and Noncompliance. 10CFR21, September 1987.
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6. Regulatory Analysis for Resolution of Unresolved Safety Issue A-46, Seismic Qualification of Equipment in Operating Plants. USNRC, NUREG-1211, February 1987.
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14. Verification of Seismic Adequacy of Mechanical and Electrical Equipment in Operating Reactors, Unresolved Safety Issue (USI) A-46. USNRC, Generic Letter 87-02, February 1987.
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16. Lubrication Guide. EPRI, January 1987. NP-4916.
17. Generic Seismic Ruggedness of Power Plant Equipment. EPRI, May 1987. NP-5223.
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19. Life Expectancy of Motors in Mild Nuclear Plant Environments. EPRI, February 1985. NP-3887.
20. Correlation Between Aging and Seismic Qualification for Nuclear Plant Electrical Components. EPRI, December 1983. NP-3326.
21. Seismic Ruggedness of Aged Electrical Components. EPRI, January 1987. NP-5024.
22. Commercial Grade Motors in Safety Related Applications in Nuclear Power Plants. EPRI, May 1988. NP-4917.

Section 5  
BIBLIOGRAPHY

This Bibliography provides a general reading list of applicable documents which may be of interest to the reader. These documents have been reviewed during the course of developing this guideline and have contributed to its preparation and content. All references to bibliographic type information in the typical manner of using footnotes throughout the guideline has been avoided.

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Applicability of 10CFR21 to Nonlicensees. USNRC, IE Information Notice No. 87-33, July 24, 1987.

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Degraded Motor Leads in Limitorque DC Motor Operators. USNRC, IE Information Notice No. 87-08, February 4, 1987.

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Quality Assurance Program Requirements for Nuclear Power Plants. ANSI/ASME NQA-1-1986.

Quality Assurance Program Requirements for Nuclear Power Plants. ANSI/ASME NQA-2-1986.

Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants. USNRC, Regulatory Guide 1.123, Rev. 1, July 1977.

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## APPENDIXES



**Appendix A**  
**TECHNICAL EVALUATIONS**

Figure A-1 depicts the technical evaluation which is inherent to any commercial grade item procurement.

A commercial grade item procurement may be one of three scenarios - a like-for-like replacement, an alternative replacement, or an item required for the first time.

**A.1 LIKE-FOR-LIKE REPLACEMENT**

If the purchaser has assurance through planned coordination with a supplier (8), that the design of the item has not been changed by the manufacturer or supplier, a like-for-like procurement should be implemented without performing an engineering evaluation (2). Reference (2) further emphasizes:

"Procedures shall be established and implemented to ensure that purchased materials and components associated with structures or systems important to safety are:

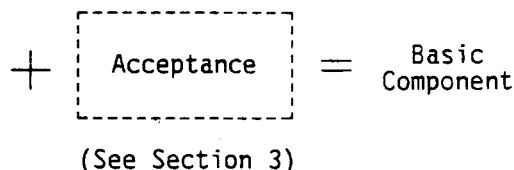
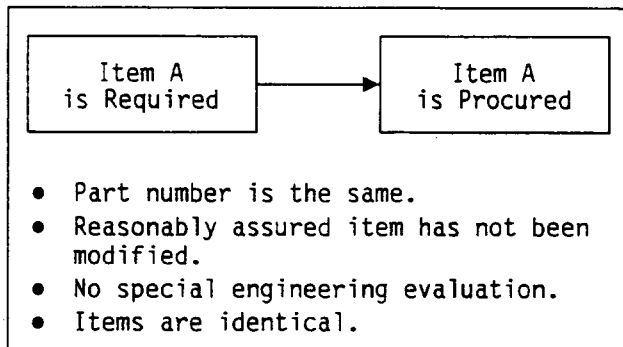
Purchased to specifications and codes equivalent to those specified for the original equipment, or those specified by a properly reviewed and approved revision. In those cases where the original item or part is 'off the shelf', or without specifically identified quality assurance requirements, spare and replacement parts may be similarly procured but care shall be exercised to assure at least equivalent performance." (2)

The care necessary to assure at least equivalent performance for like-for-like items should be demonstrated through the appropriate acceptance method.

An example of a like-for-like procurement scenario is as follows. The purchaser requires a replacement bearing for a safety-related pump. The original equipment manufacturer has furnished this bearing in the past and the part number has not been changed. The item is procured like-for-like without performing an engineering evaluation. Acceptance of the like-for-like item is still required utilizing any of the methods discussed herein.

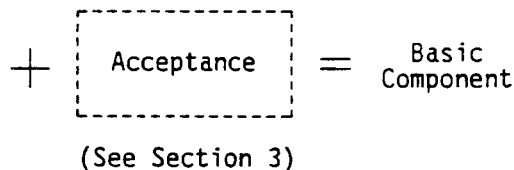
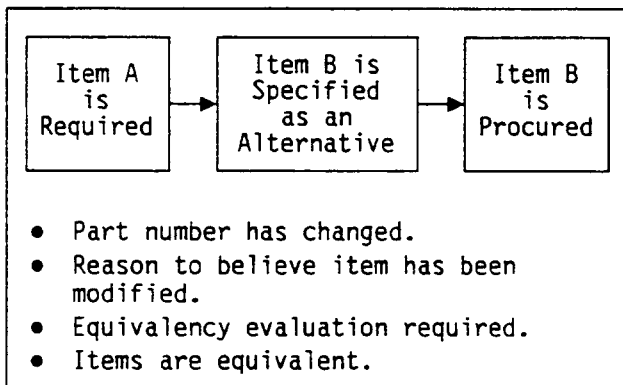
Scenario 1

Like-for-Like Commercial Grade Item Replacement



Scenario 2

Alternative Commercial Grade Item Replacement



Scenario 3

Initial Procurement of Commercial Grade Item

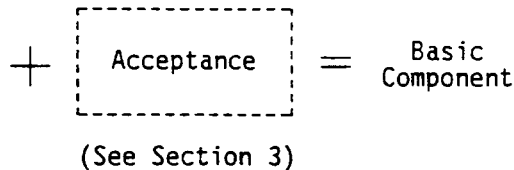
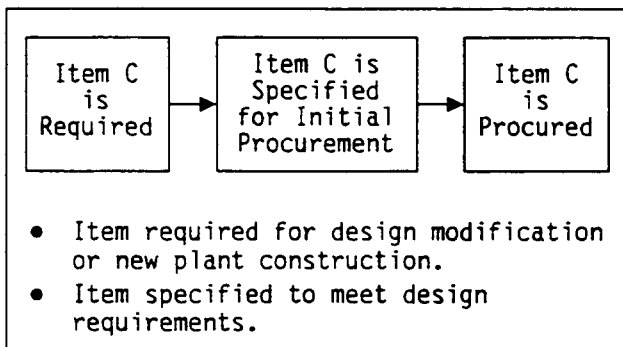


Figure A-1. Technical Evaluation

## A.2 ALTERNATIVE REPLACEMENT

An equivalency evaluation should typically be conducted for alternative replacements caused by the following situations:

- Cannot purchase original item like-for-like.
- Technical/quality requirements of the original item cannot be determined.
- There is reason to believe the design of the item was changed.

Equivalency evaluations, typically referred to as "equal-to-or-better-than", are safety-related engineering activities and should be controlled as such by the purchaser. Reference (2) additional evaluations:

"shall assure that interfaces, interchangeability, safety, fit and function are not adversely affected or contrary to applicable regulatory or code requirements. The results of this evaluation shall be documented." (2)

The equivalency evaluation in itself is not a means to accept a commercial grade item for safety-related use as defined herein. Rather, it is a sound engineering method to assure that an alternative item specified is an acceptable substitute for the originally designed item.

An example of an alternative replacement procurement scenario is as follows. The purchaser is informed that a replacement asbestos gasket is required for a safety-related valve. The original equipment manufacturer has furnished this gasket in the past but has recently discontinued supplying asbestos materials. The alternative gasket is constructed of a graphite base material. The manufacturer has also provided a new part number for this item. The purchaser conducts an equivalency evaluation to confirm the alternative item meets the design conditions of the component. Additionally, the purchaser confirms that the replacement item will not adversely affect the interface, interchangeability, safety, fit, and function of the original component. The substitute gasket is specified with applicable technical and quality procurement requirements. Acceptance of the alternative item is still required utilizing any of the methods discussed herein.

### **A.3 INITIAL PROCUREMENT OF A COMMERCIAL GRADE ITEM**

A design modification or new plant construction may require the procurement of a new commercial grade item. In these cases, engineering determines whether the commercial grade item's design is adequate for the item to perform its intended safety functions. A technical evaluation is performed as part of the design process to ensure the appropriate technical and quality requirements are specified in the procurement documents for the item. This evaluation, as in the alternative replacement scenario, is not a means to accept the commercial grade item for safety-related use.

An example of an initial procurement scenario is as follows. A solenoid valve is required for a design modification. Suppliers meeting the design requirements of the valve are commercial grade suppliers. A technical evaluation is conducted to develop the necessary technical and quality procurement requirements and to ensure the valve specified will satisfactorily meet the intended design conditions. Acceptance of the initially procured item is still required utilizing any of the methods discussed herein.

## Appendix B PART CLASSIFICATION

### B.1 COMPONENT AND PART CLASSIFICATION SYSTEMS

Most nuclear utilities have classified their components as being either safety-related or nonsafety-related. This information is normally maintained in a design verified document such as a Q-List or Equipment List. This listing accurately reflects the safety designation of each component as shown on the latest revision of the applicable piping flow diagram, electrical diagram, or instrument diagram. For each component, a parts breakdown can be obtained either from the supplier's assembly drawing of the component, a bill of material, or recommended spare parts list. Each part can then be assigned a safety classification as described below.

### B.2 HOW TO DETERMINE A PART'S SAFETY FUNCTION

The safety function of the item should be determined by an engineering analysis. The analysis should be based on a logical and methodical process which addresses the following criteria:

- What is the safety function of the parent component in which this item is to be installed?

Consideration should be given to the parent component's safety classification such as ASME Section III, Class 1, 2, or 3, or Class 1E Electrical and Qualified Associated 1E Items. This safety classification was determined based on the component's and its nuclear system's need to perform its safety-related function. Consideration should also be given to the function of the component, such as whether it is active or passive. For example, one could classify internal items such as a valve stem to nonsafety-related if the valve was passive and its only safety-related function was to maintain its pressure boundary. If the stem is not considered to be an ASME Section III pressure

retaining piece, it would not be critical to the passive valve maintaining its pressure boundary. Consideration should also be given to the original seismic or environmental qualifications of the parent component.

- What is the function of the item?

It is important to understand the function of the item under both normal operating conditions and accident conditions. This may be difficult to ascertain from simply examining the supplier's assembly or outline drawing of the parent component, and direct interface with the supplier may be required.

- What are the various ways in which the item could fail in actual service?

Consideration should be given to failures associated with:

- Normal operation,
- Postulated accidents such as design basis accidents and seismic occurrences,
- Aging,
- Degradation due to radiation, temperature, and humidity exposure, and
- Material compatibility (e.g., stress-corrosion fracturing of adjacent parts induced by the leaching of halogens).

There may be items, by virtue of their inherent design and the design conditions of the parent components, that do not have credible failure modes. In these cases, one can justify and document the non-critical nature of the item, and reclassify the item to nonsafety-related. Consideration may also be given to whether the proposed failure is catastrophic in nature or gradual.

- Would any of the postulated failures of the item prevent the parent component or associated components from performing intended safety functions?

This is the most important criteria which must be evaluated to determine if the item is critical to function, i.e., having a safety function. There may be many cases where the postulated failures of an item would have no effect on the parent component or

associated components performing satisfactorily. Typical examples could be non-pressure retaining items installed on passive mechanical components, items comprising handwheels or actuators installed on passive mechanical components, nameplates, or adjustment and installation hardware. Caution must be exercised in assuming all the preceding items can be classified as nonsafety-related for all applications.

The preceding engineering analyses should be performed by persons knowledgeable with the functions of the parent component and the system in which it is installed.

### B.3 SUGGESTED CLASSIFICATIONS FOR REPLACEMENT ITEMS

From a technical basis, replacement items should be assigned a safety classification of either safety-related items or nonsafety-related items. From a procurement basis, safety-related items should be further classified into those items which are considered basic components and those items meeting the definition of a commercial grade item. Figure B-1 illustrates this distinction. Methods for accepting commercial grade items intended for use in safety-related applications are discussed in detail in Section 3 of this document.

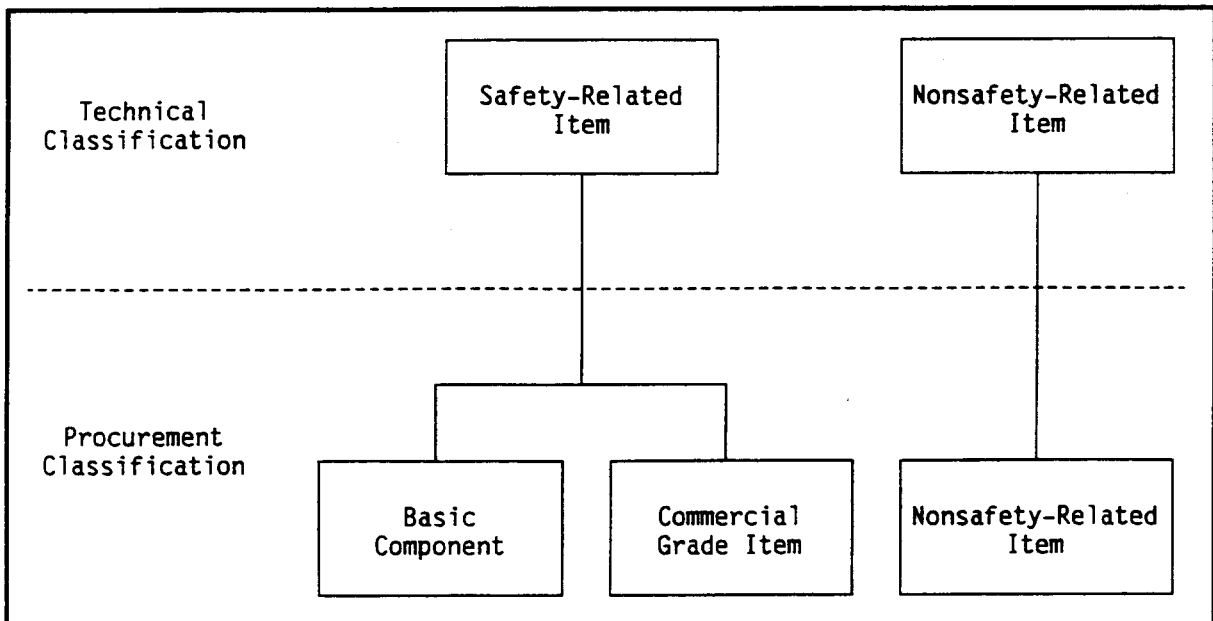


Figure B-1. Distinctions Between Technical and Procurement Classifications

#### B.4 BENEFITS OF CLASSIFYING ITEMS

There are several benefits to capturing the information derived from the engineering analysis which assigns a safety classification to an item. First, is the obvious cost savings associated with procuring items nonsafety-related once they have been classified as such. The price variance between a nonsafety-related item and an identical item purchased safety-related is often significant.

Second, items that have a nonsafety-related function need not be accepted utilizing the methods described herein.

Third, by clearly differentiating safety-related items from nonsafety-related items, and concurrently obtaining information regarding potential end use applications, a utility maximizes the opportunity for parts consolidation and part interchangeability among like components. This can enable the utility to improve plant availability and reduce the frequency with which items are reordered.

A thorough parts classification system can be integrated with the technical and quality procurement requirements to enable the purchaser to automate the procurement process. This has been employed by identifying each replacement item with a utility specific stock code number. Using a computerized data base, the stock code number can be used to identify supplier part numbers, end use components, technical procurement requirements, quality procurement requirements, special tests or inspections (Method 1), and approved suppliers. The automated system has eliminated the repetitiveness associated with establishing technical and quality procurement requirements.

## Appendix C

### DETERMINATION OF COMMERCIAL GRADE ITEM DESIGNATION

To determine if an item is commercial grade, the following series of questions should be asked:

1. Is the item not subject to design or specification requirements that are unique to facilities or activities licensed or regulated by the USNRC?

If NO, the item is not commercial grade.

If YES, proceed to the next question.

2. Is the item used in applications other than facilities or activities licensed or regulated by the USNRC?

If NO, the item is not commercial grade.

If YES, proceed to the next question.

3. Is the item ordered from the manufacturer/supplier on the basis of specifications set forth in the manufacturer's published product description?

If NO, the item is not commercial grade.

If YES, all three criteria have been satisfied, and the item meets the definition of a commercial grade item.

#### Note 1

Components qualified to a nuclear unique standard (e.g., IEEE 344-75 and IEEE 323-74) contain commercial grade parts. These parts were not originally purchased from part suppliers to these nuclear unique standards.

Consequently for these items, the answer to Question 1 is YES even though the answer for the parent component is NO.

Note 2

To satisfactorily answer the questions, interface with the supplier or manufacturer should usually be considered.

Note 3

Specifications for many commercial grade items set forth in the manufacturer's published product description or assembly drawing typically include more than the item's part number. For instance, ASTM material specifications, special processes, material properties such as Rockwell hardness or Durometer hardness, or dimensions may be provided. Also, inherent in the design and fabrication of many commercial grade items are the performance of nondestructive tests and examinations, references to non-nuclear qualification reports, and prototype tests.

Invoking requirements in procurement documents, such as those discussed in the preceding paragraph, does not preclude the item from meeting the third criteria of the commercial grade item definition. Furthermore, invoking these specifications or requesting copies of test results is recommended as a practical means of providing the purchaser with additional assurance that the correct item has been furnished.

Appendix D  
ESTABLISHING PROCUREMENT REQUIREMENTS  
FOR COMMERCIAL GRADE ITEMS

D.1 GENERAL

Before issuing a purchase order for a commercial grade item, an evaluation should be performed to determine the applicable design requirements. Important references can include:

- Component assembly part drawings.
- Component procurement specifications.
- Environmental qualification reports.
- Seismic qualification reports.
- Supplier catalogs.
- Original component documentation packages.

If an item is purchased as a commercial grade item, it must meet the three commercial grade qualifying criteria discussed in Appendix C. In addition, the appropriate procurement category should be determined and a system developed to identify, to the purchaser's receiving personnel, the appropriate procurement category for a received item. This is important when a commercial grade item is purchased nonsafety-related, but is intended to be accepted for safety-related use. A method is needed to distinguish this order from one being issued for items intended strictly for nonsafety-related application.

A most important parameter to be specified in the purchase order is the part number. If the part number specified is the same as the item in the original equipment, there is some assurance that an identical item is being provided. Further assurance is obtained by employment of the applicable acceptance method. In addition to the part number, a description of the item being purchased should be provided to the supplier. This description could include items like the part description, type, size, material of construction, pressure class rating, or range of operation.

When applicable, the appropriate material or part standards to be referenced in purchase orders can usually be determined from the following sources:

- Component assembly drawings or bills of material.
- Part supplier or distributor catalogs.
- Communication with suppliers.
- General industry standards for a particular product.

Requesting material and product test reports provides valuable information which can identify when an item is not in compliance with the purchase order. For example, if a material is ordered to an ASTM Standard having a minimal yield strength requirement and the supplied material test report shows a value below the minimum, then the nonconforming item can be identified and rejected during receipt inspection.

Providing a nuclear unique requirement is not specified in the purchase order for a commercial grade item, the purchaser may include requirements in addition to those contained in the supplier's product description. For example, if material test reports or product test results are requested, although they are not normally furnished with commercial orders, this is not a nuclear unique requirement. If a nuclear unique standard, such as 10CFR50, Appendix B, IEEE 323, or ASME Section III were specified, then the item could no longer be considered as a commercial grade item.

The content of the purchase order will vary depending on whether it is issued to the original equipment manufacturer, the original part supplier, or a distributor. The purchase order requirements will also vary depending on the acceptance method chosen for a specific commercial grade part.

## **D.2 PURCHASE ORDER REQUIREMENTS BASED ON SUPPLIER SELECTED**

### **D.2.1 Original Equipment Manufacturer**

When a purchase order is issued to the original equipment manufacturer for a commercial grade item, the following should be considered for inclusion in the purchase order:

- The component supplier's part number. This can normally be obtained from the component assembly drawing or bill of material. Sometimes the supplier will not furnish part numbers on the drawing. An appropriate means to identify the item is to reference

the drawing number, including revision, and the item number on the drawing parts list.

- A description of the item being purchased.
- The component supplier's assembly drawing number, including revision number.
- When a specific end use exists for the item, providing the serial number of the parent component will also assist the supplier in furnishing the correct item.
- References to the applicable environmental and seismic qualification reports for the parent component (for purposes of identification).
- General engineering requirements such as:
  - Material or part standards to which the item is manufactured (e.g., ASME, ASTM, non-nuclear IEEE, ANSI, NEMA, AMS, SAE, AISI, AFBMA, API, UL)
  - Cleanliness
  - Marking and tagging
  - Packaging
  - Testing
  - Material restrictions
  - Shelf life
- General quality assurance requirements such as:
  - Rights of access
  - Shipment release restrictions
  - Inspection hold points
  - Identification of noncompliances to the purchase order
  - Non-substitution clauses
- Documentation requirements such as:
  - Material test reports or material certificates of conformance
  - Certifications of interchangeability, equivalence, and equipment qualification maintenance
  - Test reports
  - Reports of noncompliances to the purchase order
  - Certificate of conformance to the purchase order

### D.2.2. Original Part Supplier or Distributor

When a purchase order is issued to the original part supplier or a distributor rather than the original component supplier, the following should be considered for inclusion in the purchase order:

- The part supplier's part number. Caution must be exercised to assure the supplier's part number is equivalent to the original component supplier's part number. To do this, direct communication with the original component supplier or part supplier may be required. The original component supplier's assembly drawing, bill of material, or qualification reports may have to be reviewed or physical examination of installed or stocked components may be necessary to determine the correct part number.

For base materials such as forgings and plates, a reference to a material specification rather than a part number would be more appropriate.

- A description of the item being purchased, including a catalog reference.
- References to the component supplier's assembly drawing would usually be meaningless since the part suppliers and distributors have little knowledge of how their commercial grade items are specifically being used.
- General engineering requirements such as:
  - Material or part standards to which the item is manufactured (e.g., ASME, ASTM, non-nuclear IEEE, ANSI, NEMA, AMS, SAE, AISI, AFBMA, API, UL)
  - Cleanliness
  - Marking and tagging
  - Packaging
  - Testing
  - Material restrictions
  - Shelf life

- General quality assurance requirements such as:
  - Rights of access
  - Shipment release restrictions
  - Inspection hold points
  - Identification of noncompliances to the purchase order
  - Non-substitution clauses
- Documentation requirements such as:
  - Material test reports or material certificates of conformance
  - Test reports
  - Reports of noncompliance to the purchase order
  - Certificate of conformance to the purchase order

The purchaser should determine if the component supplier did any conditioning to the part supplied with the original equipment. If conditioning was performed and is determined to affect a critical characteristic, the purchaser should evaluate if similar conditioning is still required for the replacement items. Examples of conditioning are heat treatment of metallic materials, calibration of instrumentation, burn-in, machining, and selection testing.

### **D.3 PURCHASE ORDER REQUIREMENTS BASED ON ACCEPTANCE METHOD SELECTED**

As suggested earlier, the purchase order requirements will also vary depending on the acceptance method selected for a commercial grade item. Examples are provided in the following to demonstrate this point.

#### Method 1 - Special Tests and Inspections

Because Method 1 relies on purchaser tests and inspections for acceptance, additional purchase order requirements are not normally necessary. Purchase order references to testing, rights of access, shipment release restrictions, and inspection hold points may not be necessary. If the item is manufactured to a national code or standard, then the purchase order should reference the code or standard.

#### Method 2 - Commercial Grade Survey of Supplier

For items being accepted by Method 2, the purchase order should specify the applicable commercial controls the supplier implements based on the survey observations. This may consist of a reference to specific program controls, reference to a commercial quality control manual, procedures, or standards.

As examples in the case of a supplier of commercially produced items, the purchaser might state:

"This order shall be processed in accordance with the design, procurement, manufacturing, calibration, inspection, and testing controls observed during the survey dated \_\_\_/\_\_\_/\_\_\_ as documented in Survey Report Number \_\_\_\_\_ of Company X. Any significant change in the observed controls shall be identified to the Purchaser."

or

"This order shall be processed in accordance with Company X's Commercial Grade Products Manual dated \_\_\_/\_\_\_/\_\_\_ . Any revisions to this manual shall be forwarded to the Purchaser for review."

or

"This order shall be processed in accordance with the following Company Y procedures:

Heat Treat Procedure XXXX, Rev. X  
Calibration Procedure XXXX, Rev. X  
Product Testing Procedure XXXX, Rev. X  
Inspection Procedure XXXX, Rev. X."

#### Method 3 - Source Verification

For items being accepted by Method 3, the purchase order should specify a right of access to examine the supplier's product controls in the areas of design, procurement, manufacture, calibration, testing, and inspection, and others as applicable to the critical characteristics being verified. In-process or final inspection hold points should also be specified in the purchase order if deemed necessary to effectively conduct the source verification and witness the controls necessary to verify critical characteristics.

#### Method 4 - Acceptable Supplier/Item Performance Record

For items being accepted by Method 4, the purchase order should require the results of independent product test results the supplier has had performed on its product if the testing was relevant to the verification of the item's critical characteristics. Also, the national codes and standards to which the item has been manufactured should be referenced in the purchase order. Material test reports, material certificates of compliance, and product test reports should be required to be submitted, as applicable, to assure the product meets these national codes and standards. The acceptable supplier/item performance record provides the validity of the documentation requested and received.

## Appendix E

### USE OF NATIONAL CODES AND STANDARDS

Many commercial grade items are produced to National Codes and Standards. This fact may facilitate the acceptance of commercial grade items using Acceptance Methods 1 and 4.

For Acceptance Method 1, verification of certain critical characteristics may result when a commercial grade item is manufactured to a national code or standard. If the national code or standard includes some independent product endorsements based on qualification testing or periodic testing of selected critical characteristics, then credit can be taken for those critical characteristics being verified. When a national code or standard (e.g., ASTM) only establishes certain process controls and end product acceptance requirements, the accepting party must still verify the selected critical characteristics.

For Acceptance Method 4, the supply of a product to a national code or standard in combination with an acceptable supplier/part performance record, provides confidence in the uniformity and quality of the item. This is particularly true if an independent endorsement is given based on testing. Production to a national code or standard helps to justify continual acceptance of a commercial grade item by Method 4.

Some typical commercial grade items and the general national codes and standards to which they can be produced are listed in Table E-1. The credit a purchaser can take for a product manufactured to a national code or standard must be investigated on a case-by-case basis. For example, certain electrical items can be manufactured to a UL product specification (9). These product specifications may require tests or controls of certain attributes that could be considered critical characteristics. If the commercial grade item is listed by UL, then UL will periodically test the product to assure continued product conformance.

Table E-1

EXAMPLES OF NATIONAL CODES AND STANDARDS  
ASSOCIATED WITH COMMERCIAL GRADE ITEMS

<u>Commercial Grade Item</u>	<u>National Code or Standard</u>
Bearings	Anti-Friction Bearing Manufacturers Association
Circuit Breakers	American National Standards Institute
Connectors (Lugs)	Underwriters Laboratories, Inc.
Connectors, Electric	Military Standards
Electrical Devices	National Electrical Manufacturers Association
Electronic Devices	Military Standards
Fasteners	American Society for Testing and Materials American Society of Mechanical Engineers Society of Automotive Engineers Military Standards
Fuses	Underwriters Laboratories, Inc.
Gaskets	American Society for Testing and Materials
Internal Wiring	Underwriters Laboratories, Inc.
Pressure and Temperature Switches	Underwriters Laboratories, Inc.
Relays	Underwriters Laboratories, Inc.
Terminal Blocks	Underwriters Laboratories, Inc.

Many products manufactured to a military or federal specification are included on a Qualified Product List (QPL). To be added to the QPL, the product must undergo qualification testing. Upon successful qualification, the supplier's product is added to the QPL. References (10 and 11) detail:

- Qualification requirements
- Conditions for placement and retention on the QPL
- Notification requirements should the supplier make any changes in his product (design, materials, or process) after qualification
- Significance of the listing on a QPL.

If credit is taken for a commercial grade item being on the QPL, then the appropriate military or federal specification must be invoked in the purchase order.

## Appendix F

### MAINTAINING SEISMIC AND ENVIRONMENTAL QUALIFICATION

If a commercial grade item is intended for installation in a seismically or environmentally qualified component, the purchaser should be reasonably assured that the item once installed, will not adversely affect the original qualification of the component. This assurance can be obtained by performing a technical evaluation and by accepting the item utilizing any of the four acceptance methods provided in this guideline.

#### F.1 ENVIRONMENTAL QUALIFICATION

##### F.1.1 Harsh Environment

For devices requiring environmental qualification, the identification and verification of material type or composition of nonmetallic parts such as lubricants, O-rings, gaskets, seals, and packing should be evaluated. The use of improper nonmetallic material could result in material decomposition, degradation, and failure after exposure to harsh environments. Acceptance of such commercial grade items should include verification of correct materials of construction since they are critical to performance.

##### F.1.2 Mild Environment

The threshold of radiation, temperature, and humidity deterioration for nonmetallic materials is normally above the level encountered in a mild environment (12, 13). Thus, for nonmetallic commercial grade items installed in components located in a mild environment, material verification should not be necessary.

The need for material verification should be evaluated if the material is critical from a functional standpoint (e.g., potential degradation of an incorrect material by lubricants) or the parent component is subject to equipment qualification requirements.

### **F.1.3 Seismic Qualification**

The purchaser should reasonably assure that the commercial grade items will not adversely affect the original seismic qualification of the parent component in which they are intended for installation. Reasonable assurance for a simple metallic item can typically be achieved by verifying three critical characteristics - part number, material of construction, and dimensions. Verification of these characteristics will generally ensure that the mass, its distribution, and the strength of the item are identical to the original item.

For more complex items, modifications made to internal piece-parts may result in a redistribution of mass. Changes in assembly or types of materials should also be considered for complex items. These modifications could all adversely affect the way in which the item reacts during a seismic event. Therefore, the verification of design controls, modifications to internal part characteristics, and assembly procedures should be considered if maintaining seismic qualification is an issue.

### **F.1.4 Developments in Nuclear Industry**

The user should be aware that the nuclear industry is conducting generic ongoing research in the areas of seismic qualification for critical safety-related components. The Seismic Qualification Utilities Group (SQUG), is developing separate guidelines which the user of this document may find of value in addressing seismic and environmental concerns for commercial grade items. This information is based on actual seismic experience data (5, 6, 14, 15). EPRI and its Equipment Qualification Advisory Group (EQAG) and Nuclear Utilities Group on Equipment Qualification (NUGEQ) are also conducting research in the area of seismic and environmental qualification (7, 16 to 22).

## Appendix G

### SPECIFIC VERSUS GENERIC APPLICATION OF COMMERCIAL GRADE ITEMS

#### G.1 SPECIFIC APPLICATION ITEMS

Commercial grade items should be distinguished by their intended end use application. These applications may be either specific or generic. Specific application items are generally engineered items which may be installed only in specific components. Procurement of these items are normally made through the original equipment manufacturer or their distributor.

When determining the safety function, procurement requirements, and critical characteristics for specific application items, some grouping of end use components is possible to increase the efficiency of performing the evaluation. For example, if a line of Company A's centrifugal pumps is comprised of different sizes, pressure classes, and materials, but pumps of the same model and safety class are installed in the plant, one analysis may be performed for each like item performing the same basic function in each pump (e.g., impeller, deflector, wear rings, impeller keys, bearing housings, end covers, and shaft).

Critical characteristics should be identified and be dependent upon the specific application and design function of each item.

#### G.2 GENERIC APPLICATION ITEMS

Generic application items are typically commodity items which have a wide range of end use applications in the plant. For instance, a carbon steel lockwasher may be a replacement item on pumps, valves, motor operators, cranes, or the turbine. Similarly, a Buna-N O-ring may be installed in many types of components. When selecting critical characteristics for these generic items, then certain considerations should be made. First, because the end use may not necessarily be known at the time of the analysis, a worst case scenario should be assumed. In this way, one is assured that the item can be installed in any less severe application and meet or exceed the capabilities of the item being replaced. The worst case scenario will assume that the item is safety-related, and the critical characteristics will be determined based on the most severe application.

If a generic item is intended to be used in a more severe application than for what it was originally accepted, additional critical characteristics may have to be verified. For example, assume critical characteristics were established for a given type O-ring based on it only being used in a mild environment. If the O-ring is then requested for use in a harsh environment, additional critical characteristics may have to be specified and verified before use.

Appendix H

EXHIBITS



**EXAMPLE WORKSHEET FOR PARTS CLASSIFICATION**

1. What is the safety function of the parent component in which this item is to be installed? (Consider ASME Section III, 1E Class, seismic qualification, environmental qualification, active/passive function, etc.)

2. What is the function of the item?

3. What are the ways in which the item could fail in actual service?

4. Would any of these postulated failures of the item prevent the parent component or associated components from performing their intended safety functions?

If YES, item has a safety function.

If NO, item has a nonsafety function.

If UNSURE, assume item has a safety function.

**EXAMPLE WORKSHEET FOR IDENTIFYING CRITICAL CHARACTERISTICS  
FOR A COMMERCIAL GRADE ITEM**

Based on the safety function of the item, what characteristics are considered critical to ensuring it performs its safety function?

**Product Identification Characteristics**

- 
- 
- 

**Physical Attributes**

- 
- 
- 
- 
- 

**Performance Characteristics**

- 
- 
- 
- 
-

COMMERCIAL GRADE ITEMS SUPPLIER SURVEY CHECKLIST

Supplier Data

Name \_\_\_\_\_

Address \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Telephone No. \_\_\_\_\_

Survey Team

Name

Title

Team Leader \_\_\_\_\_

Team Member(s) \_\_\_\_\_

\_\_\_\_\_

Personnel Contacted

Name

Title

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Scope of Commercial Grade Items Subject to this Survey

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Does this supplier furnish basic components under a 10CFR50, Appendix B program as well as commercial grade items (CGI)?

Yes \_\_\_\_\_ No \_\_\_\_\_

Definition and Clarification of Terms as Used in this Checklist

**Commercial Grade Items**

An item is defined as a commercial grade item only if it is:

1. Not subject to design or specification requirements that are unique to facilities or activities licensed by the USNRC, and
2. Used in applications other than facilities or activities licensed by the USNRC, and
3. To be ordered from the manufacturer/supplier on the basis of specifications set forth in the manufacturer's published product description, such as a catalog.

**I. ORGANIZATION**

1. Determine the number of Quality Assurance (QA) personnel in relation to the total production force.

QA No. \_\_\_\_\_ QC No. \_\_\_\_\_ Production No. \_\_\_\_\_

**II. QUALITY ASSURANCE PROGRAM**

1. Does a documented program exist describing how commercial products are controlled? What areas of control (e.g., design control, inspection, procurement, calibration) are covered by this program?
2. Are engineering, QA, and other applicable support personnel indoctrinated to the handling of commercial grade items?

**III. DESIGN CONTROL**

1.
  - a. Are CGIs designated differently from basic components or nonsafety items?
  - b. How is this documented?
  - c. How would this supplier handle an order which invoked 10CFR50, Appendix B and 10CFR21 requirements for CGIs?
2. How are part numbers assigned to CGIs? Changes in what parameters could result in part number changes?
3. How have changes to CGIs been made since the original equipment was shipped, been controlled.
4. Does engineering do equivalency evaluations for CGIs purchased from new subsuppliers?
5. Does this supplier identify critical characteristics of CGIs?

**IV. PROCUREMENT DOCUMENT CONTROL**

1. Do purchase orders for CGIs adequately specify technical requirements?
2. Who is responsible for review and acceptance of purchase orders for CGIs?
3. If utility purchase orders are sent to sales office or headquarters, are CGI purchase order requirements being properly communicated to the supply facility?

**V. CONTROL OF SUBSUPPLIERS**

1. Does an Approved Suppliers List (ASL) exist for CGI subsuppliers?
2. What methods are used for including a supplier on the CGI ASL?
3. Where a CGI ASL does not exist, does the system provide feedback to assure only qualified subsuppliers are furnishing CGIs; e.g., periodic vendor trending?
4. Are orders for CGIs placed to a limited number of subsuppliers where a satisfactory history has been established, or are orders issued strictly on price?

**VI. TEST AND INSPECTION CONTROLS**

1. Are receipt inspections performed for CGIs to procedures?
2. Are CGI drawings available and used for receipt inspection? Where catalogs rather than drawings are applicable, are configuration checks made?
3. What do CGI receipt inspections typically include?
4. Are results of CGI receipt inspections documented and maintained?
5. Is material receipt testing conducted? If so, for what items?
6. Are cure dates maintained, if applicable to CGIs?
7. Does supplier have system to ensure the CGI is inspected against requirements of the utility purchase order?
8. Are any tests and inspections conducted to verify critical characteristics?
9. Is test and inspection equipment used to inspect CGIs calibrated in accordance with an approved program?
10. For in-house manufactured CGIs, are in-process and final inspections/tests conducted to assure product conformance?

**VII. MATERIAL CONTROL**

Review material storage/stockroom areas to evaluate the accuracy of suppliers CG material control system.

**VIII. SPECIAL PROCESSES**

Are any special processes required in the manufacture of the CGIs which are controlled?

**IX. HANDLING AND STORAGE CONTROLS**

1. Are procedures available to properly package CGIs in accordance with ANSI N45.2.2-1978 requirements?
2. Verify CGIs pulled directly from stock are properly controlled and identified.
3. Who is responsible for inspection of CGI packaging and shipment release?

**APPLICATION OF ACCEPTANCE METHODS FOR TYPICAL CGIs  
INCLUDING VARYING PROCUREMENT SCENARIOS**

Included are instructive examples demonstrating hypothetical applications of the acceptance methods for six selected commercial grade items. The critical characteristics utilized in the examples are provided for illustration only. These critical characteristics are not intended to be all inclusive or exclusive of those which may be deemed important. The examples are provided to illustrate some of the various ways a particular commercial grade item could be accepted for safety-related use by using the acceptance methods in this guideline.

An assumption is made in each case that a technical evaluation was conducted prior to procurement to ensure the correct requirements for each item were specified in the procurement document. It is further assumed that the evaluation of the items considered seismic and environmental qualification issues and identified critical characteristics requiring verification during acceptance, to assure seismic and environmental qualification is maintained.

Hypothetical procurement scenarios are also provided for each of the six examples.

The six commercial grade items selected for inclusion in this exhibit are:

- Pressure Switch
- O-ring (nonmetallic)
- Torque Switch
- Valve Stem
- Resistor
- Pressure Transmitter

For brevity, it is assumed that the part number is a critical characteristic for each commercial grade item, and its verification is an integral part of each acceptance method.

## Description of CGI: Pressure Switch

Application: Mild environment, seismically qualified. (A technical evaluation was conducted prior to procurement which assured that the items specified in each scenario were identical to the item seismically tested, as referenced in the original test report.)

Selected Critical Characteristics (Hypothetical Technical Data)

1. Pressure Range (0 to 100 psi).
2. Material, for pressure retaining parts (commercial stainless steel).
3. Enclosure, NEMA class (NEMA 4).
4. Accuracy/Deadband ( $\pm 2\%$  of full scale).
5. Electrical Ratings (120 Vac, 5 amp).
6. Configuration (reference is made to the Supplier's catalog outline drawing).

**Application of Acceptance Methods**

## ACCEPTANCE METHOD 1:

Selected Critical CharacteristicsSpecial tests and inspections used to verify the critical characteristics.

- |  |   |
|--|---|
| 1. Pressure Range                      | Verify the 0 to 100 psi pressure range as it appears on the nameplate. Verify operability at pressure range of 0 to 100 psi during post-installation testing.                         |
| 2. Material (pressure retaining parts) | Normally this critical characteristic cannot be verified by Method 1 without disassembling the switch. If this is not feasible, the user must augment with another acceptance method. |
| 3. Enclosure (NEMA class)              | Conduct visual inspection and nameplate check during receipt inspection.  |
| 4. Accuracy/Deadband                   | Verify accuracy is $\pm 2\%$ of full scale during post-installation testing.  |
| 5. Electrical Ratings                  | Verify the voltage and current rating on the nameplate and as part of post-installation testing.  |
| 6. Configuration                       | Dimensionally check end connections and mounting connections, visually inspect against catalog drawing, and check nameplate for proper switch type.                                   |

## ACCEPTANCE METHOD 2:

Selected Critical CharacteristicsCGI Supplier's activities used to control the critical characteristics subject to survey.

- |   |   |
|---|---|
| 1. Pressure Range and Accuracy/Deadband | Examine in-process or final testing practices to determine how the Supplier verifies the pressure range of the switch. Verify that equipment is properly calibrated. Review test records generated. |
|---|---|

- |  |   |
|--|---|
| 2. Material (pressure retaining parts) | Examine design controls, procurement controls, receipt inspection activities, and material controls for commercial stainless steel. |
| 3. Enclosure (NEMA class)              | Examine design controls, procurement controls, receipt inspection activities, and material controls.                                |
| 4. Electrical Ratings                  | Review design controls, procurement controls, electrical test practices, test equipment calibration, and test records generated.    |
| 5. Configuration                       | Examine design controls, manufacturing practices, final inspection, calibration of measuring equipment, and appropriate records.    |

## ACCEPTANCE METHOD 3:

Selected Critical Characteristics

Supplier's activities used to control the critical characteristics witnessed and examined during source surveillance.

- |   |  |
|---|--|
| 1. Pressure Range and Accuracy/Deadband | Witness final testing, review test procedures, review final test data for acceptability, and assure test equipment is properly calibrated.                                   |
| 2. Material (pressure retaining parts)  | Examine design controls, procurement controls, receipt inspection activities, and material controls applicable to the switch.  |
| 3. Enclosure (NEMA class)               | Conduct visual and nameplate inspection.   |
| 4. Electrical Ratings                   | Visually inspect nameplate data and review applicable test records.  |
| 5. Configuration                        | Dimensionally check end connections and mounting connections, visually inspect against catalog/drawing, and check nameplate for proper switch type. Examine design controls. |

## ACCEPTANCE METHOD 4:

Selected Critical Characteristics

Performance information used to provide reasonable assurance the critical characteristics have been met.

- |   |   |
|---|---|
| Pressure Range, Material (pressure retaining parts), Enclosure (NEMA class), Accuracy/Deadband, Electrical Ratings, and Configuration | Results from monitored performance, results from successfully using Method 2 that are still valid, results from successfully using Method 3, periodic maintenance and surveillance tests, Supplier responses to CG program controls, use of national standards, and review of USNRC issued documents. |
|---|---|

### Pressure Switch Procurement Scenarios

- I. Utility 1 has been buying and accepting pressure switches from Supplier A employing Method 2 for the past two years. During the commercial grade item surveys, the utility examined the activities listed in the preceding application example for Method 2. The utility has documented results of monitored performance that has been acceptable. The utility considers sufficient data exists to employ Method 4 and a formal evaluation is performed.

During the evaluation, a USNRC, IE Bulletin is received indicating problems at the plants where Supplier A's pressure switches failed to perform in accordance with design requirements. Based on this new input, the evaluation concludes an acceptable Supplier/performance record can no longer be justified. However, assurance that Supplier A adequately controls the critical characteristics on a replacement switch procurement can be accomplished using a combination of Methods 2 and 3. Method 2 is relied upon to accept the switch supplemented by Method 3 to assure the problem identified in the bulletin does not affect the switch being accepted.

Utility 1 issues a purchase order to Supplier A for pressure switches, imposing rights of access, and requesting a Certificate of Conformance to the current program controls surveyed. A source verification visit is conducted and the results are documented. Upon receipt of the switches, a Standard Receipt Inspection is performed. Utility 1 accepts the items based on Supplier A's Certificate of Conformance to the purchase order and the source verification results. Thus, a combination of Methods 2 and 3 is used to accept the switches.

- II. Utility 2 has also been purchasing pressure switches from Supplier A utilizing Method 2. Upon receipt of the USNRC, IE Bulletin, Utility 2 elects to purchase switches from a new Supplier for which there is little historical information. Utility 2 feels that Method 2 will provide adequate assurance for their purposes. A survey is then conducted of the new Supplier. The selected critical characteristics Utility 2 desires to verify remain the same. Utility 2 examines the same Supplier activities as before and determines that the new Supplier adequately controls the selected critical characteristics. A report documenting the survey results is prepared. Utility 2 issues a purchase order to Supplier B requesting pressure switches, and requesting a Certificate of Conformance to the program controls surveyed.

Upon receipt of the pressure switches, a Standard Receipt Inspection is performed. Utility 2 accepts the switches based on Supplier B's Certificate of Conformance to the purchase order. Thus, Method 2 is used to accept the switches, but consideration will be given to using Method 4 after some historical background can be developed and documented.

- III. Utility 3 purchases pressure switches from a number of commercial Suppliers. The utility does not wish to use Method 2 for each of these Suppliers. Instead, sufficient technical data has been gathered to permit the utility to verify critical characteristics upon receipt. The utility selects a Supplier and purchases a batch of switches. Utility 3 conducts the special tests and inspections shown in the application example for Method 1 to verify selected critical characteristics. This assumes that the materials of construction are verified after disassembling a sample switch. Based on satisfactory, documented results of the inspections and tests, Utility 3 accepts the switches by using Method 1.

**Description of CGI: O-ring (nonmetallic)**

Application: Maintain a seal to prevent leakage of fluid. Mild environment.

**Selected Critical Characteristics (Hypothetical Technical Data)**

1. Dimensions (ID = 5.0" (nominal) = 4.989"  $\pm$ 0.037", cross-section diameter = 1/8" (nominal) = 0.070"  $\pm$ 0.003").
2. Material (EPDM compound).
3. Durometer Hardness (Shore A 70  $\pm$ 5).

**Application of Acceptance Methods****ACCEPTANCE METHOD 1:****Selected Critical Characteristics****Special tests and inspections used to verify the critical characteristics.**

- |                       |  |
|-----------------------|--|
| 1. Dimensions         | Measure at receipt inspection using a layout cone for ID and calipers for the cross-section diameter.  |
| 2. Material           | Verify color at receipt inspection against the Supplier's comparison chart, or verify chemical composition of O-ring is that of EPDM compound. |
| 3. Durometer Hardness | Test at receipt inspection and verify reading of Shore A 70 $\pm$ 5 Durometer hardness.  |

**ACCEPTANCE METHOD 2:****Selected Critical Characteristics****CGI Supplier's activities used to control the critical characteristics subject to survey.**

- |                       |   |
|-----------------------|---|
| 1. Dimensions         | Examine design controls, tooling controls, in-process and final inspection practices, and measuring equipment controls to verify O-rings are made to the correct size.  |
| 2. Material           | Examine design controls, procurement controls, receipt inspection controls, processing controls, and material controls for EPDM compound.   |
| 3. Durometer Hardness | Examine in-process and final testing practices to verify that the Supplier controls the Durometer hardness of EPDM to Shore A 70 $\pm$ 5. Verify test equipment is calibrated. Review test records generated. |

**ACCEPTANCE METHOD 3:****Selected Critical Characteristics****Supplier's activities used to control the critical characteristics witnessed and examined during source surveillance.**

- |               |  |
|---------------|--|
| 1. Dimensions | Dimensionally inspect ID, and cross-section diameter against Supplier's fabrication drawing. Review design and calibration controls. |
|---------------|--|

2. Material Witness control of batch material from which O-rings are fabricated, and the mixing and fabrication processes. Verify color against the Supplier's comparison chart. A Supplier could be willing to conduct chemical analysis or destructive testing on a sample basis, which the purchaser may also choose to witness.
3. Durometer Hardness Witness Durometer hardness test and verify reading of Shore A 70 ±5.

Although this method is technically feasible, it may not be economically feasible to employ. For example, ordering a batch of sufficient quantity to justify a source verification would not be economical, since the shelf life would expire prior to use of the entire batch.

#### ACCEPTANCE METHOD 4:

<u>Selected Critical Characteristics</u>	<u>Performance information used to provide reasonable assurance the critical characteristics have been met.</u>
1. Dimensions	Results of monitored performance, results from using other methods, Supplier responses to CG program controls, CG program industry surveys.
2. Material and Durometer Hardness	Results from monitored performance, results from successfully using other methods, periodic maintenance and surveillance tests, Supplier responses to CG program controls, use of national standards, and CG program industry surveys.

#### O-ring Procurement Scenarios

- I. Utility 1 conducts a survey of Commercial Supplier A. It is determined that the Supplier adequately controls the manufacture of EPDM material and tests the Durometer hardness of selected O-rings, but has a high rate of deficiencies in controlling the correct size of O-rings. Utility 1 obtains the dimensional data while at the survey in order to dimensionally inspect the ID and cross-section diameter of the O-rings upon receipt. A report is issued documenting the survey results, including the need to use Method 1 to verify O-ring dimensions. Utility 1 issues a purchase order for O-rings requesting a Certificate of Conformance to the program surveyed. Upon receipt, a Standard Receipt Inspection is performed plus a special dimensional inspection. Utility 1 accepts the O-rings based on Supplier A's Certificate of Conformance to the purchase order and the documented inspection results. Thus, a combination of Methods 1 and 2 is used to accept the O-rings.
- II. Utility 2 buys O-rings from Commercial Supplier B. A survey is conducted and credit is taken for this Supplier adequately controlling selected critical characteristics. During the survey the utility examines in-process and final test inspection practices to verify the Supplier controls the ID and cross-section diameter of O-rings. The utility also examines the material controls employed for EPDM compound, and verifies that the Supplier tests the Durometer hardness of EPDM. Utility 2 also performs dimensional inspections and Durometer hardness tests upon receipt of a selected sample from each batch. This practice is continued for three years after the initial survey was conducted with no reported problems in the supplied

O-rings. Also during this time, Utility 2 documents the satisfactory performance of these O-rings in numerous applications in the plant. Utility 2 decides to conduct an evaluation to determine if an Acceptable Supplier/Item Performance Record can be justified. Utility 2's historical performance results, historical verification results from using Method 1 and 2, and industry-wide performance data is collected and reviewed for Supplier B's O-rings. Based on the evaluation, an Acceptable Supplier/Item Performance Record is documented. A purchase order is issued to Supplier B for O-rings. The O-rings are received and subjected to a Standard Receipt Inspection. Utility 2 accepts the O-rings by issuing certification based on the Acceptable Supplier/Item Performance Record. **Methods 1 and 2 were initially used to accept the O-rings, then after a period of time, Method 4 was used.**

- III. Utility 3 desires to use Method 1 to accept the O-rings. No interface is conducted with the Supplier during the procurement, and the O-rings are received. In developing the receipt inspection plan, the utility then requests that the Supplier furnish them with the ID and cross-section diameter, Durometer hardness, and material of construction to accomplish the special tests and inspections. The Supplier informs Utility 3 that the dimensions, the chemical composition of the EPDM material, and the Durometer hardness are proprietary information and cannot be furnished.

**Utility 3 cannot accept the O-rings for safety-related use employing Method 1, without obtaining the necessary technical data from the Supplier.**

**Description of CGI: Torque Switch**

**Application:** Valve operators located in a harsh environment. (A technical evaluation was conducted prior to procurement which assured that the items specified in each scenario were identical to the item seismically and environmentally tested, as referenced in the original test report.)

**Selected Critical Characteristics** (Hypothetical Technical Data)

1. Dimensions (4.20"  $\pm$ 0.010" width, 6.50"  $\pm$ 0.010" depth, 2.67"  $\pm$ 0.010" height).
2. Configuration (reference is made to the Supplier's catalog outline drawing).
3. Material, nonmetallic parts (phenolic, dark brown color).
4. Operability (transfer state at  $\pm$ 5% of applied torque).

**Application of Acceptance Methods****ACCEPTANCE METHOD 1:****Selected Critical Characteristics****Special tests and inspections used to verify the critical characteristics.**

- |                                    |   |
|------------------------------------|---|
| 1. Dimensions                      | Measure width, depth, and height at receipt inspection.   |
| 2. Configuration                   | Verify at receipt inspection using the catalog outline drawing as reference.  |
| 3. Material<br>(nonmetallic parts) | Visually inspect for dark brown color.  |
| 4. Operability                     | Manually test at receipt inspection to confirm spring action and air gap between contact metal bar and holder. Post-installation test after torque setting is made to verify the switch transfers state and the valve seats properly. This also indicates that the switch is compatible with the spring pack. |

**ACCEPTANCE METHOD 2:****Selected Critical Characteristics****CGI Supplier's activities used to control the critical characteristics subject to survey.**

- |                                    |   |
|------------------------------------|---|
| 1. Dimensions                      | Examine design controls, measuring equipment used by the Supplier, calibration controls, and final inspection practices.  |
| 2. Configuration                   | Examine design controls and final inspection practices.   |
| 3. Material<br>(nonmetallic parts) | Examine design controls, procurement controls, receipt inspection activities, and material controls for phenolic material used for switch housings.   |
| 4. Operability                     | Activities surveyed during a commercial grade survey do not lend themselves to verifying this critical characteristic. Conduct a post-installation test as described in the Method 1 application to augment the survey results. |

## ACCEPTANCE METHOD 3:

Selected Critical CharacteristicsSupplier's activities used to control the critical characteristics witnessed and examined during source surveillance.

- |                                 |   |
|---------------------------------|---|
| 1. Dimensions and Configuration | Dimensionally inspect against Supplier's assembly drawing. Review design and calibration controls applicable to the switch.   |
| 2. Material (nonmetallic parts) | Examine design controls, procurement controls, receipt inspection activities, and material handling controls the Supplier employs for phenolic material.  |
| 3. Operability                  | Activities witnessed during source verification do not lend themselves to verifying this critical characteristic. Conduct a post-installation test as described in the Method 1 application to augment the source verification results. |

## ACCEPTANCE METHOD 4:

Selected Critical CharacteristicsPerformance information used to provide reasonable assurance the critical characteristics have been met.

Dimensions, Configuration, Material (nonmetallic parts), and Operability

Results from monitored performance, results from successfully using Method 1, periodic maintenance and surveillance tests, Supplier responses to CG program controls, and review of USNRC issued documents.

**Torque Switch Procurement Scenarios**

- I. Utility 1 requires torque switches on an expedited basis. The switches are not an item frequently procured. Utility 1 places an order for several torque switches and obtains the right to access the commercial Supplier's facility. Utility 1 conducts source verification by witnessing activities used to control critical characteristics. While at the facility, the utility measures the dimensions and verifies the configuration of the switches using the Supplier's assembly drawing as a reference. The utility examines how the Supplier procures and handles the phenolic material used for the switch casing. Finally, the utility witnesses final testing of the switches. The switches are released for shipment by Utility 1 based on the documented source verification results. Upon receipt, a Standard Receipt Inspection is performed. Provisions are made to verify operability by means of post-installation testing. Utility 1 accepts the switches based on source verification results and the documented completion of post-installation testing. **The switches are accepted using Methods 1 and 3.**

- II. Utility 2 procures a line of torque switches on a frequent basis from Commercial Supplier ABC. A survey of Supplier ABC is arranged to examine activities used to control selected critical characteristics. The Supplier has a commercial Quality Assurance manual for the design and manufacture of an entire line of switches. The survey indicates that the Supplier satisfactorily employs the controls as delineated in the manual and that these activities adequately control the dimensions, configuration, and phenolic materials of the switches. A report is issued documenting the survey results. Utility 2 issues a purchase order to Supplier ABC requesting torque switches, invoking rights of access, and requesting a Certificate of Conformance to the commercial Quality Assurance manual (dated). Upon receipt of the items, a Standard Receipt Inspection is conducted. Provisions are made to verify operability by means of post-installation testing. Utility accepts the switches based on the Supplier's Certificate of Conformance to the purchase order and the documented completion of post-installation testing. The switches are accepted using Methods 1 and 2.

**Description of CGI: Valve Stem**

Application: Installed in an active isolation valve.

Selected Critical Characteristics (Hypothetical Technical Data)

1. Dimensions (diameter = 1.663"  $\pm$ 0.001", length = 6.250" +0.000" -0.002").
2. Configuration (reference is made to the Supplier's valve assembly drawing).
3. Material (ASTM A276, Type 316 stainless steel).
4. Hardness (Brinnell hardness 165 to 195 range as specified on Supplier's drawing).

**Application of Acceptance Methods**

## ACCEPTANCE METHOD 1:

Selected Critical CharacteristicsSpecial tests and inspections used to verify the critical characteristics.

- |                  |  |
|------------------|--|
| 1. Dimensions    | If dimensional tolerances are unknown, verify dimensional acceptance by post-installation testing. Ensure stroke time is acceptable. If dimensions are known, measure diameter and length. |
| 2. Configuration | Visually inspect at receipt inspection against Supplier's valve assembly drawing.  |
| 3. Material      | Verify the material is ASTM A276, Type 316 stainless steel with an alloy analyzer (utilizing utility equipment or the services at an approved test facility).                              |
| 4. Hardness      | Verify Brinnell hardness is between 165 and 195 utilizing a hardness tester (utilizing utility equipment or the services at an approved test facility).                                    |

## ACCEPTANCE METHOD 2:

Selected Critical CharacteristicsCGI Supplier's activities used to control the critical characteristics subject to survey.

- |                  |  |
|------------------|--|
| 1. Dimensions    | Examine design controls, measuring equipment, calibration controls, and final inspection practices.  |
| 2. Configuration | Examine design controls, manufacturing controls, and final inspection practices.   |
| 3. Material      | Examine design controls, procurement controls, receipt inspection activities, and material controls for ASTM A276, Type 316 stainless steel.     |
| 4. Hardness      | Examine heat treatment practices, testing, and calibration controls to verify the finished material has a Brinnell hardness between 165 and 195. |

## ACCEPTANCE METHOD 3:

Selected Critical Characteristics

Supplier's activities used to control the critical characteristics witnessed and examined during source surveillance.

- |                                 |   |
|---------------------------------|---|
| 1. Dimensions and Configuration | Dimensionally inspect against the detailed design drawing of the stem. Review design and calibration controls applicable to the stem.   |
| 2. Material                     | Examine design controls, procurement controls, receipt inspection activities, and material controls for ASTM A276, Type 316 stainless steel.  |
| 3. Hardness                     | Review heat treatment records, calibration records, and heat treatment procedure. Alternatively, witness a hardness test to verify material Brinnell hardness is between 165 and 195. |

## ACCEPTANCE METHOD 4:

Selected Critical Characteristics

Performance information used to provide reasonable assurance the critical characteristics have been met.

Dimensions, Configuration, Material, and Hardness

Results of monitored performance, results from successfully using Method 2 that are still valid, periodic maintenance and surveillance tests, INPO NPRDS, Supplier responses to CG program controls, and USNRC issued documents.

**Valve Stem Procurement Scenarios**

- I. Utility X procures replacement valve stems from the Original Equipment Manufacturer. The valve assembly drawing indicates the material of construction and hardness of the stem, but dimensions are not provided. A Standard Receipt Inspection is conducted upon receipt. Utility 1 verifies the material is ASTM A276, Type 316 stainless steel by utilizing an alloy analyzer. Hardness is measured at 175 with a Brinnell hardness tester. Critical dimensions are verified after the stem is installed by stroking the valve and ensuring its proper operation. The results of the special receipt tests and post-installation test are documented. Utility X utilizes Method 1 to accept stems for safety-related use.
- II. Utility 2 conducts a commercial grade item survey in conjunction with its triannual 10CFR50, Appendix B audit. While at the facility, it is determined that the Supplier controls valve stems under their 10CFR50, Appendix B program. The Supplier passes the audit and remains on the utility's approved nuclear supplier list. The utility procures the stem as a basic component and not as a commercial grade item.

In this case, the utility does not need to employ commercial grade item acceptance methods because the stem is being purchased as a basic component.

## Description of CGI: Resistor

Application: Item in Class 1E Radiation Monitoring Equipment. Harsh environment. (A technical evaluation was conducted prior to procurement. It assured that the items specified in each scenario were identical to the item installed in the component, which was seismically and environmentally qualified, as referenced in the original component test report.)

Selected Critical Characteristics (Hypothetical Technical Data)

1. Resistance ( $\pm 10\%$  of 10,000 ohms rated resistor).
2. Power Rating (10 watts).
3. Markings (brown, black, orange, double space, silver).
4. Configuration (reference is made to the Supplier's catalog outline drawing).

## Application of Acceptance Methods

## ACCEPTANCE METHOD 1:

Selected Critical CharacteristicsSpecial tests and inspections used to verify the critical characteristics.

- |                  |  |
|------------------|--|
| 1. Resistance    | Confirm resistance is 10,000 ohms $\pm 10\%$ utilizing test equipment.                         |
| 2. Power Rating  | Confirm power rating utilizing test equipment.   |
| 3. Markings      | Verify color markings are brown, black, orange, double space, and silver (from left to right). |
| 4. Configuration | Visually inspect making reference to the Supplier's catalog outline drawing.                   |

## ACCEPTANCE METHOD 2:

Selected Critical CharacteristicsCGI Supplier's activities used to control the critical characteristics subject to survey.

- |                              |   |
|------------------------------|---|
| 1. Resistance                | Examine manufacturing controls, in-process, and final testing practices of 10,000-ohm resistors. Verify test equipment is properly calibrated. Review test records generated. Examine controls of raw material. |
| 2. Power Rating and Markings | Examine design controls, manufacturing controls, and marking practices.   |
| 3. Configuration             | Examine design controls, measuring equipment calibration controls, and in-process/final inspection practices.   |

## ACCEPTANCE METHOD 3:

Selected Critical Characteristics

Supplier's activities used to control the critical characteristics witnessed and examined during source surveillance.

- |                  |   |
|------------------|---|
| 1. Resistance    | Witness resistance test measures 10,000 ohms $\pm 10\%$ .               |
| 2. Power Rating  | Examine Supplier's procedure for identifying power rating.              |
| 3. Markings      | Examine Supplier's marking procedures. Visually inspect color markings. |
| 4. Configuration | Dimensionally inspect against design drawing of 10,000-ohm resistor.    |

## ACCEPTANCE METHOD 4:

Selected Critical Characteristics

Performance information used to provide reasonable assurance the critical characteristics have been met.

Resistance, Power Rating, Markings, and Configuration

Results of successfully using Method 1, purchased to a national standard, Supplier is on Qualified Product List, Supplier reliability data, survey report of military qualifying agency, and Supplier responses to CG program controls.

### Resistor Procurement Scenarios

- I. Utility 1 conducts a commercial grade item survey of Supplier A by examining manufacturing controls, in-process and final testing practices, design controls, manufacturing controls, and marking practices for 10,000-ohm resistors. These activities are deemed adequate to control the rated resistance and power, color markings, and configuration of the resistor.

The survey results are documented. Purchase order requirements are established which invoke the surveyed controls. A Certificate of Conformance is furnished by the Supplier to confirm that the required Quality Control activities were exercised. Upon receipt, a Standard Receipt Inspection is required to complete the acceptance of these resistors.

Thus, Utility 1 employs Method 2 to accept the resistors.

- II. Utility 2 conducts a commercial grade item survey of Supplier B, but determines that the Supplier's raw material controls are inadequate to control the rated resistance of the items. Supplier B does demonstrate adequate marking practices and final inspection practices to control the configuration of the resistor. These survey results are documented. Purchase order requirements are established which invoke the surveyed controls. A Certificate of Conformance is furnished by the Supplier to confirm that the required Quality Control activities were exercised. A Standard Receipt Inspection is conducted upon receipt.

To verify the resistance, Utility 2 measures 10,000 ohms resistance by utilizing an ohm meter upon receipt of a selected sample. The results of the special tests are documented. Thus, a combination of Methods 1 and 2 is used to accept the resistors.

Description of CGI: Pressure Transmitter

Application: Harsh environment, seismically qualified. (A technical evaluation was conducted prior to procurement which assured that the items specified in each scenario were identical to the item seismically and environmentally tested, as referenced in the original test report.)

Selected Critical Characteristics (Hypothetical Technical Data)

1. Pressure Range (50 to 150 psi).
2. Materials (commercial stainless steel, Buna-N seals).
3. Accuracy ( $\pm 2.5\%$  of full scale).
4. Electrical Ratings (120 Vac, 5 amp contact rating, 4 to 20 mA output).
5. Configuration (reference is made to the Supplier's catalog outline drawing).

**Application of Acceptance Methods**

ACCEPTANCE METHOD 1:

Selected Critical Characteristics

Special tests and inspections used to verify the critical characteristics.

- |                       |  |
|-----------------------|--|
| 1. Pressure Range     | Verify the 50 to 150 psi pressure range as it appears on the nameplate. Verify operability at pressure range of 50 to 150 psi during post-installation testing.  |
| 2. Materials          | Cannot verify this critical characteristic by Method 1 without disassembling a sample transmitter. Must augment with other acceptance method.                    |
| 3. Accuracy           | Verify accuracy is $\pm 2.5\%$ of full scale during post-installation testing.   |
| 4. Electrical Ratings | Verify the voltage, current rating, and output amperage on the nameplate, and as part of post-installation testing.  |
| 5. Configuration      | Dimensionally check end connections and mounting connections, visually inspect against Supplier's drawing, and check nameplate data for proper transmitter type. |

ACCEPTANCE METHOD 2:

Selected Critical Characteristics

CGI Supplier's activities used to control the critical characteristics subject to survey.

- |                                |  |
|--------------------------------|--|
| 1. Pressure Range and Accuracy | Examine in-process or final testing practices to determine how the Supplier verifies the pressure range of the transmitter. Verify test equipment is properly calibrated. Review test records generated. |
| 2. Materials                   | Examine design controls, procurement controls, receipt inspection activities, and material controls for commercial stainless steel pressure retaining parts and the Buna-N seals.                        |

- |                       |   |
|-----------------------|---|
| 3. Electrical Ratings | Examine design controls, procurement controls, electrical test practices, test equipment calibration, and test records generated. |
| 4. Configuration      | Examine design controls, manufacturing practices, final inspection, calibration of measuring equipment, and appropriate records.  |

## ACCEPTANCE METHOD 3:

Selected Critical Characteristics

Supplier's activities used to control the critical characteristics witnessed and examined during source surveillance.

- |                                |   |
|--------------------------------|---|
| 1. Pressure Range and Accuracy | Witness final testing, review test procedures, review final test data for acceptability, and assure test equipment is properly calibrated.  |
| 2. Materials                   | Examine design controls, procurement controls, receipt inspection activities, and material controls for stainless steel pressure retaining parts and the Buna-N seals.            |
| 3. Electrical Ratings          | Visually inspect nameplate data and review applicable test records.   |
| 4. Configuration               | Dimensionally check end connections and mounting connections, visually inspect against catalog/drawing, and check nameplate for proper transmitter type. Examine design controls. |

## ACCEPTANCE METHOD 4:

Selected Critical Characteristics

Performance information used to provide reasonable assurance the critical characteristics have been met.

- |  |   |
|--|---|
| Pressure Range, Materials, Accuracy, Electrical Ratings, and Configuration | Results from monitored performance, results from successfully using Method 2 that are still valid, results from successfully using Method 3, periodic maintenance and surveillance tests, Supplier responses to CG program controls, use of national standards, review of USNRC issued documents, and INPO NPRDS. |
|--|---|

### Pressure Transmitter Procurement Scenarios

- I. Utility 1 procures the pressure transmitters without conducting a commercial grade item survey or source verification. Method 1 is intended to be used to accept the transmitters. Upon receipt, a Standard Receipt Inspection is performed. A bench test is conducted which verifies a  $\pm 2.5\%$  accuracy, 120 Vac, 5 amp contact rating, 4 to 20 mA output, pressure range of 50 to 150 psi, and the general configuration of the transmitter. Because the transmitters is required to operate in a harsh environment, the material of construction of the pressure retaining and nonmetallic parts is considered critical. The bench test cannot demonstrate the operability of these parts under the harsh environmental conditions. Thus, Utility 1 cannot verify that stainless steel pressure retaining parts and Buna-N seals were furnished by using a bench test.

The Supplier furnishes Utility 1 with the necessary technical information regarding the materials of construction with a Certificate of Conformance. Utility 1 uses this information to verify the materials by disassembling a sample transmitter and having the material of the parts tested at an approved laboratory.

The test indicates that the material of the pressure parts is ASTM A276, Type 304 stainless steel and that the seals are Buna-N rubber. These results confirm the data furnished on the Supplier's certification. The remaining transmitters are accepted for safety-related use based on the documented special test and inspection results.

In this case, the utility employs Method 1 to accept the transmitters.

- II. Utility 2 conducts a commercial grade item survey of Supplier X. The Supplier does not have a commercial Quality Assurance manual, but does adequately control the selected critical characteristics by programmatically employing various quality activities. While at the facility, Utility 2 examines the Supplier's in-process and final testing practices to assure that the transmitter pressure range and accuracy are 50 to 150 psi and  $\pm 2.5\%$ , respectively. The utility examines how the Supplier controls design changes to the transmitter and the material controls for stainless steel pressure retaining parts and Buna-N seals. Finally, manufacturing, receipt inspection, and final test practices are examined to verify the electrical ratings of 120 Vac, 5 amp contact rating, 4 to 20 mA output, and the general configuration of a typical assembled transmitter. A report documenting the results of the survey is prepared.

Utility 2 issues a purchase order to Supplier X for pressure transmitters, requesting a Certificate of Conformance stating the order was processed in accordance with the design control, procurement control, material control, final testing, and receipt inspection practices observed during the survey. Upon receipt, a Standard Receipt Inspection is performed. The transmitters are accepted based on the Supplier's Certificate of Conformance to the purchase order. Utility 2 accepts the transmitters for safety-related use utilizing Method 2.



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