SECURITY CLASS : UNCLASSIFIED
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DOCUMENT IDENTIFIER **PS850110E**

SUBJECT: **ACCEPTANCE TESTING OF INCOMING AEROSPACE FASTENERS**

MATERIAL ENGINEERING & TECHNOLOGY DEVELOPMENT
ENGINEERING & DEVELOPMENT CENTER

PREPARED BY: Y. Amran DEPT: 4481

CHECKED BY: S. Essel DEPT: 4481

APPROVED BY: Dr. O. Levi DEPT: 4479

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REVISION STATUS

REV	--	B	C	D	E	E1	F	G	H	J	K
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1. APPLICABILITY

1.1. Applicable to all projects.

1.2. This Revision is effective within 30 days of issue at IAI Ltd. Processors performing acceptance testing of fasteners in accordance with requirements of the previous issue of this PS shall implement the changes defined herein within three (3) months from the date of issue of this PS, unless otherwise agreed upon with relevant Divisional QA department.

2. SCOPE

2.1. This Process Specification (PS) establishes the quality control surveillance procedures for each incoming production lot of aerospace fasteners (refer to Appendix A para. A15) at IAI Ltd, at its designated distributors, and at its subcontractors.

2.2. Refer to Appendix A for definition of terms used in this PS.

3. APPLICABLE DOCUMENTS

Except where a specific issue is indicated, the latest issue of the following specifications shall be considered as part of this PS to the extent specified herein.

3.1. American Society for Quality Control

ANSI/ASQC Z1.4 Sampling Procedures and Tables for Inspection by Attributes

3.2. Society of Automotive Engineers (SAE)

ARP9013/1 Statistical Product Acceptance Requirements Using Isolated Lot Sampling Methods

3.3. The current issues of applicable Procurement Specifications for fasteners.

4. ENGINEERING DRAWING CALL-OUT

The applicable Engineering document (QA Procedure, E.O., etc.) and other relevant documents shall reference this PS by number.

NOTE: When an fastener is procured for IAI Ltd projects the requirements of this PS shall apply even if the Engineering document does not specifically call-out this PS by number.

5. TABLE OF CONTENTS

6. **MATERIALS**

Not applicable.

7. **EQUIPMENT AND TOOLS**

Not applicable.

8. REQUIREMENTS

8.1. Quality Assurance (QA)

8.1.1. QA shall maintain an updated list of "preferred manufacturers" (refer to Appendix A, para. A3.1) and "approved manufacturers" (refer to Appendix A, para. A3.2) authorized to manufacture fasteners to IAI Ltd in accordance with the Divisional QA Procedures.

8.1.2. QA shall verify that the vendor/supplier has established a system for the handling, storage and identification of fasteners.

8.1.3. The vendor/supplier shall furnish to the purchaser with each lot a certificate of conformance (C.O.C) as well as the certificate of test (C.O.T) covering all the acceptance tests, as required by the procurement specifications, performed by manufacturer.

8.1.4. The Certificates shall include the purchase order number, name of manufacturer, part number, lot number, procurement specification and revision letter, and quantity from each lot supplied.

8.1.5. The vendor/supplier is responsible to ensure that all the inspections as specified by the procurement specification have been performed and conform to the requirements.

NOTE: A C.O.C furnished by a vendor/supplier shall not be considered an acceptable substitute for the manufacturer's C.O.T that includes all laboratory test results.

8.2. Fastener Qualification

The manufacturer shall make available to IAI Ltd, if requested, the qualification test report for a specific fastener showing that the product satisfactorily conforms to the applicable procurement specification. The QA provisions of the procurement specification, purchase order descriptions, or other contractual documents usually specify the minimum amount of tests required.

8.3. "Preferred Manufacturer" Qualification

A manufacturer shall be granted "preferred manufacturer" (refer to para A3.1) status in accordance with Divisional QA Procedures.

8.4. Inspector Qualification

Inspectors performing inspections and testing required in this PS shall be trained and qualified.

8.5. Acceptance Tests

NOTE: When Receiving Inspection is mentioned in this PS it shall include an IAI Ltd department as well as an inspection department at a framework agreement supplier or subcontractor approved by any IAI Divisional QA Department to perform acceptance testing.

8.5.1. Applicable to all types of fasteners (refer to Appendix A para. A15), including critical fasteners, purchased by and for the different Plants of IAI Ltd.

8.5.2. The acceptance testing frequencies for the subsequent production lots received at IAI LTD shall be based on the quality history of the manufacturer.

8.5.3. Subcontractors to the various IAI Divisions/Plants need not perform any destructive acceptance tests when purchasing fasteners from a "preferred" (refer to para. A3.1) producer. Subcontractor must ensure that all inspections and tests required by the procurement specification have been performed, reported in the C.O.T and conform to the requirements.

8.5.4. Receiving Inspection

8.5.4.1. For all IAI Groups and approved framework agreement suppliers or subcontractors in-coming lots of fasteners shall be inspected by Receiving Inspection in accordance with an applicable Divisional QA Procedure or per agreement with approved framework agreement supplier or subcontractor as outlined below:

a. Shipment:
Check for compliance with requirements specified in Purchase Order (identification of the fastener, quantity, packing requirements, etc.).

b. Documentation:
Check for a vendor/supplier's C.O.C and manufacturer's C.O.T as per para. 8.1.

c. Visual and dimensional examination for design characteristics (e.g. dimensions, thread form, surface finish and identification marking) and absence of defects.

8.5.4.2. Any deviations from design characteristics and other contractual requirements shall be reported as a defect.

8.5.4.3. If a lot is found acceptable for documentation and dimensional requirements but suspect indications are found during visual inspection the Receiving Inspection Department may choose to determine the nature of the suspect indication as follows:

- Send a random sample as per Sampling Plan III (Table 3) of the suspect specimens to an approved metallurgical laboratory (refer to para. 8.5.6).
- The specimens that were sent with suspect visual indications shall be micro-examined to decide if indications are defects requiring rejection of the lot.

8.5.4.4. If the lot fails to conform to the Receiving Inspection requirements, no sample shall be sent to the laboratory for further testing.

8.5.5. Implementation of Test Plan

8.5.5.1. Receiving Inspection shall verify that the incoming fastener is being supplied from either a “preferred manufacturer” or an “approved manufacturer”.

8.5.5.2. If the fastener is not from a “preferred” or “approved” manufacturer, the lot shall be referred to Quality Assurance for disposition.

8.5.5.3. When required per applicable testing frequency plans, Fig. 2 or Fig. 3 for “preferred” or “approved” manufacturer respectively, Receiving Inspection shall send samples from the incoming lot of fasteners for laboratory destructive testing per requirements of this PS.

8.5.6. Laboratory Destructive Testing

Laboratory testing shall be performed by the Metallurgical Laboratory in the Aviation Group ~~Engineering Division~~ / Engineering & Development Center ~~Group~~, or at any other IAI metallurgical laboratory suitably equipped and staffed by personnel qualified specifically for the purpose and authorized by the relevant Divisional QA authority or by IAI Training Center, or at any other qualified metallurgical laboratory capable of testing aerospace fasteners and approved by one of the following organizations: International Laboratory Accreditation Cooperation (ILAC), National Aerospace and Defense Contractors Accreditation Program-Material Testing Laboratories (NADCAP-MTL), American Association for Laboratory Accreditation (A2LA) or International Organization for Standardization 17025 (ISO 17025).

Destructive laboratory testing shall include, but not limited to:

8.5.6.1. Metallurgical examination as defined in the relevant procurement specifications: for example voids, bursts, cracks, segregations, oxidation, intergranular attack, carburization, decarburization, grain flow and other discontinuities.

8.5.6.2. Mechanical properties examinations as defined in the relevant procurement specifications: for example tensile strength, shear strength, hardness, fatigue, hydrogen embrittlement examination and other mechanical properties.

8.5.6.3. Finish examinations as defined in the relevant procurement specifications: for example coating thickness, salt spray tests and other properties.

8.5.6.4. Laboratory testing to be performed for “Acceptance Test” (refer to para. A10) shall include all mechanical properties and metallurgical examinations as required for acceptance (quality conformance) tests in the relevant fastener part number drawing and the applicable procurement specification.

8.5.6.5. Laboratory testing to be performed for “Control Test” (refer to para. A11) shall be determined for each fastener tested using the following general criteria:

a. To retest the property that failed to meet the requirements.

b. To evaluate one or more tests required by procurement specification when requested by Receiving Inspection QA.

NOTE: Sample size for “Control Test” shall be a function of the testing to be performed and shall be determined per Table 3.

9. PROCEDURES

Refer to Fig. 1 for a general outline of acceptance testing of incoming fastener procedure.

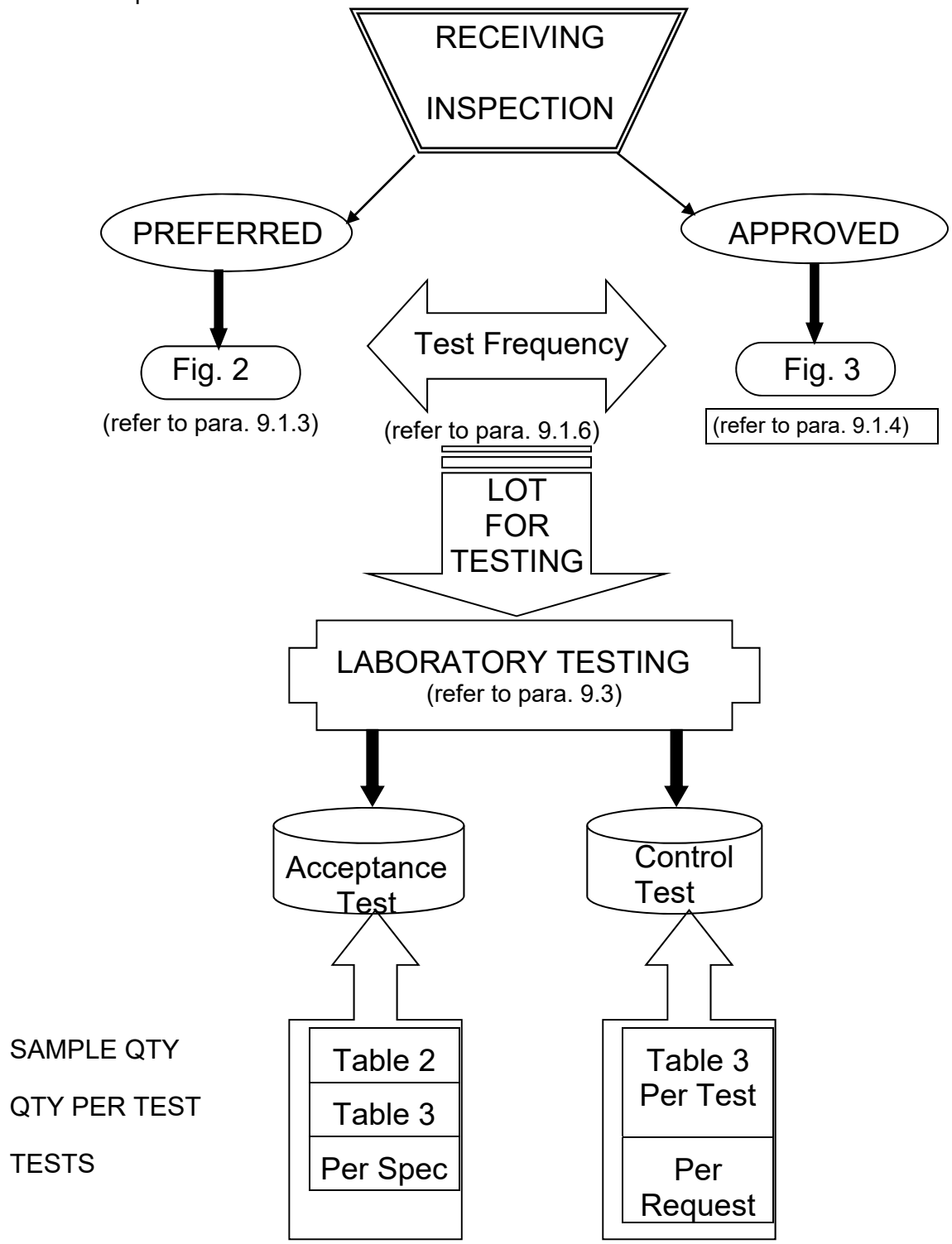


Figure 1 - General Flow Chart of Acceptance/Control Testing Procedures

9.1. Test Plan

9.1.1. Receiving Inspection per para. 8.5.4 shall be performed on a random sample(s) for in-coming lots of fasteners received in accordance with Group QA Procedures.

9.1.2. Receiving Inspection shall verify that the incoming fastener is being received from either a “preferred” manufacturer or an “approved” manufacturer and shall record the lot number and manufacturer’s code.

9.1.3. Laboratory testing frequency shall be in accordance with Fig. 2 for fasteners manufactured by a “preferred” manufacturer, where lots are grouped per Manufacturer.

9.1.4. Laboratory testing frequency shall be in accordance with Fig. 3 for fasteners manufactured by an “approved” manufacturer, where lots are grouped per Manufacturer and Procurement Specification.

9.1.5. For “non-approved” manufacturer each in-coming lot shall be sent for laboratory testing.

9.1.6. Receiving Inspection shall determine in accordance with Fig. 2 or Fig. 3, as applicable, whether the in-coming lot requires laboratory testing and shall send a sample for testing in accordance with requirements of para. 9.2.

9.2. Sampling

The number of specimens, as determined herein in accordance with ANSI/ASQC Z1.4 with zero defects acceptance criteria required for the lot (as defined in para. A1) of fasteners tested shall be as follows:

9.2.1. For Receiving Inspection

For in-coming lots of fasteners received, a random sample as per Sampling Plan I in Table 1 shall be inspected as per para. 8.5.4. For critical fasteners, sampling plans shall not be applicable and 100% of the parts shall be inspected at this stage.

9.2.2. For Laboratory Testing

9.2.3. When a lot is sent for laboratory testing, the number of fasteners required, as determined herein, depends on the type of testing to be performed.

9.2.4. Type of testing may be one of the following:

a. Acceptance Test

b. Control Test

9.2.5. Determine sample size for “Acceptance Test” from Sampling Plan II in Table 2.

9.2.6. Testing for “Control Test” shall be in accordance with para. 8.5.6.5 criteria and the number of samples tested for each laboratory destructive test shall be in accordance with Sampling Plan III in Table 3.

NOTE: Receiving inspection shall transfer, if required by the procurement specification, a random sample of installed fasteners to the laboratory.

9.2.7. Samples shall be accompanied by the C.O.T received with shipment.

TABLE 1 - SAMPLING PLAN I (VISUAL AND DIMENSIONAL INSPECTION) 1/
(Reference ARP 9013/1 Table A1, 3% Equal Risk Point [ERP])

LOT SIZE (Units)	**SAMPLE SIZE** (Units)	**ACCEPTANCE NUMBER 2/**
up to 17	All	0
18 - 37	17	0
38 - 44	18	0
45 - 68	19	0
69 - 101	20	0
102 - 183	21	0
184 - 949	22	0
950 and up	23	0

Notes:

1/ Requirements of Table are applicable to both minor and major characteristics.

2/ Acceptance number: is the maximum number of defective units that permits the acceptance of the lot.

TABLE 2 - SAMPLING PLAN II (ACCEPTANCE TEST)

LOT SIZE	**SAMPLE SIZE**	
	SELF-LOCKING NUTS AND BLIND RIVETS	ALL OTHER FASTENERS
2 - 25	In consultation with METD laboratory	
26 - 50	15	9
51 - 90	15	9
91 - 150	15	9
151 - 280	25	15
281 - 500	25	15
501 - 1200	25	15
1201 - 3200	40	24
3201 - 10000	40	24
10001 - 35000	40	24
35001 - 150000	65	39
150001 - 500000	65	39
≥ 500001	65	39

TABLE 3 - SAMPLING PLAN III (FOR EACH LABORATORY DESTRUCTIVE TEST) 1/

LOT SIZE (Units)	SAMPLE SIZE	ACCEPTANCE NUMBER 2/
2 - 25	2	0
26 - 50	3	0
51 -90	3	0
91 - 150	3	0
151 - 280	5	0
281 - 500	5	0
501 - 1200	5	0
1201 - 3200	8	0
3201 - 10000	8	0
10001 - 35000	8	0
35001 - 150000	13	0
150001 – 500000	13	0
≥ 500001	13	0

Notes:

1/ Reference ASQC Z1.4 Table 1, Level S-2 for Single Sampling.

2/ Acceptance number: is the maximum number of defective units that permits the acceptance of the lot.

9.3. Laboratory Testing

9.3.1. For "Acceptance Test", the fasteners shall be tested for all mechanical and metallurgical tests required for acceptance (quality conformance) testing by the respective fastener part number Engineering drawing and the procurement specification.

9.3.2. For "Control Test", only tests required by para. 8.5.6.5 criteria shall be performed.

9.3.3. The number of samples tested for each laboratory destructive test shall be in accordance with Sampling Plan III in Table 3.

9.3.4. All tests shall be performed in accordance with and shall conform to the requirements of the fastener part number drawing and the applicable procurement specification.

9.4. Conformance

9.4.1. The lot of fasteners, tested in accordance with the procedures of this PS, shall be considered acceptable for use when all test results were found conforming to the relevant procurement specification/part number drawing requirements.

9.4.2. Laboratory test report, issued by an IAI Ltd approved laboratory (refer to para. 8.5.5), stating that fastener conforms to requirements shall be sent to Receiving Inspection for reference.

9.5. Non Conformance

The following procedure shall be followed in the case of failure of any one of the tests:

9.5.1. A laboratory test report shall indicate in what tests the fasteners failed to meet the requirements of the procurement specification.

9.5.2. Receiving Inspection shall refer the non-conformance for evaluation to the material review board (MRB) or reject the lot (without MRB).

9.5.3. After rejection of a lot of fasteners, the next consecutive two lots from the same manufacturer shall be tested for acceptance tests (para. 8.5.6.4) and the next two lots from the same manufacturer representing the rejected basic part number shall be control tested to retest the property that failed to meet the requirements as indicated in the applicable test plan in Fig. 2 or Fig. 3.

10. QUALITY ASSURANCE

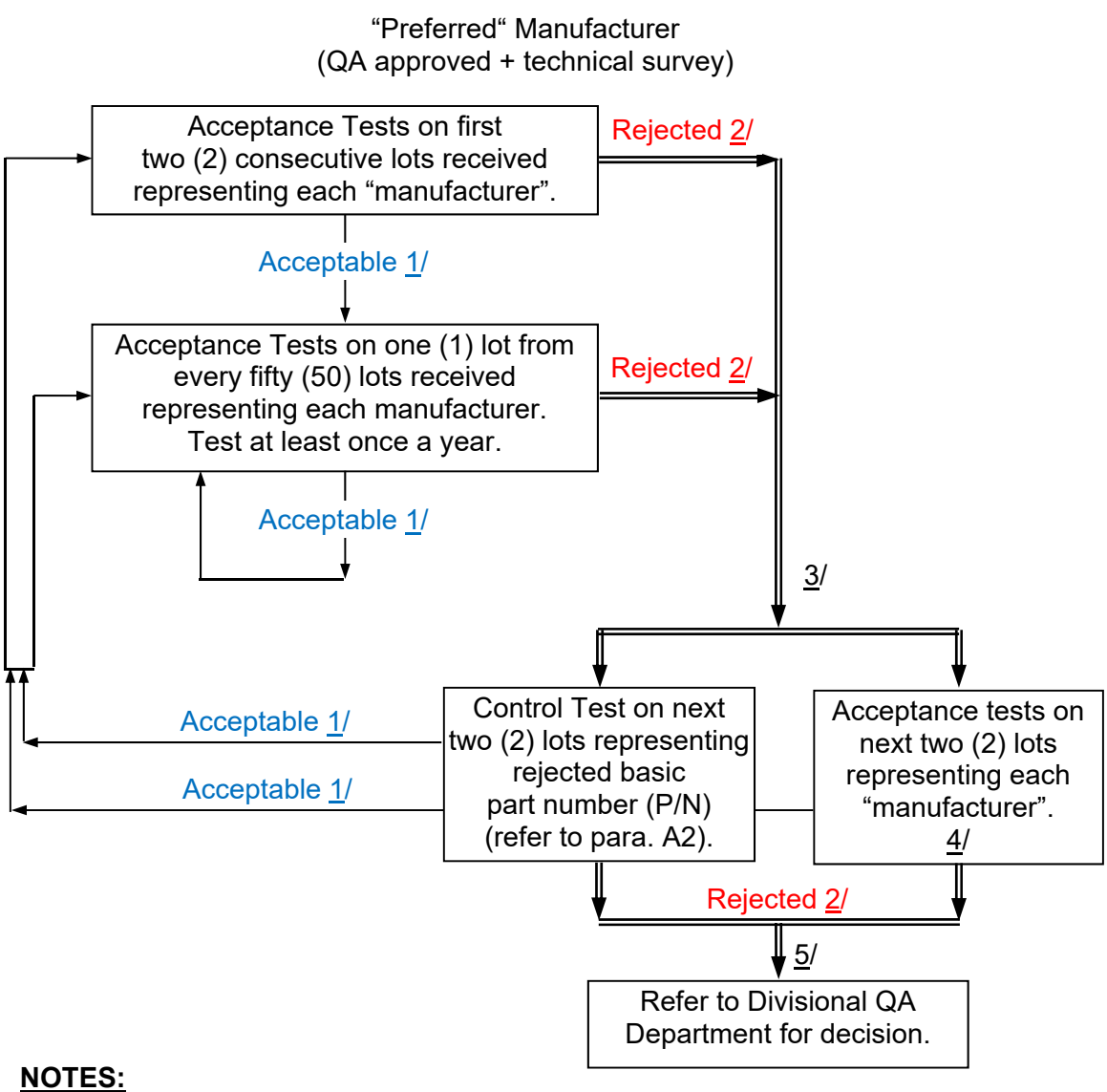
NOTE: When Quality Assurance is mentioned in this PS it shall refer to either an IAI Divisional Quality Assurance department or a Quality Assurance department at an IAI approved framework agreement supplier or subcontractor.

10.1. Quality Assurance shall be responsible for enforcing all the requirements of this PS.

10.2. Quality Assurance shall ensure that all the equipment that requires calibration are checked by an approved Standards Laboratory as per Quality Assurance requirements.

10.3. All records of inspection, calibration and product testing shall be maintained in accordance with and retained for a period specified in the relevant IAI Divisional Quality Management Procedures.

10.4. Training and refreshing of personnel involved in the implementation of this PS shall be in accordance with IAI Divisional Quality Management Procedures.



NOTES:

1/ The results of all tests meet the requirements.

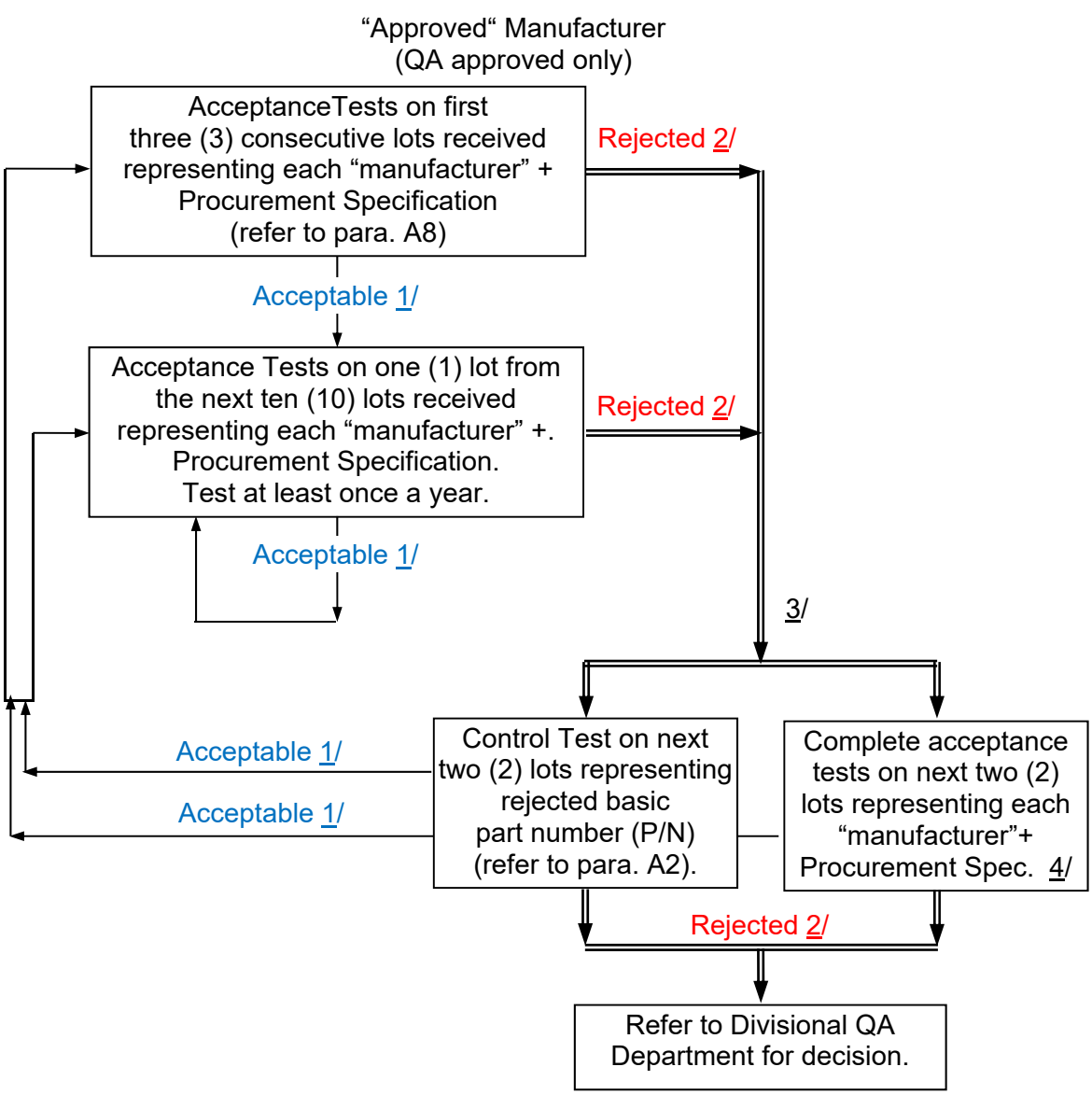
2/ The results of at least one test do not meet requirements.

3/ Next two lots from manufacturer shall be acceptance tested. In parallel the next two lots from the reject P/N shall be tested as well for the property that failed to meet requirements.

4/ If one of the lots for the Acceptance Tests performed after the rejection is the same as the rejected fastener basic part number only one more additional lot need be control tested.

5/ Divisional QA shall decide whether to down-grade status of "Preferred" Producer.

Figure 2 - Laboratory Testing Plan for "Preferred" Manufacturers



NOTES:

1/ The results of all tests meet the requirements.

2/ The results of at least one test do not meet requirements.

3/ Next two lots from manufacturer shall be acceptance tested. In parallel the next two lots from the reject P/N shall be tested as well for the property that failed to meet requirements.

4/ If one of the lots for the Acceptance Tests performed after the rejection is the same as the rejected fastener basic part number only one more additional lot need be control tested.

Figure 3 - Laboratory Testing Plan for "Approved" Manufacturers

APPENDIX A - DEFINITIONS OF TERMS

A1. Lot

A collection of fasteners ordered to the same drawing and of the same heat melt combination and chemical composition, the same type, form and diameter, the same coating and heat treatment batch. Manufactured by a single manufacturer on the same equipment at the same time.

A2. Basic Part Number (P/N)

A collection of fasteners manufactured to the same drawing part number regardless of diameter and grip length of fastener by a single manufacturer.

A3. Manufacturer

The entity that manufactures the fasteners to his own engineering design or by a recognized standard specification. The manufacturer may or may not be the "Vendor/Supplier".

A3.1 Preferred Manufacturer (1D): A manufacturer that has been approved in accordance with Divisional Quality Management Procedures and has successfully passed a technical survey (refer to para. A13).

A3.2 Approved Manufacturer (14) A manufacturer that has been approved only by Quality Assurance in accordance with Divisional Quality Management Procedures and has not, or as yet, successfully passed a technical survey.

A3.3 Non-Approved Manufacturer: A manufacturer that has not been approved by Quality Assurance in accordance with Divisional Quality Management Procedures.

A4. Vendor/Supplier

The entity supplying IAI Ltd with the fasteners specifically defined in a purchase order or contract. The vendor/supplier may be a manufacturer, sub-contractor, approved framework agreement supplier, or wholesaler.

A5. Sample

One or more units drawn from a lot. Unless otherwise specified a sample is randomly drawn from the corresponding lot.

A6. Specimen

A unit drawn from the sample to be tested.

A7. Sample Plan

A statement of the sample size to be used.

A8. Procurement Specification

An applicable standard, showing the technical and quality assurance requirements for a product to be met for conformance.

A9. Quality Assurance

A planned and systematic pattern of all the actions necessary to provide adequate confidence that the product conforms to the requirements.

A10. Acceptance (Quality Conformance) Test

A set of tests applicable to every lot and intended to prove the conformance of a lot of fasteners to the requirements of all acceptance (conformance) tests required in the applicable procurement specification. The acceptance (conformance) test shall be performed by the manufacturer on every lot before delivery.

A11. Control Test

Testing of one or more tests required by procurement specification (e.g. metallographic examination and/or tensile testing) to be performed by Metallurgical Laboratory as required by para. 8.5.6.5 criteria.

A12. Laboratory Destructive Test

All the mechanical and metallurgical performed by any approved metallurgical laboratory (refer to para. ~~8.5.5~~ 8.5.6).

A13. Technical Survey

A technical survey verifying the metallurgical, mechanical, and chemical testing capabilities of the manufacturer's laboratories to perform all qualification and acceptance tests required by procurement specification. This survey shall be performed by METD personnel or QA approved technical representative.

A14. Sub-Contractor

A supplier that designs and/or manufactures products and/or performs engineering processes by engineering design, and/or engineering specifications for IAI Ltd and/or its customers.

A15. Aerospace Fastener

For the purpose of this PS an aerospace fastener is one that has been used in a structural or semi-structural application.