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Technical Specification for RECORDsplice Cleave and Assembly Tool (RCAT).

This document describes Tyco's view of generic requirements and characteristics, required on the RECORDsplice cleave and assembly tool that should be met in order to provide for satisfactory operation in a typical Outside Plant Environment.
This document contains the information necessary to perform a product analysis on the RECORDsplice cleave and assembly tool, including requirements for features and characteristics of the tool itself and procedures for environmental testing to simulate field conditions and field wear.
The performance tests specified for analyzing the RECORDsplice cleave and assembly tool are intended to reflect a composite picture of various operating conditions to which these types of tools may be subjected. The tools to which the requirements apply are primarily intended for use in the Central Office and outside plant environments.
Quality assurance procedures and a list of references complete the document.
The document is intended for use:

- by Tyco Electronics for internal qualification and re-qualification purposes
- by other organisations to:
  - provide information on product performance
  - act as a guide for test programmes
  - analyse and compare product performance in, for example, tender situations
- by Tyco Electronics customers worldwide, except in countries where a customised document has been prepared.

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1 Product description

The RCAT **(RECORDsplice Cleaver and Assembly Tool)** provides the following functions:

- Makes a cleave of 8° to a fiber at a specified length from the coating
- Inserts the fiber with a specified force and cleave orientation in the splice
- Ejects and holds after cleaving the fiber left-over in a waste bin
- Provides, each cleave, automatic progression of the fiber scouring blade
- Indicates the number of cleaves the tool can still make
- Indicates a fiber break due to fiber damage during coating removal

2 Product requirements

2.1 General requirements

The tooling shall be capable of meeting the functional requirements as specified on the following pages when used in accordance with the applicable operation instructions and tested according to the methods of test described in this document.

A complete set of documentation shall be available upon request and shall provide all related information to describe use and application, operational instructions, testing operations, maintenance and cleaning procedures, adjustment and repair procedures, safety instructions, storage and transportation instructions and a packaging list of all items included in the shipping container

The tooling shall be capable of handling 250µm and 900µm fibers. The 900µm fibers shall be of the tight construction

All testing will be done with Non Dispersion Shifted Single Mode Fiber (ITU-T G.652 – Matched Cladding)

The tooling is intended for use in several outside plant applications in addition to a central office environment. These include aerial, underground or buried applications. It is expected that the tooling would be functional under the conditions of temperature, humidity, cleanliness and vibration that are found in these environments.

Operational temperature range: -5°C to +45°C
Operational humidity limits: 10%RH to 100%RH

Dimensions of the tool shall comply with the applicable specification control drawings as provided by the manufacturer.

All device materials, which are likely to come into contact with personnel, shall be non-toxic and shall not be a potential environmental hazard.

2.2 Selection of Optical Fiber

All splicing will be done with following fiber types:

Fiber type used for all test samples:

Fiber characteristics	
Fiber type:	Dispersion unshifted singlemode fiber – matched cladding, zero water peak (ITU-T G.652D or IEC 61793-2-50 B1.3)
Proof stress strain:	≥ 1%
Mode field diameter at 1310 nm:	9.2 µm ± 0.4 µm
Mode field diameter at 1550 nm:	10.4 µm ± 0.8 µm
Mode field eccentricity error:	≤ 0.6 µm at 1310 nm
Cable cut-off wavelength:	≤ 1250 nm
1625 nm loss performance:	< 0.5 dB for 100 turns on 60 mm mandrel diameter
Cladding diameter:	125 µm ± 1 µm
Non coloured coating diameter:	245 µm ± 10 µm
Coloured coating diameter:	250 µm ± 15 µm

2.3 Surface Finish, Marking, Packaging and Shipping

The carrying case shall be marked with:
- Supplier's name
- Product name

The tooling shall be marked with:
- Supplier's name
- Product name
- The model
- Date of manufacture and/or serial number

The surface finish and markings shall be resistant to chemicals that are normally found in the telephone plant and shall not exhibit any perceivable changes when exposed to ultraviolet light. In particular, the surfaces shall not be affected by the following:
- Lubricants
- Cable Filling Compound
- Splicing Encapsulating Compound
- Isopropyl Alcohol
- Insecticide as used in the field
- Cable Cleaning Solution

Packaging of the products shall be adequate to ensure that no damage will occur to the tooling under normal shipping, handling and storage.

The carrying case shall protect the product against shock and vibration that may be experienced in transportation.

2.4 Portability

The carrying case shall be equipped with a carrying handle so that it may be carried with one hand.
The complete tool, including case, shall not exceed 16kg in weight.
The tool itself should be equipped with a handle.

2.5 Product Information

The operating instructions and handling procedures shall be packaged with the equipment
A list of all the tools, materials and supplies used with the product and ordering information for their replacement shall be provided with the system

2.6 Selecting the RCAT for testing

The RCAT for the testing is to be selected at random from an inventory that is ready for shipment.

2.7 Instructions and Training

All RCAT installations shall be performed according to Tyco Electronics' standard installation instructions and at room temperature, unless otherwise stated. The instructions received with the RCAT shall constitute the training to be given to the operators who are fabricating splices for the testing.

2.8 Test Program & Test Sample Description

The reference specification for the test program "Storage and Transportation functional requirement" was ETSI EN 300 019-2-2 v2.1.2. - 1999: Equipment Engineering; Environmental conditions and environmental tests for telecommunications equipment; Part 2-2: Specification of environmental tests; Transportation – Specification T2.3. Public transportation.

All testing in this program to be done on the RCAT in the carrying case + empty carton box.

The reference specification for the test program "RCAT functional requirement" was ETSI EN 300 019-2-7 – May 1997: Equipment Engineering; Environmental conditions and environmental tests for telecommunications equipment; Part 2-7: Specification of environmental tests; Portable and non-stationary use – Specification T7.2. Partly temperature-controlled locations

All testing in this program to be done on the unpacked RCAT in the ready to use configuration.

Testing is at room temperature[1] unless otherwise specified. When tests are specified at temperatures other than ambient, the samples shall be preconditioned for a period of 2 hours at those temperatures.

All samples shall be made with dispersion unshifted single mode fiber. Other fiber types shall be qualified by similarity.

After each test on the RCAT minimum 3 test samples for each fiber type will be prepared, unless otherwise specified.

[1] Room temperature : (23 ± 3)ºC

2.9 Functional requirements-Performance criteria

Test	Method and conditions		International norm / reference	Requirements
Performance criteria references				
Insertion loss	Source wavelength:	1310 nm, 1550 nm and 1625 nm	IEC 61300-3-4	IL maximum ≤ 0.5 dB
Return loss	Source wavelength:	1310 nm, 1550 nm and 1625 nm	IEC 61300-3-6	RL > 60 dB
Visual appearance	Examination of RCAT with the unaided naked eye.		IEC 61300-3-1	No defects which would adversely affect RCAT performance.

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2.10 Storage and Transportation functional requirements

Test	Method and conditions		International norm / reference	Requirements
Environmental tests				
Cold	Temperature: Duration:	(-40±2)°C 72 hours	IEC 60068-2-1	Visual appearance Insertion loss Return loss
Dry Heat	Temperature: Duration:	(+70±2)°C 72 hours	IEC 60068-2-2	Visual appearance Insertion loss Return loss
Temperature Cycling	Lowest Temperature: Highest Temperature: Humidity: Dwell Time: Transition Rate: Number of Cycles:	(-40±2)°C (+30±2)°C Uncontrolled 3 hours 1°C/min. 5	IEC 60068-2-14	Visual appearance Insertion loss Return loss
Damp Heat, Cyclic	Temperature: Relative Humidity: Number of Cycles:	(40±2)°C 90-100% 2	IEC 60068-2-30 Variant 1	Visual appearance Insertion loss Return loss
Shower Test	Spray medium: Flow rate: Head to sample: Sample position: Duration:	Tap water 40 l/min. (400 ± 100) mm Handle Up 15 minutes	IEC 60068-2-18	No water ingress which would adversely affect RCAT performance.
Mechanical tests				
Vibration	Frequency Range: ASD (5-20Hz): Slope (20-200Hz): Duration: Axes of Vibration:	5-200Hz $1m^2/s^3$ -3dB/oct. 30 minutes 3	IEC 60068-2-64	Visual appearance Insertion loss Return loss
Bump	Shock Spectrum: Duration: Acceleration: Number of Bumps: Direction of Bumps:	Half Sine 6ms $180m/s^2$ 100 6	IEC 60068-2-29	Visual appearance Insertion loss Return loss
Free Fall	Test Height: Duration:	0.75m 1 fall/surface	ISO4180-2	Visual appearance Insertion loss Return loss

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2.11 Functional RCAT requirements

Test	Method and conditions		International norm/ reference	Requirements
Installation Test	Installation Temperature:	(-5±2)°C (23±3)°C (+45±2)°C		Visual appearance Insertion loss Return loss
Environmental tests				
Dust Test	Temperature: Dust Air Velocity: Dust Concentration: Test Duration	+23 ± 2°C Arizona Road Dust 750 ft/min 8.5 ± 0.9g/min 4 x 2 minutes	Telcordia GR-326	Visual appearance Insertion loss Return loss
Mixed Flowing Gas Test	H_2S: NO_2: CL_2: SO_2: Temperature: Relative Humidity: Test Duration:	10 ± 5 ppb 200 ± 5 ppb 10 ± 5 ppb 200 ± 5 ppb 25 ± 1 °C 75 ± 3 % 10 days	IEC 60068-2-60 Method 4	Visual appearance Insertion loss Return loss
Cold	Temperature: Duration:	(-5±2)°C 16 hours	IEC 60068-2-1	Visual appearance Insertion loss Return loss
Dry Heat	Temperature: Duration:	(+45±2)°C 16 hours	IEC 60068-2-2	Visual appearance Insertion loss Return loss
Temperature Cycling	Lowest Temperature: Highest Temperature: Humidity: Dwell Time: Transition Rate: Number of Cycles:	(-5±2)°C (+25±2)°C Uncontrolled 3 hours 1°C/min. 3	IEC 60068-2-14	Visual appearance Insertion loss Return loss
Damp Heat Steady State	Temperature: Relative Humidity: Duration:	(40±2)°C (93±3)% 4 days	IEC 60068-2-66	Visual appearance Insertion loss Return loss
Damp Heat, Cyclic	Temperature: Relative Humidity: Number of Cycles:	(30±2)°C 90-100% 2	IEC 60068-2-30 Variant 1	Visual appearance Insertion loss Return loss

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2.3 Functional RCAT requirements

Mechanical tests				
Endurance	Number of installations:	10000 (= 20000 Cleaves)		Visual appearance Insertion loss Return loss
Vibration	Frequency Range: ASD (10-12Hz): Slope (12-150Hz): Duration: Axes of Vibration:	10-150Hz $0.96m^2/s^3$ -3dB/oct. 30 minutes 3	IEC 60068-2-64	Visual appearance Insertion loss Return loss
Shock	Shock Spectrum: Duration: Acceleration: Number of shocks: Direction of shocks:	Half Sine 6ms $300m/s^2$ 3 6	IEC 60068-2-27	Visual appearance Insertion loss Return loss
Drop and Topple	Test Height: Angle: Edges: Duration:	0.1m 30°C Bottom edges and corners 4 + 4	IEC 60068-2-31	Visual appearance Insertion loss Return loss

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3 Quality assurance provisions

Quality provisions are based upon the philosophy of TQM (Total Quality Management) with a system approved to EN ISO 9001 by Lloyds Register Quality Assurance.

3.1 Responsibility for quality

Unless otherwise stated in the customer order, it shall be Tyco Electronics' responsibility to assure qualification and lot conformance to this specification. Tyco Electronics may utilize its own or other testing and inspection facilities acceptable to the customer.

3.2 Qualification conformance

For the purposes of internal qualification, the program shall consist of examinations and tests to determine conformance with the requirements of this specification.
It shall be performed once, on introduction of the product.
Subsequent design changes shall be partially or fully re-qualified depending upon their area of impact in the context of product functionality.
Regular requalification testing shall be performed as defined by the Quality Department.

3.3 Manufacturing follow-up

Tyco Electronics products target Six Sigma levels of performance by the integration of capable processes from the development throughout the entire supply chain. The goal is to reduce variability to achieve zero defects for products and services. Systems used are based on preventive and statistical techniques during development and manufacturing.

This also includes suppliers of materials, components or systems. Dedicated procedures for supplier selection, development and follow-up are implemented to ensure conformance to TQM and specification requirements.

Best demonstrated practices are identified and implemented throughout the company, with a continuing challenge to identify opportunities for innovation and improvement.

4 References

Reference *	Title
ISO 9001	Quality Management Systems - requirements
IEC 60068-2-x	Environmental Testing:
2-1	Cold
2-2	Dry Heat
2-14	Change of Temperature
2-18	Water
2-27	Shock
2-29	Bump
2-30	Damp heat, cyclic
2-31	Drop and topple
2-60	Flowing mixed gas corrosion test
2-64	Vibration, broad-band random (digital control) and guidance
2-66	Damp heat, steady state
ISO 4180-2	Complete, filled transport packages -- General rules for the compilation of performance test schedules -- Part 2: Quantitative data
Telcordia GR-326	Generic Requirements for Singlemode Optical Connectors and Jumper Assemblies
IEC 61300-3-x	Examination and measurements:
3-1	Visual examination.
3-4	Attenuation.
3-6	Return Loss.
ITU-T G.652	Characteristics of single-mode fibre:Dispersion Unshifted Fiber

The documents listed here shall form a part of this specification.
The versions in effect at the date of issue of this specification shall apply, unless otherwise indicated.
Other equivalent national standards may be used as substitutes for international ones.

* Copies of the documents referred to may be obtained from:

ASTM	www.astm.org
ETSI	www.etsi.org
European Committee for Standardisation	www.cenorm.be
International Standards Organisation	www.iso.ch
International Telecommunications Union	www.itu.int
TELXXXX and K XXXX	tcomosp@tycoelectronics.com

TEL XXXX and TEL K3XXX are Quality Assurance Procedures obtainable from the address on the bottom of this page.

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