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TECHNICAL REPORT

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Fibre optic active components and devices – Reliability standards – Part 4: Guidelines for optical connector end-face cleaning methods for receptacle style optical transceivers

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FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES – RELIABILITY STANDARDS –

Part 4: Guidelines for optical connector end-face cleaning methods for receptacle style optical transceivers

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IEC/TR 62572-4, which is a technical report, has been prepared by subcommittee 86C: Fibre optic active components and devices, of IEC technical committee 86: Fibre optics.

The text of this technical report is based on the following documents:

Enquiry draft	Report on voting
86C/1147/DTR	86C/1182/RVC

Full information on the voting for the approval of this technical report can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in IEC 62752 series, under the general title *Fibre optic active components and devices – Reliability standards*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

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INTRODUCTION

High speed internet communication systems and subscriber systems have spread rapidly owing to the increased capacity of data communication. In these systems, receptacle style optical transceivers such as SFP (small form factor pluggable), XFP (10-Gbps small form factor pluggable), which can be mounted and removed during transmission systems operation, are widely used. Optical receptacles of optical transceivers are connected to optical connector plugs of optical patch cords and optical signals are transmitted and received through these optical receptacles. Pluggable type optical transceivers are required to be low cost and of small size, and the designs are often simplified. Therefore, the internal structure, especially the receptacle structure, tends to vary between optical transceiver manufacturers.

Generally, to maintain high reliability, optical connections require cleaning of the optical connector end-face. The technical report on cleaning of optical connector plugs and optical adaptors, IEC/TR 62627-01, which was proposed by Japan, was published in August, 2010.

There are, however, no standard cleaning methods for the optical receptacles of optical transceivers. It is a concern that the failure of optical transceivers due to damage and contamination of the optical receptacle end-face may lead to failure in optical network systems.

This technical report is based on OITDA TP12/TP-2012.[1][1]

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1 References in square brackets refer to the Bibliography.

FIBRE OPTIC ACTIVE COMPONENTS AND DEVICES – RELIABILITY STANDARDS –

Part 4: Guidelines for optical connector end-face cleaning methods for receptacle style optical transceivers

1 Scope

IEC/TR 62572-4, which is a technical report, provides guidelines for optical connector end-face cleaning methods for receptacle style optical transceivers. It includes details about handling receptacle style optical transceivers, internal structures of optical transceivers, information on cleaning tools and machines, applicable cleaning methods and cleaning procedures.

Receptacle style optical transceivers as well as optical fibre patch cords are handled by operators and maintenance staff of optical network systems. This technical report may be used as a guideline to prepare instruction manuals for the operators and maintenance staff of optical network systems.

2 Normative references

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

IEC/TR 62627-01, *Fibre optic interconnecting devices and passive components – Part 01: Fibre optic connector cleaning methods*

IEC/TR 62627-05, *Fibre optic interconnecting devices and passive components – Part 05: Investigation on impact of contamination and scratches on optical performance of single mode (SM) and multimode (MM) connectors*[2]

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
stub
polished short ferrule, including optical fibre inside, mounted in a receptacle style optical transceiver

Note 1 to entry: The stub is connected to an optical connector plug of an optical patch cord.

3.2
stub type optical transceiver
receptacle style optical transceiver with a stub

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2 To be published.

3.3
lens type optical transceiver
receptacle style optical transceiver without a stub, optically connecting an optical semiconductor device to an optical connector plug of an optical patch cord with converging optical beam by a lens (lenses)

3.4
plate contact type optical transceiver
receptacle style optical transceiver without a stub connected by contacting a flat or convex plate (material of glass or plastic) to an end-face of an optical connector plug of an optical patch cord

3.5
optical transceiver
optical module having both the functions of an optical transmitter and an optical receiver

3.6
reel type cleaner
optical connector plug end-face cleaning tool, in which a cleaning cloth is rolled and is packed in a cassette box, and with a small window for cleaning

3.7
stick type cleaner
optical connector receptacle and optical connector adaptor end-face cleaning tool in which a cleaning cloth is attached on top of a stick

Note 1 to entry: It is sometimes called a swab type cleaner.

3.8
pen type cleaner
optical connector receptacle and optical connector adaptor end-face cleaning tool in which a tape-shaped cleaning cloth on the top of the tool moves and cleans

3.9
gas and vacuum type cleaning machine
optical connector end-face cleaning machine in which volatile liquid solvent (gas) is injected and extracted from a nozzle

3.10
air duster
cleaning tool in which compressed air is blown from a nozzle of a can

Note 1 to entry: It is sometimes called canned air.

3.11
dust cap
cover or cap which is attached to an optical connector plug, an optical connector adaptor or an optical receptacle when the optical connector is not connected to protect it from contamination

4 Application of receptacle style optical transceivers and influence of contamination on optical connector end-face

4.1 Application of receptacle style optical transceivers

Almost all optical receptacle style transceivers are of a pluggable type. Pluggable optical transceivers are often attached to the front panels of optical network equipment, for installation and maintenance the pluggable optical transceivers (as well as patch cords) are

mounted and removed from optical network equipment by operators and maintenance staff of optical network systems.

When optical components and modules with connector plugs are mounted in optical network equipment by equipment manufacturers, the environment (temperature, humidity and dust) in the optical network equipment factories is generally well controlled and precautions are taken to assure that components are kept clean. However, the environments in which optical network systems operate, such as the central office, data centres and computer rooms are not generally as clean as those in the equipment factories. In these environments, there is the possibility that dust or condensation may be introduced onto the optical connector end-faces of optical transceivers.

4.2 Influence of contamination on optical connector plugs

Optical signals propagate within or slightly outside of the core of optical fibres, the diameter of which is very small, typically from about 10μm to around 50μm. If a very small particle of dust of a few micrometres (μm) in size is deposited on an optical fibre core of an optical connector plug, the optical connector may not achieve its designed optical performance (loss and return loss), and may adversely impact the performance of the optical network system in which it is used. Cleaning of optical connector plugs is important and is described in IEC/TR 62627-01. IEC/TR 62627-05 summarizes the relationship observed between contamination on optical connector end-faces and optical performance (loss and return loss).

4.3 Transferring of contamination

Optical connector plugs and optical connector receptacles may be mated many times, and they may also be mated to different connectors. Once contamination is attached to the end-face of an optical connector plug, the contamination may be transferred to the optical receptacle to which the optical connector plug is mated. Moreover, contamination may be transferred from the receptacle to another optical connector plug to which it is mated. Contamination may be spread from one component to another like an infection. Therefore, it is most important to prevent contamination on the optical connector end-face, and to clean the end-face when contaminated.

4.4 Influence of contamination on optical connector for optical transceivers

Contamination of optical connector end-face of receptacle style optical transceivers may impact optical performance, in the same way that contamination of optical connector plugs impacts optical performance. The International Electronics Manufacturing Initiative (iNEMI) presented a paper at the Warsaw meeting of IEC/SC86B, in April 2012, that illustrates the impact of contamination on transmitter/receiver optical subassemblies (TOSA/ROSA) [2] .

5 Care in handling of receptacle style optical transceivers

5.1 General

This clause describes general care in handling of receptacle style optical transceivers. It is advisable to follow the manufacturer’s operating manuals or instructions, where provided.

5.2 Storage of receptacle style optical transceivers

Receptacle style optical transceivers should be stored so as to protect the device from static electric discharge, dust, mechanical shock and vibration, and should also be kept within a specified temperature and humidity range. During storage, dust caps should be placed on optical receptacles to prevent contamination.

5.3 Installation of receptacle style optical transceivers

Pluggable type receptacle style optical transceivers are used on the front panels of optical network equipment. When a pluggable type optical transceiver is mounted while network equipment is operating, the optical transceiver is driven by the electrical power provided through the electrical pins of the transceiver. Dust caps should be put on optical receptacles when mounting on operating equipment to prevent eye damage to maintenance staff as well as preventing contamination to the transceiver.

5.4 Connection of optical connector plugs to receptacle style optical transceivers

Optical connector plugs are connected to the optical receptacles of an optical transceiver after mounting on equipment. Dust caps should be removed just before the optical connector plugs are connected. Care should also be taken to prevent dust from entering the optical receptacle. Optical connector plug end-faces should be inspected and cleaned if contamination is observed. After optical connector plug end-faces are inspected and found to be in compliance with the specified visual inspection requirements, the optical connector plugs are connected to the optical receptacles of the transceivers. Optical receptacle end-faces are more difficult to clean than optical connector plug end-faces. Moreover, there are several different internal structures of optical receptacles of optical transceivers, and applicable cleaning methods will differ depending on these internal structures. To prevent transferring of contamination, as described previously, optical connector plugs should be inspected and cleaned as needed.

5.5 Removing of receptacle style optical transceivers

When optical transceivers are removed from equipment, optical connector plugs should be disconnected first, dust caps should then be placed on both the optical receptacles and the optical connector plugs, and only then should the optical transceivers be removed from the equipment.

5.6 Action in case of abnormality

When the performance of network equipment is degraded to the point at which it fails to function properly, and it is determined that failure has been caused by an optical transceiver, the optical transceiver should be removed and analysed. After removing the failed transceiver, the optical receptacle end-faces should be inspected. There is a danger of eye damage if the end-faces are directly observed while still mounted to operating equipment and the transmitter is emitting optical radiation. Annex D shows examples of optical connector receptacle end-face visual inspection equipment. When contamination is observed on the end-faces of optical receptacles, it should be cleaned by appropriate cleaning methods depending on the internal structure of the receptacles. If the internal structure is not distinguished, it should not be cleaned, or cleaned only by an air duster.

6 Cleaning tools and machines

6.1 General

It is well known that reel type cleaners work well for cleaning optical connector plug end-faces. However, it is more difficult to clean optical receptacle end-faces because the end-faces are located in the bottom of small diameter holes.

IEC/TR 62627-01 gives general information on optical cleaning methods and cleaning tools and machines for optical connector plug end-faces. The typical cleaning method for connector plug end-faces is by rubbing the end-face with a cloth. As rubbing may produce a static electric charge, which may hold contamination, it is recommended to use an optical connector cleaner with cloth that has been processed so that it will not create a static electric charge on the end-face. Lint-free cloths are also recommended to prevent contamination from the cleaning cloths themselves.

Sometimes a solvent, such as isopropyl alcohol, is used with cleaning papers (normally used for cleaning optical elements), to clean end-faces. Care should be taken, as residue from the solvent may remain on the end-face after cleaning.

6.2 Cleaning tools and machines for optical receptacles

Table 1 shows typical optical connector receptacle end-face cleaning tools and machines. Annex A also provides detailed information on optical connector end-face cleaning tools and machines.

Table 1 – Typical optical connector receptacle cleaning tools and machines

Cleaning tools and machines	Features
Stick type	Cleaning cloth is attached to the top of a stick. It is called a swab type cleaner. The stick-type cleaners for optical connector receptacle end-faces are sold in the market and almost all cleaning cloth material is processed to prevent electro-static charge build-up
Pen type	Cleaning cloth attached to the top of this type of pen type cleaner moves and cleans the end-face of optical connector receptacles. Pressing the top onto end-faces causes the cleaning cloth to rotate. They are used for optical connector receptacle end-face cleaning. As the width of cleaning cloth limits the area of cleaning, only the centre of end-faces is cleaned
Gas and vacuum type cleaning machine	Volatile liquid solvent (gas) is injected and extracted by a nozzle to clean optical connector end-faces. This cleaning machine is available on the market
Air duster	A propellant and compressed air are packed into a dispensing can; the compressed air is blown from a nozzle. It is widely used for removing dust from electronic and electrical equipment. The jet of compressed air from the air duster removes the dust from the end-face
Wet cleaning	A solvent such as isopropyl alcohol and cleaning papers are used to clean the end-face. Using a solvent prevents the creation of a static electric charge on the end-face

7 Internal structure of receptacle style optical transceivers and their applicable cleaning tools and machines

Optical emitting units and receiving units of receptacle style optical transceivers are composed of optical units, called transmitter optical sub-assembly (TOSA) and receiver optical sub-assembly (ROSA). TOSA and ROSA are components that are connected to optical connector plugs of optical patch cords. Typical internal structures of TOSA and ROSA are of three types; stub type, lens type and plate contacting type.

Table 2 shows the internal structures of receptacle style optical transceivers and their applicable cleaning tools and machines. When the internal structure is not distinguished, only an air duster should be used for cleaning. The detail information of the internal structures of receptacle style optical transceivers and their applicable cleaning tools and machines, and the cleaning procedures are described in Annex B and Annex C, respectively.

Table 2 – Applicable cleaning tools and machines depending on the internal structure of optical transceivers

Cleaning tools and machines	Stub type optical transceivers	Lens type optical transceivers	Plate contacting type optical transceivers
Stick type	Applicable	Not applicable	Check individual transceiver type for compatibility
Pen type	Applicable	Not applicable	Check individual transceiver type for compatibility
Gas and vacuum cleaning machine	Check individual transceiver type for compatibility	Check individual transceiver type for compatibility	Check individual transceiver type for compatibility
Air duster	Applicable, check for effectiveness	Applicable; check for effectiveness	Applicable; check for effectiveness

Annex A
(informative)

Detail information of optical connector end-face cleaning tools and machines

A.1 Reel type cleaner

A reel type cleaner is used for cleaning optical connector plug end-faces, but is not suited for cleaning optical receptacles. The cleaning cloth is rolled and packed in a cassette. The cassette has a small window into which the plug end-face is inserted for cleaning. The optical connector plug end-face is pressed and rubbed on cleaning cloth to clean it. Figure 1 shows an example of a reel type cleaner. It is recommended that the cleaning cloth is processed to prevent the creation of a static electric charge. The area of the cleaning cloth should be advanced before every cleaning to prevent contamination.

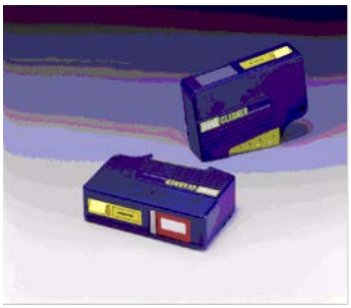

Figure A.1 – Example of a reel type cleaner

A.2 Stick type cleaner

A stick type cleaner has a cleaning cloth at the end of a stick. This cleaner is suitable for optical receptacles and optical adaptors. Figure A.2 shows examples of stick type cleaners.

The cleaning cloth material should be processed to prevent the creation of a static electric charge on the end-face. This cleaner is used only once.

Figure A.2 – Examples of stick type cleaners

A.3 Pen type cleaner

Pen type cleaners have a cleaning cloth at the end of the cleaner. The cleaning cloth moves when the top of the cleaner is pressed on the end-face of an optical receptacle, and cleans the end-face. Figure A.3 shows examples of pen type cleaners.

Figure A.3a – Example 1

Figure A.3b – Example 2

Figure A.3 – Examples of pen type cleaners

A.4 Gas and vacuum cleaning machine

A volatile liquid solvent is injected and extracted from a nozzle. This cleaning machine is available on the market. Figure A.4 shows the picture of this cleaning machine. Contamination is removed by the solvent.

Figure A.4 – Example of pen type cleaner

A.5 Air duster

An air duster is widely used for cleaning electronic and electric equipment. Compressed air is blown from the nozzle of a can. It is sometimes called canned air. Examples of materials include ifluoroethane (HFC-152a), trifluoroethane (HFC-143a) or tetrafluoroethane (HFC-134a). HFC-152a has a lower global warming potentials (GWP) index than HFC-143a, which is better for the environment. Figure A.5 gives examples of air dusters.

Figure A.5a – Example 1

Figure A.5b – Example 2

Figure A.5 – Examples of air dusters

A.6 Wet clean

The wet cleaning method uses a solvent such as isopropyl alcohol with cleaning papers for optical elements to clean the optical connector end-face. Care should be taken to ensure that no residue from the solvent remains after cleaning. Using a solvent prevents the creation of a static electric charge on the end-face and is sometimes effective for reducing stick contamination. Solvent cleaning should not be used with pen type cleaners. After wet cleaning, dry cleaning is recommended for removing residue from the solvent.

Annex B
(informative)

Detailed information on the internal structure of receptacle style optical transceivers and their applicable cleaning tools and machines

B.1 Internal structure of receptacle style optical transceivers

Receptacle style optical transceivers, especially pluggable optical transceivers are uniquely designed by manufacturers with their own ideas of how to realize low cost and small size. Consequently, there are many different internal structures. One such typical receptacle style transceiver, SFP (small form factor pluggable), generally includes optical units of transmitter optical subassembly (TOSA) and receiver optical subassembly (ROSA) for optical transmitter and optical receiver components. TOSA and ROSA optically connect to optical connector plugs of optical patch cords. Figure B.1 shows typical internal structures of TOSA and ROSA.

In Figure B.1a, stub type, shows a stub contacting on optical connector plug. In Figure B.1b, lens type, this optically connects an optical semiconductor device to an optical connector plug with converging optical beam by a lens(es). An optical connector plug stops at the small ring inside. In Figure B.1c, plate-contacting type, a plate contacts an optical connector plug. The optically connecting mechanism is the same as the lens type.

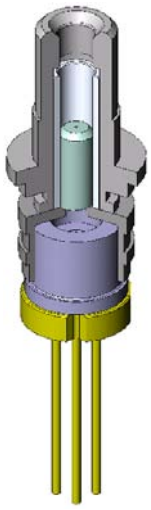

Figure B.1a – Stub type

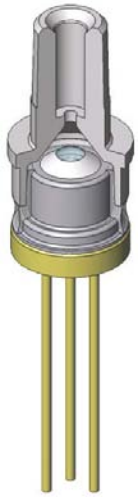

Figure B.1a – Lens type

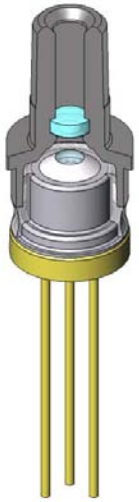

Figure B.1a – Plate contacting type

Figure B.1 – Internal structures for connecting to optical connector plugs

B.2 Example of the method to distinguish internal structure of receptacle style optical transceivers

It is well known that there are three types of internal structures for receptacle style optical transceivers as shown in Clause B.1. As mentioned, applicable cleaning tools and machines may vary for different internal structures. The internal structure cannot generally be distinguished by appearance. This clause provides an example of a method to distinguish the internal structure of receptacle style optical transceivers.

SFPs, one of the typical pluggable optical transceivers, generally mates to LC connector plugs (standardized by IEC 61754-20) [5] and have the structure of an LC connector receptacle for the connector mating part. Standards of optical connectors define “mechanical reference plane” and “optical reference plane” for mating. For example, an optical connector plug of the type LC connector has a latching part in a lever and the optical receptacle has a corresponding latching part inside a connector housing. As the distance between the latching part and the optical reference plane is defined, the stub surface for a stub type receptacle (the stopper for lens type, or the surface of the plate for plate contacting type) can be observed by a microscope when adjusting the focus length to the optical reference plane. The stub surface (ferrule and optical fibre cladding and core) for the stub type can be observed, a dimly illuminated lens for lens type can be observed and the surface of plane can also be observed. This is an example on how to distinguish the internal structures of receptacle style optical transceivers.

B.3 Applicable cleaning tools and machines according to internal structure of receptacle style optical transceivers

B.3.1 General

As explained in Clause B.1, there are typically three types of internal structures; stub type, lens type and plate contacting type for receptacle style optical transceivers. Clause B.3 explains how the characteristics of these different types of transceivers influence the choice of optical connector end-face cleaning methods.

B.3.2 Characteristics of stub type optical transceivers

For stub type optical transceivers, the stub surface contacts an optical connector plug end-face for connecting. This mechanism and the structure are the same as the combination of a first optical connector plug, optical adaptor and a second optical connector plug combination. Contamination is generally attached on the stub surface and the inner surface of the split sleeve. Stick type cleaners and pen type cleaners are available to remove contamination. For a gas and vacuum cleaning machine, it should be verified that solvent is not trapped inside the optical transceivers prior to adoption. Generally, air dusters are not effective in cleaning receptacles. It is difficult to remove contamination with a compressed air blast because the structure of the optical receptacle has a small diameter bore of 1,25 mm (or 2,5 mm) which may be 10 mm deep. Larger contamination particles may effectively be removed by air injection.

B.3.3 Characteristics of lens type optical transceivers

Almost all lens type optical transceivers have a stopper inside, stopping the optical connector plug as shown in Figure B.1. Typically, an optical semiconductor device is contained in a lensed can behind the stopper. Contamination is sometimes attached on the surface of the lens or inner surface of the split sleeve. Generally, stick type cleaners and pen type cleaners should not be used for lens type optical transceivers. The size of the cleaning cloth on the top of stick type cleaners is slightly less than the diameter of the 1,25 mm (or 2,5 mm) of the inner diameter of the split sleeve of the optical adaptors. The small hole of the stopper of lens type optical transceivers is typically 0,5 mm to 1 mm in diameter, which is smaller than the size of the cleaning cloth of the stick type cleaners. When the stick type cleaner is inserted into the receptacle, a part of the cleaning cloth may be caught by the hole of the stopper and remain after the stick cleaner is removed. The pen type cleaner is not effective for cleaning, as the cleaning cloth moves around the hole of the stopper. Moreover, the stick type cleaner and the pen type cleaner cannot reach as far as the lens surface, so neither can clean the lens surface. The lens type optical transceivers are designed with a converging optical beam focused at the stopper. If a small amount contamination is on the surface on the lens, the effect on optical performance (optical output power and return loss) is considered to be small, because the beam diameter is relatively large at the lens’ surface. For lens type optical transceivers, the gas and vacuum cleaning machine may be effective. However, depending on the internal structure of optical transceivers, the solvent may not be fully extracted and may remain inside the receptacle. Although, the solvent used in the gas and vacuum cleaning

machine is considered to be highly volatile, it should be determined that solvent not trapped in the receptacle and that there is no impact on optical performance and reliability. It is difficult to remove contamination with a blast of compressed air because of the structure of the optical receptacle having a small diameter bore (of 1,25 mm or 2,5 mm) that is relatively deep. Larger sized contamination particles may effectively be removed by compressed air injection.

B.3.4 Characteristics of plate contact type optical transceivers

For plate contacting type optical transceivers, the optical connector plug contacts the surface of the plate when connected. For some optical transceivers, the optical connector plug may rest slightly above the surface of the plate when connected. For this type of plate contacting optical transceiver, contamination is generally attached on the surface of the plate or inner surface of the split sleeve. For some optical transceivers, stick type cleaners and pen type cleaners can be used, depending on the internal structure of the optical transceiver. However, caution is advised when cleaning plate contact type transceivers. For the stub type optical transceiver, the stub (ferrule) is made of a relatively hard zirconia ceramic. In the plate type transceiver, the plate is not as hard because it is typically made from glass or plastic depending on the optical transceiver design. Where the plate is made of a plastic material, scratches may be created by cleaning if excess pressure is used. For some of the plate contacting type optical transceivers, a gas and vacuum cleaning machine may be effective. However, as already suggested, it should be verified that solvent is not trapped in the receptacle which would adversely impact optical performance and reliability. Air dusters may not effectively clean the receptacle. It is difficult to remove contamination with blast of compressed air because the structure of the optical receptacle has a small diameter bore (of 1,25 mm or 2,5 mm) that is relatively deep. Larger sized contamination particles may effectively be removed by compressed air injection.

Annex C
(informative)

Cleaning procedure of optical connector end-face of receptacle style optical transceivers

C.1 Basic cleaning procedure

The following describes the basic procedure for cleaning:

a) Inspect the optical connector end-face for contamination or damage before cleaning.

b) Dry clean the optical connector the end-face if contamination, scratches or defects are found.

c) Inspect the optical connector end-face after every cleaning to determine if the contamination has been removed.

d) Repeat b) and c) several times if contamination still remains; this might be due to contamination of the stick cleaner.

e) If contamination remains after dry cleaning several times, try wet cleaning, using a solvent.

f) After wet cleaning, dry clean again.

g) Inspect optical connector end-face after every cleaning, and judge according to the pass/fail criteria.

h) Repeat f) to g) several more times.

C.2 Cleaning procedure of stick type cleaner

Insert stick type cleaner into the optical receptacle, press and rotate to clean. A light pressing force of a few Newton (N) magnitudes is recommended. Rotate several times. Rotate in the same direction to avoid re-contamination of the optical connector end-face. When using stick type cleaners, care must be taken to see that the cleaning cloth does not contact the housing of optical receptacles and contaminate the cleaning cloth before cleaning. Stick type cleaners can be used only once. Never use them a second time.

The size of the cleaning cloth is slightly smaller than the inner diameter of the split sleeve. When contamination is not in the centre, it may be more effective to insert the stick at an angle to reach the location of the contamination when rotating the stick. Figure C.1 shows the picture of cleaning by stick type cleaner.

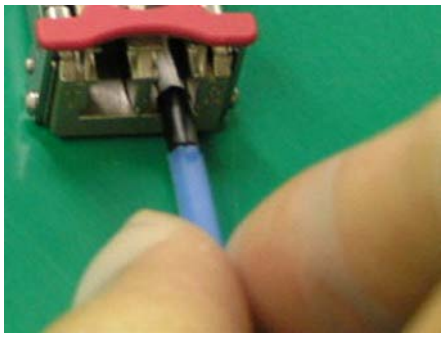

Figure C.1a – Front view

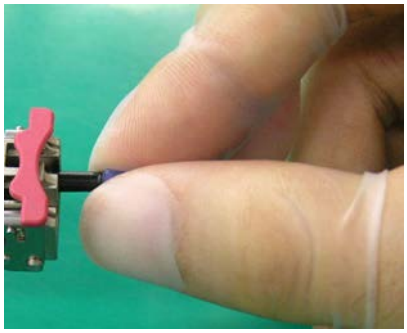

Figure C.1b – Side view

Figure C.1 – Cleaning an optical transceiver receptacle end-face by a stick type cleaner

C.3 Cleaning procedure of pen type cleaner

Insert the pen type cleaner into the optical receptacle and press to clean. Generally, for the pen type cleaner, the cleaning cloth on top of the cleaner moves when pressed. The width of the cleaning cloth is slightly smaller than that of stick type cleaners. Pen type cleaners may only clean the centre of the end-face. Follow the instruction manual provided by the cleaner supplier.

Figure C.2 shows a picture of cleaning using a pen type cleaner.

Figure C.2 – Cleaning optical transceiver receptacle end-face using a pen type cleaner

C.4 Cleaning procedure of gas and vacuum type cleaning machine

Insert the nozzle into the receptacle of an optical transceiver to clean the optical end-face. The cleaning machine injects a volatile solvent into the transceiver to dislodge contamination and then extracts the solvent to remove the contamination. For operating details, the instruction manual provided with the machine by the supplier should be thoroughly reviewed before cleaning.

C.5 Cleaning procedure of air duster

The nozzle of the air duster is positioned at the proper distance (10 to several tens of millimetres) from the receptacle bore of an optical transceiver, and compressed air is directed into the transceiver bore for several seconds and then repeated. The proper distance for the nozzle may vary for different air dusters, because of differing velocities of the air jet. Care should be taken to see that propellant is not sprayed from the can, either because the can is nearly empty of compressed air or because it is being held in an inverted position.

C.6 Other important points

This clause describes general considerations for cleaning optical connector end-face.

a) Optical connector cleaning tools or machines should be used. Cotton swabs are not typically lint-free and are not processed to prevent static electric creation. Some cotton swabs also use glue to attach the cotton material which may be transferred to the optical connector end-face when cleaning. When a solvent such as alcohol is used with a cotton swab, the glue used to attach the cotton may dissolve and deposit an adhesive film on the optical connector end-face which is extremely difficult to remove.

b) Not all cleaning tools are effective for cleaning.

c) Lint-free cleaning cloth that has been processed to prevent creating a static electric charge should be used.

d) Alcohol may absorb water vapour from the air; care should be taken to store alcohol in a sealed container.

e) Solvents such as alcohol may leave a residue, therefore, dry cleaning after wet cleaning is recommended.

f) Cleaning tools, machines and cleaning cloths should be stored to prevent contamination from dirt.

g) Follow the gas and vacuum cleaning machine supplier's instruction manual for proper set-up, cleaning procedure, periodic maintenance and storage.

Annex D
(informative)

Examples of inspection instruments for an optical connector receptacle end-face

Optical connector visual inspection should be used when an optical connector end-face is cleaned. Annex D describes instruments used for inspecting the optical connector receptacle end-face.

IEC 61300-3-35 [3] defines the method of visual inspection of an optical connector plug end-face and the pass/fail criteria. IEC 61300-3-44 [4] defines the inspection method and pass/fail criteria for receptacle style optical transceivers with stub.

Examples of visual inspection instruments for optical connector receptacle end-faces are shown in Figure D.1.

Figure D.1 – Examples of visual inspection instruments for optical connector end-face

Care shall be taken not to contaminate the optical connector end-face with the inspection instrument camera probe or camera plug adapter. The camera probe is inserted into the bore of the optical receptacle to inspect the end-face and the camera plug adapter receives the connector plug to inspect its end-face. The probe and the plug adapter should be clean at all times. The probe should not be allowed to contact the outside of the optical receptacle housing to prevent introducing contamination into the receptacle bore.

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[3] IEC 61300-3-35, *Fibre optic interconnecting devices and passive optical components – Basic tests and measurements procedures – Part 3-35: Fibre optic connector endface visual and automated inspection*

[4] IEC 61300-3-44, *Fibre optic interconnecting devices and passive optical components – Basic tests and measurements procedures – Part 3-44: Fibre optic transceiver receptacle endface visual and automated inspection*

[5] IEC 61754-20, *Fibre optic interconnecting devices and passive optical components – Interface standards – Part 20: LC connector family*

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