SFP Insertion and Seating Field Notice
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Insertion and Seating of SFPs – Field Notice and Best Practices

All SFPs (and other transceiver form-factors for that matter) comply with an MSA (Multi-Source Agreement). This document specifies the mechanical and opto-electrical characteristics of the transceiver, and was developed between the transceiver manufacturers and those that manufacture the ports they will reside in.
There are allowed variations in the design and function of the transceivers' housings. This allowed variation can lead to slight differences in deployment and installation.
Within the standards document, specifically the latching/seating (or actuation) mechanisms employed by various manufacturers can (and do) vary.
The purpose of this field notice is to describe these differences and tolerances, as well as to provide a plan of best practices for field technicians and engineers when mixing vendors, or moving from one vendor style to another in the field.

SFP MSA Overview

While all SFPs should comply with the MSA for mechanical and opto-electrical characteristics and performance, the agreement allows for a variety of locking mechanisms, alignment and grounding springs, and other slight modifications to the overall dimensions of the SFP case. The paragraph and the table below (taken from the Final Version of the SFP MSA document) shows the detail of tolerances that are allowed in the SFP's case design.

Excerpt taken from SFF Committee document
INF-8074i Specification for SFP (Small Form factor Pluggable) Transceiver
Rev 1.0 May 12, 2001

A. General

The parties agree to cooperate by supporting common product specifications for pluggable fiber optic transceivers with the package "Package Dimensions", "Cage and Electrical Connector System", "Host Board Layout", "Electrical Interfaces", and "Front Panel Bezel Requirements" as shown in Appendices A-B. The overall package dimensions shall not exceed the maximum indicated dimensions, and the mounting features shall be located such that the products are mechanically interchangeable with the cage and connector system. In addition the overall dimensions and mounting requirements for the cage and connector system on a circuit board shall be configured such that the products are mechanically and electrically interchangeable.

The electrical and optical specifications shall be compatible with those enumerated in the appropriate standards (i.e. the IEEE 802.3z Gigabit Ethernet standard and the ITU G.957 Synchronous Digital Hierarchy standard). Recommended circuit layouts for electrical input and output terminations, and grounding practices are also described in Appendix B.

The transceivers per this Agreement will accept an optical connector such as the duplex LC, MT-RJ or the SG connector. This Agreement does not preclude any of the parties from offering SFP transceivers with other connectors.

Internal design of the SFP transceiver is entirely at the discretion of each party and is not covered by this Agreement. The parties recognize that their products may not be identical, but need only meet the above criteria.

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Dimension Table for Drawing of SFP Transceiver

(Excerpt taken from SFF Committee document INF-8074i Specification for SFP Transceiver Rev 1.0 May 12, 2001)

Designator	Dimension (mm)	Tolerance (mm)	Comments
A	13.7	± 0.1	Transceiver width, nosepiece or front that extends inside cage
B	8.6	± 0.1	Transceiver height, front, that extends inside cage
C	8.5	± 0.1	Transceiver height, rear
D	13.4	± 0.1	Transceiver width, rear
E	1.0	Maximum	Extension of front sides outside of cage, see Note 2 Figure 1B
F	2.3	Reference	Location of cage grounding springs from centerline, top
G	4.2	Reference	Location of side cage grounding springs from top
H	2.0	Maximum	Width of cage grounding springs
J	28.5	Minimum	Location of transition between nose piece and rear of transceiver
K	56.5	Reference	Transceiver overall length
L	1.1x45°	Minimum	Chamfer on bottom of housing
M	2.0	± 0.25	Height of rear shoulder from transceiver printed circuit board
N	2.25	± 0.1	Location of printed circuit board to bottom of transceiver
P	1.0	± 0.1	Thickness of printed circuit board
Q	9.2	± 0.1	Width of printed circuit board
R	0.7	Maximum	Width of skirt in rear of transceiver
S	45.0	± 0.2	Length from latch shoulder to rear of transceiver
T	34.6	± 0.3	Length from latch shoulder to bottom opening of transceiver
U	41.8	± 0.15	Length from latch shoulder to end of printed circuit board
V	2.5	± 0.05	Length from latch shoulder to shoulder of transceiver outside of cage (location of positive stop).
W	1.7	± 0.1	Clearance for actuator tines
X	9.0	Reference	Transceiver length extending outside of cage, see Note 2 Figure 1B
Y	2.0	Maximum	Maximum length of top and bottom of transceiver extending outside of cage, see Note 2 Figure 1B
Z	0.45	± 0.05	Height of latch boss
AA	8.6	Reference	Transceiver height, front, that extends inside cage
AB	2.6	Maximum	Length of latch boss (design optional)
AC	45°	± 3°	Entry angle of actuator
AD	0.3	Maximum	Radius on entry angle of actuator
AE	6.3	Reference	Width of cavity that contains the actuator
AF	2.6	± 0.05	Width of latch boss (design optional)
AG	0.40	Minimum	Maximum radius of front of latch boss, 2 places (design optional)

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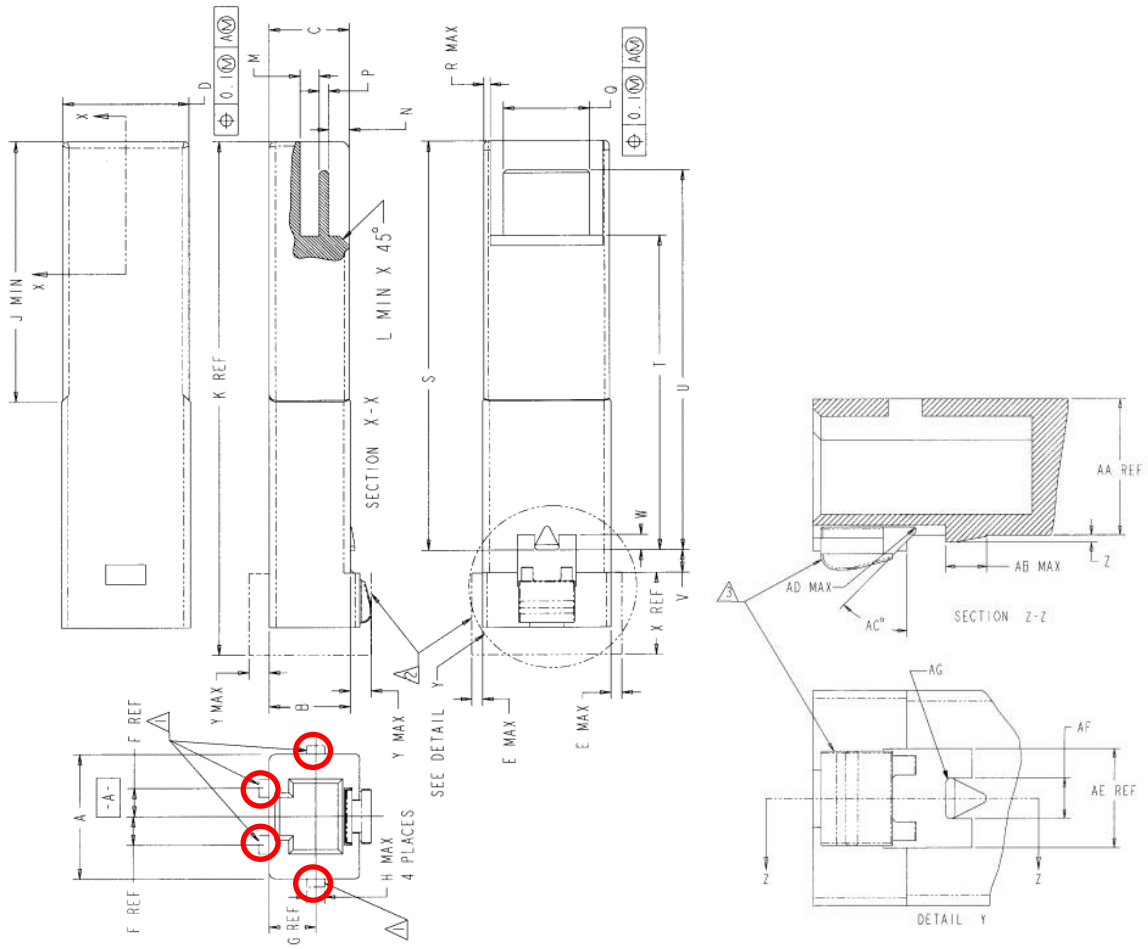

Drawing of SFP Transceiver
(Taken from SFF Committee document INF-8074i Specification for SFP Transceiver Rev 1.0 May 12, 2001)

Notes:

1. Cage grounding springs permitted in this area and may extend full length of transceiver, 4 places. Grounding springs may contribute a maximum force of .79 pounds to the withdrawal force of the transceiver from the cage (encircled in red above)
2. A representative MT-RJ configuration is illustrated. Indicated outline defines the preferred maximum envelope outside of the cage.
3. Design of actuation method and shape is optional.
4. Color code: An exposed colored feature of the transceiver (a feature or surface extending outside the cage assembly) shall be color coded as follows:
   - Black or beige for multi-mode
   - Blue for single mode

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It is worth observing in the notations above that there are several mentions of the allowable length extension, as well as actuation method and actuation shape differences. These two variations in the SFP design can cause some issues when a certain 'style' of cage (from a particular vendor) is used regularly and then replaced or inter-mixed with a different style of case. It is important, therefore, for field technicians and engineers to verify the locked-in seating of SFPs manually, rather than visually or audibly (listening for a 'click').

Visual Inspection:
'Visual only' inspection of the seating of an SFP into the SFP port cage can yield either intermittent or eventual loss of connectivity due to the transceiver not being LOCKED into position. The electrical interface will make contact with the internal connections of the port, but vibration, cable movement, or temperature changes can result in the unseating of the SFP.

Audible Verification:
Likewise, "audible only' verification of the seating and locking of an SFP can result in faulty seating. Some vendor's cases will emit an audible 'click' once seated, whereas others will click upon actuation of the latching mechanism, but will still require additional force to seat the case, which will NOT necessarily yield a secondary 'click'. This is a function of the case material type as well as the style of latching mechanism utilized, and therefore does not occur on all makes or models.

Insertion, Extraction, and Retention Forces

Measurement	Minimum	Maximum	Units	Comments
SFP transceiver insertion	0	9	lbs. force	
SFP transceiver extraction	0	2.6	lbs. force	
SFP transceiver retention	20.2	38.2	lbs. force	No damage to transceiver below 20.2lbs force
Cage retention (Latch strength)	40.5	N/A	lbs. force	No damage to latch below 40.5lbs force
Cage kick-out spring force	2.6	4.95	lbs. force	
Insertion / removal cycles, connector/cage	100	N/A	cycles	
Insertion / removal cycles, SFP	50	N/A	cycles	

Best Practices for seating and locking of SFPs:

Given the shortcomings of the methods of verifying installation described above, the best practice suggested when seating SFPs of mixed or new origin is to apply sufficient force when inserting to ensure locked seating of the transceiver. As described above, there is a wide range of force (0-9lbs) that can be required to properly seat and lock an optic in place, and this force will NOT damage the transceiver. The case's grounding extensions serve as guides as well, so there is not a risk of the electrical contacts misaligning (as can happen with line cards).
A simple mechanical verification after the jumpers are plugged in can be performed where slight outward force is applied to the jumper cable (less than the 9lbs of force required to seat).
If the transceiver is NOT properly seated and locked, any outward force will cause both the cable and the optic to come out of the port. If it is seated, the bail latch will not allow for removal without the excessive force described in the above table.