Specification for CS® Connector

Rev 1.1 March 11th, 2019

Abstract:

This specification defines the fiber optic connector interface, a single position plug connector set of plug/adapter configuration that is characterized by two 1.25 mm nominal diameter ferrules.

This document provides a specification for systems manufacturers, system integrators, and suppliers. It summarizes the receptacle interface into a clearly defined solution for users.

Limitations of the use of this information: This specification is being provided under and subject to the provisions of the QSFP-DD Multi Source Agreement.

Points of Contact:

Tiger Ninomiya
SENKO Advanced Components
450 Donald Lynch Blvd.
Marlborough, MA 01752

Change History:

Revision	Date	Changes
0.1	3/13/2017	First Release
1.0	9/18/2017	Receptacle and connector dimensions updated
1.1	3/11/2019	Added Single Channel Adapter, and Receptacle.

Definitions

QSFP-DD

The QSFP-DD MSA is a multi-company industry group. The QSFP-DD MSA has defined a high density 8-channel (8x) module, cage, and connector system. QSFP-DD supports up to 400 Gb/s in aggregate over an 8 x 50 Gb/s electrical interface. The cage and connector design provides backwards compatibility to QSFP28 modules which can be inserted into a QSFP-DD port and connected to 4 of the 8 electrical channels.

LC Connector

LC Connector is a small form factor fiber optic connector. The LC connector has been standardized as FOCIS 10 (Fiber Optic Connector Intermateability Standards) in EIA/TIA-604-10. The LC connector uses a 1.25 mm ferrule. A single pair of LC connectors (dual LC connector) fit in the form-factor of a QSFP transceiver module.

Hooks

Adapter hooks are required in the CS receptacle and allow the plug connector to latch (lock in place) on to the receptacle. For clarity, the drawings are provided with and without hooks.

The drawings of the receptacle interface with hooks shows the completed assembly for the CS connector. The connector plug frame mates with a receptacle with hooks.

The drawings without hooks are for reference only to allow transceiver vendors to design their module housing. A module housing, designed to the receptacle drawings without hooks, will allow the CS hooks to be subsequently installed into the module housing.

Foreword

The QSFP-DD MSA specification defines an 8-channel module, cage and connector system. The cage and connector system provides backward compatibility to the 4-channel QSFP28 modules. Doubling the number of duplex optical links with the QSFP-DD specification requires a new smaller optical interconnect to fit in the same physical cage form factor. The CS connector provides the characteristics and simplicity of the duplex LC connector into a smaller footprint to allow 2 pairs of CS connectors to fit within the physical constraints of the QSFP-DD form factor.

TABLE OF CONTENTS

1. SCOPE

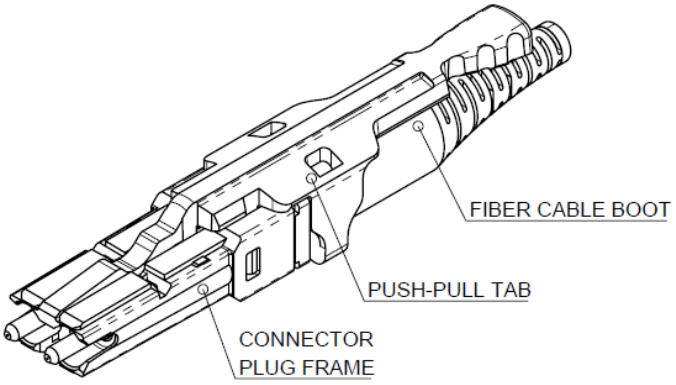
This specification defines the standard interface dimensions for the CS Connector.

2. INTRODUCTION

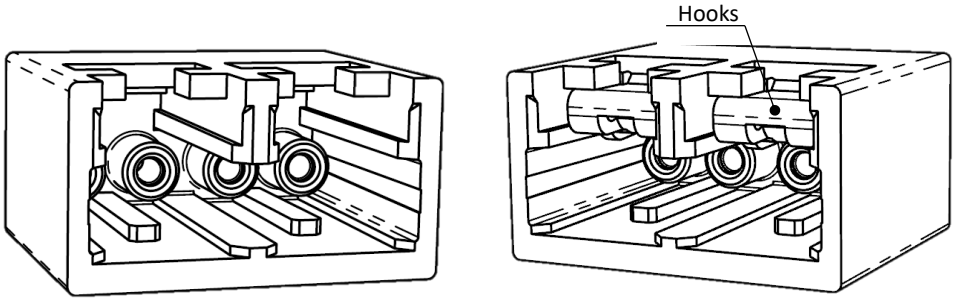
2.1 Overview

The CS connector is a miniature single-position plug which is characterized by duo cylindrical, spring-loaded butting ferrule(s) of a 1.25 mm typical diameter, and a push-pull coupling mechanism. The optical alignment mechanism of the connectors is a rigid bore sleeve or a resilient sleeve.

The document also defines the standard interface dimensions of active device receptacles for dual CS connectors. The receptacles are used to retain the connector plugs and mechanically maintain the optical datum target of the plugs at a defined position within the receptacle housings.



CS Connector appearance



Receptacle interface without hooks Receptacle interface with hooks

Dual CS Receptacle appearances

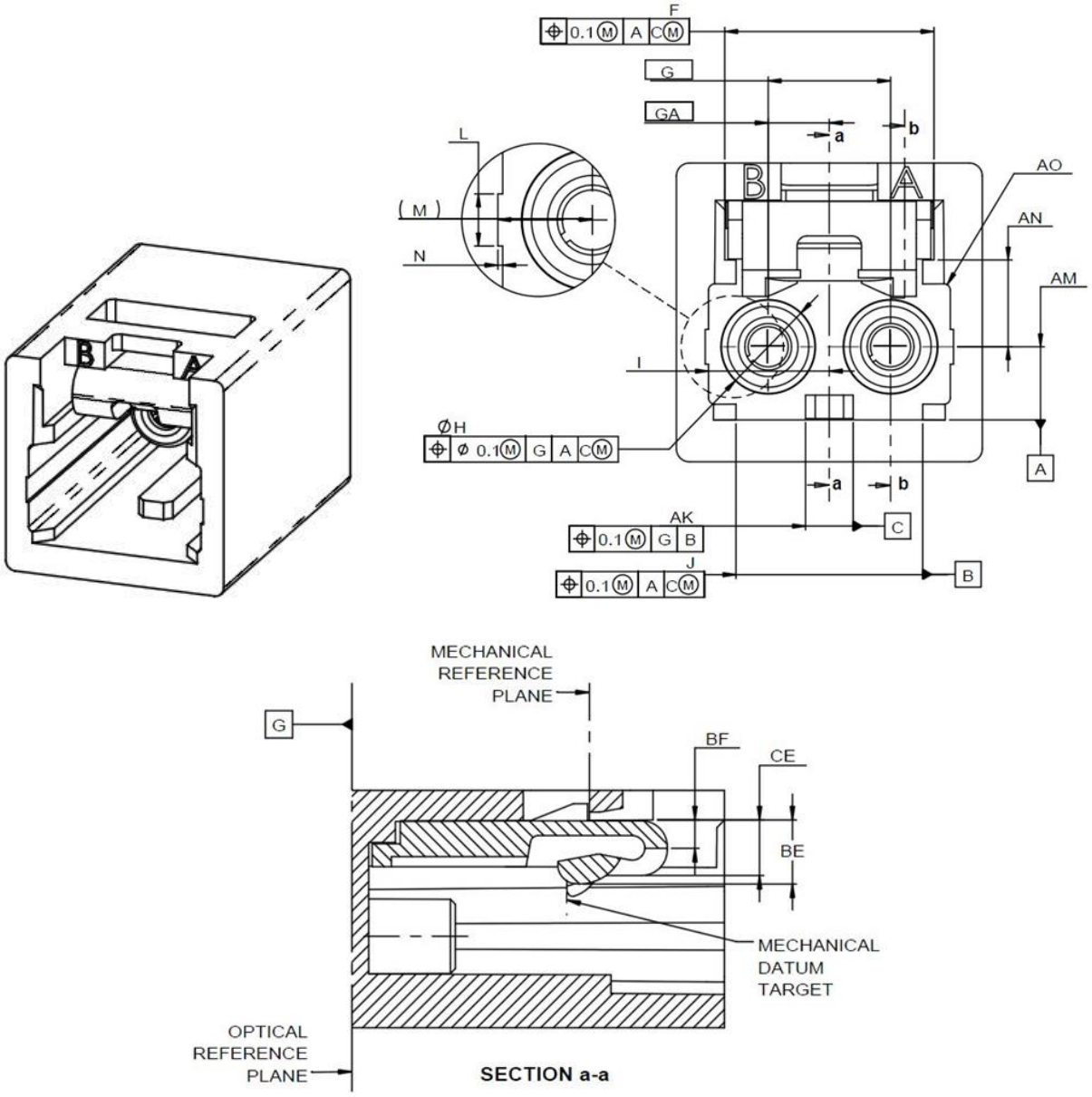


Figure 2.2.1a – Duplex adapter interface

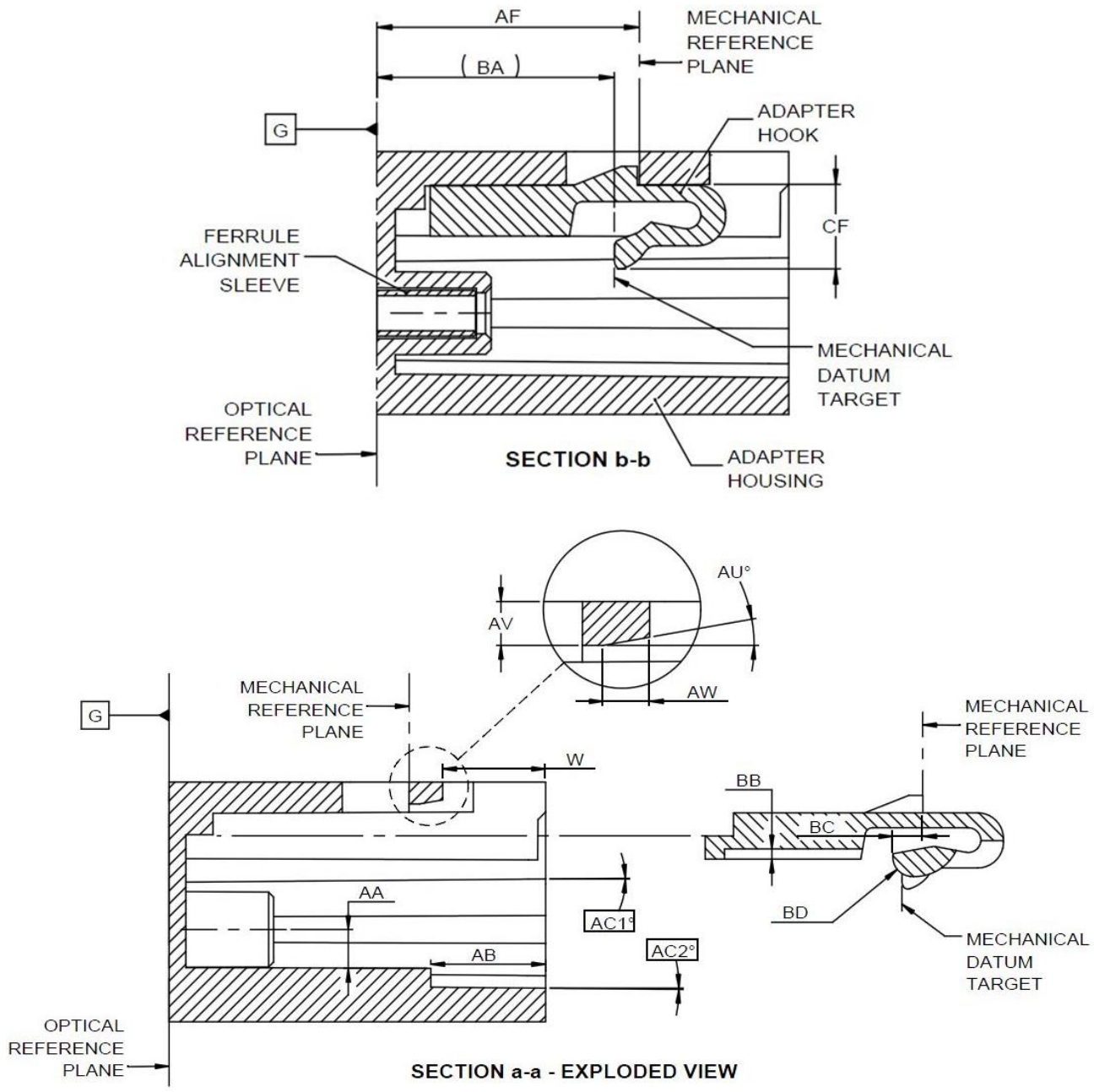


Figure 2.2.1a – Duplex adapter interface

Dim.	Min. (mm)	Max. (mm)	Notes
F	6.5	6.7	
G	3.8		BASIC DIMENSION
GA	1.90		BASIC DIMENSION
H	2.87	2.97	DIAMETER. SEE NOTE # 1, 2
I	3.7	3.8	SEE NOTE # 4

J	5.75	5.85	
L	1.03	1.13	
M	-		CALL-OUT NOT USED
N	0.05	-	
W			CALL-OUT NOT USED
AA	1.44	1.54	
AB	4.35	4.55	
AC1	-	0.5	DEGREE, SEE NOTE # 3
AC2	-	0.5	DEGREE, SEE NOTE # 3
AF	9.24	9.38	
AK	1.43	1.53	
AM	2.25	2.30	
AN	2.65	2.75	
AO	0.15	0.25	RADIUS
AU	10	-	DEGREE
AV	0.8	0.9	
AW	0.85	0.95	
BA	-		CALL-OUY NOT USED
BB	0.2	0.4	
BC	1.1	1.3	
BD	0.7	0.8	RADIUS
BE	2.40	2.60	
BF	-	1.25	
CE	2.0	2.2	
CF	2.9	3.1	

Figure 2.2.1a– Duplex adapter interface (Table 1)

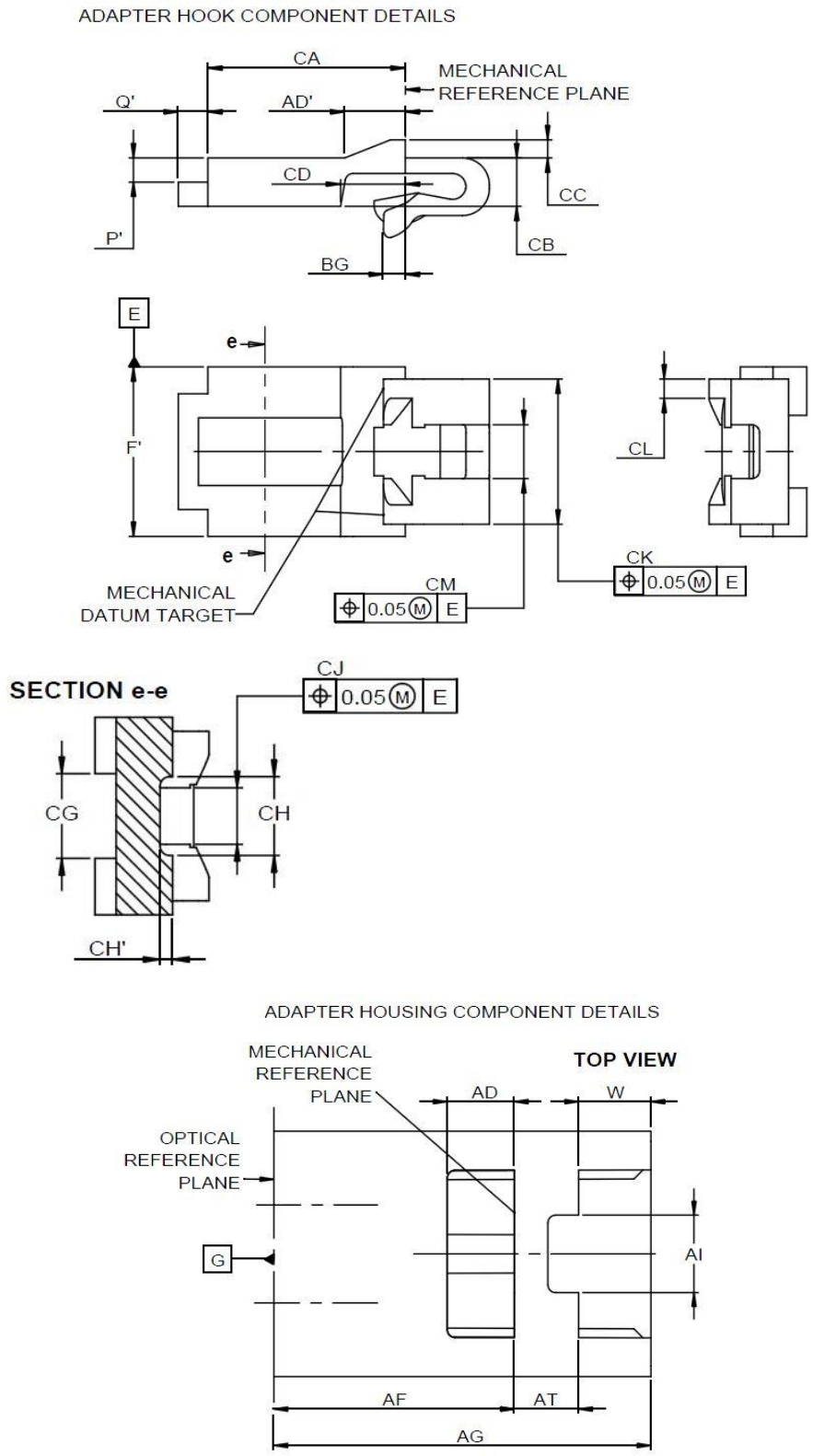


Figure 2.2.1a– Duplex adapter individual component dimensions

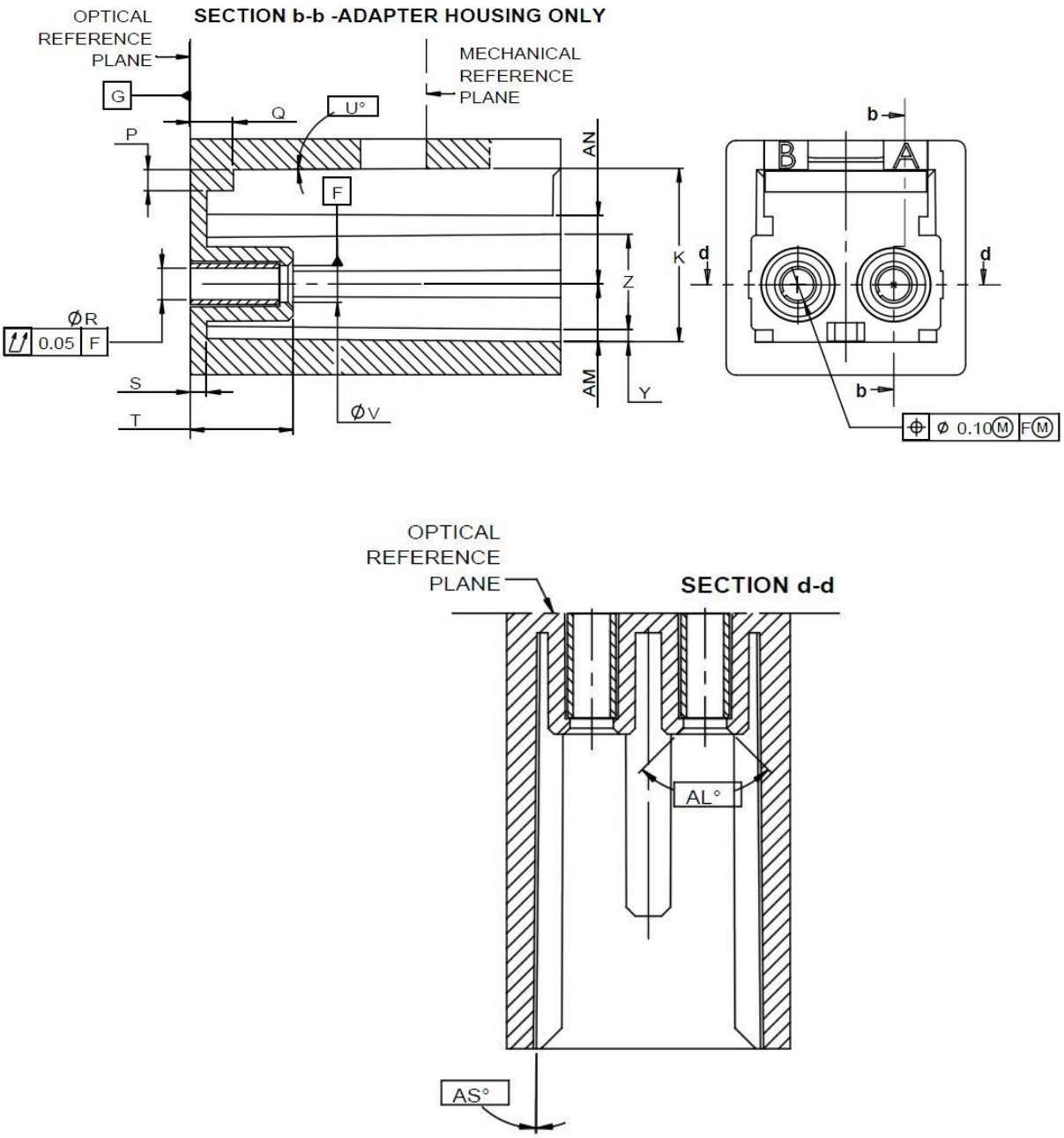


Figure 2.2.1a– Duplex adapter individual component dimensions

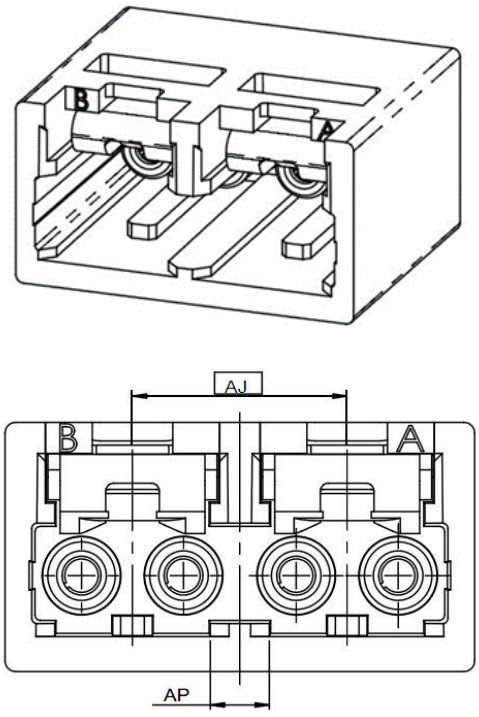
Dim.	Min. (mm)	Max. (mm)	Notes
F’	6.3	6.4	
K	6.75	6.90	
P	0	0.8	
Q	0	1.7	
P’	0.85	-	
Q’	-	1.15	
R	-	1.25	DIAMETER, SEE NOTE # 1, 2

S	0.55	0.75	
T	4.0	4.1	
U	0.3		DEGREE, DRAFT ANGLE, BASIC DIMENSION
V	1.4	1.5	DIAMETER
W	-		CALL-OUT NOT USED
Y	0.4	0.5	
Z	3.7	3.8	
AD	2.55	2.65	
AD'	-	2.3	
AF	9.24	9.38	
AG	14.5	14.7	
AI	3.0	3.2	
AL	90		DEGREE, BASIC DIMENSION
AM	2.25	2.30	SEE NOTE # 3
AN	2.65	2.75	SEE NOTE # 3
AT	1.25	1.35	
AS	-	0.5	DEGREE, SEE NOTE # 4
BG	0.79	0.99	
CA	7.29	7.39	
CB	1.70	1.80	
CC	0.3	-	
CD	2.3	-	
CG	-	3.5	
CH	2.4	2.6	
CH'	0.25	0.35	
CJ	1.75	1.85	
CK	5.35	5.45	
CL	0.67	0.77	
CM	1.95	2.05	

Figure 2.2.1a– Duplex adapter interface (Table 2)

Notes:

1. See section 2.2.2 for specifications of the I.D. of adapter alignment sleeve.
2. The sleeve may be fixed or floating. For a fixed sleeve the positional tolerance of dimension ØH (table 1) applies to both ØR (table 2) and ØH dimension. Dimension ØR defines the inner diameter of the alignment feature.
   For a floating sleeve, a gauge pin inserted in the sleeve must be capable of moving freely into a position such that it is coincident with datum F from diameter ØV (table 2).
3. Taper dimension AC1 & AC2 (table 1) are draft angle applied to surface associate with dimensions AM and AN (table 2) that are measured at outer edges of the surface
4. Taper dimension AS (table 2) are draft angle applied to surface associate with dimension I (table 1) that is measured to outer edge of the surface.

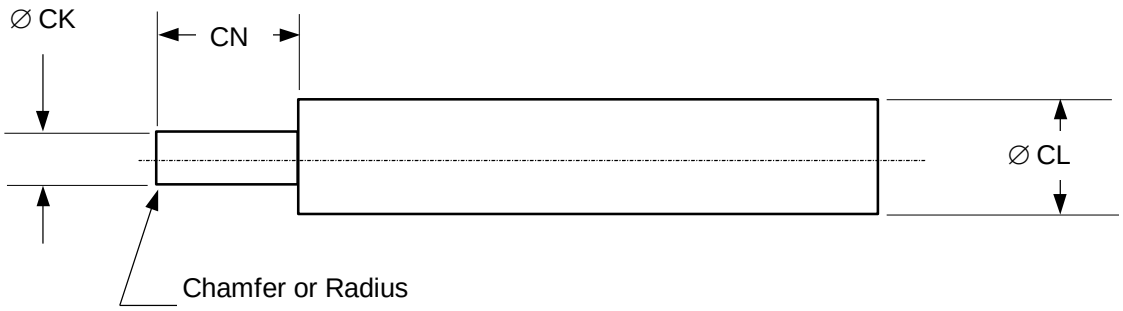


Dim.	Min. (mm)	Max. (mm)	Notes
AJ	8.0		BASIC DIMENSION
AP	2.1	2.3	

Note:

1. Each of the units in the Quadruplex receptacle shall comply with all the dimensions of Figure 2.2.1a

Figure 2.2.1b – Quadruplex adapter interface

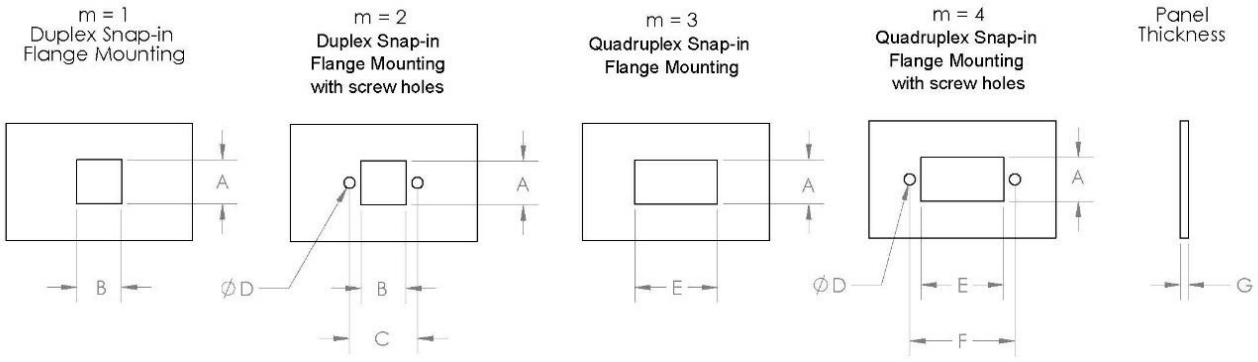


PIN GAUGE GRADE	CK (mm)		CL (mm)		CN (mm)		NOTES
	MIN	MAX	MIN	MAX	MIN	MAX	
1.249	1.2488	1.2492	2.6	4.4	4.2	15	1

Notes:

1. Surface roughness should be 0.2 μm Ra and cylindricity is less than 0.5 μm.

Figure 2.2.2 - Pin Gauge for Resilient Sleeve



Dimension	Minimum (mm)	Maximum (mm)
A	9.4	9.9
B	9.6	10.1
C	14.4	14.6
D	2.4	2.6
E	17.65	18.15
F	22.4	22.6
G	-	1.7

Figure 2.2.4 – Adapter mounting dimensions

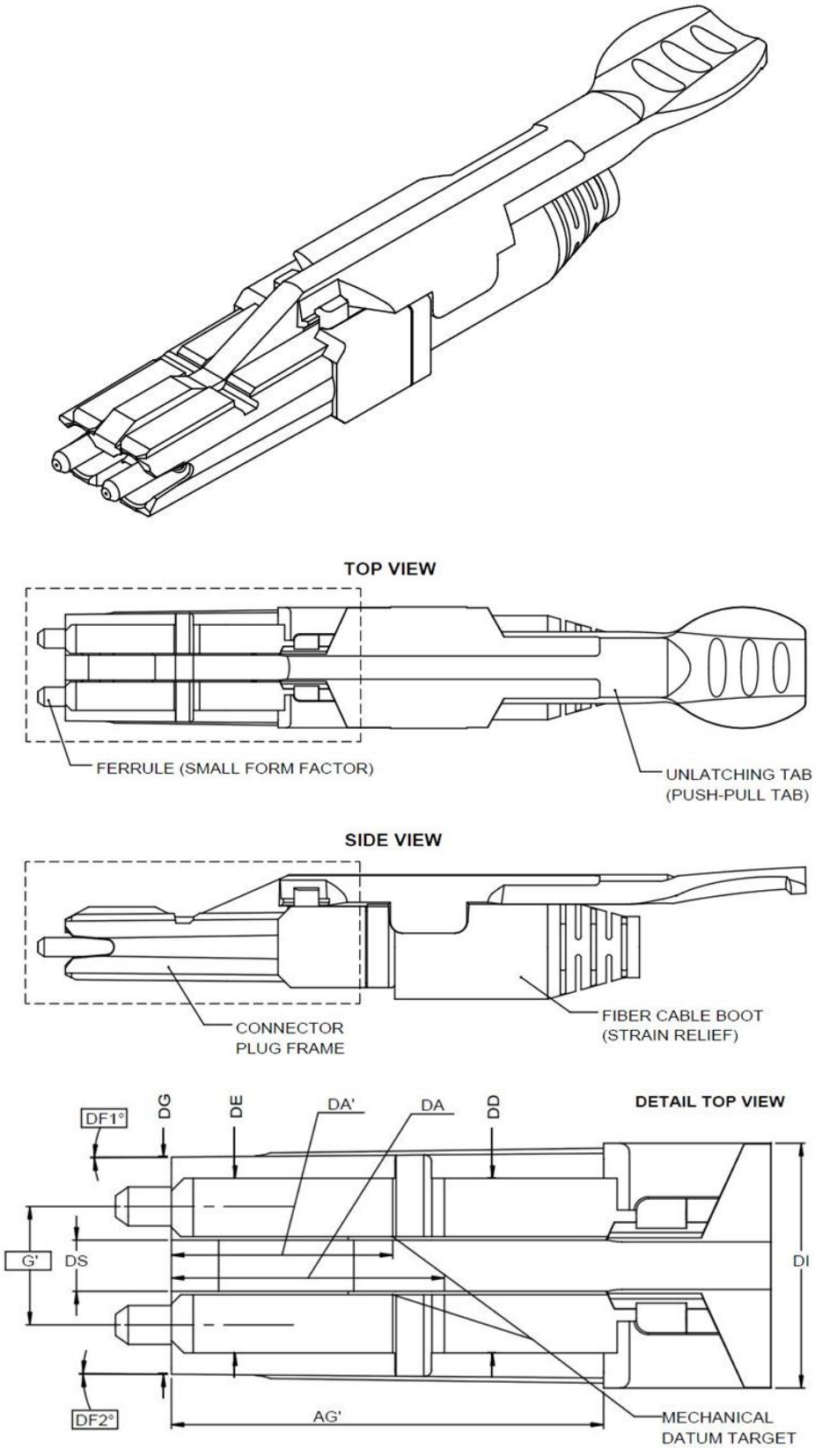


Figure 3.2.3a – Duplex plug interface

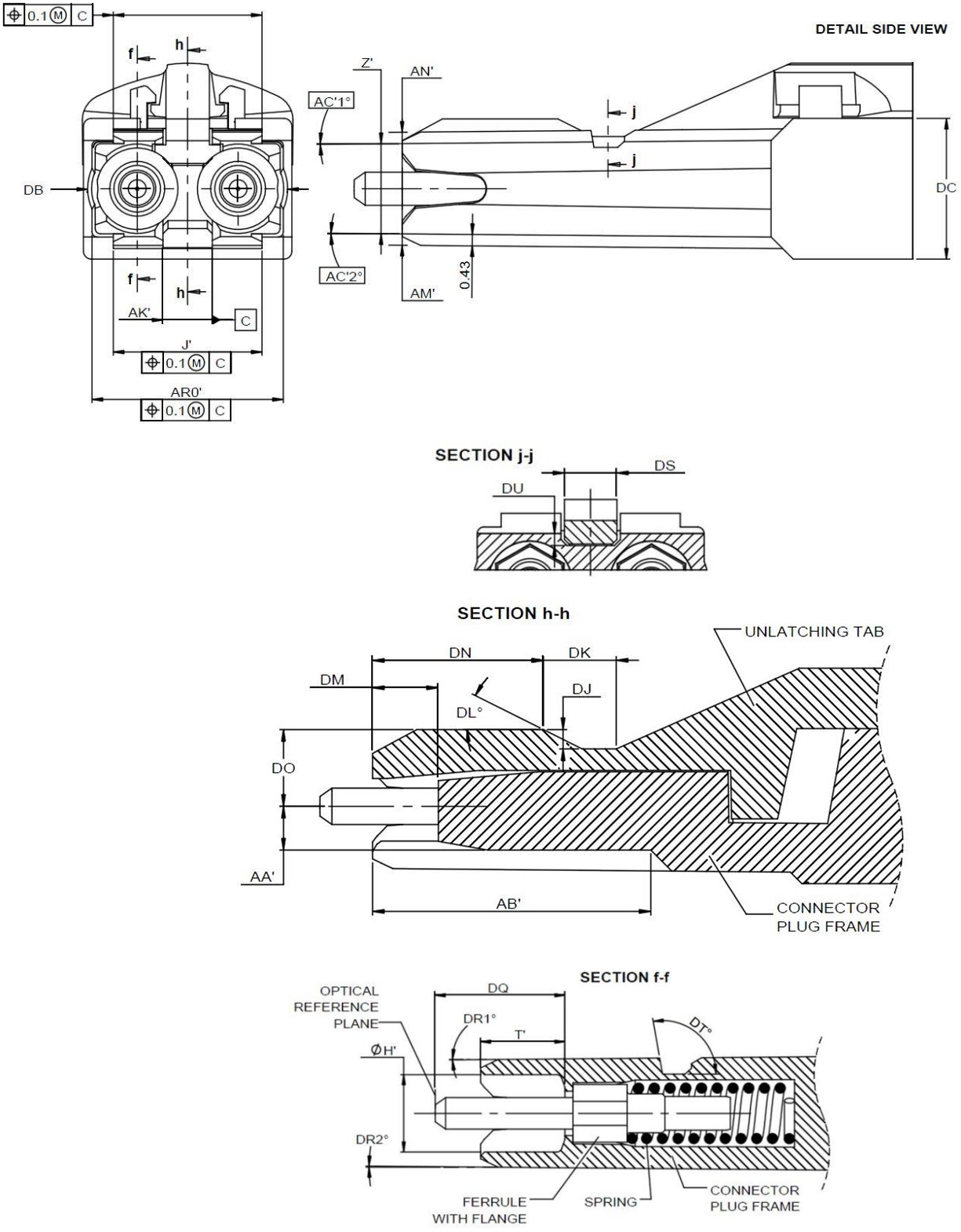


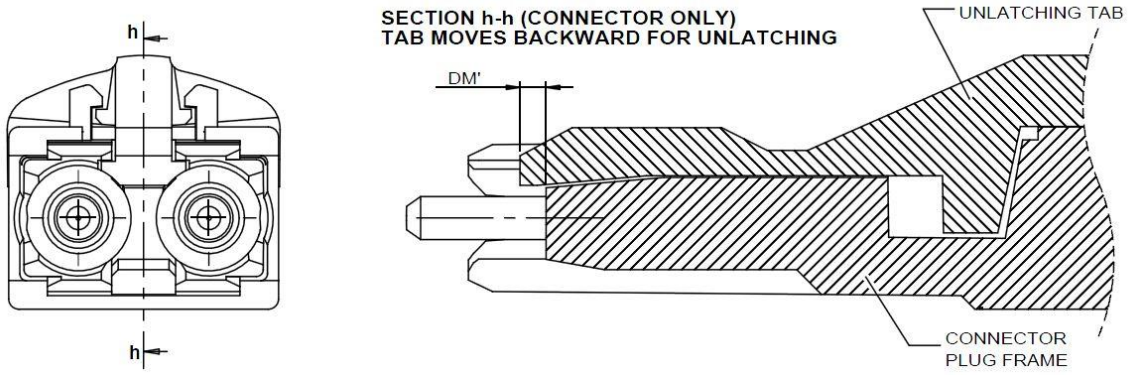
Figure 3.2.3 – Duplex plug interface

Dim.	Min. (mm)	Max. (mm)	Notes
G’	3.8		BASIC DIMENSION
H’	3.0	3.2	DIAMETER
J’	5.5	5.7	
T’	3.3	3.4	
Z’	3.3	3.5	SEE NOTE # 1
AA’	1.5	1.6	
AB’	9.45	9.65	
AC’1	-	0.5	DEGREE, SEE NOTE # 1
AC’2	-	0.5	DEGREE, SEE NOTE # 1
AK’	1.78	1.94	
AG’	13.75	14.05	SEE NOTE # 1, 3
AM’	2.08	2.18	SEE NOTE # 2
AN’	2.08	2.18	SEE NOTE # 2
AR0’	7.1	7.3	SEE NOTE # 3
DA	8.28	8.48	
DA’	7.06	7.16	
DB	7.45	7.6	
DC	5.2	5.4	
DD	5.5	5.7	
DE	5.5	5.7	
DF1	-	0.5	DEGREE, SEE NOTE # 3
DF2	-	0.5	DEGREE, SEE NOTE # 3
DG	6.86	7.06	SEE NOTE # 3
DI	7.75	7.95	
DJ	0.61	0.71	
DK	2.45	2.55	
DL	25.5	27.5	DEGREE
DR1	0.45	0.55	DEGREE SEE NOTE # 2
DR2	0.45	0.55	DEGREE SEE NOTE # 2
DM	2.21	2.31	SEE NOTE # 4
DN	5.82	5.92	
DO	2.48	2.78	
DQ	5.14	5.26	SEE NOTE # 5
DS	1.59	1.72	
DT	95	105	DEGREE
DU	0.30	0.45	

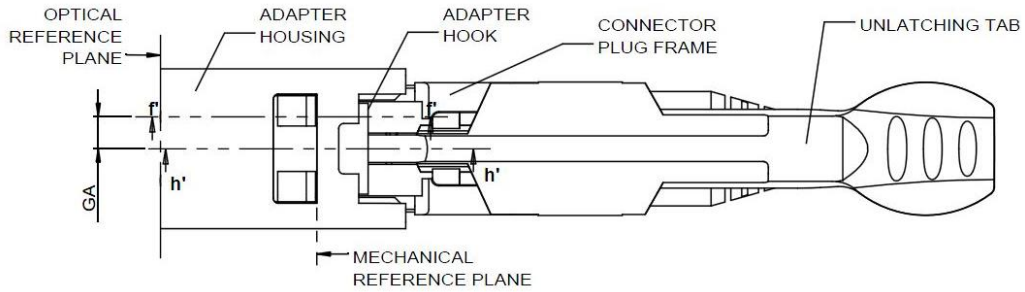
Note:

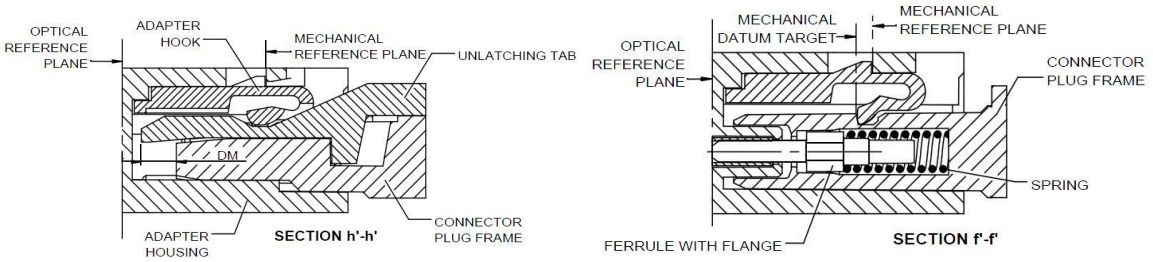
1. Taper dimension AC1 & AC2 are draft angle applied to surface associate with dimension Z',
2. Taper dimension DR1 & DR2 are draft angles applied to surfaces associate with dimension AN' & AM', where are located at intercept points of chamfers feature at front of the surface.
3. Taper dimension DF1 & DF2 are draft angles applied to surfaces associate with dimension AR0' measured at root level, and DG measured at front edges of the surfaces.
4. Dimension DM is when connector engaged with adapter / receptacle (Figure 4.2), i.e. in stationary (latched) condition. Dimension DM will vary in condition of unlatching-tab being activated. When DM value reaches DM' (Figure 3.2.3b), it releases SEN Connector from adapter / receptacle interface.
5. Dimension DQ' are given for a plug end-face, that was terminated with optical fiber(s) after polishing when not mated. The ferrules are movable by a certain axial compression force, with direct contacting end-face, Ferrule travel and contact force requirement is described by dimension BA' (Figure 3.2.6)

Figure 3.2.3 – Duplex plug interface

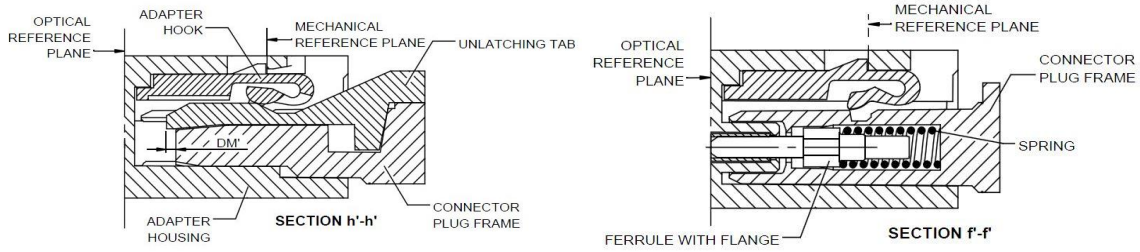


WHEN CONNECTOR (DUPLEX INTERFACE) INSTALLED TO ADAPTER.





WHEN PULL THE UNLATCHING TAB FOR CONNECTOR (DUPLEX INTERFACE) RELEASE.

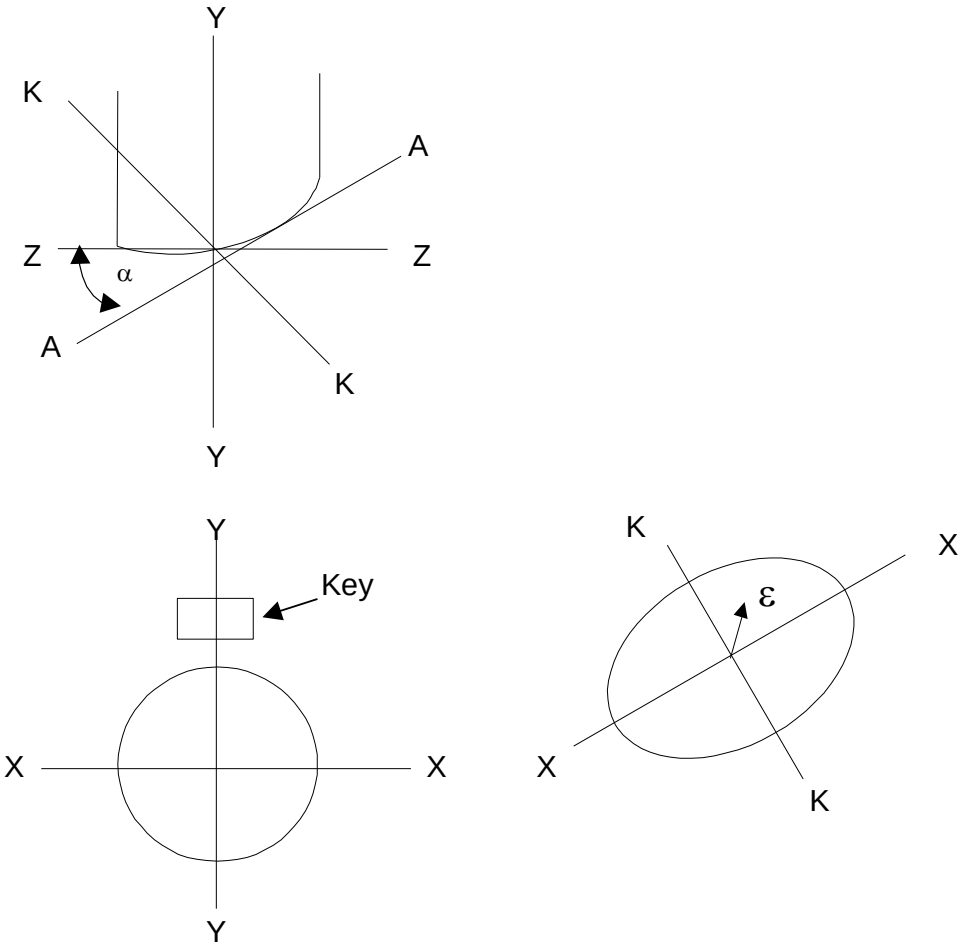


Dim.	Min. (mm)	Max. (mm)	Notes
GA	1.90		BASIC DIMENSION
DM	2.21	2.31	SEE NOTE
DM’	0.71	0.81	SEE NOTE

Note:

1. Dimension DM is condition in latched condition when connector engaged with adapter / receptacle (Figure 4.2)..Dimension DM’, is the final condition when connector be released from adapter / receptacle, i.e. unlatched condition.

Figure 3.2.4 – Duplex plug interface when unlatching from Adapter



Definitions for 3.2.2:

1. Plane Y-Y contains the centerline of the ferrule and passes through the center of the key.
2. Plane X-X contains the centerline of the ferrule, and is perpendicular to Plane Y-Y.
3. Plane Z-Z is perpendicular to Planes X-X and Y-Y and contains the point at which the centerline of the ferrule intersects the end of the ferrule.
4. Plane A-A is inclined at an angle α to Plane Z-Z, is perpendicular to Plane X-X, and is tangent to the end of the ferrule.
5. Plane K-K is perpendicular to Planes A-A and X-X and contains the point at which the centerline of the ferrule intersects the end of the ferrule.
6. Ferrule apex is the point of tangency between Planes A-A and the end of the ferrule.
7. ε is the distance on Plane A-A between the apex, and the projection on Plane A-A, of the point at which the centerline of the ferrule intersects the end of the ferrule.

Figure 3.2.2 – Geometry of an Angled Ferrule.

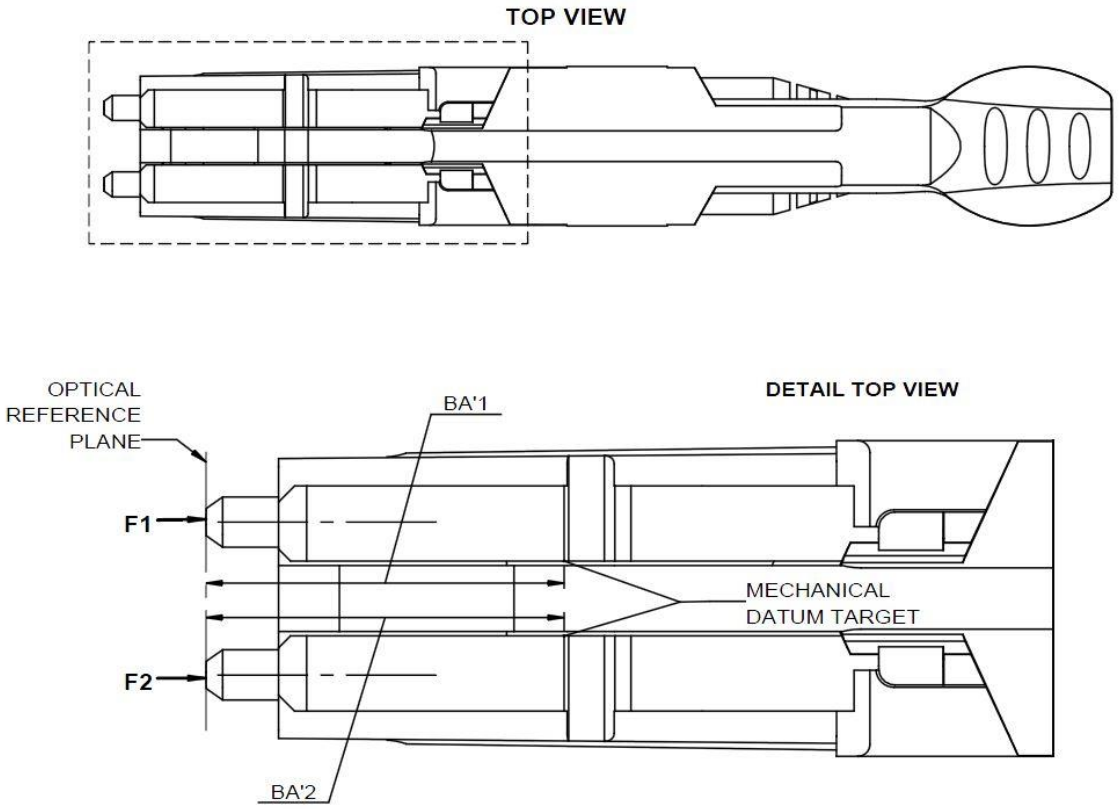


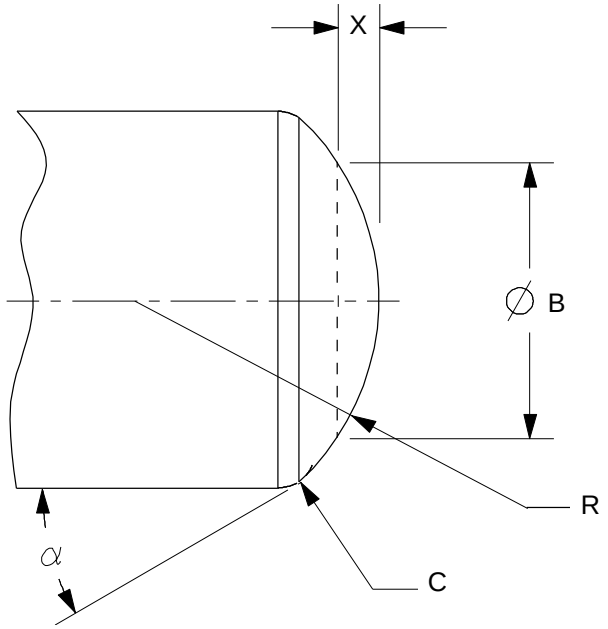
Figure 3.2.6 - Ferrule extension and contact force

Requirements for Ferrule Travel and Contact Force, option k = 1		
	IF	**THEN**
1	*F1* = 0	*BA'1* ≥ 8.9 mm
2	*BA'1* ≤ 8.4 mm	*F1* ≥ 5.0 N (510 gf)
3	*BA'1* ≥ 8.15 mm	*F1* ≤ 6.0 N (612 gf)
4	*F2* = 0	*BA'2* ≥ 8.9 mm
5	*BA'2* ≤ 8.4 mm	*F2* ≥ 5.0 N (510 gf)
6	*BA'2* ≥ 8.15 mm	*F2* ≤ 6.0 N (612 gf)

Requirements for Ferrule Extension k=2		
	Minimum	Maximum
BA'1	8.27 mm	8.45 mm
BA'2	8.27 mm	8.45 mm

Note: Dimension BA'1 & BA'2 applies to finished ends after all polishing has been completed. Forces are for buffered fiber only. Different cord constructions can result in higher forces than those shown in the table above.

Figure 3.2.6 - Ferrule extension and contact force



	t = 1 (Singlemode) mm	t = 2 (Multimode) mm	Notes
B	0.60 - 0.85	0.60 - 0.85	1
X_{max} (R_{min})	0.0145 (7)	0.0145 (7)	2 (3)
X_{min} (R_{max})	0.0041 (25)	0.0041 (25)	2 (3)
C	-	-	4
α	32.5 - 37.5	32.5 - 37.5	degrees

Notes:

1. *B* is the diameter of a circle on the surface of the ferrule that is concentric with the axis of the ferrule.
2. *x* is the distance that the apex of the end of the ferrule extends beyond the circle described in note 1.
3. The values of *R* are reference values. They are the radii of the end of the ferrule when the surface of the ferrule is spherical, and "*B*" is as given:

   $R_{min\ radius}$ when $X = X_{max}$

   R_{max} radius when $X = X_{min}$

4. Break corner or edge “C”. These dimensional requirements apply to the finished ferrule, after all polishing procedures have been completed.

Figure 3.2.4 - Ferrule end geometry

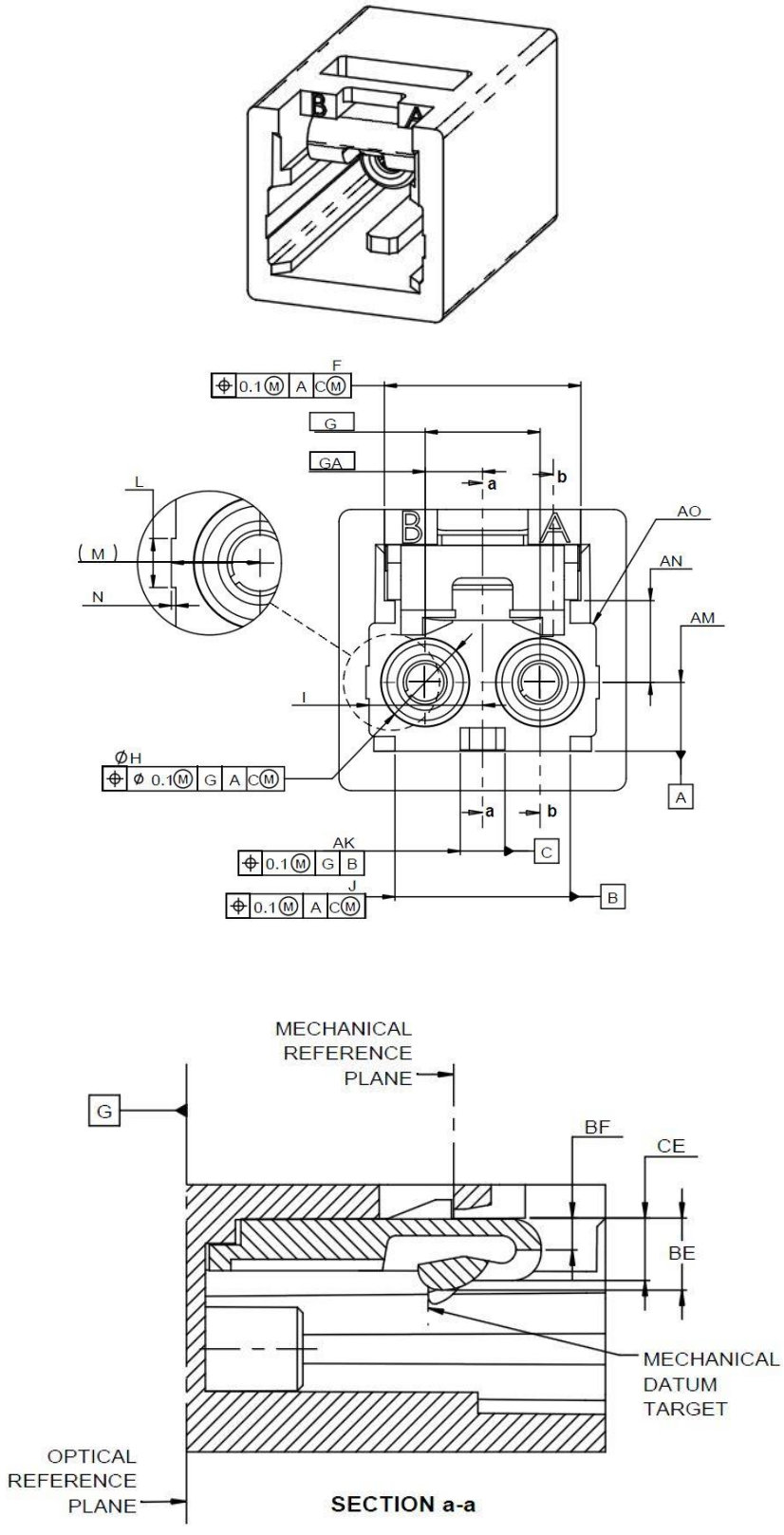


Figure 4.2a – Duplex receptacle interface

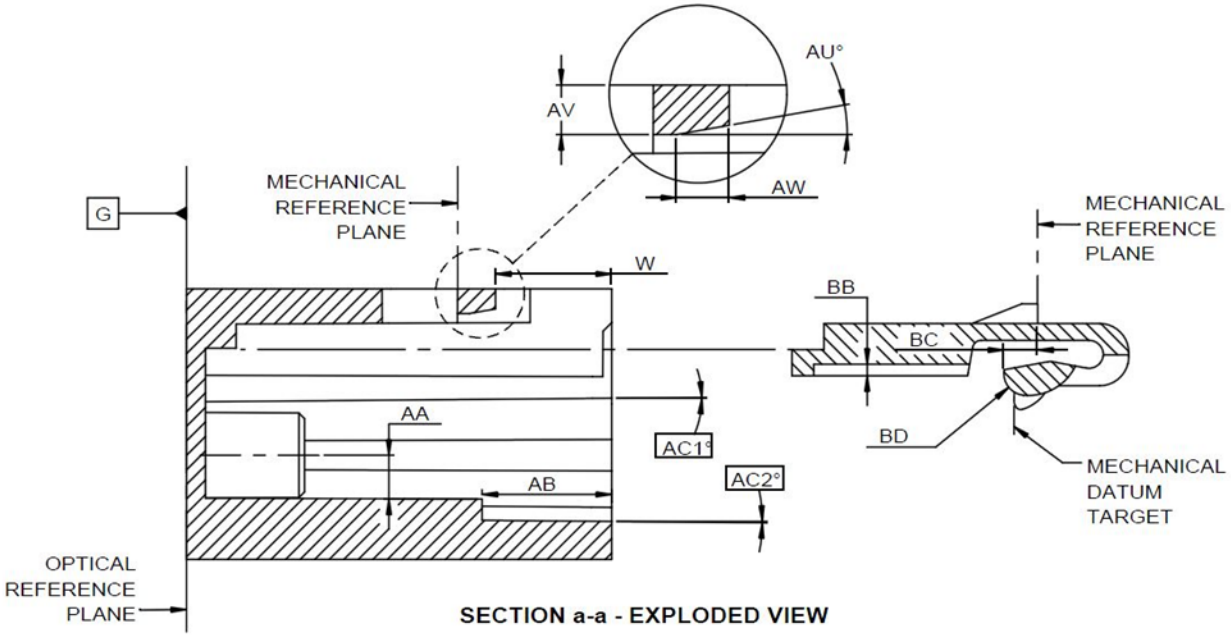


Figure 4.2a – Duplex receptacle interface

Dim.	Min. (mm)	Max. (mm)	Notes
F	6.5	6.7	
G	3.8		BASIC DIMENSION
GA	1.90		BASIC DIMENSION
H	2.87	2.97	DIAMETER
I	3.7	3.8	SEE NOTE # 4
J	5.75	5.85	
L	1.03	1.13	
M	-		CALL-OUT NOT USED
N	0.05	-	
W			CALL-OUT NOT USED
AA	1.44	1.54	
AB	4.35	4.55	
AC1	-	0.5	DEGREE, SEE NOTE # 3
AC2	-	0.5	DEGREE, SEE NOTE # 3
AF	9.24	9.38	
AK	1.43	1.53	
AM	2.25	2.30	
AN	2.65	2.75	
AO	0.15	0.25	RADIUS
AU	10	-	DEGREE

AV	0.8	0.9	
AW	0.85	0.95	
BA	-		CALL-OUY NOT USED
BB	0.2	0.4	
BC	1.1	1.3	
BD	0.7	0.8	RADIUS
BE	2.40	2.60	
BF	-	1.25	
CE	2.0	2.2	
CF	2.9	3.1	

Figure 4.2a – Duplex receptacle interface dimensions (Table 1)

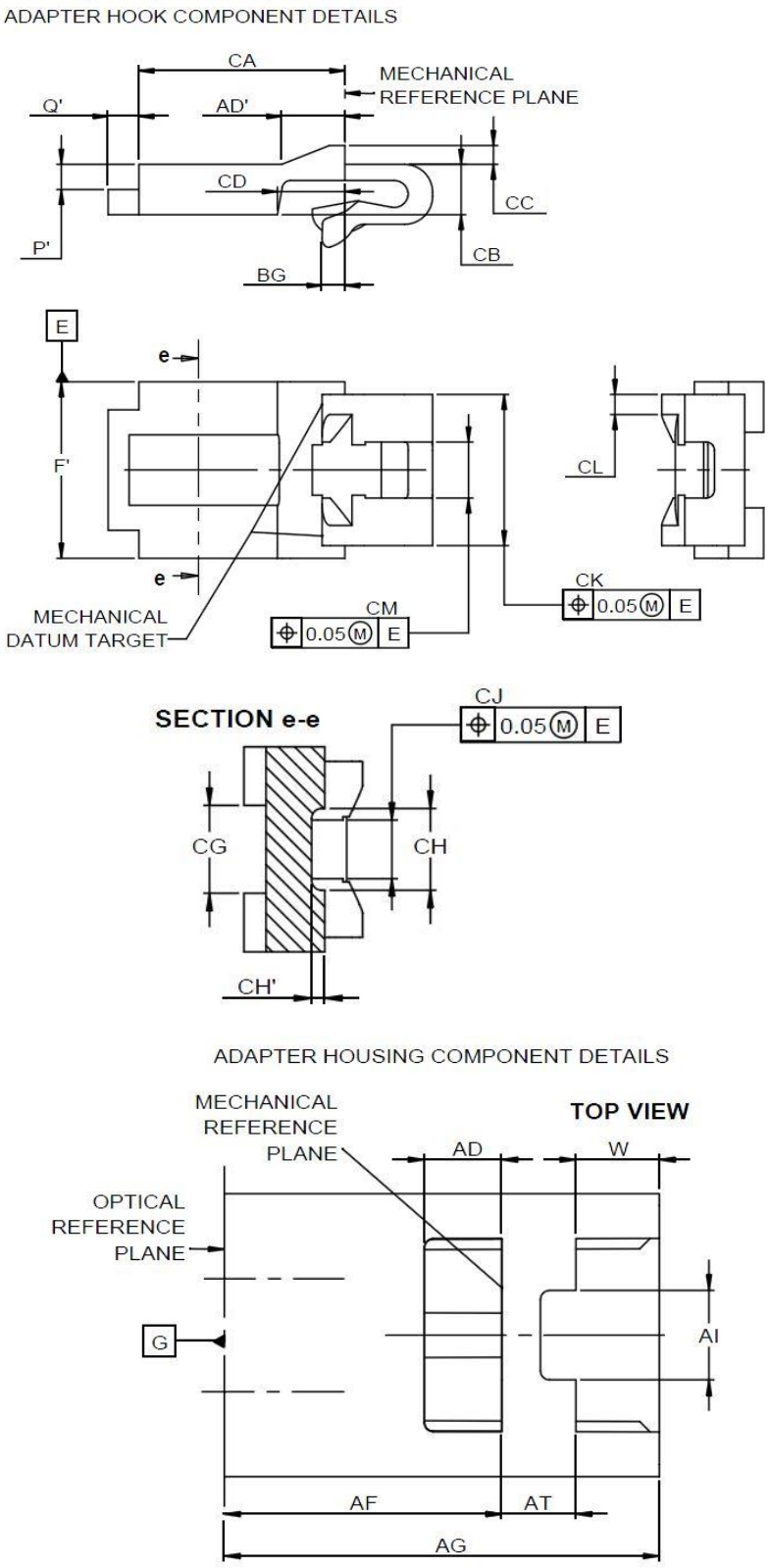


Figure 4.2a – Duplex receptacle interface, individual components dimensions

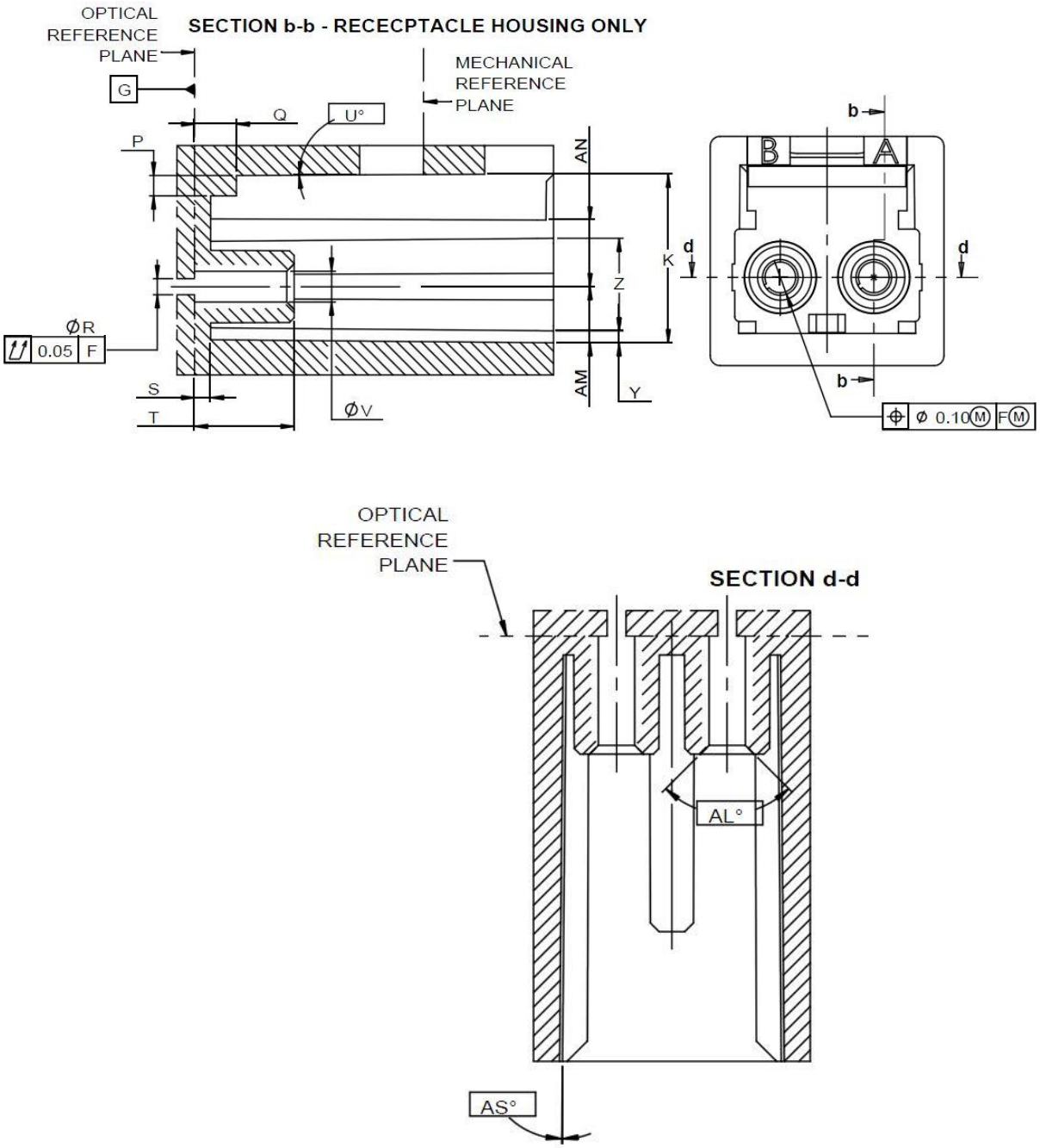


Figure 4.2a – Duplex receptacle interface

Dim.	Min. (mm)	Max. (mm)	Notes
F’	6.3	6.4	
K	6.75	6.90	

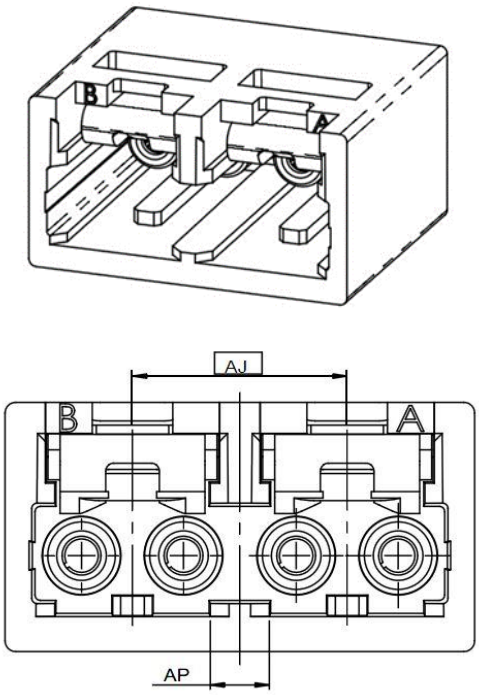
P	0	0.8	
Q	0	1.7	
P’	0.85	-	
Q’	-	1.15	
R	0.5	0.8	DIAMETER
S	0.55	0.75	
T	4.0	4.1	SEE NOTE # 6
U	0.3		DEGREE, DRAFT ANGLE, BASIC DIMENSION
V (t = 1)	RESILIENT SLEEVE		DIAMETER SEE NOTE # 1, 2, 5, 7
V (t = 2)	1.251	1.252	DIAMETER SEE NOTE # 1, 2, 6, 7
V (t = 3)	1.251	1.254	DIAMETER SEE NOTE # 1, 2, 6, 7
V (t = 4)	1.251	1.257	DIAMETER SEE NOTE # 1, 2, 6, 7
W	-		CALL-OUT NOT USED
Y	0.4	0.5	
Z	3.7	3.8	
AD	2.55	2.65	
AD’	-	2.3	
AF	9.24	9.38	
AG	14.5	14.7	
AI	3.0	3.2	
AL	90		DEGREE, BASIC DIMENSION
AM	2.25	2.30	SEE NOTE # 3
AN	2.65	2.75	SEE NOTE # 3
AT	1.25	1.35	
AS	-	0.5	DEGREE, SEE NOTE # 4
BG	0.79	0.99	
CA	7.29	7.39	
CB	1.70	1.80	
CC	0.3	-	
CD	2.3	-	
CG	-	3.5	
CH	2.4	2.6	
CH’	0.25	0.35	
CJ	1.75	1.85	
CK	5.35	5.45	
CL	0.67	0.77	
CM	1.95	2.05	

Figure 4.2a – Duplex receptacle interface – Individual Component Dimensions (Table 2)

Notes:

1. “t” refers to alignment sleeve grade tolerance option. Dimension ØV (table 2) applies to the inside diameter of solid bore sleeves. The requirement for the inside diameter of a split resilient sleeve is given in section 2.2.2.
2. For a solid sleeve the positional tolerance applies. For a floating sleeve, a gauge pin as defined in Figure 2.2.2 inserted in the sleeve must be capable to move freely into a position such that it is coincident with datum F from diameter ØV (table 2).
3. Taper dimension AC1 & AC2 (table 1) are draft angle applied to surface associate with dimensions AM and AN (table 2) that are measured at outer edges of the surface
4. Taper dimension AS (table 2) are draft angle applied to surface associate with dimension I (table 1) that is measured to outer edge of the surface.
5. The connector alignment feature is an alignment sleeve, the feature must accept a pin gauge completely to the left side of dimension T (table 2), with a force specified in Section 2.2.2 (1.0 N to 2.5 N). Insert the pin gauge completely, from only one side, the connector side of the receptacle interface. The pin gauge shall be defined in Figure 2.2.2
6. The connector alignment feature is a rigid bore sleeve. The Dimension ØV (table 2) shall be tested using two pin gauges. One pin gauge has the pin gauge grade number 1 µm larger than the maximum value of dimension ØV. The other pin gauge grade number 1 µm smaller than the minimum value of dimension ØV.
7. Add grade number to the interface reference number.

Figure 4.2a – Duplex receptacle interface



Dim.	Min. (mm)	Max. (mm)	Notes
AJ	8.0		BASIC DIMENSION
AP	2.1	2.3	

Note:

1. Each of the units in the Quadruplex receptacle shall comply with all the dimensions of Figure 4.2a

Figure 4.2b – Quadruplex receptacle interface