Jameco Part Number 800788

1.0 SCOPE

This Product Specification covers the performance requirements for Molex's 0.8 mm pitch Flat Pad I/O connector series with gold plating.

2.0 PRODUCT DESCRIPTION

2.1 PRODUCT NAME AND SERIES NUMBER (S)

SMT Receptacle Connector,	44828-****
Accessory Plug Modules,	45339-****, 45593-****
SMT Cradle Connector,	45560-****

2.2 DIMENSIONS, MATERIALS, PLATINGS AND MARKINGS

Please see the applicable Sales Drawings for information on dimensions, materials, platings and markings.

2.3 SAFETY AGENCY APPROVALS

UL/CSA file numbers to be determined.

3.0 APPLICABLE DOCUMENTS AND SPECIFICATIONS

See applicable Sales Drawings and other sections of this specification for specific references to applicable documents and specifications.

4.0 RATINGS

4.1 VOLTAGE

30 Volts AC/DC maximum

4.2 CURRENT

1.5 Amps continuous; 1.8 Amps for 1 minute; 5 Amps peak for 3 milliseconds;
2.1 Amps pulsed, 33% duty cycle @ 50 Hz on alternating circuits.

4.3 TEMPERATURE / HUMIDITY

Operating: - 40°C to + 85°C
Storage: - 40°C to + 85°C, 50% RH

PRELIMINARY RELEASE: THIS SPECIFICATION IS BASED ON DESIGN OBJECTIVES AND THE VALUES GIVEN ARE STRICTLY TENTATIVE. THIS SPECIFICATION IS SUBJECT TO CHANGES BASED ON THE RESULTS OF ADDITIONAL TESTING AND EVALUATIONS.

5.0 PERFORMANCE

5.1 ELECTRICAL REQUIREMENTS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
1	**Contact Resistance (Low Level)**	Mate connectors: Using a maximum open circuit potential of **20** mV and a current of **100** mA, measure contact resistance. (Measurement locations and methods are shown in Section 7.1) [EIA 364-23]	**50 milliohms** MAXIMUM (initial)
2	**Insulation Resistance**	Un-mate connectors: apply a voltage of **250** VDC between adjacent terminals and between terminals to ground for 1 minute. [EIA 364-21]	**1000 Meg-ohms** MINIMUM
3	**Withstanding Voltage**	Un-mate connectors: apply a voltage of **300 volts** AC for **1** minute between adjacent terminals and between terminals to ground. [EIA 364-20]	No breakdown; current leakage < **5 mA**
4	**Capacitance**	Measure between adjacent terminals at **1** MHz. [EIA 364-30]	**2 Pico farads** MAXIMUM [USB 2.0]
5	**Temperature Rise (Current Cycling)**	Mate connectors: measure the temperature rise at the rated current after **96** hours. (**45** minutes ON and **15** minutes OFF per hour). [EIA 364-55]	Temperature rise: **+30°C** MAXIMUM

5.2 MECHANICAL REQUIREMENTS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
6	**Contact Normal Force**	Condition a plug terminal by displacing it fully in the mating direction (to the housing wall). Retract fully, then apply a displacement to within 0.55mm of the housing wall and measure the corresponding reaction force. [EIA 364-04]	**0.5 N** minimum.
7	**Connector Mate and Un-mate Forces**	Mate and un-mate connector (plug to receptacle) at a rate of **25 ± 6** mm per minute applying forces parallel to the central axis of symmetry (straight pull). [EIA 364-13]	**20 N** MAXIMUM mating force **40 N** MAXIMUM, 7.5N MINIMUM un-mating force.

5.2 MECHANICAL REQUIREMENTS (continued)

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
8	**Angular Connector Un-Mate Forces**	Un-mate connector (plug from receptacle) by applying pulling forces away from the central axis of symmetry as follows: a) parallel to the plane of the PCB to which the receptacle connector is mounted; b) out of plane to the PCB to which the receptacle connector is mounted. See Section 7.3 for details about the test method.	**7.5 N** MINIMUM retention force at : a) 20 degrees off axis parallel to the PCB; b) 15 degrees off axis out of plane to the PCB.
9	**Perpendicular Connector Un-Mate Forces**	Apply a side load to the exterior housing of a plug connector that is mated with a corresponding receptacle connector. See Section 7.4 for details about the test method.	**25 N** MINIMUM
10	**Terminal Retention Force (in Housing)**	Apply an axial pullout force on the terminal in the housing at a rate of **25 ± 6** mm per minute. [EIA 364-29]	**2.5 N** MINIMUM retention force
11	**Durability**	Mate and un-mate connectors up to 15000 cycles at a maximum rate of **720** cycles per hour. Measure contact resistance. [EIA 364-09]	**10 milliohms** MAXIMUM (change from initial) **7.5 N** MINIMUM un-mating force (straight pull)
12	**Vibration (Random)**	Mate connectors and vibrate 15 minutes in each direction of each axis. [EIA 364-28, Cond. VII, C; IEC 68-2-36]	**10 milliohms** MAXIMUM (change from initial) Discontinuity < **1** microsecond
13	**Shock (Mechanical)**	Mate connectors and shock at **50** g's with ½ sine wave (11 milliseconds) shocks in the ±X,±Y,±Z axes (**18** shocks total). [EIA 364-27, Cond. A; IEC 68-2-27]	**10 milliohms** MAXIMUM (change from initial]) Discontinuity < **1** microsecond
14	**PCB Connector Shear Strength**	Apply a load parallel to the PCB plane that would shear the soldered connector from the board.	**P/N 44828-1162: 200N** MIN. P/N 45560-0160: 400N MIN. P/N 45560-0161: 50N MIN. (no mounting screws) or physical damage to parts

5.3 ENVIRONMENTAL REQUIREMENTS

ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
15	**Thermal Shock**	Mate connectors; expose to **100** cycles of: Temperature °C — Duration (Minutes) **-40 +0/-3** — **30** **+25 ±10** — **5** MAXIMUM **+85 +3/-0** — **30** **+25 ±10** — **5** MAXIMUM [EIA364-32, Cond. I; IEC 68-2-14]	**10 milliohms** MAXIMUM (change from initial) & Visual: No Damage
16	**Thermal Aging**	Mate connectors and expose to: **70 ± 2°**C for **500** hours. [EIA364-17, Method C, Cond. 2]	**10 milliohms** MAXIMUM (change from initial]) & Visual: No Damage
17	**Cold Resistance**	Operating: Mate connectors and expose to **-25± 2°C** for **96** hours [EIA364-59, Condition 4D] Storage: Mate connectors and expose to **-40± 2°C** for **96** hours [EIA 364-59, Condition 3D; IEC 68-2-1]	**10 milliohms** MAXIMUM (change from initial]) & Visual: No Damage
18	**Mating Integrity**	Verify mating of connectors subjected to the following temperature extremes: 1) **-40± 2°C** for **8** hours; 2) **85± 2°C, 95%RH** for **8** hours.	Connectors must mate after being exposed to opposite temperature extremes.
19	**Humidity (Steady State)**	Mate connectors, expose to a temperature of **40 ± 2°**C with a relative humidity of **90-95**% for **96** hours. Note: Remove surface moisture and air dry for **1** hour prior to measurements. [EIA 364-31, Method II, Cond. C; IEC 68-2-3]	**10 milliohms** MAXIMUM (change from initial) & Withstanding Voltage: No Breakdown at **250 VAC** & Insulation Resistance: **1000 Megohms** MINIMUM & Visual: No Damage

5.3 ENVIRONMENTAL REQUIREMENTS (continued)

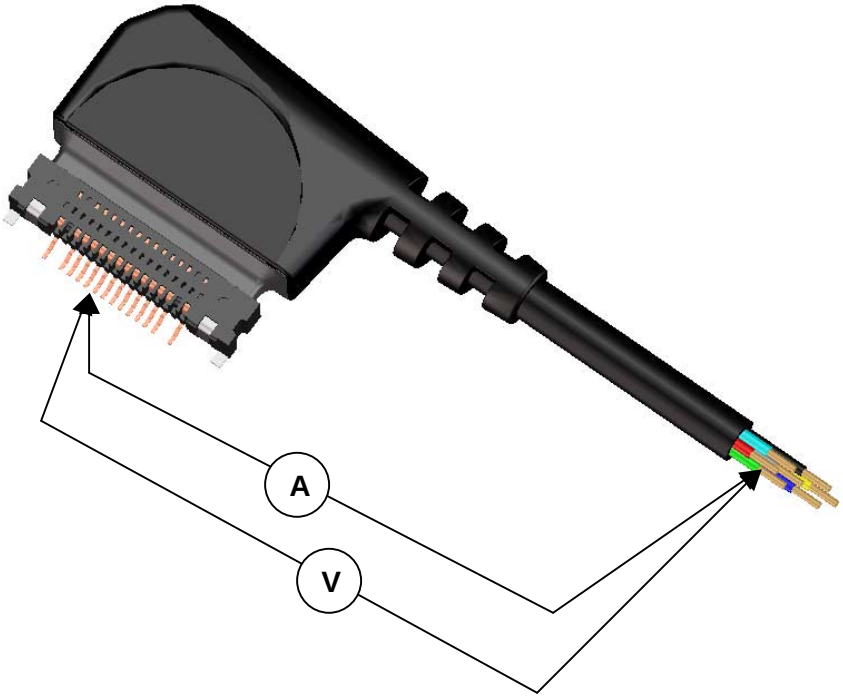
ITEM	DESCRIPTION	TEST CONDITION	REQUIREMENT
20	**Humidity (Cyclic)**	Mate connectors, cycle as follows: **10** cycles at temperature **25 ± 3°**C at **80 ± 5**% relative humidity and **70 ± 3°**C at **95 ± 5**% relative humidity; dwell time of **1.0** hour; ramp time of **0.5** hours. {Note: Remove surface moisture and air dry for **1** hour prior to measurements.} [EIA 364-31, Method III]	**10 milliohms** MAXIMUM (change from initial) & Dielectric Withstanding Voltage: No Breakdown at **250 VAC** & Insulation Resistance: **1000 Megohms** MINIMUM & Visual: No Damage
21	**Solderability**	Per EIA 364-52	Solder coverage: **95**% MINIMUM
22	**IR Reflow Solder Resistance**	Subject connectors to the standard IR Profile (see Section 7.2)	Visual: No Damage to insulator material
23	**Salt Spray**	Un-mated connectors: Duration: **48** hours exposure; Atmosphere: salt spray from a **5**% solution, pH: **6.5 to 7.2**, temperature: **35 +1/-2°**C Mate connectors and measure contact resistance. [EIA 364-26; IEC 68-2-11]	**10 milliohms** MAXIMUM (change from initial) & Visual: No Damage
24	**Dust Exposure**	Expose non-mated connectors to 140 mesh silica flour. Take LLCR measurements with the connectors mated. [EIA 364-50]	**10 milliohms** MAXIMUM (change from initial) & Visual: No Damage

6.0 PACKAGING

Parts shall be packaged to protect against damage during handling, transit and storage.

7.0 TEST GAGES, FIXTURES, AND SET-UP METHODS

7.1 CONTACT RESISTANCE PROBE POINTS



Plug assembly and SMT receptacle shown mated.

Four point probe method: 20mV, 100mA max.
Wire and terminal bulk resistances must be subtracted from the result to obtain the contact resistance values.

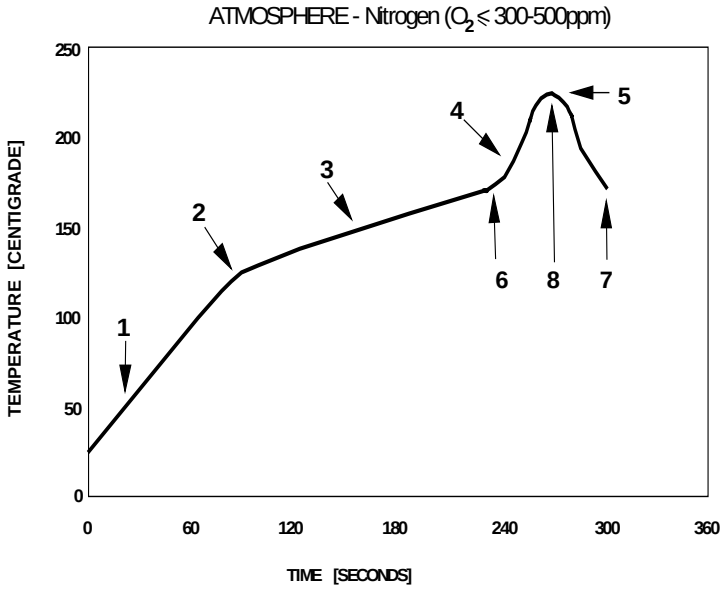
7.2 IR REFLOW SOLDERING PROFILES USED BY MOLEX

A. TIN / LEAD:

PROFILE ELEMENTS	IR CONVECTION
Ramp rate: 183°C to peak	2.5°C - 3°C/second max.
Preheat / Soak temperature: 150°C (+/-20°C)	60 to 120 seconds max.
Temperature mainatined above 183°C	60 to 90 seconds
Peak temperature range	205°C to 240°C
Ramp-down rate	6°C/second max.

B. LEAD - FREE:

PROFILE ELEMENTS	IR CONVECTION
Ramp rate: 217°C to peak	2.5°C - 3°C/second max.
Preheat / Soak temperature: 155°C (+/-15°C)	60 to 90 seconds max.
Temperature mainatined above 217°C	60 seconds
Peak temperature range	235°C to 250°C
Ramp-down rate	6°C/second max.



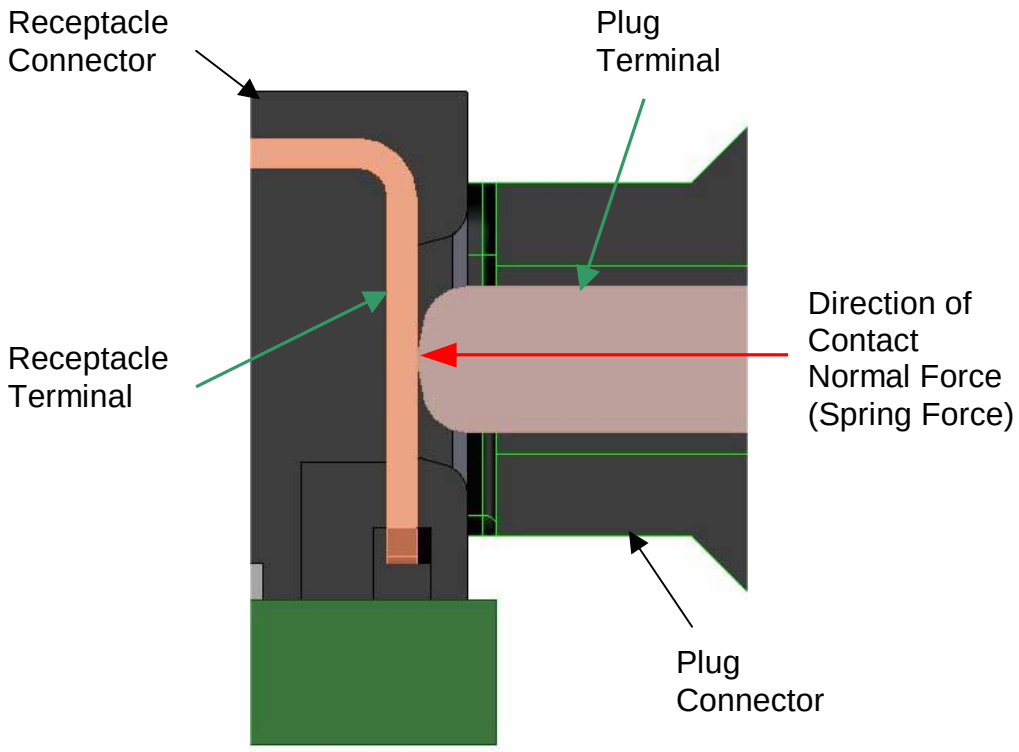
Description	Values
1. Initial Ramp	1.0 - 1.5 C/Second
2. Initial Soak	120 - 130 C
3. Soak Ramp	0.25 - 0.5 C/Second
4. Spike Ramp	1.25 - 2.0 C/Second
5. Peak Temperature	
6. Time to First Liquidus	175 - 275 Seconds
7. Time to Second Liquidus	220 - 360 Seconds
8. Total Liquidus Time	45 - 90 Seconds

NOTE: ACTUAL REFLOW SOLDERING PROFILES MUST BE DETERMINED BASED ON EVALUATIONS CONDUCTED WITH THE CUSTOMERS' OWN BOARDS, COMPONENTS AND SOLDERING EQUIPMENT.

7.2 DEFINITION OF MECHANICAL FORCES (SECTION 5.2, Items 8, 9, 10, AND 14)

Section 5.2, Item 8: Contact Normal Force

Normal force is defined as the force generated by the plug terminal's spring force on the mating surface of the receptacle connector.



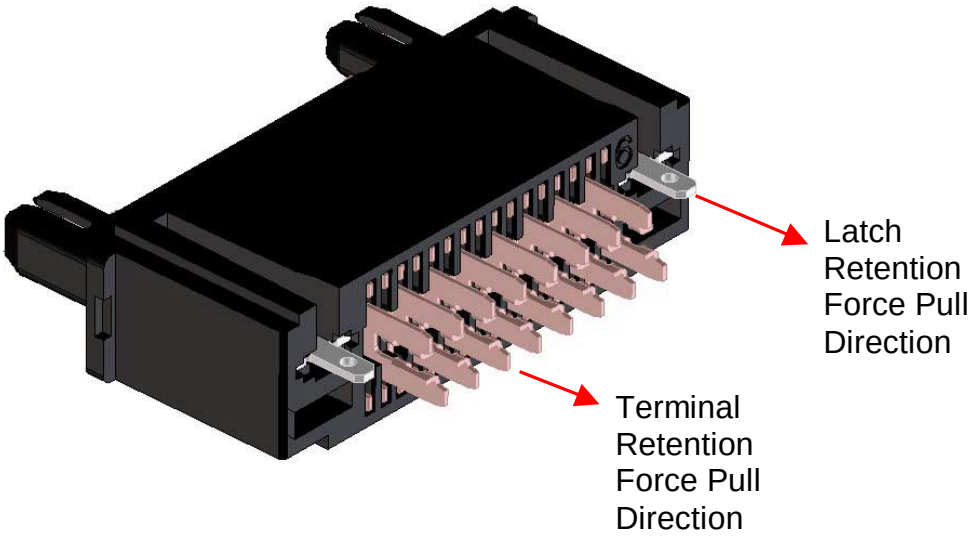
Section 5.2, Item 9: Connector Mate and Un-Mate Forces

Connector mate and un-mate forces are defined as the force required to fully engage and disengage the plug connector with the receptacle. The receptacle is rigidly mounted to a PCB and the forces are applied using a strain gauge tester along the pricipal axis of symmetry of the connectors, perpendicular to the mating (front) face of the receptacle connector.

(See Section 7.3, below, for a description of how un-mating forces are measured at angles that are off-axis)

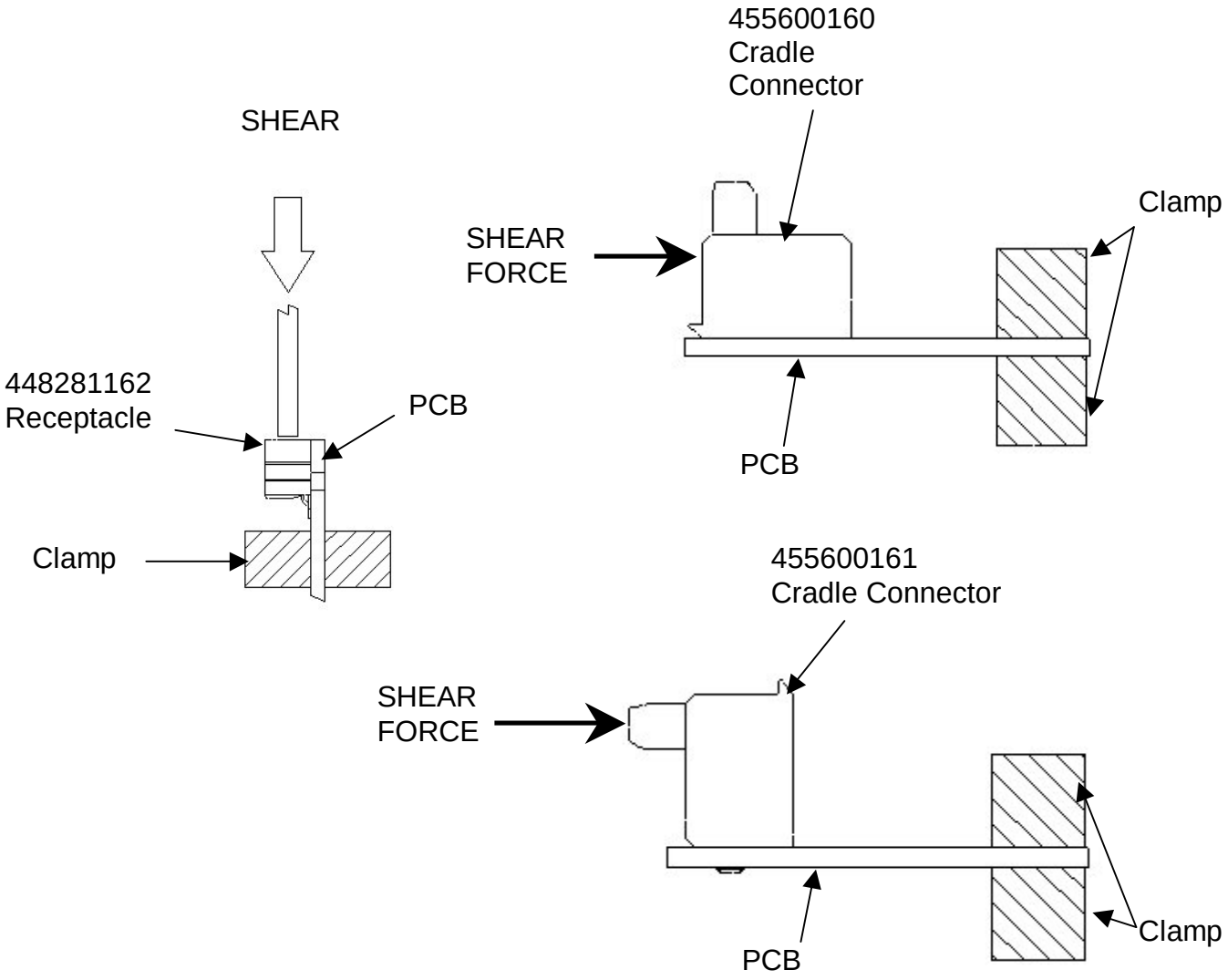
Section 5.2, Item 10: Terminal Retention Force in Housing

Terminal retention force is defined as the forces required to dislodge the plug or receptacle terminal from the respective plastic housing.
The contact terminals used in the Handylink™ receptacle connector are encased in plastic during the manufacturing process and cannot be removed from the housing.
The contact terminals and spring latches are press-fitted into recesses in the plastic housing during the manufacturing process. The retention force is defined as the axial force necessary to remove the terminals or latches in the opposite direction to that used during assembly, as illustrated below.



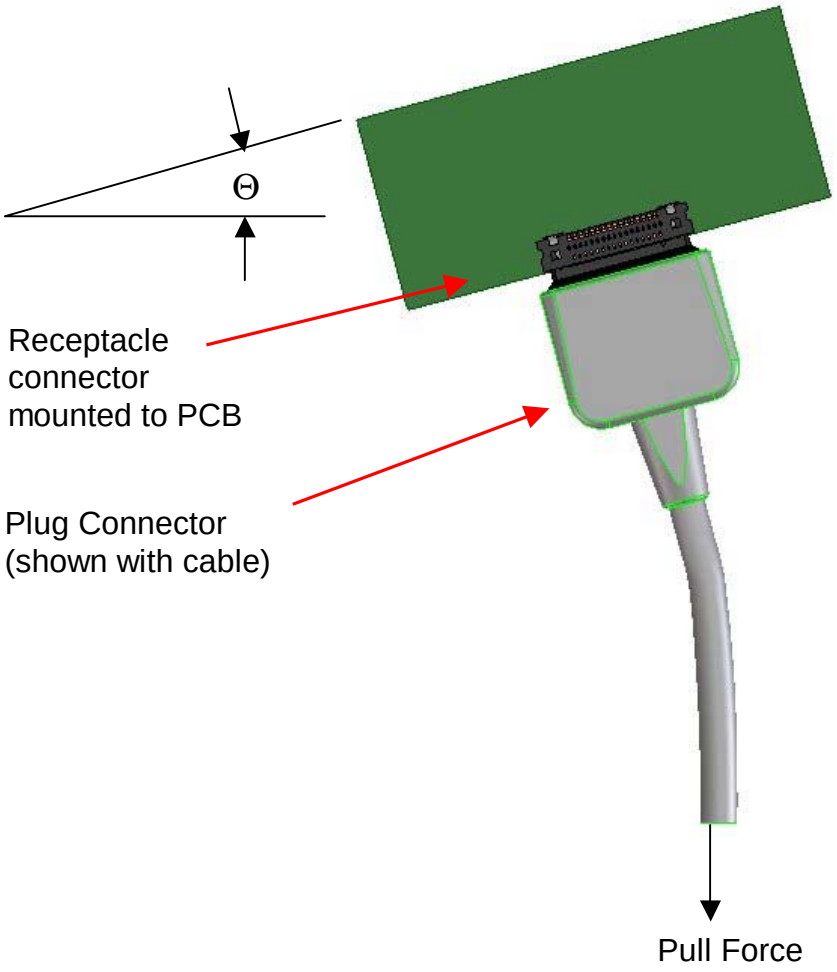
Section 5.2, Item 14: PCB Connector Shear Strength

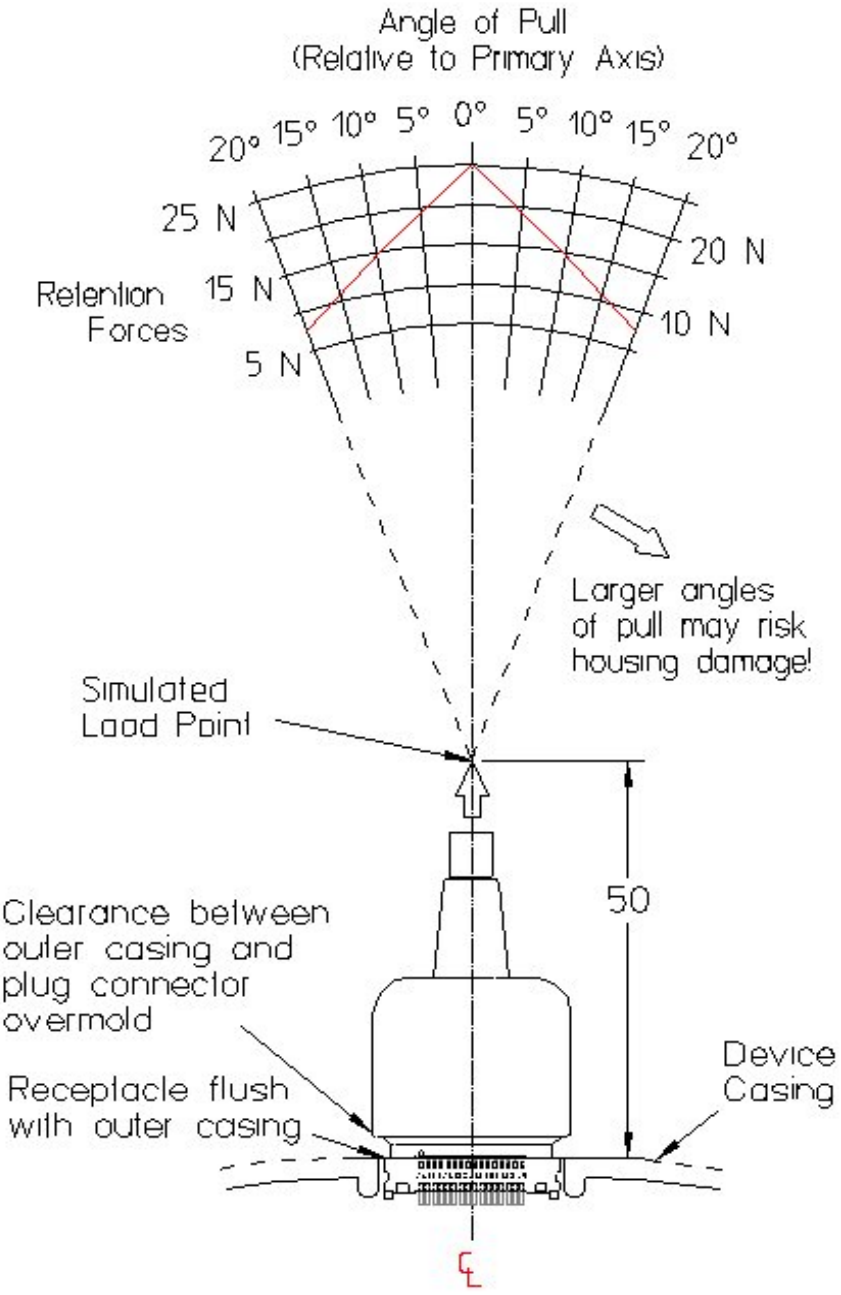
PCB shear strength is defined as the force necessary to irreperably damage or remove a soldered connector from the copper traces on a PCB. The connector is mounted in a vice and the forces are applied with a flat blade attached to a strain gauge tester as indicated in the diagrams, below. The peak force is recorded.



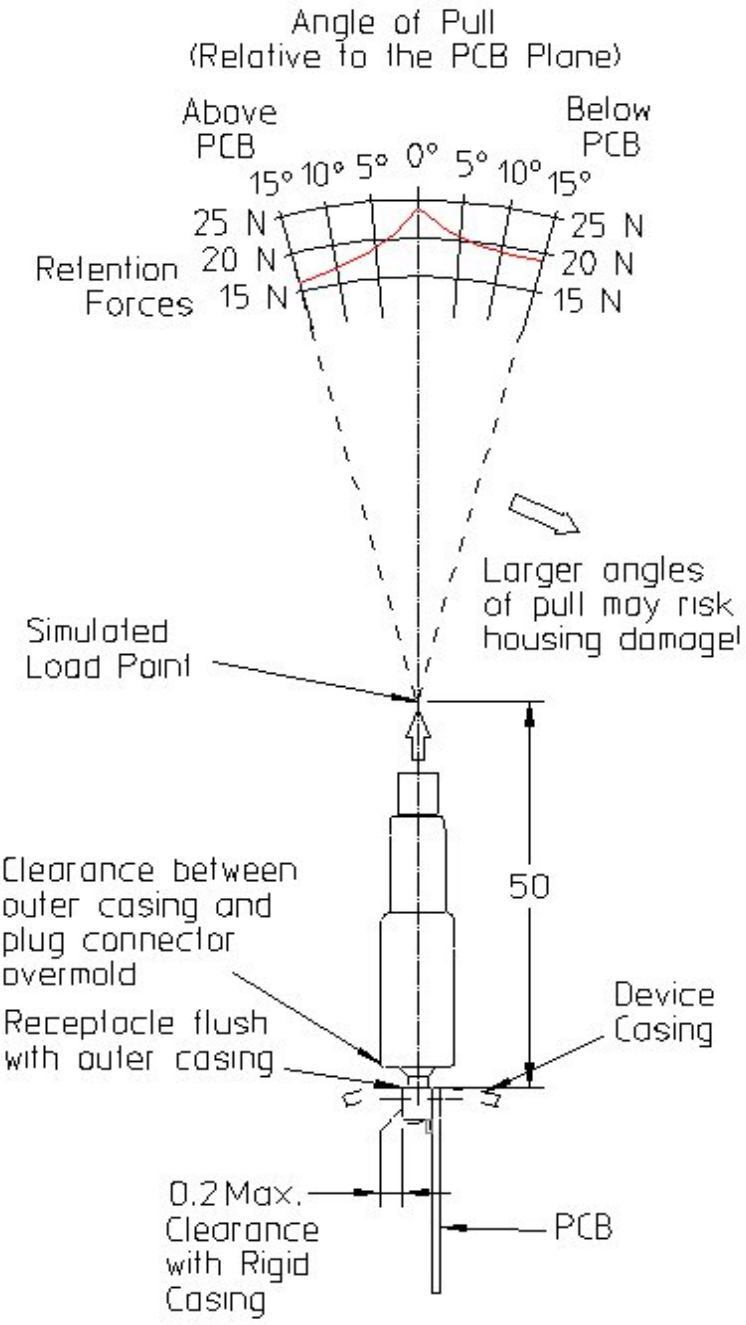
7.3 ANGULAR PULL FORCE TEST METHOD

A 16 circuit receptacle connector is soldered to a board and fixed to an angle measurement gauge that is mounted vertically. The force necessary to cause the plug connector latches to disengage is recorded at various angles and the results charted on a polar plot (see the diagrams on the pages that follow).
Units: Newtons, mm, degrees





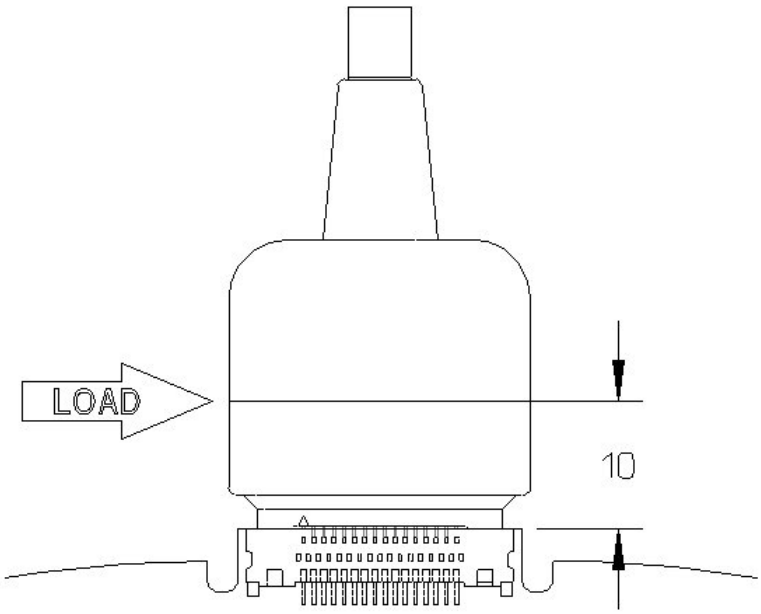
Note: Polar chart at the top of the diagram shows typical initial values. The actual change in retention force values from the axial (0 degree) pull may vary due to differences in the fit of the overmolded plug connector with the device casing, and the stiffness of both the cable and the overmolded strain relief. For further information, please see the application specification, AS-44828-001.



Note: Polar chart at the top of the diagram shows typical initial values. The actual change in retention force values from the axial (0 degree) pull may vary due to differences in the fit of the overmolded plug connector with the device casing, and the stiffness of both the cable and the overmolded strain relief. For further information, please see the application specification, AS-44828-001.

7.4 SIDE LOAD TEST METHOD

A 16 circuit receptacle connector is soldered to a board, and mated with a 16 circuit plug connector. A side-ways load, parallel to the mating front face of the receptacle housing is applied as shown in the diagram below. The force required to cause separation by one of the latches is recorded.
Units: Newtons, mm.

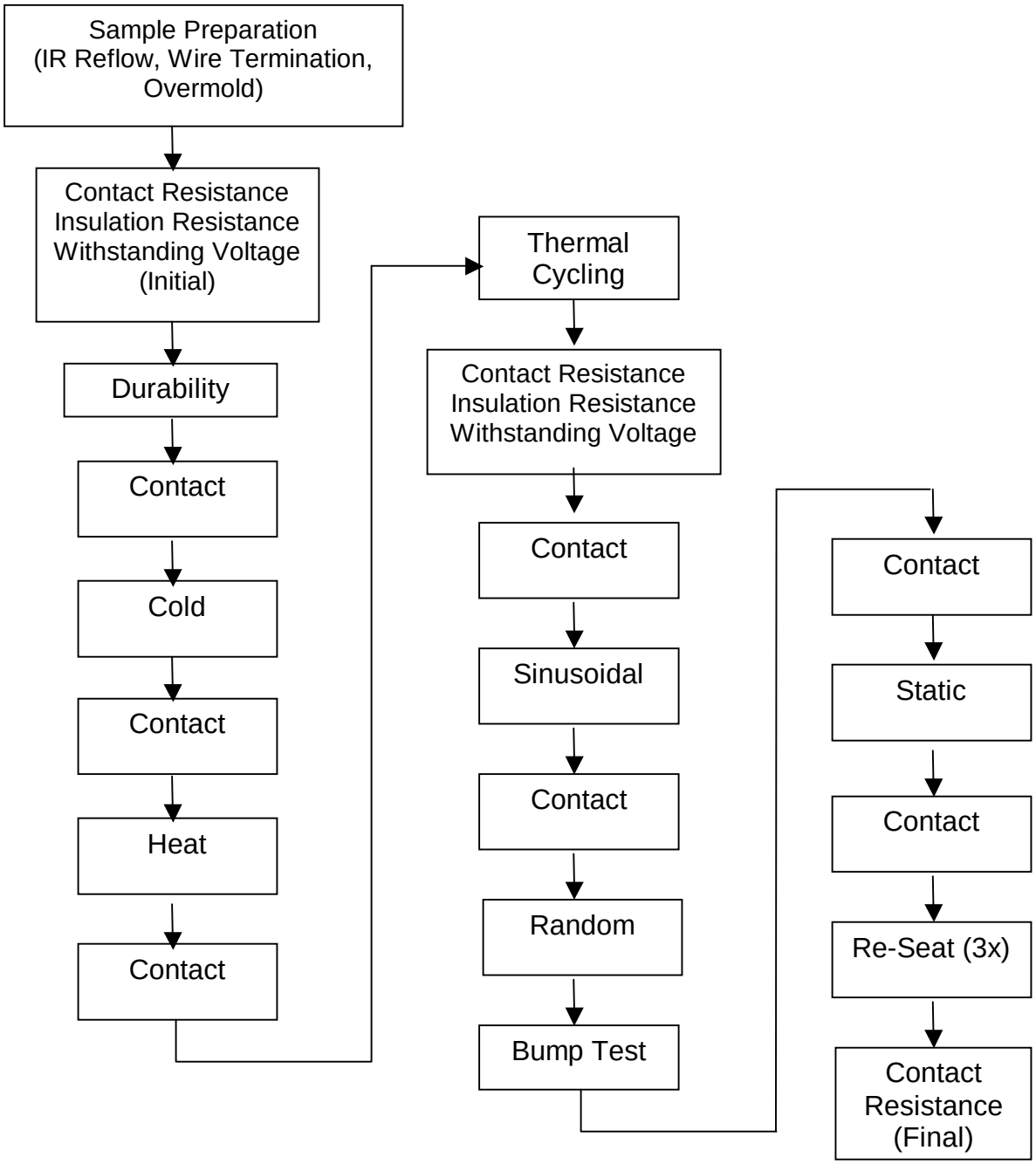


Note: The actual sustainable load may vary due to differences in the fit of the overmolded plug connector with the device casings. For further information, please see the application specification, AS-44828-001.

8.0 TEST PLAN

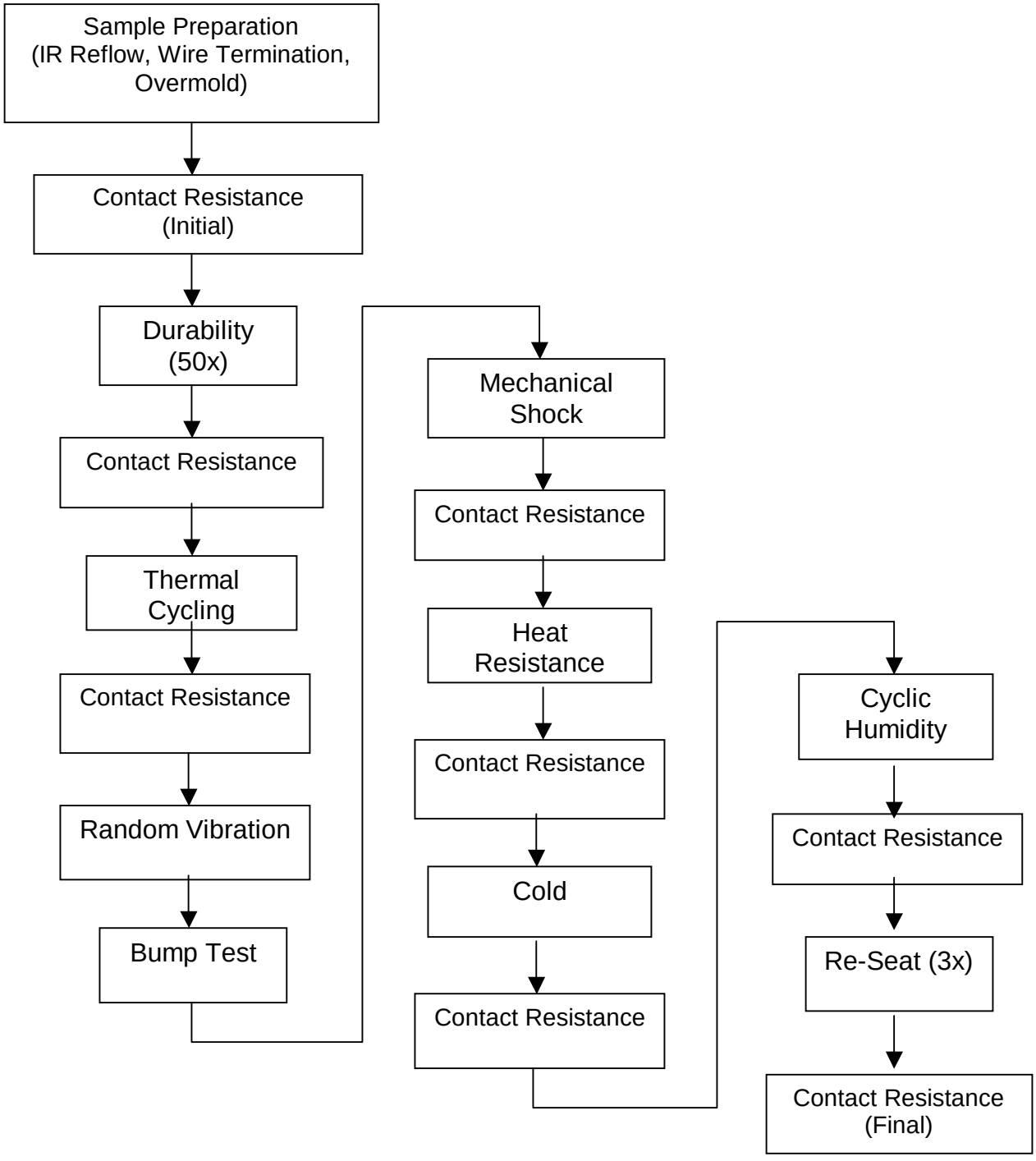
8.1 GROUP 1 - STORAGE AND TRANSPORTATION SEQUENCE

Sample Size: 5 mated connector pairs

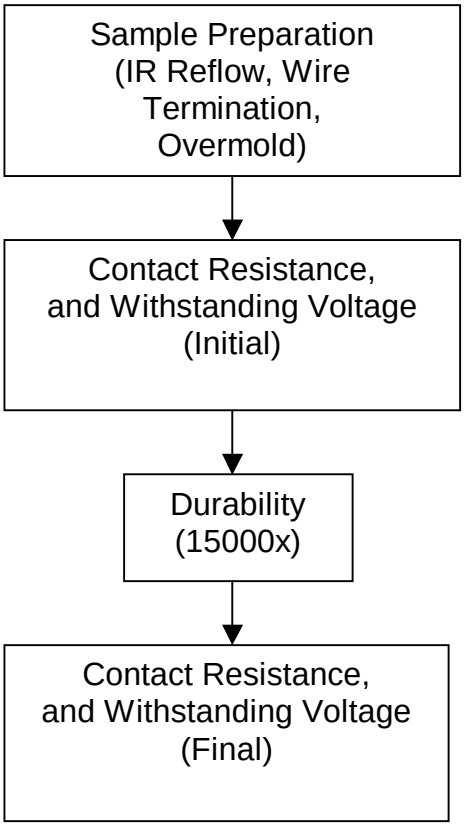


8.2 GROUP 2 - OPERATING SEQUENCE

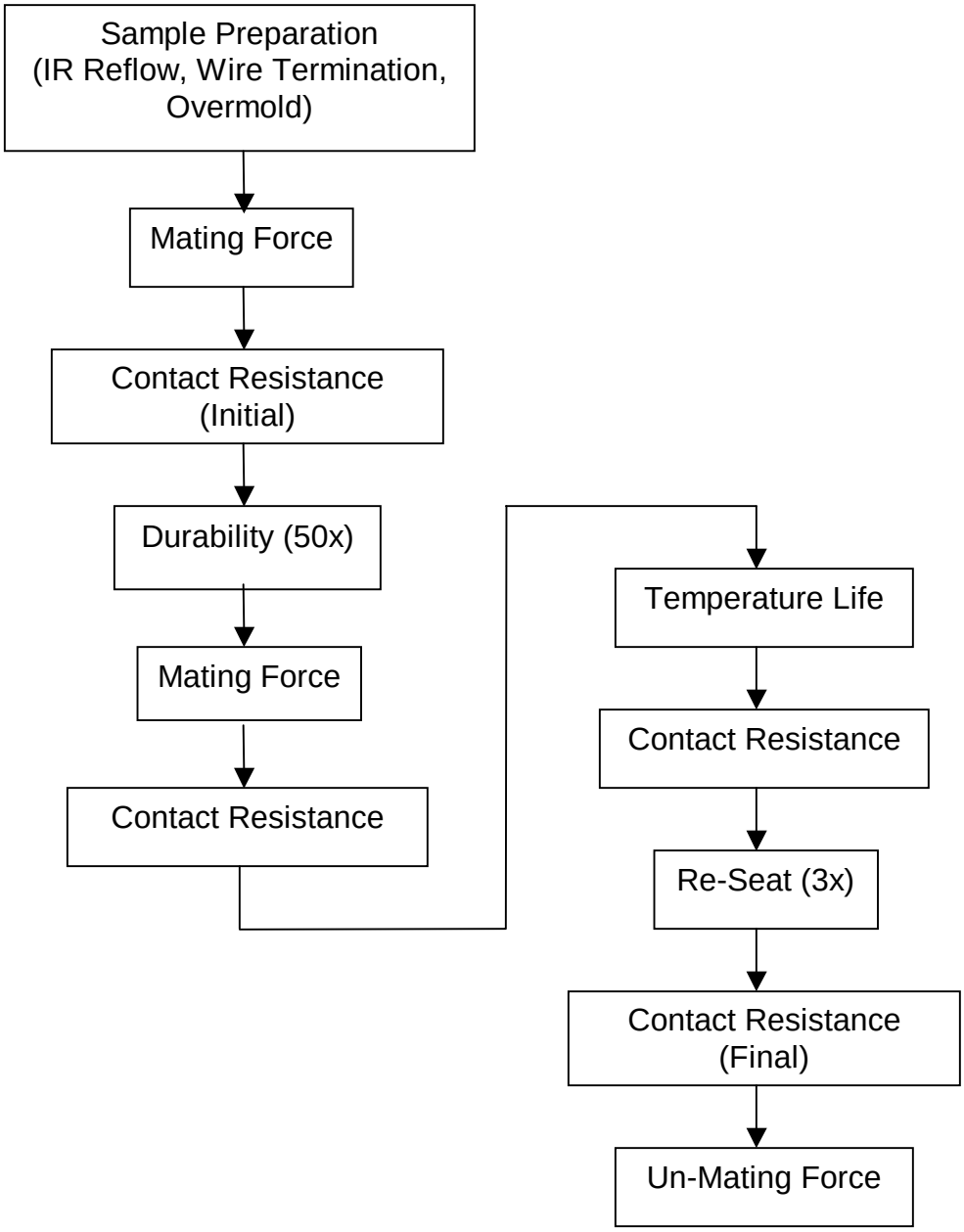
Sample Size: 5 mated connector pairs



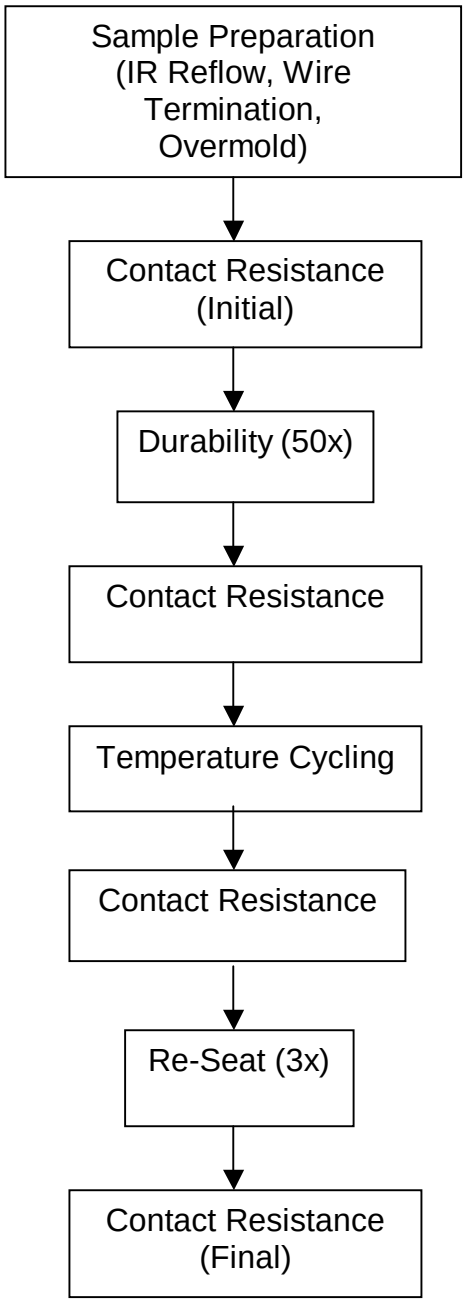
8.3 GROUP 3 – DURABILITY



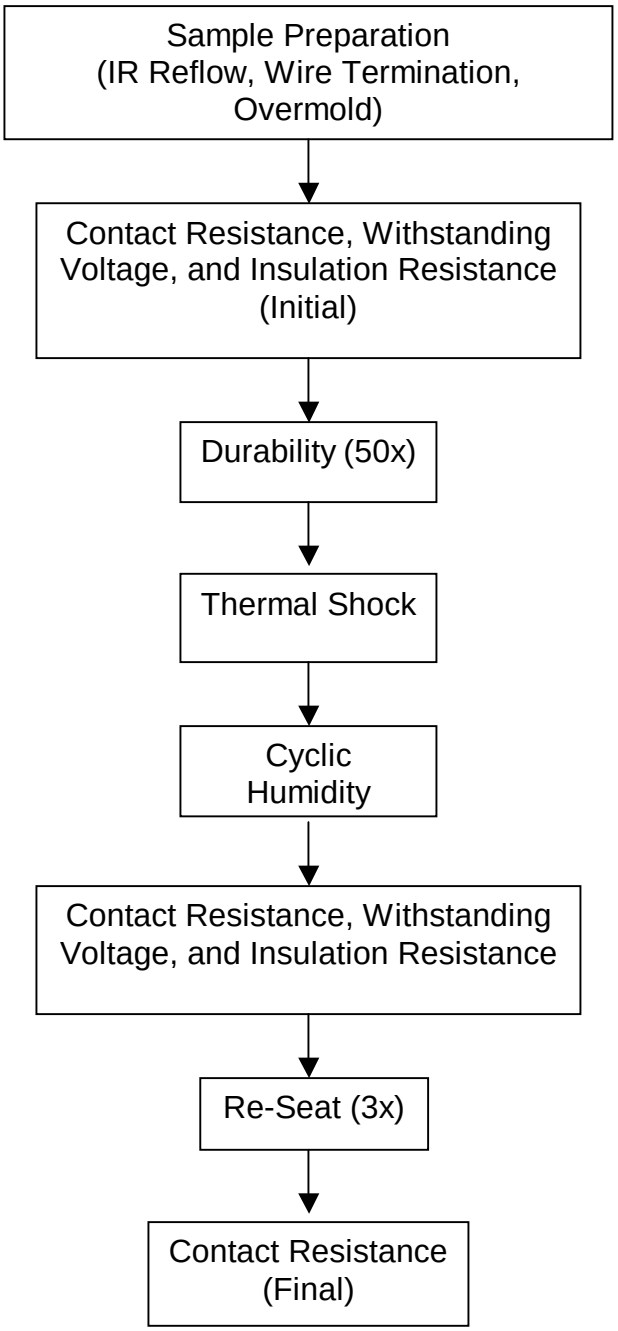
8.4 GROUP 4 - MATING / UN-MATING FORCES



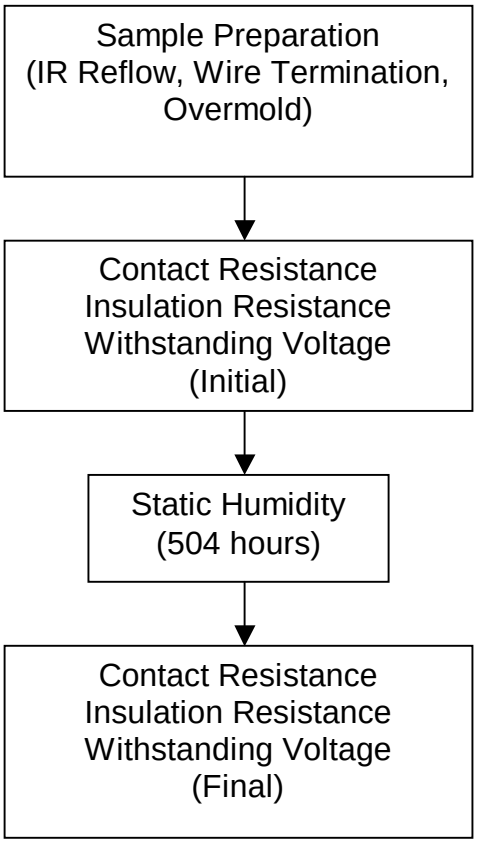
8.5 GROUP 5 - TEMPERATURE CYCLING



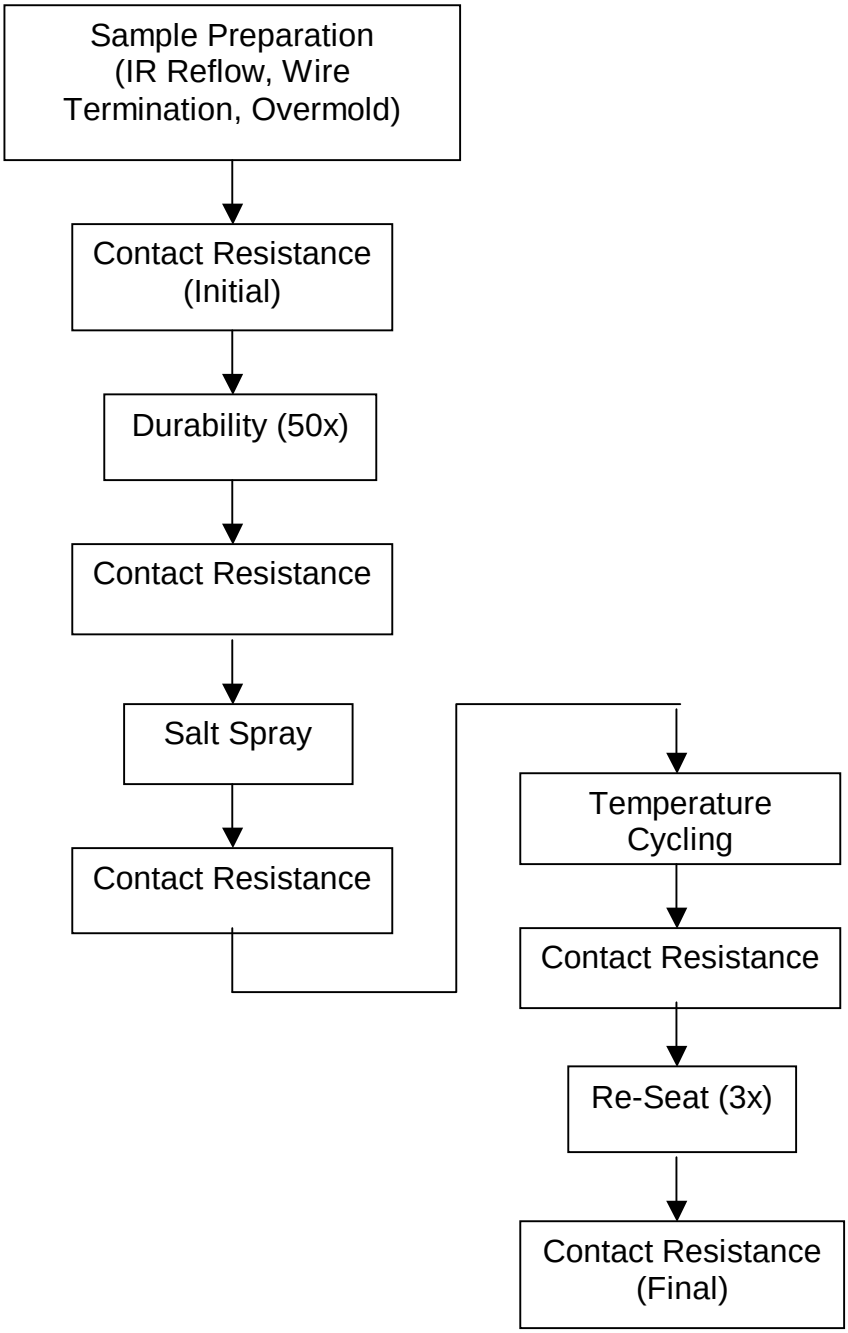
8.6 GROUP 6 - CYCLIC HUMIDITY



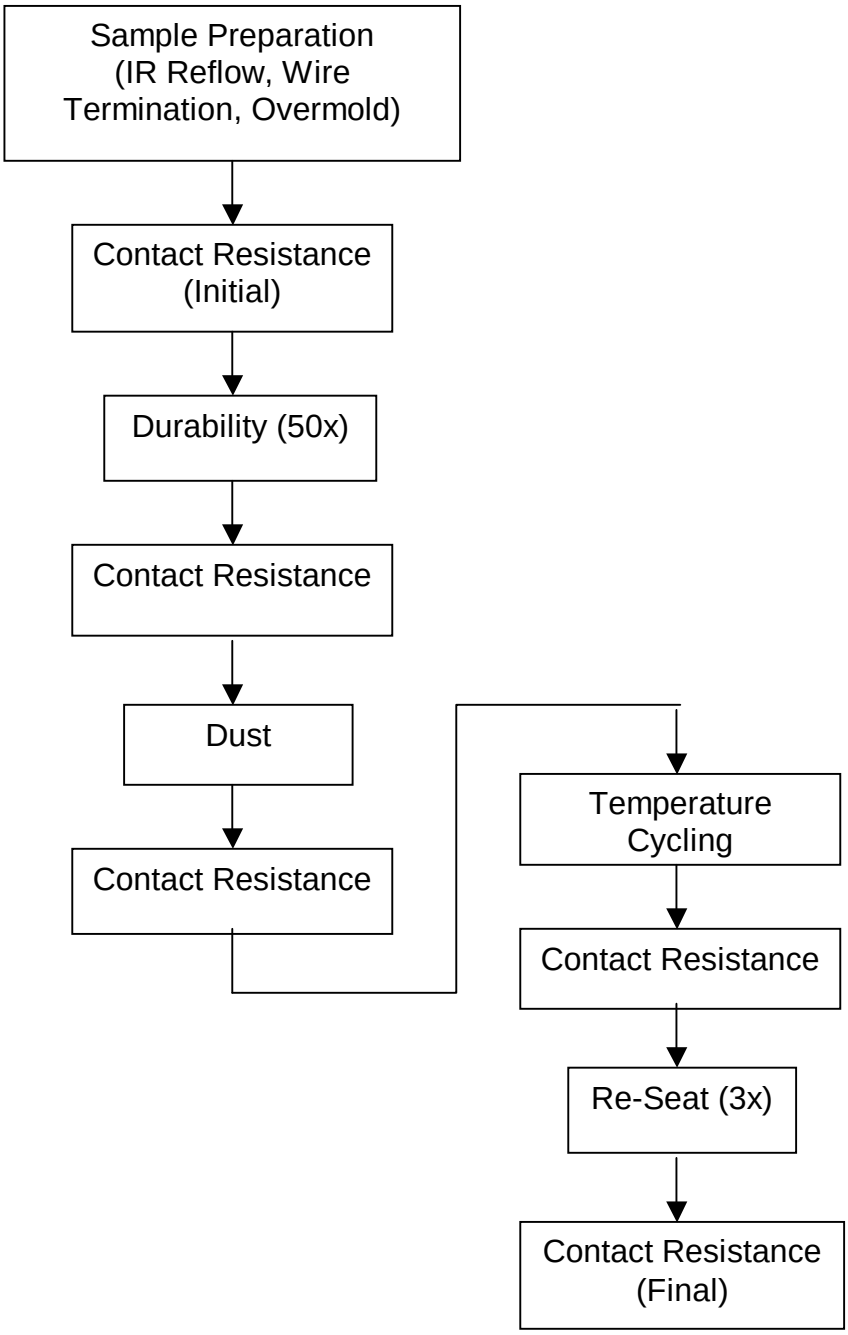
8.7 GROUP 7 - STATIC HUMIDITY



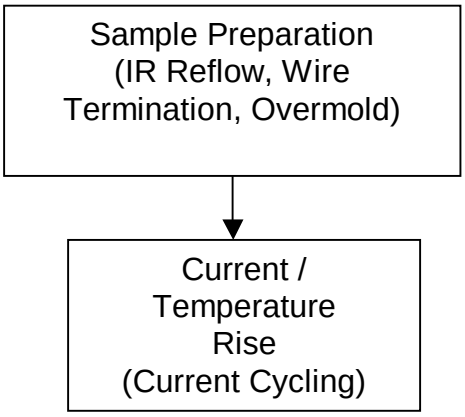
8.8 GROUP 8 - SALT SPRAY

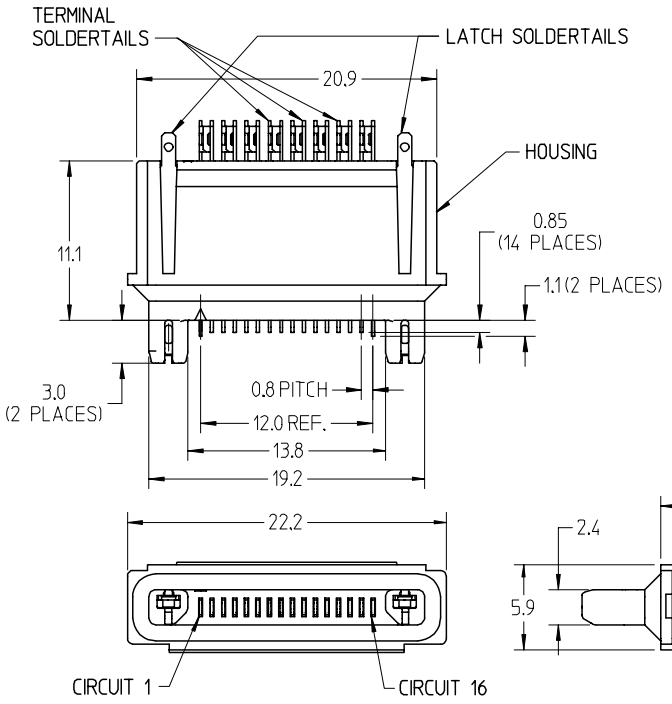


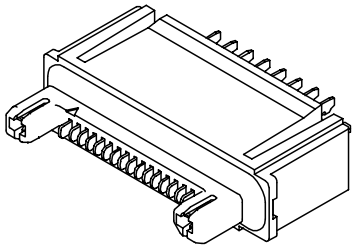
8.9 GROUP 9 – DUST



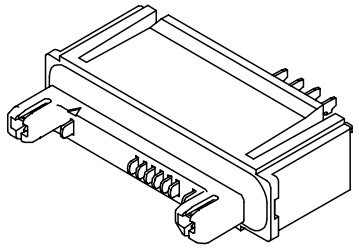
8.10 GROUP 10 - CURRENT / TEMPERATURE RISE







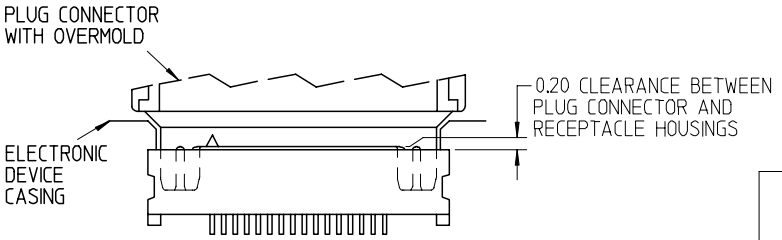
ISOMETRIC VIEW
16 CIRCUIT MODULE



MODULE WITH VOIDED CIRCUITS
(EXAMPLE)

NOTES:
1. MATERIALS:
   HOUSING - THERMOPLASTIC, UL94V-0, COLOR:BLACK
   TERMINALS - COPPER ALLOY
   LATCHES - STAINLESS STEEL
2. FINISHES: GOLD OVER NICKEL ON CONTACT AREAS,
   TIN OVER NICKEL ON SOLDER AREAS.
3. PRODUCT SPECIFICATION: PS-44828-001
   APPLICATION SPECIFICATION: AS-44828-001
4. PLEASE REFER TO MOLEX APPLICATION SPECIFICATION NO. AS-45339-001 FOR RECOMMENDATIONS FOR OVERMOLDING AFTER CABLE ASSEMBLY.
5. PACKAGED IN VACUUM-FORMED TRAYS (2100 PIECES PER CARTON).

NO. OF CIRCUITS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	MATERIAL NO.S
	TERMINAL LOCATIONS (PRESENCE DENOTED BY AN X)																
5				X	X	X	X									X	453391607
14	X	X	X	X	X	X			X	X	X	X	X	X	X	X	453391606
15	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	453391605
10	X	X	X	X	X	X		X	X			X	X				453391604
9	X							X	X	X	X	X	X	X		X	453391603
8	X								X	X	X	X	X	X		X	453391602
2	X															X	453391601
16	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	453391600



RECOMMENDATIONS FOR CONFIGURATION OF MATED CONNECTORS

IMPORTANT: PLEASE REFER TO MOLEX APPLICATION SPECIFICATION AS-44828-001 FOR DETAILED DESIGN LAYOUT AND MATING REQUIREMENTS

REVISED PER EC
EC NO: UCP2006-1391 2005/12/19
DRWN: MSIMMEL 2005/12/20
CHKD: MSIMMEL 2005/12/21
APPR: JCOMERCI 2005/12/21
DESCRIPTION
REV
A

QUALITY SYMBOLS
▼ = 0
▽ = 0

GENERAL TOLERANCES (UNLESS SPECIFIED)

	mm	INCH
4 PLACES	± ---	± ---
3 PLACES	± ---	± ---
2 PLACES	± 0.10	± ---
1 PLACE	± 0.13	± ---
ANGULAR ±1/2°		

DRAFT WHERE APPLICABLE
MUST REMAIN WITHIN DIMENSIONS

SCALE 3:1
DESIGN UNITS METRIC
THIRD ANGLE PROJECTION
REVISE ON CAD ONLY
DIMENSION STYLE MM ONLY
DRAWN BY MSIMMEL DATE 20051213
CHECKED BY MSIMMEL DATE 20051213
APPROVED BY COMERCI DATE

TITLE
0.8MM HANDYLINK™
PLUG CONNECTOR MODULES
FOR WIRE TERMINATION

MOLEX INCORPORATED

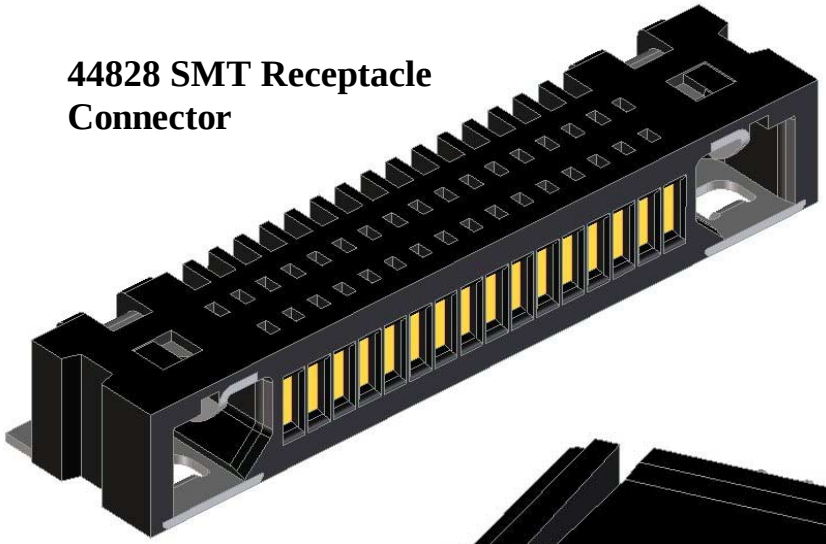
MATERIAL NO. SEE CHART
DOCUMENT NO. SD-45339-001
SHEET NO. 1 OF 26

B

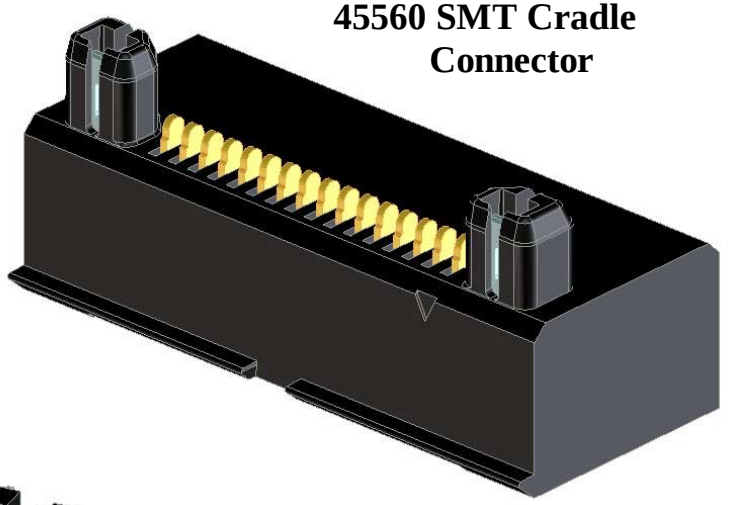
HANDYLINK™
APPLICATION SPECIFICATION

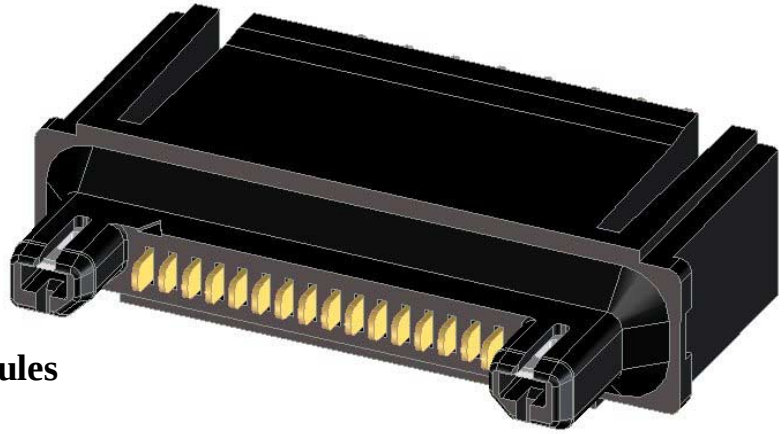
HANDYLINK™
I/O CONNECTORS

44828 SMT Receptacle Connector



45560 SMT Cradle Connector





45339 and 45593 Plug Connector Modules

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
A	EC No: **UCP2006- 1391** DATE: **2005/12/13**	**APPLICATION SPECIFICATION HANDYLINK™I/O CONNECTOR SYSTEM**	2 of 26

DOCUMENT NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPROVED BY:
SD-45339-001	**M. Simmel**	**Marc Simmel**	**Joe Comerci**

HANDYLINK™
APPLICATION SPECIFICATION

Table of Contents

1.0 SCOPE

This specification addresses the manufacturing techniques and end-usage considerations for Molex's 0.8mm pitch HandyLink™ I/O Connectors. The common contact interface used in this family of connectors consists of a flat pad mated to a radiussed edge on a compression spring blade. The flat pad is enclosed by plastic in an over-molded receptacle housing which provides a sealed ineterface to facilitate ingress protection. The compression spring blades are extremely durable and are capable of sustaining over 20,000 mating cycles. Two "passive" latches counteract the compression springs to keep the connector pairs mated but enable simple disconnection by the end-user.

The customer is encouraged to contact Molex with any questions regarding the application of this product.

2.0 PRODUCT DESCRIPTION

2.1 Product Names and Part Numbers

SMT Receptacle Connectors

Series: 44828

SMT Cradle Connectors

Series 45560 (Perpendicular and Parallel Mating)

Plug Connector Modules

Series 45339 (Wire Termination)

Series 45593 (PCB Termination)

2.2 Dimensions, Materials, Platings, and Markings

(See applicable sales drawings for information)

3.0 APPLICABLE DOCUMENTS AND SPECIFICATIONS

Product Specification: PS-44828-001; Sales Drawings: SD-44828-162, SD-45560-160, SD-45560-161, SD-45339-160, SD-45593-160

4.0 MATING AND UN-MATING OF CONNECTORS

This section describes the preferred methods for mating and un-mating the HandyLink™ connectors.

4.1 Recommendations for Mating and Un-Mating

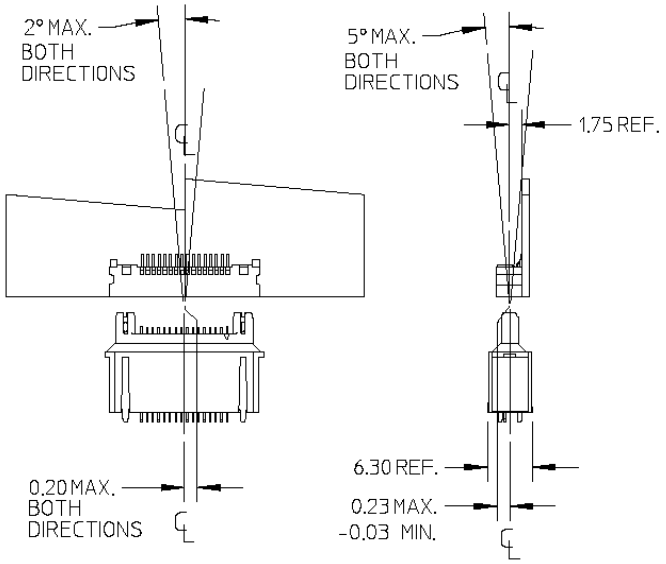
This connector system utilizes a "passive" latching feature. There is no button to press to latch or unlatch. To latch, simply push the plug into the receptacle (the connectors are polarized to discourage improper mating). To unlatch, simply grip the plug body firmly and pull it straight out of the receptacle.

4.2 Mating Alignment Tolerances

4.2.a 44828 Receptacle to 45339 or 45593 Plug Connectors

The HandyLink™ plug and receptacle have been appropriately designed and toleranced to be mated and unmated by hand. The connectors' alignment features are manufactured with clearances to allow axial mating mis-alignment, as illustrated in the Figure 1, below:

Figure 1. Receptacle to Plug Connector Axial Alignment (units: mm)

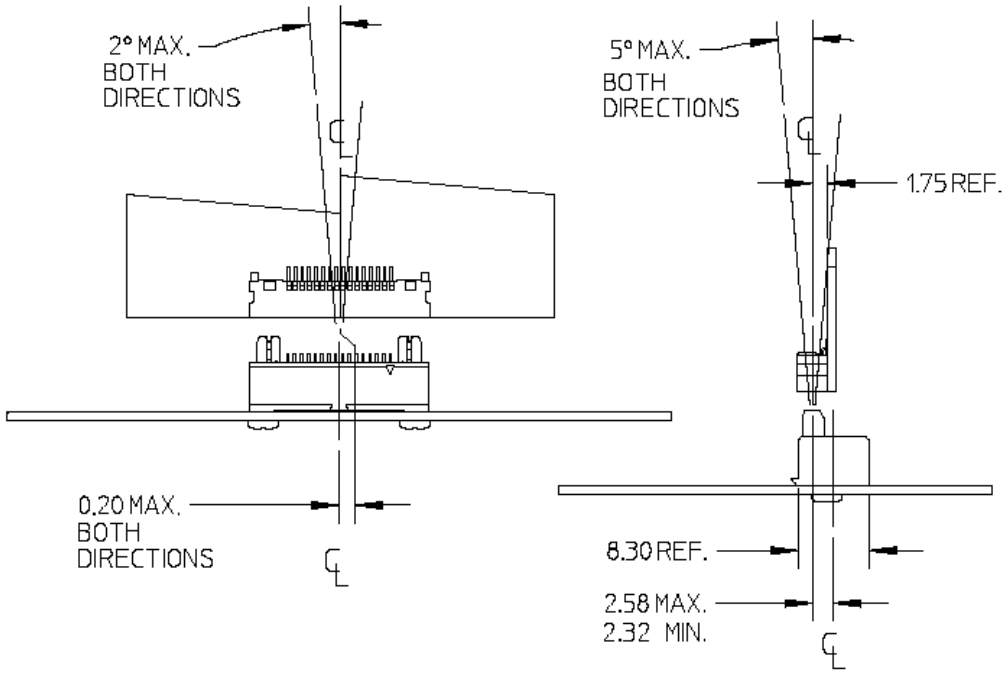


4.2 Mating Alignment Tolerances (continued)

4.2.b 44828 Receptacle to 45560 Cradle Connectors

The HandyLink™ receptacle and cradle connectors' alignment features are manufactured with clearances to allow some axial mating mis-alignment as illustrated in the Figure 2, below:

Figure 2. Receptacle to Cradle Connector Axial Alignment (units: mm)



NOTE: Mating misalignment may significantly influence the long-term durability of the connectors. The risk of housing wear diminishes with increasing the accuracy of connector alignment.

4.3 Clearances Between Mated Parts

The HandyLink connectors are designed such that the corresponding 'front' faces fully engage and then spring back 0.20mm to the final mated condition. This 'over-travel clearance' assures that the components of the passive latching system engage. Please see Section 6.4 Design Best Practices for further detailed information.

5.0 SOLDERING PROCESS RECOMMENDATIONS

5.1 44828 SMT Receptacle Connector

5.1.1 PCB Layout

See the applicable Sales Drawing for an illustration of the recommended PCB layout. Contact Molex if further assistance is required.

5.1.2 Solder Paste Stencil Layout

See Sales Drawing for solderable surfaces. Contact Molex if further assistance is required.

5.1.3 Reflow Profile

While the production solder reflow profile is typically established by the customer, based on their specific application, generic reflow profiles can be found in Product Specification PS-44828-001. The profiles are provided for reference purposes only.

5.1.4 Inspection

Solder joints should be inspected using established conventional methods.

5.2 45560 SMT Cradle Connector

5.2.1 PCB Layout

See the applicable Sales Drawings for illustrations of the recommended PCB pad layouts. Contact Molex if further assistance is required.

5.2.2 Solder Paste Stencil Layout

See Sales Drawing for recommended PCB pad layout and solder paste thickness.

5.2.3 Reflow Profile

While the production solder reflow profile is typically established by the customer, based on their specific application, generic reflow profiles can be found in Product Specification PS-44828-001. The profiles are provided for reference purposes only.

5.2.4 Inspection

Solder joints should be inspected using established conventional methods.

5.3 45339 Plug Module for Wire Termination

5.3.1 Applicable Wire Sizes

Copper conductor size: 22 to 34 AWG (stranded wires are recommended for flexibility) may be used,
however, 22 to 28 AWG conductors are necessary to transmit 1.5 Amperes DC continuously.
Maximum insulation diameter: 1.6mm
NOTE: Small conductor sizes are suitable for the transmission of digital signals, and may improve wire bundle flexibility and harness workability.

5.3.2 Wire Preparation

Strip length: 2.0 ~ 2.5mm
Pre-tinning is recommended.

5.3.3 Inspection

Solder joints should be inspected using established conventional methods.

5.4 45593 Plug Module for PCB Termination

5.4.1 PCB Layout

See the applicable Sales Drawing for an illustration of the recommended PCB hole layout.

5.4.2 Inspection

Solder joints should be inspected using established conventional methods.

6.0 MECHANICAL MOUNTING RECOMMENDATIONS

6.1 Mechanical Fasteners and Support

6.1.1 Receptacle Connector

Molex recommends that the receptacle connector be mounted within the end-application enclosure such that it is recessed by 1.6 to 2.4mm from the outermost faces and with a 0.10mm maximum clearance with the casing inner walls. Such a recess provides multiple advantages in terms of protecting the contact surfaces from accidental impact with foreign objects, providing mechanical support when the mating plug connector assembly is torqued by abusive handling, and helps to reduce direct contact with hand oils or other contamination. See Figures 3A and 3B, below, for recommendations on recess dimensions.

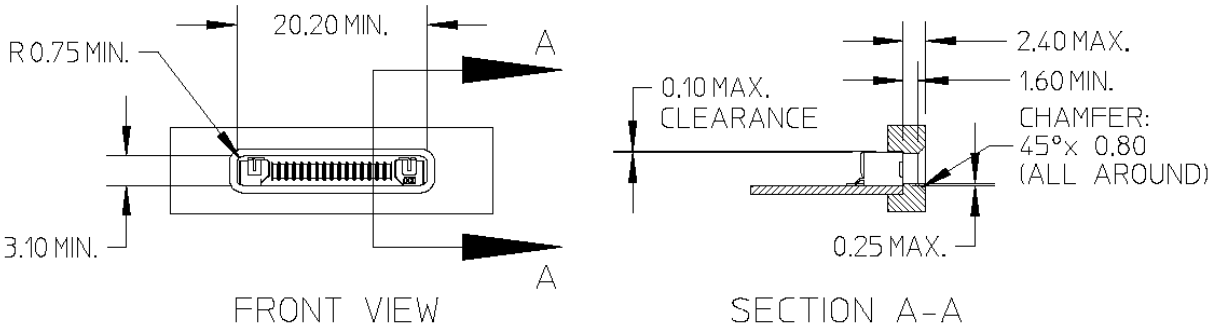


Figure 3A. Receptacle Connector Recess When Mating with the Plug Only (units: mm)

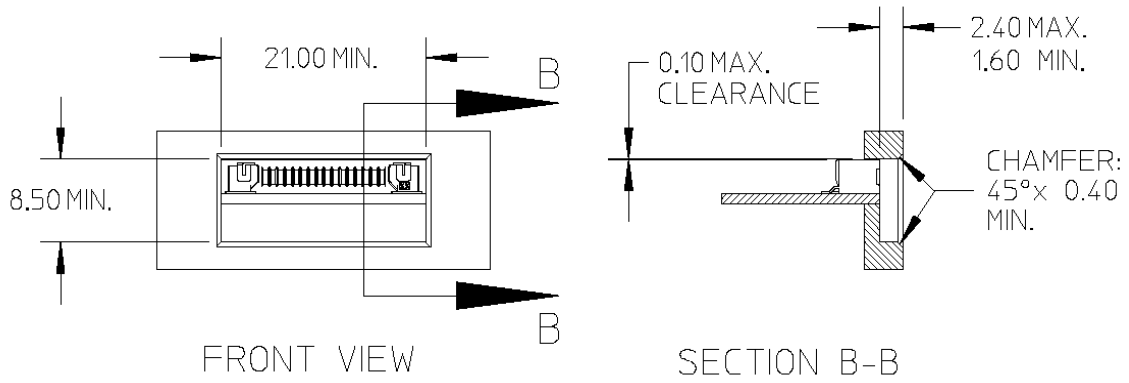


Figure 3B. Receptacle Connector Recess When Mating with the Plug or Cradle Connectors (units: mm)

Wherever possible, the 0.10 maximum clearance condition with the receptacle should be minimized by utilizing a clam-shell style package design.

6.1.2 Plug Connector Module

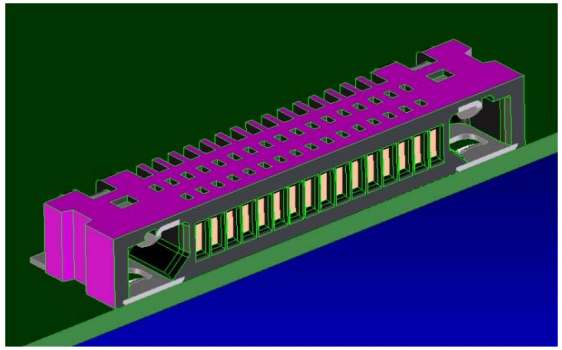
The plug connector module is intended to be used as a part of a assembly using either direct wire soldering (**45339**) or using an intermediary PCB (**45593**). Overmolding and/or clam shell style covers must be used to protect the wire connections and the appropriate service loops and wire strain reliefs must be incorporated in a cable assembly to prevent damage during use. Please refer to section 6.3 for further details about the over-molding process.
If the connector module is used as a stand-alone component on a PCB, the mating interface must be adequately supported. Please refer to section 6.4.2 for further details concerning cradle design recommendations.

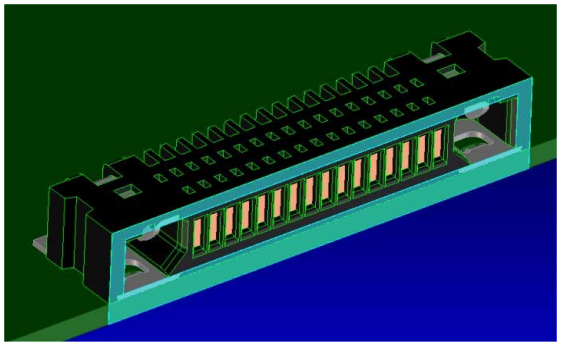
6.1.3 Cradle Connector

The cradle connector is designed to be fastened to the PCB with screws. See Sales Drawings for recommended screw size and positions. Please refer to section 6.4.2 for further details concerning cradle design recommendations.

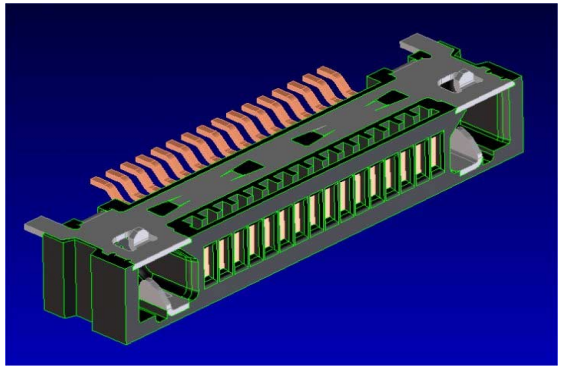
6.2 Ingress Protection

Ingress protection, as described by IEC 60529, is a function of the customer's enclosure. The HandyLink™ Receptacle Connector has been designed to facilitate enclosure design when ingress protection is required. The interfaces between the metal and plastic components of the connector are sealed to discourage intrusion of dust and liquid through the connector into the enclosure. The customer is expected to design an appropriate seal around the periphery of the connector to adequately seal the finished enclosure. Contact Molex for additional information.





Gaskets may be applied to the top and sides, or front surfaces.



The bottom surface, once soldered, forms a continuous seal with the PCB

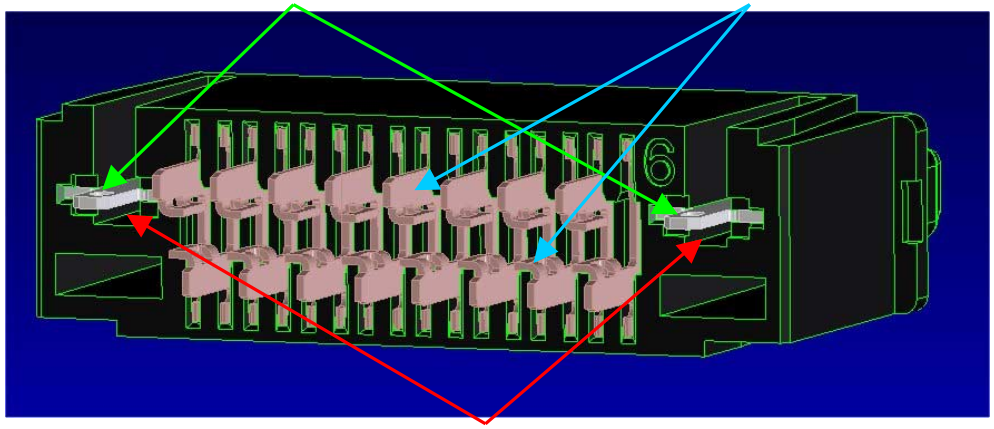
Figure 4. Sealing to achieve ingress protection with the receptacle connector

6.3 Plug Cable Over-Molding

6.3.1 Wire Soldering

This section provides an outline of the recommended plug cable over-molding practices for the 45339 and 45593 plug connector modules. The 45339 connector (a 16-circuit wire termination version) is shown, below, prior to soldering. Please note the following features:

Latch soldertails (2 places) Wire soldertails (2 rows)



Cavities under the latches (2 places)

Figure 5. Soldertail side of the plug connector

Pre-tinned wires should be terminated to the appropriate solder tails working in sequence and one row at a time, taking care that the insulation does not become exposed more than 1mm from the end of the terminals. The completed assembly after soldering of the wires is shown below. Dressing of the wires should be avoided until after the soldering and encapsulation processes are complete.

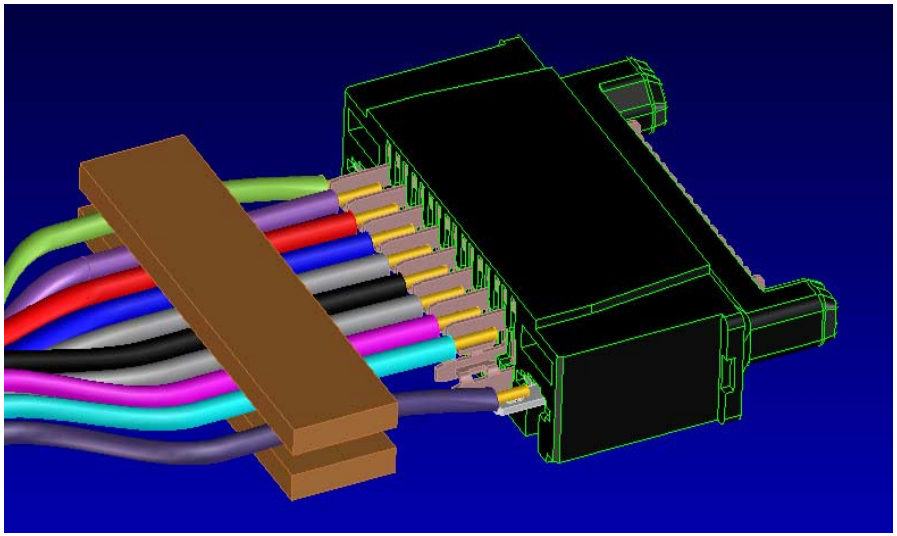


Figure 6.
Plug Soldering Set-Up

NOTE**:** The wire bundle must be properly supported or clamped as shown, during soldering and handling, to avoid dislodging terminals or latches from the housing prior to encapsulation, application of a strain relief, and the final over-mold.

6.3.2 Encapsulation

The next step after soldering is to pre-seal or encapsulate the back end of the connector and hold the wires in place using a silicone sealant or a low-pressure Macro-melt polyamide adhesive molding. The sealant will prevent accidental shorting between adjacent terminals and discourage intrusion of over-mold resin into the terminal and latch cavities. An illustration of the pre-seal coverage is shown below. Care must be taken to ensure that no encapsulant enters the terminal or latch cavities.

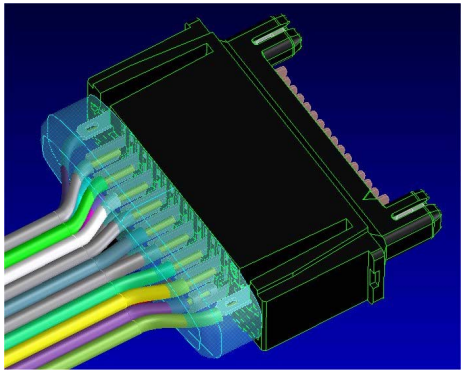


Figure 7.
Encapsulated plug connector

An alternate method is to combine one or more molded 'covers' to block entire sections where void circuits are present, then use a pre-seal or encapsulant to hold the wires separate. This is illustrated below.

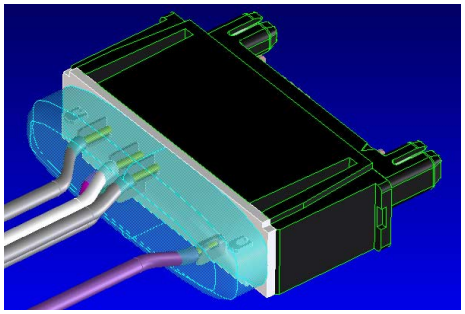


Figure 8.
Covered and encapsulated plug connector

NOTE: The sealant or cover should enclose the cavities under the latches, whether or not wires are soldered to the latches. Omission of this step would allow the final over-mold resin to extrude into cavities in the housing that could disable latch and terminal function.

6.3.3 Strain Relief

Molex strongly recommends the use of a crimp barrel or ferrule over the wire bundle (including ground or drain wire) that also captures the cable jacket and tension member, if used. This will uniformly distribute mechanical loads through the wire bundle and provide mechanical support to the cable jacket and tension member.

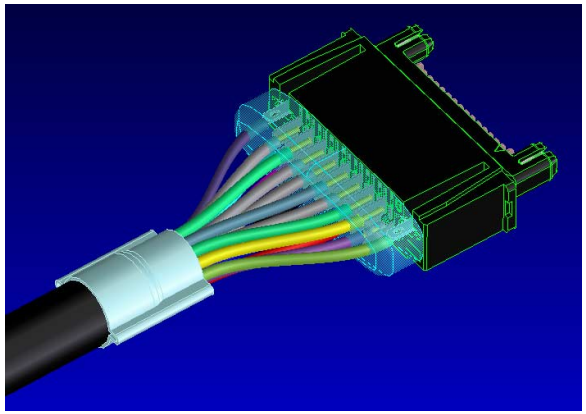


Figure 9.
Crimp barrel installed

6.3.4 Final Over-Molding

The final PVC over-mold may be injection-molded to completely cover the prepared cable assembly to provide an esthetically pleasing finished product. Please see Section 6.4.1 for a discussion of design best practices for the over-mold.

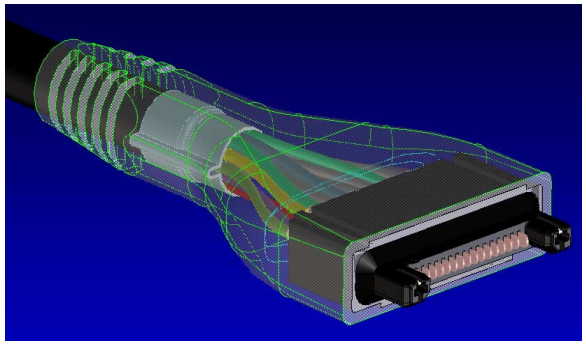


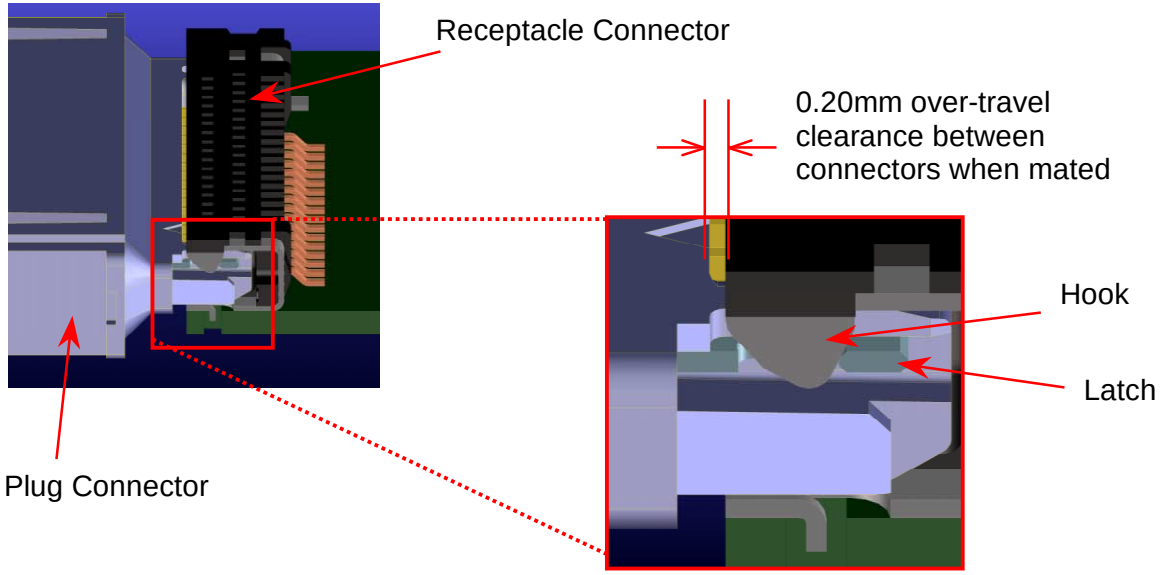
Figure 10.
Finished over-mold (shown transparent)

6.4 Design Best Practices

The information provided so far in this document has been related to the basic usage conditions of the HandyLink™ connectors. The sections that follow contain important information and guidelines for design that apply to specific applications or industrial design constraints for the end-product accessories. In all cases, Molex advises that prototype assemblies be used as early in the design and development cycle as possible to simulate and assess true usage conditions in the actual end-products.
Please contact Molex for technical assistance with design feasibility studies or design reviews.

6.4.0 Mating Over-Travel Clearance

The HandyLink connectors are designed such that the corresponding 'front' faces fully engage and then spring back 0.20mm to the final mated condition. This 'over-travel clearance' assures that the components of the passive latching system engage, as illustrated in Figure 11. This clearance must be accommodated in all device and accessory designs top assure proper function.



6.4.1 Plug Over-Mold Designs

Supplemental guide features to align the connectors during mating or un-mating are strongly recommended if any of the following conditions are present:

- A great deal of curvature in the end product (such as that illustrated, below);
- The accessory cable is stiff or bent abruptly;
- The mass of the end-product itself is greater than 1000grams and is likely to experience more than 1g of acceleration during use or under vibration;
- The cable connection and disconnection cycles are numerous (more than 5000 cycles);
- There is significant risk of the end users pulling at connections in off-axis directions.

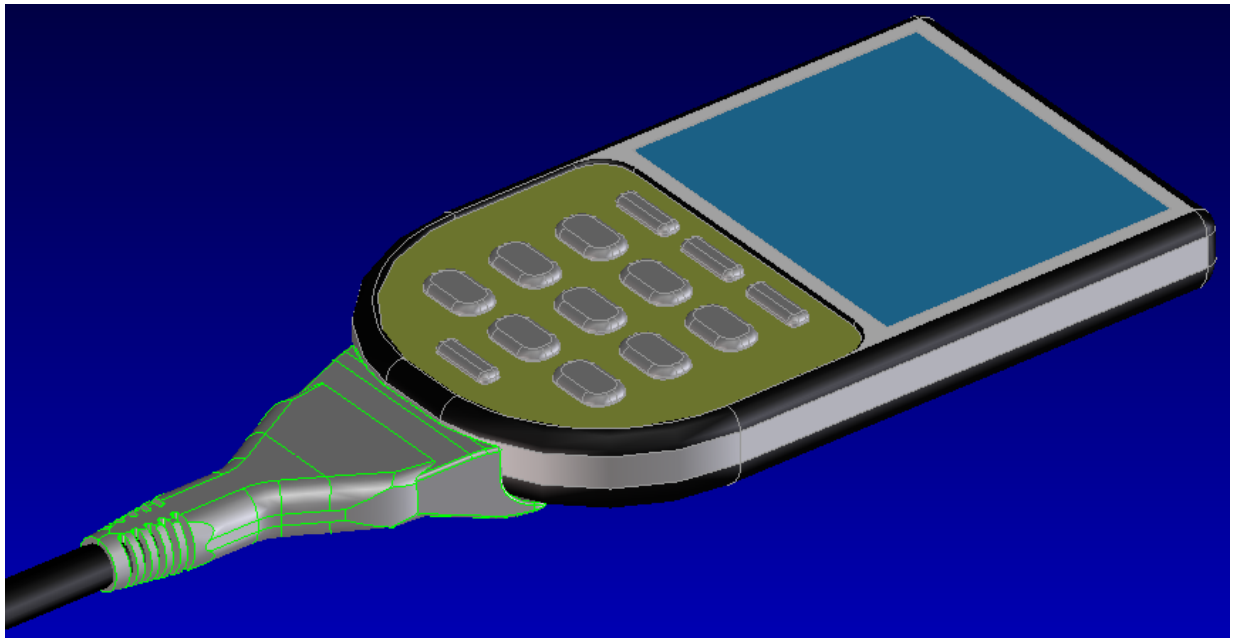


Figure 12. Example of an application with a great degree of curvature near the connector interface.

Supplemental guide features may be incorporated into or complement the over-mold design as illustrated in Figures 12 and 13:

- **Contouring with a Lip**

To provide mechanical support for torque out of the axial plane of the connectors, the over-mold must be designed to mimic the outer surfaces of the end product and include a lip such as illustrated below. NOTE: The axial clearance condition between the connectors noted in section 4.2 must be maintained.

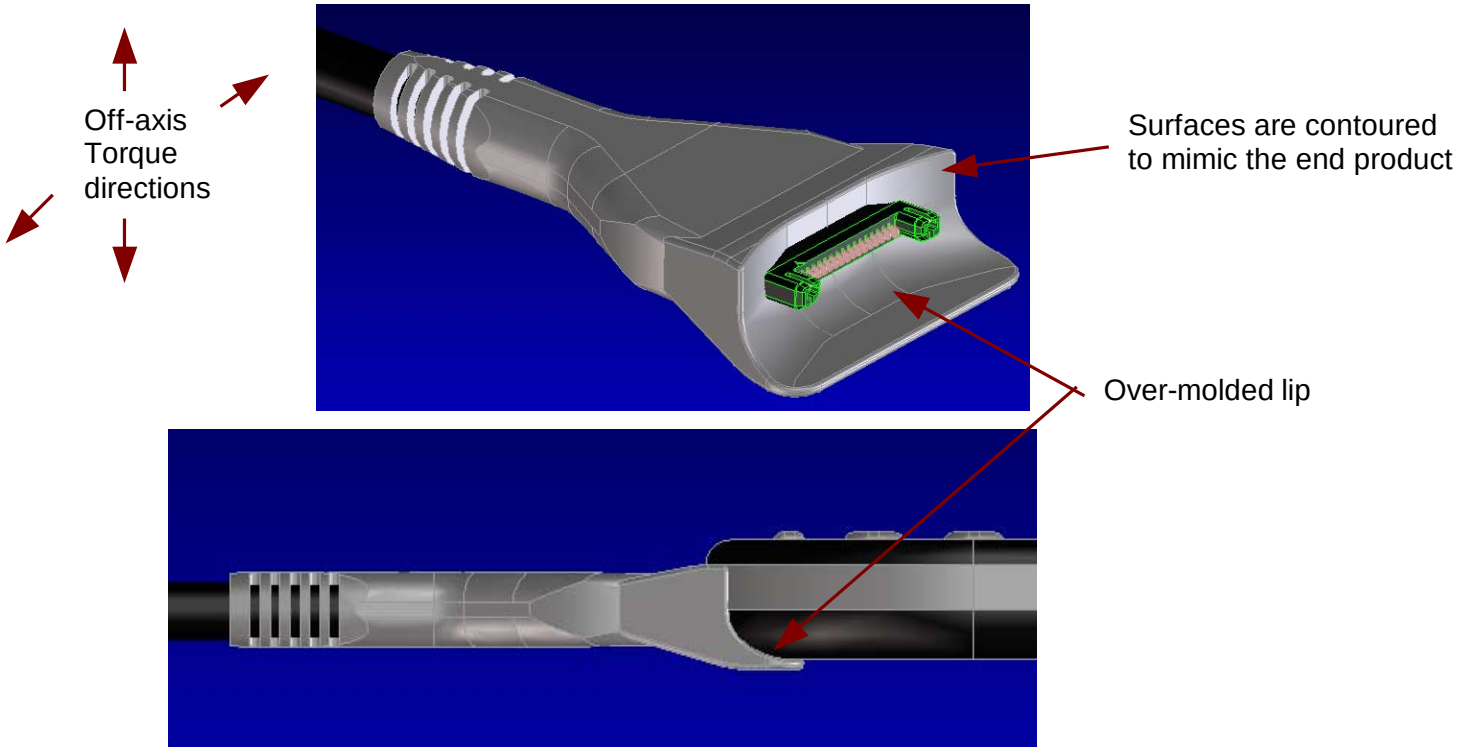


Figure 13. Example of an over-mold with contouring and a lip

This type of design will provide support for the end-user to hold the product by the connector or where a heavy or stiff accessory cable is used.

- **Supplemental Latching and Alignment Posts**

Where the mass of the end product is greater than 1000 grams and is subject to sudden accelerations or strong vibrations during use, a cup-style receptacle needs to be considered to adequately protect the connection interface. The cup-style receptacle should incorporate separate external latching features and supplemental alignment posts similar to those illustrated below. NOTE: The cup-style receptacle's dimensions must restrict angular misalignment, when mated, to within the limits specified in Section 4.2.

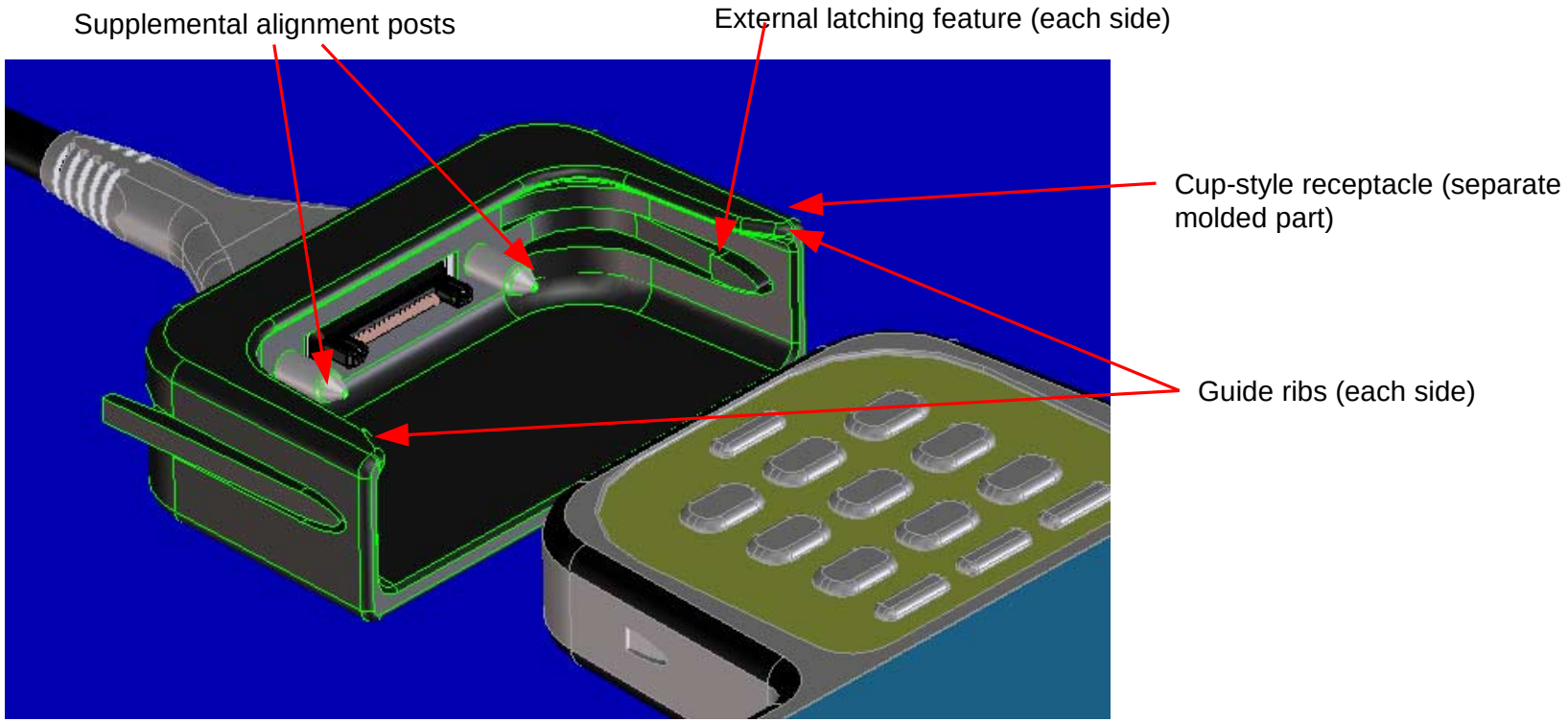


Figure 14. Use of a cup-style receptacle for added support and alignment

Supplemental alignment posts must be longer than the protrusion of the plug connector posts from the base surface of the cup-style receptacle. Further, the alignment posts' centerlines must lie in the same plane as the centerlines of the plug connector posts to provide the greatest benefits. Guide ribs are necessary to prevent front-to back rocking motion as the device is loaded into the cup-style receptacle.

NOTE: The fastening of the cup-style receptacle to the over-molded plug must be kept tight to avoid misalignment. If this is not achieved, excessive wear between the connector housings and/or electrical discontinuities may occur.

6.4.2 Cradle Designs

- **Cup Style**

The cup or holster style of cradle provides the greatest degree of alignment between mating connectors. Where the end product mass is greater than 1000 grams the use of supplemental alignment posts is recommended. The alignment posts' effective length (not including any lead-in taper) must be longer than the protrusion of the connector posts from the base surface of the cup-style receptacle. Further, the alignment posts' centerlines must lie in the same plane as the centerlines of the plug connector posts to provide the greatest benefits. Guide ribs are necessary on each side to limit front-to back rocking motion as the device is loaded into the cup-style cradle.

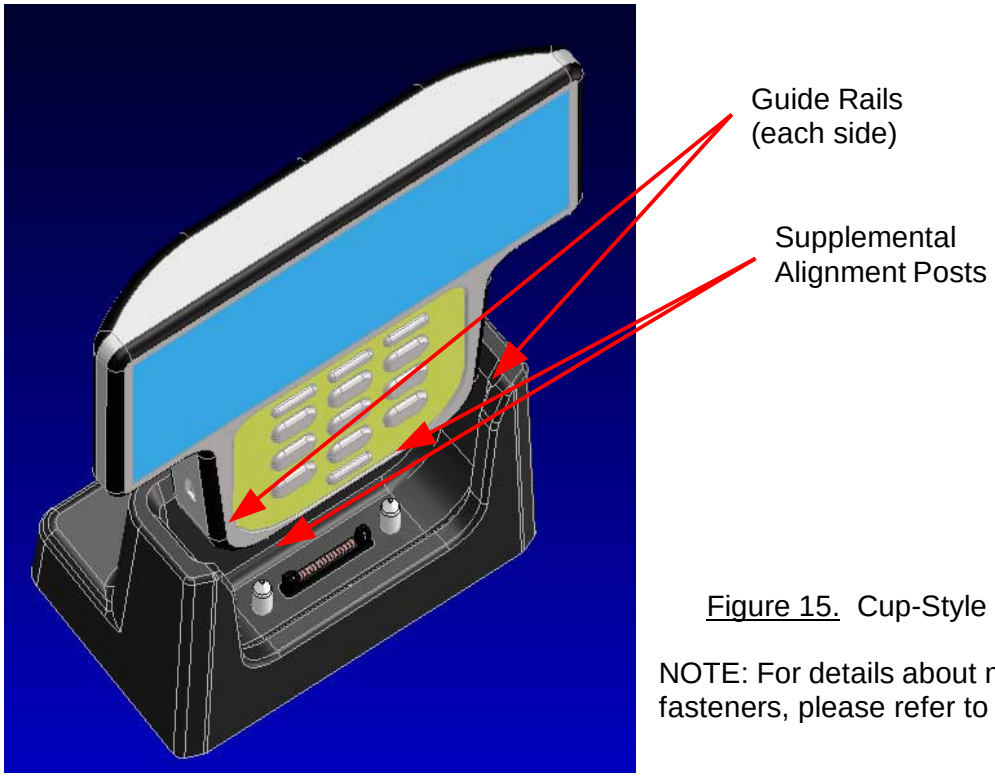


Figure 15. Cup-Style Cradle Features

NOTE: For details about mounting the connectors to the PCB and the use of fasteners, please refer to the applicable Sales Drawings.

Figures 16 and 17 show orthogonal views of showing differences in the position and size of the openings in the cradle casing, and the PCB location for the 45560 and 45593 connectors. Figure 18 shows a chamfer detail applicable to 45593.

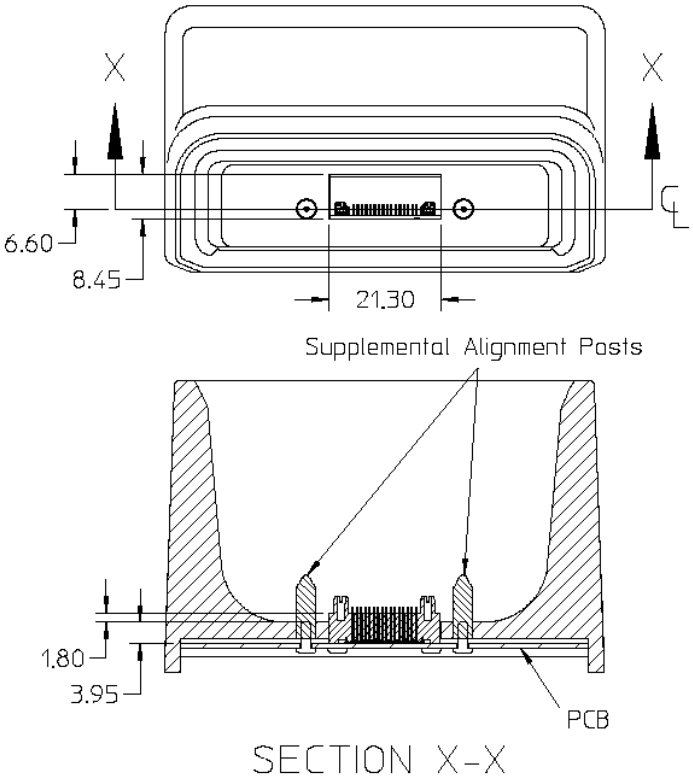


Figure 16. Cradle Detail (45560)
(units: mm)

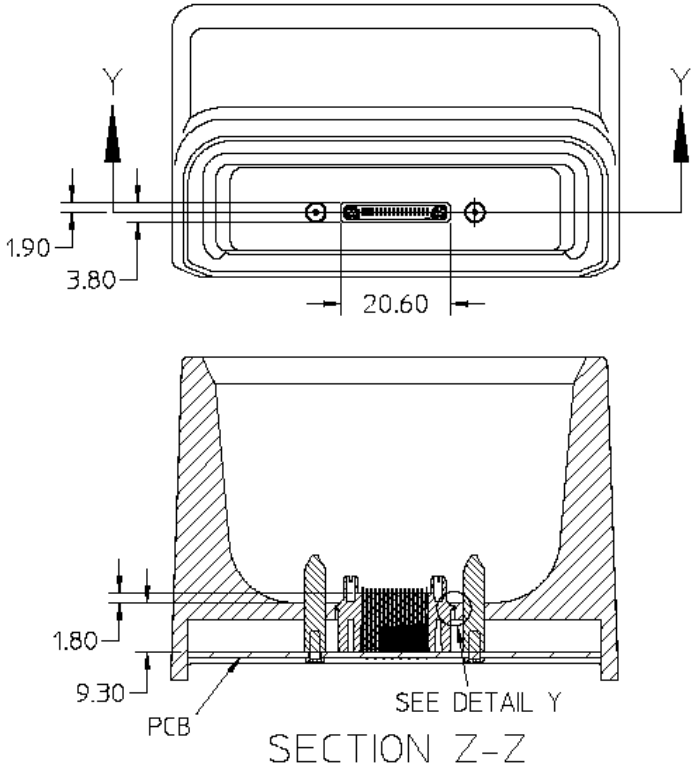


Figure 17. Cradle Detail (45593)
(units: mm)

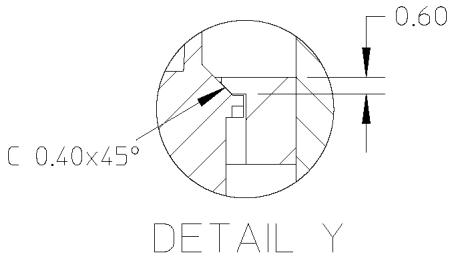


Figure 18. Detail from Fig. 17.
(units: mm)

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SD-45339-001	**M. Simmel**	**Marc Simmel**	**Joe Comerci**

- **Shelf Style**

To achieve a 'rocking' disconnection for the end product from the cradle, a shelf style cradle design may be used under the following conditions:

- No supplemental guide posts may be used;
- The end product may not have more than 1000 grams mass;
- Side-to-side motion must be limited using end-walls or a guide rail;
- The vibration conditions of the end application must be limited.

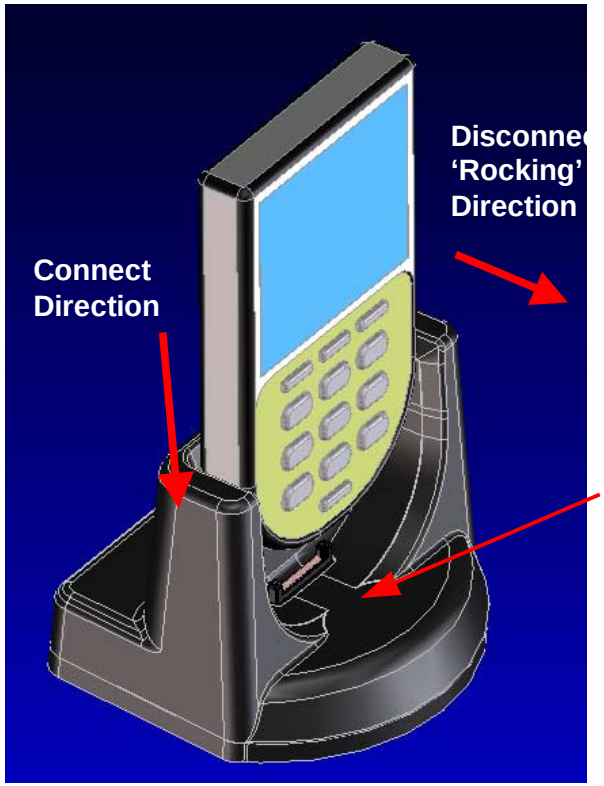


Figure 19. Shelf-Style Cradle Features

NOTE: For details about mounting the connectors to the PCB and the use of fasteners, please refer to the applicable Sales Drawings.

In addition to the differences in the position and size of the openings in the cradle casing, the PCB location for the 45560 and 45593 connectors, and the chamfer detail applicable to 45593 that is shown in Figures 16 thru 18. Figures 20 through 22 illustrate details necessary to achieve a good 'rocking' design.

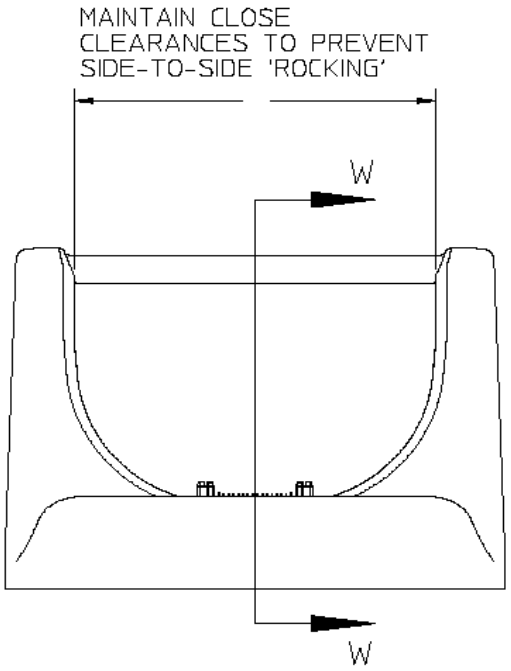


Figure 20. Front View of Shelf-Style Cradle

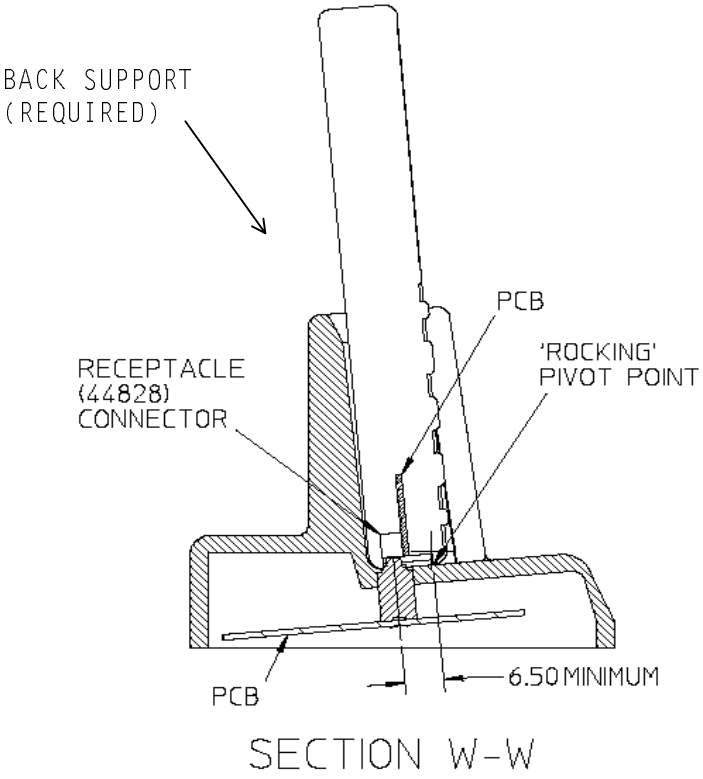
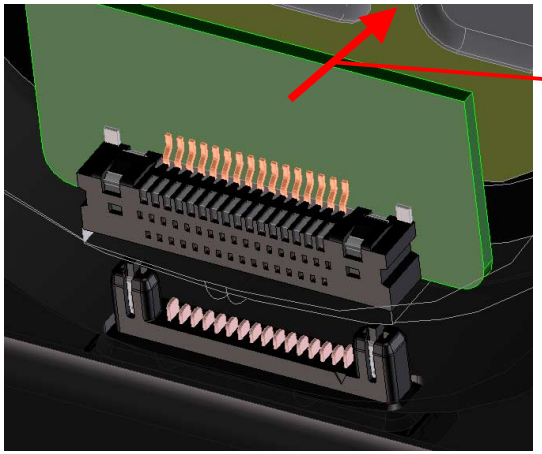


Figure 21. Section View of Shelf-Style Cradle (units: mm)



NOTE: Orientation of the receptacle connector and the plug or cradle connector must correspond to that shown for good operation of a 'rocking' design.

Figure 22. Connector Orientation

7.0 Electrical Recommendations

7.1 Power Considerations

Please see the Product Specification, PS-44828-001, for the nominal electrical specifications. For applications where the sustained electrical power usage requirements exceed the limits stated in the product specification, the use of multiple circuits is suggested.

When the end-application is likely to encounter salt spray conditions, potential differences exceeding 4VDC should be separated by more than one terminal position (i.e. 1.6mm or more) to avoid galvanic corrosion between circuits.

7.2 High Speed Signal Transmission

Testing has shown that under the USB 2.0 Specification environment for connector components and cable assemblies (200 and 500 picosecond rise times), the HandyLink connectors perform within specification for both differential and common-mode impedance.

Full compliance testing on finished cable assemblies will have to be undertaken to verify the performance level of the finished product.

Contact Molex for further assistance regarding high speed signal transmission applications.