Instead of pulling the document file USE This

The International Docking Adapter (IDA) was implemented to the specifications of the NDS IDD JSC 65795 section 4.2.3.1. A developer interested in configuring for the IDA interface should reference IDSS Revision E and the NDS IDD referenced in this paragraph. For additional guidance please contact ISS POC Michael J. Salopek (NASA/JSC-OB3) michael.j.salopek@nasa.gov.

International Docking Adapter (IDA) Resource Transfer Umbilicals

1.0 RESOURCE TRANSFER UMBILICALS

The ISS IDA accommodates umbilical connectors for transfer of electrical services with the ISS. The umbilical connectors are recessed below the docking mating plane during docking. Of the ten available umbilical connector locations, the ISS IDS uses two located at the 3 and 8 positions as shown in Figure 1.0-1, Umbilical Connector Keep-Out Zones for details.

The ISS IDA implementation is defined in the following paragraphs.

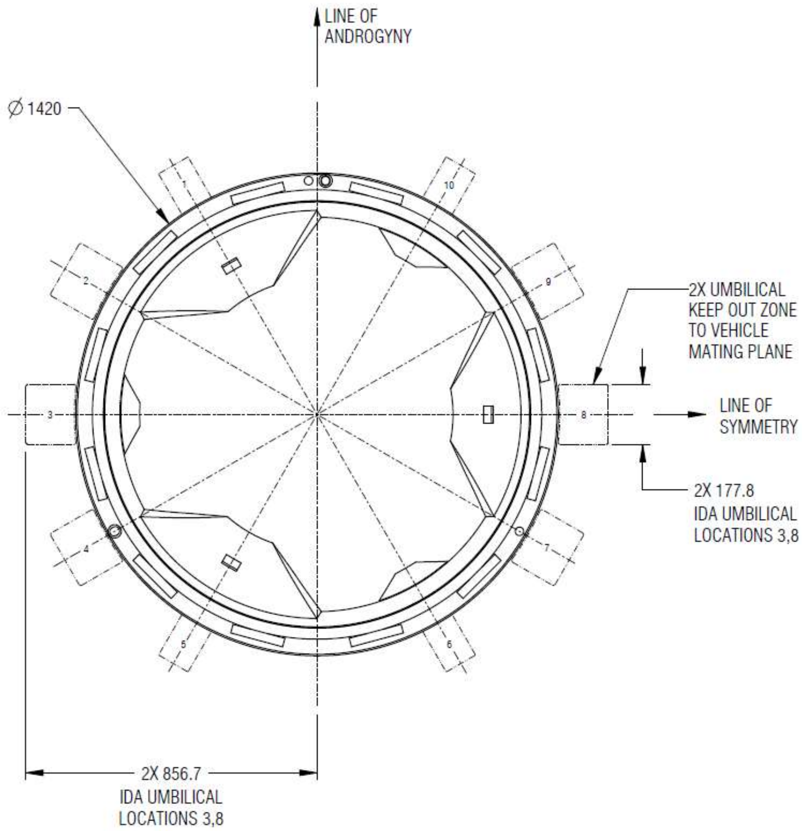


FIGURE 1.0-1 UMBILICAL CONNECTOR KEEP-OUT ZONES

1.1 POWER AND DATA TRANSFER UMBILICAL

The standard Power/Data Transfer Umbilical (PDTU) transfers power and data in the same connector shell. The PDTU function is nominally accomplished using two connector systems for redundancy and arranged to allow for androgynous operation.

1.1.1 FRAM CONNECTOR PART NUMBER

PDTU connectors are to be designed, manufactured, and tested to meet the ISS specification SSQ 22680, Connectors, Rectangular, (ORU), Space Quality, General Specification For, commonly called a Flight Releasable Attachment Mechanism (FRAM) connector. The FRAM connector part numbers which correspond to this PDTU definition are shown in Table 1.1.1-1, FRAM Connector Part Number.

TABLE 1.1.1-1 FRAM CONNECTOR PART NUMBER

PART NUMBER	DESCRIPTION
SSQ 22680-021	Plug (Pins), FRAM Using Insert Arrangement K

PART NUMBER	DESCRIPTION
SSQ 22680-022	Receptacle (Sockets), FRAM Using Insert Arrangement K

1.1.2 PDTU CONNECTOR OPERATION

The Plug PDTU Connector and Receptacle PDTU Connector (across the docking interface) shall be designed to mate to and demate from the opposing Plug PDTU Connector and Receptacle PDTU Connector as represented in Figure 1.1.2-1, PDTU Electro-Mechanical Actuator Concept of Operation.

NOTE: During docking operations, either a Plug PDTU Electro-Mechanical Actuator (EMA) or a Receptacle PDTU EMA is driven to mate the Electrical Resource Connector and trigger the Data Bus Switches.

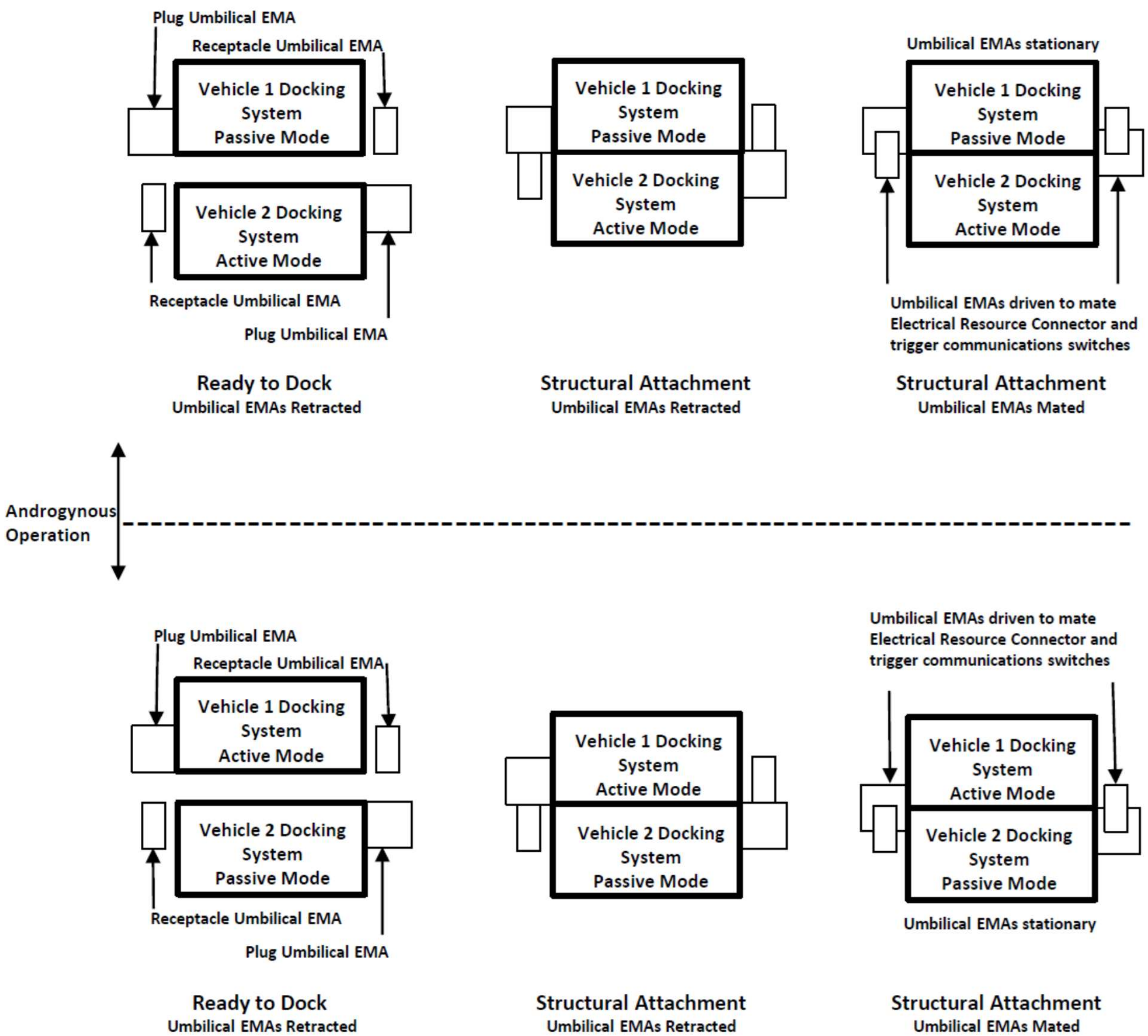


FIGURE 1.1.2-1 PDTU ELECTRO-MECHANICAL ACTUATOR CONCEPT OF OPERATION

1.1.3 CONNECTOR LOCAL COORDINATE SYSTEM

Each PDTU connector has an individual local coordinate system as represented in Figure 1.1.3-1, PDTU Connector Local Coordinate System Definition.

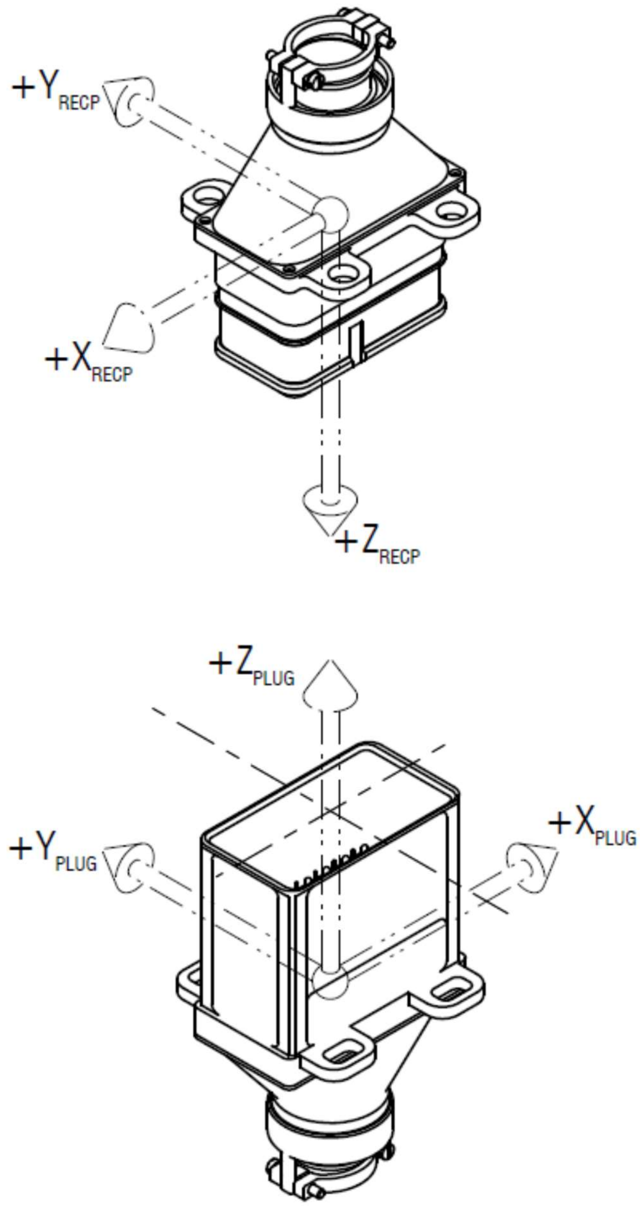
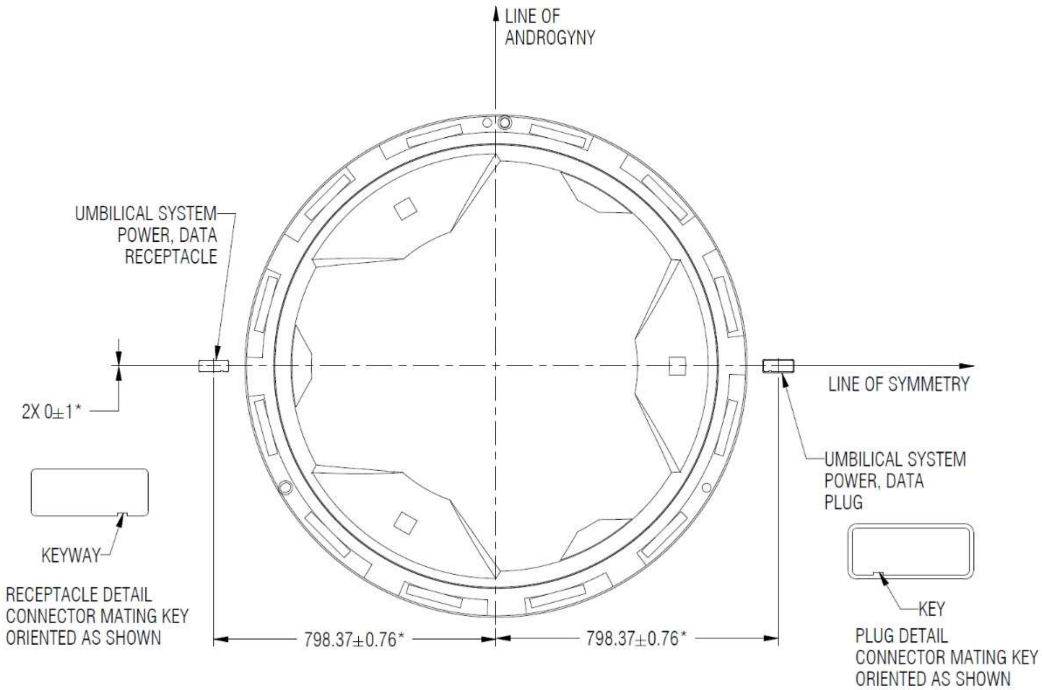


FIGURE 1.1.3-1 PDTU CONNECTOR LOCAL COORDINATE SYSTEM DEFINITION

1.1.4 LOCATING REQUIREMENTS

1.1.4.1 LATERAL MOUNTING REQUIREMENTS

The two PDTU connectors, one receptacle and one plug, are implemented as shown in Figure 1.1.4.1-1, Standard Power/Data Transfer Umbilical Connectors.



* Connector positional tolerances with respect to Line of Symmetry or Line of Androgyny.

FIGURE 1.1.4.1-1 STANDARD POWER/DATA TRANSFER UMBILICAL CONNECTORS

1.1.4.2 ROTATIONAL MOUNTING REQUIREMENTS

The Plug and Receptacle Connectors shall have a planar rotational tolerance of ±1° about the Z-axis.

1.1.4.3 CENTERLINE ANGULAR MOUNTING REQUIREMENTS

The Plug and Receptacle Connectors are mounted such that the connector centerline (Z-axis) is within a conic tolerance zone. The centerline shall be within 1° about the Z-axis with the apex of the cone being at the coordinate system origin as shown in Figure 1.1.4.3-1, Centerline Angular Mounting Requirements.

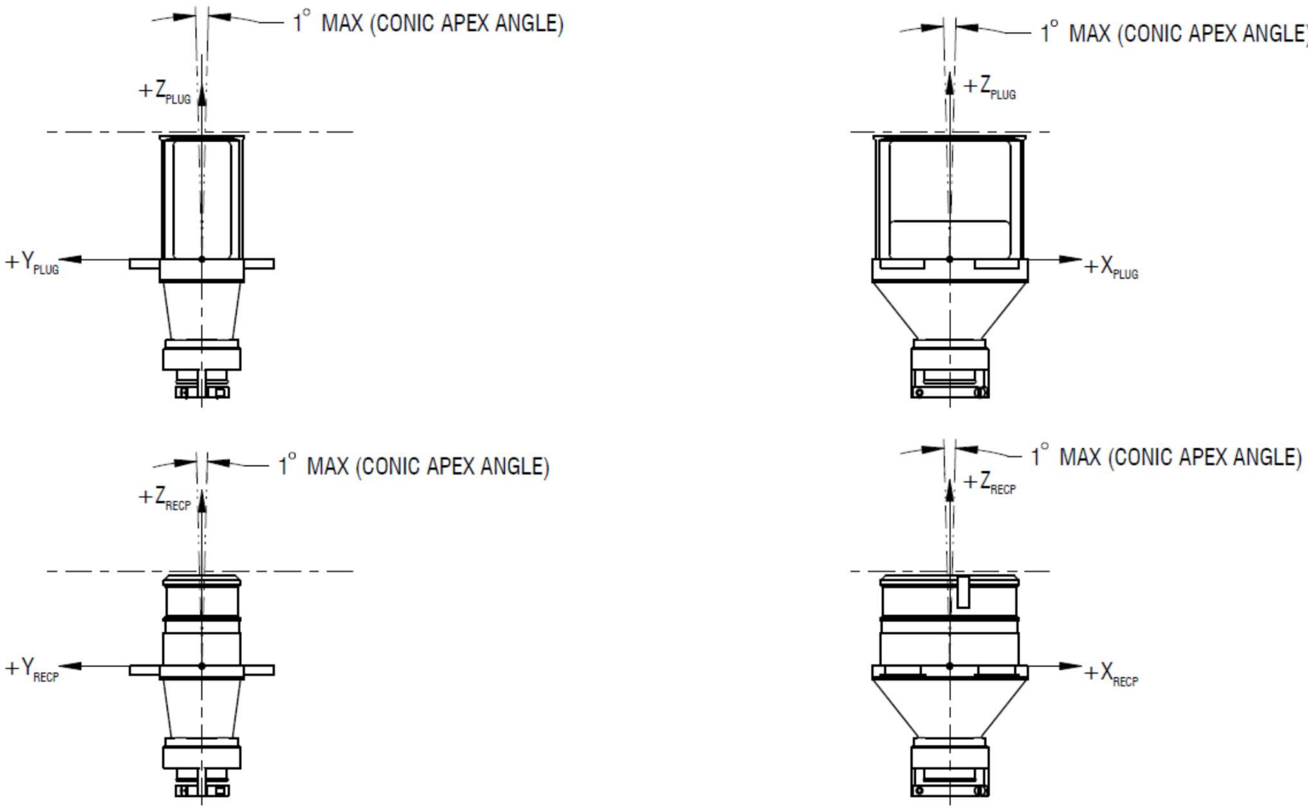
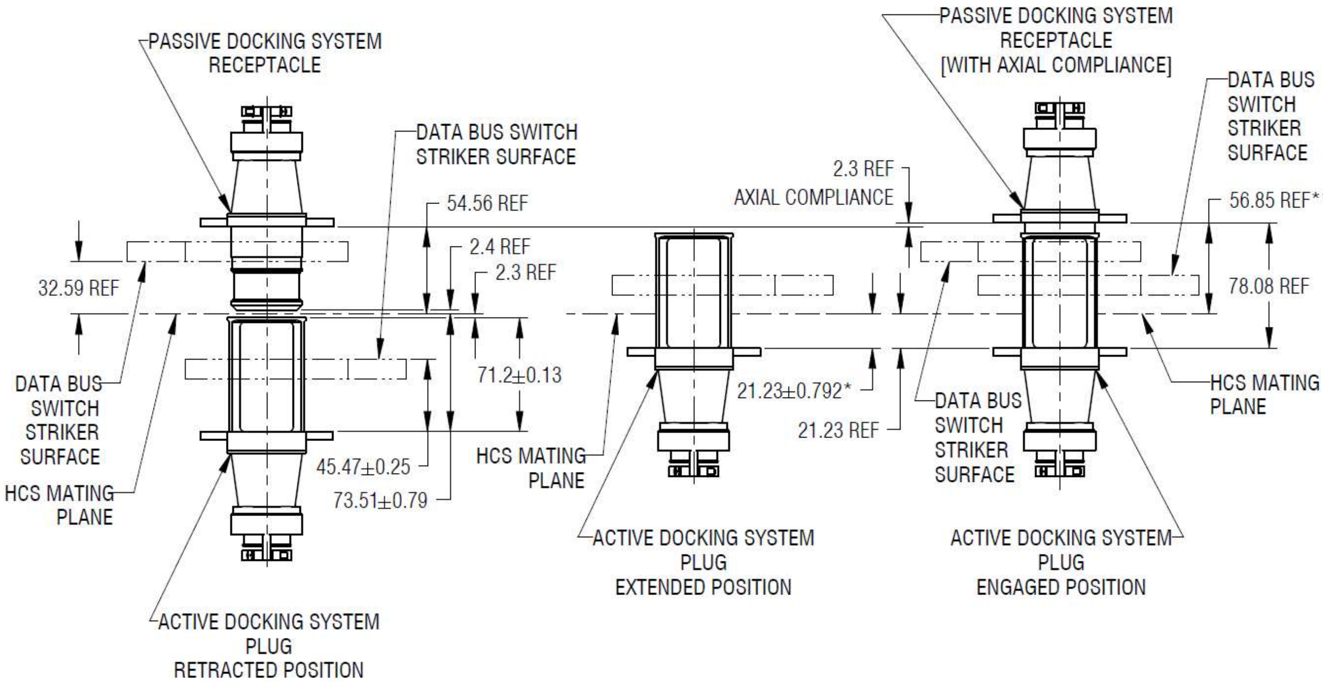


FIGURE 1.1.4.3-1 CENTERLINE ANGULAR MOUNTING REQUIREMENTS

1.1.4.4 ENGAGEMENT MECHANISM

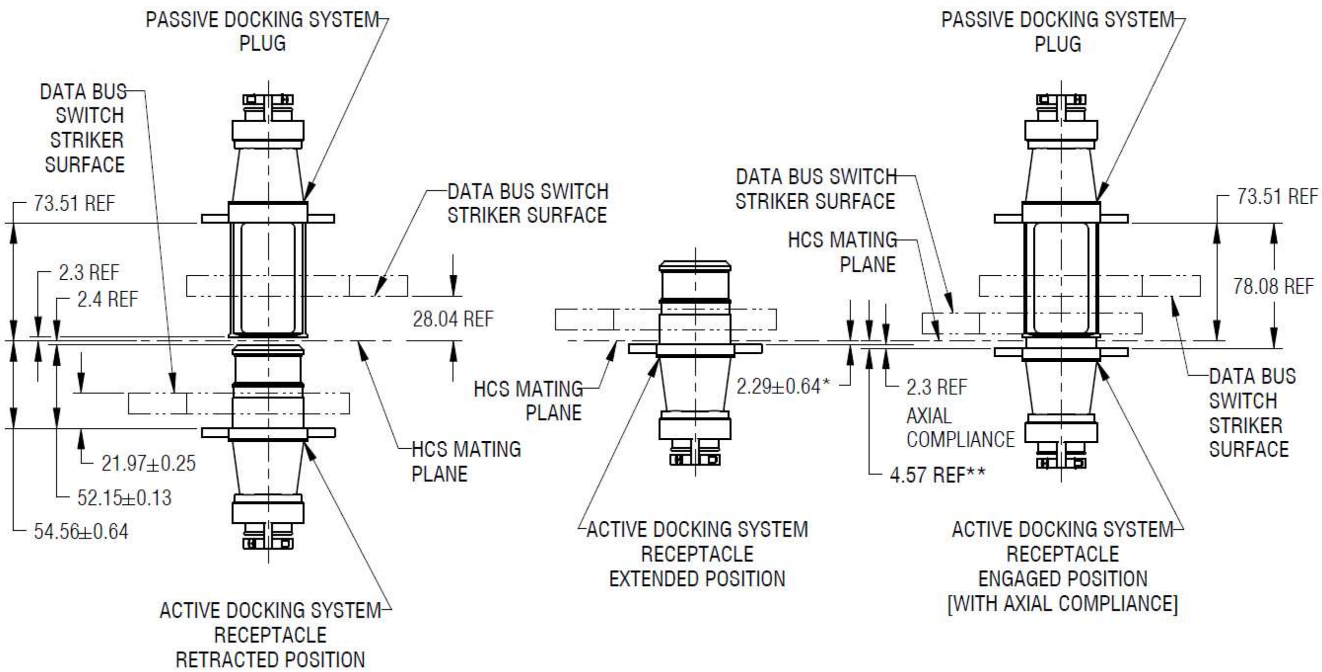
The connector system mechanism translates the connector and a data bus switch striker to engage with the opposing side as shown in Figure 1.1.4.4-1, PDTU Mating Operation with Active Plug, and Figure 1.1.4.4-2, PDTU Mating Operation with Active Receptacle.



* Mechanism end of travel requirement with no mating connector present

** Final position for engaged receptacle including axial compliance

FIGURE 1.1.4.4-1 PDTU MATING OPERATION WITH ACTIVE PLUG



* Mechanism end of travel requirement with no mating connector present

** Final position for engaged receptacle including axial compliance

FIGURE 1.1.4.4-2 PDTU MATING OPERATION WITH ACTIVE RECEPTACLE

1.1.4.4.1 RETRACTED POSITION

The mechanism active and passive connectors are located in the retracted position as shown in Figure 1.1.4.4-1 and Figure 1.1.4.4-2 prior to commencing docking or undocking operations.

1.1.4.4.2 EXTENDED POSITION

The mechanism provides sufficient stroke to meet the extended position in order to activate the axial compliance in the engaged position as shown in Figure 1.1.4.4-1 and Figure 1.1.4.4-2 after structural connection is achieved.

1.1.5 COMPENSATION OF MISALIGNMENT

During mating operations of the PDTU connectors, planar, angular, and axial system level (across the docking interface) misalignments may be present. The PDTU has misalignment mechanisms that compensate for combinations of lateral and axial misalignments via mechanical compliance, and provide re-centering of the connector when the PDTU is disconnected.

1.1.5.1 PLANAR MISALIGNMENT COMPLIANCE

The Plug Connector possesses a 3 degree of freedom (3-DOF) planar misalignment mechanism to compensate for lateral and rotational misalignments.

1.1.5.1.1 LATERAL MISALIGNMENT COMPLIANCE

The planar misalignment mechanism provides a minimum lateral misalignment compliance in both the X and Y directions when subject to zero rotational misalignment. See Figure 1.1.5.1.1-1, Plug Lateral Compliance in X Direction, and Figure 1.1.5.1.1-2, Plug Lateral Compliance in Y Direction.

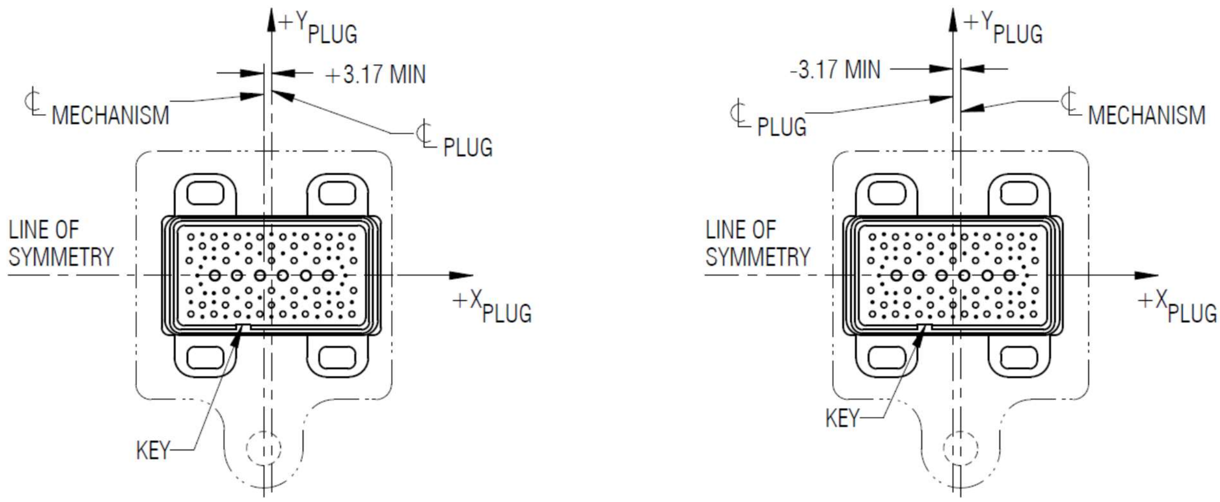


FIGURE 1.1.5.1.1-1 PLUG LATERAL COMPLIANCE IN X DIRECTION

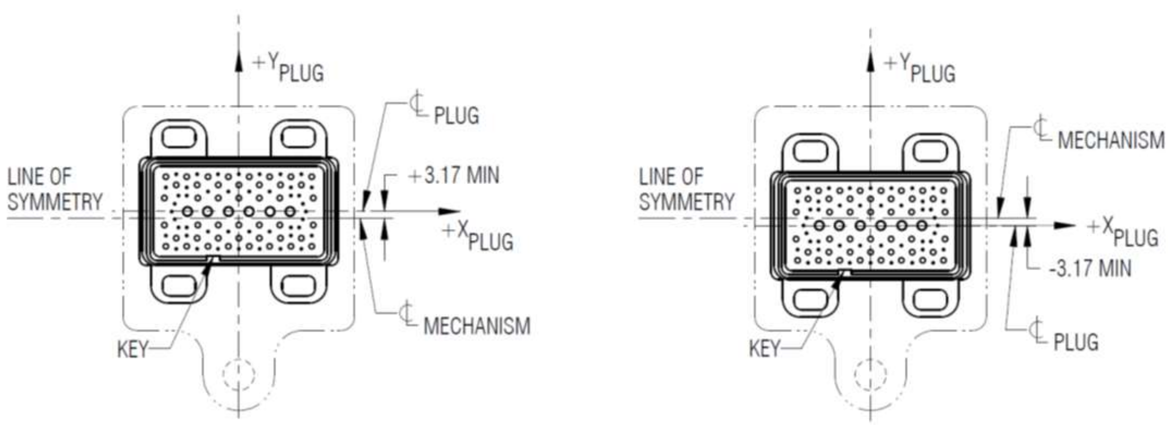


FIGURE 1.1.5.1.1-2 PLUG LATERAL COMPLIANCE IN Y DIRECTION

1.1.5.1.2 ROTATIONAL MISALIGNMENT COMPLIANCE

The planar misalignment mechanism provides a minimum rotational misalignment compliance when subject to zero lateral misalignment. See Figure 1.1.5.1.2-1, Plug Rotational Compliance about the Z axis.

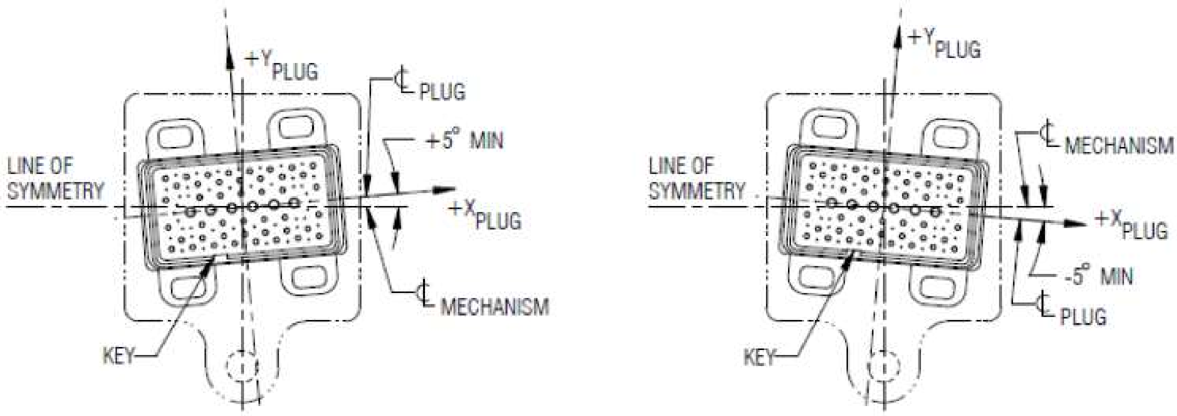


FIGURE 1.1.5.1.2-1 PLUG ROTATIONAL COMPLIANCE ABOUT THE Z AXIS

1.1.5.1.3 RE-CENTERING CAPABILITY

1.1.5.1.3.1 RE-CENTERING LATERAL POSITION

The planar misalignment mechanism returns the PDTU Connector to its neutral position within the positional tolerance shown in Figure 1.1.4.1-1.

1.1.5.1.3.2 RE-CENTERING ROTATIONAL POSITION

The planar misalignment mechanism returns the PDTU Connector to its neutral position within $\pm 1^0$ as measured from the Plug PDTU mechanism's centerline.

1.1.5.1.3.3 RE-CENTERING FORCE

The planar misalignment mechanism lateral re-centering force, at the maximum displacement, and while engaging with the opposing connector, is < 64 N.

1.1.5.2 AXIAL MISALIGNMENT COMPLIANCE

The Receptacle Connector possesses a 3-DOF axial misalignment mechanism to accommodate the need for additional stroke along the insertion axis (Z-axis), and rotational misalignments about the X and Y-axes.

1.1.5.2.1 AXIAL COMPLIANCE

The axial misalignment mechanism provides axial compliance as shown in Figure 3.4.1.5.2.1-1, Receptacle Axial Compliance, to ensure the proper connector engagement per SSQ 22680 Figure 2g (and shown as reference in Figure 1.1.4.4-1 and Figure 1.1.4.4-2).

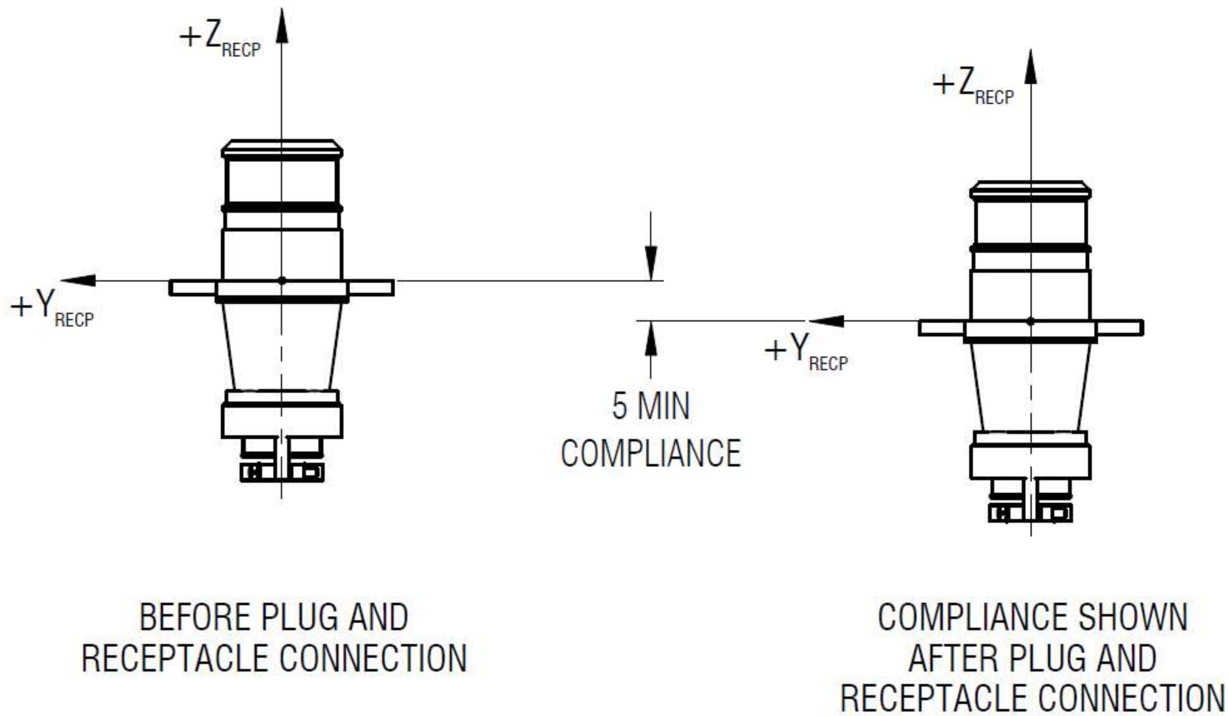


FIGURE 1.1.5.2.1-1 RECEPTACLE AXIAL COMPLIANCE

1.1.5.2.2 MINIMUM RESISTIVE FORCE

The axial misalignment mechanism must provide a minimum resistive force to ensure sufficient insertion force. The minimum resistive force is 20% greater than the maximum force required for the set of pins in the connector as determined from SSQ 22680 Table 4. For example, the minimum resistive force requirement for the ISS IDA compliant connector is 148 N, while the requirement for a fully populated connector is 406 N.

1.1.5.2.3 MAXIMUM CONNECTOR INSERTION FORCE

The axial misalignment mechanism must provide the maximum connector insertion force at the minimum compliance limit of the mechanism per paragraph 1.1.5.2.1. The maximum connector insertion force is < 650 N at a compliance of 5 mm. This force is 60% greater than the minimum resistive force for of a fully populated connector to assure mating under differential temperature conditions as specified in SSQ 22680 paragraph 3.3.10.2.

1.1.5.2.4 ANGULAR COMPLIANCE

The axial misalignment mechanism provides the capability to align the connectors for proper mating when angular misalignment exists between connector insertion axes. The maximum angular misalignment is defined as a conic tolerance zone where the centerline is within ±1° about the Z-axis with the apex being at the coordinate system origin. See Figure 1.1.5.2.4-1, Receptacle Angular Compliance about X and Y-axes.

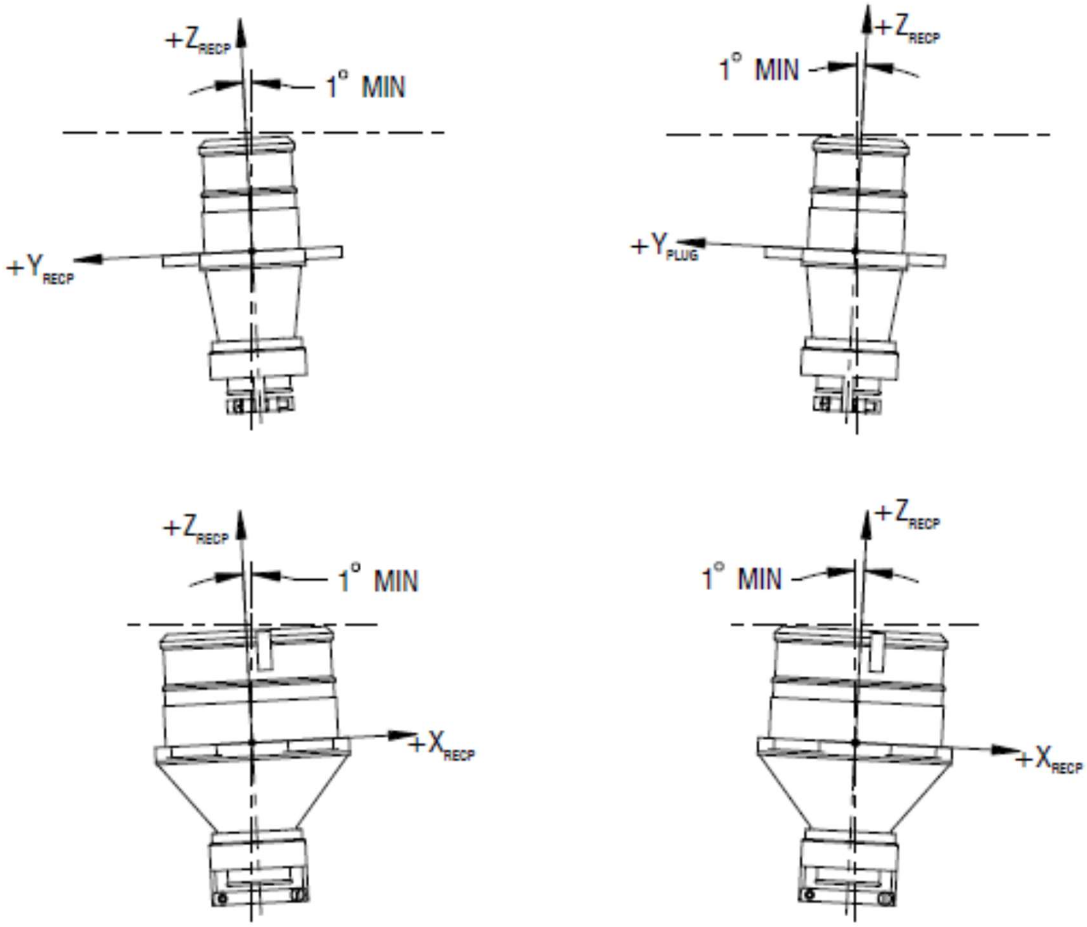


FIGURE 1.1.5.2.4-1 RECEPTACLE ANGULAR COMPLIANCE ABOUT X AND Y-AXES

1.1.5.3 MISALIGNMENT KEEP OUT ZONE

Any hardware location or mechanism behavior designed to satisfy misalignment compensation requirements does not exceed the KOZ shown in Figure 3.0-1.

1.1.6 STRUCTURAL REQUIREMENTS

1.1.6.1 STRUCTURAL STIFFNESS REQUIREMENT

The mechanism assembly must have sufficient structural stiffness to ensure the opposing connectors can engage properly. The connector origin deflects ≤ 0.13 mm axially ($-Z_{RECP}$ and $-Z_{PLUG}$ direction per Figure 1.1.3-1) when subjected to the maximum insertion force of 650 N.

1.1.6.2 STRUCTURAL LOAD REQUIREMENT

The mechanism assembly must have sufficient structural strength when subjected to the highest compression force exerted by the mating active mechanism. The mechanism assembly is capable of accommodating a maximum axial force of 3025 N.

1.1.7 DATA BUS SWITCH STRIKER

The PDTU connector carrier provides a strike surface to trigger a plunger-style switch on the opposing PDTU connector carrier.

Note: The striker is mounted to the axial translation carriage and does not move as the connector complies during insertion.

1.1.7.1 PLANAR MOUNTING REQUIREMENTS

The Data Bus Switch Striker islocated laterally per Figure 1.1.7.1-1, Data Bus Switch Striker Geometry.

* Minimum diameter required for the striker at the theoretical location

** The boxed dimension is a basic dimension to indicate the theoretical position of the striker

FIGURE 1.1.7.1-1 DATA BUS SWITCH STRIKER GEOMETRY

1.1.7.2 AXIAL MOUNTING REQUIREMENTS

The Data Bus Switch Striker is located axially with respect to the associated connector as shown in Figure 1.1.4.4.1-1.

1.1.7.3 AXIAL LOAD CAPABILITY

The data bus striker accommodates a maximum force of 54 N from the data bus switch.

1.1.8 PDTU CONNECTOR SHELL CONFIGURATION

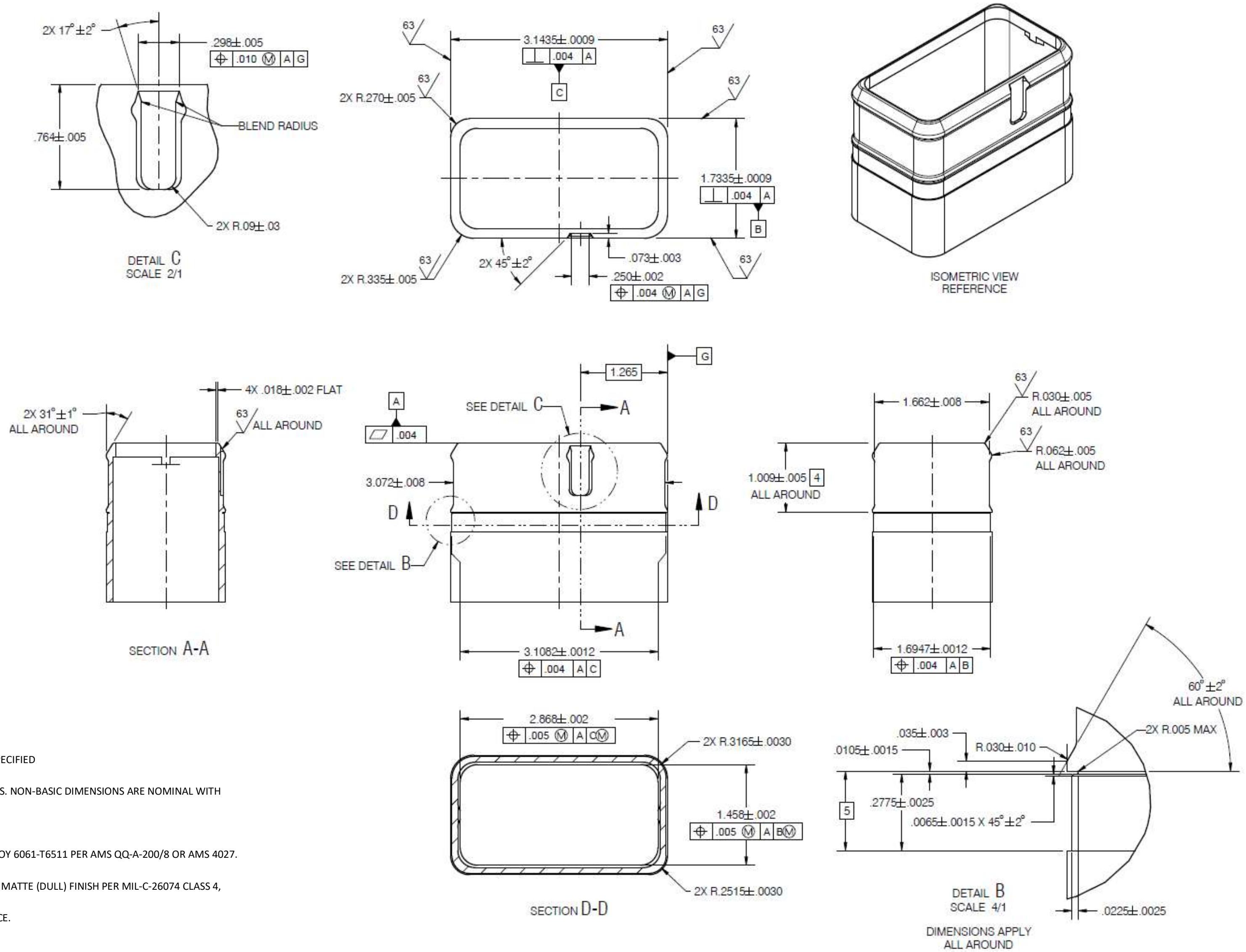
The FRAM connector is legacy hardware whose specification was generated and analyzed using U.S. Customary Units to specify dimensional fits and tolerances. The connector plug, shell, and pin dimensions are given in the U.S. Customary Unit system in order to retain the accuracy of these fits, as specified in SSQ 22680. Conversion to metric dimensions and fits is up to each implementer.

1.1.8.1 PDTU RECEPTACLE SHELL DIMENSIONS

The PDTU receptacle docking interface meets the dimensions specified in Figure 1.1.8.1-1, PDTU Receptacle Dimensions.

1.1.8.2 PDTU PLUG SHELL DIMENSIONS

The PDTU plug docking interface meets the dimensions specified in Figure 1.1.8.2-1, PDTU Plug Dimensions.



PDTU RECEPTACLE

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIMENSIONS ARE INCHES. NON-BASIC DIMENSIONS ARE NOMINAL WITH TOLERANCE AS SHOWN.

2. MATERIAL: ALUMINUM ALLOY 6061-T6511 PER AMS QQ-A-200/8 OR AMS 4027.

3. ELECTROLESS NICKEL PLATE, MATTE (DULL) FINISH PER MIL-C-26074 CLASS 4, .0015-.0018 THK PER SURFACE.

FIGURE 1.1.8.1-1 PDTU RECEPTACLE DIMENSIONS

PDTU PLUG

NOTES: UNLESS OTHERWISE SPECIFIED

1. ALL DIMENSIONS ARE INCHES. NON-BASIC DIMENSIONS ARE NOMINAL WITH

☐TOLERANCE TBD.

2. MATERIAL: ALUMINUM ALLOY 6061-T6511 PER AMS QQ-A-200/8 OR AMS 4027.

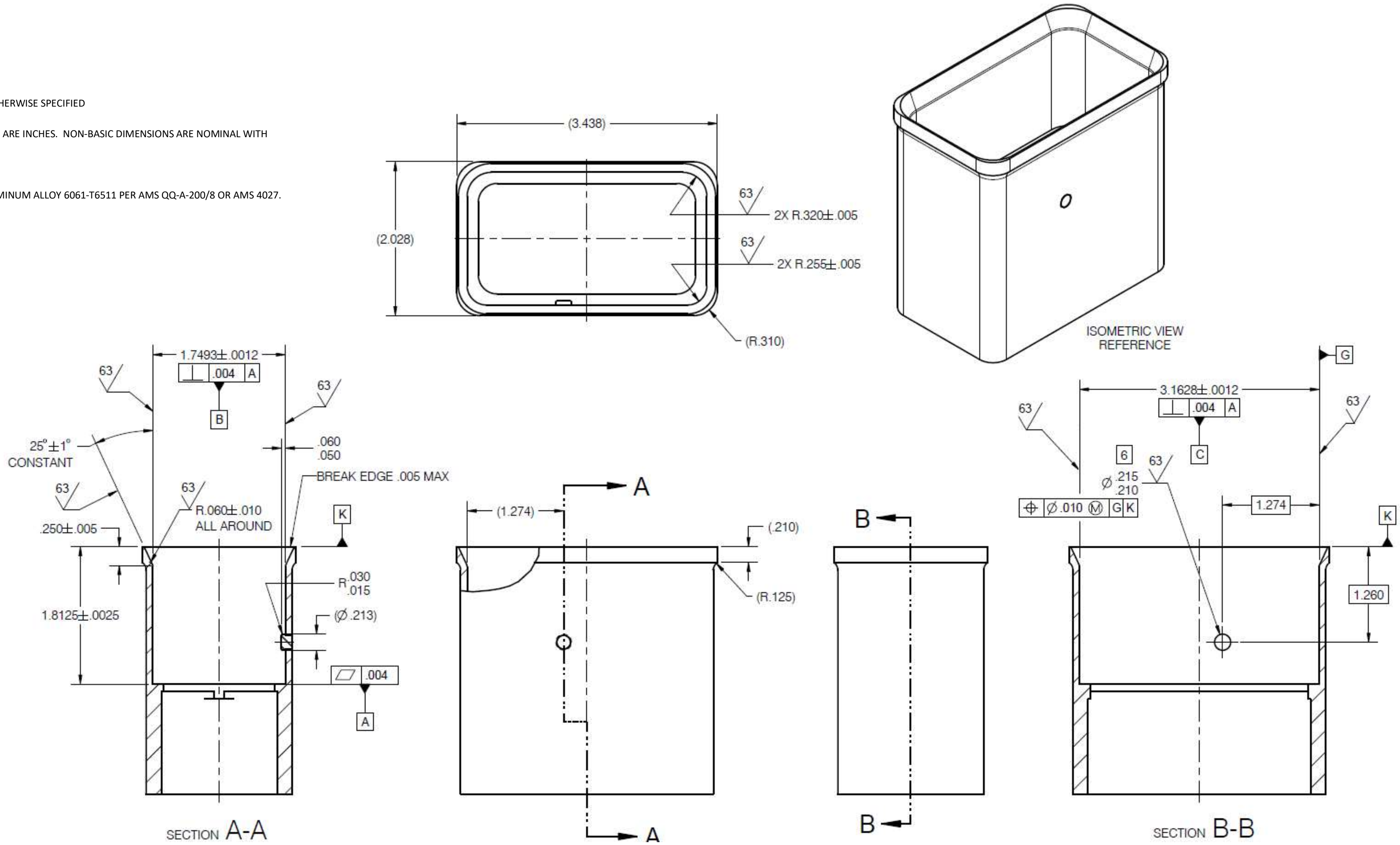


FIGURE 1.1.8.2-1 PDTU PLUG DIMENSIONS

1.1.9 PDTU PIN CONFIGURATION

The ISS IDA PDTU connectors utilize the connector pinout assignments, as designated in Table 1.1.9-1, IDA PDTU Connector Pinouts, Table 1.1.9-2, IDA PDTU Connector Pinouts Definitions, and in Figure 1.1.9-1, Receptacle (Sockets) – Front Face, and Figure 1.1.9-2, Plug (Pins) – Front Face. All pins and receptacles identified in Table 1.1.9-1 are installed

ISS IDA chose 28 VDC as the User-Defined voltage level for pins 44 and 45, these 8 gauge pins are populated in the connector, and the 28 VDC wiring is installed back to a bulkhead. However, no 28 VDC power is currently provided by ISS for these feeds.

- IDA added pins that allow contingency operation of the IDA-side active hooks from a mated vehicle.
- None of the 12 gauge 28 VDC power pins are installed or wired.

TABLE 1.1.9-1 IDA PDTU CONNECTOR PINOUTS (2 PAGES)

Plug Umbilical Power+Data			Receptacle Umbilical Power+Data		
PIN #	Size	SIGNAL	PIN #	Size	SIGNAL
42	8	120VDC_SysB	42	8	120VDC_SysA
43	8	120VDC_RTN_SysB	43	8	120VDC_RTN_SysA
44	8	User_Def_VDC_SysB	44	8	User_Def_VDC_SysA
45	8	User_Def_VDC_RTN_SysB	45	8	User_Def_VDC_RTN_SysA
46	8	Ground Safety Wire_SysB	46	8	Ground Safety Wire_SysA
13	20	SysB_100BaseT_RX_P_BI_DB_P	13	20	SysA_100BaseT_TX_P_BI_DA_P
27	20	SysB_100BaseT_RX_N_BI_DB_N	27	20	SysA_100BaseT_TX_N_BI_DA_N
86	20	SysB_100BaseT_TX_P_BI_DA_P	86	20	SysA_100BaseT_RX_P_BI_DB_P
72	20	SysB_100BaseT_TX_N_BI_DA_N	72	20	SysA_100BaseT_RX_N_BI_DB_N
14	20	SysB_1GEth_BI_DC_P	14	20	SysA_1GEth_BI_DD_P
15	20	SySB_1GEth_BI_DC_N	15	20	SysA_1GEth_BI_DD_N
87	20	SysB_1GEth_BI_DD_P	87	20	SysA_1GEth_BI_DC_P
88	20	SysB_1GEth_BI_DD_N	88	20	SysA_1GEth_BI_DC_N
25	20	SysB_1553_BUS1_P	25	20	SysA_1553_BUS1_P
38	20	SysB_1553_BUS1_N	38	20	SysA_1553_BUS1_N
70	20	SysB_1553_BUS2_P	70	20	SysA_1553_BUS2_P
57	20	SysB_1553_BUS2_N	57	20	SysA_1553_BUS2_N
21	20	SysB_Umb_Plug_LoopBack_P	21	20	Short_to_pin_34

TABLE 1.1.9-1 IDA PDTU CONNECTOR PINOUTS (2 PAGES)

Plug Umbilical Power+Data			Receptacle Umbilical Power+Data		
PIN #	**Size**	**SIGNAL**	**PIN #**	**Size**	**SIGNAL**
34	20	SysB_Umb_Plug_LoopBack_N	34	20	Short_to_pin_21
53	20	Short_to_pin_66	53	20	SysA_Umb_Receptacle_LoopBack_P
66	20	Short_to_pin_53	66	20	SysA_Umb_Receptacle_LoopBack_N
1	20	ISS-ICP_HOOK_GANG1_OP_VV_CMD_SIG	1	20	HOOK_GANG1_OP_VV_CMD_P
6	20	ISS-ICP_HOOK_GANG1_OP_VV_CMD_RTN	6	20	HOOK_GANG1_OP_VV_CMD_N
74	20	ISS-ICP_HOOK_GANG1_CL_VV_CMD_SIG	74	20	HOOK_GANG1_CL_VV_CMD_P
75	20	ISS-ICP_HOOK_GANG1_CL_VV_CMD_RTN	75	20	HOOK_GANG1_CL_VV_CMD_N
3	20	ISS-ICP_TO_VV_MON_HOOK_GANG1A/B_OP_MTR_POS_SIG	3	20	HOOK_GANG1A/B_OP_MTR_POS_P
4	20	ISS-ICP_TO_VV_MON_HOOK_GANG1A/B_OP_MTR_POS_RTN	4	20	HOOK_GANG1A/B_OP_MTR_POS_N
76	20	ISS-ICP_TO_VV_MON_HOOK_GANG1A/B_CL_MTR_POS_SIG	76	20	HOOK_GANG1A/B_CL_MTR_POS_P
77	20	ISS-ICP_TO_VV_MON_HOOK_GANG1A/B_CL_MTR_POS_RTN	77	20	HOOK_GANG1A/B_CL_MTR_POS_N

Notes:

1) System A will be crossed to System B when identically configured vehicles are mated.
2) Cable shields are intended to be grounded to backshell.

TABLE 1.1.9-2 IDA PDTU CONNECTOR PINOUTS DEFINITIONS (2 PAGES)

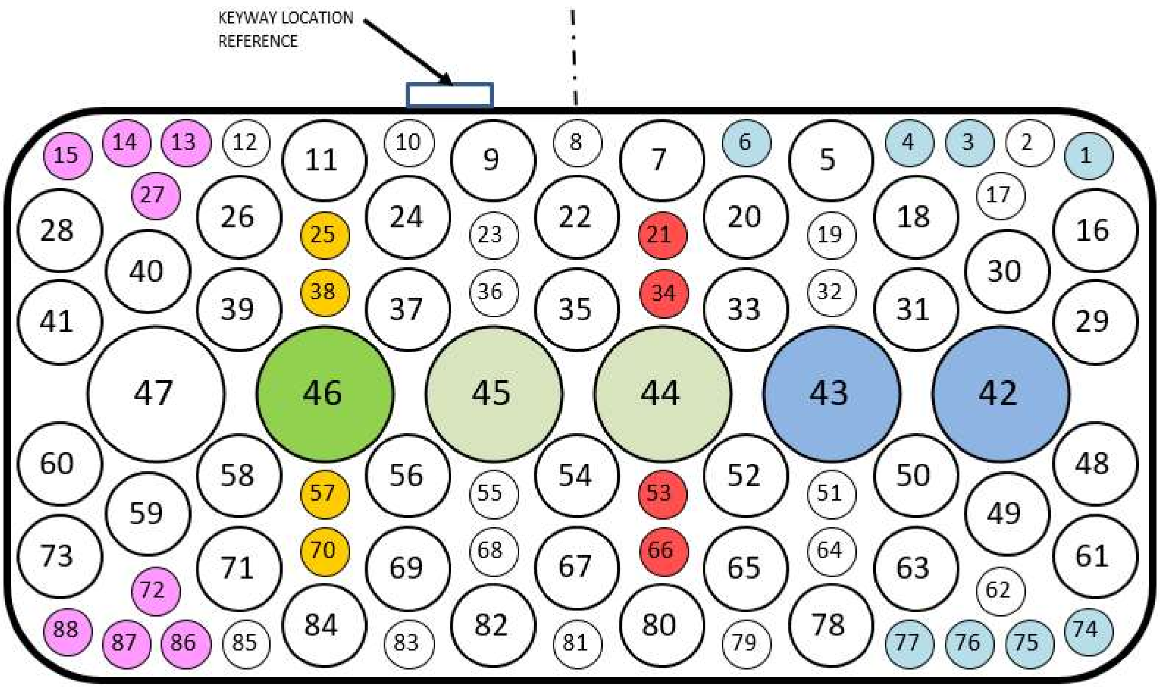
PIN #	DEFINITION
1	+28V signal to drive IDA hooks to the open position
3	Sensor indicating IDA hooks are open
4	Ground return for pin 3
6	Ground return for pin 1
13	100 Base TX (IEEE 802.3u Ethernet) Receive/Transmit positive wire (also used as BI_DB_P/BI_DA_P for gigabit Ethernet)
14	Gigabit Ethernet (IEEE 802.3ab) BI_DC_P/BI_DD_P wire
15	Gigabit Ethernet (IEEE 802.3ab) BI_DC_N/BI_DD_N wire

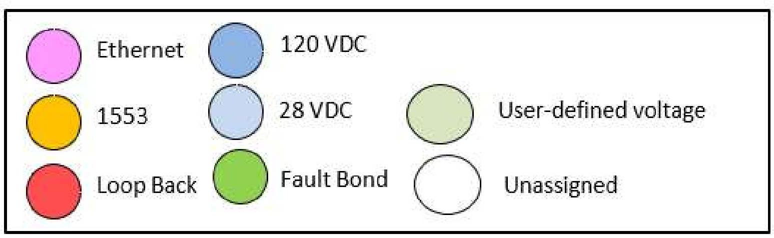
TABLE 1.1.9-2 IDA PDTU CONNECTOR PINOUTS DEFINITIONS (2 PAGES)

PIN #	DEFINITION
21	Umbilical loopback positive is shorted with pin 34 on system A; this allows the B system to detect mating
25	MIL-STD-1553 Bus 1 positive
27	100 Base TX (IEEE 802.3u Ethernet) Receive/Transmit negative wire (also used as BI_DB_N/BI_DA_N for gigabit Ethernet)
34	Umbilical loopback negative is shorted with pin 21 on system A; this allows the B system to detect mating
38	MIL-STD-1553 Bus 1 negative
42	120 Volts Direct Current from System A or B; sinks or source voltage between vehicles
43	120 Volts Direct Current Return from System A or B; return for 120 volt
44	Direct Current (user-defined voltage) from System A or B; sinks or sources voltage between vehicles; also serves as mating guide for connector
45	Direct Current (user-defined voltage) from System A or B; return line for pin 44; also serves as mating guide for connector
46	Ground Safety Wire provides bonding ground connection between vehicles
53	Umbilical loopback positive is shorted with pin 66 on system B; this allows the A system to detect mating
57	MIL-STD-1553_Bus 2 negative
66	Umbilical loopback positive is shorted with pin 53 on system B; this allows the A system to detect mating
70	MIL-STD-1553 Bus 2 positive
72	100 Base TX (IEEE 802.3u Ethernet) Transmit/Receive positive wire (also used as BI_DA_N/BI_DB_N for gigabit Ethernet)
74	+28V signal to drive IDA hooks to the closed position
75	Ground return for pin 74
76	Sensor indicating IDA hooks are closed
77	Ground return for pin 76
86	100 Base TX (IEEE 802.3u Ethernet) Transmit/Receive positive wire (also used as BI_DA_P/BI_DB_P for gigabit Ethernet)
87	Gigabit Ethernet (IEEE 802.3ab) BI_DD_P/BI_DC_P wire
88	Gigabit Ethernet (IEEE 802.3ab) BI_DC_N/BI_DC_N wire

TABLE 1.1.9-3 UNASSIGNED AND UNPOPULATED IDA PDTU CONNECTOR PINOUTS

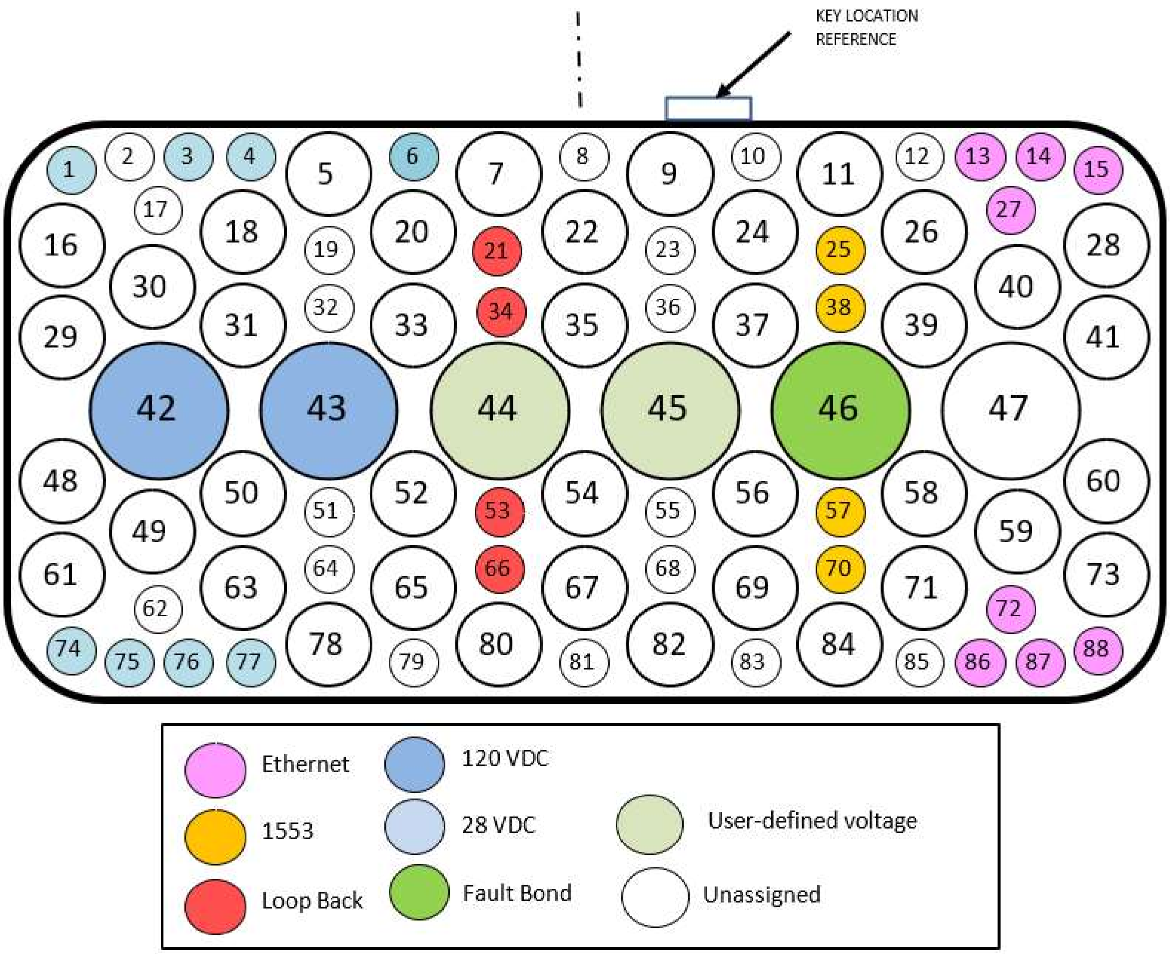
Size	Pin Numbers
8	**47**
12	**5, 7, 9, 11, 16, 18, 19, 20, 22, 24, 26, 28, 29, 30, 31, 32, 33, 35, 37, 39, 40, 41, 48, 49, 50, 51, 52, 54, 56, 58, 59, 60, 61, 63, 64, 65, 67, 69, 71, 73, 78, 80, 82, 84**
20	**2, 8, 10, 12, 17, 23, 36, 55, 62, 68, 79, 81, 83, 85**





FRONT FACE OF RECEPTACLE INSERT SHOWN, PLUG OPPOSITE

FIGURE 1.1.9-1 RECEPTACLE (SOCKETS) - FRONT FACE



FRONT FACE OF PLUG INSERT SHOWN, RECEPTACLE OPPOSITE

FIGURE 1.1.9-2 PLUG (PINS) - FRONT FACE