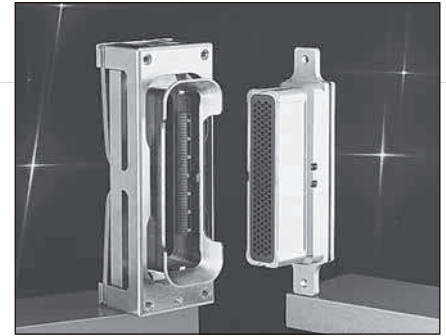


In the frame of Space Station Alpha program, SOURIAU has developed and qualified a series of high reliability rectangular connector for robotic operations. This hardware is used on the SSRMS (Space Station Remote Manipulator System) which is the Canadian contribution to the Space Station. These connectors feature :

- Low Insertion Force contacts
- Thermal differential (between plug and receptacle) compatibility
- Integrated misalignment catching system
- High durability (6000 operations)
- High EMI shielding efficiency
- Associated dismountable EMI backshells
- Deep space environment (Atox) compatibility
- Easy inspection, maintenance or repair after wiring.



Characteristics

Performances

Mechanical
Mass • < 105 g for plug • < 76 g for MSSP⁽¹⁾ receptacle • < 218 g for ORU⁽²⁾ receptacle
ORU receptacle misalignment • $\Delta\alpha = \pm 0,5^\circ$ • $\Delta\beta = \pm 0,5^\circ$ • $\Delta\gamma = \pm 0,5^\circ$ • $\Delta Y = 1,27 \text{ mm}$ • $\Delta Z = 2,03 \text{ mm}$
ORU receptacle overstroke • $\Delta X = 2,29 \text{ mm}$

(1) MSSP : Mobile Servicing System Payload

(2) ORU : Orbital Replacement Unit

Materials and finishes

	Material	Finish
Plug MSSP Receptacle ORU Receptacle	Aluminium alloy 7075	Chemical nickel plating
Compliance mechanism • Frame, flange & beam • Helicoil & axle • Spring	Aluminium alloy 7075 Stainless steel Beryllium copper	Chemical nickel plating - Thermal treatment
Insulator	3505 EPOXY	-
Backshell	Aluminium alloy 7075	Chemical nickel plating

Mating/demating forces

Shell size	Option	Contact arrangement	Mating force (N)	Demating force (N)
Large	L1	137 # 22	101	78
	L2	45 # 16	116	87
	L3	22 # 12	112	85
	L4	12 # 12, 12 # 20 & 46 # 22	108	82
	L5	12 # 12, 12 # 20 & 46 # 22 + grounding of coax lines	138	119
Medium	M1	72 # 22	53	43
	M2	41 # 20	43	37
	M3	6 # 12, 8 # 20 & 17 # 22	52	42

Алматы (7273)495-231
Ангарск (3955)60-70-56
Архангельск (8182)63-90-72
Астрахань (8512)99-46-04
Барнаул (3852)73-04-60
Белгород (4722)40-23-64
Благовещенск (4162)22-76-07
Брянск (4832)59-03-52
Владивосток (423)249-28-31
Владикавказ (8672)28-90-48
Владимир (4922)49-43-18
Волгоград (844)278-03-48
Вологда (8172)26-41-59
Воронеж (473)204-51-73
Екатеринбург (343)384-55-89

Иваново (4932)77-34-06
Ижевск (3412)26-03-58
Иркутск (395)279-98-46
Казань (843)206-01-48
Калининград (4012)72-03-81
Калуга (4842)92-23-67
Кемерово (3842)65-04-62
Киров (8332)68-02-04
Коломна (4966)23-41-49
Кострома (4942)77-07-48
Краснодар (861)203-40-90
Красноярск (391)204-63-61
Курск (4712)77-13-04
Курган (3522)50-90-47
Липецк (4742)52-20-81

Магнитогорск (3519)55-03-13
Москва (495)268-04-70
Мурманск (8152)59-64-93
Набережные Челны (8552)20-53-41
Нижний Новгород (831)429-08-12
Новокузнецк (3843)20-46-81
Ноябрьск (3496)41-32-12
Новосибирск (383)227-86-73
Омск (3812)21-46-40
Орел (4862)44-53-42
Оренбург (3532)37-68-04
Пенза (8412)22-31-16
Петрозаводск (8142)55-98-37
Псков (8112)59-10-37
Пермь (342)205-81-47

Ростов-на-Дону (863)308-18-15
Рязань (4912)46-61-64
Самара (846)206-03-16
Санкт-Петербург (812)309-46-40
Саратов (845)249-38-78
Севастополь (8692)22-31-93
Саранск (8342)22-96-24
Симферополь (3652)67-13-56
Смоленск (4812)29-41-54
Сочи (862)225-72-31
Ставрополь (8652)20-65-13
Сургут (3462)77-98-35
Сыктывкар (8212)25-95-17
Тамбов (4752)50-40-97
Тверь (4822)63-31-35

Тольятти (8482)63-91-07
Томск (3822)98-41-53
Тула (4872)33-79-87
Тюмень (3452)66-21-18
Ульяновск (8422)24-23-59
Улан-Удэ (3012)59-97-51
Уфа (347)229-48-12
Хабаровск (4212)92-98-04
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Челябинск (351)202-03-61
Череповец (8202)49-02-64
Чита (3022)38-34-83
Якутск (4112)23-90-97
Ярославль (4852)69-52-93

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Казахстан +7(7172)727-132

Киргизия +996(312)96-26-47



Contact layouts

All arrangements are seen from male front view.

Large				Medium			
Option	Layout		Configuration	Option	Layout		Configuration
	Nb	contact size			Nb	contact size	
L1	137	# 22		M1	72	# 22	
L2	45	# 16		M2	41	# 20	
L3	22	# 12		M3	17	# 22	
					8	# 20	
					6	# 12	
L4 and L6 (1)	46	# 22					
	12	# 20					
	12	# 12					
L5 and L7 (2)	46	# 22					
	12	# 20					
	12	# 12 coax					

(1) Option 4 with Captive Hardware (+CH)

(2) Option 5 with Captive Hardware (+CH)

Crimping, Insertion & Removal tools for contacts

Contact size	Contact part number	Crimping tools	Positioner	Insertion and removal plastic tools
# 22	Pin Socket	M22520/2-01	8976-700 M22520/2-07	M81969/14-01
# 20	Pin Socket	M22520/1-01	M22520/1-04	M81969/14-10
# 16	Pin Socket			M81969/14-03
# 12	Pin Socket			M81969/14-04
# 12 coax	Inner pin Inner socket Crimping sleeve	M22520/5-01	8976-720 8976-710 8976-730	

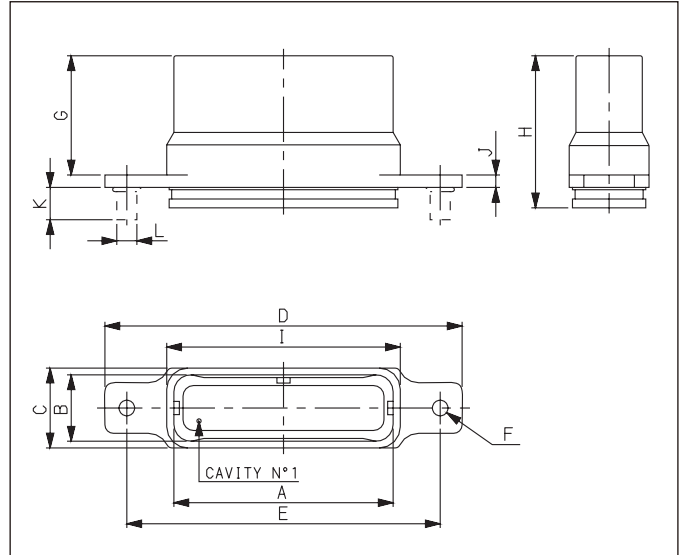


Dimensions (in mm)

Plug (Packed reference)

Shell size	Large				
Option	L1	L2	L3	L4	L5
Part number	8976-550	8976-560	8976-570	8976-580	8976-620
Mass (g)	100	104	103	102	102
Shell size	Large		Medium		
Option	L6	L7	M1	M2	M3
Part number	8976-630	8976-640	8976-590	8976-600	8976-610
Mass (g)	103	103	62	58	61

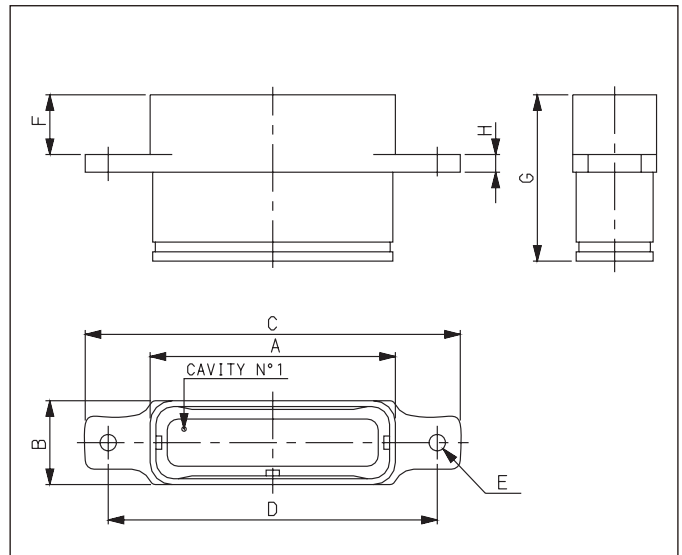
Dimensions						
Shell size	A	B	C	D	E	F*
Large	74,70 ^{+0,10} _{-0,10}	18,80 ^{+0,1} _{-0,1}	22,00 ^{+0,1} _{-0,1}	107,45 ^{+0,3} _{-0,3}	97,00	Ø 3,65 ^{+0,2} _{-0,2}
Medium	52,10 ^{+0,10} _{-0,10}	15,80 ^{+0,1} _{-0,1}	19,00 ^{+0,1} _{-0,1}	84,85 ^{+0,3} _{-0,3}	74,40	Ø 3,65 ^{+0,2} _{-0,2}
Shell size	G	H	I	J	K	L
Large	28,30 ^{+0,1} _{-0,1}	36,15 ^{+0,2} _{-0,2}	78,10 ^{+0,1} _{-0,1}	3,00 ^{+0,1} _{-0,1}	7,67 _{maxi}	Ø 6,73 _{maxi}
Medium	28,30 ^{+0,1} _{-0,1}	36,15 ^{+0,2} _{-0,2}	55,50 ^{+0,1} _{-0,1}	3,00 ^{+0,1} _{-0,1}	7,67 _{maxi}	Ø 6,73 _{maxi}



MSSP receptacle (packed reference)

Shell size	Large				
Option	L1	L2	L3	L4	L5
Part number	8976-100	8976-110	8976-120	8976-130	8976-170
Mass (g)	73	76	76	74	74
Shell size	Medium				
Option	M1	M2	M3		
Part number	8976-140	8976-150	8976-160		
Mass (g)	49	50	49		

Dimensions						
Shell size	A	B	C	D	E*	F
Large	78,10 ^{+0,10} _{-0,10}	22,00 ^{+0,1} _{-0,1}	107,45 ^{+0,3} _{-0,3}	97,00	Ø 3,65 ^{+0,2} _{-0,2}	13,50 ^{+0,30} _{-0,05}
Medium	55,50 ^{+0,10} _{-0,10}	19,00 ^{+0,1} _{-0,1}	84,85 ^{+0,3} _{-0,3}	74,40	Ø 3,65 ^{+0,2} _{-0,2}	13,50 ^{+0,30} _{-0,05}
Shell size	G	H				
Large	37,65 ^{+0,2} _{-0,2}	4,05 ^{+0,1} _{-0,1}				
Medium	37,65 ^{+0,2} _{-0,2}	4,05 ^{+0,1} _{-0,1}				



Rectangular Robotic Connectors



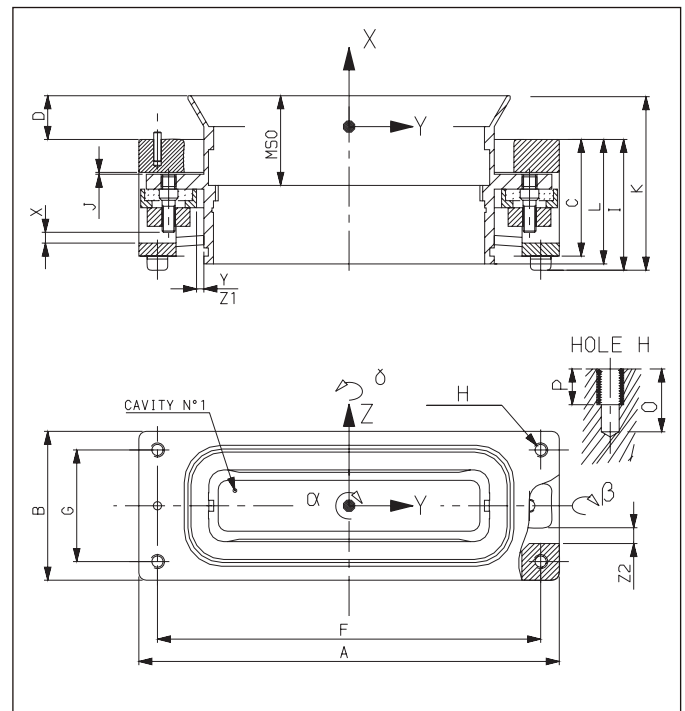
Dimensions (in mm)

ORU receptacle with compliance mechanism (Packed reference)

Part N°	Layout See Page	Shell Style
8970 - 250	L1	Large Receptacle
8970 - 260	L2	Large Receptacle
8970 - 270	L3	Large Receptacle
8970 - 280	L4	Large Receptacle
8970 - 320	L5	Large Receptacle
8970 - 290	M1	Large Receptacle
8970 - 300	M2	Large Receptacle
8970 - 310	M3	Large Receptacle

Shell size	Large				
Option	L1	L2	L3	L4	L5
Mass (g)	214	218	218	217	217
Shell size	Medium				
Option	M1	M2	M3		
Mass (g)	162	164	163		

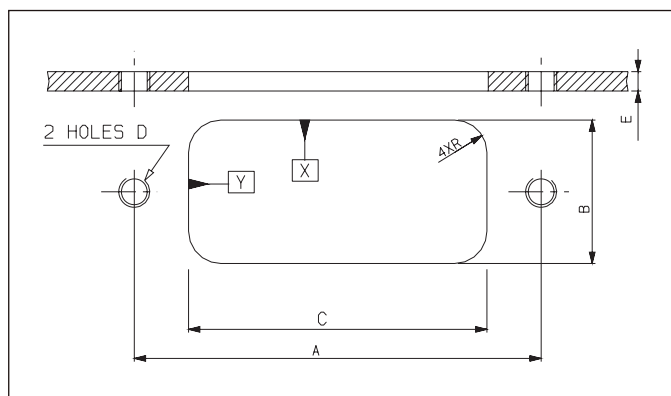
Dimensions						
Shell size	A	B	C	D	F	G
Large	113,1 ⁰ _{-0,19}	40,1 ⁰ _{-0,19}	31,56 ^{+0,05} _{-0,25}	11,7 ^{+0,34} _{-0,1}	103,00 ⁰ _{00,10}	30,00 ⁰ _{00,10}
Medium	90,5 ⁰ _{0,10}	37,1 ⁰ _{0,1}	31,56 ^{+0,05} _{-0,25}	11,7 ^{+0,34} _{-0,1}	80,50 ⁰ _{00,10}	27,00 ⁰ _{00,10}
Shell size	H	I	J	K	L	O
Large	6-32 UNC class 3B	35,36 ^{+0,13} _{-0,47}	1,15 ^{+0,20} _{-0,10}	47,06 ^{+0,38} _{-0,48}	33,55 ^{+0,05} _{-0,49}	11,00 _{mini}
Medium	6-32 UNC class 3B	35,36 ^{+0,13} _{-0,47}	1,15 ^{+0,20} _{-0,10}	47,06 ^{+0,38} _{-0,48}	33,55 ^{+0,05} _{-0,49}	11,00 _{mini}
Shell size	P	X*	Y*	Z1*	Z2*	MSO
Large	6,00 _{mini}	3,40 ^{+0,15} _{-0,15}	2,025 _{mini}	2,525 _{mini}	2,775 _{mini}	24,10 ⁰ _{0,05}
Medium	6,00 _{mini}	3,40 ^{+0,15} _{-0,15}	2,025 _{mini}	2,525 _{mini}	2,775 _{mini}	24,10 ⁰ _{0,05}



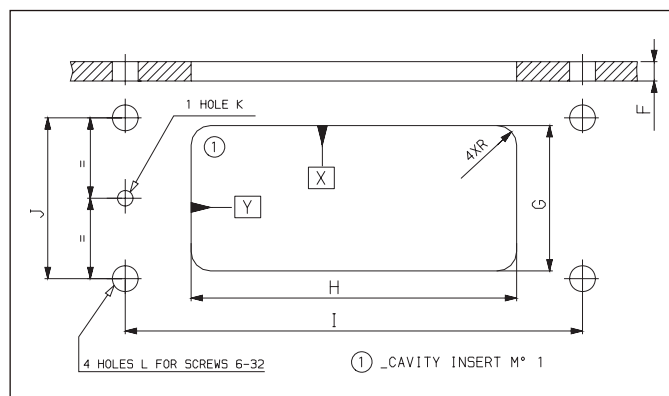


Panel cut-out

For plug and receptacle						
Shell size	A	B	C	D	E	R
Large	97	22,3	78,4	6-32 UNC-3B	3,15	4
Medium	74,4	19,3	55,8	6-32 UNC-3B	3,15	4



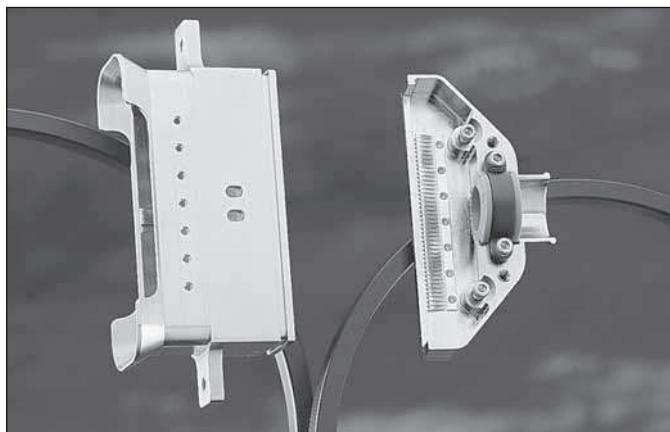
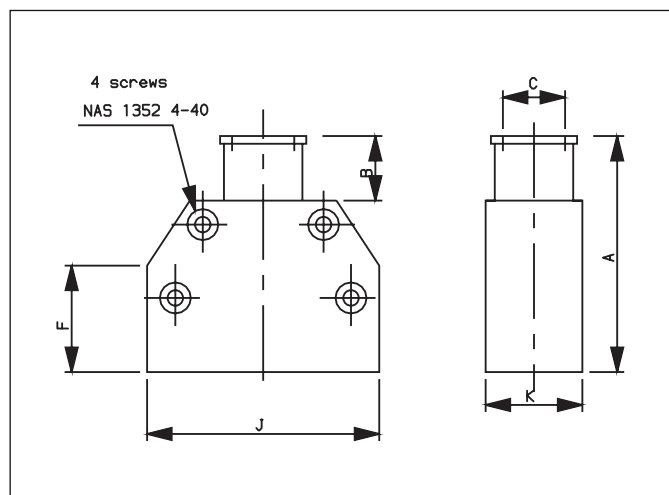
For compliance mechanism								
Shell size	F	G	H	I	J	K	L	R
Large	3,5	32	90	103	30	Ø 2,05	Ø 3,8	4
Medium	3,5	29	67,5	80,5	27	Ø 2,05	Ø 3,8	4



Backshells

Straight outlet normal profile

Dimensions							
Shell size	Part number	A	B	C	F	J	K
Large	8976-180	39,50 ^{+0,15} _{-0,25}	9,45 ^{+0,1} _{-0,1}	368 mm ²	15,05 ^{+0,3} _{-0,4}	80,05 ⁰ _{-0,2}	25,4 ⁰ _{-0,35}
Medium	8976-190	39,50 ^{+0,15} _{-0,25}	9,45 ^{+0,1} _{-0,1}	173 mm ²	15,45 ^{+0,3} _{-0,4}	57,45 ⁰ _{-0,2}	22,4 ⁰ _{-0,37}

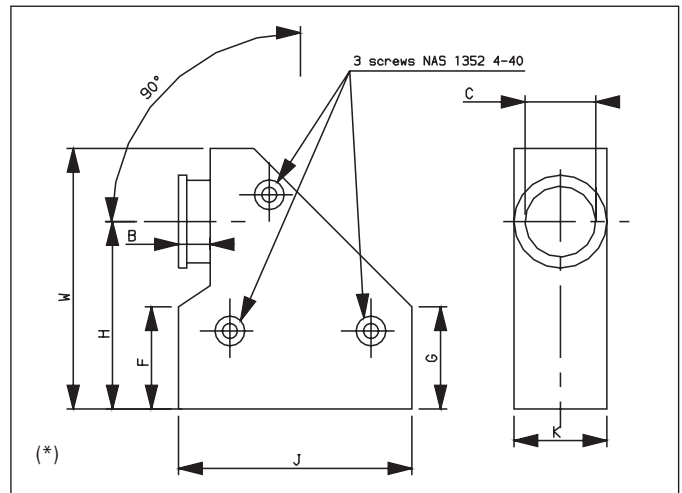




Backshells

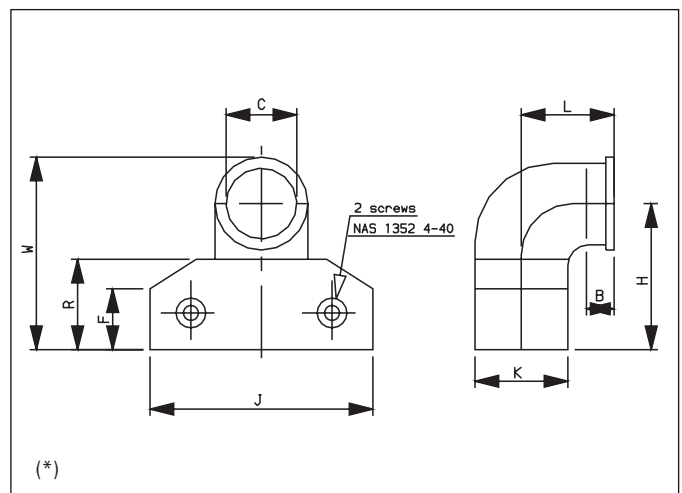
90° longitudinal outlet normal profile

Dimensions					
Shell size	Part number	F	G	H	W
Large	8976-200	$16,85^{+0,25}_{-0,15}$	$22,2^{+0,1}_{-0,1}$	$36,35^{+0,05}_{-0,05}$	$54,85^{+0,10}_{-0,20}$
Medium	8976-210	$16,00^{+0,1}_{-0,1}$	$22,2^{+0,1}_{-0,1}$	$38,10^{+0,05}_{-0,05}$	$54,85^{+0,10}_{-0,20}$



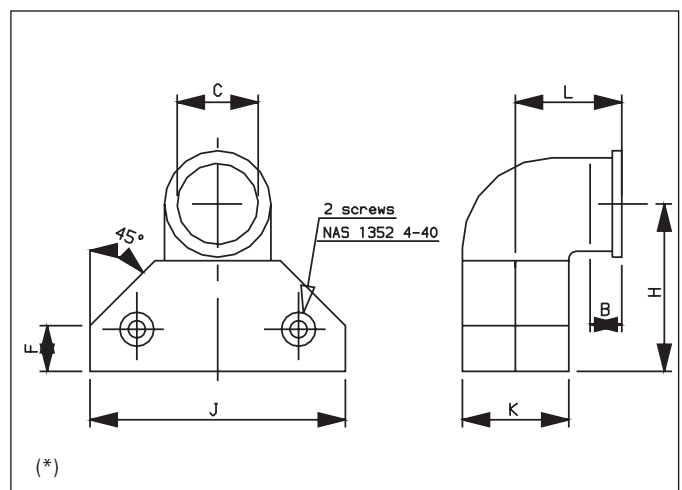
90° transverse outlet normal profile

Dimensions				
Shell size	Part number	L	W	R
Large	8976-220	$26,50^{+0,50}_{-0,50}$	$51,00^{+0,40}_{-0,40}$	$24,45^{+0,35}_{-0,35}$
Medium	8976-230	$25,40^{+0,50}_{-0,50}$	$48,90^{+0,40}_{-0,40}$	$24,45^{+0,35}_{-0,35}$



90° transverse outlet low profile

Dimensions					
Shell size	Part number	C	F	H	L
Large	8976-400	$17,60^{+0,2}_{-0,2}$	$9,5^{0}_{-0,2}$	$49,2^{0}_{-0,35}$	$26,8^{0}_{-0,5}$



(*) For other dimensions see page 89



In the frame of Space Station Alpha program, SOURIAU has developed and qualified a series of Quick Disconnect high reliability circular connector for robotic operations. This hardware is used as ORU interface on the JEM (Japanese Experiment Module Exposed) Facility which is part of the Japanese contribution to the Space Station. These connectors feature :

- Low Insertion Force contacts
- Thermal gradient compatibility
- Integrated misalignment catching system
- High durability (6000 operations)
- High EMI shielding efficiency
- Deep space environment (Atox) compatibility
- Arrangements from MIL-DTL-38999.



Performances

Mechanical and electrical

Mechanical
Mass • < 180 g for ORU plug • < 95 g for receptacle
ORU plug misalignments • $\Delta\alpha = \pm 0,9^\circ$ (movement around the X axis) • $\Delta\beta = \pm 0,9^\circ$ (angle authorized between the panels) • $\rho = 1,95$ mm (plane movement according to Y and Z requirements)
ORU receptacle overstroke • $\Delta X \geq 1,5$ mm

Electrical
Contact resistance as per MIL-DTL 39029

Materials and finishes

	Components	Material	Finish
Connector	Shells (receptacle & plug)	Aluminium alloy 7075	Nickel plating
	Inserts - Insulator	Epichlorhydrile + Polyal + Glass fiber or Polyetherimide resin	-
	- Grommet	Silicone	-
	Contacts	see contacts L.I.F.	see contacts L.I.F.
	Contact retaining clip	Copper alloy	-
LSD (*)	Receptacle & plug bottom plate and mechanical parts	Aluminium alloy 7075	Nickel plating
	Springs	Stainless steel	-

(1) **LSD** : Launching **S**ecurity **D**evice

Mating/Demating forces

	Mating force (N) (2)	Demating force (N)
25L-3	62	52
25L-7	84	63
25-19	125	102
25-20 (1)	161	158
25-35	142	116
25-61	110	84

(1) Configuration 3 # 16 optical contacts + 3 # 16 electrical contacts

(2) At room condition before compliance mechanism acting.

Circular Robotic Connectors



Part Number / Characteristics

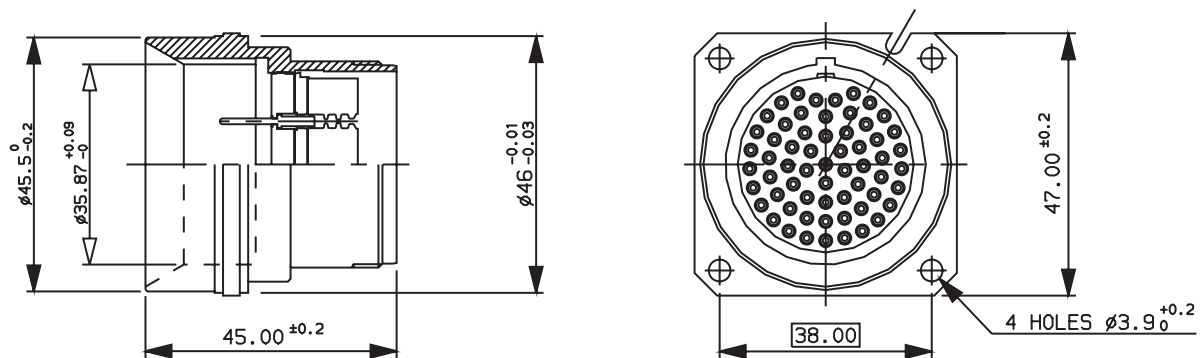
SOURIAU Part number	Type	Mass in gram (with contacts)	Insert	Layouts		Male insert (in front view)
				Qty	Type	
8977-09A	Plug	178	25L-3	1	# 8 (pc)	
8977-10A	Receptacle	92		2	# 4 (pc)	
8977-11A	Plug	187	25L-7	7	# 8 (pc)	
8977-12A	Receptacle	96				
8977-15A	Plug	177	25-19	19	# 12 (pc)	
8977-16A	Receptacle	87)				
8977-17A	Plug	177	25-20	10	# 20 (pc)	
8977-18A	Receptacle	87		13	# 16 (pc)	
				4	# 12 (cc)	
				3	# 8 (cc)	
8977-19A	Plug	174	25-35	128	# 22 (sc)	
8977-20A	Receptacle	81				
8977-13A	Plug	169	25-61	61	# 20 (sc)	
8977-14A	Receptacle	77				
8977-31A	Receptacle	70	25-43	23	# 20 (pc)	
8977-32A	Plug	135		20	# 16 (pc)	
8977-25A	LSD-P	86		for plug		
8977-24A	LSD-R	11		for receptacle		

(pc) : power contact ; (cc) : coax contact ; (sc) : signal cotnact

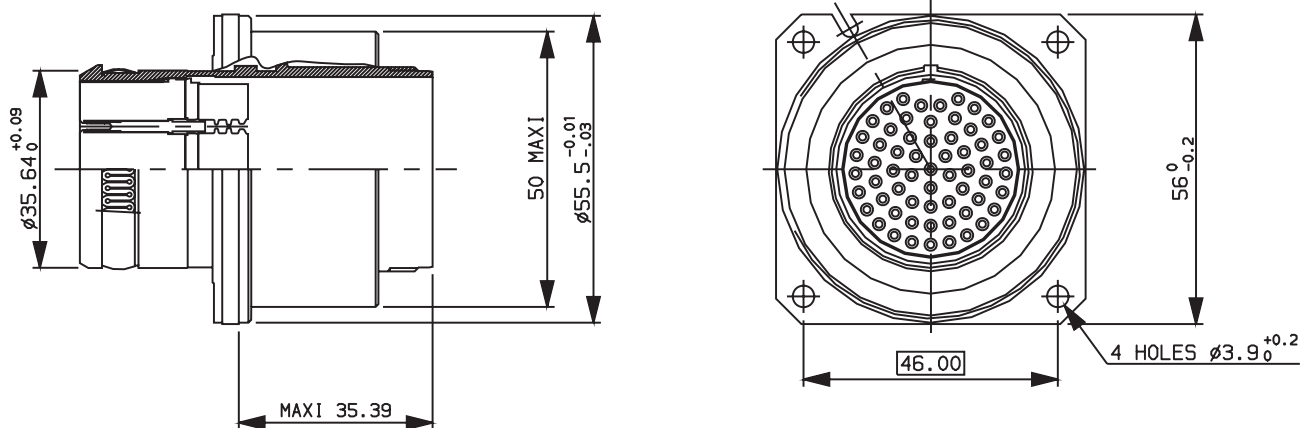


Dimensions for Quick Disconnect (QD) Connector

Receptacle



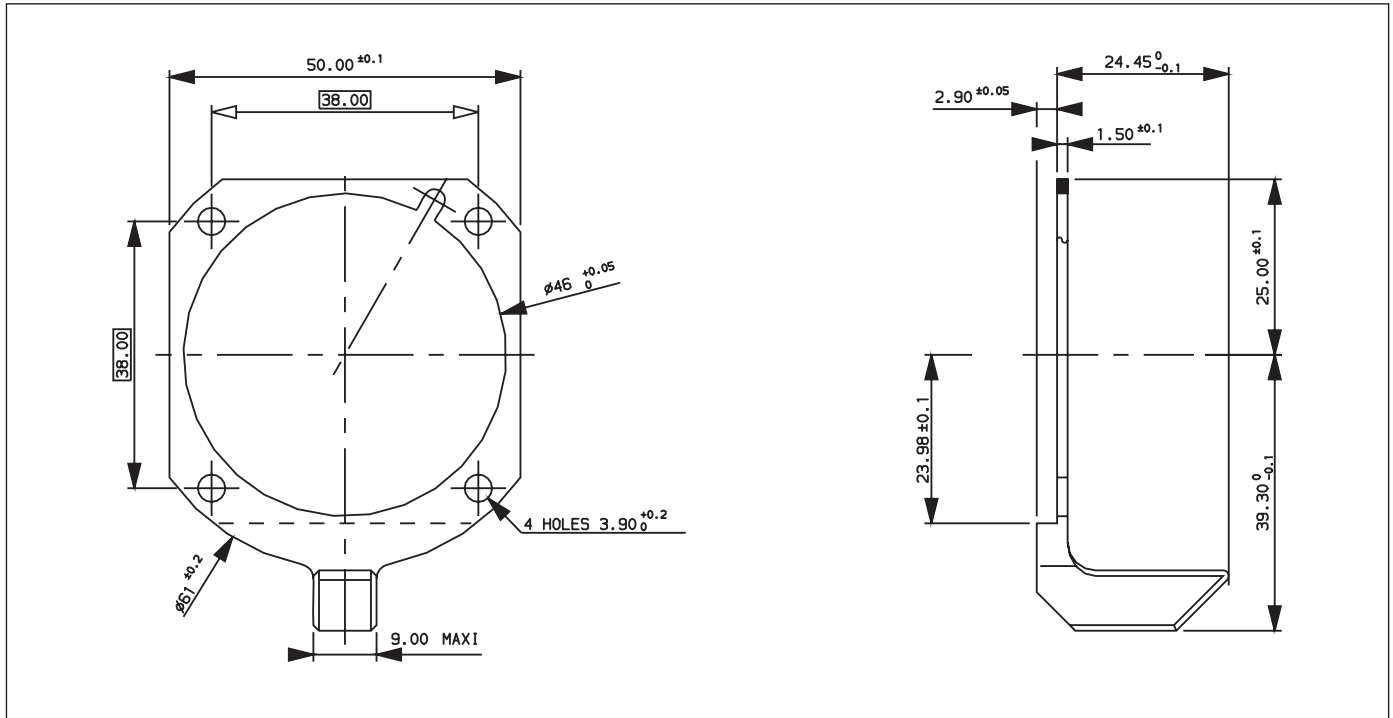
Plug



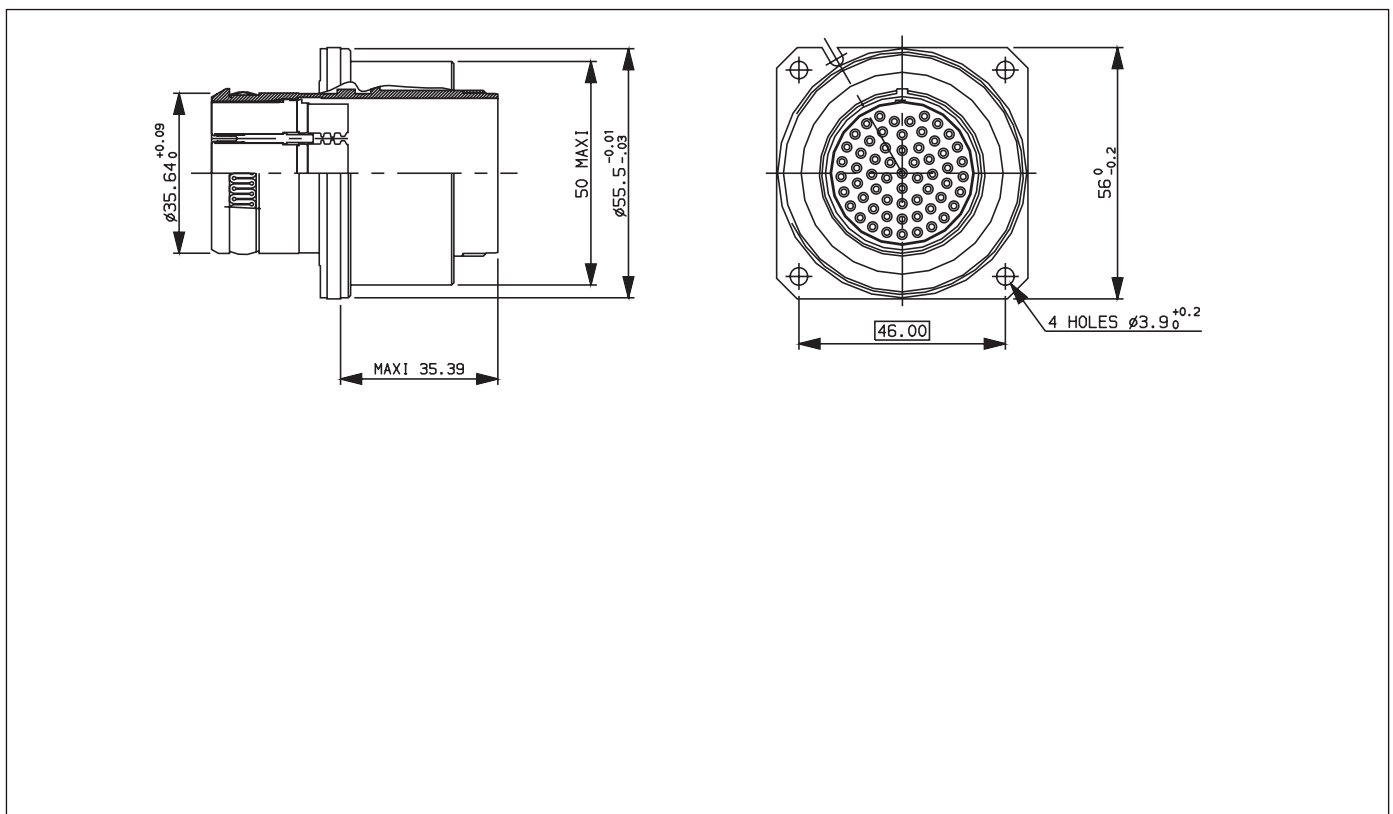


Dimensions for Launching Security Device (LSD)

LSD Receptacle



LSD Plug

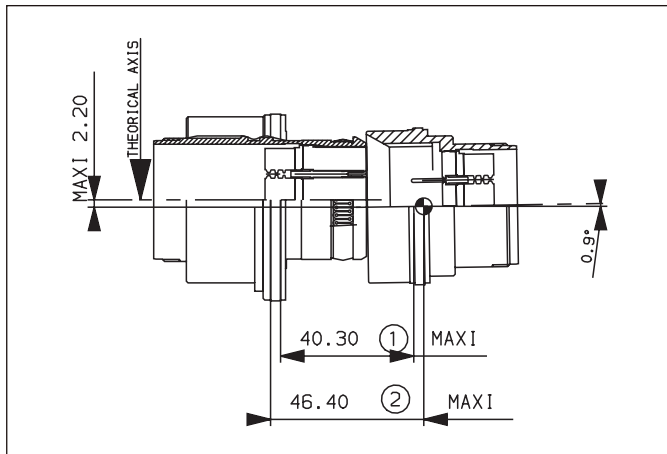




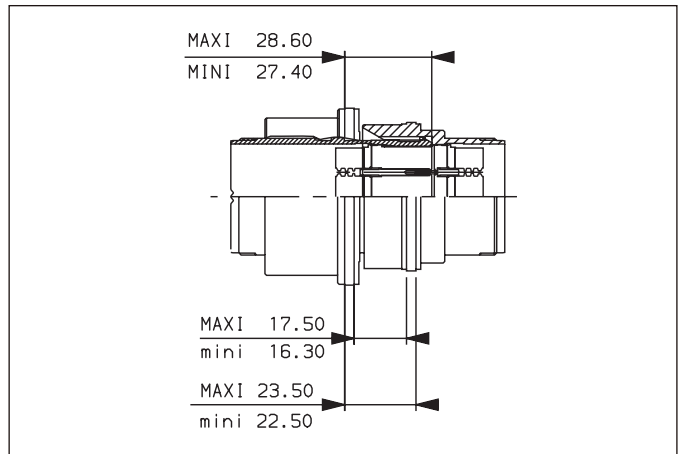
Presentation & Configuration for coupling

Receptacle & Plug

Before mating



After mating



During the mating operation, the receptacle comes up to plug. The front of plug enters in receptacle cone. When plug touches the cone, this induces a lateral movement of plug shell relatively to the flange fixed on panel. This movement stops when the plug shell axis is in conformance with the receptacle ones.

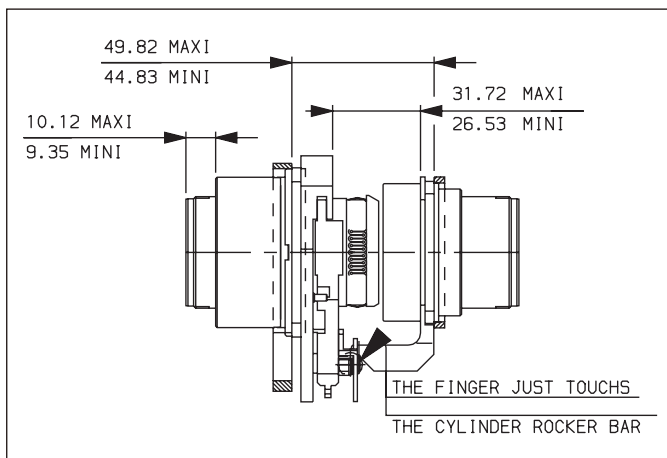
The axial movement induces engagement of the plug shell key in the plug receptacle keyway, its entry cone inducing the rotation of plug shell around the X axis.

At the end of the total connection, plug comes to touch the internal face of the receptacle. The relative axial movement continues, which induces the displacement of plug shell comparatively to the flange fixed on panel. This displacement of plug shell compresses the spring in external casing.

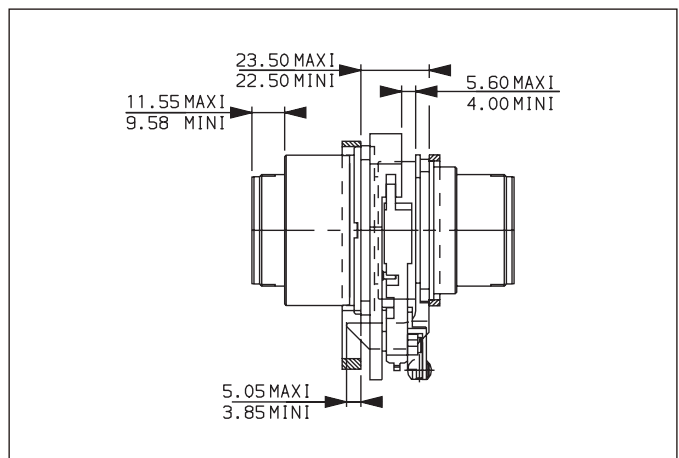
The minimum guaranteed overstroke is 1,5 mm.

Connector with Launching Security Device (LSD)

Before mating



After mating



The Launching Security Device is designed to catch the floating connector plug shell during the flight.

Its two principal parts are respectively fixed with plug and receptacle flanges.

LSD side is fixed on plug flange. The plug shell is blocked by two arms and the system is locked by the cylinder rocker bar.

The LSD arms prevent plug shell movements caused by vibrations and acceleration during the launch.

When the coupling of the two parts happens, the finger of receptacle part pushes the cylinder rocker bar which releases the arms and liberates plug shell.

At this point, the mating occurs as described above.

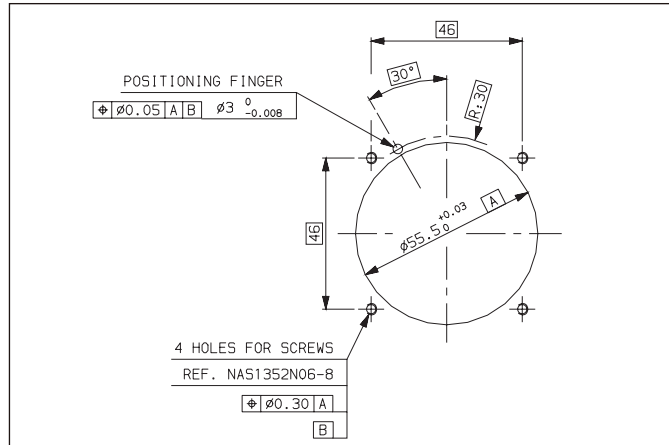
The LSD in unlocked position will necessitate an external and manual action to be locked again on plug shell.



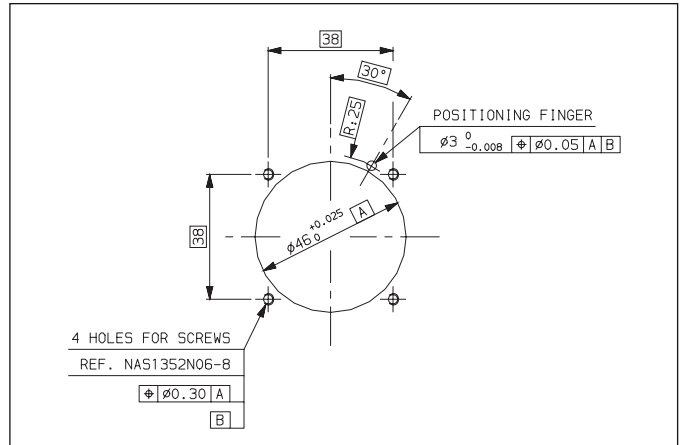
Panel cut-out

Without Launching Security Device (LSD)

Plug

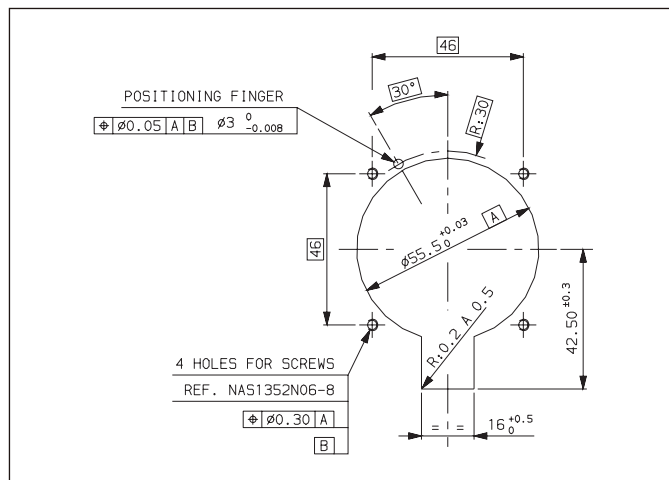


Receptacle

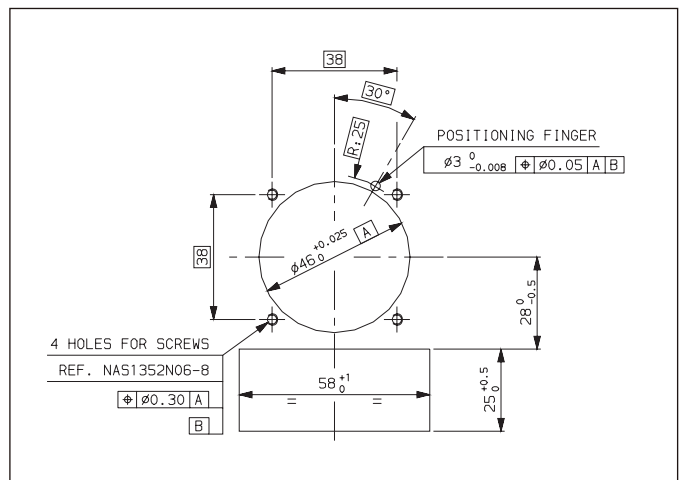


QD connector with Launching Security Device (LSD)

Plug



Receptacle



Crimping, Insertion & Removal tools for contacts

Size contacts	Contact	Crimping tools	Positioner	Insertion & Removal plastic tools
# 22	Pin Socket	M 22520/2-01	M 22520/2-09 M 22520/2-07	M 81696/14-01
# 20	Pin Socket	M 22520/1-01	M 22520/1-04	M 81696/14-10
# 16	Pin Socket			M 81696/14-03
# 12	Pin Socket			M 81696/14-04
# 8	Pin Socket	M 22520/23-01 + M 22520/23-02	M 22520/23-09	M 81696/14-12*
# 4	Pin Socket	M 22520/23-01 + M 22520/23-04	M 22520/23-11	M 81696/14-07*
# 8 coax	Pin Socket	M 22520/1-01 + M 22520/5-01 + M 22520/5-45 (jaws)	C31-SN 1891 K103	8660-197* (1)



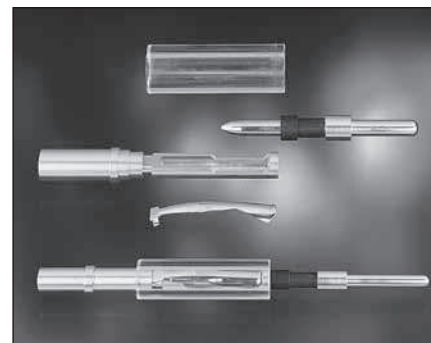
Field of Application

This type of contact is used when low mating/demating forces and/or high number of mating/demating cycles are required. These contacts are compatible with following connectors :

- MIL-DTL-38999 connectors
- Rack-panel
- Extra Vehicular Activity Connectors (8976, MAXI-D & 8977).

Developed Sizes

- # 22
- # 20
- # 16
- # 12 power
- # 12 coax
- # 8 power
- # 8 triax
- # 4 power



Characteristics

Description and assets

LIF contacts insure a minimum mating/demating force and are qualified for over 6000 mating/demating cycles (instead of 500 for standard contacts). The other benefits of such contacts are :

- They are suitable for Extra-Vehicular Activity (EVA) operations performed by astronauts or by manipulator arms in deep space environment.
- They limit the force needed for mating and demating thanks to their elastic concept.
- The insulator cavities are based on the MIL-DTL-38999.
- They suffer no variation of contact resistance versus mechanical lifetime.

Parameters

Size of contacts		Max insertion Force (N)	Contact resistance (mΩ)
# 22		0,4	14
# 20		0,9	7
# 16		2,7	4
# 12		4,4	3,5
# 12 coax	Inner contact	3 (mounted)	5,5
	Outer contact		6,25
# 8		7,5	3
# 8 triax	Inner contact	6 (mounted)	10
	Intermediate contact		10
	Outer contact		6,25
# 4		12	2,5

These figures explain the naming «Low Insertion Force» and its direct effect on the increase of contact life.

Design and materials

Contact type		Material	Finish
Pin Socket (# 20 to # 4)		Copper alloy	Electroless nickel 2,54 µm gold doped nickel
		Beryllium copper (plastic properties)	2,54 µm gold doped nickel
Pallet Lif (# 22)		Beryllium nickel	2,54 µm gold doped nickel
# 12 coax	Pin	Copper alloy	2 µm ± 20 % nickel underplate
	Socket	Beryllium copper	1,27 µm mini gold plate
	Insulator	PTFE (Teflon)	-
# 8 triax	Pin	Copper alloy	2 µm ± 20 % nickel underplate
	Socket	Beryllium copper	1,27 µm mini gold plate
	Insulator	PTFE (Teflon)	-



Part Number & Dimensions (in mm)

Size of contacts	Pin	Socket
# 22	Part number : 8976-350 (packed per 250)	Part number : 8976-650 (packed per 250)
# 20	Part number : 8976-360 (packed per 250)	Part number : 8976-660 (packed per 250)
# 16	8976-93A (for information)	8976-30A (for information)
# 12	Part number : 8976-370 (packed per 100)	Part number : 8976-670 (packed per 100)

LOW Insertion Force (L.I.F.) contacts

Size of contacts	Pin	Socket
# 12 coax	Part number : 8976-380 (qty : 30)	Part number : 8976-680 (qty : 30)
# 8 triax	Part number : 8977-388A (qty : 1)	Part number : 8977-389A (qty : 1)
# 8	Part number : 8975-1949	Part number : 8975-1988
# 4	Part number : 8975-1952	Part number : 8975-1989

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Киргизия +996(312)96-26-47

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