Objet /*Subject* :

TS 2000
NEW GOLD PLATING ON CONTACTS ESA/SCC 3401/009

Sizes 20, 16 AND 12 (TS 228)

QUALIFICATION IN ACCORDANCE WITH ESA/SCC 3401

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Approbations / *Approvals* (dernier indice)

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Evolutions / *Revisions*

Indice/ *Issue*	Nature des évolutions / *Description of evolution*	Page	Date	Auteur / *Author*
∅	Creation of document	/	17/03/03	C. SVINH
a	Added data sheet nr 24 “Joint strength test” according to request from CNES	1-6-8-32 app. 2 (p.4/4)	27/05/04	C. SVINH

Contents

1. *SCOPE OF THE TEST*

This document reports the results of the tests in order to verify if contacts with selective gold plating code 228 (new overall gold plating 1.3 µm over unchanged nickel 1.5 µm applied on DBAS SCC products) meet or exceed the requirements of the ESA/SCC general specification 3401 for contacts size 20, 16 and 12.

2. *REFERENCE DOCUMENTS*

➢ ESCC 3401	Connectors, electrical, non-filtered circular and rectangular. Generic specification.
➢ ESCC 3401/009	Contact, electrical, crimp, for 3401/007 and 3401/008 connectors. Detail specification.
➢ ECSS-Q-70-26A	Crimping of high-reliability electrical connections.
➢ ECSS-Q-70-08A	Brasure.
➢ DTS/AQ/QCP/TP-2001-112	Etude des paramètres de mise en œuvre de sertissage de contacts.
➢ Deutsch technical specification:	STD 540-1-12 (selective gold coating 1,3 µm, code TS 228, applied on standard products).
➢ Coating process qualification :	DQP 305 999 001.
➢ SE 006-001 VA	Test sequence.

3. *GENERAL CONDITIONS*

Tests shall be conducted in laboratory under the following ambient conditions :

- temperature : 22°C ± 3°C
- relative humidity : 45 to 75%
- air pressure : 860 to 1 060 mbar

4. SAMPLES UNDER TEST

4.1 Designation

- contact size 20 : - Pin : 006-0937-20A (TS 228, selective coating 1.3 µm).
  - Socket : 006-0912-20A (TS 228, selective coating 1.3 µm).
- contact size 16 : - Pin : 006-0937-16A (TS 228, selective coating 1.3 µm).
  - Socket : 006-0912-16A (TS 228, selective coating 1.3 µm).
- contact size 12 : - Pin : 006-0937-12A (TS 228, selective coating 1.3 µm).
  - Socket : 006-0912-12A (TS 228, selective coating 1.3 µm).

4.2 Distribution of samples lot

- Contacts pairs each size, shall be distributed in 3 groups (defined in § 5 of this document) as follows :

  - group I : 8 contacts pairs of each size, contacts not installed in connectors.
  - group II : -20 contacts pairs size 20,
    -12 contacts pairs size 16,
    -6 contacts pairs size 12, installed in appropriate connectors.
  - group III : -20 contacts pairs size 20,
    -12 contacts pairs size 16,
    -6 contacts pairs size 12, installed in appropriate connectors

4.3 Wiring

Group I, II and III :

- 50% of the contact of each size shall be crimped on max wire size,
- 50% of the contact of each size shall be crimped on min wire size.

Minimum and maximum gauge wires

Size		Wire	
Contact	Barrel	Section (mm²)	Closest AWG (*)
20	20	0.60	20
		0.21	24
16	16	1.34	16
		0.60	20
12	12	2.98	12
		1.82	14

(*) AWG : American Wire Gage

for contact size 20, 16, and 12 :

- Crimping tool : M22520/1-01
- Turret : M22520/1-02

5. *TEST SEQUENCE*

GROUP I (contacts not installed in connectors)

ESA/SCC 3401	TEST DESCRIPTION	DATA SHEET N°
9.14	Plating thickness	1
9.10	Wiring	2
9.1.1.3	Low level contact resistance	3
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GROUP II

ESA/SCC 3401	TEST DESCRIPTION	DATA SHEET N°
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9.1.1.3	Contact resistance at rated current (*)	12
9.28	Gauge insertion and extraction in and out of female contact	13
9.13	Climatic sequence (*)	14
9.13.2	Climatic sequence - Dry heat (*)	15
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9.13.5	Climatic sequence – Low air pressure (*)	18
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9.28	Gauge insertion and extraction in and out of female contact	21
9.1.1.3	Drift of low level contact resistance (*)	22
9.1.1.3	Drift of contact resistance at rated current (*)	23
9.15	Joint strength	24

GROUP III

ESA/SCC 3401	TEST DESCRIPTION	DATA SHEET N°
9.28	Gauge insertion and extraction in and out of female contact	25
9.26	Electrical overload test (*)	26
9.1.1.3	Contact resistance at rated current	27
9.18	Mechanical endurance (*)	28
5.2.2	Gold plate porosity	29

(*) for these tests, all contacts are inserted in following appropriate connectors parts :

Contact size	Receptacle	Plug
20	DBAS 70-61-0 SN (according to ESA/SCC3401)	DBAS 76-61-0 PN (according to ESA/SCC3401)
16	DBAS 70-61-14 SN (according to ESA/SCC3401)	DBAS 76-61-14 PN (according to ESA/SCC3401)
12	DBAS 70-37-3 SN (according to ESA/SCC3401)	DBAS 76-37-3 PN (according to ESA/SCC3401)

6. CONCLUSION

Contacts passed sucessfully all the tests and controls defined in § 5. TEST SEQUENCE.

Note : Coating removes itself if contacts were not rinsed shortly afterwards the immersion in nitric acid.

7. RESULTS

All results are noted on the data sheets nr 1 thru 29 and in the appendices of the following pages.

8. APPENDICES

Appendix 1 :

∗-Initial measurement for :

- Contact resistance low level,
- Contact resistance at rated current,
- Gauge insertion and extraction forces socket.

∗-Measurement of thickness of coating on contact.

Appendix 2 :

∗-Final measurement for :

- Drift of low level contact resistance,
- Drift of contact resistance at rated current,
- Gauge insertion and extraction forces socket.
- Joint strength.

DATA SHEET nr 1			
Plating thickness			**GROUP I**
Date : 01/07/02	**Tested by : JN. LAURENT**	**Reference : ESA/SCC 3401 § 9.14**	

Test equipment : **Last cal date :**

X-ray fluorescence FISHER 7020 0160 00 002 02/02

Procedure :

Contacts were introduced in the machine and thickness of coating was measured.

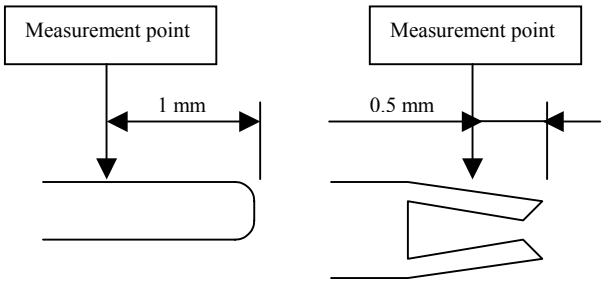
Requirements :

Thickness of coating on contacts shall be checked in the contact active area and recorded.
Minimum thickness of coating permitted : 1.3 µm.

Results :

At the end of the test, results are conformable.
Minimum thickness measured : # 20 : 1.40 µm
16 : 1.30 µm
12 : 1.30 µm

Note : measurement was conducted as follows :



For detailed results, see Appendix 1.

D A T A S H E E T n r 2			
Wiring			**GROUP I**
Date : 22/10/02	**Tested by : X. POTEL**	**Reference : ESA/SCC 3401 § 9.10**	

Test equipment : **Last cal date :**

Binocular OLYMPUS	7501 0005 00 001	None

Procedure :

Verify the integrity of contacts.
Marking and aspect shall be examined.

Requirements :

- The conductor shall be visible in the inspection hole.
- The crimp barrel shall have no unintentional sharp edges, peeled metal, burrs, cracked plating or cuts after crimping.

Results :

At the end of inspection, results are conformable.

No cracking, no peeled metal, no burr was observed.

DATA SHEET nr 3

Low level contact resistance			GROUP I
Date : 22/10/02	**Tested by : X. POTEL**	**Reference : ESA/SCC 3401 § 9.1.1.3**	

Test equipment : **Last cal date :**

Ammeter MA 602	7320 0039 04 001	07/01
Current generator DIGISTANT	7342 0005 01 001	None
Voltmeter 7061 SCHLUMBERGER	7341 0001 01 001	03/01

Procedure :

Contact resistance shall be measured under a 10mA current :

Contact size	Wire size	Max contact resistance (mΩ)
20	20-24	9
16	16-20	9
12	12-14	9

The resistance of the wire included between the measurement points shall be deducted from the contact resistance.

Measurement shall be performed once in each direction of the current. The average of the 2 measurements shall be noted. Voltage drop shall be measured within 5 seconds.

Requirements :

Contact resistance shall be in accordance with the values of the table above.

Results :

At the end of the test, results are conformable.
Maximum contact resistance measured : # 20 : 1.51 mΩ
16 : 0.83 mΩ
12 : 0.53 mΩ

See complete results in appendix 1.

DATA SHEET nr 4

Contact resistance at rated current			GROUP I
Date : 22/10/02	**Tested by : X. POTEL**	**Reference : ESA/SCC 3401 § 9.1.1.3**	

Test equipment : **Last cal date :**

Ammeter MA 602	7320 0039 04 001	07/01
Current generator DIGISTANT	7342 0005 01 001	None
Current generator FONTAINE (for size 12)	7342 0002 03 003	None
Voltmeter 7061 SCHLUMBERGER	7341 0001 01 001	03/01

Procedure :

Contact resistance shall be measured under rated current :

Contact size	Wire size	Test current (A)	Max contact resistance (mΩ)
20	20-24	7.5	8
16	16-20	13	6
12	12-14	23	6

The resistance of the wire included between the measurement points shall be deducted from the contact resistance.

Measurement shall be performed once in each direction of the current. The average of the 2 measurements shall be noted. Voltage drop shall be measured within 5 seconds.

Requirements :

Contact resistance shall be in accordance with the values of the table above.

Results :

At the end of the test, results are conformable.
Maximum contact resistance measured : # 20 : 1.75 mΩ
16 : 0.68 mΩ
12 : 0.37 mΩ

See complete results in appendix 1.

DATA SHEET nr 5

Gauge insertion and extraction in and out of female contact			GROUP I
Date : 23/10/02	**Tested by : X. POTEL**	**Reference : ESA/SCC 3401 § 9.28**	

Test equipment : **Last cal date :**

Paper recorder SEFRAM	7320 0047 10 001	02/02
Force gauge TME	7107 0001 01 001	01/02

Procedure :

Maximum gauge is inserted and extracted three times in a socket contact.
The insertion force is measured with the maximum size gauge and the extraction force with the minimum gauge (see table below).
The gauges are inserted in each contact at 0.7 x Socket depth.

Requirements :

Maximum insertion and minimum extraction forces shall be as follows :

Contact size	Insertion (g)	Maximum gauge	Extraction (g)	Minimum gauge
20	≤ 333	1.041 mm	≥ 20	0.993 mm
16	≤ 555	1.613 mm	≥ 56	1.562 mm
12	≤ 840	2.413 mm	≥ 85	2.362 mm

Results :

At the end of the test, results are conformable.

		#20	average	#16	average	#12	average
TS 228	Maximum insertion force measured (g)	290	251	460	366	620	543
	Minimum extraction force measured (g)	120	155	210	267	320	386

See complete results in appendix 1.

DATA SHEET nr 6

Endurance at temperature			GROUP I
Date : 24/10/02 to 05/12/02	**Tested by : X. POTEL**	**Reference : ESA/SCC 3401 § 9.21**	

Test equipment : **Last cal date :**

Oven CLIMATS	7601 0010 02 001	09/02

Procedure :

Mated contacts were introduced in a hot chamber at a temperature of 200°C.
They were maintained for 1000 hours in these conditions.

Requirements :

No defect except discolouration shall be accepted.
Contacts shall withstand the "contact resistance" test.

Results :

At the end of examination, results are conformable.
See data sheet nr 9 and 10 hereafter.

DATA SHEET nr 7

Corrosion			GROUP I
Date : 09/12/02 To 11/12/02	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.22**	

Test equipment : **Last cal date :**

Salt spray chamber	7600 0010 00 001	Checked when used

Procedure :

Unmated contacts shall be introduced in the salt spray chamber (in horizontal position) and maintained in this condition for 48 hours :

- Chamber temperature : 35 ± 2°C.
- Saturator temperature : 45 ± 2°C.

At the end of the exposing period, connectors shall be cleaned and rinsed in running tap water and then dried.

Requirements :

There shall be no electrical or mechanical defect that will affect life, serviceability or appearence.

Results :

At the end of the test, results are conformable.
No damage was observed.

DATA SHEET nr 8

Gauge insertion and extraction forces in and out of female contact			GROUP I
Date : 11/12/02	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.28**	

Test equipment : **Last cal date :**

Paper recorder SEFRAM	7320 0047 10 001	02/02
Force gauge TME	7107 0001 01 001	01/02

Procedure :

Maximum gauge is inserted and extracted three times in a socket contact.
The insertion force is measured with the maximum size gauge and the extraction force with the minimum gauge (see table below).
The gauges are inserted in each contact at 0.7 x Socket depth.

Requirements :

Maximum insertion and minimum extraction forces shall be as follows :

Contact size	Insertion (g)	Maximum gauge	Extraction (g)	Minimum gauge
20	≤ 333	1.041 mm	≥ 20	0.993 mm
16	≤ 555	1.613 mm	≥ 56	1.562 mm
12	≤ 840	2.413 mm	≥ 85	2.362 mm

Results :

At the end of the test, results are conformable.

		#20	average	#16	average	#12	average
TS 228	Maximum insertion force measured (g)	270	176	380	314	440	348
	Minimum extraction force measured (g)	50	61	160	184	220	261

See complete results in appendix 1.

DATA SHEET nr 9

Drift of low level contact resistance			GROUP I
Date : 12/12/02	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.1.1.3**	

Test equipment : **Last cal date :**

Ammeter MA 602	7320 0039 04 001	11/02
Current generator DIGISTANT	7342 0005 01 001	None
Voltmeter 7061 SCHLUMBERGER	7341 0001 01 001	03/01

Procedure :

Contact resistance shall be measured under 10mA current :

Contact size	Wire size	Max contact resistance (mΩ)	Drift max
20	20-24	9	3 mΩ
16	16-20	9	
12	12-14	9	

The resistance of the wire included between the measurement points shall be deducted from the contact resistance.

Measurement shall be performed once in each direction of the current. The average of the 2 measurements shall be noted. Voltage drop shall be measured within 5 seconds.

Requirements :

Contact resistance shall be in accordance with the values of the table above.

Results :

At the end of the test, results are conformable.

			Drift
Maximum contact resistance measured :	# 20	: 1.67 mΩ	0.16 mΩ
	# 16	: 0.80 mΩ	0.03 mΩ
	# 12	: 0.60 mΩ	0.07 mΩ

See complete results in appendix 2.

DATA SHEET nr 10

Drift of contact resistance at rated current			GROUP I
Date : 12/12/02	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.1.1.3**	

Test equipment : **Last cal date :**

Ammeter MA 602	7320 0039 04 001	11/02
Current generator DIGISTANT	7342 0005 01 001	None
Current generator FONTAINE (for size 12)	7342 0002 03 003	None
Voltmeter 7061 SCHLUMBERGER	7341 0001 01 001	03/01

Procedure :

Contact resistance shall be measured under rated current depending on the wire size :

Contact size	Wire size	Test current (A)	Max contact resistance (mΩ)	Drift max.
20	20-24	7.5	8	3 mΩ
16	16-20	13	6	
12	12-14	23	6	

The resistance of the wire included between the measurement points shall be deducted from the contact resistance.

Measurement shall be performed once in each direction of the current. The average of the 2 measurements shall be noted. Voltage drop shall be measured within 5 seconds.

Requirements :

Contact resistance shall be in accordance with the values of the table above.

Results :

At the end of the test, results are conformable.

			Drift
Maximum contact resistance measured :	# 20	: 1.81 mΩ	0.06 mΩ
	# 16	: 0.82 mΩ	0.16 mΩ
	# 12	: 0.44 mΩ	0.07 mΩ

See complete results in appendix 2.

DATA SHEET nr 11

Low level contact resistance			GROUP II
Date : 13/12/02	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.1.1.3**	

Test equipment : **Last cal date :**

Ammeter MA 602	7320 0039 04 001	11/02
Current generator DIGISTANT	7342 0005 01 001	None
Voltmeter 7061 SCHLUMBERGER	7341 0001 01 001	03/01

Procedure :

Contact resistance shall be measured under a 10mA current :

Contact size	Wire size	Max contact resistance (mΩ)
20	20-24	9
16	16-20	9
12	12-14	9

The resistance of the wire included between the measurement points shall be deducted from the contact resistance.

Measurement shall be performed once in each direction of the current. The average of the 2 measurements shall be noted. Voltage drop shall be measured within 5 seconds.

Requirements :

Contact resistance shall be in accordance with the values of the table above.

Results :

At the end of the test, results are conformable.
Maximum contact resistance measured : # 20 : 1.19 mΩ
16 : 0.58 mΩ
12 : 0.54 mΩ

See complete results in appendix 1.

DATA SHEET nr 12

Contact resistance at rated current			GROUP II
Date : 13/12/02	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.1.1.3**	

Test equipment : **Last cal date :**

Ammeter MA 602	7320 0039 04 001	11/02
Current generator DIGISTANT	7342 0005 01 001	None
Current generator FONTAINE (for size 12)	7342 0002 03 003	None
Voltmeter 7061 SCHLUMBERGER	7341 0001 01 001	03/01

Procedure :

Contact resistance shall be measured under rated current :

Contact size	Wire size	Test current (A)	Max contact resistance (mΩ)
20	20-24	7.5	8
16	16-20	13	6
12	12-14	23	6

The resistance of the wire included between the measurement points shall be deducted from the contact resistance.

Measurement shall be performed once in each direction of the current. The average of the 2 measurements shall be noted. Voltage drop shall be measured within 5 seconds.

Requirements :

Contact resistance shall be in accordance with the values of the table above.

Results :

At the end of the test, results are conformable.
Maximum contact resistance measured : # 20 : 1.13 mΩ
16 : 0.58 mΩ
12 : 0.59 mΩ

See complete results in appendix 1.

DATA SHEET nr 13

Gauge insertion and extraction forces in and out of female contact			**GROUP II**
Date : 30/01/03	**Tested by : C.SVINH**	**Reference : ESA/SCC 3401 § 9.28**	

Test equipment : **Last cal date :**

Paper recorder SEFRAM	7320 0047 10 001	02/02
Force gauge TME	7107 0001 01 001	01/02

Procedure :

Maximum gauge is inserted and extracted three times in a socket contact.
The insertion force is measured with the maximum size gauge and the extraction force with the minimum gauge (see table below).
The gauges are inserted in each contact at 0.7 x Socket depth.

Requirements :

Maximum insertion and minimum extraction forces shall be as follows :

Contact size	Insertion (g)	Maximum gauge	Extraction (g)	Minimum gauge
20	≤ 333	1.041 mm	≥ 20	0.993 mm
16	≤ 555	1.613 mm	≥ 56	1.562 mm
12	≤ 840	2.413 mm	≥ 85	2.362 mm

Results :

At the end of the test, results are conformable.

		#20	average	#16	average	#12	average
TS 228	Maximum insertion force measured (g)	330	296	520	391	640	580
	Minimum extraction force measured (g)	140	160	199	302	400	437

See complete results in appendix 1.

DATA SHEET nr 14			
Climatic sequence			GROUP II
Date : 25/02/03	**Tested by : C.SVINH**	**Reference : ESA/SCC 3401 § 9.13**	

Test equipment : **Last cal date :**

See data sheets nr 15 to 19.

Procedure :

Contacts shall be installed in connectors and submitted to the following tests :

- Dry heat (200°, 2 hours)
- Damp heat
- Cold test
- Low air pressure
- Damp heat

Requirements :

After all the tests defined above, the components shall be visually inspected.

Results :

At the end of the test, results are conformable.

See data sheets nr 15 to 19 hereafter.

DATA SHEET nr 15			
Climatic sequence – Dry heat			**GROUP II**
Date : 25/02/03	**Tested by : C.SVINH**	**Reference : ESA/SCC 3401 § 9.13.2**	

Test equipment : **Last cal date :**

Oven CLIMATS	7601 0015 02 006	09/02

Procedure :

The mated connectors shall be exposed to 200° C for a period of 2 hours.

Requirements :

There shall be no damage detrimental to the contacts.

Results :

At the end of the test, results are conformable**.**

No damage was observed.

D A T A S H E E T n r 1 6			
Climatic sequence – Damp heat			**GROUP II**
Date : 26/02/03	**Tested by : C.SVINH**	**Reference : ESA/SCC 3401 § 9.13.3**	

Test equipment : **Last cal date :**

Climatic chamber SAPRATIN	7600 0001 00 001	09/02

Procedure :

The mated connectors shall be subjected to the test “Db”, severity "b", variant 2 of IEC publication N°68-2-30. Duration : 1 cycle. See the graph below :

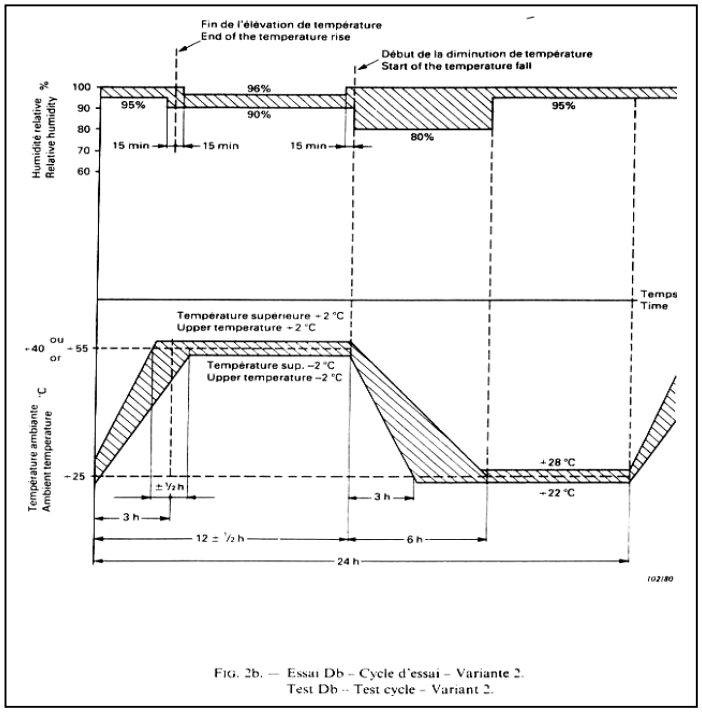


FIG. 2b. — Essai Db – Cycle d'essai – Variante 2.
Test Db – Test cycle – Variant 2.

Requirements :

There shall be no damage detrimental to the contacts.

Results :

At the end of the test, results are conformable**.**
No damage was observed.

DATA SHEET nr 17			
Climatic sequence – Cold test			**GROUP II**
Date : 27/02/03	**Tested by : C.SVINH**	**Reference : ESA/SCC 3401 § 9.13.4**	

Test equipment : **Last cal date :**

Climatic chamber SERVATHIN	7601 0005 00 001	09/02

Procedure :

The mated connectors shall be subjected to the test "Aa" of IEC publication N°68-2-1. The connectors shall be exposed to – 65°C $^{\pm 3°C}$ during 2 hours.

Requirements :

There shall be no damage detrimental to the contacts.

Results :

At the end of the test, results are conformable**.**

No damage was observed.

DATA SHEET nr 18

Climatic sequence – low air pressure			GROUP II
Date : 27/02/03	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.13.5**	

Test equipment : **Last cal date :**

Vacuum pump ELNOR	9004 0000 00 001	None
Manometer ALCATEL CN 121	7250 0001 01 001	07/01
Dielectrimeter MPCF 45 A	7301 0007 04 001	06/02

Procedure :

The mated connectors shall be subjected to test 'M' of I.E.C. Publication No-68-2-13 under the following condition :- Altitude 33 000 m,
- Temperature : + 15°C to + 35°C.

After 10 minutes the applied voltage shall be raised from zero to 200 Vrms and shall be maintained for 1 minute.

Requirements :

During the test the connectors shall be monitored for evidence of electrical breakdown, flashover, corona discharge, or current leakage in excess of 1.0 mA.

Results :

At the end of the test, results are conformable**.**

No damage was observed.

DATA SHEET nr 19

Climatic sequence – Damp heat			GROUP II
Date : 27/02/03 to 03/03/03	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.13.6**	

Test equipment : **Last cal date :**

Climatic chamber SAPRATIN	7600 0001 00 001	09/02

Procedure :

The mated connector shall be subjected to the test "Db", severity "b", variant 2 of IEC publication N°68-2-30. Duration : 5 cycles. See the graph below :

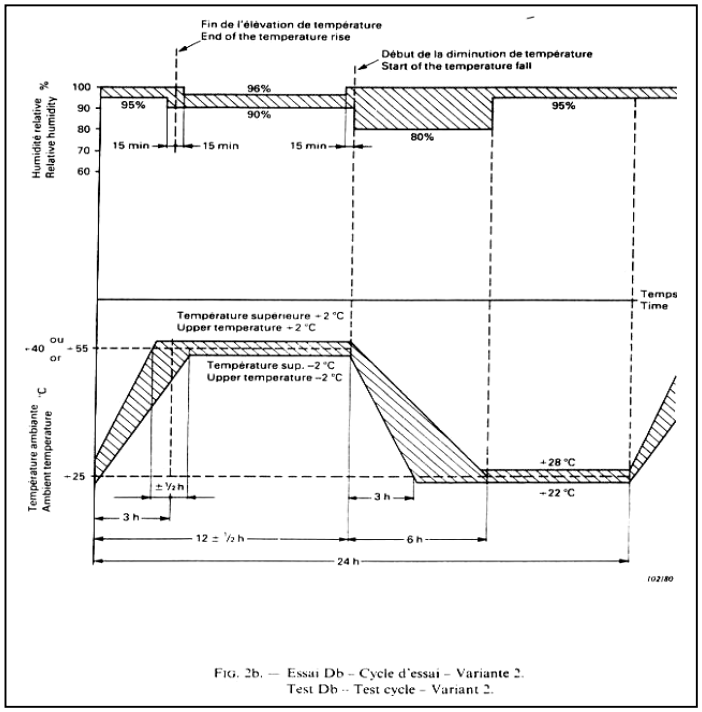


FIG. 2b. — Essai Db – Cycle d'essai – Variante 2.
Test Db – Test cycle – Variant 2.

Requirements :

There shall be no damage detrimental to the contacts.

Results :

At the end of the test, results are conformable**.**
No damage was observed.

DATA SHEET nr 20			
Mechanical endurance			**GROUP II**
Date : 04/03/03	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.18**	

Test equipment : **Last cal date :**

None (hand operated)

Procedure :

Contacts shall be installed in suitable connectors.
The connectors shall be submitted, without electrical load, to 500 mating and unmating operations at the rate of 300 cycles/hour.

The connectors shall be mated and unmated so that plug and receptacle are completely separed, which constitutes one cycle.

Requirements :

There shall be no damage detrimental to the contacts.

Results :

At the end of the test, results are conformable**.**

No damage was observed.

DATA SHEET nr 21

Gauge insertion and extraction forces in and out of female contact			GROUP II
Date : 05/03/03	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.28**	

Test equipment : **Last cal date :**

Paper recorder SEFRAM	7320 0047 10 001	02/02
Force gauge TME	7107 0001 01 001	01/02

Procedure :

Maximum gauge is inserted and extracted three times in a socket contact.
The insertion force is measured with the maximum size gauge and the extraction force with the minimum gauge (see table below).
The gauges are inserted in each contact at 0.7 x Socket depth.

Requirements :

Maximum insertion and minimum extraction forces shall be as follows :

Contact size	Insertion (g)	Maximum gauge	Extraction (g)	Minimum gauge
20	≤ 333	1.041 mm	≥ 20	0.993 mm
16	≤ 555	1.613 mm	≥ 56	1.562 mm
12	≤ 840	2.413 mm	≥ 85	2.362 mm

Results :

At the end of the test, results are conformable.

		#20	average	#16	average	#12	average
TS 228	Maximum insertion force measured (g)	180	166	420	347	480	402
	Minimum extraction force measured (g)	80	105	160	230	240	297

See complete results in appendix 2.

DATA SHEET nr 22

Drift of low level contact resistance			GROUP II
Date : 05/03/03	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.1.1.3**	

Test equipment : **Last cal date :**

Ammeter MA 602	7320 0039 04 001	11/02
Current generator DIGISTANT	7342 0005 01 001	None
Voltmeter 7061 SCHLUMBERGER	7341 0001 01 001	03/03

Procedure :

Contact resistance shall be measured under a 10mA current :

Contact size	Wire size	Max contact resistance (mΩ)	Drift max.
20	20-24	9	3 mΩ
16	16-20	9	
12	12-14	9	

The resistance of the wire included between the measurement points shall be deducted from the contact resistance.
Measurement shall be performed once in each direction of the current. The average of the 2 measurements shall be noted. Voltage drop shall be measured within 5 seconds.

Requirements :

Contact resistance shall be in accordance with the values of the table above.

Results :

At the end of the test, results are conformable.

			Drift
Maximum contact resistance measured :	# 20	: 1.46 mΩ	0.27 mΩ
	# 16	: 0.58 mΩ	0.00 mΩ
	# 12	: 0.58 mΩ	0.04 mΩ

See complete results in appendix 2.

.

DATA SHEET nr 23

Drift of contact resistance at rated current			GROUP II
Date : 05/03/03	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.1.1.3**	

Test equipment : **Last cal date :**

Ammeter MA 602	7320 0039 04 001	11/02
Current generator DIGISTANT	7342 0005 01 001	None
Current generator FONTAINE (for size 12)	7342 0002 03 003	None
Voltmeter 7061 SCHLUMBERGER	7341 0001 01 001	03/03

Procedure :

Contact resistance shall be measured under rated current :

Contact size	Wire size	Test current (A)	Max contact resistance (mΩ)	Drift max.
20	20-24	7.5	8	3 mΩ
16	16-20	13	6	
12	12-14	23	6	

The resistance of the wire included between the measurement points shall be deducted from the contact resistance.

Measurement shall be performed once in each direction of the current. The average of the 2 measurements shall be noted. Voltage drop shall be measured within 5 seconds.

Requirements :

Contact resistance shall be in accordance with the values of the table above.

Results :

At the end of the test, results are conformable.

			Drift
Maximum contact resistance measured :	# 20	: 1.76 mΩ	0.63 mΩ
	# 16	: 0.71 mΩ	0.13 mΩ
	# 12	: 0.69 mΩ	0.10 mΩ

See complete results in appendix 2.

D A T A S H E E T n r 2 4			
Joint Strength			**GROUP II**
Date : 12/05/04	**Tested by :** C.SVINH	**Reference :** ESA/SCC 3401 § 9.15.	

Test equipment : **Last cal date :**

Traction machine INSTRON 7130 0016 01 001 04/04

Procedure :

The test shall be performed on 5, or all (whichever is less) contacts from each connector.
Traction speed is 50 mm/min.

Requirements :

Contact size	Wire gauge	Minimum tensile strength of crimp (N)
20	20	60
	24	30
16	16	170
	20	90
12	12	450
	14	270

Results :

At the end of the test , results are conformable.
Minimum tensile strength measured :

Contact size	Wire gauge	Minimum tensile strength measured (N)
20	20	107
	24	66
16	16	241
	20	130
12	12	470
	14	282

(see in appendix 2)

DATA SHEET nr 25

Gauge insertion and extraction forces in and out of female contact			GROUP III
Date : 10/02/03	**Tested by : C.SVINH**	**Reference : ESA/SCC 3401 § 9.28**	

Test equipment : **Last cal date :**

Paper recorder SEFRAM	7320 0047 10 001	02/02
Force gauge TME	7107 0001 01 001	01/02

Procedure :

Maximum gauge is inserted and extracted three times in a socket contact.
The insertion force is measured with the maximum size gauge and the extraction force with the minimum gauge (see table below).
The gauges are inserted in each contact at 0.7 x Socket depth.

Requirements :

Maximum insertion and minimum extraction forces shall be as follows :

Contact size	Insertion (g)	Maximum gauge	Extraction (g)	Minimum gauge
20	≤ 333	1.041 mm	≥ 20	0.993 mm
16	≤ 555	1.613 mm	≥ 56	1.562 mm
12	≤ 840	2.413 mm	≥ 85	2.362 mm

Results :

At the end of the test, results are conformable.

		#20	average	#16	average	#12	average
TS 228	Maximum insertion force measured (g)	300	246	540	504	640	627
	Minimum extraction force measured (g)	120	140	220	296	430	455

See complete results in appendix 1.

DATA SHEET nr 26

Electrical overload test			GROUP III
Date : 11/02/03	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.26**	

Test equipment : **Last cal dates :**

Ammeter MA 602	7320 0039 04 001	11/02
Current generator SODILEC	7320 0038 02 001	None
Voltmeter 7061 SCHLUMBERGER	7341 0001 01 001	03/03

Procedure :

A current of 1 ½ of rated current shall flow through all contacts of mated connectors for a period of 30 s.
This period shall be followed by a period of 90 s with no current flowing.
This shall constitute 1 cycle.
The cycle shall be repeated 5 times.

Size	20	16	12
1 ½ rated current	11.25	19.5	34.5

Requirements :

The internal temperature of the connectors shall not exceed 100° C.
Contacts shall withstand the "contact resistance at rated current" test.

Results :

At the end of the test, results are conformable.
No damage detrimental to the contacts was observed.
Maximum temperature was measured during the 5 cycles : # 20 = 71.3°C
: # 16 = 75.7°C
: # 12 = 43.5°C

See data sheet nr 27 hereafter.

DATA SHEET nr 27

Contact resistance at rated current			GROUP III
Date : 17/02/03	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.1.1.3**	

Test equipment : **Last cal date :**

Ammeter MA 602	7320 0039 04 001	11/02
Current generator DIGISTANT	7342 0005 01 001	None
Current generator FONTAINE (for size 12)	7342 0002 03 003	None
Voltmeter 7061 SCHLUMBERGER	7341 0001 01 001	03/01

Procedure :

Contact resistance shall be measured under rated current :

Contact size	Wire size	Test current (A)	Max contact resistance (mΩ)
20	20-24	7.5	8
16	16-20	13	6
12	12-14	23	6

The resistance of the wire included between the measurement points shall be deducted from the contact resistance.

Measurement shall be performed once in each direction of the current. The average of the 2 measurements shall be noted. Voltage drop shall be measured within 5 seconds.

Requirements :

Contact resistance shall be in accordance with the values of the table above.

Results :

At the end of the test, results are conformable.
Maximum contact resistance measured : # 20 : 1.87 mΩ
16 : 0.65 mΩ
12 : 0.48 mΩ

See complete results in appendix 1.

DATA SHEET nr 28			
Mechanical endurance			**GROUP III**
Date : 18/02/03	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 9.18**	

Test equipment : **Last cal date :**

None (hand operated)

Procedure :

Contacts shall be installed in suitable connectors.
The connectors shall be submitted, without electrical load, to 500 mating and unmating operations at the rate of 300 cycles/hour.

The connectors shall be mated and unmated so that plug and receptacle are completely separed, which constitutes one cycle.

Requirements :

There shall be no damage detrimental to the contacts.

Results :

At the end of the test, results are conformable**.**

No damage was observed.

DATA SHEET nr 29			
Gold plate porosity			**GROUP III**
Date : 19/02/03	**Tested by : C. SVINH**	**Reference : ESA/SCC 3401 § 5.2.2**	

Test equipment : **Last cal date :**

Nitric acid (specific gravity 1.33)	None
Glass container	None

Procedure :

Contacts were placed in glass container and covered with Nitric acid, so that all contacts may be observed during the test.
The contacts were observed during 30 s.

Requirements :

Plated contacts shall show no reaction in the form of bubbles on the outside surfaces of contacts during the 30 s. observation period.

Results :

At the end of the test, results are conformable.
No reaction in the form of the bubbles was observed.

APPENDIX 1

INITIAL MEASUREMENTS

(10 pages)

APPENDIX 1

INITIAL MEASUREMENT OF CONTACT RESISTANCE

LOW LEVEL

Data sheets nr 3 and 11

Contact nr	GROUP I			GROUP II		
	# 20	# 16	# 12	# 20	# 16	# 12
Requirement	9 mΩ	9 mΩ	9 mΩ	9 mΩ	9 mΩ	9 mΩ
1	1.41	0.67	0.37	1.07	0.58	0.50
2	1.24	0.82	0.31	1.00	0.50	0.54
3	1.02	0.76	0.53	1.19	0.46	0.50
4	1.19	0.43	0.44	1.07	0.56	0.51
5	1.26	0.48	0.31	-	-	-
6	1.51	0.59	0.37	-	-	-
7	1.25	0.50	0.28	-	-	-
8	1.04	0.83	0.49	-	-	-

CONTACT RESISTANCE AT RATED CURRENT

Data sheets nr 4 and 12

Contact nr	GROUP I			GROUP II		
	# 20	# 16	# 12	# 20	# 16	# 12
Requirement	8 mΩ	6 mΩ	6 mΩ	8 mΩ	6 mΩ	6 mΩ
1	1.75	0.54	0.33	1.08	0.48	0.59
2	1.04	0.64	0.34	1.03	0.50	0.56
3	1.00	0.61	0.35	1.13	0.49	0.57
4	1.06	0.45	0.37	1.02	0.58	0.57
5	1.48	0.44	0.36	-	-	-
6	1.35	0.68	0.37	-	-	-
7	1.41	0.52	0.30	-	-	-
8	1.08	0.63	0.36	-	-	-

APPENDIX 1

INITIAL MEASUREMENT OF GAUGE INSERTION AND EXTRACTION FORCES SOCKET

Contact size	Insertion (g)	Maximum gauge	Extraction (g)	Minimum gauge
20	≤ 333	1.041 mm	≥ 20	0.993 mm
16	≤ 555	1.613 mm	≥ 20	1.562 mm
12	≤ 840	2.413 mm	≥ 85	2.362 mm

GROUP I data-sheet nr 5

Contact nr	# 20		# 16		# 12	
	Insertion (g)	Extraction (g)	Insertion (g)	Extraction (g)	Insertion (g)	Extraction (g)
1	235	160	310	230	540	440
2	270	180	260	260	560	360
3	200	200	400	210	520	320
4	280	150	310	300	500	400
5	260	120	460	310	560	380
6	250	140	450	240	620	420
7	220	120	360	280	620	350
8	290	170	380	305	420	420
Average	**251**	**155**	**366**	**267**	**543**	**386**

APPENDIX 1

INITIAL MEASUREMENT OF GAUGE INSERTION AND EXTRACTION FORCES SOCKET

GROUP II data-sheet nr 13

Contact nr	# 20		# 16		# 12	
	Insertion (g)	Extraction (g)	Insertion (g)	Extraction (g)	Insertion (g)	Extraction (g)
1	300	140	350	339	600	400
2	300	200	230	219	640	480
3	310	150	410	279	520	400
4	320	160	450	339	540	400
5	300	170	450	300	640	480
6	290	160	430	340	540	460
7	290	160	270	199	-	-
8	310	180	450	339	-	-
9	330	140	520	355	-	-
10	210	140	350	299	-	-
Average	**296**	**160**	**391**	**302**	**580**	**437**

APPENDIX 1

INITIAL MEASUREMENT OF GAUGE INSERTION AND EXTRACTION FORCES SOCKET

GROUP III data-sheet nr 24

Contact nr	# 20		# 16		# 12	
	Insertion (g)	Extraction (g)	Insertion (g)	Extraction (g)	Insertion (g)	Extraction (g)
1	200	120	500	300	640	460
2	220	130	480	220	640	430
3	220	155	500	300	640	440
4	260	145	520	320	640	480
5	230	120	480	280	640	460
6	300	140	480	260	560	460
7	300	130	520	380	-	-
8	240	160	480	260	-	-
9	240	160	540	300	-	-
10	250	140	540	340	-	-
Average	**246**	**140**	**504**	**296**	**627**	**455**

APPENDIX 1

Measurement of thickness of coating on contact

```
Référence      : jn
No d'OF        : 006091316228s
Mesures  du    : 05/07/2002 - 10:32:07
         au    : 05/07/2002 - 10:43:31

Moyenne                    1.602   µm
Ecart type                 0.185   µm
Coeff. de var.              11.6    %

Mini                       1.317   µm
Maxi                       2.273   µm
Etendue                    0.956   µm

Prélèvement                  50

Operateur    : jn 1
Date         : 05/07/2002  Heure : 10:43:36


 Mes. Couche finale distance fixe   / µm
oupe No 152   No de Cde: 006091316228s          Opérateur: jn 1
 1     Epaisseur couche       =     1.58   05/07/2002   10:32:07
 2     Epaisseur couche       =     1.63   05/07/2002   10:32:17
 3     Epaisseur couche       =     1.53   05/07/2002   10:32:28
 4     Epaisseur couche       =     1.59   05/07/2002   10:32:38
 5     Epaisseur couche       =     1.32   05/07/2002   10:32:49
 6     Epaisseur couche       =     1.69   05/07/2002   10:32:59
 7     Epaisseur couche       =     1.64   05/07/2002   10:33:10
 8     Epaisseur couche       =     1.52   05/07/2002   10:33:21
 9     Epaisseur couche       =     1.57   05/07/2002   10:33:31
 10    Epaisseur couche       =     1.58   05/07/2002   10:33:42
 11    Epaisseur couche       =     1.58   05/07/2002   10:33:52
 12    Epaisseur couche       =     1.32   05/07/2002   10:34:03
 13    Epaisseur couche       =     1.57   05/07/2002   10:34:13
 14    Epaisseur couche       =     2.27   05/07/2002   10:34:24
 15    Epaisseur couche       =     1.55   05/07/2002   10:34:35
 16    Epaisseur couche       =     1.53   05/07/2002   10:34:45
 17    Epaisseur couche       =     1.61   05/07/2002   10:34:56
 18    Epaisseur couche       =     1.50   05/07/2002   10:35:06
 19    Epaisseur couche       =     1.56   05/07/2002   10:35:17
 20    Epaisseur couche       =     1.55   05/07/2002   10:35:27
 21    Epaisseur couche       =     1.81   05/07/2002   10:35:38
 22    Epaisseur couche       =     1.50   05/07/2002   10:35:48
 23    Epaisseur couche       =     1.76   05/07/2002   10:35:59
 24    Epaisseur couche       =     1.82   05/07/2002   10:36:09
 25    Epaisseur couche       =     1.52   05/07/2002   10:36:20
 26    Epaisseur couche       =     1.58   05/07/2002   10:39:18
 27    Epaisseur couche       =     1.61   05/07/2002   10:39:29
 28    Epaisseur couche       =     1.38   05/07/2002   10:39:39
 29    Epaisseur couche       =     1.49   05/07/2002   10:39:50
 30    Epaisseur couche       =     1.53   05/07/2002   10:40:00
 31    Epaisseur couche       =     1.72   05/07/2002   10:40:11
 32    Epaisseur couche       =     1.38   05/07/2002   10:40:21
 33    Epaisseur couche       =     1.46   05/07/2002   10:40:32
 34    Epaisseur couche       =     1.68   05/07/2002   10:40:42
 35    Epaisseur couche       =     1.48   05/07/2002   10:40:53
 36    Epaisseur couche       =     1.47   05/07/2002   10:41:03
 37    Epaisseur couche       =     1.70   05/07/2002   10:41:14
 38    Epaisseur couche       =     1.83   05/07/2002   10:41:24
 39    Epaisseur couche       =     1.53   05/07/2002   10:41:35
 40    Epaisseur couche       =     1.45   05/07/2002   10:41:46
 41    Epaisseur couche       =     1.55   05/07/2002   10:41:56
 42    Epaisseur couche       =     1.44   05/07/2002   10:42:06
 43    Epaisseur couche       =     1.65   05/07/2002   10:42:17
 44    Epaisseur couche       =     1.85   05/07/2002   10:42:27
 45    Epaisseur couche       =     1.73   05/07/2002   10:42:38
 46    Epaisseur couche       =     2.27   05/07/2002   10:42:48
 47    Epaisseur couche       =     1.38   05/07/2002   10:42:59
 48    Epaisseur couche       =     1.82   05/07/2002   10:43:09
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APPENDIX 2

FINAL MEASUREMENTS

(3 pages)

APPENDIX 2

FINAL MEASUREMENT OF CONTACT RESISTANCE

LOW LEVEL

Data sheets nr 9 and 22

Contact nr	GROUP I			GROUP II		
	# 20	# 16	# 12	# 20	# 16	# 12
Requirement	9 mΩ	9 mΩ	9 mΩ	9 mΩ	9 mΩ	9 mΩ
1	1.53	0.69	0.33	1.26	0.58	0.51
2	1.60	0.53	0.35	1.46	0.50	0.54
3	1.55	0.49	0.60	1.20	0.46	0.55
4	1.51	0.48	0.47	1.07	0.48	0.58
5	1.60	0.66	0.34	-	-	-
6	1.62	0.52	0.34	-	-	-
7	1.67	0.50	0.30	-	-	-
8	1.61	0.80	0.59	-	-	-

CONTACT RESISTANCE AT RATED CURRENT

Data sheets nr 10, 23 and 25

Contact nr	GROUP I			GROUP II			GROUP III		
	# 20	# 16	# 12	# 20	# 16	# 12	# 20	# 16	# 12
Requirement	8 mΩ	6 mΩ	6 mΩ	8 mΩ	6 mΩ	6 mΩ	8 mΩ	6 mΩ	6 mΩ
1	1.81	0.70	0.35	1.36	0.66	0.69	1.47	0.52	0.48
2	1.16	0.53	0.36	1.63	0.69	0.67	0.89	0.65	0.42
3	1.13	0.52	0.33	1.76	0.67	0.65	1.87	0.65	0.35
4	1.19	0.44	0.41	1.33	0.71	0.62	1.45	0.60	0.47
5	1.69	0.70	0.26	-	-	-	-	-	-
6	1.47	0.71	0.39	-	-	-	-	-	-
7	1.65	0.51	0.27	-	-	-	-	-	-
8	1.29	0.82	0.44	-	-	-	-	-	-

APPENDIX 2

FINAL MEASUREMENT OF GAUGE INSERTION AND EXTRACTION FORCES SOCKET

Contact size	Insertion (g)	Maximum gauge	Extraction (g)	Minimum gauge
20	≤ 333	1.041 mm	≥ 20	0.993 mm
16	≤ 555	1.613 mm	≥ 20	1.562 mm
12	≤ 840	2.413 mm	≥ 85	2.362 mm

GROUP I data-sheet nr 8

Contact nr	# 20		# 16		# 12	
	Insertion (g)	Extraction (g)	Insertion (g)	Extraction (g)	Insertion (g)	Extraction (g)
1	270	60	300	160	300	250
2	200	80	260	160	320	260
3	170	60	300	220	320	220
4	140	55	290	180	380	280
5	115	50	380	240	320	280
6	120	60	330	160	380	280
7	220	50	330	170	440	280
8	170	75	320	180	320	240
Average	**176**	**61**	**314**	**184**	**348**	**261**

APPENDIX 2

FINAL MEASUREMENT OF GAUGE INSERTION AND EXTRACTION FORCES

GROUP II data-sheet nr 21

Contact nr	# 20		# 16		# 12	
	Insertion (g)	Extraction (g)	Insertion (g)	Extraction (g)	Insertion (g)	Extraction (g)
1	160	110	350	260	480	320
2	180	120	340	210	450	360
3	150	110	380	250	340	260
4	175	90	360	260	340	240
5	150	100	300	160	420	320
6	150	100	340	220	380	280
7	160	120	300	210	-	-
8	180	130	360	230	-	-
9	180	90	420	280	-	-
10	170	80	320	220	-	-
Average	**166**	**105**	**347**	**230**	**402**	**297**

APPENDIX 2

FINAL MEASUREMENT OF JOINT STRENGTH

GROUP II data-sheet nr 24

Contact nr	# 12		# 16		# 20	
	AWG 12	AWG 14	AWG 16	AWG 20	AWG 20	AWG 24
1S	515	320	266	143	113	68
1P	519	315	255	144	113	69
2S	503	318	265	147	111	68
2P	499	282	260	140	111	68
3S	470	322	259	145	107	71
3P	481	319	256	145	114	66
4S	-	-	267	143	112	69
4P	-	-	240	130	115	73
5S	-	-	270	143	143	71
5P	-	-	247	140	111	66