Socitec/Schroff MIL-S-901D 19” Cabinet

ABSTRACT

This document presents the qualification of a 19'' ruggedized and mounted cabinet developed by Socitec and Schroff according to the MIL-S-901D specification. This cabinet is adapted from the Varistar model.

First, Socitec has studied the mounted cabinet and then the test has been performed in the Italian laboratory CETENA on the MWSM (Medium Weight Shock Machine) in September of 2008.

Here are presented the following steps:

- Calculations for definition (structure and suspension).
- Tests in CETENA laboratory.
- Calculations to be made to justify a new suspended cabinet for a new application.

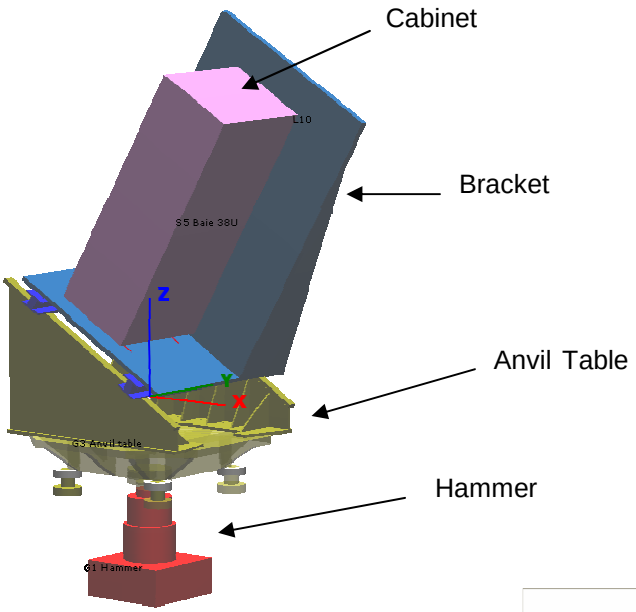
MOUNTS CALCULATION

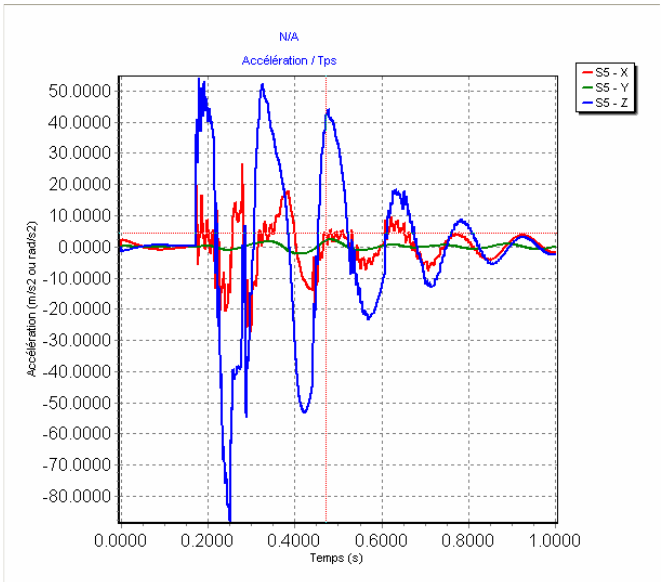
Residual accelerations transmitted by the suspension are calculated with Symos software developed by Socitec.

The model takes into account:

- Cabinet and his equipments (mass, dimensions, position of cog).
- Mounts and their characteristics.
- Modelisation of the Medium Weight Shock Machine.

Symos model:

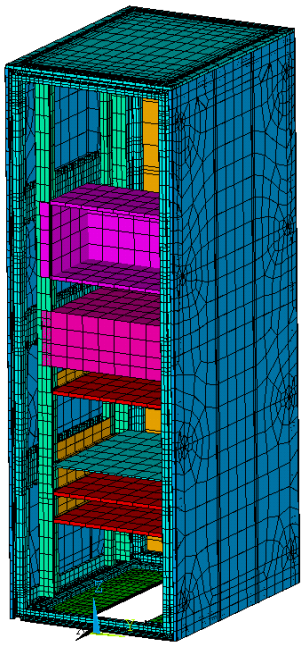


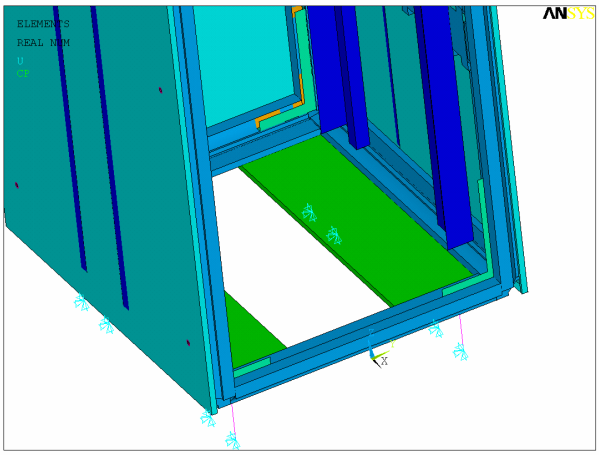


Response of mounts

STRUCTURE MODELISATION

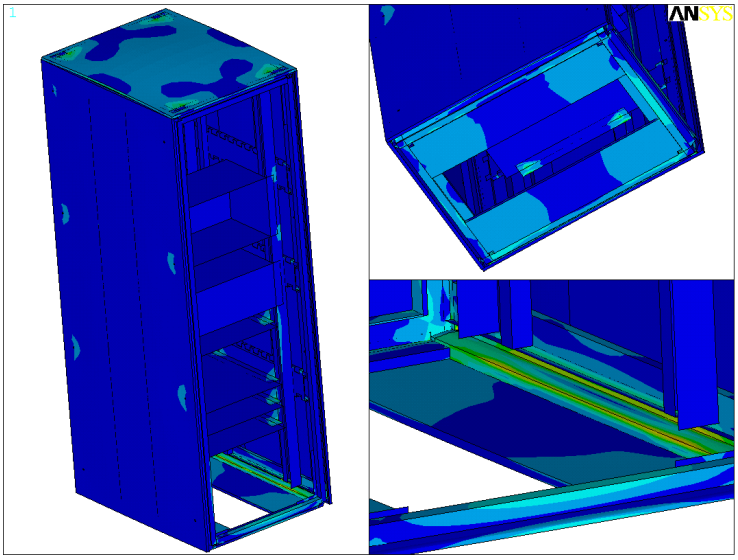
The Varistar cabinet is adapted to take into account shock specification from MIL-S-901D, adding reinforcements especially for the fixing of the mounts and of the 19” mounting angles.
The modelisation is realised with the Ansys Finite Elements software and stress calculations are made for the different shocks according to MIL-S-901D.





Meshing

Stress analisys



TEST PRESENTATION –EXTRACT OF TECHNICAL REPORT (CETENA)

CETENA S.p.A. CENTRO PER GLI STUDI DI TECNICA NAVALE

RAPPORTO TECNICO

TECHNICAL REPORT

Titolo/Title

Shock Test results carried out according to MIL S 901 for a 19'' SCHROFF cabinet (38 U) on SOCITEC shock mounts.

Autori/Authors G.Gigliotti; F.Gaggero

Sommario

In questo rapporto vengono descritti i risultati delle prove d'urto eseguite nei giorni 15 ÷ 19 Settembre 2008 su un armadio da 19" SCHROFF Varistat montato su resilienti antishock SOCITEC.
Le prove sono state realizzate utilizzando la macchina d'urto per pesi medi della sala prove CETENA di Riva Trigoso, per conto della ditta SOCITEC.
I test sono stati eseguiti secondo quanto previsto dalla norma MIL S 901

Abstract

This report describes shock test results performed on September 15÷19, 2008 on a 19" SCHROFF Varistat cabinet mounted on SOCITEC shock mounts.
Tests have been carried out using medium- weight shock machine located at the CETENA's laboratory in Riva Trigoso, as required by SOCITEC.
Tests have been carried out according to MIL S 901.

Autori	*Capo Servizio*	*Capo Settore*	*Resp. Sicurezza Segreto di Stato*

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Classificata	☐	Classified

Pagine /Sheets	*Note / Notes*
164	

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6924238034	

1. PURPOSE.

This report contains the results of shock qualification test of a 19'' Schroff cabinet (38 U) carried out according to MIL S 901. Cabinet has been mounted on SOCITEC shock mounts. Tests have been performed at CETENA's test laboratories in Riva Trigoso yard on 15th – 19th September 2008 (see shock testing machine drawing in Annex 1).

2. Description of the tested machinery.

The cabinet contains mockups for equipment simulation, a BARCO rack and a SCHROFF rack.
Two set of shock mounts have been used:

- rubber mounts reference BFN45-130e25 (Annex 2, Fig.1)
- cable mounts reference Z143272 (Annex 2, Fig.2)

3. Shock test.

3.1 Machinery connection to shock machine

The assembly was fixed over the anvil plate using three ''standard channels'', as foreseen by MIL S 901 for Kg 962 net weight.
Annex 3 shows how the tested equipment has been connected to the shock machine.

3.2 Test methodologies.

The tests consisted in submitting the object to 9 shocks divided in three series of three shock each. Every series is characterized by two values of anvil table travel (76 and 38 mm) and two values of height of hammer drop, that depends on the total weight on the anvil table.
During the first test series, the assembly was mounted directly to the anvil table, receiving shock in the vertical direction; in the second series, the assembly was mounted to the anvil plate with inclined retainer in longitudinal direction; in the third series the assembly was mounted to the anvil plate with inclined retainer in transversal.
Heights of hammer drop depend on total weight above the anvil plate and are reported in Annex 4.

3.3 Machinery conditions during test.

Barco equipments were operating during tests, as required by contractual rules.
As contemplated by SOCITEC technical specification, shock have been measured in six different positions, 12 axial accelerometers have been used in 4 position (one for each direction) and two triaxial accelerometers have been used in position 5 and 6. This arrangement is used for all tests (vertical and inclined in the three directions). See photos in Annex 3.

Point	Location	axis
1	Shock machine Anvil table	x, y ,z
2	Mount 1 attachment point	x, y, z
3	Mount 5 attachment point	x, y, z
4	Plate belove Barco Rack front left (Cog plane)	x, y, z
5	Barco Rack front right	x, y, z
6	Cabinet front left roof edge	x, y, z

The characteristics of the acquisition in the time domain were as follows:

- Acquisition Parameter 1024
- Spectral Lines 8192
- Resolution 0.125 Hz

3.4 Results of inspections after each shock test.

After each shock the item was controlled to check structural integrity.

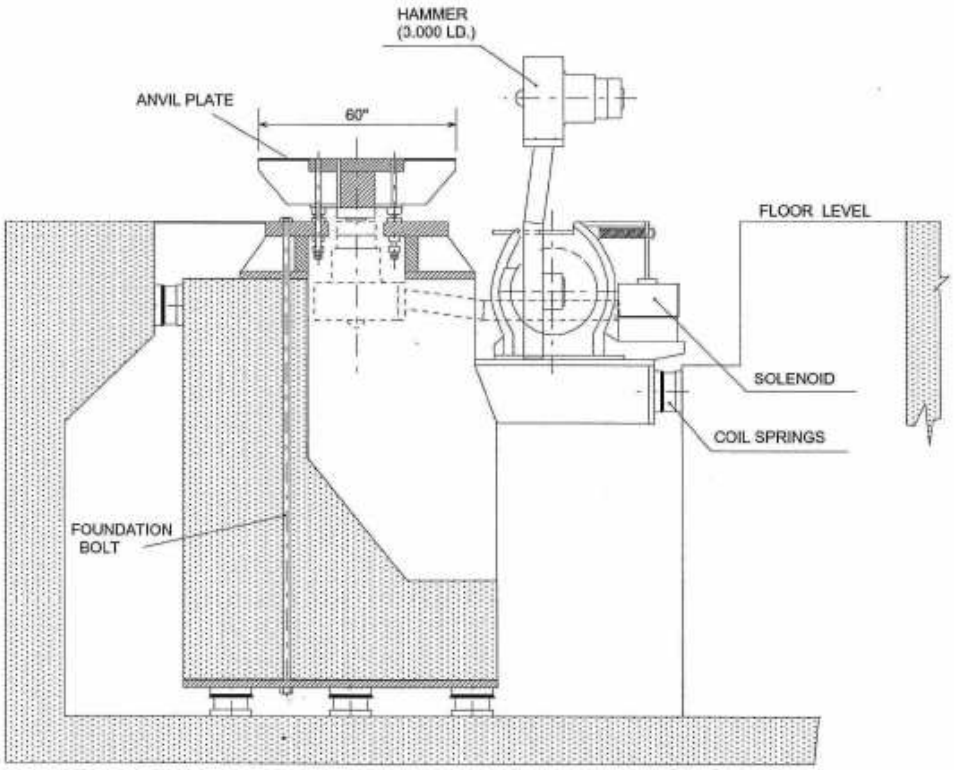
3.5 Shock Test documentation.

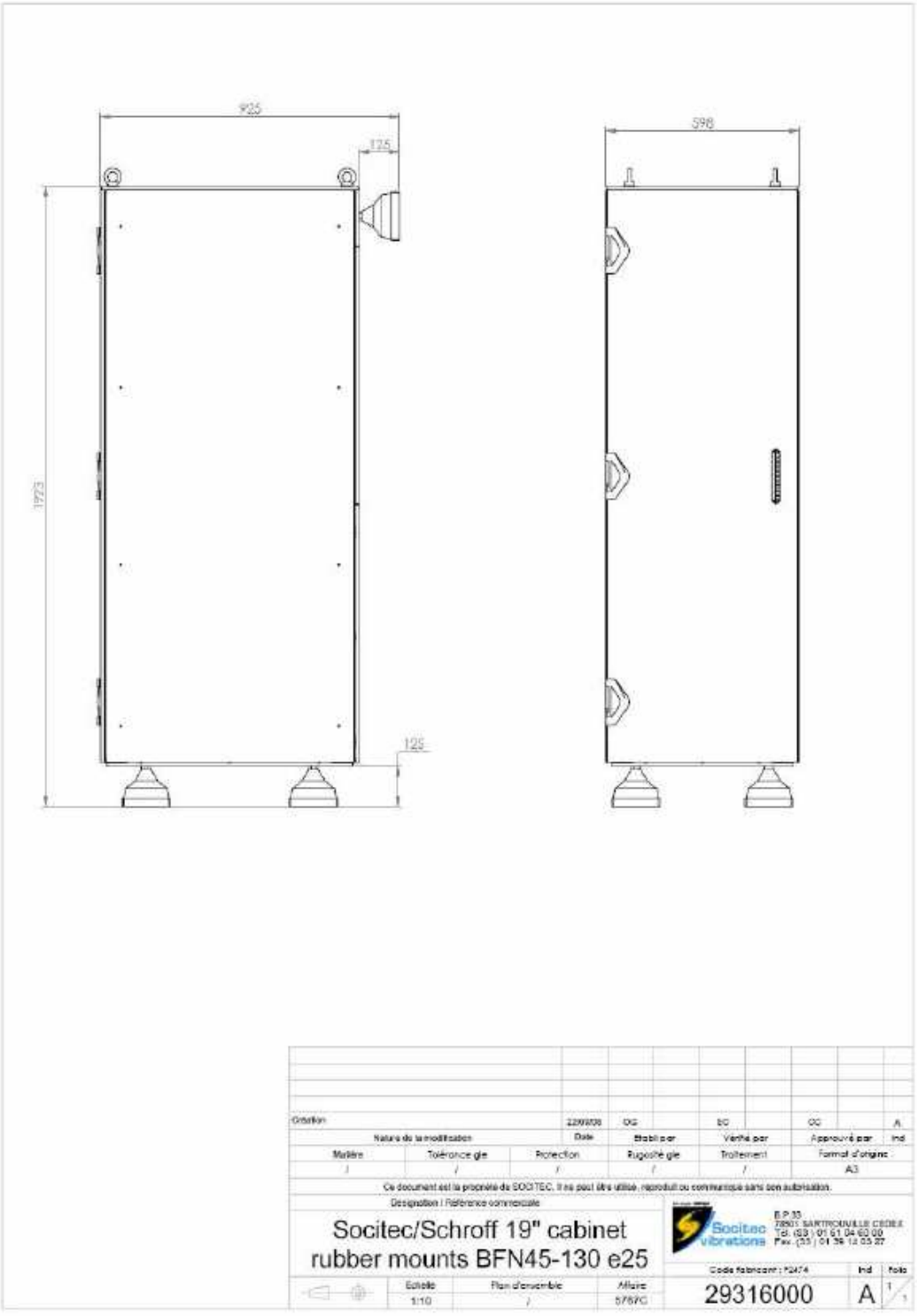
The certificates that testifies test executions and results have been annexed.
Copies of these certificates are in attachment 5.
Annex 4 reports test summary where weights, height of hammer drop and the results of each visual control are reported. The shock test results are in Annex 6.
Copies of reference calibration certificates are reported in annex 7.

4. Test results.

No problem was detected during the tests.
We can conclude that the item has satisfied the test equipment.

SHOCK TESTING MACHINE

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Socitec/Schroff 19" cabinet
rubber mounts BFN45-130 e25
29316000
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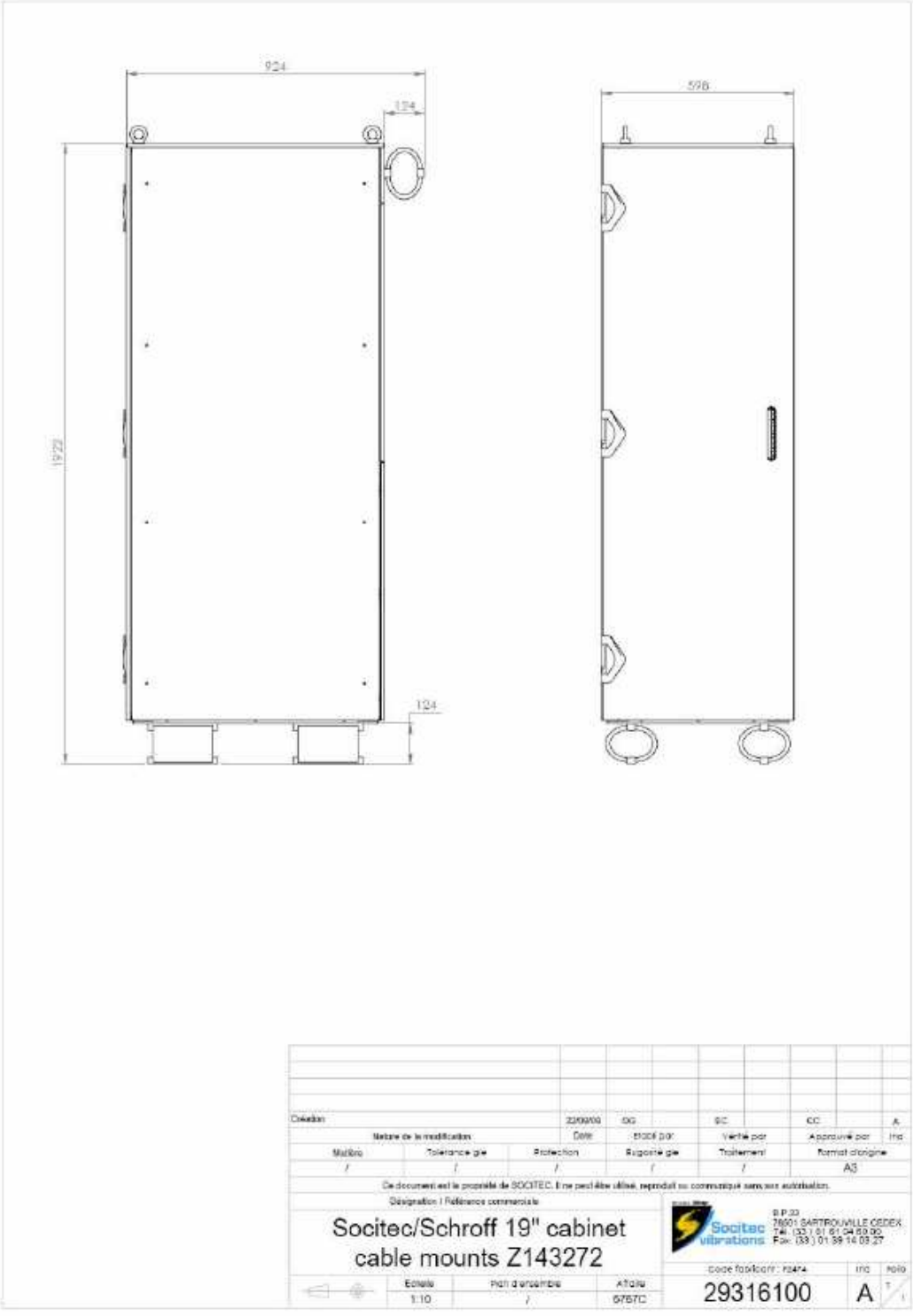
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Désignation / Référence commerciale
Socitec/Schroff 19" cabinet
cable mounts Z143272
Socitec vibrations
B.P.33
78601 SARTROUVILLE CEDEX
Tél. (33) 01 61 04 69 00
Fax. (33) 01 39 14 08 27
Code fabricant : 62474
29316100
Indice
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Echelle
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Plan d'ensemble
/
Affaire
67670

Fig.1 The 19 Cabinet on the Horizontal shock testing machine (rubber mounts)

Fig.2 The 19 Cabinet on the Horizontal shock testing machine (cable mounts)

Fig.3 The 19 Cabinet on the 30° Long. shock testing machine (rubber mounts)

Fig.4 The 19 Cabinet on the 30° Long. shock testing machine (cable mounts)

Fig.5 The 19 Cabinet on the 30° Transv. shock testing machine (rubber mounts)

Fig.6 The 19 Cabinet on the 30° Transv. shock testing machine (cable mounts)

Fig.7 Pictures of the accelerometers location Pos.1

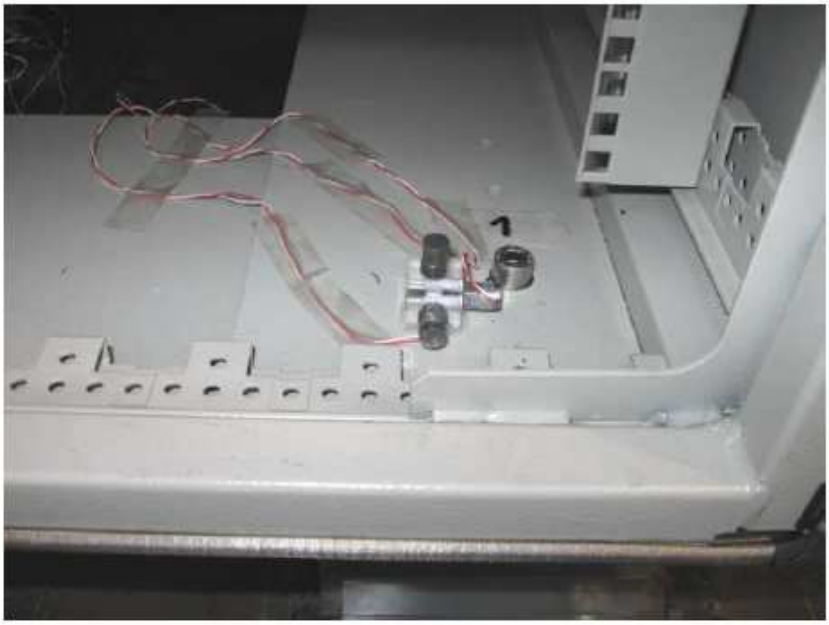


Fig.8 Pictures of the accelerometers location Pos.2

Fig.9 Pictures of the accelerometers location Pos.3

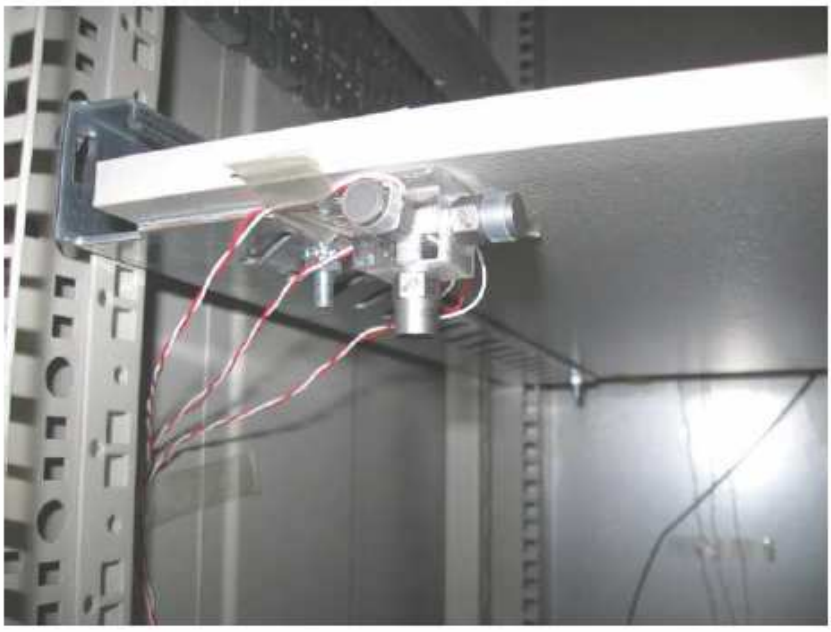
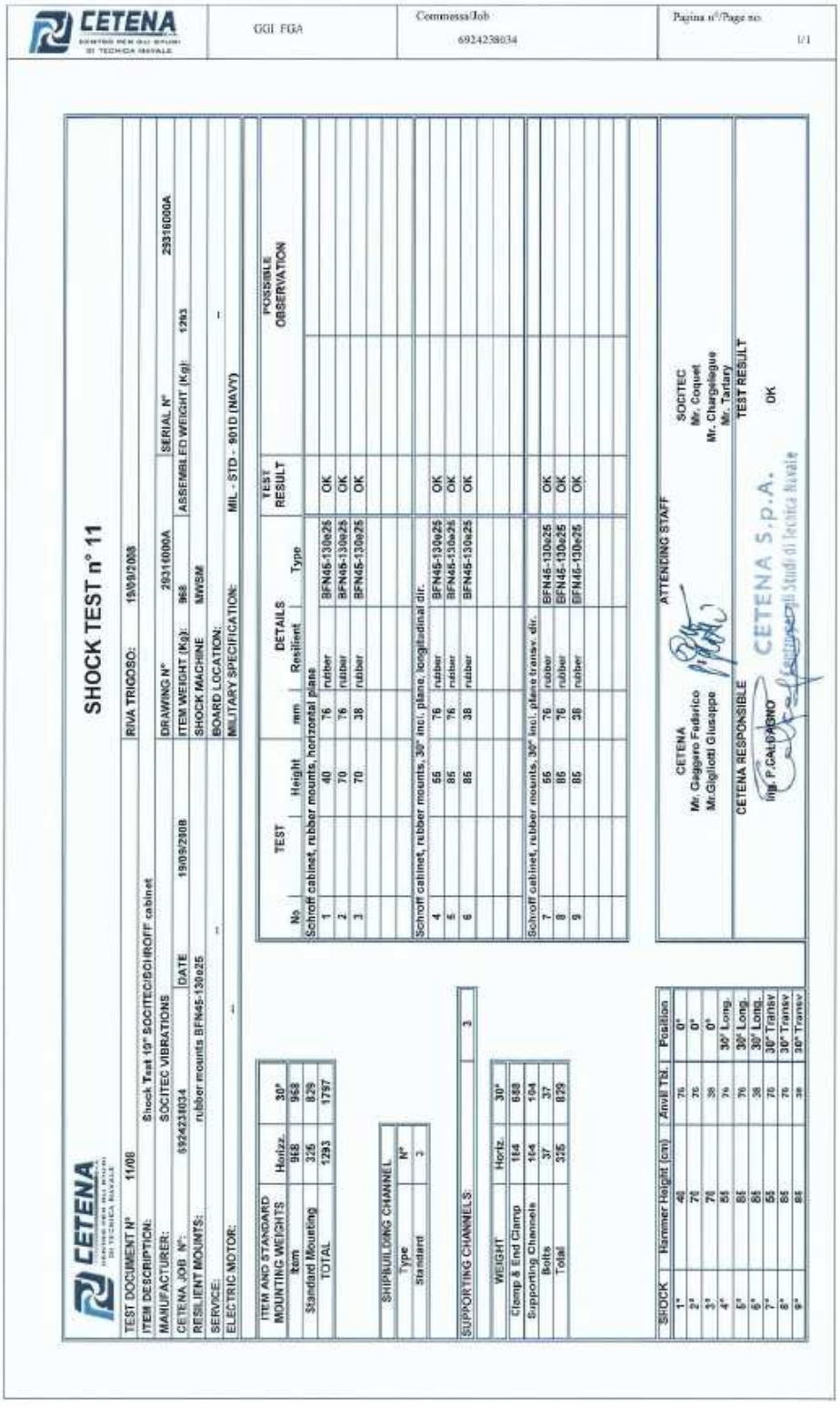


Fig.10 Pictures of the accelerometers location Pos.4

Fig.11 Pictures of the accelerometers location Pos.5

Fig.12 Pictures of the accelerometers location Pos.6



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SHOCK TEST n° 11

TEST DOCUMENT N°	11/08	RIVA TRIGOSO:	19/09/2008
ITEM DESCRIPTION:	Shock Test 19" SOCITEC/SCHROFF cabinet		
MANUFACTURER:	SOCITEC VIBRATIONS	DRAWING N°	29316000A
CETENA JOB N°:	6924238034	DATE	19/09/2008
RESILIENT MOUNTS:	rubber mounts BFN45-130x25		
SERVICE:	-		
ELECTRIC MOTOR:	-		

SERIAL N°		29316000A
ITEM WEIGHT (Kg):	968	ASSEMBLED WEIGHT (Kg): 1293
SHOCK MACHINE	MWSM	
BOARD LOCATION:	-	
MILITARY SPECIFICATION:	MIL - STD - 901D (NAVY)	

ITEM AND STANDARD MOUNTING WEIGHTS	Horiz.	30°
Item	968	968
Standard Mounting	325	829
TOTAL	1293	1797

SHIPBUILDING CHANNEL	
Type	N°
Standard	2

SUPPORTING CHANNELS:		3

WEIGHT	Horiz.	30°
Clamp & End Clamp	164	688
Supporting Channels	164	104
Bolts	37	37
Total	325	829

SHOCK	Hammer Height (cm)	Anvil Tbl.	Position
1°	40	76	0°
2°	70	76	0°
3°	70	76	0°
4°	85	38	
5°	85	76	30° Long.
6°	85	38	30° Long.
7°	55	76	30° Transv
8°	85	76	30° Transv
9°	85	38	30° Transv

No	TEST Height	DETAILS mm	Resilient	Type	TEST RESULT	POSSIBLE OBSERVATION
Schroff cabinet, rubber mounts, horizontal plane						
1	40	76	rubber	BFN45-130x25	OK	
2	70	76	rubber	BFN45-130x25	OK	
3	70	38	rubber	BFN45-130x25	OK	
Schroff cabinet, rubber mounts, 30° incl. plane, longitudinal dir.						
4	55	76	rubber	BFN45-130x25	OK	
5	85	76	rubber	BFN45-130x25	OK	
6	85	38	rubber	BFN45-130x25	OK	
Schroff cabinet, rubber mounts, 30° incl. plane transv. dir.						
7	55	76	rubber	BFN45-130x25	OK	
8	85	76	rubber	BFN45-130x25	OK	
9	85	38	rubber	BFN45-130x25	OK	

ATTENDING STAFF

CETENA
Mr. Gaggero Federico
Mr.Gigliotti Giuseppe

SOCITEC
Mr. Coquet
Mr. Chargelegue
Mr. Tartary

CETENA RESPONSIBLE
Ing. P. CALCAGNO

TEST RESULT
OK

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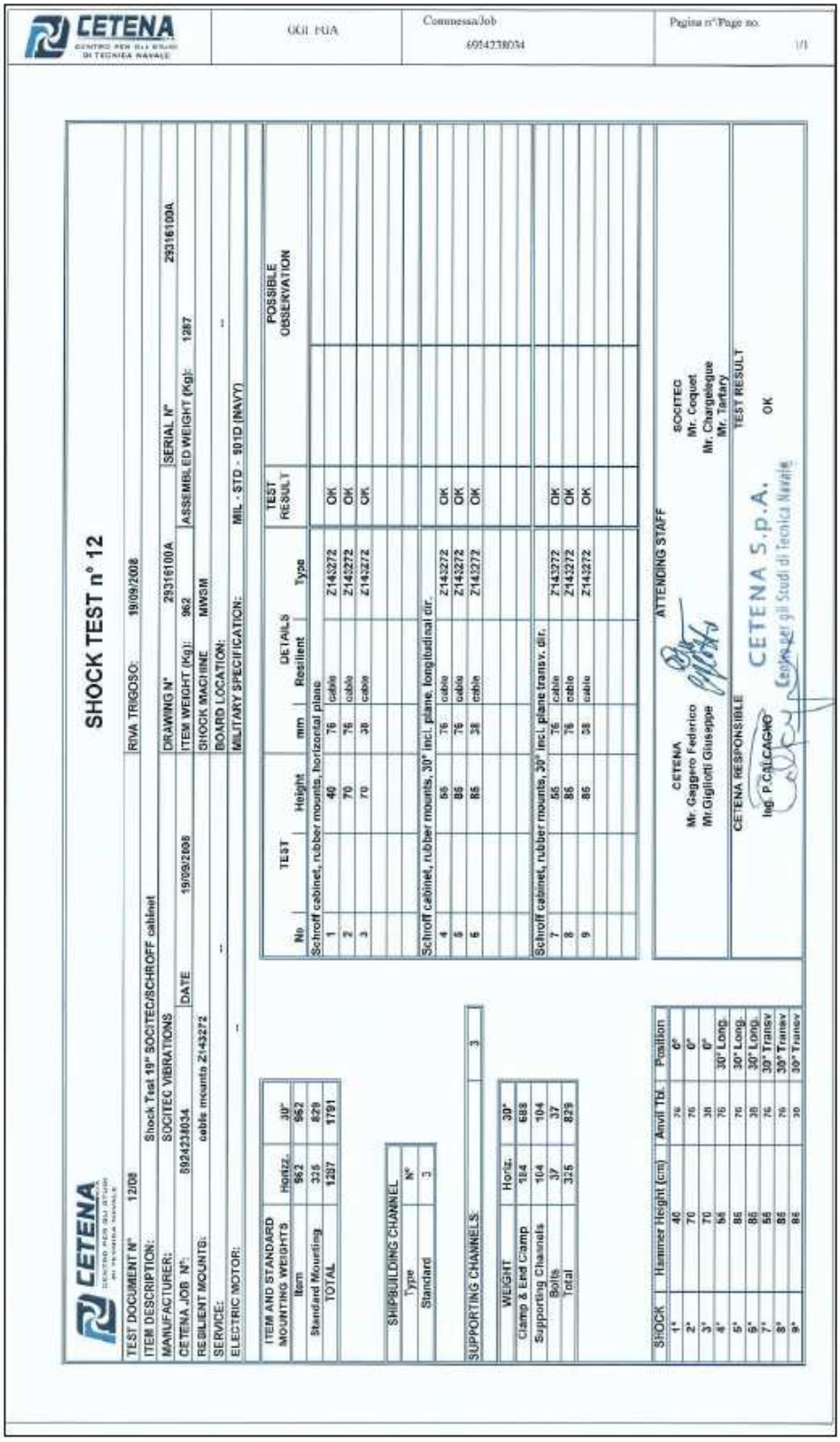

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SHOCK TEST n° 12

TEST DOCUMENT N°	1208	RIVA TRIGOSO:	19/09/2008
ITEM DESCRIPTION:	Shock Test 19" SOCITEC/SCHROFF cabinet		
MANUFACTURER:	SOCITEC VIBRATIONS	DRAWING N°	29316100A
CETENA JOB N°:	6924238034	DATE	19/09/2008
REGILIENT MOUNTS:	cable mounts 2143272		
SERVICE:	-		
ELECTRIC MOTOR:	-		

SERIAL N°	29316100A		
ITEM WEIGHT (Kg):	962	ASSEMBLED WEIGHT (Kg):	1287
SHOCK MACHINE	MWSM		
BOARD LOCATION:	-		
MILITARY SPECIFICATION:	MIL - STD - 901D (NAVY)		

ITEM AND STANDARD MOUNTING WEIGHTS	Horiz.	30°
Item	962	962
Standard Mounting	325	829
TOTAL	1287	1791

SHIPBUILDING CHANNEL	
Type	N°
Standard	3

SUPPORTING CHANNELS: 3

WEIGHT	Horiz.	30°
Clamp & End Clamp	184	688
Supporting Channels	104	104
Bolts	37	37
Total	325	829

SHOCK	Hammer Height (cm)	Anvil Tbl.	Position
1°	40	76	0°
2°	70	76	0°
3°	70	38	0°
4°	85	76	30° Long.
5°	85	76	30° Long.
6°	85	38	30° Long.
7°	55	76	30° Transv.
8°	85	76	30° Transv.
9°	85	38	30° Transv.

No	TEST Height	mm	DETAILS Resilient	Type	TEST RESULT	POSSIBLE OBSERVATION
Schroff cabinet, rubber mounts, horizontal plane						
1	40	76	cable	Z143272	OK	
2	70	76	cable	Z143272	OK	
3	70	38	cable	Z143272	OK	
Schroff cabinet, rubber mounts, 30° incl. plane, longitudinal dir.						
4	85	76	cable	Z143272	OK	
5	85	76	cable	Z143272	OK	
6	85	38	cable	Z143272	OK	
Schroff cabinet, rubber mounts, 30° incl. plane transv. dir.						
7	55	76	cable	Z143272	OK	
8	85	76	cable	Z143272	OK	
9	85	38	cable	Z143272	OK	

ATTENDING STAFF

CETENA: Mr. Gaggero Federico, Mr.Giglioti Giuseppe

SOCITEC: Mr. Coquet, Mr. Chargelegue, Mr. Tartary

CETENA RESPONSIBLE: Ing. P.CALCAGNO

TEST RESULT: OK

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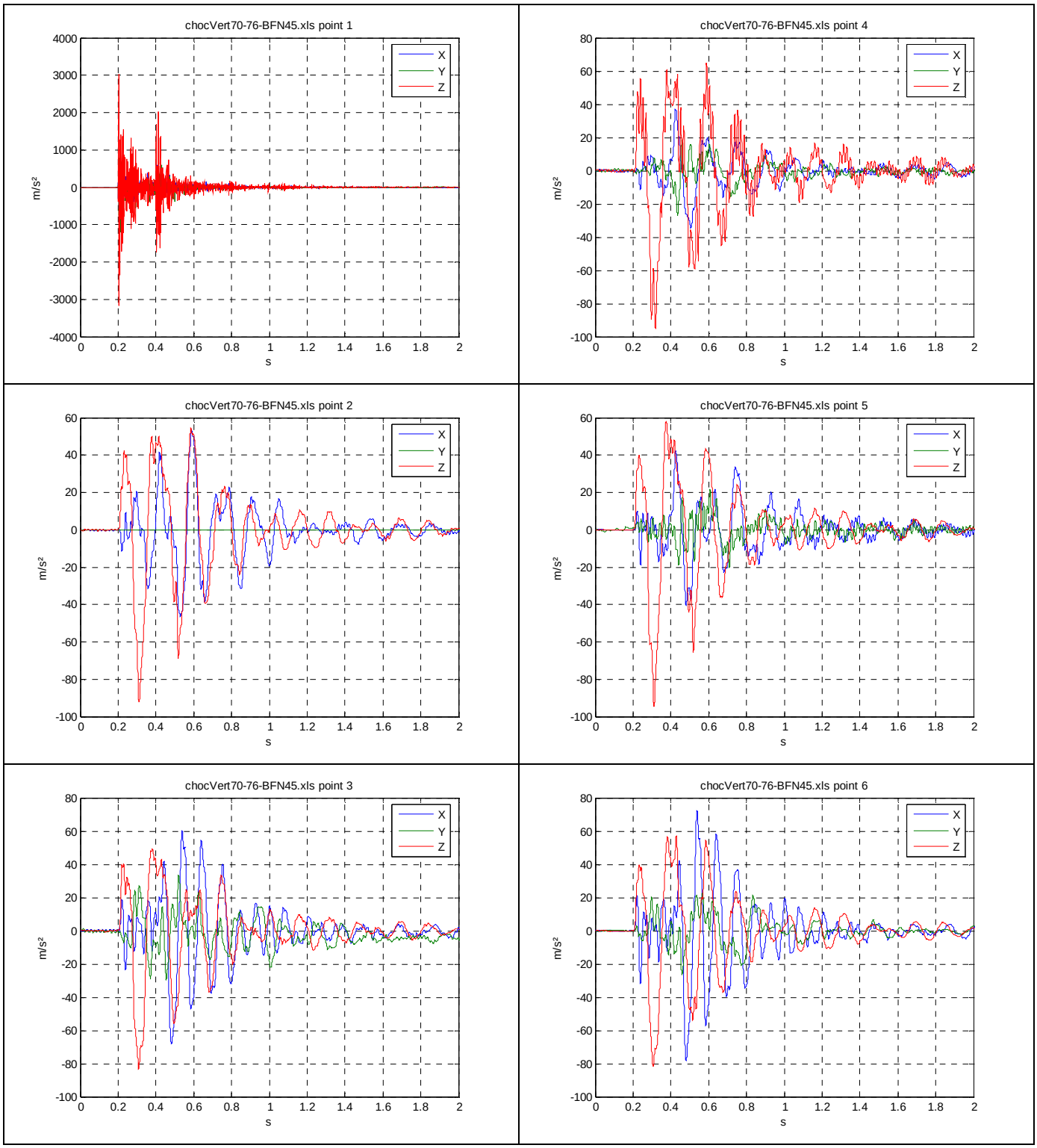
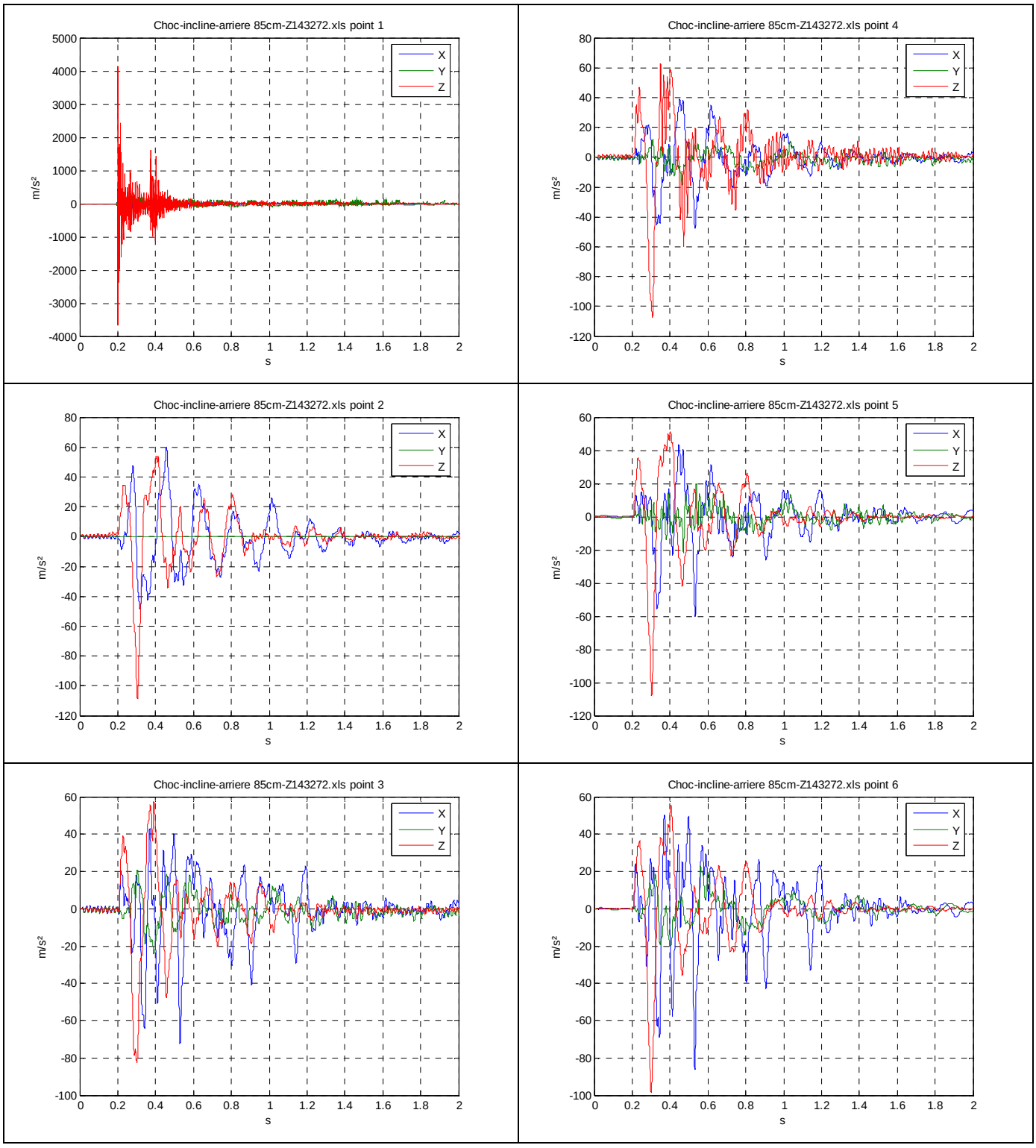
EXAMPLE: RESULTS FOR VERTICAL SHOCK WITH RUBBER MOUNTS

Hammer height: 70 cm –Anvil table: 76.2 mm



EXAMPLE: RESULTS FOR 30° INCLINED PLANE SHOCK WITH CABLE MOUNTS

Hammer height: 85 cm – Anvil table: 76.2 mm



MAIN RESULTS

Tables hereafter present residual accelerations measured for the point n°5 located on a rigid fixing block placed near the centre of gravity. Displacements are given as an indication.

Configuration with BFN45-130 mounts

Shock reference	Vertical		30° incl long dir		30° incl trans dir	
	Max Acc	Max Disp	Max Acc	Max Disp	Max Acc	Max Disp
GROUP I	4.7g	26 mm	5g	28 mm	3.9g	27 mm
GROUP II	9.6g	53 mm	9.1g	47 mm	7.8g	36 mm
GROUP III	7g	62 mm	6.7g	52 mm	5.6g	42 mm

Configuration with Z143272 mounts

Shock reference	Vertical		30° incl long dir		30° incl trans dir	
	Max Acc	Max Disp	Max Acc	Max Disp	Max Acc	Max Disp
GROUP I	4.9g	12 mm	4.8g	42 mm	4.4g	38 mm
GROUP II	12.8g	45 mm	11g	62 mm	8.4g	54 mm
GROUP III	10g	33 mm	6.5g	40 mm	7.9g	40 mm

Whatever the type of mounts, the maximum response correspond to the vertical position.

FROM QUALIFICATION TO CUSTOMIZATION

We present here the way to qualify a new structure of cabinet derived from the one has been tested in laboratory according to MIL-S-901D.
It consists in modifying theoretical model adapting it to the new terms of the specification, and in realising finite element calculations (shock and vibrations).
Most of the time, this numerical simulation is necessary and sufficient to justify the mounted cabinet, saving lengthy and expensive tests in laboratory.

Cabinet

The structure of the reinforced cabinet is adapted to the new specification:

- Shocks and vibrations
- Fragility
- Dimensions
- Fixing of equipments
- Ventilation
- Connecting plates
- Accessories…

Suspension

The suspension is adapted to the shock and vibration specification. The definition is made from a Symos simulation. This software developed by Socitec integrates mounts characteristics and allows dynamic simulations as shocks, drops, sinusoidal or random vibrations, etc...On a model with 6 or more degrees of freedom.

Validation of the structure

The structure of the cabinet is verified by a calculation with Ansys software and is adapted if necessary to comply with all the requirements of the specification.

Socitec Vibrations

19" MIL-S-901D Cabinets ...

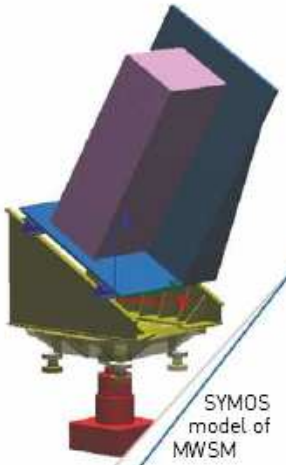
A CUSTOMIZED STANDARD

From engineering ... to qualification

Socitec and his partner Schroff offer 19" ruggedized cabinets, validated as per MIL-S-901D. This specification covers most naval demands in terms of shock and vibration.

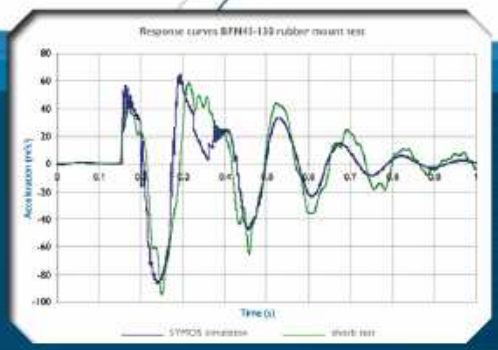
This cabinet is derived from the standard Varistar and combines today's integration necessities:

- High performances elastomer or cable elastic mountings for COTS equipments
- 19" standard
- Large selection of dimensions (height and depth)
- Great variety of accessories available
- Reduced engineering and fabrication costs
- EMC or HF adaptable
- RoHs conform



SYMOS model of MWSM

Test as per MIL-S-901D on MWSM (Medium Weight Shock Machine)



Response of mounts Calculation vs. tests

From qualification ... to customization

Developing a specific cabinet to your needs is quick. It can be validated by numerical simulation thereby saving lengthy and expensive tests in laboratory.

The elastic suspension is defined in order to take into account the mechanical environment and resistance of components, within the dimensions and weight of the cabinet suited to your integration requirements.

The structure is then validated by Finite Elements calculation with a model calibrated on real tests.

Mount selection

Example of cabinet with BARCO rugged Computer

F.E. model- Mesh and stress analysis

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