REPORT ON
Type Approval Testing of the
Tellumat TELLUSART
(Ser. Nos. 00007,00077,63679)
In Accordance With IEC 1097-1
First edition 1992-07

Report No 102208B July 1993

ASSESSMENT
SERVICES

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REPORT ON: Type Approval Testing of the Tellumat TELLUSART in accordance with IEC 1097-1

Report No 102208B

PREPARED FOR:
Tellumat Limited
Tellumat House
Hook Rise South
Surbiton
Surrey
KT6 7LD

DISTRIBUTION:

Tellumat Ltd.	Mr D Ashmore	Copy No. 1
D.T.I. Waterloo Bridge House	Mr J Poole	Copy No. 2
Assessment Services Limited		Copy No. 3
		COPY NO. 6

APPLICANT'S DETAILS	
CATEGORY OF APPLICANT	(a) [ ] Manufacturer
(Please tick relevant box)	(b) [ ] Importer
If box (b),(c) or (d)is ticked complete details in box below with respect to the manufacturer	(c) [✓] Distributor
	(d) [ ] Agent
COMPANY NAME :	Tellumat Ltd.
ADDRESS :	Tellumat House Hook Rise South Surbiton Surrey KT6 7LD
NAME FOR CONTACT PURPOSES :	David Ashmore
TELEPHONE No.: 081 974 1155	FAX No : 081 974 1148
	TELEX No : 917340 TELLCH G

MANUFACTURERS DETAILS	
COMPANY NAME :	Plessey Tellumat S.A. Limited
ADDRESS :	64174 White Road Retreat 7945 PO Box 23 Plumstead 7800 South Africa
NAME FOR CONTACT PURPOSES :	Michael Urry
TELEPHONE No : 010 2721 710 2466	FAX No : 010 2721 729 609
	TELEX No :

TYPE DESIGNATION[1]	
The type designation may be either a single alphanumeric code or an alphanumeric/code divided into two parts. Please fill in	
EITHER :	
TYPE DESIGNATION AS A SINGLE ALPHANUMERIC CODE	/ T / E / L / L / U / S / A / R / T / / / / / /
OR :	
TYPE DESIGNATION IN TWO PARTS :	
1. EQUIPMENT SERIES NO.[2] ("MODEL NUMBER")	/ / / / / / / / / / / / / / / / / / / /
AND	
2. EQUIPMENT SPECIFIC NO.[3] ("IDENTIFICATION NO")	/ / / / / / / / / / / / / / / / / / / /

(1) This is the manufacturer's numeric or alphanumeric code or name that is specific to a particular equipment.

(2) This is the number, code or trade name used by the manufacturer to describe a series or 'family' of equipment of substantially the same mechanical and electrical construction which will include a number of related equipments. This number is often referred to as the "model no.".

(3) This is the manufacturer's identification number given to a specific equipment in the series or 'family' of equipments. It is often referred to as the "identification number".

TYPE OF SART	
[ ]	Fixed Installation in lifeboats, life rafts or on board ship.
[✓]	Portable unit
[ ]	Installed in a release mechanism and/or combined with a float free EPIRB.

BATTERY					
[ ]	Nickel Cadmium	[ ]		Lead Acid	
[ ]	Mercury	[ ]		Leclanché	
[ ]	Alkaline	[✓]		Lithium	
[ ]	Other				
	Nominal voltage	15.0	Volts	End point voltage	11.0 Volts

OTHER ITEMS SUPPLIED		
Spare batteries e.g. (portable equipment)	[ ]	Yes
	[✓]	No
Battery charging device	[ ]	Yes
	[✓]	No
Special tools for dismantling equipment	[ ]	Yes
	[✓]	No
Test interface box (if applicable) or where appropriate the RF test fixture		
	[ ]	Yes
	[✓]	No
Full documentation on equipment (Handbook and circuit diagrams)	[✓]	Yes
	[ ]	No
Others	[ ]	Yes
	[ ]	No
If Yes, please specify :		

DECLARATIONS
Does the equipment comply with the requirements of section 3.2.14 [✓] Yes [ ] No If no state reasons: .....
Are the equipments submitted representative production models? [✓] Yes [ ] No If not are the equipments pre-production models? [ ] Yes [ ] No
If pre-production equipments are submitted will the final production equipments be identical in <u>all</u> respects with the equipment tested [ ] Yes [ ] No If no supply full details : .....

I hereby declare that I am entitled to sign on behalf of the applicant and that the information supplied is correct and complete.

Signature

Name : David M Ashmore

Position held : Managing Director

Date : 30 June 1993

LIST OF CONTENTS.

The list of observations and measured parameters called for in IEC 1097-1 is given below.

Operational Requirements Clause 6.2

Clause No.

6.2.1 The unit is fitted with a single rotary switch on the base capable of activation by unskilled personnel.

6.2.2 The unit is fitted with a means to prevent inadvertent activation. Manual activation requires a 'weak link' to be broken. The switch must be depressed and then turned to activate.

6.2.3 The unit has a visual indication of correct operation (yellow flashing L.E.D.) and both visual and audible indication of activation by a radar (green flashing L.E.D. and buzzer).

6.2.4 The unit is capable of manual activation and deactivation. No provision is made for automatic operation.

6.2.5 The unit has a visual indication of the standby condition i.e. activated but not triggered.

6.2.6 The equipment, serial no. 00077, was set up ready for normal use and allowed to fall freely from a height of 20 m into water. The unit suffered external damage and switched on when entering the water. The test was repeated using serial no. 00007 with the mounting mast fitted. Again external damage occurred and the unit would not switch off unless struck sharply. The design of the casing was modified to increase strength and extra mechanical support provided internally. The test was repeated with the modified sample, serial no. 63679, no damage occurred and the unit functioned correctly.

6.2.7 Test combined with 6.2.8. No leakage was observed.

6.2.8 The unit, serial no. 63679, was placed in an environmental chamber at a temperature of +65°C for ≥ 3 h. It was then transferred to a pressure vessel containing water at +18°C and immersed to a depth of 100 mm. The pressure was raised to 100kPa for a period of 1 h. The test was then repeated with the environmental chamber at a temperature of -12°C. On completion the unit showed no signs of leakage or malformation and functioned correctly.

6.2.9 The unit is not specifically designed to be an integral part of a survival craft. The check for floating was performed (5 minutes) following test 6.2.8.

6.2.10 The unit is fitted with a 10 m buoyant lanyard suitable for use as a tether.

6.2.11 Corrosion test not performed. Manufacturer supplied information in report supplement.

6.2.12 Manufacturers supplied information in report supplement.

6.2.13 The unit is made of highly visible orange coloured plastic with yellow labels. A reflective band is fitted to the top of the unit.

6.2.14 See manufacturer's declaration in the application form.

Battery capacity Clause 6.3

Average Current in Standby at V_{nom} - I_1	58.5 mA
Average Current during interrogation(1) at V_{nom} - I_2	96.3 mA
Lowest voltage for correct operation	11.0V

Dowty battery pack Type No. 670-00406-V

Test Conditions	Initial Voltage at I_1	Voltage after 96 hours at I_1	Voltage after further 8 hours at I_2
T_{nom} +15 to +35°C	15.92	14.36	13.87
T_{max} = +55°C	15.73	14.69	14.54
T_{min} = -20°C	15.03	12.41	12.30

Tadiran battery pack Type No. 670-00408N

Test Conditions	Initial Voltage at I_1	Voltage after 96 hours at I_1	Voltage after further 8 hours at I_2
T_{nom} +15 to +35°C	13.82	13.73	13.73
T_{max} = +55°C	13.83	14.20	14.19
T_{min} = -20°C	13.58	12.26	12.03

Hoppecke battery pack Type No. D-5790 Brilon 2

Test Conditions	Initial Voltage at I_1	Voltage after 96 hours at I_1	Voltage after further 8 hours at I_2
T_{nom} +15 to +35°C	15.90	14.60	14.26
T_{max} = +55°C	15.92	14.95	14.74
T_{min} = -20°C	15.47	13.05	12.94

(1) Continuous interrogation with test signal 3.

Limit Clause 6.3.2

Limit under normal and extreme test conditions	Final Voltage ≥ 11.0

TEST EQUIPMENT USED

5,6,8

.....

Environment (temperature): Dry heat cycle Clause 6.4.1

Performance check : Output Power/Modulation

Output Power (mW)	Modulation characteristics		
	F_l in range 9.2 GHz +0/-60 MHz	12 Sweeps	F_h in range 9.5 GHz +60/-0 MHz
> 400	Yes	Yes	Yes

Remarks: Unit interrogated using test signal 2
Performance check made during the final 2 hours of cycle
F_l = lowest frequency of sweep
F_h = highest frequency of sweep

TEST EQUIPMENT USED

2,3,4,5,6,7,10,12,14,15,16,17,18,20,21,22

Environment (temperature): Low temperature cycle Clause 6.4.2

Performance check : Output Power/Modulation

Output Power (mW)	Modulation characteristics		
	F_l in range 9.2 GHz +0/-60 MHz	12 Sweeps	F_h in range 9.5 GHz +60/-0 MHz
> 400	Yes	Yes	Yes

Remarks: Unit interrogated using test signal 2
Performance check made during final 2 hours of cycle
F_l = lowest frequency of sweep
F_h = highest frequency of sweep

TEST EQUIPMENT USED

2,3,4,5,6,7,10,12,14,15,16,17,18,20,21,22
.....

Range performance Clause 6.7

Response to marine X band radar.

The SART operated correctly when interrogated at a distance of 7.25 n.miles by a navigational radar complying with IMO resolution A.477 (XII). Details supplied in report supplement part 2.

Response to airborne radar.

Assumptions;

Antenna height	1m (actual 1.2m)
Receiver sensitivity	-56.2 dBm (test signal 2 at 9.5 GHz)
Radiated power	28.7 dBm (minimum including antenna characteristics)

For a search height of 3000 ft and a peak power equal to 10 kW:

Approximate detection range	55 n.miles

Range deduced from Fig. 3 contained in CCIR report 1036.

Labelling Clause 6.8

The labelling conforms to the requirements of IMO Resolution A.694 (17). Brief operating instructions and the battery expiry date are also indicated in English on the exterior of the equipment.

Receiver sensitivity Clause 6.9.3

Test Conditions	Test Signal	9.20 GHz (mW/m^2)	9.35 GHz (mW/m^2)	9.50 GHz (mW/m^2)
T_{amb} = +18°C V_{mon}(15.0V)	1	0.031	0.043	0.055
	2	0.015	0.017	0.024
Measurement Uncertainty		±0.3 dB		

Limit CLAUSE 6.9.3.2

Test Signal 1	< 2.0 mW/m^2
Test Signal 2	< 0.1 mW/m^2

TEST EQUIPMENT USED

2,3,4,5,6,7,9,10,12,13,14,15,16,17,18,20,21,22

Sweep characteristics - Frequency range Clause 6.9.4

Test Conditions	12 Sweeps	Minimum Frequency (GHz)	Maximum Frequency (GHz)
T_{nom} = +18°C V_{nom}(15.0V)	Yes	9.170	9.516
Measurement Uncertainty		±5.0 MHz	

Limit Clause 6.9.4.2

12 Sweeps each covering the range 9.2 GHz (+0/-60 MHz) to 9.5 GHz (+60/-0 MHz)

Sweep characteristics - Sweep time Clause 6.9.4

Test Conditions	Forward Sweep Time (μs)	Return Sweep Time (μs)	First Sweep Type
T_{nom} = +17°C V_{nom}(15.0V)	7.523	0.386	Return
Measurement Uncertainty (μs)	±0.022	±0.003	N/A

Limit Clause 6.9.4.2

Forward Sweep	7.5 ± 1.0 μs
Return Sweep	0.4 ± 0.1 μs

Sweep characteristics - Sweep profile Clause 6.9.4.1

Test Conditions	Forward Sweep Error (MHz)	Return Sweep Error (MHz)
T_{nom} = +18°C V_{nom}(15.0V)	7.8	7.8
Measurement Uncertainty	±2.5 MHz	

Limit Clause 6.9.4.2

Forward Sweep	Within ± 20 MHz of a linear Sweep between 9.2 and 9.5 GHz
Return Sweep	

TEST EQUIPMENT USED

2,3,4,5,6,7,9,10,12,13,14,15,16,17,18,20,21,22

Radiated power Clause 6.9.5

Rotation (n x π/8)	0° (ref.)
	dBm
0	30.51
1	29.77
2	29.73
3	29.90
4	30.34
5	30.22
6	30.04
7	30.82
8	30.60
9	30.24
10	30.46
11	30.38
12	30.12
13	29.97
14	30.47
15	30.71
Maximum	30.82
Minimum	29.73
Range	1.09 dB
Measurement Uncertainty	±0.6 dB

Limit Clause 6.9.5.2

Minimum power	≥ 400 mW (+26 dBm)
Power Range	The maximum and minimum signals shall be within 4 dB

TEST EQUIPMENT USED

2,3,4,5,6,7,9,10,12,13,14,15,16,17,18,19,20,21,22

.....

Antenna characteristics Clause 6.9.6

Rotation (n x π/8)	0° (ref.) (dBm)	+ 12.5° (dBm)	Variation from ref.(dB)	- 12.5° (dBm)	Variation from ref.(dB)
0	30.51	29.36	-1.15	29.77	-0.74
1	29.77	29.51	-0.26	29.25	-0.52
2	29.73	29.39	-0.34	28.94	-0.79
3	29.90	29.76	-0.14	29.28	-0.62
4	30.34	29.16	-1.18	29.17	-1.17
5	30.22	29.01	-1.21	29.05	-1.17
6	30.04	29.17	-0.87	29.20	-0.84
7	30.82	29.40	-1.42	29.36	-1.46
8	30.60	29.31	-1.29	29.42	-1.18
9	30.24	29.17	-1.07	29.34	-0.90
10	30.46	29.15	-1.31	29.12	-1.34
11	30.38	29.00	-1.38	29.26	-1.12
12	30.12	28.80	-1.32	29.18	-0.94
13	29.97	28.74	-1.23	29.07	-0.90
14	30.47	29.30	-1.17	29.78	-0.69
15	30.71	29.42	-1.29	29.87	-0.84
Maximum	30.82	29.76	-0.14	29.87	-0.52
Minimum	29.73	28.74	-1.42	28.94	-1.46
Range (dB)	1.09	1.02		0.93	
Measurement Uncertainty	±0.6 dB				

Limit Clause 6.9.6.2

Limit under normal test conditions	Minimum horizontal power 26 dBm (400mW)
	Power at ± 12.5° within ± 2 dB of horizontal value.
	Maximum power range in each plane 4 dB

Remarks: Measured Antenna height with mounting pole 1.2 m - requirement ≥ 1 m, clause 6.5.1
Antenna polarisation - horizontal. Requirement - horizontal, clause 5.2.

TEST EQUIPMENT USED

2,3,4,5,6,7,9,10,12,13,14,15,16,17,18,19,20,21,22

.....

Recovery time following excitation Clause 6.9.7

Test Conditions	Recovery Time (μs)
T_{nom} = +18°C V_{nom}(15.0V)	9.12
Measurement Uncertainty	$\pm$0.022 μs

Limit Clause 6.9.7.2

Limit under normal test conditions	$\leq$ 10 μs

TEST EQUIPMENT USED

2,3,4,5,6,7,9,10,12,13,14,15,16,17,18,20,21,22

.....

Delay - Receipt of radar interrogation and SART transmission Clause 6.9.8

Test Conditions	Delay Time (μs)
$T_{nom} = +18°C$ $V_{nom}(15.0V)$	0.197
Measurement Uncertainty	± 0.003 μs

Limit Clause 6.9.8.2

Limit under normal test conditions	≤ 0.5 μs

TEST EQUIPMENT USED

2,3,4,5,6,7,9,10,12,13,14,15,16,17,18,20,21,22

Receiver front end protection Clause 6.9.9

The receiver operated correctly after being subjected to the radiated field (28 dBW/m^2) emitted from a radar complying with IMO resolution A.477 (XII). Details in report supplement part 2.

Date of Receipt: 29 Jan 1993

Start of Test : 03 Feb 1993

Finish of Test : 21 Jun 1993

Engineer : **T Phillips**

Project Manager : **H E Ward**

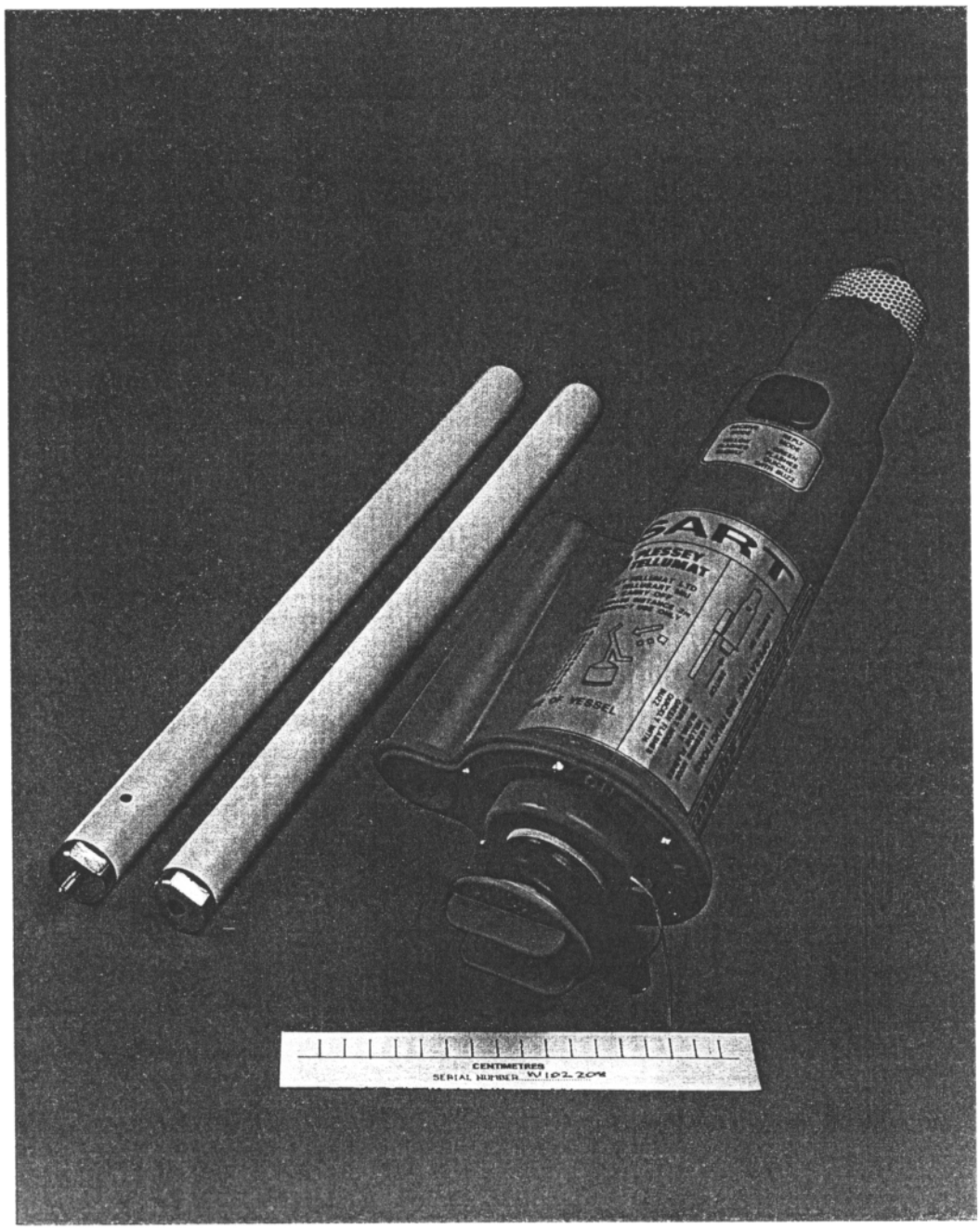
Approved by : 16th July 1993

C M Parry
Radio Regulatory Manager

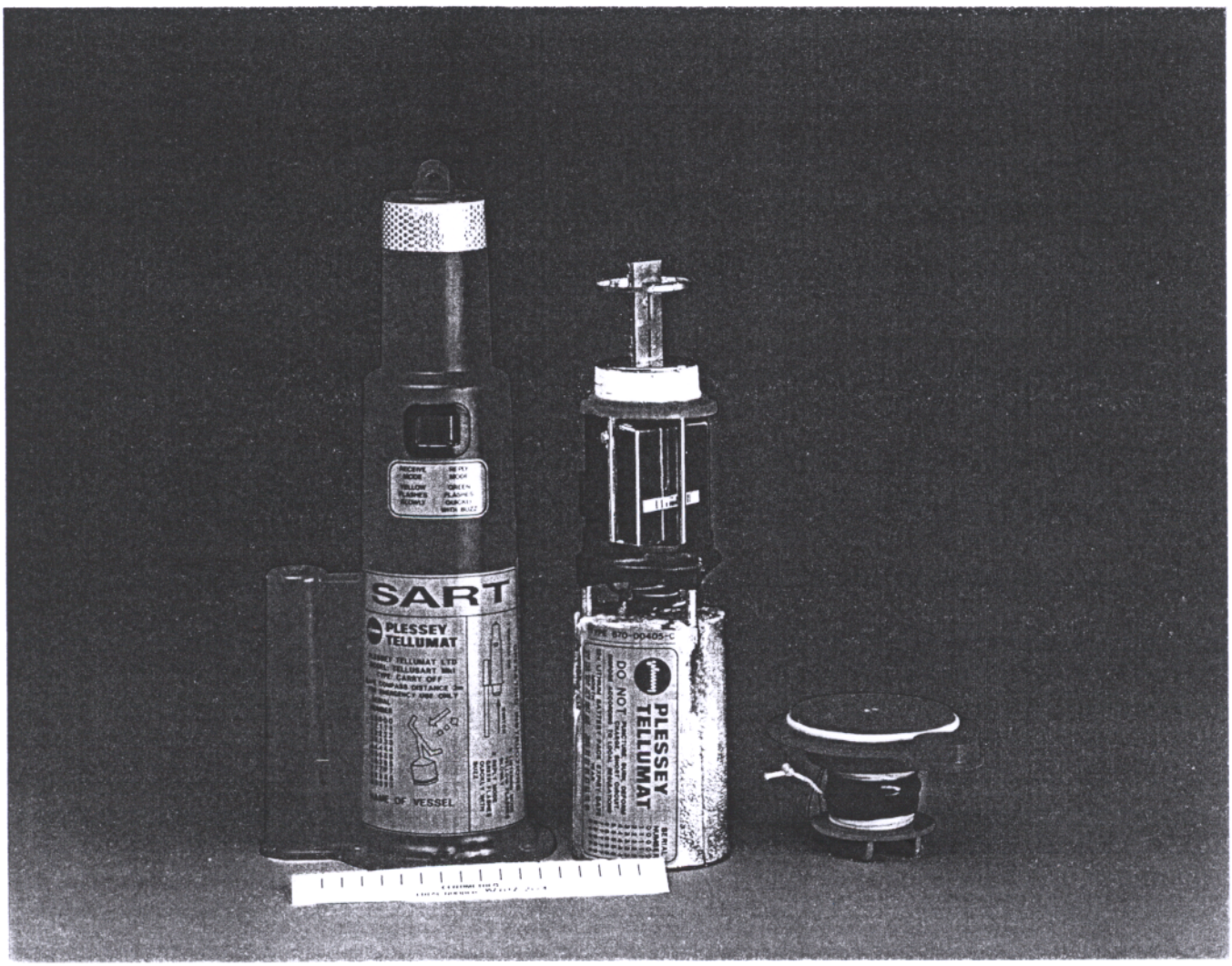
TEST EQUIPMENT AND ANCILLARIES USED FOR TESTS

Each item of test and ancillary equipment is identified by number thus;

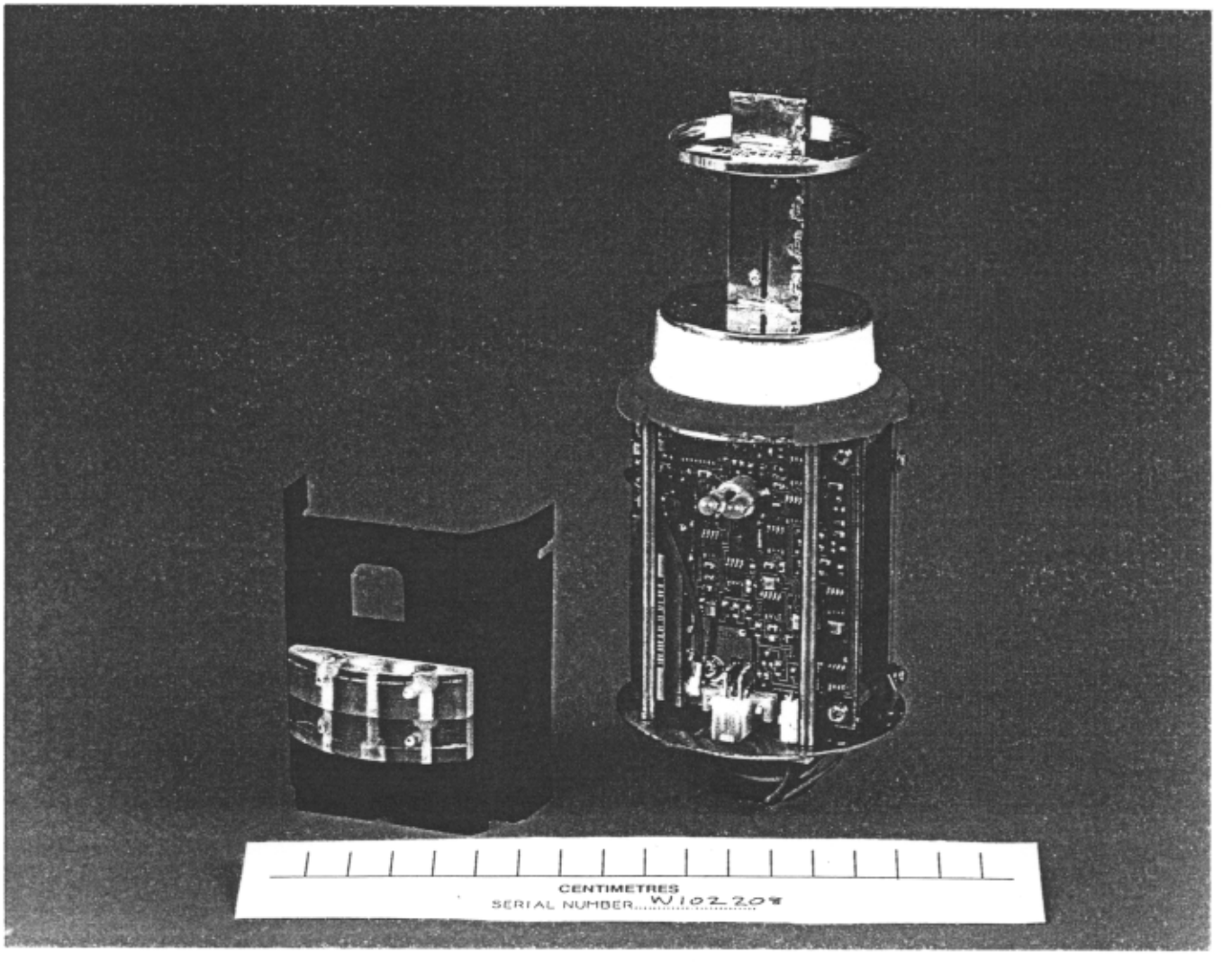
No	Instrument/Ancillary	Type	Manufacturer	Serial No.
1	Programable pulse generator	8161A	Hewlett Packard	2202G00326
2	Sweep generator	8350B	Hewlett Packard	2331U00440
3	Peak power analyser/sensor	8990A/8481	Hewlett Packard	3107A00124
4	Standard 20 dB gain horn	1624-20	Flann Microwave	326
5	Thermohygrograph	T9184\C\MK	Cassella	013058
6	Digital voltmeter	8050A	Fluke	494008
7	Power supply unit	6253A	Hewlett Packard	2412A06566
8	Environmental Chamber	VM04/100	Herraus	40608
9	Environmental Chamber	2F3	Montford	3090-K5467
10	Signal Generator	8673B	Hewlett Packard	2147A00421
11	Standard 20 dB gain horn	1624-20	Flann Microwave	238
12	Freq. & T.I. Analyser	5372A	Hewlett Packard	3141A1073
13	Function Generator	3314A	Hewlett Packard	2141A03192
14	Pulse Generator	8012B	Hewlett Packard	1448A11578
15	Oscilloscope	S-5321	Iwatsu	2618556/1
16	Circulator	7099	Phase Devices Ltd	S3C08001240A00
17	Microwave Mixer	HMXR-5001	Hewlett Packard	0489
18	Power Splitter	1506A	Weinschel	AO5346
19	Power Meter	436A	Hewlett Packard	2347A17582
20	Cable 3.5m	065-9AA-3500-000	Sealectro	Not Serialised
21	Cable 1.0m	065-9AA-1000-000	Sealectro	Not Serialised
22	Cable 1.0m	065-9AA-1000-000	Sealectro	Not Serialised



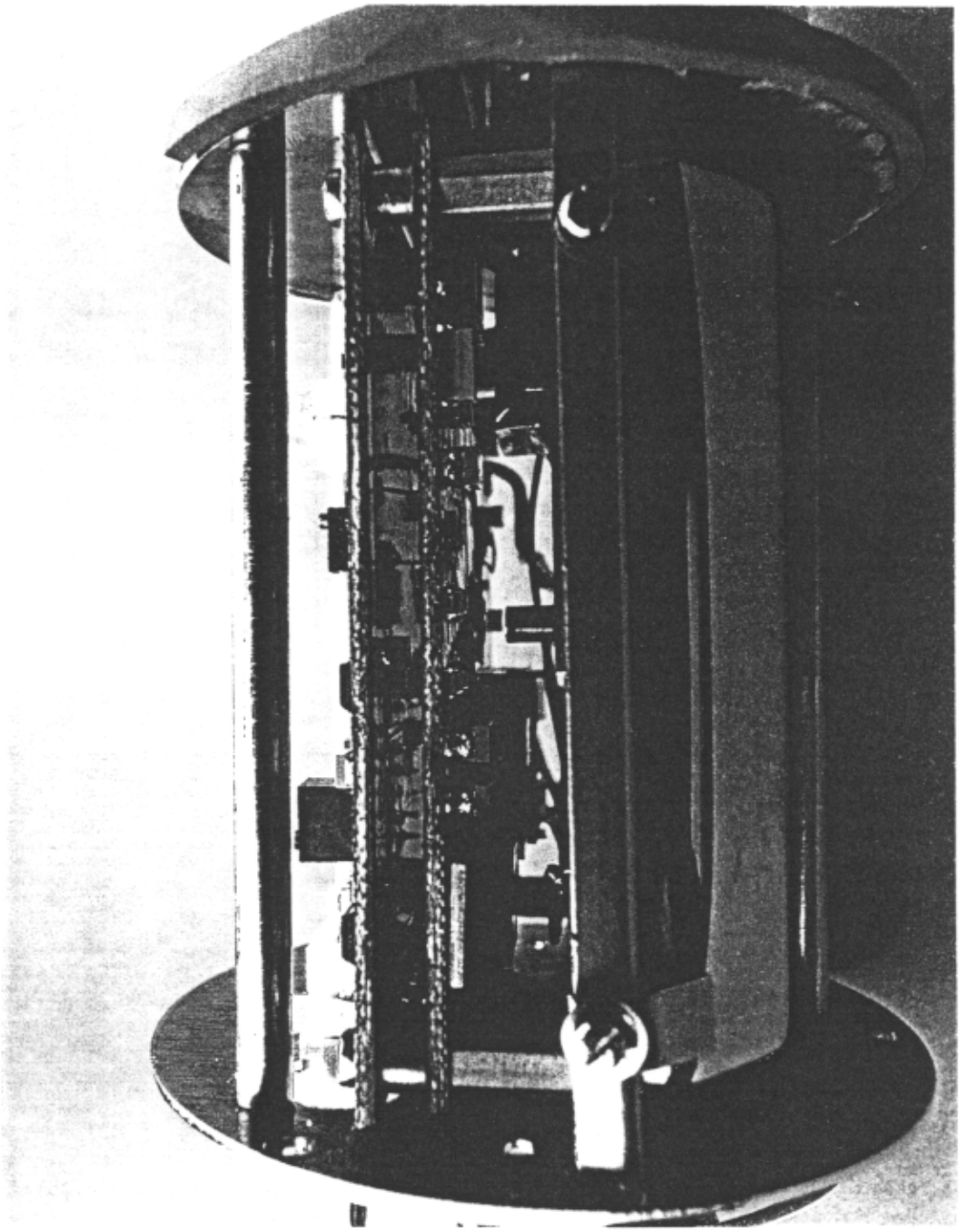
External View



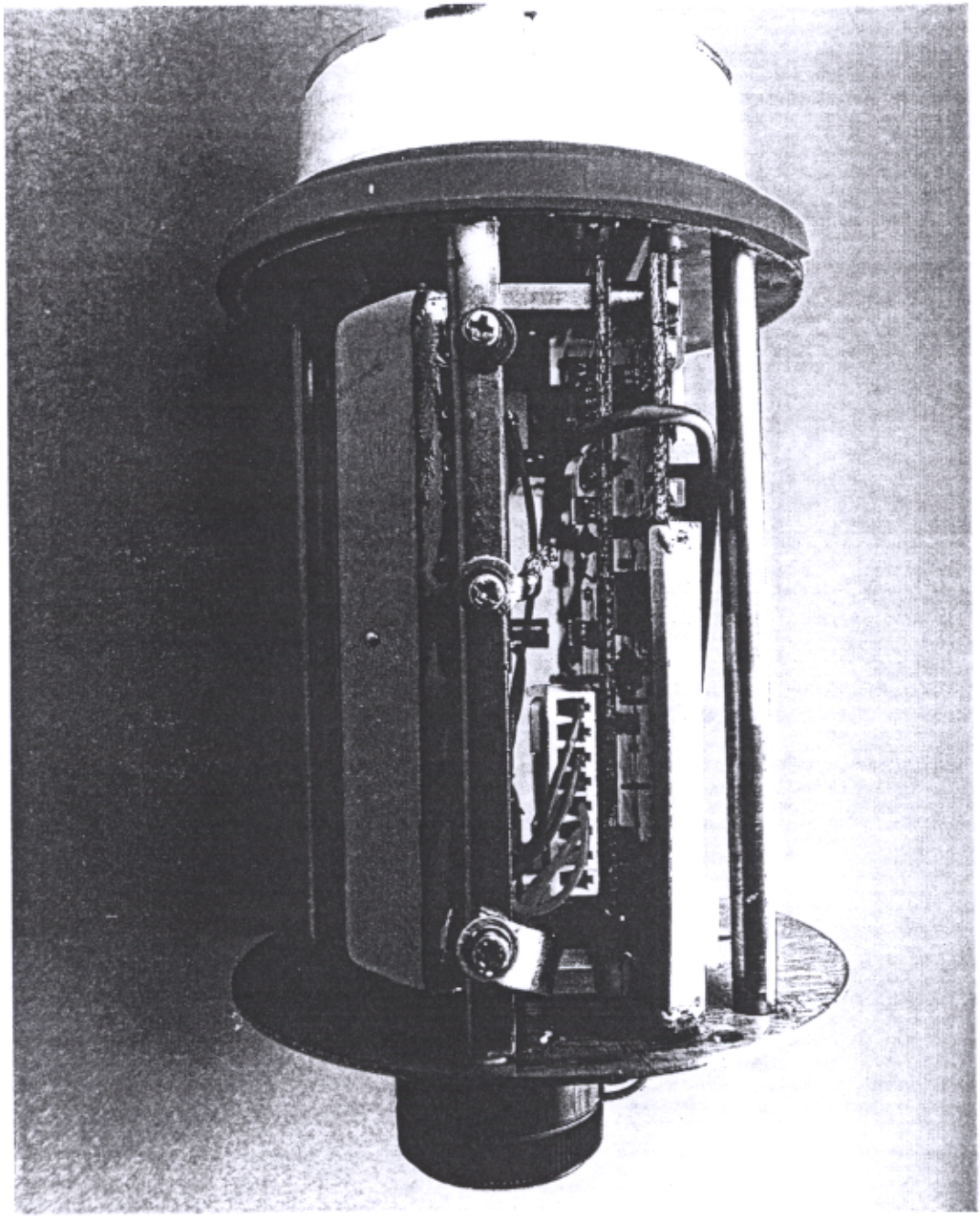
Internal View 1



Internal View 2



Internal View 3



Internal View 4

PART 1

Manufacturer Supplied Information

CERTIFICATE OF CONFORMANCE

PLESSEY TELLUMAT SA LIMITED PO BOX 30451 7966 TOKAI TELEPHONE: 021-7102237 (R&D QA) FACSIMILE: 021-729609 (R&D QA)	Certificate No.	SART1
	Release Date:	2 DECEMBER 1992

Customer:	Contract/Order No:	Contract/Order Date:	File Reference:
N/A	N/A	N/A	N/A

Item	Drawing/Spec/ Part No and Issue	Description	Qty	Serial Number	Test Procedure
1	670-00380-H	SART XDM	1	00001	N/A

Remarks: Only limited qualification performed on unit.
Released for further qualification testing by testing house in U.K.
No pressure tests or flotation tests to be conducted on this unit.

It is certified that the whole of the supplies detailed hereon have been inspected/tested and unless otherwise stated, conform in all respects to the contract/order relative thereto.

Presented by: D G W Mence — Position in Company: Tech Manager — Date: 2/12/92.

Authorised by: — Position in Company: R&D QA — Date: 2/12/92

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CC 8 7 1 8 1

FAX MESSAGE

PLASTOMARK (PTY) LTD
Reg.No. 72/04848/07

Cape Town Office :
P.O. Box 6448, Roggebaai 8012
Fax No : (021) 557-1846
Tel No : (021) 557-1131
Telex : J27923

Date 02.12.92 Page 1 of 3

From R WALTERS

To D SEDDON - PLESSEY
FAX NO: 721278

Subject GC7260HL SPECIFICATION

Herewith a data sheet of GC7260, as requested.

GC7260HL is a special recipe for resistance to light UV and weathering. Both these grades have the same physical as well as rheological properties.

Please contact the undersigned if you do require any further assistance.

Regards

ROELOF WALTERS

GC 7260

	PROPERTY		VALUE	UNIT	TEST METHOD	TEST CONDITIONS
1.	Density at 23°C		0,957	g/cm³	ASTM D 792 DIN 53 479	Method A2 Method A
2.	Melt Flow Index	2.1. MFI 190/2,16	7	g/10 min	ASTM D 1238 DIN 53 735	Method A, Condition E
		2.2. MFI 190/5	21	g/10 min	ASTM D 1238 DIN 53 735	Method A, Condition P
3.	Tensile Properties	3.1 Tensile yield strength 3.2. Elongation at yield	28 12	N/mm² %	ASTM D 638	Testing rate 100 mm/min Specimen IV, 1 mm compression moulded
		3.3. Ultimate tensile strength	29	N/mm²	DIN 53 455	Specimen 4, 1 mm compression moulded
		3.4. Elongation at break	>600	%		
4.	Hardness	4.1. Rockwell R	61	—	ASTM D 785	Procedure A, compression moulded specimen
		4.2. Ball indentation (30 sec value)	47	N/mm²	DIN 53 456	132 N
		4.3. Shore D	62	—	ASTM D 2240 DIN 53 505	Loading time 1 s
5.	Impact Strength	5.1. Notched IZOD : 23°C	32	J/m	ASTM D 256	Compression moulded specimen
		5.2. Charpy : 23°C	3.0	mJ/mm²	DIN 53 453	Compression moulded specimen
6.	Crystalline Melting Range		130-132	°C		Polarizing microscope, microtome section, 20 µm
7.	Vicat Softening Point		127	°C	ASTM D 1525 DIN 53 460	Rate A, 5 mm compression moulded specimen Method A/50, compression moulded specimen
8.	Average Linear Expansion Co-efficient (between 20°C and 90°C)		1,5 x10⁻⁴	K⁻¹	DIN 53 752	50 x 4 x 4 (mm)
9.	Thermal Conductivity at 20°C		0,43	$\frac{W}{m.K}$	DIN 52 612	8 mm specimen, injection moulded

Rosside 27-413

PROCESSING

® Hostalen GC 7260 can readily be processed successfully on all modern generation injection moulding machines. Preferably reciprocating screws with non-return valves should be used (three-zone screw, 15 to 20 D long). Special designs, e.g. for venting, are not required. Typical processing conditions are:

- Melt temperature between 200 °C and 260 °C
- Injection pressure * up to the machine maximum
- Follow-up pressure * 50 MPa maximum.
- Injection rate usually maximum, depending on the moulding.
- Back pressure * 5 MPa to 30 MPa.
- Mould temperature 30 °C to 60 °C.
- Mould clamping force greater than 2 500 N per cm² projected moulding area.

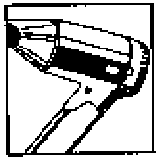
The optimum moulding conditions are dependent on article flow length, mould gating, mould cooling facilities etc. and should be adhered to when processing this grade.

* at the screw tip.

Location [illegible]

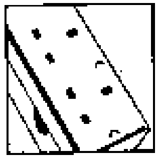
APPLIANCE, BUSINESS MACHINE AND OTHER HOUSINGS

Advantages of CALIBRE: Toughness, high heat distortion and excellent appearance with the ability to mould into complex shapes.
Grades: 700 and 800 series for ignition resistance up to U.L. 94 V-0 at 1 mm. 300 series up to a U.L. of 94 V-2.



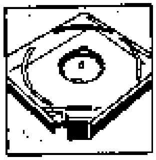
ELECTRICALS

Advantages of CALIBRE: Good electrical properties with excellent heat and impact resistance.
Grades: 300, 700 and 800 series all possess these properties with varying degrees of ignition resistance.



DATA STORAGE MEDIA

Advantages of CALIBRE: High impact strength and dimensional stability to protect critical discs and magnetic tapes.
Grades: 300 series opaque colours and smoked tints.

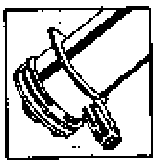


FOOD CONTAINERS AND UTENSILS[1]

Advantages of CALIBRE: Shatterproof, glass-like transparency, good chemical resistance and food agency compliance.
Grades: 200 series high viscosity for blow moulding, lower for injection moulding.

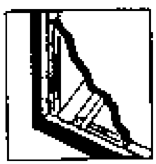
MEDICAL[1]

Advantages of CALIBRE: Biological inertness and low migration, glass like transparency and sterilisable by many methods in compliance with International Medical Regulations as and where required.
Grades: Special CALIBRE medical grades are being made. Please request further information by completing the attached card.



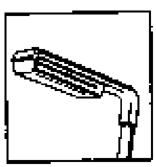
STRUCTURAL AND GLAZING SHEET

Advantages of CALIBRE: Transparency, good weatherability (with added UV stabiliser), high impact strength.
Grades: 302 5 (special extrusion viscosity). 700 and 800 series for speciality sheets with higher flammability requirements.



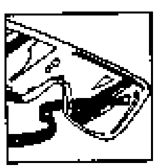
LIGHTING

Advantages of CALIBRE: High heat distortion, impact strength and mouldability into complex lens designs.
Grades: Transparent 300 series (with UV stabiliser) for lenses. 300 series in opaque colours for low maintenance domestic lighting.



SAFETY

Advantages of CALIBRE: Glass-like transparency, shatter proof.
Grades: 300 series. Specialty grades are also made for safety glasses and ophthalmic lenses. Please request further information by completing the attached card.



	Units	ASTM	DIN	ISO
Physical Properties[2]				
Melt flow rate (300°C, 1.2kg)	g/10min	D-1238	53735	1133
Density	g/cm³	D-792	53479	R 1183
Water absorption in standard Atmosphere (23°C, 50% RH)	%	D-570	53473	–
Water absorption in water Equilibrium, 23°C	%		53495 mthd A	62
Mould shrinkage	%	D-955	16901	–
Optical Properties				
Transmittance	%	D-1003	–	–
Haze	%	D-1003	–	–
Refractive index (nD)		D-542	53491	–
Thermal Properties				
Heat distortion temperature				
Method B (0.45 MPa) annealed	°C	D-648	53461	75
Method A (1.81 MPa) annealed	°C	D-648	53461	75
Method A (1.81 MPa) unannealed	°C	D-648	53461	75
Specific heat	kJ/kg K	D-2766	–	–
Thermal conductivity	W/K m	C-177	based on 52612	–
Coefficient of thermal expansion	m/m K x10⁻⁵	D-696	53752	–
Vicat softening point (B/50)	°C	–	53460	306 B
Mechanical Properties				
Tensile strength, yield / break	MPa	D-638	53455	R 527
Elongation, yield / break	%	D-638	53455	R 527
Tensile modulus	MPa	D-638	53457	R 527
Flexural strength	MPa	D-790	53452	178
Flexural modulus	MPa	D-790	53457	178
Compressive strength	MPa	D-695	53454	R 604
Shear strength, yield / break	MPa	D-732	–	–
Izod impact strength[3] Notched, 3.2mm thick; Unnotched, 3.2 mm	J/m	D-256	– / –	R 180
Charpy impact strength 23°C; -40°C	kJ/m²	–	53453	179
Charpy notched impact strength 23°C[3]	kJ/m²	–	53453	179
Ball indentation hardness (H 30)	N/mm²	–	53456	2039/2
Rockwell hardness, R / M		D-785	–	–
Instrumented Dart Impact (3.4 mm/s, 3.2mm thick)	J, at energy	–	–	–
Taber Abrasion Resistance (500 cycles)	Δ % Haze	D-1044 (500 g on each CS-10F wheel)		
Flammability Ratings[4]				
Average extent of burning	mm	D-635		
UL 94, 1.6mm; UL 94, 1.8mm; UL 94, 3.2 mm		UL 94; UL 94; UL 94		
Oxygen Index	%	D-2863		
Glow Wire Test, 3 mm	°C	–	VDE 0471 pt 2	IEC 695-2
Electrical Properties				
Dielectric Strength 2mm (in transformer oil with Tween)	kV/mm	–	VDE 0303 pt 2	IEC 243
Volume resistivity	Ohm-cm	–	VDE 0303 pt 3	IEC 93
Dissipation factor tan δ x10⁴ 50 Hz; 1 kHz; 300 kHz		–	VDE 0303 pt 4	IEC 250
Surface Resistivity	Ohm		VDE 0303 pt 3	IEC 93
Relative Permittivity 50 Hz; 1 kHz; 300 kHz		–	VDE 0303 pt 4	IEC 250
Tracking CTI, 2mm	Rating		VDE 0303 pt 1	IEC 112

1. The 200 and 200E series of CALIBRE polycarbonate resins comply with FDA regulation 21 CFR 177.1580 and most European regulations [illegible]

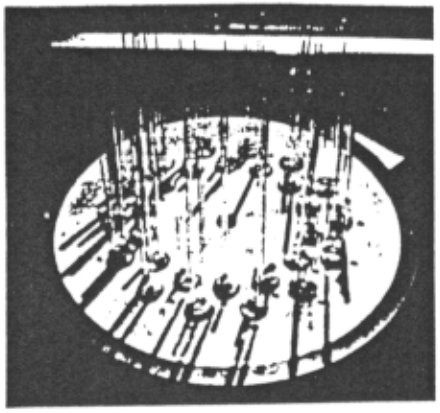
physical properties of Santoprene® thermoplastic rubber

environmental stability

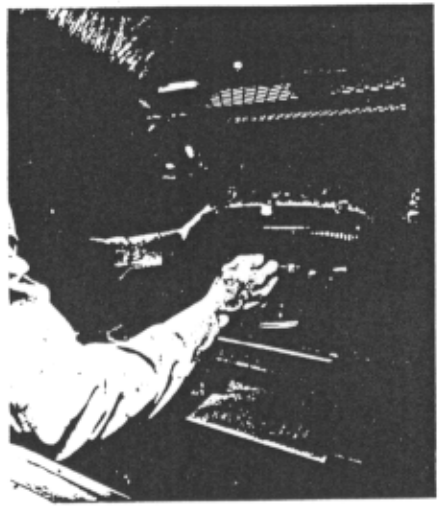
The environmental stability of SANTOPRENE rubber is excellent, exceeding many thermoset rubbers. Table III illustrates the retention of physical properties for SANTOPRENE rubber grades 101-73 and 103-40 after exposure in a xenon arc weatherometer. The retention of tensile strength, elongation and 100% modulus after 2000 hours exceeds 90% in all cases.

Many thermoset rubbers deteriorate when they have prolonged exposure to air, oxygen or ozone. SANTOPRENE rubber is designed to be resistant to these gases, with its ozone resistance rated as outstanding. Testing according to ASTM D-518 demonstrates that all grades surpass the required criteria after 70 hours in 50 pphm ozone.

Extensive heat-aging of thermoset rubber compounds frequently causes a severe change in mechanical properties. Table IV illustrates the retention of tensile strength, elongation and 100% modulus for SANTOPRENE rubber after hot-air aging for up to 1000 hours (41.7 days) at 125°C. SANTOPRENE rubber shows less than a 25% chance in these mechanical properties at all conditions. This excellent hot-air aging represents a significant performance advantage compared to most thermoset rubber compounds. Improved heat aging can be achieved by additives designed for this purpose.



SANTOPRENE rubber has excellent heat aging characteristics.



SANTOPRENE rubber has superior static and dynamic ozone resistance.

weatherability of Santoprene® rubber in xenon arc weatherometer, percent retention of tensile properties after exposure[1]

TABLE III.

Time, Hrs.	SANTOPRENE RUBBER 101-73 Tensile Strength	Elonga-tion	100% Modulus	SANTOPRENE RUBBER 103-40 Tensile Strength	Elonga-tion	100% Modulus
1000	103%	94%	104%	101%	98%	105%
2000	102%	94%	106%	107%	100%	107%

heat aging, percent retention of mechanical properties for Santoprene rubber at 125°C[1]

TABLE IV.

SANTOPRENE Rubber Grade, Property	1 Day (24 hrs.)	7 Days (168 hrs.)	15 Days (360 hrs.)	30 Days (720 hrs.)	41.7 Days (1000 hrs.)
201-55, 101-55					
Change in hardness, Shore A units	+2	+3	+5	+3	+7
Tensile Strength	92.0	101.0	99.0	80.0	88.0
% Elongation	86.0	97.0	104.0	92.0	99.0
100% Modulus	107.0	106.0	104.0	105.0	110.0
201-64, 101-64					
Change in hardness, Shore A units	0	0	0	+3	+3
Tensile Strength	96.1	94.1	103.0	113.9	112.8
% Elongation	88.9	88.9	93.6	101.3	100.5
100% Modulus	102.8	105.7	103.4	107.7	109.9
201-73, 101-73					
Change in hardness, Shore A units	−1	−1	0	+2	+4
Tensile Strength	93.7	100.0	105.1	119.8	107.9
% Elongation	87.4	97.7	98.2	105.1	89.2
100% Modulus	100.6	103.1	103.5	106.9	112.1
201-80, 101-80					
Change in hardness, Shore A units	−1	−1	0	+2	+2
Tensile Strength	96.6	96.5	107.1	102.5	92.8
% Elongation	92.1	89.1	91.7	83.2	73.3
100% Modulus	105.5	110.3	111.5	116.3	121.7
201-87, 101-87					
Change in hardness, Shore A units	−3	−2	−3	−1	0
Tensile Strength	95.4	94.2	98.8	96.4	85.4
% Elongation	89.1	85.4	83.5	80.1	67.5
100% Modulus	107.2	107.5	113.6	116.6	120.0
203-40, 103-40					
Change in hardness, Shore D units	−1	−1	+2	+3	+4
Tensile Strength	98.8	96.5	97.6	97.4	93.9
% Elongation	89.8	83.3	83.6	78.9	71.0
100% Modulus	106.6	111.8	112.4	118.3	126.6
203-50, 103-50					
Change in hardness, Shore D units	0	0	+1	+3	+4
Tensile Strength	98.8	100.8	98.6	93.1	92.9
% Elongation	97.5	94.4	87.3	83.9	84.8
100% Modulus	115.4	119.2	121.6	121.6	124.9

PART 2

Range Test Verification

DEFENCE RESEARCH AGENCY

FRASER, PORTSMOUTH PO4 9LJ

CIVIL MARINE GROUP
SART RANGE TEST REPORT

NAMAS TESTING No 1217

No: TT 42/92/1 Date of Issue 27/4/1992

SPECIFICATION of TEST IEC 1097 First Edition 1992-07 Part 1

Test Requirement Para 3.7 Range Performance (Page 15)

Equipment under test

Date(s) 14 April 1993

Manufacturer Plessey Tellumat **Serial No** 00077

Model or type TelluSART Mk 1 **Date of Manufacture** 1992

Submitted by Assessment Services **Address** Segensworth Road Titchfield Fareham Hampshire PO15 5RH

Range Details

Radar site Fraser, Eastney **Target site** Bracklesham Bay **Separation** 7.25 nm

Radar installation Details

Test Radar FR-1505DA **Manufacturer** Furuno **Serial No** 343-0318

Frequency 9.410 GHz **Output power** 5 Kw Peak **PRF** 1200 Hz

Antenna Height 15 metres **Antenna size** 1.23m **Pulse width** 0.6uS

Environmental Conditions

Sea state 3-4 **Visibility** Approx 5 nm **Tide** Low - 2hrs

Performance Checks

Date 14 April 1993 **Time** 1000 - 1100

SART response was tested as defined in above specification with an X Band marine radar meeting IMO Resolution A477(XII)

Screen photographs were taken using a Polaroid screen camera

No of Photographs taken 3 (1 enclosed) **RESULT** ~~Satisfactory / Unsatisfactory~~

Remarks

Test was conducted with the SART positioned at the waters edge with the lowest part of the antenna set at 1 metre above the surface of the sea and in line of sight to the radar antenna at Fraser Range over a sea path.

Signature .....

Officer conducting tests Mr J. Hiscock

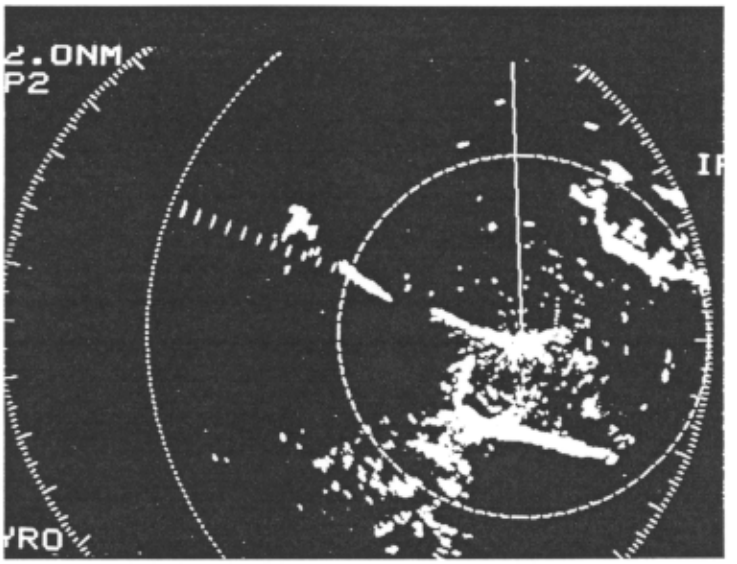
DEFENCE RESEARCH AGENCY

FRASER, PORTSMOUTH PO4 9LJ

CIVIL MARINE GROUP
SART RANGE TEST REPORT

No: TT 42/92/1 Date of Issue 27/4/1992

NAMAS TESTING No 1217



SART Response during testing

Signature .....

Officer conducting tests Mr J. Hiscock

DEFENCE RESEARCH AGENCY

FRASER, PORTSMOUTH PO4 9LJ

CIVIL MARINE GROUP
SART RECEIVER FRONT END PROTECTION TEST REPORT

NAMAS TESTING No 1217

No: TT 42/92/1 Date of Issue 27/4/1992

SPECIFICATION of TEST IEC 1097 First Edition 1992-07 Part 1

Test Requirement Para 5 Note 1.4 Receiver Front End Protection

Equipment under test **Date(s)** 14 April 1993

Manufacturer Plessey Tellumat **Serial No** 00077

Model or type TelluSART Mk 1 **Date of Manufacture** 1992

Submitted by Assessment Services **Address** Segensworth Road
Titchfield Fareham Hampshire PO15 5RH

Radar installation Details

Test Radar Pathfinder **Manufacturer** Raytheon **Serial No** 50-9248

Frequency 9.375 GHz **Output power** 50 Kw Peak **PRF** 1800 Hz

Antenna Height 15 metres **Antenna size** 1.83m **Pulse width** 0.5us

Performance Checks

Date 14 April 1992 **Time** 1000 - 1100

SART response was tested as defined in above specification with an X Band marine radar meeting IMO Resolution A477(XII)

Screen photographs were taken using a Polaroid screen camera

No of Photographs taken 3 (1 enclosed) **RESULT** ------- Satisfactory / ~~Unsatisfactory~~

Remarks

Test was conducted with the SART positioned at the distance required to give the specified radiated field. The SART was switched on and the response was monitored on the test radar.

Signature .....

Officer conducting tests Mr J. Hiscock

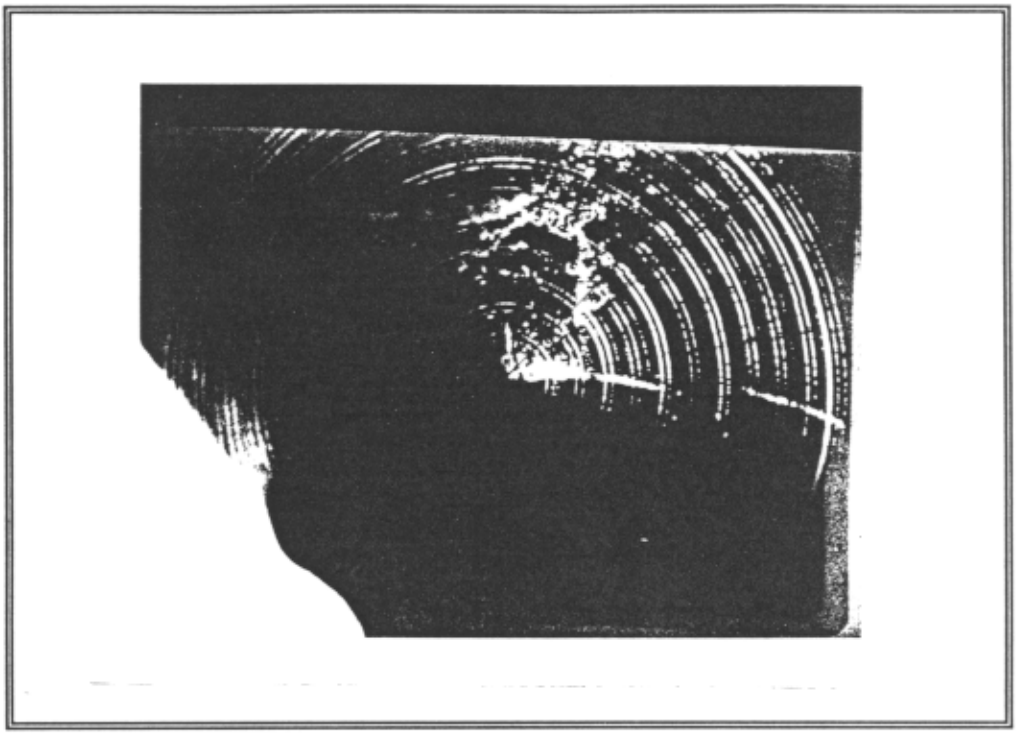
DEFENCE RESEARCH AGENCY

FRASER, PORTSMOUTH PO4 9LJ

CIVIL MARINE GROUP
SART RECEIVER FRONT END PROTECTION TEST REPORT

No: TT 42/92/1 Date of Issue 27/4/1992

NAMAS
TESTING
No 1217



SART Response during testing

Signature .....

Officer conducting tests Mr J. Hiscock