

ENVIRONMENTAL TEST REPORT

ACCORDING TO: IEC 60529:89+A1:99, IP68

FOR:

ARAD Ltd.

EUT:

Water meter

Models:

1) Sonata DN20

S/N: 14313788

2) Sonata DN20 Encoder

S/N: 172601632

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Table of contents

1	Applicant information.....	3
2	Equipment under test attributes	3
3	Manufacturer information	3
4	Test details.....	3
5	EUT description.....	4
5.1	General information.....	4
5.2	EUT mechanical characteristics	4
5.3	Acceptance criteria.....	4
5.4	EUT visual inspection and functional check	4
6	Tests summary.....	5
6.1	Degrees of protection against solid foreign objects indicated by the first characteristic numeral (IP6X test) – test procedure and results.....	6
6.2	Degrees of protection against ingress of water indicated by the second characteristic numeral (IPX8 test) - test procedure and results.....	10
7	APPENDIX A Test equipment and ancillaries used for tests.....	14
8	APPENDIX B Test laboratory description.....	15
9	APPENDIX C Abbreviations and acronyms	15
10	APPENDIX D Tests specifications	16
11	APPENDIX E Measurement uncertainties.....	16
12	APPENDIX F Customer internal visual inspection	17

1 Applicant information

Client name: ARAD Ltd.
Address: Dalia, 1923900 Israel
Telephone: 049897911
E-mail: ulyana@arad.co.il
Contact name: Mrs. Ulyana Bilik

2 Equipment under test attributes

Product name: Water meter
Product type: Industrial
Models: 1) Sonata DN20
2) Sonata DN20 Encoder
Serial numbers: 1) 14313788
2) 172601632
Hardware version: 3.2
Software release: 5.01.27
Condition of equipment: Production model
Receipt date 20-Feb-18

3 Manufacturer information

Manufacturer name: ARAD Ltd.
Address: Dalia, 1923900 Israel
Telephone: 049897911
E-Mail: ulyana@arad.co.il
Contact name: Mrs. Ulyana Bilik

4 Test details

Project ID: 30720
Location: Hermon Laboratories Ltd. P.O. Box 23, Binyamina 3055001, Israel
Test started: 20-Feb-18
Test completed: 28-Feb-18
Test specification: IEC 60529:89+A1:99

5 EUT description

5.1 General information

The Equipment Under Test (EUT) are 2 Water meters (Residential Sonata ultrasonic water meter, digital register), Models: Sonata DN20 (S/N: Sonata DN20) and Sonata DN20 Encoder (S/N: 172601632).

5.2 EUT mechanical characteristics

The Equipment Under Test (EUT) measures (H) 110 mm by (W) 80 mm by (D) 200 mm.
The Equipment Under Test (EUT) weighs 1 kg.

5.3 Acceptance criteria

The EUT shall not sustain any physical damage or deterioration when subjected to Dust and Immersion conditions expected in its application environment.

After the test the EUT shall function properly.

No water or dust penetration within the EUT enclosure is acceptable.

5.4 EUT visual inspection and functional check

The functional check is performed to verify that the EUT operates properly or within acceptable performance degradation if any.

Before and after Dust and Immersion tests, the EUT was visually inspected by the HL engineers and functionally checked by the customer.



The display area was visually inspected for signs of water or dust penetration.

Also units dismantling and a complete internal inspection was performed by customer (see Appendix F).

The functional check result represents the customer sole responsibility.

6 Tests summary

Test	Status
IEC 60529:89+A1:99 IP 6X: Dust-tight (Category 1) test	Pass
IEC 60529:89+A1:99 IP X8:Continuous immersion test	Pass

Date	File No.	Prepared	Reviewed and approved	Amendment Description
19-Mar-18	ARAENV_IEC.30720_Rev1	Ms. Anna Gorovoy, Environmental Certification Engineer 	Mr. Mihaeli Feldmann, Environmental Group Manager 	Updating photographs is Appendix F
19-Mar-18	ARAENV_IEC.30720	Ms. Anna Gorovoy, Environmental Certification Engineer	Mr. Mihaeli Feldmann, Environmental Group Manager	Original report



Test specification:		IP 6X: Dust-tight (Category 1) test	
Test procedure:		STANDARD: IEC 60529 TEST METHOD: IP6X, Dust - tight PROCEDURE: Sections 13.4, 13.6 CATEGORY: 1 enclosure	
Test mode:		Compliance	
Test Date:		27-Feb-18 - 28-Feb-18	
Atmospheric conditions during the test:		Temperature: 25 °C	Air Pressure: 1010 hPa
Remarks:		Verdict:	PASS
		Relative Humidity: 50 %	

6.1 Degrees of protection against solid foreign objects indicated by the first characteristic numeral (IP6X test) – test procedure and results

6.1.1 Test purpose

The test was performed to verify that the EUT enclosure withstand the dust penetration.

6.1.2 Test procedure

6.1.2.1 A hole was performed in the EUT's case to create a depression of 20 mBar inside the EUT.

6.1.2.2 The EUTs were placed in the dust chamber, as presented in Figure 6.1.1 and Photograph 6.1.1.

6.1.2.3 The chamber temperature was adjusted to +40°C and relative humidity to 25%.

6.1.2.4 After the chamber conditions stabilization the dust feed was switched on and the EUTs were subjected to the blowing dust for 8 hours, as presented in Table 6.1.2.

6.1.2.5 The vacuum pump was switched on and a maximum depression of 20 mBar was maintained inside the EUT's enclosure.

6.1.2.6 The temperature and pressure conditions are presented in Plot 6.1.1.

6.1.2.7 The EUTs after the test are presented in Photograph 6.1.2.

6.1.2.8 The EUTs were removed from the chamber and cleaned from the accumulated dust

6.1.3 Test results

Table 6.1.1 Test results

Observation	Verdict
No damages or dust penetration were noticed during the EUT visual inspection of display area. According to customer statement, no deterioration in functional performance was noticed.	Pass

Reference numbers of test equipment used:

HL 1420	HL 1932	HL 1974	HL 4706	HL 3874	HL 950
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Full description is given in Appendix A.



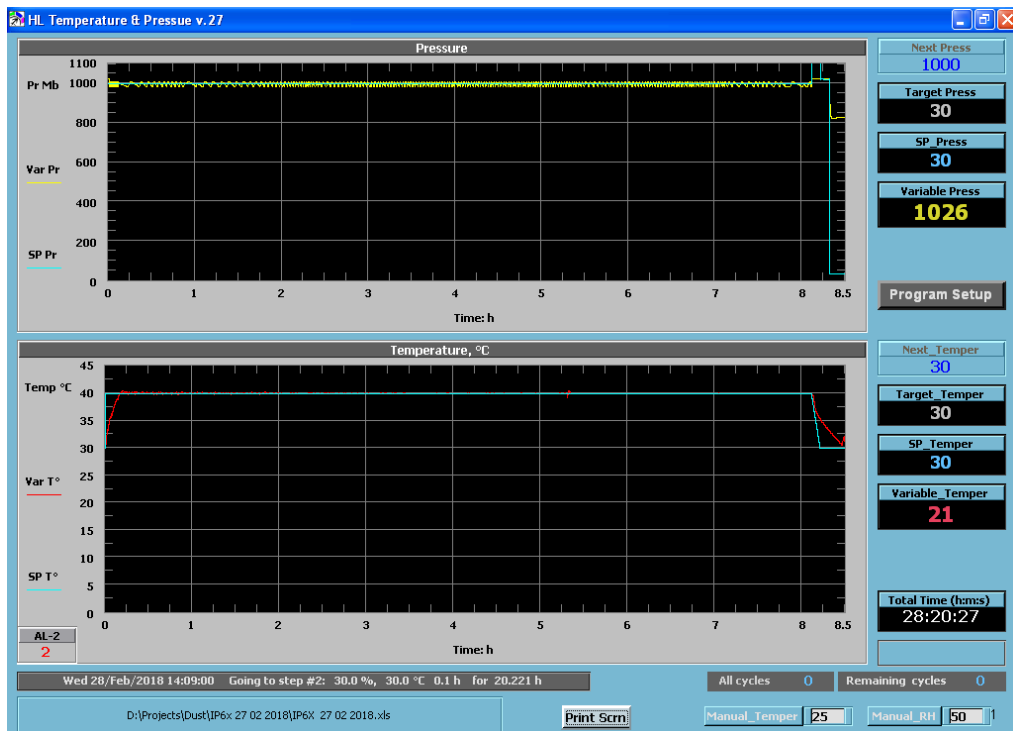
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Test specification:		IP 6X: Dust-tight (Category 1) test	
Test procedure:		STANDARD: IEC 60529 TEST METHOD: IP6X, Dust - tight PROCEDURE: Sections 13.4, 13.6 CATEGORY: 1 enclosure	
Test mode:	Compliance	Verdict:	PASS
Test Date:	27-Feb-18 - 28-Feb-18		
Atmospheric conditions during the test:	Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 50 %
Remarks:			

Table 6.1.2 Dust tight test sequence

Step No	Event	Temperature	Talcum circulation	Air pressure inside enclosure	RH	Duration
		[°C]	-	[mBar]	[%]	[h]
1	Heating	+25 to +40	No	1020	25 to 50	0.1
2	Stabilization	+40	Yes	1000	25	8
3	Cooling	+40 to +25	No	1020	50 to 25	0.1

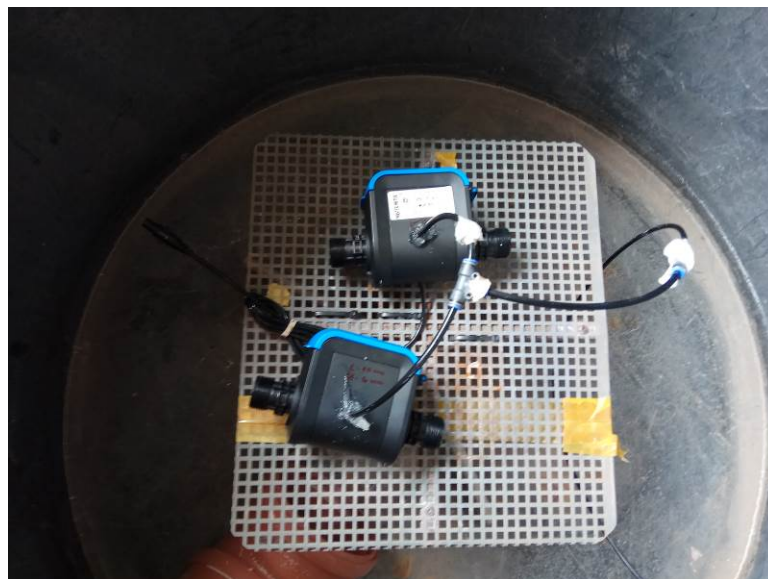
Plot 6.1.1 Air pressure and temperature monitoring during dust test





Test specification:	IP 6X: Dust-tight (Category 1) test		
Test procedure:	STANDARD: IEC 60529 TEST METHOD: IP6X, Dust - tight PROCEDURE: Sections 13.4, 13.6 CATEGORY: 1 enclosure		
Test mode:	Compliance	Verdict:	PASS
Test Date:	27-Feb-18 - 28-Feb-18		
Atmospheric conditions during the test:	Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 50 %
Remarks:			

Photograph 6.1.1 The EUTs in the dust chamber (before the test)



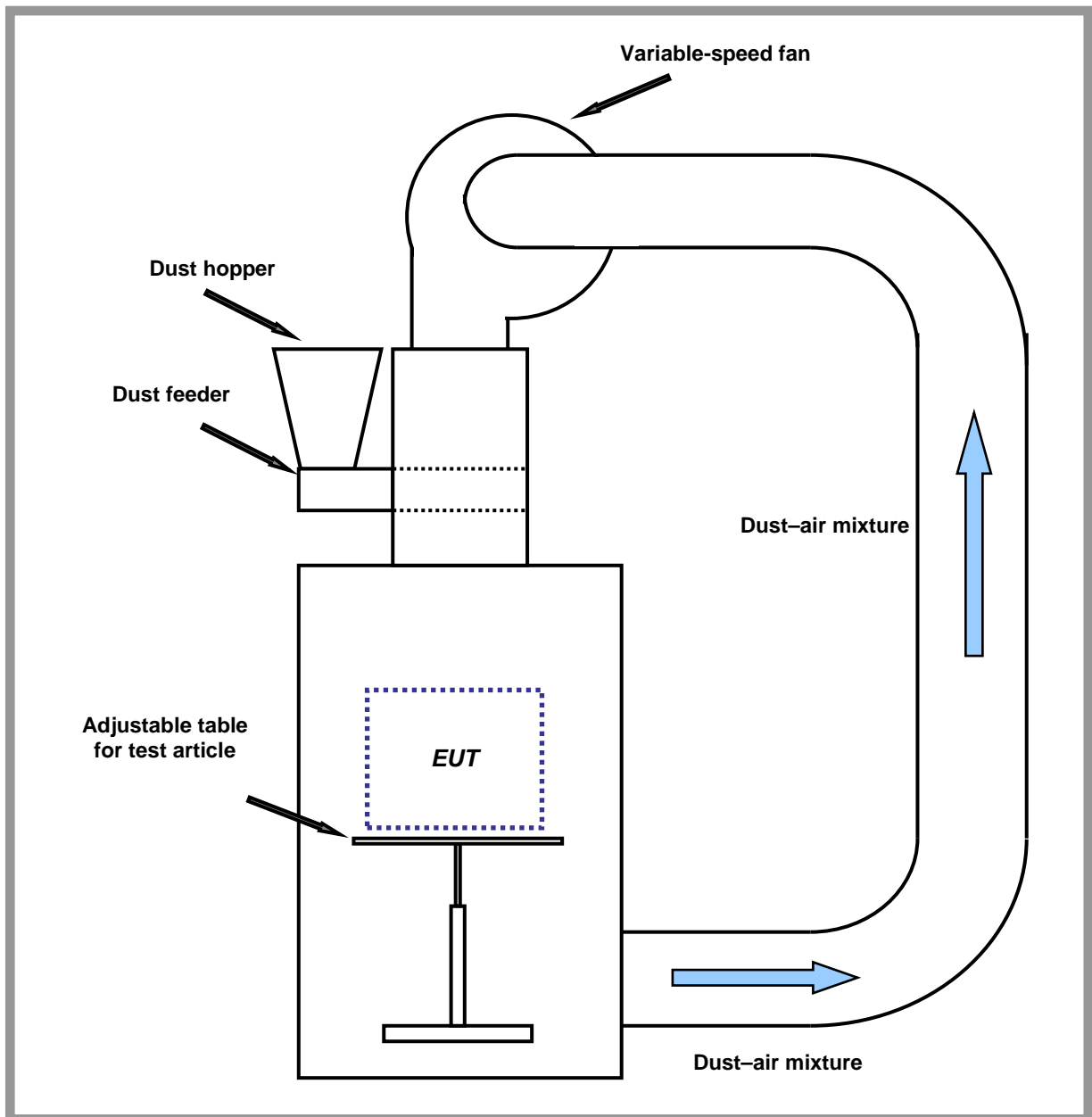
Photograph 6.1.2 The EUTs in the dust chamber (after the test)





Test specification:	IP 6X: Dust-tight (Category 1) test		
Test procedure:	STANDARD: IEC 60529 TEST METHOD: IP6X, Dust - tight PROCEDURE: Sections 13.4, 13.6 CATEGORY: 1 enclosure		
Test mode:	Compliance	Verdict:	PASS
Test Date:	27-Feb-18 - 28-Feb-18		
Atmospheric conditions during the test:	Temperature: 25 °C	Air Pressure: 1010 hPa	Relative Humidity: 50 %
Remarks:			

Figure 6.1.1 Dust setup block scheme





Test specification:		IP X8: Continuous immersion test	
Test procedure:		STANDARD: IEC 60529 TEST METHOD: IPX8, Continuous immersion SECTION: 14.2.8	
Test mode:	Compliance	Verdict: PASS	
Test Date:	20-Feb-18		
Atmospheric conditions during the test:	Temperature: 24.3 °C	Air Pressure: 1014 hPa	Relative Humidity: 36 %
Remarks:			

6.2 Degrees of protection against ingress of water indicated by the second characteristic numeral (IPX8 test) - test procedure and results

6.2.1 Test purpose

The water test-immersion was performed to determine the effect of protective covers or cases to shield equipment from water. This test is applicable to equipment, which may be exposed to continuous immersion under service conditions.

6.2.2 Test procedure

6.2.2.1 The water tank volume was filled with water so that the lowest point of the EUTs was located 1000 mm below the surface of the water. The immersion test setup is presented in Photographs 6.2.1 and 6.2.2.

6.2.2.2 The water temperature did not differ from the EUTs by more than 5°C. Test conditions are presented in Table 6.2.2.

6.2.2.3 The above conditions were maintained for 60 minutes.

6.2.2.4 At the end of exposure, the EUTs were removed from the water tank and wiped using a towel. The visual inspection after the test is presented in Photograph 6.2.3.

6.2.3 Test results

Table 6.2.1 Test results

Observation	Verdict
No damages or dust penetration were noticed during the EUT visual inspection of display area. According to customer statement, no deterioration in functional performance was noticed.	Pass

Reference numbers of test equipment used:

HL 3368	HL 4108	HL 4099	HL 3633	HL 4755
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Full description is given in Appendix A.



Test specification:	IP X8: Continuous immersion test		
Test procedure:	STANDARD: IEC 60529 TEST METHOD: IPX8, Continuous immersion SECTION: 14.2.8		
Test mode:	Compliance	Verdict:	PASS
Test Date:	20-Feb-18		
Atmospheric conditions during the test:	Temperature: 24.3 °C	Air Pressure: 1014 hPa	Relative Humidity: 36 %
Remarks:			

Table 6.2.2 Continuous immersion test severity

Test means	Water level on enclosure (above bottom)	Test time
	[mm]	[min]
Continuous immersion	1000	60

Photograph 6.2.1 Immersion test setup





Test specification:	IP X8: Continuous immersion test		
Test procedure:	STANDARD: IEC 60529 TEST METHOD: IPX8, Continuous immersion SECTION: 14.2.8		
Test mode:	Compliance	Verdict: PASS	
Test Date:	20-Feb-18		
Atmospheric conditions during the test:	Temperature: 24.3 °C	Air Pressure: 1014 hPa	Relative Humidity: 36 %
Remarks:			

Photograph 6.2.2 Immersion test setup





Test specification: IP X8: Continuous immersion test		
Test procedure: STANDARD: IEC 60529 TEST METHOD: IPX8, Continuous immersion SECTION: 14.2.8		
Test mode: Compliance	Verdict: PASS	
Test Date: 20-Feb-18		
Atmospheric conditions during the test: Temperature: 24.3 °C	Air Pressure: 1014 hPa	Relative Humidity: 36 %
Remarks:		

Photograph 6.2.3 The EUT inspection after immersion test



**7 APPENDIX A Test equipment and ancillaries used for tests**

HL No	Description	Manufacturer	Model	Ser. No.	Last Cal./Check	Due Cal./Check
1420	Digital Thermo Anemometer	Dwyer Instruments	471	NA	13-Jul-17	13-Jul-18
1932	Walk-in Chamber	Hermon Laboratories	WC-1	1932	18-Jul-17	18-Jul-18
1974	Humidity and Temperature Controller	Hermon Laboratories	HTCL-3	1974	05-Jul-17	05-Jul-18
4706	Humidity & Temperature sensors 0-100%	Rotronic	NA	NA	04-Jan-18	04-Jan-19
950	Dehumidifier	Munters	MG90	950	18-Jul-17	18-Jul-18
3874	Pressure Transducer, (0-30) PSI, (0-5) V	OMEGA	PX419-030A5V	413906	16-May-16	16-May-18
3368	Immersion Tank, according to IEC-60529 IPX7, 8 and MIL-STD-810C, D, E	Elbit Systems	Elbit 1982	3368	13-Nov-17	13-Nov-18
4108	Thermocouple, K-Type, -40°C to 260°C, 1m	Fluke	80PK-1	NA	25-Jan-18	25-Jan-19
4099	Thermometer 54 II	Fluke	Fluke-54-2	15400255	25-Jan-18	25-Jan-19
3633	Tape-measure, 8 m	The Stanley works Israel Ltd	33-198	NA	11-Dec-17	11-Dec-18
4755	Digital Hygrometer / Thermometer, (0 to +50) deg., (20 to 99) %RH	WESTERN Humidor Corporation	Caliber 4	NA	06-Nov-17	06-Nov-18



8 APPENDIX B Test laboratory description

The tests were performed at Hermon Laboratories Ltd., which is a fully independent, private Environmental, EMC, Radio, Product safety and telecommunication testing facility recognized through the entire world. The Laboratory is accredited by American Association for Laboratory Accreditation (A2LA, USA) for Environmental testing (Certificate No. 0839.04, Mechanical testing).

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9 APPENDIX C Abbreviations and acronyms

°C	degree Celsius
cm	centimeter
dB	decibel
EUT	equipment under test
g_n	acceleration due to gravity
HL	Hermon Laboratories
hPa	hectopascal
Hz	Hertz
kg	kilogram
m	meter
min	minute
ms	millisecond
oct	octave
pH	acidity scale
RMS	root mean square
RH	relative humidity
s	second



10 APPENDIX D Tests specifications

1. IEC 60529:89+A1:99 Degrees of Protection Provided by Enclosure (IP Code)
2. Dust IP Code TP-5_2013 Dust Test Procedure according to IEC 60068-2-68, IEC 60529 standards
3. Water IP Code TP-7_2014 Water Test Procedure according to IEC 60068-2-18, IEC 60529 standards

11 APPENDIX E Measurement uncertainties

Parameter	Uncertainty estimation at 95% confidence	
	Calculated	Limit
Air pressure	± 1.16 mBar	± 4.1 mBar
High (Low) temperature	± 2.2 °C	± 2 (3)°C
Thermometer Fluke	± 1.4 °C	± 2 (3)°C
Relative humidity	± 2.86 %	± 5.0 %
Water rate	3.6 %	5 %
Wind velocity	5 %	10 %



12 APPENDIX F Customer internal visual inspection

Photographs 12.1





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Photograph 12.2

