



SPECIFICATION 108-120026

Formerly Raychem RW-2102 RBK-105 Automotive Cable Sealing System

**RBK-105 is an Automotive Cable Sealing System designed to block wire bundles,
for continuous use at temperatures from -40°C up to and including 105°C.**

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1. SCOPE

This specification establishes the quality standard for an Automotive Cable Sealing System designed to block cable bundles and wires, for continuous use at temperatures from -40°C up to and including 105°C. The adhesive profile is designed to hold the cable wires in position during assembly on the harness board or similar device, prior to recovery of the adhesive lined heat shrinkable sleeve at 150°C to complete the seal.

RBK-105 kits can be used on a wide range of wire configurations; this specification uses the RBK-105-KIT-0110-A0 as a “typical kit” for testing purposes.

2. REVISION HISTORY

As RW-2102

Revision number	Change request	Date	Incorporated By
0	Formerly RK 6633/2 Rev 6		
1	CRF T 1020 CR98-DM-0154	27 August 1997 13 August 1998	C.Woosnam L.Abrams
2	CR04-DM-0215	11 August 2004	C.Diss
3	Via DMTec	17 March 2014	C.Diss

As 108-120026

A	Via PDM link	May 2019	C. Diss
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3. RELATED DOCUMENTS

This specification takes precedence over documents referenced herein. Unless otherwise specified, the latest issue of referenced documents applies. The following documents form a part of this specification to the extent specified herein.

IEC 60068-2-6	Environmental testing- Part 2: Test Fc: Vibration (sinusoidal)
IEC 60068-2-14	Environmental testing- Part 2: Test Na: Change of temperature



4. REQUIREMENTS

4.1 Composition, Appearance and Colour

The jacket shall be a heat shrinkable sleeving and shall be essentially free from pinholes, bubbles cracks, seams, defects and inclusions. The standard colour shall be black. The profile shall be manufactured from a hot melt adhesive which is amber in colour.

4.2 Properties

The tubing shall meet the requirements of Table 3.

5. QUALITY ASSURANCE PROVISIONS

5.1 Classification of Tests

Tests shall be carried out on a sample taken at random from each batch of finished tubing. A batch of tubing is defined as that quantity of tubing extruded at any one time. Testing frequency shall be Qualification or Production routine as detailed below:

5.1.1 Qualification tests (frequency in accordance with the Design Authority)

Qualification tests are those performed on tubing submitted for qualification as a satisfactory product and shall consist of all tests listed in this specification.

5.1.2 Production routine tests (every batch)

Dimensions of the constituent parts of the kit.

5.1.3 Minor change (in accordance with the Design Authority)

Minor change testing may be carried out to verify Form/Fit/Function where minor changes are made and shall consist of the following tests:

- Clause 4.1 Composition Appearance and Colour
- Clause 6.2 Sealing performance
- Clause 6.3 Electrical Performance Testing
- Clause 6.5 Accelerated ageing test
- Clause 6.7 Sequential test

6. TEST METHODS

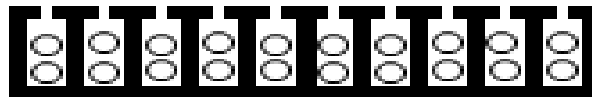
6.1 Preparation of Test Specimens

The samples shall be prepared using an RBK-105-KIT-0110-A0 (Part # 209731-002 i.e. HTAT-32/8-0-65MM and RBK-105-NR5100/A-X-12MM) with the wire configuration given below:

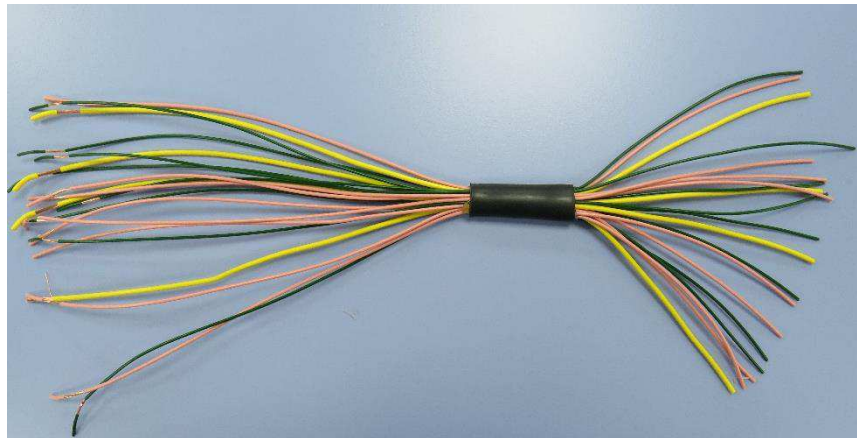
Cable bundle should consist of 20 wires to ISO 6722 T2 LFPVC thin wall only.

<u>Wire gauge</u>	<u>Number of wires</u>
20 gauge 0.5mm ²	8 wires
18 gauge 0.75mm ²	8 wires
14 gauge 2.00 mm ²	4 wires

These should be assembled as below with a maximum of 2 wires per channel.



The samples should be installed in an air circulating oven for 5 minutes at 150°C and should be allowed to cool to room temperature for 30 minutes and then verified for sealing in accordance with clause 6.2.



6.2 Sealing Performance

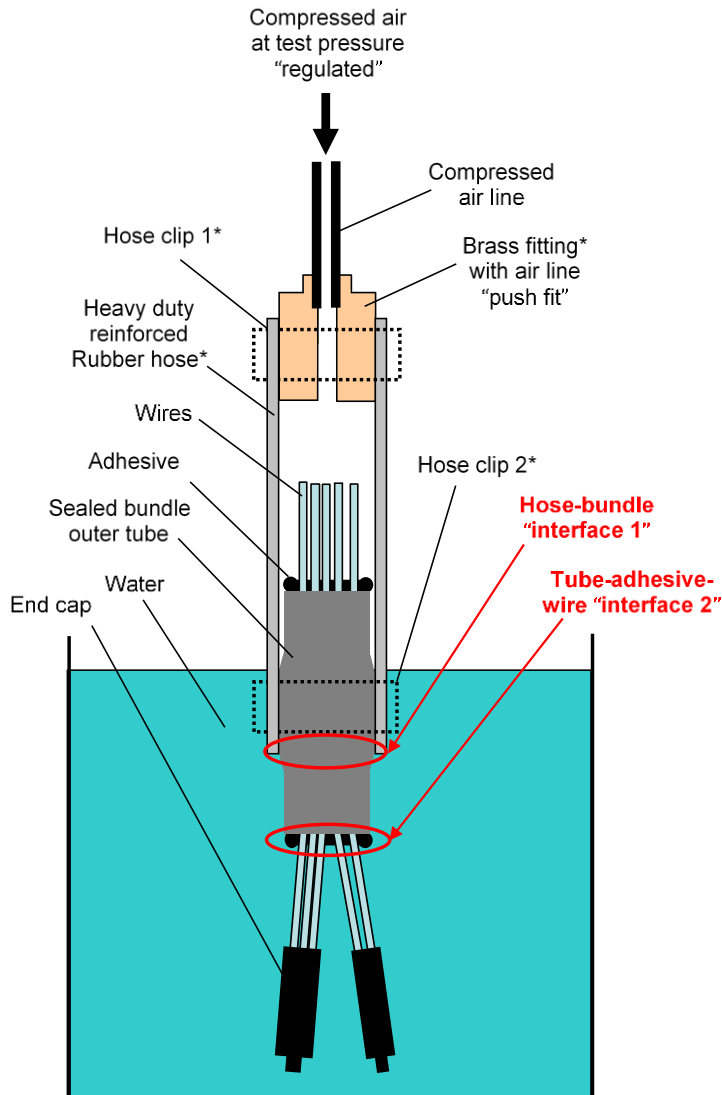


Figure 1: Sealing performance test rig

1. The bundle should be pressurised with an air pressure of 0.5bar for 1 minute
2. Next ensure that there is no leakage from the hose bundle "Interface 1" to determine the integrity of the test apparatus
3. All interfaces should be observed for leakage (air bubbles)

A RayBlock seal shall be deemed to have failed the sealing performance test if any leakage of air is seen at "Interface 2".

6.3 Electrical Performance

Insulation resistance (block to salt water)

The primary wire ends should be stripped back to allow test probes to be connected and sealed at one end using an adhesive lined cap e.g. ES-Cap. The prepared RayBlock shall be immersed in the salt water for 5 ± 1 minute at room temperature (ensuring that ends of wires remain outside of water). The wire to salt water insulation resistance shall be tested by connecting a test probe to all primary wire ends and another to the electrode immersed in the salt water solution. A test voltage of 500V shall be applied and the insulation resistance recorded.

The measurement of Insulation resistance shall be made after a 500V dc, 2A load has been applied to the block for 1min + 15 seconds.

The insulation resistance in a RayBlock seal should be at least $2 \times 10^8 \Omega$ in all cases.

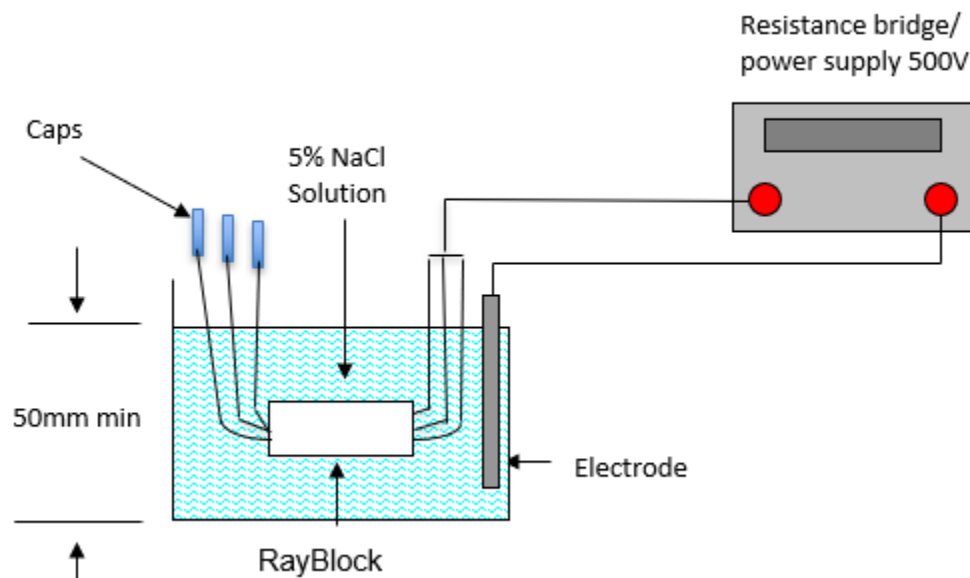


Figure 2: Electrical test block to salt water

Electrical continuity (wire to wire)

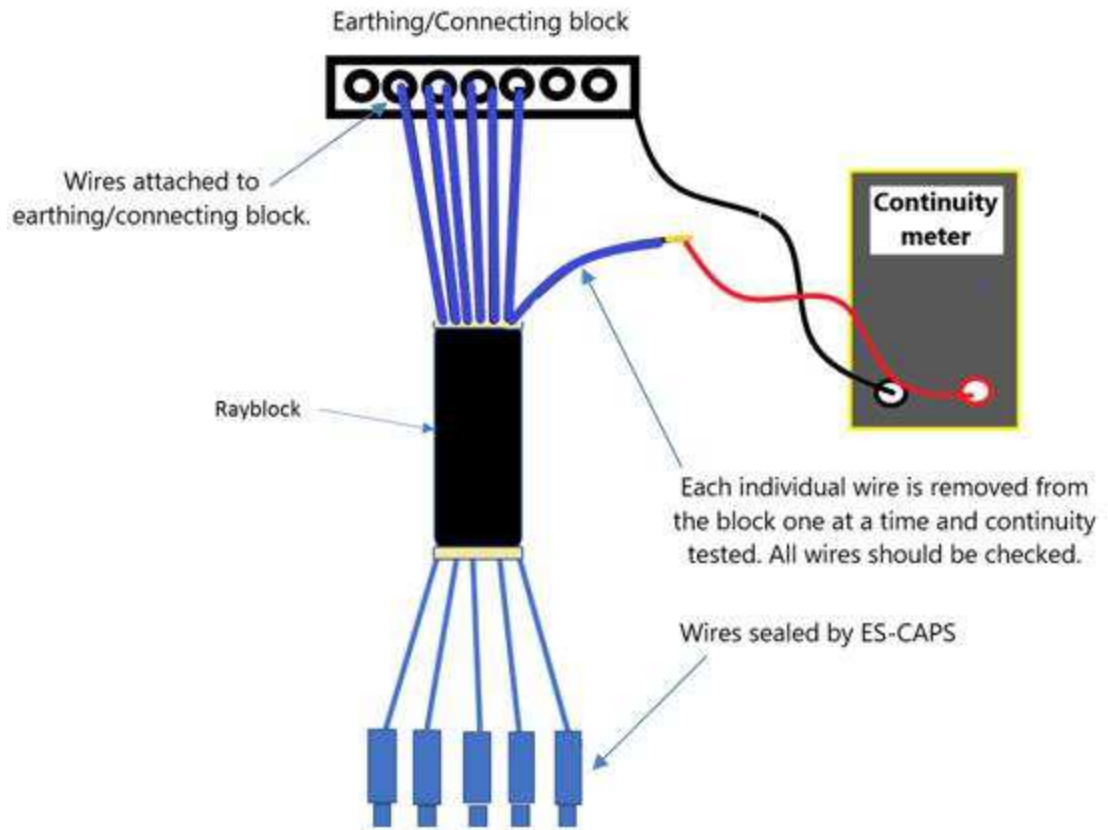


Figure 3: Electrical test (wire to wire)

The test specimens shall be prepared according to clause 6.1. The primary wire ends should be stripped back to allow test probes to be connected and sealed at one end using an adhesive lined cap e.g. ES-CAP.

The free wires should be terminated to an earthing/connecting block. Using crocodile clips, each individual wire will then be subjected to a continuity test.

6.4 Cold Impact

The test apparatus shall be essentially as shown in Figure 4 and the test method based on ISO 6722. Five RayBlock specimens shall be conditioned together with the test apparatus in a suitable cold chamber for a minimum of 4 hours at $-40 \pm 2^\circ\text{C}$. The apparatus shall be pre-conditioned for a minimum of 4 hours prior to commencement of testing.

Each specimen shall be subjected to a single drop of a 1 kg weight from a height of 100mm whilst still in the cold chamber ensuring that the weight centrally impacts the splice area.

After test the specimens shall be removed from the cold chamber, allowed to stabilize to room temperature and examined visually for signs of cracking of the outer jacket. Each specimen shall then be subjected to the sealing test Clause 6.2.

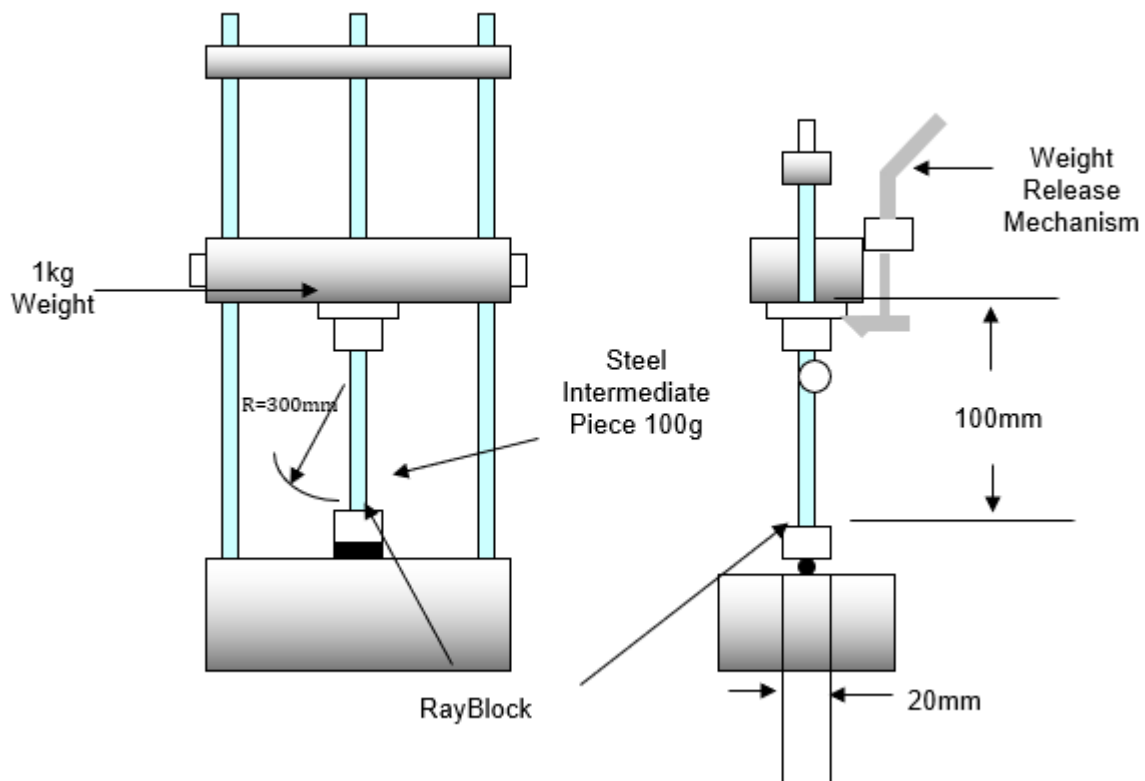


Figure 4: Cold impact rig

6.5 **Accelerated Ageing**

Five samples prepared according to Clause 6.1 shall be visually examined and tested for Sealing and Electrical performance according to clause 6.2 and 6.3.

The samples shall be placed horizontally in an air circulating oven and maintained at the elevated temperature of 120°C for a period of 336 + 2 hours.

On removal, the samples shall be stabilised at ambient temperature for 2 hours + 15 minutes. Each specimen shall then be subjected to Visual examination, the sealing test Clause 6.2.

6.6 **Fluid Resistance**

Three samples shall be prepared as described in clause 6.1 and shall be immersed in each of the fluids as specified in Table 1. On removal the specimens shall be wiped and air dried for 1 hour + 15 minutes at ambient temperature prior to a visual examination and sealing performance test clause 6.2.



Table 1 – Fluid resistance conditions				
	Fluid Description	Fluid Specification	Immersion Time (hrs)	Immersion Temp (°C)
a)	Engine Oil	ISO 1817 Oil No. 1 (IRM 901)	24 ± 2	23 ± 2
b)	Automatic Transmission Fluid (ATF)	Dexron VI™	24 ± 2	23 ± 2
c)	Diesel Fuel	90% ISO 1817 Oil No. 3, 10% p-xylene	24 ± 2	23 ± 2
d)	Brake Fluid	DOT 4	24 ± 2	23 ± 2
e)	Engine Cleaner	Gunk™ Degreaser	24 ± 2	23 ± 2
f)	Petrol (without oxygen compounds)	ISO 1817 Liquid C*1	24 ± 2	23 ± 2
g)	Screen wash	50% Iso-propanol / 50% Distilled H ₂ O by volume	24 ± 2	23 ± 2
h)	Multi-purpose Detergent (Carwash)	1% Teepol / 99% Distilled H ₂ O by volume	24 ± 2	23 ± 2
i)	Engine Coolant	50% Ethylene Glycol / 50% Distilled H ₂ O by volume	24 ± 2	23 ± 2

*1 Use fresh fluid for each batch test. Seal in airtight containers when not in use to avoid evaporation.

6.7 **Sequential Tests**

Five specimens prepared as per clause 6.1 shall be visually examined and tested for sealing and electrical performance in accordance with clauses 6.2 and 6.3. All the following steps shall be completed sequentially:

6.7.1 **Thermal shock**

The test method shall be in accordance with IEC 60068-2-14. The thermal shock samples shall be subjected to rapid temperature changes with exposure times at T_{min} (minimum service temperature) and T_{ex} (the maximum excursion temperature) set as 30 minutes. Fifty cycles shall be completed and the samples subjected to sinusoidal vibration in accordance with clause 6.7.2.

6.7.2 Vibration

The test method shall be in accordance with IEC 60068-2-6. The samples from the thermal shock test shall be subjected to the following vibration regime:

Table 2 - Vibration regime		
Frequency range	Acceleration level m/s ²	Acceleration Rate ^{Note 1} Octave /min
10-25Hz	9.8 (1G)	1
25-500Hz	44 (4.5G)	1
Test Duration		8 hrs ± 15 minutes
Vibration axis		X axis only

Note 1: 1 octave/minute acceleration rate is the doubling of the frequency each minute, e.g. if starting at 25Hz, the frequency will be 50Hz after 1 minute, 100Hz after 2 minutes, 200Hz after 3 minutes etc.

Each specimen shall be clamped horizontally as shown in Figure 5. The wires should be clamped so that they are not under tension ensuring that the vibration is transferred to the bundle area of the test piece. At the completion of the test, each specimen shall be subjected to the sealing and electrical tests.

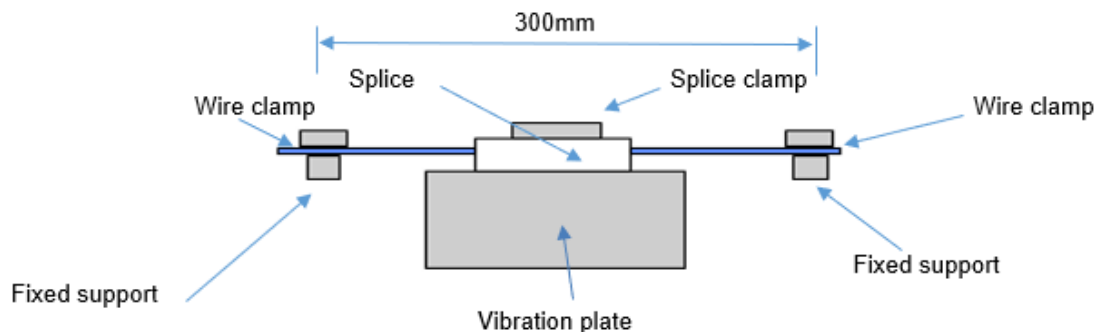


Figure 5: Vibration jig layout

At the conclusion of the test, the samples shall be subjected to the fuel immersion test as described in clause 6.7.3.

6.7.3 Fuel immersion

The samples from the vibration test shall be immersed in ISO 1817 Liquid C for a period of 1 hour + 5 minutes at 23 + 2°C. On removal, the samples shall be allowed to dry for 24 hrs + 2hrs at ambient temperature. On completion of the test the samples should be subjected to the temperature/humidity cycle described in Clause 6.7.4.



6.7.4 Temperature/humidity cycle

The samples from the fuel immersion test shall be subjected to the following temperature/humidity cycle:

- a) The samples shall be conditioned in an atmosphere of 95% relative humidity at $40 \pm 3^{\circ}\text{C}$ for 16 hours \pm 15 minutes.
- b) On removal, the samples shall be immediately transferred (within 30 seconds) to a cold chamber at $-40 \pm 3^{\circ}\text{C}$ for 2 hours \pm 15 minutes.
- c) On removal, the samples shall be immediately transferred (within 30 seconds) to an air circulating oven set at the appropriate T_{max} (maximum continuous operating temperature) as specified in Table 3 for 2 hours \pm 15 minutes.
- d) The cycle shall be completed by storing the samples at $23 \pm 2^{\circ}\text{C}$ for 4 hours \pm 15 minutes.

The samples shall be subjected to 10 complete cycles each of 24 hours duration. At the end of the test, the samples shall be resubmitted for visual examination, sealing and electrical performance testing in accordance with clauses 4.1, 6.2, and 6.3 respectively.

7. SAMPLING

The tests carried out on a sample taken at random from each batch of finished product.

A batch of product is defined as that quantity of sleeving or profile extruded at any one time. Testing frequency shall be Production routine tests consisting of Visual examination and dimensions of the constituent parts of the kit (tubing and profile). And shall be carried out on every batch.

Qualification tests shall be carried out to the requirements of the Design authority.

Minor change testing shall be carried out to the requirements of the Design authority as appropriate.

8. PACKAGING

Packaging shall be in accordance with good commercial practice. Each package shall bear an identification label showing material quantity, description, size, colour and batch number. Additional information shall be supplied as specified in the contract or order.



TABLE 3
Requirements

PROPERTY	TEST METHOD	REQUIREMENT
Visual examination		As per Clause 4.1
Dimensions	ASTM D2671	As per relevant SCD
Sealing performance	Clause 6.2	No leakage
Electrical performance - Insulation resistance - - Wire to Wire (Electrical Continuity)	Clause 6.3	2 x 10 ⁸ Ohm minimum Pass
Cold impact (4 hrs + 15 min at -40 ± 2°C) - Visual examination - Sealing performance	Clause 6.4	No fracture No leakage
Accelerated ageing (336 hours at 120 ± 2°C) - Visual examination - Sealing performance - Insulation resistance	Clause 6.5	No deterioration No leakage 2 x 10 ⁸ Ohm minimum
Fluid resistance (24 ± 2h immersion at 23 ± 2°C) • Engine Oil to ISO 1817 (Oil No. 1) • Automatic Transmission Fluid (Dexron VI™) • Diesel Fuel (90% ISO 1817 No. 3/ 10% p-xylene) • Brake Fluid to DOT 4 • Engine Cleaning Fluid (Gunk™ Degreaser) • Petrol to ISO 1817 Liquid C • Screen Wash (50% iso-propanol / 50% distilled H ₂ O v/v) • Multi-purpose Detergent (1% Teepol/99% distilled H ₂ O v/v) • Engine Coolant (50% ethylene glycol/50% distilled H ₂ O v/v) - Visual examination - Sealing performance	Clause 4.1 Clause 6.2	No deterioration No leakage



PROPERTY	TEST METHOD	REQUIREMENT
SEQUENTIAL TESTS	Clause 6.7	
<ul style="list-style-type: none"> • Thermal shock ($T_{\min} = -40\text{C}$, $T_{\text{ex}} = +120\text{C}$) - Vibration - Fuel Immersion 	IEC-60068-2-14	
	IEC-60068-2-6	
	Clause 6.7.3	
<ul style="list-style-type: none"> • Temperature / Humidity Cycle ($T_{\min} = -40\text{C}$, $T_{\max} = +105\text{C}$) - Visual examination - Sealing performance - Insulation Resistance 	Clause 6.7.4	
	Clause 4.1	No deterioration
	Clause 6.3	No leakage
	Clause 6.3	2×10^8 Ohm minimum