

PERFORMANCE SPECIFICATION FOR AUTOMOTIVE WIRE HARNESS RETAINER CLIPS

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1. SCOPE

This specification describes a method and acceptance criteria for testing automotive wire harness retainer clips. Retainer clips are plastic parts that hold a wire harness or electrical connector in a specific position. Typical plastic retainers work by having a set of “branches” that can be inserted into a hole sized to be easy to install but provide acceptable retention. This specification tests retainer clips for mechanical retention when exposed to the mechanical and environmental stresses typically found in automotive applications over a 15-year service life. This specification has several test options to allow the test to match to the expected service conditions. The variability of applications typically arises from different ambient temperatures near the clip, different proximity to automotive fluids, different exposure to standing water or water spray, and different thicknesses of the holes that the clip is inserted into. Clips are typically inserted into sheet or rolled metal from 0.6 to 8 mm thick, so this specification focuses on that range. Outside of this range requires a custom test.

The procedures described in this document have been evaluated for the design types shown in Table 2. Use of USCAR-44 for other than a design shown in Table 2 may or may not produce acceptable test correlation to actual experience, but USCAR has not reviewed any data. USCAR-44 can be used at all phases of development, production, and field analysis since it is a performance test and not a process validation or quality assessment.

No retainer may be represented as having met USCAR/EWCAP specifications unless conformance to all applicable requirements of this specification have been verified and documented. All required verification and documentation must be provided by the supplier of the part. If testing is performed by another source, it does not relieve the primary supplier of responsibility for documentation (DVP&R) of all test results and for verification that all samples tested met all applicable acceptance criteria.

2. TEST REQUIREMENTS

The tests in each section must be performed in the order given unless otherwise specified in the test request/order. Construction details for selected test fixtures and equipment are provided in this specification.

If the products tested to this specification are or may be subjected to conditions beyond those described in this document, they must pass special tests simulating the actual conditions to be encountered before they can be considered acceptable for actual vehicle application. The authorized person is the final authority as to what tests are to be performed on his or her parts and for what purpose these tests are required. He or she is also the final authority for resolving any questions related to testing to this specification and to authorizing any variance (with supporting data) to the equipment or procedures contained in this specification. Any such deviation must be documented and included in the final test report. Moisture content or all CUT must be documented in the final test report (unless agreed to be not recorded). Apply the flow chart in Figure 1 to determine whether USCAR-44 is applicable to the CUT and what tests must be run.

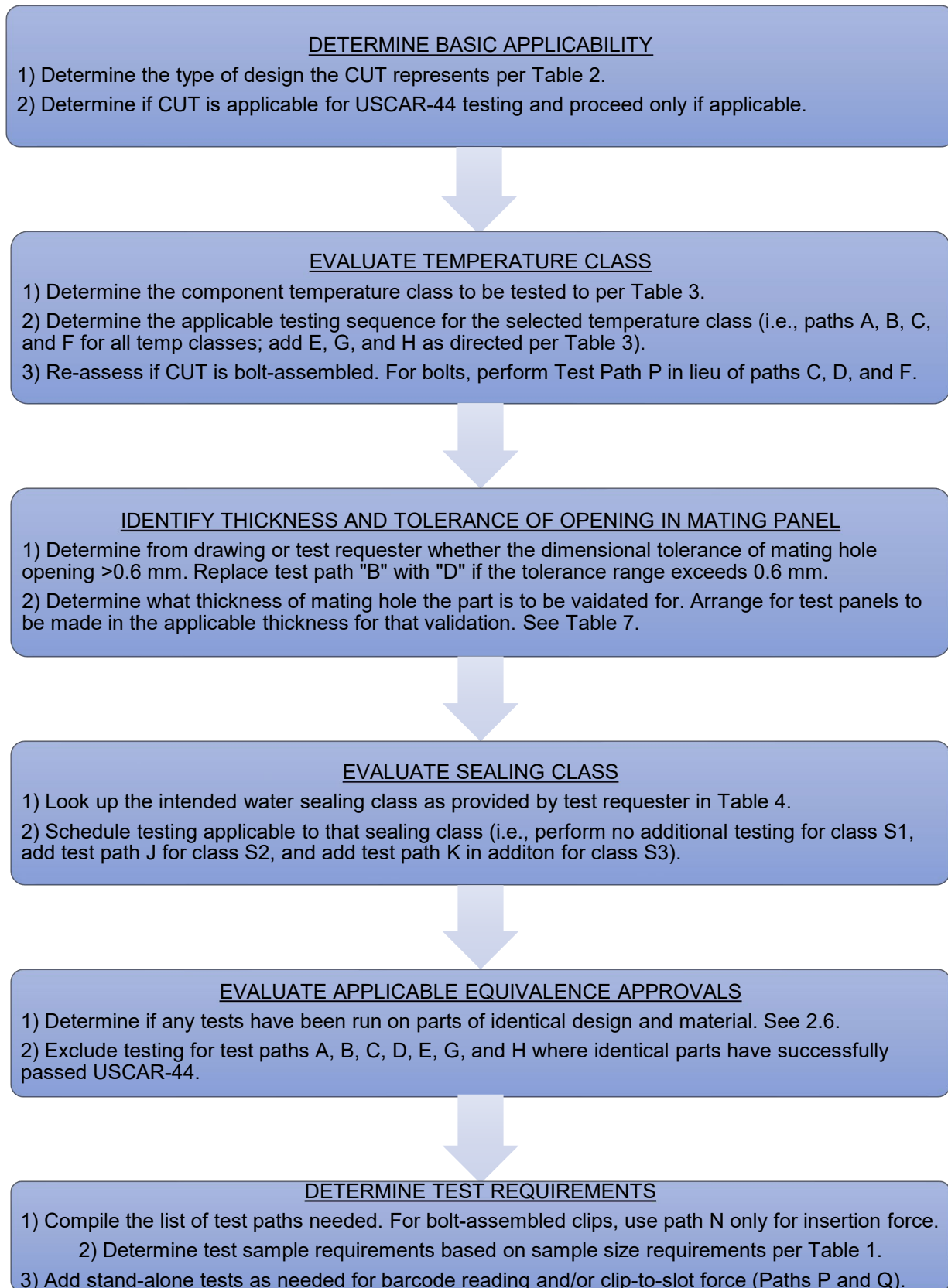


Figure 1 - Flow chart for determining tests to be run

2.1 Test Schedule

Table 1 - Test schedule

	Nominal Hole Insertion	Nominal Hole Removal	Min Hole Insertion	Max Hole Retention	High Temp Retention	Shear Force	End-of-Life Retention	Fluid Resistance	Sealing (Static)	Sealing (Spray)	Tie Strap Strength	Offset Deflection	Clip-to-Slot Insertion	Bolt Attachment	Barcode Functionality
Test Sequence ID (Sample Size Minimum) ^d	A 30 ^m	B 30 ^k	C 30	D 30 ^k	E 12	F 30	G 12 ^k	H 1	J 15 ^c	K 10 ^g	L 60 ^{f,i}	M 20 ^f	N 30	P 10	Q 10
General (5.1)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Visual Inspection (5.2)	2	2 ^h	2	2	2	2	2	2, 4	2, 4	2, 5	2, 5	2, 5	2, 4	2, 4	2, 4
Condition to Dry-As-Molded (5.3.3)	3														
Humidity Conditioning (5.3.3)		3	3	3		3				3	3	3			
Clip Insertion Force (5.3.3.2)	4	4	4 ^a	4	3		3 ^j								
Clip Removal Force (5.3.3.3)		5		5 ^b	4 ^e		6								
Shear Force (5.4)						4									
Temperature/Humidity (5.5)							4								
High Temperature Exposure (5.6)							5								
Automotive Fluids Exposure (5.7)								3							
Sealing - Static (5.8)									3						
Sealing - High Pressure Spray (5.9)										4					
Loop Tensile Strength (5.10)											4				
Offset/Standoff Load Test (5.11)												4			
Clip-to-Slot Insertion/Removal (5.12)													3		
Bolt-Attachment Torque (5.13)														3	
Barcode Function (5.14)															3

NOTES:

- ^a Make test plate using smallest allowed hole size per the supplied interface drawing.
- ^b Required only if mating hole tolerance >0.6 mm. Test plate to have largest allowed hole tolerance.
- ^c Fifteen-piece sample size: five pieces for each axis. Use new sample for each of x, y, and z axis.
- ^d Minimum sample is 30 pieces, or one piece per tool cavity plus sample for retention per 5.2.1.
- ^e Perform while CUT is in an oven (see 5.6.2). Special equipment is required. Note oven temperature in the test report.
- ^f The need for this test is design dependent. Perform this test only when directed.
- ^g Ten-piece sample consists of five loaded in spray direction and five loaded opposite spray direction.
- ^h Do not perform a final inspection on parts that have been removed; damage is expected after removal.
- ⁱ If UL 62275 has been run, omit 5.10.3.1. Sample size is reduced to 30 for test 5.10.3.2.
- ^j Hand insertion of CUT is allowed with no measurement taken since intent of test is unrelated to insertion.
- ^k Additional retention testing may be needed in test sequences B or D and G, if the part under test is made of multiple subcomponents. When applicable, test subcomponent retention using USCAR-2 Section 5.4.11.
- ^m Samples to be dry-as-molded; special handling is needed from time of molding. See 5.3.3.

The sequence of USCAR-44 tests is shown in Table 1. To be USCAR-44 compliant, the CUT must meet all applicable test requirements appropriate for the intended use. The intended use must be listed in the test request by specifying application levels per Tables 3 and 4. The numbers in the matrix of Table 1 represent the order the tests run in the test sequence.

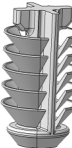
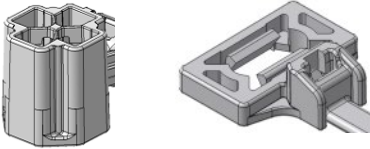
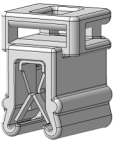
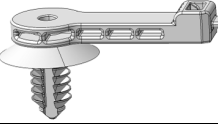
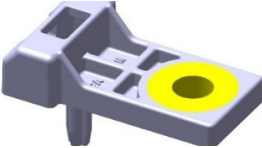
2.2 Test Paths: Required and Optional

The far-right column of Tables 3 and 4 show what test paths must be performed or applied to be validated for that listed temperature, sealing class, or re-use level.

2.3 Applicability to Design Variants

Table 2 describes how to apply USCAR-44 to designs other than fir trees (the default design for USCAR-44 tests).

Table 2 - Applicability to tests to various retainer designs

Design Type	Typical Part Illustration	How USCAR-44 is Applied Differently to This Class	Test Changes Required in for This Part Class
Fir tree		No difference.	Test Path L applicable only for designs with cable tie. Path M applies to offset parts only.
Arrowhead		No difference.	Test plate must match application thickness.
Stud-mount		No difference.	Custom test plan needed. Recommendations are to delete Path F, test and use exact thread intended for production.
Edge-biter clip (attaches to an edge, not a hole)		USCAR-44 cannot be used as-written but can be the basis of custom tests developed using engineering assessment.	Custom test plan needed. Recommendation is that test panel should match actual vehicle design.
Retainer with integral wire tie strap		Optional test to evaluate cable tie strength. Can also be certified separately using UL 62275.	Add Test Path L as requested.
Retainer with offset between and wire bundle		Test Path M is applicable only to offset parts.	Add Test Path M only if requested and criteria for acceptance provided.
Bolt assembled retainer		Test Path P is applicable to bolt-assembled clips (only). Traditional pull tests are not applicable.	Add Test Path P. Do not perform test paths for retention: A, B, C, D, E, G.
Bar-coded retainer		Test Path Q is applicable to barcode clips (only).	Add Test Path Q in addition to required tests per Table 1.

2.4 Temperature Classifications

Components to be tested must be assigned a temperature class from Table 3 according to the environment in the intended vehicle application. Use the class with a temperature at or above the ambient range.

Table 3 - Component temperature classes

Temperature Class	Temperature Range	Typical Application	Typical Materials in Class ²	Test Paths per Table 1
T1	-40 to +85 °C	Cabin (lower than IP), trunk, doors	POM, PA66	A B ³ C F
T2	-40 to +100 °C	IP top, headliner	POM, PBT, PA66, Recycled PA6, PA12	A B ³ C F
T3	-40 to +125 °C	Engine compartment	POM (co-polymer), PBT, PA66, Vydine, IMHS 47H0688	A B ³ C E F G H
T3.5	-40 to +135 °C	Engine compartment	PBT, PA66, Vydine, IMHS 47H0688, HHBN	A B ³ C E F G H
T4 ¹	-40 to +150 °C	Hotter on-engine applications	PA46, Flex PPS, Thermaplus	A B ³ C E F G H
T5 ¹	-40 to +175 °C	Special high-temp applications	Flex PPS	A B ³ C E F G H
T6 ¹	-40 to +200 °C	Special high-temp applications	PAEK, PEEK	A B ³ C E F G H

¹ T4 thru T6 test sequences are identical except for the oven temperature in 5.6 (where the setting equals the highest temperature of the target temperature class).

² Listing of "typical materials for this class" is for reference only and is not a product endorsement.

³ When Hole tolerance is >0.6 mm, perform D instead of B.

2.5 Water Sealing Classifications

Components to be tested must be assigned a class from Table 4 according to the expected environment in the intended vehicle application.

Table 4 - Component sealing classes

Seal Class	Description of Class	Typical Application	Test Paths Required per Table 1
S1	Unsealed	S1 is applicable for use in passenger compartment and dry vehicle areas	No additional testing required
S2	Sealed - Static	S2 applicable for applications exposed to vehicle exterior	J
S3	Sealed - High Pressure Spray	S3 is applicable for locations at-risk to direct water spray	J K

2.6 Validation by Equivalence

If a part is identical to the CUT in retainer design and material (where CUT differs only in the design features unrelated to the retainer section), a "validation by equivalence" is allowed for some tests that eliminates some testing. Follow these instructions for equivalent parts: Exclude testing for Test Paths D, E, G, and H, if identical parts have successfully passed that section of USCAR-44. Note that Test Path A is always required.

2.7 Specification of Test Level

To specify testing per USCAR-44, it is recommended to use the following wording be used to give a consistent format: "Test to USCAR-44 (revision number, if applicable) per temperature class Tx, sealing class Sy, and thickness range t1~t2" (where

x is the desired temperature class per Table 3, y is the desired sealing class per Table 4, and t1 and t2 are the minimum and maximum thicknesses for a specific range per Table 7).

2.8 Test Plan Approval

The test request shall identify the tests to be performed, including any additional non-USCAR tests. Any revisions or deviations from tests in USCAR-44 must be noted. The customer has the final decision on whether to accept a test result for production part validation. Typically, approval is awarded by passing testing on parts made from a prototype mold providing the mold has the same dimensions and material as the production part mold. Also, it is typical that passing all testing using steel test plates typically allows validation for use in both steel and aluminum applications.

2.9 Test Request Instructions

Instructions must be included in the test request/order concerning applicable tests and the order in which the tests are to be performed if different than outlined by this specification in Table 1. Note that Test Paths B, L, M, and Q must be specifically called out if desired since they are not referenced in any mandatory test path.

2.10 Unique Requirements

If user requirements are different than what is described in this specification, instructions must be given in the test request for what changes are needed, including definition of the conditions under which those limits apply.

3. REFERENCED DOCUMENTS

3.1 Documents Required to Perform Tests

- Engineering drawing for CUT (containing required information per 3.3)

3.2 Documents Helpful to Perform Tests

- USCAR/EWCAP-007, "Connector Clip Mating Hole." Available online on the USCAR website <https://uscar.org>
- SAE/USCAR-2, "Performance Specification for Automotive Electrical Connectors." Section 5.4.5 (Miscellaneous Component Engage/Disengage Force). USCAR-2 includes a specification for connector clip slot testing. This specification can be purchased at: <https://www.sae.org/standards/>.
- SAE/USCAR-25, "Electrical Connector Assembly Ergonomic Design Criteria." Current version can be purchased at: <https://www.sae.org/standards/>.
- AIAG, "Measurement Systems Analysis." (Product Code: MSA-4). Available at: <http://www.aiag.org/store/publications/details?ProductCode=MSA-4>.
- ISO TS16949, "Automotive Quality Management Standard." Available at: http://www.iso.org/iso/home/store/catalogue_tc/catalogue_detail.htm?csnumber=52844.
- UL 62275, "Cable Tie Test Specification." This specification may be required by customer for retainers integrated with a cable tie in addition to USCAR-44. UL 62275 can be purchased at www.ul.com.

3.3 Part Details

USCAR-44 tests use nominal, minimum, and maximum tolerance for hole dimensions, so tests cannot be run without having a fully toleranced drawing describing the target sheet metal interface including thickness. Also, temperature and water sealing requirements are required.

4. GENERAL REQUIREMENTS

4.1 Record Retention

The supplier shall maintain a central file for the storage of laboratory reports and calibration records. Such record storage must be in accordance with established ISO TS16949 and AIAG policies and practices.

4.2 Sample Documentation

All test samples shall be identified in accordance with the requirements of ISO TS16949 and the AIAG PPAP. When documenting about specific parts of the CUT, use the names in Figure 2 to avoid confusion about what is being described.

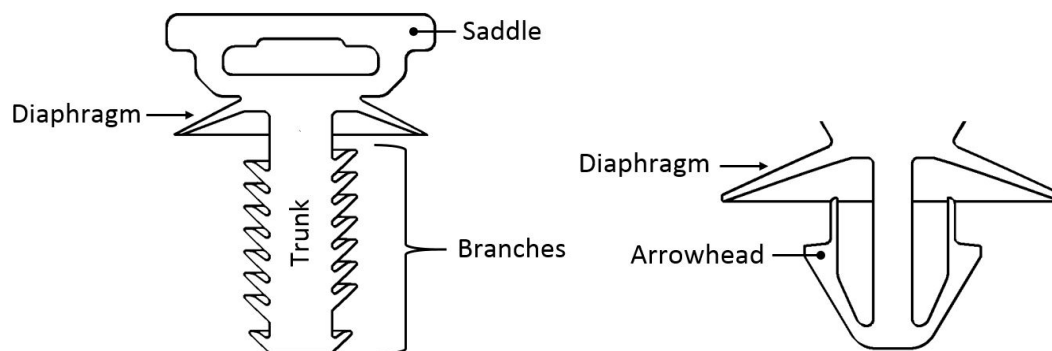


Figure 2 - Names for parts of fir-tree and arrowhead clip types

4.3 Sample Size

Minimum sample sizes are given for each test in this specification. A greater number of samples may be required by the test request/order. However, no part or device may be represented as having met this specification unless the minimum sample size has been tested and all samples of the group tested have met the applicable acceptance criteria for that test. It is never permissible to test a larger group; select the minimum sample size from among those that passed and represent that this specification has been met.

4.4 Default Test Parameters

4.4.1 Default Tolerances

Default tolerances, expressed as a percentage of the nominal value, are shown in Table 5.

Table 5 - Default tolerances

Attribute and Tolerance		Attribute and Tolerance		Attribute and Tolerance	
Temperature	±3 °C	Time	±5%	Sound	±5%
Voltage	±5%	Force	±5%	Speed	±5%
Current	±5%	Frequency	±5%	Pressure	±5%
Resistance	±5%	Flow Rate	±5%	Vacuum	±5%
Length	±5%	Relative Humidity	±5%		

4.4.2 Default Test Conditions

When specific test conditions are not given elsewhere in this specification, the following conditions apply:

Room Temperature = 23 °C ± 5 °C.

Relative Humidity = 50%. (RH applies to extraction testing test and samples. RH is uncontrolled for other tests.)