



Installation and Removal/Retention Load for Snap-in Fasteners Press-in and Retaining Force

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. To determine the assembly/disassembly characteristics of a snap-in fastener.

1.2 Applicability. This procedure applies to any joint using a snap-in fastener that is installed by the application of axial force without the use of mechanical tools.

1.3 Remarks.

1.3.1 This procedure evaluates the performance of a snap-in fastener when subjected to loads, constraints, and environments representative of the installation or disassembly process.

- Option A of this procedure is a general procedure to record all performance data representative of the installation or disassembly process.
- Option B is a specific method to identify the Press-in Force and Retaining Force of a snap-in fastener.

1.3.2 Unless otherwise specified, any requirements or direction provided in the Test Request documentation will supercede this test procedure.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ISO 9513

2.2 GM Standards/Specifications.

GMW2

GMW3221

3 Resources

3.1 Facilities. GM approved laboratory or location for this test procedure.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Slot table or other suitable surface.

3.2.2 Fixturing as required to fasten the joint in the manner specified by its design.

3.2.3 Arbor press or load frame.

3.2.4 Load cell of appropriate capacity to measure the maximum anticipated load.

3.2.5 Linear measurement device capable of measuring test specimen displacement, e.g., high resolution linear variable displacement transducer, extensometer, ultrasonic gage, leaf gage, etc.

3.2.6 Recording device for simultaneous recording of load and displacement.

3.2.7 Device capable of performing the press-in and extraction operation at a maximum speed of 100 mm/minute (Class 2 extensometer per ISO 9513 or equivalent or better). The overall accuracy of the force/load measuring

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equipment shall be $\pm 2\%$ of the measured value. One side of the device shall be equipped with a clamping fixture capable of securely holding the fastener during the press-in and extraction operation. The other side of the device shall be equipped with a clamping fixture capable of securely holding the test panel.

Note: In principle other simplified test setups simulating the practical application of the fastener may be used, provided the resulting assembly/disassembly values are representative and can be accurately recorded.

3.2.8 Test Panel. If not otherwise specified in the test request documentation, an uncoated test panel made from sheet steel to GMW2-M-ST-S shall be used. The steel test panel must be degreased with a cleaning agent which allows no water drop buildup. This test panel shall be provided with a reamed and deburred hole (both sides to not influence test direction) without chamfer of diameter per fastener drawing. In the area of the test hole, the thickness of the test panel shall be specified by the test requester.

3.2.9 Apparatus for conditioning to the appropriate requirements of GMW3221.

3.2.10 Environmental chamber with air circulation capable of maintaining required temperatures within $\pm 2^\circ\text{C}$.

3.3 Test Vehicle/Test Piece.

3.3.1 A complete bill of materials of required test pieces will be specified in the test request documentation.

3.3.2 Unless otherwise specified, eight samples are to be used for this procedure.

3.4 Test Time.

Calendar time: 2 days

Test time: 8 h

Coordination time: 8 h

3.5 Test Required Information. Test request documentation shall outline specific information and test parameters (reference Appendix A, Data Sheet A1 example).

3.6 Personnel/Skills. Test technician shall be qualified on the basis of appropriate education, training, experience, and/or demonstrated skills.

4 Procedure

4.1 Preparation.

4.1.1 If necessary, rework parts of the assembly to allow them to be mounted in the load frame or press. Any alteration of the parts must not change any characteristics of the parts that would be prevalent during installation or removal of the fastener.

4.1.2 Configure the instrumentation to record load and displacement.

4.1.3 If not specified otherwise in the test request documentation, condition test pieces for initial sample approval and arbitration purposes according to GMW3221, Code B and do not condition test pieces for quality control tests (as-received condition).

4.2 Conditions. Conditions should be representative of those the test assembly would experience during regular production assembly and field service.

4.2.1 Environmental Conditions. Environmental conditions should be representative of those the test assembly would experience during regular production assembly and field service. When testing plastic fasteners, it may be desirable to repeat the tests at extreme environments common during assembly/disassembly (high temperature/high humidity, low temperature/low humidity) as these may affect the characteristics of the fastener. Nylon parts may need to be conditioned by immersion in water if parts are dry so that friction and flex modulus are representative of production parts.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

Loading and constraint conditions should represent those of the test assembly during production.

4.2.2.1 If not specified otherwise in the test request documentation, parts shall be tested under the following conditions: insertion force shall be measured at minimum hole size and maximum panel thickness, and removal force shall be measured at maximum hole size and minimum panel thickness.

4.3 Instructions.

4.3.1 Option A, Characteristic Installation and Disassembly Performance Data.

4.3.1.1 Record load-displacement data while installing the fastener into the test piece, and then while removing it, if requested. Use any fixturing and adapters necessary to accurately reproduce installation/removal conditions.

4.3.1.1.1 Start the recording device and push the fastener through the entirety of its travel on the press or load frame. If possible, use a load or displacement rate that is representative of how the fastener will be installed during regular production assembly or field service. Stop when it bottoms out, if applicable to the fastener is being tested. If the fastener being tested is a two stage design (such as a pushpin), place the fastener fully into the test hole by hand, then record the load and displacement required to fully seat the locking plunger.

4.3.1.1.2 Visually examine the parts for any deformation or damage that might have occurred as a result of the installation.

4.3.1.1.3 If requested, remove the fastener from the test piece while recording load and displacement.

4.3.1.1.4 Repeat 4.3.1.1.1 thru 4.3.1.1.3 for the required number of installations for each sample.

4.3.1.1.5 Repeat for each sample specified in step 3.3.1.

4.3.1.2 Visually examine the parts for any deformation or damage that might have occurred as a result of the test.

4.3.1.3 Photograph the test setup and test assemblies.

4.3.1.4 Record any visual, audible or procedural observations noted during the test.

4.3.2 Option B, Press-In Force and Retaining Force.

4.3.2.1 Press-in Force. Store test pieces and test panels for 1 h minimum at $+23\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$.

4.3.2.1.1 Clamp the test piece and the test panel into the clamping fixture of the test device (3.2.7). Ensure that the clamping fixture for the snap-in fastener is in exact alignment with the hole of the test panel.

4.3.2.1.2 Run the test device at a uniform maximum speed of 100 mm/minute to press the snap-in fastener into the test hole.

4.3.2.1.3 Read and record the maximum force in newtons from the force indicator of the test device.

4.3.2.2 Retaining Force. Press the snap-in fastener into the test hole of the test panel.

Note: Test piece and test panels from 4.3.2.1 can be reused for this test.

4.3.2.2.1 Store test pieces and test panels for 1 h minimum at $+80\text{ }^{\circ}\text{C}$ minimum.

4.3.2.2.2 Clamp the test piece and the test panel into the clamping fixture of the test device (3.2.7).

4.3.2.2.3 Run the test device at a uniform maximum speed of 100 mm/minute to separate the snap-in fastener from the test panel.

4.3.2.2.4 Read and record the force in newtons from the force indicator of the test device when separation appears.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results.

5.2.1 Option A, B. When interpreting the test results, the following applies:

5.2.1.1 To pass the test for press-in force, each press-in force single value shall be less than or equal to the required press-in force maximum value on the test request documentation (e.g., part drawing).

5.2.1.2 To pass the test for retaining force, each retaining force single value shall be greater than or equal to the required retaining force minimum value on the test request documentation (e.g., part drawing).

5.3 Test Documentation.

5.3.1 Option A.

5.3.1.1 Summary of Results - Required.

5.3.1.1.1 Test incidents to be recorded on Test Data Summary Sheet or similar (reference Appendix B, Data Sheet B1 example).

5.3.1.1.2 Test data summarization to be on Test Data Log Sheet or similar (reference Appendix C, Data Sheet C1 example).

5.3.1.1.3 Provide load versus displacement plot for each sample evaluated with displacement on the X axis and load on the Y axis.