



Insertion/Extraction - Weatherstrips

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. This standard describes the test to determine the insertion (push-on) and extraction (pull-off) forces of sealing profiles installed on metal flanges.

1.2 Applicability. This standard is applicable to all flange mounted weatherstrips.

1.3 Remarks. Not applicable.

2 References

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

2.1 External Standards/Specifications.

ISO 188

ISO 7500-1

ISO 9513

2.2 GM Standards/Specifications.

GMW14147

2.3 Additional References.

- ACT Test Panels, LLC, 273 Industrial Dr., Hillsdale, MI 49242, sales@acttestpanels.com
- GM Drawing ANZ45805
- Part number CET-19-T-V3D-0001, available from Magna International

3 Resources

3.1 Facilities.

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 Test Machine. The test machine shall fulfill the following requirements: the force measuring device of the test machine shall correspond to ISO 7500-1 Class 1; the deflection measuring device shall correspond to ISO 9513 Class 0.2. The test machine shall be such that the required velocity can be maintained.

3.2.2 Test Fixtures. Test fixtures shall be capable of securely holding the sample to be tested. The sample shall be held securely within the fixture such that the base of the carrier and the test blade are perpendicular to one another. Test fixtures are shown in Appendix A, Figure A1 through Figure A25.

3.2.3 Test Blades for Body Seals. Length of blade shall be 100 mm $\pm$ 1 mm. Blades shall be metal having the appropriate sheet metal thickness with Arlington Assembly production representative paint system, utilizing ACT for test blade painting (ACT Test Panels, LLC, 273 Industrial Dr., Hillsdale, MI 49242, sales@acttestpanels.com). Contact GM Materials or Paint Engineering to obtain the latest paint system information, at the start of each program. Blade thicknesses as defined in Table 1.

Table 1: Blade Thicknesses for Body Seals ^{Note 1}

	Open Insertion ^{Note 2}	Open Extraction ^{Note 2}	Fixture Closed Extraction ^{Note 2}	Service/Repair Extraction ^{Note 2}
Design Validation(DV)	5 mm	2 mm	2, 3, and 4 mm	3 mm
Process Validation (PV)	5 mm	2 mm	3 mm	3 mm

Note 1: The thicknesses defined in Table 1 include paint.

Note 2: See Appendix A, Figure A26 through Figure A28 for Examples of Open position, Closed position and Service/Repair position.

3.2.4 Test Blades for Glass Run Channels (GRC) and Belt Seals. Length of blade shall be 100 mm $\pm$ 1 mm. Blades shall be production representative, having the appropriate sheet metal thickness with production representative paint system. Blades/fixtures must match program specific vehicle environment; blades/fixtures must match door outer panel, inner panel, and any reinforcements that interface with the weatherstrip. See Appendix A, for examples of blades/fixtures. Nominal flange thickness must be specified on the part drawing/math data file. Insertion shall be tested on maximum flange thickness; extraction shall be tested on minimum flange thickness.

3.2.5 Fixture Closing Tool. Part number CET-19-T-V3D-0001, available from Magna International, contact Fred Muxlow, fred.muxlow@magna.com.

3.2.6 Pyrometer.

3.2.7 Oven. Heating oven capable of maintaining the required temperatures within the specified tolerances (e.g., heat oven to ISO 188 Method B).

3.3 Test Vehicle/Test Piece. Test samples shall consist of sections cut from production weatherstrips.

3.3.1 For initial sample approval and arbitration purposes, at least five (5) test pieces cut from at least two (2) components shall be tested.

3.4 Test Time. Reference the lab test procedure(s) in Section 4 for timing details.

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Per laboratory accreditation requirements.

4 Procedure

4.1 Preparation.

4.1.1 Test Sample Preparation. Cut weatherstrips in appropriate lengths for the test fixture used (see Appendix A). Remove the sponge bulb and any external lips from the carrier, if the bulb or lips affect mounting or testing.

4.2 Conditions. Unless otherwise specified, the tests shall be performed at +23 °C $\pm$ 5 °C and +80 °C $\pm$ 3 °C.

4.2.1 Environmental Conditions. The minimum time period between vulcanization and testing of elastomers shall be 72 h. The test piece shall remain at a temperature of +23 °C $\pm$ 5 °C for at least 8 h before testing and shall be free from strain during this period.

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.

4.3 Instructions. See Table A1, Appendix A, for required testing by part classification.

4.3.1 Mount the appropriate blade into the crosshead of the test machine. Zero the force measuring device.

4.3.2 Mount the insertion/extraction fixture to the base.

4.3.3 Insertion Test (Push-on Force) for Traditional Flange.

4.3.3.1 Insert part manually into the fixture, as shown in Appendix A, Figure A1.

4.3.3.2 Insertion with Stop of Test Machine at a Defined Force. Set the automatic force limitation adequate to the force measurement device. Insert the blade into the part with the speed of 50 mm/minute $\pm$ 5 mm/minute,

unless otherwise specified on part drawing or math data file. Run the machine until the automatic force limitation stops the test. Record a force/deflection diagram.

4.3.3.3 Insertion with Stop of Test Machine at a Defined Deflection.

4.3.3.3.1 Lower the blade into the carrier of the part. Stop the blade 0.25 mm to 0.50 mm from the bottom of the carrier or before entering the mastic/hot melt. Zero the deflection measurement of the test machine.

4.3.3.3.2 Raise the blade until the blade clears the part and fixture. Note the distance traveled and re-zero test machine.

4.3.3.3.3 Set the test machine travel for distance noted in 4.3.3.3.2. Run the insertion at 50 mm/minute $\pm$ 5 mm/minute, unless otherwise specified, recording the forces.

4.3.4 Insertion Test for Non-Traditional Flanges (T-Flange, Snap-on Flange, etc.) Insertion testing shall be performed in a manner that most represents the motion used to install the part. The procedure (as specified by the Design Release Engineer) used for evaluation shall be specified on the part drawing or math data file.

4.3.5 Extraction Test (Pull-off Force) for Open and Service Applications.

4.3.5.1 Prior to each test, one (1) blade shall be placed in a blade holder and shall be cleaned (both sides) with isopropanol (70% IPA minimum). Wait 1 minute before seal is installed to allow for flash off alcohol and ensure blades are dry. Weatherstrip shall be installed onto the blade by pushing seal vertically/downward onto blade, avoiding horizontal side movement. Remove blade from holder and insert the blade with attached sample in tensile tester as shown in Appendix A, Figure A1. Run the extraction at 50 mm/minute $\pm$ 5 mm/minute, unless otherwise specified, recording the peak effort required to remove blade from seal. Repeat process for each additional retention test sample (each sample shall be tested (pulled) only once).

4.3.6 Extraction Test (Pull-off Force) for Fixture Closed Applications. Supplier must complete extraction test on closed seal. Fixture closing tool, Part Number CET-19-T-V3D-0001, shall be obtained from Magna International. See Appendix A, Figure A18 through Figure A21. Roller gap setting shall be 10 mm, unless otherwise agreed to by GM Bill of Materials Family Owner, GM Engineer and Supplier. Roller texture as shown in Appendix A, Figure A22.

4.3.6.1 Preparation of the Fixture Closed Weatherstrips.

4.3.6.1.1 Sample Preparation. Three (3) metal blades (Blade 1, Blade 2 and Blade 3, respectively) shall be mounted continuously on a rail (see Appendix A, Figure A10). Blade 1 and Blade 3 are alignment blades; Blade 2 is the test blade. Blade 1 and Blade 3 shall be 50 mm in length and 2.5 mm in thickness; Blade 2 shall be 100 mm in length, thickness as defined in 3.2.3. Blade 2 shall be painted. The blades shall be mounted such that the ends of the blades are touching. All blades shall be the same height. See Appendix A, Figure A8 through Figure A15 for fixturing.

4.3.6.1.2 Cut weatherstrip samples 200 mm in length.

4.3.6.1.3 Prior to each test, all three (3) blades shall be cleaned (both sides) with isopropanol (70% IPA minimum), Wait 1 minute before seal is installed to allow for flash off alcohol and ensure blades are dry. Weatherstrip shall be installed onto the blade by pushing seal vertically/downward onto blade, avoiding horizontal side movement. Using Fixture closing tool shown in Figure A18 through Figure A21, Appendix A, use fixture to close the seal, passing only once over seal. Remove the seal and three (3) blades from rail without disturbing the seal. Remove 50 mm blades (Blade 1 and Blade 3) by sliding the blades out each end (do not pull blades in direction of retention pull). Take 100 mm variable blade with closed weatherstrip installed undisturbed to test machine.

4.3.6.1.4 Insert the test blade with sample in tensile tester. Run the extraction at 50 mm/minute $\pm$ 5 mm/minute, unless otherwise specified, recording the peak effort required to remove blade from seal. Repeat process for each additional retention test sample (each sample shall be tested (pulled) only once).

4.3.6.2 Hot Extraction on Fixture Closed Body Seals. Prepare and close sample as described in 4.3.6.1.1 through 4.3.6.1.3. Prior to taking the sample to the tester, place closed sample in holding fixture, (see Appendix A, Figure A16 and Figure A17). Place holding fixture in hot chamber (minimum 30 minutes) until seal reads 80 °C when measured with a with pyrometer. Once sample reaches temperature, remove from hot chamber and test for extraction as described in 4.3.6.2. Testing must be done within 60 s of removing from hot chamber.

4.3.6.2.1 Insert the blade in tensile tester. Run the extraction at 50 mm/minute $\pm$ 5 mm/minute, pull only once per sample unless otherwise specified, recording the peak effort required to remove blade from seal. Repeat process for each additional retention test.

4.3.7 Extraction Test (Pull-off Force) for T-Flanges.

4.3.7.1 Insert the part onto the proper T-flange fixture (as specified on the part drawing or math data file).

4.3.7.2 Mount the insertion/extraction fixture to the base.

4.3.7.3 Zero the force measuring device. Lower the gripper jaws and clamp to the part.

4.3.7.4 Set the test machine travel for the distance required to remove the part from the T-flange fixture.

4.3.7.5 Set the appropriate chart speed and load scale.

4.3.7.6 Run the extraction at 50 mm/minute $\pm$ 5 mm/minute, unless otherwise specified, recording the force.

4.3.8 Extraction Test after Heat Aging (Glass Runs and Belt Strips Only), Appendix A, Figure A23 through Figure A25.

4.3.8.1 Insert blade into carrier of the weatherstrip.

4.3.8.2 Heat age the part with inserted blade for 72 h -2 h at +80 °C $\pm$ 3 °C per ISO 188 Method B.

4.3.8.3 Remove assembly from oven and allow to cool for 1 h $\pm$ 0.1 h at +23 °C $\pm$ 3 °C.

4.3.8.4 Remove blade from weatherstrip at 50 mm/minute $\pm$ 5 mm/minute, recording the forces.

5 Data

5.1 Calculations. Not applicable.

5.2 Interpretation of Results. Evaluate the force-deflection diagram, if existent, and report the recorded forces. The specified values for insertion (push-on) and extraction (pull-off) force shall be documented on the relevant part drawing or performance specification.

5.3 Test Documentation.

5.3.1 With reference to this test procedure, the results shall be represented in a test report. The report shall include the following:

5.3.1.1 Complete identification of the specimen.

5.3.1.2 Conditioning of the test specimen, if any.

5.3.1.3 Test conditions - temperature, humidity, etc.

5.3.1.4 Blade thickness and paint system.

5.3.1.5 Insertion/extraction values.

5.3.1.6 Any additional observations.

6 Safety

This Engineering Standard may involve safety requirements for hazardous materials, the method of operations and equipment. This standard does not propose to address all the safety issues associated with its use. It is the responsibility of the user of this standard to ensure compliance with all appropriate safety and health practices. This would include any specific training that may be required. The safety and health standards include site specific rules and procedures, company rules and procedures, and Government Standards. Contact shall be made with the appropriate site Safety and Health personnel for further direction and guidance in these matters.

7 Notes

7.1 Glossary. Not applicable.

7.2 Acronyms, Abbreviations, and Symbols.

DV Design Validation

GRC Glass Run Channel

PV Process Validation

8 Coding System

This standard shall be referenced in other documents, drawings, etc., as follows:

Test to GMW14712

9 Release and Revisions

This standard was originated in October 2005. It was first approved by the Global Elastomers Team in December 2006. It was first published in May 2007.

Issue	Publication Date	Description (Organization)
1	MAY 2007	Initial publication.
2	AUG 2011	Revised Glass Run and belt test blades; added heat aged test; added additional graphics for fixtures, and Table A1. (Global Elastomers Team)
3	SEP 2016	Updated to current template. (Materials – Elastomers Global Subsystem Leadership Team)
4	MAR 2020	Revised Body extraction preparation, fixturing and testing. (Materials – Elastomers Global Subsystem Leadership Team)

Appendix A

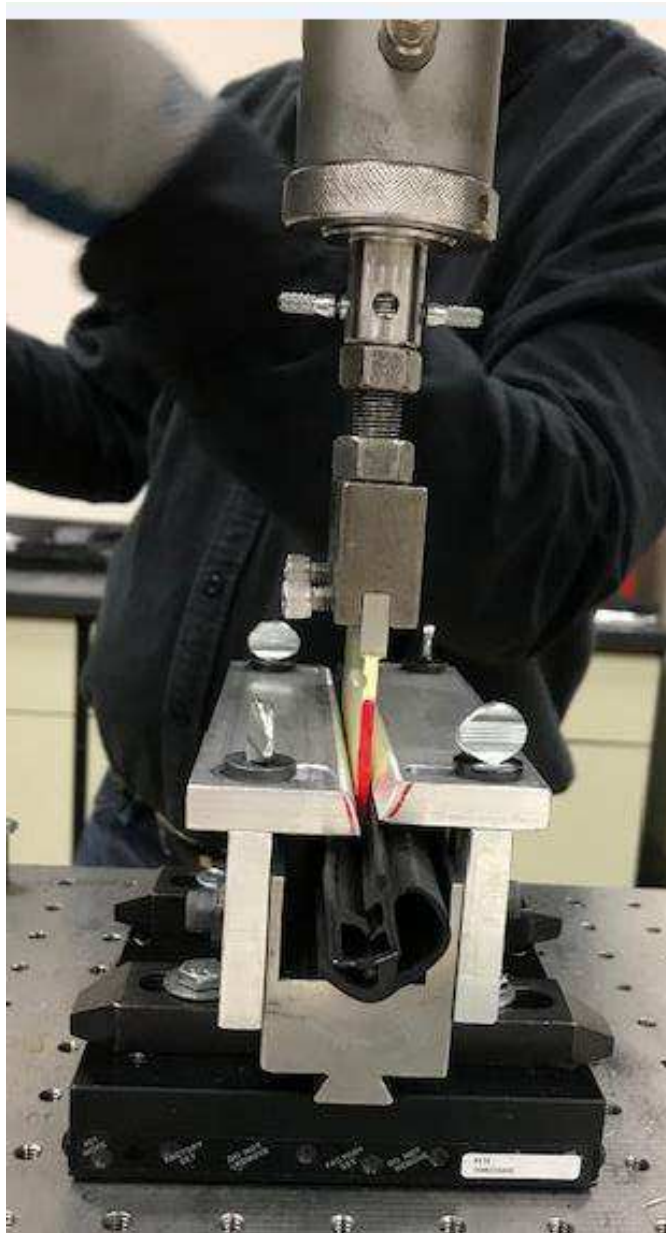


Figure A1: Overview of Body Seal Insertion/Extraction Fixture

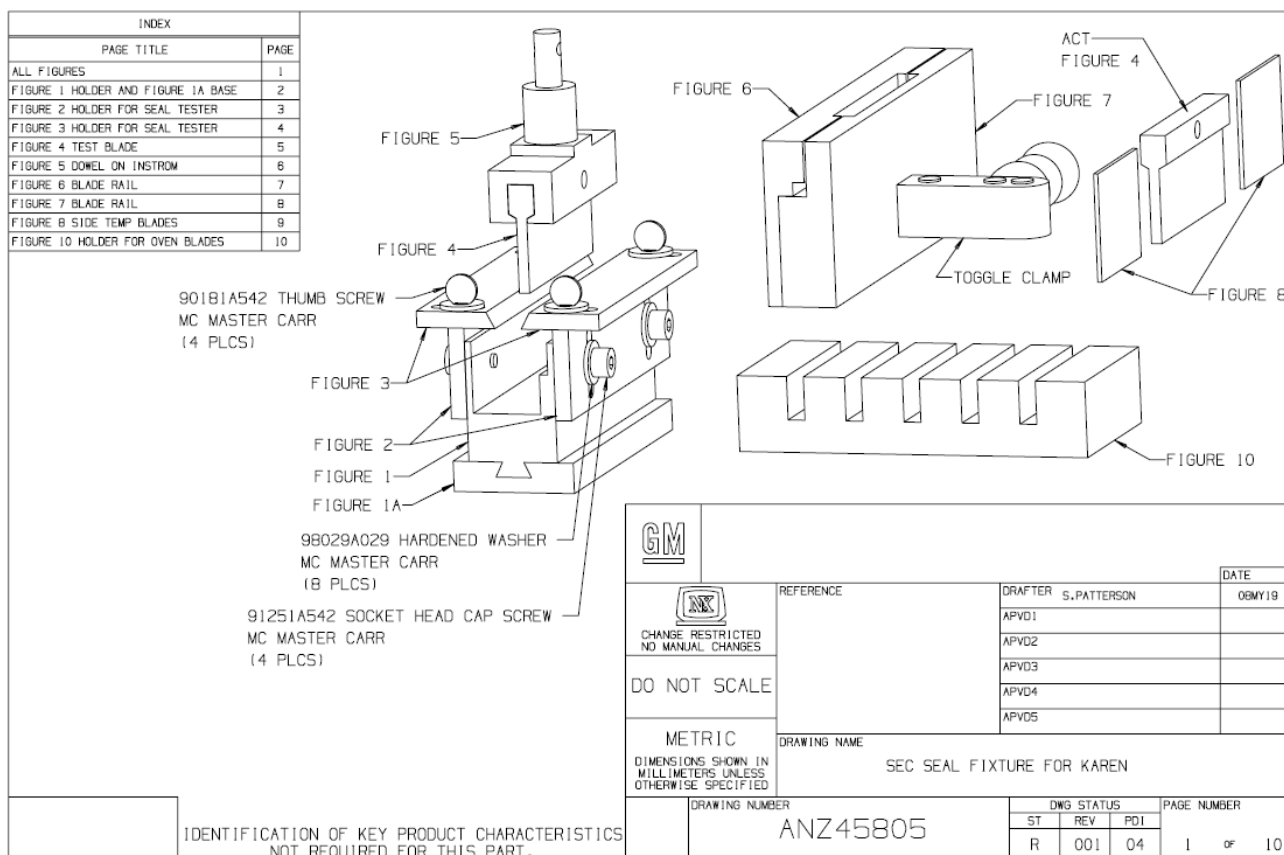


Figure A2: Overview of Body Seal Insertion/Extraction Fixture

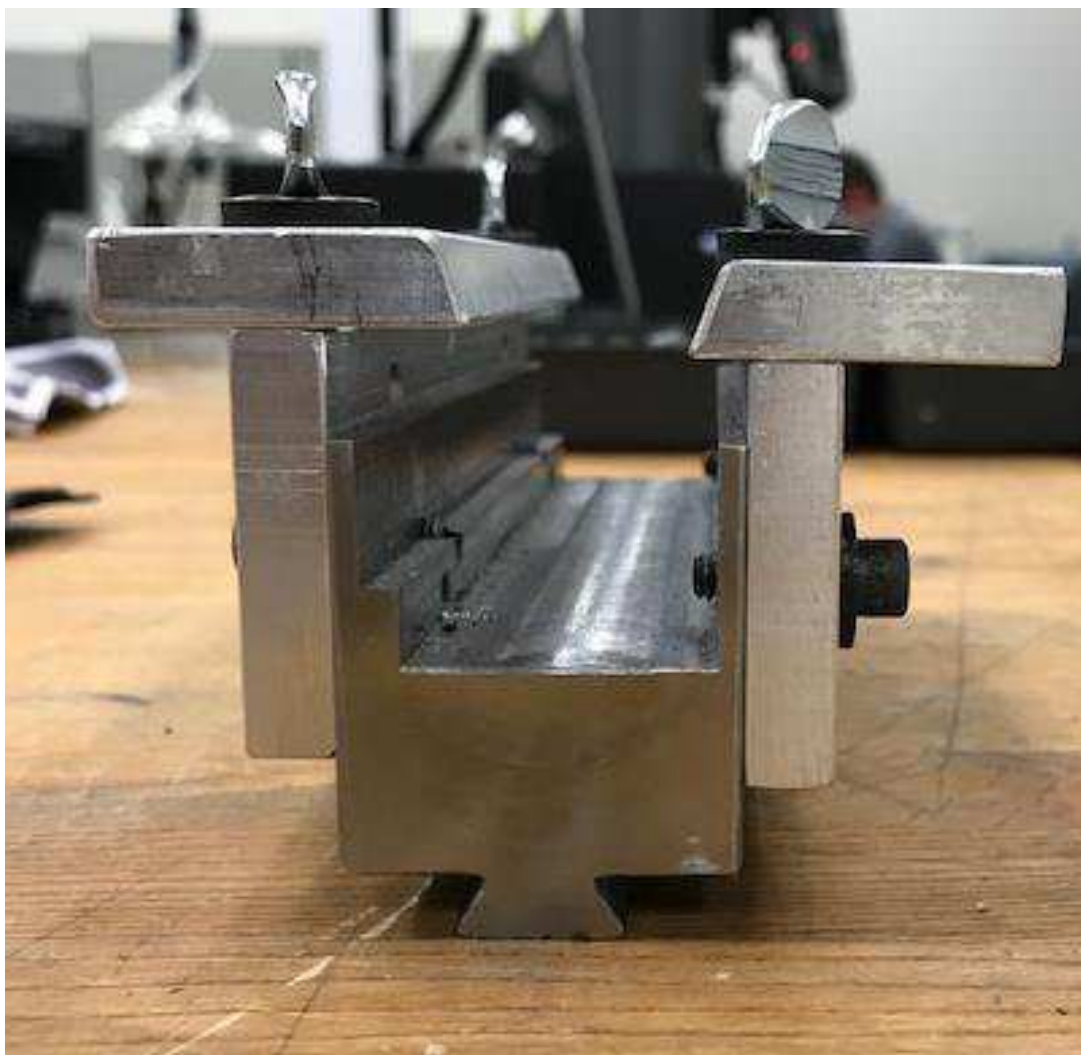


Figure A3: Body Seal Holding Fixture

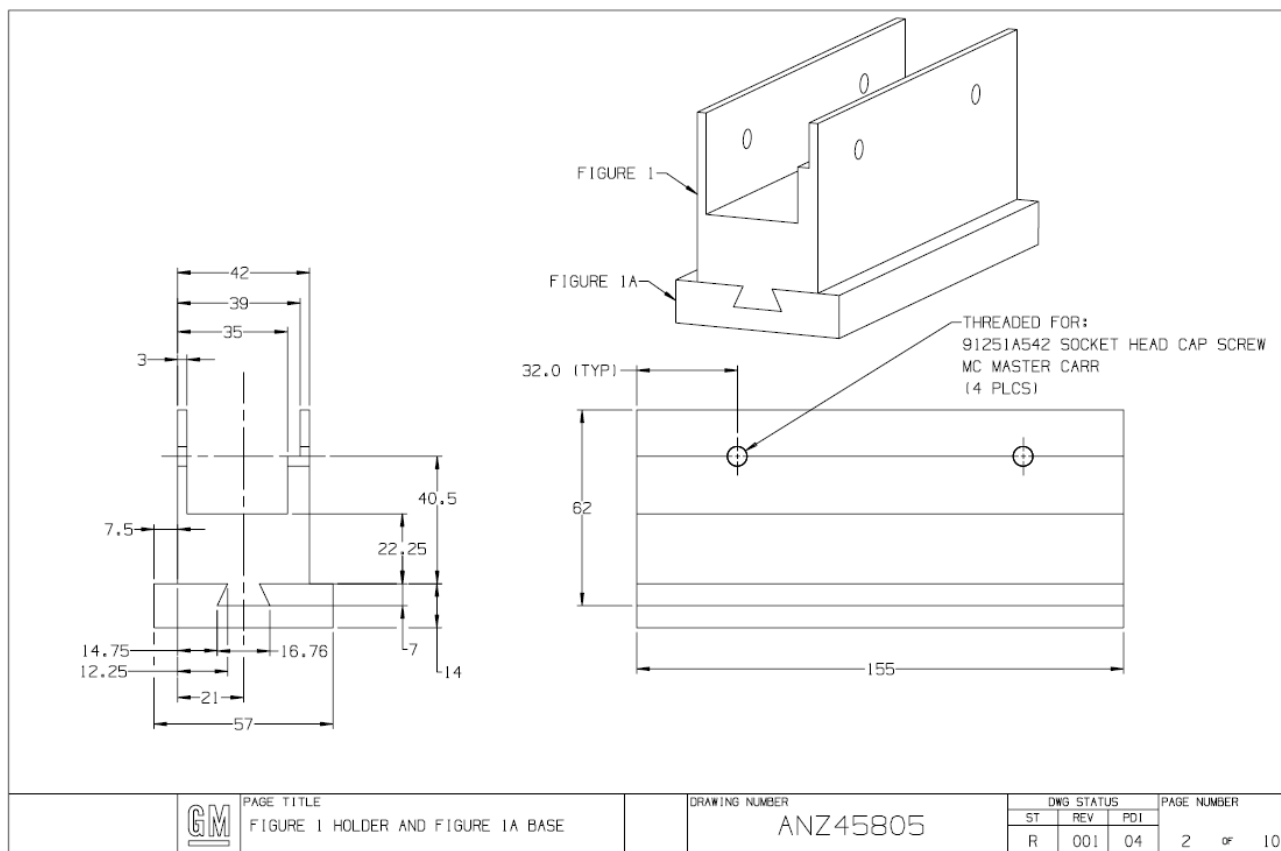


Figure A4: Body Seal Holding Fixture