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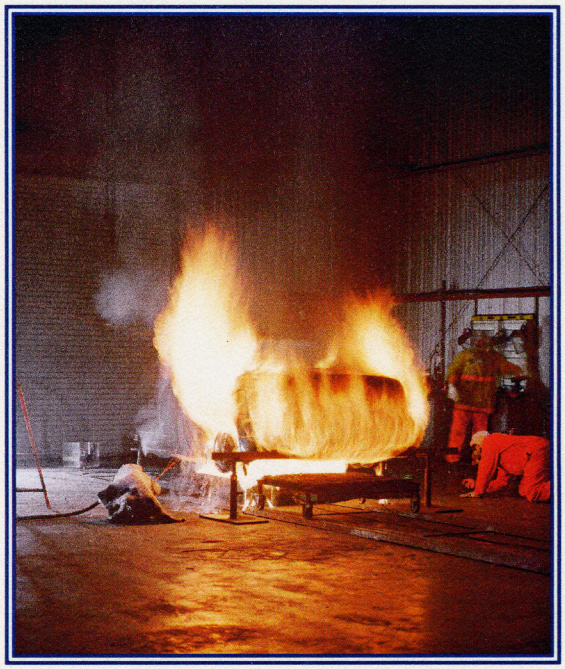
AUTOMOTIVE FUEL TANK EVALUATION

COMPARATIVE EVALUATION OF AUTOMOTIVE FUEL TANKS IN GENERAL ACCORDANCE WITH THE ECE R34.01, ANNEX 5 SECTION 5.0 "RESISTANCE TO FIRE;" AND SECTION 1.0 "IMPACT RESISTANCE;" THE US DEPARTMENT OF TRANSPORTATION 49 CFR 393.67, SECTION E "DROP TEST;" AND ASTM D 638-00, "STANDARD TEST METHOD FOR TENSILE PROPERTIES OF PLASTICS"



FINAL REPORT
Consisting of 228 Pages
SwRI® Project No. 01.06081.01.001
August 2003

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EXECUTIVE SUMMARY

Southwest Research Institute® (SwRI®) located in San Antonio, Texas, conducted a comparison evaluation program on existing plastic fuel tanks to performance standards applied in Europe and the United States for the Motor Vehicle Fire Research Institute (MVFRI) located in Charlottesville, Virginia.

"Conditioned" fuel tanks ranging between 1998 and 2001 Models and "new" original equipment manufacture (OEM) production fuel tanks were evaluated. The conditioned tanks were obtained from vehicles that have been operated in a warm climate in the vicinity of San Antonio, Texas. The new tanks were purchased from the OEM supplier and not from an after market supplier.

The following test standards were used to conduct the fuel tank evaluation or comparison test: ECE R34.01, Annex 5, Section 5.0 "Resistance to Fire;" and Section 1.0 "Impact Resistance;" United States Department of Transportation (U.S. DOT) Code of Federal Regulations (CFR) 393.67, Section E "Drop Test;" and ASTM D 638-00, "Standard Test Method for Tensile Properties of Plastics." The ECE R34.01 standard test method is a European standard used to evaluate automotive plastic fuel tanks. CFR 393.67, Section E "Drop Test," is used for evaluating commercial motor carries fuel tanks not automotive fuel tanks. The CFR standard was used as a guideline to evaluate the test tanks. The ASTM standard was used to evaluate the tanks structural properties.

Vehicles for this program were selected by SwRI based on the requirement of 3 different shaped designs and installation locations in the test bucks. The three different types and shapes of tank designs considered were as follows: 1) a Saturn Twin Cam 4-Door vehicle fuel tank (considered a "thin profile" tank) typical of tanks in front wheel drive cars mounted to an underbody near the rear seat area and in front of the rear axle; 2) a Jeep Grand Cherokee vehicle fuel tank (considered a "square" tank) typical of some SUV tanks mounted behind the rear axle; and 3) a Plymouth Grand Voyager vehicle fuel tank (considered a "long" tank) typical of tanks with a narrow shape mounted inside the frame rail and in front of the rear axle or rear suspension.

The fire resistance comparison evaluation between "conditioned" plastic fuel tanks and "new" OEM plastic fuel tanks, mentioned above, was conducted in general accordance with ECE R34.01, Annex 5, Section 5.0 "Resistance to Fire." The results suggest that despite the aging condition of the plastic fuel tanks, the integrity of the materials to resist fire exposure was maintained and not degraded.

In order to provide additional fire protection to fuel tanks during the fire resistance evaluations, the Jeep Grand Cherokee fuel tank was tested using a new OEM fuel tank skid-plate and the Plymouth Grand Voyager fuel tank was tested using a fabricated fuel tank shield. The Jeep Grand Cherokee shielded fuel tank provided better fire resistance as demonstrated by a 3 min 58 sec extended failure time as compared to the two nonshielded fuel tanks that resulted in a 2 min 10 sec and 1 min 50 sec normal failure time, respectively. The Plymouth Grand Voyager shielded fuel tank did not provide additional fire protection as demonstrated by a 2 min 21 sec test time as compared to the two nonshielded fuel tanks that resulted in a 2 min 22 sec and a 2 min 32 sec test time, respectively.

To establish repeatability of the fire resistance evaluations, three additional new OEM 1998 Saturn Twin Cam 4-Door plastic fuel tanks, typical of those previously tested, were also evaluated. The first repeatability test was considered a nonfailure test due to a false appearance of fuel tank leakage. The last two repeatability tests demonstrated slightly different fire performance characteristics compared to the initial fuel tanks previously tested since the fire exposure time was extended until failure occurred. In most cases the fire exposure time exceeded the required time of exposure specified in ECE R34.01, Annex 5, Section 5.0 "Resistance to Fire."

The fire resistance evaluation included comparison testing of plastic and metal fuel tanks. The test buck used for this part of the study was a 1999 Model Chevrolet Cavalier vehicle. The first tank tested was a new 2000 Chevrolet Cavalier plastic fuel tank. The second tank tested was the test buck's own conditioned 1999 Chevrolet Cavalier metal fuel tank. The duration of the fire exposure subjected to the plastic fuel tank and metal fuel tank were similar, but each test was terminated due to different modes of failure. Fuel tank pressures were significantly different: the new 2000 Chevrolet Cavalier plastic fuel tank pressure reached 160 Pa (0.023 psi) at 7 min 05 sec into the test whereas, the conditioned 1999 Chevrolet Cavalier metal fuel tank pressure reached 134 KPa (19.4 psi) at 6 min 48 sec into the test. The significant

difference between the tested plastic and metal fuel tank is that the plastic fuel tank did not fail due to excessive pressures. The plastic fuel tank failed due to leaks and minimal venting whereas the metal fuel tank developed excessive pressures and abruptly released large amounts of fuel vapors.

The impact resistance comparison evaluation of the same model Saturn Twin Cam 4-Door, Plymouth Grand Voyager and Jeep Grand Cherokee fuel tank designs mentioned above, was also conducted in general accordance with ECE R34.01, Annex 5, Section 1.0 "Impact Resistance." Impact resistance tests evaluate the fuel tanks design's ability to resist puncture at a cold temperature of –40°C. All three sets of fuel tanks performed satisfactorily when subjected to standard testing, even when subjected to an impact with approximately 50% more energy than required by the standard. No degradation was noted in the conditioned tanks.

The drop test comparison evaluation of the same model Saturn Twin Cam 4-Door, Plymouth Grand Voyager and Jeep Grand Cherokee fuel tank designs mentioned above, was conducted in general accordance with the U.S. DOT 49 CFR 393.67, Section E "Drop Test." The required performance states that neither the tank nor any fitting may leak more than a total of 1 ounce by weight of water per minute. All three new fuel tanks performed satisfactorily when subjected to the standard 30-ft drop test. Yet, the conditioned 2000 Plymouth Grand Voyager fuel tank and the conditioned 1998 Jeep Grand Cherokee fuel tank leaked and failed the test due to pinch-off separations[1]. Test results suggest some mechanical degradation of the conditioned fuel tanks when subjected to a severe drop test.

Since the drop tests indicated there could possibly be an issue of bond strength weakness at the pinch-off locations of the failed tanks previously mentioned, tensile tests were conducted in general accordance with ASTM D 638-00, "Standard Test Method for Tensile Properties of Plastics." Specimen coupons for these tests were extracted from the new and conditioned Plymouth Grand Voyager fuel tanks and the new and conditioned Jeep Grand Cherokee fuel tanks that underwent the previously mentioned drop test. The pinch-off locations of these coupons were perpendicular to the long-axis of the specimen. Failure for all specimen coupons was attributed to elongation in the long-axis of the specimen's parent material and not from the bond at the pinch-off location. Alternative test methods should be considered or developed to evaluate the bond strength at the pinch-off location under conditions more representative of the dynamics of the drop test, for example to evaluate the effect of shear stresses.

[1] Failure at end-seams along edges of a plastic fuel tank resulting from a blow molding process.

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1.0 INTRODUCTION

Southwest Research Institute® (SwRI®), located in San Antonio, Texas, conducted a comparison evaluation program on existing plastic fuel tanks to performance standards applied in Europe and the United States for the Motor Vehicle Fire Research Institute (MVFRI) located in Charlottesville, Virginia.

"Conditioned" fuel tanks ranging between 1998 and 2001 Models and "new" original equipment manufacture (OEM) production fuel tanks were evaluated. The conditioned tanks were from vehicles that have been operated in a warm climate in the vicinity of San Antonio, Texas. The new tanks were purchased from the OEM supplier and not from an after market supplier.

The following test standards were used to conduct the fuel tank evaluation or comparison test: ECE R34.01, Annex 5, Section 5.0 "Resistance to Fire;" and Section 1.0 "Impact Resistance;" United States Department of Transportation (U.S. DOT) Code of Federal Regulations (CFR) 393.67, Section E "Drop Test;" and ASTM D 638-00, "Standard Test Method for Tensile Properties of Plastics." The ECE R34.01 standard test method is a European standard used to evaluate automotive plastic fuel tanks. CFR 393.67, Section E "Drop Test," is used for evaluating commercial motor carries fuel tanks not automotive fuel tanks. The CFR standard was used as a guideline to evaluate the test tanks. The ASTM standard was used to evaluate the tanks structural properties.

Vehicles for this study were selected by SwRI based on the requirement of 3 different shaped designs and installation locations in the test bucks. The three different types and shapes of fuel tank designs considered for this program were as follows: 1) Figure 1[2], a Saturn Twin Cam 4-Door vehicle fuel tank (considered a "thin profile" tank), typical of tanks in front wheel drive cars with a thin shape mounted to an underbody near the rear seat area and in front of the rear axle; 2) Figure 2, a Jeep Grand Cherokee vehicle fuel tank (considered a "square" tank) typical of some SUV tanks mounted behind the rear axle; and 3) Figure 3, a Plymouth Grand Voyager vehicle fuel tank (considered a "long" tank) typical of tanks with a narrow shape mounted inside the frame rail and in front of the rear axle or rear suspension.

The following code was used to identify the fuel tanks during their tests: The first letter is for the vehicle type, S(Saturn), J(Jeep), P(Plymouth), C(Chevrolet); the second letter is for the tank type C(Conditioned), N(New); and the third letter is the tank material, P(Plastic) and M(Metal). An S is added for the tests with a skid/shield.

Test SCP1 = Test No. 1
Test SNP1 = Test No. 2
Test SNP2 = Repeatability Test No. 1
Test SNP3 = Repeatability Test No. 2
Test SNP4 = Repeatability Test No. 3
Test JCP1 = Test No. 3
Test JNP1 = Test No. 4
Test JNP2(S) = Test No. 5S
Test PCP1 = Test No. 5
Test PNP1 = Test No. 6A
Test PNP2(S) = Test No. 7S
Test CNP1 = Cavalier Test No. 1 (plastic)
Test CCM1 = Cavalier Test No. 1 (metal)

Figure 1. Thin Profile Tank.

Figure 2. Square Tank.

Figure 3. Long Tank.

This report includes the test procedure and the results obtained. The results presented in this report apply specifically to the fuel tanks tested, in the manner tested, and not to the entire production of these or similar assemblies, nor to the performance when used in combination with other materials.

[2] Enlarged photos of Figures 1-41 are located in Appendix A, pp. A-1 through A-23.

2.0 FIRE RESISTANCE COMPARISON AND REPEATABILITY EVALUATIONS

The fire resistance comparison evaluation of the plastic fuel tanks was conducted in general accordance with ECE R34.01, Annex 5, Section 5.0 "Resistance to Fire," at SwRI's Department of Fire Technology's indoor test facility, located in San Antonio, Texas. Testing was conducted between December 18, 2002, and May 20, 2003. For specific dates of each test conducted, please refer to the test results in Section 2.4 of this report.

The building housing the indoor test facility is 40 ft wide × 60 ft long with a ceiling height of 36 ft. The building has a concrete floor, metal roof, and metal siding. Combustion air is allowed to enter the facility through five louvered vents (each 4 × 4 ft) mounted at floor level and equally spaced in the 60-ft walls. By adjusting the appropriate vents, combustion air is allowed to enter the facility while negating any wind effects. An exhaust fan at the ceiling level is used to evacuate smoke from the building; however, it remained off and closed during the fire exposure tests.

The test bucks selected for the fire resistance comparison evaluation were identified as a 1998 Model Saturn Twin Cam 4Door vehicle, a 1998 Model Jeep Grand Cherokee vehicle, a 1998 Model Plymouth Grand Voyager vehicle, and a 1999 Model Chevrolet Cavalier vehicle. Precautionary measures were taken prior to testing to confirm vehicle identification numbers corresponding to type, make, and model of these vehicles through automotive dealership resources. One conditioned and one new fuel tank for each type model test buck was used for the fire evaluation.

2.1. Test Procedure

The complete plastic fuel tank assembly was mounted in a test buck and positioned to provide the proper clearances as required in ECE R34.01, Annex 5, Section 5.0. The tank was filled to 1/2 of its rated capacity with commercially available unleaded gasoline. The fuel in the pan was ignited and allowed to burn freely for 1 min at a distance greater than 3 meters from the test tank. The fuel pan, was constructed as required in ECE R34.01, Section 5.0, and was filled with enough fuel to allow the flames to burn at least 5 min under free-burning conditions. After 1 min of free burning, the fuel pan was positioned beneath the tank assembly and allowed to burn freely for 1 min.

After 1 min of free burning beneath the tank assembly, the screen, constructed as required in ECE R34.01, Section 5.0, was positioned above the burning fuel, which decreased the intensity of the fire exposure. The standard test method required 1 min of fire exposure while the screen was above the fuel pan. After 2 min of fire exposure to the fuel tank assembly, both the fuel pan and the screen were typically removed simultaneously, and burning of the residual fuel within the pan was extinguished. If failure occurs during the 2 min of exposure, this is considered and documented as normal failure termination. However, for this research study, as requested by the client, only the screen was removed at the 2 min time period, leaving the fuel pan under the tank assembly for an extended fire exposure period and until significant leakage occurred. This is considered and documented as extended failure termination. In most cases, during the extended failure termination exposure it was difficult to determine when initial leakage of fuel from the test tank occurred due to the free burning of the fuel pan.

Once leakage was observed, flaming in the area of the fuel tank assembly was immediately extinguished using a dry chemical powder. Afterwards, while still in the test position, the fuel tank assembly was inspected for fuel leaks. After the fuel tank assembly and vehicle had sufficiently cooled, the fuel tank assembly was removed, and a detailed examination and post-test photographic and video documentation was conducted.

2.2. Test Setup

2.2.1. "Thin" Tank: 1998 Model Saturn Twin Cam 4-Door – Tests SCP1, SNP1, SNP2, SNP3 and SNP4

The test buck was identified as a 1998 Model Saturn Twin Cam 4-Door vehicle. Figure 4 provides a photograph of the test buck and typical setup. Since the Saturn fuel tank is nested in the underbody near the rear seat area and in front of the rear axle, the plastic exterior components (i.e., quarter panels, door fascias, deck-lid, and bumper fascia.) did not affect the performance characteristics of the fuel tank during the fire exposure period. This is based on all Saturn tests meeting the ECE R34.01, Annex 5, Section 5.0 requirements of no leakage of fire after fire exposure.

Figure 4. Saturn Test Setup.

The test buck held the plastic fuel tank assembly in a position representative of production vehicles. The test buck consisting of the fuel tank assembly was positioned such that the distance from the lowest surfaces of the fuel tank to the level of the fuel, in the fuel pan, was 204 mm. The fuel pan and the screen were mounted on a caster/track arrangement to facilitate movement to the appropriate position during the test.

The fuel pan required by the ECE R34.01 test procedure exceeded the horizontal fuel tank dimensions by at least 200 mm but no more than 500 mm. The tank plan view dimensions were 800 mm long × 610 mm wide. The pan had overall rectangular dimensions of 1010 mm long × 900 mm wide for Tests SCP1, SNP1, SNP2, SNP3 and SNP4.

The procedure also specified that the screen dimensions be between 20 and 40 mm smaller than the dimensions of the pan to allow ventilation. The screen was constructed using ECE R34.01 standard bricks, which were held in a fixture with outside dimensions of 987 mm long × 870 mm wide for the tests. The brick placement and spacing of the holes were as specified in the test procedure. When in position, the assembly holding the screen was designed such that the screen was 30 mm above the level of the fuel in the pan.

The 1998 Saturn Twin Cam 4Door fuel tanks were filled to 1/2 of their rated capacity with 23.1 liters (6.1 gallons) of 87-octane unleaded gasoline prior to testing. As in the production models, each tank was mounted on the vehicle test buck using metal straps and a skid plate. The filler necks were capped prior to the fire exposure.

2.2.2. "Square" Tank: 1998 Model Jeep Grand Cherokee – Tests JCP1, JNP1, and JNP2(S)

The test buck was identified as a 1998 Model Jeep Grand Cherokee vehicle. Figure 5 provides a photograph of the test buck and typical setup. Since the Jeep Grand Cherokee fuel tank is typical of SUV tanks mounted behind the rear axle, the rear plastic exterior components (i.e., exhaust vents, bumper fascia, and license plate housing) coupled with ventilation did affect the performance characteristics of the fuel tank during the fire exposure period. As demonstrated by JCP1's 2 min 10 sec total exposure time, the whole complete vehicle test buck helped minimize ventilation during testing and allowed for a pass condition in accordance with ECE R34.01, Annex 5, Section 5.0 requirements of no leaks of fuel after fire exposure; whereas JNP1's 1 min 50 sec total exposure time failed in accordance with ECE R34.01 Annex 5 requirements of no leaks of fuel after fire exposure as a result of not replacing the rear bumper fascia which would have minimized ventilation.

Figure 5. Jeep Test Setup.

The test buck held the plastic fuel tank assembly in a position representative of production vehicles. The test buck consisting of the fuel tank assembly was positioned such that the distance from the lowest surfaces of the fuel tank to the level of the fuel, in the fuel pan, was 331 mm. The fuel pan and the screen were mounted on a caster/track arrangement to facilitate movement to the appropriate position during the test.

The fuel pan required by the ECE R34.01 test procedure exceeded the horizontal fuel tank dimensions by at least 200 mm but no more than 500 mm. The tank plan view dimensions were 808 mm long × 533 mm wide. The pan had overall rectangular dimensions of 1010 mm long × 900 mm wide for Tests JCP1, JNP1, and JNP2(S).

The procedure also specified that the screen dimensions be between 20 and 40 mm smaller than the dimensions of the pan to allow ventilation. The screen was constructed using ECE R34.01 standard bricks, which were held in a fixture with outside dimensions of 987 mm long × 870 mm wide for the tests. The brick placement and spacing of the holes were as specified in the test procedure. When in position, the assembly holding the screen was designed such that the screen was 30 mm above the level of the fuel in the pan.

The 1998 Jeep Grand Cherokee fuel tanks were filled to 1/2 of their rated capacity with 43.5 liters (11.5 gallons) of 87-octane unleaded gasoline prior to testing. As in the production models, each tank was mounted on the vehicle test buck using metal straps. The filler necks were capped prior to the fire exposure.

2.2.3. "Long" Tank: 1998 Model Plymouth Grand Voyager – Tests PCP1, PNP1, and PNP2(S)

The test buck was identified as a 1998 Model Plymouth Grand Voyager vehicle. Figure 6 provides a photograph of the test buck and typical setup. Since the Plymouth Grand Voyager fuel tank is typical of tanks with a narrow shape mounted inside the frame rail and in front of the rear axle or rear suspension, the rear plastic exterior component (i.e., bumper fascia) did not affect the performance of the fuel tank during the fire exposure period. This is based on PCP1 and PNP1 meeting ECE R34.01, Annex 5, Section 5.0 requirements of no leakage of fuel after fire exposure.

Figure 6. Plymouth Test Setup.

The test buck held the plastic fuel tank assembly in a position representative of production vehicles. The test buck consisting of the fuel tank assembly was positioned such that the distance from the lowest surfaces of the fuel tank to the level of the fuel, in the fuel pan, was 206 mm. The fuel pan and the screen were mounted on a caster/track arrangement to facilitate movement to the appropriate position during the test.

The fuel pan required by the ECE R34.01 test procedure exceeded the horizontal fuel tank dimensions by at least 200 mm but no more than 500 mm. The tank plan view dimensions were 1240 mm long × 530 mm wide. The pan had overall rectangular dimensions of 1465 mm long × 740 mm wide for Tests PCP1, PNP1, and PNP2(S).

The procedure also specified that the screen dimensions be between 20 and 40 mm smaller than the dimensions of the pan to allow ventilation. The screen was constructed using ECE R34.01 standard bricks, which were held in a fixture with outside dimensions of 1440 mm long × 710 mm wide for the tests. The brick placement and spacing of the holes were as specified in the test procedure. When in position, the assembly holding the screen was designed such that the screen was 30 mm above the level of the fuel in the pan.

The 1998 Plymouth Grand Voyager fuel tanks were filled to 1/2 of their rated capacity with 37.9 liters (10 gallons) of 87-octane unleaded gasoline prior to testing. As in the production models, each tank was mounted on the vehicle test buck using metal straps. The filler necks were capped prior to the fire exposure.

2.2.4. Comparison Evaluation of Plastic and Metal Fuel Tanks Using A 1999 Model Chevrolet Cavalier – Test CNP1 and CCM1

The purpose of this study was to evaluate results of plastic versus metal tanks when exposed to ECE R34.01, Annex 5, Section 5 fire exposure requirements. The test buck was identified as a 1999 Model Chevrolet Cavalier vehicle. Figure 7 provides a photograph of the test buck and typical setup. All plastic exterior components of the test buck were used during the plastic fuel tank test and were not replaced or modified for the subsequent metal fuel tank test.

Figure 7. Chevrolet Test Setup.

The test buck held the plastic and metal fuel tank assemblies in a position representative of production vehicles. The test buck consisting of the plastic or metal fuel tank assembly was positioned such that the distance from the lowest surfaces of the fuel tanks to the level of the fuel, in the fuel pan, was 203 mm. The fuel pan and the screen were mounted on a caster/track arrangement to facilitate movement to the appropriate position during the test.

The fuel pan required by the ECE R34.01 test procedure exceeded the horizontal fuel tank dimensions by at least 200 mm but no more than 500 mm. The plastic and metal tank plan view dimensions were 1175 mm long × 545 mm wide. The pan had overall rectangular dimensions of 1486 mm long × 935 mm wide for Tests CNP1 and CCM1.

The procedure also specified that the screen dimensions be between 20 and 40 mm smaller than the dimensions of the pan to allow ventilation. The screen was constructed using ECE R34.01 standard bricks, which were held in a fixture with outside dimensions of 1455 mm long × 855 mm wide for the tests. The brick placement and spacing of the holes were as specified in the test procedure. When in position, the assembly holding the screen was designed such that the screen was 30 mm above the level of the fuel in the pan.

The 2000 Chevrolet Cavalier plastic fuel tank and the 1999 Chevrolet Cavalier metal fuel tank were filled to 1/2 of their rated capacity with 28.4 liters (7.5 gallons) of 87-octane unleaded gasoline prior to testing. As in the production models, each tank was mounted on the vehicle test buck using metal straps. The filler necks were capped prior to the fire exposure.

2.3. Test Instrumentation

Instrumentation for the fire resistance evaluation consisted of six thermocouples. Four 20-gauge, Type K thermocouples (TCs) were placed approximately 1 in. from each corner of the test tank assembly. One 1/8-in. inconel sheathed exposed junction, Type K TC was placed within the tank below the fuel level while a second internal 1/8-in. Type K TC was placed in the vapor area of the fuel tank. The internal tank pressure was measured using a Dwyer Magnahelic Differential Pressure Indicating Transmitter Model 60-10 that was connected to the top of the tank fuel delivery module (FDM) by a sampling line.

The TCs and pressure indicating transmitter were connected to a Fluke 2289A Helios I Computer Front End (Serial No. 4752005), which was used to measure and record the temperature and pressure from the test assembly in °F and Pa, respectively. The signals were scanned, monitored, and recorded every 3 sec throughout the test using SwRI's PC data acquisition system. Table 1 provides the TC locations.

Table 1. Thermocouple Locations.

TC ID	Location
TC 1	1 in. from bottom of fuel tank (fuel TC)
TC 2	1 in. from top of fuel tank (vapor TC)
TC 3	Rear left bottom corner of fuel tank
TC 4	Rear right bottom corner of fuel tank
TC 5	Front right bottom corner of fuel tank
TC 6	Front left bottom corner of fuel tank

2.4. Test Results

2.4.1. 1998 Model Saturn Twin Cam 4-Door

2.4.1.1 Tests SCP1 and SNP1

On December 18, 2002, Test SCP1 was conducted on the conditioned 1998 Saturn Twin Cam 4-Door fuel tank utilizing the original Saturn test buck. Test SCP1 demonstrated no leaks during the 2-min ECE R34.01 fire exposure period. At 3 min 39 sec from the start of fuel tank fire exposure (or 1 min 39 sec into the extended fire exposure), the fuel tank leaked at the rear left side bottom corner of the fuel tank. Figure 8 provides a photograph of the fuel tank after the fire exposure. For additional photographs see Figures A-42 through A-51 in Appendix A.

Figure 8. Test SCP1 After Exposure.

On December 18, 2002, Test SNP1 was conducted on the new 1998 Saturn Twin Cam 4-Door fuel tank. The Saturn test-buck combustible body panels were not installed. Test SNP1 demonstrated no leaks during the 2-min ECE R34.01 fire exposure period. At 3 min 36 sec from the start of fuel tank fire exposure (or 1 min 36 sec into the extended fire exposure), the fuel tank leaked at the rear left side bottom corner of the fuel tank. Figure 9 provides a photograph of the fuel tank after the fire exposure. For additional photographs see Figures A-52 through A-60 in Appendix A.

Figure 9. Test SNP1 After Exposure.

2.4.1.2 Tests SNP2, SNP3, and SNP4

To establish repeatability of the fire resistance evaluations, three additional new 1998 Saturn Twin Cam 4-Door plastic fuel tanks were evaluated.

On February 19, 2003, Test SNP2 was conducted on the new 1998 Saturn Twin Cam 4-Door fuel tank utilizing the Saturn test buck rebuilt with plastic quarter panels only. At 3 min 13 sec (or 1 min 13 sec into the extended fire exposure) the test was inadvertently terminated due to the false appearance of leakage and not actual fuel tank leakage. The test was categorized as a nonfailure. Subsequently, this test was rerun on April 28, 2003, as indicated below. Figure 10 provides a photograph of the fuel tank after the fire exposure. For additional photographs see Figures A-61 through A-68 in Appendix A.

Figure 10. Test SNP2 After Exposure.

On February 19, 2003, Test SNP3 was conducted on the 1998 Saturn Twin Cam 4-Door plastic fuel tank utilizing the Saturn test buck rebuilt with plastic quarter panels only. Test SNP3 demonstrated no leaks during the 2-min ECE R34.01 fire exposure period. Test results were slightly different due to extended failure termination when compared to the normal failure termination evident in initial Saturn Fuel Tank Tests, (Tests SCP1 and SNP1) in Section 2.4.1. Leakage did occur on the rear right side corner of the fuel tank at 4 min 36 sec from the start of the fuel tank fire exposure (or 2 min 36 sec into the extended fire exposure period). Figure 11 provides a photograph of the fuel tank after the fire exposure. For additional photographs see Figures A-69 through A-77 in Appendix A.

Figure 11. Test SNP3 After Exposure.

On April 28, 2003, Test SNP4 was conducted on the 1998 Saturn Twin Cam 4-Door plastic fuel tank utilizing the Saturn test buck rebuilt with plastic quarter panels, door fascias, deck-lid and a bumper fascia. Test SNP4 demonstrated no leaks during the 2-min ECE R34.01 fire exposure period. Results were slightly different due to extended failure termination when compared to the normal failure termination evident in the initial Saturn Fuel Tank Tests (Tests SCP1 and SNP1) in Section 2.4.1. Leakage did occur on the front left bottom corner of the fuel tank at 4 min 19 sec from the start of the fuel tank fire exposure (or 2 min 19 sec into the extended fire exposure period) but was allowed to continue leaking until 4 min 25 sec (or 2 min 25 sec into the extended fire exposure period). Figure 12 provides a photograph of the fuel tank after the fire exposure. For additional photographs see Figures A-78 through A-88 in Appendix A.

Figure 12. Test SNP4 After Exposure.

2.4.2. 1998 Model Jeep Grand Cherokee – Tests JCP1, JNP1, and JNP2(S)

On December 18, 2002, Test JCP1 was conducted on the conditioned 1998 Jeep Grand Cherokee fuel tank utilizing the original Jeep Grand Cherokee test buck. Test JCP1 demonstrated no leaks during the 2-min ECE R34.01 fire exposure period. At 2 min 10 sec from the start of fuel tank fire exposure (or 10 sec into the extended fire exposure), the fuel tank leaked at the front right side bottom of the tank along the outboard side of the strap and the front right top corner of the fuel tank. Figure 13 provides a photograph of the fuel tank after the fire exposure. For additional photographs see Figures A-89 through A-100 in Appendix A.

Figure 13. Test JCP1 After Exposure.

On December 18, 2002, Test JNP1 was conducted on the new 1998 Jeep Grand Cherokee fuel tank utilizing the same non-modified Jeep Grand Cherokee test buck. Test JNP1 demonstrated a leak at 1 min 50 sec into the 3-min ECE R34.01 test period. Leakage occurred on the front right side bottom of fuel tank, on the outboard side of the strap. The early failure mode demonstrated by this test may have been attributed to an increase in ventilation due to the loss of body material resulting from Test JCP1. Figure 14 provides a photograph of the fuel tank after the fire exposure. For additional photographs see Figures A-101 through A-110 in Appendix A.

Figure 14. Test JNP1 After Exposure.

On April 30, 2003, Test JNP2(S) was conducted on the new 1998 Jeep Grand Cherokee fuel tank modified with a new OEM fuel tank skid-plate, utilizing the Jeep Grand Cherokee test buck rebuilt with plastic exhaust vents, bumper fascia and a license plate housing. Test JNP2(S) demonstrated no leaks during the 2-min ECE R34.01 fire exposure period. At 2 min 52 sec from the start of fuel tank fire exposure (or 52 sec into the extended fire exposure), the fuel tank leaked at rear left corner, rear middle and along the rear right corner. Because the leaks were minimal and not growing due to the skid-plate, the fire exposure was allowed to continue. At 3 min 15 sec and at 3 min 35 sec the rear side windows shattered and broke away. At 3 min 49 sec and 3 min 51 sec, the lift-gate strut-supports, on both sides of the rear window opening, ruptured loudly. At 3 min 58 sec the test was terminated and the fuel pan was immediately pulled out from underneath the vehicle due to safety concerns stemming from the loud abrupt rupture of the lift-gate strut supports. Figures 15, 16, 17, and 18 provide photographs of the fuel tank installed without skid-plate, with skid-plate, after fire exposure with skid-plate, and after fire exposure without skid-plate, respectively. For additional photographs see Figures A-111 through A-131 in Appendix A.

Figure 15. Test JNP2(S) Before Exposure Without Skid-Plate.

Figure 16. Test JNP2(S) Before Exposure With Skid-Plate.

Figure 17. Test JNP2(S) After Exposure With Skid-Plate.

Figure 18. Test JNP2(S) After Exposure Without Skid-Plate.

2.4.3. 1998 Model Plymouth Grand Voyager – Tests PCP1, PNP1, and PNP2(S)

On December 19, 2002, Test PCP1 was conducted on the conditioned 1998 Plymouth Grand Voyager fuel tank utilizing the original Plymouth Grand Voyager test buck. Test PCP1 demonstrated no leaks during the 2-min ECE R34.01 fire exposure period. At 2 min 22 sec from the start of the fuel tank fire exposure (or 22 sec into the extended fire exposure), leakage occurred on the front right side bottom corner of the fuel tank. Figure 19 provides a photograph of the fuel tank after the fire exposure. For additional photographs see Figures A-132 through A-141 in Appendix A.

Figure 19. Test PCP1 After Exposure.

On January 2, 2003, Test PNP1 was conducted on the new 1998 Plymouth Voyager fuel tank utilizing the same non-modified Plymouth Grand Voyager test buck. Test PNP1 demonstrated no leaks during the 2-min ECE R34.01 fire exposure period. At 2 min 32 sec from the start of the fuel tank fire exposure (or 32 sec into the extended fire exposure), leakage occurred along the front strap and topside of the fuel tank. Figure 20 provides a photograph of the fuel tank after the fire exposure. For additional photographs see Figures A-142 through A-154 in Appendix A.

Figure 20. Test PNP1 After Exposure.

On May 20, 2003, Test PNP2(S) was conducted on the new 1998 Plymouth Voyager fuel tank consisting of the fabricated fuel tank shield utilizing the same non-modified Plymouth Grand Voyager test buck. Test PNP2(S) demonstrated no leaks during the 2-min ECE R34.01 fire exposure period. At 2 min 21 sec from the start of the fuel tank fire exposure (or 21 sec into the extended fire exposure), leakage occurred through the drain hole of the 14-gauge thick heat shield and along the left perimeter side of the fuel tank and heat shield interface. The fire exposure continued until extended failure occurred at 6 min 5 sec. Figures 21, 22, 23, and 24 provide photographs of the fuel tank installed without shield, with shield, after fire exposure with shield and after fire exposure without shield, respectively. For additional photographs see Figures A-155 through A-183 in Appendix A.

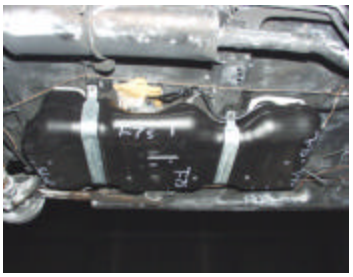


Figure 21. Test PNP2(S) Before Exposure Without Fuel Tank Shield.

Figure 22. Test PNP2(S) Before Exposure With Fuel Tank Shield.

Figure 23. Test PNP2(S) After Exposure With Tank Shield.

Figure 24. Test PNP2(S) After Exposure Without Shield.

2.4.4. 1999 Model Chevrolet Cavalier Plastic and Metal Fuel Tank Comparison – Tests CNP1 and CCM1

On January 21, 2003, Test CNP1 was conducted on the new 2000 Chevrolet Cavalier plastic fuel tank utilizing the original Chevrolet Cavalier test buck. Test CNP1 demonstrated no leaks during the 2-min ECE R34.01 fire exposure period. At 5 min 45 sec from the start of the fuel tank fire exposure (or 3 min 45 sec into the extended fire exposure period), leakage occurred on the front right side corner and on the rear top inboard side of each strap of the fuel tank. Figure 25 provides a photograph of the plastic fuel tank after the fire exposure. For additional photographs see Figures A-184 through A-194 in Appendix A.

Figure 25. New Plastic Fuel Tank After Exposure.

On February 18, 2003, Test CCM1 was conducted on the conditioned 1999 Chevrolet Cavalier metal fuel tank utilizing the same non-modified Chevrolet Cavalier test buck. Test CCM1 demonstrated no leaks during the 2-min ECE R34.01 fire exposure period. At 1 min 32 sec from the start of fuel tank fire exposure, the vapor canister at the rear of the metal fuel tank melted and fell away allowing the carbon contents to spill out and burn. At 4 min 57 sec from the start of the fuel tank fire exposure (or 2 min 47 sec into the extended fire exposure period), venting noises were beginning to develop. At 5 min 15 sec from the start of the fuel tank fire exposure (or 3 min 5 sec into the extended fire exposure period), an increase of ignited gaseous vapors developed at the back end of the vehicle.

At 6 min 15 sec from the start of the fuel tank fire exposure (or 4 min 5 sec into the extended fire exposure period), a considerable increase in flaming vapors occurred at the passenger side rear window opening. The metal fuel tank post-test analysis indicated that the plastic spring-load rollover valve and the plastic sending unit, melted. As the melting effect developed, a minimal amount of gaseous vapors escaped as pressure in the fuel tank was rapidly increasing. It was determined that this effect attributed to the venting noise heard at about 4 min 49 sec.

At 6 min 22 sec from the start of the fuel tank fire exposure (or 4 min 12 sec into the extended fire exposure period), the metal fuel tank vented at an approximate pressure of 20 psig and the test concluded. The metal fuel tank post-test analysis indicated that this occurrence resulted from additional melting of the rollover valve and rupturing of the fill neck hose, causing a rapid release of fuel vapors and ignition of these vapors. The fuel tank contained a small amount of gasoline at the conclusion of testing. Figure 26 provides a photograph of the metal fuel tank after exposure. For additional photographs see Figures A-195 through A-201 in Appendix A.

Figure 26. Conditioned Metal Fuel Tank After Exposure.

Documentation for the fire exposure tests consisted of a color videotape and color photographs taken during the fire exposure and post-test inspection. Photographs of the fuel tanks and test setup are located in Appendix A. Test data is presented in Appendix B.

3.0 IMPACT RESISTANCE EVALUATION

The impact resistance evaluation of the plastic fuel tanks was conducted in general accordance with ECE R34.01, Annex 5, Section 1.0 "Impact Resistance," at SwRI's Department of Fire Technology Indoor Test Facility, located in San Antonio, Texas. Testing was conducted from January 8, through January 10, and January 13, 2003. The fuel tanks selected for this series of tests were identified as one conditioned 1999 and one new 1998 Saturn Twin Cam 4-Door fuel tank; one conditioned 1988 and one new 1998 New Jeep Grand Cherokee fuel tank; and one conditioned 1998 and one new 1998 Plymouth Grand Voyager fuel tank. Figure 27 provides a photograph of the test setup.

Figure 27. Impact Resistance Test Setup.

3.1. Test Procedure

The ECE R34.01, Annex 5, Section 1.0, "Impact Resistance" Standard states that the pendulum impact-testing fixture was to be used for the fuel tank test. The impact body was made of steel and had the shape of a pyramid with equilateral triangle faces and a square base. The summit and the edges were rounded to a radius of 3 mm. The center of percussion of the pendulum coincided with the center of gravity of the pyramid; its distance from the axis of rotation of the pendulum was 1 m. The total mass of the pendulum referred to its center of percussion was 15 kg. The energy of the pendulum at the moment of impact should not be less than 30.1 Nm and be as close to that value as possible[3]. Prior to each impact, a protractor was used to establish the correct calculated angle of the pendulum in order to produce the correct energy level at the moment of impact.

It should be noted, that impacts were implemented on the points of the tank that were regarded as vulnerable or those which were most exposed or weakest, considering the shape of the tank and/or the way in which it is installed on the vehicle. During testing, the tank was held in position by fittings on the side or sides opposite the side of impact. No leaks should result from the test.

Prior to impacting the fuel tanks, the tanks were filled to their rated capacity with a water-glycol mixture, or equivalent, having a low freezing point that does not change the properties of the tank material while being conditioned in a conditioning chamber to –40°C ± 2°C.

[3] The pendulum is a body of steel and has the shape of a pyramid with equilateral triangle faces and square base. The distance (***L***) between the center of gravity of the pyramid and the axis of rotation is 1.0 m and the total mass (***m***) of the pendulum is 15 kg. The total energy at the moment of impact must be 30.1 Nm = $mgL(1-\cos\beta)$ where β is the pendulum angle from vertical. The angle is calculated as being 37.3° to provide an impact moment of 30.1 Nm.

After the water-glycol mixture temperature in the tanks and conditioning chamber environment reached a stable temperature of -40°C ± 2°C, the tanks were hoisted from the freezer, marked, positioned within the test fixture and impact tested at the pre-selected locations. The right side corner and left side corner of the tanks were regarded as vulnerable, most exposed, or weakest, based on the shape of the tank and/or the way in which it is installed on the vehicle. As each impact was delivered, the fuel tank was immediately repositioned by 1/4 in. in order to repeat the impact process within the same localized area.

3.2. Test Instrumentation

Instrumentation for the impact resistance evaluation consisted of two TCs. A 1/8-in. diameter exposed inconel 20-gauge, Type K sheathed TC, tied to a portable John Fluke Digital Thermometer, was used to monitor temperature of the water-glycol mixture in the fuel tanks. This assured that the liquid temperature was within tolerance before removing the tank from the conditioning chamber.

The second TC, a 1/8-in. 20-gauge, Type K glass sheathed TC, was used with a Watlow Series 942 Temperature Ramp Controller. This combination controlled the liquid nitrogen flow into the conditioning chamber as needed to reach the required -40°C ± 2°C temperature.

Documentation for the impact resistance evaluation consisted of color photographs taken before, during, and after each impact location. Photographs of the fuel tank and test setup are located in Figures A-202 through A-224 in Appendix A.

3.3. Test Results

Results of the impact resistance evaluations conducted on one conditioned 1999 and one new 1998 Saturn Twin Cam 4-Door fuel tank; one conditioned 1998 and one new 1998 Jeep Grand Cherokee fuel tank; and one conditioned 1998 and one new 1998 Plymouth Grand Voyager fuel tank indicated that all the fuel tanks in this study passed the impact resistance tests with no leaks, as required by the standard.

The pendulum impacts were made on the front right side corner and on the front left side corner of each tank. These impact locations are regarded as the most vulnerable points due to the installation of the tanks in their respective vehicles and the fact that material is thinner on radial corners of tanks due to the blow-molding processes when manufacturing tanks. Yet, despite the impacts, no identifiable differences between the performances of conditioned plastic fuel tanks and new plastic fuel tanks were apparent.

There were no leaks after five impacts were delivered on the front right side corner of each tank. The impact energy levels consisted of 30.1 Nm, 33.3 Nm, 36.6 Nm, 40.1 Nm, and 43.6 Nm. Also, there were no leaks after two additional impacts were delivered on the front left side corner of each tank. These impact energy levels consisted of 43.6 Nm and 147.2 Nm. Figure 28 provides a photograph of the new 1998 Plymouth Voyager fuel tank after impact.

Figure 28. New Plymouth Plastic Fuel Tank After Impact.

4.0 DROP TEST

The drop evaluation of the plastic fuel tanks was conducted in general accordance with U.S. DOT 49 CFR 393.67, Section E "Drop Test" at SwRI's Department of Fire Technology's Test Facility, located in San Antonio, Texas. Testing was conducted on January 9, and 10, 2003. Figure 29 provides a photograph of the test setup.

The fuel tanks selected for this series of tests were identified as one conditioned 2001 and one new 1998 Saturn Twin Cam 4-Door fuel tank, one conditioned 1998 and one new 1998 Jeep Grand Cherokee fuel tank, one conditioned 2000 and one new 1998 Plymouth Grand Voyager fuel tank.

Figure 29. Drop Test Setup.

The Section E "Drop Test" of the referenced standard states that the fuel tanks shall be filled with a quantity of water having a weight equal to the weight of the maximum fuel load of the tank. The fuel tank is filled then dropped from a 30 ft elevation to assess the durability of the fuel tanks and measure the leak rate.

4.1. Test Procedure

After filling the fuel tank with a quantity of water having a weight equal to the weight of the maximum fuel load and selecting the vulnerable point of impact, the fuel tank was then positioned and strapped to the drop apparatus before being hoisted. Based on SwRI's experience, the combination of weight, strapped position and time of day (or calmness of day) ensured that the specified locality was accurately impacted.

The Saturn Twin Cam 4-Door fuel tanks were filled with 9 gallons of water equal to 12.2 gallons of fuel, the maximum fuel load of the tank. The Jeep Grand Cherokee fuel tanks were filled with 17 gallons of water equal to 23 gallons of fuel, the maximum fuel load of the tank. The Plymouth Voyager fuel tanks were filled with 14.83 gallons of water equal to 20 gallons of fuel, the maximum fuel load of the tank.

Once the fuel tank assemblies were filled with the proper amount of water the right passenger side corner of each tank was selected as the most vulnerable location for impacting. Each fuel tank was then individually hoisted to a 30 ft elevation and dropped according to the standard.

4.2. Test Instrumentation

A 43-ft steel framed test fixture consisting of a Dayton® 115 Volt electric winch and hook assembly was fabricated and erected over a 17-ft long × 17-ft wide × 18-in. thick concrete slab to provide an unyielding surface for one corner of the fuel tank to squarely impact. The required performance is that neither the fuel tank nor any fitting may leak more than a total of 1 oz by weight of water per minute. Photographs of the fuel tanks and test setup are located in Figures A-225 through A-243 in Appendix A.

4.3. Test Results

Testing was conducted on January 9 and 10, 2003. Results of the 30-ft drop tests indicated that both the conditioned and new 1998 Model Saturn Twin Cam 4-Door fuel tanks passed with no leaks, the new 1998 Model Plymouth Grand Voyager Van fuel tank passed with no leaks and the new 1998 Model Jeep Grand Cherokee fuel tank passed with no leaks.

The conditioned 2000 Model Plymouth Grand Voyager fuel tank leaked approximately 150 oz by weight of water per minute due to pinch-off separations[4] at the front strap location (Figure 30). The conditioned 1998 Model Jeep Grand Cherokee fuel tank leaked approximately 900 oz by weight of water per minute due to pinch-off separation along the front right side of the tank (Figure 31).

Figure 30. Leakage of Conditioned Plymouth Plastic Fuel Tank After Sever Drop.

Figure 31. Leakage of Conditioned Jeep Grand Cherokee Fuel Tank After Sever Drop.

[4] Failure at end-seams along edges of a plastic fuel tank resulting from a blow molding process.

Since drop testing indicated there could possibly be an issue of bond strength weakness at the pinch-off locations, tensile tests were considered. By conducting these tests in general accordance to the ASTM D 638-00, "Standard Test Method for Tensile Properties of Plastics" one could determine if the bond strength pinch-off location as demonstrated by the failed drop tanks is a weak aspect of the tank design.

Figures 32 and 33 below depict the external and internal view of the pinch-off sections of the conditioned 2000 Plymouth Grand Voyager fuel tank that failed during the drop test.

Figure 32. External View of Plymouth Tank Pinch-Off Section

Figure 33. Internal View of Plymouth Tank Pinch-Off Section

Figures 34 and 35 below depict the external and internal view of the pinch-off sections of the 1998 Model Jeep Grand Cherokee fuel tank that failed during the drop test.

Figure 34. External View of Jeep Tank Pinch-Off Section.

Figure 35. Internal View of Jeep Tank Pinch-Off Section.

5.0 TENSILE TEST

5.1. Test Procedure

Test Results The specimen coupons required by ASTM D 638-00, "Standard Test Method for Tensile Properties of Plastics" were extracted from the previously dropped failed fuel tanks, the new 1998 Plymouth Grand Voyager fuel tank, the conditioned 2000 Plymouth Grand Voyager fuel tank and the new and conditioned 1998 Jeep Grand Cherokee fuel tanks, using a band saw. The general layout of the specimen coupon extraction is presented in Figure 36 below.

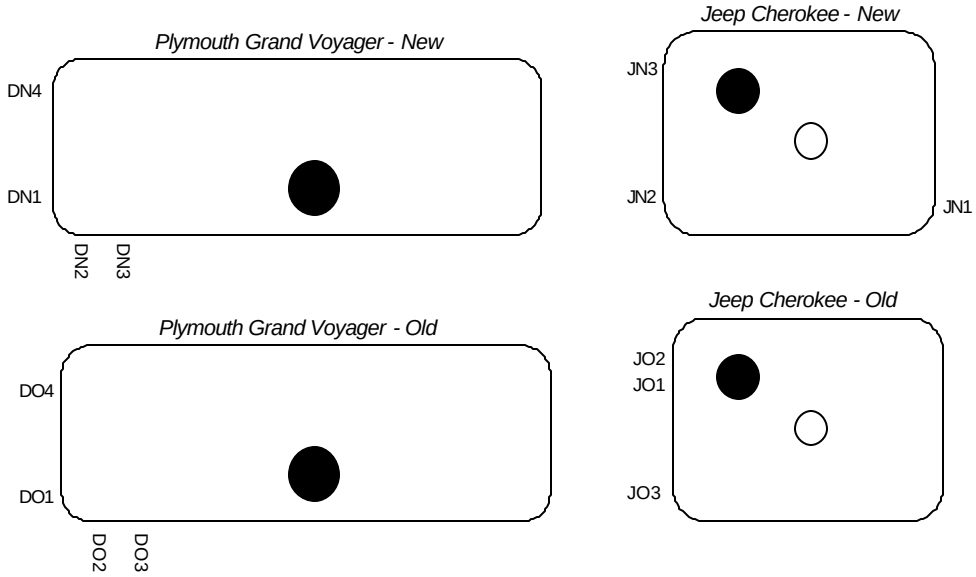


Figure 36. Tensile Test Extraction Layout.

As these coupons were extracted from the fuel tanks, the pinch-off location in each was perpendicular to the long-axis of the specimen parent material. The overall length of the specimen coupons depended on the location of extraction and ranged from 6 in. to 9 in. in length. The thickness of the specimen coupons varied as well, ranging from 0.2 in. to 0.5 in. For all specimen coupons, the thickest region was at the pinch-off location. Figures 37 and 38 depict the typical specimen coupons.

Figure 37. Typical Tensile Test Specimen Coupon.

Figure 38. Thickest Region at Pinch-Off Location.

5.2. Test Instrumentation

A 20-kip Sintech load frame, using mechanical wedge grips, was used to conduct the uniaxial tensile tests. Figure 39 provides a photograph of the typical tensile test setup, depicting mechanical grips and a specimen coupon.

A head displacement rate of 0.2-in./min, as recommended by ASTM D 638-00, was used during the evaluation. MTS TestWorks digital software was used to control and record data during the testing. Data collection included load, head displacement, and time. Testing was performed in the laboratory under ambient conditions, approximately 70°F and 50% RH.

Figure 39. Typical Tensile Test Setup.

Prior to testing, the load cell was zeroed (0 lbs load) with no specimen in place. Once the specimen coupon was gripped and in place, the load cell was then rezeroed by using cross-head displacement. Testing was concluded when the specimen coupon had completely failed or at which time significant amount of elongation had occurred.

5.3. Test Results

Tensile testing was conducted on June 12, and 13, 2003. Results of the tests indicated that failure for all specimen coupons was attributed to elongation in the long-axis of the specimen's parent material and not at the pinch-off location. The bond pinch-off location was maintained despite the uniaxial stresses imposed during the test. Figure 40, provides a photograph of elongation in the long-axis of the specimen parent material during testing.

Figure 40. Elongation of Parent Material.

The maximum load per unit width achieved for each specimen coupon is presented below in Table 2, Maximum Load Results.

Table 2. Maximum Load Results.

Fuel Tank	Specimen ID	Nominal Width *(in.)*	Maximum Load Per Unit Width *(lbs/in.)*	Failure Location
Plymouth – New	DN1	1.0	528	parent material
	DN3	1.0	552	parent material
	DN4	1.0	683	parent material
Plymouth – Old	DO1	1.0	515	parent material
	DO2	1.0	630	parent material
	DO4	1.0	573	parent material
Jeep – New	JN1	1.0	664	parent material
	JN2	1.0	744	parent material
	JN3	1.0	706	parent material
Jeep – Old	JO1	1.0	450	parent material
	JO2	1.0	536	parent material
	JO3	1.0	532	parent material

The typical maximum load per unit width versus displacement diagram is presented below in Figure 41.

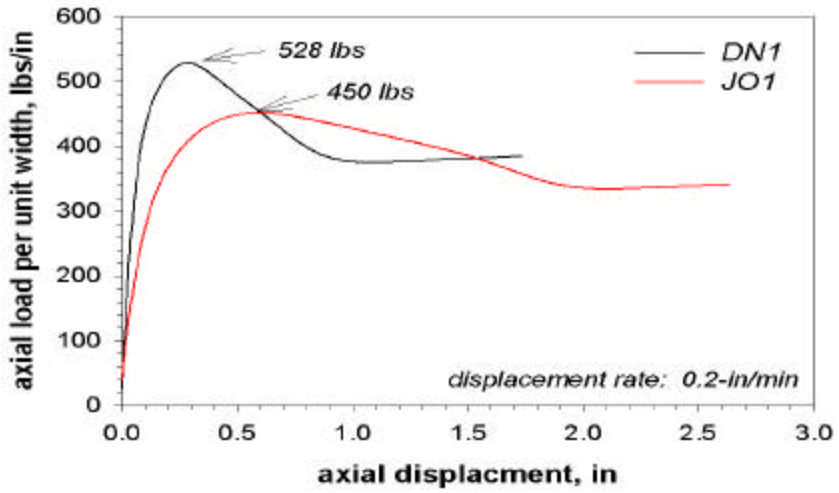


Figure 41. Typical Axial Load Per Unit Width Versus Displacement Diagram.

Table 3 listed below is a summary table of all of the fire resistance evaluations conducted for MVFRI between December 18, 2002 and May 20, 2003.

Table 3. Fire Resistance Test Summary.

Test	Date	Conditioned or New Tank	Vehicle Status	Total Exposure Time (min:sec)	Extended Exposure Time (min:sec)	Test Termination
SCP1	12/18/02	Conditioned	Original	3:39	1:39	Normal Failure Termination
SNP1	12/18/02	New	Not Rebuilt	3:36	1:36	Normal Failure Termination
SNP2	12/19/02	New	Rebuilt: Quarter Panels Only	3:13	1:13	Non-Failure Termination
SNP3	12/19/02	New	Rebuilt: Quarter Panels Only	4:36	2:36	Extended Failure Termination
SNP4	4/28/03	New	Rebuilt: Quarter Panels, Door Fascias, Deck-Lid, Bumper Fascia	4:25	2:25	Extended Failure Termination
JCP1	12/18/02	Conditioned	Original	2:10	0:10	Normal Failure Termination
JNP1	12/19/02	New	Not Rebuilt	1:50	N/A	Normal Failure Termination
JNP2(S)	4/30/03	New	Rebuilt: Fuel Tank Skid Plate, Right/Left Exhaust Vents, Bumper Fascia, License Plate Housing	3:58	1:58	Extended Failure Termination
PCP1	12/19/02	Conditioned	Original	2:22	0:22	Normal Failure Termination
PNP1	1/2/03	New	Not Rebuilt	2:32	0:32	Normal Failure Termination
PNP2(S)	5/20/03	New	Rebuilt: Tank Shield Added	6:05[5]	4:05	Extended Failure Termination
CNP1	1/21/03	New (Plastic)	Original	5:45	3:45	Extended Failure Termination
CCM1	2/18/03	Conditioned (Metal)	Not Rebuilt	6:22	4:22	Extended Failure Termination

[5] At 2 min 21 sec from the start of the fuel tank fire exposure (or 21 sec into the extended fire exposure), leakage occurred through the drain hole of the 14-gauge thick heat shield and along the left perimeter side of the fuel tank and heat shield interface. The fire exposure continued until extended failure occurred at 6 min 5 sec.

6.0 SUMMARY AND DISCUSSION

The following information is based on results from the test described in the report.

Three different types and shapes of tank designs were considered for this program. The geometry and the location of the tank installed in the vehicle play an important part in the fire test results. A thin profile tank when installed in the middle underbody of a vehicle has good fire protection. Most of these tanks are installed in cars. The square profile tank when installed near the rear underbody of a vehicle has little fire protection. These tanks are typically installed on high clearance vehicles. A long profile tank typically narrow in shape and installed near the inside of the vehicle frame rail provides minimum fire protection. These tanks are typically installed in trucks and vans.

The test results from the comparison evaluation, between conditioned plastic fuel tanks and new fuel tanks, suggest that despite the aging condition of a plastic fuel tank, the integrity of the materials to resist fire exposure was maintained and not degraded. This is based on all fuel tanks except the one square fuel tank meeting the ECE R34.01, Annex 5, Section 5.0. "Resistance to Fire" requirement that states the test shall be considered satisfactory if no liquid fuel is leaking from the tank. This requirement is after the standard protocol of 2 min of fire exposure.

After the comparison testing, the thin profile tank design installed in a Saturn vehicle was selected for repeatability testing. For this discussion all Saturn test results are considered in two different categories due to the different termination times. Two different times of test terminations were used for these tests; terminate at the first sign of normal failure and terminate at extended failure. During extended failure test, the first sign of fuel leakage is difficult to detect; therefore, the time for normal termination versus extended termination is considered separately. One additional test was conducted that was terminated before failure.

The first and second tests under normal termination tests had termination times of 3 min 39 sec and 3 min 36 sec, respectively. The termination time of the test that was terminated before failure is 3 min 13 sec. This is an important data point to show the tanks perform well after 3 min 13 sec. The failure time difference for the first two normal termination tests is 3 sec.

The fourth and fifth tests under extended termination tests had termination times of 4 min 36 sec and 4 min 25 sec, respectively, having a difference in test time of 11 sec. Based on these observations, repeatability appears to be good and within approximately ± 10 sec. Due to the limited number of data points, a confidence level cannot be established. However, the repeatability estimate confirms the aforementioned conclusion that aging does not appear to have a significant effect on plastic fuel tank fire performance when tested as in this study.

The fire resistance evaluation also included comparison testing of plastic and metal fuel tanks in general accordance with ECE R34.01, Annex 5, Section 5.0. The duration of the fire exposure subjected to the plastic and metal fuel tank were similar, but each test was terminated due to different modes of failure. The fuel tank pressures were significantly different: the new 2000 Chevrolet Cavalier plastic fuel tank pressure reached 160 Pa (0.023 psi) at 7 min 05 sec into the test whereas the conditioned 1999 Chevrolet Cavalier metal fuel tank pressure reached 134 Kpa (19.4 psi) at 6 min 48 sec into the test. The significant difference between the tested plastic and metal tank is that the plastic fuel tank did not fail due to excessive pressures. The plastic fuel tank failed due to leaks and minimal venting whereas the metal tank developed excessive pressures and abruptly released large amounts of fuel vapors.

The Impact Resistance evaluations of new and conditioned fuel tanks pertaining to the Saturn, Plymouth Grand Voyager and the Jeep Grand Cherokee vehicles used in this program were conducted in general accordance with ECE R34.01, Annex 5, Section 1.0. Results of this evaluation indicated that despite the five energy level impacts of 30.1 Nm, 33.3 Nm, 36.6 Nm, 40.1 Nm and 43.6 Nm delivered to the right side corner of each new and conditioned tank at −40 °C, the tanks still resisted punctures and did not leak. Also, despite the two additional energy level impacts of 43.6 Nm and 147.2 Nm delivered to the left side corner of each new and conditioned tank at −40 °C, the tanks still resisted punctures and did not leak. As a result, no identifiable differences between the performances of new plastic fuel tanks and conditioned plastic fuel tanks were apparent.

The 30-ft Drop Evaluation of new and conditioned plastic fuel tanks pertaining to the Saturn, Plymouth Grand Voyager and the Jeep Grand Cherokee vehicles used in this program were conducted in general accordance with United States Department of Transportation (U.S. DOT) Code of Federal Regulations (CFR) 393.67, Section E "Drop Test." Even though the CFR 393.67 was meant to evaluate commercial motor carries fuel tanks and not automotive fuel tanks, it was used in this instance as a guideline to evaluate the performance of plastic fuel tanks when subjected to a sever drop. As a result, the conditioned 2000 Plymouth Grand Voyager fuel tank and the conditioned 1998 Jeep Grand Cherokee fuel tank leaked and failed the test due to pinch-off seperations[6] resulting from the severe drop.

Since the drop tests indicated there could possibly be an issue of bond strength weakness at the pinch-off locations of the conditioned 2000 Plymouth Grand Voyager fuel tank and the conditioned 1998 Jeep Grand Cherokee fuel tank, tensile tests were conducted in general accordance with ASTM D 638-00, "Standard Test Method for Tensile Properties of Plastics." Results of this evaluation indicated that failure for all specimen coupons was attributed to elongation in the long-axis of the specimen's parent material and not from the bond at the pinch-off location. Alternative test methods should be considered or developed to evaluate the bond strength at the pinch-off location under conditions more representative of the dynamics of the drop test, for example to evaluate the effect of shear stresses.

[6] Failure at end-seams along edges of a plastic fuel tank resulting from a blow molding process.

APPENDIX A

PHOTOGRAPHIC DOCUMENTATION

Report Figures

Fire Resistance Evaluation

Fire Resistance Repeatability Evaluation

Chevrolet Cavalier Fire Resistance Evaluation (Plastic Versus Metal)

Impact Resistance Evaluation

Drop Evaluation

(Consisting of 131 Pages)

Report Figures

Figure A-1. Thin Profile Tank.

Figure A-2. Square Tank.

Figure A-3. Long Tank.

Figure A-4. Saturn Test Setup.

Figure A-5. Jeep Test Setup.

Figure A-6. Plymouth Test Setup.

Figure A-7. Chevrolet Test Setup.

Figure A-8. Test SCP1 After Exposure.

Figure A-9. Test SNP1 After Exposure.

Figure A-10. Test SNP2 After Exposure.

Figure A-11. Test SNP3 After Exposure.

Figure A-12. Test SNP4 After Exposure.

Figure A-13. Test JCP1 After Exposure.

Figure A-14. Test JNP1 After Exposure.

Figure A-15. Test JNP2(S) Before Exposure Without Skid-Plate.

Figure A-16. Test JNP2(S) Before Exposure With Skid-Plate.

Figure A-17. Test JNP2(S) After Exposure With Skid-Plate.

Figure A-18. Test JNP2(S) After Exposure Without Skid-Plate.

Figure A-19. Test PCP1 After Exposure.

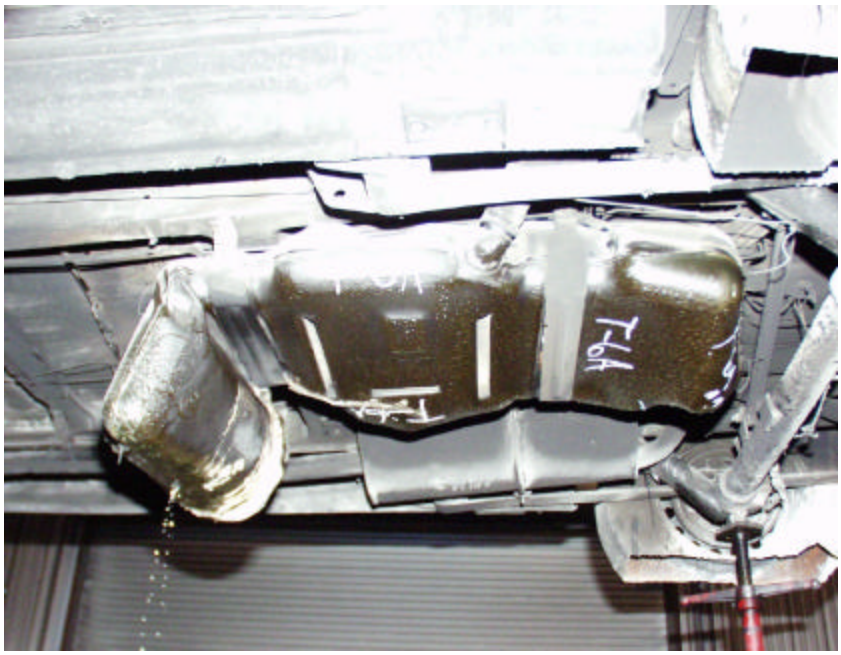


Figure A-20. Test PNP1 After Exposure.

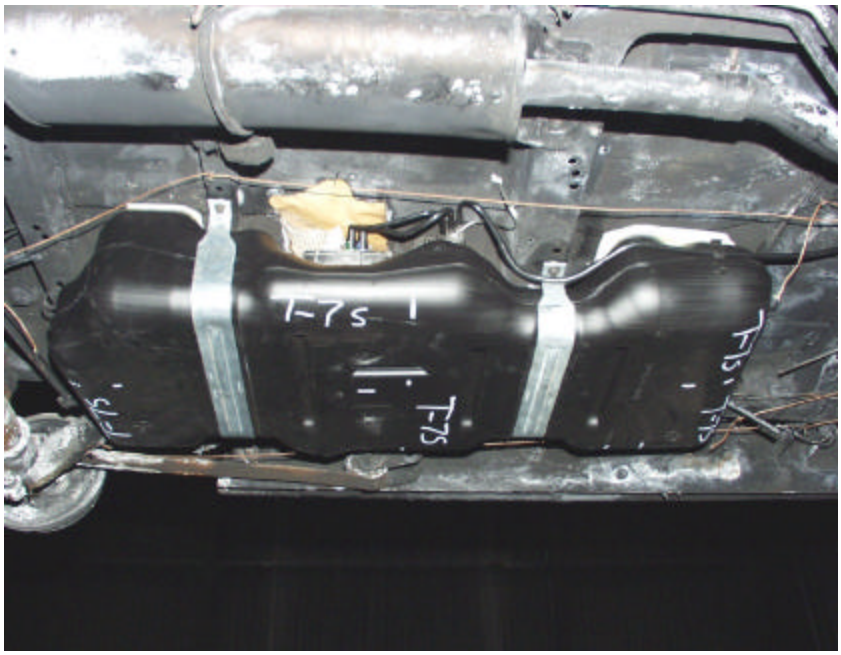


Figure A-21. Test PNP2(S) Before Exposure Without Fuel Tank Shield.

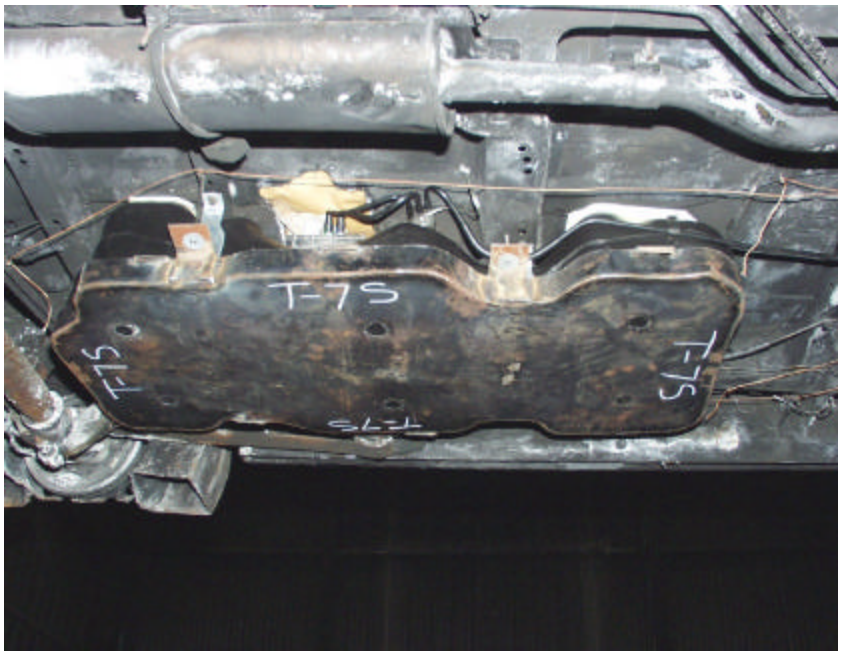


Figure A-22. Test PNP2(S) Before Exposure With Fuel Tank Shield.

Figure A-23. Test PNP2(S) After Exposure With Tank Shield.

Figure A-24. Test PNP2(S) After Exposure Without Shield.

Figure A-25. New Plastic Fuel Tank After Exposure.

Figure A-26. Conditioned Metal Fuel Tank After Exposure.

Figure A-27. Impact Resistance Test Setup.

Figure A-28. New Plymouth Plastic Fuel Tank After Impact.

Figure A-29. Drop Test Setup.

Figure A-30. Leakage of New Plymouth Plastic Fuel Tank After Impact.

Figure A-31. Leakage of Conditioned Plymouth Plastic Fuel Tank After Impact.

Figure A-32. External View of Plymouth Tank Pinch-Off Section.

Figure A-33. Internal View of Plymouth Tank Pinch-Off Section.

Figure A-34. External View of Jeep Tank Pinch-Off Section.

Figure A-35. Internal View of Jeep Tank Pinch-Off Section.

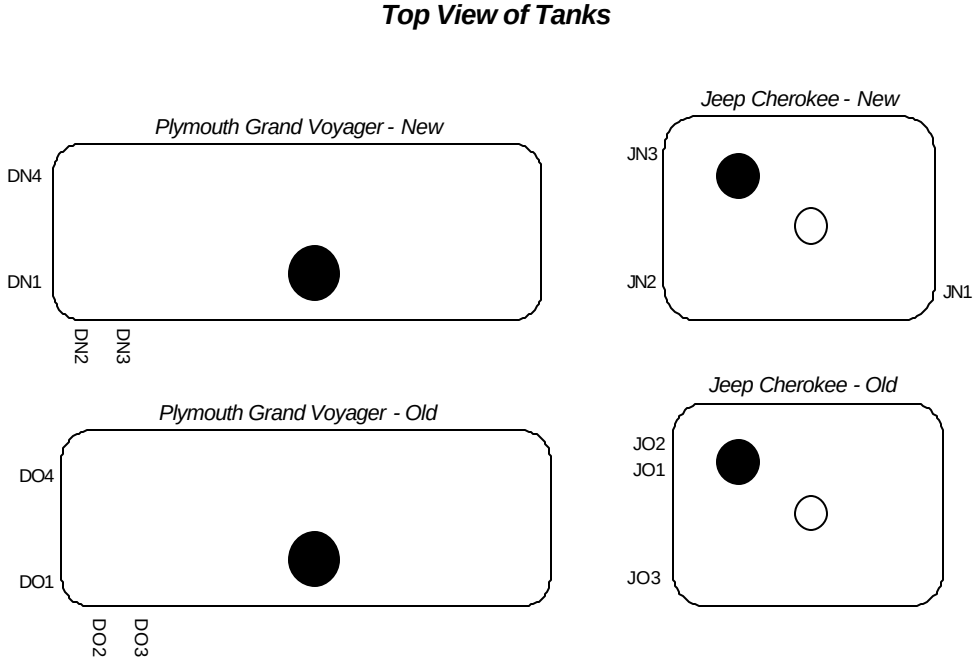


Figure A-36. Tensile Test Extraction Layout.

Figure A-37. Typical Tensile Test Specimen Coupon.

Figure A-38. Thickest Region at Pinch-Off Location.

Figure A-39. Typical Tensile Test Setup.

Figure A-40. Elongation of Parent Material.

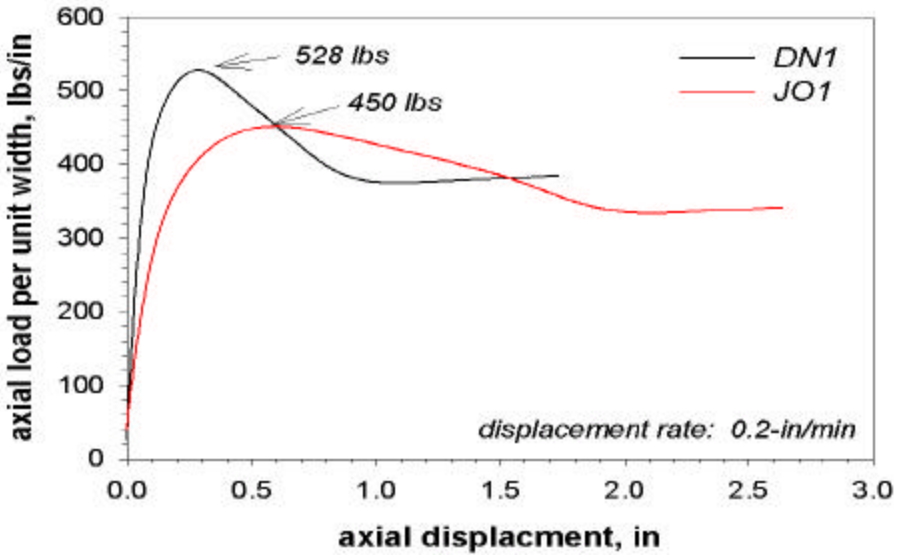


Figure A-41. Typical Axial Load Per Unit Width Versus Displacement Diagram.

Fire Resistance Evaluation

Figure A-42. Conditioned 1998 Saturn Twin Cam 4-Door Fuel Tank Assembly.

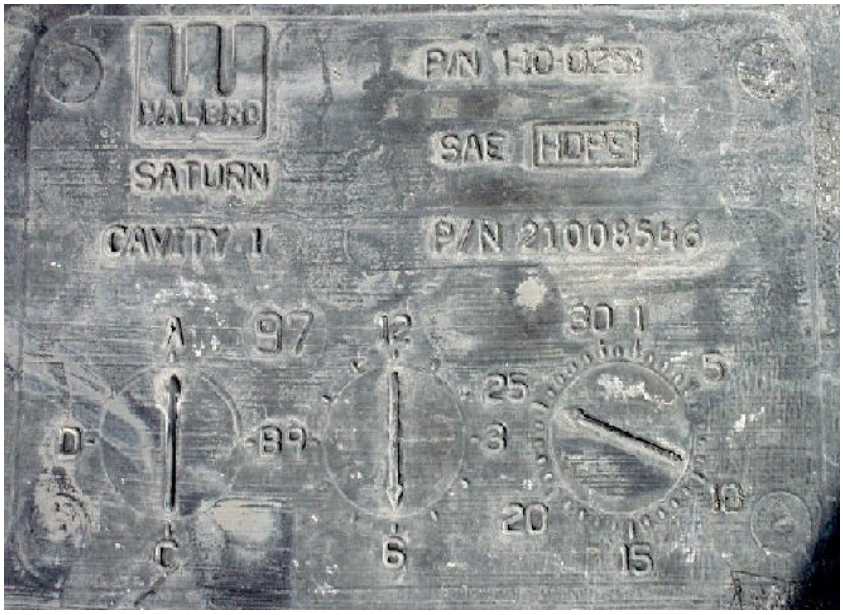


Figure A-43. WALBRO Manufacturer Imprint on Bottom Side of Conditioned 1998 Saturn Twin Cam 4-Door Twin Fuel Tank.

Figure A-44. 1998 Saturn Twin Cam 4-Door Test Setup.

Figure A-45. Test No. 1, Conditioned 1998 Saturn Twin Cam 4-Door Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-46. Test No. 1, Conditioned 1998 Saturn Twin Cam 4-Door Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-47. Test No. 1, Conditioned 1998 Saturn Twin Cam 4-Door Fuel Tank Immediately After Fire Exposure.

Figure A-48. Test No. 1, Conditioned 1998 Saturn Twin Cam 4-Door Fuel Tank Immediately After Fire Exposure.

Figure A-49. Test No. 1, Top View of Conditioned 1998 Saturn Twin Cam 4-Door Fuel Tank After Fire Exposure.

Figure A-50. Test No. 1, Bottom View of Conditioned 1998 Saturn Twin Cam 4-Door Fuel Tank After Fire Exposure.

Figure A-51. Test No. 1, Fire Exposure Hole at Rear Left Side Bottom Corner of Conditioned 1998 Saturn Twin Cam 4-Door Fuel Tank.

Figure A-52. New 1998 Saturn Twin Cam 4-Door Fuel Tank Assembly.

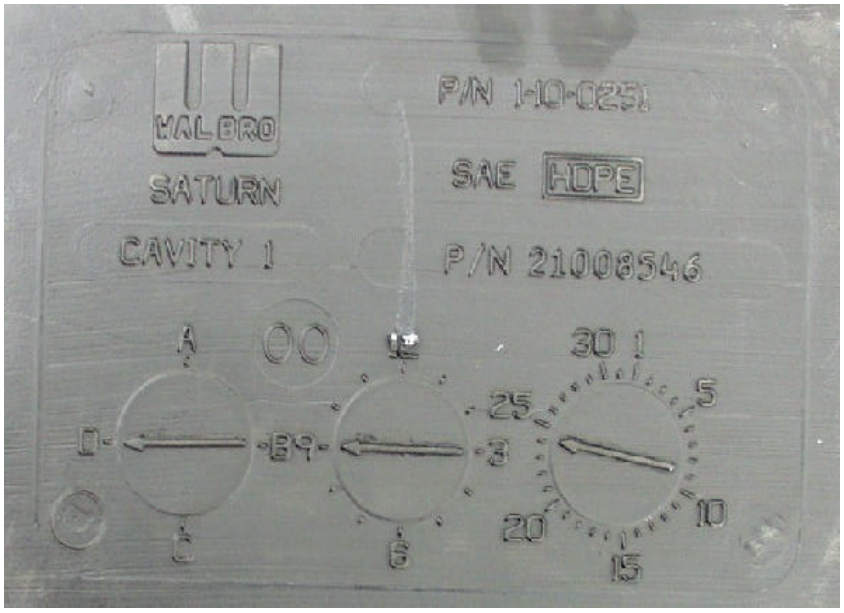


Figure A-53. WALBRO Manufacturer Imprint on Bottom Side of New 1998 Saturn Twin Cam 4-Door Fuel Tank.

Figure A-54. Test No. 2, New 1998 Saturn Twin Cam 4-Door Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-55. Test No. 2, New 1998 Saturn Twin Cam 4-Door Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-56. Test No. 2, New 1998 Saturn Twin Cam 4-Door Fuel Tank Immediately After Fire Exposure.

Figure A-57. Test No. 2, New 1998 Saturn Twin Cam 4-Door Fuel Tank Immediately After Fire Exposure.

Figure A-58. Test No. 2, Top View of New 1998 Saturn Twin Cam 4-Door Fuel Tank After Fire Exposure.

Figure A-59. Test No. 2, Bottom View of New 1998 Saturn Twin Cam 4-Door Fuel Tank After Fire Exposure.

Figure A-60. Test No. 2, Fire Exposure Hole at Front Left Side Bottom Corner of New 1998 Saturn Twin Cam 4-Door Fuel Tank.

Fire Resistance Repeatability Evaluation

Figure A-61. New 1998 Saturn Twin Cam 4-Door Fuel Tank Assembly.

Figure A-62. New 1998 Saturn Twin Cam 4-Door Repeatability Test Setup, Test Nos. 1 and 2.

Figure A-63. Test No. 1, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank Mounted in the Test Platform Prior to Testing.

Figure A-64. Test No. 1, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-65. Test No. 1, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank with No Leaks; Classified as a Non-Failed Test.

Figure A-66. Test No. 1, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank with No Leaks; Classified as a Non-Failed Test.

Figure A-67. Test No. 1, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank with No Leaks, Top View; Classified as a Non-Failed Test.

Figure A-68. Test No. 1, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank with No Leaks, Bottom View; Classified as a Non-Failed Test.

Figure A-69. Test No. 2, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank Mounted in the Test Platform Prior to Testing.

Figure A-70. Test No. 2, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank Mounted in the Test Platform Prior to Testing.

Figure A-71. Test No. 2, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank Immediately After Fire Exposure with a Leak on Rear Passenger Side Corner of Fuel Tank.

Figure A-72. Test No. 2, Repeatability Evaluation on a New Twin Cam 4-Door Fuel Tank Immediately After Fire Exposure with a Leak on Rear Passenger Side Corner of Fuel Tank.

Figure A-73. Test No. 2, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank Immediately After Fire Exposure with a Leak on Rear Passenger Side Corner of Fuel Tank.

Figure A-74. Test No. 2, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank Immediately After Fire Exposure with Leak on Rear Passenger Side Corner of Fuel Tank.

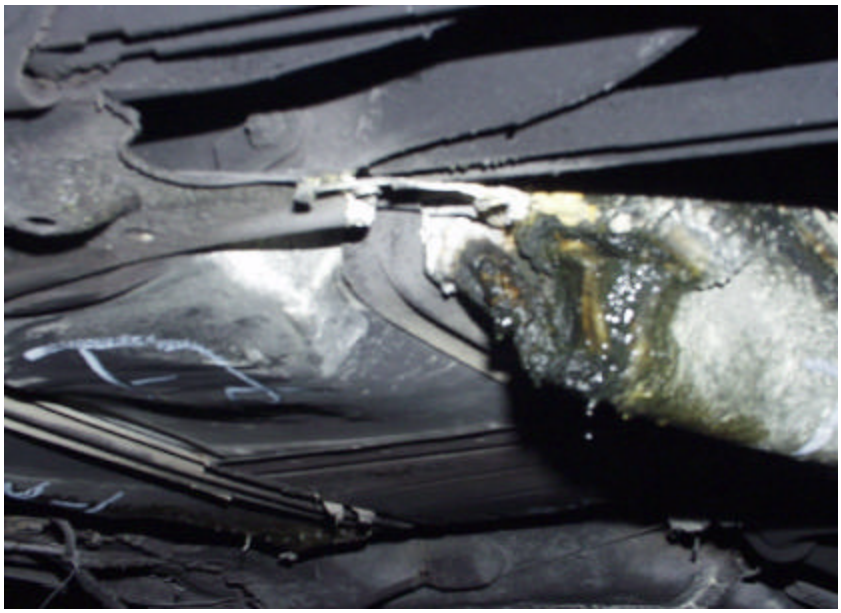


Figure A-75. Test No. 2, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank Immediately After Fire Exposure with Leak on Rear Passenger Side Corner of Fuel Tank.

Figure A-76. Test No. 2, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank After Fire Exposure, Top View.

Figure A-77. Test No. 2, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank After Fire Exposure, Bottom View.

Figure A-78. New 1998 Saturn Twin Cam 4-Door Fuel Tank Assembly.

Figure A-79. 1998 Saturn Twin Cam 4-Door Repeatability Test Setup, Test No. 3.

Figure A-80. Test No. 3, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank Assembly Mounted in the Test Platform Prior to Testing.

Figure A-81. Test No. 3, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank Assembly Mounted in Test Platform Prior to Testing.

Figure A-82. Test No. 3, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank Immediately After Fire Exposure with a Leak at Front Left Passenger Side Bottom Corner.

Figure A-83. Test No. 3, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank Immediately After Fire Exposure with a Leak at Front Left Passenger Side Bottom Corner and Rear Left Passenger Side of Fuel Tank.

Figure A-84. Test No. 3, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank After Fire Exposure, Top View.

Figure A-85. Test No. 3, Repeatability Evaluation on a New 1998 Saturn Twin Cam 4-Door Fuel Tank After Fire Exposure, Bottom View.

Figure A-86. Test No. 3, New 1998 Saturn Twin Cam 4-Door Fuel Tank Post-Test Observation at Front Left Passenger Side Bottom Corner of Fuel Tank.

Figure A-87. Test No. 3, New 1998 Saturn Twin Cam 4-Door Fuel Tank Post-Test Observation at Front Left Passenger Side Bottom Corner of Fuel Tank.

Figure A-88. Test No. 3, Saturn Twin Cam 4-Door Fuel Tank Post-Test Observation at Rear Left Passenger Side of Fuel Tank.

Figure A-89. Conditioned 1998 Jeep Grand Cherokee Fuel Tank Assembly.

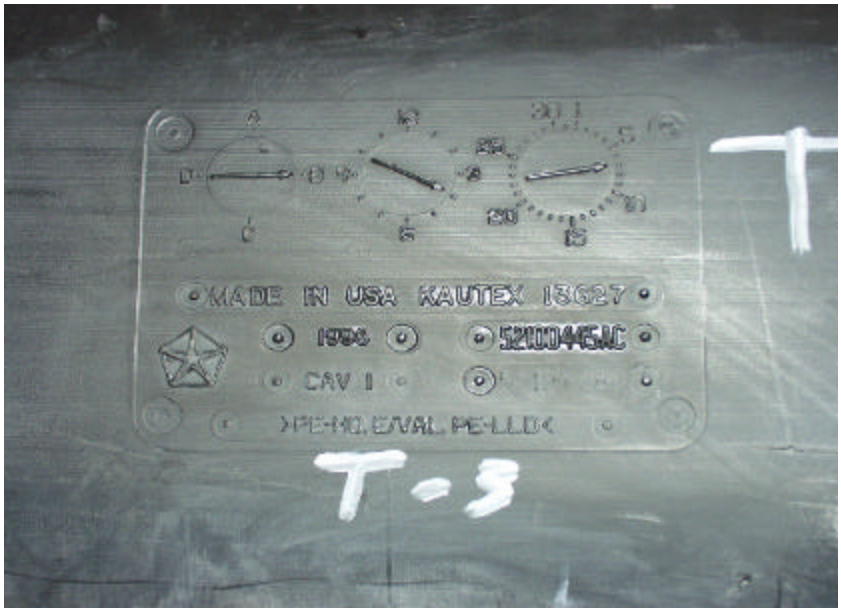


Figure A-90. KAUTEX Manufacturer Imprint on Bottom Side of Conditioned 1998 Jeep Grand Cherokee Fuel Tank.

Figure A-91. 1998 Jeep Grand Cherokee Test Setup.

Figure A-92. Test No. 3, Conditioned 1998 Jeep Grand Cherokee Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-93. Test No. 3, Conditioned 1998 Jeep Grand Cherokee Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-94. Test No. 3, Conditioned 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Leak at Front Right Side Along Outboard Side of Strap.

Figure A-95. Test No. 3, Conditioned 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Leak at Front Right Side Along Outboard Side of Strap.

Figure A-96. Test No. 3, Conditioned 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Leak at Front Right Side Along Outboard Side of Strap.

Figure A-97. Test No. 3, Top View of Conditioned 1998 Jeep Grand Cherokee Fuel Tank After Fire Exposure.

Figure A-98. Test No. 3, Bottom View of Conditioned 1998 Jeep Grand Cherokee Fuel Tank After Fire Exposure.

Figure A-99. Test No. 3, Fire Exposure Hole at Front Right Side Along Outside of Strap of Conditioned 1998 Jeep Grand Cherokee Fuel Tank.

Figure A-100. Test No. 3, Fire Exposure Hole at Front Right Side Top Corner of Conditioned 1998 Jeep Grand Cherokee Fuel Tank.

Figure A-101. New 1998 Jeep Grand Cherokee Fuel Tank Assembly.

Figure A-102. KAUTEX Manufacturer Imprint on Bottom Side of New 1998 Jeep Grand Cherokee Fuel Tank.

Figure A-103. Test No. 4, New 1998 Jeep Grand Cherokee Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-104. Test No. 4, New 198 Jeep Grand Cherokee Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-105. Test No. 4, New 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Leak at Front Right Side Bottom of Fuel Tank.

Figure A-106. Test No. 4, New 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Leak at Front Right Side Bottom of Fuel Tank.

Figure A-107. Test No. 4, New 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Leak at Front Right Side Bottom of Fuel Tank.

Figure A-108. Test No. 4, Top View of New 1998 Jeep Grand Cherokee Fuel Tank After Fire Exposure.

Figure A-109. Test No. 4, Bottom View of New 1998 Jeep Grand Cherokee Fuel Tank After Fire Exposure.

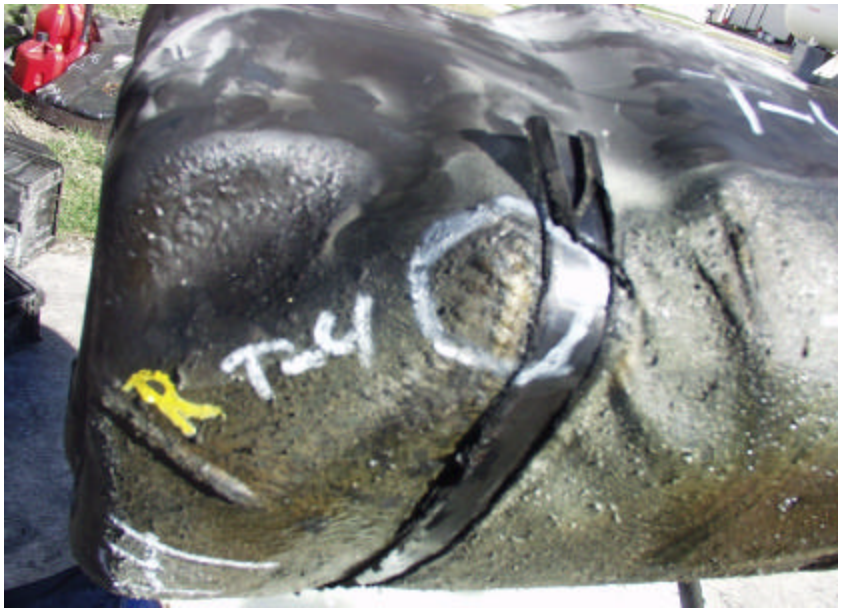


Figure A-110. Test No. 4, Fire Exposure Hole at Front Right Side Bottom Outboard Side of Strap of New 1998 Jeep Grand Cherokee Fuel Tank.

Figure A-111. New 1998 Jeep Grand Cherokee Fuel Tank Assembly.

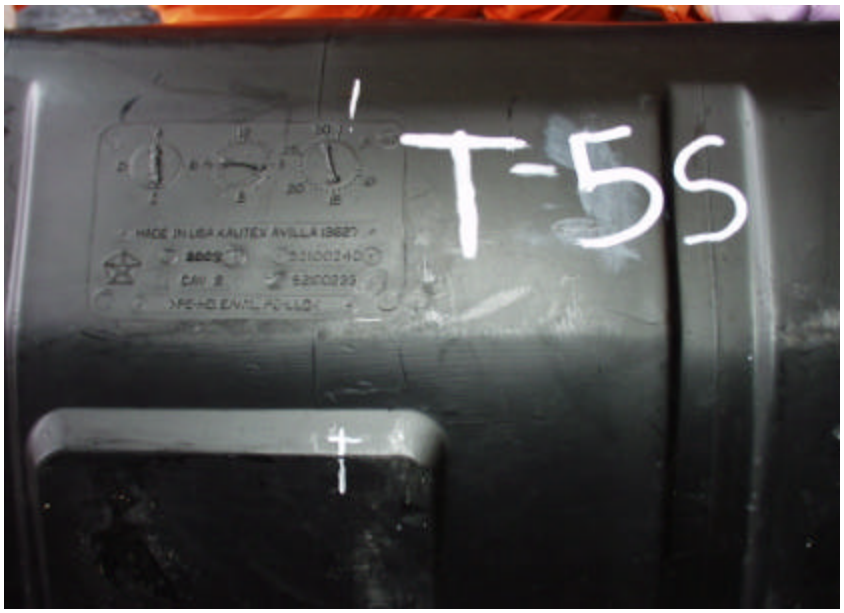


Figure A-112. KAUTEX Manufacturer Imprint on Bottom Side of New 1998 Jeep Grand Cherokee Fuel Tank.

Figure A-113. Test No. 5S, 1998 Jeep Grand Cherokee Test Setup.

Figure A-114. Test No. 5S, New 1998 Jeep Grand Cherokee Fuel Tank Mounted in Test Platform Prior to Heat Shield and Testing.

Figure A-115. Test No. 5S, New 1998 Jeep Grand Cherokee Fuel Tank Mounted in Test Platform with Heat Shield, Prior to Testing.

Figure A-116. Test No. 5S, New 1998 Jeep Grand Cherokee Fuel Tank Mounted in Test Platform with Heat Shield, Prior to Testing.

Figure A-117. Test No. 5S, New 1998 Jeep Grand Cherokee Fuel Tank Mounted in Test Platform with Heat Shield, Prior to Testing.

Figure A-118. Test No. 5S, New 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Heat Shield and Leak Location at Rear of Tank.

Figure A-119. Test No. 5S, New 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Heat Shield and Leak Location at Rear of Tank.

Figure A-120. Test No. 5S, New 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Heat Shield and Leak Location at Rear Middle of Tank.

Figure A-121. Test No. 5S, New 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Heat Shield Removed and Leak Location at Rear Left Corner and Rear Middle of Tank.

Figure A-122. Test No. 5S, New 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Heat Shield Removed and Leak Location at Rear Left Corner and Rear Middle of Tank.

Figure A-123. Test No. 5S, New 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Heat Shield Removed and Leak Location at Rear Left Corner and Rear Middle of Tank.

Figure A-124. Test No. 5S, New 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Heat Shield Removed and Leak Location at Rear of Tank.

Figure A-125. Test No. 5S, New 1998 Jeep Grand Cherokee Fuel Tank Immediately After Fire Exposure with Leak Location at Front Right Corner of Tank due to Exhaust Shield.

Figure A-126. Test No. 5S, Top View of New 1998 Jeep Grand Cherokee Fuel Tank After Fire Exposure.

Figure A-127. Test No. 5S, Bottom View of New 1998 Jeep Grand Cherokee Fuel Tank After Fire Exposure.

Figure A-128. Test No. 5S, Post-Test Observation of New 1998 Jeep Grand Cherokee Fuel Tank Leak Locations at Rear of Tank.

Figure A-129. Test No. 5S, Post-Test Observation of Rear of 1998 Jeep Grand Cherokee Vehicle.

Figure A-130. Test No. 5S, Post-Test Observation of 1998 Jeep Grand Cherokee Lift Gate Strut Support That Vented Loudly During the Test.

Figure A-131. Test No. 5S, Post-Test Observation of 1998 Jeep Grand Cherokee Lift Gate Strut Support That Vented Loudly During the Test.

Figure A-132. Conditioned 1998 Plymouth Grand Voyager Fuel Tank Assembly.

Figure A-133. Bottom Side of Conditioned 1998 Plymouth Grand Voyager Fuel Tank.

Figure A-134. DaimlerChrysler Manufacturer Imprint on Bottom Side of Conditioned 1998 Plymouth Grand Voyager Fuel Tank.

Figure A-135. 1998 Plymouth Grand Voyager Test Setup.

Figure A-136. Test No. 5, Conditioned 1998 Plymouth Grand Voyager Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-137. Test No. 5, Conditioned 1998 Plymouth Grand Voyager Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-138. Test No. 5, Conditioned 1998 Plymouth Grand Voyager Fuel Tank Immediately After Fire Exposure with Leak at Front Right Bottom Corner of Fuel Tank.

Figure A-139. Test No. 5 Conditioned 1998 Plymouth Grand Voyager Fuel Tank Immediately After Fire Exposure with Leak at Front Right Bottom Corner of Fuel Tank.

Figure A-140. Test No. 5, Top View of Conditioned 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure.

Figure A-141. Test No. 5, Bottom View of Conditioned 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure.

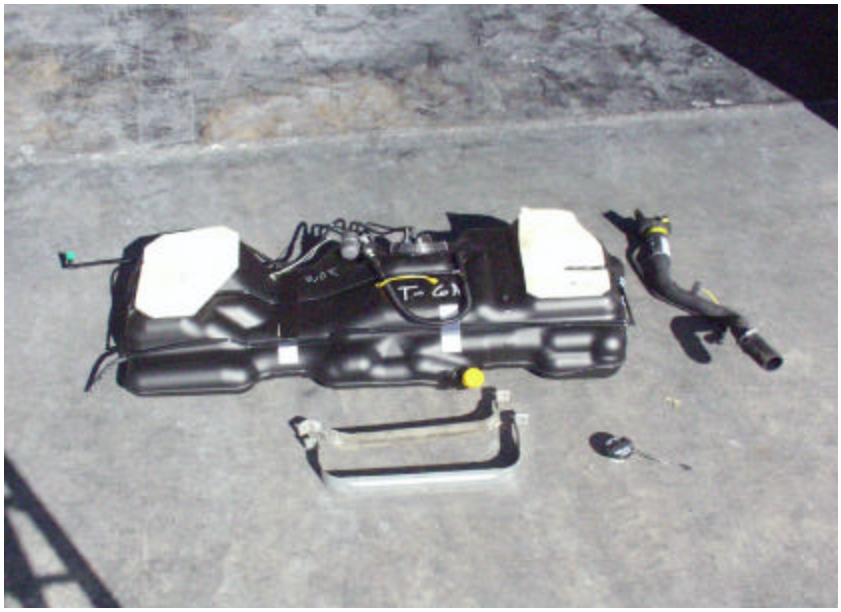


Figure A-142. New 1998 Plymouth Grand Voyager Fuel Tank Assembly.

Figure A-143. Bottom Side of New 1998 Plymouth Grand Voyager Fuel Tank Assembly.

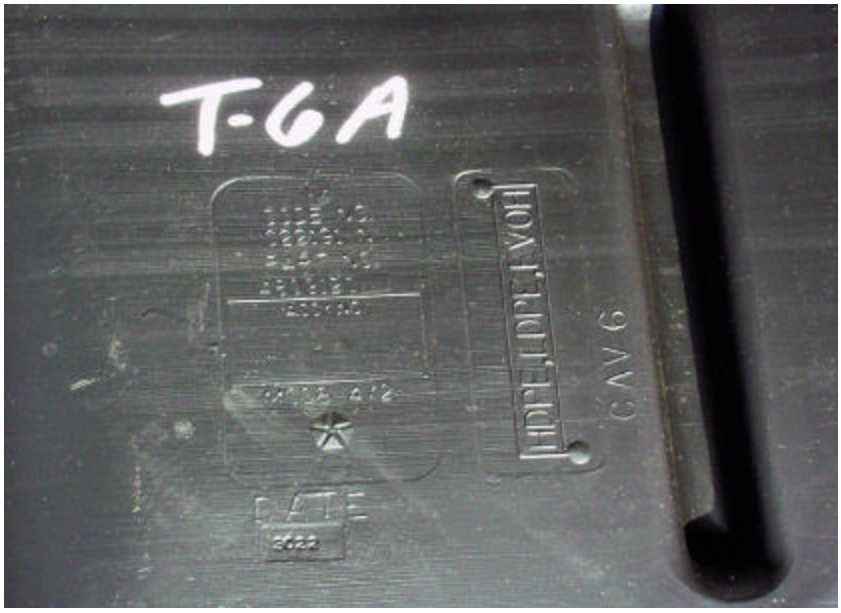


Figure A-144. DaimlerChrysler Manufacturer Imprint on Bottom Side of New 1998 Plymouth Grand Voyager Fuel Tank.

Figure A-145. Test No. 6A, New 1998 Plymouth Grand Voyager Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-146. Test No. 6A, New 1998 Plymouth Grand Voyager Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-147. Test No. 6A, New 1998 Plymouth Grand Voyager Fuel Tank Immediately After Fire Exposure with Leak at Front Strap and Front Top Side of Fuel Tank.

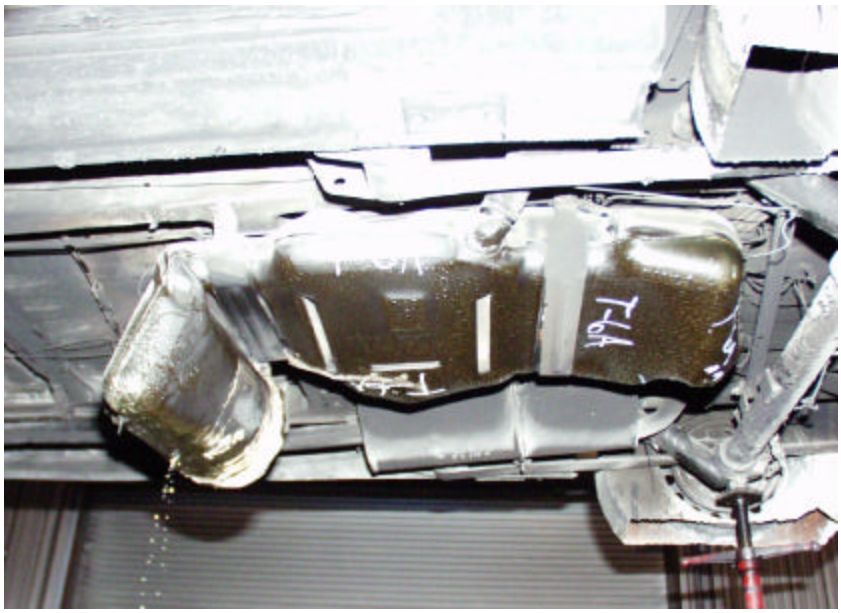


Figure A-148. Test No. 6A, New 1998 Plymouth Grand Voyager Fuel Tank Immediately After Fire Exposure with Leak at Front Strap and Front Top Side of Fuel Tank.

Figure A-149. Test No. 6A, Top View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure.

Figure A-150. Test No. 6A, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure.

Figure A-151. Test No. 6A, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure at Front Strap Leak Location.

Figure A-152. Test No. 6A, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure at Front Strap Leak Location.

Figure A-153. Test No. 6A, Front Top View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure at Leak Location.

Figure A-154. Test No. 6A, Top Front View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure at Leak Location.

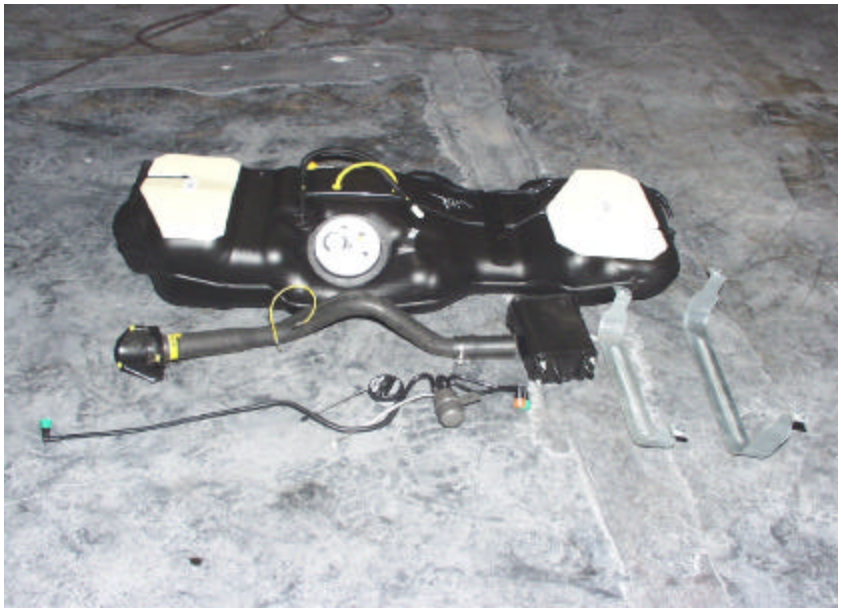


Figure A-155. New 1998 Plymouth Grand Voyager Fuel Tank Assembly.

Figure A-156. DaimlerChrysler Manufacturer Imprint on Bottom Side of New 1998 Plymouth Grand Voyager Fuel Tank.

Figure A-157. 1998 Plymouth Grand Voyager Test Setup.

Figure A-158. Test No. 7S, Bottom Side of New 1998 Plymouth Grand Voyager Fuel Tank Assembly Without Bottom Heat Shield, Prior to Test.

Figure A-159. Test No. 7S, Bottom Side of New 1998 Plymouth Grand Voyager Fuel Tank Assembly Without Bottom Heat Shield, Prior to Test.

Figure A-160. Test No. 7S, Bottom Side of New 1998 Plymouth Grand Voyager Fuel Tank Assembly Without Bottom Heat Shield, Prior to Test.

Figure A-161. Test No. 7S, Bottom Side of New 1998 Plymouth Grand Voyager Fuel Tank Assembly With Bottom Heat Shield, Prior to Test.

Figure A-162. Test No. 7S, Bottom Side of New 1998 Plymouth Grand Voyager Fuel Tank Assembly With Bottom Heat Shield, Prior to Test.

Figure A-163. Test No. 7S, Bottom Side of New 1998 Plymouth Grand Voyager Fuel Tank Assembly With Bottom Heat Shield, Prior to Test.

Figure A-164. Test No. 7S, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank With Heat Shield After Fire Exposure With Leak Location at Front Side and Middle Drain Holes.

Figure A-165. Test No. 7S, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank With Heat Shield After Fire Exposure With Leak Location at Front Side and Middle Drain Holes.

Figure A-166. Test No. 7S, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank With Heat Shield After Fire Exposure With Leak Location at Front Side and Middle Drain Holes.

Figure A-167. Test No. 7S, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank With Heat Shield After Fire Exposure With Leak Location at Front Side and Middle Drain Holes.

Figure A-168. Test No. 7S, Bottom View Indicating How New 1998 Plymouth Grand Voyager Plastic Fuel Tank Melted Down Into the Heat Shield After Fire Exposure.

Figure A-169. Test No. 7S, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank With Heat Shield Removed After Fire Exposure.

Figure A-170. Test No. 7S, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank With Heat Shield Removed After Fire Exposure.

Figure A-171. Test No. 7S, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank With Heat Shield Removed After Fire Exposure.

Figure A-172. Test No. 7S, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank With Heat Shield Removed After Fire Exposure With Leak Location at Front Driver Side Corner of Fuel Tank.

Figure A-173. Test No. 7S, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank With Heat Shield Removed After Fire Exposure With Leak Location at Front Driver Side Corner of Fuel Tank.

Figure A-174. Test No. 7S, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank With Heat Shield Removed After Fire Exposure With Leak Location at Front Bottom Passenger Side of Fuel Tank.

Figure A-175. Test No. 7S, Top View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure With Leak Location at Rear Corner and Rear Top Driver Side of Fuel Tank.

Figure A-176. Test No. 7S, Top View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure With Leak Location at Rear Corner Driver Side of Fuel Tank.

Figure A-177. Test No. 7S, Top Front View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure.

Figure A-178. Test No. 7S, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure With Leak Location at Front Bottom Passenger Side of Fuel Tank.

Figure A-179. Test No. 7S, Bottom View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure With Leak Location at Front Bottom Passenger Side of Fuel Tank.

Figure A-180. Test No. 7S, Top View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure With Leak Location at Sending Unit of Fuel Tank.

Figure A-181. Test No. 7S, Top View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure With Leak Location at Top Driver Side of Fuel Tank.

Figure A-182. Test No. 7S, Top View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure With Leak Location at Rear Corner Passenger Side of Fuel Tank.

Figure A-183. Test No. 7S, Top View of New 1998 Plymouth Grand Voyager Fuel Tank After Fire Exposure With Leak Location at Rear Corner Passenger Side of Fuel Tank.

Chevrolet Cavalier Fire Resistance Evaluation
(Plastic Versus Metal)

Figure A-184. New 2000 Chevrolet Cavalier Plastic Fuel Tank Assembly.

Figure A-185. 1999 Chevrolet Cavalier Test Setup.

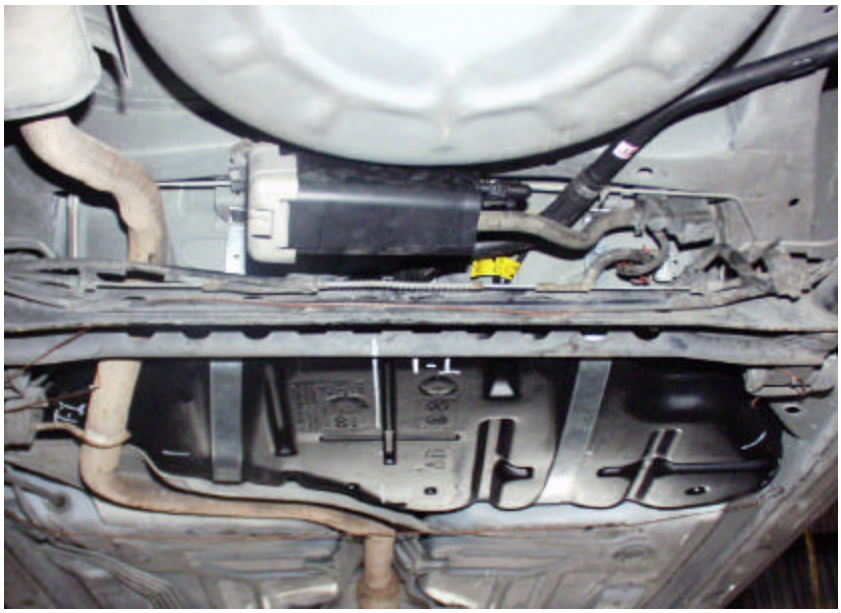


Figure A-186. Test No. 1 (January 21, 2003), New 2000 Chevrolet Cavalier Plastic Fuel Tank Mounted in Test Platform Prior to Testing.

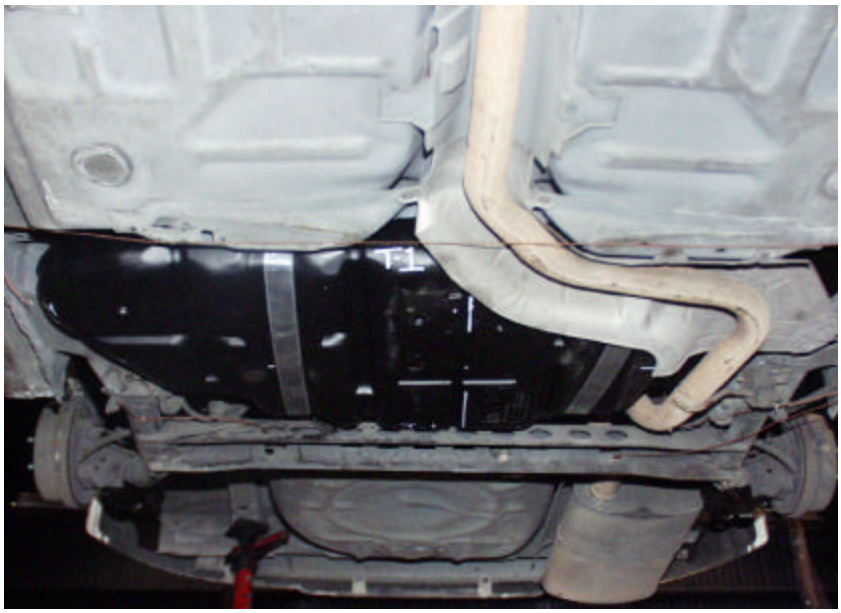


Figure A-187. Test No. 1 (January 21, 2003), New 2000 Chevrolet Cavalier Plastic Fuel Tank Mounted in Test Platform Prior to Testing.

Figure A-188. Test No. 1 (January 21, 2003), New 2000 Chevrolet Cavalier Plastic Fuel Tank Immediately After Fire Exposure with Passenger Side of Fuel Tank Sagging.

Figure A-189. Test No. 1 (January 21, 2003), New 2000 Chevrolet Cavalier Plastic Fuel Tank Immediately After Fire Exposure with Passenger Side Fuel Tank Sagging.

Figure A-190. Test No. 1 (January 21, 2003), Top View of New 2000 Chevrolet Cavalier Plastic Fuel Tank After Fire Exposure.

Figure A-191. Test No. 1 (January 21, 2003), Bottom View of New 2000 Chevrolet Cavalier Plastic Fuel Tank After Fire Exposure.

Figure A-192. Test No. 1 (January 21, 2003), Front Side View of New 2000 Chevrolet Cavalier Plastic Fuel Tank After Fire Exposure.

Figure A-193. Test No. 1 (January 21, 2003), Driver Side Fire Exposure Hole, Rear Topside of New 2000 Chevrolet Cavalier Plastic Fuel Tank.

Figure A-194. Test No. 1 (January 21, 2003), Passenger Side Fire Exposure Hole, Rear Topside of New 2000 Chevrolet Cavalier Plastic Fuel Tank.

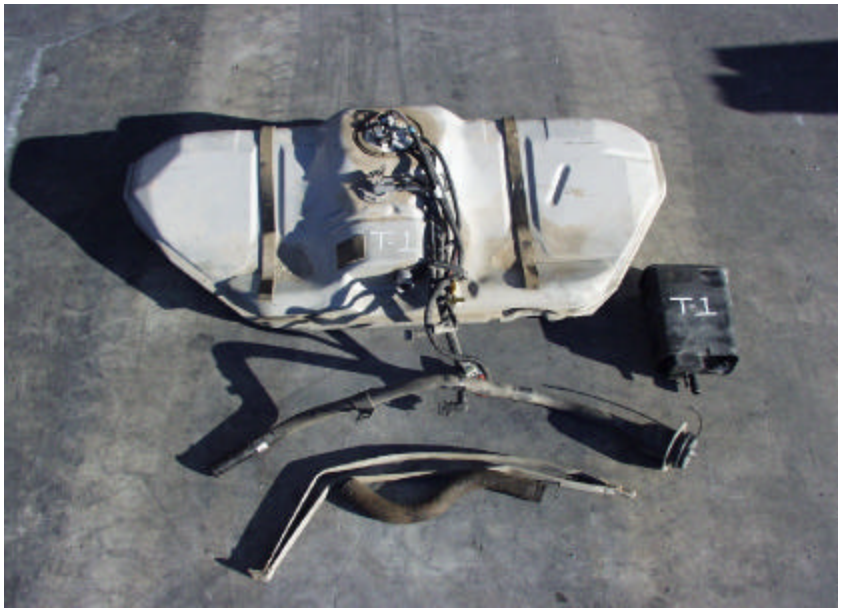


Figure A-195. Conditioned 1999 Chevrolet Cavalier Metal Fuel Tank Assembly.

Figure A-196. Test No. 1 (February 18, 2003), Conditioned 1999 Chevrolet Cavalier Metal Fuel Tank Assembly Mounted in Test Platform Prior to Testing.

Figure A-197. Test No. 1 (February 18, 2003), Conditioned 1999 Chevrolet Cavalier Metal Fuel Tank Assembly Mounted in Test Platform Prior to Testing.

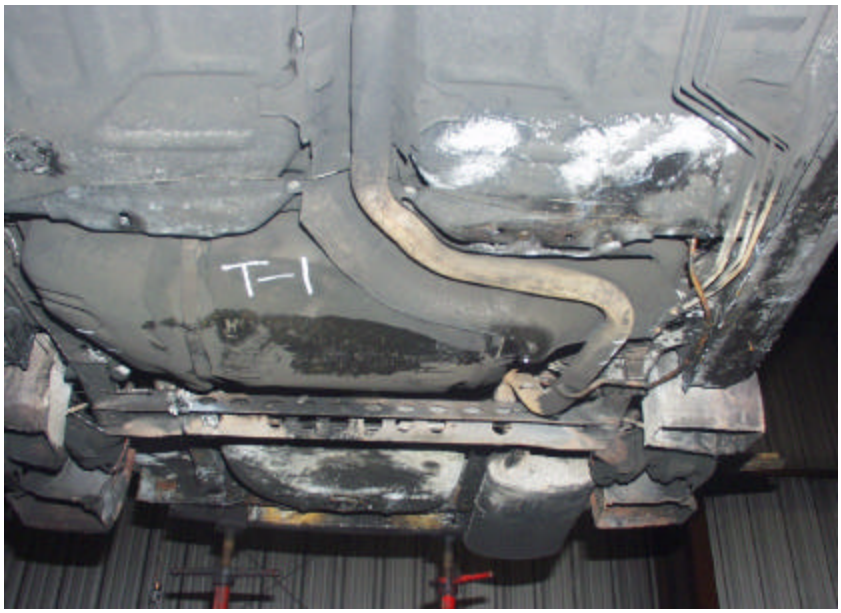


Figure A-198. Test No. 1 (February 18, 2003), Conditioned 1999 Chevrolet Cavalier Metal Fuel Tank Immediately After Fire Exposure.

Figure A-199. Test No. 1 (February 18, 2003), Conditioned 1999 Chevrolet Cavalier Metal Fuel Tank Immediately After Fire Exposure.

Figure A-200. Test No 1, (February 18, 2003), Top View of Conditioned 1999 Chevrolet Cavalier Metal Fuel Tank After Fire Exposure.

Figure A-201. Test No. 1 ((February 18, 2003), Bottom View of Conditioned 1999 Chevrolet Cavalier Metal Fuel Tank After Fire Exposure.

Impact Resistance Evaluation

Figure A-202. Impact Resistance –40°C ± 2°C Conditioning Chamber Connected to 180-lb Bottles of Liquid Nitrogen.

Figure A-203. Impact Resistance Saturn Fuel Tank After Being Conditioned to a –40°C ± 2°C.

Figure A-204. Front Passenger Side of the Conditioned 1998 Saturn Twin Cam 4-Door Fuel Tank Prior to Impact.

Figure A-205. No Leaks to the Front Passenger Side of the Conditioned 1999 Saturn Twin Cam 4-Door Fuel Tank After Five Impacts Ranging Between 30.1 Nm to 43.6 Nm.

Figure A-206. No Leaks to the Front Driver Side of the Conditioned 1999 Saturn Twin Cam 4-Door Fuel Tank After Two Impacts Ranging Between 43.6 Nm and 147.2 Nm.

Figure A-207. Front Passenger Side of the New 1998 Saturn Twin Cam 4-Door Fuel Tank Prior to Impact.

Figure A-208. No Leaks to the Front Passenger Side of the New 1998 Saturn Twin Cam 4-Door Fuel Tank After Five Impacts Ranging Between 30.1 Nm to 43.6 Nm.

Figure A-209. Front Driver Side of the New 1998 Saturn Twin Cam 4-Door Fuel Tank Prior to Impact.

Figure A-210. No Leaks to the Front Driver Side of the New 1998 Saturn Twin Cam 4-Door Fuel Tank After Two Impacts Ranging Between 43.6 Nm and 147.2 Nm.

Figure A-211. Front Passenger Side of the Conditioned 1998 Jeep Grand Cherokee Fuel Tank Prior to Impact.

Figure A-212. No Leaks to the Front Passenger Side of the Conditioned 1998 Jeep Grand Cherokee Fuel Tank After Five Impacts Ranging Between 30.1 Nm to 43.6 Nm.

Figure A-213. Front Driver Side of the Conditioned 1998 Jeep Grand Cherokee Fuel Tank Prior to Impact.

Figure A-214. No Leaks to the Front Driver Side of the Conditioned 1998 Jeep Grand Cherokee Fuel Tank After Two Impacts Ranging Between 43.6 Nm and 147.2 Nm.

Figure A-215. Front Passenger Side of the New 1998 Jeep Grand Cherokee Fuel Tank Prior to Impact.

Figure A-216. No Leaks to the Front Passenger Side of the New 1998 Jeep Grand Cherokee Fuel Tank After Five Impacts Ranging Between 30.1 Nm to 43.6 Nm.

Figure A-217. No Leaks to the Front Driver Side of the New 1998 Jeep Grand Cherokee Fuel Tank After Two Impacts Ranging Between 43.6 Nm and 147.2 Nm.

Figure A-218. Front Passenger Side of a 1998 Plymouth Grand Voyager Fuel Tank Prior to Impact.

Figure A-219. No Leaks to the Front Passenger Side of the New 1998 Plymouth Grand Voyager Fuel Tank After Five Impacts Ranging Between 30.1 Nm to 43.6 Nm.

Figure A-220. No Leaks to the Front Driver Side of the New 1998 Plymouth Grand Voyager Fuel Tank After Two Impacts Ranging Between 43.6 Nm and 147.2 Nm.

Figure A-221. Front Passenger Side of Conditioned 1998 Plymouth Grand Voyager Fuel Tank Prior to Impact.

Figure A-222. No Leaks to the Front Passenger Side of the Conditioned 1998 Plymouth Grand Voyager Fuel Tank After Five Impacts Ranging Between 30.1 Nm to 43.6 Nm.

Figure A-223. Front Driver Side of Conditioned 1998 Plymouth Grand Voyager Fuel Tank Prior to Impact.

Figure A-224. No Leaks to the Front Driver Side of the Conditioned 1998 Plymouth Grand Voyager Fuel Tank After Two Impacts Ranging Between 43.6 Nm and 147.2 Nm.

Drop Test Evaluation

Figure A-225. The Conditioned 2001 Saturn Fuel Tank Filled with 9.05 Gallons of Ethylene Glycol Water Mixture (Equal to 12.2 Gallons of Gasoline) Prior to 30-ft Drop Test on Front Passenger Side Corner.

Figure A-226. The Conditioned 2001 Saturn Fuel Tank at 30-ft Elevation.

Figure A-227. No Leaks on the Front Passenger Side of the Conditioned 2001 Saturn Fuel Tank After the 30-ft Drop Test.

Figure A-228. The New 1998 Saturn Fuel Tank Filled with 9.05 Gallons of Ethylene Glycol Water Mixture (Equal to 12.2 Gallons of Gasoline) Prior to 30-ft Drop Test on Front Passenger Side Corner.

Figure A-229. The New 1998 Saturn Fuel Tank at 30-ft Elevation.

Figure A-230. No Leaks on the Front Passenger Side Corner of the New 1998 Saturn Fuel Tank After the 30-ft Drop Test.

Figure A-231. The Conditioned 2000 Plymouth Grand Voyager Fuel Tank Filled with 14.83 Gallons of Ethylene Glycol Water Mixture (Equal to 20 Gallons of Gasoline) Prior to 30-ft Drop Test of the Front Passenger Side Corner.

Figure A-232. The Conditioned 2000 Plymouth Grand Voyager Fuel Tank at 30-ft Elevation.

Figure A-233. Leak Rate of 149.98 oz/min of Ethylene-Glycol Water Mixture Due to Pinch-Off Separation at Front Strap Location of the 2000 Plymouth Grand Voyager Fuel Tank After the 30-ft Drop Test.

Figure A-234. The New 1998 Plymouth Grand Voyager Fuel Tank Filled with 14.83 Gallons of Ethylene Glycol Water Mixture (Equal to 20 Gallons of Gasoline) Prior to 30-ft Drop Test on the Front Passenger Side Corner.

Figure A-235. The New 1998 Plymouth Grand Voyager Fuel Tank at 30-ft Elevation.

Figure A-236. No Leaks on Front Passenger Side Corner of the New 1998 Plymouth Grand Voyager Fuel Tank After the 30-ft Drop Test.

Figure A-237. The New 1998 Jeep Grand Cherokee Fuel Tank Filled with 17.05 Gallons of Ethylene Glycol Water Mixture (Equal to 23 Gallons of Gasoline) Prior to 30-ft Drop Test on the Front Passenger Side Corner.

Figure A-238. The New 1998 Jeep Grand Cherokee Fuel Tank at 30-ft Elevation.

Figure A-239. No Leaks on Front Passenger Side Corner of the New 1998 Jeep Grand Cherokee Fuel Tank After the 30-ft Drop Test.

Figure A-240. The Conditioned 1998 Jeep Grand Cherokee Fuel Tank Filled with 17.05 Gallons of Ethylene Glycol Water Mixture (Equal to 23 Gallons of Gasoline) Prior to 30-ft Drop Test on the Front Passenger Side Corner.

Figure A-241. The Conditioned 1998 Jeep Grand Cherokee Fuel Tank During 30-ft Drop.

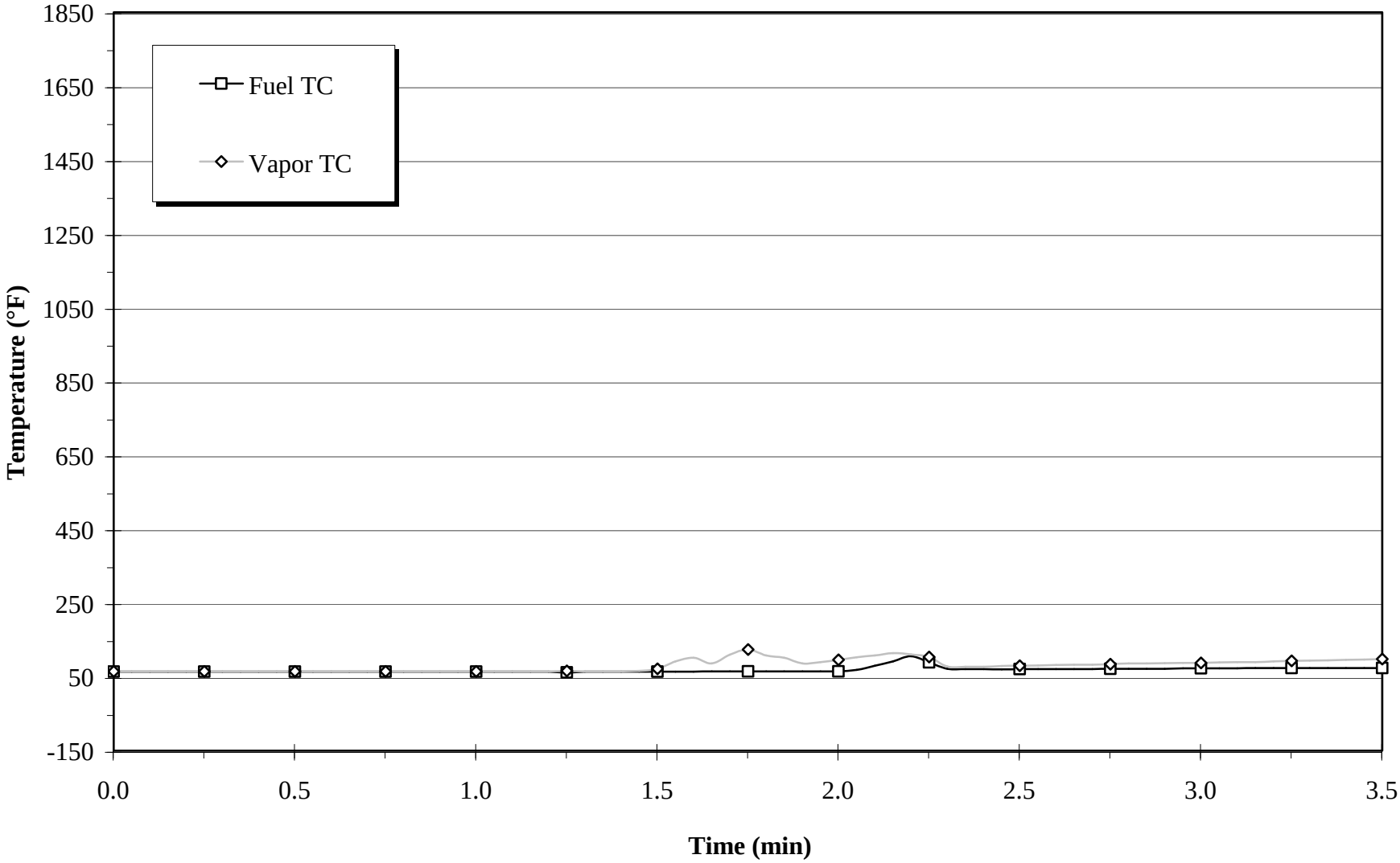
Figure A-242. Leak Due to Pinch-Off Separation of the Conditioned 1998 Jeep Grand Cherokee Fuel Tank After the 30-ft Drop Test.

Figure A-243. Leak Rate of 899.49 oz/min of Ethylene-Glycol Water Mixture Due to Pinch-Off Separation at the Front of the Conditioned 1998 Jeep Grand Cherokee Fuel Tank After the 30-ft Drop Test.

APPENDIX B
TEST DATA
(Consisting of 70 Pages)

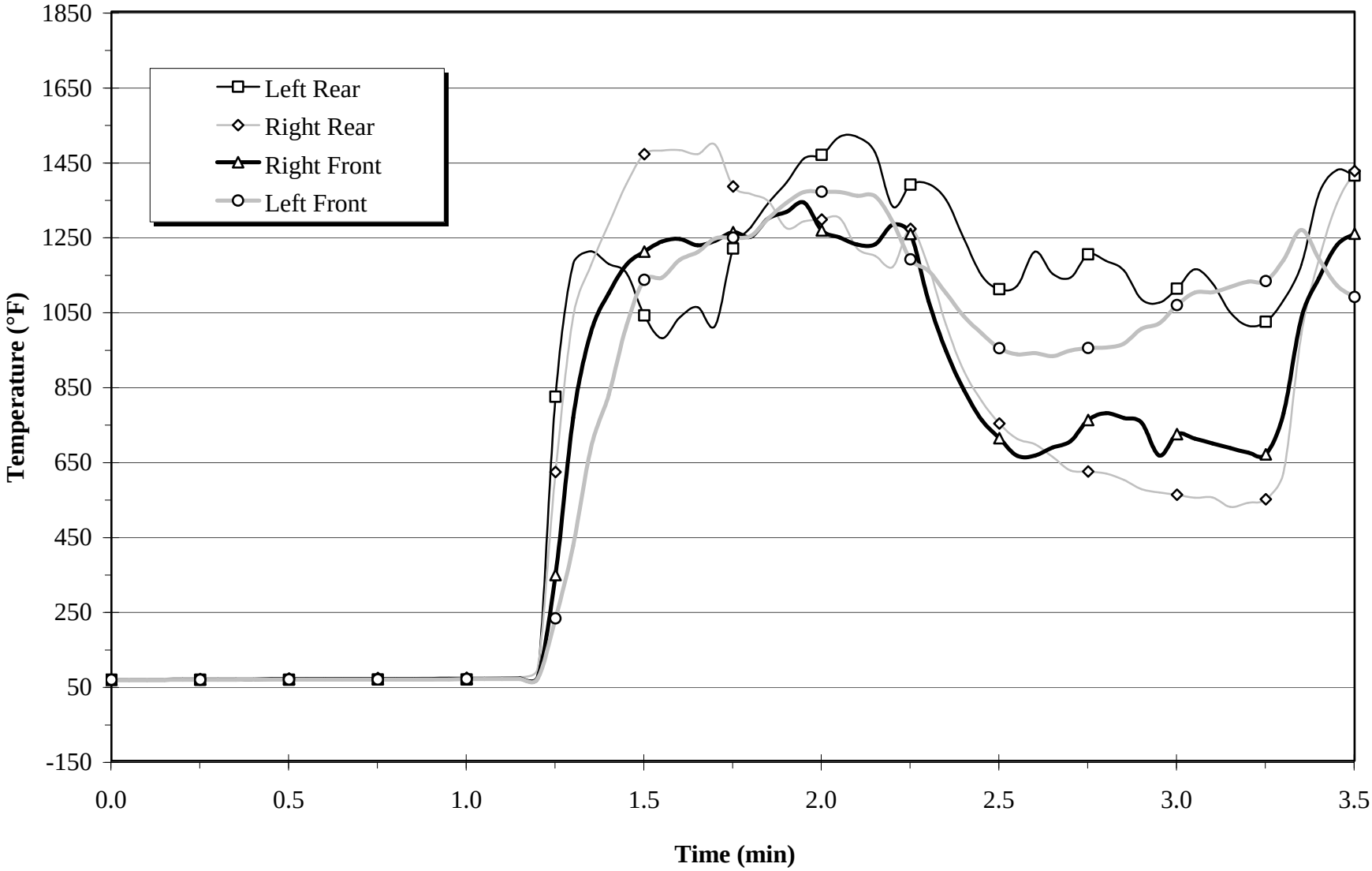
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 18 December 2002
File: 352MVF1.DAT

TEST SCP1: Conditioned 1998 Saturn Twin Cam 4-Door Fuel Tank Test No. 1 - Internal Tank Temperatures



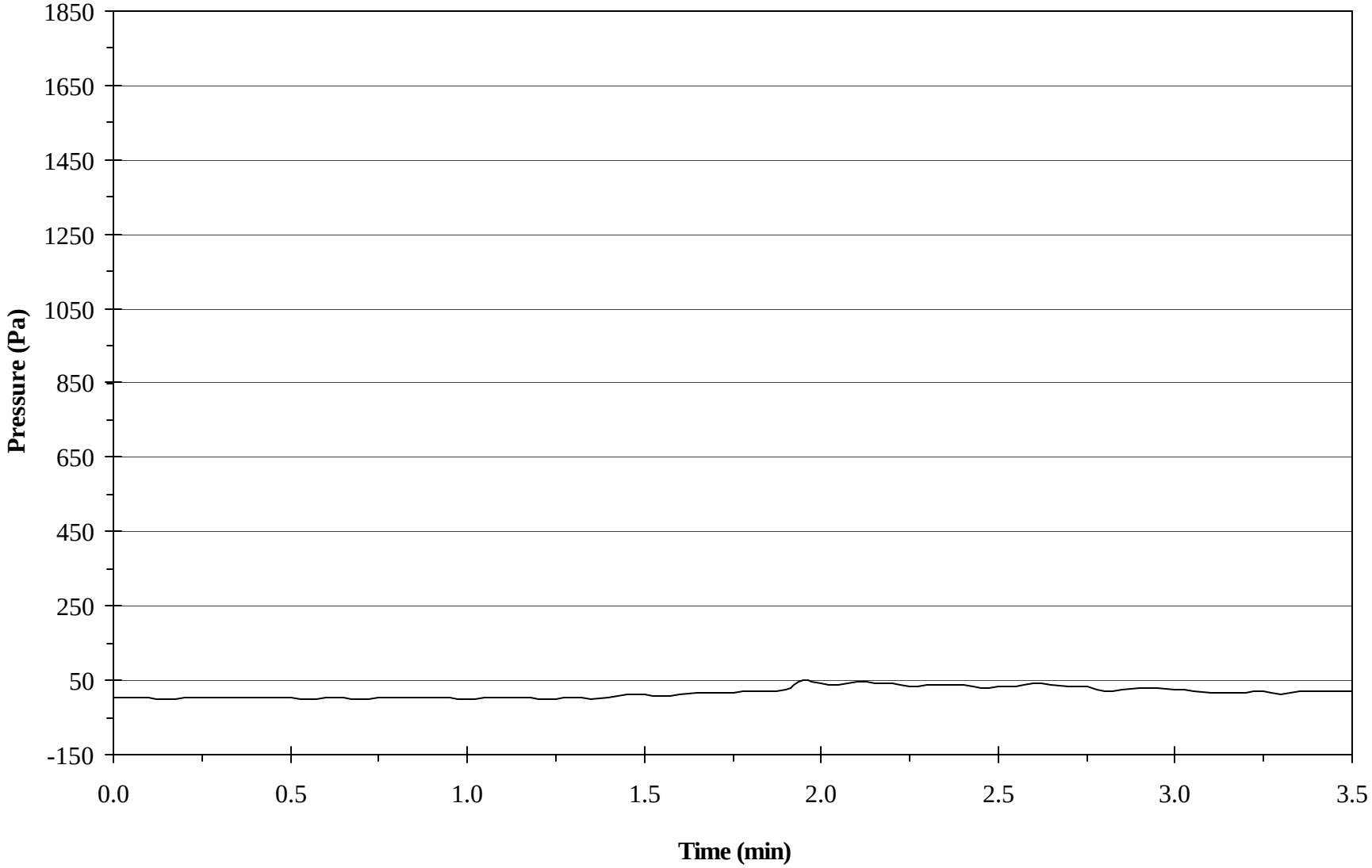
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 18 December 2002
File: 352MVF1.DAT

TEST SCP1: Conditioned 1998 Saturn Twin Cam 4-Door Fuel Tank Test No. 1 - Flame Temperatures



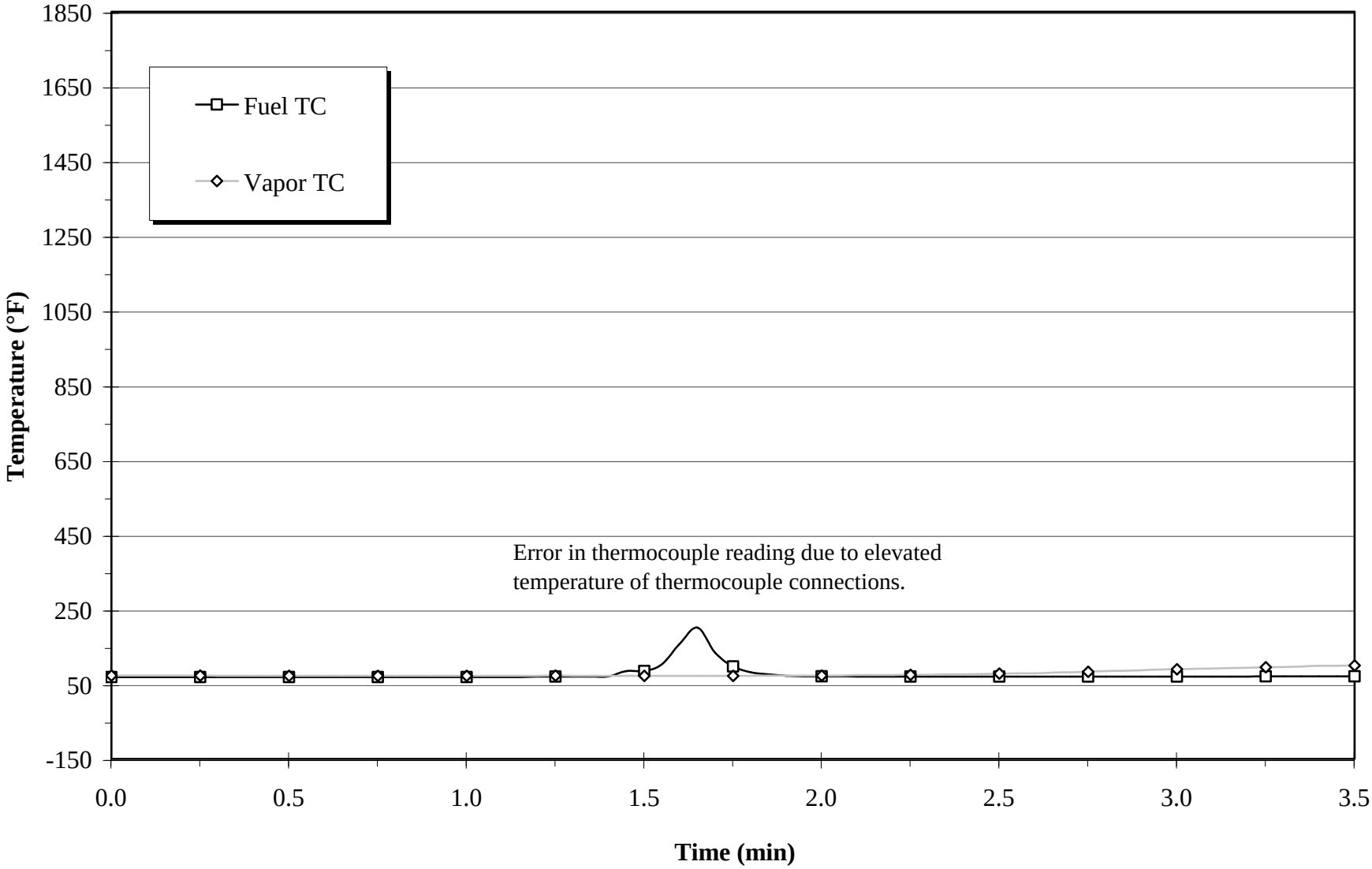
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 18 December 2002
File: 352MVF1.DAT

TEST SCP1: Conditioned 1998 Saturn Twin Cam 4-Door Fuel Tank Test No. 1 - Tank Pressure



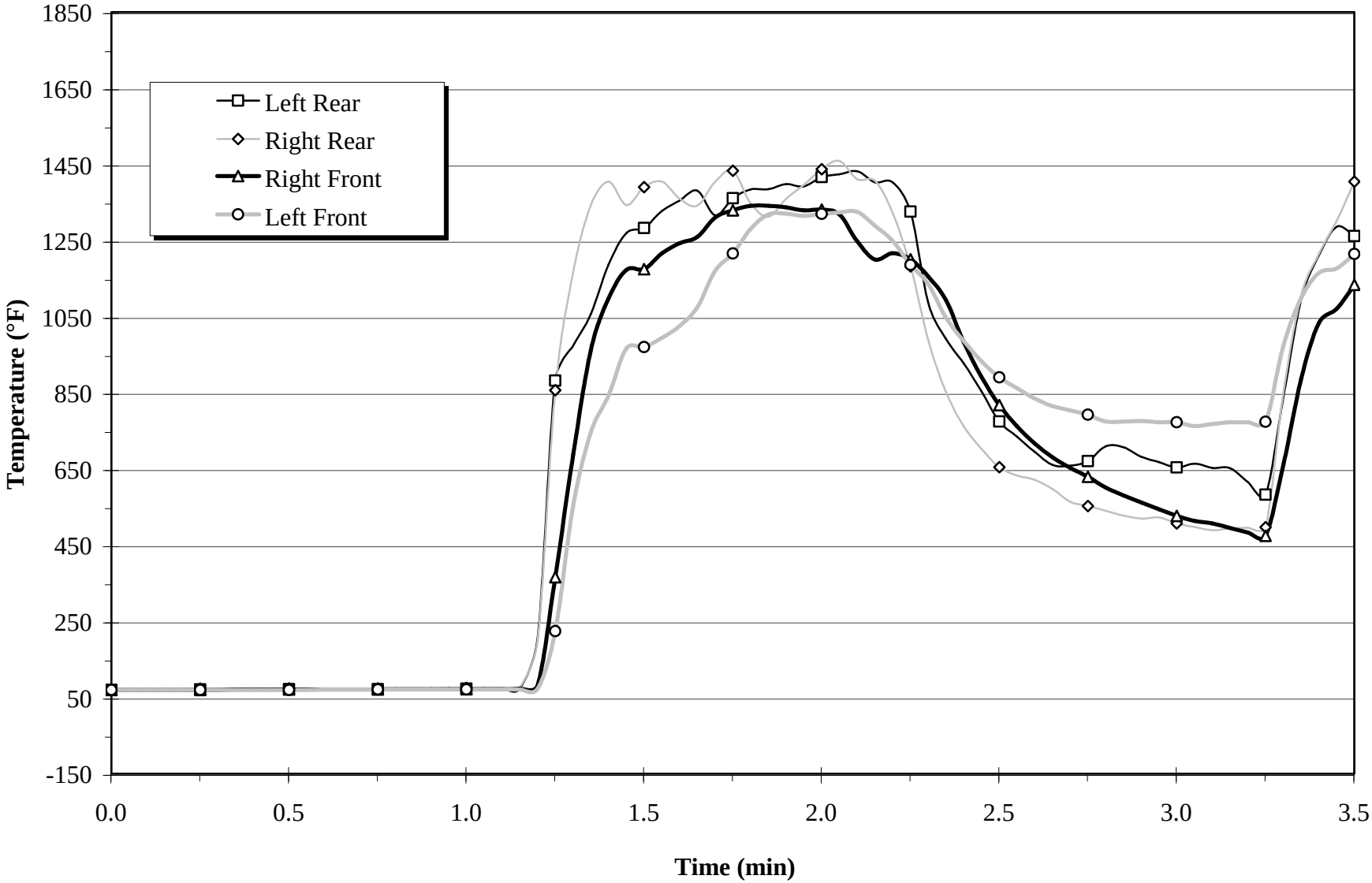
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 18 December 2002
File: 352MVF2.DAT

Test SNP1: New 1998 Saturn Twin Cam 4-Door Fuel Tank Test No. 2 - Internal Tank Temperatures



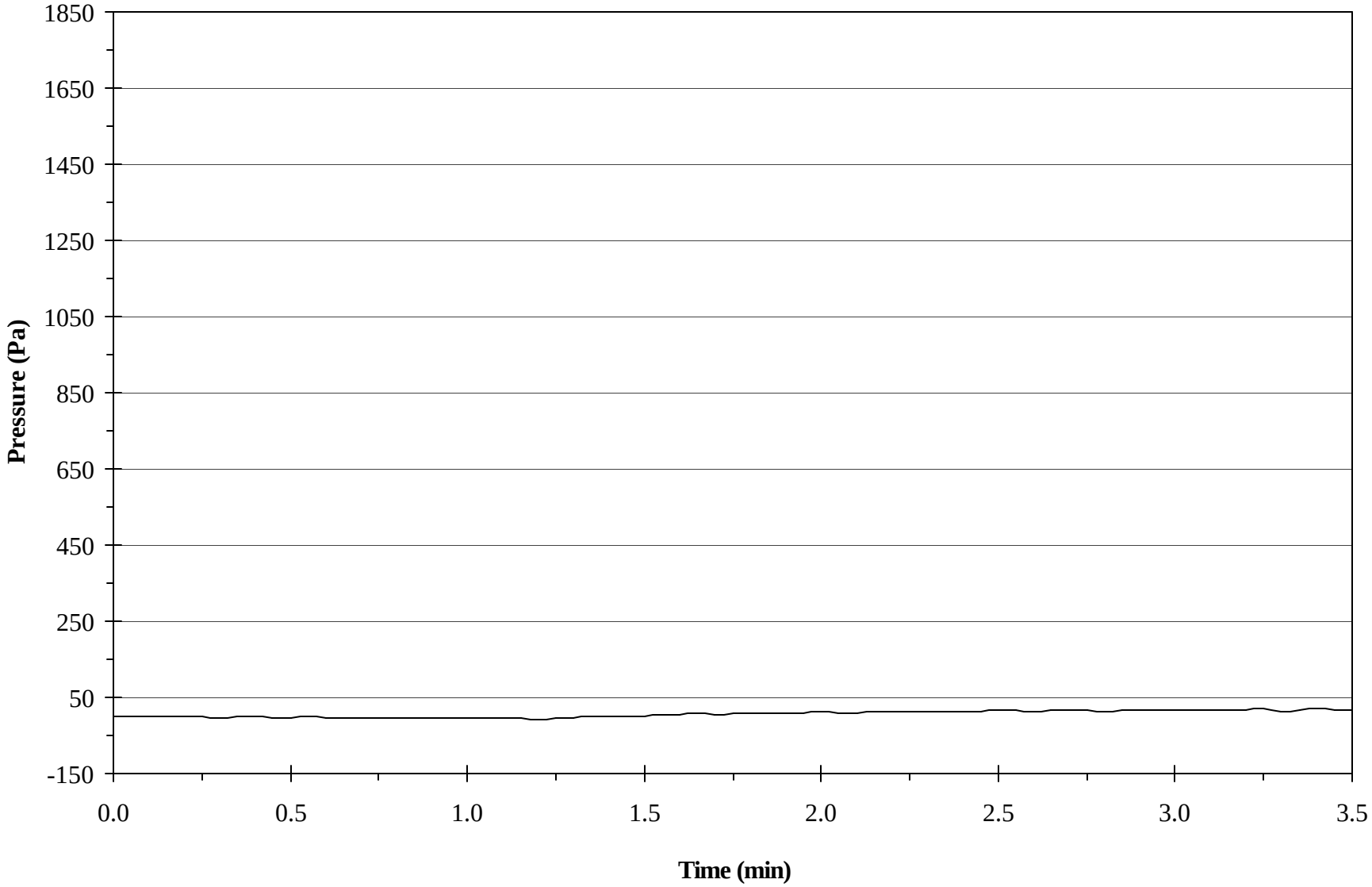
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 18 December 2002
File: 352MVF2.DAT

Test SNP1: New 1998 Saturn Twin Cam 4-Door Fuel Tank Test No. 2 - Flame Temperatures



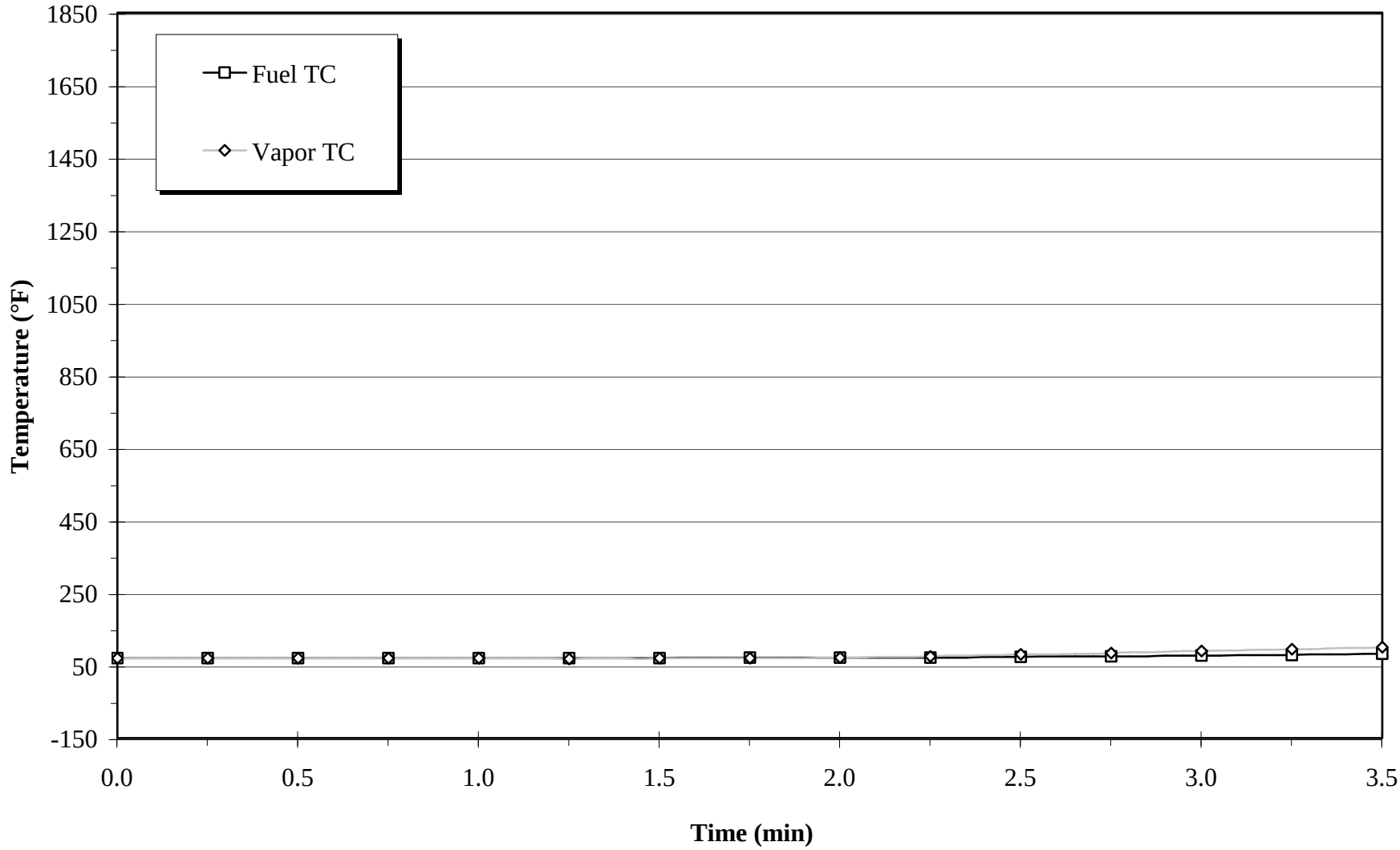
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 18 December 2002
File: 352MVF2.DAT

Test SNP1: New 1998 Saturn Twin Cam 4-Door Fuel Tank Test No. 2 - Tank Pressure



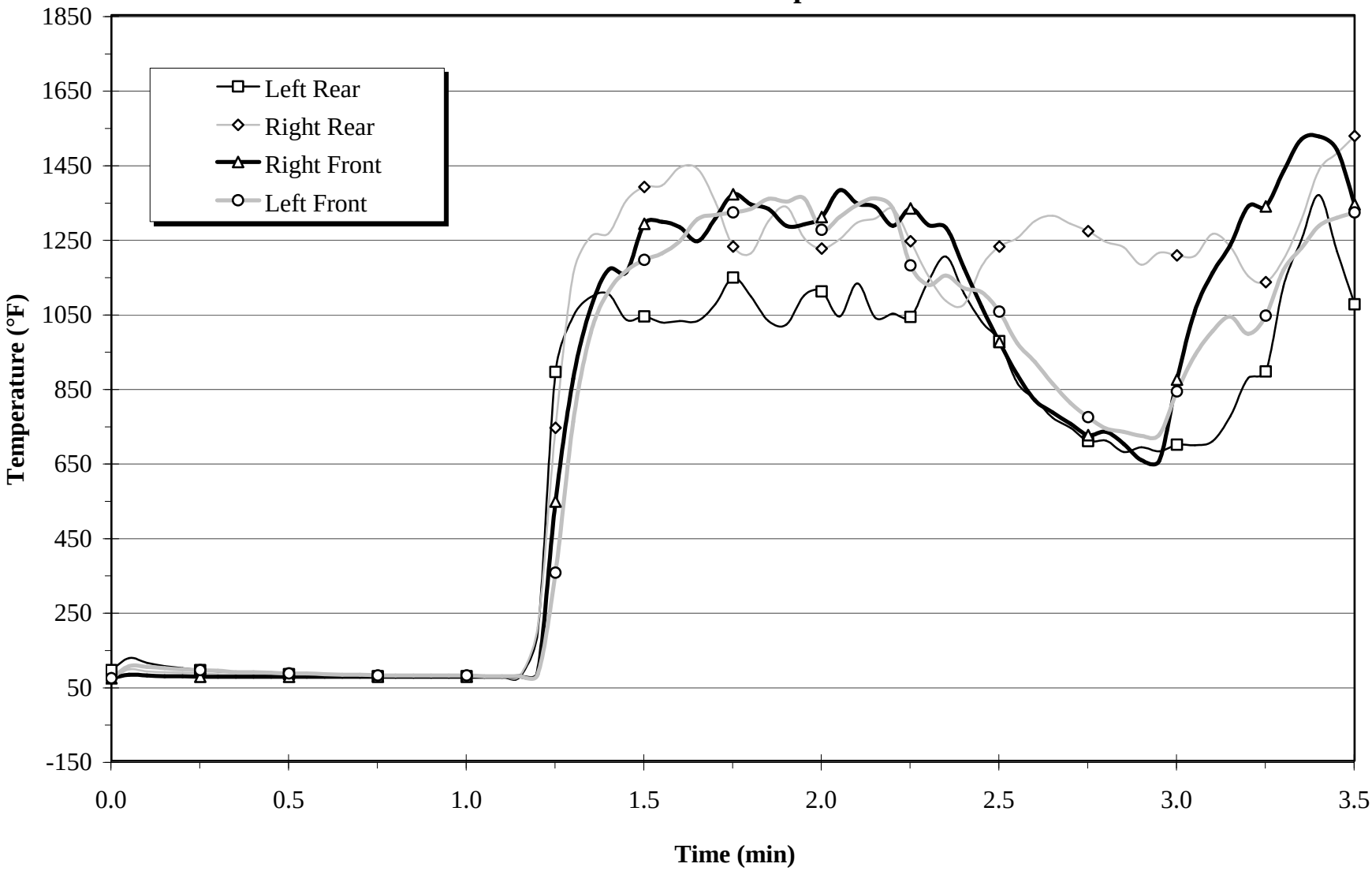
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 19 February 2003
File: 050MVF1.DAT

Test SNP2: New 1998 Saturn Twin Cam 4-Door Repeatability Fuel Tank Test No. 1 - Internal Tank Temperatures



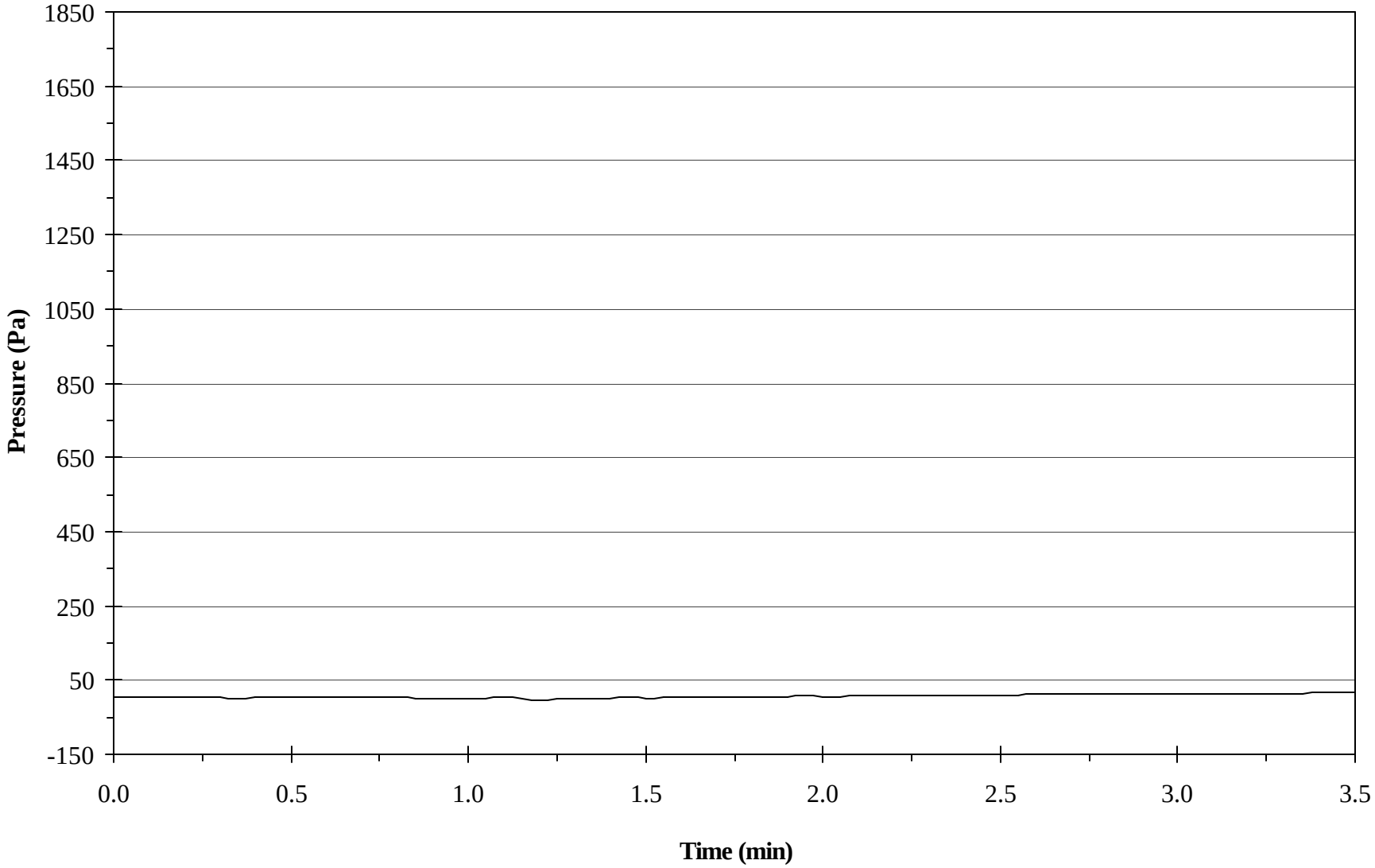
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 19 February 2003
File: 050MVF1.DAT

Test SNP2: New 1998 Saturn Twin Cam 4-Door Repeatability Fuel Tank Test No. 1- Flame Temperatures



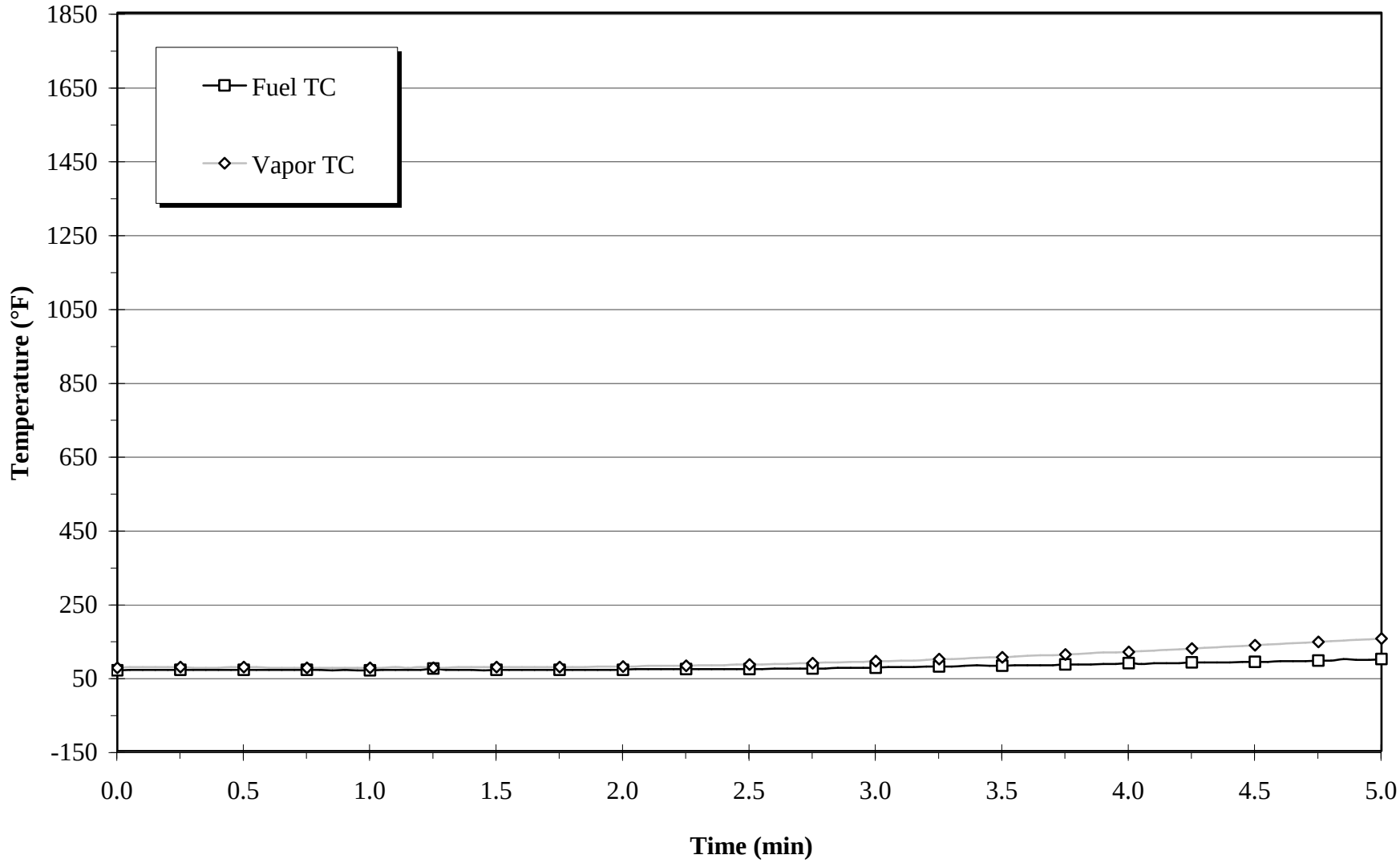
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 19 February 2003
File: 050MVF1.DAT

Test SNP2: New 1998 Saturn Twin Cam 4-Door Repeatability Fuel Tank Test No. 1 - Tank Pressure



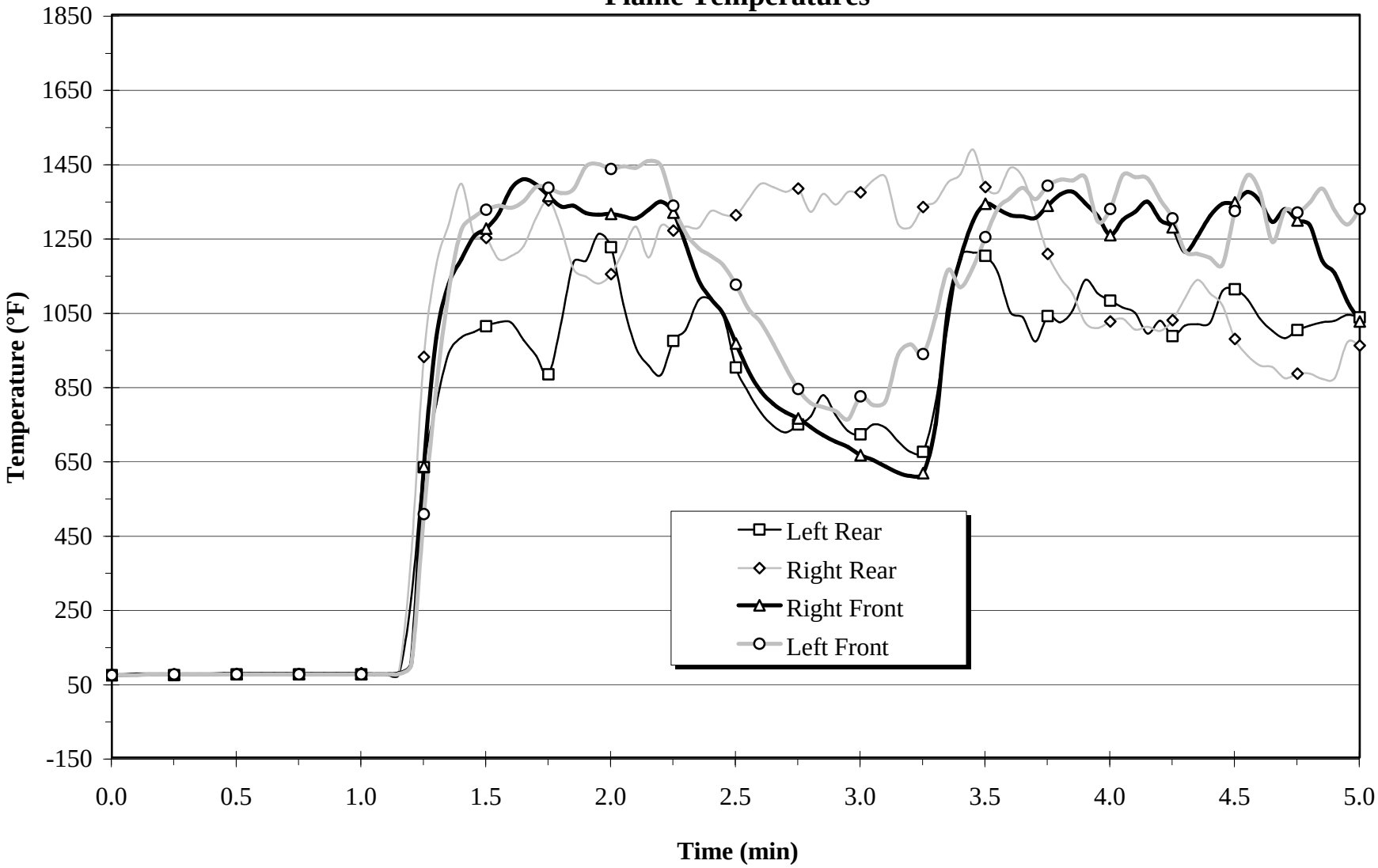
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 19 February 2003
File: 050MVF2.DAT

Test SNP3: New 1998 Saturn Twin Cam 4-Door Repeatability Fuel Tank Test No. 2- Internal Tank Temperatures



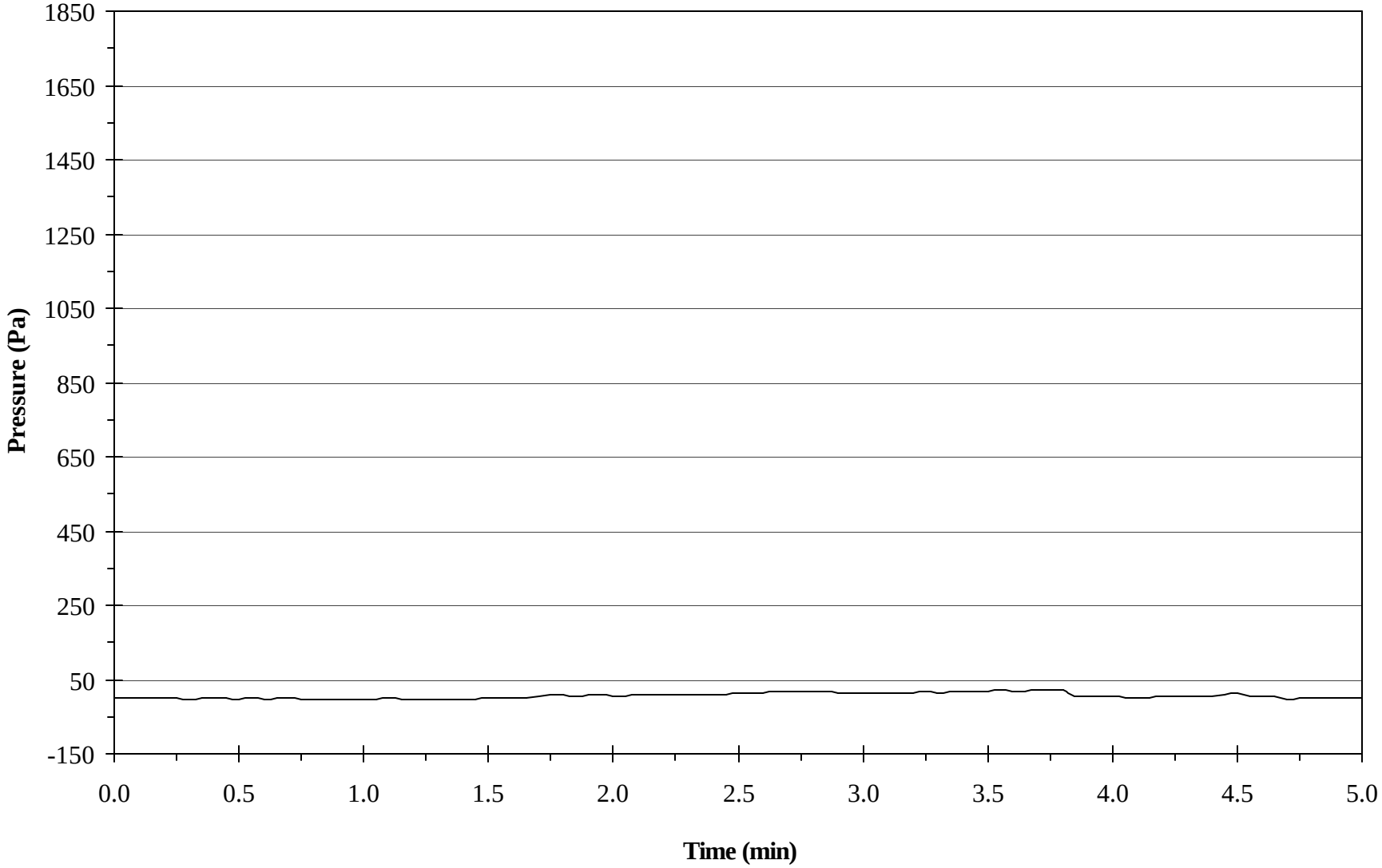
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 19 February 2003
File: 050MVF2.DAT

Test SNP3: New 1998 Saturn Twin Cam 4-Door Repeatability Fuel Tank Test No. 2 - Flame Temperatures



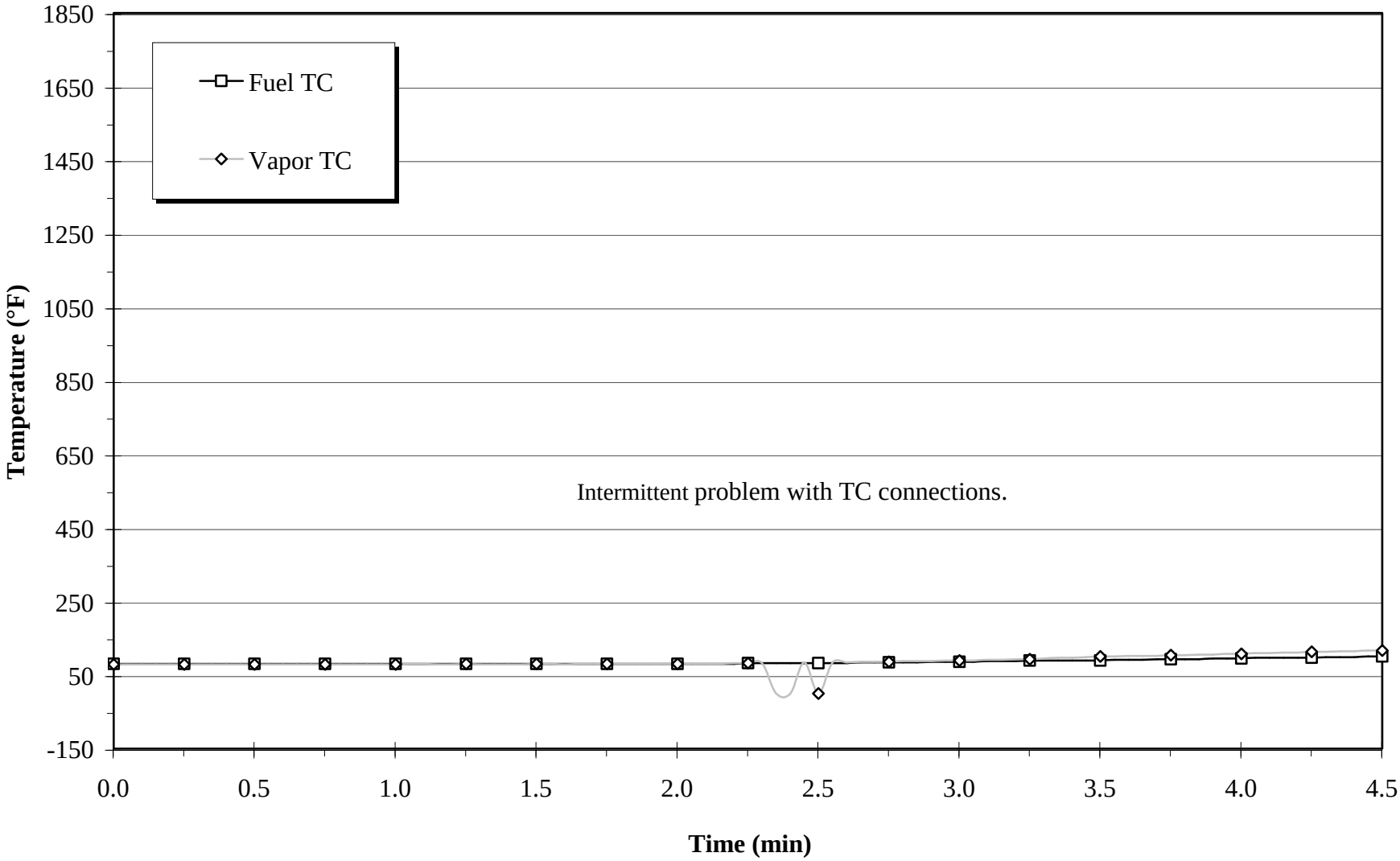
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 19 February 2003
File: 050MVF2.DAT

Test SNP3: New 1998 Saturn Twin Cam 4-Door Repeatability Fuel Tank Test No. 2 - Tank Pressure



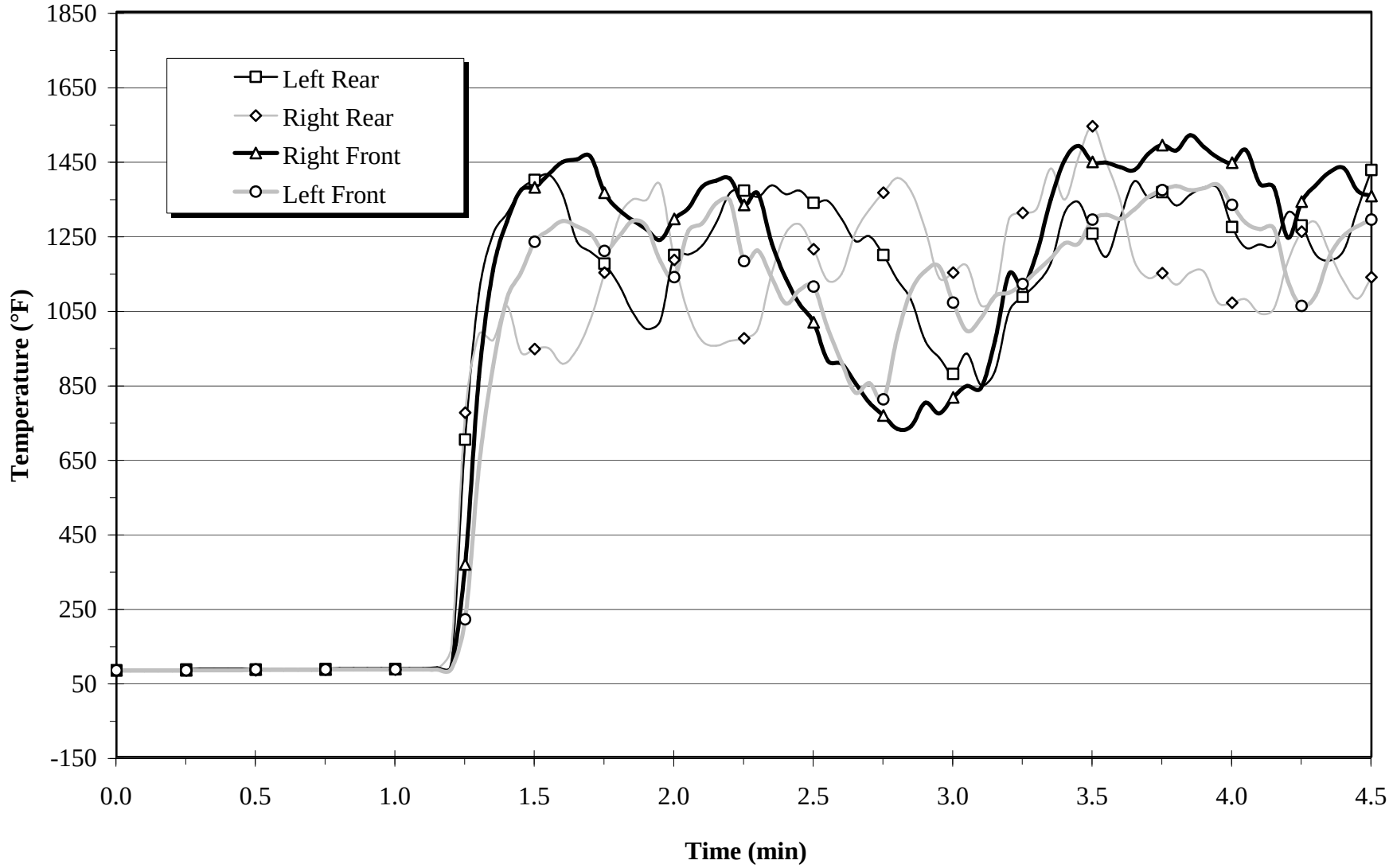
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 28 April 2003
File: 118MVF1.DAT

Test SNP4: New 1998 Saturn Twin Cam 4-Door Repeatability Fuel Tank Test No. 3 - Internal Tank Temperatures

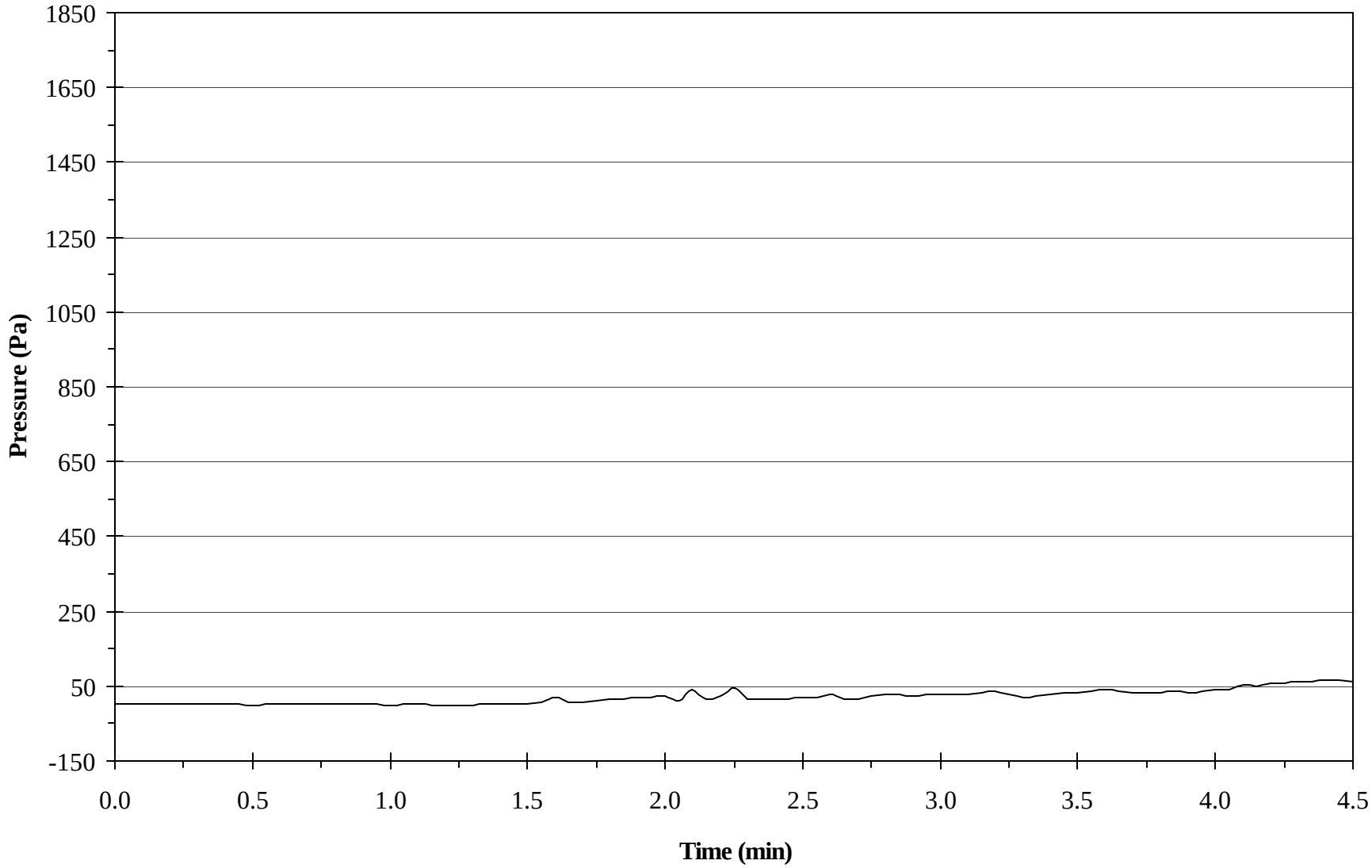


Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 28 April 2003
File: 118MVF1.DAT

Test SNP4: New 1998 Saturn Twin Cam 4-Door Repeatability Fuel Tank Test No. 3 - Flame Temperatures

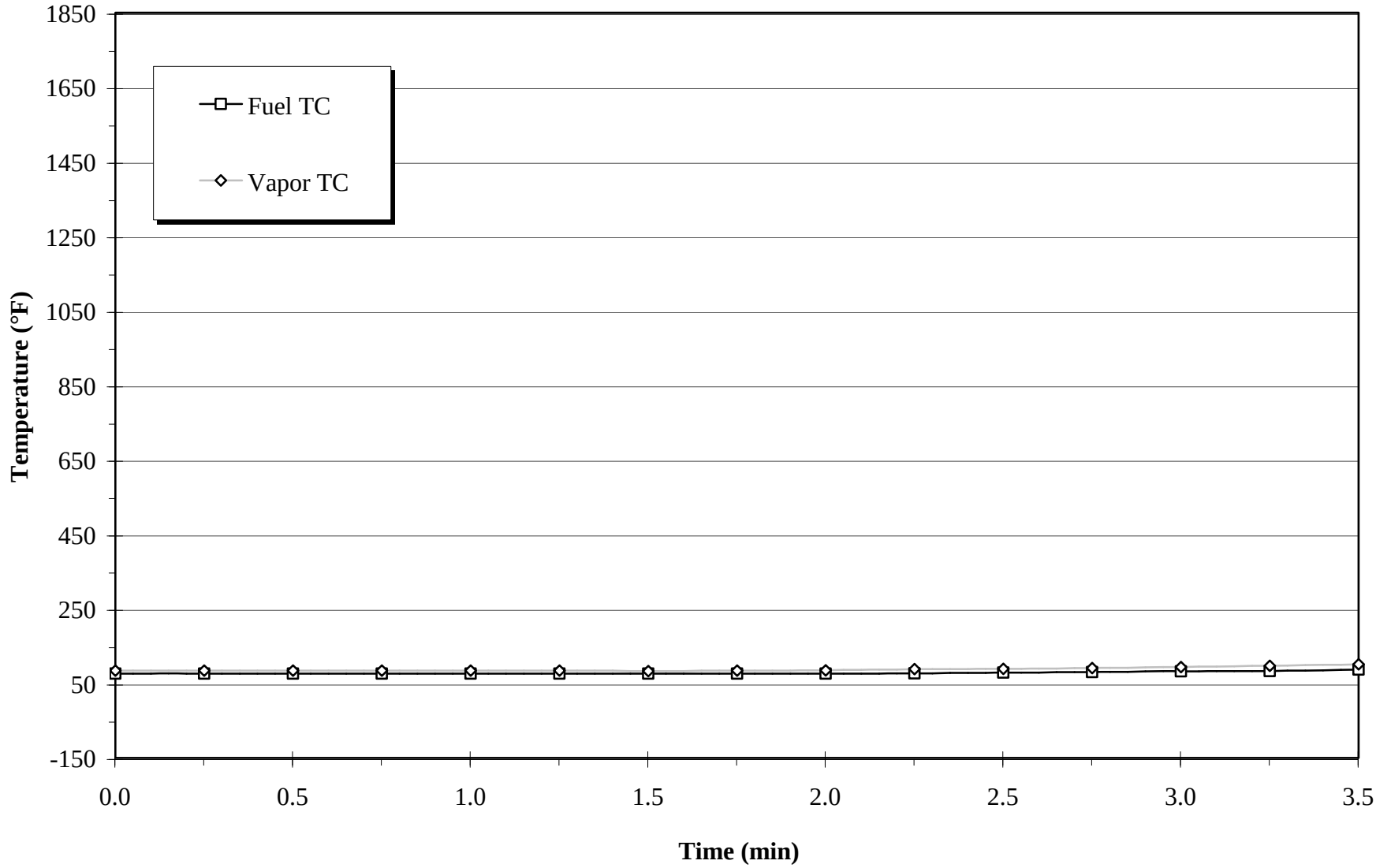


Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 28 April 2003
File: 118MVF1.DAT **Test SNP4:New 1998 Saturn Twin Cam 4-Door Repeatability Fuel Tank Test No. 3 - Tank Pressure**



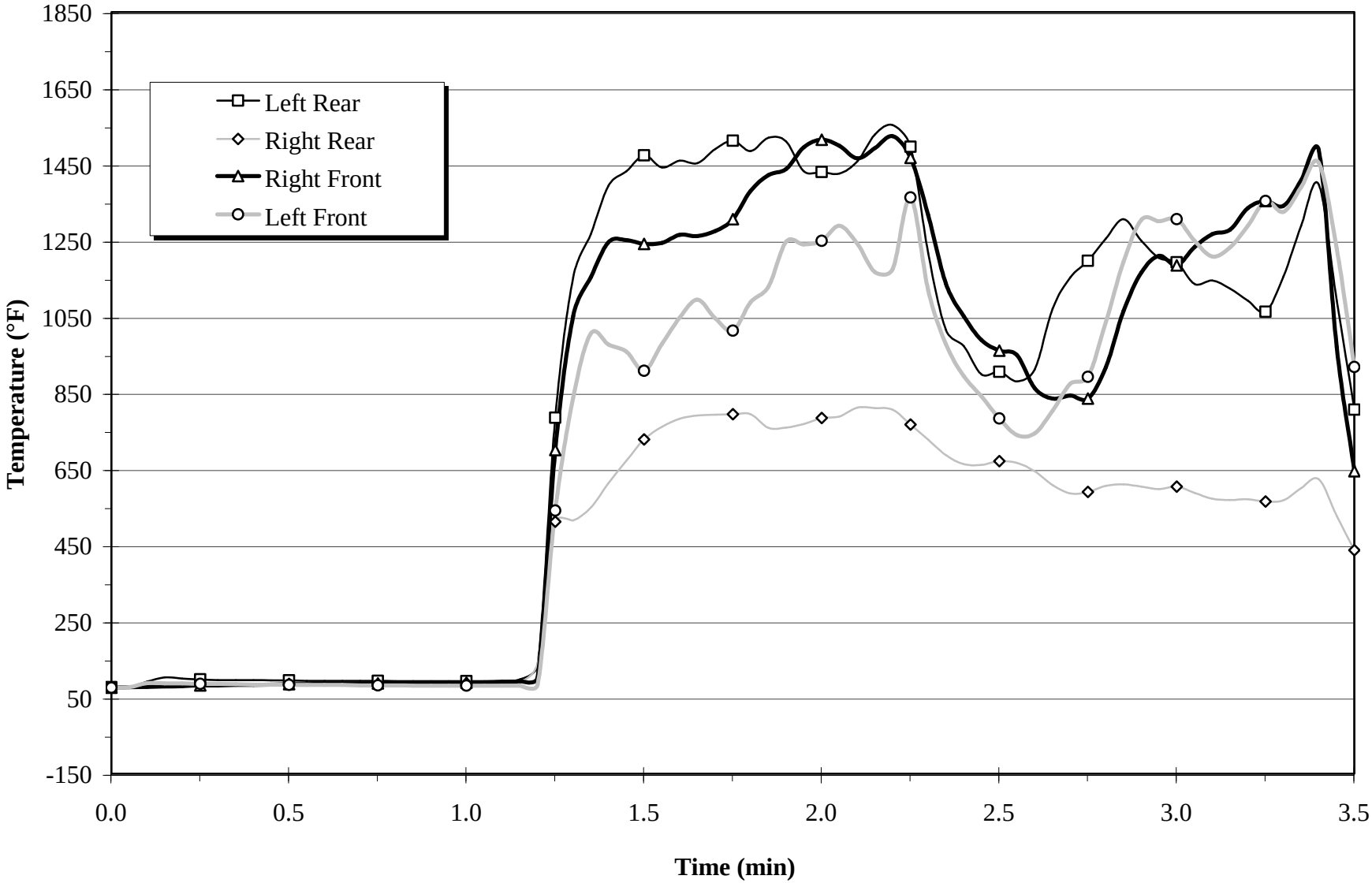
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 18 December 2002
File: 352MVF3.DAT

Test JCP1: Conditioned 1998 Jeep Grand Cherokee Fuel Tank Test No. 3 - Internal Tank Temperatures



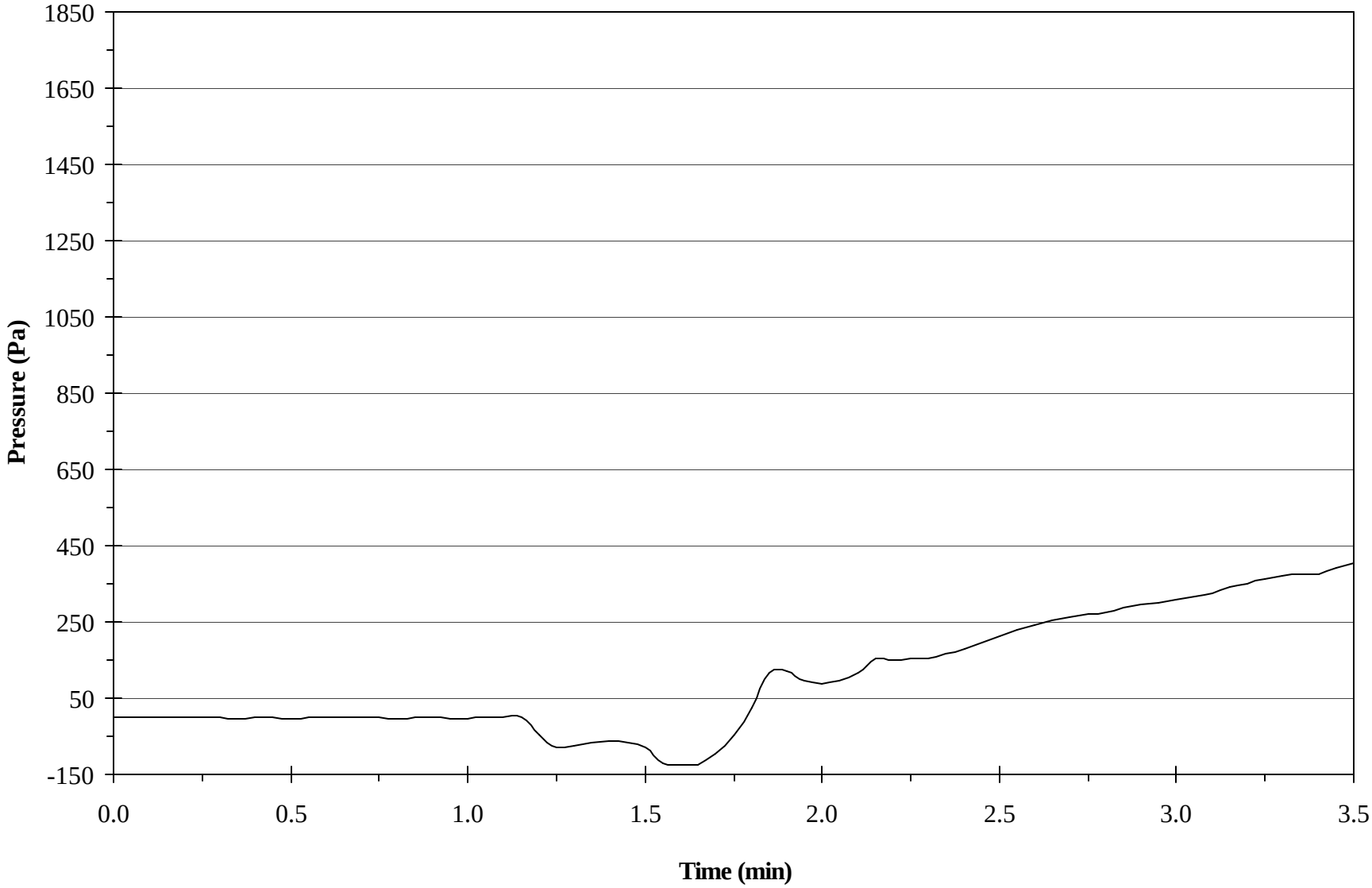
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 18 December 2002
File: 352MVF3.DAT

Test JCP1: Conditioned 1998 Jeep Grand Cherokee Fuel Tank Test No. 3 - Flame Temperatures



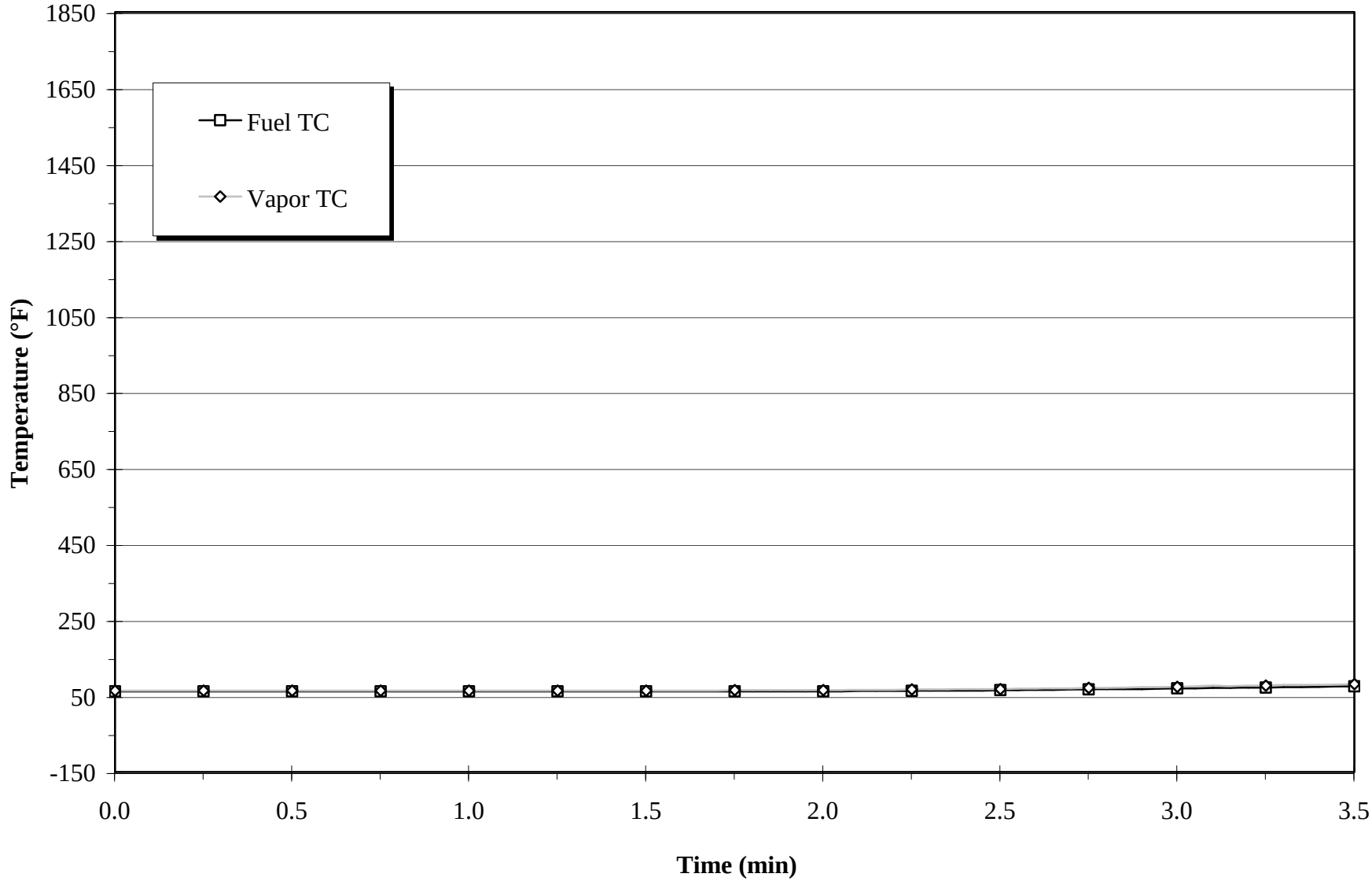
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 18 December 2002
File: 352MVF3.DAT

Test JCP1: Conditioned 1998 Jeep Grand Cherokee Fuel Tank Test No. 3 - Tank Pressure



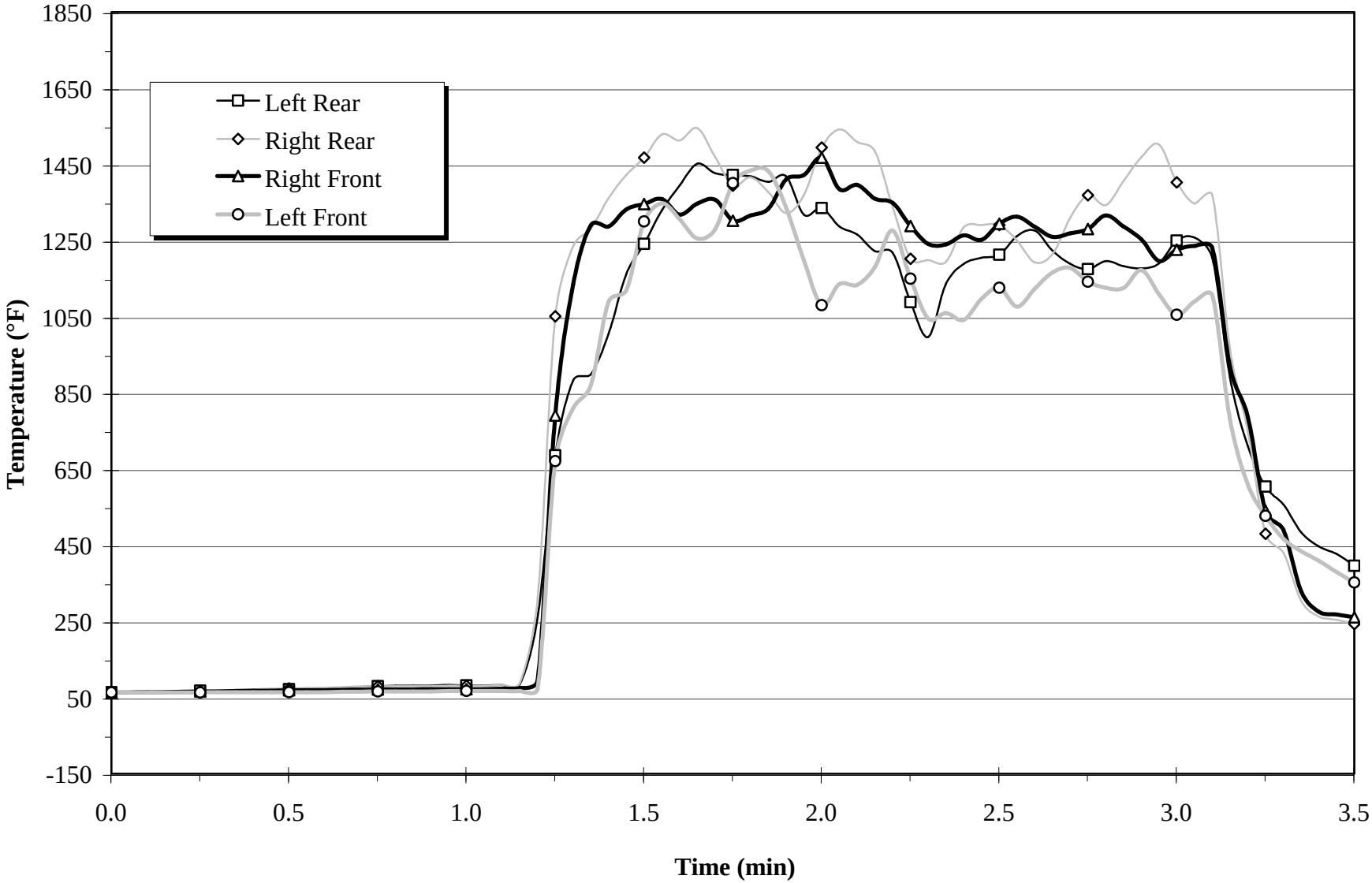
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 19 December 2002
File: 353MVF4.DAT

Test JNP1: New 1998 Jeep Grand Cherokee Fuel Tank Test No. 4 - Internal Tank Temperatures



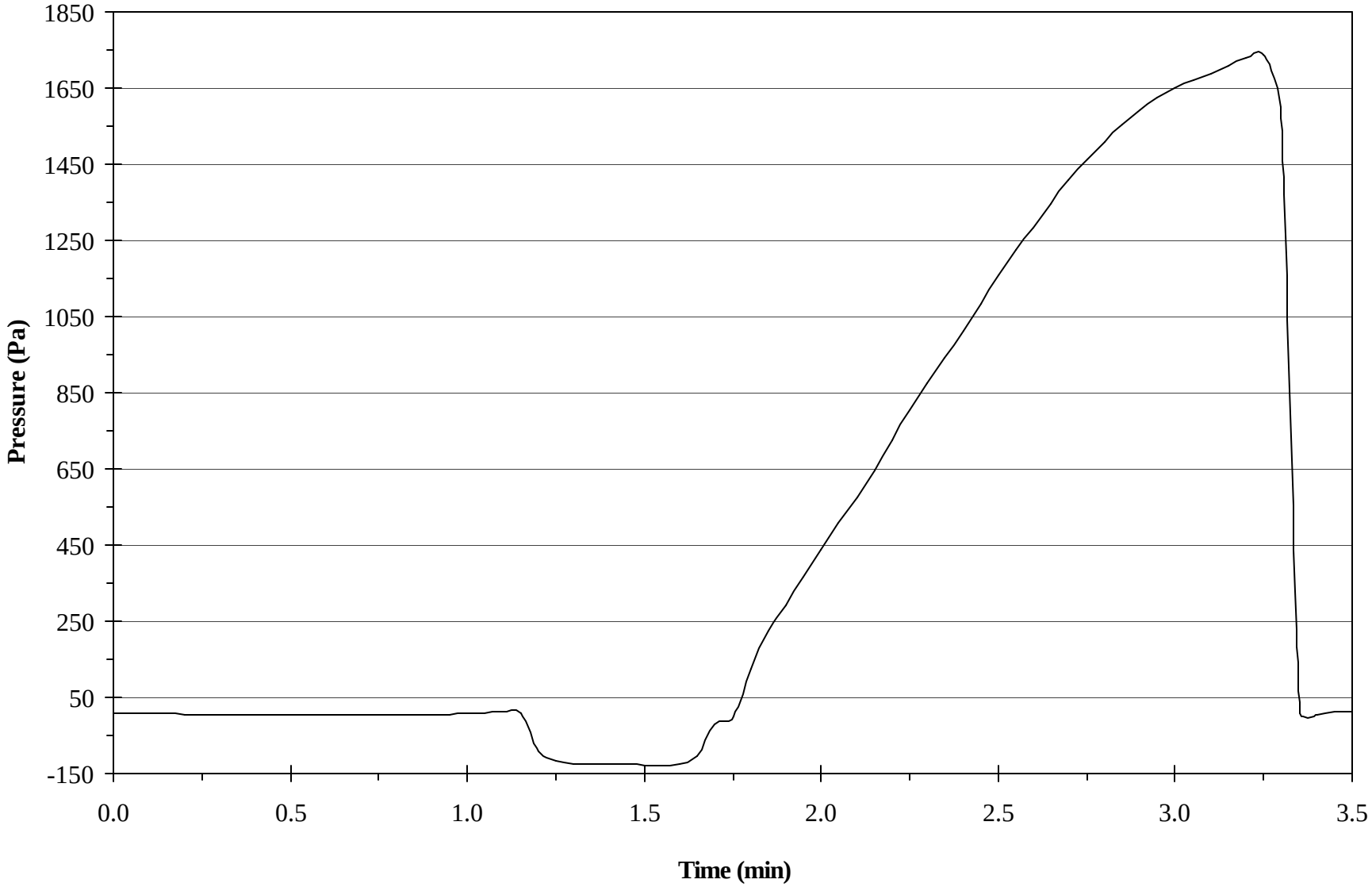
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 19 December 2002
File: 353MVF4.DAT

Test JNP1: New 1998 Jeep Grand Cherokee Fuel Tank Test No. 4 - Flame Temperatures



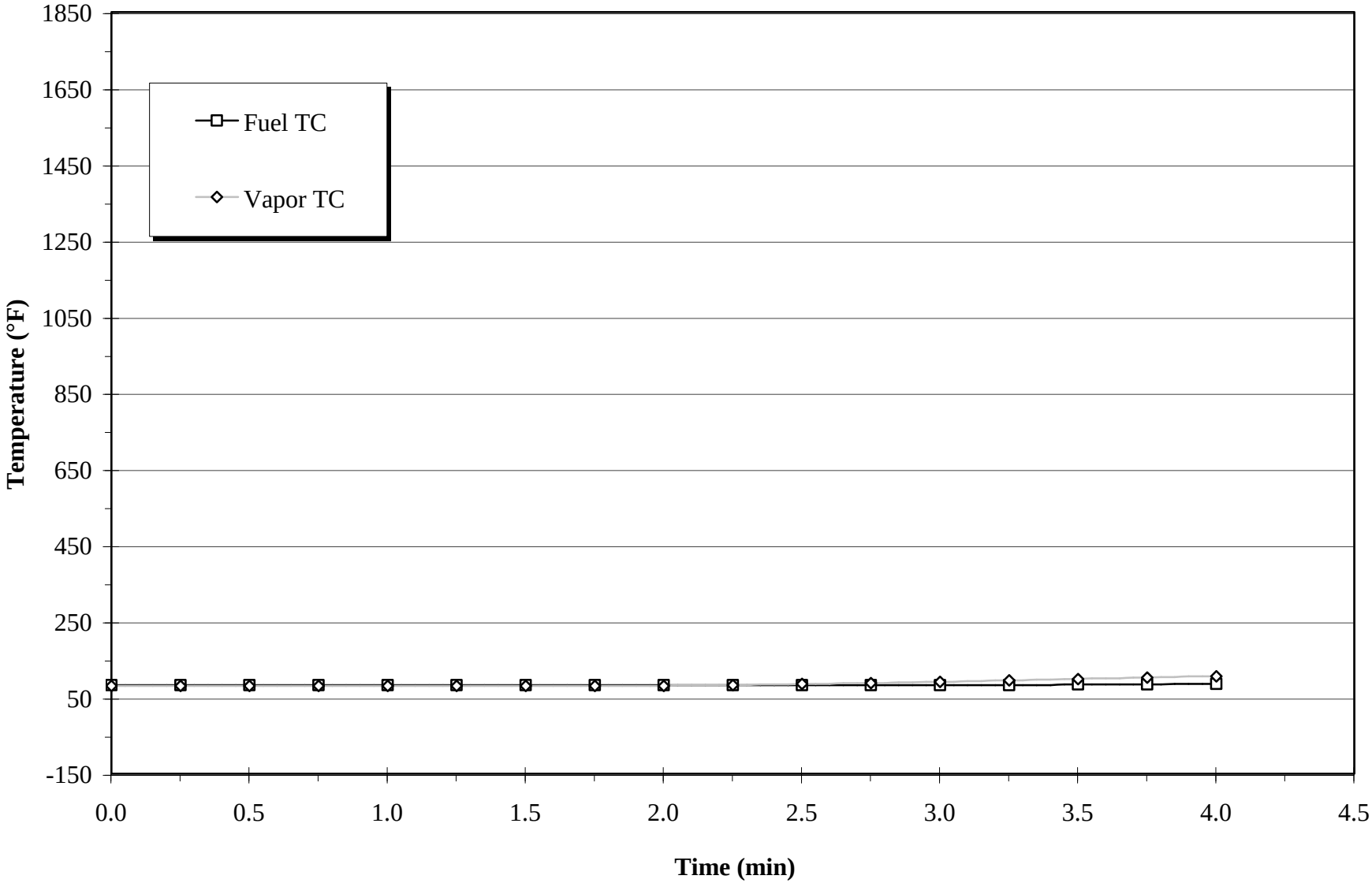
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 19 December 2002
File: 353MVF4.DAT

Test JNP1: New 1998 Jeep Grand Cherokee Fuel Tank Test No. 4 - Tank Pressure



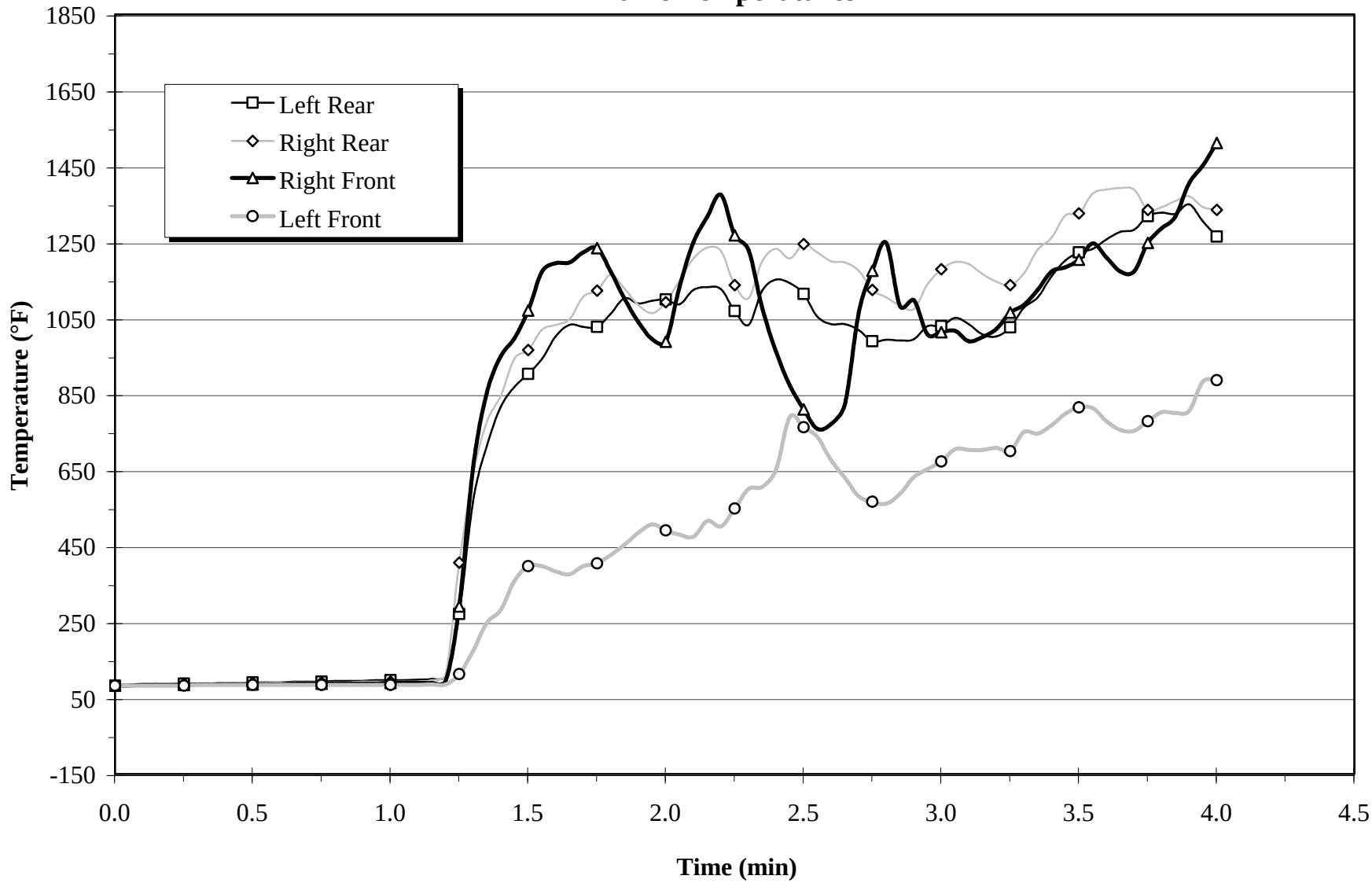
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 30 April 2003
File: 120MVF1.DAT

Test JNP2(S): New 1998 Jeep Grand Cherokee Fuel Tank Test No. 5S-Internal Tank Temperatures



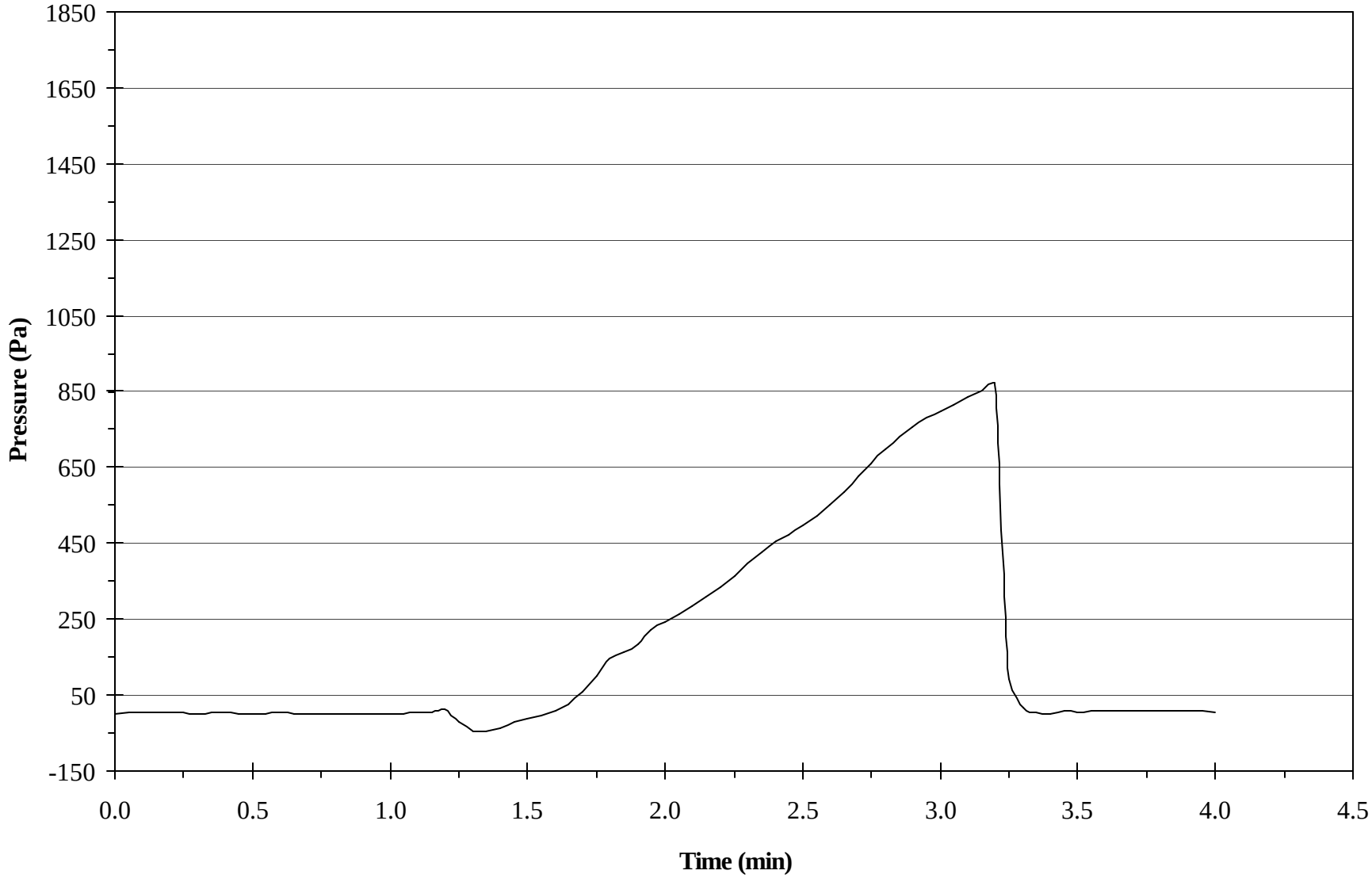
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 30 April 2003
File: 120MVF1.DAT

Test JNP2(S): New 1998 Jeep Grand Cherokee Fuel Tank Test No. 5S- Flame Temperatures



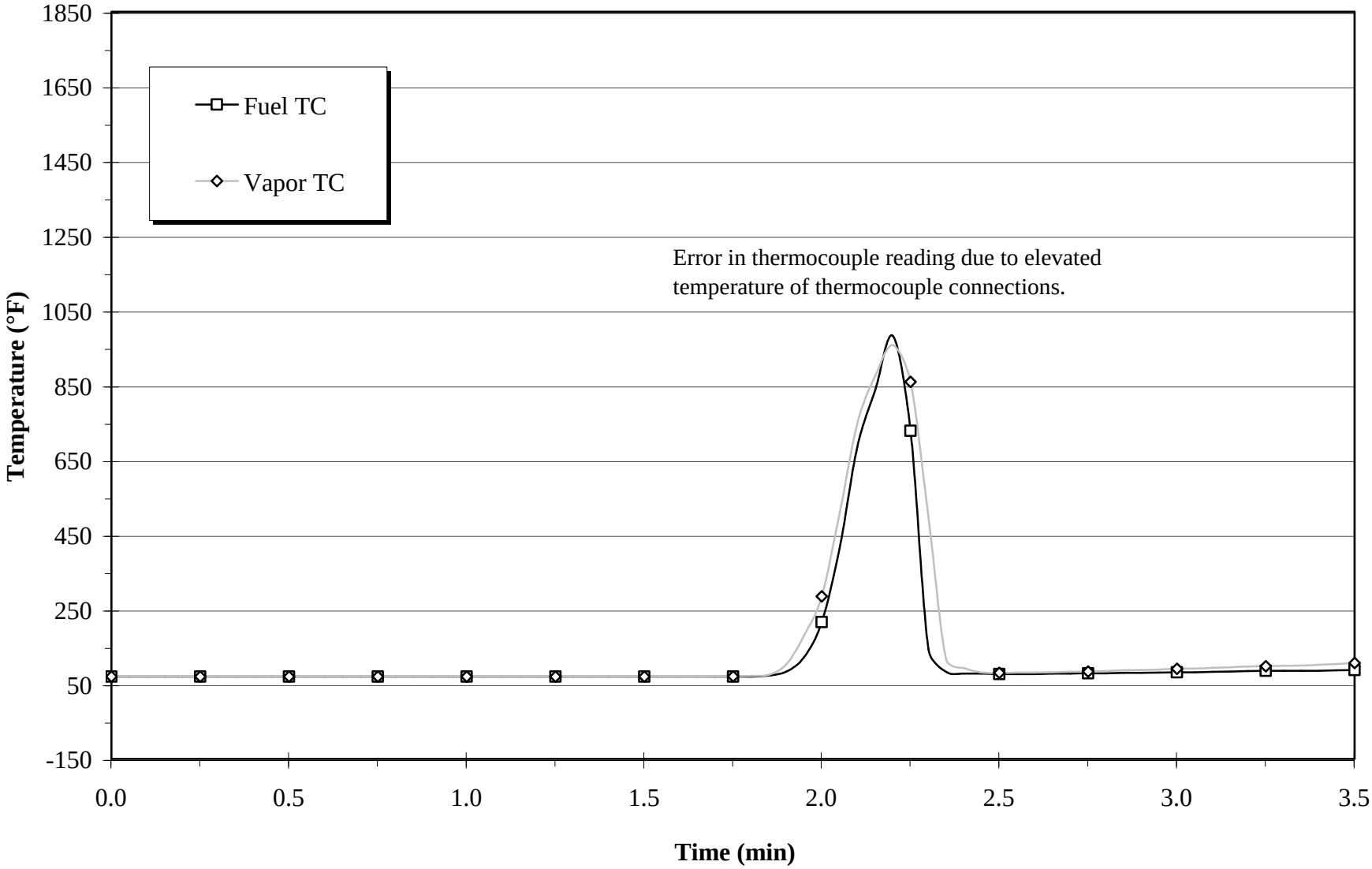
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 30 April 2003
File: 120MVF1.DAT

Test JNP2(S): New 1998 Jeep Grand Cherokee Fuel Tank Test No. 5S - Tank Pressure



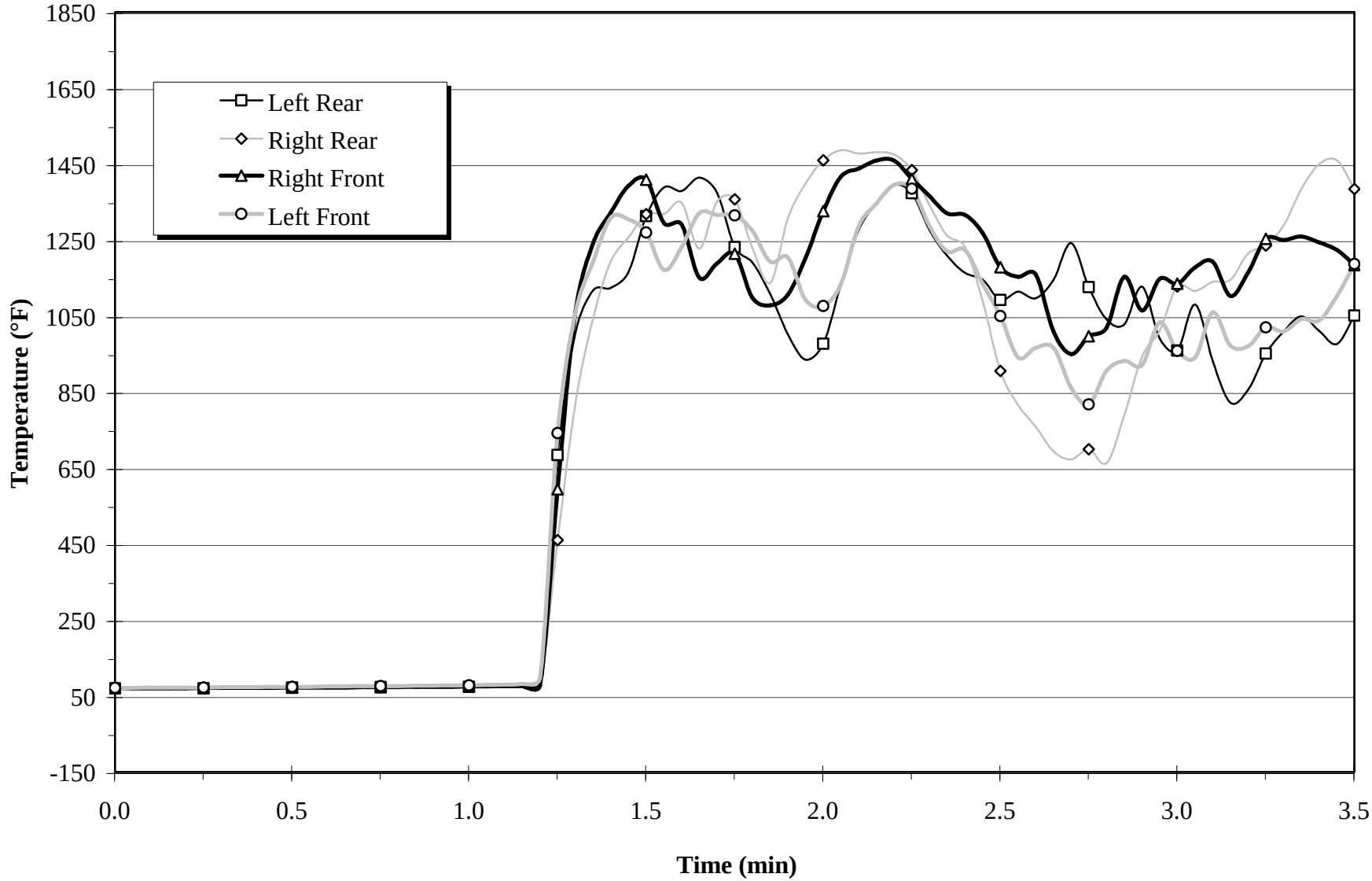
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 19 December 2002
File: 353MVF5.DAT

Test PCP1: Conditioned 1998 Plymouth Voyager Van Fuel Tank Test No. 5 - Internal Tank Temperatures



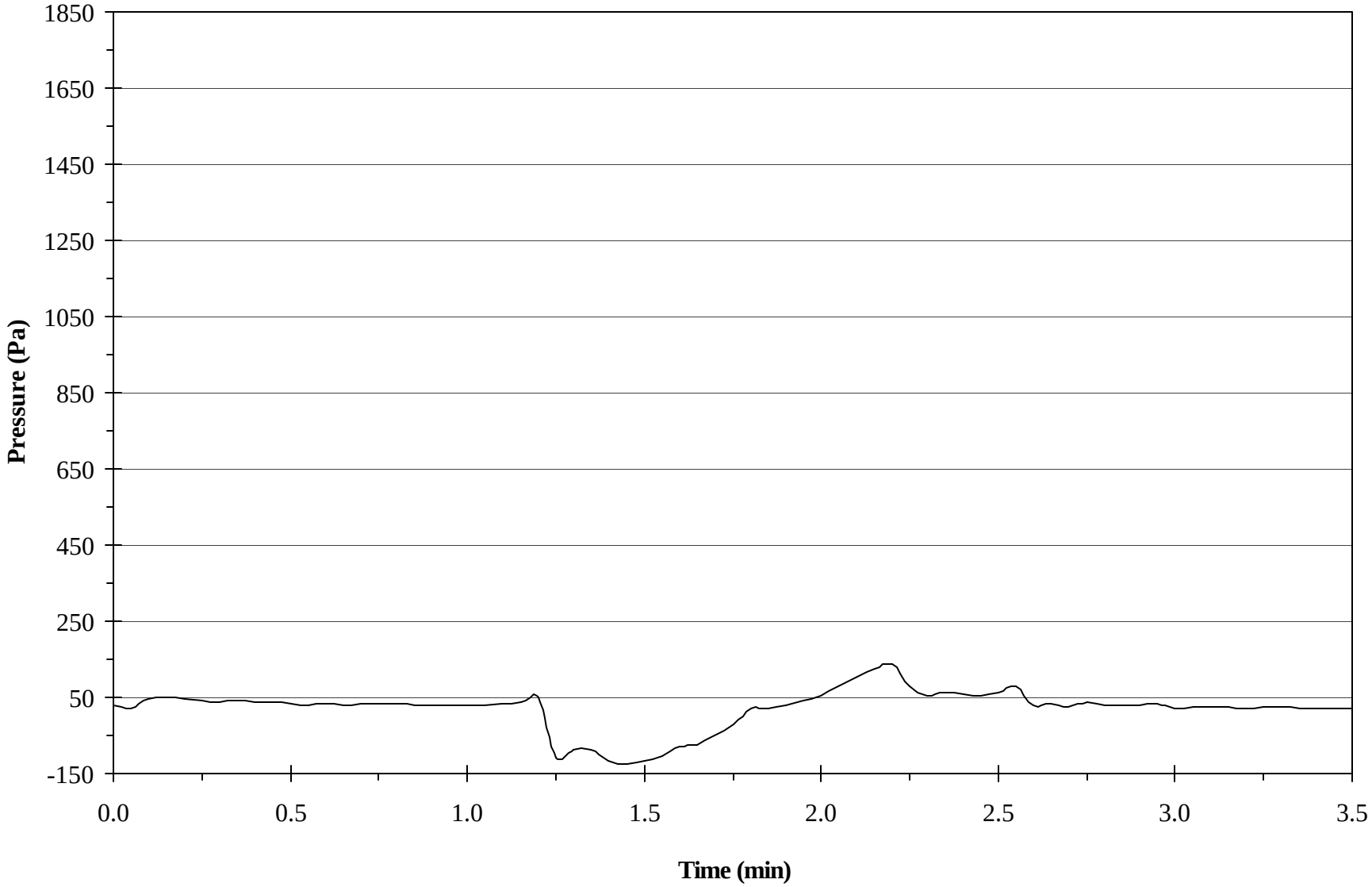
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 19 December 2002
File: 353MVF5.DAT

Test PCP1: Conditioned 1998 Plymouth Voyager Van Fuel Tank Test No. 5 - Flame Temperatures



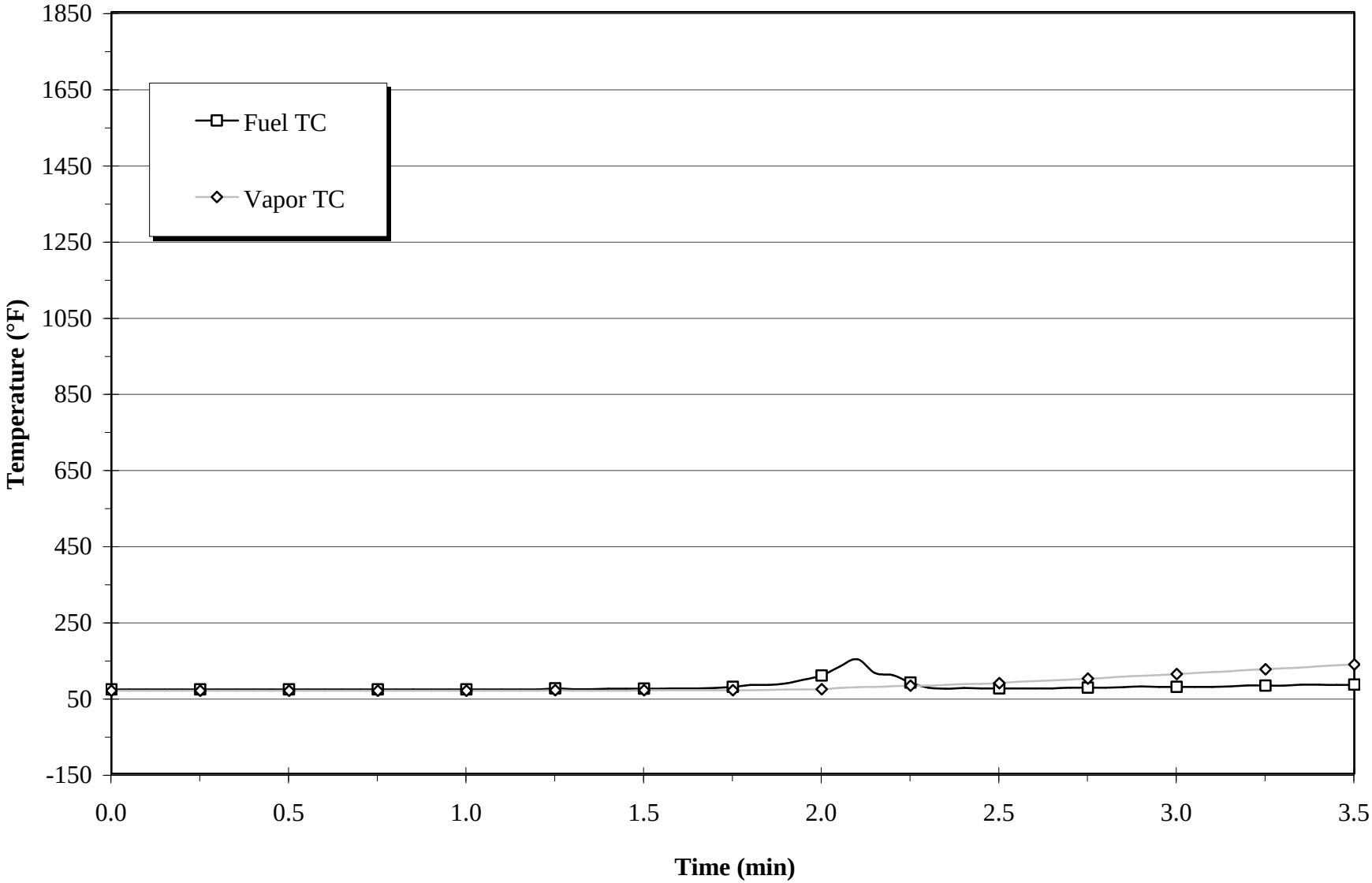
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 19 December 2002
File: 353MVF5.DAT

Test PCP1: Conditioned 1998 Plymouth Voyager Van Fuel Tank Test No. 5 - Tank Pressure



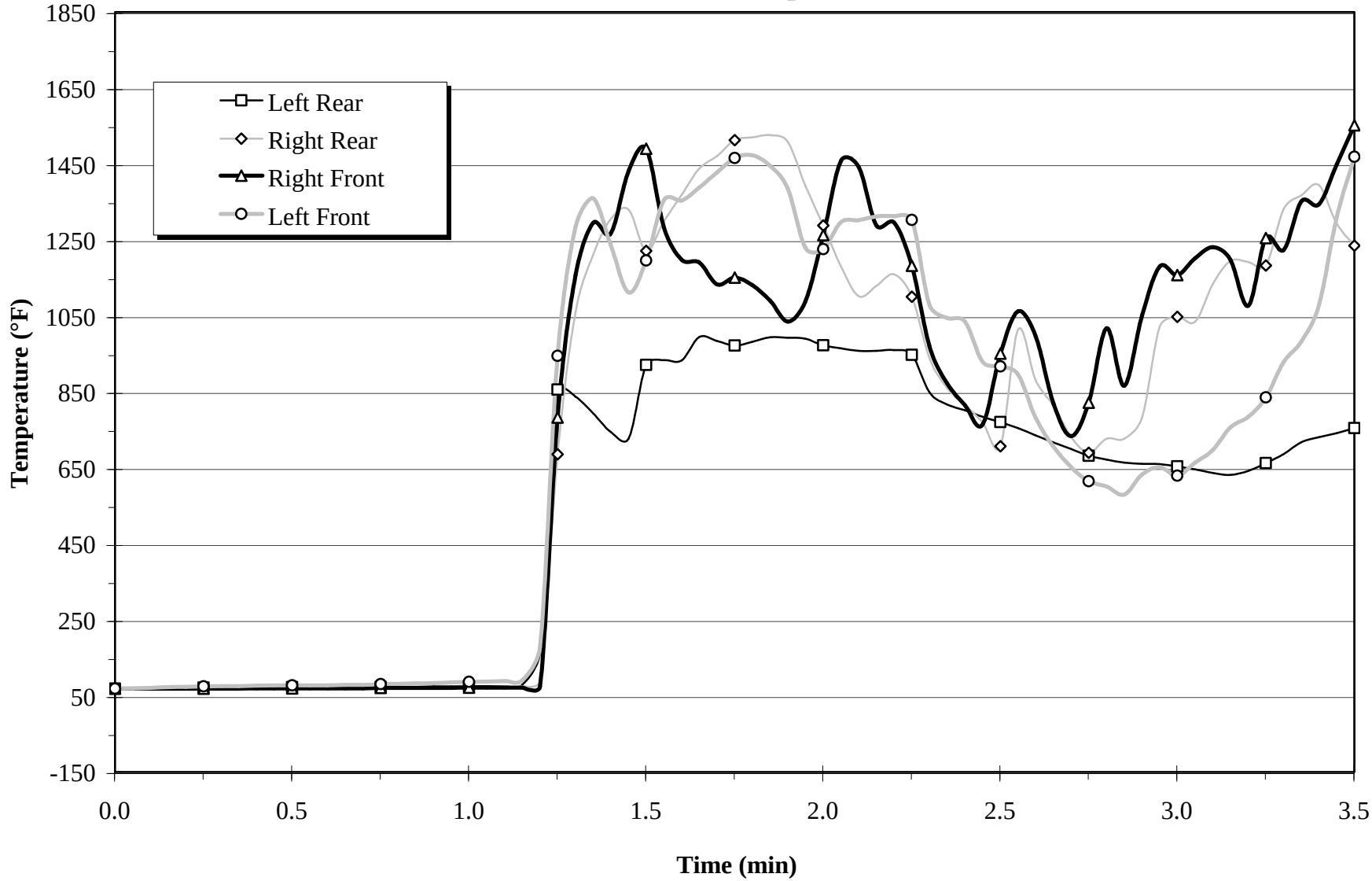
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 2 January 2003
File: 2MVFRI6a.DAT

Test PNP1: New 1998 Plymouth Voyager Van Fuel Tank Test No. 6A - Internal Tank Temperatures



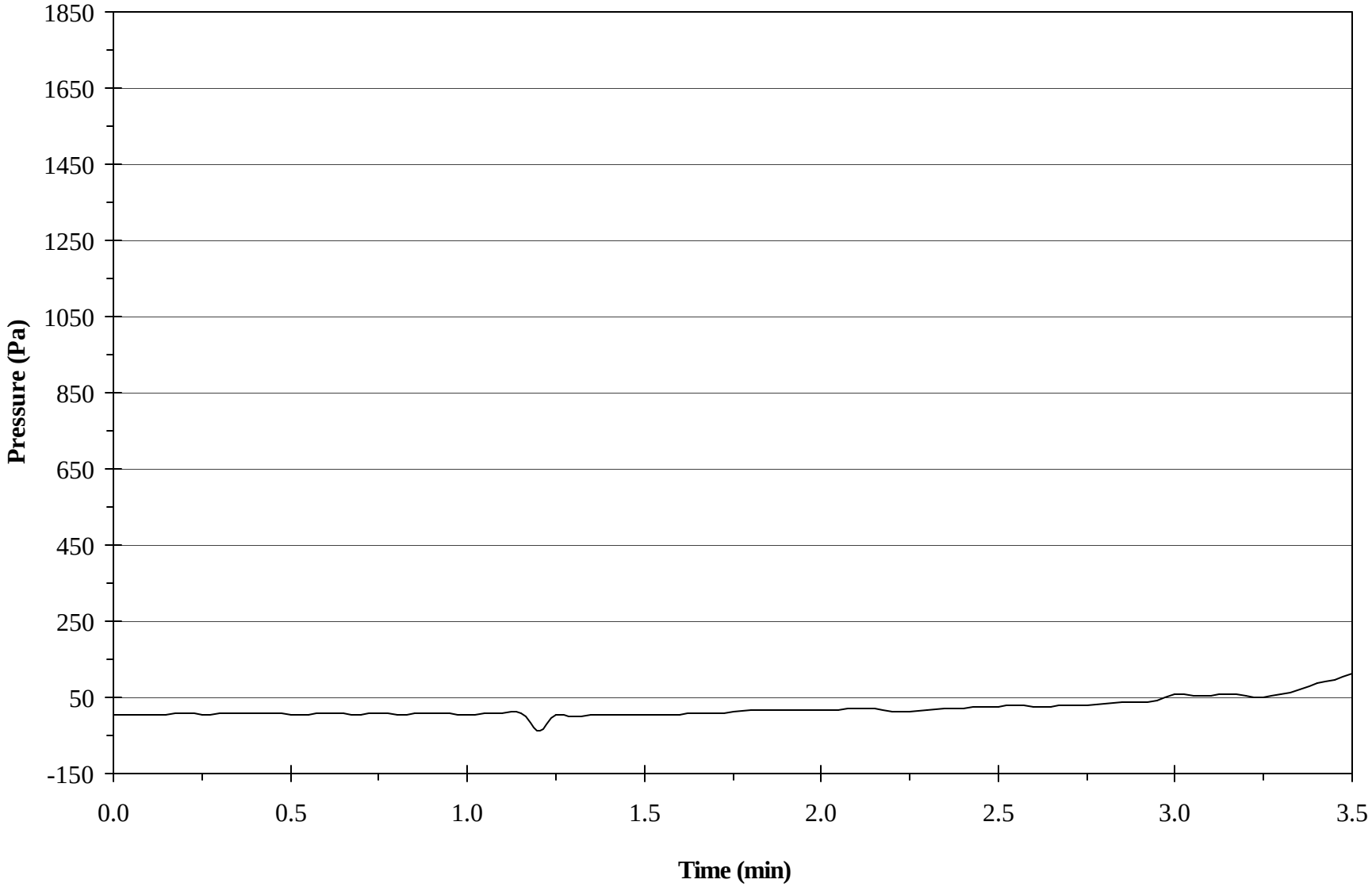
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 2 January 2003
File: 2MVFRI6a.DAT

Test PNP1: New 1998 Plymouth Voyager Van Fuel Tank Test No. 6A - Flame Temperatures



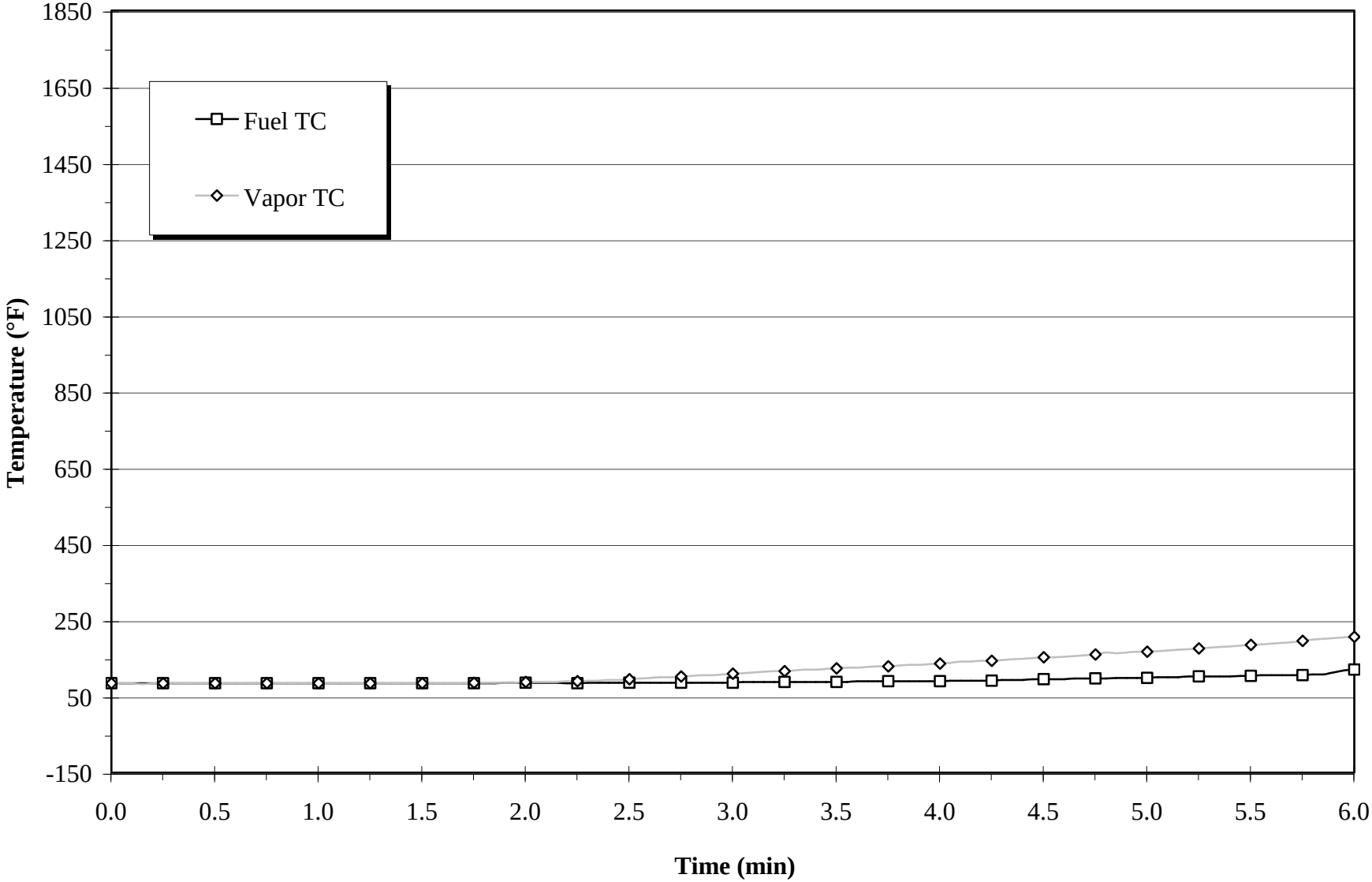
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 2 January 2003
File: 2MVFRI6a.DAT

Test PNP1: New 1998 Plymouth Voyager Van Fuel Tank Test No. 6A - Tank Pressure



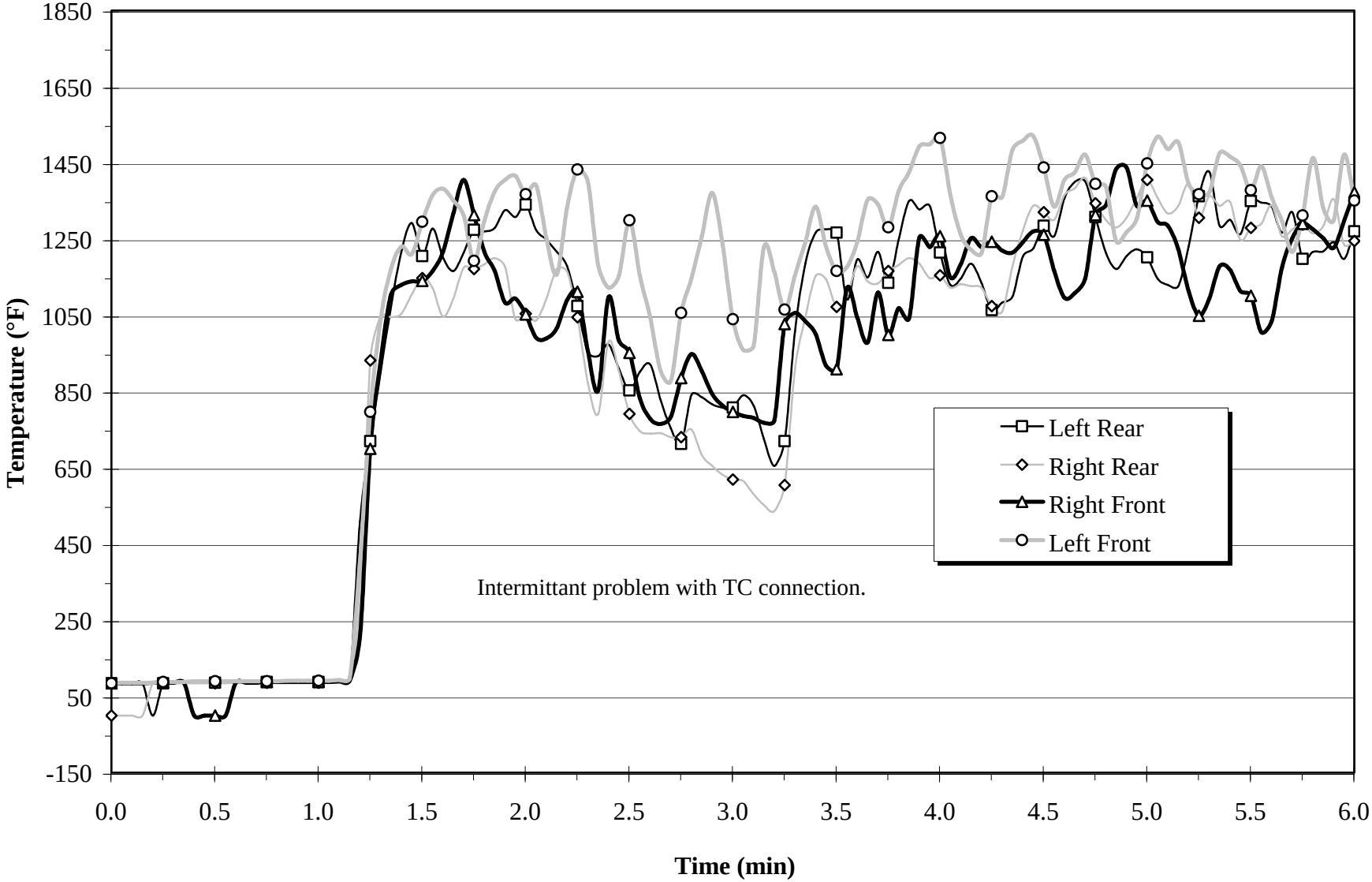
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 20 May 2003
File: 140MVF1.DAT

Test PNP2(S):New 1998 Plymouth Voyager Van Fuel Tank Test No. 7S - Internal Tank Temperatures



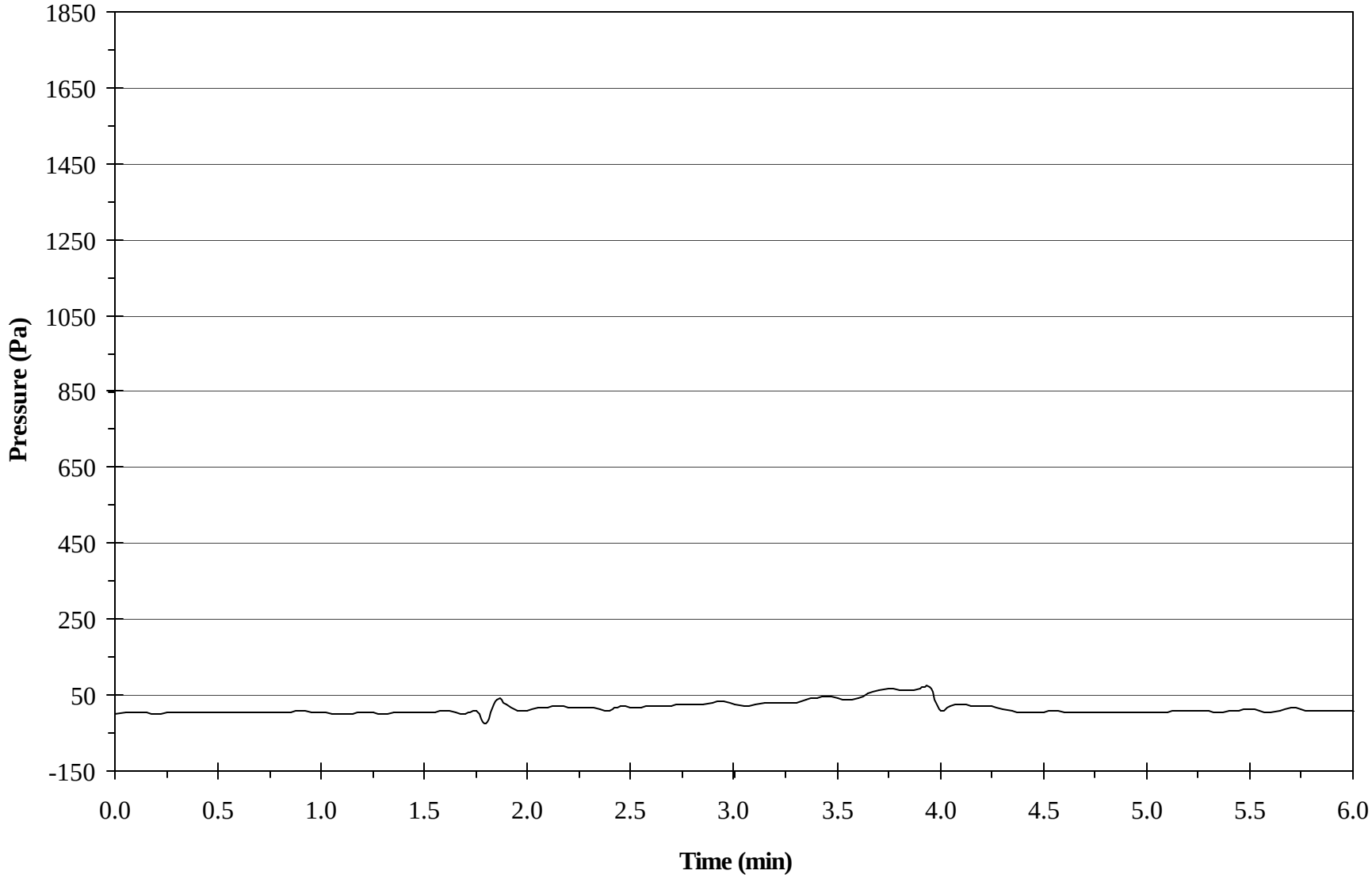
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 20 May 2003
File: 140MVF1.DAT

Test PNP2(S): New 1998 Plymouth Voyager Van Fuel Tank Test No. 7S - Flame Temperatures



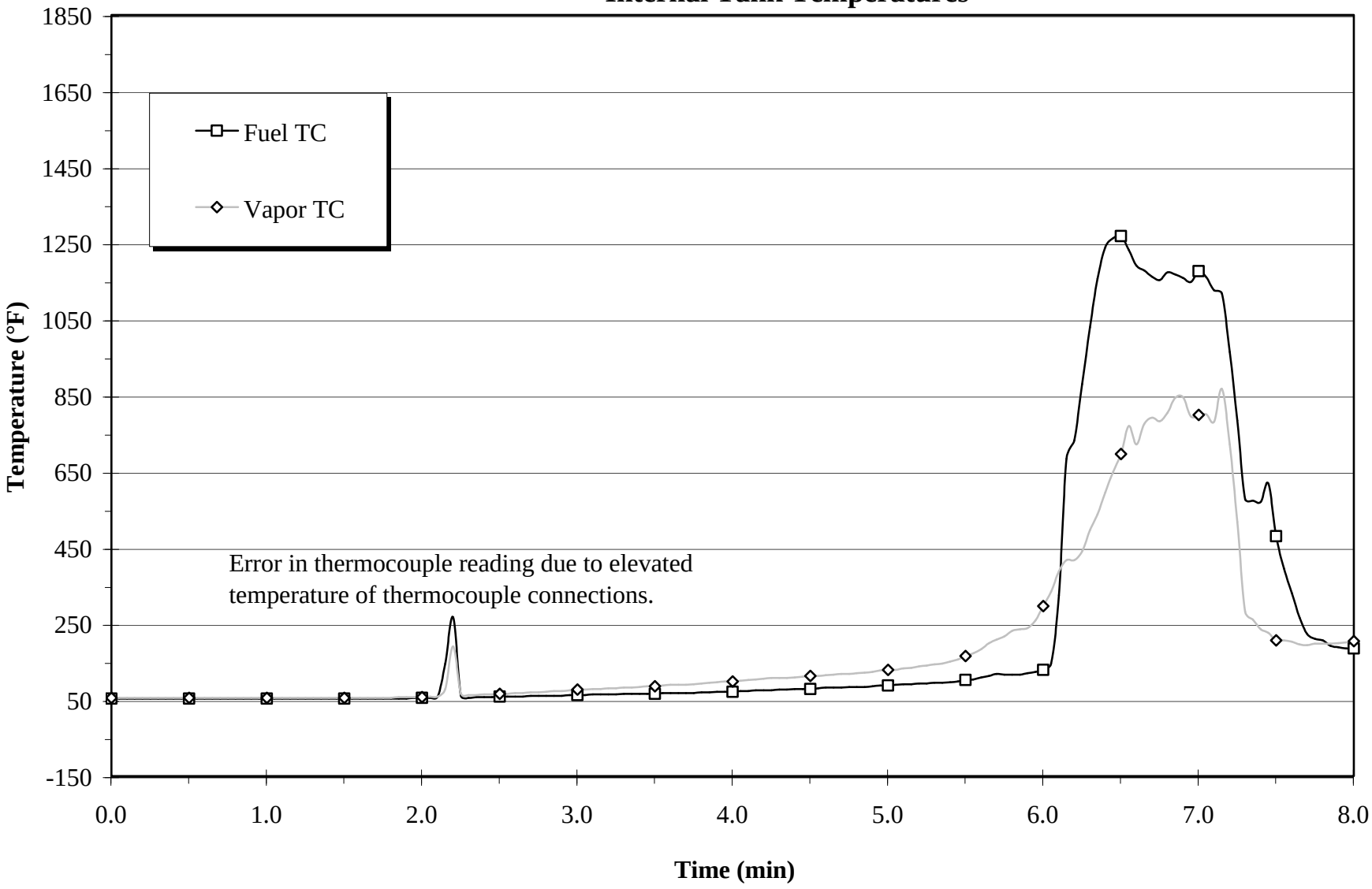
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 20 May 2003
File: 140MVF1.DAT

Test PNP2(S): New 1998 Plymouth Voyager Van Fuel Tank Test No. 7S - Tank Pressure



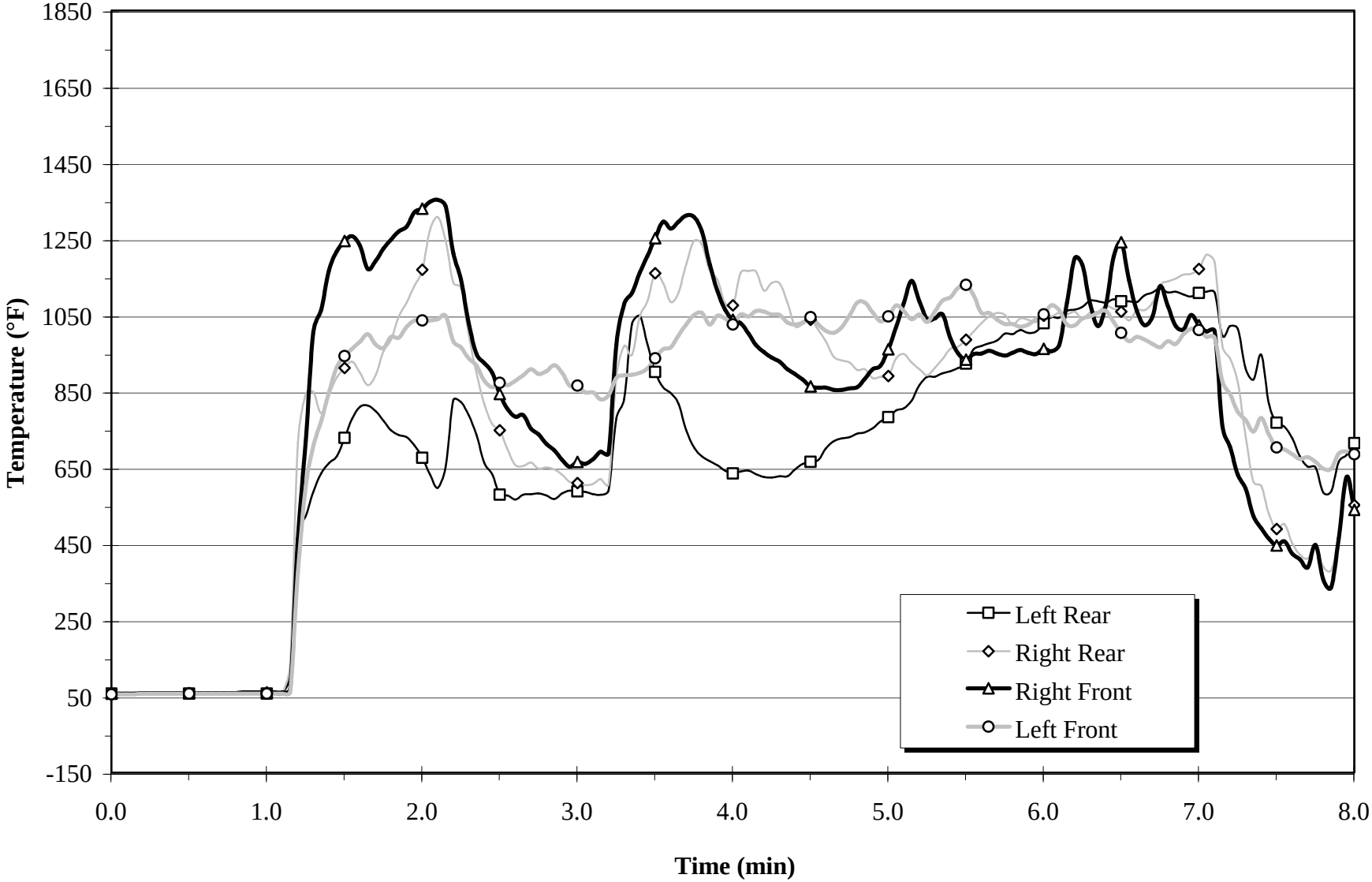
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 21 January 2003
File: 021MVFR1.DAT

Test CNP1: New 2000 Chevrolet Cavalier Plastic Fuel Tank Test No. 1 - Internal Tank Temperatures



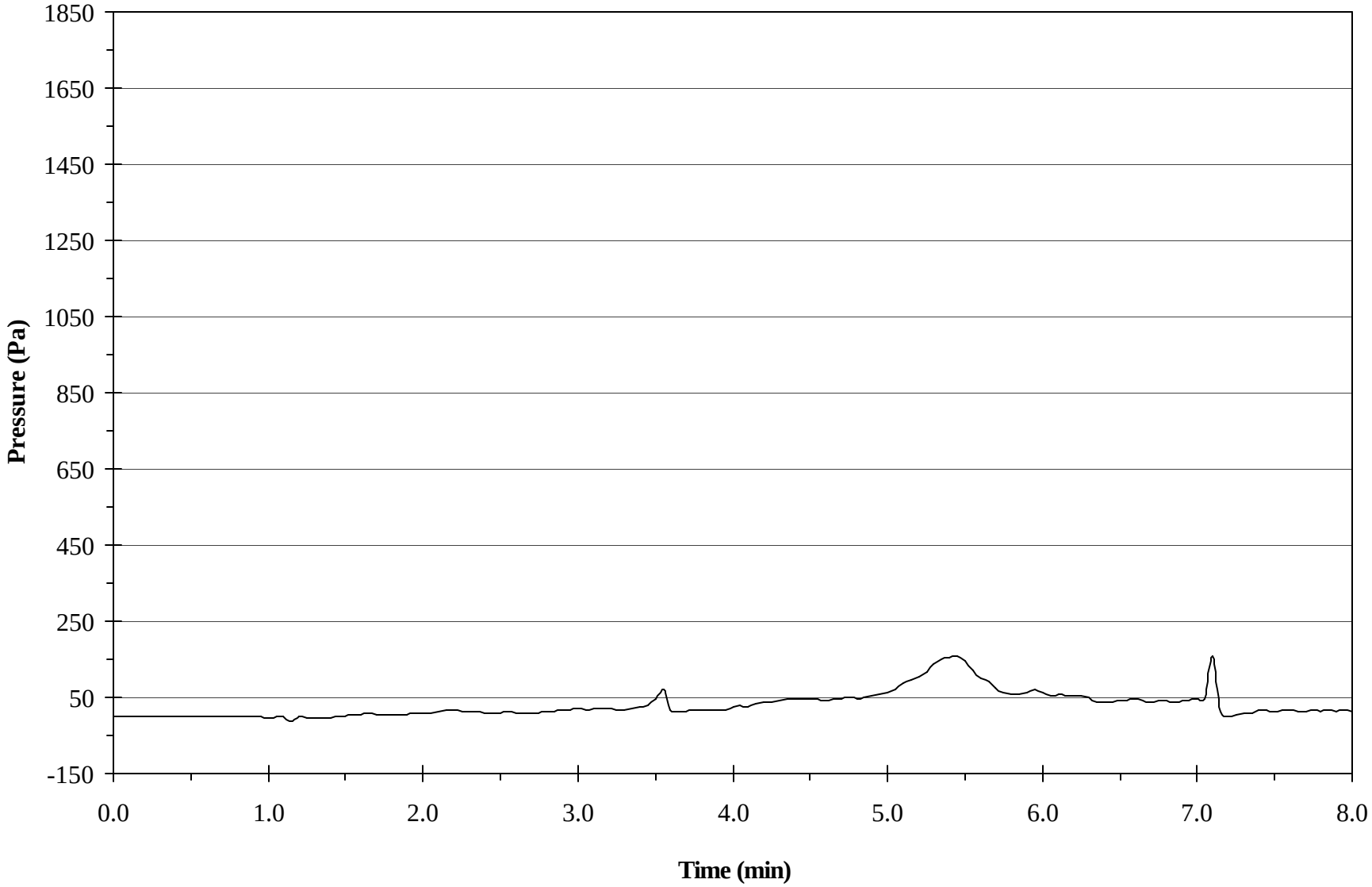
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 21 January 2003
File: 021MVFR1.DAT

Test CNP1: New 2000 Chevrolet Cavalier Plastic Fuel Tank Test No. 1 - Flame Temperatures

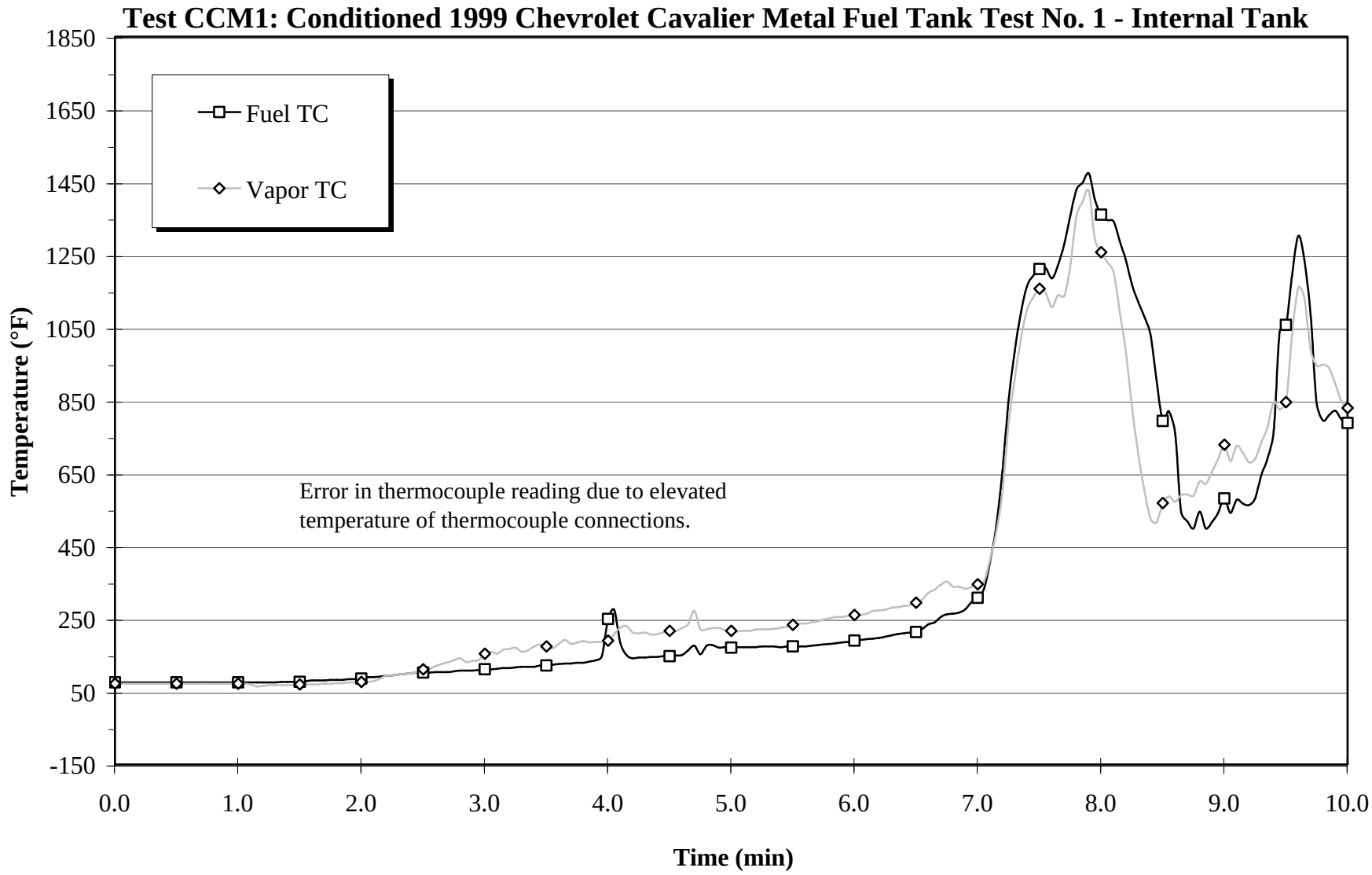


Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 21 January 2003
File: 021MVFR1.DAT

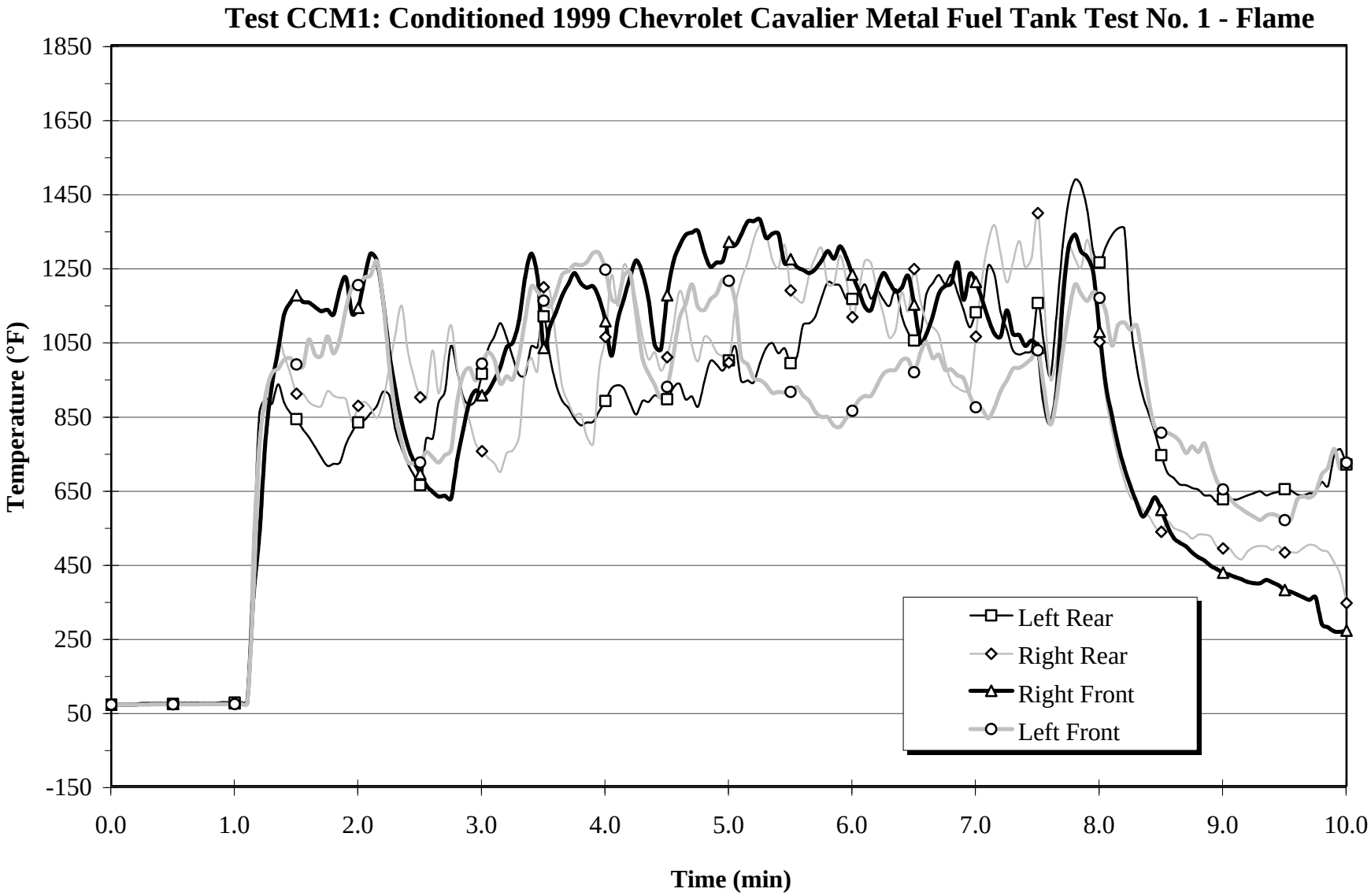
Test CNP1: New 2000 Chevrolet Cavalier Plastic Fuel Tank Test No. 1 - Tank Pressure



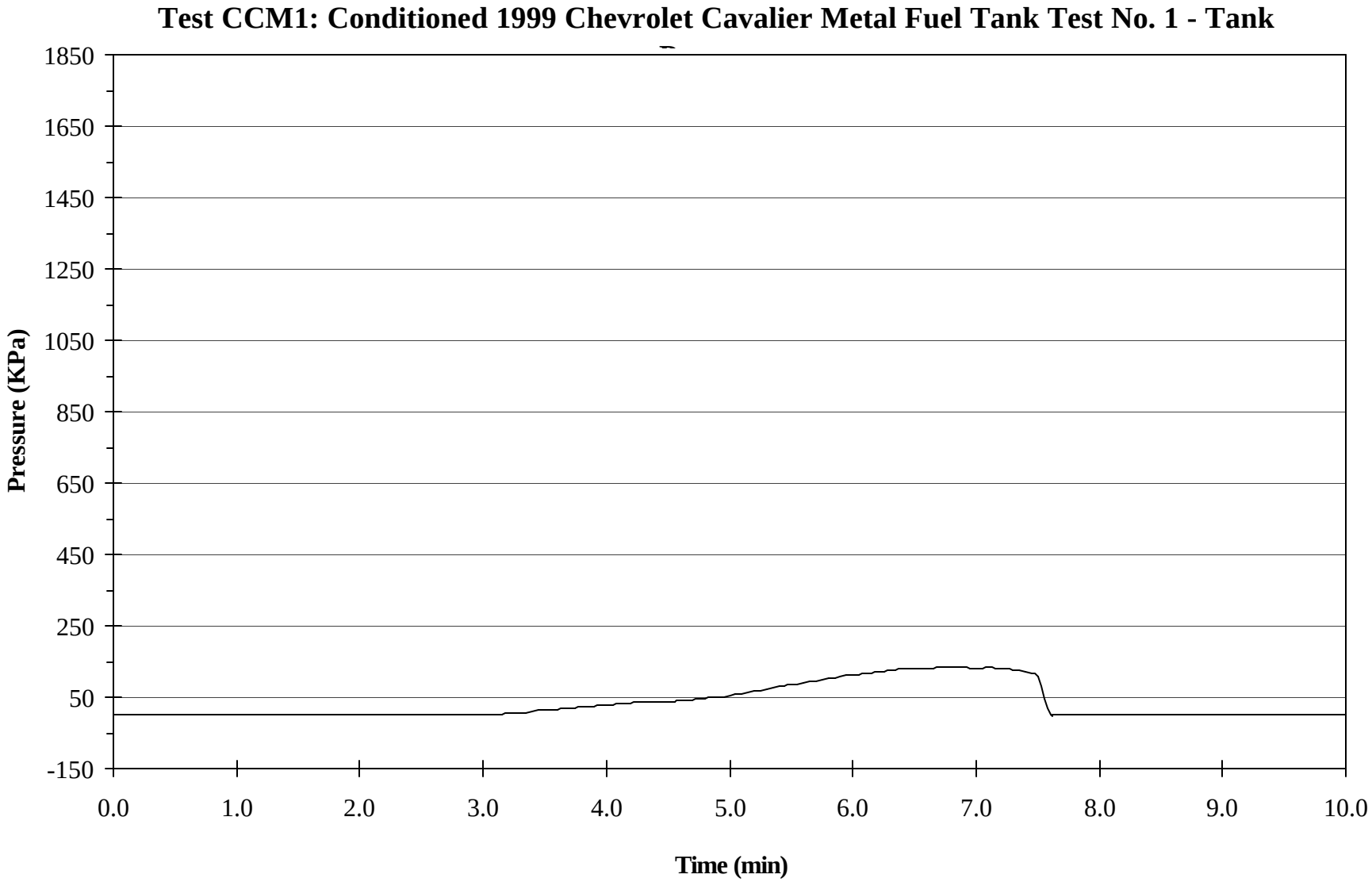
Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 18 February 2003
File: 049MVF1.DAT



Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 18 February 2003
File: 049MVF1.DAT



Client: Motor Vehicle Fire Research Institute
SwRI Project No: 01.06081.01.001
Date: 18 February 2003
File: 049MVF1.DAT



MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST SCP1: CONDITIONED 1998 SATURN TWIN CAM 4-DOOR FUEL TANK TEST NO. 1
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 18 DECEMBER 2002 **SwRI Project No.: 01.06081.01.001**
FILE: 352MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
0:00	64	65	66	66	66	66	1.959
0:03	64	65	66	66	66	66	2.425
0:06	64	65	66	67	66	66	1.549
0:09	64	65	66	67	66	66	1.287
0:12	64	65	66	68	67	66	2.475
0:15	64	65	66	68	67	66	1.45
0:18	64	65	66	68	67	66	2.425
0:21	64	65	66	69	67	66	1.81
0:24	64	65	66	69	67	67	2.22
0:27	64	65	66	70	68	67	1.655
0:30	64	65	66	70	68	67	2.984
0:33	64	65	67	70	68	67	1.195
0:36	64	65	67	70	68	67	2.517
0:39	64	65	67	71	68	67	1.86
0:42	64	65	67	71	68	67	1.138
0:45	64	65	67	71	68	67	1.655
0:48	64	65	67	71	68	67	2.27
0:51	64	65	67	71	68	67	1.959
0:54	64	65	67	72	68	67	2.164
0:57	64	65	67	72	69	67	1.655
1:00	64	65	67	72	69	68	1.195
1:03	64	65	67	72	69	68	1.697
1:06	64	65	67	73	69	68	2.475
1:09	64	65	68	74	70	68	2.22
1:12	64	65	78	96	71	69	0.783
1:15	62	66	822	621	346	230	-0.296
1:18	64	65	1176	1036	766	424	2.065
1:21	64	65	1210	1172	993	684	1.195
1:24	64	65	1176	1283	1098	827	2.63
1:27	64	66	1152	1390	1174	1011	12.424
1:30	64	72	1039	1469	1209	1134	10.43
1:33	64	92	978	1479	1236	1140	7.75
1:36	64	102	1033	1480	1243	1187	11.299
1:39	65	86	1061	1469	1226	1208	17.246
1:42	65	110	1012	1494	1238	1244	16.072
1:45	65	124	1217	1383	1261	1246	17.713
1:48	65	108	1274	1363	1249	1251	20.018
1:51	65	102	1339	1343	1298	1298	21.772
1:54	65	86	1393	1272	1315	1339	24.996
1:57	65	90	1458	1290	1340	1368	51.06
2:00	65	96	1467	1295	1266	1369	43.614
2:03	69	103	1516	1299	1247	1368	36.133
2:06	80	108	1515	1217	1228	1358	47.567
2:09	92	114	1473	1198	1229	1357	42.801
2:12	106	111	1329	1169	1281	1287	43.564
2:15	89	104	1388	1270	1256	1188	35.461
2:18	72	78	1390	1169	1078	1158	38.643
2:21	71	77	1347	1013	944	1098	38.495
2:24	71	77	1243	890	839	1036	37.922
2:27	70	79	1145	810	760	991	28.645
2:30	71	80	1109	750	711	951	31.36
2:33	71	81	1118	709	664	935	34.082
2:36	71	82	1209	695	665	938	42.44
2:39	71	83	1150	661	686	930	38.233
2:42	71	83	1140	625	703	945	33.877

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST SCP1: CONDITIONED 1998 SATURN TWIN CAM 4-DOOR FUEL TANK TEST NO. 1
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 18 DECEMBER 2002 **SwRI Project No.: 01.06081.01.001**
FILE: 352MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
2:45	72	84	1202	622	760	952	33.969
2:48	72	86	1184	617	778	953	21.609
2:51	72	86	1159	600	765	963	26.948
2:54	72	87	1082	575	753	1003	30.377
2:57	73	88	1073	566	665	1018	30.893
3:00	73	88	1110	560	722	1066	24.529
3:03	73	89	1162	552	710	1100	20.28
3:06	73	90	1124	553	697	1101	17.918
3:09	74	90	1047	528	685	1115	18.222
3:12	74	92	1011	539	673	1129	17.451
3:15	74	93	1022	548	668	1130	19.049
3:18	74	94	1079	619	777	1186	12.07
3:21	74	95	1174	989	1032	1267	19.502
3:24	74	96	1365	1189	1139	1189	19.092
3:27	74	97	1427	1338	1227	1119	21.658
3:30	74	98	1412	1424	1257	1088	20.117
Maximum	**106**	**124**	**1516**	**1494**	**1340**	**1369**	**51.06**

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST SNP1: NEW 1998 SATURN TWIN CAM 4-DOOR FUEL TANK TEST NO. 2
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 18 DECEMBER 2002 **SwRI Project No.: 01.06081.01.001**
FILE: 352MVF2.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
0:00	69	73	70	70	70	70	-1.709
0:03	69	73	71	70	70	70	-1.602
0:06	69	73	71	71	70	70	-1.602
0:09	69	73	71	72	70	70	-1.04
0:12	69	73	71	72	70	70	-0.89
0:15	69	73	71	73	70	70	-1.191
0:18	69	72	71	73	70	70	-3.813
0:21	69	72	71	73	71	70	-1.86
0:24	69	72	72	73	71	70	-1.04
0:27	69	72	72	74	71	70	-2.583
0:30	69	72	72	74	71	70	-2.227
0:33	69	72	72	74	71	70	-1.807
0:36	69	72	72	74	71	71	-2.734
0:39	69	72	72	74	71	71	-3.091
0:42	69	72	72	74	71	71	-2.637
0:45	69	72	72	74	71	71	-2.529
0:48	69	72	73	74	72	71	-2.119
0:51	69	72	73	74	72	71	-3.048
0:54	69	72	73	74	72	71	-2.583
0:57	69	72	73	75	72	71	-2.681
1:00	69	72	73	75	72	71	-3.048
1:03	69	72	73	75	72	71	-2.174
1:06	69	72	74	76	72	71	-2.432
1:09	69	72	74	78	73	71	-2.993
1:12	70	72	206	199	82	73	-7.352
1:15	70	73	882	857	366	224	-2.583
1:18	70	72	974	1167	688	554	-2.788
1:21	70	72	1057	1343	962	746	-0.576
1:24	71	72	1187	1405	1098	843	-1.914
1:27	85	72	1270	1343	1173	967	-0.835
1:30	85	72	1283	1390	1175	970	-0.166
1:33	103	72	1328	1405	1217	995	3.267
1:36	158	72	1355	1360	1243	1026	4.455
1:39	201	72	1381	1342	1260	1075	8.867
1:42	134	72	1316	1405	1311	1171	5.07
1:45	97	72	1361	1433	1329	1216	7.417
1:48	82	72	1384	1348	1341	1280	6.654
1:51	76	73	1385	1313	1341	1319	7.623
1:54	72	73	1398	1360	1337	1321	9.574
1:57	71	73	1392	1396	1329	1315	10.14
2:00	71	73	1417	1437	1331	1320	10.656
2:03	71	73	1424	1459	1319	1324	9.935
2:06	70	74	1432	1411	1248	1325	10.302
2:09	70	74	1403	1407	1200	1289	11.738
2:12	70	74	1403	1323	1217	1249	12.608
2:15	70	75	1326	1182	1201	1186	12.912
2:18	70	75	1087	989	1156	1136	12.608
2:21	70	76	992	853	1094	1048	14.191
2:24	70	76	927	762	983	986	13.428
2:27	70	77	854	703	892	933	13.838
2:30	70	78	775	655	818	891	15.273
2:33	70	79	735	633	762	862	14.658
2:36	70	79	695	622	717	835	14.552
2:39	70	81	661	597	681	815	14.962
2:42	70	82	659	564	653	804	14.602

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST SNP1: NEW 1998 SATURN TWIN CAM 4-DOOR FUEL TANK TEST NO. 2
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 18 DECEMBER 2002 **SwRI Project No.: 01.06081.01.001**
FILE: 352MVF2.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
2:45	70	83	671	553	630	793	14.658
2:48	70	85	710	540	601	775	14.552
2:51	70	86	707	528	581	775	15.988
2:54	70	87	682	520	562	776	16.355
2:57	70	89	668	523	544	773	16.504
3:00	70	90	654	507	527	773	17.677
3:03	70	91	664	498	514	763	17.677
3:06	70	92	653	489	507	768	18.144
3:09	70	93	652	494	495	773	18.498
3:12	70	94	616	496	483	773	18.349
3:15	71	95	583	497	475	774	19.785
3:18	71	96	840	852	662	975	13.937
3:21	71	97	1095	1106	887	1099	18.201
3:24	71	99	1211	1215	1033	1165	20.506
3:27	71	99	1286	1302	1071	1177	17.996
3:30	71	100	1262	1405	1134	1215	16.765
Maximum	**201**	**100**	**1432**	**1459**	**1341**	**1325**	**20.51**

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
Test SNP2: NEW 1998 SATURN TWIN CAM 4-DOOR REPEATABILITY FUEL TANK TEST NO. 1
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 19 FEBRUARY 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 050MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
0:00	69.8	69.8	93.2	69.8	71.6	71.6	3.191
0:03	69.8	69.8	125.6	95.0	80.6	104.0	2.109
0:06	69.8	69.8	113.0	89.6	78.8	102.2	2.513
0:09	69.8	69.8	104.0	87.8	77.0	98.6	2.874
0:12	69.8	69.8	98.6	86.0	77.0	95.0	2.563
0:15	69.8	69.8	93.2	84.2	75.2	93.2	3.235
0:18	69.8	69.8	89.6	82.4	75.2	91.4	3.154
0:21	69.8	69.8	87.8	80.6	75.2	87.8	1.972
0:24	69.8	69.8	86.0	80.6	75.2	87.8	2.42
0:27	69.8	69.8	84.2	78.8	75.2	86.0	2.42
0:30	69.8	69.8	82.4	78.8	75.2	84.2	3.372
0:33	69.8	69.8	80.6	78.8	75.2	84.2	3.055
0:36	69.8	69.8	78.8	78.8	75.2	82.4	2.513
0:39	69.8	69.8	78.8	77.0	75.2	80.6	2.924
0:42	69.8	69.8	78.8	77.0	75.2	80.6	2.743
0:45	69.8	69.8	77.0	77.0	75.2	78.8	3.011
0:48	69.8	69.8	77.0	77.0	75.2	78.8	5.219
0:51	69.8	69.8	77.0	77.0	75.2	78.8	-1.272
0:54	69.8	69.8	77.0	77.0	75.2	78.8	0.168
0:57	69.8	69.8	77.0	77.0	75.2	78.8	0.566
1:00	69.8	69.8	77.0	77.0	75.2	78.8	0.666
1:03	69.8	69.8	75.2	77.0	75.2	77.0	0.075
1:06	69.8	69.8	75.2	77.0	75.2	77.0	3.334
1:09	69.8	69.8	75.2	78.8	77.0	77.0	1.431
1:12	69.8	69.8	192.2	206.6	84.2	80.6	-4.434
1:15	69.8	68.0	892.4	743.0	545.0	354.2	0.566
1:18	69.8	69.8	1041.8	1155.2	874.4	759.2	1.431
1:21	69.8	69.8	1094.0	1256.0	1065.2	998.6	1.026
1:24	69.8	69.8	1101.2	1265.0	1167.8	1110.2	1.157
1:27	69.8	68.0	1032.8	1353.2	1160.6	1164.2	2.24
1:30	69.8	69.8	1041.8	1389.2	1290.2	1193.0	1.698
1:33	71.6	69.8	1025.6	1392.8	1295.6	1211.0	2.6
1:36	71.6	69.8	1029.2	1441.4	1281.2	1243.4	3.415
1:39	71.6	69.8	1029.2	1437.8	1243.4	1302.8	3.913
1:42	71.6	69.8	1074.2	1349.6	1304.6	1313.6	4.274
1:45	71.6	69.8	1146.2	1229.0	1369.4	1320.8	3.813
1:48	71.6	69.8	1095.8	1211.0	1342.4	1329.8	3.322
1:51	71.6	69.8	1029.2	1297.4	1329.8	1356.8	4.728
1:54	71.6	69.8	1020.2	1335.2	1284.8	1349.6	5.991
1:57	71.6	71.6	1097.6	1252.4	1288.4	1358.6	6.663
2:00	71.6	71.6	1108.4	1223.6	1308.2	1274.0	6.302
2:03	71.6	71.6	1041.8	1248.8	1380.2	1308.2	5.667
2:06	71.6	73.4	1130.0	1293.8	1344.2	1340.6	6.352
2:09	71.6	73.4	1038.2	1304.6	1335.2	1358.6	7.154
2:12	71.6	73.4	1049.0	1329.8	1284.8	1331.6	7.695
2:15	71.6	75.2	1040.0	1243.4	1331.6	1178.6	7.975
2:18	71.6	77.0	1137.2	1149.8	1286.6	1126.4	7.658
2:21	71.6	77.0	1202.0	1083.2	1279.4	1151.6	7.515
2:24	73.4	78.8	1103.0	1074.2	1171.4	1117.4	7.926
2:27	73.4	78.8	1027.4	1176.8	1067.0	1106.6	9.188
2:30	73.4	80.6	975.2	1229.0	973.4	1054.4	9.599
2:33	75.2	80.6	863.6	1252.4	885.2	969.8	10.184
2:36	75.2	80.6	820.4	1297.4	816.8	919.4	10.632
2:39	75.2	82.4	770.0	1311.8	784.4	861.8	11.36
2:42	75.2	82.4	743.0	1290.2	753.8	809.6	10.993

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
Test SNP2: NEW 1998 SATURN TWIN CAM 4-DOOR REPEATABILITY FUEL TANK TEST NO. 1
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 19 FEBRUARY 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 050MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
2:45	75.2	84.2	707.0	1270.4	723.2	771.8	11.584
2:48	75.2	86.0	708.8	1241.6	732.2	741.2	12.579
2:51	75.2	86.0	678.2	1227.2	699.8	732.2	12.579
2:54	77.0	87.8	690.8	1180.4	656.6	721.4	13.842
2:57	77.0	89.6	680.0	1212.8	654.8	725.0	12.94
3:00	77.0	89.6	698.0	1205.6	872.6	840.2	12.579
3:03	77.0	91.4	696.2	1203.8	1056.2	937.4	13.792
3:06	78.8	91.4	707.0	1263.2	1158.8	1002.2	13.562
3:09	78.8	93.2	773.6	1229.0	1232.6	1041.8	13.972
3:12	78.8	93.2	876.2	1149.8	1337.0	995.0	13.705
3:15	78.8	95.0	894.2	1133.6	1337.0	1043.6	12.94
3:18	80.6	95.0	1122.8	1194.8	1430.6	1166.0	12.262
3:21	80.6	96.8	1247.0	1301.0	1517.0	1225.4	14.744
3:24	80.6	98.6	1367.6	1434.2	1524.2	1284.8	17.269
3:27	82.4	98.6	1216.4	1479.2	1488.2	1306.4	18.489
3:30	82.4	100.4	1074.2	1526.0	1342.4	1320.8	18.539
Maximum	**82.4**	**100.4**	**1367.6**	**1526**	**1524.2**	**1358.6**	**18.54**

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
Test SNP3: NEW 1998 SATURN TWIN CAM 4-DOOR REPEATABILITY FUEL TANK TEST NO. 2
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 19 FEBRUARY 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 050MVF2.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
0:00	68.0	75.2	71.6	73.4	71.6	71.6	-1.263
0:03	69.8	77.0	71.6	73.4	71.6	71.6	-1.443
0:06	69.8	77.0	71.6	73.4	73.4	71.6	-1.035
0:09	69.8	77.0	71.6	73.4	73.4	73.4	-1.348
0:12	69.8	77.0	71.6	73.4	73.4	73.4	-1.348
0:15	69.8	77.0	71.6	73.4	73.4	73.4	-0.902
0:18	69.8	75.2	71.6	73.4	73.4	73.4	-1.757
0:21	69.8	75.2	73.4	73.4	73.4	73.4	-1.035
0:24	69.8	75.2	73.4	75.2	73.4	73.4	-0.494
0:27	69.8	77.0	73.4	75.2	75.2	73.4	-0.855
0:30	69.8	77.0	73.4	75.2	75.2	73.4	-2.117
0:33	69.8	77.0	73.4	75.2	75.2	73.4	-0.541
0:36	69.8	75.2	73.4	75.2	75.2	73.4	-2.165
0:39	69.8	75.2	73.4	75.2	75.2	73.4	-1.481
0:42	69.8	75.2	73.4	75.2	75.2	73.4	1.045
0:45	69.8	75.2	73.4	75.2	75.2	73.4	-2.022
0:48	69.8	75.2	73.4	75.2	75.2	73.4	-3.693
0:51	68.0	75.2	73.4	75.2	75.2	73.4	-2.611
0:54	69.8	75.2	73.4	77.0	75.2	73.4	-3.38
0:57	68.0	75.2	73.4	77.0	75.2	73.4	-2.839
1:00	68.0	75.2	73.4	77.0	75.2	73.4	-4.016
1:03	69.8	75.2	73.4	77.0	75.2	75.2	-2.25
1:06	69.8	77.0	73.4	77.0	75.2	75.2	-1.301
1:09	69.8	75.2	73.4	80.6	77.0	75.2	-2.117
1:12	69.8	77.0	278.6	395.6	102.2	100.4	-3.152
1:15	73.4	75.2	631.4	928.4	633.2	505.4	-2.345
1:18	69.8	75.2	800.6	1176.8	980.6	845.6	-2.478
1:21	69.8	77.0	939.2	1284.8	1124.6	1104.8	-3.333
1:24	69.8	77.0	980.6	1394.6	1191.2	1270.4	-2.25
1:27	68.0	77.0	995.0	1257.8	1252.4	1304.6	-1.937
1:30	69.8	77.0	1011.2	1248.8	1274.0	1324.4	-1.301
1:33	69.8	77.0	1022.0	1191.2	1313.6	1335.2	-0.133
1:36	69.8	77.0	1020.2	1200.2	1382.0	1329.8	1.356
1:39	69.8	77.0	973.4	1227.2	1407.2	1347.8	1.717
1:42	69.8	77.0	932.0	1302.8	1392.8	1385.6	3.701
1:45	69.8	77.0	881.6	1349.6	1362.2	1383.8	7.316
1:48	69.8	77.0	1020.2	1274.0	1333.4	1369.4	8.809
1:51	69.8	77.0	1184.0	1164.2	1335.2	1380.2	6.775
1:54	69.8	78.8	1187.6	1144.4	1315.4	1441.4	8.038
1:57	69.8	78.8	1259.6	1126.4	1311.8	1446.8	7.223
2:00	69.8	78.8	1223.6	1151.6	1313.6	1434.2	6.233
2:03	71.6	78.8	1068.8	1214.6	1306.4	1441.4	6.775
2:06	71.6	80.6	953.6	1279.4	1301.0	1437.8	7.135
2:09	71.6	80.6	905.0	1196.6	1324.4	1455.8	8.355
2:12	71.6	80.6	879.8	1281.2	1346.0	1443.2	9.3
2:15	71.6	80.6	971.6	1268.6	1317.2	1335.2	9.35
2:18	71.6	82.4	1002.2	1279.4	1230.8	1261.4	8.448
2:21	71.6	82.4	1081.4	1275.8	1135.4	1221.8	9.12
2:24	71.6	82.4	1083.2	1320.8	1085.0	1200.2	8.398
2:27	71.6	84.2	1040.0	1311.8	1043.6	1175.0	8.759
2:30	71.6	84.2	899.6	1310.0	964.4	1122.8	12.909
2:33	71.6	84.2	833.0	1353.2	890.6	1058.0	14.725
2:36	73.4	86.0	779.0	1394.6	836.6	1022.0	14.806
2:39	73.4	86.0	743.0	1385.6	802.4	964.4	15.988
2:42	73.4	87.8	725.0	1373.0	779.0	899.6	16.249

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
Test SNP3: NEW 1998 SATURN TWIN CAM 4-DOOR REPEATABILITY FUEL TANK TEST NO. 2
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 19 FEBRUARY 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 050MVF2.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
2:45	73.4	87.8	746.6	1382.0	762.8	842.0	18.507
2:48	73.4	89.6	768.2	1319.0	739.4	804.2	18.557
2:51	75.2	89.6	825.8	1367.6	717.8	793.4	15.708
2:54	75.2	91.4	771.8	1338.8	699.8	782.6	15.167
2:57	75.2	91.4	728.6	1373.0	685.4	761.0	13.412
3:00	75.2	93.2	719.6	1371.2	663.8	822.2	13.052
3:03	77.0	93.2	746.6	1403.6	651.2	798.8	13.68
3:06	77.0	95.0	737.6	1412.6	633.2	809.6	13.232
3:09	77.0	95.0	701.6	1286.6	617.0	933.8	14.856
3:12	78.8	96.8	672.8	1277.6	608.0	962.6	15.577
3:15	78.8	98.6	672.8	1331.6	615.2	935.6	16.025
3:18	78.8	98.6	804.2	1346.0	744.8	1036.4	11.335
3:21	80.6	100.4	1016.6	1398.2	1056.2	1162.4	16.84
3:24	82.4	102.2	1202.0	1419.8	1193.0	1115.6	18.016
3:27	80.6	104.0	1209.2	1486.4	1293.8	1169.6	18.868
3:30	80.6	104.0	1200.2	1385.6	1340.6	1250.6	19.005
3:33	82.4	105.8	1155.2	1371.2	1326.2	1328.0	20.131
3:36	82.4	107.6	1049.0	1437.8	1310.0	1356.8	19.148
3:39	82.4	109.4	1034.6	1410.8	1306.4	1383.8	18.688
3:42	82.4	109.4	969.8	1313.6	1302.8	1353.2	20.903
3:45	84.2	111.2	1038.2	1205.6	1335.2	1389.2	21.444
3:48	84.2	113.0	1022.0	1140.8	1365.8	1405.4	20.772
3:51	84.2	114.8	1054.4	1097.6	1373.0	1403.6	6.681
3:54	86.0	116.6	1135.4	1020.2	1342.4	1412.6	5.151
3:57	86.0	116.6	1099.4	1005.8	1308.2	1293.8	4.877
4:00	87.8	118.4	1079.6	1023.8	1256.0	1326.2	2.712
4:03	86.0	120.2	1061.6	1031.0	1297.4	1418.0	2.028
4:06	87.8	122.0	1047.2	1002.2	1319.0	1412.6	0.952
4:09	87.8	123.8	991.4	1009.4	1346.0	1409.0	2.669
4:12	87.8	125.6	1025.6	998.6	1297.4	1351.4	2.98
4:15	89.6	127.4	984.2	1027.4	1277.6	1301.0	3.434
4:18	89.6	129.2	1013.0	1086.8	1211.0	1212.8	3.16
4:21	89.6	131.0	1016.6	1135.4	1252.4	1205.6	6.731
4:24	89.6	132.8	1020.2	1099.4	1308.2	1194.8	6.551
4:27	91.4	134.6	1106.6	1067.0	1340.6	1176.8	9.35
4:30	91.4	136.4	1110.2	977.0	1344.2	1320.8	12.007
4:33	91.4	138.2	1083.2	932.0	1373.0	1418.0	3.795
4:36	93.2	140.0	1031.0	905.0	1347.8	1371.2	3.434
4:39	93.2	141.8	998.6	901.4	1292.0	1238.0	4.112
4:42	93.2	143.6	978.8	870.8	1326.2	1322.6	-1.624
4:45	95.0	145.4	1000.4	883.4	1295.6	1317.2	-1.576
4:48	95.0	147.2	1013.0	883.4	1283.0	1344.2	-1.168
4:51	98.6	149.0	1022.0	869.0	1187.6	1382.0	-1.263
4:54	96.8	150.8	1025.6	870.8	1153.4	1322.6	-0.037
4:57	96.8	152.6	1041.8	968.0	1077.8	1284.8	0.952
5:00	98.6	154.4	1034.6	959.0	1023.8	1326.2	1.313
Maximum	**82.4**	**104**	**1259.6**	**1486.4**	**1407.2**	**1455.8**	**19.01**

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST SNP4: NEW 1998 SATURN TWIN CAM 4-DOOR REPEATABILITY FUEL TANK TEST NO. 3
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 28 APRIL 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 118MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
0:00	80.6	78.8	82.4	80.6	82.4	82.4	1.792
0:03	80.6	78.8	82.4	82.4	82.4	82.4	1.568
0:06	80.6	78.8	82.4	82.4	82.4	82.4	1.879
0:09	80.6	78.8	82.4	82.4	82.4	82.4	1.879
0:12	80.6	78.8	82.4	82.4	82.4	82.4	0.703
0:15	80.6	78.8	84.2	82.4	82.4	82.4	1.972
0:18	80.6	78.8	84.2	82.4	84.2	82.4	0.927
0:21	80.6	78.8	84.2	82.4	84.2	82.4	1.064
0:24	80.6	78.8	84.2	82.4	84.2	82.4	0.485
0:27	80.6	78.8	84.2	82.4	84.2	82.4	1.064
0:30	80.6	78.8	84.2	82.4	84.2	84.2	-0.285
0:33	80.6	78.8	84.2	82.4	84.2	84.2	1.518
0:36	80.6	78.8	84.2	82.4	84.2	84.2	1.929
0:39	80.6	78.8	84.2	84.2	84.2	84.2	2.781
0:42	80.6	78.8	84.2	84.2	84.2	84.2	2.289
0:45	80.6	78.8	86.0	84.2	84.2	84.2	2.42
0:48	80.6	78.8	86.0	84.2	86.0	84.2	0.435
0:51	80.6	78.8	86.0	84.2	86.0	84.2	1.568
0:54	80.6	78.8	86.0	84.2	86.0	84.2	1.064
0:57	80.6	78.8	86.0	84.2	86.0	84.2	1.026
1:00	80.6	78.8	86.0	84.2	86.0	84.2	-0.418
1:03	80.6	80.6	86.0	84.2	86.0	84.2	2.731
1:06	80.6	80.6	86.0	84.2	86.0	84.2	2.874
1:09	80.6	78.8	86.0	86.0	87.8	84.2	-0.2
1:12	80.6	78.8	93.2	141.8	89.6	86.0	-1.595
1:15	80.6	80.6	701.6	773.6	366.8	219.2	0.342
1:18	80.6	78.8	1094.0	984.2	869.0	627.8	0.162
1:21	80.6	78.8	1252.4	968.0	1155.2	896.0	1.698
1:24	80.6	78.8	1308.2	1059.8	1286.6	1079.6	0.977
1:27	80.6	78.8	1373.0	935.6	1371.2	1149.8	2.961
1:30	80.6	80.6	1398.2	944.6	1378.4	1232.6	2.874
1:33	80.6	80.6	1412.6	946.4	1414.4	1263.2	8.517
1:36	80.6	78.8	1358.6	905.0	1446.8	1288.4	19.117
1:39	80.6	80.6	1234.4	942.8	1454.0	1274.0	8.019
1:42	80.6	80.6	1205.6	1023.8	1461.2	1254.2	8.741
1:45	80.6	80.6	1173.2	1149.8	1364.0	1207.4	11.857
1:48	80.6	80.6	1119.2	1295.6	1319.0	1245.2	17.133
1:51	80.6	80.6	1043.6	1346.0	1290.2	1288.4	15.017
1:54	80.6	80.6	998.6	1344.2	1266.8	1274.0	18.215
1:57	80.6	80.6	1020.2	1385.6	1238.0	1180.4	19.889
2:00	80.6	80.6	1196.6	1184.0	1293.8	1137.2	21.786
2:03	80.6	80.6	1198.4	1040.0	1322.6	1261.4	12.529
2:06	80.6	80.6	1221.8	966.2	1380.2	1281.2	40.611
2:09	80.6	80.6	1283.0	953.6	1396.4	1335.2	15.465
2:12	80.6	82.4	1364.0	966.2	1401.8	1342.4	23.54
2:15	82.4	82.4	1369.4	973.4	1331.6	1180.4	45.755
2:18	82.4	82.4	1353.2	998.6	1362.2	1209.2	15.963
2:21	82.4	no data	1383.8	1149.8	1227.2	1135.4	13.574
2:24	82.4	no data	1360.4	1256.0	1133.6	1067.0	14.153
2:27	82.4	84.2	1369.4	1279.4	1065.2	1103.0	16.28
2:30	82.4	no data	1337.0	1212.8	1016.6	1112.0	17.904
2:33	82.4	84.2	1342.4	1128.2	914.0	1000.4	18.899
2:36	82.4	84.2	1293.8	1146.2	905.0	908.6	28.554
2:39	84.2	86.0	1234.4	1257.8	852.8	827.6	17.313
2:42	84.2	86.0	1247.0	1319.0	800.6	852.8	15.416

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST SNP4: NEW 1998 SATURN TWIN CAM 4-DOOR REPEATABILITY FUEL TANK TEST NO. 3
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 28 APRIL 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 118MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
2:45	84.2	86.0	1196.6	1364.0	766.4	809.6	22.414
2:48	84.2	87.8	1130.0	1403.6	730.4	980.6	28.324
2:51	84.2	87.8	1076.0	1367.6	737.6	1101.2	26.701
2:54	86.0	87.8	966.2	1266.8	800.6	1153.4	23.994
2:57	86.0	89.6	921.2	1135.4	771.8	1166.0	26.794
3:00	86.0	89.6	878.0	1149.8	815.0	1068.8	29.911
3:03	86.0	89.6	932.0	1167.8	845.6	993.2	25.848
3:06	87.8	91.4	847.4	1061.6	840.2	1027.4	27.472
3:09	87.8	91.4	885.2	1085.0	966.2	1086.8	30.358
3:12	87.8	93.2	1045.4	1293.8	1146.2	1095.8	34.514
3:15	89.6	93.2	1085.0	1310.0	1112.0	1119.2	26.259
3:18	89.6	95.0	1121.0	1320.8	1202.0	1153.4	18.395
3:21	89.6	96.8	1175.0	1428.8	1346.0	1187.6	23.77
3:24	89.6	96.8	1311.8	1346.0	1452.2	1229.0	26.34
3:27	89.6	98.6	1338.8	1459.4	1490.0	1227.2	30.763
3:30	89.6	100.4	1254.2	1542.2	1446.8	1292.0	32.387
3:33	91.4	100.4	1193.0	1445.0	1445.0	1304.6	36.044
3:36	91.4	102.2	1299.2	1340.6	1432.4	1293.8	41.954
3:39	91.4	102.2	1394.6	1180.4	1425.2	1319.0	37.127
3:42	93.2	102.2	1351.4	1135.4	1468.4	1353.2	32.523
3:45	93.2	104.0	1365.8	1148.0	1491.8	1371.2	31.715
3:48	93.2	104.0	1329.8	1117.4	1477.4	1382.0	31.982
3:51	93.2	105.8	1358.6	1149.8	1518.8	1371.2	34.912
3:54	95.0	105.8	1378.4	1151.6	1486.4	1376.6	34.06
3:57	95.0	107.6	1374.8	1068.8	1457.6	1385.6	36.679
4:00	95.0	107.6	1272.2	1068.8	1445.0	1331.6	40.107
4:03	96.8	109.4	1216.4	1077.8	1479.2	1283.0	42.234
4:06	96.8	109.4	1225.4	1040.0	1387.4	1266.8	54.819
4:09	96.8	111.2	1223.6	1052.6	1378.4	1268.6	49.718
4:12	96.8	111.2	1311.8	1180.4	1243.4	1126.4	55.815
4:15	96.8	113.0	1275.8	1259.6	1340.6	1059.8	57.389
4:18	98.6	113.0	1198.4	1284.8	1383.8	1088.6	60.736
4:21	98.6	114.8	1182.2	1202.0	1419.8	1194.8	61.955
4:24	98.6	114.8	1209.2	1126.4	1430.6	1248.8	64.891
4:27	100.4	116.6	1319.0	1079.6	1369.4	1274.0	64.35
4:30	100.4	116.6	1425.2	1137.2	1355.0	1292.0	61.407
Maximum	100.4	116.6	1425.2	1542.2	1518.8	1385.6	116.6

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST JCP1: CONDITIONED 1998 JEEP GRAND CHEROKEE FUEL TANK TEST NO. 3
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 18 DECEMBER 2002 **SwRI Project No.: 01.06081.01.001**
FILE: 352MVF3.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
0:00	76	84	77	77	76	76	-1.85
0:03	76	84	77	77	77	77	-1.03
0:06	76	84	92	79	78	88	-0.933
0:09	77	84	103	81	79	87	-0.156
0:12	76	84	100	83	80	87	-0.986
0:15	76	84	98	83	82	86	0.146
0:18	76	84	96	84	82	86	-1.397
0:21	76	84	96	85	83	85	-2.314
0:24	76	84	96	85	83	84	-0.317
0:27	76	84	95	85	84	84	-1.602
0:30	76	84	95	86	85	83	-2.669
0:33	76	84	94	86	85	83	-0.371
0:36	76	84	94	85	86	83	-2.012
0:39	76	84	94	85	86	83	-0.933
0:42	76	84	94	85	86	82	-0.112
0:45	76	84	94	85	87	82	-1.191
0:48	76	84	93	85	87	82	-2.724
0:51	76	84	93	86	88	81	-0.619
0:54	76	84	93	86	89	81	-1.44
0:57	76	84	93	86	89	81	-2.162
1:00	76	84	93	87	89	81	-3.857
1:03	76	84	93	87	90	81	-0.879
1:06	76	84	94	88	91	81	-0.156
1:09	76	84	98	90	93	81	0.46
1:12	76	84	136	140	103	84	-46.076
1:15	76	84	785	512	700	541	-79.879
1:18	76	84	1153	515	1052	838	-74.441
1:21	76	84	1267	549	1154	1006	-66.953
1:24	76	84	1394	613	1246	977	-61.009
1:27	76	83	1432	672	1251	958	-66.953
1:30	76	83	1474	728	1241	908	-77.527
1:33	76	83	1442	761	1244	979	-119.445
1:36	76	83	1460	782	1265	1048	-124.213
1:39	76	84	1453	791	1262	1095	-123.911
1:42	76	84	1490	793	1275	1046	-96.56
1:45	76	84	1512	794	1306	1013	-43.832
1:48	76	84	1485	794	1380	1088	25.59
1:51	76	84	1520	758	1422	1129	116.544
1:54	76	84	1510	759	1438	1247	122.024
1:57	76	85	1432	768	1495	1240	97.552
2:00	76	85	1430	784	1515	1249	86.938
2:03	76	86	1426	788	1499	1289	94.384
2:06	76	86	1458	811	1466	1242	117.775
2:09	76	87	1529	810	1493	1167	155.583
2:12	77	87	1553	806	1524	1175	151.574
2:15	77	88	1496	767	1467	1363	153.476
2:18	77	88	1217	727	1317	1119	154.855
2:21	78	88	1016	687	1137	978	165.377
2:24	78	88	973	663	1051	894	180.77
2:27	78	89	899	661	989	841	196.927
2:30	79	89	905	671	961	783	212.731
2:33	79	89	880	666	949	739	228.839
2:36	79	90	911	644	862	744	241.864
2:39	80	90	1071	608	835	803	254.69
2:42	80	91	1153	586	843	874	264.187

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST JCP1: CONDITIONED 1998 JEEP GRAND CHEROKEE FUEL TANK TEST NO. 3
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 18 DECEMBER 2002 **SwRI Project No.: 01.06081.01.001**
FILE: 352MVF3.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
2:45	80	91	1197	590	835	892	270.282
2:48	81	92	1255	606	917	1036	275.925
2:51	81	92	1306	610	1065	1194	288.864
2:54	82	93	1249	604	1166	1305	296.812
2:57	83	94	1204	597	1210	1301	301.84
3:00	82	94	1193	604	1185	1306	310
3:03	82	95	1136	587	1233	1249	317.75
3:06	83	95	1145	572	1267	1208	326.313
3:09	83	96	1124	569	1278	1232	340.059
3:12	83	97	1092	571	1335	1289	351.549
3:15	83	97	1063	565	1354	1354	362.481
3:18	84	98	1156	568	1341	1325	369.149
3:21	84	99	1289	600	1408	1390	373.766
3:24	85	100	1397	623	1487	1454	374.275
3:27	86	100	1093	527	971	1229	389.612
3:30	87	101	806	437	644	918	406.137
Maximum	**87**	**101**	**1553**	**811**	**1524**	**1454**	**406.14**

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST JNP1: NEW 1998 JEEP GRAND CHEROKEE FUEL TANK TEST NO. 4
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 19 DECEMBER 2002 **SwRI Project No.: 01.06081.01.001**
FILE: 353MVF4.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
0:00	62	64	64	63	63	63	9.426
0:03	62	64	64	63	63	63	8.704
0:06	62	64	65	64	64	63	7.58
0:09	62	64	66	65	64	63	7.729
0:12	62	64	67	66	65	63	4.752
0:15	62	64	68	67	66	63	3.988
0:18	62	64	68	68	66	64	6.088
0:21	62	64	69	70	67	64	4.292
0:24	62	64	70	71	68	64	3.882
0:27	62	64	71	73	68	64	5.07
0:30	62	64	72	74	69	64	4.398
0:33	62	64	73	75	69	64	3.373
0:36	62	64	74	76	69	64	4.957
0:39	62	64	76	77	70	65	6.088
0:42	62	64	78	79	70	65	4.236
0:45	62	64	80	80	71	66	5.883
0:48	62	64	81	80	71	66	2.652
0:51	62	64	81	80	71	66	3.267
0:54	62	64	81	80	72	66	3.062
0:57	62	64	83	81	72	67	4.441
1:00	62	64	82	81	72	67	6.654
1:03	62	64	82	81	72	67	6.392
1:06	62	64	83	84	73	67	10.451
1:09	62	64	86	89	75	67	9.32
1:12	62	64	261	310	95	73	-90.313
1:15	62	64	686	1051	791	671	-118.279
1:18	62	64	883	1235	1135	810	-125.821
1:21	62	64	899	1281	1290	870	-126.274
1:24	62	64	1005	1361	1287	1089	-126.123
1:27	62	64	1163	1423	1332	1120	-126.738
1:30	62	64	1241	1468	1346	1300	-127.871
1:33	62	64	1330	1529	1359	1348	-127.299
1:36	62	64	1395	1513	1318	1306	-126.231
1:39	62	64	1452	1545	1347	1255	-103.239
1:42	62	64	1427	1469	1357	1280	-22.08
1:45	62	65	1422	1394	1302	1401	0.038
1:48	62	65	1419	1416	1316	1434	125.312
1:51	62	65	1404	1377	1334	1432	223.62
1:54	62	65	1419	1322	1411	1336	292.93
1:57	62	65	1318	1369	1422	1199	366.653
2:00	62	65	1335	1494	1468	1080	437.61
2:03	62	65	1287	1542	1385	1136	508.256
2:06	63	66	1266	1509	1396	1134	574.589
2:09	63	66	1222	1484	1360	1181	645.703
2:12	63	66	1218	1338	1349	1276	726.305
2:15	63	67	1088	1202	1288	1150	802.184
2:18	64	67	997	1199	1241	1045	874.626
2:21	64	67	1136	1194	1240	1060	939.672
2:24	64	68	1189	1285	1264	1042	1011.556
2:27	64	68	1205	1291	1252	1097	1084.515
2:30	65	68	1213	1291	1294	1126	1156.49
2:33	65	69	1262	1250	1313	1076	1223.234
2:36	66	69	1276	1193	1286	1123	1283.924
2:39	66	70	1223	1215	1260	1166	1347.089
2:42	67	70	1189	1310	1269	1178	1406.436

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST JNP1: NEW 1998 JEEP GRAND CHEROKEE FUEL TANK TEST NO. 4
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 19 DECEMBER 2002 **SwRI Project No.: 01.06081.01.001**
FILE: 353MVF4.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
2:45	67	71	1175	1369	1280	1142	1462.417
2:48	68	71	1196	1343	1316	1126	1506.385
2:51	68	72	1183	1406	1287	1125	1553.173
2:54	68	73	1177	1469	1253	1172	1589.808
2:57	69	73	1190	1502	1196	1109	1625.361
3:00	70	74	1250	1403	1226	1055	1650.647
3:03	70	75	1258	1347	1236	1090	1672.56
3:06	71	77	1204	1369	1230	1106	1688.208
3:09	71	76	890	966	919	781	1708.785
3:12	72	77	710	748	786	609	1730.74
3:15	72	77	604	480	540	527	1736.072
3:18	73	79	557	430	490	467	1601.61
3:21	73	79	484	304	329	434	7.58
3:24	74	79	447	263	275	409	5.834
3:27	75	80	427	254	268	379	11.83
3:30	75	81	396	243	261	352	11.533
Maximum	**75**	**81**	**1452**	**1545**	**1468**	**1434**	**1736.07**

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
Test JNP2(S): NEW 1998 JEEP GRAND CHEROKEE FUEL TANK TEST NO. 5S
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 30 APRIL 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 120MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
0:00	82.4	80.6	82.4	82.4	82.4	82.4	2.352
0:03	82.4	80.6	82.4	84.2	82.4	82.4	3.484
0:06	82.4	80.6	84.2	84.2	84.2	82.4	2.943
0:09	82.4	80.6	86.0	86.0	84.2	82.4	2.893
0:12	82.4	80.6	86.0	86.0	84.2	82.4	3.701
0:15	82.4	80.6	87.8	87.8	84.2	82.4	2.619
0:18	82.4	80.6	87.8	87.8	86.0	84.2	1.947
0:21	82.4	80.6	87.8	87.8	86.0	84.2	2.532
0:24	82.4	80.6	89.6	89.6	86.0	84.2	3.521
0:27	82.4	80.6	89.6	89.6	86.0	84.2	1.897
0:30	82.4	80.6	91.4	89.6	86.0	84.2	1.226
0:33	82.4	80.6	91.4	89.6	86.0	84.2	2.352
0:36	82.4	80.6	91.4	91.4	86.0	84.2	2.569
0:39	82.4	80.6	93.2	91.4	87.8	84.2	0.865
0:42	82.4	80.6	93.2	91.4	87.8	84.2	-1.528
0:45	82.4	80.6	93.2	91.4	87.8	84.2	-1.035
0:48	82.4	80.6	95.0	91.4	87.8	84.2	0.18
0:51	82.4	80.6	95.0	91.4	87.8	84.2	0.865
0:54	82.4	80.6	95.0	93.2	87.8	84.2	2.352
0:57	82.4	80.6	96.8	93.2	87.8	84.2	1.767
1:00	82.4	80.6	96.8	93.2	89.6	84.2	1.667
1:03	82.4	80.6	96.8	93.2	89.6	84.2	-0.627
1:06	82.4	80.6	98.6	93.2	89.6	84.2	3.16
1:09	82.4	80.6	100.4	96.8	89.6	86.0	6.501
1:12	82.4	80.6	109.4	113.0	95.0	86.0	14.906
1:15	82.4	80.6	271.4	406.4	291.2	113.0	-20.713
1:18	82.4	80.6	568.4	638.6	656.6	174.2	-43.998
1:21	82.4	80.6	714.2	777.2	854.6	248.0	-46.666
1:24	82.4	80.6	816.8	845.6	950.0	282.2	-35.379
1:27	82.4	80.6	869.0	942.8	996.8	357.8	-19.223
1:30	82.4	80.6	903.2	966.2	1070.6	397.4	-13.404
1:33	82.4	80.6	942.8	1020.2	1173.2	397.4	-5.591
1:36	82.4	80.6	1002.2	1032.8	1194.8	383.0	8.629
1:39	82.4	80.6	1032.8	1047.2	1196.6	375.8	26.638
1:42	82.4	80.6	1027.4	1106.6	1223.6	397.4	57.6
1:45	82.4	80.6	1027.4	1122.8	1234.4	404.6	100.115
1:48	82.4	80.6	1061.6	1164.2	1173.2	426.2	148.408
1:51	82.4	80.6	1103.0	1128.2	1101.2	453.2	163.625
1:54	82.4	80.6	1088.6	1085.0	1040.0	485.6	183.887
1:57	82.4	80.6	1095.8	1063.4	995.0	507.2	220.802
2:00	82.4	80.6	1099.4	1092.2	987.8	491.0	243.104
2:03	82.4	82.4	1086.8	1149.8	1133.6	480.2	265.089
2:06	82.4	82.4	1124.6	1207.4	1250.6	474.8	285.936
2:09	82.4	82.4	1131.8	1236.2	1317.2	516.2	308.723
2:12	82.4	82.4	1126.4	1227.2	1374.8	501.8	334.229
2:15	82.4	82.4	1068.8	1137.2	1268.6	548.6	364.152
2:18	82.4	82.4	1032.8	1103.0	1229.0	600.8	396.831
2:21	82.4	84.2	1122.8	1200.2	1077.8	606.2	425.18
2:24	82.4	84.2	1151.6	1232.6	962.6	651.2	456.951
2:27	82.4	84.2	1142.6	1207.4	872.6	789.8	474.015
2:30	82.4	86.0	1113.8	1245.2	809.6	762.8	496.305
2:33	82.4	86.0	1054.4	1223.6	759.2	737.6	522.807
2:36	82.4	86.0	1034.6	1200.2	771.8	676.4	551.915
2:39	82.4	87.8	1034.6	1196.6	824.0	629.6	583.828
2:42	82.4	87.8	1018.4	1175.0	1065.2	581.0	624.588

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
Test JNP2(S): NEW 1998 JEEP GRAND CHEROKEE FUEL TANK TEST NO. 5S
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 30 APRIL 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 120MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
2:45	82.4	87.8	989.6	1124.6	1175.0	566.6	661.958
2:48	82.4	87.8	993.2	1104.8	1248.8	561.2	698.612
2:51	82.4	89.6	991.4	1083.2	1081.4	588.2	731.198
2:54	82.4	89.6	995.0	1074.2	1097.6	631.4	755.976
2:57	82.4	91.4	1029.2	1139.0	1007.6	653.0	779.354
3:00	82.4	91.4	1029.2	1178.6	1013.0	672.8	798.36
3:03	82.4	91.4	1050.8	1198.4	1016.6	705.2	816.27
3:06	82.4	93.2	1034.6	1193.0	989.6	703.4	836.04
3:09	82.4	93.2	1007.6	1166.0	1000.4	703.4	852.88
3:12	82.4	95.0	1002.2	1146.2	1022.0	708.8	868.041
3:15	82.4	95.0	1025.6	1137.2	1065.2	699.8	93.57
3:18	82.4	95.0	1077.8	1167.8	1085.0	750.2	17.693
3:21	82.4	96.8	1104.8	1230.8	1124.6	746.6	6.233
3:24	82.4	96.8	1160.6	1261.4	1173.2	768.2	1.667
3:27	84.2	98.6	1202.0	1320.8	1184.0	798.8	7.546
3:30	84.2	98.6	1223.6	1326.2	1203.8	815.0	5.238
3:33	84.2	100.4	1232.6	1378.4	1247.0	813.2	6.912
3:36	84.2	100.4	1257.8	1389.2	1209.2	779.0	9.531
3:39	84.2	100.4	1277.6	1392.8	1173.2	755.6	8.038
3:42	84.2	102.2	1283.0	1389.2	1173.2	753.8	8.485
3:45	84.2	102.2	1319.0	1335.2	1248.8	779.0	9.711
3:48	84.2	104.0	1328.0	1342.4	1286.6	802.4	9.891
3:51	86.0	104.0	1324.4	1358.6	1317.2	800.6	9.387
3:54	86.0	105.8	1349.6	1371.2	1405.4	806.0	8.305
3:57	86.0	105.8	1304.6	1342.4	1452.2	883.4	6.731
4:00	86.0	105.8	1265.0	1335.2	1511.6	887.0	6.321
Maximum	86.0	105.8	1349.6	1392.8	1511.6	887.0	868.0

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST PCP1: CONDITIONED 1998 PLYMOUTH VOYAGER VAN FUEL TANK TEST NO. 5
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 19 DECEMBER 2002 **SwRI Project No.: 01.06081.01.001**
FILE: 353MVF5.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
0:00	70	70	70	70	71	71	30.822
0:03	70	70	70	71	70	71	20.11
0:06	70	70	70	71	70	72	47.036
0:09	70	70	70	71	70	72	48.062
0:12	70	70	70	71	70	72	44.264
0:15	70	70	70	71	71	72	41.493
0:18	70	70	71	71	71	73	37.908
0:21	70	70	71	71	71	73	39.591
0:24	70	70	71	71	71	73	37.858
0:27	70	70	71	72	71	74	36.515
0:30	70	70	72	72	72	74	32.923
0:33	70	70	72	72	72	74	30.518
0:36	70	70	72	72	72	75	32.923
0:39	70	70	72	73	72	75	30.985
0:42	70	70	73	73	73	76	31.954
0:45	70	70	73	73	73	76	32.923
0:48	70	70	73	73	73	76	34.316
0:51	70	70	73	73	74	77	27.336
0:54	70	70	73	73	74	77	29.083
0:57	70	70	74	73	74	78	28.362
1:00	70	70	74	74	75	78	28.715
1:03	70	70	75	74	75	79	30.165
1:06	70	70	76	74	76	80	33.241
1:09	70	70	77	75	76	82	36.515
1:12	70	70	85	78	77	97	52.014
1:15	70	70	684	460	594	742	-109.842
1:18	70	70	1007	821	1062	1059	-87.475
1:21	70	70	1117	1044	1241	1193	-88.651
1:24	70	70	1124	1193	1322	1308	-117.028
1:27	70	70	1166	1257	1393	1304	-123.491
1:30	70	70	1313	1318	1409	1270	-116.208
1:33	70	70	1388	1319	1294	1171	-105.947
1:36	70	70	1379	1348	1291	1231	-78.391
1:39	70	70	1414	1227	1151	1321	-75.672
1:42	70	71	1374	1351	1189	1316	-48.482
1:45	70	71	1231	1357	1214	1315	-21.702
1:48	70	72	1191	1229	1098	1274	21.39
1:51	73	75	1108	1137	1078	1193	21.489
1:54	84	103	1002	1307	1106	1204	28.418
1:57	122	180	935	1398	1202	1093	40.778
2:00	216	285	977	1460	1326	1076	56.222
2:03	414	507	1133	1486	1417	1134	77.823
2:06	685	748	1277	1478	1438	1287	104.488
2:09	837	875	1347	1481	1459	1346	126.705
2:12	982	958	1394	1475	1459	1395	137.531
2:15	728	859	1373	1434	1411	1385	79.252
2:18	143	497	1276	1342	1366	1287	55.698
2:21	83	117	1209	1262	1320	1220	61.298
2:24	78	93	1164	1232	1316	1224	58.937
2:27	78	81	1146	1091	1269	1135	53.86
2:30	77	80	1092	905	1178	1050	61.709
2:33	77	81	1114	816	1153	941	78.997
2:36	77	81	1097	759	1160	966	29.847
2:39	78	82	1145	694	1009	966	32.774
2:42	78	83	1242	673	950	861	26.05

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST PCP1: CONDITIONED 1998 PLYMOUTH VOYAGER VAN FUEL TANK TEST NO. 5
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 19 DECEMBER 2002 **SwRI Project No.: 01.06081.01.001**
FILE: 353MVF5.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
2:45	79	84	1126	699	997	817	39.237
2:48	79	85	1041	663	1019	906	27.542
2:51	80	87	1028	788	1153	932	30.257
2:54	80	88	1127	943	1064	921	28.305
2:57	81	89	991	1011	1148	1033	32.47
3:00	82	91	959	1128	1135	958	22.564
3:03	82	92	1080	1116	1178	941	23.129
3:06	83	94	931	1140	1193	1060	24.975
3:09	84	95	822	1145	1103	972	25.286
3:12	85	97	856	1215	1165	971	21.8
3:15	86	98	951	1235	1253	1020	24.112
3:18	86	99	1009	1289	1250	1009	23.999
3:21	86	100	1049	1384	1259	1042	20.874
3:24	86	102	1011	1449	1244	1038	21.489
3:27	87	104	976	1460	1224	1102	19.382
3:30	88	107	1051	1384	1184	1187	20.562
Maximum	**982**	**958**	**1414**	**1486**	**1459**	**1395**	**137.53**

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
Test PNP1: NEW 1998 PLYMOUTH VOYAGER VAN FUEL TANK TEST NO. 6A
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 2 January 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 2MVFRI6a.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
0:00	71	68	69	69	69	69	5.862
0:03	71	68	69	69	69	70	5.204
0:06	71	68	70	70	69	71	6.123
0:09	71	68	70	70	69	73	6.067
0:12	71	68	71	70	69	74	6.739
0:15	71	68	72	70	69	75	4.384
0:18	71	68	72	71	69	76	7
0:21	71	68	72	71	69	76	8.28
0:24	71	68	73	71	70	77	7.615
0:27	71	68	73	71	70	78	6.272
0:30	71	68	73	72	70	78	6.067
0:33	71	68	73	72	70	78	5.508
0:36	71	68	73	72	70	78	6.696
0:39	71	68	73	72	70	79	8.231
0:42	71	68	73	72	70	79	6.23
0:45	71	68	74	73	71	81	6.696
0:48	71	68	74	73	71	82	4.95
0:51	71	68	74	73	71	83	8.584
0:54	71	68	75	74	71	84	6.59
0:57	71	68	75	74	71	86	6.385
1:00	71	68	75	74	72	87	5.819
1:03	71	68	76	74	72	88	8.075
1:06	71	68	76	75	72	89	6.944
1:09	71	68	80	76	72	92	7.559
1:12	71	68	165	90	75	179	-35.89
1:15	74	69	856	686	783	945	2.531
1:18	72	68	838	1059	1157	1284	1.153
1:21	72	68	794	1211	1295	1360	2.843
1:24	73	68	745	1305	1267	1237	5.862
1:27	73	68	727	1330	1431	1112	5.713
1:30	73	69	921	1221	1490	1196	4.016
1:33	73	69	934	1300	1282	1356	5.303
1:36	74	69	933	1369	1198	1354	4.384
1:39	74	69	995	1438	1191	1388	6.901
1:42	75	69	984	1471	1133	1428	8.846
1:45	78	69	972	1513	1151	1466	11.872
1:48	83	69	982	1520	1131	1473	15.924
1:51	83	70	994	1526	1090	1445	15.874
1:54	87	71	993	1508	1035	1385	16.999
1:57	97	71	990	1392	1089	1229	18.187
2:00	108	72	973	1288	1263	1226	16.744
2:03	131	75	965	1181	1458	1297	18.024
2:06	151	77	958	1102	1442	1302	20.746
2:09	114	78	958	1129	1288	1312	21.927
2:12	109	80	960	1160	1296	1313	12.282
2:15	89	81	948	1101	1182	1303	13.774
2:18	76	81	849	939	970	1079	15.973
2:21	73	83	817	861	873	1045	19.007
2:24	75	85	802	815	815	1035	21.361
2:27	74	86	785	770	764	930	26.233
2:30	74	88	771	707	951	917	23.257
2:33	74	91	755	1014	1062	896	27.725
2:36	74	93	736	881	997	782	25.102
2:39	74	95	717	814	819	706	26.594
2:42	76	97	700	732	734	652	27.315

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
Test PNP1: NEW 1998 PLYMOUTH VOYAGER VAN FUEL TANK TEST NO. 6A
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 2 January 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 2MVFRI6a.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
2:45	76	100	682	690	822	615	28.235
2:48	76	102	672	727	1018	601	33.927
2:51	77	105	664	727	866	580	37.314
2:54	79	107	661	783	1052	633	36.797
2:57	78	109	660	1022	1180	652	42.907
3:00	78	112	654	1048	1158	630	57.89
3:03	78	114	646	1035	1202	664	53.626
3:06	78	117	637	1134	1231	697	55.175
3:09	79	119	632	1195	1198	757	57.275
3:12	82	122	642	1192	1077	785	54.298
3:15	81	124	663	1183	1255	836	51.838
3:18	81	127	687	1332	1224	929	59.481
3:21	84	129	718	1368	1352	983	70.463
3:24	84	132	731	1394	1344	1079	86.259
3:27	83	135	742	1293	1449	1311	96.258
3:30	84	137	755	1235	1552	1469	110.986
Maximum	**151**	**137**	**995**	**1526**	**1552**	**1473**	**110.99**

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
Test PNP2(S): NEW 1998 PLYMOUTH VOYAGER VAN FUEL TANK TEST NO. 7S
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 20 MAY 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 140MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
0:00	84.2	84.2	84.2	no data	84.2	84.2	2.706
0:03	84.2	84.2	84.2	no data	84.2	86.0	3.521
0:06	84.2	84.2	84.2	no data	84.2	86.0	2.432
0:09	84.2	82.4	84.2	no data	84.2	86.0	2.165
0:12	84.2	84.2	no data	84.2	86.0	86.0	2.526
0:15	84.2	84.2	84.2	84.2	86.0	87.8	3.608
0:18	84.2	84.2	86.0	84.2	86.0	87.8	3.471
0:21	84.2	84.2	86.0	84.2	86.0	87.8	3.291
0:24	84.2	84.2	86.0	84.2	no data	89.6	3.111
0:27	84.2	84.2	86.0	84.2	no data	89.6	3.017
0:30	84.2	84.2	86.0	84.2	no data	89.6	5.506
0:33	84.2	84.2	86.0	84.2	no data	89.6	3.198
0:36	84.2	84.2	86.0	86.0	86.0	89.6	4.33
0:39	84.2	84.2	86.0	86.0	86.0	89.6	4.734
0:42	84.2	84.2	86.0	86.0	86.0	89.6	3.291
0:45	84.2	84.2	87.8	86.0	87.8	89.6	4.734
0:48	84.2	84.2	87.8	86.0	87.8	89.6	4.46
0:51	84.2	84.2	87.8	86.0	87.8	91.4	7.079
0:54	84.2	84.2	87.8	86.0	87.8	91.4	5.997
0:57	84.2	84.2	87.8	86.0	87.8	91.4	6.457
1:00	84.2	84.2	87.8	86.0	87.8	91.4	1.53
1:03	84.2	84.2	87.8	86.0	87.8	91.4	2.072
1:06	84.2	84.2	87.8	86.0	89.6	93.2	1.487
1:09	84.2	84.2	93.2	87.8	91.4	96.8	2.569
1:12	84.2	84.2	509.0	293.0	206.6	406.4	4.423
1:15	84.2	84.2	719.6	932.0	699.8	797.0	1.53
1:18	84.2	84.2	901.4	1047.2	930.2	1040.0	4.604
1:21	84.2	84.2	1072.4	1045.4	1104.8	1171.4	3.739
1:24	84.2	84.2	1216.4	1054.4	1130.0	1230.8	3.198
1:27	84.2	84.2	1292.0	1104.8	1139.0	1211.0	3.291
1:30	84.2	84.2	1205.6	1148.0	1140.8	1295.6	5.866
1:33	84.2	84.2	1277.6	1121.0	1166.0	1365.8	7.036
1:36	84.2	84.2	1202.0	1047.2	1216.4	1382.0	5.363
1:39	84.2	84.2	1166.0	1094.0	1317.2	1351.4	1.984
1:42	84.2	84.2	1214.6	1175.0	1405.4	1311.8	9.294
1:45	84.2	86.0	1274.0	1171.4	1313.6	1193.0	-23.969
1:48	84.2	86.0	1270.4	1184.0	1216.4	1297.4	36.461
1:51	84.2	86.0	1279.4	1200.2	1166.0	1374.8	27.117
1:54	86.0	86.0	1326.2	1176.8	1083.2	1405.4	8.485
1:57	86.0	86.0	1308.2	1040.0	1094.0	1416.2	10.557
2:00	86.0	87.8	1340.6	1054.4	1052.6	1367.6	16.784
2:03	86.0	87.8	1274.0	1036.4	991.4	1391.0	18.632
2:06	86.0	87.8	1248.8	1094.0	989.6	1252.4	22.203
2:09	86.0	87.8	1216.4	1171.4	1016.6	1157.0	18.955
2:12	84.2	89.6	1178.6	1164.2	1090.4	1333.4	18.451
2:15	84.2	89.6	1074.2	1045.4	1112.0	1432.4	17.829
2:18	86.0	91.4	953.6	874.4	957.2	1401.8	11.098
2:21	86.0	91.4	942.8	791.6	852.8	1182.2	8.523
2:24	86.0	93.2	973.4	980.6	1097.6	1122.8	19.677
2:27	86.0	93.2	910.4	903.2	984.2	1153.4	16.965
2:30	86.0	95.0	852.8	791.6	951.8	1299.2	15.702
2:33	86.0	96.8	901.4	746.6	833.0	1155.2	21.35
2:36	86.0	98.6	921.2	739.4	779.0	1045.4	21.929
2:39	86.0	100.4	829.4	741.2	764.6	905.0	22.657
2:42	86.0	100.4	753.8	730.4	784.4	878.0	24.548

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
Test PNP2(S): NEW 1998 PLYMOUTH VOYAGER VAN FUEL TANK TEST NO. 7S
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 20 MAY 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 140MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
2:45	86.0	102.2	712.4	730.4	885.2	1056.2	24.728
2:48	86.0	104.0	842.0	750.2	948.2	1148.0	27.167
2:51	86.0	105.8	834.8	683.6	903.2	1257.8	27.939
2:54	86.0	105.8	816.8	654.8	843.8	1371.2	33.705
2:57	86.0	107.6	807.8	631.4	813.2	1236.2	24.461
3:00	86.0	109.4	807.8	618.8	797.0	1040.0	22.924
3:03	87.8	111.2	840.2	615.2	786.2	959.0	26.396
3:06	87.8	113.0	813.2	581.0	780.8	969.8	29.606
3:09	87.8	114.8	725.0	552.2	768.2	1229.0	30.595
3:12	87.8	116.6	654.8	536.0	773.6	1164.2	30.819
3:15	87.8	116.6	719.6	604.4	1027.4	1065.2	31.41
3:18	87.8	118.4	1007.6	908.6	1056.2	1155.2	39.715
3:21	87.8	120.2	1185.8	1043.6	1034.6	1241.6	43.373
3:24	87.8	120.2	1266.8	1153.4	1000.4	1335.2	46.894
3:27	87.8	122.0	1275.8	1144.4	917.6	1230.8	43.958
3:30	87.8	123.8	1266.8	1072.4	908.6	1166.0	38.228
3:33	87.8	125.6	1092.2	1101.2	1121.0	1176.8	41.93
3:36	89.6	125.6	1196.6	1178.6	1043.6	1243.4	53.843
3:39	89.6	127.4	1149.8	1139.0	978.8	1353.2	63.23
3:42	89.6	129.2	1216.4	1133.6	1110.2	1340.6	65.899
3:45	89.6	129.2	1135.4	1166.0	998.6	1281.2	62.148
3:48	89.6	131.0	1248.8	1182.2	1068.8	1376.6	63.952
3:51	89.6	132.8	1349.6	1200.2	1041.8	1425.2	68.555
3:54	89.6	132.8	1328.0	1185.8	1254.2	1493.6	71.081
3:57	89.6	134.6	1337.0	1148.0	1229.0	1499.0	6.719
4:00	89.6	136.4	1214.6	1155.2	1257.8	1515.2	21.612
4:03	91.4	138.2	1130.0	1122.8	1149.8	1365.8	23.876
4:06	91.4	141.8	1146.2	1131.8	1184.0	1261.4	19.447
4:09	91.4	141.8	1185.8	1126.4	1252.4	1221.8	21.251
4:12	91.4	143.6	1135.4	1122.8	1229.0	1212.8	22.383
4:15	91.4	143.6	1063.4	1074.2	1243.4	1362.2	13.45
4:18	93.2	145.4	1083.2	1059.8	1220.0	1360.4	6.899
4:21	93.2	147.2	1099.4	1178.6	1214.6	1484.6	6.177
4:24	93.2	149.0	1203.8	1272.2	1241.6	1508.0	5.363
4:27	95.0	150.8	1225.4	1337.0	1270.4	1520.6	3.608
4:30	95.0	152.6	1284.8	1320.8	1261.4	1437.8	6.999
4:33	95.0	152.6	1257.8	1301.0	1167.8	1335.2	5.232
4:36	95.0	154.4	1356.8	1365.8	1095.8	1405.4	5.145
4:39	96.8	156.2	1400.0	1383.8	1108.4	1425.2	4.964
4:42	96.8	158.0	1401.8	1410.8	1146.2	1472.0	3.739
4:45	96.8	159.8	1308.2	1344.2	1313.6	1394.6	4.784
4:48	96.8	165.2	1214.6	1301.0	1338.8	1387.4	3.919
4:51	98.6	163.4	1171.4	1281.2	1434.2	1245.2	5.232
4:54	98.6	165.2	1205.6	1306.4	1437.8	1268.6	5.095
4:57	98.6	167.0	1223.6	1358.6	1337.0	1304.6	6.227
5:00	98.6	167.0	1202.0	1405.4	1351.4	1448.6	5.953
5:03	100.4	168.8	1146.2	1358.6	1295.6	1518.8	4.915
5:06	100.4	170.6	1130.0	1317.2	1284.8	1486.4	6.999
5:09	100.4	172.4	1126.4	1337.0	1223.6	1504.4	9.568
5:12	102.2	174.2	1230.8	1394.6	1113.8	1396.4	8.255
5:15	102.2	176.0	1362.2	1306.4	1049.0	1367.6	7.26
5:18	102.2	177.8	1427.0	1362.2	1094.0	1373.0	5.593
5:21	102.2	179.6	1284.8	1337.0	1178.6	1475.6	7.49
5:24	102.2	181.4	1301.0	1347.8	1169.6	1466.6	9.157
5:27	104.0	183.2	1263.2	1248.8	1113.8	1443.2	12.274

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
Test PNP2(S): NEW 1998 PLYMOUTH VOYAGER VAN FUEL TANK TEST NO. 7S
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 20 MAY 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 140MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
5:30	104.0	185.0	1349.6	1279.4	1101.2	1378.4	7.851
5:33	105.8	186.8	1346.0	1290.2	1005.8	1441.4	6.277
5:36	105.8	188.6	1335.2	1338.8	1034.6	1360.4	8.666
5:39	105.8	190.4	1266.8	1257.8	1175.0	1297.4	17.325
5:42	105.8	192.2	1320.8	1275.8	1252.4	1216.4	11.011
5:45	105.8	195.8	1198.4	1288.4	1290.2	1311.8	8.162
5:48	107.6	199.4	1216.4	1265.0	1275.8	1463.0	7.621
5:51	107.6	201.2	1218.2	1284.8	1252.4	1331.6	7.26
5:54	113.0	203.0	1241.6	1355.0	1227.2	1299.2	9.114
5:57	118.4	204.8	1198.4	1236.2	1297.4	1472.0	7.758
6:00	120.2	206.6	1270.4	1245.2	1373.0	1351.4	8.255
Maximum	120.2	206.6	1427.0	1410.8	1437.8	1520.6	206.6

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST CNP1: NEW 2000 CHEVROLET CAVALIER PLASTIC FUEL TANK TEST NO. 1
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 21 January 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 021MVFR1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
0:00	54	55	57	55	57	55	-0.257
0:03	54	55	57	55	57	55	-0.462
0:06	54	55	57	57	57	55	-0.764
0:09	54	55	57	57	57	55	0.465
0:12	54	55	57	57	59	57	0.929
0:15	54	55	57	57	59	57	0.272
0:18	54	55	57	57	59	57	0.066
0:21	54	55	57	57	59	57	0.163
0:24	54	55	57	57	59	57	-0.095
0:27	54	55	57	57	59	57	-0.808
0:30	54	55	57	57	59	57	-0.916
0:33	54	55	57	57	59	57	0.272
0:36	54	55	57	57	59	57	0.272
0:39	54	55	57	59	59	57	0.272
0:42	54	55	57	59	59	57	0.163
0:45	54	55	57	59	59	57	-1.887
0:48	54	55	57	59	59	57	-1.887
0:51	54	55	57	59	61	57	-1.833
0:54	54	55	57	59	61	57	-1.941
0:57	54	55	57	59	61	57	-1.423
1:00	54	55	57	59	61	57	-2.243
1:03	54	55	57	59	61	57	-0.139
1:06	54	55	57	59	61	57	-1.271
1:09	54	55	106	133	68	61	-13.528
1:12	54	55	477	716	464	376	-0.398
1:15	54	55	523	844	720	599	-4.401
1:18	54	55	586	849	1006	707	-5.167
1:21	54	55	635	793	1063	772	-4.865
1:24	54	55	662	842	1168	847	-2.61
1:27	54	55	680	887	1218	914	-0.916
1:30	54	55	729	912	1245	943	0.573
1:33	54	55	779	928	1258	963	2.581
1:36	54	55	810	900	1233	981	4.73
1:39	54	55	813	867	1171	1000	7.036
1:42	54	55	799	892	1193	973	5.551
1:45	54	55	774	955	1225	964	4.426
1:48	54	55	748	986	1249	993	4.476
1:51	54	57	736	1047	1270	991	4.525
1:54	54	57	730	1083	1283	1020	5.042
1:57	55	57	709	1128	1321	1036	6.831
2:00	55	57	676	1170	1330	1036	7.707
2:03	55	59	633	1272	1348	1036	9.914
2:06	59	59	597	1308	1353	1040	13.4
2:09	145	79	651	1247	1337	1049	15.401
2:12	268	190	828	1135	1213	982	16.122
2:15	61	66	822	1123	1144	966	13.35
2:18	55	63	788	999	1029	937	14.425
2:21	57	63	736	898	948	918	11.193
2:24	57	64	662	817	925	878	9.397
2:27	57	64	633	765	900	862	7.092
2:30	59	66	579	748	844	873	9.348
2:33	59	66	577	698	804	867	10.529
2:36	59	68	567	657	784	878	8.224
2:39	59	68	579	655	788	892	7.502
2:42	61	70	581	664	752	909	7.502
2:45	61	70	583	648	738	896	8.881

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST CNP1: NEW 2000 CHEVROLET CAVALIER PLASTIC FUEL TANK TEST NO. 1
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 21 January 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 021MVFR1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
2:48	61	72	577	651	712	903	11.243
2:51	61	73	568	646	696	919	14.22
2:54	61	73	583	631	671	900	14.948
2:57	63	75	590	613	653	865	16.942
3:00	63	77	588	610	666	865	20.796
3:03	63	77	586	604	660	847	18.632
3:06	64	79	581	608	673	847	21.248
3:09	64	79	579	621	693	829	19.657
3:12	64	81	590	606	687	840	22.79
3:15	64	81	779	889	972	885	17.253
3:18	66	82	831	970	1080	892	18.731
3:21	66	82	1027	946	1108	894	21.559
3:24	66	84	1049	1047	1162	900	23.66
3:27	66	86	975	1087	1206	910	28.949
3:30	66	86	901	1161	1252	937	47.164
3:33	68	88	862	1135	1296	961	70.455
3:36	68	90	846	1085	1278	966	16.016
3:39	68	90	819	1108	1296	997	13.866
3:42	68	90	748	1184	1312	1026	13.4
3:45	68	91	703	1245	1308	1051	14.991
3:48	70	93	680	1236	1270	1056	15.507
3:51	70	95	667	1168	1184	1026	15.358
3:54	72	97	657	1144	1116	1049	16.016
3:57	72	99	642	1081	1065	1042	16.787
4:00	72	99	635	1076	1038	1026	24.07
4:03	73	100	640	1162	1029	1053	27.103
4:06	73	102	642	1166	1002	1047	23.61
4:09	75	104	633	1164	972	1062	32.951
4:12	75	106	626	1116	954	1060	37.462
4:15	75	108	624	1135	939	1053	39.265
4:18	77	108	628	1134	928	1051	41.981
4:21	77	108	628	1083	909	1031	47.058
4:24	79	109	646	1022	896	1026	45.877
4:27	79	111	660	1027	882	1031	44.031
4:30	79	113	666	1038	864	1045	47.107
4:33	81	113	671	1011	860	1026	46.287
4:36	82	115	702	981	860	1009	42.136
4:39	82	117	720	941	855	1004	44.13
4:42	82	118	727	932	855	1018	46.647
4:45	84	118	730	927	858	1049	49.73
4:48	84	120	739	907	862	1083	45.622
4:51	84	122	743	909	883	1083	50.699
4:54	86	124	754	885	909	1058	53.881
4:57	88	127	772	889	918	1035	58.138
5:00	88	129	783	891	961	1047	61.115
5:03	90	129	801	937	1020	1076	69.381
5:06	91	133	806	948	1081	1062	87.44
5:09	91	135	826	927	1141	1040	96.823
5:12	93	138	867	909	1087	1053	103.138
5:15	93	140	889	892	1040	1033	117.852
5:18	95	144	889	912	1042	1060	135.615
5:21	95	145	898	936	1053	1089	149.771
5:24	97	151	903	963	990	1098	155.824
5:27	99	156	912	968	950	1123	156.495
5:30	102	165	923	986	934	1130	146.589
5:33	104	172	961	1008	948	1103	121.091

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST CNP1: NEW 2000 CHEVROLET CAVALIER PLASTIC FUEL TANK TEST NO. 1
TEMPERATURE (°F), PRESSURE (Pa)

DATE: 21 January 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 021MVFR1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
5:36	109	183	970	1029	950	1056	101.038
5:39	113	199	977	1047	957	1056	92.1
5:42	118	208	984	1056	950	1038	76.346
5:45	117	217	1002	1051	945	1027	64.24
5:48	117	232	1000	1026	952	1027	57.07
5:51	117	235	1011	1042	959	1020	57.162
5:54	120	239	1004	1038	952	1026	63.01
5:57	124	259	1008	1033	948	1040	72.506
6:00	129	297	1029	1049	963	1053	63.165
6:03	145	334	1045	1047	955	1076	55.21
6:06	325	388	1044	1056	972	1063	58.802
6:09	684	417	1062	1053	1083	1026	54.758
6:12	732	417	1065	1060	1200	1024	55.111
6:15	880	441	1072	1040	1182	1042	52.545
6:18	1029	496	1089	1058	1080	1047	48.394
6:21	1157	538	1087	1060	1022	1056	35.716
6:24	1240	595	1083	1074	1076	1062	36.083
6:27	1263	649	1092	1067	1204	1033	36.748
6:30	1269	696	1087	1060	1242	1004	40.234
6:33	1233	770	1087	1036	1143	982	40.085
6:36	1191	721	1085	1063	1062	993	43.982
6:39	1179	775	1103	1063	1024	986	39.718
6:42	1162	792	1110	1083	1047	975	39.265
6:45	1153	783	1121	1130	1126	966	40.538
6:48	1173	804	1110	1139	1074	982	40.496
6:51	1168	844	1112	1146	1022	975	37.978
6:54	1159	846	1105	1157	1013	1000	40.439
6:57	1148	795	1099	1159	1051	1015	41.521
7:00	1177	799	1108	1171	1024	1011	43.982
7:03	1161	801	1112	1209	1008	993	46.591
7:06	1126	781	1110	1189	1009	991	159.515
7:09	1117	867	997	970	759	876	11.448
7:12	964	721	1022	937	705	844	1.556
7:15	784	518	1015	874	631	797	5.657
7:18	577	282	910	732	595	775	8.118
7:21	574	261	882	613	523	745	9.397
7:24	570	235	946	603	491	781	15.401
7:27	619	226	819	529	464	738	15.712
7:30	480	207	768	489	446	703	12.735
7:33	396	207	757	502	457	698	16.065
7:36	331	203	727	451	424	685	16.737
7:39	266	196	680	423	410	673	13.499
7:42	223	194	653	412	388	678	13.35
7:45	210	198	651	446	448	666	18.279
7:48	207	198	585	390	356	648	13.866
7:51	192	198	588	381	336	648	15.86
7:54	189	199	666	468	464	687	13.76
7:57	185	201	684	604	626	693	17.868
8:00	185	205	714	552	540	685	12.841
Maximum	**1269**	**867**	**1121**	**1308**	**1353**	**1130**	**159.515**

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST CCM1: CONDITIONED 1999 CHEVROLET CAVALIER METAL FUEL TANK TEST NO. 1
TEMPERATURE (°F), PRESSURE (KPa)

DATE: 18 February 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 049MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
0:00	75.2	71.6	69.8	69.8	69.8	69.6	0.172
0:03	75.2	71.6	69.8	69.8	69.8	69.6	0.172
0:06	75.2	71.6	69.8	69.8	69.8	69.7	0.172
0:09	75.2	71.6	71.6	69.8	69.8	69.8	0.172
0:12	75.2	71.6	71.6	69.8	69.8	69.8	0.172
0:15	75.2	71.6	71.6	69.8	71.6	69.9	0.172
0:18	75.2	71.6	71.6	69.8	71.6	70.0	0.172
0:21	75.2	71.6	71.6	69.8	71.6	70.1	0.165
0:24	75.2	71.6	71.6	69.8	71.6	70.1	0.165
0:27	75.2	71.6	71.6	71.6	71.6	70.1	0.172
0:30	75.2	71.6	71.6	71.6	71.6	70.2	0.172
0:33	75.2	71.6	73.4	71.6	71.6	70.3	0.172
0:36	75.2	71.6	73.4	71.6	71.6	70.4	0.172
0:39	75.2	71.6	73.4	71.6	71.6	70.5	0.172
0:42	75.2	71.6	73.4	71.6	71.6	70.6	0.165
0:45	75.2	71.6	73.4	71.6	71.6	70.7	0.165
0:48	75.2	71.6	73.4	71.6	71.6	70.8	0.165
0:51	75.2	71.6	73.4	73.4	71.6	71.0	0.165
0:54	75.2	71.6	73.4	73.4	73.4	71.1	0.159
0:57	75.2	71.6	73.4	73.4	73.4	71.2	0.165
1:00	75.2	71.6	75.2	73.4	73.4	71.4	0.172
1:03	75.2	71.6	75.2	73.4	73.4	71.6	0.172
1:06	75.2	69.8	75.2	75.2	75.2	72.2	0.165
1:09	75.2	64.4	487.4	543.2	359.6	369.7	0.186
1:12	75.2	66.2	858.2	800.6	530.6	762.6	0.228
1:15	75.2	68.0	896.0	872.6	791.6	907.0	0.234
1:18	75.2	68.0	881.6	924.8	930.2	964.2	0.228
1:21	77.0	68.0	933.8	1050.8	1025.6	976.0	0.248
1:24	77.0	68.0	885.2	1013.0	1122.8	1000.7	0.241
1:27	77.0	68.0	856.4	962.6	1155.2	1004.6	0.221
1:30	77.0	69.8	840.2	908.6	1175.0	987.4	0.207
1:33	78.8	69.8	813.2	908.6	1157.0	981.5	0.193
1:36	80.6	69.8	791.6	887.0	1155.2	1055.1	0.200
1:39	80.6	69.8	764.6	876.2	1142.6	1013.5	0.200
1:42	80.6	71.6	737.6	876.2	1131.8	1011.7	0.214
1:45	82.4	71.6	714.2	915.8	1135.4	1063.6	0.214
1:48	82.4	73.4	719.6	903.2	1122.8	1017.5	0.214
1:51	82.4	73.4	723.2	897.8	1189.4	1058.2	0.234
1:54	84.2	75.2	771.8	894.2	1221.8	1138.2	0.228
1:57	84.2	75.2	806.0	833.0	1124.6	1198.8	0.248
2:00	86.0	77.0	831.2	876.2	1140.8	1201.6	0.269
2:03	89.6	77.0	838.4	887.0	1221.8	1222.5	0.324
2:06	89.6	78.8	856.4	870.8	1286.6	1228.5	0.393
2:09	91.4	86.0	876.2	843.8	1266.8	1265.7	0.427
2:12	93.2	93.2	914.0	887.0	1164.2	1164.8	0.379
2:15	95.0	95.0	905.0	978.8	1020.2	985.1	0.296
2:18	96.8	96.8	813.2	1068.8	921.2	858.9	0.290
2:21	98.6	98.6	761.0	1146.2	833.0	778.1	0.303

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST CCM1: CONDITIONED 1999 CHEVROLET CAVALIER METAL FUEL TANK TEST NO. 1
TEMPERATURE (°F), PRESSURE (KPa)

DATE: 18 February 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 049MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
2:24	100.4	100.4	721.4	1027.4	770.0	725.3	0.296
2:27	102.2	104.0	689.0	953.6	725.0	721.1	0.317
2:30	102.2	111.2	662.0	899.6	692.6	723.0	0.365
2:33	102.2	113.0	788.0	896.0	662.0	751.8	0.448
2:36	104.0	120.2	788.0	1025.6	644.0	737.5	0.476
2:39	104.0	125.6	885.2	910.4	631.4	723.1	0.586
2:42	104.0	131.0	915.8	1013.0	633.2	743.6	1.014
2:45	105.8	136.4	1038.2	1094.0	626.0	756.3	1.262
2:48	107.6	141.8	968.0	973.4	732.2	888.6	1.413
2:51	107.6	131.0	899.6	888.8	813.2	961.5	1.496
2:54	107.6	134.6	878.0	834.8	888.8	978.1	1.896
2:57	109.4	136.4	892.4	773.6	917.6	945.2	1.772
3:00	111.2	154.4	962.6	753.8	905.0	989.5	2.275
3:03	111.2	159.8	1029.2	735.8	915.8	1020.6	2.434
3:06	113.0	154.4	1063.4	721.4	946.4	1000.4	2.689
3:09	114.8	165.2	1099.4	698.0	980.6	936.5	3.151
3:12	114.8	167.0	1059.8	748.4	1034.6	956.1	3.640
3:15	116.6	170.6	1007.6	755.6	1047.2	948.5	3.992
3:18	118.4	159.8	960.8	793.4	1106.6	1010.6	4.523
3:21	118.4	163.4	959.0	966.2	1221.8	1107.8	5.440
3:24	118.4	174.2	1036.4	1005.8	1286.6	1198.0	9.735
3:27	122.0	179.6	1034.6	971.6	1225.4	1184.9	12.810
3:30	122.0	174.2	1117.4	1196.6	1032.8	1160.1	13.334
3:33	123.8	168.8	1011.2	1185.8	1088.6	1144.2	14.858
3:36	125.6	181.4	933.8	1052.6	1130.0	1181.1	15.913
3:39	127.4	192.2	890.6	930.2	1173.2	1229.7	17.306
3:42	127.4	181.4	870.8	885.2	1205.6	1239.7	18.905
3:45	129.2	185.0	842.0	851.0	1234.4	1258.0	20.429
3:48	129.2	188.6	824.0	852.8	1207.4	1255.6	22.098
3:51	132.8	185.0	831.2	793.4	1194.8	1263.9	23.097
3:54	136.4	186.8	833.0	773.6	1198.4	1288.8	24.849
3:57	147.2	186.8	861.8	973.4	1166.0	1288.4	26.283
4:00	249.8	190.4	888.8	1061.6	1104.8	1243.7	27.565
4:03	275.0	208.4	923.0	1229.0	1011.2	1165.3	28.565
4:06	183.2	226.4	932.0	1146.2	1108.4	1160.1	30.040
4:09	150.8	230.0	923.0	1256.0	1164.2	1227.4	31.344
4:12	141.8	212.0	883.4	1220.0	1223.6	1234.3	32.985
4:15	143.6	210.2	852.8	1157.0	1268.6	1124.6	34.688
4:18	143.6	212.0	888.8	1063.4	1232.6	1003.8	35.446
4:21	145.4	206.6	887.0	1002.2	1162.4	963.8	35.584
4:24	145.4	208.4	905.0	1020.2	1040.0	931.7	36.156
4:27	147.2	212.0	896.0	971.6	1029.2	897.4	36.391
4:30	147.2	217.4	894.2	1007.6	1175.0	927.0	37.638
4:33	149.0	215.6	924.8	1088.6	1263.2	1010.3	38.880
4:36	150.8	224.6	935.6	1185.8	1308.2	1112.5	40.224
4:39	163.4	235.4	894.2	1135.4	1337.0	1150.3	41.624
4:42	176.0	271.4	901.4	1040.0	1344.2	1204.1	43.120
4:45	152.6	221.0	874.4	996.8	1347.8	1143.0	44.692

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST CCM1: CONDITIONED 1999 CHEVROLET CAVALIER METAL FUEL TANK TEST NO. 1
TEMPERATURE (°F), PRESSURE (KPa)

DATE: 18 February 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 049MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
4:48	176.0	221.0	941.0	1061.6	1290.2	1134.6	46.560
4:51	177.8	224.6	996.8	1054.4	1252.4	1162.8	48.705
4:54	170.6	224.6	987.8	1020.2	1263.2	1179.0	50.132
4:57	172.4	219.2	971.6	1009.4	1266.8	1217.6	52.055
5:00	170.6	217.4	998.6	993.2	1319.0	1213.8	54.489
5:03	172.4	215.6	1036.4	1144.4	1310.0	1157.5	57.792
5:06	172.4	217.4	942.8	1216.4	1338.8	1005.6	61.019
5:09	172.4	217.4	944.6	1263.2	1373.0	988.6	63.466
5:12	172.4	221.0	939.2	1324.4	1374.8	951.0	66.107
5:15	174.2	221.0	991.4	1364.0	1378.4	945.2	69.368
5:18	174.2	221.0	1031.0	1344.2	1329.8	933.0	72.678
5:21	174.2	222.8	1045.4	1270.4	1340.6	911.3	76.311
5:24	172.4	226.4	1018.4	1248.8	1340.6	913.5	79.586
5:27	174.2	228.2	1031.0	1310.0	1261.4	911.9	82.406
5:30	174.2	233.6	991.4	1187.6	1272.2	913.7	84.854
5:33	174.2	237.2	1009.4	1164.2	1250.6	926.7	87.088
5:36	174.2	237.2	1094.0	1157.0	1243.4	904.3	89.901
5:39	176.0	240.8	1099.4	1232.6	1234.4	889.1	92.921
5:42	177.8	242.6	1117.4	1277.6	1245.2	860.0	96.216
5:45	179.6	248.0	1167.8	1301.0	1268.6	846.5	99.443
5:48	181.4	251.6	1209.2	1205.6	1293.8	845.5	102.242
5:51	183.2	255.2	1203.8	1207.4	1274.0	822.2	104.828
5:54	185.0	255.2	1200.2	1281.2	1306.4	819.6	107.848
5:57	186.8	258.8	1164.2	1214.6	1275.8	843.5	110.137
6:00	190.4	260.6	1164.2	1115.6	1230.8	862.9	111.867
6:03	192.2	260.6	1175.0	1185.8	1187.6	891.3	113.791
6:06	194.0	264.2	1203.8	1266.8	1144.4	902.8	116.225
6:09	195.8	271.4	1166.0	1261.4	1135.4	903.6	117.907
6:12	197.6	273.2	1187.6	1187.6	1193.0	932.4	120.382
6:15	201.2	275.0	1162.4	1122.8	1234.4	962.4	121.996
6:18	204.8	280.4	1146.2	1059.8	1209.2	971.7	123.954
6:21	208.4	282.2	1191.2	1083.2	1184.0	974.0	126.484
6:24	210.2	285.8	1119.2	1182.2	1194.8	999.6	129.353
6:27	212.0	287.6	1074.2	1131.8	1227.2	1001.3	130.504
6:30	213.8	294.8	1052.6	1245.2	1149.8	966.9	131.069
6:33	222.8	303.8	1072.4	1160.6	1049.0	1019.0	130.594
6:36	235.4	321.8	1178.6	1101.2	1070.6	1048.1	131.724
6:39	240.8	330.8	1207.4	1088.6	1119.2	1005.2	132.090
6:42	255.2	343.4	1229.0	1067.0	1178.6	1013.9	132.986
6:45	262.4	352.4	1205.6	993.2	1200.2	973.1	133.579
6:48	264.2	338.0	1229.0	941.0	1207.4	974.8	133.903
6:51	267.8	338.0	1182.2	924.8	1263.2	958.7	133.538
6:54	276.8	332.6	1135.4	915.8	1162.4	950.2	132.297
6:57	296.6	338.0	1088.6	917.6	1232.6	903.8	131.738
7:00	307.4	345.2	1128.2	1063.4	1211.0	872.2	131.262
7:03	332.6	352.4	1144.4	1221.8	1162.4	866.5	131.600
7:06	406.4	413.6	1254.2	1317.2	1112.0	843.0	132.434
7:09	507.2	489.2	1229.0	1364.0	1070.6	872.0	132.145

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST CCM1: CONDITIONED 1999 CHEVROLET CAVALIER METAL FUEL TANK TEST NO. 1
TEMPERATURE (°F), PRESSURE (KPa)

DATE: 18 February 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 049MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
7:12	654.8	597.2	1130.0	1286.6	1063.4	915.4	130.628
7:15	851.0	786.2	1081.4	1209.2	1133.6	945.2	128.966
7:18	984.2	908.6	1025.6	1263.2	1070.6	976.4	127.519
7:21	1092.2	1020.2	1014.8	1320.8	1067.0	978.9	126.353
7:24	1164.2	1099.4	1020.2	1250.6	1038.2	989.2	120.989
7:27	1193.0	1133.6	1025.6	1275.8	1052.6	1003.9	115.494
7:30	1211.0	1157.0	1153.4	1396.4	1032.8	1025.8	109.958
7:33	1214.6	1146.2	1045.4	1167.8	890.6	925.1	45.354
7:36	1185.8	1106.6	957.2	948.2	827.6	826.2	0.214
7:39	1221.8	1139.0	1113.8	1004.0	910.4	891.1	0.179
7:42	1279.4	1137.2	1304.6	1212.8	1153.4	1020.2	0.193
7:45	1356.8	1220.0	1428.8	1302.8	1304.6	1122.4	0.193
7:48	1430.6	1356.8	1486.4	1274.0	1338.8	1202.8	0.221
7:51	1448.6	1396.4	1472.0	1248.8	1293.8	1178.6	0.214
7:54	1473.8	1425.2	1403.6	1324.4	1277.6	1160.0	0.234
7:57	1401.8	1293.8	1292.0	1241.6	1234.4	1183.6	0.179
8:00	1360.4	1257.8	1263.2	1049.0	1076.0	1167.2	0.165
8:03	1346.0	1230.8	1304.6	903.2	935.6	1132.0	0.159
8:06	1342.4	1203.8	1337.0	811.4	849.2	1039.7	0.159
8:09	1290.2	1097.6	1355.0	735.8	771.8	1093.8	0.159
8:12	1236.2	984.2	1355.0	674.6	708.8	1101.0	0.159
8:15	1169.6	834.8	1113.8	629.6	660.2	1081.3	0.159
8:18	1121.0	705.2	982.4	618.8	615.2	1092.8	0.159
8:21	1081.4	606.2	905.0	595.4	577.4	1002.2	0.159
8:24	1031.0	525.2	852.8	577.4	600.8	887.6	0.159
8:27	906.8	514.4	802.4	550.4	629.6	817.4	0.159
8:30	793.4	568.4	743.0	536.0	595.4	803.6	0.159
8:33	820.4	586.4	696.2	564.8	552.2	803.6	0.165
8:36	759.2	572.0	681.8	546.8	519.8	795.6	0.159
8:39	543.2	590.0	663.8	539.6	507.2	780.2	0.159
8:42	518.0	591.8	662.0	532.4	496.4	749.0	0.159
8:45	498.2	588.2	654.8	518.0	480.2	766.8	0.159
8:48	545.0	627.8	649.4	528.8	467.6	751.6	0.159
8:51	498.2	620.6	635.0	528.8	458.6	774.6	0.159
8:54	516.2	654.8	633.2	523.4	444.2	721.8	0.152
8:57	541.4	689.0	617.0	496.4	435.2	674.3	0.159
9:00	581.0	728.6	624.2	491.0	426.2	650.5	0.159
9:03	541.4	683.6	626.0	492.8	420.8	629.6	0.165
9:06	577.4	725.0	622.4	471.2	413.6	609.7	0.172
9:09	566.6	707.0	627.8	462.2	408.2	598.3	0.179
9:12	563.0	680.0	635.0	483.8	401.0	586.5	0.179
9:15	581.0	689.0	640.4	494.6	397.4	577.1	0.193
9:18	645.8	735.8	645.8	498.2	397.4	568.0	0.207
9:21	689.0	775.4	635.0	496.4	406.4	579.7	0.221
9:24	766.4	845.6	640.4	487.4	399.2	583.5	0.179
9:27	1040.0	825.8	644.0	498.2	392.0	577.4	0.165
9:30	1058.0	845.6	651.2	480.2	379.4	567.6	0.172
9:33	1193.0	1029.2	647.6	482.0	374.0	570.3	0.165

MOTOR VEHICLE FIRE RESEARCH INSTITUTE (MVFRI)
TEST CCM1: CONDITIONED 1999 CHEVROLET CAVALIER METAL FUEL TANK TEST NO. 1
TEMPERATURE (°F), PRESSURE (KPa)

DATE: 18 February 2003 **SwRI Project No.: 01.06081.01.001**
FILE: 049MVF1.dat **TEST TYPE: ECE R34.01**

Time min:sec	TC 1 Fuel	TC 2 Vapor	TC 3 Left Rear	TC 4 Right Rear	TC 5 Right Front	TC 6 Left Front	Pressure
9:36	1302.8	1160.6	636.8	480.2	366.8	623.0	0.159
9:39	1236.2	1131.8	635.0	492.8	359.6	631.4	0.159
9:42	1083.2	989.6	640.4	501.8	352.4	628.4	0.179
9:45	842.0	946.4	642.2	498.2	359.6	642.1	0.159
9:48	795.2	948.2	671.0	485.6	287.6	691.5	0.145
9:51	809.6	939.2	660.2	482.0	278.6	709.6	0.145
9:54	822.2	896.0	743.0	453.2	267.8	760.1	0.145
9:57	798.8	849.2	759.2	420.8	266.0	705.9	0.145
10:00	788.0	829.4	717.8	343.4	269.6	722.4	0.138
Maximum	1473.8	1425.2	1486.4	1396.4	1378.4	1288.8	133.9