

FLAMMABILITY TESTING

FEDERAL MOTOR VEHICULAR SAFETY STANDARD 302
FMVSS 302

A2LA MTAC MEETING

APRIL 04, 2009

Historic Overview

- Flammability requirements for interior vehicle components have been in place for almost 40 years in the United States
- National Highway Traffic Safety Administration announced a proposed flammability standard that would protect occupants from serious harm in the event that lighted matches, lighters or smoldering cigarettes should ignite the automotive interior.
- FMVSS 302 was adopted in 1971 and became effective for vehicle model 1972. This standard set a flame spread rate not to exceed 102 mm/m. This was deemed adequate for the occupant to stop the vehicle and exit without serious harm.
- FMVSS 302 is applicable to interior components including seating, door panels, headliner, carpet, seat belts, air bags, package shelves, instrument panels, steering wheel covers and padding, etc. (note – this is not everything – just some examples)

Testing Equipment

- Metal cabinet of specific interior dimensions and window on the front
- Bunsen burner (the burner has specific dimensions and needs to be checked) supplied with the equivalent of natural gas (or 100% Methane delete – this is not in the standard)
- Stop watch calibrated to 0.5 ± 0.1 seconds
- Measuring ruler with an accuracy of 1.0 mm
- Laboratory-type fume hood
- Stainless steel or aluminum specimen holder with reference points spaced crosswise 38mm from each end of the length direction. For specimens that curl downward during testing, a bottom section with 0.25mm diameter nichrom wire spaced at 25mm intervals. shall be used for support.
- Specimen holder frame located inside the test chamber

Outline of Testing

- **NOTE: MVSS 302 does NOT specify the number of samples to test. The recommendation below is great but is not to standard. However, 302 is RARELY specified alone. OEM/customer normally specifies sample size.**
- Note here what standard calls out the 10 and 10 Prepare 10 specimens of material measuring 102X356 mm. Five specimens in warp (machine) direction and five in filling (cross machine) direction. For materials with no discernable directional orientation, label as length-wise and cross length-wise
- Condition specimens no less than 24 hr at 21C and 50% R.H. Place specimen onto the U-shape holder with the side that faces the occupant down. Without distorting the specimen, place the top holder into position.
- Ignite the Bunsen burner and adjust the flame height to 38 mm.
- Place the specimens onto the chamber rack.
- Position the specimen so that the center of the burner tip is 19mm below the center of the bottom edge of the open end of specimen. **The flame should bisect the edge of the specimen**
- Expose flame to specimen for 15 seconds then remove the flame (extinguish). (302 does not say extinguish) Observe the burning characteristics of the specimen during the test. (Remove the flame from the specimen, not the specimen from the flame. There may be a problem with chambers that have a burner in the door)

Outline of Testing cont.

- If the burner is mounted on the door of the chamber, leave the door open until the specimen is inserted. If the burner is located at the opposite end of the test chamber, do not insert the specimen into the specimen holder frame until the flame has been adjusted.
- At the conclusion of the ignition time extinguish the flame. Observe the burning characteristics of the specimen at all times during the test. It is very important that the test results are accurately recorded as the test progresses. This is a critical aspect in complying with the legal requirements of the Standard
- Begin the timing (without reference to the period of application of the burner flame) when the flame from the burning specimen reaches a point 38mm from the open end of the specimen
- Measure the time that it takes the flame to progress to a point 38mm from the clamped end of the specimen. If the flame does not reach the end point of the timing zone, time its progress to the point where flaming stops.
- If the material is slow burning it must still be burnt all the way to the end if the testing is to 302. Other test methods allow the test to be terminated early.
- Record the burn length. Make some comment about this not having to be a complete specimen burn but the length of the final flame front.

Calculate the Burn Rate

- Calculate the burn rate from the formula:
 - $B = (60 \times D)/T$

Where

- B = Burn rate in mm/minute
- D = Length the flame travels in mm
- T = Time in s for the flame to travel D mm

Terminology From Automotive Procedures (Methods)

THIS IS NOT CALLED OUT IN FMVSS 302

- DNI Does Not Ignite. Specimen does not support combustion during or after ignition.
- SE Self-Extinguishing. Specimen ignites but does not burn to the timing zone.
- SE/NBR Self-Extinguishing/No Burn Rate. Specimen ignites but stops burning before it has burned for 60s from the start of the timing and does not burn more than 50.8mm from start of timing. (if calculated above 102 mm/min)
- SE/(B) Self-Extinguishing/With a Burn Rate (B). Specimen does not burn or transmit a flame front across the surface at a rate of more than **102** (101.6 to be consistent) mm/minute. Specimen stops burning before it has burned for 60s and not more than 50.8mm. If calculated below 102 mm/min)
- B If the flame does not stop before reaching the end of the timing zone, the burn rate is calculated.

Pitfalls To Testing

- IT IS CRITICAL THAT AUDITORS LOOK FOR THE THINGS THAT CAN AFFECT TEST RESULTS!!!!!!!!!!!!!!
- Improper specimen conditioning
- Contamination of specimen (hand lotion, oil from hand, silicone from saw blade, surface contaminants)
- Ignition fuel source incorrect (using propane, for example)
- Improper fume hood draft control. Test run draft free
- Blocking of ventilation holes in test apparatus
- Re-ignition of specimen from droplets
- Improper placement of specimen to burner tip.
- **The tilting of the burner (this is a BIG issue!)**
- Specimen not prepared properly. Bias cut give radical results
- Inaccurate timing and inaccurate measurement
- Introduction of foreign materials into test apparatus, i.e. foil for drip
- Not cleaning debris from frames and support wires between tests
- Test specimens need to be flat, without any bends or curves
- Improper sample size. Note customer requirements
- Improper pass/fail criteria. GM and Nissan have statistical requirements, for example. Some OEM's specify 80 mm/min max burn rate.
- Difficult to conduct any type of Measurement System Analysis or make any interlaboratory competency or proficiency conclusions
- Note measurement thickness – 13 mm is the maximum thickness
- Note composites that are adhered 100 % versus materials not adhered (like cut and sew)

Other Standards

- Technically Equivalent:
- SAE J369
- ASTM D5132
- ISO 3795

- Automotive Manufacturers Specification Maybe/Maybe Not Equal
- GM 9070P, GMW 3232
- Ford FLTM 24-2
- Honda HES D6003
- Toyota TSM 0500G
- Chrysler MS JP 9-4
- Nissan NE E M 0094
- Mazda MES CF 050C
- Hyundai MS 300 08
- VW PV 3904
- Mercedes (Daimler) DBL 5307
- Navistar TMS 9544
- Suzuki SES N 3245
- Subaru TS 420 – 0 – 2
- Isuzu ISC C93 – 001
- Mitsubishi ES X60410

Auditors Notes

- Auditors MUST audit to all the test methods listed on scope or put on test reports.
- Labs need to show that they conduct periodic Interlaboratory Studies to demonstrate proficiency
- ILS studies should show several materials and MATERIALS WITH BURN RATES. ILS all with “0” do not demonstrate proficiency