U.S. ARMY TEST AND EVALUATION COMMAND
TEST OPERATIONS PROCEDURE

AMSTE-RP-702-101
*Test Operations Procedure (TOP) 2-2-615 24 September 1993
AD No.

SECURITY FROM DETECTION (VEHICLES)

			Page
Paragraph	1.	SCOPE	1
	2.	FACILITIES AND INSTRUMENTATION	1
	3.	REQUIRED TEST CONDITIONS	2
	4.	TEST PROCEDURES	3
	4.1	Visibility	3
	4.2	Exhaust Visibility	6
	4.3	Road Dust Visibility	13
	4.4	Illumination Visibility	14
	4.5	Ground Signature Tests	16
	4.6	Jury-Type Noise Tests	17
	5.	PRESENTATION OF DATA	19
Appendix	A.	REFERENCES	A-1

1. SCOPE. This TOP describes the procedures to be followed for the evaluation of the visual and aural characteristics of a vehicle which render it susceptible to detection and of the extent to which measures taken to minimize these characteristics are effective. The procedures are limited to the assessment of vehicles detected by unaided observers. Infrared signature testing is described in TOP 2-2-812[a]**. Instrumental measurements of sound are described in TOP 1-2-608[b].

2. FACILITIES AND INSTRUMENTATION.

2.1 Facilities.

Item	Requirement
Viewing area	Unobstructed for a distance of 2000 meters with backgrounds as required for various subtests.
Test courses	For moving vehicle tests. Paved and gravel with level and hilly terrain.
Video equipment	For real-time documentation of testing.

*This TOP supersedes MTP 2-2-615, 10 August 1966.

**Superscript letters/numbers correspond to references in Appendix A.

Approved for public release; distribution unlimited.

Check the source to verify that this is the current version before use.

Item	Requirement
Still photograph equipment	To document test results.
Communication equipment	For test vehicle coordination.

2.2 Instrumentation.

Devices for Measuring:	Permissible Error of Measuring Device:
Engine speed	±2% full scale (0 to 5000 rpm)
Luminance contrast	±4% of full scale (0.002 to 300 Footlamberts)
Ambient illumination	±4% of full scale (0.002 to 10000 lux)
Wind speed	±0.8 m/s (0 to 9 m/s)
Wind direction	±3°
Ambient temperature	±2°C (-35° to +50°C)
Relative humidity	±3% (5% to 95% RH)

3. REQUIRED TEST CONDITIONS.

a. Personnel used as observers must have their vision screened for acuity (20/20 corrected vision) and color blindness. These personnel must also have hearing ability consistent with the Normal Threshold of Audibility as defined in ANSI S3.6[1].

b. Visibility and audibility tests should be conducted simultaneously whenever possible in order to minimize total test time.

c. For both visibility and audibility testing, a baseline vehicle with known characteristics shall be required whenever comparison tests are to be made, or comparison test data are not available.

d. The highest grade of fuel shall be used in all subtests, unless otherwise specified. Fuel type affects the noise and exhaust characteristics of diesel engines.

e. Vehicle interior and exterior illuminating systems must be operational.

f. Prior to conducting vehicle visibility tests, the vehicle should be clean and the power train should function properly. Unless required otherwise, all equipment designated to be stowed on board the vehicle should be mounted (combat weight).

4. TEST PROCEDURES.

Check the source to verify that this is the current version before use.

4.1 Visibility.

a. The main interest in conducting visibility tests on an engineering basis is to determine the extent that a vehicle, either by its appearance and/or operation, provides a means of being visually detected.

b. The following shall be observed during the conduct of visibility tests:

(1) Visibility conditions shall be clear, even in darkness. Visibility shall be at least 5000 meters.

(2) A minimum of 10 observers shall be used for each test to ensure that the sample size is large enough for the analysis performed on the results to have statistical significance.

(3) Photography shall be used whenever possible to document the results.

(4) No data shall be taken under a specific engine operating (steady-state) condition until torque, speed and temperatures have been maintained substantially constant for at least 1 minute.

(5) Observations shall be made over terrains free from visual obstructions.

(6) The size of the visual field should be clearly defined to the observers.

(7) Observers should be allowed sufficient time to scan the viewing area (2 to 3 minutes).

(8) Time should be allowed to acclimate observers' eyes to darkness (at least 30 minutes) for tests conducted in the dark.

4.1.1 Size, Shape, Silhouette.

4.1.1.1 Method.

a. Visibility of a vehicle usually should be tested against various backgrounds. A comparison of views from various angles and distances of two similar vehicles is desirable. In the case of smaller vehicles, comparisons are made when the vehicles are partially obscured by brush or tall grass. The vehicles are viewed under normal conditions and care should be taken to view them without enhancing the susceptibility of the vehicle to visual detection. Vehicle placement and motion shall be randomized to preclude the observers from detecting patterns in the test sequence.

b. Determine the maximum distance at which the vehicle is discernible against a background of trees, brush, and tall grass.

c. View each vehicle under the conditions of step a in the following orientation with respect to the observers with the vehicle in a stationary position:

(1) Front view.

Check the source to verify that this is the current version before use.

(2) Side views.

(3) Angular views, front (approximately 45°).

(4) Angular views, rear (approximately 45°).

(5) Rear view.

Note: Observers shall be positioned so that the vehicles are not backlit (i.e., the sun shall be at the observers' backs).

d. For moving vehicle tests, the test course shall comply with the definition in paragraph 2.1. The vehicle shall be operated at 8 km/hr oriented as described in paragraph 4.1.1.1c.

e. Repeat steps a through d for the test vehicle and the baseline vehicle on a clear moonlit night.

4.1.1.2 Data required.

a. Observation number.

b. Observer identity.

c. Vehicle identity.

d. Distance at which the vehicle is discernible, in meters.

e. Observer's radial direction with respect to the vehicle, in degrees.

f. Background description (trees, brush, tall grass).

g. Reflective surfaces discernible (description and comments).

h. Comments on silhouette symmetry which tend to reveal vehicle position and identity.

i. Photographs of the test vehicle and the baseline vehicle at the various angles and distances.

j. Contrast measurement of the vehicle with respect to the background.

k. Ambient illumination.

4.1.2 Hot Surfaces.

a. Red hot exhaust systems constitute a source of visible radiation that can also betray a vehicle at night unless the surfaces are shielded. Night observations must be made to determine the extent which these surfaces are shielded; hence, visual observations must be reliable.

Check the source to verify that this is the current version before use.

b. Observations are made of the test vehicle and the baseline vehicle at full combat weight and at varying engine speeds to determine the angles and elevations (with respect to the vehicle) at which the hot surfaces are visible under conditions of normal usage.

4.1.2.1 Method.

a. Determine the distances and radial directions at which hot surfaces such as engine components, exhaust components, etc., of the vehicles can be detected by operating the vehicles under the following conditions in a stationary position:

(1) Vehicle engines operating at low idle.

(2) Vehicle engines operating at maximum rpm.

(3) Vehicle engines operating at mid-range rpm.

Note: Vehicle "warm-up" times shall be of sufficient length to ensure that "steady-state" conditions are obtained for each observation.

b. Determine the maximum distances and radial directions that hot surfaces are visible to observers at a height of 4.5 meters under the operating conditions of step a.

c. Repeat steps a and b until a minimum of three observations have been made for each operating condition.

4.1.2.2 Data required.

a. Observation number.

b. Observer identity.

c. Vehicle identity.

d. Vehicle orientation.

e. Distance at which a hot surface is visible, in meters.

f. Observer's radial direction with respect to the vehicle, in degrees.

g. Nomenclature of vehicle surfaces.

h. Engine operating speed in rpm.

i. Distance in meters at which a hot surface is visible from a height of 4.5 meters.

j. Contrast measurement of the hot surface with respect to the background.

k. Ambient illumination.

Check the source to verify that this is the current version before use.

4.2 Exhaust Visibility[2].

a. Exhaust visibility is a characteristic primarily associated with diesel-powered vehicles; therefore, these tests need not be performed on vehicles with spark-ignition engines.

b. The following procedures are applicable prior to the initiation of exhaust visibility tests:

(1) Vehicles shall be operated by at least three different drivers during each of the tests.

(2) Vehicle engines shall be serviced for normal operation under the prevailing climatic conditions.

(3) Control rack adjustments shall be made, as specified, for the particular engine, if applicable.

(4) Fuel grades used during the test shall be those specified for engine operation under the particular climatic condition.

(5) Observations shall be made with the observers in the most advantageous positions to view the exhaust outlet opening.

4.2.1 Smoke.

a. Exhaust smoke is a problem associated primarily with diesel engines. The amount and characteristic color and intensity of the smoke produced is determined by vehicle operating conditions such as load, fuel type, temperature, humidity, and rack position.

b. Observations of exhaust smoking should be made throughout the daylight portions of the testing period to provide data for representative operating conditions.

4.2.1.1 Method. Perform the following in clear sunlight, under moderate ambient temperatures with low relative humidity, and with the test vehicle and the baseline vehicle at full combat weight.

a. Determine the exhaust smoke classifications as listed in Table 1 under the following operating conditions in a stationary position:

(1) Engine operating at low idle.

(2) Engine operating at maximum rpm.

(3) Engine operating at mid-range rpm.

(4) Engine accelerating to maximum rpm.

(5) Engine decelerating to low idle.

Note: Observations shall not be conducted when the wind velocity is greater than 4.5 m/s.

Check the source to verify that this is the current version before use.

TABLE 1. EXHAUST SMOKE CLASSIFICATION

Smoke Description	Classification
Clear	1
Haze	2
Light gray	3
Medium gray	4
Dark gray to black	5

b. Repeat step a until a minimum of three observations have been made for each condition.

c. Operate the vehicles, at 8 km/hr, over a test course consisting of the following types of terrain:

(1) Level paved road.

(2) Level cross-country.

(3) Hilly paved roads with slope grades between 10 and 60%, as applicable.

(4) Hilly cross-country.

d. Determine the exhaust smoke visibility classifications (utilizing Table 1) during the traverse of each course section.

e. Repeat steps c and d until at least three observations have been made for each course section.

f. Repeat steps c through e with the vehicles operating at increasing speeds, in increments of 8 km/hr until the maximum rated speed for each individual course section or vehicle is obtained.

g. Repeat steps c through f with the vehicles operated at partial control rack position (approximately 1/2 throttle), if applicable.

h. Repeat steps a through g, using the appropriate fuel grades, under the following conditions:

(1) Moderate ambient temperature and high relative humidity.

(2) High ambient temperatures and low relative humidity.

(3) High ambient temperatures and high relative humidity.

(4) Low ambient temperatures and low relative humidity.

(5) Low ambient temperatures and high relative humidity.

4.2.1.2 Data required.

a. For exhaust smoke visibility tests of stationary vehicles:

(1) Observation number.

Check the source to verify that this is the current version before use.

(2) Observer identity.

(3) Vehicle identity.

(4) Driver identity.

(5) Exhaust smoke classification (Grades 1, 2, 3, 4, or 5).

(6) Engine operating speed in rpm (for steady-state conditions only).

(7) Engine operating speed range in rpm (for transient conditions only).

(8) Fuel grade nomenclature.

(9) Temperature and humidity conditions at appropriate intervals.

(10) Color photographs of the various exhaust smoke conditions.

b. For exhaust smoke visibility tests of moving vehicles:

(1) Observation number.

(2) Observer identity.

(3) Vehicle identity.

(4) Driver identity.

(5) Exhaust smoke classification (Grades 1, 2, 3, 4, or 5).

(6) Vehicle operating speed in km/hr.

(7) Engine operating speed in rpm.

(8) Control rack position (full, partial), if applicable.

(9) Course section description (level paved road, hilly paved road with 15% grade, etc.).

(10) Fuel grade nomenclature.

(11) Temperature and humidity conditions at appropriate intervals.

(12) Color photographs of the various exhaust smoke conditions.

4.2.2 Flame.

a. Exhaust flames, particularly torching, occur when a high concentration of unburned fuel in the exhaust gases is ignited by hot exhaust manifolds and pipes. This phenomenon is best observed after dark under varying load and speed conditions, particularly during acceleration and deceleration.

Check the source to verify that this is the current version before use.

b. To best determine whether exhaust flames are detectable and the extent to which they affect the security of the vehicle, photography is utilized. The exhaust flames furnish the illumination and the vehicle is not lighted externally. Comparison photographs of different vehicles must be made under identical conditions.

4.2.2.1 Method. Perform the following in darkness (blackout), under moderate ambient temperatures with low relative humidity, and with the test vehicle and the baseline vehicle at full combat weight.

a. Determine the maximum distances at which exhaust flames are visible under the following operating conditions in a stationary position:

(1) Engine operating at low idle.

(2) Engine operating at maximum rpm.

(3) Engine operating at mid-range rpm.

(4) Engine accelerating to maximum rpm.

(5) Engine decelerating to low idle.

b. Repeat step a until at least three observations have been made for each condition.

c. Operate the vehicles, at 8 km/hr, over a test course consisting of the following types of terrain:

(1) Level paved road.

(2) Level cross-country.

(3) Hilly paved roads with slope grades between 10 and 60%, as applicable.

(4) Hilly cross-country.

d. Determine the maximum distances that the exhaust flames are visible during the traverse of each course section.

Note: Observations shall be made with the cameras oriented to view the exhaust system outlet opening.

e. Repeat steps c and d until at least three observations have been made for each course section.

f. Repeat steps c through e with the vehicle operating at increasing speeds in increments of 8 km/hr until the maximum rated speed for each individual course section or vehicle is attained.

Check the source to verify that this is the current version before use.

g. Obtain still photographs and video recordings of the various exhaust flame conditions.

h. Repeat steps c through g with the vehicles operated at partial control rack position (1/2 throttle), if applicable.

i. Repeat steps a through h using the appropriate fuel grades, under the following conditions:

(1) Moderate ambient temperature and high relative humidity.

(2) High ambient temperatures and low relative humidity.

(3) High ambient temperatures and high relative humidity.

(4) Low ambient temperatures and low relative humidity.

(5) Low ambient temperatures and high relative humidity.

4.2.2.2 Data required.

a. For exhaust flame visibility tests of stationary vehicles:

(1) Observation number.

(2) Observer identity.

(3) Vehicle identity.

(4) Distance at which exhaust flames are visible, in meters.

(5) Engine operating speed in rpm (for steady-state conditions only).

(6) Engine operating speed range in rpm (for transient conditions only).

(7) Fuel grade nomenclature.

(8) Temperature and humidity conditions at appropriate intervals.

(9) Photographs or video recordings of the various exhaust flame conditions.

(10) Contrast measurement between exhaust flame and background.

(11) Ambient illumination.

b. For exhaust flame visibility tests of moving vehicles:

(1) Observation number.

(2) Observer identity.

(3) Vehicle identity.

Check the source to verify that this is the current version before use.

(4) Driver identity.

(5) Distance at which exhaust flames are visible, in meters.

(6) Vehicle operating speed in km/hr.

(7) Engine operating speed in rpm.

(8) Control rack position (full, partial), if applicable.

(9) Course section description (level paved road, hilly paved road with 15% grade, etc.).

(10) Fuel grade nomenclature.

(11) Temperature and humidity conditions at appropriate intervals.

(12) Photographs or video recordings of the various exhaust flame conditions.

(13) Contrast measurement between exhaust flame and background.

(14) Ambient illumination.

4.2.3 Ice Fog.

Ice fog, a phenomenon associated with operation under conditions of extreme cold, is often visible at great distances, particularly in convoy operations. Ice fog should be observed qualitatively during the conduct of tests under arctic conditions. Visibility characteristics attributable to the design of the exhaust system should be particularly recorded. Thus, a vehicle which disperses engine exhaust with cooling air may be less visible than one exhausting upward without turbulence.

4.2.3.1 Method.

a. Determine whether the vehicle exhaust system produces ice fog under the following conditions in a stationary position:

(1) Vehicle engine operating at low idle.

(2) Vehicle engine operating at maximum rpm.

(3) Vehicle engine operating at mid-range rpm.

Note: Observations shall not be conducted when the wind velocity is greater than 4.5 m/s.

b. Determine the ultimate height of the ice fog cloud, as applicable, by:

Check the source to verify that this is the current version before use.

(1) Estimation from visual observations.

(2) Photographing the ice fog and the vehicles from a suitable vantage point.

c. Determine the maximum distance that the ice fog is visible (against an appropriate background).

d. Repeat steps a through c until a minimum of three separate observations have been made for each condition.

4.2.3.2 Data required.

a. Observation number.

b. Observer identity.

c. Vehicle identity.

d. Driver identity.

e. Distance at which ice fog cloud is visible, in meters.

f. Background against which ice fog was observed (clear sky, trees, etc.).

g. Engine operating speed in rpm.

h. Ultimate height of ice fog cloud, in meters.

i. Temperature and humidity conditions at appropriate intervals.

j. Photographs of the ice fog.

k. Ambient illumination.

4.3 Road Dust Visibility.

a. Road dust disturbances caused by poorly located exhaust pipes, engine cooling air exhausts or other vehicle peculiarities must also be taken into consideration. The visibility of the dust pattern raised by the test vehicle is evaluated by comparing it with dust from a comparable baseline vehicle operating under the same conditions.

b. To compare the dust patterns, each vehicle is operated separately over a selected section of a dusty cross-country course at various speeds and the dust pattern observed. Qualitative observations are to be made from appropriate vantage points and the heights of the dust clouds recorded on color motion picture film for later analyses.

4.3.1 Method.

Check the source to verify that this is the current version before use.

Perform the following on a clear sunlit day with the test vehicle and the baseline vehicle at full combat weight.

a. Operate the vehicles separately, over a selected section of dusty cross-country terrain at 8 km/hr.

Notes: If there is appreciable wind in or away from the direction of travel, the vehicle shall be driven in both directions. The dust pattern tests shall not be conducted if the wind velocity exceeds 3.6 m/s.

b. Record the resultant dust cloud from each vehicle on color photographs.

c. Repeat steps a and b until a minimum of three observations have been made for each vehicle.

d. Repeat steps a through c with the vehicle operating at increasing speeds in increments of 8 km/hr until the maximum rated speed for the slower vehicle or test course is attained.

4.3.2 Data required.

a. Observation number.

b. Observer identity.

c. Vehicle identity.

d. Driver identity.

e. Vehicle operating speed in km/hr.

f. Engine operating speed in rpm.

g. Comments on the placement of:

(1) Engine exhaust pipes.

(2) Cooling air exhausts.

(3) Vehicle peculiarities contributing to dust pattern characteristics.

h. Photographs of the dust clouds produced by each vehicle.

i. Wind velocity and direction.

j. Ambient illumination.

4.4 Illumination Visibility.

4.4.1 Exterior Illumination.

The location of exterior lights on the test item must be compared to their locations on the baseline vehicle. Vehicles are viewed from various distances, elevations, and at various radial positions in

Check the source to verify that this is the current version before use.

darkness. Care must be taken to ensure that the observers' eyes are fully adapted to darkness.

4.4.1.1 Method. Perform the following in darkness (blackout) for the test vehicle and the baseline vehicle in stationary positions.

a. Determine the maximum distances and radial directions that the following (as applicable) are visible to the observers at eye level:

(1) Service headlights.

(2) Service taillight(s).

(3) Service stoplight(s).

(4) Blackout marker stoplight.

(5) Blackout driving light(s).

b. Determine the maximum distances and the radial directions that the lights in step a (as applicable) are visible to observers at a height of 4.5 meters.

c. Repeat steps a and b until a minimum of three observations have been made for each light and condition.

4.4.1.2 Data required.

a. Observation number.

b. Observer identity.

c. Vehicle identity.

d. Distance at which the exterior light is visible, in meters.

e. Observer's radial direction with respect to the vehicle, in degrees.

f. Light identity (service headlight, blackout driving light, etc.).

g. Light location (front, rear, front left, etc.).

h. Distance at which the exterior light is visible at a height of 4.5 meters, in meters.

i. Ambient illumination.

4.4.2 Interior Illumination.

The extent to which the interior lights of a combat vehicle can betray its position is observed at various distances in darkness. Three observers are used to view the vehicle from all directions. Care must

Check the source to verify that this is the current version before use.

be taken to ensure that the observers' eyes are fully adapted to darkness. When light is detected, the distance of observation is increased, and the positions at which the light is no longer observed are recorded. When the elevation of the vehicle is too high for direct observation of the light, the vehicle may be backed up a slope to get the desired angle (about 17°). Care shall be taken to ensure that the periscopes and sights are unobscured from the inside. Particular attention should be given to light leakage around the mantlet openings provided for primary and secondary armament, and around hatches.

4.4.2.1 Method. Perform the following in darkness (blackout) for the test vehicle and the baseline vehicle in stationary positions with the vehicles in the "buttoned-up" configuration and the combat lighting and instrument lighting illuminated.

a. Determine the maximum distances and radial directions that the vehicle interior lighting and various instrument lights (as applicable) are visible to the observers at eye level.

b. Determine the maximum distances and radial directions that the interior illumination and instrument lights are visible to observers at a height of 4.5 meters.

Note: Direct observation from a 4.5-meter height can be simulated by backing the vehicle up a slope to an approximate angle of 17°.

c. Repeat steps a and b until a minimum of three observations have been made for each condition.

4.4.2.2 Data required.

a. Observation number.

b. Observer identity.

c. Vehicle identity.

d. Distance at which interior light is visible, in meters.

e. Observer's radial direction with respect to the vehicle, in degrees.

f. Location(s) of interior light detected.

g. Light identity (dome light leak, instrument light, etc.).

h. Type of lighting in use (white lighting, combat lighting).

i. Distance in meters at which interior light is visible at a height of 4.5 meters.

j. Ambient illumination.

4.5 Ground Signature Tests.

4.5.1 Method.

Check the source to verify that this is the current version before use.

Perform the following with the test vehicle and the baseline vehicle at full combat weight, as applicable:

a. Operate the vehicles over the following level test courses at slow to moderate speeds:

(1) Paved road - asphalt.

(2) Cross-country terrain - heavy dust.

(3) Cross-country terrain - mud.

(4) Paved or cross-country terrain - heavy new snow.

b. Determine the characteristics of the vehicle imprint (track or trail), which is distinctive of the vehicle itself, over each type of terrain and condition of step a.

c. Repeat steps a and b until a minimum of three observations have been made by each observer.

4.5.2 Data required.

a. Observation number.

b. Observer identity.

c. Vehicle identity.

d. Distinctive features of the vehicle imprint (track or trail) on each type of terrain.

e. Type and condition of terrain traversed.

f. Photographs of the imprints made by each vehicle.

4.6 Jury-Type Noise Tests.

a. To utilize the human ear as a qualitative noise measuring device, jury-type tests are conducted for comparing a baseline vehicle with the test vehicle. These tests consist of independent observations made by a minimum of 10 "jury" members. Each observer must have hearing ability consistent with that defined in paragraph 3a. The assumption is made in tests of this nature that comparisons based upon individual vehicles will be valid if several vehicles are operating in convoy.

b. Tests are generally conducted on both hard-surface roads and over cross-country terrain with vehicles operating in circles and/or figure-eights. This provides opportunities for observing directional effects, particularly in the case of the engine, which can be considerably masked from some directions.

c. It is preferable to conduct these tests at a distance from which both vehicles can be heard regardless of instantaneous orientation with respect to the observers. A low gear ratio should be used so that engine noise will be at or near maximum. When suspension system or track noises are the principal concern, however, it may be desirable to

Check the source to verify that this is the current version before use.

operate in the gear producing the lowest level of engine and transmission noise.

d. The test shall be conducted with the observers positioned at various distances to allow for differences in vehicle types and for differences in the surrounding conditions such as wind direction, humidity, ambient noise, air density, presence of snow cover, etc. However, when the observation distance is increased to the threshold of hearing, the effects of ambient noise and outside interferences increase so that greater care in judgment must be exercised in the observations.

e. The tests shall not be conducted when the wind velocity at the test site is greater than 4.5 m/sec.

f. Tests should be conducted at dawn in order to minimize extraneous noise and to provide a standard of detection susceptibility using the worst-case condition.

4.6.1 Method.

Perform the following in moderate ambient temperatures with low relative humidity for the test vehicle and the baseline vehicle:

a. Operate the vehicles, simultaneously, but at opposite ends, over a test course of circular or figure-eight configuration at least 1.5 km in length consisting of:

(1) Hard surfaced road.

(2) Cross-country terrain.

Note: A low gear rate shall be used so that engine noise will be at or near maximum levels.

b. With a "jury" of observers positioned at a distance of 60 meters from the center of the test course, rate the vehicles with respect to each other by the noise which each produces using the following rating scale:

The test vehicle is:
1. louder than the baseline vehicle.
2. somewhat louder than the baseline vehicle.
3. the same as the baseline vehicle.
4. somewhat quieter than the baseline vehicle.
5. quieter than the baseline vehicle.

c. Repeat steps a and b until a minimum of three runs have been made by the vehicles over the test course.

d. Repeat steps a through c at increased observation distances, in increments of 60 meters, until the threshold of hearing is approached.

e. Repeat steps a through d for the following conditions:

(1) Moderate ambient temperatures and high relative humidity.

Check the source to verify that this is the current version before use.

(2) High ambient temperatures and low relative humidity.

(3) High ambient temperatures and high relative humidity.

(4) Low ambient temperatures and low relative humidity.

(5) Low ambient temperatures and high relative humidity.

(6) Low ambient temperatures with surroundings under heavy snow cover.

4.6.2 Data required.

a. Observation number.

b. Observer identity.

c. Vehicle identity.

d. Driver identity.

e. Course layout description.

f. Observation distance from the center of the vehicle, in meters.

g. Test vehicle noise relative to baseline vehicle noise.

h. Directional effects due to the orientation of the test vehicle with respect to the observer.

i. Presence of snow cover, as applicable.

5. PRESENTATION OF DATA.

a. Data taken from observations of the test vehicle and the baseline vehicle, for each observer, shall be averaged and tabulated for comparison. Qualitative observer comments shall also be noted in the final evaluation. Photographs and videos shall be retained, suitably identified, analyzed and compared for each vehicle.

b. Observation distances and radial directions shall be plotted on polar coordinate graph paper and suitably identified and keyed to the narrative.

c. An analysis of the susceptibility of the test vehicle to detection because of its size, shape, or silhouette shall be made taking into consideration the background and lighting conditions.

d. Evaluation of the effectiveness of the hot surface shielding shall be made and compared to that of the baseline vehicle. Recommendations for the improvement of shielding shall be made as required based on the conclusions drawn from the observation data.

e. The evaluation of the exhaust visibility shall include correlation of the results with such factors as engine speed, weather conditions, vehicle speed, type of terrain traversed, type of fuel used and driver

Check the source to verify that this is the current version before use.

characteristics. Conclusions drawn from the analysis and comparison of photographs of the vehicles must be included as part of the narrative report. The evaluation of the various exhaust components must be evaluated in terms of their contribution to the vehicle's overall detectability.

f. Particular angles at which the vehicle lights and light leakages are visible shall be noted and tabulated or plotted.

g. Jury test results of vehicle noise studies shall be presented in tabular form keyed to plots on polar coordinate graph paper showing the course layout and observer positions. Comments by individual observers shall be compared.

Recommended changes of this publication should be forwarded to Command, U.S. Army Test and Evaluation Command, ATTN: AMSTE-CT-T, Aberdeen Proving Ground, MD 21005-5055. Technical Information may be obtained from the preparing activity: Commander, U.S. Army Aberdeen Test Center, ATTN: STEAC-TE-I, Aberdeen Proving Ground, MD 21005-5059. Additional copies are available from the Defense Technical Information Center, Cameron Station, Alexandria, VA 22304-6145. This document is identified by the accession number (AD No.) printed on the first page.

Check the source to verify that this is the current version before use.

APPENDIX A. REFERENCES

Required References

1. ANSI S3.6, American National Standards Institute Specifications for Audiometers, New York, 1969.

2. Woomert, Dale E., A Research Test to Evaluate the Techniques and Precision of the Measurements of Smoke from Diesel Engines, Aberdeen Proving Ground, Report No. DPS-1204, March 1964.

References for Information Only

a. US TOP 2-2-812, Infrared Measurements of Vehicles and Weapons, 8 May 1984.

b. US TOP 1-2-608, Sound Level Measurements, 12 July 1981.

Check the source to verify that this is the current version before use.