# Airbus Industrie

# Technical Specification

## Material Test Specification

"PRELIMINARY COMBINED FIRE HAZARD STANDARD TEST PROCEDURE FOR NON-METALLIC PARTS TO BE INSTALLED OR EMPLOYED IN THE PRESSURIZED PORTION OF THE FUSELAGE OF TRANSPORT CATEGORY AIRCRAFT."

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|---|---|
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| **ATA-Chapter** | All, inside pressurized fuselage |
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1. SCOPE

This specification is inteded to establish a combined fire hazard standard test procedure, taking into consideration the aspects of flammability, density of the smoke emitted and the toxicity of the smoke gases, applicable to aircraft parts , that are intended to be used inside the pressurized portion of the fuselage of large commercial transport category aircraft.

This specification shall be applied until it will be superseded by a relevant amendment to FAR Part 25 or a special condition officially imposed to the type-certification of the respective aircraft by the airworthiness authorities.

2. APPLICABLE DOCUMENTS

FAR 25.853 and Appendix F, Amendment 32.
NBS Technical Note No. 708, Appendix II
ANSI/ASTM F501-77.
Airworthiness Technical Manual Doc 9051-AN/896 (ICAO)

3. SUPPLIER RESPONSIBILITY

The supplier is responsible for the performance of all test and inspection requirements as specified herein. The supplier may use his own or any other appropriate test facility that has been agreed upon by the procuring activity. Test records and all relevant documents shall be made available in total to the procuring activity and the originals of all test records and relevant documents shall be kept for a minimum of one year by the supplier. The procuring activity reserves the right to perform any of the tests or inspections to confirm that the product complies with the specification requirements and with the test records that have been submitted by the supplier.

Procuring activity is defined by AIRBUS INDUSTRIE, their industrial partners, or any subcontractor purchasing the product for an intended use as an AIRBUS INDUSTRIE end item.

4. FLAMMABILITY REQUIREMENTS

In accordance with the requirements set forth in FAR Part 25, para 853, all materials, including finishes or decorative surfaces applied to the materials, used in each compartment occupied by the crew or passengers must meet the following test criteria:

4.1. Equivalent to FAR 25.853 (a)

Interior ceiling panels, interior wall panels, partitions, galley structure, large cabinet walls, structural flooring, and materials used in the construction of stowage compartments (other than underseat stowage compartments and compartments for stowing small items such as magazines and maps) must be self-extinguishing when tested vertically in accordance with the applicable portions of Appendix F of FAR Part 25, refer to para 7.1.4. of this specification, or other approved equivalent methods (however, in case of any doubt, the present specification must be considered as the only valid document). The average burn length may not exceed 152 mm (6 in.) and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of three seconds after falling.

4.2. Equivalent to FAR 25.853 (b)

Floor covering, textiles, (including draperies and upholstery), seat cushions, padding, decorative and non-decorative coated fabrics, leather, trays and galley furnishings, electrical conduit, thermal and acoustical insulation and insulation covering, air ducting, joint and edge covering, cargo compartment liners, insulation blankets, cargo covers, and transparencies, molded and thermoformed parts, air ducting joints, and trim strips (decorative and chafing), that are constructed of materials not covered in para (b-2) of this section, must be self-extinguishing when tested vertically in accordance with the applicable portions of Appendix F of FAR Par 25, refer to para 7.1.4. of this specification, or other approved equivalent methods (however, in case of any doubt, the present specification must be considered as the only valid document). The average burn length may not exceed 203 mm (8 in.) and the average flame time after removal of the flame source may not exceed 15 seconds. Drippings from the test specimen may not continue to flame for more than an average of 5 seconds after falling.

4.3. Equivalent to FAR 25.853 (b-1)

Motion picture film must be safety film meeting the Standard Specifications for Safety Photographic Film PH 1.25 (available from the United States of America Standards Institue, 10 East 40 Street, New York, N.Y. 10018), or an approved FAA equivalent. If the film travels through ducts, the ducts must meet the requirements for para 4.2. of this specification.

4.4. Equivalent to FAR 25.853 (b-2)

Acrylic windows and signs, parts constructed in whole or in part of elastomeric materials, edge lighted instrument assemblies consisting of two or more instruments in a common housing, seat belts, shoulder harnesses, and cargo and baggage tiedown equipment, including containers, bins, pallets, etc. used in passenger or crew compartments, may not have an average burn rate greater than 63.4 mm (2.5 in.) per minute when tested horizontally in accordance with the applicable portions of Appendix F of FAR Part 25, refer to para 7.1.5. of this specification, or other approved equivalent methods (however, in case of any doubt, the present specification must be considered as the only valid document).

4.5. Equivalent to FAR 25.853 (b-3)

Except for electrical wire and cable insulation, and for small parts (such as knobs, handles, rollers, fasteners, clips, grommets, rub strips, pulleys, and small electrical parts) that the procuring activity (refer to para 3. of this specification) in accordance with the respective airworthiness authorities finds would not contribute significantly to the propagation of a fire, materials in items not specified in paragraphs 4.1., 4.2., 4.3. or 4.4. of this specification may not have a burn rate greater than 102 mm (4.0 in.) per minute when tested horizontally in accordance with the applicable portions of Appendix F of FAR Part 25, refer to para 7.1.5. of this specification, or other approved equivalent methods (however, in case of any doubt, the present specification must be considered as the only valid document).

4.6. Equivalent to FAR 25.853 (d)

Each receptacle for towels, paper, or waste must be at least fire resistant and must have means for containing possible fires.

4.7. Equivalent to FAR 25.855 (a)

Thermal and acoustic insulation (including coverings) and liners, used in each cargo and baggage compartment not occupied by passengers or crew, must be constructed of materials that at least meet the requirements set forth in FAR 25.853 (b).

4.8. Equivalent to FAR 25.855 (a-1)

Class B through Class E cargo or baggage compartments as defined in FAR 25.857, must have a liner and the liner must be constructed of materials that at least meet the requirements set forth in para 4.2. of this specification. In addition a test must be carried out at a 45° angle in accordance with the applicable portion of the test procedure as set forth in para 7.1.6. of this specification or other approved equivalent test methods (however, in case of any doubt, the present specification must be considered as the only valid document). In the course of the 45° angle test, the flame may not penetrate (pass through) the material during application of the flame or subsequent to its removal, the average flame time after removal of the flame source may not exceed 15 seconds, and the average glow time may not exceed 10 seconds.

4.9. Equivalent to FAR 25.1359 (d)

Insulation on electrical wire and electrical cable installed in any area of the fuselage must be self-extinguishing when tested in an angle of 60° in accordance with the applicable portions of the test procedure as set forth in para 7.1.7. of this specification, or other approved equivalent methods (however, in case of any doubt, the present specification must be considered as the only valid document). The average burn length may not exceed 76 mm (3 in.) and the average flame time after removal of the flame source may not exceed 30 sec. Drippings from the test specimen may not continue to flame for more than an average of 3 sec. after falling.

5. SMOKE EMISSION REQUIREMENTS

This section of this specification covers the smoke emission requirements to be applied for non-metallic parts and sub-assemblies manufactured thereof, that are intended to be used inside the pressurized portion of the fuselage of transport category aircraft, using the NBS (National Bureau of Standards)-smoke density test chamber, amended and modified as defined in chapter 7.2. and/or 7.3. of this specification.

5.1. Applicable Specifications

The smoke density requirements shall be as specified in the AIRBUS INDUSTRIE MATERIAL SPECIFICATION (AIMS) or an AIRBUS INDUSTRIE-approved Material Specification established by an AI-industrial partner or -subcon-

tractor, applicable to the material being tested.

5.2. Airworthiness Requirements

The maximum acceptable smoke density may be - at a later date - limited by official airworthiness requirements. The airframe manufacturer, however, reserves the right to specify smoke densities he deems to be reasonable for a given application until such official airworthiness requirements have been issued. Furthermore, the airframe manufacturer reserves the right to specify smoke densities lower than the values set forth by official airworthiness requirements - after such requirements have been issued - if this is considered advisable for a given application.

## 6. TOXICITY REQUIREMENTS FOR SMOKE GASES

This section of this specification covers the toxicity requirements of smoke gases to be applied for non-metallic aircraft parts manufactured therof that are intended to be used inside the pressurized portion of the fuselage of transport category aircraft.

### 6.1. Measurement of toxic Gases

The measurement of the toxicity of smoke gases shall be carried out in using the NBS smoke test chamber. The test shall be carried out concurrently with the measurement of the density of the smoke gases when testing the materials in the NBS smoke chamber in accordance with the test procedure as per section 7.2. of this specification. The test procedure for the measurement of the toxicity is defined in chapter 7.3. of this specification.

### 6.2. Gases to be considered toxic

The smoke gases shall systematically be examined for the following toxic components :

| | |
|---|---|
| Hydrogen Fluoride | (HF) |
| Hydrogen Chloride | (HCl) |
| Hydrogen Cyanide | (HCn) |
| Sulphur Dioxide | ($SO_2$) |
| Carbon Monoxide | (CO) |
| Nitrous Gases | (NO + $NO_2$) |

If deemed necessary, AIRBUS INDUSTRIE reserves the right to amend or alter above list of toxic components. Furthermore, the issueing of relevant official airworthiness requirements may have an impact

on the list of toxic components to be examined. Such official airworthiness requirements are imperatively to be fulfilled.

Other toxic components than listed up in this specification which are expected or come up during testing, have to be indicated on the test report.

The procuring activity reserves the right to reject a material or a material combination if the occurence and concentration of such other toxic components are deemed to be harmful or hazardous in case of a fire.

The maximum admissible concentrations for the toxic components to be measured shall be as specified in the AIRBUS INDUSTRIE MATERIAL SPECIFICATION (AIMS) or an AIRBUS INDUSTRIE-approved Material Specification established by an AIRBUS INDUSTRIE-Industrial Partner or -Subcontractor, applicable to the material being tested.

## 7. TEST PROCEDURES

### 7.1. Flammability Testing

The test procedure described hereunder takes into consideration the "acceptable test procedure" as set forth in FAR Part 25, Appendix F, Amendment 32.

#### 7.1.1. Apparatus

Tests must be conducted in a draft-free cabinet in accordance with Federal Test Method Standard 191 Method 5903 (revised Method 5902) for the vertical test, or Method 5906 for horizontal test, or other approved equivalent methods (however, in case of any doubt, the present specification must be considered as the only valid document). A cabinet, that corresponds to paragraph 2 of ANSI/ASTM F501-77 and Figure 1, 2 and 3 of the I.C.A.O. Technical Manual Doc. 9051-AN/896 is considered to be suitable to the intended purpose (refer to fig. 1 - 5 of this specification). Specimens which are too large for the cabinet must be tested in similar draft-free conditions.

The specimen must be exposed to a Bunsen or Tirrill burner with a nominal 9.5 mm (3/8 in.) I.D. tube adjusted to give a flame of 38 mm (1 1/2 in.) in height.

#### 7.1.2. Definition of Burnlength

Burnlength is the distance from the original edge to the farthest evidence of damage to the test specimen due to flame impingement, including areas of partial or complete consumption, charring, or embrittlement, but not including areas sooted, stained, warped, or discolored, nor areas where material has shrunk or melted away from the heat source.

7.1.3. Specimen Configuration and Conditioning

Except as provided for materials used in electrical wire and cable insulation and in small parts, materials must be tested either as a section cut from a fabricated part as installed in the airplane or as a specimen simulating a cut section of the fabricated part. The specimen may be cut from any location in a fabricated part; however, fabricated units, such as sandwich panels, may not be separated for test. The specimen thickness must not be thicker than the minimum thickness to be qualified for use in the airplane, except that :

-thick foam parts, such as seat cushions, must be tested in 12,5 mm (1/2 in.) thickness;
-when showing compliance with the applicable regulations for materials used in small parts that must be tested, the materials must be tested in not more than 3 mm (1/8 in.) thickness;
-when showing compliance with the applicable regulations for materials used in electrical wire and cable insulation, the wire and cable specimens must be the same size as used in the airplane;
-in the case of fabrics, both the warp and fill direction of the weave must be tested to determine the most critical flammability condition.

The configuration of test specimens destinated for the use of comparative testing of different materials rather than qualifying real aircraft parts are defined as follows :

-Thermoplastic materials are to be 2 mm thick,
-Foam materials are to be 12.7 mm (1/2 in.) thick
-Laminated materials shall contain four layers.

When performing the tests prescribed in para 7.1.4. through 7.1.5. of this specification, the specimen must be mounted in a metal frame so that

-in the vertical tests of para 7.1.4., the two long edges and the upper end are held securely,
-the exposed area of the specimen is at least 51 mm (2 in.) wide and 356 mm ( 14 in.) long, unless the actual size used in the aircraft is smaller.

-in the horizontal test of para 7.1.5. the two long edges and one side edge are held securely.
-the exposed area of the specimen is at least 51 mm (2 in.) wide and 330 mm (13 in.) long, unless the actual size used in the aircraft is smaller, and
-the edge to which the burner flame is applied must not consist of the finished or protected edge of the specimen but must be representative of the actual cross-section of the material or part installed in the airplane.
-when performing the test prescribed in para 7.1.6. of this specification, the specimen must be mounted in a metal frame so that all four edges are held securely and the exposed area of the specimen is at least 203 mm by 203 mm (8 in. by 8 in.).
Summary of specimen dimensions:

| | | | |
|---|---|---|---|
| Vertical test | 368 mm x 76 mm | (14.5 in. x 3 | in.) |
| Horizontal test | 356 mm x 102 mm | (14 in. x 4 | in.) |
| Inclined test | 318 mm x 375 mm | (12.5 in. x 14.8 | in.) |
| Cable isolation test | 914 mm length | (36 in. | ) |

-specimen must be conditioned to 21°C (min. 18°C, max. 24°C) and at 50 percent plus or minus 5 percent relative humidity for 24 hours Only one specimen at a time may be removed from the conditioning environment immediately before subjecting it to the flame.

7.1.4. Vertical Test

This test is intended to show compliance with the requirements as set forth in para 4.1. and 4.2. of this specification.

A minimum of three, in case of any doubt, a minimum of 5 specimen must be tested and the results averaged. For fabrics, the direction of weave corresponding to the most critical flammability conditions must be parallel to the longest dimension. Each specimen must be supported vertically. The flame temperature measured by a calibrated thermocouple pyrometer in the center of the flame must be 850°C (1563°F) plus 30°C (86°F) minus 7 °C (44°F). The lower edge of the specimen must be 19 mm (3/4 in.) above the top edge of the burner. The flame must be applied to the center line of the lower edge of the specimen. For materials covered by para 4.1. of this specification the flame must be applied for 60 seconds and then removed. For materials co-

vered by para 4.2. of this specification, the flame must be applied for 12 seconds and then removed. Flame time, burn length, and flaming time of drippings, if any, must be recorded. The burn length determined in accordance with para 7.1.2. of this specification must be measured to the nearest 2 mm or 1/10 in. The after flame time of the specimen and the burn time of drops have to be measured within a tolerance of plus/minus 2/10 seconds.

7.1.5. Horizontal Test

This test is intended to show compliance with the requirements set forth in para 4.4. and 4.5. of this specification.

A minimum of three, in case of any doubt, a minimum of 5 specimen must be tested and results averaged. Each specimen must be supported horizontally. The exposed surface when installed in the aircraft must be face down for the test. The flame temperature measured by a calibrated thermocouple pyrometer in the center of the flame must be 850°C (1562°F) plus 30°C (86°F) minus 7 °C (44°F). The specimen must be positioned so that the edge being tested is 19 mm (3/4 in.) above the top of, and on the center line of, the burner. The flame must be applied for 15 seconds and then removed. A minimum of 254 mm (10 in.) of the specimen must be used for timing purposes, approximately 38 mm (1 1/2 in.) must burn before the burning front reaches the timing zone, and the average burn rate must be recorded. The after flame time of the specimen and the burn time of drops have to be measured within a tolerance of plus/minus 2/10 seconds.

7.1.6. Fourty-Five Degree Test

This test is intended to show compliance with the requirements set forth in para 4.8. of this specification. A minimum of three, in case of any doubt, a minimum of 5 specimen must be tested and the results averaged. The exposed surface when installed in the aircraft must be face down for the test. The flame temperature measured by a calibrated thermocouple pyrometer in

the center of the flame must be 850°C (1563°F), plus 30°C (86°F), minus 7°C (44°F). Suitable precautions must be taken to avoid drafts. One-third of the flame must contact the material at the center of the specimen and must be applied for 30 seconds and then removed. Flame time, glow time, and whether the flame penetrates (passes through) the specimen must be recorded.

7.1.7. Sixty Degree Test

This test is intended to show compliance with the requirements set forth in para. 4.9. of this specification.
A minimum of three (in case of any doubt, a minimum of five specimen) of each wire specification (make and size) must be tested. The specimen of wire or cable (including insulation) must be placed at an angle of 60° with the horizontal in the cabinet specified in para. 7.1.1 of this specification, with the cabined door open during the test or must be placed within a chamber (see Fig. 1).
The lower end of the specimen must be held rigidly clamped.
The upper end of the specimen must pass over a pulley or rod and must have an approximate weight attached to it so that the specimen is held tautly throughout the flammability test. The test specimen span between lower clamp and upper pulley or rod must be 610 mm (24 in.) and must be marked 203 mm (8 in.) from the lower end to indicate the central point for flame application. A flame from a Bunsen or Tirrill burner must be applied for 30 seconds at the test mark. The burner must be mounted underneath the test mark on the specimen, perpendicular to the specimen and at an angle of 30° to the vertical plane of the specimen.
The temperature of the hottest portion of the flame, as measured with a calibrated thermocouple pyrometer may not be less than 954°C (1750°F) plus 32°C (90°F) minus zero. The burner must be positioned so that the hottest portion of the flame is applied to the test mark on the wire. Flame time, burn length and flaming time of drippings if any, must be recorded. The burn length determined in accordance with para. 7.1.2 of this specification must be measured to

the nearest increment of 2 mm (1/10 in.). Breaking of the wire specimen is not considered as a failure. The extinguish time of the flames and the burn time of drops have to be measured within a tolerance of plus/minus 2/10 sec.

## 7.2. Smoke Density Testing

The test procedure described hereunder takes into consideration the requirements and recommendations as set forth in NBS Technical Note No. 708, Appendix II and in the operational documentation supplied by the manufacturer of the NBS test chamber.

### 7.2.1. Apparatus

The apparatus and related parts shall essentially be identical to the Aminco NBS Smoke Density Chamber available from American Instrument Co., 8030 Georgia Ave., Silver Spring, Maryland 20910. However, in order to allow the use of the NBS Smoke Density Chamber at the same time to determine the toxicity of smoke gases, some modifications and amendments have to be applied in order to facilitate thes toxicity measurements. These modifications are described under section 7.3. of this specification.

### 7.2.2. Specimen Configuration

Unless otherwise specified for the purpose of the measurement of the toxicity of smoke gases under chapter 6 and 7.3. of this specification, four specimens shall be tested under flaming exposure and four specimens under non-flaming exposure. For test specimens for comparative testing refer also to para 7.1.3.

7.2.2.1. Each specimen shall be 76 x 76 mm x installation thickness (3 x 3 in.), up to and including 25 mm (1 in.). Materials furnished in thickness exceeding 25 mm (1 in.) shall be sliced to 25 mm (1 in.) thickness and the uncut surface tested. Thick foam parts, such as seat cushions, must be tested in 12 mm (1/2 in.) thickness.

7.2.2.2. The exposed surface when installed in the aircraft of a multi-layer assembly (up to and including 25 mm; 1 in.) shall be tested if the assembly consists of different face materials. Multi-layer assemblies exceeding 25 mm thickness (1 in.) shall be sliced to 25 mm thickness (1 in.) and the uncut surface tested. If the cut surface is different material from the uncut face, both surfaces shall be tested.

7.2.2.3. Flat sections of the same thickness and composition may be tested in place of curved molded or special parts.

7.2.2.4. For electrical wire and cable insulation, each specimen tested must consist of 3050 mm (10 ft) length of 20 gage wire or cable, with insulation of the specification to be qualified for the airplane.

7.2.2.5. For testing, each wire or cable specimen must be would tighly around an open frame metal fixture, per Figure11, designed to form 20 turns of wire extending into the center opening of the fixture. The open frame containing the wire must be backed by aluminium foil, leaving one side exposed, and placed in the specimen holder with the exposed side facing the heat source.

7.2.3. Cleaning of Apparatus

The chamber walls and windows shall be cleaned periodically. An ammoniated spray detergent and soft scouring pad have been found effective. The exposed surfaces of the glass windows (separating the photodetector and light source housings from the interior of the chamber) shall be cleaned after each test. A non-abrasive cloth dampened with ethyl alcohol has been found effective. Charred residus on the specimen holder and horizontal rods securing the holder shall be removed to prevent contamination of subsequent specimens.

7.2.4. "Blank" Specimen Holder

A "blank" specimen holder with the asbestos millboard backing exposed shall always be in front of the furnace, except when placed to the side by the specimen holder during a test of the radiometer during calibration.

7.2.5. Specimen Mounting

The specimen shall be covered accross the back, along the edges and over the front surfaces peri-

phery with a sheet of aluminium foil, 0.04 mm (0.0015 in.) thick. Care shall be taken not to puncture the foil or to introduce unnecessary wrinkles. The specimen shall then be placed in the holder containing the trough, backed with a sheet of asbestos millboard, and locked in place with the spring plate and retaining rod. Care shall be taken not to compress flexible materials beyond their normal thickness. Excess foil shall be trimmed off around the front edges after mounting.

7.2.6. Calibration

Prior to each day's testing, the chamber shall be calibrated in the following manner : (see fig. 9,10,11, & 12 for diagram of chamber and test set-up).

7.2.6.1. Place the radiometer on the horizontal rods of the furnace support framework and position in front of the furnace opening by sliding and displacing the "blank" specimen holder against the prepositioned stop. Connect the radiometer to the electrical and air supplies. Place the thermometer in the radiometer slot provided.

7.2.6.2. Close the door and exhaust vent and open the inlet vent. Switch on the line voltage, furnace, lamp and the light transmission meter.

7.2.6.3. The chamber is at steady-state condition and ready for furnace calibration when the surface temperature on the center of the back wall has reached 35 $\pm$ 2°C (95 $\pm$ 4°F). The exhaust vent may be used to introduce cooler air if the wall temperature rises above 37°C (99°F).

7.2.6.4. The air supply to the radiometer cooler shall be adjusted to maintain the radiometer body temperature at 93 $\pm$ 3°C (200 $\pm$ 5°F).

7.2.6.5. adjust the low heat adjust variac on the earlier chamber models to obtain the calibrated millivolt output of the radiometer corresponding to a steady-state irradiance of 2.5 $\pm$ 0.05 watts/cm2 (2.2 $\pm$ 0.04 BTU/sec/ft2). This millivolt reading is specific for each chamber. On newer models the transformer is adjusted to obtain the calibrated millivolt output. The radiometer output shall be monitored with a high impedance DC-voltmeter.

7.2.6.6. The radiometer output shall be monitored for a minimum of 10 minutes after the irradiance level has been reached. Slight adjustment on the low heat adjust variac, or the transformer setting, may be necessary during this time to keep the furnace at the required irradiance level.

7.2.6.7. The radiometer shall then be removed from the chamber and replaced with the "blank" specimen holder.

7.2.6.8. On the earlier chamber models the high heat adjust variac shall then be set two dimensions higher than the final setting on the low heat adjust variac and the pyrotroller shall be set 28°C (50°F) lower than the indicated temperature. Turn on the controller switch.

7.2.6.9. Adjust the light transmission meter or chart recorder to zero percent and then adjust the meter or chart recorder to zero percent by closing (pull out) the shutter on the shutter assembly, set the meter multiplier switch on the light transmission meter to the maximum sensitivity range, adjust the "dark current" to read zero percent transmission. Set the multiplier switch back to a setting of one and then open the shutter (push in and turn to lock).

7.2.7. Test Sequence, Non-Flaming Exposure

The non-flaming exposure test shall be conducted with the radiant furnace only.

7.2.7.1. Vent the chamber for about two minutes by opening the door, exhaust and inlet vents. Place the loaded specimen holder on the support bar. Close the chamber door and exhaust vent and verify the starting temperature of the chamber, 35 ± 2°C (95 ± 4°F).

7.2.7.2. Push the specimen into position in front of the furnace by displacing the "blank" holder to the prepositioned stop. Close the inlet vent completely only when the light transmission meter or chart recorder indicates smoke.

7.2.7.3. Record percent light transmission versus time in minutes, either as a continuous curve on the chart recorder or at sufficient time intervals with the light transmission meter. Make full-scale range changes in decade steps.

7.2.7.4. Observe the chamber pressure with the manometer. The pressure shall be maintained at 100 ± 50 mm (4 ± 2 in.) of water during most of the test. If negative pressure develops (below atmospheric), open the inlet vent slightly.

7.2.7.5. Record the behaviour of the specimen, such as shrinking, melting, sagging, delaminating, color of smoke, and nature of particulate matter.

7.2.7.6. Continue the test until Ds max. but for at least 8 min. on all materials except electrical wire and cable insulation. Electrical wire and cable shall be tested for at least 20 minutes.

7.2.7.7. If the transmittance falls below 0.01 %, the chamber window shall be covered with an opaque screen to avoid light scattering effects from laboratory lights.

7.2.7.8. Start exhausting the chamber within one minute after the specified test period. Remove the specimen from in front of the furnace and replace with "blank" specimen holder. Continue to exhaust the chamber with the inlet vent open until maximum transmittance is reached. Record the maximum transmittance value as the $T_c$, "clear beam" reading, which shall be used to correct for soot deposits on the photometer windows.

7.2.8. Test Sequence, Flaming Exposure

The flaming exposure test shall be conducted in the same manner as the non-flaming exposure test (ref. para 7.2.7) except that the three-directional, six-flamelet burner shall be used with the furnace for all materials with the exception of wire and cable. The straight burner (six flamelets horizontal) shall be used for wire and cable.

7.2.8.1. Position the burner in front of and parallel to the specimen holder (see fig.10). A premixed air and propane (at least 95 % pure propane) gas mixture shall be used. The air and propane shall be metered at 500 cm3/minute and 50 cm3/minute, respectively. The flowmeter setting to control the flow rate of each gas is specific for each chamber.

7.2.8.2. Monitor the air and propane settings during the test to maintain constant flow rates.

7.2.9. Calculations

7.2.9.1. Specific optical density, Ds, shall be calculated from the following equiation :

$$Ds = \frac{V}{LA}\left[\log_{10}\left(\frac{100}{T}\right)\right]$$

Where V is the chamber volume, L is the light path length, A is the exposed specimen area and T is the percent light transmission. The Ds value for a given light transmission value may be taken from the table supplied with the apparatus.

7.2.9.2. Determine maximum Ds values, Ds at 90 seconds, 4 and 8 minutes of test.

7.2.9.2.1. The minimum light transmission (MLT, in percent) reading during the first 90 seconds of test.

7.2.9.2.2. The MLT reading during the first 4 minutes of test.

7.2.9.2.3. The MLT reading during the first 8 minutes of test.

7.2.10. Reporting Data

The following data on each specimen shall be reported for non-flaming and flaming exposure, unless otherwise specified :

7.2.10.1. Complete indication of the material tested, including name, number, supplier, batch or lot number, construction, thickness of specimen, density, etc.

7.2.10.2. The minimum light transmission (MLT, in percent) reading during the first 90 seconds of test and corresponding Ds value.

7.2.10.3. The MLT reading during the first 4 minutes and corresponding Ds value.

7.2.10.4. The MLT reading during the first 8 minutes, and corresponding $D_S$ value.

7.2.11. Reference Samples

Two reference samples may be used for checking operational and procedural details of the apparatus and test methods described herein. Nominal 1.016 mm (0.040 in.) thick No. 1006 alpha-cellulose paper should exhibit a $D_S$ value of 170 + 8 under nonflaming exposure. Nominal 0.813 mm (0.032 in.) thick No. 1007 plastic sheet should exhibit a $D_S$ ( value of 445 $\pm$ 26) under flaming exposure. These reference samples may be purchased from the Office of Standard Reference Materials, Natural Bureau of Standards, Washington, D.C., 20234. Testing of these reference materials does not eliminate the need for following the calibration procedure outlined in this specification.

7.3. Toxicity Testing of Smoke Gases

The test procedure described hereunder takes into consideration the requirements and recommendations as set forth by NBS-Technical Note No. 708, Appendix II. The test will be carried out concurrently with the measurement of the density of the smoke gases.

7.3.1. General Description

For the purpose of the determination of toxic gases, samples are being taken from the materials to be tested and tests carried out in the NBS-chamber. To accomplish this, the front surface of the samples is pyrolysed under a defined density of energy and/or burned by an additional application of defined gas-flames.

From the fumes being emitted, samples are being taken and examined for toxic components. The measuring process is being carried out by means of colorimetric test tubes (DRAEGER tubes), and wet analysis. The above described test method provides as sufficiently exact in order to allow a well based judgement on the applicability of the material being tested.

The type and/or the time of gas measurement is carried out by means of three different methods :

1 - the reactive gas of hydrochloric acid (HCl) is being analysed directly during the test, drawn from the NBS-chamber.
2 - Hydrogen Fluorid is measured by using the wet analysis.
3 - For the purpose of measuring any other gases, the fumes are being collected in a plastic bag with a high gas-isolation value. The gas-sampling can be made at a defined point of time, however, the measuring of the gases can be carried out consecutively at a later time.

The direct measurement of the gases can due to the conditions of the method not be made at a certain point of time, as the sampling of the gas requires a definite period of time.

The result of the measurement can be influenced by several factors :

When measuring the gases NO + $NO_2$, HCl and $SO_2$, other gases can also cause an indication due to cross-sensitivity.

Strong fluctuations of the humidity of the gases during measurements of the Halogens as well as NBS-chamber temperatures above $50^{o}C$ can also influence the test result. While testing HF deposits of soot as well as extension of gas sampling times may affect the test result.

7.3.2. Terminology

The Halogens chlorine and fluorine exists due to their reactivity only in affilated form and are being determined in fumes in the form of hydrogen chloride (HCl) and hydrogen fluoride (HF).

Non-flaming-testing (NF) is a pyrolysis of the samples caused by heat-radiation of the radiator (2.5 W/cm2) in the NBS-chamber.

Non-flaming and flaming (NF + F) is a pyrolitic desintegration of the sample caused by heat radiation and additional application of defined gas flames.

7.3.3. Apparatus

The apparatus and related parts shall be essentially identical to the AMINCO NBS Smoke Density

Chamber (ref. to para 7.2.1. of this specification) modified and amended for the purpose of gas sampling as described hereunder. For the general arrangement refer to Fig. 9 of this specification.

7.3.3.1. Gas Sampling Probes - The gas sampling is carried out by means of three probes made of plastic material reaching into the geometrical center of the chamber. Two probes consist of a polypropylen-tube (inside-diameter approx. 5 mm), the third one consists of PTFE-tube (internal diameter approx. 8 mm). These are connected to the supply lines for the gas sampling by means of tube connectors provided at the top side of the chamber. A shut-off valve in each line closes the flow in the supply line when not in use.

A rubber sleeve for the holding of the HCl test-tube is positioned on one of the PP-sampling probes inside the chamber and is connected, for the purpose of direct measurement, via an extension tube to the gas quantimeter.

7.3.3.2. Plastic Sampling Bags - The plastic sampling bags are made from a multilayer plastic film having a high resistance to gases and a high isolating value. The minimum volume amounts to 10 dm3 (2.5 US Gal.).

Gas-penetration : $O_2$ - max. 20 cm3 NTP/m2/24 h
$N_2$ - max. 6 cm3 NTP/M2/24 h
$CO_2$ - max.140 m3 NTP/M2/24 h

Water Vapour : $H_2O$ - max. 1,3 g /m2/24 h

7.3.3.3. Gas Sampling Installation - Gas sampling by means of the sampling bags has to be carried out in such a manner that the original composition of the combustion gases will not be altered.

A change of the composition can for instance occur when utilizing unsuitable installations, by loss of gas due to leakages, condensation or acceleration of the gases.

These influences can be eliminated by using a chamber into which an empty gas bag can be put and evacuated. The filling is effected by the differential pressure between the vacuum chamber and the NBS-chamber or by means of a gas pump.

For test set-up see fig. 12 of this specification.

The vacuum chamber is provided with two shut-off valves (1 and 2) and a cover made of acrylic glass. The chamber is connected to the vacuum pump by which the evacuation is carried out through a valve (1). Through the second valve (2) the venting of the chamber is made after the filling of the sampling bags. A vacuum-meter allows a control of the evacuation pressure.

The acrylic glass cover has been provided with a fix coupling for the connection of the sampling bag to the vacuum chamber. This in turn is connected by a supplyline made of Polypropylen-tube to the NBS-chamber. The venting of the feed line prior to the gas sampling is effected through a bypass provided on the tube close to the acrylic glass cover, with a shut-off cock (3) and a fix-coupling.

7.3.3.4. Gas Quantimeter Pump - Two motor-driven gas quantimeter pumps are used, manufactured by the DRAEGER Company.

7.3.3.5. Colorimetric Tubes - The measuring of toxic gases as per para 6.2. of this specification is carried out by means of colorimetric tubes manufactured by the DRAEGER Company.

The types of colorimetric tubes to be employed are listed in Fig. 13, Table II, attached to this specification.

7.3.3.6. Extension Hose - The gas sampling is carried out through extension hoses made by the DRAEGER Company.

For sampling of gases from the sampling bag a hose is provided with a connecting nipple for the connection to the fix coupling immediately in front of the test tube retainer. For sampling of

any other gases the extension hoses are connected to the NBS-chamber directly.

7.3.4. Specimen Configuration

The dimensions of the specimens to be tested are described in chapter 7.2.2. of this specification. A minimum of 4 specimens for non-flaming and 4 specimens for radiation and flaming testing will be tested. (This statement is based on the use of two quantimeter pumps. A single pump would require 8 samples per pyrolysis-mode (refer to Fig. 15 , attached to this specification).

For test specimens for comparative testing refer also to para 7.1.3. of this specification.

7.3.5. Test Procedure

7.3.5.1. Number, Time and Duration of Sampling

The time at which samples have to be taken, i.e. the direct measurement of gases is defined by test sequence chart, Fig. 15.

The determination of HCL is carried out by direct measurements after 1.5 minutes and after 4 minutes, on two samples each time. Sampling of the other gases is performed after 1.5 minutes and then after 4 minutes, taking three samples each time.

The point of time indicated for the measurement is the begin of the measurement, i.e. of the gas sampling. The duration of the measurement of Halogens is up to 3 minutes. It can be substantially extended in the case fine carbon particles have been absorbed. Filling of the plastic gas-bags requires 15 seconds, approximately.

7.3.5.2. Sampling by Means of Plastic Bags

Before starting the test, the sampling bag on connection F1 has to be evacuated.

The sampling bag will be introduced into the vacuum chamber and then connected to the fix connection on the acrylic glass cover. Open the shut-off cock (4) on the bag, then evacuate tubing between NBS-chamber and plastic sampling bag. Finally,

evacuate vacuum chamber to a pressure of 500 Torr.

Introduce sample into NBS-chamber and test in accordance with the applicable portions of chapter 7.2. of this specification. Open shut-off valve (7) on the chamber and valve (3) on the vacuum chamber at the point of time being fixed in para 7.3.5.1. After the sampling bag has been filled, close both valves in the supply line. Pressurize vacuum chamber by means of valve (2) Close shut-off cock (4) on gas bag and disconnect bag from the cover. The measuring of the gases contained in the plastic sheet bag must be carried out within a period of 5 hours.

7.3.5.3. Direct Sampling by Means of a Quantimeter Pump - Sampling for the measurement of HCL is made during the test and directly out of the NBS-chamber, by using a gas quantimeter pump.

The connections have to be checked for leaks several times a day, by means of a closed test tube and of the gas quantimeter pump.

7.3.5.4. Gas Measurement

7.3.5.4.1. Handling of Calorimetric tubes

Before starting the test, both points of the calorimetric tube must be broken. By notching the tube with the aid of a glass saw, a clean break is achieved, therby avoiding a later breaking-off of glass shivers which might make impossible a satisfactory seat of the glass tube in its support (fixture), that means the required tightness.

For handling and/or preparations of the test tube, the manufacturers directions for use have to be observed.

7.3.5.4.2. Measuring of Halogens

(A) Hydrogen Chloride (HCl)

Immediately prior to starting the test, the prepared HCl-test tube will be fixed in the support of the prove within the NBS-chamber. 1.5 minutes after the test has been started, the supply line to the gas pump will be opened by means of valve (5) and the gas pump switched

on. The number of strokes of the gas pump as well as use of the corresponding test tube must be in accordance with Table I hereunder. Test sequence is according to figure 14. When using the test tube HCl 1/a and 2 pump strokes, the values shown on the scale have to be increased by a factor of five. After having finished the test, the test tube has to be removed from the NBS-chamber. Subsequently, 8 desorption strokes have to be performed with the test tube used, i.e. by means of the gas pump, a further 8 strokes have to be performed, thereby absorbing ambient air. When using the test tube HCl 50/a after 1.5 minutes, a measurement after an elapsed time of 4 minutes is not necessary due to the fact that the measuring period is at least between 1.5 and 6 minutes. The duration of the pump operations has to be recorded.

| Time of Measurement | Test Tube | Stroke Number |
|---|---|---|
| 1.5 minutes | HCl 1/a | 2 |
| | HCl 50/a | 10 |
| 4 minutes | HCl 50/a | 10 |

Table I : Pump stroke numbers and gas test tubes used for measuring of HCl

B) Hydrogen Fluoride (HF)
Potentiometric Measurement
(Wet analysis)

Measurement method (see fig. 123)

The quantity of fluoride is measured by means of a ion specific fluoride electrode as indicator electrode and a silver chloride reference electrode using an electrode potential in mV. The corresponding HF concentration is measured by means of a calibration curve. In order to draw the calibration curve, the electrode potentials of the various molar NaF buffer solutions are determined and represented by the floating point procedure.

Testing (see Fig.12A )

A 100 ml Impinger scrubber is filled with 10 ml 0.1 Na OH. 1000 cm3 of the combustion gas to be tested (measured with a gasmeter) is rimed by means of a membrane pump in this liquid where the fluoride content reacts according to the following reaction :

$$NaOH + HF \longrightarrow NaF + H_2O$$

The content of the scrubber is put into a 25 ml measuring flask and completed with a buffer solution up to the measuring mark. The buffer solution consists of :

- 200 g sodium acetate
- 200 ml 1 m NaOH
- 36 g Titriplex IV

completed with distilled water up to 1000 $cm^3$ and is used to buffer the analysis solution and for the complexing of heavy metal ions, if any. The solution is poured into a beaker and the fluoride specific electrode and the reference electrode are immersed in the analysis solution, and the electrode potential is determined by means of the digital pH meter. It is advisable to stir the solution during the measurement with a quirl in order to reduce the electrode reaction time.

## Test analysis

The HF concentration in Vppm is calculated as follows :

$$\text{Vppm (HF)} = \frac{\text{HF molarity} . V(25\text{ml}) . 22.4 . 10^6}{\text{quantity of combustion gas used (1000 cm3)}}$$

The HF molarity (mlF/l) is given by introducing the mV indication in the calibration curve.
V (cm3) = volume of measuring flask (25 ml).

7.3.5.4.3. Measuring of other Gases

The measurement of carbon monoxide (CO), hydrogen cyanid (HCN), sulphur dioxide ($SO_2$) as well as nitrous gases ($NO + NO_2$) is carried out by means of the sampling bags.

The quantimeter extension hose and the sampling bag filled with flue gas are connected by means of the fix-coupling. The corresponding colorimetric tube provided for the measurement of the gas to be tested, is then inserted into the connector of the extension hose.

After having opened the shut-off cock on the sampling bag, testing is performed using the gas quantimeter pump.

The corresponding test tube as well as the number of strokes of the gas quantimeter pump must be selected according to Table II, Fig. 13 of this specification.

When using the test tube CO 0.1 %/a, a quantitative statement for quantities below the measuring range cannot be made.

7.3.5.5. Discharging of Sampling Bags - After having finished the test, the sampling bag must be discharged with the aid of the vacuum pump and via the fix-coupling.

The discharged bag can be reused. Larger (heavier) deposits of carbon particles are not acceptable for reuse. Cleaning of the plastic shut-off cock on the bag by means of Isopropanol is necessary from time to time.

7.3.6. Cleaning of the NBS-Chamber

A larger accumulation of deposits within the NBS-chamber which can affect the results of the measurements must be avoided. The inner surface of the PTFE-probe have to be cleaned after each material test at the latest.(Refer also to para 7.2.4.).

7.3.7. Alternative Sampling Methods

Alternatively to the sampling method of filling the sampling bags in a vacuum chamber as per para 7.3.3.3. of this specification, other methods, e.g. filling of sampling bags by a suitable pump, might be appropriate. However, in order to avoid later misinterpretation or rejection of test results by AIRBUS INDUSTRIE, such deviating sampling methods have to be accepted in writing by AIRBUS INDUSTRIE prior to the execution of the first test.

7.3.8. Reporting Data

The following data on each specimen shall be reported (an example is attached to this specification) for non-flaming and flaming exposures, unless otherwise specified :

7.3.8.1. Complete identification of material tested including name, number, supplier, batch or lot number, construction, thickness of specimen, density, etc.

7.3.8.2. Type of test and test conditions, reference to this specification.

7.3.8.3. Time and conditions of sample conditioning.

7.3.8.4. Detailed test results and mean value obtained. Admissible max. limit value as specified in the relevant Material Specification to be stated.

7.3.8.5. Special observations during testing.

7.3.8.6. Other toxic components to be expected or found during test (ref para 6.2)

7.3.8.7. Date of test, signature.

## 8. GAS LIMITS

### 8.1. Smoke Density

Aircraft parts, except for small parts (such as knobs, handles, rollers, fasteners, clips, grommets, rubstrips, pulleys, and small electrical parts) whichthe procuring activity (refer to para. 3 of this specification )

finds would not contribute significantly to the propagation of smoke emission, installed in the pressurized portion of the fuselage must be tested for smoke emission in accordance with the test, may not exceed the following values :

- Ds 100 within 4 minutes after start of the test for textiles (including draperies and upholstery), air ducting, and thermal insulation and insulation covering.
- Ds 100 within 90 sec. after start and between 90 sec. and 240 sec. Ds 200 for interior celing panels, interior wall panels (including window reveals), partitions, large cabinet walls, , materials used in the construction of stowage compartments (other than underseat stowage compartments and compartments for stowing small items such as magazines and maps), seat cushions, padding, structural flooring, covering, transparencies, parts constructed of elastomeric materials, and thermoformed parts.
- Ds 15 within 20 minutes after start of the test for insulation on electrical wire and cable installed in any area of the fuselage.

### 8.2. Toxicity

Aircraft parts, except for small parts (such as knobs, handles, rollers, fasteners, clips, grommets, rubstrips, pulleys, and small electrical parts) whichthe procuring activity (refer to para. 3 of this specification)

finds would not contribute significantly to the propagation of toxic gases, installed in the pressurized portion of the fuselage must be tested for toxicity in accordance with para. 6 and 7.3. of this specification. The measured ppm results, determined in accordance with the test, may not exceed the following values :

- Hydrogen Fluoride (HF) : 50 ppm after 1.5 min and 4 min
- Hydrogen Chloride (HCl) : 50 ppm after 1.5 min and 500 ppm after 4 min.

- Hydrogen Cyanid (HCN) : 100 ppm after 1.5 min and 150 ppm after 4 min.
- Sulphur Dioxide (SO2) : 50 ppm after 1.5 min and 100 ppm after 4 min.
- Carbon Monoxide (CO) : 3000 ppm after 1.5 min and 3500 ppm after 4 min.
- Nitrous Gases (NO+NO2) : 50 ppm after 1.5 min and 100 ppm after 4 min.

## 9. COMBINED FIRE TEST INDEX

The combined fire test index is determined by means of the information provided by the flammability tests and is used as a comparison value for the choice of materials.

The following parameters are taken into account for the calculation of the combined fire test index :

1 burn length ) see 4.1 - 4.9
2 flame time )
3 smoke density after 1.5 min. ) see 8.1
4 smoke density after 4 min )
5 CO )
6 HF )
7 HCl ) After 1.5 min see 8.2
8 $NO/NO_2$ )
9 $SO_2$ )
10 HCN )

Each parameter is defined with a specific limit value.

### 9.1 Calculation of the "Combined fire test index"

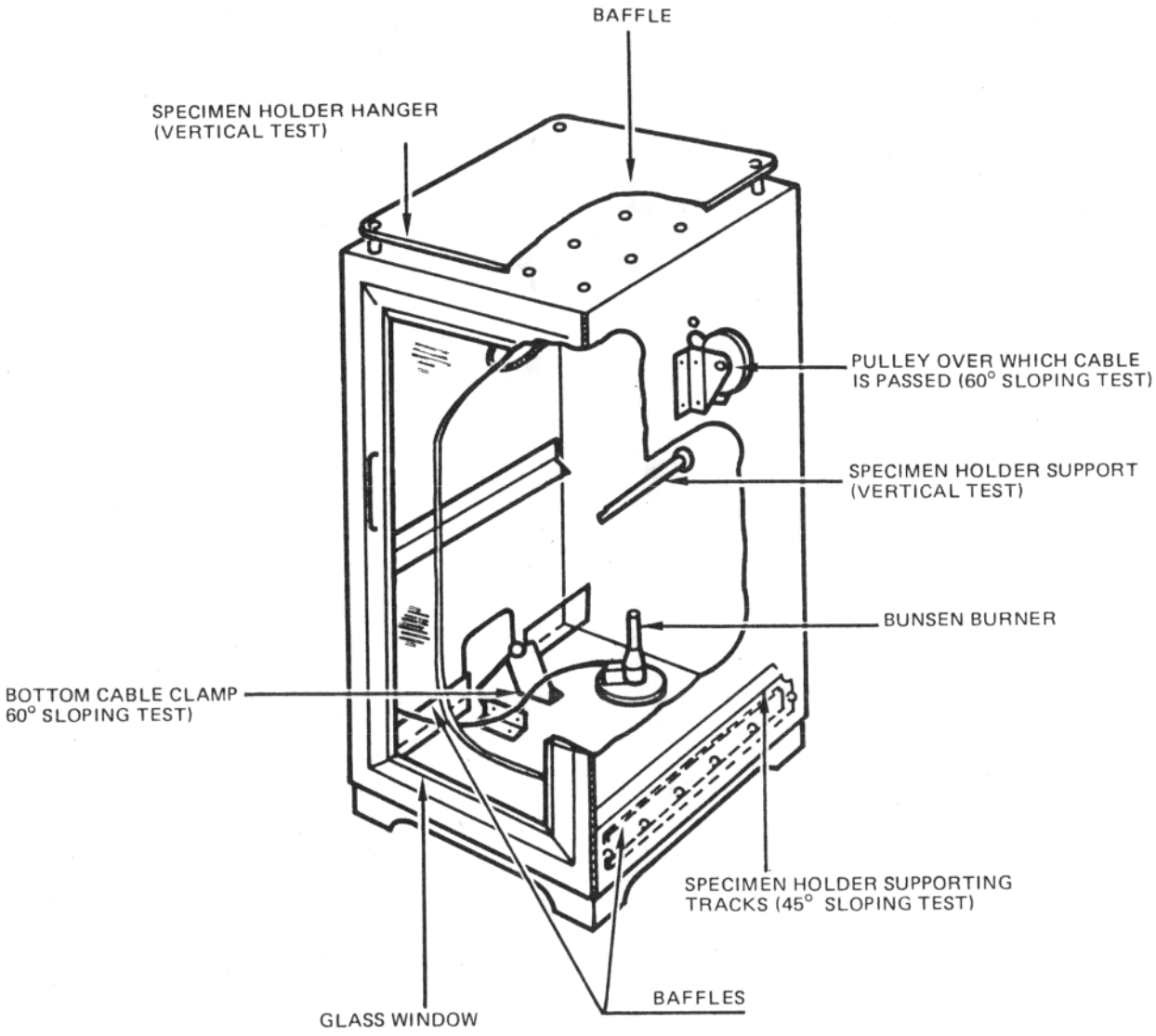
All the results of the indicated parameters are converted into a limit value stated as a percentage (e.g. limit value HF = 50 ppm = 100 % ; 5 ppm = 10 %).

If we add all these limit values and divide them by the number of parameters, we obtain the combined fire test index. If the result is greater than 100 % of the limit value, the combined fire test index is "out of limit" and cannot be calculated.

The Combined fire test index has to be carried out.

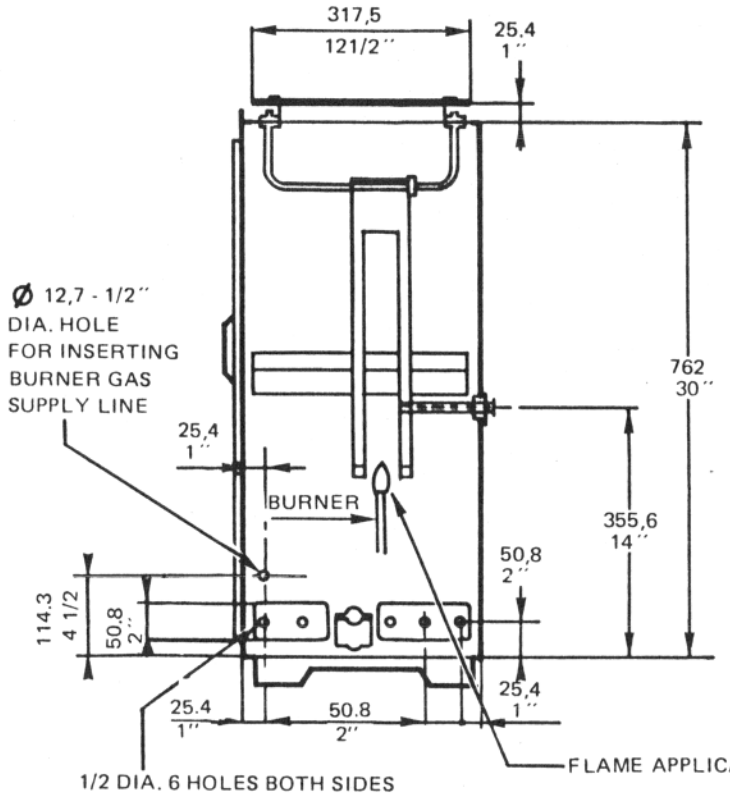
## 10. TEST REPORT

It is requested that all reporting data from the tests carried out in accordance with the applicable portions of paragraphs 7.1., 7.2. and 7.3.and 9. are presented in a common test report, that has to be duly signed by the responsible laboratory assistand and by the relevant inspector of the test laboratory. The inspector must be approved by the airworthiness authorities.

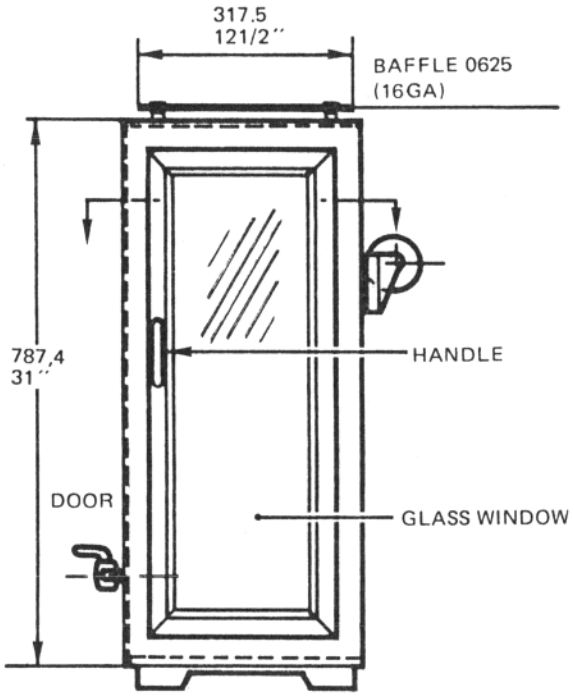


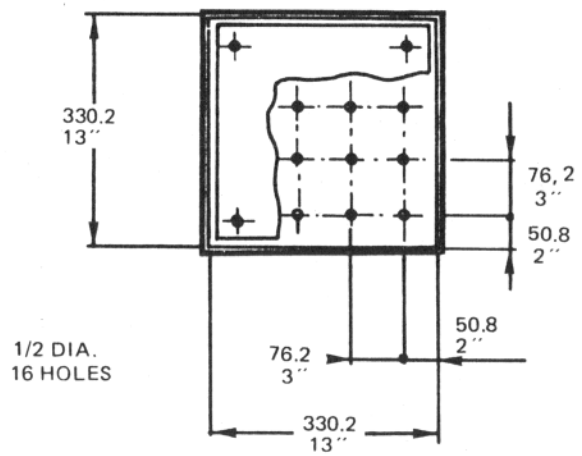

GENERAL ASSEMBLY VIEW
CHAMBER FOR VERTICAL AND INCLINED TESTS

R.H. SIDE (SIDE PANEL NOT SHOWN)
VERTICAL TESTS

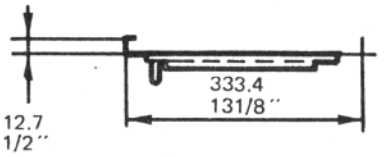



FRONT VIEW




TOP VIEW

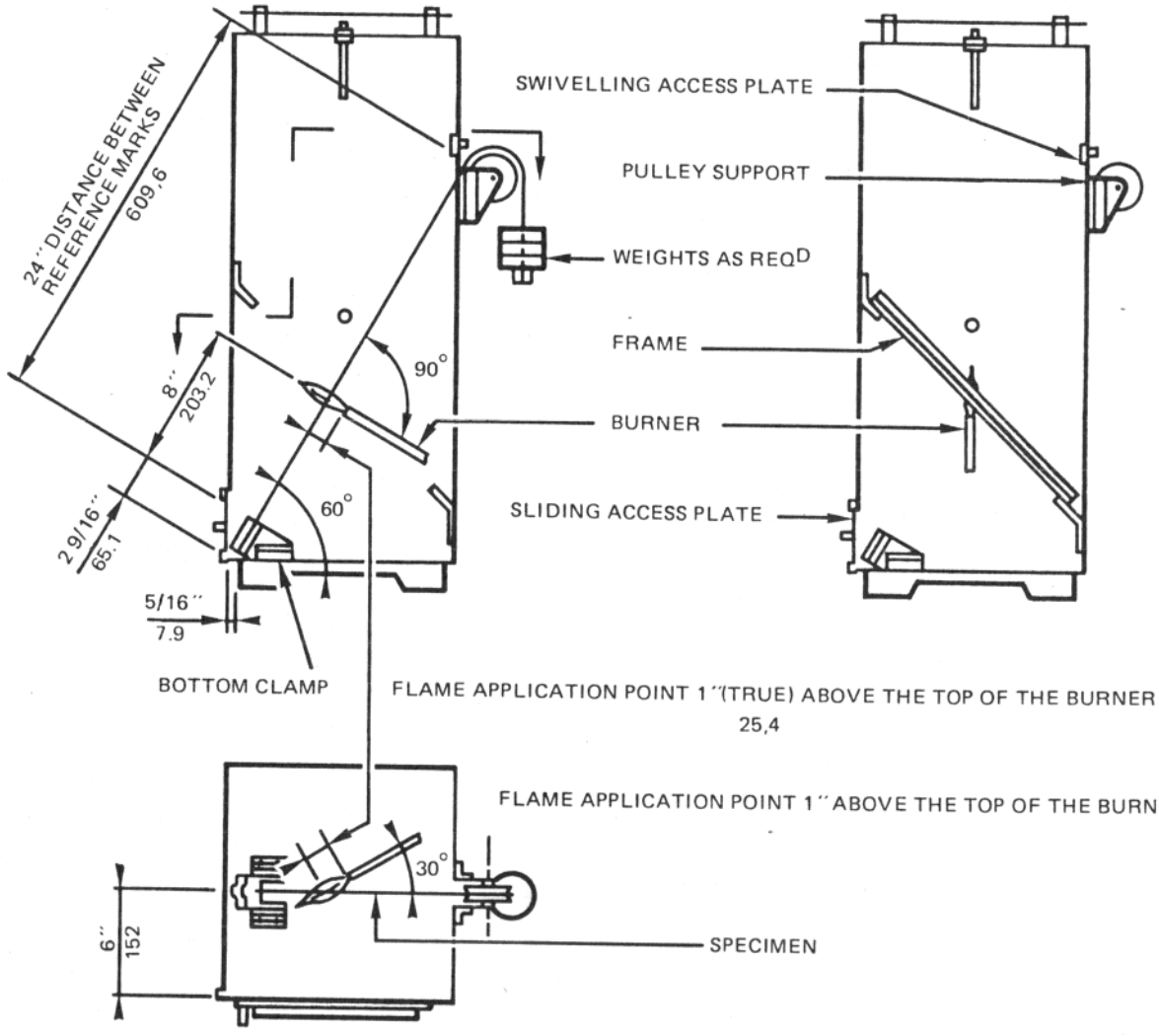



SECTION OF DOOR

CHAMBRE FOR VERTICAL AND INCLINED TESTS

FRONT VIEW (DOOR NOT SHOWN)
ELECTRICAL CABLES TEST (60°)

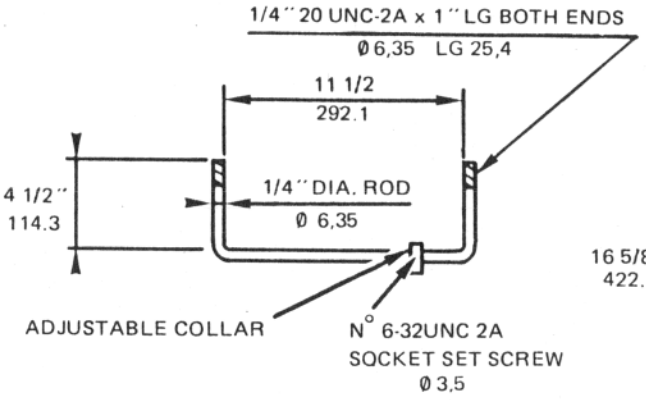
FRONT VIEW (DOOR NOT SHOWN)
SLOPING TESTS (45°)



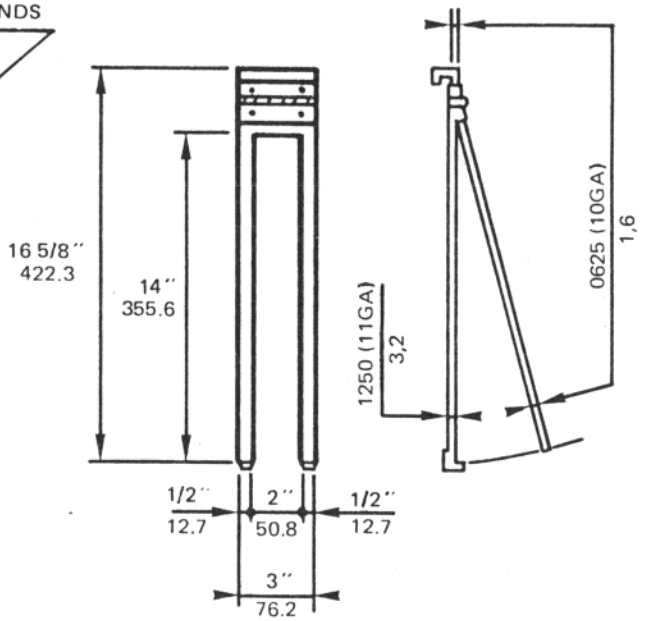

CABINET SECTION (TOP VIEW)

CHAMBER FOR VERTICAL AND INCLINED TESTS

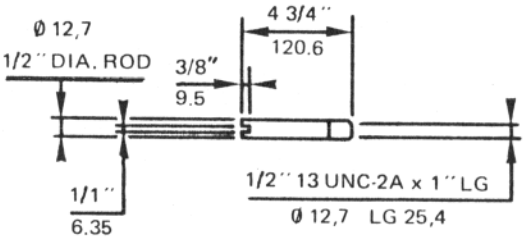
SPECIMEN HOLDER HANGER




SPECIMEN HOLDER

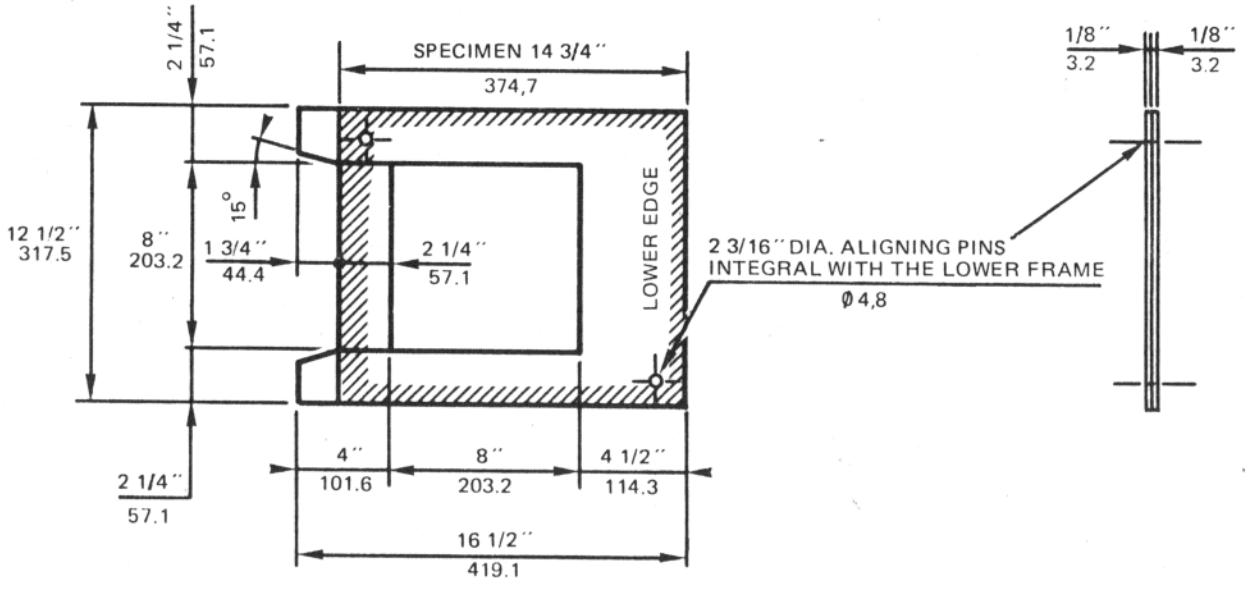



SPECIMEN HOLDER SUPPORT



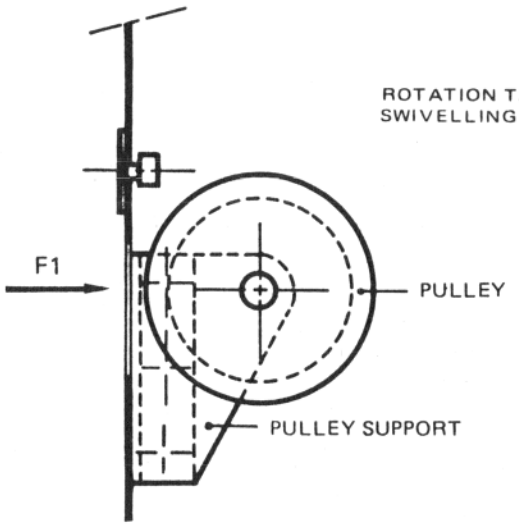

VERTICAL TEST ACCESSORIES

SPECIMEN HOLDER

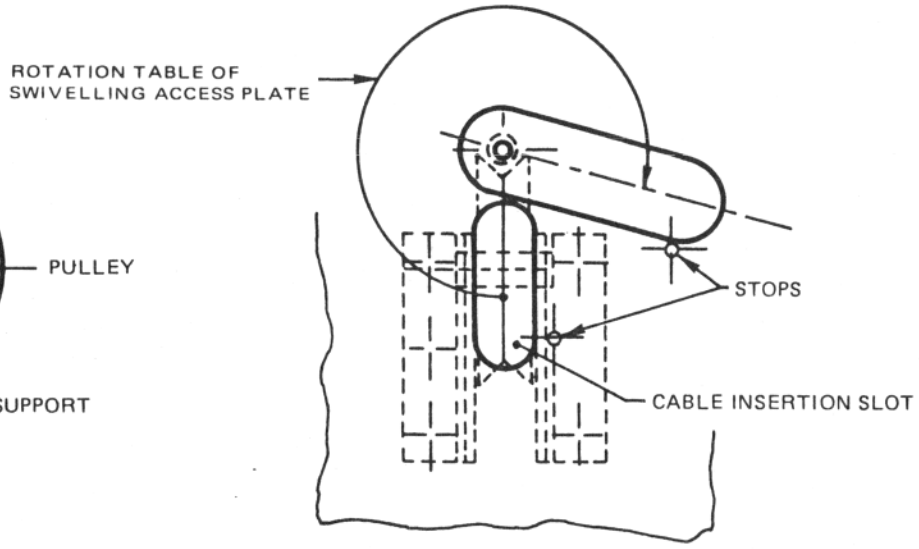



SLOPING TEST ACCESSORIES
CHAMBER FOR VERTICAL AND INCLINED TESTS

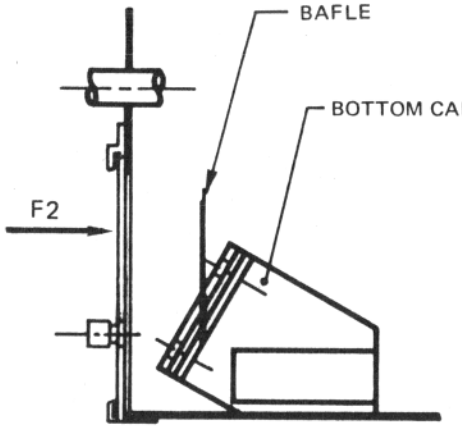
CABINET UPPER SECTION



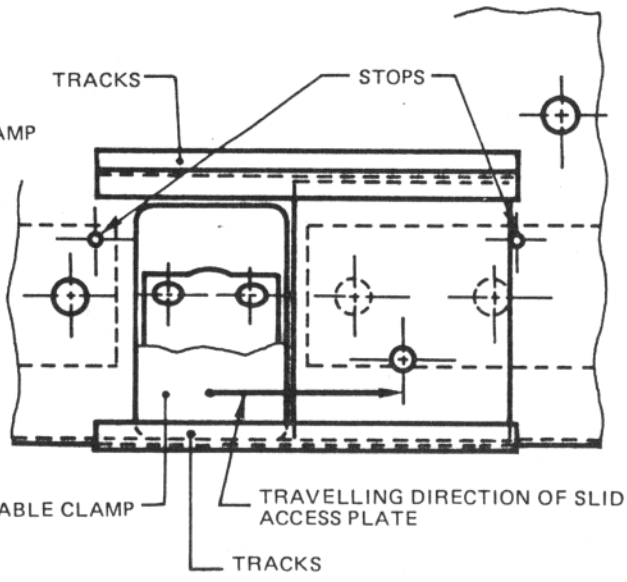

VIEW ON F1



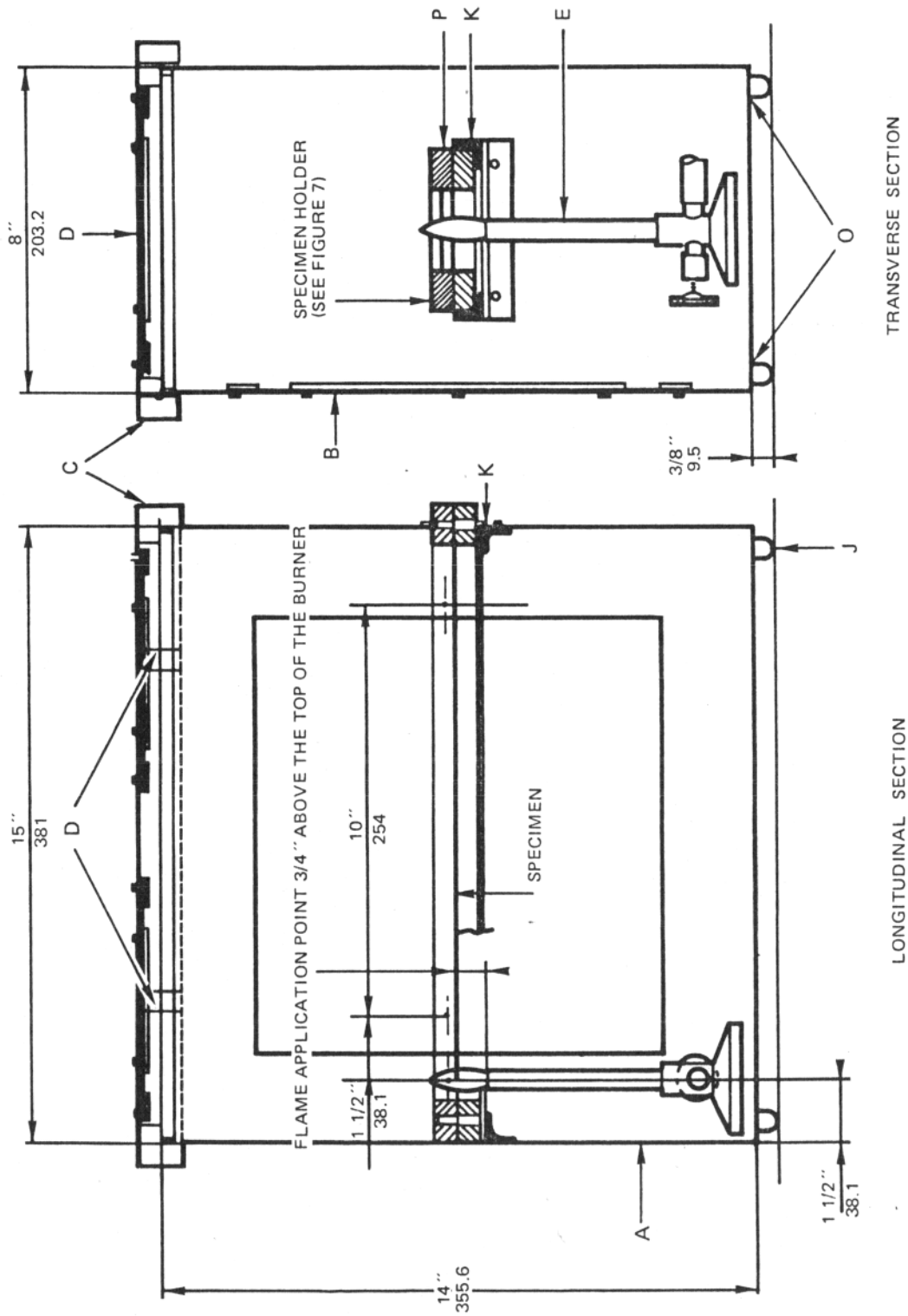

CABINET LOWER SECTION




VIEW ON F2

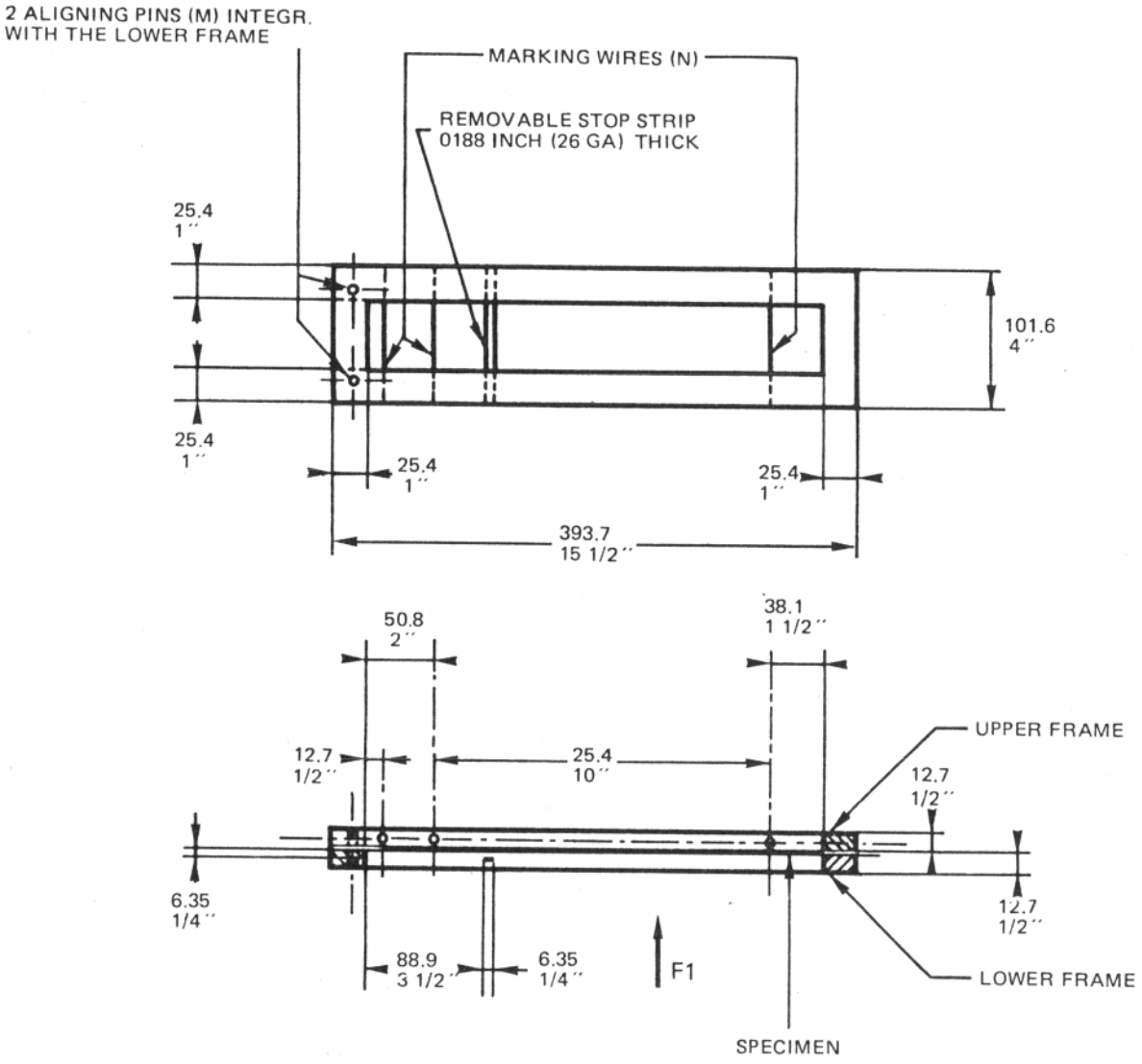



SCRAP VIEWS OF 60° TEST CABINET EQUIPMENT
CHAMBER FOR VERTICAL AND INCLINED TESTS



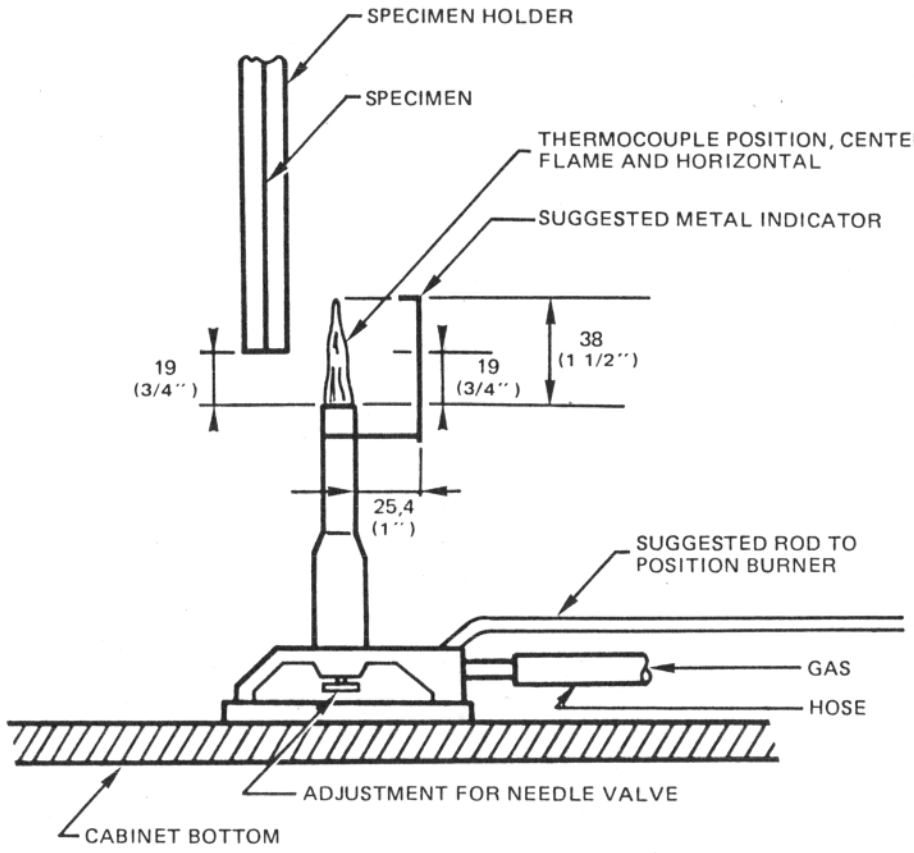

CHAMBER FOR HORIZONTAL TESTS

VIEW ON F1 (SPECIMEN NOT SHOWN)



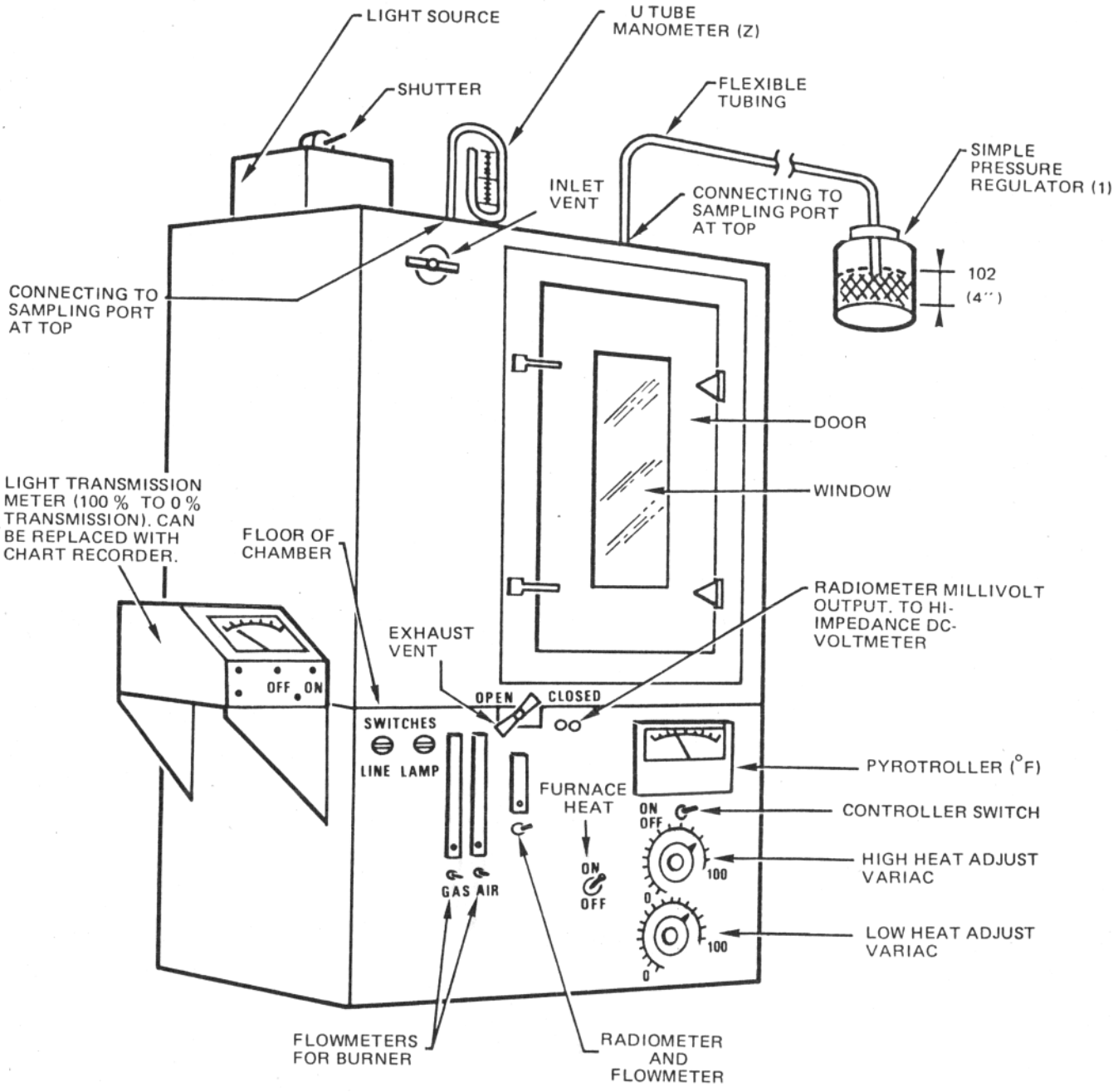

SPECIMEN HOLDER

CHAMBER FOR HORIZONTAL TESTS




NOTE : THE BURNER DOES NOT NEED TO BE RESTING ON THE CABINET BOTTOM, BUT IT IS CONSIDERED MORE CONVENIENT IN THIS MODE.

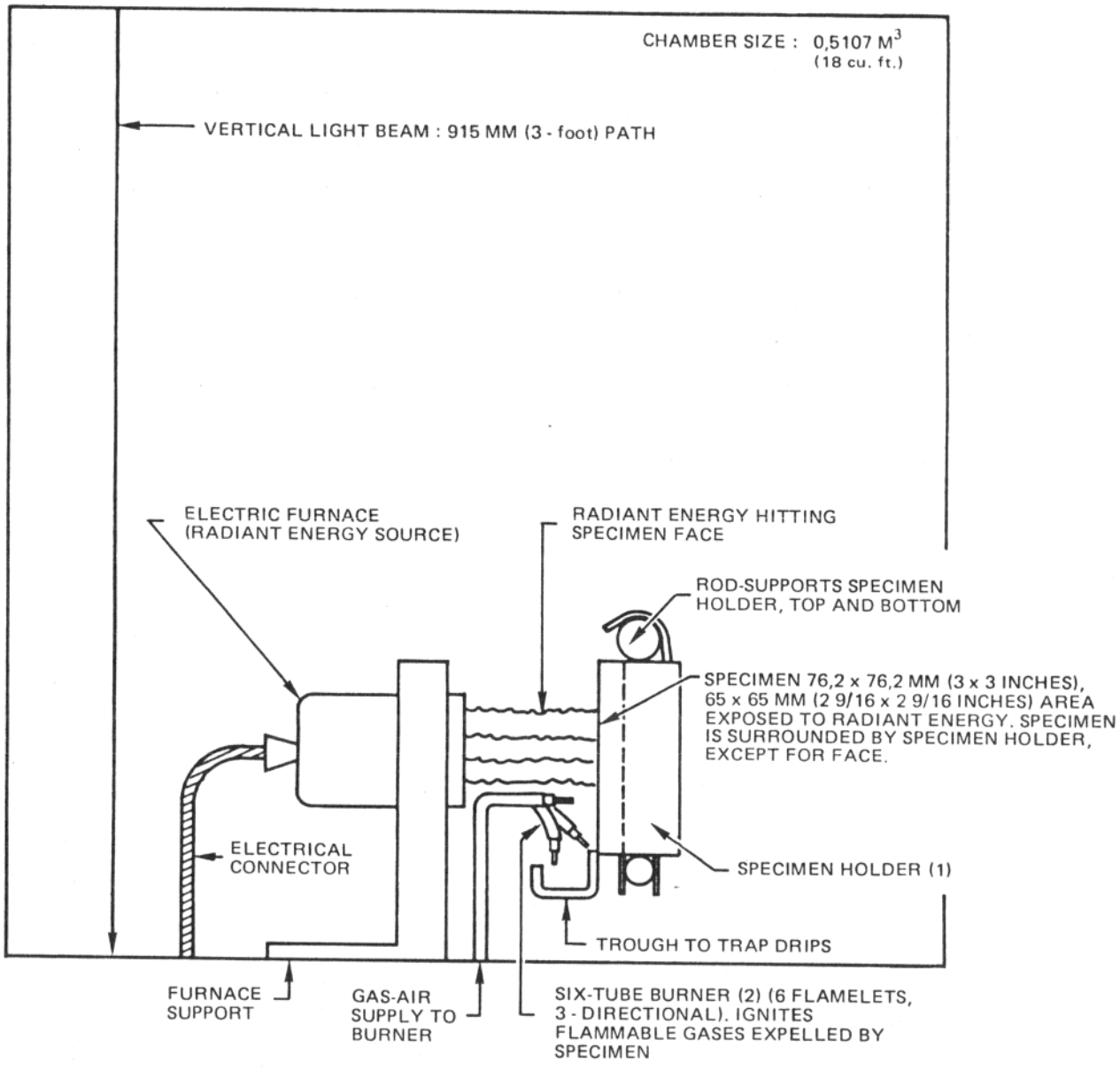
TYPICAL BURNER AND SPECIMEN (EXCEPT FOR CRITICAL DIMENSIONS)




(1) OPEN, WATER-FILLED BOTTLE LOCATED AT SAME LEVEL AS THE FLOOR OF CHAMBER.

(2) RANGE UP TO 152 MM (6 INCHES) OF WATER.

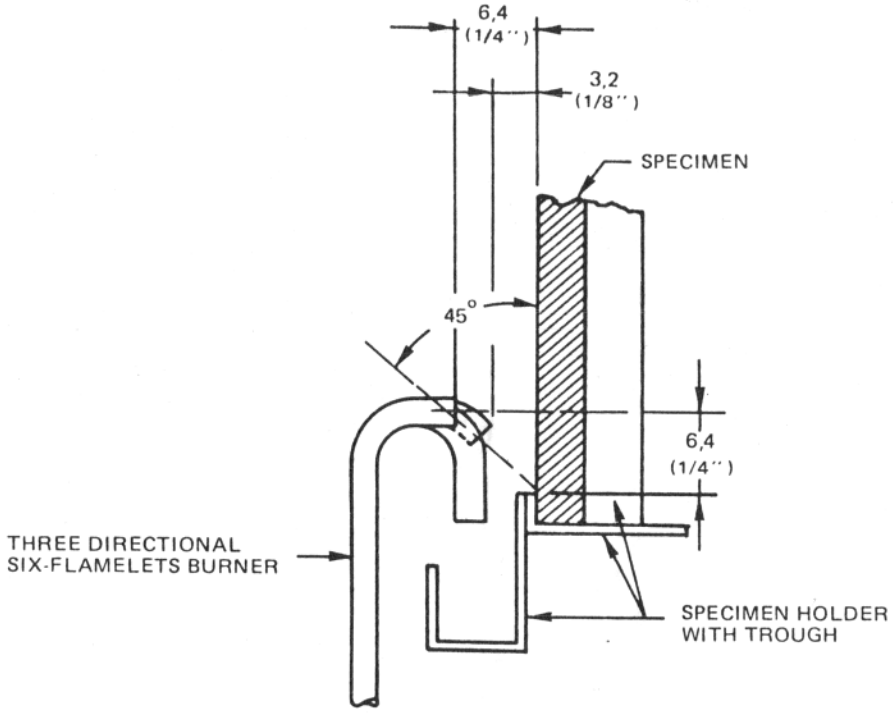
NBS SMOKE DENSITY CHAMBER




(1) REPLACED BY RADIOMETER WHEN CALIBRATING THE CHAMBER.

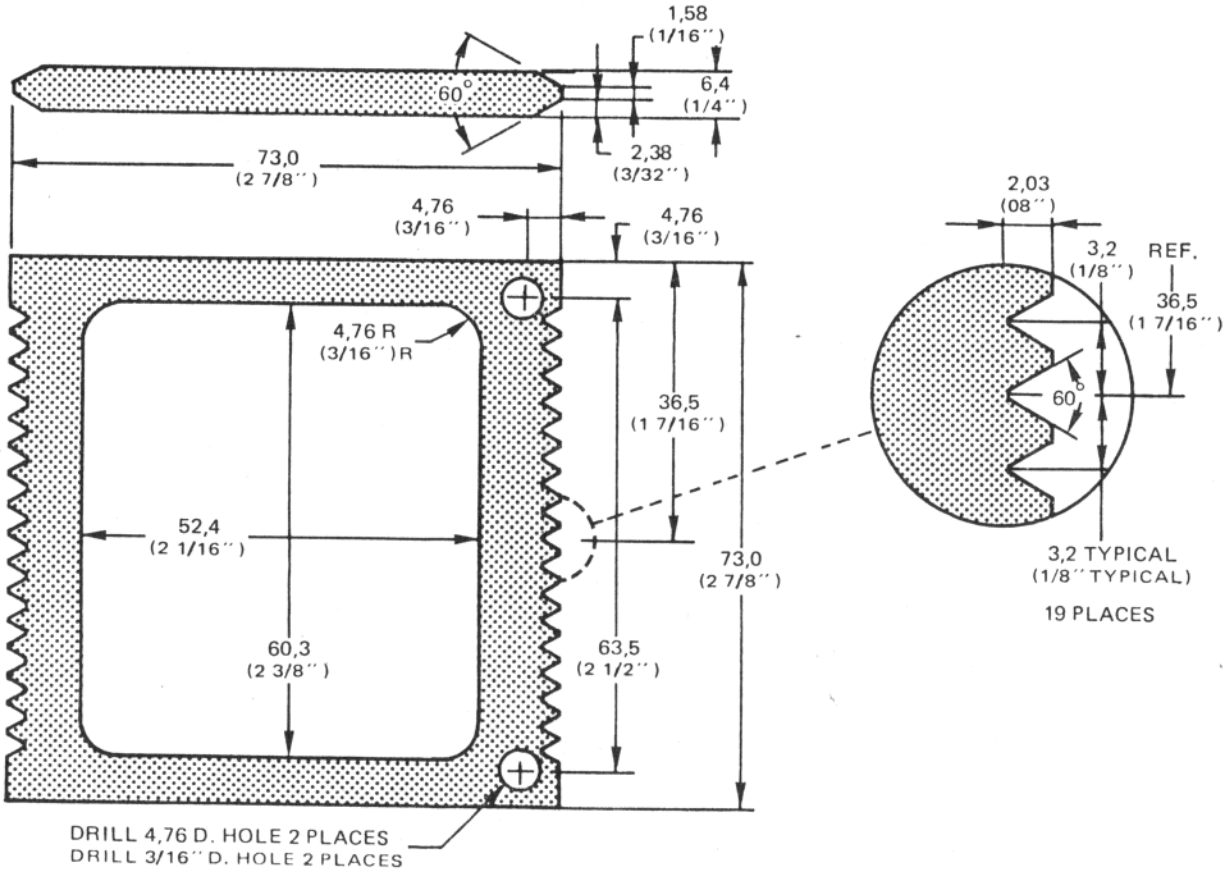
(2) BURNER IS REMOVED DURING CALIBRATION AND DURING NON-FLAMING EXPOSURE TEST.

TEST SET-UP, NBS SMOKE DENSITY CHAMBER

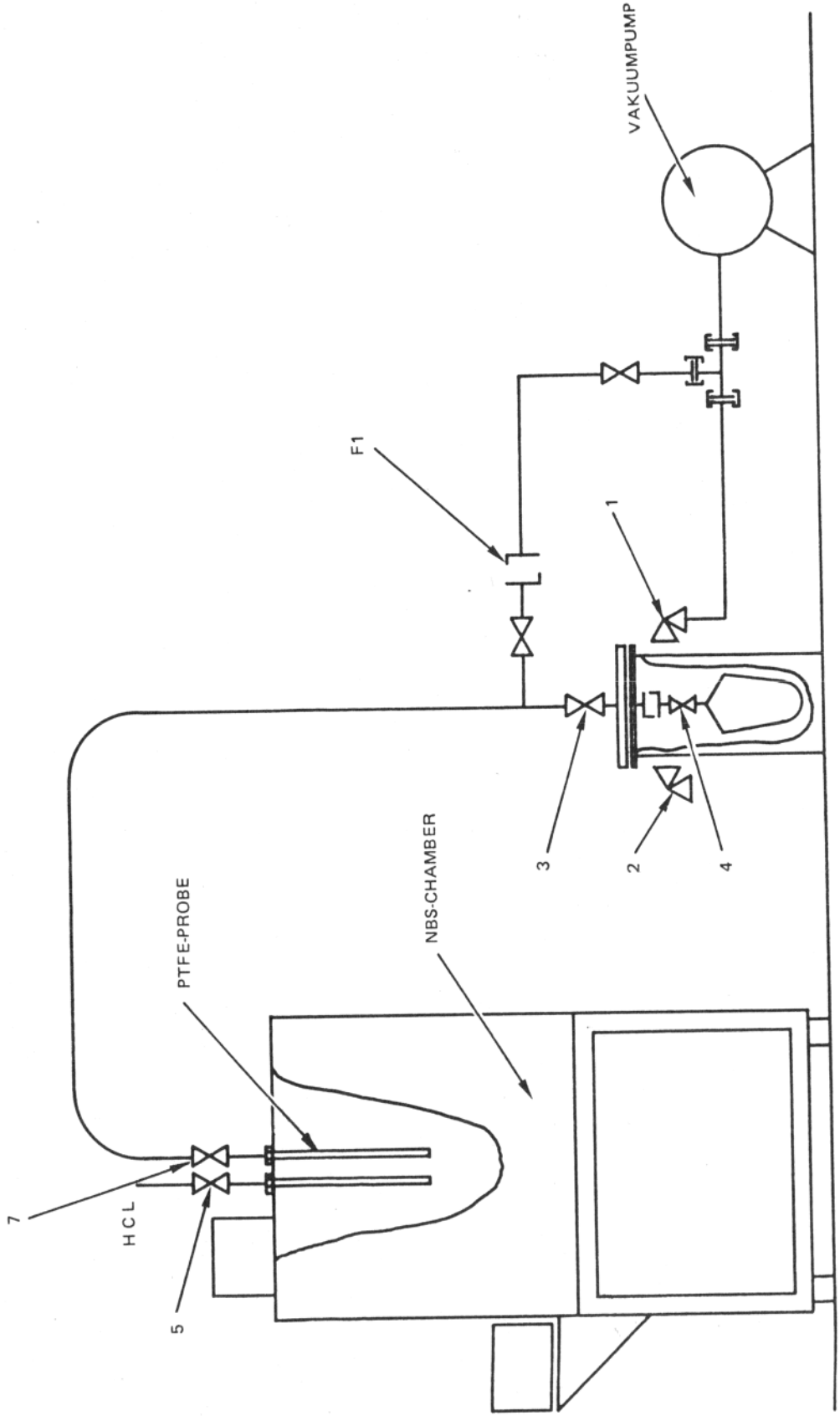



POSITION OF BURNER IN FRONT OF AND PARALLEL
TO THE SPECIMEN HOLDER, SIDE VIEW

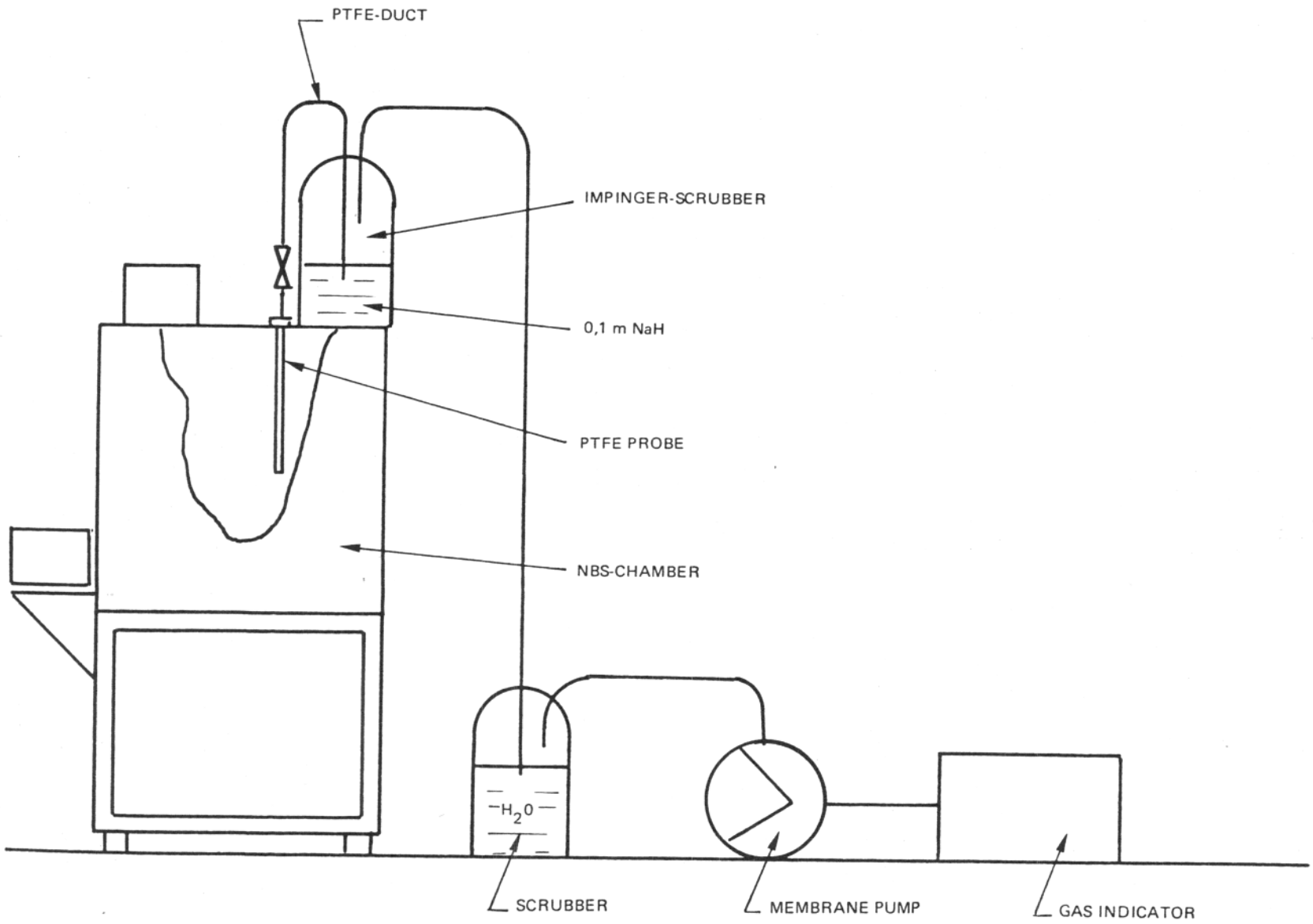
FIGURE 8

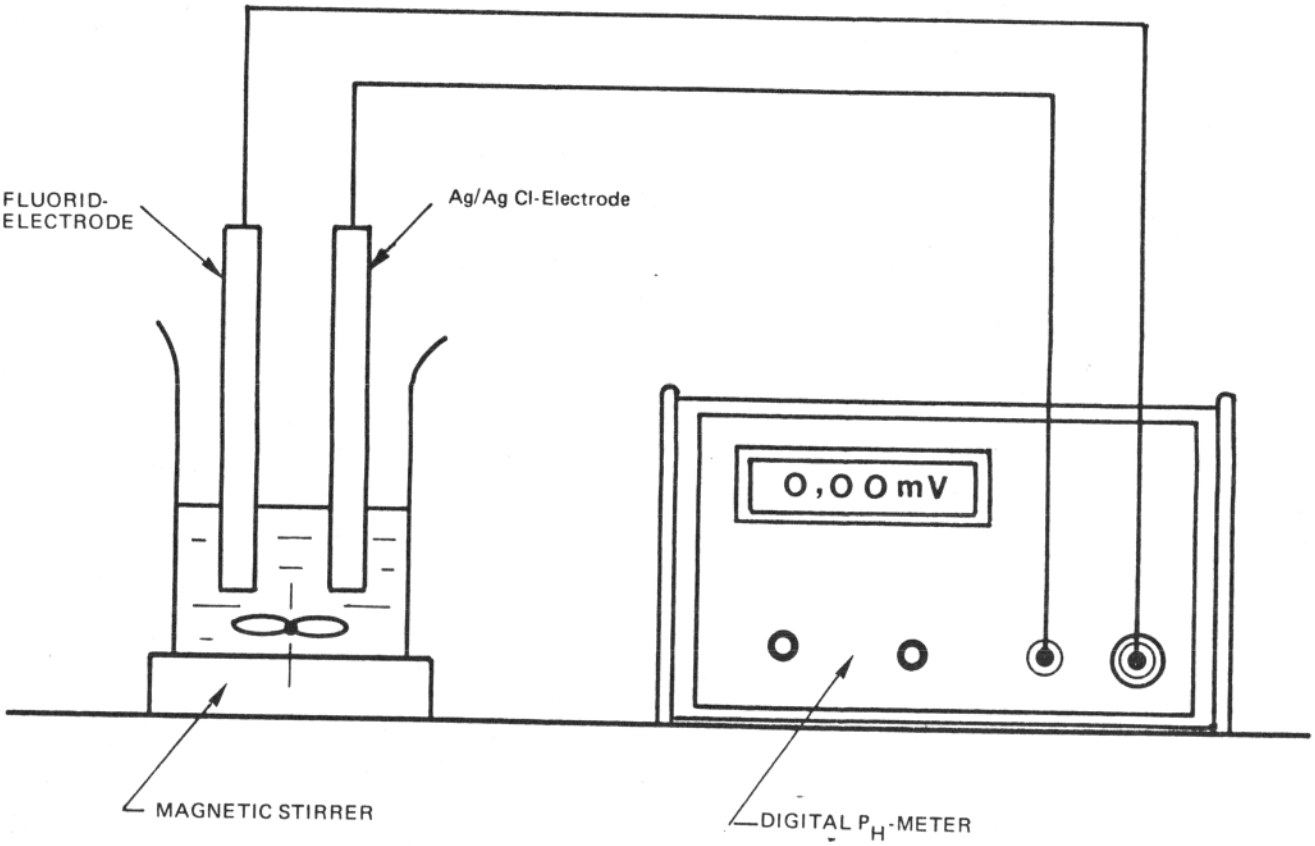



DETAILS OF STAINLESS STEEL FIXTURE FOR WIRE & CABLE TESTING




GAS SAMPLING TEST SET-UP


PTFE-DUCT
IMPINGER-SCRUBBER
0,1 m NaH
PTFE PROBE
NBS-CHAMBER
$-H_2O-$
SCRUBBER
MEMBRANE PUMP
GAS INDICATOR

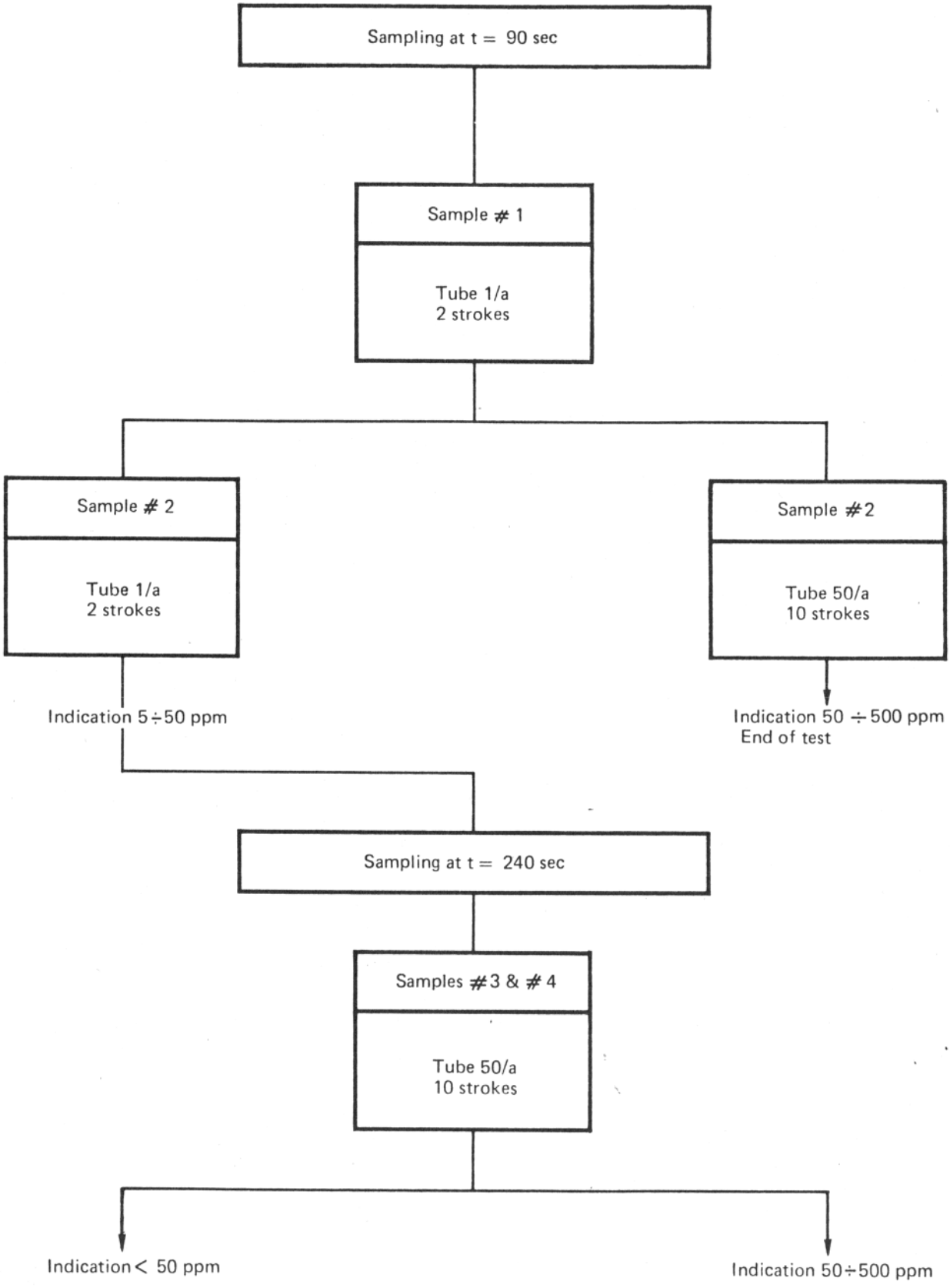



MEASUREMENT OF HF

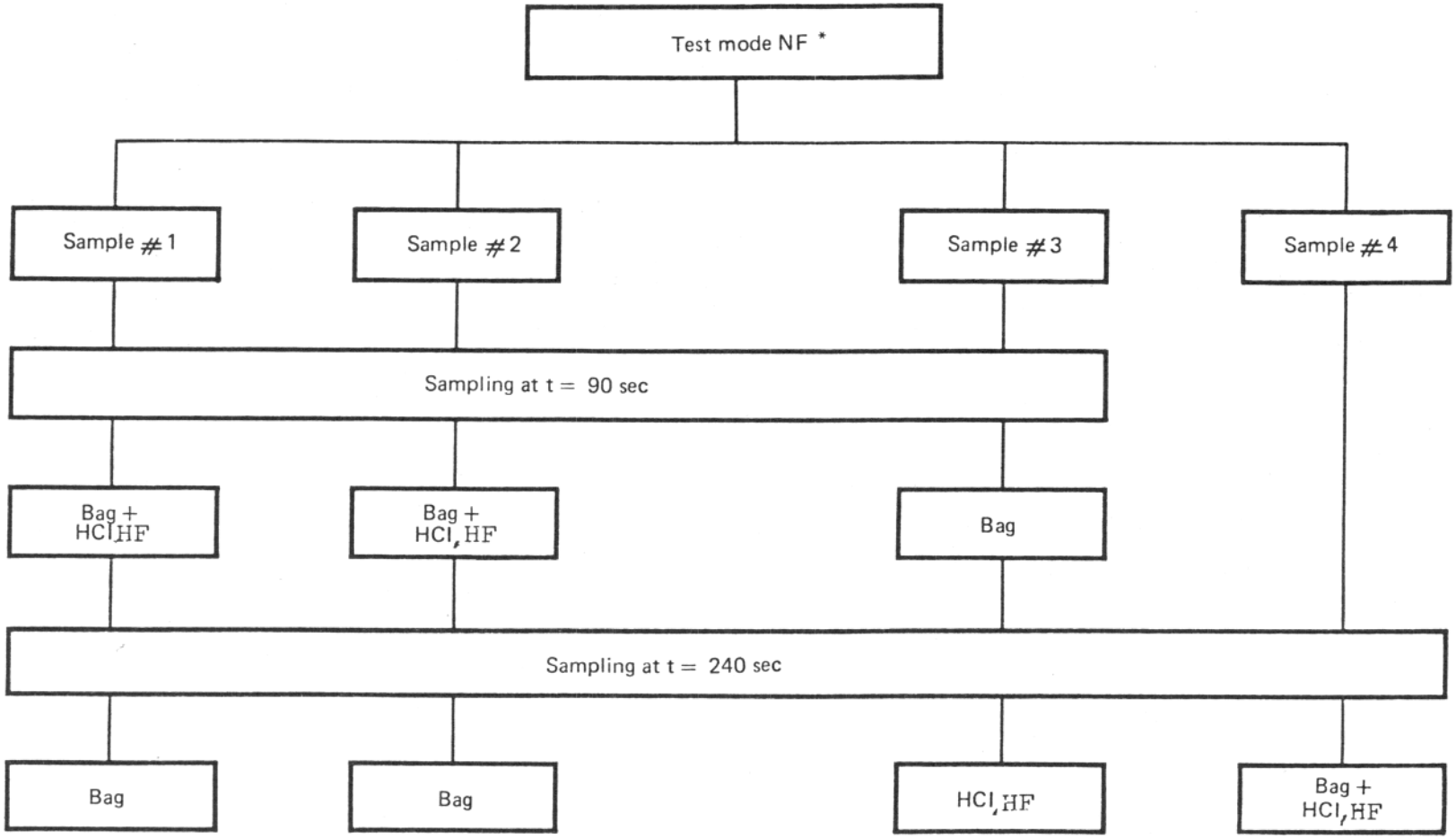
TABLE II : APPLICATION OF COLORIMETRIC TUBES (DRAEGER)

| | Hydrogen Cyanid HCN | Carbon Monoxyde CO | Carbon-Monoxyde CO | Nitrous Gases NO + $NO_2$ | Sulphur-Dioxyde $SO_2$ | Hydrogen Fluoride HF | Hydrogen Chloride HCL | Hydrogen Chloride HCL |
|---|---|---|---|---|---|---|---|---|
| Type of colorimetric tube | 2/a | 10/b | 0,1%/a | 2/a | 20/a | 1,5/b | 1/a | 50/a |
| Range [ ppm ]<br>n° of strokes | 2-30<br>5 | 100-3000<br>1 | 1000-12000<br>1 | 2-50<br>10 | 20-200<br>10 | 1,5-15<br>20 | 2-20 *<br>5<br>2-3 Desorpt-strokes | 50-500<br>10 |
| Range [ ppm ]<br>n° of strokes | 10-150<br>1 | 10-300<br>10 | | 5-100<br>5 | | 3-30 *<br>10 | – 5-50 * *<br>2<br>8 Desorpt-strokes | 500-5000<br>1 |
| Rel. deviation [ %] at range | ppm: 2-30 / 10-250<br>%: 15-10 | ppm: 3000<br>%: 15-10 | ppm: 1000-12000<br>%: 15-10 | ppm: 2-50 / 5-100<br>%: 15-10 | ppm: 20-200<br>%: 15-10 | ppm: 1,5-15 / 3-30<br>%: 20-15 / – 35 | ppm: 2-20 * / 5-50 * *<br>%: 15-10 | |
| Colour change | Red | Brown-green | Brown-green | Dark blue-grey | Brown-yellow white | Light pink | Yellow-grey | White |
| N° of utilization per day | 5X | 10X | 1X | 2X | 1X | 1X | 3X | 2X |
| | | | | | | * indication to multiplied by 2 | * indication to multiplied by 2 | * * indication to multiplied by 5 |

Test sequence for measurement of HCl after 1.5 and 4.0 minutes respectively employing 2 quantimeter pumps.



SEQUENCING OF TEST FOR SAMPLING




* Equivalent for F

| Designation : fuselage * | Standard : |
|---|---|
| Manufacturer : | Thickness of specimen : |
| Material : | Conditioning : |

Structure of specimen :

NON FLAMING (NF)

| Specimen No. | $D_S$ after t (min) | | | | | | | | | Passed |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 1,5 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| | | | | | | | | | | Yes |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Mean value | | | | | | | | | | No |
| Max. value * .. | 100 | | 200 | | | | | | | |
| Max. value Air ducts | 100 | | | | | | | | | |

FLAMING (F)

| Specimen No. | $D_S$ t (min) | | | | | | | | | Passed |
|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 1,5 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | |
| | | | | | | | | | | Yes |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | No |
| | 100 | | 200 | | | | | | | |
| | 100 | | | | | | | | | |

| Test passed : | YES | NO |
|---|---|---|

| Date : | Name : | Checked/Approval | | PAGE 55/58 |
|---|---|---|---|---|

| Designation : | Standard : |
|---|---|
| Manufacturer: | Size : |
| Material : | Conditioning : |

NON FLAMING (NF)

| Specimen No. | $D_S$ after t (min) | | | | | Passed |
|---|---|---|---|---|---|---|
| | 5 | 10 | 15 | 20 | 25 | |
| | | | | | | Yes |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Mean value | | | | | | No |
| Max. value | 15 | | | | | |

FLAMING (F)

| Specimen No. | $D_S$ t (min) | | | | | Passed |
|---|---|---|---|---|---|---|
| | 5 | 10 | 15 | 20 | 25 | |
| | | | | | | Yes |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | No |
| | 15 | | | | | |

| Test passed : | YES | NO |
|---|---|---|

| Date : | Name : | Checked/Approval | | PAGE 56/58 |
|---|---|---|---|---|
| | | | | |

Date :

Name :

Checked/Approval

| | | |
|---|---|---|
| Désignation : | Drawing N° : | |
| Manufacturer : | Standard : | Conditioning of samples : |
| Material : | Composition : | Drying at 21°C · |
| Dimensions : | | 50% relative humidity: (h) |

| Gas | Non-Flaming (NF) 1,5 min Sample Nr. | Result [ppm] | Max. Value [ppm] | 4 min Sample Nr. | Result [ppm] | Max. Value [ppm] | Flaming (NF + F) 1,5 min Sample Nr. | Result [ppm] | Max. Value [ppm] | 4 min Sample Nr. | Result [ppm] | Max. Value [ppm] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Hydrogen Cyanid HCN | | | 100 | | | 150 | | | 100 | | | 150 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | mean value | | | | | | | | | | | |
| Carbon Monoxyde CO | | | 3000 | | | 3500 | | | 3000 | | | 3500 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Nitrous Gases NO + NO2 | | | 50 | | | 100 | | | 50 | | | 100 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Sulphur-Dioxyde SO2 | | | 50 | | | 100 | | | 50 | | | 100 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Hydrogen Fluoride HF | | | 50 | | | 50 | | | 50 | | | 50 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Hydrogen Chloride HCL | | | 50 | | | 500 | | 50 | 50 | | | 500 |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Duration of HF pump operation HCL | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Remarks | | | | | | | | | | | | |

| Designation : | Standard: |
|---|---|
| Manufacturer: | Size: |
| Material: | Conditioning: |

| | PARAMETER | PERCENTAGE | (see Note) |
|---|---|---|---|
| 1 | Burn length | | |
| 2 | Flame time | | |
| 3 | Ds after 1,5 min. | | |
| 4 | Ds after 4 min. | | NOTE: The worst result has to be considered either at non flaming or flaming condition |
| 5 | Co | | |
| 6 | HF | | |
| 7 | HCl | | |
| 8 | $NO/NO_2$ | | |
| 9 | $SO_2$ | | |
| 10 | HCN | | |
| | Total | % | divided by 10 (No. of param.) = |

Additionnel toxic gases not listed up which
came during testing or which have to be expected :