

**Ministry of Defence
Defence Procurement Agency, ADRP2
Abbey Wood
Bristol
BS34 8JH**

OBSOLESCENCE NOTICE

All DTD specifications were declared obsolescent from 1st April 1999. All DTD 900 series approvals also lapsed at that time. The standards will no longer be updated but will be retained as obsolescent documents to provide for the servicing of existing equipment.

Further Guidance

The aim in declaring the specifications obsolescent is to recognise that the documents are not being updated and thus should be used with care by both purchaser and supplier. For example, a specification could contain valid technical information but may also contain type approval clauses that contradict procurement policy and/or use materials that do not comply with environmental legislation. The obsolescent specification can still be used as a basis for a purchase provided that the supplier and purchaser agree suitable changes to the specification within the purchase order/contract.

For the DTD 900 system, each specification has provided an MoD approved material and process. For these items, the declaration of obsolescence will constitute the termination of both the extant MoD approval and the continuing MoD assessment that had underpinned those approvals. Again, the technical content of the document remains valid and can be used by both purchaser and supplier as a basis for a contract but an acceptable (to the parties) approval/assessment procedure would be required.

Aerospace Material Specification
FIBROUS POLYESTER MATERIAL FOR USE AS A FLAME AND FIRE
SUPPRESSANT IN AIRCRAFT DRY BAYS

NOTE 1: *This specification is one of a series issued by the Procurement Executive, Ministry of Defence, either to meet a limited requirement not covered by an existing British Standard for aircraft material, or to serve as a basis for inspection of material, the properties and uses of which are not sufficiently developed to warrant submission to the British Standards Institution for standardisation.*

NOTE 2: *The tests employed in this specification are mostly chosen for their reproducibility and ability to control the properties of the material. Simulated service tests are included as an indication of what may be achieved under specific conditions. The user is advised to confirm the suitability of the material for any given application.*

NOTE 3: *This specification calls for the use of substances and/or test procedures that may be injurious to health if adequate precautions are not taken. It refers only to technical suitability and in no way absolves either the supplier or the user from statutory obligations related to health and safety at any stage of manufacture or use.*

This Specification has been devised for the use of the Ministry of Defence and its contractors in the execution of contracts for the Ministry and, subject to the Unfair Contract Terms Act (1977), the Ministry will not be liable in any way whatever (including but without limitation negligence on the part of the Ministry, its servants or agents) where the Specification is used for other purposes.

SECTION 1

Scope

The material covered by this specification is a polyester fibrous structure intended for the suppression of flame and fire in the dry bays which are adjacent to fuel tanks in aircraft. It is coloured grey to distinguish it from the white polyamide material used for in-tank explosion protection.

It is intended for long term use in non load-bearing applications at temperatures between -54°C and 140°C, and in applications where incidental contamination may occur with water or the usual aircraft liquids.

SECTION 2

Related Documents

2. Reference is made in this specification to the following:

BS 506	Methanol
BS 509	Acetone
BS 3150	Corrosion-inhibited ethanediol antifreeze for water-cooled engines. Type A.
BS 5214	Testing machines for rubbers and plastics.
DEF STAN 68-10	Corrosion preventitive compound: water displacing PX-24, NATO C-634.
DEF STAN 80-38	Thinners for cellulose nitrate paints and dopes.
DTD 585	Hydraulic fluid, petroleum. NATO Code No H-515. Joint Service Designation: OM-15.
DERD 2453	Aviation turbine fuel Avtur/FS11.
DERD 2454	Aviation turbine fuel Avtag/FS11.
DERD 2485	Aviation gasolines. Avgas 100LL.
DERD 2487	Lubricating oil: aircraft turbine engines: synthetic type OX-38.
MILL-23699	Lubricating oil, aircraft turbine engines, synthetic base.
ASTM D1692	Test for rate of burning or extent and time of burning, or both, of cellular plastics.

The related documents listed are those applicable at the date of publication of this specification. Their current applicability must be confirmed by all users of this specification. The Quality Assurance Authority will supply, on request, information concerning any changes that may be necessary due to cancellation, replacement, supersession or amendments of any related document.

SECTION 3

General Requirements

3.1 Composition

The material covered by this specification shall consist of a fibrous polyester construction in which bonds between fibres are formed by a melding process, and no extraneous adhesives are used.

Melding may be described as a combination of melting and welding, in which a bond is formed between two fibres in contact with each other by raising their temperature to a point where the polymer forming the surface layer of the fibres softens sufficiently for bonding to occur.

3.2 Freedom from Defects

The blocks or sheets of material supplied shall be such that they lie substantially flat on both of the main faces. The blocks or sheets shall be free from surface imperfections or any other defects which would impair satisfactory performance.

However, in cases where the material will be further shaped before fitting into an aircraft, it is permissible for material possessing surface defects to be supplied, provided that the positions of any such defects are suitably identified by the manufacturer, and their nature and level of incidence are such that the material can be accepted by the firm concerned with the shaping operation.

SECTION 4

Type Approval

4.1 Before any particular material can be accepted as complying with the requirements of this specification it shall have received type approval. To obtain such approval the manufacturer shall satisfy the Type Approval Authority that the materials will meet all the requirements of this specification.

4.2 The Type Approval Authority for material to this specification is:
Director, Aeronautical Quality Assurance
Directorate, Aeronautical Materials Division
Harefield House,
Harefield
UXBRIDGE
Middlesex UD9 6DB

4.3 When applying for type approval the manufacturer shall submit the following:

4.3.1 Full details of the physical and chemical composition of the fibre and the length and crimp ratio of the fibre used in the carding and subsequent melding process.

4.3.2 Details of the standard melding process.

4.3.3 Details of the composition and amount of any surface treatment applied to the fibres.

4.3.4 A sample of the material in the form of a standard sheet or block.

4.3.5 Test results for the properties listed in Table 1 of a sample similar to the one submitted and coming from the same manufactured batch.

4.4 The tests listed in Table 1 shall be carried out to the satisfaction of the Type Approval Authority on the sample specified in 4.3.4. using the pattern stipulated in Appendix 1 for cutting the test specimens from the sheet. Each property of the material, when determined by the method given in Table 1 shall comply with the requirement also listed in Table 1.

4.5 The manufacturer shall also submit a certificate that material complying with the requirements of Table 1 has also been tested according to Table 2 and has satisfied the requirements listed. The certificate must be from a source which is acceptable to the Type Approval Authority and it is advisable for this fact to be established at an early stage in the development and testing of a material.

4.6 After formal type approval has been given, no change in the details listed in 4.3.1, 4.3.2, 4.3.3 shall be made without the consent of the Type Approval Authority.

All information and data supplied will be treated as commercial-in-confidence.

SECTION 5

Routine Quality Control

5.1 Frequency of Testing

Every sheet or block manufactured shall be tested for compliance with the requirements of tests (a) and (b) in Table 3.

Every batch shall be tested for compliance with the requirements of test (c) in Table 3. For the purposes of this specification a batch is defined as a maximum of 62 sheets or blocks.

One sheet or block, chosen at random from every batch made from one fibre feedstock will be tested for compliance with the requirements of tests (d), (e), (f), (g) and (h) in Table 3. If it fails to comply with the requirement of any one of these tests then a further two sheets from the batch may be tested for that particular requirement, and both must comply for the batch to be released as complying with this specification.

Whenever a change is made in the fibre feedstock, the bonded fibre diameter shall be tested (i).

5.2 The Quality Assurance Authority may, at any time, require any batch to be checked for compliance with any requirement of Tables 1, 2 and 3.

SECTION 6

Supply, Packaging and Identification

6.1 Supply

Unless otherwise agreed between supplier and customer, the supply shall be as standard sheets of 1000 mm (+5,0) x 750 mm (+5,0) x 40 mm (± 1), with the density gradient always being in the 40 mm direction, and the main fibre orientation always in the 750 mm direction.

6.2 Packaging

Each sheet shall be enclosed in a heat-sealed envelope of 65 mm natural (transparent) low density polyethylene film.

The sheets shall be packed in telescopic cases complying with International Fibreboard Case Code 0320.

6.3 Identification

A label bearing the batch number shall be securely attached to the polyethylene envelope of each sheet.

Each case shall also be marked with the appropriate batch number.

TABLE 1
TYPE APPROVAL TESTS

PROPERTY	REQUIREMENT	TEST METHOD
Colour	Grey	
Polyester content, % min.	99	
Density, Kg/m ³	18 \pm 1	Appendix 2
Density gradient, maximum	1.80	Appendix 2
Fibre diameter, μ m	37.5 \pm 4.0	Appendix 3
Grab strength, N minimum	650	Appendix 4
Initial (10%) compression force, N minimum	15	Appendix 5
Loss of compression force after 5 cycles, % maximum	4.0	Appendix 5
Anti-wicking properties, penetration mm, maximum	1.0	Appendix 6
Flammability, rate of burning mm/minute, maximum	165	ASTM D1692

NOTE: Specimens for the tests detailed in Table 1 shall be cut from a standard sheet to the pattern stipulated in Appendix 1.

TABLE 2
SERVICE TESTS

PROPERTY	REQUIREMENT	TEST METHOD
Flame propagation arrest	Successful in 10 successive firings	Appendix 7
Fire suppression	Successful in all test conditions	Appendix 8
Temperature stability	No visible signs of change or deterioration in handling characteristics	Appendix 9
Resistance to liquids	No visible signs of change or deterioration in handling characteristics	Appendix 10

TABLE 3
ROUTINE QUALITY CONTROL TESTS

PROPERTY	REQUIREMENT	TEST METHOD
a) Colour	Grey	
b) Density of individual sheet, Kg/m ³	18±4	Appendix 2
c) Density of batch of 62 sheets, Kg/m ³	18±1	Appendix 2
d) Density gradient, maximum	2.0	Appendix 2
e) Grab strength, N minimum	500	Appendix 4
f) Initial (10%) compression force, N minimum	10	Appendix 5
g) Loss of compression force after 5 cycles, % maximum	5.0	Appendix 5
h) Anti-wicking properties, penetration mm maximum	1.0	Appendix 6
i) Bonded Fibre Diameter, µm	Mean 37.5±5	Appendix 3

NOTE: Test specimens shall be cut from standard sheets according to the pattern stipulated in Appendix 1. When the product is not in the form of a standard sheet, test specimens shall be cut to a pattern agreed between the manufacturer and the customer.

APPENDIX 1

PATTERN FOR CUTTING TEST SPECIMENS

The specimens shall be cut with a band knife from a standard sheet (1000 x 750 X 40 mm) to the pattern shown in Figure 1.

Each specimen shall be clearly identified on the bottom (high density side of the sheet) with the number shown in Figure 1.

All cutting dimensions shall be set on the band knife.

Cutting shall be to within ±1 mm of the given dimensions.

APPENDIX 2

DETERMINATION OF DENSITY AND DENSITY GRADIENT

The size of the specimen cut from the standard sheet as detailed in Appendix 1 is 200 X 200 X 40 mm.

The specimen shall be cut into two halves of 200 x 100 x 40 mm. A 20 mm thick section shall be cut from the bottom (high density side) of one of the halves and from the top of the other using the same blade setting. In each case the top and bottom sections shall be carefully identified.

$$\text{Density} = \frac{\text{Mass of all four sections}}{1.6} \text{ Kg/m}^3$$

$$\text{Density gradient} = \frac{\text{Mass of the two bottom sections}}{\text{Mass of the two top sections}}$$

Masses shall be measured to the nearest 0.01 g.

Two specimens shall be tested, and the mean of their results shall be reported as the density and density gradient respectively of the sheet.

APPENDIX 3

DETERMINATION OF FIBRE DIAMETER

The size of the specimen cut from the standard sheet is 100 x 100 x 40 mm.

A 15 mm section shall be cut from the top of the specimen and discarded. Three further sections, each not thicker than 2 mm, shall be cut and pieces cut at random from these sections shall be mounted on microscope slides using a suitable mounting material.

Using a microscope fitted with a suitable measuring device, the diameters of 20 different fibre sections shall be measured in micrometres to the nearest 0.1 μm , at comparatively straight regions between bonds.

The average of the 20 results to the nearest 0.5 μm , shall be reported as the fibre diameter.

APPENDIX 4

DETERMINATION OF GRAB STRENGTH

The size of the specimen cut from the standard sheet is 200 x 100 x 40 mm and the main orientation of the fibres is in the 200 mm direction.

A centre section 25 mm wide shall be marked in the 200 mm direction.

The specimen shall be tested in tension using a tensile testing machine conforming to BS5214 Part 1 Grade A, and having clamps with jaws 25 mm wide and 50 mm deep. The jaws shall be fitted with rubber facings.

The specimen shall be inserted with the 200 mm dimension in the direction of separation and the marks of the 25 mm wide strip aligned with the edges of the jaws to give a test length of 100 mm approximately at the centre of the specimen.

The crosshead speed shall be 200 mm/minute and separation shall continue until rupture of the specimen.

Three specimens shall be tested. The maximum force attained for each specimen shall be calculated and the mean reported as the grab strength.

APPENDIX 5

DETERMINATION OF COMPRESSION FORCE AND LOSS OF COMPRESSION FORCE

The size of the specimen cut from the standard sheet is 100 X 100 X 40 mm.

Two specimens shall be placed together with their high density faces uppermost, to form a block of 80 mm height.

Using a testing machine conforming to BS5214 Part 1 Grade A, five compression cycles shall be carried out on the block using a compression speed of 100 mm/min and compressing the block by 10% compression of its height.

Three pairs of specimens shall be tested and, for each pair, the maximum force attained on the first and fifth cycles recorded.

APPENDIX 6

DETERMINATION OF RESISTANCE TO WICKING

Two specimens cut as detailed in Appendix 1 shall be gently lowered onto the surface of water in a container having optically clear sides. The depth of water shall be at least 100 mm and the specimens shall be separated from each other and from the sides of the container by a distance of at least 10 mm.

For both specimens the low density face shall be in contact with the water. Clean cold tap water shall be used.

After 48±24 hours the penetration of the specimens through the meniscus of the water surface shall be measured using a travelling microscope having an accuracy of ±0.1 mm.

APPENDIX 7

FLAME PROPAGATION ARREST TEST

The apparatus is shown in Figure 2. It basically consists of two glass tubes 30 cm long and 63 mm diameter coupled in the centre where the test specimen is supported on cross-wires.

A flammable mixture of propane and air is passed along the tube and ignited by a spark.

A specimen 25 mm in width shall be subjected to ten successive firings and shall prevent flame propagation in all cases to pass this test.

APPENDIX 8

TEST FOR FIRE SUPPRESSION

Firing trials shall be carried out using high velocity inert fragments and shell attacks on aircraft fuel tanks fitted with adjacent dry bays on the target face.

Three widths of dry bay, 25 mm, 50 mm and 75 mm shall be separately tested.

The dry bays shall be completely filled with the polyester fibrous structure.

The trials shall cover both metal and rubber bag tanks, and the fuel shall be AVTAG/FS11 (Specification DERD 2454) at 15°C.

All combinations of dry bay width, construction of tank and type of attack shall be tested. For the polyester fibrous structure to be rated successful, no sustained fuel based fires shall occur in any test, either within the dry bays or on the target face.

APPENDIX 9

TEST FOR TEMPERATURE STABILITY

Specimens approximately 15 cm X 2.5 cm x 2.5 cm shall be aged continuously for 1000 hours at 160°C in an air-circulating oven.

The specimens shall be removed, allowed to cool and inspected for visual changes and deterioration in handling characteristics.

APPENDIX 10

TEST FOR RESISTANCE TO LIQUIDS

1 A specimen, 150 mm x 25 mm x 25 mm, shall be held vertically with half of its length immersed in the test liquid at room temperature for 9000 hours. One specimen shall be used for each of the following liquids:

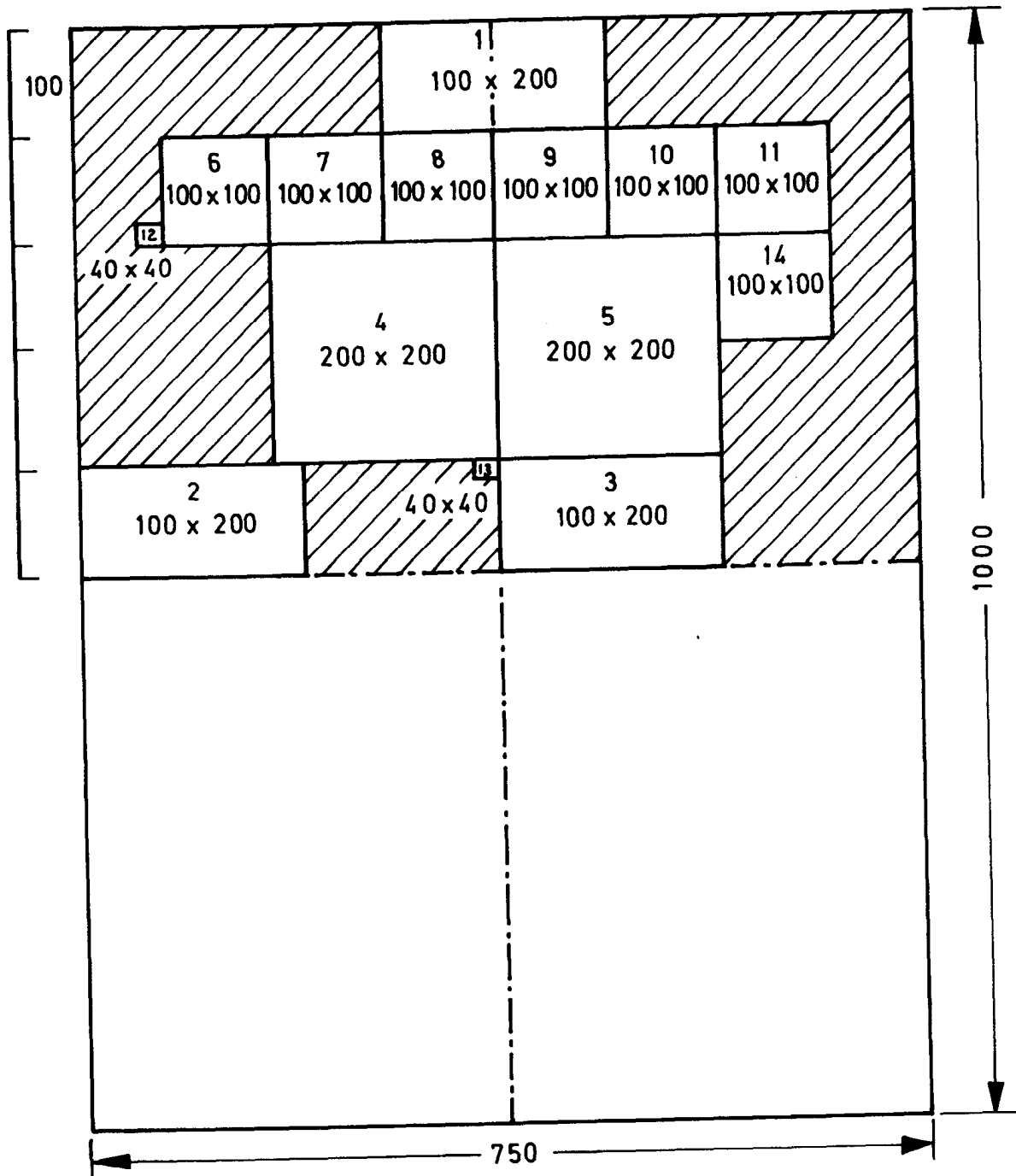
AVTUR/FS11	DERD 2453
AVGAS 100LL	DERD 2485
AVTAG/FSII	DERD 2454
Oil OM-15	DTD 585
Oil OX-27	MIL - L - 23699
Oil OX-38	DERD 2487
Temporary protective PX-24	DEF STAN 68-10
Antifreeze AL-3	BS 3150
Acetone	BS 509
Methanol	BS 506
Cellulose paint thinner	DEF STAN 80-38

2 A specimen, 150 mm x 25 mm x 25 mm, shall be held vertically so that half its length is immersed in water and half in a layer of AVTUR/FSII above the water, the liquids being maintained at 90°C for 1000 hours.

3 In each case, after removal from the liquid, the specimen shall be allowed to drain and shall then be examined for signs of change or deterioration in handling characteristics.

Approved for issue

D. K. Thomas
Head of Materials Department
Royal Aircraft Establishment
Farnborough, Hants.
GU14 6TD.



All dimensions in mm

Specimens	1, 2, 3	Grab strength
	4, 5,	Density gradient
	6 to 11,	Compression force
	12,13	Resistance to wicking
	14	Fibre diameter

Fig 1 Standard cutting plan for test specimens

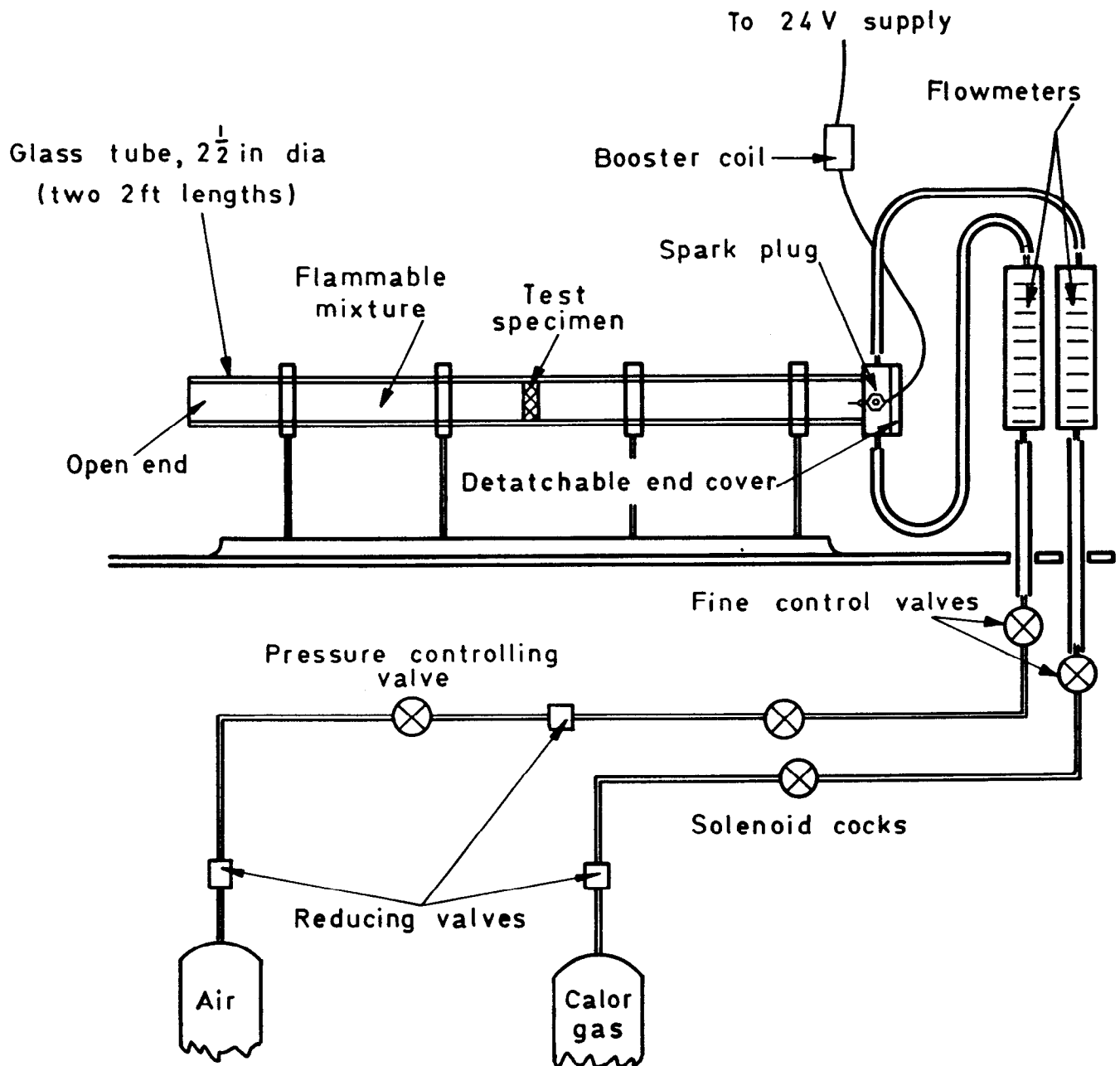


Fig2 Diagrammatic arrangement of flame tube apparatus

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