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Trials of medium and high expansion foams on petrol fires

P. L. Parsons

SCIENTIFIC RESEARCH & DEVELOPMENT BRANCH

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FIRE RESEARCH AND DEVELOPMENT UNIT

SAB REPORT 12/81

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P L Parsons

Moreton in Marsh
Gloucestershire

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SUMMARY

A series of foam tests was carried out at the Fire Service Technical College in August 1980 on pool fires of area 84 square metres (30 feet square) using 1370 to 1827 litres of two star petrol (motor spirit) as fuel for each test. The foams used were fluoroprotein at low expansion (12), and synthetic foam at expansions of 65, 140, 400 and 500. Commercially available branch pipes and foam generators were used. The total liquid flow of extinguishant was controlled at 227 litres per minute (50 gallons per minute) in all trials. The solution strength used was that recommended by the manufacturer of the foam concentrates.

The times for 90 per cent and 100 per cent extinction were observed, and burn-back tests were conducted. The test fires were recorded on video tape.

The trials conditions were identical to those used in 1974 (Reference 1), when a variety of low-expansion foams were tested. The results therefore permit direct comparison.

In the present tests, all foams gave convincing control and extinction. High-expansion (400 and 500) synthetic foam gave the quickest control and extinction, but also the quickest burn-back.

Under the conditions of the tests, the higher expansion foams used (140, 400, and 500) gave progressive extinction and depended less on the skill of the branch men in application than lower expansion foams.

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1. INTRODUCTION

Fire-fighting foams are now well established as extinguishing media, particularly for fires of flammable liquids. Spill fires of volatile hydrocarbon (petrol, motor spirit, AVGAS) are a prominent risk for which foam is required. However, a variety of foam types is available, and no precise doctrine is yet accepted in the Fire Service as to the best choice for fires of differing materials and situations. There is a particular need to explore the tactical uses of medium and high expansion foams.

The Home Office Scientific Advisory Branch carried out a series of tests in 1974, (Ref 1) in which foams of various types were applied to pool fires of 84 square metres, using two-star petrol (motor spirit) as fuel. Extinction times and burn-back times were measured, the experimental fires being conducted at the Fire Service Technical College.

The 1974 tests were concerned almost exclusively with low expansion foams, one test only at high expansion being made, and no satisfactory medium expansion equipment being available.

The tests now described were designed to follow the 1974 trials conditions as closely as possible, but to explore adequately the use of medium and high expansion foams. The identical fire tray of 84 square metres at the Fire Service Technical College was used, again with two-star petrol as fuel. Two tests using fluoroprotein foam at low expansion were included in the series to verify comparability with the 1974 tests.

Personnel conducting the tests were staff of the Home Office Scientific Advisory Branch Fire Research and Development Unit at Moreton-in-Marsh, assisted by a team from the West Midlands Fire Brigade. A member of the Fire Research Station of the Department of the Environment attended some tests as observer and advisor. Staff of the Fire Service Technical College made the video recordings of the tests.

2. FOAM CONCENTRATES AND EQUIPMENT TESTED

The foam concentrates used were:

Fluoroprotein concentrate, used at low expansion	FP70[1]
Synthetic concentrate, used at medium and high expansion	Expandol[1]

The foam making equipments used were:

Low expansion branch pipe	F225H[1]
Medium expansion branch pipes	KR2/75[2] KR2/150[2]
High expansion generator	Turbex[1]

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1 Angus Fire Armour, Thame, Oxfordshire.

2 Total Export, Mannheim, Germany, available through John Kerr, Kirkby, Liverpool.

3. TRIALS CONDITIONS

The fires were conducted in a square steel tray with 9.15 m sides of height about 40 cm. This was the identical tray used in the 1974 tests (Ref 1), and it is sited in an open position at the Fire Service Technical College clear of buildings and other obstructions.

The tray was cleaned by scrubbing with brooms and clean water before each test. Sufficient clean water was run into the tray to cover the steel bottom and provide a level surface. The approximate water depth over the majority of the tray's area was 8 cm. On to this, for each test, two-star petrol (motor spirit) was dispensed by gravity feed from a tanker, the amount having previously been metered into the tanker from the FSTC petrol pump. Fuel quantity used for each test was 300, 350, or 400 gallons (1370, 1598, or 1827 litres), giving a fuel depth of 16.3 mm, 19.0 mm or 21.7 mm. At an estimated free burning rate of 4 mm per minute (Refs 2 and 3), these figures correspond to burning times of 4 minutes 5 seconds, 4 minutes 46 seconds, and 5 minutes 27 seconds. (The fuel quantity for each test was decided on a judgement of the minimum amount required to avoid fuel starvation during the fire test and also give useful information during the subsequent burn-back test.)

Ignition was by an electrically fired cartridge suspended a few centimetres above the petrol surface at the upwind side of the tray.

A preburn time of one minute was allowed from ignition to the start of foam application. This preburn time was considered sufficient to allow the fire column to attain equilibrium and for the burning rate to steady (Ref 4), while allowing reasonable economy in fuel.

Foam was applied from the upwind side of the tray, application being made as gently as possible to avoid churning the surface and to minimise contamination of foam by the fuel. Further notes on the methods of application for medium and high expansion foams are given in Section 5. The time to extinction of 90 per cent of the fire area was noted, as was the time to 100 per cent extinction. After extinction, foam application was continued for a further 30 seconds. This was intended to provide a standard condition for the burn-back test which could be regarded as representing practical circumstances of use in fire-fighting operations.

A metal frame one metre square with sides about 25 centimetres in height was then placed in the large fire tray in the centre of the upwind side. Foam within this frame was scraped out with a plywood paddle, about 10 litres of petrol was added and ignited by a torch. When the fire in the frame was well developed, the frame was pulled out of the tray by attached wires. The time elapsing from this point until the entire fire tray was covered by flame was taken as the burn-back time.

The total liquid supply, that is foam concentrate plus clean water, was controlled at 227 litres per minute (50 gallons per minute), equivalent to 2.73 litres/m^2/min. This constant rate is appropriate to the various branches and generators used, and provides a basis for comparison between the various foams. The percentage of concentrate used followed the maker's recommendation for each material.

4. INSTRUMENTATION AND OBSERVATION OF TRIALS

A water tender and control van were sited together upwind of the fire site. They functioned as a centre for control and instrumentation of the tests.

Figure 1 is a diagrammatic representation of the hydraulic system. Clean water from the pump passed through a standard in-line inductor and an electromagnetic flowmeter, then through two or three 60 foot lengths of $1\frac{3}{4}$ inch hose[1] to the foam branchpipe or generator. The foam compound to be used was poured into an open drum. From this it was lifted by a small electrically-driven gear-pump[2] and passed through a second electromagnetic flowmeter before reaching the in-line inductor. (The inductor served merely as a convenient piece of plumbing, rather than fulfilling its normal function). The gear-pump was provided with an electrical variable-speed drive control, and both flowmeters were linked to digital displays. By adjusting the main pump throttle and the gear-pump control, the operator could secure flowmeter readings indicating a total liquid flow of 227 litres per minute (50 gallons per minute) containing the specified percentage of foam concentrate. This arrangement ensured that the solution strength and flow supplied to the hose line were accurately known and controlled.

The low and medium expansion-ratio branchpipes used in the tests had no foam concentrate pick-up tubes. The high expansion-ratio generator used had such a tube, but this was blanked to permit operation with a pre-mixed solution as described.

Observations of the progress and timing of each fire were made by two observers equipped with split-second-hand stop watches. The figures reported are means of these timings. The conduct of each test was recorded using colour video equipment, the camera and operator being placed in the cage of a hydraulic platform, generally at about 9 metres in height, and at a distance of about 40 metres from the nearest part of the tray. The direction of view of the camera was approximately broad-side to the wind-direction. The associated video recorders were operated in a control van adjacent to the hydraulic platform.

Two large synchronised digital clocks[3] displaying minutes and seconds were sited near the fire tray, one being conveniently in the field of view of the video camera, and one at least being visible to all personnel engaged in the conduct of the trial. The clocks were started about 30 seconds before ignition, which took place at zero indicated time. Thus the video records were accurately timed, and a means of co-ordination provided for the pump operator, the branch man and his number two, the observers, video equipment operators, those controlling water sprays monitors cooling the concrete tray surround, and the two firemen with water spray branches who stood by acting as safety crew in case of mishap.

For each trial, the wind speed was measured by a portable anemometer sited on open ground near the fire tray. The anemometer head was one metre above ground. The approximate wind direction was also noted.

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1 The $1\frac{3}{4}$ inch hose was preferred to $2\frac{3}{4}$ inch hose partly for ease of handling of the foam branch, and partly to reduce the volume of liquid in the hose line between the concentrate inductor and the branch, thus reducing the time delay in producing finished foam after pumping commenced.

2 Alpha Pumps, Turkey Court, Ashford, Kent. Model GP$\frac{1}{2}$/125/E.

3 Timeon Cinque, Rickmansworth, Herts. Model SD1200L.

Measurements were made on the trials ground of foam quality in respect of expansion ratio, drainage time, and shear stress. These served as a general check on the quality of the foam concentrates and on the correct functioning of the foam producing equipment. In the case of the fluoroprotein foam used at low expansion, laboratory tests on samples of the concentrate were also made using the FRS 5 litre per minute branchpipe (Ref 5).

For the trials ground tests of low and medium expansion foam properties, foam was collected in a 100 gallon plastic tub. The expansion ratio was determined by weighing a 2440 ml plastic jug of foam. Shear stress was determined using a torsional vane viscometer as described in Ref 6. The 25 per cent drainage time was measured using a 6320 ml drainage pan of depth 20 cm as described in Ref 7.

For the trials ground tests of high expansion foam properties, foam was collected directly in a light alloy bin to the specification of Refs 8 and 9. Expansion ratio and 50 per cent drainage time were then determined by weighing, as described in the References.

5. RESULTS

5.1 Foam properties

Table 1 shows the measured foam properties which are to be associated with the fire tests. Where appropriate, the figures quoted are means of a number of measurements made.

All the foam concentrates used can be considered to be of good quality, and all the branches and generators used for the trials performed well.

There is some evidence that the FP70 fluoroprotein concentrate used was of rather lesser quality than that used in the 1974 tests (Ref 1), the drainage time and shear stress tending to be somewhat lower. However, the results were within the specification requirements.

The two medium expansion branchpipes, KR2/75 and KR2/150, gave expansions close to the nominal performance figures of 75 and 150. The Turbex generator gave expansion ratios rather lower than its performance specification indicates, but this may have been influenced by the length of metal ducting fitted to the generator outlet. (See notes on Tests 6, 7, 8 and 11 in Section 5.2 below). The 50% drainage time of 7 mins 44 secs measured was acceptable however, against the requirement of 8 mins of Ref 8.

5.2 Fire tests

Table 2 gives details of 13 fire tests, shown in four groups, according to foam type and expansion ratio.

After ignition, the petrol fires grew to cover the full tray area within about 5 seconds.

5.2.1 Fluoroprotein foam, low expansion ratio, Tests 1, 2 and 3

Test 1 was a preliminary exercise using 200 gallons of diesel oil as fuel. In Test 2, 300 gallons of petrol was used. However, the fire was terminated by fuel exhaustion, and extinction times are not quoted. This result was no doubt influenced by conditions of high wind and by the relative inexperience of the branch men at that point in gently applying the jet of foam to the petrol tray to avoid churning the foam and fuel. This effect is discussed in Section 6 of Ref 1.

In all subsequent tests, the fuel quantity was increased to 350 or 400 gallons of petrol.

In Test 3, the extinction and burn-back times obtained were consistent with those measured in the 1974 tests (Ref 1). The slow, progressive and controlled nature of the burn-back fire was noticeable, as in 1974.

5.2.2 Medium expansion foam (ratio 65), using branchpipe KR2/75, Tests 4, 5 and 10

The throw of this branch was sufficient to enable it to be hand-held and used much as a low expansion branch. Convincing control and extinction were obtained. During the final stages of extinction, it was noticeable that small flames could persist in a narrow gap between the foam blanket and the tray sides, due no doubt to the action of the hot metal in breaking down the foam. Burn-back times were variable, ranging from 1 min 57 secs in Test 5 to 5 mins 7 secs in Test 10.

5.2.3 Medium expansion foam (ratio 140), using branchpipe KR2/150, Tests 9, 12, 13

In Test 9, the branchpipe was hand-held in the normal manner, but the short throw of foam produced gave the branch men difficulty in approaching sufficiently close to the fire. In Tests 12 and 13, the branch was mounted on a wheeled trolley which enabled the branch men to manoeuvre the foam stream while remaining at a tolerable distance from the flame wall (Figure 8). The improved extinction times of Test 13 may have resulted from experience in the use of this arrangement. Burn-back times were again variable, from 2 mins 12 secs in Test 9 to 8 mins 28 secs in Test 12.

5.2.4 High expansion foam, Tests 6, 7, 8 and 11

The Turbex generator was mounted on a four-wheeled trolley, and provided with a sheet metal foam duct 8 feet in length (Figure 10). This enabled the two branch men to approach the fire to apply the foam, and allowed some freedom to manoeuvre.

In Tests 6, 7 and 8 the Turbex bypass was closed, and the generator was fed with metered pre-mix solution as described in Section 4. In Test 11, to obtain a higher expansion ratio, the bypass was open, and the foam concentrate was inducted locally at the Turbex pick-up tube. The liquid flow applied to the fire was maintained at 227 litres per minute, as for all other tests. As discussed in Section 5.1 above, the expansion ratios measured using both these conditions were lower than those indicated by the manufacturer's figures.

The foam blanket was applied to the fire from the upwind side and extended steadily across the tray, giving quick, systematic and progressive extinction. Burn-back was quick, ranging from 25 seconds in Test 8 to 1 min 49 secs in Test 11.

5.3 Summary of fire test results

Table 3 summarises the fire test results averaged under 5 headings. Results from the 1974 tests (Ref 1) are included in the calculations for fluoroprotein foam and for synthetic foam used at high expansion. Also included in Table 3 for comparison are results obtained in 1974 for synthetic foam in the expansion range 20-30.

Figure 2 presents the results of Table 3 in graphical form.

6. DISCUSSION

In the present tests, fluoroprotein foam at low expansion (12), and synthetic foam at all expansions used (from 20/30 to 500) gave convincing control and extinction at the liquid rate of application of 2.73 litres/m^2/min. High expansion foam gave the quickest control and extinction times.

With fluoroprotein foam (expansion 12), and with synthetic foam used at expansions of 20/30 and 65, there was a relatively large difference between 90 and 100 per cent extinction times. This is attributed to the geometry of the tray sides, which sheltered wisps of flame from the foam stream, and to the tendency of the hot metal sides to break down the foam raft. A similar effect was noted in the 1974 tests (Ref 1). However, at expansions of 140 and 400, the 90 and 100 per cent extinction times were relatively closer. The larger volume of finished foam at these expansions and the greater depth of the foam raft appeared to overcome the tendency of the tray sides to shelter small remnants of flame.

At low expansions, the effectiveness of the foam is noticeably dependent on the skill of the branch men in obtaining gentle application to avoid churning the fuel and foam together and thus to build up the foam raft speedily.

At the higher expansions (140 and 400) it was noticeable that the extinction process was more progressive and predictable. The large volume of low density foam flowed gently across the fuel surface causing a minimum of disturbance, and requiring less skill from the branch men for effective application.

However, in a practical case the tactical situation may imply difficulties in application or retention of the foam at the higher expansion ratios. Thus, the limited throw of the KR2/150 branchpipe (expansion 140) produced difficulties in application, as the heat from the flames discouraged a close approach by the branch men. A wheeled mounting for the branch was successful in overcoming this difficulty. Similarly, a wheeled mounting with a short metal ducting was devised for the Turbex high expansion generator. The upstanding tray sides assisted in retaining the higher expansion foams on the fuel surface, and satisfactory extinction was obtained in winds of up to 12 metres per second (24 knots) with an expansion ratio of 500 (Test 11).

As in the 1974 tests (Ref 1), fluoroprotein foam at low expansion gave the best burn-back performance, recording the longest time, and maintaining a seal at the tray edges. Synthetic foams at all expansions gave poorer and more variable burn-back performance, fire sometimes propagating rapidly along the tray edges. High expansion foam gave the least satisfactory burn-back performance.

7. CONCLUSIONS

Using test fires of 1370 to 1827 litres (300 to 400 gallons) of petrol in a tray of 84 square metres (30 feet square) and a foam solution application rate of 2.73 litres/m^2/min., it was found that:

1. Fluoroprotein foam at low expansion (12) gave convincing control and extinction.

2. Synthetic foam at expansions of 65, 140, 400 and 500 also gave convincing control and extinction.

3. The quickest control and extinction was given by high expansion (400) synthetic foam.

4. The burn-back fires developed more slowly and more predictably with fluoroprotein foam of expansion 12 than with synthetic foam at expansions of 65, 140, 400 or 500.

5. The high expansion synthetic foam at expansions of 400 or 500 gave the shortest burn-back times.

6. Under the conditions of the tests, the higher expansion foams used (140, 400 and 500) gave progressive extinction and depended less on the skill of the branch men in application than did the lower expansion foams.

7. Under the conditions of the tests, high-expansion (500) foam was effective in wind speeds up to 12 m/sec (24 knots).

8. RECOMMENDATION

Tactical trials of medium and high-expansion foam should be extended to cover a variety of fuels and situations, including fires involving obstructions or difficulties of access.

9. ACKNOWLEDGEMENTS

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TABLE 1 : FOAM PROPERTIES : TEST MEANS

Foam type	Foam concentrate	Solution strength %	Branchpipe or Generator	Temp °C	Expansion ratio	Shear stress N/m²	Drainage time min-sec
Fluoroprotein	FP70	3	FRS 5 litre/min[1]	20.0	7.4	14.4	5-19[2]
"	FP70	4	FRS 5 litre/min[1]	20.0	8.9	-	8-13[2]
"	FP70	3	F225H	17.7	10.3	7.5	7-16[2]
"	FP70	4	F225H	20.0	12.2	6.5	-
Synthetic	Expandol	3	KR2/75	15.5	61	5.1	7-18[2]
"	Expandol	3	KR2/150	14.0	139	-	8-30[2]
Synthetic	Expandol	1½	Turbex[4]	15.0	390	-	7-44[3]
"	Expandol	1½[5]	Turbex[6]	13.7	521	-	-

1. See Reference 5.
2. 25% drainage time
3. 50% drainage time
4. Turbex by-pass closed : pre-mix solution used
5. Approximate solution strength, not metered.
6. Turbex by-pass open : self induction used at Turbex.

TABLE 2 : FIRE TEST RESULTS

Foam type	Expansion range	Test No	Foam concentrate	Solution %	Foam branch	Fuel quantity gallons	Wind Speed m/s	Wind Direction[1] degrees	Air temperature °C	90% extinction time min. sec.	100% extinction time min. sec.	Burn-back time min. sec.
Fluoroprotein	Low (12)[2]	1	FP70	3	F225H	200[3]	4	180	18.0	-[4]	-[4]	-[4]
"	"	2	"	3	"	300	6-10	240	18.5	-[4]	-[4]	-[4]
"	"	3	"	4	"	400	2-3	180	20.0	1 - 05	2 - 22	4 - 04
Synthetic	Medium (65)[2]	4	Expandol	3	KR2/75	400	3-6	60	14.0	1 - 37	2 - 26	2 - 14
"	"	5	"	3	"	400	2-3	60	16.0	1 - 25	3 - 13	1 - 57
"	"	10	"	3	"	350	3-4	230	19.5	1 - 09	2 - 19	5 - 07
"	Medium (140)[2]	9	"	3	KR2/150	300	6-8	240	19.5	1 - 49	2 - 07	2 - 12
"		12	"	3	"	350	4-5	150	19.0	1 - 45	2 - 19	8 - 28
"		13	"	3	"	350	5-8	150	20.5	1 - 11	1 - 29	2 - 28
"	High (400)[2]	6	"	1½	Turbex	400	5-7	180	17.5	0 - 25	0 - 42	0 - 45
"	"	7	"	1½	"	400	4-6	210	17.1	0 - 36	0 - 56	0 - 31
"	"	8	"	1½	"	400	4-6	270	17.0	0 - 52	1 - 17	0 - 25
"	High (500)[2]	11	"	1½	"	350	7-12	200	21.0	2 - 00	2 - 19	1 - 49

1. A wind from the North is represented as 0 degrees, from the East as 90 degrees.
2. See section 5.1 and Table 1.
3. Test 1 used diesel fuel, all others used two-star petrol.
4. See section 5.2.1.

TABLE 3 : FIRE TESTS : SUMMARY

Foam type	Expansion range	90% extinction time min. sec.	100% extinction time min. sec.	Burn-back time min. sec.	Number of fire tests averaged.
Fluoroprotein	Low (12)	1 - 01	1 - 58	5 - 28	3[1]
Synthetic	Low (20-30)	1 - 19	2 - 12	3 - 58	4[2]
Synthetic	Medium (65)	1 - 24	2 - 39	3 - 06	3
Synthetic	Medium (140)	1 - 35	1 - 58	4 - 23	3
Synthetic	High (400)	0 - 48	1 - 18	1 - 29	4[3]

1. Test 3 of present series, Tests 6 and 7 of 1974 (Ref 1).
2. 1974 Tests (Ref 1)
3. Tests 6, 7 and 8 of present series, Test 12 of 1974 (Ref 1).

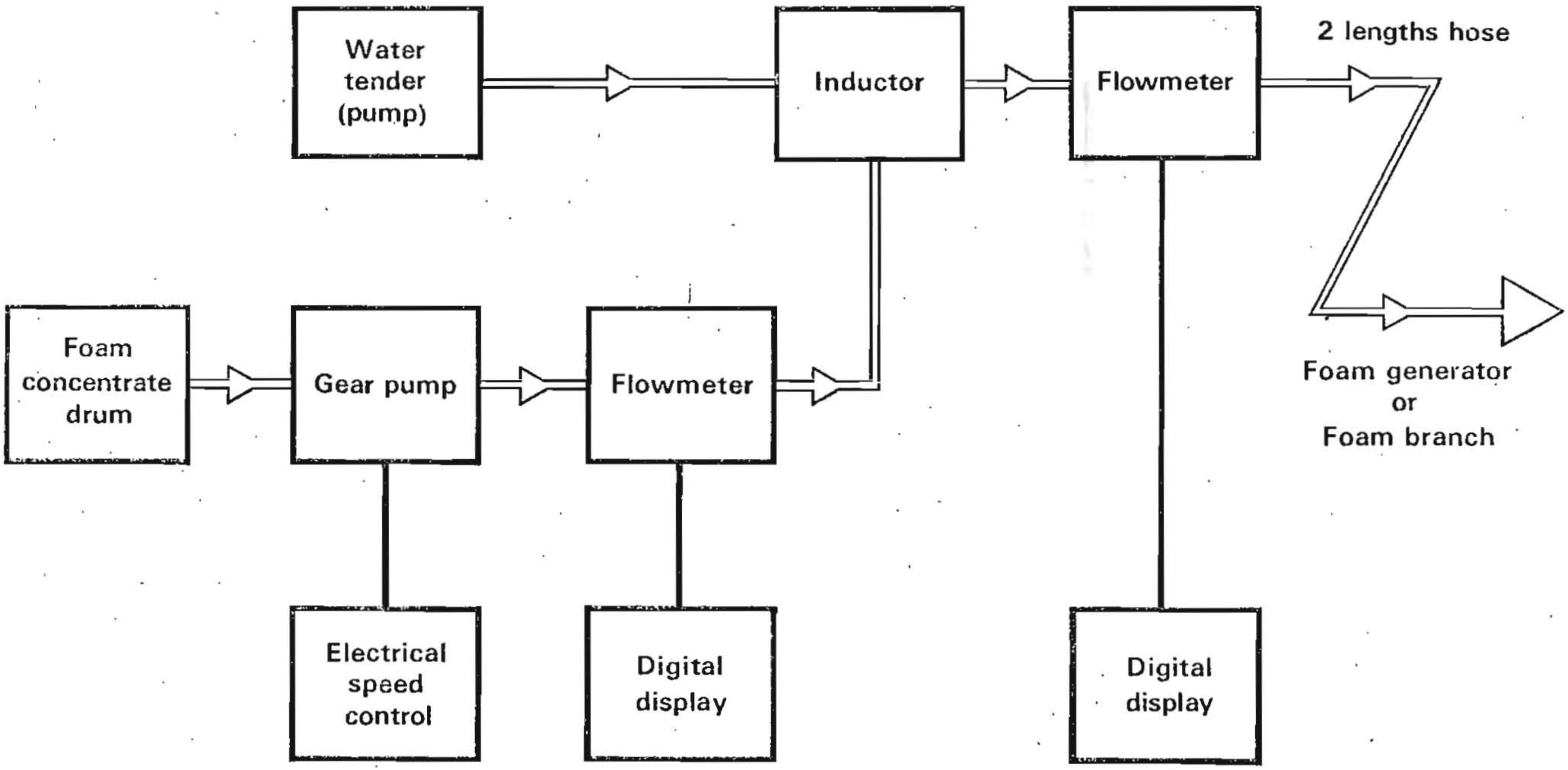


Fig. 1 EXPERIMENTAL ARRANGEMENT OF HYDRAULICS.

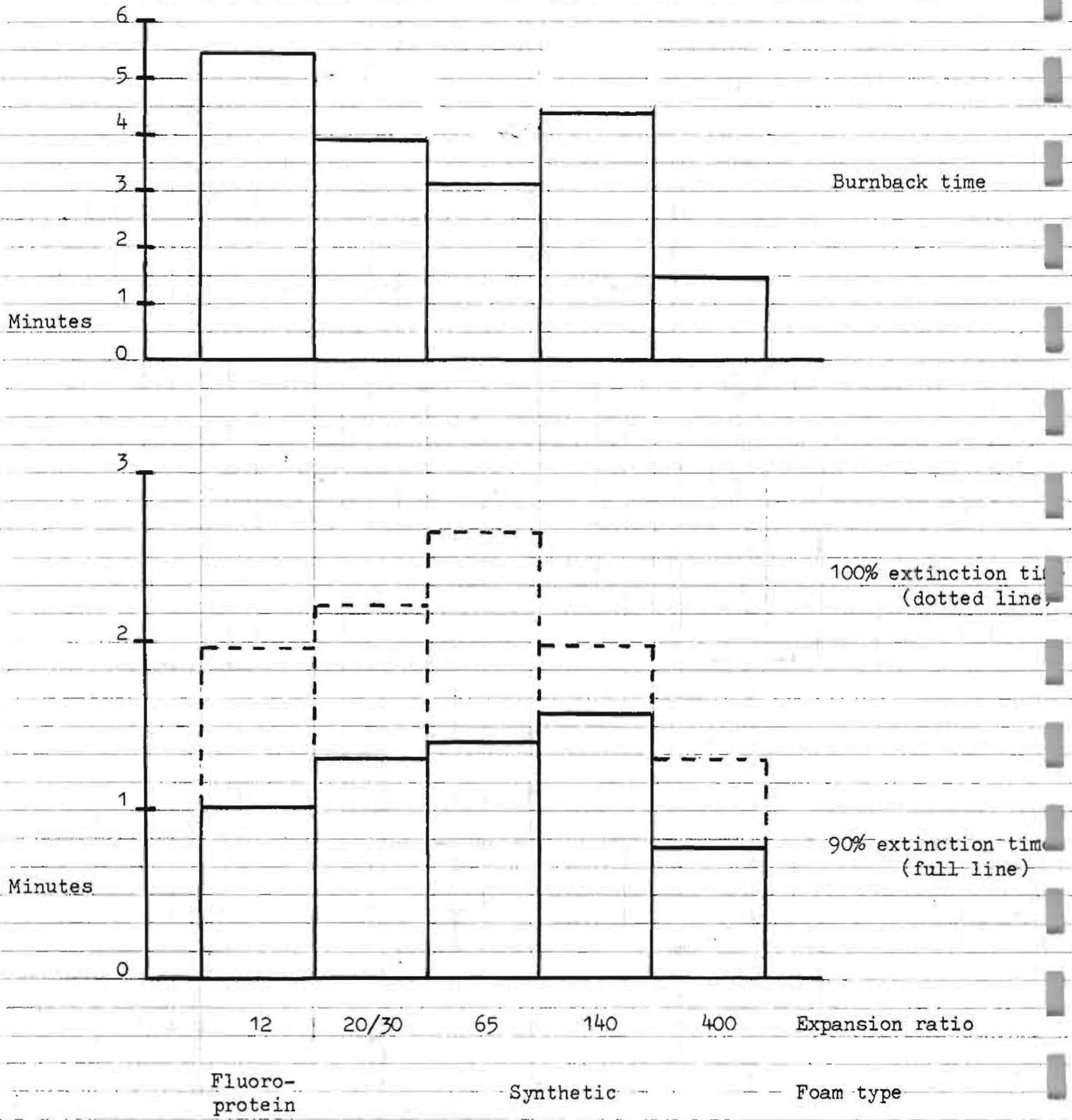


Figure 2 Fire Tests : Summary

Figure 3: Low and medium expansion branches used
Total KR 2/75, Angus F225H, Total KR2/150

4.2/30

Figure 4 : Fire development 3 seconds after ignition. (Test 5)

471/80

Figure 5: General view : commencement of extinction. (Test 5)

N75/80

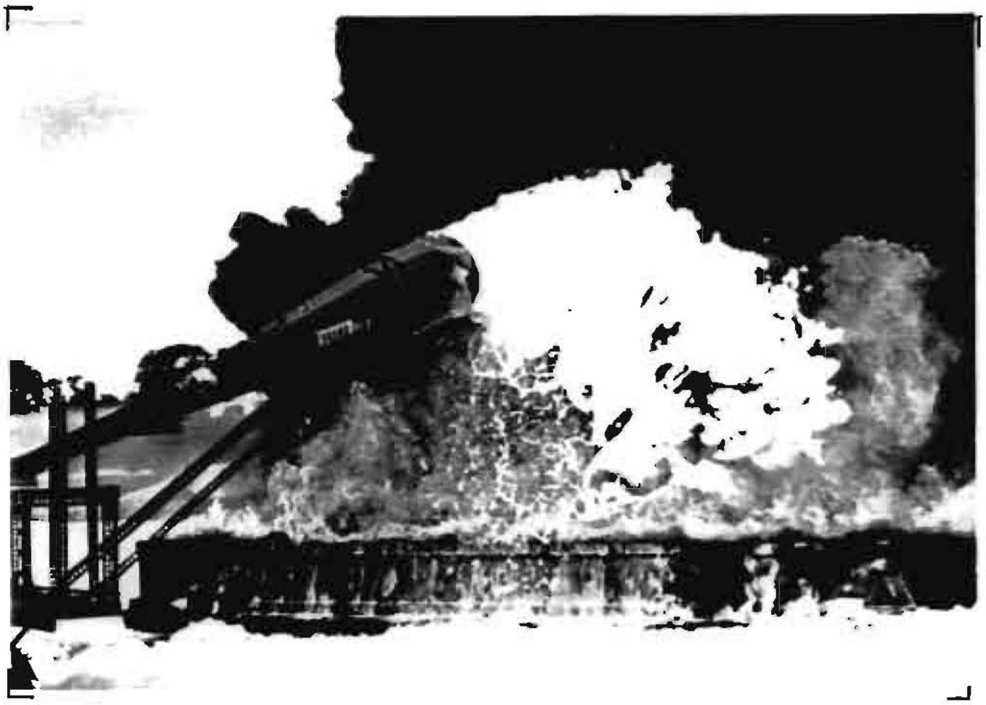
Figure 6: Application of low-expansion foam. (Test 2)

446/80

Figure 7: Application of medium-expansion (65) foam from KR2/75 branchpipe. (Test 4)

621/80

Figure 8: Trolley mounting of KR2/150 branchpipe.



609/80

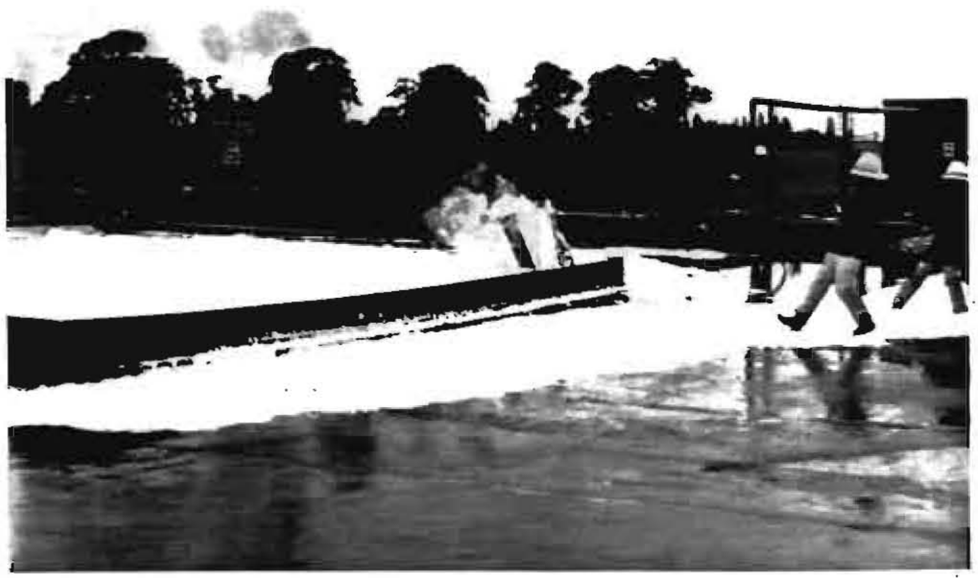
Figure 9: Application of medium-expansion (140) foam from KR2/150 branchpipe. (Test 12)

600/80

Figure 10: Trolley mounting of Turbex high-expansion foam generator with ducting.

526/80

Figure 11: Application of high-expansion foam. (Test 3)



494/80

Figure 12: Removal of burn-back **tray.** (Test 5)

APPENDIX

Scheme for safe handling and dispensing of petrol for 30 foot square tray fires

1. Prior to the trial period 3,000 gallons of two star petrol will be delivered into the FSTC fireground petrol tank by a commercial tanker. This underground tank (capacity 5,000 gallons)is approximately 85 metres from the 30 feet square tray to be used for the tests. Three hundred gallons are required for each test and 10 tests are planned.

Before each test the following procedure will be carried out

2. The tray which will be earthed will be cleaned out by scrubbing with brooms and clean water.

3. Barriers and "No Smoking" signs will be placed around the test and petrol tank areas.

4. Sufficient clean water will be run into the tray to cover the bottom and provide a level surface. The water will be approximately 6" deep.

5. Three hundred gallons of petrol from the fireground petrol tank will be transferred to the rear compartment of the FSTC tanker using the hand delivery nozzle attached to the garage forecourt type petrol pump. The rear tank capacity is 500 gallons. The delivery nozzle will be suspended at a predetermined position in the tank with the automatic cut-off device set. This arrangement will allow the operator to withdraw from the tanker for most of the filling time. Three hundred gallons will be metered by the pump indicator. The time to transfer 300 gallons by this method is estimated to be 30 minutes.

6. A fire tender and crew with foam equipment will be standing by the tanker during the transfer of petrol from the tank.

7. A fire tender and crew with foam equipment will stand by the fire tray during the transfer of petrol to the tray and for the rest of the test. They will be concerned purely with safety, ie they will take no part in the experimental extinction of the fire.

8. When all other preparations for the tests are complete all non-essential personnel will be moved upwind of the tray. Smoking or naked lights will be prohibited. Adjacent FSTC roads will be closed for the test.

9. The tanker will be driven to a position 40 feet upwind of the tray, and earthed. It will then be connected to a previously positioned length of approved 2½ inch delivery hose, the other end of which is secured over the tray edge. The hose will be provided with an independent earth connection.

10. The tanker delivery valve will be opened and the 300 gallons discharged by gravity. The estimated time for dscharge is 10 minutes.

11. When the tanker is completely discharged, the hose will be underrun towards the tray. The end of the hose will be withdrawn from the tray and capped. The tanker valve will then be closed, the hose disconnected from the tanker and capped.

12. The tanker earth will be removed, and the tanker driven away.

13. The earth connection to the hose will be removed: the hose will be removed from the test area.

14. An electrical cartridge for ignition will be placed over the tray edge by a person wearing protective clothing.

15. Ignition will be electrical from a distance of 100 feet upwind. The test, including a burn back test will be carried out. The burn back test should burn off all petrol.

16. The remaining liquid/foam in the tray will be pumped by a standard fire service pump to waste settlement tanks approximately 250 metres from the tray.

17. If the tanker is loaded with petrol which is not used on the same day, the tanker with petrol will be stored in the FSTC garage overnight.