

WAsc 1895

NC Density Reports
1949 - 1951

MEMORANDUM *cps 7/7*

— 1 — 194 —

From:- *E. Trist*To:- *M^r W.N. Hewson*

Ref.

Ref.

Subject Densities

Samples recently submitted have been measured and the results obtained are given below :-

<i>CPA 102T</i>	<i>1.530 gms/c.c. at 20°C</i>
<i>" 102B</i>	<i>1.534 — ditto —</i>

E.N.R. Trist
12.1.51.

*The Port ^{6.38}
Mr Clifford, D.O. &
pl write return
15
1/51*

MEMORANDUM

111 11950

From:- R.S. Dawson
 Ref. Propellant Factory

To:- Mr. Hewson
 Ref. F107A

Subject Density determinations

Densities of the 14 samples submitted are as follows:—

CPA	81 TOP	1.556
"	82 TOP	1.560
"	83 TOP	1.567
"	84 TOP	1.569
"	86 TOP	1.548
"	87 TOP	1.546
"	88 TOP	1.539
"	89 TOP	1.547
"	93 BOTTOM	1.547
"	93 TOP	1.546
"	95 BOTTOM	1.550
"	95 TOP	1.552
"	100 BOTTOM	1.547
"	100 TOP	1.551

~~Mr. Hewson~~ 2/15/50
~~Mr. Clifford~~ seen t.g.
 Pl. record
 and return.
 W.H. 2/15/50

R.S. Dawson

Propellants Factory,
Woolwich.

M^r Henson,

Density

The following value has been
obtained on a sample of cast double
base propellant submitted recently.

Sample

CPB.43 H/W

1.385 gms/c.c. at 20°C.

P. H. V.

2. 10. 50.

~~Mr. Henson~~ 22B. 21/1/50
~~Mr. Clifton~~ Noted & y
To note as return for 20/5
W. H. 3
10.

Propellants Factory,
Woolwich.

~~Mr. Hewson~~

Densities

The following values have been
determined on samples submitted:

CPA 72	1.543	gms/cc. at 20°C
CPA 73	1.546	ditto
CPA 79	1.529	ditto

~~Mr. Bond~~ Soted in R.B. 82B.
20/9/50.

~~Mr. Clifton~~

Pl note and return

~~Mr. 89/50~~

Noted T.Y.

D.B. 22/9/50

~~Shir~~

18.9.50

Propts. Factory,
Woodward

~~Mⁿ Section~~

Densities

Values for density, in grams
per c.c. at 20°C, on two samples
recently submitted by you are given below.

CPA 69 1.546

CPA 70 1.542

Mr. Befford Seen t.y.
D.C.B.

pl. rec & return

S.B.

14/8/50.

P. H. S.

14.8.50

Properly Treated
(Woolrich)

Mr. Henson

Densities.

Sample	CPA 67 Top	=	1.5387
"	" " Bottom	=	1.5429
"	CPA 76 Top	=	1.5045
"	" 76 Bottom	=	1.5053

Sample	CPA 64 Top	=	1.5353
"	" " Bottom	=	1.5377
	CPA 65 Top	=	1.5449
"	" " Bottom	=	1.5358

All at 20°C.

Entered in R/B. 15/6/50. 828.

~~Mr. Clifford~~ pt. see:
a return.

seen t.y.

D.V.C. 16:6:50

P. L. W.

12. VI. 50

721

Woodwork

M^r Hewson,

C. D. B. Project - density

The density of the sample
designated CPA 59 has been found
to be 1.537 grams/c.c. at 20°C.

Chick

31. 3. 50.

The Cliff/wood. Seen 7. 9. 0. 8
Pl see and return.

Little 31.
3.
50.

Propts. Factory,
Woolwich.

Mr Henson,

Density of Propt

A sample of CPA 61

submitted by you has been found to
have a density of 1.539 grams/cc.
at 20°C.

Yours
Sincerely

2.3.50.

Mr Clifton Secy T.Y.
Pl see and return D.V.C.
W.H. $\frac{3}{50}$

~~Mr. Hewson~~
 Pl enter in
 record book.
 (and return)
 14/12/49
 Propk. Factory,
 Woolwich.

Cast Propk. samples - densities

Samples recently submitted
 have given the following results: -

CPB 34	1.599	grams/c.c. at 20°C
35	1.595	"
36	1.598	"
37	1.528	"
38	1.519	"
CPA 46	1.511	
47	1.510	
CPA 51	1.535	
53	1.540	

~~Mr. Clifford~~
 Pl enter in
 record book.
 (and return)
 15/12/49
 Sent t.y.
 D.D.B.

P. Frost
 13.12.49.

Densities of CDB propellants.

11T	1.5344	11B	1.5276
13T	1.5285	13B	1.5311
14T	1.5265	14B	1.5321
15T	1.5378	15B	1.5315
CPB1(T)	1.5110	CPB1(B)	1.5764
CPB3(T)	1.5662	CPB3(B)	1.5661
CPB4(T)	1.5302	CPB4(B)	1.5335

These are all at 20°C.

M^r Hanson,

Propts. Factory,
Worwick.

Cast D.P. Propts. - densities

Figures as below have been
obtained on samples of items submitted on
20. 1. 49.

CPA 34	Top	1.535	gms./c.c.	at 20°C
CPA 34	Bottom	1.533	" / " "	" "
CPA 35	Top	1.538	" / " "	" "
CPA 35	Bottom	1.535	" / " "	" "
CPA 36	Top	1.535	" / " "	" "
CPA 36	Bottom	1.536	" / " "	" "

P. *[Signature]*
1. 2. 49.

CP^A~~B~~ 17 (T).
CP^A~~B~~ 17 (B)
CP^A~~B~~ 18 (T)
CP^A~~B~~ 18 (B)

.78

.74

.75

.71

P 46/9"

1080

Parallel to grain

5(T)	1.03
5(B)	1.013
7(T)	1.08
7(B)	1.08

CPB

25/8/45

Perpendicular to grain

5(T)	1.025
5(B)	1.008
7(T)	1.072
7(B)	1.127

CPB

13B	1.060
13T	1.043

$\bar{p}$

1886 p.s.c.

Propellants Factory,
Woolwich.

M^r Hawson,

Cast D.B. Propts. — Densities at 20°C

The following mean values for
density of individual samples submitted
have been obtained.

CPB 5 (T)	1.550	grams/c.c.	at 20°C
CPB 5 (B)	1.548	~ ~ ~ ~	
CPB 7 (T)	1.570	~ ~ ~ ~	
CPB 7 (B)	1.569	~ ~ ~ ~	
CP 23 (T)	1.567	~ ~ ~ ~	
CP 23 (B)	1.546	~ ~ ~ ~	
CP 24 (T)	1.529	~ ~ ~ ~	
CP 24 (B)	1.519	~ ~ ~ ~	
CP 25 (T)	1.541	~ ~ ~ ~	
CP 25 (B)	1.542	~ ~ ~ ~	

P. Trist

6.9.48

Mr. Clifton
M. B. Hewson, Pt. Rust and
relieve. Mr. 13

Propellants Factory,
Woolwich.

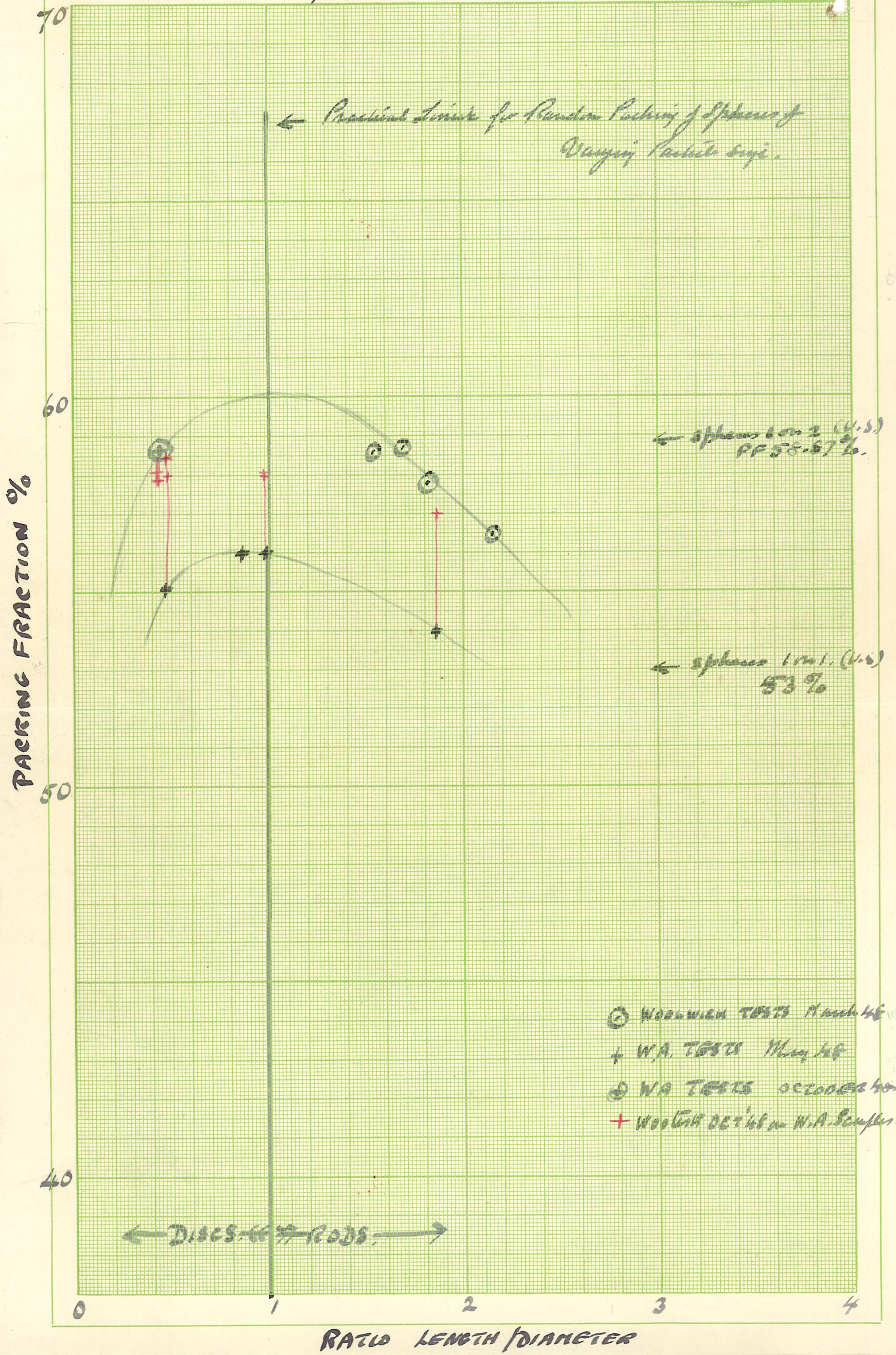
Cast D. B. Propots. - Densities at 20°C

The following further mean values
have been obtained :-

CP 17	{ T17	1.552	gms/cc.	at 20°C
	{ B17	1.525	"	"
CP 18	{ T18	1.535	"	"
	{ B18	1.536	"	"
CP 19	{ T19	1.530	"	"
	{ B19	1.531	"	"
CP 20	{ T20	1.529	"	"
	{ B20	1.523	"	"
CP 21	{ T21	1.527	"	"
	{ B21	1.533	"	"
CP 26	(T)	1.536	"	"
"	(B)	1.531	"	"
CP 27	(T)	1.530	"	"
"	(B)	1.533	"	"
CP 28	(T)	1.529	"	"
"	(B)	1.531	"	"
CPB 8		1.546	"	"
CPB 9 T		1.543	"	"
CPB 9 B		1.554	"	"

P. H. R.
13.9.48

↑ spheres 1 in 4 and 1 in 3 PF = 74.05%
(of uniform size)



Mr. Hewson,

Mr. Clifford
to see and
return for.

27/10/48

Propt. Factory,
Woolwich.

Cast D.B. Propt. - Densities

The following results have been
obtained:

C.P.B. 20 Top	1.571 gms/cc at 20°C
C.P.B. 20 Bottom	1.565 " " "

F. Trip
26.10.48

Mr. Hewson,

Noted E.G.

L.V.B.

28.10.48

Propts. Factory,
Woolwich.

W. P. Hudson,

Bulk densities of Powders for East D.B.

Two determinations have been made
on each of the four samples supplied and the
results obtained are listed below.

Lst N ^o	Comp ⁿ	Bulk density
W.A.C.X. 193/4	F428 ¹⁸³	① .9294 ② .924
W.A.C.X. 165/2B	F428 ¹⁷⁵	① .917 ② .917
W.A.C.X. 165/2C	F428 ¹⁷⁵	① .935 ② .945
W.A.C.X. 165/2D	F428 ¹⁷⁵	① .934 ② .933

Normal Woolwich method (25cc.)

[Signature]

25.10.48

Propk. Factory,
Woolwich

M^r Hewson,

The following values for densities
have been obtained:-

Sample CPB13(T)	1.543	gms./c.c. at 20°C.
" CPB13(B)	1.545	" " " "
" CPB14(T)	1.569	" " " "
" CPB14(B)	1.571	" " " "

P. H. R.

21.10.48

Mr Clifford
re note and
rebuttal

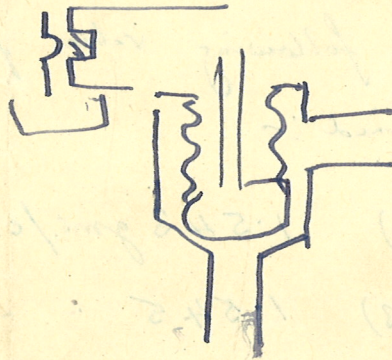
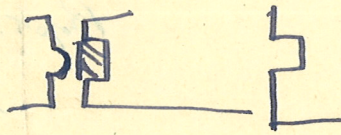
21/10

Mr Hewson,

Noted t.y.

D.V.B.

28.10.48



M^r ~~Hewson~~, ~~Mr Clifford~~
Please note and return

Propts. Factory,
Woolwich.

Densities of Cast D.B. Charges.

The following are the results
obtained on the samples submitted.

CPB 15 T	1.571	gms./c.c.	at 20°C
CPB 15 B	1.572	"	"
CPB 16 T	1.571	"	"
CPB 16 B	1.569	"	"
CPB 18 T	1.562	"	"
CPB 18 B	1.556	"	"

Mr Hewson

P. Trust
8.11.48.

Noted t.y.

D.V.C.
11.11.48

C.M. Section

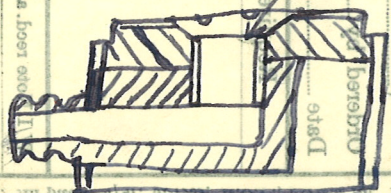
E.R.D.E

Waltham Abbey

Mr Hewson,

How one of
the brass bases
I agreed to a
brass tube being brazed
in to ensure a perfect
seal between the inlet
tube and the grooved
base plate.

I applied pressure
at $15\frac{1}{2}$ lb/sq" to each
base while it was
immersed and could
find no evidence of leak.



Brazed in
brass tube

D.V. Blufford
9:3:49

S.

E.R.-

Waltham Abbey

Mr Hewson

Apw CPB, 25, 26

and 27

Date has been
supplied.

D.V. Blufford

2:38/49

P.S.

I have also included

1/ Perspex screen and
frame

2/ Three anemls which
belong to the impact
tests.

S.P.R.I.

E.R.D.E.

Walter C. Hobbie

Mr. Hanson,

When I dried and desiccated N.G. and TH before making up mixtures for the determination of denaturation etc I found that, even after prolonged evacuation, further vigorous bubbling occurred after agitation; so further evacuation with occasional agitation was carried out.

In the casting process there is no agitation of the liquid except when it is transferred to the casting vessel so possibly some of the bubbling in ~~the~~ which occurs when the liquid comes in contact with the cordite may be due ~~to~~ ^{to} it.

Dimensional Vial

Spore

Ve. v. v.

Water Ours

Made to knowledge ✓

1946

to the agitation of the liquid
In the case of CPA clays
the surface area of the powder
is probably greater and the
amount of bubbling or further
cleavage of the liquid would
be expected to be greater.

This could be checked
experimentally and I will
evacuate a $\frac{1}{10}$ to $\frac{1}{20}$ least mixture
for 6 hrs without agitator
then see how much agitator
is required before no further
bubbling is obtained.

There are other ways
of investigating this which would
require more thought & preparation.
If this should prove to
be an important factor it might
be overcome by evacuating the
liquid phase separately before

beginning the caking process,
using agitation and/or a lower
pressure, or as suggested
previously, transferring the
liquid at a pressure
higher than that attained
during the 6 hours preliminary
evacuation.

Perhaps you have
some comments?

D.V. Bedford

P.S. With regard to the application
I made to A.E.R.E. I have been
asked to attend an interview on
Wed. 17/13, but I will not
try putting over any sales talk,
i.e. that there will also be an opportunity
to contribute to the greatest achievement
in the history of man or that
I have absolute proof will make
me a valuable addition to their
staff.



S.P.R.1

E.R.D.F

Waltham Abbey



Mr Hewson,

A/w the results of the simple experiment as promised.

There was no temperature control but a few degrees rise in temp did not affect the unagitated liquid which had been evacuated for 6 hours (i.e. did not cause it to bubble).

D. V. Clifford

10.3.49

within liquid, on surface	Thess fell to 1.0mm	after 7½ min. bubbles < 1 per min
- - - - -	"	" 16 " " " "
- - - - -	0.95mm	" 11 " " " "
- - - - -	"	" 12 " " " "
- - - - -	"	" 4½ " " " "
- - - - -	"	" 3¼ " " " "
- - - - -	"	" 3¼ " " " "
- - - - -	1.0mm	" 2¾ " " " "

~~Mr. Clifford~~
~~Clifford~~
Mr. Henson

Repts. Factory,
Woolwich.

Two determinations of density
have been made on the sample of CPB 23B
submitted - no residues remain.

The figures obtained were:-

1.574 gm/cc at 20°C

1.564 do.
3.1138

1.569 P. Hill

Mr Henson

Seen t.y.
D.O.B
12.4.49

6.4.49

1.57

DGN TA CARB
60 cc of 94 25 1

99 33.41 1.338

133.748

DGN CARB
99 1

100 99 gm DGN 1 CARB

99 = 74%

33.41 gm

$\frac{99}{74} \times 25$

Mr. Clifton

CPB24 has been
found to give
a smooth very
close

S.I. ± 175

This is more promising
we are getting rid
of the bumps due
possibly to more uniform
packing.

Ull 14/4

The Clifford
seen per
Mr 14
Mr Hewson,

Propst. Factory,
Woolwich.

The density of the sample of
CPB 23T submitted on 12.4.49 is
1.573 grams /c.c. at 20°C (mean
of three concordant determinations).

E. Trill.

13.4.49.

Mr Hewson,

Seen t.y.

D.V.B.

21.4.49

Propts. Factory
Workbook

Mr. Hewson,

Densities
Samples recently submitted by
you have given the following values:-

CPB 25T 1.576 gms./cc. at 20°C

CPB 26T 1.572 gms/c.c. at 20°C

CPB 27T 1.574 gms./c.c. at 20°C.

P. Tait
17. 5. 49.

Mr. Clifton

pl note and return.

Mr. Hewson

Noted t. y.

J.C.B

22. 5. 49

19
5
49.

Propts. Factory.
Woolwich

Densities determined on the two
samples submitted are:—

- (a) C.A. container 1.301 gms./c.c. at 20°C
(b) " " + NG. 1.358 " " " "

the result at (a) is the mean of two determinations,
in the case of (b) the sample was sufficient for
only one determination.

These results indicate the difference ^{viscosity of} between the two samples; in regard to the ^{viscosity of} absolute values of the above figures it should be noted that the expts. were performed at 24°C & that the correction applied for higher temp. of det. may not be strictly appropriate to Cellulose Acetate.

Remains of samples are being returned
to you.

P. trist. 26. 5. 49.

SPR(1)
Watson Hubey
Mr. Hewson,

① I had arranged
the transport of CPB
31 and 32, but the
lorry has broken down.

② It will interest
you I expect to note
that I have traced
some poor readings to
an error in a thermometer.

I managed to borrow a
thermometer which had been
checked against a standard
having a N.P.L. certificate:-

Standard	67070C	4152437	67001C	491728
24.1	24.1	24.25	25.1	
25.0	24.95	25.1	25.9	

(1992)
 This has taught me
 the importance of picking
 new theorems

J.O.B.

beginning at 24.6:49

29 to 30 of 1992

at 25, 52 to 12

and 25 to 12

to 25 to 12

to 25 to 12

to 25 to 12

to 25 to 12

to 25 to 12

to 25 to 12

to 25 to 12

to 25 to 12

to 25 to 12

Standard	1992	1991	1990
520	54.62	52.1	52.5
54.1	54.1	54.52	52.1
50500	54.52	54.52	52.5
54.52	54.52	54.52	52.5

SPR(1)

Waltham Abbey

Mr. Hewson,

D.M.P. Sp.gr. at 25°C = 1.1855

Viscosity 25°C = 11.696 cS

TRIACETIN (3/49)

Sp.gr. at 25°C = ~~1.1698~~

1.1698

Viscosity 25°C = 14.859 cS

There was a slight error in
Sp.gr. reported previously for
D.M.P., due to thermometer error
(N.B. Sp.gr.'s previously reported
have been referred to erroneously
as densities)

In future my figures
for viscosities will be in

centistokes (cs) is the
kinematic viscosity ν

$$\eta (\text{centipoise}) = \nu (\text{centistokes}) \times \rho_4^{25}$$

$$\rho_4^{25} = \text{Sp gr at } 25^\circ\text{C} \times \rho_{\text{H}_2\text{O}} \text{ at } 25^\circ\text{C}$$

Comments (P/E) INTEREST

The lower viscosity
of D.M.P., if reproduced in
the mixtures will be in
its favour

D.V.B.
29:6:49

for viscosity will be in
its favour



Mr Ward.
present in Booth.
Mr Brett will explain
11/11/26

S.P.R.I.

E.R.D.E.

Waltham Abbey

Mr Lawson,

At/o mixing ratios + nominal compositions
of CPB 329 33.

Charge	Mixing Ratio	NC	NG	DGN	DNT	TA	Gast	C. black
CPB32	$\frac{100}{23.0}$ ^{81.3} _{10.7}	46.4	39.8	-	5.7	4.7	3.4	0.1
CPB33 (1)	$\frac{100}{23.1}$ ^{81.3} _{10.7}	46.3	39.9	-	5.7	4.7	3.4	0.1
(2)	$\frac{100}{13.7}$ ^{87.9} _{12.1}	50.2	37.0	-	6.2	3.0	3.6	0.1
(3)	$\frac{100}{18.0}$ ^{84.8} _{15.2}	48.3	38.4	-	5.9	3.8	3.6	0.1

from
packing
density
all <
2% cont

Steps in calculating CPB33

	1	2	3
Packing P	1.275	1.387	1.33
Charge wt	700 gms	659 gms	299 gms
Vol	550 cc	475 cc	225 cc
Vol of propellant (if $\rho = 1.594$)	439 cc	413 cc	188 cc
Space to be filled by liquid	111 cc	62 cc	37 cc
Wt of liquid (if $\rho = 1.44$)	160 gms	89.48 gms	53.3 gms

? Since calc'd wt of liquid required = 302.7 gms
ad wt of liquid used (by difference) = 306 gms the
last figures were corrected by $\frac{306}{302.7}$

Wts of liquid corrected	161.8 gms	90.3 gms	53.8 gms
Ratios	$\frac{700}{161.8}$	$\frac{659}{90.3}$	$\frac{299}{53.8}$

I trust I have got that straightened out!
L.O.C.
22.7.49

C.P.B. 33

1
good ribbing

2
bad
muff bad ribbing

3
very bad ribbing

~~Packing Density~~

~~Packing fraction~~

~~80.1%~~

~~82%~~

~~83.5%~~

~~Solid increase~~

~~19.9% air~~

~~18% air~~

~~16.5% air~~

~~plagues 1.44 g/cc~~

~~wt higher~~

~~Volumes~~

~~S~~

~~$$\frac{19.9 \times 550}{100} = \text{vol liques}$$~~