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Technical Report

No. 168

The Compatibility of 'Loctite' Sealants with Explosives

Pembridge //

January 197

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DRIC/ (19) BR-43689 EXPLOSIVES RESEARCH AND DEVELOPMENT ESTABLISHMENT Technical Repart, Now 68 Jant Ω The Compatibility of "Loctite" Sealants with Explosives, DERDE-TR-168 by N.J. Blay E.E /Pembridge SUMMARY The explosives compatibility properties of a number of commercially obtainable sealants, marketed under the trade name "Loctite", are discussed and reported. Sand Land 12,2 11 1976 ON かか

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INTRODUCTION

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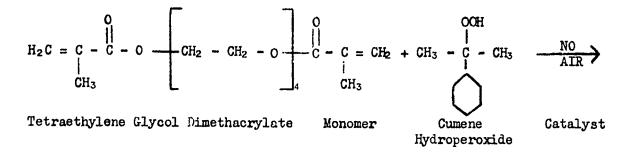
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"Loctite"⁷ sealants are anaerobic adhesives based upon acrylate acid diesters and having the general formula:

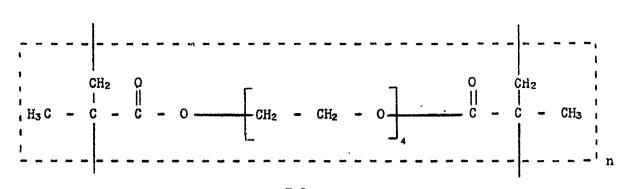
m = 1 to 8, n = 1 to 20, p = 0 or 1

The adhesives are essentially monomeric, thin liquids, which with suitable catalysts, polymerise to form a tough plastic bond when confined between closely fitting metal parts in the absence of air. Their self hardening properties are based on two factors: (1) contact with air keeps the monomeric adhesive liquid and (2) metal surfaces accelerate the anaerobic polymerisation out of contact with air. A typical composition is tetraethylene glycol dimethacrylate monomer with catalysts such as cumene hydroperoxide (2%)and accelerators such as benzoic sulphimide (0.3%). To prevent premature gelling, benzoquinones may be added as stabilisers, and various other ingredients, such as silica to alter the viscosity and dyestuffs to aid identification, may also be included.

Polymerisation or curing of the acrylate acid diesters is essentially a free-radical type addition polymerisation, viz:¹



*"Loctite", Trademark, Loctite Corporation USA, marketed by Douglas Kane Group Ltd, Swallowfields, Welwyn Garden City, Herts.





The presence of tetra functionality in the monomer can lead, of course, to crosslinking and a thermoset structure.

During the past decade these sealants have found increasing use in various items of ammunition where there has been need for compatibility with explosives, and as a result a large number of "Loctites" have been tested. It was the purpose of this report to collect all the results obtained and to present this information together with the judgements relating to explosives compatibility.

2 MATERIALS TESTED

In all cases materials are identified by the manufacturer's code name. Further information is available from the firms' published data sheets. In general there are no Government specifications controlling the chemical composition of these materials, although some element of control can be exercised by MQAD through Approved Firms Schedules. This is always an important consideration for materials required to be compatible with explosives, since assurance is required that the formulation of the material tested will not be changed without notification to the Inspecting Authority.

Readers are therefore advised to confirm with MQAD and/or ERDE that materials chosen on the basis of this report are still of the same composition.

3 METHODS OF COMPATIBILITY TESTING

3.1 Preparation of Samples

The tests were carried out mainly with the materials in the liquid state as received, but in some cases further tests were performed using the polymerised (solid) sample. In order to obtain the cured sample, a special procedure was devised. The liquid sealant was poured into a dish, approx 2.5 cm diameter by 2.5 cm deep, made of aluminium foil. Having added a small amount of stainless steel filings, between 0.1 - 0.2 g, the dish was placed in a small glass desiccator, the lid of which was fitted with a cork carrying two

taps. With both taps open, one was connected to a supply of nitrogen and the desiccator purged for 15 minutes. This was repeated twice a day, and after three days the sealant had cured to a hard solid disc. The foil having been peeled away, the sample was rasped to a powder for the tests.

3.2 <u>Methods of Testing</u>

These have already been described in a previous report on the testing of epoxy resins for compatibility with explosives.²

Tests with initiators were carried out either (a) in contact, ie the sample mixed with the initiator, or (b) in the vapour phase, ie the sample in proximity to, but not in contact with, the initiator. In the table of results the tests used are identified by (C) A for contact tests and (C) B for vapour phase.

4 <u>RESULTS</u>

The results of tests on both liquid and polymerised sealants are given in Table 1.

4.1 Compatibility with Double-Base Propellants

Only in isolated cases has incompatibility been detected by the normal methods with double-base propellants. However, as is shown by the low pH values recorded for many of these materials in Table 1, they are frequently quite strongly acidic. Because of this, approvals for their use have usually included stipulations that contact with propellants should be minimised and in some cases approval has been withheld. The materials extracted from the more acidic grades by water behave as strong acids when titrated and, because of the known catalytic action of strong acids on the decomposition reactions of nitrate esters, the compatibility of thes. "Loctites" must be regarded with some suspicion despite the satisfactory compatibility results which are usually obtained. Fortunately, the use of "Loctites" usually involves their application to a small component or area to be sealed and they are left enclosed between two surfaces with very little exposure where contact with propellants can occur.

Only in these circumstances, can approval for the use of many of the grades listed in Table 1 be given without question.

4.2 Compatibility with High Explosives

With the exception of amatol, high explosives usually appear satisfactorily compatible with "Loctites" although a degree of reactivity is often observed,

particularly with Torpex. However the same qualifications in regard to the high acidity and its effects on compatibility which are discussed in Section 4.1 apply equally to high explosives.

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4.3 Plastic Propellants

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No instance of incompatibility with the sealants has been recorded with plastic propellants typified by RD2304 and containing ammonium picrate and perchlorate. The same reservations must be made however regarding the use of those "Loctites" which are excessively acidic.

4.4 Pyrotechnics and Gunpowder

No instances of chemical incompatibility which could lead to a hazard have been recorded between pyrotechnics and the sealants. Once again however note would have to be taken of any high residual acidity in the sealants. Gunpowder has also been tested with many sealants and found to be compatible.

4.5 Initiatory Explosives

Direct contact between the sealants and most of the common initiatory explosives does not appear to introduce any serious risk of chemical action leading to explosion.

Some adverse effects should however be mentioned. Absorption of an unpolymerised liquid sealant by an initiatory explosive would be expected to cause a great reduction in sensitiveness and this combination of materials is therefore not advisable. Regard should also be taken of the acidic nature of most of these sealants. Lead azide is especially susceptible to increase in decomposition under acid conditions. This is particularly undesirable since the evolution of hydrazoic acid vapour in such circumstances is a proven cause of hazard due to the formation of sensitive azide deposits on the metal of the weapon assembly.

5 CONCLUSIONS

As a rule, "Loctite" sealants can be expected to be compatible with high explosives (except amatols), and with single-, double- and triple-base propellants, plastic propellants, pyrotechnics, gunpowder and most initiatory compositions.

Some aspects of the composition of these materials are however obscure, and clearance for compatibility with explosives cannot be assumed without confirmation that the particular grade has been tested and that its composition is

adequately guaranteed to correspond to the approved sample. The considerable acidity of some grades of "Loctite" also casts doubts on their acceptability although this is not as a rule reflected in their behaviour in compatibility tests.

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1	Twiss S B	Adhesives of the Future. Applied
		Polymer Symposium No 3.
		Interscience Publishers, NY, 1966,
		pp 455 - 488
2	Blay N J, Pembridge E F	The Compatibility of Epoxy Resins with
		Explosives.
		FRDE TR 110. July 1972

NOTE

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REFERENCES

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LOCTITE (UK) Limited expressed concern lest the references in this report to the acidity of some grades of LOCTITE could be misconstrued as indicating that these materials could be corrosive to metals. They wish to state that LOCTITE anaerobic adhesives are in no way corrosive. TABLE 1 Tests of "Loctite" Sealants

Clearance with Pyrotechnics, < < Plastic Propellents Plastic Prop RD2304 (C) Plastic Prop RD2304 (C) RD1303 Composition (C) RD1651 Composition (C) *A* Composition (C) A Plastic Prop RD2304 (C) < < **~** ~ Initiators and (0.32 ml) Lead Azide (C) A VH2 Composition (C) A 'A' Composition (C) A (0.55 ml) Lead Aride (C) A VH2 Composition (C) A 'A' Composition (C) A Gunpowder G23 (C) Lead Azide (C) A. Gunpowder G20 (C) Gunpowder G20 (C) (TH 12.0) Consumption in Stabiliser Increase 2)K) (5)K) c (25%) c (58%) н (<u>Ж</u>Е) 52K) (52K) I (55%) г (55%) ပန် ပစ္တိ Stabiliser Tests Trial Conditions Colloidal Propellants 4 weeks. 80°C 3 wegke, 80 c weeks, 80°C veeks. 80°C weeks, 80°C weeks, 80°C veeks, 80°C weeks, 80°C z = 4 ņ 4 + sc 8.81 (Carbamite) N 7.21 (Carbamite) sc 8.81 (Carbamite) sc 8.81 (Carbamite) N 7.21 (Carbamite) and Stabiliser Content Propellant 80°1 90°1 1,064 (A90) 1.06A = = Compatibilities (C = Compatible; I = Incompatible) с (666 b) с (еңор) с (1468 h) с (260 h) с (388 h) SV Test at 80°C Fcntolite (C)
(2.47 ml) Pentolite (C)
(3.38 ml) Pontolite (C) (2.46 ml) Pentolite (C) (3.40 ml) Others د (4.61 ml) c (1,52 ml) RDX/TNT 120°C High Explosives (VS Results) C (3.94 ml) с (5.06 в1) (זש 10.0t) (נו 10.94) c (ב.41 ml) Torpex 4A at 120°C с (5.03 ml) с (†.00 л.) (۲۳ 60.2) د (>12.9 ml) (> 14.2 ml) (1 = 70.5) Amatol at 100°C 7 c (2.^8 ∎ì.) C (0.72 ml) د 12 مر (0.78 مر) c (1.59 ml) (1.79 ml) င် စိုးနူ အ (aqueous extract) pH Value 5.5 4.5 6.1 6.4 2.4 3.1 5.7 liquid polymerised polymerised liquid liquid polymerised liquid "Loctite" Sealant Description Code Number and brie ٨V N æ ~ ~ m N ÷. ů

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						" (C	<u>TABLE 1 (Contd)</u> Compatibilities Compatible; I = Incompatible)	s compatible)				
"Loctite" Sealant Code Number		pH Value		Eigh E	Explosives (VS	Results)			Colloidel	Colloidal Propellants		Clearance with Pyrotechnics.
		(aqueous extract)	ę					 	ŝ	Stabiliser Tests	5	Initiators and Plastic Pronellants
Jescription			100°c	Amatol at 100 C	Torpex 4K at 120°C	at 120°C	Others		Propellant and Stabiliser Content	Trial Conditions	Increase in Stabiliser Consumption	0211991790 1790 1790 1790 1790 1790 1790 1
B poly	polymerised	5.7	(1.04 ∎1)	(TH 8.41<)	c (1. 57 ml)		Pentolite (C) (3.68 ml)	с (715 в)	sc 8.81 (Carbamite)	4 weeks.	c (52%)	Plastic Prop RD2304 (C) (0,48 ml) (unpovder G20 (C)
									EN1 90°L (Vac)	3 weeks, 80°c	c (16%)	Lead Azide (C) A RD1305 Composition (C) A RD1551 Composition (C) A 'A' Composition (C) A
CVV	lıquid	2.4	c (0.81 ml)	(נשור 14,1<) (נושור 14,1	(11 11.7)	c (4.86 ml)	Pentolite (C) (2.08 ml)	с (928 h)	N 7.21 (Carbewite)	4 vecks, 80°C	I (¥05)	Plastic Frop RD2304 (C) (0.41 ml) Lead Azide (C). A VH2 Composition (C) A 'A' Composition (C) A
polyn	polymerised	2.9			ديد c (۲۰۳۶ سا				-	=	c (23%)	
EV	lıquid	3.5	(ته ۲۰۰۱)									
WW	lıquid Dol ya erised	2.4	(م. 39 ها)	I (13.8 al)	c (5.03 ml) c	c (4.37 ml)	Pentolite (C) (2.73 ml)	(1624 h)	.N. 7.21 (Carbamite) 1.	= 0066		Plastic Frop RD2304 (C) (0.33 ml) Lead Azide (C) A VH2 Composition (C) A 'A' Composition (C) A
					(2.62 ml)						(26%)	
Screw Lock (Cat No 59)	lıquid	4 N	(1.20 ml)	I (12 + 12 - 12 - 12 - 12 - 12 - 12 - 12 -	(tm 17.4)	c (2.50 ml)	Pentalite (C) (2.08 ml)	(6) (6)	SC 8.81 N N 7.21 (Carbamite) 7.21 (Carbamite) 1.06 (1.06 (1.06 (1.06 (1.06) (1.06)	202 202 202 202 002 004 202 004 004 004 004 004 004 004 004 004 004	ဗဗ္ဗိ ဗန္တိ ဗဗ္ဗိ ဗ	Plastic Prop BD2304 (C) -(0.37 ml)

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		Glearance with Pyrotechnics, Initiators and	Flastic Fropellants	Plastic Prop RD2304 (C) (0.25 ml)				Plastic Prop RD2304 (C) (0.31 ml)				Plastic Prop RD2304 (C) (0.59 ml)			
		5	Increase in Stabiliser Consumption	(3%) (3%)	c (۱3%)	ບ ີ່ ອີ	ວ ເ	ວ (%0)	с (13%)	u 🕅	ა (ჯ ა	ر م	c (13%)	5 X	رد (ور
	Colloidal Propellants	Stabiliser Tests	Trial Conditions	4 veeks. 80°c	4 weeks. 80°C	3 WASKES	3 days. 80°C	4 veeks. 80°C	4 weeks, 80°C	3 weeks, 80°c	3 days, 80°c	4 weeks, 80°c	4 veeks, 80°c	3 weeks, 80°c	3 days. 800cs.
	Colloidal	ŝ	Propellant and Stabiliser Gontent	sc 8.81 (Carbamite)	N 7.21 (Carbawite)	90°L	CDB T.70 (2-NDPA)	sc 8.81	N 12-1	90°L	CDB CDB 1.70 (2-NDPA)	sc 8.81	(Carbamite) N 7.21	(Carbamite) FNE 1.06	(2-NDPA)
: cempatible)			SV Test So 80°C	с (1671 b)	<u></u>			c (1551 h)				с с (ч 660)	-		
Compatible; I = Incompatible)			Others	Pentolite (C) (2.32 ml)				Pentolite (C) (3.80 al)				Pentolite (C) (2.66 ml)			
(C = Comp	Results)		RDX/THT at 120°C	c (1.79 ml)				c (1.25 ml)				c (2.22 ml)			
	High Explosives (VS Resul		Torpex 4A at 120°C	C (3.71 ml)				c (2.97 ml)				с (4.59 ml)			
	High E		Amatol at 100°C	I (1m 4.81<)				1 (> 14.2 ml)				I (17.9 ml)			
		1	င အ t င င	(تھ c (0.82 میں				C (0.67 ml)				رتة 1.50 ملك)			
	DE Value	(aqueous ;		0.4				3.3				4.5			
	"Loctite" Sealant	code austoer	Description	Plastic Gacket (Cat No 65) liquid				Fipe Seal (Cat No 71) liquid				Nut Lock (Cat No 74) l:quiù			
	1 *	<u>.</u>		. O		ومذموق آماك سعاك	• Orse & Swa	.9							

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		VIERTENCE VICE FJrotechnics, Initiators and Distis Ducedlets		Plastic Prop BD2304 (C) (0.69 ml)				Pleatic Prop 202304 (C) (0.76 al)	Composition SKOHON (C)			. Plastic Prop BD2304 (C) (0.44 ml)			
		ts	Increase in Stabiliser Consumption	; (11%)	(14%) (14%)	د (و¥)	ა (ჯი ე	, o ())()	с (2Ж)	с (Жа)	ບ <mark>(9</mark>	ບ ⁽³⁵⁹⁾	وي (وي	90 0 U	ບ (ສິຍິ
	Collend 1 Propellants	Stabiliser Tests	Trial Conditions	×€\$¥34	4 wee 3. 60°C	3 .e.ks.	S S S S S S S S S S S S S S S S S S S	4 weeks, 80°C	4 veeks. 80°C	3 weeks, 80°C	3 deys. 80°C	4 veeks, 80°C	4 weeks, 80°C	3 keeke, 80°c	3 days, 80 C
	C.)] 1-14	Ś	Propeilant and Stabiliser Content	sr 8.81	N 12.7	Cerbani, e. FNE 1.06	(1.70 CDB 1.70 (2-CDPA)	sc 8.81	Caroamite)	(Carbamite) FNH 1.06	CDB CDB 1.70 (2-NDPA)	sc 8.81	(Carbamite) N 7.21	(Carbamite) FNH 1.06	(DPA) CDB 1.70 (2-HDPA)
ies "rompatible)			V Test	, " Lyl: \ 5				с (1359 h)				c (1359 h)			
Compatible;			0, 15	Pentorit			an anger yn Mannadagene	<pre>Pentolite (C) (2.07 Ml)</pre>	(0.51 ml)			Rentolits (C) (3.32 ml)			
(C = Com)	ñer 1ts)		RDX/TNT at 120°C	ر 15 روم. ^{در})				(1.36 ml)				c (2.74 ml)			
	High Explosives (VS Rev		Torpex 4A at 120°C	с (5.04 ml)			<u></u>	C (4.22 ml)				c (5.03 ml)			
	High Ex		Amatol at 100°C	I (>18.4 ml)				I (>18.5 ml)				I (>16.9 ml)			
			cE at 100°C	כ (1.21 ml)				((1= 144.0) د (0.44 ها)				c (0.94 ml)			
	outon u.	(aqueous		N, O				3.4				3.1			
	"Loctite" Sealant	Code Nurber and	Description	Retaining Compound (Cat No 75) liquid				Instant Flastic Gasket liquid				Tube Teld liquid			
		No		72				51				71			

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(C) Control (Control of States of Control of

Clearance with Pyrotechnics, Initiators and Plastic Propellants Plastic Prop RD: 304 (C)
 (0.45 ml)
 Lead Aride (C) B
 Silver Aride (2) B Plastic Prop RD2304 (C)
 (0.82 ml) Plastic Prop 2D2304 (C)
(1.04 al) Stabiliser Consumption Increase 0 3 3 0 **v** 🛞 u 👸 0 (15k) c (11%) ပန္ကိ vð აჭ ပန္တိ υĝ c (15K) υĝ Stabiliser Tests Trial Conditions Colloidal Propellants 4 weeks. 80°C weeks, 80°C weeks, 80°C 80 cr 5 **weeks.** 80 C veeks. 80°C weeks, 80°C veeks. 80°C weeks. 80°C နိုင်ငံ စိုင်ငံ စိုင်ငံ 3 days. 80 00 3 days, 80 c sc 8.81 (Carbamite) 7.21 (Carbamite) FNH 1.06 (DPA) CDB 1.70 (2-NDPA) W 7.21 (Carbamite) FNH 1.06 (DPA) CDB 1.70 (ZaNDPA) N 7.21 (Carbamite) FNH 1.06 (DPA) CDB 1.70 (2-NDPA) SC 8.81 (Carbamite) sc 8.81 (Carbamite) and Stabiliser Content **Propellant** Compatibilities (C = Compatible; I = Incompatible) с (942 h) с (1383 h) с (1272 h) Test နိုင် စစ် sv Pentolite (C) (2.08 ml) EDCX (C) (0.91 ml) Pentolite (C)
(2.11 ml) Pentolite (C)
(1.55 ml) Others C (1.89 ∎1) c (1.29 ml) c (1.88 ml) BDX/TNT at 120°C High Explosives (VS Results) د (۴.60 ml) د (4.62 ها) с (4.60 ml) Torpex 4A. at 120°C I (>17.6 ml) (T= 1,51<) (T= 20.0) (>16.3 ml) Amatol at 100°C н с (0.68 ш1) c (۱.41 ml) စ်န ရ ဂ pH Value (aqueous extract) 3.3 0.4 2.4 liquid Stud Lock (Cat No 41) liquid liquid "Loctite" Sealant Code Number Description pue Loctite 270 Weld Seal <u>ب</u> 9 5 , M

	-	Stabiliser Tests Clearance with Pyrotechnics,	Increase in Stabiliser Consumption		800 6 (3%)			4 weeks, C Plastic Prop RD2304 (C) 80°C (15%) (0.45 ml) 4 weeks, C Lead Azide (C) B	(* v (* v (*) * v * v *)
	Colloidal Propellants	Stabili	Propellant and Stabiliser Cond Content	SC 4 W 8.8~ 2 (Carbannite) 4 W 7.21 8 (Carbannite) 3 W 1.06 8 1.06 8 1.06 3 4 CDB	()				(Carbamite) 0 (Carbamite) 3 1066 8 (DPA) 3 CDB 3 CDB 3 3 d
Compatibilities = Compatible; I = Incompatible)		-	SV Test - SV Test - SOC	Pentolite (C) C C (1743 h)				Pentolite (C) I (2.49 ml) (435 h) PETN (C) (0.44 ml)	
Compa (C = Compatible	Results)		RDX/TNT at 120°C	ر (۲۰۰۴ (۲۰۰۲)		c (ב.72 ml)	c (3.08 ml)	C (2.40 ml)	
	High Explosives (VS Regults)		Torpex 4A at 120°C	ر لته 61 میل (بد 61 میل				с (4.86 ml)	
			Amatol et 100°C	I الله عالية (الله عالية)				I (6.75 ₪1)	
			00 00 00 00	c.68 ਜ਼) (0.68 ਜ਼)		c (1= 16.0)	(נה יב.ו)	c (0.73 ml)	
	pH Value (aqueous extract)			ж. 4		2.7	ć	5.5	
	ter ford Horiton II	Code Number	4.74 Description	Refrigerant Sealant lıquid		Loctie 308 Lapact Resistant Adhesive liquid	Loctite 312 (Adhesive/Accelerator) cured 2 ⁴ h at RT	Locquic Primer T liquid	
		ž	2 ·	ಭ		19	8	۶.	

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(Section)

					(C = Comp	Compatibilities Compatible; I = Ince	bilities I = Incompatible)				
UT, set toll Seal ant			I High E	High Explosives (VS Pesults	Pesults)			Collordal	Colloidel Propellants		. Marance with Benchachnics
Code Number	pH Value . (aqueous							σ	Stabiliser Tests	83	Visuance min til visuance, Initiators and Discrete Deservisionte
Description	extract)	CE at CE	Amatol at 100°C	Torpex 4A at 120°C	RDX/TWT at 120°C	Others	SV Test at 80°C	Propellant and Stabiliser Content	Trial Conditions	Increase in Stabiliser Consumption	231100-1-1-1-2-2-2-2-2-2-2-2-2-2-2-2-2-2-2
Locquic Activator Batch E198 liquid (activator diluted 1 part in 20 with TCE)	5	с. 86 mJ) (0.86 mJ)		د مع (2.97 هد)				SC 8.81 (Carbamite) 7.21 (Carbamite) FNH 1.06 (DPA)	4 4 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	υ <mark>≶</mark> υ (36 υ (36) (30 (36) (30)	Flastic Prop RD2304 (C) (0.27 ml)
Sealant AVX liquid " CVX " " D " Locquic Retaining Compound (liquid) Locquic Primer N (liquid)	∾										Lead Azide (C) A Lead Azide (C) A

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DOCUMENT CONTROL SHEET

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(Notes on completion overleaf)

Overall security classification of sheet

(As far as possible this sheet should contain only unclassified information. If is is necessary to enter classified information, the box concerned must be marked to indicate the classification eg (R),(C) or (S)).

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l. FRIC Reference (if known)	2. Originator's Refe ERDE TR 168	rence 3. Agency Reference	4. Report Security Classification UNLIMITED
5. Originator's Code (if known) 445050		rate Author) Name and Locatio search and Development	
5a.Sponsoring Agency's Code (if known)	6a.Sponsoring Agency	(Contract Authority) Name an	d Location
7%. Title COMPATIBILITY	OF "LOCTITE" SEAI	LANTS WITH EXPLOSIVES	_
7a.Title in Foreign La .are	(in the case of trans	lations)	
76.Presented at (for conferen	ce papers).Title, plac	ce and date of conference	
8. Author 1.Surname, initials	9a Author 2	9b Authors 3, 4	10. Date pp ref
Blay N J	Pembridge E F		1.1974 12 2
11. Contract Number	12. Period	13. Project	14. Other References
15. Distribution statement		<u> </u>	
Descriptors (or keywords)			
Sealers, Compatibilit	y, Explosives, Lo	octite (R)	
		continue on separate p	(TEST) iece of paper if necessary
		erties of a number of a e trade name "Loctite",	

Technical Report No 168	Technical Report No 168
Explosives Research and Development Establishment	Explosives Research and Development Establishment
THE CONFATBLITY OF "LOCTITE" SEALANTS WITH EXPLOSIVES	THE COMPATIBILITY OF "LCOTITE" S.M.ANTS WITH EXPLOSIVES
Blay N J, Pembridge E F	Blay N J, Pembridge E F
January 1974	January 1974
16 pp. 1 tab. no figs	16 pp, 1 tab, no figs
The explosives compatibility properties of a number of corrercially	The explosives compatibility properties of a number of commercially
obtainable sealants, markated under the trade name "Loctite", are discussed	obtainable sealants, marketed under the trade name "Loctite", are discussed
and reported.	and reported.
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