63-4-1

GIIIIII ID

GENERAL DYNAMICS | CONVAIR

Report No. 8926-158

Material - Adhesives - Structural - Metlbond 4021

Effect of Genitian Violet Dye on Tensile Shear Strength

V. Lintvedt, M. C. Miyaji, Sutherland, W. M.

26 July 1957

Published and Distributed
under
Contract AF33(657)-8926

Post Office Box 1950, San Diego 12, California 296-6611
Material Post Office Box 2071 273-8000 | Accounting Post Office Box 510

Report No. 8926-158

Material - Adhesives - Structural - Metlbond 4021

Effect of Genitian Violet Dye on Tensile Shear Strength

Abstract:

The addition of 0.1 per cent genitian violet to Metlbond 4021 adhesive primer (Narmco Resins and Coatings Inc.) was evaluated with respect to its effect on the strength of metal to metal bonds. Tensile-shear tests made in accordance with Specification Mil-A-5090B were made to compare tinted with un-tinted primers used in the preparation of joints which were bonded at 275°F under a pressure of 100 psi. The comparative test results showed that the dye did not adversely affect the Metlbond 4021 primer.

Reference: Lintvedt, V., Miyaji, M. C., Sutherland, W. M., "Tensile-Shear Strength of Tinted Metlbond Primer," General Dynamics/Convair Report MP 56-39, San Diego, California, 26 July 1957. (Reference attached).

CONVAIR
A DIVISION OF GENERAL DYNAMICS CORPORATION
SAN DIEGO

STRUCTURES-MATERIALS LABORATORIES

REPORT 56-39
DATE 7-26-57
MODEL 8-10

TITLE

REPORT NO. 56-39
TENSILE-SHEAR STRENGTH OF
TINTED METLSONL PRIMER

MODEL: 8-10

CONTRACT NO.: AF33(600)-23563

PREPARED BY V. Lintvedt
V. Lintvedt

GROUP MATERIALS & PROCESSES LAB.

CHECKED BY M. C. Miyaji
M. C. Miyaji

REFERENCE

CHECKED BY W. M. Sutherland
W. M. Sutherland,
Group Engineer

APPROVED BY E. F. Strong
E. F. Strong,
Chief of Test Laboratories

NO. OF PAGES 10

NO. OF DIAGRAMS 8

REVISIONS

NO.	DATE	BY	CHANGE	PAGES AFFECTED

FORM 1612A-4

rn

REPORT NO. 56-39
TENSILE-SHEAR STRENGTH OF TINTED METLBOND PRIMER

INTRODUCTION:

Shop personnel suggested the use of dye in adhesive primers for easy identification of primer in the liquid state and on primed parts before bonding. Preliminary tests by Narmco indicated that gentian violet did not adversely affect the bond strength of their Metlbond 4021 system.

OBJECT:

To determine the practicability of using 0.1% gentian violet in Metlbond 4021 adhesive primer to facilitate identification, inspection, and control of the spraying process.

CONCLUSION:

Tinting of Metlbond 4021 Type II primer with 0.1% gentian violet does not adversely affect the bond strength.

It is feasible to use this dye to facilitate application, identification, and inspection of Metlbond primer.

TEST SPECIMEN:

Material - .064" 2024T3 Alclad
Dimensions - 1/2" overlap tensile shear as specified in MIL-A-5090B
Tape - Narmco's Metlbond 4021 type I, Batch 146 Roll-13 (Later test groups M, N, and O were bonded with Batch 211 Roll 6)
Surface Preparation - All samples except those groups listed below cleaned and Alodized (600) in Dept. 31 processing tanks according to Convair Spec. 8-07308. Group D-2 was cleaned by immersion in water - sulfuric acid - sodium dichromate (30-10-1 parts by wt.) cleaning solution and was not Alodized. Groups M through R were cleaned and Alodized in laboratory solutions in the Materials and Processes Laboratory.

Bonding Procedure - All groups except the last six (M through R) placed in a press which was at 200°F. or lower and allowed to heat up to the bonding temperature under pressure.
The last six groups were placed in a press which was preheated to 275°F. and the 100 psi pressure quickly applied. The silicone rubber strips were taped to the bottom of the panels so that very little heat was applied to the panels until they contacted the upper platen.

TEST PROCEDURE:

Tensile-shear testing was done on a Tinius-Olsen machine with a tank adaptor to provide a temperature controlled bath for low and elevated temperatures.

Tensile-shear creep tests were conducted by the use of spring loaded tension applying levers placed in an oven. Creep measurements were made by microscopic examination (using a calibrated eyepiece) of lines scribed across the bond on the edge of the overlap. A direct reading extensometer was made which operates on a zero gauge length and permits reading of deformation at any time. The values obtained with this extensometer were compared with those of the microscope. Specimens were selected at random for each test.

Tests of groups J, H, and L were added to the original tests to furnish more data comparing tinted and untinted primers in low temperature tensile shear tests.

DISCUSSION OF RESULTS:

The gentian violet provided sufficient color to easily identify the primer and showed some color change in prime baking.

The direct reading extensometer values differed from the microscope readings by 0.7 mil. In a subsequent test, play developed between the supporting pins and their bearings. This resulted in a discrepancy of two mils.

Omitting of Alodized surface treatment in the case of group D-2 produced high -67°F. tensile shear values. This is further evidence that the gentian violet does not adversely affect the bond.

Data shown in Table IV indicates that with a good sample of tape, carefully controlled processing solutions, and a desirable bonding cycle a very high shear strength at -67°F. can be attained. There is no significant difference in the tinted and the untinted prime in the results of these salt spray and humidity exposure tests.

TABLE I

Tensile Shear Results Using Tinted Metlbond Primer

Group A Tinted Test Temp. -67°F.	Group B Tinted Test Temp. -67°F. 30 Days Salt Spray	Group C Tinted Test Temp. -67°F. 168 Hrs. of 100% Humidity
PSI	PSI	PSI
1510	2005	2250
2115	1540	2165
2210	2215	1845
2150	1960	2040
2270	2115	1625
2160	1885	2690
2165	1645	2000
1960	1710	2115
Ave. 2068	Ave. 1884	Ave. 2091

Group D Tinted Room Temp. Test	Group E Tinted Test Temp. +300°F.	Group J Tinted Test Temp. -67°F.
PSI	PSI	PSI
4565	1820	2155
4460	2020	2257
4525	1765	2068
4640	1780	2529
3970	1535	Ave. 2252
4640	1845	
4690	1805	
4400	1835	
Ave. 4486	Ave. 1801	

Group D-2 (Special Surface Treatment
Tinted FPL Cleaning)
Test Temp. -67°F.

PSI
3940
3880
1860
4235
2120
4314
4088
3817
Ave. 3544

TABLE II

Tensile Shear Results Using Untinted Metlbond 2021 Primer

Group G Test Temp. -67°F. 30 Days of Salt Spray PSI	Group H Test Temp. -67°F. 168 Hours 100% Humidity PSI	Group L Test Temp. -67°F. PSI
1485	2900	2149
1330	3385	2070
2220	2170	2772
2185	2170	2592
2165	2650	Ave. 2396
1325	3450	
1715	1800	
1970	3430	
Ave. 1799	Ave. 2744	

TABLE III

TENSILE SHEAR CREEP

Load --- 900 Psi
Test Temperature - 300°F.
Time under load and temperature - 192 hours

TINTED GROUP F		UNTINTED GROUP I	
Sample No.	Creep Deformation Mils	Sample No.	Creep Deformation Mils
1	7.	1	8.5
2	6.5	2	5.5
3	9.5	3	6.5
4	10.5	4	8.
5	6.5	5	6.5
6	11.5	6	7.
7	9.5	7	7.
8	Sample broke under load	8	6.5
	Ave. excluding No. 8 - 8.7		Ave. 6.9

Extensometer Readings for No. 6 of Group F Above

Time In Oven	Deformation Mils.
15 min.	6.0
1 hour	10.0
16 hours	11.7
72 hours	12.0
192 hours	12.2

TABLE IV

Results of Tensile Shear Tests At -67°F. Using Lab Alodine And A Preheated Press

CONTROLS

Untinted M	Tinted N
3231	2577
2735	2696
3577	2240
3569	3840
3885	4587
4069	4078
3942	4060
4510	2304
3404	2235
3185	3814
4558	3550
2406	4010
3283	4333
4029	4215
Ave. 3613	Ave. 3467

30 Days Salt Spray Exposure

Untinted Q	Tinted R
2844	4276
3185	4571
4414	4596
3038	2935
3410	4692
3762	4414
3057	3324
3219	3555
4706	2455
3010	4425
3693	3119
3882	2718
3381	2846
2816	4150
4379	
4187	
Ave. 3561	Ave. 3720

Tested After 168 Hours Exposure to 100% Relative Humidity

Untinted O	Tinted P
2462	3933
2157	4124
4471	3733
3952	4585
2580	3943
4385	4192
3490	4077
3353	4297
3685	2129
4904	2510
2906	2564
4556	2218
2790	2510
2631	2337
3514	4198
4317	4371
2088	3095
4269	3897
3728	2933
3943	4305
3913	2760
4667	4210
4703	3077
4208	4178
4447	2202
4752	4466
4654	2058
4314	4602
	4706
Ave. 3825	Ave. 3494

Figure 1.

TENSILE SHEAR STRENGTH OF BONDS USED TINTED AND UNTINTED PRIMER

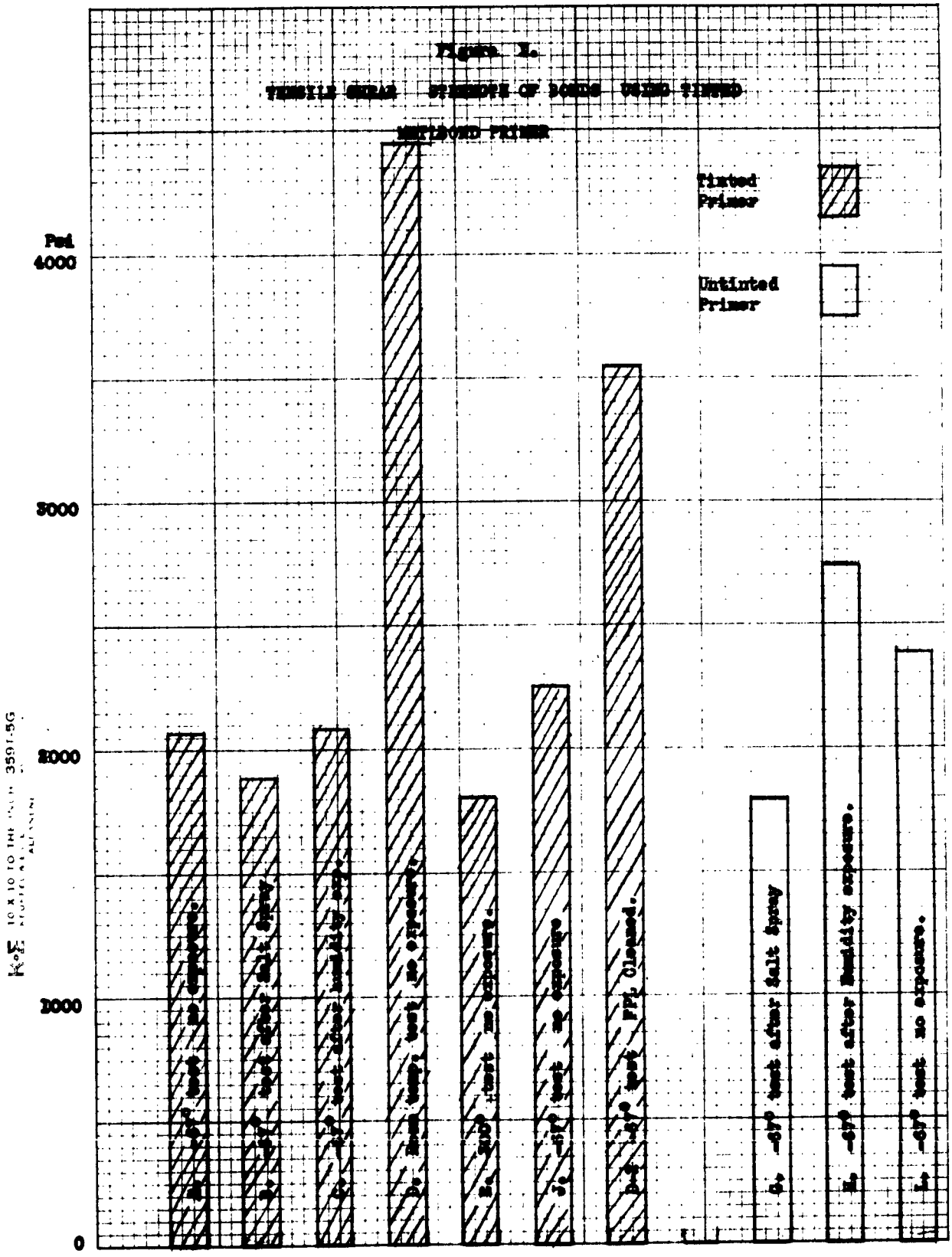


Figure 2a.

Tensile Shear Creep Tests of Tinted and Untinted

Metlbond 4021 Type II

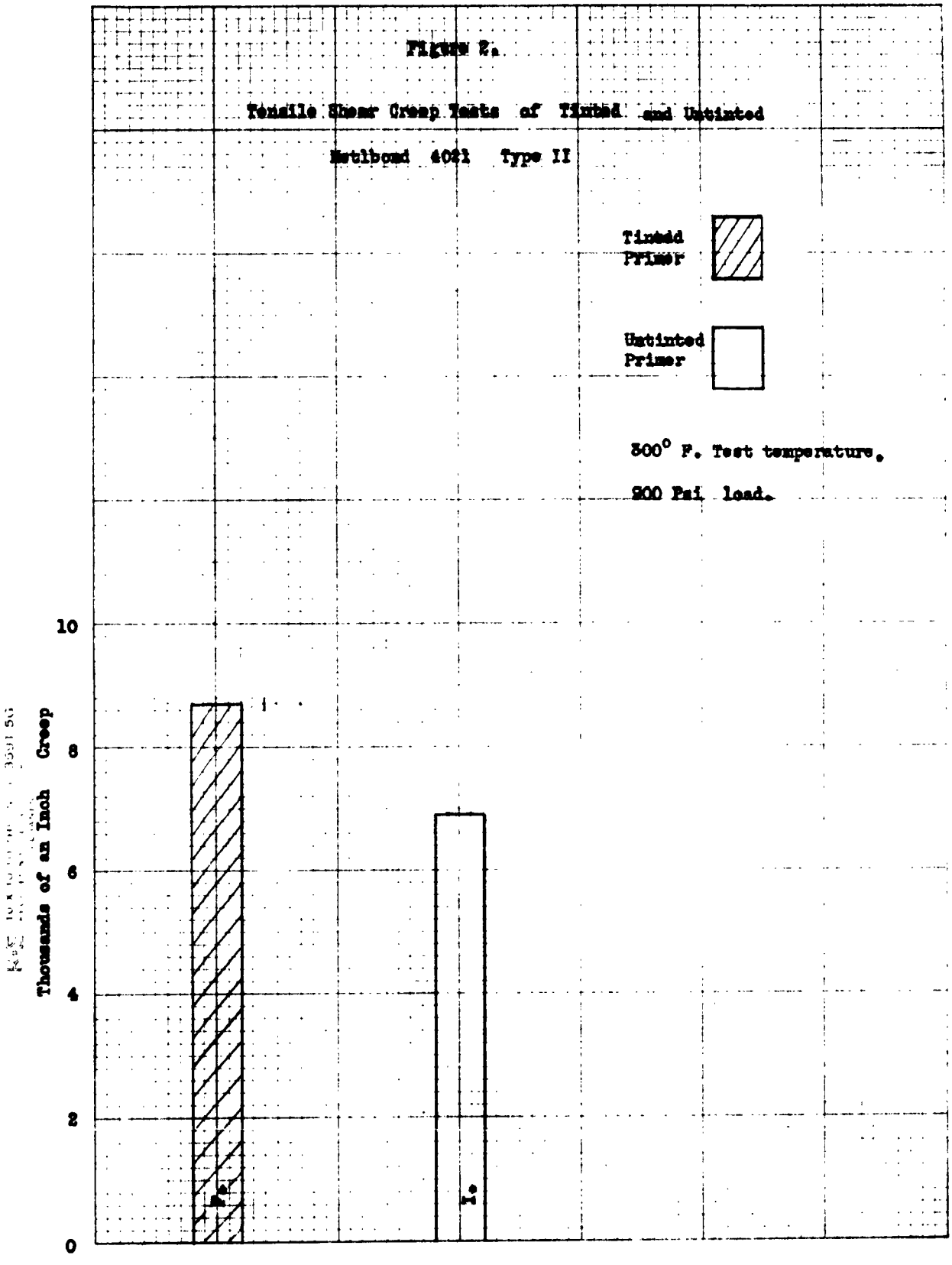


Figure 8

ALCLAD Tensile Shear Tests.

Aladdized In Test Laboratory

Bonded by "Hot Press Method"

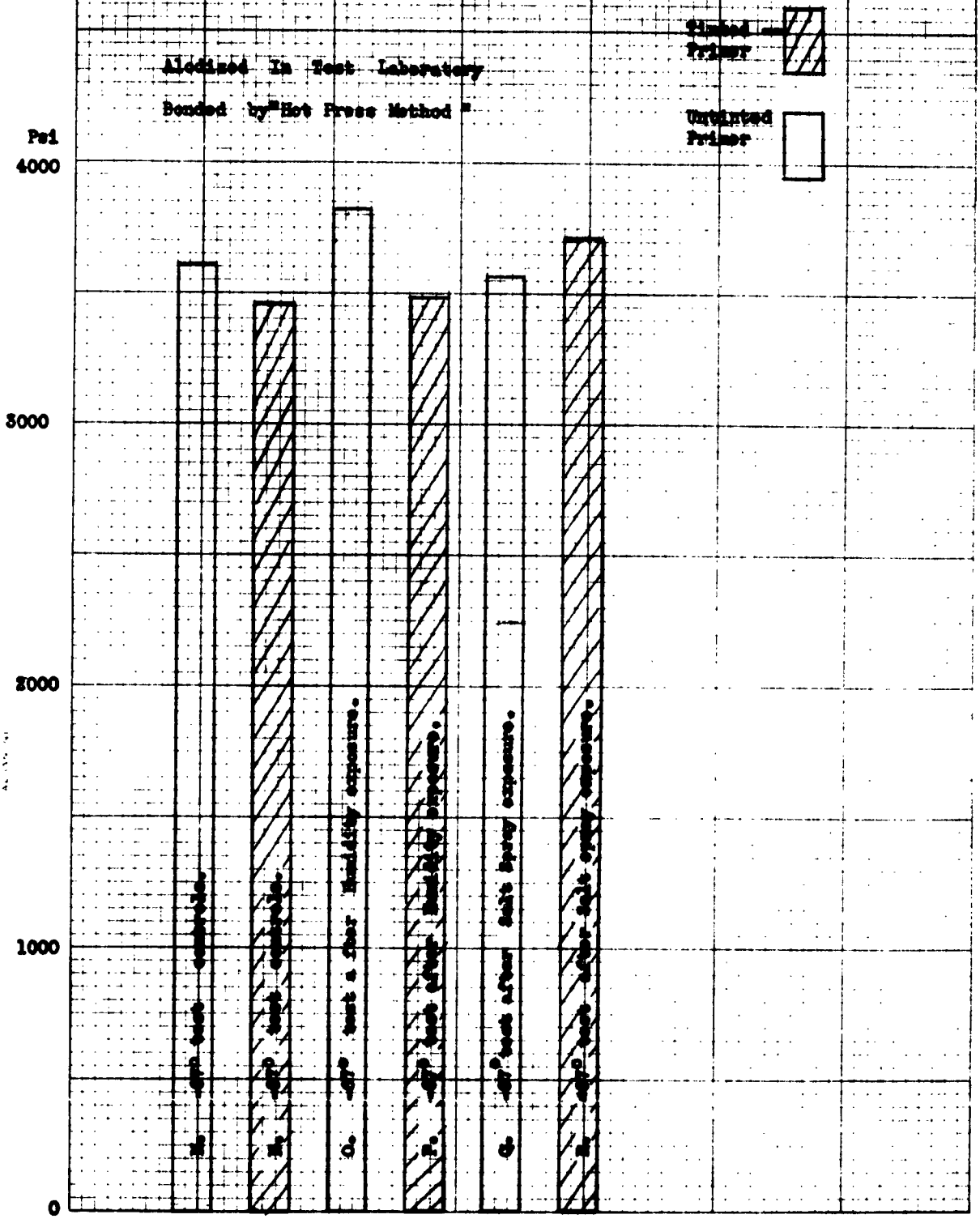
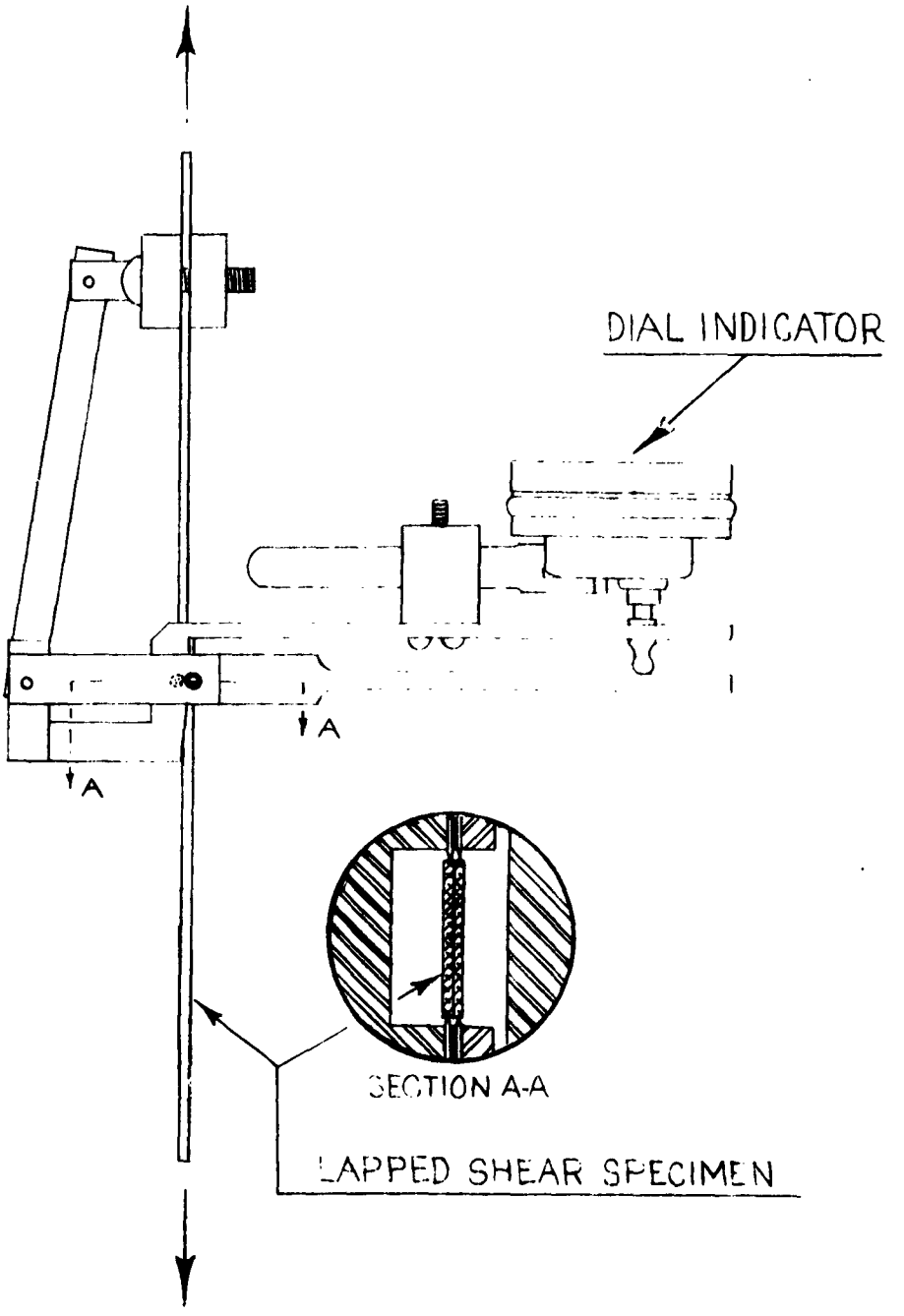


Figure 4.



" Zero Guage Length" EXTENSOMETER