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COMPILATION OF GENERAL DYNAMICS/CONVAIR

UNPUBLISHED MATERIALS INFORMATION

U.S.A.F. Contract AF33(657)-8926

Project No. 7381

Task No. 738103

Progress Report

1 March 1963

General Dynamics/Convair
San Diego 12, California

**COMPILATION OF GENERAL DYNAMICS/CONVAIR
UNPUBLISHED MATERIALS INFORMATION**

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NOTICE

This document may not be reproduced or published in any form in whole or part without prior approval of the Government. Since this is a progress report, the information herein is tentative and subject to changes, corrections and modifications.

FOREWORD

This report was prepared by General Dynamics/Convair under U.S.A.F. Contract AF33(657)-8926. This contract was initiated under Project No. 7381, Task No. 738103. The work is administered under the direction of Materials Central, Directorate of Laboratories, Aeronautical Systems Division with Mr. George C. Young acting as project engineer.

This report covers the period of work from December 1, 1962 to March 1, 1963.

The work described in this report was conducted by the Structures Engineering Group, General Dynamics/Convair with Mr. C. W. Alesch acting as project engineer.

ABSTRACT

Approximately eight hundred individual test reports have been screened for pertinent content: about three hundred individual reports are in process for compilation. One hundred and thirty-one reports have been reviewed and are in various stages of issuance. Tabulations outlining subjects and listing report titles are given.

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COMPILATION OF GENERAL DYNAMICS/CONVAIR UNPUBLISHED MATERIALS INFORMATION

Scope

Approximately eight hundred individual test reports generated from January 1, 1957 to the present by the materials and processes, structural, thermodynamic, dynamic, electronic component reliability, and process control facilities at General Dynamics/Convair have been screened. Those reports dealing with service, systems, structural and proprietary items are withheld from this compilation. In addition those reports in which materials are not described by any means other than identification symbols, or are so inadequately described that file search and vendor inquiry are unavailing, also are screened out. Approximately three hundred individual reports descriptive of materials, their characteristics, and behavior in various environments are presently being processed for compilation.

Sponsorship of Information

Those reports included in the compilation have resulted in part from materials test and study programs carried out in connection with Air Force, Navy Bureau of Weapons and General Dynamics/Convair funded vehicle and systems construction. In addition, the compilation includes reports pertaining to company sponsored materials test programs undertaken to obtain engineering and manufacturing information pertinent to the utilization of materials. In a few instances internal or external proprietary interests require the holding back of information. Information developed under contract with Air Force and Bureau of Weapons contractors outside the General Dynamics/Convair organization likewise is withheld from compilation in order to allow the buyer option to release information.

Content

The reports being compiled include discussions pertaining to adhesives, metals and alloys, finishes and coatings, fuels and lubricants, graphite, insulations, laminates and plastics. These reports generally deal with mechanical, physical, electrical and thermal characteristics of various materials, and with their resistance to various environmental conditions. An initial listing of the various subject materials is given in Table 1.

Compiled Data

Topical information pertinent to the subject matter of the one hundred and six reports already incorporated into compilation are listed in Table 2. This tabulation gives cross reference for abstract and reference reports. Notations in this table indicate the status of each report at time of writing. For convenience abstract sheets pertaining to each report distributed are appended.

TABLE 1 (Cont.)

SUBJECT INDEX

Subject	Report No.
1. Adhesives	8926-014, -025, -026, -028, -032, -037, -053, -054, -055, -059, -089, -091, -092, -109, -117, -120, -122, -126
2. Aluminum	8926-010, -018, -022, -040, -058, -073, -074, -108, -124
3. Atmospheric Dust	8926-110
4. Brazing Alloys	
4.1 Titanium	8926-024
5. Ceramics	8926-101
6. Columbium	8926-010
7. Corrodents and Corrosion Products	8926-106
8. Elastomers	8926-086
9. Fabrics	8926-107
10. Finishes and Coatings	8926-006, -017, -029, -033, -034, -038, -041, -042, -051, -056, -060, -066, -068, -069, -071, -075, -078, -079, -083, -088, -093, -094, -098, -104, -105, -111, -119
11. Fuels and Lubricants	8926-023, -027, -065, -080
12. Graphite	8926-011
13. Hull Bottom	8926-112
14. Insulation	
14.1 Thermal	8926-008, -020, -050, -123
14.2 Sound	8926-090, -125

TABLE 1 (Cont.)
SUBJECT INDEX

	Subject	Report No.
15.	Laminates	
15.1	Fiberglass	8926-015, -049, -061, -067, -072, -076, 081, -096, -097, -100
15.2	Nylon	8926-031
15.3	Cotton	8926-031
15.4	Dacron	8926-031
16.	Magnesium	8926-010, -043
17.	Nickel Base Alloy	8926-003, -004, -005, -009, -010, -021, -036, -084, -103, -128
18.	Nickel-Cobalt-Base Alloy	8926-048
19.	Sealants	8926-077, -115
20.	Steel	
20.1	Alloy	8926-062, -085
20.2	Stainless	8926-001, -010, 012, -016, -021, -114, -127
20.3	Structural	8926-019
21.	Structure	
21.1	Fuselage, Corrosion	8926-039
22.	Titanium	8926-002, -010, -035, -044, -045, -046, -047, -052, -057, -063, -064, -070, -099, -102, -113, -116, -118, -121
23.	Uranium	8926-013
24.	Welding Electrodes	8926-095

TABLE 2

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-001 ***	Material - Stainless Steel - Armco 17-7 PH. Effect of Various Con- ventional Heat Treatments on Stress Corrosion Resistance.	MP 58-271	Stress Corrosion in 17-7 PH Sheet in Various Conditions of Heat Treatment
-002 ***	Material - Titanium Alloy - Ti 13V-11Cr-3Al (B120 VCA) Strength and Driving Character- istics of Cold Headed Rivets.	MP 58-262	Cold Headed Rivets of B120 VCA Titanium Alloy.
-003 ***	Material - Nickel Base Alloy - Hastelloy R-235. Effect of 1500 °F Exposures on the Mech- anical Properties of 10% Cold Worked Hastelloy R-235.	MP 58-261	Effect of Exposure Time at 1500 °F on the Room Temperature Properties of Hastelloy R-235 with 10% Cold Work.
-004 ***	Material - Nickel Base Alloy - Hastelloy R-235 and Haynes Alloy No. 25. Mechanical Properties of Welded and Riveted Joints.	MP-58-233	Element Tests of Alloys for 1500 °F Service.
-005 ***	Material - Nickel Base Alloy - Hastelloy R-235. Bauschinger Effects.	MP 58-290	Elimination of Bauschinger Effect in 10% Cold Worked Hastelloy R-235.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-006 ***	Material - Coatings and Finishes - Heat Treat Protective - Titanium Alloys.	MP 58-309	An Evaluation of Coatings to Protect Titanium Alloys During Heat Treatment.
-007 ***	Material - Steel - Heat Resistant - Allegheny-Ludlum D-979. Spot Weld Strength.	MP 58-384	Spot Weld Strength of D-979 Steel.
-008 ***	Material - Insulation - Thermal - Silicone Rubber Foam, Fiberglass Batting Composite, Epoxy Bonded.	MP 58-211	Thermal Conductivity Measurements of Various Materials.
-009 ***	Material - Nickel Base Alloy - J 1650, Rene 41 and Hastelloy R-235. Elevated Temperature Mechanical Properties.	MP 59-217	Elevated Temperature Mechanical Properties of J 1650, Rene 41 and R-235 High Temperature Alloys.
-010 ***	Material - Aluminum, Columbium, Magnesium, Nickel Base, Stainless Steel and Titanium Alloys. Effect of Hydrogen Environments at 400° to 2400°F.	MP 60-204	Preliminary Report on Hydrogen Compatibility (Screening Tests of Various Alloys).
-011 ***	Material - Graphite - Resin Bonded with Metallic or Non-Metallic Inorganic Additions. Effect of Composition and Processing Variables on Mechanical and Thermal Properties	MP 59-421	Resin Bonded Graphite Systems with Metallic and Non-Metallic Inorganic Additions.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-012 ***	Material - Stainless Steel - Allegheny-Ludlum AM-350 and AM-355, and Armco PH 15-7 Mo. Stress Corrosion Cracking Behavior	MP 58-469-1	Stress Corrosion Properties of AM-355, AM-350, and PH 15-7 Mo Stainless Steel Sheet.
-013 ***	Material - Uranium - Depleted, Pure and Alloyed (2% Molybdenum). Galvanic Corrosion Behavior in Aqueous Salt Solutions.	MP 60-085	Corrosion Characteristics of Pure Depleted Uranium and Pure Depleted Uranium Alloyed with 2% Molybdenum.
-014 ***	Material - Adhesive - Vinyl Fabric. Engineering and Process Characteristics.	MP 61-092	An Appraisal of Decorative Vinyl Trim Adhesive Bonding.
-015 ***	Material - Fiberglass Laminate - Filament Wound for Radomes.	MP 58-455	Mechanical and Physical Properties of Filament Wound Fiberglass Radome Materials.
-016 ***	Material - Stainless Steel - Armco PH 15-7 Mo. Effect of Chemical Milling on Mechanical Properties.	MP 57-207	Properties of Chem-Etched PH 15-7 Mo Sheet.
-017 ***	Material - Coatings and Finishes - Porcelain Enamel and Organic. Non-Reflecting Vacuum Tank Interior Finishes.	MP 61-085	Evaluation of Non-Reflecting Aluminum Finishes for Interior of Vacuum Tank.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-018 ***	Material - Aluminum Alloy - 2014-Dynapak and Precision Forgings. Mechanical and Fatigue Properties.	PCL-84	Dynapak Forged Gas Tight Corner - Comparison Study.
-019 ***	Material - Structural Steel - United States Steel Corporation T-1 and ASTM A-201. Strength of Welded Joints.	SL 59-433	Dynapak Versus Present Parts, Bending Fatigue Comparison Tests.
-020 ***	Material - Insulation - Thermal - Fluroelastic Rubber, Silastic Rubber, Impregnated Fiberglass, and Cork.	MP 58-440	Mechanical Tests of Welded Joints in USS T-1 and A-201 Steels.
-021 ***	Material - Stainless Steel - Nickel Base Alloy - 410, A-268, 17-7 PH, PH-15-7 Mo, AM 350, Incoloy 901 and Inconel X. Shear Strength of 100° Countersunk Head Rivets.	MP 58-440 Add. 1	Fusion Welded ASTM A-201 Steel Plate.
-022 ***	Material - Aluminum Alloy - 5052- Honeycomb Core. Corrosion Characteristics.	RT 58-149	Evaluation of Thermal Insulating Materials for Aluminum Structures.
		MP 58-469	Shear Strength of 100° Head Rivets of 410, A-268, 17-7 PH, PH 15-7 Mo and AM 350 Stainless Steels, Incoloy 901 and Inconel X.
		-MP 60-274	Corrosion of Honeycomb Core.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-023 ***	Material - Aviation Fuel - Additives - Anti-Static - JP4 with Shell ASA-3 and Esso WS-3966.	MP 61-164	Anti-Static Fuel Additive Evaluation Program.
-024 ***	Material - Brazing Alloys - Titanium Alloy Joining. Flow- ability, Joint Ductility, and Cor- rosion Test Screening.	MP 59-115	Brazing Titanium By Experimental Alloys.
-025 ***	Materials - Adhesives and Cements- Rubber Base and Liquid Polymer Base - Bostik 4585 (B. B. Chem- icals Co.) and PR 1201Q (Products Research Corp.). Electrical Characteristics.	438- Electrical Component Reliability Group	Evaluation of Electrical Characteristics of PR 1201 and Bostik 4585 Plastic Bonding Materials
-026 ***	Material - Adhesives - Structural - Minnesota Mining and Manufacturing Co. AF41, AF202, AF-204 and XS 909844, and Narmco Resins and Coatings Co., Narmco 406. Fluid and Sonic Fatigue Resistance and Flexural, Tensile and Peel Strength.	MP 60-137	Test of Structural Adhesives to Standards of MIL-A-25463. Sonic Fatigue Tests - Anti-Shock Floor Panels. Ambient and -67 °F Environ- ments.
-027 ***	Material - Fuels and Lubricants - MIL-L-7808 Lubricant. Decompo- sition Products.	MP 60-137-2 MP 60-255	Sonic Fatigue Tests Anti-Shock Body Floor Panels. Ambient and -67 °F Environments. Oil Decomposition Products in Engine Bleed Supply.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-028 ***	Material - Adhesives - Structural - Teflon to Metal Bonding - Eastman Chemical Products Co. No. 910, Raybestos-Manhattan Inc. Ray Bond R 86004, Rubber and Asbestos Corp. Bondmaster M 648T, Minnesota Mining and Manufacturing Co. EC-1300 and EC 1751/EC 1752, and Narmco Resins and Coatings Co. Narmco 3119. Tensile Shear and Peel Strength.	MP 61-086	Tensile Shear and Peel Strength Tests of Bonded Teflon Slide Blocks for Supersonic Seat.
-029 ***	Material - Coatings and Finishes - Organic-Primers, Corrosion Inhibiting - Lacquer and Epoxy Resin Vehicle - Zinc Chromate Pigment. Chromate Leaching Under Weathering Conditions	MP 61-052 MP 61-052 Add. 1	Leaching of Chromate From Aluminum Primers Under Accelerated Weathering Conditions - Investigations Using Radio- active Tracers. Leaching of Chromate From Aluminum Primers Under Accelerated Weathering Conditions - Investigation Using Radio- active Tracers. Coatings, Epoxy, Skydrol Resistant and Corrosion Preventative.
-030 ***	Material - Laminate-Nylon Base- Phenolic Resin - Formica YN-25. Electrical Characteristics	0-03021 440- Electronic Component Reliability Group.	Evaluation of Electrical Characteristics of Formico YN-25 Dielectric Material.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-031 ***	Materials - Laminates - Plastic - Cotton Base Phenolic (Westinghouse Corp. Micarta), Cotton Base Epoxy (Bloomington Rubber Co. LP-138), Nylon Base Epoxy (General Dynamics/Convair), and Dacron Base Epoxy. Closed System Gas Pressures at 300 and 325 °F.	MP 60-247	Comparative Measurements of Gas Pressure Exerted By Low Density Reinforced Plastics in Closed Systems at 300 and 350 °F.
-032 ***	Material - Adhesives - Structural - Narmco Manufacturing Co. Metalbond 406. Tensile Strength and Fluid Resistance.	MP 59-409	Preliminary Evaluation of Narmco's Metalbond 406 Adhesive System.
-033 ***	Material - Coatings and Finishes - Chemical Conversion Films. Corrosion Resistance, Electrical Conductivity and Adhesion Characteristics.	MP 59-194	Evaluation of Chemical Conversion Films for Aluminum Alloys.
-034 ***	Material - Coatings and Finishes - Organic - Zinc Chromate Primers for Aluminum. Moisture Resistance Under Alternate Freezings and Thawings.	MP 59-113	Freeze Cycle Test - Various Finishes in Continuous Moisture.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-035 ***	Material - Titanium - Ti 5Al-2 $\frac{1}{2}$ Sn Alloy (A 110 AT). Heat Treatment Relief of Bauschinger Effect.	MP 59-173	Effect of Stress Relieving on Formed A 110 AT Titanium Alloy Sheet.
-036 ***	Material - Nickel Base Alloy - Heat Resistant - Hastelloy R-235. Spot Weld Strengths.	MP 59-205	Properties of Resistance Spot Welds in Hastelloy R-235 Alloy.
-037 ***	Material - Adhesives - Structural - Narmco Manufacturing Co. Narmco 3135. Skydrol 500 Fluid Resistance.	MP 59-269	Tensile Shear Strengths of Narmco 3135 Resin After Immersion in Skydrol 500 Fluid.
-038 ***	Materials - Coatings and Finishes - Metal Spray Coatings for Aluminum. Effects of Aluminum Alloy Metal Sprayed Overlaps on Clad 2024-T3 Sheet on Mechanical Properties, Corrosion Resistance, and Fatigue Life.	MP 59-356	Metal Spray Effects on Clad 2024-T3 Aluminum Alloy.
-039 ***	Structures - Fuselage - Structural Test - Hydrostatic. Corrosion of Water Immersed Fuselage Test Articles.	MP 59-157	Corrosion Protection of Model 22 Fuselage During Hydrostatic Fatigue Tests.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-040 ***	Material - Aluminum Alloys - Surface Treatments for Structural Adhesive Bonding. Effect of ab- sorbed Chromium on Bonding Surfaces Upon Joint Strengths.	MP 59-309	Treatment of Metal Surfaces for Adhesion.
-041 ***	Material - Finishes and Coatings - Anti-Icing - Conductive - Sierracote No. 3, Sierracin Corpo- ration, Light Transmittance.	MP 59-309	Treatment of Metal Surfaces for Adhesive Bonding.
-042 ***	Material - Finishes and Coatings - Insulative-Thermal-Open Cell Foam Coatings. Fluid, Abrasion, and Aging Resistance.	MP 58-422	Light Transmittance Characteristics of F-106B Canopy Window Materials.
-043 ***	Material - Magnesium Alloy - AZ31A (Federal Specification QQ-M-44H). Effect of Chemical Milling on Mechanical and Fatigue Properties, and Corrosion Resistance.	MP 60-106	Coating of Air Conditioning Duct Insulation.
		MP 56-313	Dynamically Etched QQ-M-44H Magnesium Alloy Sheet.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-044 ***	Material - Titanium Alloy - Commercially Pure" - Embossed Sheet. Seam Weld Strengths.	MP 57-980	Embossed Titanium Welding Analysis.
-045 ***	Material - Titanium Alloy - Ti 6Al-4V. Effect of Flame Impingement on Mechanical Properties.	MP 56-786	Test of Titanium Alloy Ti 6Al-4V to Firewall Requirements.
-046 ***	Material - Titanium Alloy - Ti 4Al 4Mn (C-130-AM). Effect of Acid Etching and Baking on Hydrogen Content.	MP 56-701	Effect of Surface Etching on the Hydrogen Content of C-130-AM Titanium Alloy.
-047 ***	Material - Titanium Alloy - Ti 5Al-2.5 Sn, Ti 8Mn, Ti 6Al 4V. Effect of Hot Stretch Forming on Compression Yield Strength.	MP 57-531	Bauschinger Effect in Hot Formed Titanium Alloys.
-048 ***	Material - Nickel-Cobalt Base Alloy - N-155 (Multimet Alloy). Hellarc Spot Weld Strengths.	MP 56-626	Hellarc Spot Welding of N-155 Sheet.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-049 ***	Material - Fiberglass Laminate Fiberglass Cloth No. 181 Volan A- Conolon 506 Phenolic Resin (Narmco Resins and Coatings Co.) Specification MIL-P-25515 Qualification.	MP 57-627	Qualification Tests of Laminates of Fiberglass Cloth No. 181 Volan, A, with Narmco Conolon 506 Phenolic Resin, MIL-P-25515, Type I, Class II.
-050 ***	Material - Insulative - Thermal- Organic and Inorganic Hollow Spheres - Compressed Glass Fibers - Phenolic Honeycomb. Screening for Aerodynamic Heat Resistance Characteristics.	MP 57-500	Screening Tests of Thermal Insulating Materials for Exterior Surface of Structural Skins.
-051 ***	Materials - Finishes and Coatings- Fluorescent Marking. Brightness Retention.	MP 57-601	Fluorescent Coating Materials, Evaluation of.
-052 ***	Material - Titanium Alloy - Ti 7Al 3Mo. Effect of Heat Treatment on Mechanical Properties.	MP 56-205	Mechanical Properties of Beta Extruded 7Al-3Mo Titanium Alloy.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-053 ***	Material - Adhesives - Epoxy Resins - EC 1596 (Minnesota Mining and Manufacturing Co.), and Epon VI and VIII (Shell Chemical Co.). Static and Fatigue Strength of Adhesive Bonded Anti-Friction Bearing Mounts.	MP 57-463	Tests of Liquid Epoxy Resins for Bonding Anti-Friction Control System Bearings.
-054 ***	Material - Adhesives - Structural - Heat Resistant. Effect of High Temperature (600°F) on Bond Strength.	MP 57-190	Evaluation of High Temperature Structural Adhesives.
-055 ***	Material - Adhesives - Structural - High Temperature. Narmco X-207 (Narmco, Inc.). Bond Strength at Room Temperature, -67° and 600°F.	MP 56-711	Preliminary Evaluation of Narmco X-207 Adhesives.
-056 ***	Materials - Finishes and Coatings MIL-R-3043 Permanent Resin Coating, Lacquer, Acrylic-Nitrocellulose Lacquer MIL-V-1174 Varnish. Cold Resistance (-320°F).	MP 57-617	Evaluation of Various Finish Systems for Coating of Oxygen Filler and Vent Lines.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-057 ***	Materials - Titanium Alloy - Ti 6Al-4V. Effect of Oxygen Content on Strength.	MP 57-587	Elevated Temperature Mechanical Properties of 6Al-4V Titanium Alloys With Two Heat Treatments.
-058 ***	Material - Aluminum Alloy - X2020-T6. Shear Strengths.	MP 57-557A(2)	Tests of X2020-T6 Rivets
-059 ***	Materials - Adhesives and Cements - Metlbond 4021 (Narmco Coatings and Resins, Inc.) Scotchweld AF-10 (Minnesota Mining and Manufacturing Co.) Adhesive Tapes. Effects of Humidity on Bond Strengths.	MP 57-936	Effects of Atmospheric Humidity Upon the Bonding Properties of Metlbond 4021 and Scotchweld AF-10 Adhesive Tapes.
-060 ***	Materials - Finishes and Coatings - Alumina, Zirconia, Tungsten Carbide. Rocket Blast Impinge- ment Resistance.	MP 57-927	Preliminary Evaluation of Flame- Sprayed Coatings.
-061 ***	Material - Laminates Fiberglass- Epoxy Resin (Selectron 5016, Pittsburgh Plate Glass Co.). Qualification Tests MIL-P-8013B.	MP 56-840	Qualification Test for Laminates of 181 Volan "A" Glass Fabric Fabri- cated with Selectron 5016 Resin.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-062 ***	Material - Alloy Steel - Ultra' High Strength - "HALMO" (Crucible Steel Co.) Resistance Spot Weld Strengths.	MP 57-643	Resistance Welding "HALMO" Hot Work Die Steel.
-063 ***	Material - Titanium Alloy - Ti 4Al-3Mo-1V Spot Weld Strengths.	MP 57-618	Resistance Welding 4Al-3Mo-1V Titanium Alloy Sheet.
-064 ***	Material - Titanium Alloy - Ti 6Al-4V Bauschinger Effects and Their Alleviation.	MP 57-480	Restoration Heat Treatments of 6Al-4V Titanium Alloy.
-065 ***	Material - Fuels and Lubricants - RP-1 Fuel. Physical Properties.	MP 57-684	Determination of Various Physical Properties of RP-1.
-066 ***	Materials - Finishes and Coatings - Acrylic Paints Laboratory and Service Evaluations.	MP 57-934	Acrylic Paint System, Evaluation of.
-067 ***	Materials - Fiberglass Laminates - Fiberglass Cloth No. 181, Volan A - Type F.C.R. Polyester Resin (U.S. Polymetric Chemicals Co.). Specification MIL-P-8013-B, Type I Qualification.	MP 57-647	Qualification Test for Laminates of Fiberglass Cloth No. 181, Volan A U.S. Polymetric C.F.R. MIL-P-8013B, Type I.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-068 ***	Materials - Finishes and Coatings - Fire Retardant - Albi 99 (Albi Manufacturing Co.), Thermo Clad 94HA1 (Sherwin-Williams Co.), Duo Tex (Glidden Co.). Flame Impingement Resistance.	MP 57-605	Fire Retardant Coatings - Laboratory Evaluations of.
-069 ***	Materials - Finishes and Coatings - Alkyd Enamel MIL-E-7729 Grey. Protect of Weathering on Reflec- tivity.	MP 58-436	Total Reflectivity of Weathered Paint From 0.225 Microns to 2.5 Microns.
-070 ***	Material - Titanium Alloy - Ti 6Al-4V - High Oxygen Content. Effect of Heat Treating Variables and Elevated Temperatures on Mechanical Properties.	MP 57-682	Effect of Heat Treating Variables and Elevated Temperatures on the Mech- anical Properties of High Oxygen 6Al-4V Ti Alloy.
-071 ***	Materials - Finishes and Coatings - Chromium Plating Solutions. Radioactive Isotope Determination of Sulfate Concentrations.	MP 58-024-1	Determination of Sulfate. Concentrations in Chromium Plating Solutions With Radioactive Isotopes.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-072 ***	Materials - Fiberglass Laminates - Fiberglass Cloth No. 181 Volan A - Epon 828 Epoxy Resin (Shell Chemical Co.) - APCO 320 Catalyst (Applied Plastics Co.).	MP 58-046	Qualification Tests for Laminates of Fiberglass Cloth No. 181 Volan A With Shell Epon 828 Catalyzed With APCO 320, MIL-P-25421, Type I.
-073 ***	Materials - Aluminum Alloy - X2020-T6. Elevated Temperature Mechanical Properties.	MP 58-078	Tests of X2020-T6 Aluminum Alloy at Elevated Temperatures.
-074 ***	Materials - Aluminum Alloy - X2020-T6, 7075-T6. Stress Corrosion Cracking Resistance.	MP 58-078 Add. 1	Comparison of Stress - Corrosion Resistance of Bare X2020-T6 and Bare 7075-T6 Sheet.
-075 ***	Materials - Finishes and Coatings - Adhesives. Skydrol 500 Synthetic Hydraulic Fluid Resistance.	MP 58-080	Organic Coatings and Materials, Skydrol 500 Hydraulic Fluid, Resistance of.
-076 ***	Materials - Fiberglass Laminates - Fiberglass Cloth No. 181, Volan A - Trevarno F-104-11 Polyester Resin (Coast Manufacturing and Supply Co.).	MP 58-111	Qualification Test for Laminates of Fiberglass Cloth No. 181 Volan A With Trevarno F-140-11 Resin.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-077 ***	Materials - Sealants - Fairprene 5570 (E. I. duPont de Nemours & Co., Wilmington, Delaware). Aviation Fuel Immersion Swelling Characteristics.	MP 58-112	Fairprene Integral Tank Fuel Sealing Swelling Characteristics of.
-078 ***	Materials - Fiberglass Laminates - Fiberglass Cloth No. 181 Volan A - PolyLite 8000 Polyester Resin (Reichhold Chemicals Co.) Specification MIL-P-8013C, Type I Qualification.	MP 57-120	Qualification Test for Laminates of Fiberglass Cloth No. 181 Volan A With PolyLite 8000.
-079 ***	Materials - Finishes and Coatings - Watts Nickel Plate and Chromic - Sulfuric Acid Chromium Plate on H-11 Hot Work Die Steel. Hydrogen Embrittlement.	MP 58-123	Hydrogen Relief of Electro-Plated Hot Work Die Steels.
-080 ***	Materials - Fuels and Lubricants - Anti Friction Bearing Grease - Supermil M100 Regular and Roll Milled M-40 Regular (Standard Oil Company of Indiana) and Versilube 300 (General Electric Co.). Heat Resistance.	MP 58-130	Grease Evaluation - Anti Friction Control Bearing Lubrication.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-081 ***	Materials - Fiberglass Laminates - Fiberglass Cloth No. 181 Volan A, Type FR Polyester Resin (U.S. Poly- metric Chemicals Co.) Specification MIL-P-8013C, Type I Qualification.	MP 58-131	Qualification Test for Laminates of Fiberglass Cloth No. 181, Volan A With U.S. Polymetric FR, MIL-P-8013C, Type I.
-082 ***	Materials - Fuels and Lubricants - Anti-Freeze Lubricants. Seizure Characteristics At Low Temperature.	MP 58-140	Selection of Canopy Seal Anti-Freeze Lubricant.
-083 ***	Materials - Finishes and Coatings - Cadmium Plate Chemical. Surface Treatment - Iridite #8 (Allied Research Products Inc.). Effect of Iridite #8 Coatings on Cadmium Plated 4130 Steel on the Strength of Adhesive Bonds Made With Minnesota Mining and Manufacturing Co. AF-31 Adhesive.	MP 58-167	Adhesion of Scotch Weld AF-31 Adhesive To Cadmium Plated Steel.
-084 ***	Material - Nickel Base Alloys - Monel Metal. Shear Strengths.	MP 58-235	Monel Rivets in Bare 7178-T6 Sheet.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-085 ***	Materials - Alloy Steel - Ultra-High Strength - H-11 Hot Work Die Steel - Vascojet 1000 (Vanadium Alloy Steel Co.). Rivet Shear Strength and Corrosion Resistance.	MP 58-238	Mechanical & Corrosion Properties of Vascojet 1000 Rivets.
-086 ***	Materials - Elastomer-Petroleum Hydraulic Fluid Resistant - O-Rings (E. B. Wiggins Oil and Tool Co., Inc.) Ethylene Glycol Resistance.	MP 58-258	Test of MIL-P-5516 Seals for Compatibility With Ethylene Glycol.
-087 ***	Materials - Finishes and Coatings - Anti-Galling - For Titanium Fasteners.	MP 58-287	Titanium Anti-Galling Treatment for Threaded Assembly.
-088 ***	Materials - Finishes and Coatings - Vapor Deposited Nickel, Iron, Chromium, Molybdenum - For Joining Stainless Steel and Titanium Alloy. Plating and Joining Characteristics.	ZR-658-046	A Study of the Joining of Metals By the Decomposition of Some Organic metallic Compounds.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-089 ***	Materials - Adhesives - Structural - EC 1290 and AF-10 (Minnesota Mining and Manufacturing Co.) Skydrol 500 Hydraulic Fluid Resistance.	MP 58-371	Skydrol 500 Hydraulic Fluid Resistance of EC 1290 Scotchweld Prime and AF-10 Adhesive Bonded Joints.
-090 ***	Materials - Insulation - Sound Deadening - Neoprene Coated Fiberglass - Fiberglass Cloth FS 821 (B. F. Goodrich Co.) Fire Resistance.	MP 58-473	Cargo Compartment Liner Material Fire Resistance Test.
-091 ***	Material - Adhesives - High Temperature Ceramic, Literature Survey and Tensile Strengths	MP 58-475	High Temperature Ceramic Adhesives.
-092 ***	Material - Adhesives - Structural - FM-47 (Bloomington Rubber Co.) Tensile and Peel Strength Relations	MP 58-441	Structural Adhesives FM-47 Peel Strength.
-093 ***	Material - Finishes and Coatings - Plastisol - For Fabricated Parts Storage (Western Coating Co., Westoflex Plastisol). Hardness, Blocking, Peel Strength, Heat Resistance	MP 58-402	Plastisol Coated Parts

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-094 ***	Material - Finishes and Coatings - Wear Resistant. Abrasion Resis- tance.	MP 58-470	Abrasion Wear Preventive Devices In Vibrating Faying Surfaces, Evaluation of.
-095 ***	Material - Welding Electrodes - Metal Arc - Smithway 151 (A. O. Smith Corporation), Weld Strength and Ductility After Heat Treatment.	MP 56-660	Evaluation Tests of 1/8" Smithway SW-151 Electrodes.
-096 ***	Material - Laminates - Fiberglass - Polyester Resin (No. 190-2, Fibresin Plastics Co.)	MP 59-028	Qualification Test of Laminates of Fiber- glass Cloth No. 181, Volan A, With Polyester 190-2 Resin, Mil-P-8013C, Type I.
-097 ***	Material - Laminates - Fiberglass - Polyester Resin (CFR 474-MA U. S. Polymetric Resins Co.). Qualifi- cation Tests (Mil-P-8013C, Type I).	MP 59-028	Qualification Test of Laminates of Fiber- glass Cloth No. 181 Volan A, With U. S. Polymetric CFR 474-MA Resin, Mil-P- 8013C, Type I.
-098 ***	Material Finishes and Coatings - Anti-Static For Radio Antennas. Surface Resistivity and Application Characteristics.	MP 59-042	Anti-Static Coatings for Model 22 Dorsal Antenna

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-099 *	Material - Titanium Ti2.5Al-5Sn (A110AT). Stress Corrosion Study	MP 59-053	Effects of Sodium Chloride on Stress Corrosion Cracking of Titanium Alloy During Stress Relieving.
-100 ***	Material - Fiberglass Laminate Fiberglass Cloth No. 181, Volan A - Type C Polyester Resin (U. S. Polymetric Chemicals Co.). Specification Mil-P-8013C, Type I, Qualification.	MP 58-045	Qualification Test for Laminated (181) Glass Fabric Made With U. S. Polymetric C Resin, Mil-P-8013C, Type I.
-101 ***	Material - Ceramics - Ceramic Fiber - Ceramic Matrix Systems	MP 59-086	Ceramic Fiber - Ceramic Matrix Systems.
-102 ***	Material - Titanium - Ti2.5Al5Sn Mechanical Properties of Hot Formed Sheet.	MP 59-103	Mechanical Properties of Hot Formed 5Al-2.5Sn Titanium Alloy.
-103 ***	Material - Nickel Base Alloy - Hastelloy R-235, 10 Percent Cold Worked. Effect of Stretching and Heat Treatment On Mechanical Properties	MP 59-106	Effect of Tensile Deformation and Heat Treatment Upon the Mechanical Properties of 10% Cold Worked Hastelloy R-235.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-104 ***	Material - Finishes and Coatings - Reflective Tapes - No. 630, 633 and 3270, Minnesota Mining and Manufacturing Co. Reflectance Characteristics.	MP 59-191	Reflectance Characteristics of Reflective Tapes.
-105 ***	Material - Finishes and Coatings - Aluminum Foil, Flame Sprayed Aluminum and Flame Sprayed Tin Reflecting Surfaces. Reflectance Characteristics.	MP 59-191	Reflectance Characteristics of Reflective Tapes.
-106 ***	Material - Corrodents and Corrosion Products - Solid Rocket Propellant Residues. Composition and Removal.	MP 59-204	Chemical Analysis and Removal of Solid Rocket Propellant Residues.
-107 ***	Material - Fabrics - Aluminized. Light Transmittance and Abrasion Resistance.	MP 59-344	Light Transmittance and Abrasion Resistance of Various Aluminized Fabrics.
-108 ***	Material - Aluminum - 7075 - T651. Effect of Stretching on Mechanical Properties	MP 59-214	Effect of Varying Stretch to Produce - T651 Condition in Extruded 7075 Aluminum Alloy Bar Stock

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-109 ***	Material - Adhesives - Ceramic - High Temperature. Development and Evaluation Study	MP 59-110	Development and Evaluation of High Temperature Adhesives.
-110 ***	Material - Atmospheric Dust.	MP 59-199	Analysis of Atmospheric Dust
-111 **	Material - Finishes and Coatings - Temperature Indication by Heat Discoloration.	MP 57-111	Temperature Indication by Paint Discoloration
-112 **	Material - Hull Bottom - Corrosion Resistant. Corrosion and Foul- ing Resistance.	MP 57-134	Hull Bottom Materials Corrosion and Fouling Test.
-113 **	Material - Titanium - Ti 6Al-4V, Ti 5Al-2.5Sn, Ti 75A. Spotweld Strengths of Dissimilar Alloy Combinations.	MP 57-345	Elevated Temperature Spotweld Shear Evaluation
-114 **	Material - Stainless Steel - Allegheny-Ludlum AM-350. Resistance and Fusion Weld Strengths in SCT Condition.	MP 57-231	Welding Characteristics of AM-350 Precipitation Hardening Stainless Steel Alloy Steel

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-115 **	Materials - Sealants - Fuel Tank. Elevated Temperature and Fuel Resistance.	MP 59-197	High Temperature Materials Test Program - Elevated Temperature Tank Sealing.
-116 **	Material - Titanium - Ti 6Al-4V, Ti 4Al-4Mn - Extrusions. Fatigue Life Comparisons.	MP 57-195	Titanium Extrusions in Transverse Bending.
-117 **	Material - Adhesives - Parting Agents for. Effect on Structural Adhesive Bond Strengths.	MP 57-124	Evaluation of Parting Films for Two Stage Curing of Metlbond 4021 and 3(M) Co. AF-31 Structural Adhesives.
-118 **	Material - Titanium - Ti 6Al-4V. Effect of Heat Treatments on Elevated Temperature Stress Stability.	MP 57-212-1	Stability of Short Time Ages 6Al-4V Titanium Alloy.
-119 **	Material - Finishes and Coatings - Chemical Pretreatment - Alodine 600 (American Chemical)	MP 57-273	Comparison of Various Pre-Cleaning Methods for the Alodine 600 - Scotchweld AF-10 Adhesive System.
-120 **	Material - Adhesives - Structural - Protective Tapes for. Effect of Tapes on Structural Adhesive Strengths.	MP 57-297	Protection of EC 1290 Precured Primed Surfaces.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-121 **	Material - Titanium - Protective Coatings for Heat Treatment.	MP 57-458	Protective Coatings for Use in Heat Treating Titanium.
-122 **	Material - Adhesives - Structural - AF10 and AF32 (Minnesota Mining and Manufacturing Co.). Tensile-Shear and Peel Strengths.	MP 57-464	Comparison of AF10 and AF32 Adhesives for Integral Tank Sealing Applications.
-123 **	Material - Insulation - Thermal - Structural Laminations.	MP 57-490	"Heat Barrier" Efficiency Tests.
-124	Material - Aluminum - 2024-T81 and 2024-T31. Stretcher Levelled Plate. Stress Corrosion from Rivet Swelling.	MP 57-506	Stress Corrosion Cracking Test of 2024-T81 Aluminum Alloy Plate.
-125 **	Material - Insulation - Sound - Polyurethane and Neoprene Rubber Foam. Sweat and Ozone Resistance.	MP 57-532	Resistance of Plastic Foam Materials to Sweat and Ozone.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-126 **	Material - Aluminum - 2024-T4 Extrusions. Effect of Stretching on Mechanical and Fatigue Properties.	MP 57-997	2024 Extrusion #E-801903 - Effects of Stretching on Tensile Yield, Ultimate & Elongation - Compression Yield - Fatigue Properties - Thickness.
-127	Material - Stainless Steel - Type 410, Casting. Effect of Surface Preparation on Adhesive Bond Strengths.	MP 57-603	Aluminum to Stainless Steel Bond Tests.
-128 **	Material - Nickel Base Alloy - Monel Metal. Countersunk Rivet Shear Strengths.	MP 57-651	Monel Rivet - Machine Countersunk in Titanium Sheet - Design Ultimate Shear Test.
-129 **	Material - Adhesives - EC 1459, EC 1469, AF102 (Minnesota Mining and Manufacturing Co.) Effect of Curing Cycles on Bond Strengths.	MP 57-461	Effect of Various Cure Cycles on Metal to Metal and Metal-to-Core Bonds Using Adhesive System Detailed in Specification 8-01318.
-130	Material - Adhesives - Metlbond 4021 (Narmco Resins and Coatings, Inc.). Effect of Aluminum Alloys on Bond Strength.	MP 57-983	Effects of Crystalline Structure of Aluminum Alloy Sheets, as Determined by X-Ray Diffraction, Upon Adhesive Bond Strength.

TABLE 2 (Cont.)

COMPILED INFORMATION

Abstract Report No.	Title	Reference Report No.	Title
8926-131 **	Material - Finishes and Coatings - "Touch-up" Corrosion Preventatives for Aluminum Alloys. Long Term Effectiveness in Marine Atmospheres.	MP 57-637	Corrosion Preventative Characteristics of Touch-up Chemical Surface Treatments on Aluminum Alloy Assemblies.

* Ready for publication.

** In publication.

*** Distributed.

APPENDIX I

Appendix I, following, contains forty-one report abstracts prepared during the reporting period. The number of the reports to which these abstracts pertain are as follows.

8926-091	8926-101	8926-111	8926-121
-092	-102	-112	-122
-093	-103	-113	-123
-094	-104	-114	-124
-095	-105	-115	-125
-096	-106	-116	-126
-097	-107	-117	-127
-098	-108	-118	-128
-099	-109	-119	-129
-100	-110	-120	-130

8926-131



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PAGE
REPORT NO.

Report No. 8926-091

Material - Adhesives - High Temperature Ceramic

Literature Survey and Tensile Strengths

Abstract

A literature survey pertinent to high temperature ceramic adhesives was conducted. Seven literature references are given in the body of the report. Appendix I of the report gives 101 references taken from the technical literature and Appendix II cites 9 references taken from WADC TR 58-184, August 1958. Tensile tests were made with University of Illinois U-1067 composition with indifferent results.

Reference: Pratt, D. S., Shoffner, J. E., Keller, E. E.,
"High Temperature Ceramic Adhesives," General
Dynamics/Convair Report MP 58-475, San Diego,
California, 2 March 1959. (Reference attached).



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REPORT NO.

Report No. 8926-092

Material - Adhesives - Structural - FM-47
(Bloomington Rubber Co.)

Tensile and Peel Strength Relations

Abstract

Tension (Mil-Std-401A) specimens and T-peel specimens, which applied force normal to bond lines at a constant linear rate of failure in the bond between two bonded aluminum alloy strips, were prepared with fiberglass cloth reinforced (supported) and non-reinforced FM-47 (Bloomington Rubber Co.) structural adhesives. Generally, all adhesives used were pre-cured at 220°F for one hour prior to bonding at 320°F for one hour under a pressure of 100 psi. Various combinations of testing temperature, adhesive weights and bond line thicknesses were tested to arrive at an empirical expression which related the metal peel strength of FM-47 bonds to the mechanical properties of the resin and facings. This relation is given as follows:

$$\frac{FD}{W} = K T_s m^{5/3} \frac{T_s t}{E}^{1/3}$$

where: F = applied force, pounds; d = moment of applied force, inches; W = width of specimen, inches; K = a constant; T_s = strength of resin in pure tension, psi; m = thickness of facing, inches; t = thickness of bond line, inches; and E = modulus of elasticity of resin, psi.



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REPORT NO.

Report No. 8926-093

Material - Finishes and Coatings - Plastisol -
For Fabricated Parts Storage (Western Coating Co.,
Westoflex Plastisol)

Hardness, Blocking, Peel Strength, Heat Resistance

Abstract

Duplicate SAE-1020 finish machined parts 8-96176-133, -141, -171 (Ground Run-up Screen) details were plastisol coated with Western Coating Co., Pasadena, California, Westoflex Plastisol compound. After coating, the hardness, blocking, peel strength and heat resistance of the coatings were tested in accordance with Paragraphs 4.5.3, 4.5.4, 4.5.5 and 4.5.6, Specification Mil-P-3999. The hardness of the applied coatings ranged from 65 to 75 Shore Durometer "A" hardness. Very slight blocking was observed along with a 12 to 18 pounds per inch peel strength. No hardness increase resulted from the heat resistance tests.

Reference: Mark, H., George, J. C., Keller, E. E.,
"Plastisol Coated Parts," General Dynamics/
Convair Report MP 58-402, San Diego,
California, 30 January 1959. (Reference
attached.)



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REPORT NO.

Report No. 8926-094

Material - Finishes and Coatings - Wear Resistant

Abrasion Resistance

Abstract

Twenty materials consisting of various fabrics and tapes (polyester, teflon, nylon, dacron), fiberglass laminate (epoxy, polyester, phenolic), epoxy enamel hard anodized coatings (Anachrome Corp., Southgate, California), lubricant films, and Type 301 Half Hard stainless steel were applied to 2024-T3 and 7075-T6 aluminum alloy materials and wear tested in various combinations in a sliding abrasion test machine. Dacron tape (Connecticut Hard Rubber Co., New Haven, Connecticut, Temp - R- Tape) sandwiched between sliding 2024-T3 aluminum alloy surfaces displayed the best wear preventative characteristics of all the materials tested at 14 cycles of oscillation*under 2.5 psi pressure.

Reference: Mappus, L. A., George, J. C., Keller, E. E.,
"Abrasion Wear Preventive Devices In Vibrating
Faying Surfaces, Evaluation of," General Dynamics/
Convair Report MP 58-470, San Diego, California,
21 July 1959. (Reference attached.)

*Per Second



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REPORT NO.

Report No. 8926-095

Material - Welding Electrodes - Metal Arc -
Smithway SW-151 (A. O. Smith Corporation)

Weld Strength and Ductility After Heat Treatment

Abstract

SAE 4130 steel plates 1/4, 3/8 and 1/2 inch thick were double "V" chamfered with 1/16" lands on the edges to be welded. SAE 4130 steel plates 1/8 inch thick were squared preparatory to welding. The steel plates were welded with 1/8 inch diameter Smithway 151 (A. O. Smith Corporation, Milwaukee, Wisconsin), as follows: 1/8 and 1/4 inch thick, two passes, one from each side; 3/8 and 1/2 inch thick, four passes, two from each side. After welding, all test specimens were heat treated as follows: 1600°F one hour, oil quench, 830°F or 1000°F one hour, air cool. Tension, bend and shear testing subsequent to heat treatment showed the welds capable of developing satisfactory strengths in 150,000 psi (830°F temper) and 175,000 psi (1000°F temper) ranges. Those welds heat treated to the 150,000 psi range displayed satisfactory ductility, but those heat treated to the 175,000 psi range appeared to be somewhat brittle.

Reference: Koppernal, T. J., Turner, H. C., Sutherland, W. M.,
"Evaluation Tests of 1/8" Smithway SW-151 Electrodes,"
General Dynamics/Convair Report MP 56-660, San Diego,
California, 10 June 1957. (Reference attached).



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REPORT NO.

Report No. 8926-096
Materials - Laminates - Fiberglass - Polyester Resin
(No. 190-2, Fiberesin Plastics Co.)

Qualification Tests (Mil-P-8013C, Type I)

Abstract

Fiberglass-polyester resin laminates consisting of twelve plies of No. 181 Volan A fiberglass fabric impregnated with No. 190-2 polyester resin (Fiberesin Plastics Co., Oconomowoc, Wisconsin) were fabricated by vacuum bag curing under 26 inches of mercury at 275°F for 1 hour. The results of the several tests made are as follows:

1. Room Temperature Conditions
 - Specific Gravity - 2.22
 - Resin Content - 40.4%
 - Barcol Hardness - 67.0
 - Flexural Flatwise Ultimate Strength, ksi - 64.9
 - Flexural Initial Modulus of Elasticity, $\text{psi} \times 10^6$ - 2.8
 - Compression Ultimate Strength Edgewise, ksi - 53.6
 - Tensile Ultimate Strength, ksi - 44.1
2. Wet Condition
 - Flexural Flatwise Ultimate Strength, ksi - 59.2
 - Flexural Initial Modulus of Elasticity, $\text{psi} \times 10^6$ - 2.6
 - Compression Ultimate Strength Edgewise, ksi - 50.8
 - Tensile Ultimate Strength, ksi - 43.5

References: Gardner, G. E., Jr., Bergstedt, P. W., Turner, H. C.,
"Qualification Test of Laminates of Fiberglass Cloth
No. 181, Volan A, With Polyester 190-2 Resin (Mil P-
8013C, Type I)," General Dynamics/Convair Report
MP59-028, San Diego, California, 1 April 1959,
(Reference attached).



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PAGE
REPORT NO.

Report No. 8926-097
Materials - Laminates - Fiberglass - Polyester Resin
(CFR 474-MA, U. S. Polymetric Chemicals Co.)

Qualification Tests (Mil-P-8013C, Type I)

Abstract

Fiberglass-polyester resin laminates consisting of twelve plies of No. 181 Volan A fiberglass fabric impregnated with United States Polymetric Chemicals Co., Stamford, Connecticut, CFR 474-MA polyester resin were fabricated by vacuum bag curing under 24 inches of mercury at 275°F for 1 hour. The results of the several tests made with this material are as follows:

1. Room Temperature Conditions
 - Specific Gravity - 1.98
 - Resin Content - 34.3%
 - Barcol Hardness - 70.0
 - Flexural Flatwise Ultimate Strength, ksi - 67.0
 - Flexural Initial Modulus of Elasticity, $\text{psi} \times 10^6$ - 3.0
 - Compression Ultimate Strength, Edgewise, ksi - 47.9
 - Tensile Ultimate Strength, ksi - 59.5
2. Wet Conditions
 - Flexural Flatwise Ultimate Strength, ksi - 60.1
 - Flexural Initial Modulus of Elasticity, $\text{psi} \times 10^6$ - 2.9
 - Compression Ultimate Strength, Edgewise, ksi - 46.3
 - Tensile Ultimate Strength, ksi - 56.0

Reference: Gardner, G. E., Jr., Bergstedt, P. W., Turner, H. G.,
"Qualification Test of Laminates of Fiberglass Cloth
No. 181 Volan A With U. S. Polymetric CFR 474-MA Resin,
Mil-P-8013C, Type I. (Reference attached).



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REPORT NO.

Report No. 8926-098
Materials - Finishes and Coatings - Anti-Static -
For Radio Antennas

Surface Resistivity and Application Characteristics

Abstract

Gaco N-15 black neoprene coating applied over Bostick 1007 primer, Gaco N-81 black neoprene electron conductive coating over Gaco N-18 primer and topcoated with Gaco N-82 white ionically conductive neoprene coating and Cat-A-Lac 453-1-1 black epoxy anti-static coating were tested to determine their surface resistivity and application characteristics. The Gaco materials were made by the Gates Engineering Co., Wilmington, Delaware; the Bostik primer by B. B. Chemicals Co., Cambridge, Massachusetts; and Cat-A-Lac by Finch Chemical and Paint Co., Torrance, California. The Gaco N-51 coating had an infinite surface resistivity and was unsatisfactory. Gaco N-81 had a surface resistivity between 10 to 100 megohm per square but a critical recoat time made the material impractical for production use. Gaco N-81 topcoated with Gaco N-82 had infinite surface resistance and was not satisfactory. Cat-A-Lac black epoxy resin material required baking at 250°F and its surface resistivity varied inversely with film thickness, but was within the 10 to 100 megohm per square requirement.

Reference: Mappus, L. A., George, J. C., Keller, E. E.,
"Anti-Static Coatings for Model 22 Dorsal Antenna,"
General Dynamics/Convair Report MP59-042, San Diego,
California, 15 July 1959 (Reference attached).



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REPORT NO.

Report No. 8926-099
Materials - Titanium Alloy - Ti2.5Al-5Sn(Al10AT)
Stress Corrosion Cracking

Abstract

Ti2.5Al-5Sn(Al10AT) formed parts which were stress relieved at 1150°F for one hour in heat treating fixtures in such a manner that stresses were generated within parts during heat treatment were found to be cracked just after heat treatment. The cause of cracking was, by a process of elimination, attributed to the presence of sodium chloride deposited on the surface of parts rinsing subsequent to acid etching. The use of "sodium chloride free" rinse water eliminated the stress corrosion cracking.

Reference: Faulkenberry, B., Ianucci, A., Graber, F. M., Keller, E. E., "Effects of Sodium Chloride on Stress Corrosion Cracking of Titanium Alloy During Stress Relieving," General Dynamics/Convair Report MP59-053, San Diego, California, 19 May 1959, (Reference attached).



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REPORT NO.

Report No. 8926-100

Materials - Fiberglass Laminates - Fiberglass Cloth
No. 181, Volan A - Type C Polyester Resin
(U. S. Polymetric Chemicals Co.)

Specification Mil-P-8013C, Type I, Qualification

Abstract

Laminated panels 0.135 inch thick fabricated with 12 plies of fiberglass cloth No. 181, Volan A were impregnated with Type C polyester resin (United States Polymetric Chemicals Co., Stamford, Conn.) and cured at 190°F for two hours under 10 to 12 psi vacuum bag pressure. Qualification test outcomes (Mil-P-8013C, Type I) were as follows:

1. Standard Conditions
Specific Gravity - 2.17
Resin Content - 38%
Barcol Harness - 68.0
Flexural Flatwise Ultimate Strength, ksi - 63.4
Flexural Flatwise Initial Modulus of Elasticity, $\text{psi} \times 10^6$ - 2.8
Compression Ultimate Strength Edgewise, ksi - 43.3
Tensile Ultimate Strength, ksi - 49.8
2. Wet Conditions
Flexural Flatwise Ultimate Strength, ksi - 58.3
Flexural Flatwise Modulus of Elasticity, $\text{psi} \times 10^6$ - 2.8
Compression Ultimate Strength Edgewise, ksi - 35.1
Tensile Ultimate Strength, ksi - 43.6

Reference: Gardner, G. E., Jr., Parker, W. M., Turner, H. C.,
"Qualification Test for Laminated (181) Glass Fabric
Made With U. S. Polymetric C Resin, Mil-P-8013C,
Type I), General Dynamics/Convair Report MP 58-045,
San Diego, California, 12 May 1958. (Reference
attached.)



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REPORT NO.

Report No. 8926-101

Material - Ceramics - Ceramic Fiber - Ceramic

Matrix Systems

Abstract

Recent trends in fiber development, research topics initiated, facilities for fiber production, fiber testing techniques, and an initial composite ring specimen preparation are discussed.

Reference: Shoffner, J. E., Keller, E. E., Sutherland, W. M.,
"Ceramic Fiber - Ceramic Matrix Systems," General
Dynamics/Convair Report MP 59-086, San Diego,
California, 27 October 1959. (Reference attached).



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PAGE
REPORT NO.

Report No. 8926-102

Material - Titanium - Ti 2.5Al 5Sn

Mechanical Properties of Hot Formed Sheet

Abstract

Ti 2.5Al 5Sn sheet, 0.050 inch thick, was stretch wrapped at various rates and held for various times after wrapping against a stretch forming die which was heated to 1150°F. This treatment resulted in tensile losses of from zero to 3 per cent; ultimate strength losses of from zero to 6 per cent; elongation losses averaging about 2.5 per cent of the original elongation; and compression yield strength losses ranging upwards to 7 per cent.

References: Bergstedt, P. W., Turner, H. C., Sutherland, W. M.,
"Mechanical Properties of Hot Formed 5Al-2.5 Sn
Titanium Alloy*," General Dynamics/Convair Report
MP 59-103, San Diego, California, 19 March 1959.
(Reference attached).

*Alloy improperly designated, should be Ti 2.5Al 5Sn
titanium alloy.



Report No. 8926-103

Material - Nickel Base Alloy - Hastelloy R-235,
10 Per Cent Cold WorkedEffect of Stretching and Heat Treatment on
Mechanical PropertiesAbstract

The effect of stretching to 17 and 26 per cent permanent set, followed by heating at 1500°F for various times, upon the longitudinal and transverse room temperature mechanical properties of 0.062 inch thick 10 per cent cold worked Hastelloy R-235 nickel base alloy was determined. Generally, increased stretching resulted in increased tensile strengths and decreased compressive yield strengths. As received 10 per cent cold worked Hastelloy displayed the Bauschinger effect only in the longitudinal direction, but additional stretching to 17 per cent permanent set introduced the effect in the transverse direction. Stretching to 26 per cent permanent set resulted in increases in compression yield strength, but did not eradicate the Bauschinger effect. Only heat treatment (1500°F for 2 hours) served to eradicate the Bauschinger effect from the cold worked material. This heat treatment resulted in slight decreases in the strength of the cold worked materials.

Reference: Giuntoli, A., Bergstedt, P., Turner, H. C.,
"Effect of Tensile Deformation and Heat Treatment
Upon the Mechanical Properties of 10% Cold Worked
Hastelloy R-235," General Dynamics/Convair Report
MP 59-106, San Diego, California, 3 June 1959.
(Reference attached.)



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PAGE
REPORT NO.

Report No. 8926-104

Material - Finishes and Coatings - Reflective Tapes -
No. 630, 633 and 3270, Minnesota Mining and
Manufacturing Co.

Reflectance Characteristics

Abstract

The specular reflectance of Minnesota Mining and Manufacturing Co. No. 633 gold colored D.S. Scotchcal, and No. 630 chrome colored D.S. Scotchcal films, and No. 3270 silver W/A D.S. Flat Top (R) Scotchlite reflective film was determined in the 0.35 to 2.5 micron wavelength range with a Beckman DK-2 recording spectrophotometer, and in the 1.0 to 15 micron wavelength range with a Beckman IR-4 recording spectrophotometer. Recordings of all measurements are given.

Reference: Faulkenberry, B. H., Graber, F. M., Keller, E. E.,
"Reflectance Characteristics of Reflective Tapes,"
General Dynamics/Convair Report 59-191, San Diego,
California, 7 May 1959. (Reference attached).



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REPORT NO.

Report No. 8926-105

Materials - Finishes and Coatings - Aluminum
Foil, Flame Sprayed Aluminum and Flame Sprayed
Tin Reflecting Surfaces

Reflectance Characteristics

Abstract

The total and diffuse spectra, in the 300 to 2500 milimicron wavelength range, of commercial aluminum foil (Reynolds wrap), flame sprayed aluminum (commercially pure), and flame sprayed tin (commercially pure) applied to fiberglass laminate either by cementing or flame spraying was determined with a Beckman DK-2 spectrophotometer. The spectrophotometer readings are given.

Reference: Trias, J., Graber, F. M., Keller, E. E.,
"Reflectance Characteristics of Reflective
Tapes," General Dynamics/Convair Report
MP 59-191 Add. 1, San Diego, California,
1 February 1960. (Reference attached)



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REPORT NO.

Report No. 8926-106

Material - Corrodents and Corrosion Products -
Solid Rocket Propellant Residues

Composition and Removal

Abstract

Solid propellant combustion products resulting from firing 2.5 inch rockets from F-102 airplanes were found to consist of carbon, various organic materials, and magnesium or magnesium oxide. Twenty-nine materials were tested to determine their effectivity in removing heavy combustion product deposits. Three of these materials, Rocket Cleaners X2-6, X2-9 and X2-11, manufactured by Rocket Chemical Company, San Diego, California, were found suitable for effective and thorough combustion product removal.

Reference: Kruse, G. N., Keller, E. E., Sutherland, W. M.,
"Chemical Analysis and Removal of Solid Rocket
Propellant Residues," General Dynamics/Convair
Report MP 59-204, San Diego, California,
2 November 1959. (Reference attached).



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REPORT NO.

Report No. 8926-107

Material - Fabrics - Aluminized

Light Transmittance And Abrasion Resistance

Abstract

The abrasion resistance of Connecticut Hard Rubber Co., aluminized rubber coated fabric CHR and Minnesota Mining and Manufacturing Co., SRGA-0213 fabric was compared by Taber Abraser tests (1000 gram load, CS-17 wheel). The CHR was superior to the SRGA-0213 fabric and it withstood three times as many wear cycles to obtain about 1.3 per cent light transmittance in the 350 to 2000 micron wavelength range. The transmittance of various seam sealants (Los Angeles Standard Rubber Co., IA #1 to IA #6 inclusive) used to cover needle holes in SRGA-0213 was zero. Seam sealing tapes IA #1 and IA #7 (Los Angeles Standard Rubber Co.), and CHR Alt. No. 2 (Connecticut Hard Rubber Co.) displayed the following respective peel strengths: 2.51 2.06 and 5.16 pounds per inch width.

Reference: Mark, H., George, J. C., Keller, E. E.,
"Light Transmittance and Abrasion Resistance
of Various Aluminized Fabrics," General Dynamics/
Convair Report MP 59-344, San Diego, California,
22 September 1959. (Reference attached.)



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REPORT NO.

Report No. 8926-108

Material - Aluminum - 7075-T651

Effect of Stretching On Mechanical Properties

Abstract

Aluminum alloy bars taken from a 1" x 1-1/4" cross section 7075-T6 extrusion was solution heat treated at 870°F for 95 minutes, water quenched and stretch straightened. After stretch straightening, separate bars were stretched an additional 0.78, 1.74, 1.94 or 2.65 per cent. This stretching resulted in 5 to 10 per cent losses in tensile and yield strengths when compared with the properties of a bar which was not stretch straightened. The compression yield strength losses closely paralleled the tensile strength losses. However, stretching to 2.65 per cent appeared to result in recovery from the greatest compression yield strength loss found at 1.94 per cent stretch. Distortion measurements which related the effect of metal removal with resultant distortion indicated that from 78 to 86 per cent of the distortion resulting from the removal of metal from an unstretched bar could be eliminated by stretching.

Reference: Bergstedt, P. W., Turner, H. C., Sutherland, W. M.,
"Effect of Varying Stretch To Produce -T651 Condition
in Extruded 7075 Aluminum Alloy Bar Stock," General
Dynamics/Convair Report MP 59-214, San Diego, California,
16 November 1959. (Reference attached.)



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REPORT NO.

Report No. 8926-109

Material - Adhesives - Ceramic - High Temperature

Development And Evaluation Study

Abstract

Investigation to develop and evaluate ceramic adhesives for bonding metallic alloys - particularly Armco 17-7 PH stainless steel - at firing temperature of 1450°F or less was conducted. Eleven ceramic adhesive frits were formulated for the application, and examined for melting, flow and strength characteristics. Lap shear strengths of 700 psi at room temperature and 900 to 3200 psi at 800°F were developed in the adhesives studied.

Reference: Pratt, D. S., Shoffner, J. E., Turner, H. C.,
"Development and Evaluation of High Temperature
Ceramic Adhesives," General Dynamics/Convair
Report MP 59-110, San Diego, California, 29 March
1960. (Reference attached.)



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REPORT NO.

Report No. 8926-110

Material - Atmospheric Dust

Constitution

Abstract

The weight of dust per unit volume of air, the number of particles of dust per unit volume of air, and dust particle size in the atmosphere at Lindberg Field, San Diego, California, during the April 21 - 30, 1959 period was determined with a Staplex Hi-Vol Sampler (The Staplex Co., Brooklyn, N.Y.), a Bausch and Lomb Dust Counter, and a Millipore Aerosol Filter Apparatus (Millipore Filter Corporation, Watertown, Mass.). A dust concentration of 4.12×10^{-3} mg per cu. ft. was found at 3 PM, April 23, 1959, when the temperature was 68°F, the humidity, 64 per cent; and the wind, SW at 9 knots. At 3 PM, April 30, 1959, from 22.2 to 33.4 million particles of dust per cubic foot of air were found when the temperature was 69°F; the humidity, 68 per cent; and the wind WNW at 6 knots. A dust particle analysis made at 1 PM, April 28, 1959, when the temperature was 67°F; the humidity, 61 per cent; and the wind NW at 8 knots showed that the majority of the dust particles (74 per cent) were under one micron in size. A complete analysis of dust particle size is reported.

Reference: McGowan, M. A., Kruse, G. N., Keller, E. E.,
"Analysis of Atmospheric Dust," General Dynamics/
Convair Report MP 59-199, San Diego, California,
10 June 1959 (Reference attached.)



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REPORT NO.

Report No. 8926-111

Material - Finishes and Coatings - Temperature
Indication by Heat Discoloration

Abstract:

The discoloration of four different paint systems containing pretreatment wash primer MIL-C-8514, zinc chromate primer MIL-P-8585, zinc chromate primer MIL-P-8585, #611 green, and #512 grey enamel MIL-E-7729 was noted after heating at 300, 400, 500 and 600°F. for various times up to 2 hours. All the paint systems resisted discoloration upon heating at 300°F for 1 hour; the yellow zinc chromate primer, however, discolored after 2 hours heating at 300°F. All four paint systems discolored extensively when heated in the 300 to 400°F temperature range.

Reference: Mark, H., Whidden, R. H., Sutherland, W. M., "Temperature Indication by Paint Discoloration," General Dynamics/Convair Report No. 57-111, San Diego, California, 6 June 1959 (Reference attached.)



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REPORT NO.

Report No. 8926-112

Material - Aircraft Hull Bottom - Corrosion Resistant
Corrosion and Fouling Resistance

Abstract:

A painted clad 2024-T3 aluminum alloy panel, using bare 7075-T6 aluminum alloy stiffeners and 2017-T4 aluminum alloy rivets was slightly corroded on the primed faying surfaces of the lap joints, after 208 days of sea water immersion. At the end of this period, the rivet shanks corroded slightly. A painted clad 7075-T6 aluminum alloy panel, using bare 7075-T6 aluminum alloy stiffeners and 2017-T4 aluminum alloy rivets, was similarly corroded after 208 days sea water immersion. Two RS 110A (Ti 8MN) titanium alloy panels, using RS 110A alloy stiffeners were not corroded after 208 days of sea water immersion. Monel rivets used to fasten one of the panel-stiffener combination were moderately corroded: the Ti 75A (commercially pure) titanium rivets in the other combination were not corroded. All specimens were heavily fouled with barnacles after two months of sea water immersion.

Reference: Hooper, A. F., George, J. C., Keller, E. E., "Hull Bottom Materials Corrosion and Fouling Test." General Dynamics/Convair, Report MP57-134, San Diego, California, 26 November 1957



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REPORT NO.

Report No. 8926-113

Material - Titanium - Ti 6Al-4V, Ti 5Al-2.5 Sn, Ti 75A

Spotweld Strengths of Dissimilar Alloy Combinations

Abstract:

Electric resistance spotwelds were made by joining 0.032 inch thicknesses of one alloy sheet to 0.032 inch thicknesses of another alloy sheet. The alloy pairs joined where: (1) Ti 75A to Ti 5Al-2.5 Sn; (2) Ti 75A to Ti 6Al-4V; and (3) Ti 5Al-2.5 Sn to Ti 6Al-4V. The average room temperature strength (six to eight specimens) of each combination were: (1) 1403 pounds; (2) 1303 pounds; and (3) 1258 pounds.

Reference: Stier, H. H., Turner, H. C., Sutherland, W. M., "Elevated Temperature Spotweld Shear Evaluation," General Dynamics/Convair Report MP57-345, San Diego, California, 23 March 1957



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REPORT NO.

Report No. 8926-114

Material - Stainless Steel - Allegheny-Ludlum AM-350
Resistance And Fusion Weld Strengths In SCT Condition

Abstract

Allegheny-Ludlum AM-350 stainless steel was found to be readily weldable by the electric resistance and fusion welding methods. The average spot-weld tension-shear values exceeded MIL-W-6858 150 KSI ultimate strength materials minimum values by good margins. Best spotweld ductility as indicated by cross-tension to tension-shear ratio was obtained when welding was done between the sub-zero cooling and tempering. Highest shear strength, however, occurred when spotwelding was followed by completion of heat treatments. Electric resistance seam welding resulted in joints with 100 percent efficiency. Best fusion weld (automatic Heliarc) joint efficiency (99 percent) was obtained when complete heat treatment followed welding. Welding between sub-zero cooling and tempering resulted in 78 percent joint efficiency, and welding after complete heat treatment produced 85 percent joint efficiency. Metallographic examination revealed the absence of porosity or cracks in welds.

Reference: Harvey, J. L., Turner, H. C., Sutherland, W. M. "Welding Characteristics of AM-350 Precipitation Hardening Stainless Steel Alloy Sheet," General Dynamics/Convair, Report MP57-231, San Diego, California, 18 July 1957.



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REPORT NO.

Report No. 8926-115

Materials - Sealants - Fuel Tank.
Elevated Temperature And Fuel Resistance

Abstract

Promising elevated temperature fuel tank sealants were screened on the basis of seven day JP-4 fuel and skydrol immersion tests, thirty minutes heating at 500°F., and, in some cases, adhesion testing according to Specification MIL-S-8802. General Electric R.T.V. and Dow Corning R. T. V. 501 putties withstood the 500°F heating, but their JP-4 resistance was poor. Adhesion failures and 200 to 300 per cent swelling resulted from fuel immersion. The skydrol resistance of both materials was good, however. Viton A rubber had good JP-4 fuel resistance and withstood temperatures up to 400°F. This material was tested in sheet form.

Reference: Reschan, R. R., Keller, E. E., Sutherland, W. M., "High Temperature Materials Test Program - Elevated Temperature Tank Sealing," General Dynamics/Convair Report MP59-197, San Diego, California, 28 May 1958.

Report No. 8926-116
Material - Titanium - Ti 6Al-4V, Ti 4Al-4Mn-
Extrusions

Fatigue Life Comparisons

Abstract:

Subsize tension and Krause-type reverse bending fatigue test specimens were obtained from the flanges of 3/8 by 3-3/4 by 2-3/4 inch Tee-extrusions for test. Also special fatigue specimens similar to the Krause-type specimen were obtained from the Tee-extrusion cross sections for test. The average mechanical properties of the extruded materials were:

<u>Alloy</u>	<u>Condition</u>	<u>Ultimate Strength</u>	<u>Yield Strength</u>	<u>Elong in 2"</u>
Ti 6Al-4V	As Received	115.1	130.8 KSI	13.1%
Ti 6Al-4V	Heat Treated*	134.5	160.5	10.1
Ti 4Al-4Mn	As Received	126.2	148.5	14.8

*1650°F., 1 hr/WQ/900°F., 6 hrs 1 A.C.

The average fatigue life of the various materials was:

<u>Alloy</u>	<u>Condition</u>	<u>Stress</u>	<u>Stress Ratio</u>	<u>Life-Cycles</u>
<u>Extrusion Flange</u>				
Ti 6Al-4V	As Received	60 KSI	-1.0	56,250
Ti 6Al-4V	Heat Treated	60 KSI	-1.0	71,200
Ti 4Al-4Mn	As Received	60 KSI	-1.0	63,750
<u>Extrusion Cross Section</u>				
Ti 6Al-4V	As Received	114 KSI	0.10	155,750
Ti 6Al-4V	Heat Treated	114 KSI	0.10	100,800
Ti 4Al-4Mn	As Received	114 KSI	0.10	163,200

Reference: Bataitis, F., Turner, H. C., Sutherland, W. M., "Titanium Extrusions in Transverse Bending," General Dynamics/Convair Report MP57-195, San Diego, California, 10 June 1957.



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REPORT NO.

Report No. 8926-117
Material - Adhesives - Parting Agents for.
Effect on Structural Adhesive Bond Strengths

Abstract:

Cellophane, mylar, silicone rubber, Dow -Corning Composition 24, silicone impregnated fiberglass cloth, teflon, unplasticized Kel-F and polyethylene films were examined for protecting the adhesive characteristics of Metlbond 4021 (Narmco Coatings and Resins, Inc.) and AF-31 (Minnesota Mining and Manufacturing Co.) throughout two stage curing cycles wherein a portion of the bonding of parts is done in a first stage, and the remainder are bonded onto an assembly in a second stage. Peel strength tests indicated that teflon and unplasticized Kel-F films were highly satisfactory for the purpose described.

Reference: Conger, O., Picotte, G. L., Sutherland, W. M., "Evaluation of Parting Films for Two-Stage Curing of Metlbond 4021 and 3(M) Co. AF-31 Structural Adhesives," General Dynamics/Convair Report MP57-124, San Diego, California, 3 June 1957.



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REPORT NO.

Report No. 8926-118

Material - Titanium - Ti 6Al-4V

Effect of Heat Treatments on Elevated Temperature
Stress Stability

Abstract:

The elevated temperature stress stability of heat treated (1650°F, 1 hr/W.Q./900°F., 6 hrs, and 1650°F., 1 hr/W.Q./900°F., 12 hrs) was determined after exposing materials at 750°, 800° and 850°F., and 35,000, 50,000 and 65,000 psi stress for 1000 hours. The 1000 hour stress-rupture life of material aged at 900°F for 6 and 12 hours appeared at 50,000 psi stress at a temperature somewhere between 800° and 850°F. Considering 1 percent extension as a limiting stress-rupture deformation condition the limiting stresses appeared to lie between 35,000 and 50,000 psi, and the limiting temperature under these conditions fell between 750° and 800°F with 6 hour aged material, and between 800° and 850°F with the 12 hour aged material.

Reference: Alesch, C. W., Strong, E. F., "Stability of Short Time Aged 6 Al-4V Titanium Alloy" General Dynamics/Convair Report 57-212-1, San Diego, California, 4 September 1957. (Reference attached.)



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REPORT NO.

Report No. 8926-119

Material - Finishes and Coatings - Chemical Pretreatment -
Alodine 600 (American Chemical Paint Co.)

Effect of Metal Cleaners on Adhesion

Abstract:

Three tank-type emulsion cleaners and three hand-wipe cleaners were examined for their effectiveness in removing grease, code markings and pressure sensitive adhesive residues preparatory to Alodine 600 application. The adhesion of the Alodine 600 generated surfaces was determined by means of peel tests conducted after bonding Alodined surfaces together with Minnesota Mining and Manufacturing Company AF-10 structural adhesive, and as a result the adhesion of the Alodine 600 prepared surfaces was considered satisfactory in all cases, regardless of the metal cleaner or cleaning method used. The emulsion cleaners considered were Turco #3878 (Turco Products Co., Los Angeles), Ethnone #75 (Ethnone Inc., New Haven, Conn.) and TEC #1654 (TEC Chemical Co., Monterey Park, Calif.). The hand-wipe cleaners were (1) a mixture of equal parts of water, isopropyl alcohol and T. O. Bateman Co., San Diego, Calif., Red X Solvent Cleaner, (2) TEC Acidic Solvent Cleaner, TEC Chemical Co., Monterey Park, Calif., and (3) Brotite #25 Solvent Cleaner, Andrew H. Brown Co., Los Angeles, California.

Reference: Barringer, H. R., Picotte, G. L., Sutherland, W. M., "Comparison of Various Pre-Cleaning Methods for the Alodine 600-Scotch-weld AF-10 Adhesive System," General Dynamics/Convair Report MP57-273, San Diego, California, 29 March 1957.
(Reference attached.)



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REPORT NO.

Report No. 8926-120

Material - Adhesives - Structural - Protective Tapes for.

Effect of Tapes on Structural Adhesive Strengths.

Abstract:

The effect of applied Minnesota Mining and Manufacturing Co. Tapes #343, #344 and #141213 and Spraylat Corp. Tape SC 1503 on the tensile-shear strength of adhesive bonded joints comprised of Minnesota Mining and Manufacturing Co. EC 1290 and AF-10 structural adhesive components was determined. The specific effect observed related to the effect of tape application and storage on the precured EC 1290 primer. The protective tapes involved consisted of paper backings to which rubber base adhesives were applied. Tapes #343, #344, and #141213 caused no significant change in adhesive bond strength after 20 and 40 days of storage with their adhesives in contact with precured EC 1290 primer. The Spraylat SC 1503 tape could not be cleanly stripped from the precured primer.

Reference: Lintvedt, V. L., Picotte, G. L., Keller, E. E., "Protection of EC 1290 Precured Primed Surfaces," General Dynamics/Convair Report MP57-297, San Diego, California, 9 January 1958. (Reference attached.)



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REPORT NO.

Report No. 8926-121

Material - Titanium - Protective Coatings
for Heat Treatment

Effectiveness in Air Furnaces

Abstract:

The effectiveness of Granodraw T-LFN-L-683 and -LFN-L-785 (American Chemical Paint Co., Ambler, Penna) in preventing embrittlement of Ti 6Al-4V and Ti 8Mn alloys during heat treatment was determined. Samples of the two alloys were treated with the two compounds and heat treated: the Ti 6Al-4V samples received 1650°F., 1 hr/W.Q./900°F., 6 hrs/AC heat treatment, and the Ti 8Mn received 1275°F. 1/2 hr/AC/925°F., 4 hrs/AC. Tension and bend test results obtained from the coated and treated materials were compared with results obtained with un-coated and heat treated materials. The absence of significant differences between results with coated and un-coated materials showed the coatings to be ineffective.

Reference: Bergstedt, P. W., Sutherland, W. M., "Protective Coatings for Use in Heat Treating Titanium," General Dynamics/Convair Report MP57-458, San Diego, California, 21 August 1957, (Reference attached).



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REPORT NO.

Report No. 8926-122

Material - Adhesives - Structural - AF-10 and AF-32
(Minnesota Mining and Manufacturing Co.)

Tensile-Shear and Peel Strengths

Abstract:

The tensile-shear and peel strengths of cured joints made with clad 2024-T3 aluminum alloy, and AF-10 and AF-32 structural adhesives were determined at various temperatures both before and after immersion in JP-4 fuel. The tensile shear strengths of AF-32 were generally better at -67°F than those of AF-10. Room temperature peel tests indicated AF-10 somewhat more resistant to peeling than AF-32. Higher curing temperatures and pressures resulted in the better -67°F tensile shear strengths with both adhesives, but lower* temperatures and pressures promoted the higher peel strengths. Neither adhesive suffered from JP-4 fuel immersion.

Reference: Barringer, H. R., Pihl, A. R., Miyaji, M. C., Sutherland, W. M., "comparison of Scotchweld AF-10 and AF-32 Adhesives for Integral Tank Sealing Applications," General Dynamics/Convair Report MP57-464, San Diego, California, 8 August 1957 (Reference attached).

* curing



Report No. 8926-123

Material - Insulation - Thermal - Structural
Laminating

"Heat Barrier" Characteristics

Abstract:

The effectiveness of CTL-91-D (Cincinnati Test Laboratories, Cincinnati, Ohio), and Rocketon and Missileon (Haveg Industries, Wilmington, Delaware), when interposed as a laminate between a clad 2024-T3 aluminum alloy plate and a 2024-T3 aluminum alloy extrusion and fastened with 2017-T31 aluminum alloy rivets, was observed in terms of the temperature difference between the hot side of the plate and the extreme edge of the outstanding web of the Tee-extrusion stiffener on the cold side of the heated plate stiffener combination. The transfer of heat from the plate into the Tee-extrusion through the metallic path provided by the rivets rendered the "heat barrier" ineffective. The effectiveness of silicone rubber and foamed silastic (Dow Corning, Midland, Michigan), and teflon sheet (Shamban, Culver City, California) as "heat barriers" in .07 to .25 inch thicknesses was checked by observing the temperature drop through them when they were placed on a heated hotplate. The small temperature drop observed in these materials during test indicated their ineffectiveness as "heat barriers."

Reference: Stier, H. H., Sutherland, W. M., "Heat Barrier Efficiency Tests," General Dynamics/Convair Report MP57-490, San Diego, California, 18 October 1957, (Reference attached).



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REPORT NO.

Report No. 8926-124

Material - Aluminum - 2024-T81 and 2024-T31 -
Stretcher Levelled Plate

Stress Corrosion Susceptibility From Rivet Swelling

Abstract:

The tendency for the swelling of 2024-T31 aluminum alloy rivets, caused by gun driving them into holes in 2024-T81 stretcher levelled aluminum alloy plates, to induce stress corrosion susceptibility in the plate material was checked by means of salt spray exposure and synthetic sea water alternate immersion tests. Stress corrosion cracking was not observed during testing, and stretcher levelling thus did not appear to induce stress-corrosion susceptibility in 2024-T81 plates.

Reference: Turner, H. S., Sutherland, W. M., "Stress Corrosion Cracking Test of 2024-T81 Aluminum Alloy Plate," General Dynamics/Convair Report MP57-506, San Diego, California, 17 September 1958, (Reference attached).



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REPORT NO.

Report No. 8926-125

Material - Insulation - Sound - Polyurethane and
Neoprene Rubber Foam

Sweat and Ozone Resistance

Abstract:

The resistance of polyurethane and neoprene rubber foams (source not given) to solutions containing physiological concentrations of sodium chloride and urea, and oxygen-ozone mixtures was determined. Immersion of both materials in various "sweat solutions" for 48 hours did not impair their tensile strength or apparent elasticity. Exposure of both materials in an oxygen-ozone mixture for 40 to 60 minutes also did not impair them, although gum rubber disintegrated under these conditions of test.

Reference: McGowan, Keller, E. E., Turner, H. C., "Resistance of Plastic Foam Materials to Sweat and Ozone," General Dynamics/Convair Report MP57-532, San Diego, California, 25 July 1957, (Reference attached).



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REPORT NO.

Report No. 8926-126

Material - Aluminum - 2024-T4 Extrusions

Effect of Stretching on Mechanical and Fatigue
Properties

Abstract:

A large extruded Tee-section made from 2024 aluminum alloy was subjected to fifteen variations in degree of stretch, solution heat treatment and natural aging sequences. The various processing sequences approximated various manufacturing steps, and the mechanical and fatigue properties resulting therefrom were desired for comparison with minimum design allowable strengths already established for unstretched extrusions. In all cases the processed extrusion mechanical and fatigue properties exceeded design minima for unstretched extrusions. In general the strengths were higher than established minima, and the elongations approached minimum values.

Reference: Haney, R. J., Lindeneau, G. D., Wise, W. E., "2024 Extrusions #E-801903 - Effects of Stretching on Tensile Yield, Ultimate & Elongation - Compression Yield - Fatigue Properties - Thickness," General Dynamics/Convair MP 57-997, San Diego, California, 25 June 1958 (Reference attached).



Report No. 8926-127

Material - Stainless Steel - Type 410, Casting

Effect of Surface Preparation on Adhesive
Bond StrengthsAbstract:

The comparative effectiveness of a sulfuric acid-sodium dichromate and a boiling hydrofluoric acid surface preparation in providing suitable structural adhesive bonds between Type 410 stainless steel castings, and 7075-T6 clad and 2024-T86 bare aluminum alloys was determined. The sulfuric acid-sodium dichromate cleaner consisted of distilled water, 2 per cent sulfuric acid and 2 per cent sodium dichromate used at room temperature. The hydrofluoric acid cleaner consisted of a 10 per cent aqueous hydrofluoric acid solution used at its boiling temperature for 5 minutes. The adhesives used to compare the adhesion characteristics of the different stainless steel surfaces were EC-1459 primer and AF-10 film (Minnesota Mining and Manufacturing Co.), and they were cured at 350°F for 2 hours under a pressure of 100 psi. Satisfactory adhesive bond strengths were obtained with both surface preparation methods. The hydrofluoric acid method generally provided the higher strengths, however. Pertinent results are tabulated below:

Alloys (1)	Cleaner (2)	Bond Strength			
		R.T.	SS(3)	-67°F	300°F
7075-410	1	3190	4080	2110	2275
7075-410	2	3635	3690	2945	1620
2024-410	1	2690	3910	1690	1670
	2	3320	4050	2480	1560
7075-7075	1	4015	4155	1610	2445
2024-2024	1	3890	4165	2115	2265

- (1) 7075-T6, 2024-T86 aluminum alloys, Type 410 stainless steel.
(2) 1, sulfuric acid-sodium dichromate cleaner; 2, hydrofluoric acid cleaner.
(3) Tested at room temperature after 30 days salt spray exposure.

Reference: Pearson, H., Picotte, G. L., Keller, E. E., "Aluminum to Stainless Steel Bond Tests," General Dynamics/Convair Report MP 57-603, San Diego, California, 30 December 1957 (Reference attached).



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REPORT NO.

Report No. 8926-128

Material - Nickel Base Alloy - Monel Metal

Countersunk Rivet Shear Strengths

Abstract:

The ultimate and yield strength of AN427 Monel metal 5/32 and 3/16 inch diameter rivets driven into various thicknesses of Ti 6Al-4V alloy sheet were determined. Rivet installations in sheet thicker than 0.060 inch failed by rivet shear. Those joints which contained sheet material of less than 0.060 inch thickness failed by tear-out or crushing under the rivet. The ultimate and yield strengths of those rivets which failed in shear were: 3/16 inch diameter, 1781 and 2726 lbs. respectively; and 5/32 inch diameter, 1590 and 1985 lbs. respectively.

Reference: Neary, J. K., Buehler, H. A., Wise, W. E. "Monel Rivet - Machine Countersunk in Titanium Sheet - Design Ultimate Shear Test," General Dynamics/Convair Report MP 57-651, San Diego, California, 10 June 1958 (Reference attached).



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REPORT NO.

Report No. 8926-129

Material - Adhesives - Structural - EC-1459, EC-1469, AF-102
(Minnesota Mining and Manufacturing Co.)

Effect of Variations in Bonding Pressures and
Temperatures on Joint Strengths

Abstract:

The effects of variations in pressures and temperatures for curing adhesive bonded joints made between 2024-T86 aluminum alloy overlaps, and 2024-T86 aluminum alloy face plates and 3003-H19 aluminum alloy honeycomb cores with EC-1459, EC-1469 and AF-102 (Minnesota Mining and Manufacturing Co.) adhesives were determined. The curing cycles used were (1) 150 psi pressure at 350°F for 2 hours, (2) 100 psi pressure at 250°F for 30 minutes followed by 350°F for 2 hours, (3) 100 psi pressure at 350°F for 2 hours, and (4) 85 psi pressure at 350°F for 2 hours. The first two of the four cure cycles gave satisfactory -67°F tensile shear strengths. The 216°F tensile shear strength obtained by the last three cure cycles were slightly low. The metal to metal peel strength produced by all four cycles was satisfactory. The honeycomb sandwich flexural strengths at -67°F were satisfactory throughout. The room temperature peel strengths of the honeycomb sandwich varied considerably and only the second cure cycle produced satisfactory strengths.

Reference: Lawley, R. W. Jr., Miyaji, M. C., Sutherland, W. M.,
"Effect of Various Cure Cycles on Metal to Metal and
Metal to Core Bonds Using Adhesive System Detailed in
Specification 8-01318," General Dynamics/Convair,
Report MP 57-461, San Diego, California, 9 July 1957
(Reference attached).



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Report No. 8926-130

Material - Adhesives - Metlbond 4021 (Narmco
Resins and Coatings Co.)

Effect of Aluminum Alloys on Bond Strength

Abstract:

The differences between the surfaces of clad 2024-T3, clad 2024-T86 and bare 7075-T6 aluminum alloys caused by variations in heat treatment or alloy composition with respect to adhesive bond strength were observed by means of tests made with surfaces which were primed with Metlbond 4021 primer and joined with AT 10 (Minnesota Mining and Manufacturing Co.) adhesive tape. The results of tensile shear tests at -67°F., room temperature and 300°F., and peel tests at room temperature showed that no significant effect upon adhesive bond strengths occurred from the surface differences indicated.

Reference: Barringer, H. R., Picotte, G. L., Keller, E. E., "Effects of Crystalline Structure of Aluminum Alloy Sheets, As Determined by X-Ray Diffraction, Upon Adhesive Bond Strength," General Dynamics/Convair Report MP 57-983, San Diego, California, 23 October 1958, (Reference attached).



Report No. 8926-131

Material - Finishes and Coatings - "Touch-Up"
Corrosion Preventatives

Long Term Effectiveness in Marine Atmospheres

Abstract:

The effectiveness of 10 per cent chromic acid solution, Alodine 1200 (American Chemical Paint Co.), Iridite 14 (Allied Research Products, Co., Baltimore, Md.), and Bonderite 710 (Parker Rustproofing Co., Detroit, Michigan), when applied to clad 7075-T6 aluminum alloy sheet provided with stainless steel metal screws and Huck lockbolts, in retarding industrial-marine atmospheric corrosion, ^{WAS CHECKED} Ten months outdoor exposure of representative test panels revealed that none of the "touch-up" finishes were effective in retarding corrosive attack for this length of time.

References: Hooper, A. F., George, J. C., Keller, E. E., "Corrosion Preventative Characteristics of Touch-Up Chemical Surface Treatments on Aluminum Alloy Assemblies," General Dynamics/Convair Report MP 57-637, San Diego, California, 29 April 1959, (Reference attached).