

**AIRCRAFT**  

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**AND MISSILE**  

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**DESIGN AND**  

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**MAINTENANCE**  

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**HANDBOOK**  

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# **Aircraft and Missile Design and Maintenance Handbook**

**Charles A. Overbey**

**The Macmillan Company      New York**

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*To My Wife, Iris*

## Preface

This handbook has been written for engineers, inspectors, technicians, and mechanics who work with aircraft and missiles. The author has attempted to assist the reader in two ways. First, he has tried to save time for the user by providing, in a single source, data which heretofore have been scattered throughout the military and industrial literature. Secondly, he has provided on the basis of his own experience, and that of his associates, instruction in the proper use of tools and materials. These descriptions of standard practices should prove to be genuine timesavers because they enable the user to benefit from the experience of others.

The emphasis is on the practical aspects of aircraft and missile work. Much of the data are presented in the form of easy-to-use reference tables. Special attention is directed to the information on glass-fibre reinforced plastics, titanium, cleaning processes, aircraft and missile tube fittings, and corrosion prevention. Bolt tables in the Hardware Section indicate what nuts, washers, and cotter pins are to be utilized with bolts of specific sizes, thus saving the user considerable time in ferreting such information out of the AN and MS standards. Other tables in the Hardware Section are constructed in a similar manner. Conversion tables in the Color Codes and Conversion Tables Section are given in both U.S. and metric units.

The subjects of aircraft and missile power plants are generally beyond the scope of this work, although the following sections have information relevant to power plant systems: Color Codes and Conversion Tables, Plumbing, Materials of Construction, Hardware, and Processes. The subject of electronics is excluded from consideration in this book; however, electrical system information is given, so that the user can design and install simple electrical circuits that will meet safety standards.

The author would welcome suggestions from readers about how to make future revisions of the book more useful in the design, construction, modification, and maintenance of missiles and aircraft.

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Department of Defense  
Federal Aviation Agency  
United States Air Force  
United States Navy

### **Companies and Associations**

Air Associates, Incorporated  
Aerospace Industries Association  
Aluminum Company of America  
American Steel and Wire Company, A United States Steel Corporation  
Subsidiary

The Association of American Battery Manufacturers, Incorporated  
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Scott Aviation Corporation  
The L. S. Starrett Company  
Summerill Tubing Company

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# 1. Color Codes and Conversion Tables

## INTRODUCTION

The material in this section is of practical importance in aircraft and missile work.

Color codes are located at the beginning of the section and are followed by mathematical tables, conversion tables and other useful data. Tables on rocket symbols, oxydizers, and so forth are located near the end of the section.

Some examples of the type of information in this section are: colors of aircraft hydraulic fluids; color code for shock absorber cord and rings and elastic exerciser cord; both the "old" and "new" identification colors for fluid carrying lines; circumferences and areas of circles; pressure conversion; U.S. and metric measure of volume and capacity, masses and weights, energy, work, heat and power; decimal equivalents of number and letter drills; tolerances of holes for various classes of fits; housing dimensions for anti-friction bearings; weight, specific gravity and density of materials; melting temperatures of metals and alloys; wire and sheet metal gages; standard atmosphere table; rocket symbols; compatability of rocket propellants and materials; physical properties of oxidizers and fuels; specific impulse of different propellant combinations, and similar data.

Table 1. COLORS OF AVIATION GASOLINE

Dye Color	Grade	
	<i>Octane</i>	<i>Performance number</i>
Red	80	
Blue	91/98	
Green		100/130
Brown		108/135
Purple		115/145

Table 2. COLORS OF HYDRAULIC FLUIDS

Dye Color	Composition	Specifications
Red	Petroleum	MIL-0-5606
Blue	Castor oil and alcohol	M-574
Light green	Skydrol	

Table 3. COLOR WARNINGS FOR COMPRESSED GAS CYLINDERS<sup>ab</sup>  
(SOURCE: United States Department of Defense)

Class Standard of color	Class of material
Yellow, No. 1310	<i>Flammable materials.</i> All materials known ordinarily as flammables or combustibles.
Brown, No. 1710	<i>Toxic and poisonous materials.</i> All materials extremely hazardous to life or health under normal conditions as toxics or poisons.
Blue, No. 1520	<i>Anesthetics and harmful materials.</i> All materials productive of anesthetic vapors and all liquid chemicals and compounds hazardous to life and property but not normally productive of dangerous quantities of fumes or vapors.
Green, No. 1460	<i>Oxidizing materials.</i> All materials which readily furnish oxygen for combustion and fire producers which react explosively or with the evolution of heat in contact with many other materials.
Gray, No. 1625	<i>Physically dangerous materials.</i> All materials not dangerous in themselves, which are asphyxiating in confined areas or which are generally handled in a dangerous physical state of pressure or temperature.
Red, No. 1105	<i>Fire-protection materials.</i> All materials provided in piping systems or in compressed-gas cylinders exclusively for use in fire protection.

<sup>a</sup>Exact identification of any material contained in a compressed gas cylinder is made ONLY by means of the written title. The title appears in two locations diametrically opposite and parallel to the longitudinal axis of the cylinder.

<sup>b</sup>The appearance on the body, top, or as a band(s) on compressed gas cylinders of any of the following six colors shall provide a warning of danger from the hazard involved in handling the type of material contained in the cylinder, according to the definitions for warning colors shown under the "Class of Material" column.

Table 4. COLOR CODE FOR SHOCK ABSORBER CORD AND RINGS AND FOR ELASTIC EXERCISER CORD  
(SOURCE: MIL-C-5651A)

Year Marking			Quarter Marking		
Year	Threads	Color of threads	Quarter	Threads	Color
1959	2	yellow	Jan., Feb., Mar.	1	red
1960	2	black	Apr., May, June	1	blue
1961	2	green	July, Aug., Sept.	1	green
1962	2	red	Oct., Nov., Dec.	1	yellow
1963	2	blue			
1964	2	yellow			
1965	2	black			
1966	2	green			
1967	2	red			
1968	2	blue			

NOTES:

1. The code covers a five-year period and repeats itself, making it easy to figure forward or backward from the years shown.

2. Elastic exerciser cord (Specification MIL-C-5650) is coded in the same manner as shock absorber cord and rings, except that four colored threads are braided into the outer layer of cord, instead of three. Three of the threads are of the same color and indicate the year of manufacture; the fourth thread, of a different color, represents the quarter of the year in which the cord was made. Elastic exerciser cord in storage should be put into use within 18 months of the time of its manufacture.

3. The year marking and quarter marking columns, above, refer to the date of manufacture of shock absorber cord and rings as follows: Three colored threads are braided into the outer layer of the cord or ring. Two of these threads are of the same color and represent the year of manufacture; the third thread, of a different color, represents the quarter of the year in which the cord or ring was made.



Table 5. COLOR CODE FOR IDENTIFICATION OF STEEL

Broad Stripe		Narrow Stripe	
Color(s)	First two or three digits of steel number	Color(s)	Last two digits of steel number
Red	10	Red and Black	00
Red and yellow	13	Red	10
Yellow	23	Red and Green	12
Yellow and green	25	Red and white	15
Green	31	Yellow	20
Blue	32	Yellow and white	25
Brown	33	Black	30
Black	34	Black and white	35
Green and white	40	Green	40
Black and white	41	Green and white	45
Blue and white	43	Black and green	46
Red and black	46	Blue	50
Khaki	51	Blue and brown	55
Red and blue	53	Brown	60
White	61	Brown and white	65
Red and brown	72	Khaki	95
Blue and yellow	76		
Black and yellow	86		
Black and green	87		
Blue and brown	92		
Brown and white	512		
Brown and yellow	521		
Purple	713		
Purple and yellow	716		

Table 6. IDENTIFICATION COLORS FOR FLUID LINES (Prior to August, 1949)  
(SOURCE: AND10375)

Air Pressure (Compressed)	
Maximum 25 psi	Light blue-Light green
Minimum 25 psi	Yellow-Light green
Air Ducts (Cabin Heaters)	
Cold	Yellow-Red-Yellow
Hot	Light blue-Red