TECHNICAL MANUAL

CONSERVATION AND SEGREGATION OF CRITICAL ALLOY AND PRECIOUS METAL BEARING PARTS AND SCRAP

(ATOS)

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INTRODUCTION

1. PURPOSE.

This technical order implements Department of Defense policy governing the conservation, identification and segregation of scrap, parts, and materiel containing critical alloys and/or precious metals which are generated through overhaul, rebuild, maintenance or condemnation of aircraft, missiles, rockets, and their applicable engines. It also establishes responsibilities and provides instructions for implementation of this policy; including, specific guidelines for identifying metals. Critical alloys shall mean scrap, parts and materiel identified by the materiel specification or principle alloy elements such as nickel, chromium, cobalt, titanium, tungsten and beryllium as shown in Table 1-1. Precious metals shall mean scrap, parts and materiel containing silver, gold and platinum family metals as shown in Table 1-1, group numbers 65, 70, and 75 regardless of other materiel specification. The instructions contained herein are mandatory for all activities concerned. Table 1-2 is a list of common chemical symbols used in the metal industry. Table 1-3 is a list of American Iron and Steel Institute (AISI) Materiel Groups. Table 1-4 provides a list of Aerospace Materiel Specifications (AMS). Table 1-5 is a list of Pratt and Whitney Aircraft (PWA) Materiel Groups. Table 1-6 provides a list of Miscellaneous Specifications and Table 1-7 provides a listing Identification of Metals.

2. REFERENCES.

2.1 DoD 4160.21-M, Defense Materiel Disposition Manual, Chapter 11.

2.2 AFI 23-101, Air Force Materiel Management, Section 6C.

3. RESPONSIBILITIES.

3.1 Headquarters AFMC will:

3.1.1 Be responsible for the management, development and publication of this basic technical order.

3.1.2 Ensure implementation of and compliance with this conservation program throughout the USAF by providing administrative guidance in AFI 23-101.

3.2 The Aerospace Sustainment Directorate of the Air Logistics Complex having Inventory Control Point (ICP) responsibility will develop, prepare and publish the 00-25-113 series technical orders and changes or supplements as required for assigned aircraft, missiles, rockets, and engines according to the guidance provided herein. The ICP shall advise HQ AFMC to add new alloys or segregation groupings when new weapons systems or equipment is brought into the inventory.

3.3 Installation Commanders will ensure that maintenance and other activities generating scrap will establish local procedures for identification and segregation of condemned parts or scrap assets into the materiel segregation groups and specifications shown in Table 1-1. Identification and segregation of materiel will be accomplished at the source of generation. Segregated parts and scrap will be placed in separate containers for the appropriate materiel segregation group and specification shown in Table 1-1 for turn-in to the Defense Logistics Agency Disposition Services.

CHAPTER 1

1.1 PREPARATION OF THE 00-25-113 SERIES TECHNICAL ORDERS.

Individual technical orders or supplements for assigned aircraft, missiles, rockets, and engines identifying scrap parts and materiel which contain critical alloys or precious metals shown in Table 1-1 excluding Groups 1 and 2 will be prepared by the applicable Product Directorate.

1.1.1 The title page will include the following statements:

1.1.1.1 Critical Alloys and Precious Metals Parts List, followed by the designation of the appropriate aircraft, missile, rocket, engine, or weapon system component.

1.1.1.1.1 This publication is incomplete without the basic T.O. 00-25-113.

1.1.1.2 Parts containing materiel specification and precious metals shown in Table 1-1 (other than Groups 1 and 2) will be listed as follows:

1.1.1.2.1 Manufacturer's part number and when it is available at the time the data is being compiled, include the National Stock Number (NSN).

1.1.1.2.2 Noun/Nomenclature - do not exceed the standard 19 positions.

1.1.1.2.3 Group number. The group number for each part/component will be determined by the materiel specifications or principal alloy elements shown in Table 1-1. Inseparable parts joined by welding or other means which include materiel specifications in two or more different numbered groups will indicate each materiel group number contained in the part or assembly.

1.2 GUIDELINES FOR THE IDENTIFICATION OF METALS.

The following information is provided for use by operating personnel to identify and segregate high-temperature alloys and stainless steel.

1.2.1 Visual Inspection. First, check each item or specimen for identification markings-such as manufacturers' part numbers or specification numbers (e.g., AISI-310). When such data are visible, they should be checked against part numbers, materiel alloys, or group numbers. If identification of the materiel alloy content can be determined by the physical item markings, no further testing is necessary. However, a sample of each known specimen should be marked according to its materiel alloy grouping or specification, and be mounted on a display board for comparison with unknown specimens.

1.2.1.1 When the specimen cannot be identified by part number or specification markings, examine its physical appearance and determine its possible common use. For example, a jet engine bucket blade normally contains high-temperature alloys, and should be tested for its principal alloy elements (i.e., nickel, cobalt, titanium, etc).

1.2.1.2 Check the color of the metal. Is the color silvery, like polished aluminum or magnesium; yellow, like brass or gold; gray, like zinc or lead? Its color may guide you as to the alloys or elements to test for.

1.2.1.3 If possible, check the density (weight) of the specimen by holding it in your hand. Compare the *feel* of the weight with the weight of a known specimen or the weight of an equal volume of water. Some metals can be identified by density alone, without further testing. The density or specific gravity of some metals is as follows:

1.2.1.3.1 Very Heavy Metals. (Specific gravity is 12 to 22 times heavier than an equal volume of water). Examples include gold, mercury, platinum, tantalum, tungsten, and uranium.

1.2.1.3.2 Heavy Metals. (Specific gravity is 9.8 to 11.3 times heavier than an equal volume of water). Examples are bismuth, lead, molybdenum, and silver.

1.2.1.3.3 Average Density Metals. (Specific gravity is 6 to 9 times heavier than an equal volume of water). This type includes all irons and steel, cobalt alloys, nickel alloys, stainless steel and pure metals such as antimony, cadmium, maganese, tin, and zinc.

1.2.1.3.4 Light Density Metals. (Specific gravity is 1.5 to 3 times heavier than water). This group includes aluminum, magnesium, and titanium.

1.2.1.4 Magnetic Testing. Magnetic testing consists of determining whether the specimen is attracted by a magnet. The magnet must be free swinging from a chain, ring, or string. Usually, a metal attracted by a magnet is iron, steel or iron base alloys containing nickel, cobalt or chromium. However, there are exceptions to this rule since nickel and cobalt alloys may be either magnetic or non magnetic. This test can serve only as an initial step in identifying a specimen and never as a final test.

1.2.1.4.1 Strongly magnetic metals include pure iron, pure nickel, pure cobalt, iron-nickel-cobalt alloys, AISI-400 series (Group 2), alnico.

1.2.1.4.2 Lightly magnetic alloys include AISI-300 series (Group 1), pH grades of stainless steel and monel.

1.2.1.4.3 All other metals and alloys are non magnetic.

1.2.1.5 Spark Testing. Some metals can be readily identified by characteristic sparks thrown off when the specimen is held against a high-speed grinding wheel. The spark streams may vary from a few tiny sparks to a shower of sparks. Skill in spark-testing takes practice. When possible, compare the sparks thrown off by the unknown specimen spark streams from known samples. Standard samples of known specifications should be maintained for comparison purposes. When testing, hold the specimen with a firm, even pressure against the top of the revolving grinding wheel. The surface of the grinding wheel should be cleaned frequently to free the wheel of metal particles retained during prior use.

1.2.1.5.1 A high-speed bench grinder is recommended for spark testing. It should have a 6″ to 8″ wheel, medium grit composition, 1/2 to 3/4 horse power, 110 or 220 volt, 3,400 to 4,000 RPM. Always wear goggles when spark testing.

WARNING

Abrasive grinding wheels will not be used to grind aluminum, brass, copper, or other soft metals unless the wheel is specifically designed for that purpose. Such wheels will be used to grind soft metals only.

1.2.1.5.2 Metals and alloys which will not produce a spark on a grinder include aluminum, brass, cadmium, copper, gold, lead, zinc, and antimony.

1.2.1.5.3 Stainless steel and high-temperature alloys with iron and nickel base compositions will produce characteristic sparks. As a general rule, the more iron in a specimen the lighter the spark will be. As the percent of iron decreases and the percent of nickel increases, the spark will darken. For example:

1.2.1.5.3.1 Group 1 (7-13 percent nickel, 70 percent iron) will produce a light and diffused straw-colored spark.

1.2.1.5.3.2 Group 14 (12-20 percent nickel, 55 percent iron) will produce a dark red spark, and then turns a light straw color.

1.2.1.5.3.3 Group 8 (70-74 percent nickel, 10 percent iron) will produce a short, dark red spark, and will not brighten.

1.2.1.6 Chemical Spot (Acid) Test. Spot test may be made by placing one or more drops of acid on the metal surface of a specimen to show attack or reaction to the acid. Spot tests are based on the formation of characteristic colors produced by the reaction of the acid on the metal surface. A small surface of the specimen should be cleaned with an emery cloth, file, or grinding wheel before making a spot test.

1.2.1.6.1 Acids required for testing.

1.2.1.6.1.1 Nitric Acid (concentrated).

1.2.1.6.1.2 Hydrochloric Acid (concentrated).

1.2.1.6.1.3 Potassium Ferricyanide (10 percent solution-dissolve 10 grams of potassium ferricyanide in 100 milliliters of water).

1.2.1.6.2 In Nitric Acid testing, place one drop of concentrated Nitric Acid on a clean metal surface. The following reaction should result:

Metals	Reaction
Brass	Blue-green
Cadmium	Yellow
Cobalt (pure)	Red
Copper	Blue-green
Copper-nickel	Blue-green
Magnesium	Effervescent-no color
Monel	Green
Nickel (pure)	Pale Green
Silver	Gray-white
Tin	White
Zinc	Effervescent-black (brown fumes)

1.2.1.6.3 In Nitric Acid-diluted (50 percent acid and 50 percent water) -testing, place one drop of diluted Nitric Acid on a clean metal surface. The following reaction should result:

Metals	Reaction
Iron	Brown-black
Manganese steel	Brown
Nickel Iron Alloy 5 to 80 percent nickel-balance iron)	Brown
Hastelloy B	Blue (navy)

1.2.1.6.4 Metals and alloys that will not react to Nitric Acid (concentrated or diluted) include:

Aluminum	Lead
Antimony	Platinum
Cobalt base alloys	Stainless steel
Gold	Tantalum
High-temperature alloys	Titanium
	Tungsten

1.2.1.6.5 Aqua Regia Acid consists of one part Nitric Acid mixed with three parts of Hydrochloric Acid. Since this mixture breaks down after 24 hours, you may make this test by placing one drop of Nitric Acid and then three drops of Hydrochloric Acid on the spot to be tested. This solution should turn blue-green for cobalt base alloys and green for nickel base alloys.

1.2.1.6.6 Potassium Ferricyanide (10-percent solution) may be used to determine the iron content of nickel-base alloys, since there is no simple spot test for determining the percent of nickel contained. This test may be made by adding a drop or two of Potassium Ferricyanide to the spot tested by Aqua Regia. The color reaction will be very dark blue-black for a high iron content, and a light blue for low iron content. For example: Group 1 (7-13 percent nickel, 10 percent iron) will produce a brown color reaction.

1.2.2 Complex Tests. These are qualitative tests. If a specimen cannot be identified by these tests, obtain a spectrographic or chemical analysis if the quantity involved warrants it.

Table 1-1. Materiel Segregation Groups and Specification for Materiels Containing Critical Alloys or Precious Metals

Group No	Materiel Specifications	Principal Alloy Elements (Percent)
1 [1]	AISI 302, 303, 304, 305, 308, 316, 321, 347, 17-7PH, PH15-7MO, 321 and Inconel W when joined, ASTM A581, ASTM A582, AMS 5362, FMS-1080, -1086, MIL-S-5059, MIL-S-6721, MIL-S-7720, MIL-T-5695, MIL-T-6845, MIL-T-8808, QQ-S-763	7-13 Ni, 17-19 Cr
2 [2]	AISI 403, 405, 410, 414, 416, 420, 430, 431, 440	0-2 Ni, 12-16 Cr
3	AMS 5375, 5382, 5537, 5759, 5796, 7236 PWA 653, 654, 1032, 1064 Haynes Stellite (HS) 23, 25, 36, L251, L-605, L-650, WI-52	1-10 Ni, 12-16 Cr, 50-67 Co
4	AMS 5388, 5389, 5530, 5666, 5730, 5750, 7490 PWA 1078 Hastelloy C	55 Ni, 16 Cr
5	AMS 4783, 5382, 5608, 5768, 5769, 5772, 5789, 5794, 5801 PWA 24-4, 94, 95, 123, 641, 647, 648, 657, 658, 660, 662, 744, 766, 771, 789, 795, 1015, 1037, 1039, 1042, 1088, 1093 G-18B, N-155 (Multimet), 321 and N-155 when joined, 321 and HS25 when joined, 321 and HS21 when joined, 321 and Timken 16-25-6 and HS21 when joined, 347 and HS21 when joined, Inconel 702 and Stellite 31 when joined, Haynes 188, NM-100, MAR-M-302, MAR-M-509, Coast 63, B-100	2-20 Ni, 13-27 Cr, 10-60 Co
6	Timken 16-25-6, AMS 5725, 5726, 5728	25 Ni, 16 Cr
7	AMS 5617, 5659, 5860, Timken 16-25-6 and AMS 4340 when joined, Custom 455, 15-5 PH	1-25 Ni, 8-16 Cr
8	AMS 5391, 5540, 5542, 5550, 5580, 5582, 5598, 5599, 5607, 5665, 5667, 5668, 5669, 5670, 5671, 5679, 5683, 5687, 5695, 5698, 5699, 5771, 5778, 7232, 7490 PWA 655, 661, 1012, 1036, 1045, 1060, 1062, 1070 Inconel 600, 702, 703, 713, X, X750 Hastelloy N, FM 62, FM 69 FMS-3016, MIL-N-6840	76 Ni, 15 Cr
9	AMS 5534, 5765 S816	20 Ni, 20 Cr, 40 Co
10	AMS 4544, 4574, 4575, 4674, 4675, 4730, 7233, 7234 Monel	67 Ni, 30 Cu
11	PWA 779, WD 65	70 Fe, 14 Cr, 4 Mo, 1c, 3 Vanadium (V)

Table 1-1. Materiel Segregation Groups and Specification for Materiels Containing Critical Alloys or Precious Metals - Continued

Group No	Materiel Specifications	Principal Alloy Elements (Percent)
12	AMS 5342, 5343, 5344, 5355, 5359, 5368, 5398, 5520, 5546, 5547, 5548, 5549, 5554, 5604, 5622, 5643, 5657, 5743, 5744, 5774, 5780, 5781, 5813, 5825, 7474 PH 15-5 17-4PH, AM350, AM355, PH15-7Mo Inconel W and AISI 321 when joined	4 Ni, 17 Cr
13	AMS 5392, 5394 Ni-resist D2	15-20 Ni, 2 Cr, 2.4-3C, 0-6.5 Cu
14	AMS 5360, 5361, 5366, 5521, 5522, 5523, 5572, 5577, 5650, 5651, 5652, 5694, 7490 AISI 309, 309S, 310, 314 Inconel and 310 when joined, Immaculate No 5, WAC 7824	12-20 Ni, 24-25 Cr
15	AMS 5380, 5385 Haynes Stellite (HS) 21, 30, 31	2-15 Ni, 26-27 Cr, 50-60 Co
16	AMS 5383, 5589, 5596, 5662, 5663, 5664, 5676, 5832 PWA 96, 649, 673, 1009, 1010, 1033, 1065, 1081, 1085, 1090, 1469 Nimonic 75, 80, 80A, WAC 7830, 7831, 7832, 7834, 7835, Inconel 718	75-80 Ni, 20-21 Cr
17	AMS 5354, 5369, 5508, 5526, 5527, 5538, 5539, 5603, 5616, 5629, 5639, 5673, 5721, 5725, 5782, 5817, 7470 Greek Ascoloy, 19-9DL, 19-9DX, PH14-8Mo, QQ-W-423	2-9 Ni, 12-20 Cr
18	AMS 5384, 5544, 5586, 5704, 5706, 5707, 5708, 5709, 5712, 5713, 5751, 5753, 5828, 7471 PWA 92, 93, 625, 652, 675, 680, 686, 587, 688, 1004, 1005, 1006, 1007, 1013, 1016, 1023, 1027, 1030, 1034, 1086 Waspaloy, Rene 41, Rene 41 and Inconel 702 when joined, Astroloy, Udimet 500	55 Ni, 19 Cr, 13 Co
20	Refractaloy 26, 80, Westinghouse 9269	37 Ni, 18 Cr, 20 Co
21	AMS 5700 (TPA) Valves, WAC 8163, PWA 143	14 Ni, 14 Cr
22	Inconel-capped valves	22-35 Ni, 15-20 Cr
23	AMS 5525, 5660, 5661, 5726, 5728, 5731, 5732, 5733, 5734, 5735, 5736, 5737, 7235, 7477, 7478, 7479, 7481, 7482 PWA 788, 1002, 1003, 1022, 1049, 1052, 1075, 1092, 1094, 1191 A286, Discaloy, Incoloy 901, 903, 907, 909, (GE) M308, Incoloy A (B50TP), Incology T, Tinidur	26 Ni, 15 Cr
24	PWA 785, HR Crown, WAC 8338	12 Ni, 25 Cr
25	AMS 5378, 5758, 5844, 5845 PWA 115 Haynes Stellite (HS) 27, R30035, MP35N	30 Ni, 25 Cr, 30 Co
26	PWA 772, 773, Invar	36 Ni
27	AMS 5401, 5581, 5599, 5666, 5711, 5755, 5786, 5837, 5873 PWA 118, 1055, 1069, 1072, 1468 GMR 235, Allison EMS-73460, Inconel 625, Hastelloy S, Hastelloy W, Hastelloy R235	65 Ni, 15 Cr
28	PWA 651, Thetaloy	45 Ni, 25 Cr, 12 Co

Table 1-1. Materiel Segregation Groups and Specification for Materiels Containing Critical Alloys or Precious Metals - Continued

Group No	Materiel Specifications	Principal Alloy Elements (Percent)
29	PWA 646, 656, 658, 689, 1019, 1028, 1056, 1058, 1073, 1074, 1077, 1106 Nimonic 90, WAC 7836, IN-100, Udimet 700	58 Ni, 19 Cr, 18 Co
30	PWA 299, 645, 659, 663, 664, 1422, 1455, 1456, 1480 MAR-M-200, B-1900	64 Ni, 8 Cr, 10 Co
32	AMS 5390, 5536, 5587, 5588, 5754, 5798, 7237, 7490 PWA 24-3, 88, 94-1, 94-4, 123, 128, 1038, 1066 Hastelloy X	45 Ni, 22 Cr, 1.5 Co
33	AMS 5606, 5702 PWA 1003, 1025, 1026, 1043, 1453 AISI 330, Inconel 706	35 Ni, 15 Cr
34	AMS 6512 PWA 734, Maraging Steel	68.8 Fe, 18 Ni, 7.8 Co, 4.9 Mo, 4 Titanium,.1A1
55	AMS 7725, 7899, Tungsten (W)	90 Tungsten (W)
60	AMS 4900, 4901, 4902, 4906, 4908, 4910, 4911, 4915, 4916, 4918, 4921, 4923, 4925, 4926, 4927, 4928, 4929, 4930, 4935, 4938, 4941, 4942, 4943, 4951, 4953, 4954, 4955, 4956, 4965, 4966, 4967, 4972, 4973, 4975, 4976, 4977, 7460, 7461, 7498 PWA 91, 682, 1202, 1204, 1208, 1209, 1210, 1211, 1212, 1213, 1214, 1215, 1216, 1217-2, 1219, 1220, 1224, 1227, 1228, 1231, 1260, 1261-1, 1262, EMS 59034, 59035, FMS 1090, 1098, 1109, 1115, 3001, MIL-T-9046, MIL-T-9047	80 Titanium (Ti)
61	AMS 5553, PWA 6000, 6005, 6020, 6022	Nickel (Ni)
62	Beryllium (Be), QQ-C-530, QQ-C-533	Beryllium (Be)
63	AMS 4982, PWA 1095, C-103	55.5 Titanium (Ti), 44.5 Cb
64	AMS 5865, 5890 PWA 94-3, 1014, 1035 TD Nickel	98 Ni, 2 Thorium (Th)
65	AMS 2410, 2411, 2412, 2664, 2665, 2666, 2667, 2668, 2669, 4765, 4770, 4771, 4772, 4773, 4815, 4816 PWA 84, 85, 706, 707 Silver (Ag)	Silver lined, clad, plated, brazed or fabricated
70	AMS 2422, 2425, 4785, 4786, 4787, 7731 PWA 19, 698, 708, 718 Gold (Au)	Gold lined, clad, plated, brazed or fabricated
75	AMS 7735, Platinum (Pt), Palladium (Pd), Rhodium (Rh), Iridium (Ir), Ruthenium (Ru), Osmium (Os)	Lined, clad, plated, brazed or fabricated
76	FMS-1111, 1112	10 Ni, 8 Co

[1] Parts made from specifications shown in this group are non magnetic and can be identified by use of a hand magnet.

[2] Parts made from specifications shown in this group are magnetic and can be identified by use of a hand magnet.

Table 1-2. Common Chemical Symbols Used in the Metal Industry

Name	Symbol
Aluminum	Al
Antimony (Note 1)	Sb
Barium	Ba
Beryllium	Be
Bismuth	Bi
Boron	B
Cadmium	Cd
Calcium	Ca
Carbon	C
Chlorine	Cl
Chromium	Cr
Cobalt	Co
Columbium (Note 2)	Cb
Copper	Cu
Gallium	Ga
Gold (Note 3)	Au
Iridium	Ir
Iron (Note 4)	Fe
Lead (Note 5)	Pb
Lithium	Li
Manganese	Mn
Magnesium	Mg
Mercury (Note 6)	Hg
Molybdenum	Mo
Nickel	Ni
Osmium	Os
Palladium	pd
Platinum	Pt
Radium	Ra
Rhodium	Rh
Ruthenium	Ru
Selenium	Se
Silicon	Si
Silver (Note 7)	Ag
Sodium (Note 8)	Na
Sulphur	S
Tantalum	Ta
Tin (Note 9)	Sn
Tungsten (Note 10)	W
Uranium	U
Zinc	Zn
Zirconium	Zr

NOTES: 1. Antimony - Stibium
2. Columbium - also known as niobium
3. Gold - Aurum
4. Iron - Ferrum
5. Lead - Plumbum
6. Mercury - Hydrargyrum
7. Silver - Argentum
8. Sodium - Natrium
9. Tin - Stannum
10. Tungsten - Wolfrom

Table 1-3. American Iron and Steel Institute (AISI) Materiel Groups

AISI	Group
302	1
303	1
304	1
305	1
308	1
309	14
309s	14
310	14
314	14
316	1
321	1
330	33
347	1
403	2
405	2
410	2
416	2
420	2
430	2
431	2
440	2

Table 1-4. Areospace Materiel Specifications (AMS)

AISI	Group
4544	10
4574	10
4575	10
4674	10
4730	10
4900	60
4901	60
4902	60
4908	60
4910	60
4911	60
4921	60
4923	60
4925	60
4926	60
4927	60
4928	60
4929	60
4935	60
4941	60

Table 1-4. Areospace Materiel Specifications (AMS) - Continued

AISI	Group
4951	60
4953	60
4966	60
5350	2
5351	2
5352	2
5354	17
5355	12
5358	1
5359	12
5360	14
5361	14
5362	1
5363	1
5365	14
5366	14
5368	12
5369	17
5370	1
5371	1
5372	2
5375	3
5376	5
5378	25
5380	15
5382	3
5385	15
5388	4
5389	4
5390	32
5398	12
5504	2
5506	2
5508	17
5510	1
5511	1
5512	1
5513	1
5514	1
5515	1
5516	1
5517	1
5557	1
5558	1
5559	1
5560	1

Table 1-4. Areospace Materiel Specifications (AMS) - Continued

AISI	Group
5565	1
5566	1
5568	1
5570	1
5571	1
5572	14
5573	1
5575	1
5576	1
5577	14
5580	8
5582	5
5591	2
5610	2
5613	2
5614	2
5616	17
5620	2
5621	2
5627	2
5630	2
5631	2
5632	2
5636	1
5637	1
5639	1
5700	21
5712	18
5713	18
5725	6
5726	6
5728	6
5733	23
5735	23
5736	23
5737	23
5738	1
5742	23
5750	4
5756	17
5757	17
5518	1
5520	1
5521	14
5522	14
5523	14

Table 1-4. Areospace Materiel Specifications (AMS) - Continued

AISI	Group
5524	1
5525	23
5526	17
5527	17
5528	1
5529	1
5530	4
5531	5
5532	5
5534	9
5536	32
5537	3
5538	17
5539	17
5540	8
5541	8
5542	8
5547	12
5548	12
5549	12
5550	8
5551	17
5552	23
5554	12
5556	1
5640	1
5641	1
5642	1
5643	12
5644	1
5645	1
5646	1
5647	1
5648	1
5649	1
5650	14
5651	14
5652	14
5657	1
5665	8
5667	8
5668	8
5680	1
5681	1
5685	1
5586	1

Table 1-4. Areospace Materiel Specifications (AMS) - Continued

AISI	Group
5688	1
5689	1
5690	1
5691	1
5694	14
5695	14
5697	1
5698	8
5699	8
5759	3
5765	9
5768	5
5769	5
5775	12
5776	2
5777	2
5778	8
5779	8
5780	12
5781	12
7460	60
7498	60
7725	55
7899	55

Table 1-5. Pratt and Whitney Aircraft (PWA) Materiel Groups

PWA	Group
143	21
651	28
625	18
653	3
657	5
658	5
675	18
680	18
682	60
686	18
687	18
785	24
1004	18
1007	18
1030	18
1060	8

Table 1-6. Miscellaneous Specifications

Specification	Group
17-4PH	12
17-7PH	1
19-9DL	17
A286	23
AM355	12
Discalloy	23
ES 73640	27
G 18B	5
GEM 252	18
GEM 308	23
GMR 235	27
Greek Ascaloy	17
H. R. Crown	24
Hastelloy C	4
Hastelloy R235	27
Hastelloy X	32
Haynes Stellite (HS)	
HS 21	15
HS 23, 25	3
HS 27	25
HS 30	15
HS 31, 36	3
Immaculate No. 5	14
Incoloy, A, T, 901	23
Inconel, X, W, 702	8
Invar	26

Table 1-6. Miscellaneous Specifications - Continued

Specification	Group
L-251, 650	3
Monel	10
Multimet	5
N-155	5
Nimonic 75, 80, 80A	16
Nimonic 90	29
PH15-7MO	1
Refractalloy 26, 80	20
Rene 41	18
S816	9
Thetaloy	28
Timken 16-25-6	6
Titanium	60
Tinidur	23
TPA	21
Tungsten	55
Udimet 500	18
Waspaloy	18
Westinghouse 9269	20
Wright Aircraft (WAC)	
WAC 7830, 7831, 7832,	16
WAC 7836	29
WAC 7863	21
WAC 8338	24
X-40	3

Table 1-7. Identification of Metals

Materiel	Principal Elements	Magnetic	Spark Test	Nitric Acid Test	Appearance	Use
Group 1 300 series	7-13 Ni, 17-19 Cr, Fe	No	Light-diffused, straw color	None	Dark gray	Jet Engines
Group 2 400 series	0-2 Ni, 12-16 Cr, Fe	Yes	Very light, straw color, many forks	None	Dark gray	Jet Engines
Group 3 Stellites 2 25, 31, 36	1-10 Ni, 12-16 Cr, 50-65 Co	No	Short, orange-red	None	Dark gray	Jet Engines
Group 5 Multimet, etc	2-20 Ni, 13-17 Cr, 20-60 Co	No	Short, orange	None	Dark gray	Jet Engines
Group 8 Inconels	70-74 Ni, 15 Cr	No	Short, red	None	Dark gray	Jet Engines
Group 9 S-816 (AMS 5765)	20 Ni, 20 Cr, 40 Co	No	Short, orange-red	None	Dark gray	Jet Engines
Group 10 Monel	67 Ni, 30 Cu	Yes	Coarse, red	Green	Dark gray	Jet Engines
Group 14 309, 310, 314 series	12-20 Ni, 24-25 Cr, Fe	No	Red-orange, turning white	None	Bright	Jet Engines
Group 15 Stellites 21, 30	2-15 Ni, 26-27 Cr, 50-60 Co	No	Short, orange-red	None	Dark gray	Jet Engines
Group 16 Nimonics	75-80 Ni, 20-21 Cr, Bal. Fe	No	Short, red	None	Dark gray	Jet Engines
Group 55 Tungsten	W	No	Short, light orange	None	Bright	Aircraft
Group 60 Titanium	Ti-other alloys	No	Long, brilliant white	None	Dark gray	Aircraft
Iron/Steel	Fe	Yes	Straw white	Brown-black	Dull gray	Automotive
Aluminum	Al	No	None	None	Light gray	Aircraft
Brass	Cu-Zn	No	None	Blue-green	Yellow-green-brown	Shells
Copper	Cu	No	None	Blue-green	Red-brown	wire and cable

Table 1-7. Identification of Metals - Continued

Materiel	Principal Elements	Magnetic	Spark Test	Nitric Acid Test	Appearance	Use
Cadmium	Cd	No	None	Yellow	Bright	Bearings and batteries
Gold	Au	No	None	None	Yellow	
Lead	Pb	No	None	None	Dark gray	Batteries
Magnesium	Mn	No	None	Effervescent	Light gray	Aircraft
Silver	Ag	No	None	Gray	Silvery	Bearings, batteries and electronics
Zinc (die cast)	Zn	No	None	Effervescent black (brown fumes)	Light gray	Castings and batteries