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INTERNATIONAL UNION OF PURE AND APPLIED CHEMISTRY

ANALYTICAL CHEMISTRY DIVISION

COMMISSION ON MICROCHEMICAL TECHNIQUES AND TRACE ANALYSIS

GENERAL ASPECTS OF TRACE ANALYTICAL METHODS—II.

STANDARD REFERENCE MATERIALS FOR TRACE ANALYSIS

PART 1. PRESENT STATUS OF AVAILABILITY AND APPLICATION

PART 2. AVAILABLE STANDARD REFERENCE MATERIALS

Prepared for publication by

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P R E F A C E

The growing significance and application of trace analysis lead to an increasing interest in standard reference materials (SRM) for the calibration of trace analytical methods. During the 26th Conference of the International Union of Pure and Applied Chemistry (IUPAC) held in Washington in July 1971 the Commission on Microchemical Techniques and Trace Analysis proposed for this reason that a study of the present state of availability and application of SRM's for trace analysis be conducted. The author was charged to undertake this project. The results of this survey were presented during the 27th Conference of the IUPAC (Munich, August 1973). On the basis of these results the Commission on Microchemical Techniques and Trace Analysis decided that the author should continue his investigations and compile the data of available SRM's, which are applicable for trace analysis. The results of the second survey were presented during the 28th IUPAC Conference (Madrid, September 1975). Thereafter the compilation of data of this second report was revised, completed and updated during the subsequent two years.

The present report contains the results of the two studies mentioned above as parts 1 and 2. The aim of this report is to provide trace analysts with the necessary information on availability and sources of SRM's and high-purity substances, which are applicable in trace analysis. Moreover this work may stimulate the preparation of new SRM's with trace constituents and its increasing application in trace analysis.

The author wishes to express his thanks to all members of the Commission on Microchemical Techniques and Trace Analysis, especially Professor G. H. Morrison (Ithaca, N.Y., USA), for their encouragement, support and valuable suggestions during the performance of this project and to all officers of the Analytical Chemistry Division of the IUPAC for their efforts in publishing this report. Acknowledgment is given to the many colleagues, institutes and departments of universities, and suppliers of SRM's, who provided the author with numerous information and documents on available SRM's; to Dr. W. W. Meinke of the Analytical Chemistry Division at the National Bureau of Standards (Washington, D.C., USA) for permission to use a revised publication (NBS Misc.Publ. 260-4, 1965) on sources of SRM's; and to Dr. A. Koch (Graz, Austria) for help with the preparation of part 1 of the report. Particular thanks are due to Professor C. F. Cullis (London, Great Britain) for linguistic revision of the manuscript. Finally, the author gratefully acknowledges the valuable assistance of his wife, Dr. G. A. Koch-Dedic, in writing the final manuscript.

Neunkirchen/Saar O. G. Koch
December 1977.

ANALYTICAL CHEMISTRY DIVISION

Commission on microchemical techniques and trace analysis+)

GENERAL ASPECTS OF TRACE ANALYTICAL METHODS
II. STANDARD REFERENCE MATERIALS FOR TRACE ANALYSIS
Part 1 - Present status of availability and application

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1. Introduction

Bearing in mind the overall significance of trace analysis, the present inquiry is concerned with the question as to what extent standard reference materials (SRM) are available and, when available, are actually used for trace analysis. Only commercially obtainable SRM's are considered, i.e., substances supplied with a certificate of analysis, which are used for the control and calibration of analytical methods. Excluded from this inquiry are the following materials: -

1.1. Radiochemical standard substances, which fall under the jurisdiction of the "Commission for analytical radiochemistry and nuclear materials".

1.2. The SRM's manufactured by different institutions, but which are, nevertheless, not commercially available.

1.3. Compounds and elements of high purity, often marked "Standards", which are used, for example, in laboratories for standard or stock solutions.

1.4. Organic trace materials (e.g. pesticides), which are the concern of the "Applied Chemistry Division".

2. Results of the survey

Approximately 200 questionnaires were sent out to: -

2.1. national organizations connected with IUPAC,

+) Titular Members: O. G. Koch, Chairman (Germany); M. Pinta, Secretary (France); K. L. Cheng (USA); S. Gomiscek (Yugoslavia); A. M. G. Macdonald (UK); A. Mizuike (Japan); G. H. Morrison (USA); E. A. Terent'eva (USSR). Associate Members: N. E. Gel'man (USSR); M. Grasserbauer (Austria); R. Levy (France).

2.2. official delegates of associated organizations,
2.3. members of the "Commission on microchemical techniques and trace analysis",
2.4. other persons and firms.

The inquiry included 44 countries (see table 1) and 87 replies were received from a total of 28 countries. We have had to assume, therefore, that the 16

Table 1. Countries surveyed

No.	Country	No.	Country
1	Argentina	23	Mexico
2	Australia	24	Netherlands
3	Austria	25	New Zealand
4	Belgium	26	Nigeria
5	Brazil	27	Norway
6	Bulgaria	28	Poland
7	Canada	29	Portugal
8	Chile	30	Republic of China
9	Colombia	31	Republic of Korea
10	Cuba	32	Republic of South Africa
11	Czechoslovakia	33	Republic of Vietnam
12	Denmark	34	Romania
13	Finland	35	Spain
14	France	36	Sweden
15	Germany	37	Switzerland
16	Greece	38	Turkey
17	Hungary	39	Union of Soviet Socialist Republics
18	India	40	United Arab Republic
19	Ireland	41	United Kingdom
20	Israel	42	United States of America
21	Italy	43	Venezuela
22	Japan	44	Yugoslavia

countries which did not respond to the survey have no interest in the production and use of SRM's. On the other hand, it should be emphasized with gratitude that several of those who did reply gave very detailed information. Undoubtedly, an exhaustive and statistically accurate inquiry would require replies from at least 1000 questionnaires, but this would take up more time than the author can spare. There were also other reasons why the inquiry was restricted to the present scope, which are discussed briefly in section 6. It may be supposed however, in spite of the limited amount of information, that the received results are sufficiently representative for conclusions to be drawn on the present availability of SRM's for trace analysis.

In the answers, sources of supply of SRM's were mentioned a total of 100 times, although the number of different sources mentioned was much less than this. Table 2 shows the frequency with which given or used sources of supply were mentioned. Under Nos. 1 - 6, are quoted with decreasing frequency the sources of supply most commonly named. No. 7 contains other sources of supply which were mentioned only 1 - 3 times. According to table 2 the "National Bureau of Standards" holds the first position, so that the designation "International Bureau of Standards" would seem to be more appropriate!

Table 2. Frequency of mentioning or use of sources for standard reference materials

No.	Source for standard reference materials	Frequency of mentioning or use of sources	
		number	%
1	National Bureau of Standards (NBS), USA	35	35
2	Bureau of Analysed Samples (BAS), UK	10	10
3	Bundesanstalt für Material-prüfung (BAM), West Germany	8	8
4	International Atomic Energy Agency (IAEA), Austria	8	8
5	US-Geological Survey (USGS), USA	5	5
6	Institut de Recherches de la Siderurgie Françaises (IRSID), France	4	4
7	Other sources	30	30
	Sum	100	100

It is, however, remarkable that so many laboratories do not use, or use only rarely, the SRM's from the official sources of supply for trace analyses. There are different reasons for this: -

a) In some countries no national SRM's are produced and foreign standards are not available either for commercial or political reasons. Under these circumstances the laboratories produce their own SRM's, or they work with synthetic samples.
b) In countries where national and foreign SRM's are available there are nevertheless laboratories which do not use these standards, or use them only rarely, for several reasons:
   i) to save costs,
   ii) for reasons of method, or analytical technique,
   iii) because none of the available SRM's are suitable,
   iv) for reasons of personal conviction (e.g. a preference for working with synthetic samples on principle).

Finally, it is important to pay attention to the activities between particular laboratories, which may take place in the form of exchange of information, and reciprocal assistance with self-made SRM's. Such activities undoubtedly occur to a considerable degree, but are very difficult to estimate statistically and to catalogue. There are two reasons for that fact: -

a) lack of information,

b) lack of continuity in the production of SRM's, because the latter is often combined with the work (usually limited as to time) of specialized scientists.

3. Local and regional activities

In some countries or regions projects for the production of SRM's have been or will be carried out. Information on such projects, as detailed in the questionnaires, are listed below: -

3.1. Production and distribution of SRM's on an international basis by: Community Bureau of Reference - BCR, Directorate General XII, Commission of the European Communities, 200 rue de la Loi, B-1049 Brussels, Belgium.

3.2. Cooperation between Denmark, Norway, Sweden, and, to a lesser extent Finland, for the characterization of different substances (minerals, glasses etc.) as SRM's for trace analysis. Information is available from:

a) Dr. O. H. J. Christie, Massespektrometrisk Laboratorium, Postboks 1048, Blindern, Oslo, Norway;

b) Dr. L.-H. Andersson, Försvarets Forskningsanstalt, Avd. 4, Inst. 43, Box 416, S-172 04 Sundbyberg 4, Sweden.

3.3. Production of mineral SRM's (igneous rock samples, platinum ore samples) in the Republic of South Africa in cooperation with laboratories in Belgium, Canada, England, Germany and USA. Information is available from: South African Bureau of Standards, P. O. Box 191, Pretoria, Republic of South Africa.

3.4. Production of metallic and mineral SRM's (ferrous and nonferrous metals and alloys, minerals, ores rocks) in Canada. Information is available from: Dr. A. H. Gillieson, Canadian Standard Reference Materials Project, Mines Branch, E. M. R., 555 Booth Street, Ottawa, Ontario, K1A OG1, Canada.

3.5. Distribution of standards, reference materials and samples for comparison (uranium ores, uranium compounds, water samples, air samples, biological materials, soil, sediments) with radioactive and stable trace constituents, on an international basis, by the Analytical Quality Control Service of the International Atomic Energy Agency. Information is available from: Analytical Quality Control Services, Laboratory Seibersdorf, International Atomic Energy Agency, P. O. Box 590, A-1011 Vienna, Austria.

4. Present status of available standard reference materials for trace analysis

The conclusions drawn in this section on the present status of available SRM's for trace analysis rest on the following assumptions: -

4.1. That the sources of supply for SRM's not registered in this inquiry, provide SRM's which are similar in nature and specification to those

Table 3. Availability of ferrous SRM's with trace constituents[a,b)]

No.	Source	Material	Number of SRM's with particular trace constituents																							
			Al	As	B	C	Co	Cr	Cu	Mn	Mo	N	Nb	Ni	O	P	Pb	S	Sb	Si	Sn	Ta	Te	Ti	V	Y	Zr
1	NBS	c)			1	1		2	1		5	6		3	2 (1)	11	1	8			3	1			15		
2		d)	2	1	4 (3)		2	2			5		2	1		1	1 (1)				3	4		1	8		1
3		e)			4 (1)												5	1			2			2			1
4		f)	1	1			1				4	4						3			1				4		
5		g)			1		1				1					1	1	1					1	1	4	1	
	Sum of No. 1-5		3	2	10 (4)	1	4	4	1		15	10	2	4	2 (1)	13	8 (1)	13			9	5	1	4	31	1	2
6	BAS	h)				2	2		1	1				2		2		2		2							
7		i)	1	1	5		1					1				1	1	1	2		2						
8		j)														1	3 (1)	1				2					
9		k)																1									
	Sum of No. 6-9		1	1	5	2	3		1	1		1		2		4	4 (1)	5	2	2	2	2					

Footnotes to table 3:

a) Trace constituents in the range of 10 - 100 ppm.

b) Numbers in parantheses for trace constituents in the range of 1 - 9 ppm.

c) Steel. d) Ingot iron, low-alloy steel. e) High-alloy steel, high temperature alloy. f) Cast iron.

g) Iron, steel (solid form). h) High-purity iron. i) Steel. j) Alloyed steel. k) Cast iron.

Table 4. Availability of ferrous SRM's with trace constituents[a,b)]

No.	Source	Material	Number of SRM's with particular trace constituents											
			Al	As	B	C	Mo	N	Ni	O	P	S	Si	Ti
1	BAM	steel	2	2			1	15		2	5	2	1	
2		alloyed steel, Cr/Ni-alloy			1	1		5			4	12		
	Sum of No. 1-2		2	2	1	1	1	20		2	9	14	1	
3	IRSID	steel						5			2	4		
4		steel (solid form)	3		1						1	8		
5		alloyed steel										3		
6		cast iron (solid form)							1					1
	Sum of No. 3-6		3		1			5	1		3	15		1

Footnotes to table 4:

a) Trace constituents in the range of 10 - 100 ppm.

b) Numbers in parantheses for trace constituents in the range of 1 - 9 ppm.

Table 5. Availability of ferrous SRM's with trace constituents[a,b)]

No.	Source	Material	Number of SRM's with particular trace constituents								
			Al	As	B	C	Co	Cr	Cu	Mn	Mo
1	c)	d)	9	5	17 (4)	4	7	4	2	1	16

No.	Source	Material	Number of SRM's with particular trace constituents								
			N	Nb	Ni	O	P	Pb	S	Sb	Si
1	c)	d)	36	2	7	4 (1)	29	12 (2)	47	2	3

No.	Source	Material	Number of SRM's with particular trace constituents						
			Sn	Ta	Te	Ti	V	Y	Zr
1	c)	d)	11	7	1	5	31	1	2

Footnotes to table 5:

a) Trace constituents in the range of 10 - 100 ppm.

b) Numbers in parantheses for trace constituents in the range of 1 - 9 ppm.

c) NBS + BAS + BAM + IRSID (Sum of table 3 and 4).

d) High purity iron, steel, alloyed steel, high temperature alloy, iron, cast iron.

Table 6. Availability of nonferrous alloys and other SRM's with trace constituents[a,b,c]

No.	Source	Mate-rial	Number of SRM's with particular trace constituents																									
			Ag	Al	As	B	Be	Bi	C	Cd	Cr	Cu	Fe	Mg	Mn	Mo	N	Ni	O	P	Pb	S	Sb	Si	Sn	Te	Ti	U	V
1	NBS	d)												1															1
2		e)																		1		1							
3		f)	2	1 (2)	3		1 (2)	1 (2)		2			3		4			1		16		1	2		2	1			
4		g)											1					(1)			1								
5		h)				1			1			1				1				3		3					1		
6		i)		3							1 (1)	1			1									1			2		
7		j)						1		1								1											
8		k)	1		1																								
9		l)	(1)							2		(1)	(1)					1			2				1				
10		m)								4	5				3			3			5			1	4 (2)				
11		n)										2			(1)	1 (1)	1												
12		o)									1	1			(1)		1	(1)						1			2	(1) (1)	
13		p)v)	(1)	(1)	(1)	(1)					(1)	(1)	(1)	(1)	(1)	(1)		(1)			(1)	1			(1)	(1)			
14		q)																		1 (1)									

Table 6. (continued)

No.	Source	Mate-rial	Number of SRM's with particular trace constituents																									
			Ag	Al	As	B	Be	Bi	C	Cd	Cr	Cu	Fe	Mg	Mn	Mo	N	Ni	O	P	Pb	S	Sb	Si	Sn	Te	Ti	U	V
15	BAS	r)																				1							
16		s)					1																						
17		t)		1																		1							
18		u)										1	2		1			1							1				
Sum of No. 1-18			5 (1) $\underline{(1)}$	5 (2) $\underline{(1)}$	4 (1)	1 $\underline{(1)}$	2 (2)	2 (2)	1	9 (2)	7 (1) $\underline{(1)}$	6 (1) $\underline{(1)}$	6 (2)	1 $\underline{(1)}$	9 (2) $\underline{(1)}$	2 (1) $\underline{(1)}$	2	7 (1) $\underline{(1)}$	1 (1)	20	8 $\underline{(1)}$	8	2	3	8 (2) $\underline{(1)}$	1 $\underline{(1)}$	5	(1) $\underline{(1)}$	1

Footnotes to table 6:

a) Trace constituents in the range of 10 - 100 ppm.
b) Numbers in parantheses for trace constituents in the range of 1 - 9 ppm.
c) Numbers in parantheses underlined for trace constituents $\leq$ 0,9 ppm.
d) Aluminium alloy. e) Cobalt alloy. f) Copper alloy. g) Magnesium alloy.
h) Nickel alloy. i) Nickel oxide. j) Tin alloy. k) Lead alloy.
l) Zinc alloy. m) Die casting alloy, spelter. n) Titanium alloy.
o) Zirconium alloy. p) Selenium. q) Nitrogen. r) Copper alloy.
s) Aluminium alloy. t) Nickel alloy. u) Magnesium alloy. v) In addition: < 0,5 - < 1 ppm Ca, Cl, Tl.

Table 7. Availability of mineral, glass and biological SRM's with trace constituents[a,b,c]

No.	Source	Material	Number of SRM's with particular trace constituents																		
			Ag	As	B	Cd	Co	Cu	Fe	Hg	K	Mn	Na	Ni	Pb	Rb	Se	Sr	Th	U	Zn
1	NBS	d)																1			
2		e)	1 $(\underline{1})$				$(\underline{1})$	(1)	2		2			1	1 (2)	1 $(\underline{1})$		3	1 $(\underline{2})$	1 $(\underline{2})$	
3		f)		1	1	$(\underline{1})$		1		$(\underline{1})$		1	1	(1)	1	1	$(\underline{1})$			$(\underline{1})$	1
4		g)				$(\underline{1})$				$(\underline{1})$		1			$(\underline{1})$	1	(1)				
Sum of No. 1-4			1 $(\underline{1})$	1	1	$(\underline{2})$	$(\underline{1})$	1 (1)	2	$(\underline{2})$	2	2	1	1 (1)	2 (2) $(\underline{1})$	3 $(\underline{1})$	(1) $(\underline{1})$	4	1 $(\underline{2})$	1 $(\underline{3})$	1

Footnotes to table 7:

a) Trace constituents in the range of 10 - 100 ppm.

b) Numbers in parantheses for trace constituents in the range of 1 - 9 ppm.

c) Numbers in parantheses underlined for trace constituents in the range of 0,02 - 0,9 ppm.

d) Feldspar.

e) Glass.

f) Orchard leaves.

g) Bovine liver.

Table 8. Available SRM's with trace constituents for spectrochemical analysis[a,b)]

No.	Material	Number of SRM's with particular trace constituents[a,b)]
1	aluminium, aluminium alloys	Ag 3(2), B 9, Be 27(1), Bi 12, Ca 5, Cd 14(2), Co 5(2), Cr 28(2), Cu 36, Fe 12, Ga 12(1), Mg 34(4), Mn 35(6), Mo 3(2), Na 7(2), Ni 42(4), Pb 31(3), Sb 4, Si 16, Sn 30, Ti 34, V 20, Zn 28
2	magnesium, magnesium alloys	Al 4, Be 13(5), Ca 5, Cu 8(2), Fe 16, Mn 4, Ni 40(7), Pb 8, Pr 1, Si 11, Sn 8, Zn 2
3	copper, copper alloys	Ag 3(3), Al 1, As 7(2), Be 3, Bi 10(4), Co 6(1), Cr 3(4), Fe 10(2), Ga 4(3), Mn 3(4), Ni 6(3), P 4(1), Pb 8(3), Sb 5(5), Se 3(1), Si 3(3), Sn 3(6), Te 4, Zn 3
4	nickel, nickel alloys	Cu 1, S 13, Si 1
5	lead, lead alloys	Ag 32(9), Al 5, As 8(4), Au 4, Bi 9(1), Cd 21(4), Cu 16(7), Fe 4, Ni 28(14), Sb 4(2), Sn 5(7), Zn 7
6	tin, tin alloys	Ag 3, Al 2, As 4, Bi 5(1), Cd 3(1), Cu 6(1), Fe 9, Ni 8, Pb 1(1), Zn 3
7	zinc, zinc alloys	Al 5, Bi 2, Cd 54(7), Cr 4(4), Cu 15(9), Fe 23(1), Mg 11, Mn 1, Ni 5, Pb 49(1), Si 6, Sn 50(6)
8	zirconium, zirconium alloys	Al 6, B 3(3), C 1, Co 6, Cu 4, Hf 2, Mn 6, Mo 6, Ni 2, Pb 4, Si 3, Sn (6), Ti 5, U 2(4), V 5, W 4
9	rocks, ores	Ag (1), Be 1, Co 1, Cr 1, Sc 1
10	ceramics	Ba 1, Cu 20, Sr 1, Zr 2
11	diesel-oil	Ag 1(3), Al 3(2), B 2(2), Cr 3(2), Cu 3(2), Fe 3(2), Pb 3(2), Si 3(2), Sn 2(2)

Footnotes to table 8:

a) Trace constituents in the range of 10 - 100 ppm.

b) Numbers in parantheses for trace constituents below 10 ppm.

supplied by the institutions mentioned in table 2 under Nos. 1 - 6.

4.2. That the results of this inquiry (as already mentioned in section 2) show a representative cross-section in spite of the limited numbers of replies.

4.3. That the frequency of naming, and the use of particular sources of supply for SRM's gives a realistic picture of the actual availability of SRM's. (The mere naming of a certain institute as a source of supply for a particular SRM can be misleading. It may be held only in very low quantities, and available on a local but not international scale).

4.4. For supply of SRM's only official national or international institutions (bureaux) should be considered, because only these are able to produce the required SRM's in sufficient quantity and quality to replace exhausted stocks in time. Therefore it is not helpful to include universities, institutes, research laboratories etc., in a catalogue of potential suppliers for SRM's.

With these assumptions in mind the available SRM's from the sources of supply mentioned in table 2 under Nos. 1 - 6 were examined for their usefulness in trace analysis. The results are summarized in tables 3 - 7. From these tables the following conclusions can be drawn: -

a) The number of SRM's (mainly chemical SRM's) with certified contents of a particular trace element in different classes of materials is relatively small.
b) When trace contents are specified, most of them are in the range of 10 - 100 ppm. Only a few are in the range 1 - 10 ppm, or at a level of <1 ppm.

When SRM's used in spectrochemical work are considered, the number of SRM's for trace analysis is very much greater. An earlier report on nearly 3000 available SRM's(1), and the new catalogues were examined, but not those SRM's which are already included in tables 3 - 7. Table 8 shows the number of SRM's which are available in different material classes for trace analysis.

Especially to be mentioned are the SRM's supplied by the U.S. National Bureau of Standards (table 7) which are of great importance for trace analysis. The glass wafers are doped with 61 elements at the 1 ppm and 0,02 ppm level. At the present time only a few of these elements are certified, and for most of the elements certification is still in the future. Further work is planned with the biological SRM's to increase the number of trace elements certified.

5. Need for standard reference materials for trace analysis

Although a great number of SRM's are available for metals, the number of SRM's with a certified trace content of a particular element over a range of materials is relatively low. Also the trace contents are mostly in the range of 10 - 100 ppm rather than being high-purity materials with certified trace constituents. Further work will be necessary to close the existing gaps.

In the area of organic materials it would be desirable to get additional SRM's with organic compositions of vegetal and animal origin, besides the SRM's of the U.S. National Bureau of Standards. Therefore the planned future work of NBS on botanical materials is to be welcomed. In addition, an SRM of a synthetic organic polymer would be of interest.

In general, SRM's should contain only a limited number of certified trace constituents (e.g. 10 - 12 trace elements) and each SRM should differ from the others in both the quantities of each of the individual elements and the combinations of elements present. With regard to the number of trace elements in a particular SRM there are several compelling reasons calling for a smaller number than is often found at present: -

5.1. There is no doubt that it is difficult and expensive to produce the basic materials for SRM's. However, the ensuing period of testing, analysing and certification seems to be even more difficult and expensive. Thus a longer time is required before issuing an SRM if the SRM contains a large number of elements to be certified, because of the longer analysing period. If the SRM contained a smaller number of elements, it could be issued earlier, which is important for both the immediate and prospective users.

5.2. It is probable that most scientists do not need all of the trace elements contained, for example, in the SRM's NBS-Nos. 610 - 619 (glass wafers) at the same time. A natural consequence of this is presumably that the stock of these SRM's, or any SRM with a high number of certified elements, is exhausted more quickly than necessary. On the other hand, a stock of trace SRM's would last for a longer time, if, for example, the 61 elements in the SRM's NBS-Nos. 610 - 619 were divided into 6 groups of 10 elements each in the separate SRM's.

5.3. Finally it appears that SRM's with a small number of certified trace constituents could be cheaper than those with a high number of elements.

With regard to this points, it seems that the need for SRM's for trace analysis can be summarized succinctly as: a greater variety of SRM's with a smaller number of different trace elements in each SRM.

6. Future developments in the field of standard reference materials

Future developments in the field of production and certification of SRM's in general, and those for trace analysis in particular, are marked by increasing international cooperation. Already the first successes in this direction can be seen. However, further intensification of effort may yet be necessary in order to obtain a satisfactory state of supply of SRM's for trace analysis on the international scale. This doubtless implies much division of labour, and also coordination of the production programmes of individual national institutions, in order to avoid overlapping and hence unnecessary work.

A prerequisite for this is that there be, as a first priority, an extensive and exact listing (on an international scale) of the present state of available SRM's for trace analysis, and also of the future requirements for such substances. The aim of the study in hand was to estimate the present situation, to ascertain current trends, and to delineate future desirable developments in this field. At present, there are very few reports or catalogues(1, 3-5) on available SRM's, and on addresses of suppliers. Furthermore these are concerned with all types of available SRM's. Therefore in part 2 of this study(2) a list of the available SRM's with trace constituents will be compiled exclusively.

7. Conclusions

About 200 questionnaires on the availability and application of standard reference materials (SRM) for trace analysis were sent to 44 countries. At present many laboratories do not use official SRM's in trace analysis. In wet chemical trace analysis especially, calibration is performed mainly using synthetic standards.

As result of the survey it can be concluded that SRM's for trace analysis are not available in sufficient number with respect to several criteria: material classes, particular trace elements and concentration ranges. There is therefore a need for additional SRM's. The production and certification of such SRM's seems to be possible only on the basis of international cooperation.

References

1. R. E. Michaelis, Report on available standard samples, and high-purity materials for spectrochemical analysis. ASTM Data Series DS 2 (1963).
2. O. G. Koch, General aspects of trace analytical methods. II - Standard reference materials for trace analysis. Part 2 - Available standard reference materials. Pure Appl. Chem.
3. J. L. Hague, T. W. Mears, R. E. Michaelis, Standard reference materials: Sources of information, NBS Misc. Publ. 260-4 (1965).
4. Commission of the European Communities: Community inquiry on standard reference materials. Documentation EUR 4886, Luxembourg 1973.
5. Commission of the European Communities. Community Reference Bureau, Guidebook of addresses for standard reference materials, RM-1973-0001, ISP-1973-01.

ANALYTICAL CHEMISTRY DIVISION

Commission on microchemical techniques and trace analysis+)

GENERAL ASPECTS OF TRACE ANALYTICAL METHODS
II. STANDARD REFERENCE MATERIALS FOR TRACE ANALYSIS
Part 2 - Available standard reference materials

Prepared for publication by

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I. Introduction

Because of the essential role of standard reference materials (SRM) to trace analysis, it is important to maintain a current list of available material. The present report is a compilation of commercially available SRM's which have certified trace constituents, i.e. concentrations $\leqq$0.01%. It is based on a world-wide survey during the past four years of all known suppliers of SRM's. No claim is made as to its completeness.

The inquiry for this report was mainly concerned with certified SRM's and not with high-purity substances. Information on the latter are summarized in the last two chapters. The following materials are excluded from this compilation:

a) radioactive SRM's,
b) non-commercially available sources,
c) salts, compounds and reagents of high purity often labeled "standards" which are used to prepare standard solutions,
d) organic traces, pesticides etc.

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The supplier of particular SRM's is given at the heading of the tables in abbreviated form. For example, "S: 18" represents "supplier No. 18" which can be found in the summary of suppliers on the next page. In some cases several sources are listed in addition to the producer of the SRM. Values in parantheses are not certified, but are given for information on the composition.

In addition to serving as a useful guide of available SRM's to the trace analyst, it is anticipated that this survey will reveal needs for certification of additional elements and the preparation and certification of new SRM's.

II. Suppliers of standard reference materials

1. Aluminium Company of America
   New York Export Sales Office
   200 Park Avenue
   New York, N. Y. 10017, USA

2. Aluminium Company of Canada, Ltd.
   Research Laboratory
   P. O. Box 250
   Arvida, Quebec, Canada

3. Aluminium Pechiney, Service FD/CS
   B. P. 787-08/Paris
   23 Bis, Rue Balzac
   75 Paris 8, France

4. BNF Metals Technology Centre
   Grove Laboratories
   Denchworth Road
   Wantage, Oxfordshire OX12 9BJ, England

5. Brammer Standard Co.
   214 Essex Knoll Drive
   Coraopolis, Pennsylvania 15108, USA

6. Bundesanstalt für Materialprüfung
   Unter den Eichen 87
   D-1 Berlin-Dahlem 45, West Germany

7. Bureau of Analysed Samples, Ltd.
   Newham Hall, Newby
   Middlesbrough
   Cleveland, England

8. Canadian Certified Reference Materials Project
   Canada Centre for Mineral and Energy Technology
   555 Booth Street
   Ottawa, Ontario, Canada K1A OG1

9. a) Carpenter Technology Corp.
      Research and Development Center
      Analytical Chemistry
      P. O. Box 662
      Reading, Pennsylvania 19603, USA
   b) Carpenter Technology Corp.
      51 Square Vergote
      B-1040 Brussels, Belgium

10. Centre de Recherches Pétrographiques et Géochimiques
15, rue N. D. des Pauvres
Case Officielle No. 1
F-54 Vandoeuvre-lès Nancy, France

11. Centre Technique des Industries de la Fonderie CTJF
12, Avenue Raphael
F-75 Paris 16, France

12. Community Bureau of Reference - BCR
Directorate General XII
Commission of the European Communities
200, rue de la Loi
B-1049 Brussels, Belgium

13. Conostan Division
Continental Oil Company
P. O. Box 1267
Ponca City, Oklahoma 74601, USA

14. a) Dow Chemical Co.
Magnesium Sales Dept.
Midland, Michigan, USA
b) Dow Chemical Europe
CH-8810 Horgen, Switzerland

15. Huntington Alloys Products Division
Huntington, West Virginia, USA

16. Institut des Recherches de la Sidérurgie Française IRSID
185, rue Président Roosevelt
F-78104 St. Germain en Laye, France

17. Laboratoire de Réfractaires et Minerais
71, avenue du Général Leclerc
B. P. 3013
54012 Nancy-CEDEX, France

18. Metalimpex
Münnich Ferenc utca 9/11
H-1051 Budapest, Hungary

19. Moore Boundy Hamill Ltd.
Station House
Potters Bar, Herts EN6 1AL, England

20. Office of Standard Reference Materials
Room B 311, Chemistry Building
National Bureau of Standards
Washington, D. C. 20234, USA

21. Research Institute CKD (Standards)
Na Harfe 7
19002 Praha 9, Czechoslovakia

22. Research Institute for Ferrous Metallurgy
Fehervari ut 130
H-1116 Budapest XI, Hungary

23. Research Institute for Non-ferrous Metals
Fehervari ut 144
H-1116 Budapest XI, Hungary

24. Seishin Trading Co., Ltd.
Sanshin Building
43, Sannomiya-cho 1-chome
Ikuta-ku, Kobe, Japan

25. South African Bureau of Standards
P. O. Box X191
Pretoria, Republic of South Africa 0001

26. Spex Industries, Inc.
3880 Park Avenue
P. O. Box 798
Metuchen, N. J. 08840, USA

27. Swedish Institute for Metal Research
Drottning Kristinas väg 48
S-11428 Stockholm, Sweden

28. Swiss Aluminium Ltd.
Research and Development Division, Dept. FCAL
Bad. Bahnhofstrasse
CH-8212 Neuhausen/Rhf., Switzerland

29. The Iron and Steel Institute of Japan
Keidanren Kaikan
9-4, Otemachi 1-chome
Chiyoda-ku, Tokyo 100, Japan

30. U. S. Department of the Interior
Geological Survey
Washington, D. C. 20242, USA

31. a) United States Steel Corp.
P. O. Box 86 (Room 7000)
600 Grant Street
Pittsburgh, Pennsylvania 15230, USA
b) United States Steel Corp.
Research Laboratory
125 Jamison Lane
Monroeville, Pennsylvania 15146, USA

32. Henry Wiggin and Co., Ltd.
Holmer Road
Hereford HR4 9SL, England

33. Wiggin and Huntington Alloy Products
Av. De Tervueren, 168
B-1150 Brussels, Belgium

34. Zinc et Alliages
34, Rue Collange
B. P. No. 245
F-92 Levallois-Perret, France

35. Sumitomo Chemical Co., Ltd.
15, 5-chome, Kitahama, Higashiku
Osaka 541, Japan

36. National Institute for Metallurgy
1 Yale Road
Milner Park
Johannesburg, Republic of South Africa

37. Wieland-Werke AG
Postfach 636
D-7900 Ulm, West Germany

38. G. L. Willan Ltd.
Sheffield Works
Catcliffe
Rotherham S60 5RL, England

39. Arro Laboratories, Inc.
P. O. Box 686
Caton Farm Road
Joliet, Illinois 60434, USA

III. Standard reference materials

1. Iron and iron-base alloys

1.1 Iron, steels (chip form)

1.1.1. Iron, unalloyed steels

Table 1. Iron, plain carbon steels
S: 20

No.	Type	Analysis, %						
		C	Mn	P	S	Si	Cu	Ni
10g	Bessemer, 0.2 C	.240	.850	.086	.109	.020	.008	.005
11h	BOH, 0.2 C	.200	.510	.010	.026	$.21_1$	.061	.028
12h	BOH, 0.4 C	.407	.842	.018	.027	.235	.073	.032
13g	BOH, 0.6 C	.61	.85	.006	.031	$.35_5$	.066	.061
14e	BOH, 0.8 C	.753	.404	.008	.039	.177	.072	.053
15g	BOH, 0.1 C	.094	.485	.005	.026	.095	.036	.017
16e	BOH, 1.1 C	1.09	.381	.028	.029	$.20_2$	.052	.072
19g	AOH, 0.2 C	.223	.554	.046	.033	.136	.093	.086
20g	AISI 1o45	.462	.665	.012	.028	.305	.034	.034
51b	Electric furnace 1.2 C	1.21	.573	.013	.014	.246	.071	.053
65d	Basic electric 0.3 C	.264	.730	.015	.010	.370	.051	.060
152a	BOH. 0.5 C (tin bearing)	.486	.717	.012	.030	.202	.023	.056
178	Basic oxygen 0.4 C	.395	.284	.012	.014	.163	.032	.010

No.	Analysis, %									
	Cr	V	Mo	Co	Ti	Sn	Al	N	Nb	Al_2O_3
10g	.008	.007	.002					.015		
11h	.025	.001			.004					
12h	.074	.003	.006				(.038)	.006		
13g	.050	.001					$.04_8$			
14e	.071	.002	.013				.060			
15g	.028	.001								
16e	.118	.002								
19g	.374	.012	.013	.012	.027	.008	.031		.026	
20g	.036	.002	.008				.040			
51b	.455	.002	.014			.008		.011		
65d	.049	.002	.025			.004	.059	.013		.009
152a	.046	.001	.036			.032				
178	.016	.001	.003							

Table 2. Unalloyed steels

S: 7

B.C.S.[a] No.	E.S.[b] No.	Type	Analysis, % C	Si	Mn	P	S	Cr	Mo	Ni	Al
215/3	052-1	0.9% C	.91	.23	.68	.011	.031	.040	(.006)	.038	.004
237/2		0.1% C	.122	(.17)	.45	(.024)	(.031)	(.028)	(< .005)	(.039)	(.004)
264/1		0.01% N	$.49_5$	(.11)	(1.14)	(.044)	(.050)				
386		0.1% C	.102	(.04)	(.40)	(.012)	.037				
	085-1	0.3% S	(.1)	(.01)	(1.0)	(.05)	(.35)				
321		Mild steel	(.38)	(.12)	(.13)	(.018)	(.010)	.106	.068	.099	(.12)
431		Plain carbon steels	.019	.033	.95	.009	.014	.19	.015	.069	.012
434			.37	.51	1.54	.056	.010	.13	.011	.015	.026
431/1			(.03)	(.01)	(.9)	(.01)	(.018)				

[a] British Chemical Standards. [b] Euro-Standards.

B.C.S. No.	E.S. No.	Analysis, % As	B	Co	Cu	N	Nb	Pb	Sn	Ti	V	W	Sb
215/3	052-1				.052								
237/2					(.060)	.004			(.005)				
264/1						$.010_0$							
386						$.004_5$							
	085-1			(.02)	(.3)			(.01)			(.01)		(.007)
321		.003							.014	.13	(.004)	.077	(.003)
431					.062		.022		.006		(.03)		
434					.017		.100		.011		(.03)		
431/1							(.005)						

Table 2.(continued)

S: 7

B.C.S. No.	Type	Analysis, %										
		C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	B
451	Mild steels	.10	.030	(.02)	.003	.007	.12	.100	.024		.031	
452		$.31_5$	.086	(.03)	.033	.025	.042	$.03_5$	.19		.009	
456		.104	.22	.17	.010	.024				.008		$.001_0$
457		$.26_0$	.046	.28	.020	.048				.008		$.002_5$
458		$.25_5$	.55	.42	.035	.031				.14		$.005_0$
459		$.45_0$	.51	.088	.049	.052				.068		.010
460		$.37_5$	.11	.40	.040	.009				.028		$.003_5$

B.C.S. No.	Analysis, %										
	Co	Cu	N	Nb	Pb	Sn	Ti	V	W	Zr	Sb
451		.30				.008	.096		$.10_0$		
452		.22				.13	.020		$.05_0$		
456	.048			.005	.010			.024		(.034)	.011
457	.018			.016	.006			.16		(.006)	.029
458	.16			.050	.016			.13		(.044)	.07
459	.077			.012	.003			.075		(.097)	.007
460	.009			.087	.003			.050		(.009)	.002

Table 3. Unalloyed steels
S: 6, 17

No.	Type	Analysis, %											
		C	Si	Mn	S	P	Ni	Cu	Al	Cr	N	As	Nb
001-2	Unalloyed steels	.303	.283	$.506_5$	.012	$.009_8$	.175	$.163_5$	.043		$.010_2$		
002-2		$.235_6$	$.276_5$	$.606_7$	$.015_1$	$.009_6$	$.119_9$	$.136_5$	$.056_9$		$.010_6$		
003-3		.170	.115	.337	.020	$.006_2$	.094	(.261)	(.049)				
004-2		.754	.277	.493	.024	$.034_5$	.130	$.249_5$	.114		$.005_4$		
005-3		$.084_9$		$.394_4$	$.050_3$	$.066_4$	$.045_9$		$.015_2$		$.008_2$		
006-2		.099	.051	.388	.022	.024	$.056_5$	.031	$.024_6$		.008		
008-2		.613	$.365_6$	.552	.009	$.016_3$	.261	$.165_5$	$.128_5$		$.009_3$		
010-1		.941	.268	.410	.010	.019	.259	.279	.231				
011-1		1.07	.148	.245	.009	.010	.079	.045	$.060_2$				
017-1		.261	.266	.725	$.022_5$	.015	.085	.062	$.044_4$		$.009_1$		
020-1		$.140_5$	$.071_7$	.526	$.014_5$	$.022_7$		.275		$.093_1$	$.004_3$		
Steel 4b		.383	.231	.673	.032	.020	.038	.091	.040	(.004)	.007	.023	
Steel 4c		.46	.32	.60	.021	.018		.06		.04	.005	.011	
Steel 8b		.06	.04	.33	.021	.014		.02		.05	.005	.013	
Steel 9a		.043	.010	.287	.020	.005		.100		.033	.005	.022	
Steel 12a		.271	.282	.556	.0254	.0129	(.040)	.085	(.088)		.0044	.020	
Steel 17		.043	(.003)	.379	.022	.171		.017			.010	.018	
Steel 21		1.055	.181	.223	.006	.005	(.046)	.051	(.022)	.018	.009	.020	
Steel 22		1.310	.210	.263	.0118	.0046	.038	.071	.071	.026	.0075	.017	
Steel 24		.0073	2.614	.224	.0223	.0575	.035	.062	.045		.0038	.021	
Steel 25		.858	.194	.327	.0095	.0074	(.058)	.065	(.091)	(.015)	.0100	.0233	
Steel 26		.11	.04	.66	.024	.007		.04		.01	.008		.05
S 9		.617	.27	.857	.150	.024	.209	.072	.240		.006	.051	
S 10		.123	.029	1.313	.328	.057	(.042)	.033	(.042)	.017	.011	.009	
S 11		.159	.28	.628	.095	.012	(.015)	.021	(.010)	(.002)	.003	.006	

Table 4. Iron, unalloyed steels
S: 21

No.	Type	Analysis, %										
		C	Mn	Si	P	S	Ni	Cr	Cu	Mo	V	W
162	Iron	.02	.02	.16	.005	.002	.03	.02	.04	.00	.00	.00
163	Unalloyed steels	1.34	.21	.90	.025	.018	.07	.07	.17	.025	.00	.00
164		.34	.88	.62	.050	.008	.31	.28	.64	.02	.005	.01
165		.16	1.64	.23	.089	.013	.15	.17	.09	.06	.02	.02

No.	Analysis, %											
	Ti	Co	Al	B	As	Sn	Nb	Ta	Zr	Pb	Sb	Zn
162	.000	.005	.02	.000	.002	.003	.000	.000	.000	.001	.000	.000
163	.10	.015	.02		.031	.010						
164	.01	.03	.07		.015	.014	.015			.006	.008	
165	.005	.005	.01	.01	.023	.023				.002		.005

Table 5. Iron, unalloyed steels
S: 27

No.	Type	Analysis, %							
		C	Si	Mn	P	S	Cr	Ni	Mo
1C	Iron	.004	$<.001$	.006	.002	.010	.001	.009	.0003
2C	Unalloyed steels	.183	$.27_5$	.468	.011	.035	.067	.091	.014
3B		.742	.251	.803	.0101	.0071	.053	.059	.005
5A		.029	1.86	$.28_5$	.026	.010	.078	.100	.013
21		.175	.36	1.46	.016	.011	.024	.035	.004

No.	Analysis, %							
	Co	Cu	Al	Sn	N	Ti	V	Nb
1C	.005	.001		.002				
2C	.012	.149	.003	.012	.0085			
3B	.005	.0175	.003	.004	.0054			
5A	.013	.135	.006	.011	.006	.003		
21	.008	.045	.036	.006	.008	.0008	.002	$.017_5$

Table 6. Unalloyed steels
S: 29, 24

No.	Type	Analysis, %								
		C	Si	Mn	P	S	Cu	Ni	Cr	Mo
156-2	Unalloyed steels	.029	.50	.10	.002	.050	.044	.31	.30	
158-2		.51	.016	1.02	.052	.007	.31	.019	.014	
159-2		.004								.014
160-2		.004								.16
161-2		.005								.31
168-2		.080						.013	.011	.094
169-2		.084						.042	.095	.067
170-2		.080						.071	.036	.012
171-2		.054						.098	.064	.034
172-2		.078								
173-2		.084								
174-2		.079								
175-2		.082								
200-5		.008								

No.	Analysis, %										
	V	Co	Ti	Al	As	Sn	B	Nb	Pb	Ca	Sb
156-2				.009							
158-2				.038							
159-2	.31	.11	.016	.008	.10	.11	.0015	.21	.001		
160-2	.10	.061	.093	.006	.051	.061	.0062	.11	.002		
161-2	.012	.020	.31	.004	.010	.014	.012	.013	.003		
168-2			.066	.047	.009	.005				.0007	
169-2			.012	.053	.006	.011				.0014	
170-2			.098	.052	.028	.054				.0019	
171-2			.037	.049	.046	.033			Zr	.0025	
172-2	.010	.055		.014			.0022	.053	.010		.0021
173-2	.034	.031		.025			.0032	.031	.017		.0049
174-2	.062	.020		.034			.0054	.020	.028		.0097
175-2	.093	.011		.054			.0084	.011	.048		.0199
200-5											

Table 6. (continued)

No.	Type	Analysis, %									
		C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V
240-6	Unalloyed steels					.009					
330-1											
366-3											
367-3											
421-6		.14		.41	.014	.017	.019	.015	.017	.004	
430-8		.19	.11	.54	.029	.030	.10	.057	.099		
450-1		.54	.25	.52	.003	.006	.085				
460-6		.64	.24	.49	.015	.019	.019	.013	.019	.002	
512-2	Case hardening steel	.086	.14	.41	.011	.011	.067	.031	.036	.007	.002

No.	Analysis, %										
	Co	Ti	Al	As	Sn	B	N	Nb	Pb	Ca	Sb
240-6											
330-1			.005								
366-3							.0009				
367-3							.0036				
421-6				.005			.0027				
430-8							.0016				
450-1			.028				.0017				
460-6			.023				.0034				
512-2											

Table 7. Low impurity iron
S: 5

No.	Analysis, %			
	C	Mn	P	S
AA	.008	.021	.009	.0063

1.1.2. Low alloy steels

Table 8. Low alloy steels
S: 20

No.	Type	Analysis, %							
		C	Mn	P	S	Si	Cu	Ni	Cr
30f	Cr-V (SAE 6150)	.49	.79	.010	.010	.28	.76	.071	.95
32e	Ni-Cr (SAE 3140)	.409	.798	.008	.021	.278	.127	1.19	.678
33d	Ni-Mo (SAE 4820)	.173	.537	.006	.011	.253	.123	3.58	.143
36b	Cr2-Mo1	.114	.404	.007	.019	.258	.179	.203	2.18
72f	Cr-Mo (SAE X4130)	.301	.545	.014	.024	.256	.062	.055	.891
100b	Manganese (SAE T1344)	.397	1.89	.023	.028	.210	.064	.030	.063
106b	Cr-Mo-Al (Nitralloy G)	.326	.506	.008	.017	.274	.117	.217	1.18
125b	High-silicon	.028	.278	.029	.008	2.89	.071	.038	.019
129c	High-sulfur	.125	.769	.076	.245	.020	.013	.251	.014
139a	Cr-Ni-Mo (AISI 8640)	.404	.780	.013	.019	.241	.096	.510	.486
155	Cr 0.5-W 0.5	.905	1.24	.015	.011	.322	.083	.100	.485
361	AISI 4340	.383	.66	.014	.017	.222	.042	2.00	.69

No.	Analysis, %											
	V	Mo	W	Co	Ti	As	Sn	Al	Nb	Ta	Zr	N
30f	.18											
32e	.002	.023					(.011)					.009
33d	.002	.246										(.011)
36b	.004	.996										
72f	.005	.184										.009
100b	.003	.237										.004
106b	.003	.199						1.07				
125b		.008					.003	.329				
129c	.012	.002										
139a	.003	.183										.008
155	.014	.039	.517									
361	.011	.19	(.011)	.030	$.02_0$	$.01_2$	$.01_1$	$.02_1$	$.02_2$	(.021)	$.01_1$	(.0037)

No.	Analysis, ppm									
	B	Pb	Sb	Bi	Ag	Se	Te	Ce	La	Nd
361	(5)	(<1)	4_2	(5)	(4)	(40)	(5)	(50)	(10)	(10)

No.	Analysis, ppm								
	Ca	Mg	Zn	Pt	Ge	O	H	Au	Hf
361	(1)	(2)	(5)	(5)	(60)	(10)	(<5)	(<0.5)	(2)

Table 9. Low alloy steels
S: 7

No.	Analysis, %									
	C	Si	S	P	Mn	Ni	Cr	Mo	Cu	V
401	1.06-	.59	.009	.042	1.00	$.025$	$.030$	.52-	$.100$	.52-
402	1.29-	.27	.023	.006	.19	.73	.55	.16-	.23-	.22-

Table 10. Low alloy steels
S: 24,29

No.	Type	Analysis, %						
		C	Si	Mn	P	S	Cu	Ni
150-4	Low alloy steels	.25	.41	.31	.026	,030	.086	4.11
151-5		.25	.17	1.50	.026	.023	.46	2.92
153-5		.25	.32	.83	.017	.022	.17	.97
500-1	High tensile structural steels	.32	.29	.49	.025	.010	.12	.10
502-1		.42	.25	.71	.018	.011	.066	.050
503-1		.33	.27	.63	.029	.020	.083	1.24
505-1		.20	.30	.63	.021	.009	.10	1.81
507-2		.37	.24	.69	.020	.010	.12	.12
509-3		.30	.26	.47	.011	.012	.17	2.56
510-3		.41	.25	.75	.014	.016	.15	.51
513-2	Case hardening steels	.16	.25	.79	.012	.010	.074	.13
514-2		.23	.30	.76	.012	.011	.091	.19
515-2		.18	.24	.63	.011	.013	.080	2.29
516-2		.22	.28	.97	.011	.012	.084	3.03
517-2		.19	.27	1.07	.013	.012	.072	2.97

No.	Analysis, %					
	Cr	Mo	V	Ti	Al	N
150-4	.38	.19	.003			
151-5	.15	.054	.052			.008
153-5	1.01	1.32	.22		.005	.012
500-1	1.10	.19		.007		
502-1	1.00	.17	.004			
503-1	.70	.014	.004			
505-1	.51	.22				
507-2	.98	.17				
509-3	2.74	.54				.009
510-3	.44	.17			.041	.010
513-2	1.16	.010	.005			
514-2	1.07	.26	.007			
515-2	.36	.020	.006			
516-2	1.68	.41	.010			
517-2	1.53	.52	.006			

Table 11. Low alloy steels
S: 27

No.	Type	Analysis, %				
		C	Si	Mn	P	S
22	Low alloy steels	$.91_5$	$.25_5$	1.25	.019	.007
24		.174			.015	.0010

No.	Analysis, %							
	Cr	Ni	Mo	Co	Cu	N	V	W
22	.50	.103	.054	.009	.040	.011	$.12_0$	.48
24	1.048		.578					

Table 12. Low alloy steels
S: 6, 17

No.	Type	Analysis, %				
		C	Si	Mn	S	P
109-1	Low alloy steels	.723	.363	.656	.009	.013
301-1		.044	4.0	.065	.004	$.030_5$
MnCrV 1		.841	(.24)	1.817	.005	.009
1CrNiMo		.342	.228	.525	.028	.011
1MnCr1		.199	.359	1.290	.025	.017
1CrAl 1a		.373	.380	.726	.004	.008
1AlTi		.085	.949	.839	.007	.007

No.	Analysis, %								
	Ni	Cu	Cr	Mo	Al	V	N	As	Ti
109-1	.284	.038	1.44	.792		.334			
301-1									
MnCrV 1	(.038)	(.098)	.317			.143			
1CrNiMo	1.005	.144	1.163	.199			.010	.033	
1MnCr 1	.090	.115	1.273				.007	.032	
1CrAl 1a		.131	1.469		.873	(.008)	.011	(.026)	
1AlTi	.046	.054	.108		.286	(.008)	(.024)		.890

Table 13. Low alloy steels
S: 21

No.	Type	Analysis, %										
		C	Mn	Si	P	S	Ni	Cr	Cu	Mo	V	W
168	Low alloy steels	.40	.81	.04	.042	.040	2.78	.13	.09	.56	.01	.57
169		.23	.59	.27	.061	.055	1.20	1.23	.23	.84	.55	.05
170		.19	.33	.76	.033	.027	.16	1.97	.10	1.36	.04	.26
171		.09	.12	.03	.014	.052	1.95	2.87	.05	.04	.30	.01

No.	Analysis, %										
	Ti	Co	Al	B	As	Sn	Nb	Ta	Zr	Sb	Zn
168	.005	.28	(.01)	.002	.020	.017	.005			.000	
169	.06	.09	(.02)	.006	.025	.009		(.03)			
170	.33	.01	(.07)		.030	.015	(.03)		.02		.02
171	.005	.02	(.00)		.015	.006	.04			.01	

Table 14. Low alloy steels
S: 5

No.	Type	Analysis, %				
		C	Mn	P	S	Pb
BB	Low alloy steels	.225	1.20	.009	.110	.173
FF		.99	.25	.005	.0083	

1.1.3. High alloy steels

Table 15. High alloy steels
S: 20

No.	Type	Analysis, %						
		C	Mn	P	S	Si	Cu	Ni
126c	High-nickel (36% Ni)	.026	.47	.004	.006	.19	.040	36.05
131b	Low carbon-silicon	.0018						
344	Cr15-Ni7-Mo2-A11	.69	.57	.018	.019	.395	.106	7.28
348	Ni26-Cr15 (A 286)	.044	1.48	.015	.002	.54	.22	25.8

No.	Analysis, %								
	Cr	V	Mo	Co	Ti	Al	Ta	B	Fe
126c	$.06_4$	.001	.011	.008					
131b									
344	14.95	.040	2.40		.076	1.16	.002		
348	14.54	.25	1.3		2.24	.023		.0031	53.3

Table 16. Alloy steels

S: 7

B.C.S.[a] No.	E.S.[b] No.	Type	Analysis, %							
			C	Si	Mn	P	S	Cr	Mo	Ni
224/1		Cr-V-Steel	.50	.30	.011	.022	.008	1.06	(.05)	(.14)
261/1	252-1	Nb stabilized stainless	.090	.50	.83	.017	(.018)	17.4_5	.11	13.1_0
494		13% Mn	1.24	.26	13.5_5	.040	.005	.56	.078	.69
334		Austenitic stainless steels	.079	.45	.85	.012	.022	25.6_0		20.6_0
335			.093	.67	.94	.018	.023	18.4_5		9.47
337			.081	.50	.87	.016	.018	17.8_0		9.52
461			(.1)	(.4)	(.6)	(.01)	(.02)	(15)		(6)
462			(.1)	(.5)	(.7)	(.01)	(.02)	(12)		(13)

B.C.S. No	E.S. No.	Analysis, %										
		Al	As	Co	Cu	Nb	Pb	Sn	Ti	V	W	Ta
224/1			(.03)	(.02)	(.09)			(.01)		.19		
261/1	252-1	(.016)	.016	.050	.12	.91				(.02)		.006
494		.004		(.43)	(.19)							
334				.052	(.10)		.0011			(.04)		
335				.034	(.11)		.0015		.46	(.04)		.0017
337				(.034)	(.10)	1.02	.0012			(.02)		.048
461			(.01)			(.0005)						
462			(.01)			(.0005)						

[a] British Chemical Standards. [b] Euro-Standards.

Table 16. (continued)

S: 7

B.C.S.[a] No.	E.S.[b] No.	Type	Analysis, %							
			C	Si	Mn	P	S	Cr	Mo	Ni
463		Austenitic stainless steels	(.1)	(.5)	(.8)	(.01)	(.02)	(18)		(10)
464			(.1)	(.6)	(.8)	(.02)	(.01)	(26)		(21)
465			(.1)	(.6)	(.9)	(.01)	(.02)	(18)		(9)
466			(.1)	(.5)	(.7)	(.02)	(.02)	(18)	(2.2)	(9)
467			(.1)	(.5)	(.7)	(.02)	(.02)	(18)		(9)

B.C.S. No.	E.S. No.	Analysis, %										
		Al	As	Co	Cu	Nb	Pb	Sn	Ti	V	W	Ta
463												
464			(<.005)	(.05)			(.001)					
465				(.03)	(.05)				(.3)	(.05)		
466			(.01)			(.05)	(.0015)	(.005)				(<.005)
467					(<1.0)							(.001)

[a] British Chemical Standards. [b] Euro-Standards.

Table 17. Alloy steels

S: 27

No.	Type	Analysis, %												
		C	Si	Mn	P	S	Cr	Ni	Mo	Co	Cu	Al	Sn	N
8D	Alloy steel	.0352	.418	1.551	.029	.0102	17.21	11.03	2.625	.068	.134	.002	.007	.075

Table 18. Alloy steels
S: 6, 17

No.	Analysis, %							
	C	Si	Mn	S	P	Ni	Cu	Cr
209-1	.800	.256	.234	$.007_5$	.027			4.16
2Cr	.416	.514	.434	.009	.021	.139		13.67
2CrW	2.05	.423	.306	.0084	.0167	.140	.085	12.66
2CrNiZr	.058	.473	.863	.010	.015	10.47	.041	18.55
2CrMoV	.904	.331	.408	.005	.016	.229	.075	18.18
2CrCoMoVW 2	.865	.318	.205	.005	.024	.221		4.231
2CrMnNi	.078	.524	8.45	.007	.027	5.558		18.05
CrNiMnTiMo 2	.062	.433	1.433	.015	.035	10.63	.519	18.50
2MnCr	.91	.09	12.7	.007	.045		.07	.35
2CrNi 2	.02	.46	1.39	.005	.013	11.47		18.48

No.	Analysis, %							
	Mo	V	Ti	W	Co	N	Al	Zr
209-1	1.13	1.83		18,72	4,95			
2Cr	.024	.022			(.025)	.036		
2CrW	.049	.095		.906		.026		
2CrNiZr		(.016)				.072		.053
2CrMoV	1.058	.077			(.034)	(.052)		
2CrCoMoVW2	.953	1.982		11.92	2.731			
2CrMnNi	.298				(.061)	.159		
CrNiMnTiMo2	.464	.040	.629		.084	.008		
2MnCr	.03					.020		
2CrNi2	.016	.02			.02		.07	

Table 19. Alloy steels
S: 29,24

No.	Type	Analysis, %							
		C	Si	Mn	P	S	Cu	Ni	Cr
600-5	Tool steel	1.33	.31	.41	.013	.017	.042	.056	.85
602-5		1.23	.22	.36	.011	.012	.029	.038	.49
605-5		.56	.22	.85	.021	.005	.058	1.50	.93

No.	Analysis,%									
	Mo	W	V	Co	Ti	Al	N	Nb	Ta	Fe
600-5	.10	4.36	.041				.010			
602-5	.10	3.42	.31				.010			
605-5	.40	.014	.16				.008			

Table 19. (continued)
S: 29, 24

No.	Type	Analysis, %							
		C	Si	Mn	P	S	Cu	Ni	Cr
606-1	High speed steels	.74	.17	.31	.015	.005	.05	.10	3.89
607-4		.80	.28	.32	.016	.007	.038	.058	4.01
608-4		.77	.27	.32	.012	.006	.031	.052	4.07
609-4		.86	.30	.35	.018	.010	.040	.067	4.24
610-4		1.28	.29	.32	.017	.008	.045	.079	4.29
611-4		.90	.28	.31	.020	.005	.054	.085	3.97
650-3	Stainless steels	.055	.66	.36	.023	.005	.083	.24	16.44
651-4		.068	.47	1.77	.040	.005	.083	8.89	18.63
652-5		.062	.54	1.95	.038	.008	.22	11.80	17.41
653-3		.070	.73	1.62	.038	.006	.055	13.70	22.49
654-3		.052	.70	1.52	.021	.010	.066	19.78	24.71
655-3		.056	.60	1.59	.033	.006	.088	11.50	18.54
680-1		.070	.52	1.37	.012	.006	.020	32.44	20.99
680-2		.046	.46	1.02	.016	.005	.21	31.61	20.81
683-1		.055	.41	.31	.008	.004	.070	74.22	16.04

No.	Analysis, %									
	Mo	W	V	Co	Ti	Al	N	Nb	Ta	Fe
606-1	.51	18.09	1.01	.21						
607-4	.85	17.07	.90	4.79			.021			
608-4	.56	16.91	1.19	9.21			.026			
609-4	5.15	6.48	1.86	5.16						
610-4	3.39	9.46	3.21	9.44			.057			
611-4	4.78	6.26	1.76	.37			.038			
650-3	.012						.027			
651-4	.072			.23		.006	.023			
652-5	2.46			.41			.024			
653-3	.083						.019			
654-3	.070						.028			
655-3	.052						.025	.59	.03	
680-1				.29	.28	.30				
680-2				.40	.40	.53				
683-1				.14	.18	.10				8.42

Table 20. Stainless steels
S: 20

No.	Type	Analysis, %				
		C	Mn	P	S	Si
160b	Cr19-Ni14-Mo3	.046	1.64	.020	.018	$.50_9$
166c	Low carbon (AISI 3162)	.0078				

No.	Analysis, %							
	Cu	Ni	Cr	V	Mo	Co	Pb	N
160b	.172	12.2_6	18.4_5	.047	2.38	$.10_1$	.001	$.03_9$
166c								

Table 21. Tool steels
S: 20

No.	Type	Analysis, %					
		C	Mn	P	S	Si	Cu
50c	W18-Cr4-V1	.719	.342	.022	.009	.311	.079
132b	Mo-W-Cr-V	$.86_5$	$.34_0$	$.01_3$	.005	.18	$.08_7$
134a	Mo8-W2-Cr4-V1	.808	.218	.18	.007	.323	.101
153a	Co8-Mo9-W2-Cr4-V2	.902	.192	.023	.007	.270	.094
291	Cr-Mo (ASTM A213)	.177	$.55_0$	.008	.020	$.23_0$	.047
293	Cr-Ni-Mo (AISI 8620)	.222	$.96_0$	.018	.022	$.30_0$	.032

No.	Analysis, %									
	Ni	Cr	V	Mo	W	Co	Sn	As	N	Al
50c	.069	4.13	1.16	.082	18.44		.018	.022	.012	
132b	.23	4.38	1.84	4.9_3	6.2_8	.028				
134a	.088	3.67	1.25	8.35	2.00					
153a	.168	3.72	2.06	8.85	1.76	8.47			.024	
291	.065	1.33		$.53_8$						.002
293	48_0	$.51_0$	.004	$.20_4$						.039

Table 22. Alloy steels (granular form[a])
S: 20

No.	Type	Analysis, %					
		C	Mn	P	S	Si	Cu
163	Low alloy, 1.0 Cr	.933	.897	.007	.027	.488	.087
101f	Stainless (AISI 304L)	.014	.087	.008	.008	.876	.030

No.	Analysis, %									
	Ni	Cr	V	Mo	W	Co	N	As	Sb	Ga
163	.081	.982		.029			.007			
101f	9.96	18.49	.034	.007	(.0002)	.088		(.003)	(.0009)	(.004)

a) 25 - 200 mesh

Table 23. Alloy steels
S: 6, 17

No.	Type	Analysis, %						
		C	Si	Mn	S	P	Ni	Cu
3 NiCr	Alloy steels	.09	1.46	.41	.003	.009	61.2	(.03)
2 CrNiSi a		.15	2.05	1.29	.005	.023	19.72	.06
3 CoCr		.39	.63	1.40	.003	.005	20.38	

No.	Analysis, %								
	Cr	Mo	V	Al	Co	N	Zr	W	Nb
3 NiCr	16.1	(.03)	(.02)	.8	.22	(.04)	.13		
2 CrNiSi a	24.35	.174	.04	.07	.16	.06			
3 CoCr	20.57	4.32		.07	41.70			4.16	3.61

1.2. Iron, steels (solid form)

1.2.1. Ingot iron, unalloyed steels

Table 24. Ingot iron, unalloyed steels
S: 20

No.			Type	Analysis, %			
				Mn	Si	Cu	Ni
	803a	D803a	Acid open hearth,0.6 C	1.04	.34	.096	.190
404a	804a		Basic electric	.88	.44	.050	.040
413			Acid open hearth,0.4 C	.67	.22	.025	.18
420a	820a	D820a	Ingot iron	.017		.027	.0092

No.			Analysis, %					
			Cr	V	Mo	Sn	Al	Co
	803a	D803a	.101	.005	.033			
404a	804a		.025	.002	.007			
413			.055	.007	.006			
420a	820a	D820a	.0032		.0013	.0017	.003	.006

400 Series: 5,5 Ø x 102 mm.
800 Series: 13 Ø x 51 mm.

Table 25. Special ingot irons
S: 20

No.		Type	Analysis, %					
			C	Mn	P	S	Si	Cu
465		Ingot iron E	.037	.032	.008	(.01)	.029	.019
466	1166	Ingot iron F	.065	$.11_3$	.012	(.01)	.025	.033
665	1265	Electrolytic iron	.0067	.0057	$.002_5$	.0059	$.008_0$	.0058

No.		Analysis, %							
		Ni	Cr	V	Mo	W	Co	Ti	As
465		.026	.004	.002	.005	(.001)	.008	.20	.010
466	1166	.051	.011	.007	.011	(.006)	$.04_6$	.057	.014
665	1265	.041	$.007_2$	.0006	.0050	(~.00004)	$.007_0$	.0006	(.0002)

No.		Analysis, %					
		Sn	Al	Nb	Ta	Zr	B
465		.001	.19	(.001)	.001	(.002)	$.000_1$
466	1166	.005	$.01_5$	.005	.002	(< .005)	$(.000_2)$
665	1265	(~.0002)	(.0007)	(< .00001)	(< .00005)	(< .00001)	.00013

Table 25. (continued)
S: 20

No.		Analysis, %				
		Pb	Ag	Ge	O	N
465		(< .0005)	(.0002$_5$)	(.003$_5$)	(.003)	(.00$_5$)
466	1166	(.001$_3$)	(.0004$_5$)	(.003$_0$)	(.005)	(.00$_6$)
665	1265	.00001$_5$	(~ .000002)	(~ .0014)	(~ .0063)	(~ .0011)

No.		Analysis, %				
		H	Sb	Bi	Ca	Mg
665	1265	(~ .0001)	(< .00005)	(< .00001)	(< .00001)	(< .00002)

No.		Analysis, %				
		Se	Te	Zn	Au	Ce
665	1265	(< .00001)	(< .00001)	(< .0001)	(< .000002)	(< .000005)

No.		Analysis, %				
		Hf	La	Nd	Pr	Fe
665	1265	(< .00002)	(< .000005)	(< .000005)	(< .000005)	(99.9)

400 Series: 5.5 Ø x 102 mm.
600 Series: 3.2 Ø x 51 mm.
1100 and 1200 Series: 31 Ø x 19 mm.

Table 26. Low impurity iron
S: 26

No.	Analysis, %						
	C	Mn	P	S	Si	Cu	Ni
50 A	.017	.15	.009	.004	.11	.073	.130
50 B	.002	.0015	.004	.0035	.008	.001	.041

No.	Analysis, %					
	Cr	Mo	Sn	Al	V	Co
50 A	.067	.014	.004	.003	.002	
50 B	.003	.003	(.002)	.003	$<$.001	.004

Discs 1,5 in. Ø x 0,75 in.

Table 27. Mild steels
S: 7, 19

B.C.S.[a)] No.	Analysis, %									
	C	Si	Mn	P	S	Cr	Mo	Ni	Al	As
451	.100	.030		.003	.007	.12	.100	.024		.031
452	$.31_5$	.086		.033	.025	.042	$.03_5$	.19		.009
456	.104	.22	.17	.010	.024				.008	
457	$.26_0$	.046	,28	.020	.048				.008	
458	$.25_5$	.55	.42	.035	.031				.14	
459	$.45_0$	.51	.088	.049	.052				.068	
460	$.37_5$	.11	.40	.040	.009				.028	

B.C.S. No.	Analysis, %									
	B	Co	Cu	Nb	Pb	Sn	Ti	V	W	Sb
451			.30			.008	.096		$.10_0$	
452			.22			.13	.020		$.05_0$	
456	$.001_0$	.048		.005	.010			.024		.011
457	$.002_5$	.018		.016	.006			.16		.029
458	$.005_0$	.16		.050	.016			.13		.07
459	.010	.077		.012	.003			.075		.007
460	$.003_5$	.009		.087	.003			.050		.002

Discs 38 mm Ø

a) British Chemical Standards.

Table 28. Plain carbon steels
S: 7, 19

No.	Type	Analysis, %				
		C	Si	Mn	P	S
431	Plain carbon wrought steels	.019	.033	.95	.009	.014
433		$.19_0$	.20	.60	.070	.073
215/3		.91	.23	.68	.011	.031
431/1		(.03)	(<.01)	(.9)	(.01)	(.015)

No.	Analysis, %						
	Cr	Mo	Ni	Al	Cu	Nb	Sn
431	.19	.015	.069	.012	.062	.022	.006
433	.52	.085	.055	.016	.058	.032	.010
215/3	.040		.038	.004	.052		
431/1						(.005)	

Discs 38 mm Ø

Table 29. Unalloyed steels
S: 31

No.	Type	Analysis, %						
		C	Mn	P	S	Si	Cu	Ni
AAF	USS EX-TEN 45	.214	.97	.010	.019	(.051)	.041	(.01)
AAS	Low carbon sheet	.045	.434	.008	.012	(.046)	.015	.023
BBE	Low-carbon, boron-bearing	.038	.37	.010	.011	.034	.022	.020
BBK	ASTM A 36	.219	.95	.012	.009	.147	.015	.020
CCH	Medium carbon, low Mn	.182	.074	.010	.024	.010	.32	.402
CCL	Austenitic manganese (18.5 Mn)	1.12	18.52	.022	.023	.586	.003	.045
CCM	AISI 1025	.264	.549	.005	.025	.192	.009	(.02)
BBF	USS "T-1" Type A	.188	1.11	.025	.012	.23	.023	.026
CCS	AISI 1005, Al killed	.046	.32	.006	.016	(.010)	.017	.019

No.	Analysis, %										
	Cr	Mo	Sn	V	Ti	Al	Al[a]	Nb	Co	B	W
AAF	(.04)	.006	.007			.006		.026	.0063		
AAS	.021	.007	(< .002)	(< .005)	(< .002)	.006					(< .002)
BBE	.036			.0003		(.001)				.0055	
BBK	.044	.006				.004					
CCH	.004	.015		(< .005)	(< .005)	.111	.108				
CCL	.162	.051									
CCM	(.02)	.005	(< .003)			.050					
BBF	.59	.18		.059	.020	(.010)	.006			(.003)	
CCS	.013	.005	.008	(< .0006)	(.002)	.069					

[a] Acid soluble Al.

Discs 1.1 - 1.5 Ø x 0.75 in.

Table 30. Unalloyed steels
S: 16, 17

No.	Type	Analysis, %								
		C	Si	Mn	S	P	Cu	Ni	Cr	Al
1615	Unalloyed steels	.043	3.070	.085	.010	.024	.072	.055	.072	
1625		.041	3.81	.0115	.005$_5$	.032	.036	.048	.035	(.095)
1629		.020	3.50	.075	.009	.020	.020	.045	.125	.125
1630		.0245	3.38	.075	.010	.0195	.020	.044	.020	.118
1631		.0485	2.225	.470	.023	.019	.027	.044	.020	.009

Table 31. Iron, unalloyed steels
S: 21

No.	Type	Analysis, %										
		C	Mn	Si	P	S	Ni	Cr	Cu	Mo	V	W
162A	Iron	.02	.02	.16	.005	.002	.03	.02	.04	.00	.00	.00
163A	Unalloyed steels	1.34	.21	.90	.025	.018	.07	.07	.17	.025	.00	.00
164A		.34	.88	.62	.050	.008	.31	.28	.64	.02	.005	.01
165A		.16	1.64	.23	.089	.013	.15	.17	.09	.06	.02	.02

No.	Analysis, %											
	Ti	Co	Al	B	As	Sn	Nb	Ta	Zr	Pb	Sb	Zn
162A	.000	.005	.02	.000	.002	.003	.000	.000	.000	.001	.000	.000
163A	.10	.015	.02		.031	.010						
164A	.01	.03	.07		.015	.014	.015			.006	.008	
165A	.005	.005	.01	.01	.023	.023				.002		.005

Discs 45 Ø x 30 mm.

Table 32. Unalloyed steels
S: 29, 24

No.	Analysis, %									
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	Ca
420-5	.10	.012	.32	.029	.038	.11	.16	.054	.018	
421-5	.15	.013	.32	.029	.028	.11	.036	.026	.013	
430-5	.20	.11	.40	.029	.038	.10	.058	.10	.014	
440-5	.40	.24	.43	.022	.024	.083	.057	.10	.015	
460-5	.60	.25	.43	.022	.025	.083	.018	.023	.007	
461-5	.79	.26	.44	.023	.024	.086	.037	.024	.011	
162-2	.030	.50	.098	.002	.041	.042	.31	.30		
164-2	.50	.020	1.04	.052	.006	.31	.015	.015		
165-2	.004								.011	
166-2	.006								.15	
167-2	.009								.31	
168-1	.055						.013	.012	.095	.0007

Table 32. (continued)
S: 29, 24

No.	Analysis, %							
	V	Co	Ti	Al	As	Sn	B	Nb
420-5					.010	.012		
421-5					.010	.010		
430-5					.010	.010		
440-5					.010	.009		
460-5					.019	.006		
461-5					.022	.009		
162-2				.015				
164-2				.043				
165-2	.30	.11	.013		.089	.011	.0012	.22
166-2	.11	.060	.089		.050	.055	.0061	.12
167-2	.012	.020	.26	.013	.010	.012	.0124	.014
168-1			.065	.047	.010	.005		

No.	Analysis, %							
	C	Ni	Cr	Mo	Ca	V	Co	Ti
169-1	.054	.038	.094	.067	.0013			.013
170-1	.062	.070	.037	.011	.0017			.097
171-1	.081	.100	.067	.033	.0027			.038
172-1	.081					.010	.055	
173-1	.079					.035	.030	
174-1	.071					.062	.020	
175-1	.083					.093	.010	

No.	Analysis, %						
	Al	As	Sn	B	Zr	Nb	Sb
169-1	.046	.005	.011				
170-1	.049	.028	.053				
171-1	.052	.046	.032				
172-1	.015			.0021	.009	.053	.0019
173-1	.024			.0031	.019	.032	.0047
174-1	.032			.0052	.028	.021	.0100
175-1	.054			.0085	.048	.011	.019

Discs 35 x 35 x 30 mm.

Table 33. Plain carbon steels
S: 5, 19

No.	Type	Analysis, %				
		C	Mn	P	S	Si
57D	AISI 1020	.22	.54	.006	.018	.046
63A+)	AISI 1036	.344	.79	.010	.028	.211
56C	AISI 1045	.47	.88	.011	.028	.114
56D	AISI 1045	.45	.79	.018	.044	.21
64A	AISI 1086	.89	.23	.009	.009	.178

No.	Type	Analysis, %						
		Cu	Ni	Cr	Mo	Sn	Al	V
57D	AISI 1020	.026	.016	.020	.005	.002	.004	.002
63A+)	AISI 1036	.025	.032	.13	.029	.003	.020	.0014
56C	AISI 1045	.068	.027	.020	.008	.005	.008	
56D	AISI 1045	.024	.017	.054	.005	.003	.024	
64A	AISI 1086	.054	.039	.098	.011	.005	.017	.009

Discs 1,75 Ø x 0,75 in. +) Discs 1,6 Ø x 0,75 in.

1.2.2. Low alloy steels

Table 34. Low alloy steels
S: 20

No.			Type	Analysis, %			
				Mn	Si	Cu	Ni
405a	805a	D805a	Medium Manganese	1.90	.27	.032	.065
408a	808a		Chromium-Nickel	.76	.28	.10	1.20
409b	809b	D809b	Nickel	.46	.27	.104	3.29
414			Cr-Mo (SAE 4140)	.67	.26	.080	.080
427	827		Cr-Mo (SAE 4150)				

No.			Analysis, %						
			Cr	V	Mo	Sn	Al	Co	B
405a	805a	D805a	.037		.005		.056		
408a	808a		.655	.002	.065				
409b	809b	D809b	.072	.002	.009	.012		.025	
414			.99	.003	.32	.014	.020		
427									.0027

400 Series: 5,5 Ø x 102 mm.

800 Series: 13 Ø x 51 mm.

Table 35. Low alloy steels
S: 20

No.		Type	Analysis, %					
			C	Mn	P	S	Si	Cu
	1134	High-silicon	.026	.277	.028	.009	2.89	.070
	1135	"	.027	.094	.006	.026	3.19	.056
	1136	High-sulfur	$.11_3$	$.75_5$	.066	$.22_0$	.018	.014
461		Low alloy A	.15	.36	.053	(.02)	.047	.34
462		" B	.40	.94	.045	(.02)	.28	.20
463		" C	.19	1.15	.031	(.02)	.41	.47
464		" D	.54	1.32	.017	(.02)	.48	.094
467		" G	.11	$.27_5$	.033	(.01)	.26	.067
468		" H	.26	.47	.023	(.02)	.075	.26
	1169	Lead-bearing	.077	.992	.064	.318	.011	.083
661	1261	AISI 4340	$.38_2$	.66	.015	.017	.223	.042
662	1262	AISI 94B17(Mod)	$.16_0$	1.04	.042	.038	.39	.50
663	1263	Cr-V(Mod)	.62	1.50	$.02_9$	.008	.74	$.09_8$
664	1264	High carbon(Mod)	$.87_0$	$.25_5$	$.01_8$	.028	.067	$.24_9$

No.		Analysis, %							
		Ni	Cr	V	Mo	W	Co	Ti	As
	1134	.038	.019		.008				
	1135	.050	.022	<.01	.014				
	1136	.27	.014	.012	.002				
461		1.37	.13	.024	.30	.012	.26	(.01)	.028
462		.70	.74	.058	.080	.053	.11	.037	.046
463		.39	.26	.10	.12	$.10_5$	$.01_3$	.010	.10
464		$.13_5$	.078	$.29_5$	.029	.022	$.02_8$	.004	.018
467		.088	.036	.041	.021	.20	$.07_4$	.26	.14
468		1.03	.54	.17	.20	.077	.16	.011	.008
	1169	.032	.015	.001	.008				
661	1261	1.99	.69	.011	.19	$.01_5$	.030	.020	.017
662	1262	.59	.30	$.04_1$	$.06_8$	.21	.30	.084	$.09_2$
663	1263	.32	1.31	.31	.030	$.04_5$	.048	.050	.010
664	1264	$.14_2$	$.06_5$	$.10_5$	.49	.10	.15	.24	$.05_2$

400 Series: 5.5 Ø x 102 mm.
600 Series: 3.2 Ø x 51 mm.
1100 and 1200 Series: 31 Ø x 19 mm.

Table 35. (continued)
S: 20

No.		Analysis, %				
		Sn	Al	Nb	Ta	Zr
	1134	.003	.329			
	1135	.004	.0028			
	1136					
461		.022	.005	.011	.002	(<.005)
462		.066	$.02_3$	.096	.036	.063
463		.013	$.02_7$	$.19_5$	.15	.20
464		.043	.005	.037	.069	.010
467		.10	.16	.29	.23	.094
468		.009	$.04_2$	.006	.005	(<.005)
	1169					
661	1261	$.01_1$	$.02_1$	.022	.020	.009
662	1262	.016	$.09_5$	.29	.20	.19
663	1263	(.095)	.24	.049	(.053)	.049
664	1264	(.005)	(.008)	$.15_7$	.11	.068

No.		Analysis, ppm										
		B	Pb	Ag	Ge	O	N	H	Sb	Bi	Ca	Mg
461		2	(30)	(15)	(15)	(200)	(60)					
462		5	60	(<2)	(30)	(60)	(80)					
463		12	120	(<2)	(25)	(70)	(60)					
464		50	200	(32)	(15)	(60)	(70)					
467		(2)	6	(40)	(30)	(40)	(40)					
468		90	(<5)	(<5)	(10)	(40)	(60)					
	1169		2270									
661	1261	5	.25	4	(60)	(9)	(37)	(<5)	42	4	(<1)	(1)
662	1262	25	4.3	(10)	(20)	(11)	(41)	(<5)	120	(20)	(2)	(6)
663	1263	9.1	22	(38)	(100)	(70)	(41)	(<5)	16	(8)	(<1)	(5)
664	1264	110	240	(.2)	(30)	(17)	(30)	(<5)	(350)	(9)	(<1)	(1)

No.		Analysis, ppm, or where noted, %									
		Se	Te	Zn	Au	Ce	Hf	La	Nd	Pr	Fe
661	1261	40	6	(1)	(<.5)	13	(2)	4	3	(1.4)	(95.6%)
662	1262	(10)	(5)	(5)	(<.5)	(11)	(60)	4	(5)	(1.2)	(95.3%)
663	1263	(1)	(22)	(4)	5	(16)	(15)	6	(7)	(1.8)	(94.4%)
664	1264	(3)	(2)	10	1	(2.5)	(50)	.7	(1.2)	(.3)	(96.7%)

400 Series: 5.5 Ø x 102 mm.

600 Series: 3.2 Ø x 51 mm.

1100 and 1200 Series: 31 Ø x 19 mm.

Table 36. Low alloy steels
S: 31

No.	Type	Analysis, %			
		C	Mn	P	S
BBC	MIL-S-20166 High Tensile Structural	.127	1.00	.013	.007
CCA	ASIM A213-65 (1.25 Cr, 0.5 Mo)	.177	.56	.008	.021
CCD	SAE 98B40 (1 Ni, 0.8 Cr, 0.25 Mo)	.464	.835	.025	.029
CCF	AISI 1020 (0.5 Cu)	.20	.343	.011	.025
CCG	Low alloy	.308	.355	.009	.009
CCJ	AISI 1025 (0.5 Cr)	.272	.35	.010	.013
CCR	AISI 8640	.338	.95	.016	.022
CCT	AISI 3115	.159	.52	.005	.013
CCV	AISI 1340	.437	1.75	.013	.025

No.	Analysis, %						
	Si	Cu	Ni	Cr	Mo	Sn	V
BBC	.283	.029	.033	.080	.022		.036
CCA	.235	.047	.067	1.34	.537		
CCD	.25	.197	.91	.82	.21		.063
CCF	.012	.516	.247	.046	.076		
CCG	.037	.024	.023	.145	.105	.014	.033
CCJ	.098	.021	.075	.491	.153	.032	.012
CCR	.256	.025	.520	.584	.176		.002
CCT	.275	.029	1.27	.655	.021		.031
CCV	.275	.015	.020	.043	.007		(<.001)

No.	Analysis, %					
	Ti	Al	Al[a)]	Nb	B	Zr
BBC	.032	.020				
CCA		.004				
CCD	.033	.064		.024	.0044	.020
CCF		.005				
CCG	.117	.004				
CCJ	.083	.038				
CCR	.003	.037				
CCT	(.003)	.006	.003			(<.002)
CCV		.033				

Discs 32 - 41 Ø x 19 mm.
a) Acid soluble Al.

Table 37. Low alloy steels
S: 7, 19

No.	Analysis, %									
	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	V
401	1.06	.59	1.00	.042	.009	$.08_0$	.53	$.02_5$	$.10_0$	.52
402	1.29	.27	.19	.006	.023	.55	.16	.73	.23	.22

Discs 38 mm Ø

Table 38. Low alloy steels
S: 16, 17

No.	Analysis, %						
	C	Si	Mn	S	P	Cu	Ni
1707	.310	.320	.550	.010	.015	.130	2.750
1710	.070	.123	.380	.007	.014	.120	3.050
1713	.105	.070	.380	.020	.008	.209	3.260
1724	.36	.44	.41	.008	.013	.02	2.57
1727	.154	.335	.650	.012	.009	.050	.076
1729	.46	.38	.29	.010	.019	(.022)	4.70
1731	.38	.26	.46	.0075	.018	.062	2.88

No.	Analysis, %						
	Cr	Mo	Al	V	Sn	As	Ti
1707	.770	.090	.013				
1710	.760	.110	(.032)				
1713	.710	(.040)	.035				
1724	2.92	.42					
1727	.967	.449		(.011)	(.022)	(.036)	
1729	.38	1.18	(.02)	.48	(.003)		
1731	.73	(.036)	.013				(.045)

Table 39. Low alloy steels
S: 21

No.	Type	Analysis, %										
		C	Mn	Si	P	S	Ni	Cr	Cu	Mo	V	W
168A	Low alloy steels	.40	.81	.04	.042	.040	2.78	.13	.09	.56	.01	.57
169A		.23	.59	.27	.061	.055	1.20	1.23	.23	.84	.55	.05
170A		.19	.33	.76	.033	.027	.16	1.97	.10	1.36	.04	.26
171A		.09	.12	.03	.014	.052	1.95	2.87	.05	.04	.30	.01

Table 39. (continued)
S: 21

No.	Analysis, %										
	Ti	Co	Al	B	As	Sn	Nb	Ta	Zr	Sb	Zn
168A	.005	.28	(.01)	.002	.020	.017	.005			.000	
169A	.06	.09	(.02)	.006	.025	.009		(.03)			
170A	.33	.01	(.07)		.030	.015	(.03)		.02		.02
171A	.005	.02	(.00)		.015	.006	.04			.01	

Table 40. Unalloyed steels
S: 29, 24

No.	Analysis, %										
	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Al
150-3		.41	.31			.086	4.11	.38	.19	.003	
153-3		.32	.83			.17	.97	1.01	1.32	.22	.005
500-2	.32	.29	.49	.025	.010	.12	.10	1.10	.19	.006	
501-2	.33	.27	.74	.024	.014	.10	.062	1.03	.17	.007	
502-2	.42	.26	.70	.019	.011	.068	.050	1.00	.18	.004	
503-2	.33	.27	.64	.029	.020	.086	1.25	.70	.013	.004	
504-2	.29	.26	.50	.020	.013	.11	2.64	.73	.019	.004	
505-2	.19	.30	.63	.021	.010	.10	1.82	.50	.22	.009	

Discs 30 Ø x 35 mm.

Table 41. Low alloy steels
S: 5, 19

No.	Type		Analysis, %					
			C	Mn	P	S	Si	Cu
51C	Low alloy steels	AISI 4620	.20	.56	.007	.022	.285	.104
51D		AISI 4615	.166	.58	.008	.015	.18	.157
52C			.44	1.12	.070	.092	.26	.065
53D		AISI E52100	.98	.37	.008	.012	.103	.059
55D		AISI P20	.33	.68	.024	.020	.51	.060
58B		AISI 9310	.100	.54	.008	.011	.28	.070
59A		AISI 4140	.41	.85	.014	.021	.27	.117
59B		AISI 4140	.428	.89	.017	.023	.25	.034
60A		AISI 4340	.39	.83	.013	.022	.25	.095
60B		AISI 4340	.370	.79	.007	.015	.25	.074
61B		AISI 8620	.212	.80	.009	.0144	.36	.027
62A		AISI 6150	.534	.76	.008	.009	.254	.070
68A		Nitriding	.42	.58	.008	.008	.40	.061
69A			.25	1.41	.008	.013	1.32	.073
65A	Re-sulfurized	AISI 1117	.159	1.14	.010	.101	.014	.024
66A		AISI 1137	.372	1.51	.018	.099	.276	.028

Table 41. (continued)
S: 5, 19

No.	Analysis, %					
	Ni	Cr	Mo	Sn	Al	V
51C	1.85	.050	.24	.007	.043	.002
51D	1.75	.20	.23	.007	.022	.003
52C	.125	.08	.07	.005	.055	.001
53D	.26	1.63	.033	.007	.001	
55D	.095	1.50	.40	(.004)	.006	(.012)
58B	3.25	1.25	.12	.006	.036	
59A	.215	.98	.175	.008	.019	.003
59B	.134	.98	.19	.006	.050	.001
60A	1.67	.90	.28	.007	.030	.005
60B	1.77	.83	.27	.009	.035	.001
61B	.42	.55	.18	.006	.026	.001
62A	.184	.94	.044	.008	.031	.181
68A	.19	1.44	.40	(.002)	1.20	
69A	1.69	.34	.40	(.008)	.037	.002
65A	.020	.051	.006	.008	.005	
66A	.019	.050	.007	.005	.050	

No.	Type		Analysis, %					
			C	Mn	P	S	Si	Cu
70A+)	Leaded	AISI 41L40	.40	.92	.012	.020	.30	.088
71A+)		AISI 41L45	.45	.88	.022	.029	.30	.25
73A+)		AISI 86L20	.183	.88	.009	.025	.30	.14
74A+)		AISI 12L14	.060	1.05	.061	.278	.007	.030
75B+)		AISI 11L17	.217	1.23	.011	.140	.013	.034
75C+)		AISI 11L17	.21	1.24	.012	.150	.014	.034

No.	Analysis, %						
	Ni	Cr	Mo	Sn	Al	Pb	Te
70A+)	.105	1.03	.19		.026	.184	.034
71A+)	.14	.99	.17	(.008)	.036	.200	
73A+)	.50	.46	.17	.006	(.024)	.186	
74A+)	.036	.04	(.015)	<.005	<.003	.218	.032
75B+)	.018	.012	.008	<.005	<.003	.120	
75C+)	.019	(.012)	.007	<.005	<.003	.220	

Regular size: discs 1.75 Ø x 0.75 in.

+) size: discs 1.6 Ø x 1.5 in.

Table 42. Low alloy steels
S: 22, 18

No.	Analysis, %							
	C	S	P	Si	Mn	Cr	Ni	Cu
10	.012	.005	.006	.011	.024	.20	.07	.08
14	.21	(.07)	.068	.30	.55	.22	.87	.28
20	,19	.003	.017	.71	(1.1)	(1.6)	.68	.25
22	.78	.003	.020	.44	(.6)	.69	.25	.17
23	(1.3)	.002	.014	.86	.33	.34	.08	.18
24	.36	.019	.016	.99	.89	1.06	.93	.52
25	.075	.046	.03	1.88	1.86	1.64	.23	.54
26	(1.5)	.03	.05	.22	1.30	.36	1.03	(.3)

No.	Analysis, %						
	Mo	Ti	V	W	Co	Al	B
10	.01	.01	(.01)	.009	.02	(.01)	.0005
14	.29	(.2)	.10	(.6)	(.3)	(.04)	.004
20	.22	.27	(.7)	.18	(.02)	.04	(.007)
22	(.03)	.13	.48	(.01)	.02	.32	.001
23	.02	.02	(.04)	(.01)	.03	.01	(.006)
24	.19	.50	.19	(.04)	(.5)	(.07)	.008
25	.39	(1.4)	(.3)	.10	(.02)	.22	.009
26	.17	.10	.14	(.01)	.35	.02	.004

Discs 30 Ø x 20 mm.

Table 43. Low alloy steels
S: 19

No.	Analysis, %						
	C	Si	S	P	Mn	Ni	Cr
12 W 15256	.18	.10	.012	.003	.22	3.53	.28
12 W 15257	.54	.20	.010	.053	1.22	.50	.10
12 W 13516		.01			.01	2.10	3.45
12 W 15260	.47	.18	.027	.009	1.21	.42	3.47

No.	Analysis, %					
	Mo	Cu	Co	Al	V	Pb
12 W 15256	.14	.10	.21			.040
12 W 15257	.10	.05	.40			.037
12 W 13516	.19	.032	.28			
12 W 15260	.20	.11	.10	.69	.42	.05

Discs

Table 44. Low alloy steels
S: 29, 24

No.	Analysis, %						
	C	Si	Mn	P	S	Cu	Ni
506-3	.30	.30	.76	.018		.17	.080
509-3	.30	.26	.47	.011		.17	.56
510-3	.41	.25	.75	.014		.15	.51
512-2	.086	.14	.41	.011	.011	.067	.031
513-2	.16	.25	.79	.012	.010	.074	.13
514-2	.23	.30	.76	.012	.011	.091	.19
515-2	.18	.24	.63	.011	.013	.080	2.29
516-2	.22	.28	.97	.011	.012	.084	3.03
517-2	.19	.27	1.07	.013	.012	.072	2.07
600-5	1.33	.31	.41	.013	.017	.042	.056
602-5	1.23	.22	.36	.011	.012	.029	.038
605-5	.56	.22	.86	.020	.005	.058	1.50

No.	Analysis, %					
	Cr	Mo	W	V	Al	N
506-3	.89	.019				.010
509-3	2.74	.54				.009
510-3	.44	.17			.041	.010
512-2	.036	.007		.002		
513-2	1.16	.010		.005		
514-2	1.07	.26		.007		
515-2	.36	.020		.006		
516-2	1.68	.41		.010		
517-2	1.53	.52		.006		
600-5	.85	.10	4.36	.041		.010
602-5	.49	.10	3.42	.31		.010
605-5	.93	.40	.014	.16		.008

Discs 30 Ø x 35 mm.

Table 45. Low alloy steels

S: 22, 18

No.	Analysis, %															
	C	S	P	Si	Mn	Cr	Ni	Cu	Mo	Ti	V	Al	B	Nb	Zr	As
A1	.04		.015	.50	.50	1.60	.04	.04	.01	.003	.01	.25	.0005	.005	.01	.005
A2	.08	.07	.03	.40	1.00	1.00	.08	.08	.05	.01	.05	.15	.001	.01	.03	.01
A3	.15	.05	.05	.15	1.80	.30	.15	.15	.10	.05	.10	.08	.002	.03	.06	.02
A4	.30	.03	.07	.30	.25	.65	.30	.30	.20	.10	.20	.04	.004	.06	.10	.03
A5	.55	.015		.07	.10	.15	.40	.50	.30	.20	.30	.01	.008	.10	.15	
A6	.90	.01		.02	.03	.07	.50	.40	.40	.30			.01	.20	.20	

Discs 35 Ø x 40 mm.

1.2.3. High alloy steels and related alloys

Table 46. Stainless steels

S: 20

No.	Type	Analysis, %									
		C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo
442	Cr16-Ni10		2.88			(.09)	.11	9.9	16.1	.032	.12
443	Cr18.5-Ni9.5		3.38			(.15)	.14	9.4	18.5	.064	.12
444	Cr20.5-Ni10		4.62			(.65)	.24	10.1	20.5	.12	.23
1155	Cr18-Ni12-Mo2 (AISI 316)	.046	1.63	.020	.018	.50	.169	12.18	18.45	.047	2.38
No.		W	Co	Ti	Sn	Nb	Ta	B	Pb	Zr	Zn
442		(.08)	.13	.002	.0035	.032	(.0006)	.0005	.0017	(.004)	(.003)
443		(.09)	.12	.003	.006	.056	(.0008)	.0012	.0025		(.005)
444		(.17)	.22	.019	.014	.20	(.004)	.0033	.0037	(.011)	(.004)
1155			.101						.001		

400 Series: rods 5.5 Ø x 102 mm. 1100 Series: discs 31 Ø x 19 mm.

Table 47. Austenitic stainless steels
S: 7, 19

No.	Type	Analysis, %						
		C	Si	Mn	P	S	Cr	Mo
261/1	Austenitic stainless steels	.090	.50	.83	.017		17.4_5	.11
461		(.1)	(.4)	(.6)	(.01)	(.02)	(15)	
462		(.1)	(.5)	(.7)	(.01)	(.02)	(12)	
463		(.1)	(.5)	(.8)	(.01)	(.02)	(18)	
464		(.1)	(.6)	(.8)	(.02)	(.01)	(26)	
465		(.1)	(.6)	(.9)	(.01)	(.02)	(18)	
466		(.1)	(.5)	(.7)	(.02)	(.02)	(18)	(2.2)
467		(.1)	(.5)	(.7)	(.02)	(.02)	(18)	

No.	Analysis, %									
	Ni	As	Co	Cu	Nb	Pb	Sn	Ti	V	Ta
261/1	13.1_0	.016	.050	.12	.91					.006
461	(6)	(.01)				(.0005)				
462	(13)	(.01)				(.0005)				
463	(10)									
464	(21)	(<.005)	(.05)			(.001)				
465	(9)		(.02)	(.05)				(.3)	(.05)	
466	(9)	(.01)			(.05)	(.0015)	(.005)			(<.005)
467	(9)				(1.0)					(.001)

Table 48. Stainless Steel
S: 16, 17

No.	Analysis, %									
	C	Si	Mn	S	P	Cu	Ni	Cr	Co	Mo
1811	.099	1.43	1.65	.005	.027	.065	20.0	24.4	.26	.13

Table 49. Alloy steels
S: 29, 24

No.	Analysis, %					
	C	Si	Mn	P	S	Cu
606-3	.74	.26	.35	.018	.004	.044
607-3	.79	.29	.32	.017	.007	.038
608-3	.75	.28	.31	.012	.005	.031
609-3	.86	.30	.34	.018	.009	.039
610-3	1.27	.29	.31	.016	.008	.045
611-3	.88	.28	.31	.019	.005	.054

Table 49. (continued)

S: 29, 24

No.	Analysis, %					
	C	Si	Mn	P	S	Cu
650-3	.055	.66	.36	.023	.005	.083
651-3	.058	.75	1.70	.028	.009	.11
652-3	.062	.54	1.95	.038	.008	.22
653-3	.070	.73	1.62	.038	.006	.053
654-3	.052	.71	1.54	.021	.010	.065
655-3	.055	.59	1.58	.033	.006	.088

No.	Analysis, %									
	Ni	Cr	Mo	W	V	Co	Al	N	Nb	Ta
606-3		3.94	.67	17.11	.83					
607-3		4.01	.84	16.97	.89	1.82				
608-3		4.10	.56	16.87	1.18	9.23				
609-3		4.24	5.12	6.30	1.85	5.16				
610-3		4.29	3.12	9.51	3.19	9.47				
611-3		3.97	4.78	6.29	1.75					
650-3	.24	16.43	.012			.025	.010	.027		
651-3	9.08	18.51	.082			.21		.020		
652-3	11.80	17.41	2.46			.41		.024		
653-3	13.73	22.51	.084			.33	.004	.018		
654-3	19.78	24.69	.071			.33		.028		
655-3	11.49	18.52	.050			.28		.024	.60	.03

Discs 30 Ø x 35 mm.

Table 50. Alloy steels
S: 31

No.	Type	Analysis, %									
		C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn
AAE	AISI 347 stainless	.037	1.49	.024	.018	.472	.185	11.59	18.02	.301	.011
AAM	ASTM A 538 grade B (maraging)	.018	.018	.0017	.010	(.054)	.146	18.31	.053	4.90	
BBB	ASTM A 538 grade C (maraging)	.028	.067	.003	.009	.090	.104	18.00	.127	5.02	
BBD	AISI 430 stainless	.083	.48	.010	.009	.314	.015	.29	16.24	.006	
BBG	12 Ni maraging	.031	.13	.006	.013	.13		11.90	4.26	2.94	
BBH	4 Cobalt	.887	.43	.004	.007	.031	.007	(.01)	.049		
DDA	AISI Type 309	.119	1.67	.002	.004	.857	(<.005)	13.79	23.11	(<.005)	(.0005)
DDB	AISI Type 310(1.08Si)	.167	1.73	.002	.004	1.08	(<.005)	20.53	25.31	(<.005)	(.002)

No.	Analysis, %										
	V	Ti	Al	Al[a]	Nb	Co	B	Pb	W	Ta	N
AAE		(.003)	.006		.731	.144	.0002	.0021	(.053)	.035	
AAM		.51	.12			8.17					
BBB	(.001)	.59	.087			8.69	(.003)				.0028
BBD	.031	(.001)		(.003)			(.0009)				.0425
BBG	(<.005)	.25	.29				.0026				
BBH	.20					3.99					
DDA	(<.005)	(<.005)	.001		(<.01)		(.0008)	(.0005)			
DDB	(<.005)	(<.005)	.002		(<.01)		(.0005)	(.0003)			

[a] Acid soluble Al.

Discs 1.1-1.5 Ø x 0.75 in.

Table 50. (continued)

S: 31

No.	Type	Analysis, %									
		C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn
DDC	AISI Type 317	.090	1.69	.002	.003	.884	(<.005)	13.17	19.29	3.54	(.001)
DDD	AISI Type 321	.087	1.77	.002	.003	.971	(<.005)	10.67	18.27	(.006)	(.0009)
DDF	AISI Type 410	.050	.41	.019	.013	.620	(.03)	.23	12.35	.117	(.003)
DDG	SAE 51409 (.49Cu, .86Ni)	.049	.68	.025	.014	.789	.486	.86	11.34	(<.005)	(.0004)
DDL	AISI Type 317	.090	1.68	.002	.004	.89	(<.005)	13.22	19.27	3.55	(.001)

No.	Analysis, %										
	V	Ti	Al	Al[a]	Nb	Co	B	Pb	W	Ta	N
DDC	(<.005)	(<.005)	.001		(<.001)		.0005	(<.0001)			
DDD	(<.005)	(<.005)	(.002)		(<.001)		.0008	(<.0001)			
DDF	.032	(<.01)	(.1)		(.007)		.0005	(<.0001)			
DDG	(<.005)	.47	.003		(<.01)		(.0003)	(<.0001)			
DDL	(<.005)	(<.005)	(.007)		(<.01)		(.0008)	(<.0002)			

[a] Acid soluble Al.

Discs 1.1–1.5 Ø x 0.75 in.

Table 51. High manganese steel

S: 7, 19

No.	Type	Analysis, %								
		C	Si	Mn	P	S	Cr	Mo	Ni	Al
494	High manganese steel	1.24	.26	13.5_5	.040	.005	.56	.078	.69	.004

Disc 38 mm Ø.

Table 52. Alloy steels
S: 22, 18

No.	Analysis, %										
	C	S	P	Si	Mn	Cr	Ni	Cu	Mo	Ti	W
K7	.056	.010	.008	.88	1.86	17.7	13.1			.28	
H1	.29	.002	.015	1.15	1.23	11.6	.42	.36		.20	.50
H2	.43	.003	.018	.42	.90	15.0	.32	.36		.05	.50
H4	.51	.002	.022	.71	.78	17.9	.21	.22		.14	.29
H5	.13	.003	.016	.70	.47	21.8	.20	.22		.07	.10
H6	.08	.005	.016	.66	.44	20.7	.17	.21		.07	.10
H7	.08	.005	.017	.44	.48	10.4	.10	.06		.34	.52
S1	.054	.002	.030	.70	.71	28.0	4.25	.08	3.24	.22	
S2	.085	.004	.024	1.27	.56	18.8	2.60	.20	2.28	.25	
S3	.070	.002	.020	.14	1.25	16.4	11.8	.12	1.04	.03	
S5	.21	.003	.032	.87	(1.90)	20.2	14.8	.45	.20	.13	
S8	.51	.002	.024	1.00	.90	23.7	7.15	.16	.32	(.01)	
S10	.36	.006	.020	1.21	1.54	4.10	21.9	.47	3.67	.55	
S11	.20	.010	.018	.54	2.15	1.22	27.8	.20	.76	.19	
S12	.135	.010	.026	.43	1.35	16.7	18.1	.05	1.17	(.02)	

Discs 30 Ø x 20 mm.

Table 53. Alloy steels
S: 9

No./Type	Analysis, %									
	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Co
M1	.80	.30	.22	.012	.005	3.91	.12	8.22	.087	
M2	.82	.33	.27	.012	.004	4.03	.25	4.96	.06	.05
M7	1.00	.29	.34	.012	.003	3.60	.10	8.49	.066	
M10	.88	.27	.30	.015	.004	3.97	.14	7.89	.061	.012
D2	1.53	.48	.40	.013	.005	11.46	.10	.75	.04	.02
H13	.39	.30	1.05	.015	.005	5.23	.10	1.36	.061	
A2	.95	.72	.40	.010	.004	5.13	.10	1.05	.06	

No./Type	Analysis, %									
	Al	Ti	V	W	N	Nb	Sn	Ag	Pb	B
M1			1.05	1.58						
M2			1.81	6.47						
M7			2.02	1.78						
M10			1.99	<.05						
D2			.89	<.01						
H13			1.02							
A2			.22							

Discs 1.5 Ø x 0.75 in.

Table 53. (continued)
S: 9

No./Type	Analysis, %									
	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Co
01	.91	1.27	.36	.009	.004	.49	.06	.07	.05	
AISI 303	.070	1.64	.58	.029	.31	17.78	9.03	.41	.49	.16
AISI 304	.063	.78	.56	.026	.023	18.57	9.60	.33	.34	.20
AISI 305	.067	1.85	.55	.025	.022	18.58	11.95	.45	.29	.22
AISI 316	.061	1.67	.69	.029	.023	17.60	12.61	2.45	.25	.14
AISI 410	.11	.48	.27	.015	.023	12.04	.34	.053	.079	.023
AISI 416	.088	.52	.63	.018	.36	13.15	.24	.065	.004	.019
Carpenter 20 Cb-3	.034	.19	.38	.017	.003	19.63	33.55	2.25	3.28	.035
Custom 450	.036	.39	.29	.014	.006	15.20	6.36	.80	1.49	.16
Custom 455	.012	.074	.13	.010	.005	11.37	8.22	.027	2.32	
AISI 630	.036	.39	.63	.018	.013	15.94	4.20	.11	3.25	.11
Maraging 250	.002	.006	.008	.003	.002	.008	18.44	4.88	.008	7.54
Maraging 300	.005	.032	.030	.005	.004	.034	18.51	4.97	.047	9.07

No./Type	Analysis, %									
	Al	Ti	V	W	N	Nb	Sn	Ag	Pb	B
01			.25	.51						
AISI 303			.044				.007	.0003	.001	
AISI 304			.037			.043	.017	.0007	<.001	
AISI 305			.078							
AISI 316			.051				.006	.0005	.001	
AISI 410	.015	.015	.025		.036		.006	.0002	<.001	
AISI 416			.025		.020		.005	.0002	<.001	
Carpenter 20 Cb-3			.053			.86	.003	.0019	.002	.0023
Custom 450			.043		.028	.67	.008	.0013	.001	
Custom 455		1.18			.002	.28	.004	.0002	<.001	.0024
AISI 630			.022		.028	.36	.007	.0004	.001	.0018
Maraging 250	.058	.41								.0024
Maraging 300	.12	.69								.0020

Discs 1.5 Ø x 0.75 in.

Table 54. High speed steels
S: 9

No./Type	Analysis, %												
	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Co	Al	V	W
M2	.8x	.2x	.3x	.01x	.00x	4.xx	.2x	4.xx	.0x	.0x	.00x	1.xx	6.xx
AISI 613	.8x	.3x	.2x	.01x	.00x	4.xx	.1x	4.xx	.0x	.0x	.00x	1.xx	
Band saw	.9x	.3x	.3x	.01x	.00x	4.xx	.2x	2.6x	.0x	.0x	.00x	2.3x	2.8x
Hi alloy band saw	.8x	.3x	.9x	.01x	.00x	4.xx	.2x	4.xx	.0x	.0x	.00x	1.7x	2.8x

Discs 1.4 Ø x 0.4 in. x = variable.

Table 55. Tool and die steels
S: 9

No./Type	Analysis, %													
	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Al	Ti	V	W	B
S2	.5x	.4x	.9x	.01x	.00x	.1x	.04x	.4x	.05x	.01x				
Nitralloy	.4x	.6x	.3x	.00x	.00x	11.xx	.2x	.3x	.1x	1.1x	.00x			
AISI 3310	.1x	.5x	.2x	.00x	.00x	1.5x	3.4x	.01x	.03x	.00x		.03x		
H13	.4x	.3x	1.xx	.01x	.00x	5.xx	.1x	1.3x	.0x	.01x		1.xx		
H11	.4x	.3x	.8x	.01x	.00x	5.xx	.0x	1.3x	.0x	.00x		.4x		
A6	.6x	2.xx	.3x	.01x	.00x	1.xx	.1x	1.3x	.0x			.0xx		
L1	1.xx	.3x	.3x	.00x	.00x	1.5x	.0x	.0x	.0x	.01x		.00x		
A2-FM	.9x	.8x	.3x	.00x	.1x	5.3x	.1x	1.1x	.0x	.00x		.2x		
M2-FM	.8x	.3x	.3x	.00x	.1x	4.xx	.2x	4.xx	.1x			1.xx	6.xx	
AISI 9310	.1x	.6x	.2x	.00x	.00x	1.3x	3.xx	.1x	.1x					.004x

Discs 1.4 Ø x 0.4 in. x = variable.

Table 56. Stainless steels

S: 9

No./Type	Analysis, %																			
	C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Co	Al	Ti	V	W	N	Nb	Sn	Ag	Pb	B
AISI 616	.2x	1.xx	.3x	.01x	.00x	11.xx	.8x	1.0x	.0x		.00x	.00x	.2x	1.xx			.00x			
Lapeloy C	.2x	.9x	.3x	.01x	.00x	11.xx	.1x	2.6x	2.xx						.0xx					
AISI 406	.05x	.4x	.3x	.01x	.00x	13.xx	.1x	.0x	.0x		3.xx	.3x								
AISI 410	.1x	.5x	.3x	.01x	.00x	12.xx	.3x	.0x	.0x		.00x		.02x							
AISI 420	.3x	.4x	.5x	.01x	.00x	13.xx	.1x	.2x	.0x		.01x									
AISI 430	.07x	.4x	.4x	.01x	.00x	17.xx	.1x	.1x	.0x		.00x		.03x		.02x					
AISI 631	.06x	.6x	.3x	.01x	.00x	16.xx	6.xx	.1x	.0x	.0x	1.2x				.01x					.002x
AISI 434	.05x	.5x	.4x	.01x	.00x	16.xx	.4x	.9x	.0x		.00x				.05x					
Custom 455	.01x	.1x	.1x	.00x	.00x	11.xx	8.xx	.1x	2.xx	.0x		1.xx				.2x				.001x
Pyromet 350	.1xx	.9x	.3x	.01x	.00x	16.xx	4.xx	2.8x	.1x	.2x	.0xx				.09x					
Pyromet 355	.1xx	.9x	.4x	.01x	.00x	15.xx	4.2x	2.8x	.1x	.2x	.00x				.08x					
AISI 630	.03x	.3x	.6x	.01x	.00x	15.xx	4.xx	.0x	3.xx	.0x					.02x	.2x				
Custom 450	.03x	.4x	.3x	.01x	.01x	15.xx	6.xx	.8x	1.xx			1.xx			.01x	.3x				.002x
AISI 347	.05x	1.5x	.6x	.02x	.00x	18.xx	10.xx	.4x	.1x	.1x						.7x	.00x	.000x	.00x	
AISI 308	.03x	1.8x	.4x	.01x	.00x	20.xx	9.xx	.1x	.1x	.1x					.04x					
Pyromet 538	.02x	9.xx	.3x	.01x	.00x	19.xx	6.xx	.0x	.1x	.1x					.2x					
AISI 309, C2	.0xx	1.8x	.4x	.01x	.00x	24.xx	13.xx	.1x	.1x	.1x										
AISI 310	.1xx	1.xx	.3x	.01x	.00x	26.xx	21.xx	.1x	.1x	.1x			.0x		.0xx					
AISI 329(mod.)	.07x	1.xx	.4x	.01x	.00x	27.xx	5.xx	1.xx	.1x	.1x					.07x					
Carpenter 312	.12x	1.7x	.3x	.02x	.00x	29.xx	8.xx	.3x	.3x	.2x	.01x	.2x			.05x					
Carp.20Cb-3	.03x	.xx	.4x	.01x	.00x	19.xx	33.xx	2.3x	3.xx	.xx						.8x				
Maraging 250	.00x	.1x	.1x	.01x	.00x	.1x	18.xx	4.xx	.2x	7.xx	.1x	.4x								.00x
Maraging 300	.00x	.1x	.1x	.01x	.00x	.1x	18.xx	4.xx	.2x	9.xx	.1x	.6x								.00x
AISI 501	.0xx	.4x	.3x	.01x	.00x	5.xx	.xx	.5x	.xx											
AISI 616(422)	.2xx	.7x	.3x	.01x	.01x	12.xx	.8x	1.xx	.1x	.1x	.00x	.00x	.2x	1.xx			.0x			

Discs 1.4 Ø x 0.4 in. x = variable.

Table 57. Alloy steels

S: 9

No.	Type	Analysis, % C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Co	B	Zr	Ti	Fe	Al	Nb	Ta	W	Pb	V
171	X750	.023	.025	.126	.004	.008	15.48	72.02		.02	.22	.0021		2.10	7.56	1.25	1.15	.004			
172	"	.050	.049	.096	.009	.013	15.51	72.08		.04	.11	.0028		2.36	7.63	1.09	.85	.026			
173	"	.073	.098	.054	.012	.018	15.49	72.05		.10	.18	.0042		2.47	7.40	.79	.99	.054			
174	"	.086	.200	.034	.018	.022	15.52	71.79		.20	.02	.0065		2.66	7.28	.94	.72	.11			
069	718	.070	.002	.041	.006	.006	18.59	52.58	3.06			.0024		1.08	18.58	.58	5.18				
070	"	.067	.021	.064	.006	.006	18.63	52.30	3.07			.0049		1.08	18.52	.58	5.23				
071	"	.048	.046	.097	.010	.011	18.66	52.27	3.08			.0072		1.08	18.50	.61	5.26				
072	"	.084	.091	.161	.009	.012	18.68	52.24	3.06			.0099		1.08	18.37	.57	5.29				
667	"	.036	.08	.175	.006	.003	18.24	51.95	3.00	.055	.065	.0033		.96	19.20	.62	5.32	.013			
234	7130	.095	.235	.24	.006	.010	12.51	72.29	4.54	.23	.47	.0100	.100	.73	.30	6.05	2.18	.087			
235	"	.043	.055	.09	.005	.006	10.98	73.84	3.84	.49	.25	.0042	.053	.41	.47	6.65	2.81	.108			
220	Rene 80	.142	.004	.024	<.001	.004	13.62	60.03	4.40		8.88	.0123	.019	4.72	.12	3.40			4.39		
221	"	.166	.095	.079	.004	.008	13.92	60.04	3.95		9.48	.0147	.054	5.03	.12	2.94			4.00		
222	"	.179	.20	.179	.008	.012	14.32	59.71	3.51		10.05	.0227	.028	5.35	.12	2.56			3.55		
298	Rene 95	.135	.16	.22	.002	.004	13.10	60.90	3.32	.11	8.57	.0080	.065	2.84	.57	3.20	3.30		3.53		
299	"	.166	.11	.11	.006	.007	14.08	60.86	3.47	.06	7.80	.011	.044	2.59	.28	3.40	3.50		3.44		
300	"	.192	.004	.016	.006	.015	15.04	61.02	3.68	.003	6.99	.012	.030	2.43	.13	3.59	3.69		3.18		
304	Astroloy	.077	.05	.06	.006	.006	15.04	54.34	5.37	.06	17.26	.025	.031	3.52	.18	4.02					
305	"	.102	.003	.11	.015	.010	16.06	54.30	4.88	.10	16.58	.034	.053	3.75	.12	3.82					
317	"	.022	.11	.01	.001	.003	13.97	54.72	5.58	.002	17.83	.015		3.33	.26	4.20					
629	IN 100	.136	.20	.09	.002	.002	9.98	58.47	2.50		16.20	.0084	.041	5.08	1.08	5.20				.0055	1.13
630	"	.185	.10	.10	.007	.006	10.54	58.25	2.99		15.66	.013	.058	4.80	.80	5.52				.0060	.91
631	"	.200	.05	.16	.011	.013	11.03	58.04	3.55		15.12	.022	.082	4.64	.56	5.73				.010	.66
311	Hadfield	.67	6.96	.03	.020	.005	2.16	.22	2.04							.062					
312	"	1.14	11.95	1.14	.062	.007	1.10	.08	1.04							.068					
333	"	.70	6.90	.28	.021	.005	2.18	.26	2.02							.054					

Discs 1.25 Ø x 0.65 in.

Table 58. Alloy steels

S: 9

No.	Type	Analysis, %									
		C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Co
052	Custom 455	.005	.06	.18	.001	.004	11.64	8.20	.022	1.99	
053	"	.019	.10	.18	.001	.003	11.92	7.98	.010	1.98	
054	"	.017	.15	.16	.001	.003	11.98	7.98	.005	1.98	
055	"	.018	.24	.15	.001	.004	11.99	8.02	.006	1.98	
113	630	.024	.30	.57	.001	.004	15.65	4.28	.01	3.30	
114	"	.027	.30	.58	.001	.004	15.93	4.28	.01	3.34	
115	"	.028	.30	.57	.001	.004	15.94	4.27	.01	3.34	
116	"	.025	.30	.56	.002	.004	15.85	4.28	.01	3.35	
159	347	.019	1.46	.73	.004	.005	17.82	10.13	.10	.09	.08
160	"	.039	1.71	.67	.005	.011	17.95	10.05	.20	.19	.11
161	"	.055	1.24	.64	.006	.021	17.92	10.03	.40	.28	.16
162	"	.079	1.47	.60	.015	.030	17.95	10.03	.40	.38	.20
557	304L	.046	.87	.59	.019	.013	18.50	9.06	.28	.26	.25
558	"	.045	.85	.58	.019	.018	18.49	8.97	.25	.25	.26
559	"	.044	.86	.59	.018	.016	18.56	9.07	.24	.25	.26
061	304M	.043	.69	.40	.010	.012	18.25	8.40	.49	.10	.06
062	"	.138	.92	.48	.035	.037	18.30	8.45	.51	.46	.48
689	316M	.062	1.50	.80	.005	.006	17.48	12.52	2.48	.10	.12

No.	Analysis, %										
	B	Ti	Al	Nb	Ta	V	Sn	Pb	Ag	Zr	W
052	.0007	.80		.17	.078						
053	.0005	.95		.26	.032						
054	.0015	1.04		.36	.012						
055	.0024	1.16		.45	.001						
113	.0026			.15	.070						
114	.0030			.30	.040						
115	.0030			.44	.022						
116	.0042			.54	.002						
159				.66	.16						
160				.81	.16						
161				.94	.065						
162				1.05	.005						
557			.045				.0033	.0018	.0012		
558			.002				.0073	.0098	.0045		
559			.038				.013	.0132	.0057		
061		.03	.002	.01	.01	.03	.006	.0005	.002		.02
062		.32	.022	.01	.01	.20	.030	.0065	.011		.10
689	.0011	.005	.030	.008	.008	.030	.005	.0012	.0028	.005	

Discs 1,25 Ø x 0.65 in.

Table 59. Alloy steels
S: 9

No.	Type	Analysis, %																	
		C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Co	B	Ti	Al	Nb	Ta	W	V	N
242	A286	.023	.39	.38	.014	.015	15.01	24.99	1.21			.0015	2.11	.062				.32	
243	"	.048	.58	.28	.010	.010	15.01	25.01	1.21			.0033	2.10	.096				.34	
244	"	.070	.77	.20	.007	.005	14.98	25.05	1.21			.0058	2.11	.130				.36	
274	"	.027	.40	.37	.014	.014	14.98	25.09	1.19			.0024	2.07	.054				.30	
117	661	.068	1.52	.65	.010	.006	21.46	19.80	2.95		19.79		.007		.67	.18	1.97		.14
118	"	.098	2.03	.36	.017	.012	21.58	19.63	3.44		19.63		.007		.42	.13	2.43		.16
120	"	.131	1.51	.66	.025	.023	21.04	20.00	3.00		20.00		.007		1.30	.04	2.43		.16
121	"	.158	1.03	.65	.023	.029	21.44	20.48	2.97		19.94		.007		1.35	<.01	2.95		.15
158	"	.084	1.99	.35	.012	.012	21.26	19.54	3.42		19.34		.006		.86	.12	2.32		.12
124	CarTech 20Cb-3	.004	.52	.23	.003	.004	20.05	34.28	2.30	3.24	.54	.0011	.001		.23	.109			
125	"	.022	.40	.335	.012	.014	19.98	34.02	2.30	2.99	.54	.0019	.002		.70	.067			
126	"	.037	.29	.425	.022	.025	19.98	33.98	2.03	3.52	.42	.0039	.003		.93	.045			
127	"	.067	.12	.51	.033	.032	19.94	34.08	2.21	3.24	.28	.0045	.004		1.02	<.01			
175	Refract-alloy 26	.025	.056	.07	.004	.005	18.60	35.47	2.56	.005	20.12		3.24	.06				.07	
176	"	.043	.10	.12	.010	.010	17.54	36.90	3.02	.050	19.56		2.73	.10				.17	
167	Remendur	.003	.19	.10	.003	.002		.26	<.005	.10	46.56		.005					3.34	
168	"	.020	.28	.06	.010	.010		.23	.04	.06	48.30		.015					3.50	
169	"	.037	.38	.01	.015	.015		.20	.005	.02	49.72		.020					3.55	
164	Hysat	.018	.10	.004	.015	.015	.01	.19	<.005	.01	47.90				.20			1.83	
165	"	.010	.05	.05	.011	.010	.05	.22	.045	.06	49.42				.15			1.79	
166	"	.003	.01	.09	.003	.002	.10	.27	.10	.10	50.95				.11			1.72	Zr
519	Spec.	.029	1.17	1.07	.010	.009	16.55	29.37	2.06	1.88	.40		1.19	.88	.68			.40	.046

Discs 1.25 Ø x 0.65 in.

Table 60. Stainless steels
S: 5, 19

No.	Type	Analysis, %															
		C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Sn	Al	Nb	V	Co	Ti	Ta
	Austenitic and heat resisting																
80C	AISI 303	.067	1.78	.027	.329	.55	.20	8.16	17.24	.30	(.010)	.001	(.007)	.034	.13		
81C	" 304	.060	1.41	.036	.027	.75	.245	9.13	18.50	.35	(.016)	.002	(.019)	.044	.204		
82A+)	" 309	.071	1.73	.019	.005	.33	.18	13.16	22.81	.15	.010	.002	.005	.049	.169		
83A+)	" 310	.055	1.32	.025	.012	.40	.086	20.14	24.46	.153		.002	.012	.044	.173		
85A+)	" 321	.054	1.69	.029	.017	.50	.155	9.99	17.33	.43	.006	(.034)		.052	.141	.143	
87C	" 347	.070	1.61	.021	.006	.76	.153	9.82	17.44	.26	.005	.099	.66	.042	.20		(.031)
88C	" 17-4PH	.052	.55	.025	.010	.77	3.38	4.74	15.93	.23	.011	.018	.36	.030	(.050)		(.020)
	Chromium																
89C	AISI 410	.103	.46	.016	.014	.21	.065	.31	11.73	.075	(.005)	.006		(.048)	(.040)		
92A+)	" 431	.150	.71	.020	.014	.325	.086	2.13	15.72	.115	(.007)	(.004)	.001	.032	.036		
93C	" 440C	1.01	.47	.015	.010	.39	.068	.29	17.10	.48	(.007)	.007	(.003)	.061	(.031)		
94A+)	" 446	.088	1.22	.018	.004	.80	.070	.31	25.19	.083	(.013)	(.040)	.001	.052	.045		

Regular size: discs 1.75 Ø x 1.5 in.

+)size:discs 1.5 Ø x 0.5 in.

Table 61. Alloy steels
S: 19, 38

No.	Analysis, %												
	C	Si	S	P	Mn	Ni	Cr	Mo	Cu	Co	Al	Nb	Ti
13W14933	.02	.02	.010	.001	.03	16.7	.04	4.02		11.00	.01		.26
13W15023		.20	.009	.003	1.23	.74	11.20	1.00	.07			1.38	
13W15034		.22	.012	.005	1.20	.69	15.00	1.00	.08			1.33	
13W15035		.59	.006	.006	.87	2.50	14.50	.44	.20			.58	
13W15025		.34	.007	.005	1.44	.72	14.90	.80	.09			1.20	
13W15026		.51	.013	.003	1.22	1.71	11.50	.58	.13			.84	
13W15058		.50	.008	.004	1.32	1.60	13.20	.60	.15			.68	
13W15059		.54	.008	.006	1.27	1.60	16.50	.58	.14			.80	
13W15060		.53	.012	.007	1.24	1.71	17.20	.62	.14			.90	

Discs

Table 62. Specialty steels
S: 20

No.	Type	Analysis, %															
		C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Co	Ti	Al	Zr	B	Ca	V
1156	Maraging (Ni 19)	.023	.21	.011	.012	.184	.025	19.0	.20	3.1	7.3	.21	.047	.004	.003	<.001	
1158	High-nickel (Ni 36)	.026	.47	.004	.006	.19	.040	36.0_3	$.06_4$	.011	.008						.001

Discs 31 Ø x 19 mm.

Table 63. Electronic and expansion alloys
S: 9

No.[a]	Type	C	Mn	Si	P	S	Cr	Ni
		Analysis, %						
1	Silicon Core Iron C	.03x	.2x	4.xx	.00x	.00x	.00x	.02x
2	Silicon Core Iron B-FM	.03x	.3x	2.xx	.00x	.02x	.00x	.02x
3	Nicoseal	.01x	.2x	.1x	.00x	.00x	.0x	29.xx
4	Hiperco 50	.00x	.0x	.0x	.00x	.00x	.0x	.0x
5	Hiperco 50-FM	.2x	.0x	.1x	.00x	.00x	.xx	.0x
6	Class Sealing 27	.06x	.5x	.3x	.01x	.00x	28.xx	.3x
7	Temperature Compensator-4	.1x	.6x	.2x	.00x	.00x	.1x	29.xx
8	Temperature Compensator-32	.1x	.6x	.2x	.00x	.00x	.1x	30.xx
9	Temperature Compensator-31	.0x	.6x	.2x	.00x	.00x	.1x	31.xx
10	Dumet Core Rod	.03x	.9x	.2x	.00x	.00x	.1x	41.xx
11	Carpenter Hi Permeability	.04x	.6x	.2x	.00x	.00x	.1x	45.xx
12	Class Sealing Alloy N52	.02x	.4x	.2x	.00x	.00x	.1x	50.xx
13	Class Sealing Alloy N54	.01x	.6x	.2x	.00x	.00x	.1x	48.xx
14	HyMu 80	.02x	.5x	.3x	.00x	.00x	.0x	80.xx
15	Carpenter Cupronium D	.00x	19.xx	.00x	.00x	.00x	.00x	19.xx
16	Remendur 27	.00x	.2x	.0x	.00x	.00x	.0x	.0x
17	Hi Expansion Alloy 22.3	.1x	.4x	.2x	.00x	.00x	3.xx	22.xx
18	Carpenter Ni 200	.1x	.2x	.1x	.00x	.00x	.0x	99.xx

No.[a]	Mo	Cu	Co	Al	Ti	V	N	Nb	Sn	Pb	Fe	Mg
	Analysis, %											
1	.02x	.0x		.01x								
2	.02x	.0x		.01x								
3	.0x	.0x	17.xx	.00x	.0x				.00x	.00x		
4	.0x	.0x	48.xx			1.9x		.1x				
5	.0x	.0x	48.xx			.5x						
6	.0x	.0x	.0x	.00x		.0x	.0xx					
7	.0x	.0x	.0x	.00x								
8	.0x	.0x	.0x	.00x								
9	.0x	.0x	.0x	.00x								
10	.0x	.0x	.0x	.00x								
11	.0x	.0x	.0x	.00x								
12	.0x	.0x	.0x	.00x								
13	.0x	.0x	.0x	.00x								
14	4.xx	.0x	.1x	.01x								
15	.00x	60.xx									.01x	
16	.0x		48.xx			2.xx		.0x				
17	.0x	.0x	.2x									
18	.0x	.0x	.1x		.0x						.1x	.0x

a) Serial number of the table
x = variable
Discs 1.4 Ø x 0.4 in.

Table 64. High-temperature alloys
S: 20

No.	Type	Analysis, %							
		C	Mn	P	S	Si	Cu	Ni	Cr
1206-2	Rene-41	$.21_7$	.030	(.004)	.006	$.21_6$	.040	53.3	19.7
1207-1	Waspaloy(1)	.043	.34	.005	.009	$.47_2$	.026	56.1	18.88
1207-2	Waspaloy(2)	.083	$.29_5$	.005	.009	$.61_5$	.033	55.7	19.4_4
1208-1	Inco 718(1)	.046	$.38_5$	.003	$.01_1$	$.43_4$	$.14_7$	51.9	17.5
1208-2	Inco 718(2)	.022	$.23_0$	.003	.007	$.08_3$	.077	51.5	17.4

No.	Analysis, %						
	Mo	Co	Ti	Al	Nb	Ta	Fe
1206-2	10.3_0	11.5_5	2.9_4	1.7_4			.46
1207-1	4.50	13.0_5	3.09	1.26			2.22
1207-2	4.34	13.5_0	2.54	1.3_9			2.09
1208-1	3.2_4	.82	.46	(.15)	5.3_8	(.012)	19.2
1208-2	3.13	.76	$(.8_5)$	$(.8_5)$	4.9_8	(.012)	19.8

Discs 31 Ø x 19 mm.

Table 65. High temperature alloys
S: 9

No.[a]	Type	C	Mn	Si	P	S	Cr	Ni	Mo
		Analysis, %							
1	AISI 660 (A286)	.0xx	1.xx	.5x	.01x	.00x	14.xx	25.xx	1.3x
2	Pyromet CTX-1	.01x	.0x	.1x	.00x	.00x	.1x	27.xx	.1x
3	AISI 681 (901)	.2x	.0x	.1x	.00x	.00x	12.xx	43.xx	6.xx
4	Pyromet 860	.03x	.0x	.1x	.00x	.00x	13.xx	43.xx	5.xx
5	Alloy 276	.01x	.0x	.1x	.00x	.00x	15.xx	57.xx	15.xx
6	Carpenter 718	.03x	.0x	.1x	.00x	.00x	18.xx	52.xx	3.xx
7	AISI 680	.0xx	.xx	.6x	.01x	.00x	20.xx	47.xx	8.xx
8	AISI 685 (Waspaloy)	.04x	.0x	.0x	.00x	.00x	19.xx	57.xx	4.xx
9	AISI 683 (Rene 41)	.07x	.0x	.0x	.00x	.00x	18.xx	54.xx	9.xx
10	Pyromet 90	.03x	.0x	.0x	.00x	.00x	19.xx	57.xx	.0x
11	Inco 751	.03x	.0x	.0x	.00x	.00x	15.xx	71.xx	.0x
12	X-750	.03x	.1x	.1x	.00x	.00x	15.xx	72.xx	.0x
13	Pyromet 88	.02x	2.xx	.0x	.00x	.00x	15.xx	72.xx	
14	Nichrome weld wire	.09x	.8x	.2x	.00x	.00x	19.xx	78.xx	
15	Pyromet 80A	.02x	.0x	.0x	.00x	.00x	19.xx	71.xx	.0x
16	Pyromet 82	.02x	3.xx	.0x	.00x	.00x	19.xx	73.xx	.0x
17	Pyromet 95	.1x	.0x	.0x	.00x	.00x	14.xx	60.xx	3.xx
18	CarTech H-46	.1xx	.6x	.4x	.01x	.01x	11.xx	.5x	1.xx

No.[a]	Cu	Co	Al	Ti	V	W	Nb	B	Zr	Fe	Mg
	Analysis, %										
1	.2x	.2x	.2x	2.xx	.2x			.005x			
2	.1x	15.xx	.8x			2.xx	2.xx	.01x			
3	.0x	.0x	.2x	2.xx				.01x			
4	.0x	4.xx	1.xx	2.xx	.1x			.0xx			
5	.0x	.2x	.1x	.1x	.1x	3.xx		.0xx		5.xx	.01x
6	.0x	.2x	.6x	1.xx			5.xx			18.xx	.02x
7	.0x	1.8x	.0xx			.4x		.002x	.02x	19.xx	.0xx
8	.0x	13.xx	1.3x	3.xx				.00xx	.05x	1.xx	
9	.0x	10.xx	1.5x	3.xx				.00xx	.05x	1.xx	
10	.0x	16.xx									
11	.0x	.0x	1.4x	2.xx			1.xx	.00xx	.05x	7.xx	.0xx
12	.0x	.0x	.7x	2.xx			.9x	.00xx	.04x	7.xx	.02x
13	.0x	.0x	.06x	3.xx				.00xx	.00x	5.xx	.04x
14	.00x	.02x	.00x							.0xx	.02x
15	.0x	.6x	1.xx	2.xx				.00xx	.05x	.xx	
16	.0x	.0x	.05x	.5x			2.xx	.00xx	.01x	.xx	.05x
17	.0x	7.xx	3.xx	3.xx		3.xx	3.xx	.0xx	.05x	.xx	
18	.1x	.1x	.00x	.0xx	.2x	.1x	.4x				

Discs 1.4 Ø x 0.4 in.
x = variable.
a) Serial number of the table.

Table 66. Tool steels
S: 20

No.	Type	Analysis, %											
		C	Mn	P	S	Si	Cu	Ni	Cr	V	Mo	W	Co
1157	Tool (AISI M2)	.836	.34	.011	.004	.18	.088	.228	4.36	1.82	4.86	6.28	.028

Disc 31 Ø x 19 mm.

Table 67. Alloy steels
S: 5, 19

No.	Type		Analysis, %													
			C	Mn	P	S	Si	Cu	Ni	Cr	Sn	Al	V	W	Co	Mo
30A	AISI	T-1	.75	.25	.013	.005	.37	.056	.25	4.10	(.008)	(.01)	1.11	17.80	.11	.36
31A	"	T-4	.735	.30	.019	.004	.44	.074	.27	4.02	(.021)	(.01)	1.10	17.70	4.80	.75
33A	"	S-1	.55	.28	.012	.011	.29	.062	.095	1.44	.007	.016	.23	3.06	(.025)	.25
34A	"	H-13	.35	.42	.017	.010	1.05	.094	.265	5.12	.006	-017	1.01	.13	.029	1.25
35A	"	O-1	.93	1.16	.008	.010	.32	.050	.057	.52	.005	.013	.17	.43	(.002)	.010
36A	"	A-2	.97	.61	.010	.009	.23	.080	.12	5.35	.006	.006	.19	.014	(.015)	1.11
37A	"	D-2	1.49	.38	.012	.015	.43	.112	.26	11.78	.007	(.01)	.85	.025	(.05)	.79
38A	"	S-5	.61	.75	.008	.005	1.73	.095	.085	.28	.005	.008	.19	.012	(.003)	.46
39A	"	L-6	.73	.63	.009	.007	.20	.059	1.39	.72		.029	.005			.29

Discs 1.75 Ø x 0.5 in.

1.3. Cast irons (Chip form)

Table 68. Cast irons
S: 20

No.	Type	Analysis, % C	Mn	P	S	Si
3c	White (110 g)	2.30	.308	.100	.096	1.28
5L	Cast	2.59	.68	.280	.123	1.83
6g	Cast	2.84	1.06	.56	.123	1.06
7g	Cast (High Phosphorus)	2.69	.612	.794	.060	2.41
82b	Cast (Ni-Cr)	2.85	.745	.025	.007	2.10
107b	Cast (Ni-Cr-Mo)	2.75	.510	.058	.067	1.35
341	Ductile	1.81	.92	.024	.007	2.44
342	Nodular	2.45	.369	.020	.014	2.85
342a	Nodular	1.86	.275	.018	.006	2.73
365	Electrolytic iron	.0070	.0057	.003	.006	.0076

No.	Analysis, % Cu	Ni	Cr	V	Mo	Co	Ti
3c	.053	.012	.046	.007	.002		
5L	1.01	.086	.15	.036	.020		.05
6g	.50	.136	.37	.06	.035		.06
7g	.128	.120	.048	.010	.012		.044
82b	.038	1.22	.333	.027	.002		.027
107b	.235	2.12	.560	.008	.750		.016
341	.152	20.32	1.98	.012	.010		.018
342	.14	.023	.032	.005	.009		.019
342a	.14	.06	.034				.020
365	.0058	.041	.0072	.0006	.0050	.0070	.0006

No.	Analysis, % As	Sn	Al	Mg	N	Pb
3c						
5L	< .005				.006	
6g	.04				.006	
7g	.014				.004	
82b						
107b					(.008)	
341				.068		
342				.053		
342a				.069		
365+)	.0002	(.0002)	(.0007)		.001	.00002

+) For this No. the certificate provides information on these additional elements: W, Nb, Ag, Zn, Ge, O, H, Ta, Nd, Zr, Sb, Bi, Ca, Mg, Se, Te, Ce, La, Pr, Au, Hf and Fe.

Table 69. Cast iron
S: 7

No.	Type	Analysis, %											
		C	Si	Mn	P	S	Cr	Mo	Ni	Al	As	Cu	Mg
481-1	Nodular	3.91	2.29	.448	.019	.004	.063	(.011)	1.19	.023	.010	.150	.051

Table 70. Cast irons
S: 21

No.	Analysis, %															
	C	Mn	Si	P	S	Ni	Cr	Cu	Mo	V	Ti	As	Sn	Al	Sb	Co	Pb
207	3.67	.41	.47	.035	.021	.012	.03	.02	.00	.00	.01	.00	.010	.01	.00	.00	
208	2.52	.99	2.96	.23	.095	.15	.74	.78	.45	.65	.09	.01	.015	.03	.00	.00	.003
213	3.32	1.76	1.12	.47	.049	.034	.06	.19	.09	.09	.04	.05	.064	.01			.006
214	3.07	1.22	2.27	.19	.069	.12	.10	.80	.03	.07	.05	.04	.030	.01			.008
215	2.46	.76	3.08	.087	.17	.08	.15	.43	.05	.05	.04	.02	.048	.01			

Table 71. Cast irons
S: 29, 24

No.	Type	Analysis, %												
		C	Si	Mn	P	S	Cu	Ni	Cr	V	Ti	As	Sn	N
100-1	Pig-iron series A	3.66	.67	1.31	.140	.023	.032	.015	.022	.051	.12	.008	.002	
102-2		4.76	.19	.41	.082	.034	.010	.021		.049	.022	.003	.002	.006
110-4		4.12	1.43	.53	.090	.041	.032	.009	.008	.010	.049	.003		.0059
111-6		3.96	1.98	.46	.095	.033	.038	.016	.020	.011	.072	.003		.0055
112-3		4.12	.91	.17	.075	.022	.030	.006		.010	.041	.003		

1.4. Cast irons, blast furnace irons (solid form)

Table 72. Cast irons, blast furnace irons
S: 20

No.	Type	Analysis, %							
		C	Mn	P	S	Si	Cu	Ni	Cr
1141a	Ductile (No.2)	2.98	.53	.070	.013	1.22	.212	.57	$.15_0$
1142a	" (No.3)	2.72	.17	.18	.015	3.19	1.02	1.6_9	.051
1143	Blast furnace (No.1)	3.91	.414	.158	.028	1.68	.144	.115	.145
1144	" (No.2)	4.27	1.33	.112	.021	.276	.090	.021	.019

No.	Analysis, %										
	V	Mo	Ti	As	Al	Te	Bi	Ce	Y	Pb	Mg
1141a	.010	$.05_2$	.012	.03	(.013)		(.00006)	(.04)	.040	(.0004)	$.04_2$
1142a	.004	$.02_2$	.007	(.01)	(.088)		(.00002)	(.02)	$.01_2$	(.0003)	$.11_6$
1143	.008	(.005)	.17	(.004)		.020					
1144	.004	.007	.44	(.004)		.020					

Discs 31 x 31 x 6.4 mm.

Table 73. Cast irons
S: 7, 19

No.	Type	Analysis, %					
		C	Si	Mn	S	Ni	Mg
666	Nodular	3.89	1.72	.023	.004	1.63	.087
667		2.85	2.44	.63	.009	.72	.064
668		3.23	2.95	.32	.008	.10	.009
669		3.62	2.15	.47	.007	.42	.033
670		4.14	1.49	.11	.003	1.20	.046

Blocks 51 x 44 mm.

Table 74. Cast irons
S: 11

No.	Analysis, %											
	C	Si	Mn	S	P	Cu	Ni	Cr	Mo	Ti	V	Sn
9077	2.03	3.15	.68	.057	.043	.032	.056	.035	.020	.009	.19	.18
9090	2.17	2.55	1.22	.019	.081	.41	.009	.016	0	.012	≤.01	≤.01
378	2.62	2.09	.67	.185	.205	.05	.45	.086	.10	.018	.008	.06
398	2.85	1.54	.72	.022	.45	.27	.29	.17	.07	.04	.02	.01
400	3.17	1.17	.24	.008	1.00	.095	.17	.25	.40	.06	.13	.10

Discs 43 Ø x 5 mm.

Table 75. Cast irons
S: 21

No.	Analysis, %									
	C	Mn	Si	P	S	Ni	Cr	Mo	V	Cu
216A	2.35	.51	3.45	.035	.020	.075	1.39	.005	.63	.16
217A	2.6	.41	2.40	.071	.056	.345	1.80	.18	.12	.09
218A	2.75	.09	1.96	.97	.010	.025	2.39	.13	.035	.015
219A	2.8	1.77	1.44	.29	.042	.17	.92	.03	.205	.335
221A	3.3	.79	.69	.56	.13	.025	.19	1.48	.39	.06
222A	3.45	.385	.54	(.015)	.007	1.04	.095	.86	.01	1.15
223A	3.75	1.01	.40	.055	(.01)	1.45	.04	.66	.01	.53
224A	4.4	.105	.17	.004	(.01)	2.49	.025	.41	.005	.70

No.	Analysis, %									
	W	Ti	Co	Al	As	Sn	Sb	Pb	Mg	Zr
216A	(.005)	.035	.008	.02	.005	.025	.002	(.00)	(.0)	.00
217A	(.005)	.025	.012	.00	.04	.04	.035	.003	(.0)	.00
218A	.00	.08	.007	.035	.00	.005	.003	.001	.00	.025
219A	.01	.06	.007	.005	.105	.08	.06	(.00)	(.0)	.00
221A	.115	.18	.007	.03	.07	.135	.02	(.00)	(.0)	.00
222A	.03	(.00)	.155	(.01)	.17	.175	.11	(.00)	.10	.00
223A	.055	.005	.02	.005	.025	.005	.01	(.00)	.07	.00
224A	(.01)	.00	.035	(.01)	.015	.005	.003	(.00)	.05	.00

Discs 50 Ø x 19 mm (certified height 10 mm; white structure)

1.5. Ferrous alloys, steelmaking alloys

Table 76. Silicon, ferrosilicon
S: 20

No.	Type	Analysis, %						
		C	Mn	P	S	Si	Cu	Ni
57	Refined silicon		.034	.008	.005	96.80	.02	.002
58a	Ferrosilicon (73% Si)	.014	.16	.01	<.002	73.2	.024	.012
195	Ferrosilicon (75% Si) Hi-purity	.034	.17	.02	<.002	75.3	.047	.032

No.	Analysis, %									
	Cr	Mo	Ti	Al	Zr	Ca	Mg	Fe	B	Co
57	.025		.10	.67	.025	.73	.01	.65		
58a	.020	(.01)	.05	(.95)	(<.01)			25.2	.001	<.01
195	.047	(.01)	.037	(.05)	(<.02)			23.6	.001	<.01

Table 77. Ferrochromium
S: 7

No.	Analysis, %									
	C	Si	S	P	Cr	V	N	Mn	Ni	Co
204/4	5.62	.22	.010	.005	71.9	.14	.031			
366	.007	.53	(<.005)	(.018)	74.6	(.10)		(.09)	(.28)	(.043)

Table 78. Ferrosilicon
S: 6, 17

No.	Analysis, %							
	Mn	Si	C	P	S	Al	Ca	Mg
FeSi 2a	.32	71.9	.21	.020	.004	1.04	.85	.17
FeSi 3	.05	91.03	.09	.016	.006	.91	.48	.08

Table 79. Ferro-alloys
S: 29, 24

No.	Type	Analysis, %						
		C	Si	Mn	P	S	Cr	N
701-2	Ferromanganese	6.74	.57	76.61	.140	.008		
705-1	Silicomanganese	1.98	15.86	61.40	.116	.010		
730-1	Ferrochromium	.074	.67		.017	.007	62.73	.023

Table 80. Ferro-alloys
S: 27

No.	Type	Analysis, %											
		C	Si	Mn	P	S	Cr	Ni	V	Co	Cu	Zn	N
14A	Ferrochromium	.023	.40	.26	.016	.003	74.7	.34	.08	.043	.008	.014	.061
		C	Si	Mn	P	S	Mo	Cu	Co	Pb	Bi	As	Fe
16A	Ferromolybdenum	.014	.226	.004	.022	.030	75.8	.192	.005$_5$	.0010	.0018	.009	23.6
		C	Si	Mn	P	S	Nb	Ta	Ti	Cu	Al	Sn	Pb
23	Ferroniobium	.050	3.2	.10	.092	.037	64.5	.07	.11	.005	.32	.11	.11

Table 81. Ferro-alloys
S: 5

No.	Type	Analysis, %											
		C	Mn	P	S	Si	Cu	Ni	Cr	Al	Fe	N	Zr
121	Medium carbon manganese	1.62	81.40	.38	.005	.62	.13	(.28)	.077	(.006)	14.9	(.022)	
124	Ferrophosphorus	.047	(3.14)	25.63	.003	.95	.028	.06	.082	(.010)		(.005)	(.0048)

2. Nonferrous metals and alloys (chip form)

2.1. Aluminium-base alloys

Table 82. Aluminium alloy
S: 20

No.	Type	Analysis, %											
		Mn	Si	Cu	Ni	Cr	V	Ti	Ga	Fe	Pb	Mg	Zn
85b	Wrought	.61	.18	3.99	.084	.211	.006	.022	.019	.24	.021	1.49	.030

Table 83. Aluminium alloy
S: 7

No.	Type	Analysis, %											
		Cu	Sn	Zn	Pb	Ni	Fe	Mn	Si	Mg	Ti	Cr	Be
262/1	10% Mg aluminium alloy	.039	(.04)	.085	(.05)	.071	.20	.084	.16	10.7_5	.005	(.002)	(.003)

2.2. Cobalt-base alloys

Table 84. Cobalt-base alloy
S: 20

No.	Type	Analysis, %															
		Co	Ni	Cr	Mo	W	Nb	Ta	Fe	Mn	C	P	S	Si	Cu	V	Ti
168	Co4-Mo4-Nb3-Ta1-W4	41.20	20.25	20.33	3.95	3.95	2.95	.95	3.43	1.50	.37	.008	.005	.80	.035	.03	.06

2.3. Copper-base alloys

Table 85. Copper-base alloys
S: 20

No.	Type	Analysis, %										
		Mn	P	Si	Cu	Ni	Co	Sn	Fe	Al	Pb	Zn
37e	Brass, sheet				69.61	.53		1.00	.004		1.00	27.85
157a	Nickel silver	.174	.009		58.61	11.82	.022	.021	.174		.034	29.09
158a	Bronze, silicon	1.11	.026	3.03	90.93	.001		.96	1.23	.46	.097	2.08
184	Bronze, leaded tin		.009		88.96	.50		6.38	.005		1.44	2.69

Table 86. Copper-base alloys
S: 7

No.	Type	Analysis, %														
		Cu	Sn	Zn	Pb	P	Ni	Fe	Al	Mn	Sb	As	Si	Bi	S	C
180/2	Copper nickel	68.12			(.003)		30.35	.68		.75			(.018)		.006	.04
183/3	Leaded gunmetal	84.5	6.69	3.25	3.40	.031	1.52	.028	(<.005)		.25	.15	(<.005)	.008	.19	
374	Phosphor bronze	89.5	9.80	.006	.064	.59	.014	(<.005)			(.01)		(<.005)	(.007)	.012	

Table 87. Copper-base alloys
S: 21

No.	Analysis, %										
	Cu	Sn	Pb	Fe	Ni	Mn	Al	Zn	P	Sb	As
299	53.01	.05	.03	.06	.01	.005	.000	46.72			
311	99.8	.1	.005	.005	.005	.000	.005	.005	.003	.0	.000
315	87.9	9.9	.43	.05	.79	.00	.005	.83	.05	.0	.0
316	84.7	15.1	.005	.01	.09	.001	.005	.07	.008	.005	.007

2.4. Magnesium-base alloys

Table 88. Magnesium-base alloy
S: 20

No.	Analysis, %							
	Mn	Si	Cu	Ni	Al	Pb	Fe	Zn
171	.45	.0118	.0112	.0009	2.98	.0033	.0018	1.05

Table 89. Magnesium-base alloys
S: 7

No.	Type	Analysis, %			
		Cu	Sn	Zn	Pb
307	Cerium-zinc-zirconium alloy (ZRE 1)	.005		2.08	
316	8% Al-magnesium alloy	.040	.005	.68	.024

No.	Analysis, %						
	Ni	Fe	Al	Mn	Si	Zr	R.E.[a]
307	(<.001)	.002		.006		.56	2.84
316	.004	.009	8.01	.28	$.05_5$		

[a] Total rare earths.

2.5. Nickel-base alloys

Table 90. Nickel-base alloys
S: 20

No.	Type	Analysis, %								
		C	Mn	P	S	Si	Cu	Ni	Cr	V
162a	Monel-type (Ni64-Cu31)	.079	1.60		.007	.93	30.61	63.95	.042	
349	Ni57-Cr20	.08	.43	.002		.29	.006	57.15	19.50	.081

No.	Analysis, %										
	Mo	W	Co	Ti	Al	B	Ca	Fe	Nb	Ta	Zr
162a			.076	.005	.50		.013	2.19			
349	4.04	<.01	13.95	3.05	1.23	.0046		.13	<.01	<.01	.081

Table 91. Nickel-base alloys
S: 7

No.	Type	Analysis, %														
		C	Si	Mn	P	S	Cr	Mo	Ni	Al	B	Co	Cu	Ti	Fe	Mg
363	Monel alloy 400	.11	$.05_5$	1.03		.010	(.02)		63.8	.005		.19	32.93	(.01)	1.70	(.03)
387	Nimonic 901	.030	.28	.08	.007	.003	12.46	5.83	41.9	.24	.016	.21	.032	2.95	36.0	

2.6. Lead-base alloys

Table 92. Lead-base alloys
S: 20

No.	Type	Analysis, %							
		Cu	Ni	As	Sn	Sb	Bi	Ag	Fe
53e	Bearing metal (84Pb-10Sb-6Sn)	.054	.003	.057	5.84	10.26	.052		<.001
127b	Solder (40Sn-60Pb)	.011	.012	.01	39.3	.43	.06	.01	

2.7. Selenium

Table 93. Selenium
S: 20

No.	Type	Analysis, ppm									
		Mn	S	Cu	Ni	Cr	V	Mo	Co	As	Sn
726	Selenium, intermediate purity	<.3	12	<1	<.5	<1	N.D.	<.3	N.D.	<2	<1

No.	Analysis, ppm													
	Al	B	Pb	Bi	Ag	Ca	Mg	Te	Fe	Cl	Tl	Be	Cd	In
726	<1	<1	<1	N.D.	<1	<1	<1	.3	1	<.5	<.5	N.D.	N.D.	N.D.

N.D. = Not detected at limits of detection of <0.5 ppm.

2.8. Tin-base alloys

Table 94. Tin-base alloy
S: 20

No.	Type	Analysis, %								
		Pb	Sn	Sb	Bi	Cu	Fe	As	Ag	Ni
54d	Bearing metal	.62	88.57	7.04	.044	3.62	.027	.088	.0032	.0027

2.9. Titanium-base alloys

Table 95. Titanium-base alloys
S: 20

No.	Type	Analysis, %									
		C	Mn	Si	Cu	V	Mo	Sn	Al	Fe	N
173a	6Al-4V	.025		.037	.002	4.06	.005		6.47	.15	.018
176	5Al-2.5Sn	.015	.0008		.003		.0003	2.47	5.16	.070	.010

2.10. Zinc-base alloys

Table 96. Zinc-base alloys
S: 20

No.	Type	Analysis, %									
		Mn	Cu	Ni	Sn	Al	Cd	Fe	Pb	Ag	Mg
94c	Die casting alloy	.014	1.01	.006	.006	4.13	.002	.018	.006		.042
728	Zinc		.00057		(.000002)		.00012	.00027	.00111	.00011	

2.11. Zirconium-base alloys

Table 97. Zirconium-base alloy
S: 20

No.	Type	Analysis, ppm, or where noted, %				
		C	Mn	Si	Cu	Ni
360a	Zircaloy-2	136	3	51	140	554

No.	Analysis, ppm, or where noted, %					
	Cr	Ti	Sn	Fe	N	U
360a	1060	27	1.42%	1441	43	.15

3. Nonferrous metals and alloys (solid form)

3.1. Aluminium-base alloys

Table 98. Aluminium-base alloys
S: 1

No.	Type Alloy	Analysis, %							
		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn
WA-1000	1000	(.1)	(.1)	.01	.01	.01	.01	.01	.01
WD-1000		.004	.004	.004	.004	.004	.004	.004	.004
WE-1000		.010	.010	.010	.010	.010	.010	.010	.010
WB-1100	1100	.22	.60	.10	.02	.01			.04
SS-1188	1188	.04	.06	.00	.005	.01	.00	.00	.01
WA-1199	1199	.002	.002	.001	.001	.001	.001	.001	.001
WB-2017	2017	.35	.25	4.5	.80	.45	.10	.01	.12
SS-2024	2024	.20	.35	4.6	.65	1.6	.06	.04	.10
WE-2024		.45	.20	(4.6)	.45	(1.6)	.10	.02	.12
WF-2024		.15	.45	(4.6)	.80	(1.6)	.02	.07	.03
WA-3003	3003	.40	.65	.09	.95	.01	.03	.03	.05
WB-3003		.15	.30	.20	1.4	.05	.00	.00	.02
SS-3005	3005	.22	.60	.15	1.2	.40	.02	.01	.03
SS-3105	3105	.20	.50	.15	.40	.50	.05	.02	.20
WA-5005	5005	.12	.55	.03	.01	.35	.01	.01	.03
WB-5005		.01	.01	.00	.00	.80	.00	.00	.00

No.	Analysis, %								
	Ti	V	Pb	Sn	B	Be	Bi	Ga	Zr
WA-1000	.01	.01	.01	.01			.01		
WD-1000	.004	.004	.004					.004	
WE-1000	.010	.010	.010	.010			.010	.010	
WB-1100	.01								
SS-1188	.01	.01						.02	
WA-1199	.001	.001	.001	.001	.001	.000	.001	.001	.001
WB-2017	.01								
SS-2024	.03					.004			
WE-2024	.01					.007			
WF-2024	.06					.002			
WA-3003	.03								
WB-3003	.01								
SS-3005	.02								
SS-3105	.01								
WA-5005	.01	.01	.03	.01			.03		
WB-5005	.00	.00							

Discs 2.5 Ø x 1 in.

Table 98. (continued)
S: 1

No.	Type Alloy	Analysis, %																
		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	V	Pb	Sn	B	Be	Bi	Ga	Zr
WA-5039	5039	.15	.20	.05	.75	2.8	.10	.02	2.0	.02					.001			
SS-5052	5052	.15	.20	.06	.05	2.6	.25	.05	.08	.01					.000			
WA-5052		.25	.10	.10	.02	2.2	.30	.01	.12	.00								
SS-5252	5252	.03	.05	.04	.01	2.5	.00	.00	.01	.02	.00				.000		.02	
SS-5154	5154	.15	.25	.05	.03	3.6	.25	.03	.05	.08					.001			
SS-5454	5454	.15	.20	.07	.80	2.8	.10	.01	.05	.04					.001			
WA-5454		.08	.10	.02	.50	2.5	.05	.03	.15	.02					.001			

Discs 2.5 Ø x 1 in.

Table 99. Aluminium-base alloys
S: 1

No.	Type Alloy	Analysis, %											
		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Pb	Be	B
SS-5056	5056	.15	.20	.08	.10	5.3	.11	.05	.05	.01		.003	
WC-5056		.25	.40	.01	.05	(5.3)	.20	.02	.02	.00	.08	.008	
WD-5056		.07	.13	.12	.15	(5.3)	.05	.08	.10	.05	.02	.001	
SS-5456	5456	.15	.20	.06	.80	5.2	.10	.01	.05	.03		.001	
WA-5456		.10	.25	.10	.50	5.5	.15	.01	.25	.05		.001	
SS-5357	5357	.05	.08	.08	.25	1.1	.01	.01	.02	.01			
SS-5657	5657	.04	.06	.04	.02	.80	.01	.01	.02	.01			
SS-5083	5083	.15	.20	.05	.80	4.5	.10	.01	.05	.05		.001	

Discs 2.5 Ø x 1 in.

Table 99. (continued)

S: 1

No.	Type Alloy	Analysis, %											
		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	Pb	Be	B
SS-5086	5086	.15	.25	.05	.50	4.0	.12	.03	.05	.03		.001	
WR-6000	6000	(.6)	.25	.02	.08	(.9)	.01	.05	.08	.03			
WS-6000		(.6)	.35	.05	.02	(.9)	.03	.01	.04	.08			
WT-6000		(.6)	.15	.10	.04	(.9)	.08	.03	.02	.01			
WX-6000		.42	.20	.03	.02	.65	.32	.01	.02	.01			
WZ-6000		.40	.15	.03	.01	.70	.00	.00	.00	.00			.000
WV-6000		(.6)	.80	.30	.15	(.9)	.15	.01	.08	.10			
SS-6253	6253	.70	.25	.05	.02	1.3	.22	.01	2.0	.02			
SS-6063	6063	.48	.25	.06	.02	.65	.02	.02	.05	.03		.001	

Discs 2.5 Ø x 1 in.

Table 100. Aluminium-base alloys

S: 1

No.	Type Alloy	Analysis, %														
		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	V	Pb	Sn	Be	Bi	Zr
SS-7001	7001	.10	.15	2.1	.04	3.1	.21	.01	7.6	.03				.003		
SS-7005	7005	.15	.20	.10	.50	1.3	.10	.02	4.5	.02				.003		.14
SS-7039	7039	.15	.20	.08	.25	3.0	.20	.02	4.0	.05				.003		
SS-7050	7050	.08	.15	2.4	.03	2.3	.02	.02	6.2	.04	.00			.004		.12
SS-7075	7075	.16	.25	1.6	.08	2.6	.22	.00	5.8	.04				.004		
WG-7075		.30	.15	(1.6)	.20	(2.6)	.18		(5.8)	.08				.001		

Discs 2.5 Ø x 1 in.

Table 100. (continued)

S: 1

No.	Type Alloy	Analysis, %														
		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	V	Pb	Sn	Be	Bi	Zr
WH-7075	7075	.10	.35	(1.6)	.03	(2.6)	.30		(5.8)	.01				.008		
SS-7076	7076	.15	.35	.65	.55	1.7	.02	.02	7.6	.05				.002		
SS-7178	7178	.15	.20	2.0	.08	2.9	.25	.02	6.8	.05				.004		
SS-7079	7079	.15	.22	.65	.20	3.5	.16	.00	4.6	.03				.003		
SS-249	249	.02	.02	4.3	.42	.45	.01	.02	3.1	.06						
SS-295	295	.90	.70	4.5	.12	.05		.05	.10	.12			.005			
KA-295		.55	.85	4.1	.08	.02		.03	.08	.07			.004			
KB-295		1.1	.35	4.8	.03	.01		.06	.05	.17			.010			
SS-319	319	6.2	.85	3.8	.40	.10	.01	.20	.35	.15		.20	.20		.05	
SS-354	354	9.0	.15	1.8	.05	.55	.01	.01	.05	.12		.02	.02			
KA-355	355	4.5	.65	1.0	.05	.63	.01	.03	.05	.18						
KB-355		5.5	.15	1.5	.15	.40	.02	.01	.15	.08						
KC-356	356	7.0	.08	.04	.02	.35	.00	.01	.03	.12						
SS-443	443	5.5	.50	.08	.10	.05	.00	.05	.10	.11		.00	.00	.001		
KD-360	360	9.0	.10	.75	.05	.52	.01	.02	.03	.12						
SS-514	514	.15	.25	.05	.12	4.1	.03	.03	.08	.12				.004		
KA-514		.08	.35	.10	.05	3.6				.16		.03	.03	.001		
KB-514		.25	.10	.02	.20	4.4				.05		.06	.06	.006		.06
SS-A514		.20	.30	.05	.08	4.0	.03	.03	1.8	.03				.004		
KA-518	518	.20	1.0	.08	.05	8.1		.05	.10	.01			.05	.004		
KB-518		.15	.20	.05	.03	8.2	.01	.01	.03	.02				.004		
SS-520	520	.15	.20	.12	.05	10.2	.00	.00	.04	.10				.004		
KA-520		.20	.10	.17	.02	9.7			.08	.05				.002		
KB-520		.08	.30	.08	.08	10.6			.02	.01				.008		
SS-535	535	.10	.15	.03	.18	7.0	.02	.02	.03	.18	.01			.005		

Discs 2.5 Ø x 1 in.

Table 101. Aluminium-base alloys

S: 1

No.	Type Alloy	Analysis, %												
		Si	Fe	Cu	Mn	Mg	Cr	Ni	Zn	Ti	V	B	Ga	Zr
SS-1050	1000	.12	.30	.04	.00	.00	.00	.00	.00	.00	.00	.000	.02	.00
SS-1075		.07	.12	.00	.00	.00	.00	.00	.00	.00	.00	.000	.02	
SS-6151	6151	1.0	.45	.25	.06	.65	.22	.04	.08	.03				

No.	Type	Analysis, %							
		B	Be	Ca	Cd	Co	Ga	Li	Na
BN-1	Boron series in 1075 alloy	.001-.003							
BN-2		.004-.007							
BN-3		.008-.014							
BN-11	Boron seires in 7.5% Si alloy	.001-.003							
BN-12		.004-.007							
BN-13		.008-.014							
BN-31	Boron series in 7% Mg alloy	.001							
BN-32		.010							
BE-1	Beryllium seires in 1100 alloy		.001-.002						
BE-2			.004-.006						
CA-1	Calcium series in 1075 alloy			.001-.003					
CA-2				.004-.008					
CA-3				.009-.020					
CA-11	Calcium series in 7.5% Si alloy			.001-.002					
CA-12				.003-.006					
CA-13				.007-.012					

Discs 2.5 Ø x 1 in. Sodium and calcium standards: discs 2.5 Ø x 0.5 in.

Table 101. (continued)
S: 1

No.	Type	Analysis, %							
		Ca	Cd	Co	Ga	Li	Na	Sb	Zr
CD-1	Cadmium series in 1075 alloy		.001-.004						
CD-2			.005-.008						
CO-1	Cobalt series in 1075 alloy			.001					
CO-2				.007					
GA-2	Gallium series in 1075 alloy				.003-.007				
GA-3					.010-.020				
LI-1	Lithium series in 1075 alloy					.0002-.0009			
LI-2						.0010-.002			
LI-3						.003-.005			
LI-4						.007-.010			
NA-1	Sodium series in 1075 alloy						.001-.002		
NA-2							.003-.006		
NA-3							.007-.012		
NA-11	Sodium series in 7.5% Si alloy						.001-.002		
NA-12							.003-.006		
NA-13							.007-.012		
NA-21	Sodium series in 520 alloy						.001-.002		
NA-22							.003-.006		
NA-23							.007-.012		
NA-31	Sodium series in 4% Mg alloy						.001-.003		
NA-32							.007-.010		
AN-1	Antimony series in 1075 alloy							.005	
ZR-1	Zirconium series in 1050 alloy								.005-.010
ZR-11	Zirconium series in 6151 alloy								.01

Discs 2.5 Ø x 1 in. Sodium and calcium standards: discs 2.5 Ø x 0.5 in.

Table 102. Aluminium-base alloys
S: 2

No.	Analysis, %										
	Cu	Fe	Mg	Mn	Ni	Si	Ti	Zn	Bi	Cr	Pb
10020	.05	.50	.04	.04	.04	.20	.04	.04	.04	.04	.04
10050	.15	.60	.04	.04	.04	.30	.04	.06	.04	.04	.04
15010-1	.02	.25	.01	.01	.01	.10	.01	.02	.01	.01	.01
15010-2	.01	.15	.01	.01	.01	.10	.01	.03	.01	.01	.01
15010-3	.03	.20	.01	.02	.01	.10	.03	.03	.01	.01	.01
19920	.002	.002	.001			.002					
23520	2.0	.80	.08	.10	.03	.25	.05	.05	.03	.04	.03
24320	4.3	.50	.70	.60	.04	.50	.04	.05	.04	.04	.04
24520	4.7	.30	1.5	.80	.04	.25	.03	.05	.04	.05	.04
26820	5.7	.30	.02	.04	.04	.10	.02	.03	.50	.04	.50
31020	.05	.50	.03	1.2	.03	.30	.04	.04	.03	.03	.03
31220	.15	.60	.03	1.2	.04	.20	.04	.04	.04	.04	.04
43510	.03	.35	.25	.04	.03	5.3	.03	.06	.03	.02	.04
46010	.04	.35	.04	.04	.04	12.2	.04	.04	.04	.04	.04
46510	.90	.35	1.1	.05	.80	11.5	.06	.06	.03	.03	.03
51320	.10	.10	.80	.30	.04	.10	.04	.04	.04	.04	.04
52020	.07	.07	2.3	.04	.03	.07	.03	.03	.03	.03	.03
52320	.05	.30	2.2	.40	.04	.20	.05	.04	.04	.04	.04
52820	.05	.20	2.6	.06	.04	.10	.04	.04	.03	.30	.04

No.	Analysis, %										
	Sn	Ga	V	Be	Ca	Cd	Co	Li	Na	Sr	Zr
10020	.04	.01	.02								
10050	.04	.01	.01								
15010-1	.01	.02	.01	.002	.004				.001		
15010-2	.01	.02	.01	.005	.01	.005	.005			.005	.005
15010-3	.02	.02	.01								
19920											
23520	.03	.01	.01								
24320	.04	.01	.01								
24520	.04	.02	.01								
26820	.03	.02	.01								
31020	.04	.02	.01								
31220	.04	.02	.01								
43510	.04	.01	.01								
46010	.04				.003				.002		
46510	.03	.01	.01								
51320	.04	.02	.01								
52020	.04	.02	.01								
52320	.04	.01	.01	.005					.001		
52820	.04	.01	.01	.005							

Discs 2.25 Ø x 1 in.

Table 102. (continued)
S: 2

No.	Analysis, %																					
	Cu	Fe	Mg	Mn	Ni	Si	Ti	Zn	Bi	Cr	Pb	Sn	Ga	V	Be	Ca	Cd	Co	Li	Na	Sr	Zr
53320	.05	.25	2.7	.90	.04	.10	.05	.05	.03	.15	.04	.04	.02	.01						.001		
54320	.05	.20	4.5	.35	.04	.10	.04	.05	.04	.04	.04	.04	.01	.01						.001		
54330	.05	.20	4.7	.80	.04	.10	.04	.05	.04	.15	.04	.04	.02	.01	.005					.002		
54840	.05	.20	3.7	.05	.04	.10	.04	.04	.02	.30	.03	.03	.02	.01	.004					.002		
55310	.04	.20	5.2	.10	.04	.10	.04	.05	.03	.10	.04	.04	.02	.01	.005							
55331	.05	.30	5.0	.60	.40	.20	.04	.05	.03	.04	.04	.04	.01	.01					.002	.001		
66050	.05	.20	.55	.04	.04	.45	.05	.03	.04	.04	.04	.04	.02	.01								
66440	.05	.20	.70	.60	.04	1.1	.05	.04	.04	.04	.04	.04	.02	.01								
69260	.30	.30	1.0	.04	.04	.70	.06	.05	.04	.20	.05	.03	.02	.01								
71220-2	.65	.45	1.1	.55	.05	.90	.06	.80	.03	.05	.03	.03	.02	.01								
72520	.06	.20	1.3	.04	.04	.70	.03	2.0	.04	.20	.03	.03	.02	.01								
74510	.05	.30	1.8	.55	.04	.15	.04	4.4	.04	.04	.04	.04	.02	.01								.15
76520-1	1.6	.25	2.6	.06	.04	.15	.06	7.5	.04	.20	.04	.04			.005							
76520-2	1.7	.30	2.6	.06	.04	.15	.05	5.8	.04	.20	.04	.04	.02	.01								
42810	.10	.30	.10	.08	.05	4.2	.04	.10	.04	.05	.07	.07	.02	.01			1.1					
45540	.30	1.5	.60	.30	.03	11.5	.05	.05	.03	.03	.09	.04	.02	.01	.001							
55460	.50	.30	5.0	.40	.04	1.0	.15	.04	.04	.04	.04	.04	.02	.01	.002							
69440	1.0	.65	1.0	.70	.05	1.0	.05	.25	.04	.05	.04	.04	.01	.01								
82660	1.0	.35	.01	.05	.45	1.5	.04	.06	.04	.04	.07	6.2					.05					
97140	.06	4.5	.04	.04	.04	.15	.06	.06	.05	.05	.05	.05	.01	.01								
97260	10.3	.35	.04	.03	.04	.20	.04	.04	.04	.04	.04	.04	.02	.01								

Discs 2.25 Ø x 1 in.

Table 103. Aluminium-base alloys
S: 2

No.	Analysis, %																		
	Cu	Fe	Mg	Mn	Ni	Si	Ti	Zn	Bi	Cr	Pb	Sn	Ga	V	Be	Ca	Co	Na	Zr
24460	4.5	.40	.02	.05	.03	.85	.15	.03	.03	.03	.03	.03	.02	.01					
24465	4.1	.50	.01	.05	.03	2.6	.15	.03	.02	.02	.02	.02	.02	.01					
27465	6.8	1.2	.30	.10	.03	2.0	.15	.04	.03	.02	.03	.03	.02	.01					
29460-2	10.0	1.3	.20	.03	.03	3.8	.10	.04	.03	.04	.03	.03	.02	.01					
42220	3.0	.40	.10	.60	.04	4.5	.05	.05	.02	.03	.04	.04	.02	.01					
42230	1.3	.20	.55	.04	.04	5.0	.20	.04	.04	.03	.04	.04	.02	.01					
42520	.06	.35	.65	.05	.03	5.4	.12	.04	.03	.03	.03	.03	.01	.01					
43020	.04	.40	.03	.04	.03	5.2	.15	.03	.03	.03	.03	.03	.02	.01					
44220	3.5	.35	.03	.06	.04	9.5	.04	.04	.04	.04	.04	.04	.02	.01					
44230	3.0	.80	1.2	.30	.15	9.8	.05	.70	.02	.05	.03	.04	.02	.01	.005	.009		.006	
44520	.05	.20	.40	.03	.03	7.4	.15	.05	.02	.05	.05	.05	.01	.01	.05			.01	
45220	3.1	.60	.90	.30	.90	10.5	.10	.05	.04	.04	.05	.05	.01	.01					
45230	3.0	.40	.85	.25	.05	9.3	.10	.05	.04	.05	.05	.05	.02	.01					
46030	.04	.40	.03	.03	.03	12.2	.04	.05	.02	.05	.04	.04				.002		.002	
46050	.06	.80	.04	.04	.04	12.2	.04	.03	.03	.03	.03	.03						.001	
46220	2.5	.40	1.0	.08	.70	12.0	.05	.04	.03	.03	.03	.03	.02	.01					
46320	.06	.90	.50	.05	.04	10.0	.05	.05	.05	.05	.05	.05	.01	.01					
46820	.90	.45	1.2	.04	2.7	12.5	.12	.04	.04	.04	.04	.04	.01	.01		.002			
54070	.06	.20	4.1	.03	.03	.50	.15	.04	.04	.02	.04	.03	.02	.01	.005				
54360	.05	.80	3.4	.55	.03	.80	.04	.04	.04	.03	.04	.04	.02	.01					
57360	.04	.10	7.2	.20	.04	.10	.15	.05	.03	.04	.04	.04	.01	.01	.01			.002	
58060	.05	1.2	8.3	.03	.03	.25	.10	.04	.03	.03	.03	.03	.02	.01	.005				
59060	.10	.15	10.3	.04	.04	.15	.05	.05	.03	.03	.04	.04	.01	.01	.005				
74860	.03	.10	.03	.03	.03	.15	.02	4.7	.03	.03	.03	.10	.01						

Discs 2.25 Ø x 1 in.

Table 103. (continued)
S: 2

No.	Analysis, %																		
	Cu	Fe	Mg	Mn	Ni	Si	Ti	Zn	Bi	Cr	Pb	Sn	Ga	V	Be	Ca	Co	Na	Zr
26230	6.0	.20	.02	.30	.04	.15	.15	.05	.04	.04	.04	.04	.02	.01					
31550	.15	.55	.50	.50	.03	.25	.05	.10	.04	.07	.04	.04	.02	.01					
43230	3.0	.35	.20	.50	.03	6.0	.20	1.0	.03	.02	.03	.03	.02	.01					
43520	.06	.35	.50	.30	.03	5.6	.20	.03	.03	.03	.03	.03	.02	.01					
43720	3.0	.35	.30	.60	.05	5.5	.15	3.5	.05	.05	.05	.05	.02	.01					
44243	3.5	1.0	.04	.25	.05	9.0	.04	1.0	.04	.04	.04	.04	.02	.01		.01			
44245	3.5	.85	.08	.10	.06	9.1	.04	2.4	.04	.03	.04	.04	.02	.01					
44250	2.0	.35	.50	.04	.03	9.2	.06	.03	.03	.03	.01	.01		.001					
44320	.05	.50	.40	.55	.04	9.8	.10	.04	.04	.04	.04	.02	.02	.01					
45241	3.5	.70	1.0	.40	.04	9.8	.03	.90	.03	.04	.05	.04	.02	.01					
45320	.05	.30	.25	.34	.05	9.3	.03	.05	.03	.05	.03	.03	.02	.01					
45820	.06	.35	.25	.05	.03	9.6	.05	.05	.03	.03	.03	.03	.02	.01			.37		
46236	2.0	.80	.04	.05	.05	11.2	.04	.05	.04	.04	.04	.04	.02	.01					
46249	1.1	.35	1.0	.06	1.0	11.0	.07	.07	.04	.04	.03	.04	.02	.01					
49220	1.0	.25	1.0	.04	1.2	19.0	.04	.04	.03	.03	.03	.03	.02	.01					
69440	1.0	.30	1.2	.90	.04	1.5	.04	.04	.03	.04	.03	.03	.02	.01					
69830	.30	.25	.90	.15	.03	.65	.08	.05	.05	.10	.45	.04	.02	.01					
74520	.10	.10	1.2	.05	.05	.10	.04	4.3	.04	.05	.04	.04	.02	.01	.005				
75020	.03	.15	.03	.03	.01	.10	.04	5.5	.03	.03	.03	.03							
75520	.03	.25	1.4	.35	.04	.20	.05	4.8	.04	.20	.04	.04	.02	.01	.003				.20
76560-1	.15	.20	.65	.08	.03	.15	.20	6.1	.03	.55	.03	.03	.02	.01					
76560-2	.06	.10	.85	.03	.04	.10	.20	6.7	.04	.15	.05	.05	.02	.01					
77533	2.0	.30	2.8	.03	.03	.06	.04	7.1	.05	.20	.05	.05	.02	.01	.003				

Discs 2.25 Ø x 1 in.

Table 104. Unalloyed aluminium
S: 3

No.	Analysis, %													
	Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Sn	Ti	Cr	Ga	Sb	Co
70999	.0540	.0450	.0023	.0065	.0015	.0011	.0006	.000	.001	.0025	.0007	.0071	.0000	.0000
70998	.1240	.0690	.0074	.0220	.0045	.0083	.0008	.001	.001	.0058	.0007	.0114	.0000	.0000
67997	.2000	.1000	.0220	.0420	.0100	.0210	.0100	.010	.010	.0100	.0112	.0082	.0100	.0000
67994	.4300	.1400	.0057	.0350	.0015	.0040	.0006	.01	.001	.0190	.0007	.0145	.0000	.0000
67995									.020	.0170	.0215	.0103	.0190	.0002
67990									.040	.0330	.0420	.0148	.0360	.0003

Discs 55 Ø x 33 mm.

Table 105. Unalloyed aluminium
S: 3

No.	Analysis, %				
	Fe	Si	Cu	B	Na
67802	.070	.050	.006	.0030	
67804	.080	.060	.006	.0060	
67810	.057	.070	.006	.0180	
67720	.100	.090	.007	.0300	
67714-1					.0043
67714-2					.0029
67714-3					.0018

Discs 55 Ø x 33 mm.

Table 106. Aluminium-magnesium alloys
S: 3

No.	Form	Analysis, %										
		Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Sn	Ti	Cr
68501	C,D	.06	.04	.005	.20	1.46	.50	.08	.04	.04	.02	.02
52959	D	.05	.020	.01	.02	.65	.01	.00	.00	.00	.036	.01
53425	C,D	.007	.005	.008	.003	1.60	.001	.00	.00	.00	.001	.00
53438	C,D	.004	.002	.004	.003	3.00	.002	.00	.00	.00	.001	.00
53427	D	.013	.010	.014	.003	4.30	.002	.00	.00	.00	.001	.00

Form C: discs 55 Ø x 33 mm.
Form D: discs 55 Ø x 4 mm.

Table 107. Aluminium-silicon alloys
S: 3

No.	Form	Type Alloy	Analysis, %												
			Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Sn	Ti	Cr	V	Sb
6081	C'	A-GS	.1700	.2500	.0105	.0105	.300	.0120	.0060	.0120	.0120	.0540	.0100		
6086	C'		.2200	.4300	.0305	.0230	.500	.0310	.0105	.0310	.0320	.0090	.0280	.0010	
6092	C'		.2750	.6200	.0890	.0395	.720	.0860	.0300	.0200	.0230	.007	.0775	.0030	
6096	C'	A-SG	.1050	.8800	.1500	.1540	.920	.7900	.0105	.0600	.0600	.1480	.1520	.0100	
5344	C'	A-S2GT	.600	.95	.0110	.100	.190	.510	.0600	.02	.08	.225	.0016		
5355	C'		.080	2.90	.1000	.150	.440	.200	.0005	.10	.10	.150	.0300		.0400

Form C': discs 55 Ø x 33 mm.

Table 107. (continued)

S: 3

No.	Form	Type Alloy	Analysis, %													
			Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Sn	Ti	Cr	V	Sb	Co
5355	C'	A-S4G	.080	2.90	.100	.150	.440	.200	.0005	.10	.10	.150	.0300		.0400	
5350	C'		.530	4.85	.010	.045	.110	.470	.0310	.05	.05	.090	.0500		.0550	
2671	D'	A-S4GU	.26	3.12	.025	.02	.80	.63	.01	.02	.00	.025				
2674	D'		.48	4.00	.07	.05	.60	.43	.03	.03	.01	.055				
5350	C'	A-S5G	.530	4.85	.010	.045	.110	.470	.0310	.05	.05	.090	.0500		.055	
5357	C'	A-S7G	.041	5.85	.030	.030	.290	.051	.0100	.08	.01	.110	.0100		.150	
5351	C'		.330	7.85	.150	.090	.750	.045	.03	.01	.01	.195	.0680		.17	
57892	C,D	A-S9G	.35	7.00	.055	.09	.04	.14	.06	.04	.05	.036	.01			.01
2597	D'	A-S9KG	.64	10.22	.025	.02	.10	.03	.003	.02	.02	.03	.00			.77
2620	D'	A-S9GU	.35	13.40	.32	.19	.34	.62	.03	.03	.02	.03	.01			
63306	C	A-S10G	.06	8.16	.013	.03	.13	.20	.005	.00	.00	.024				
2620	D'	A-S12U	.35	13.40	.32	.19	.34	.62	.03	.03	.02	.03	.01			
2645	D'	A-S13	.72	10.7	.15	.15	.04	.11	.09	.01	.01	.040	.04			
2634	D'		.15	14.6	.02	.03	.09	.03	.02	.05	.05	.016	.01			
62406	D	A-S22	.12	16.0	.01	.006	.002	.01	.001	.001	.001	.01				
62409	D		.23	22.6	.01	.02	.002	.01	.002	.001	.001	.01				
62413	D		.60	28.0	.01	.02	.002	.01	.002	.001	.003	.01				

Form C, C': discs 55 Ø x 33 mm.

Form D: discs 55 Ø x 4 mm.

Form D': discs 60 Ø x 6 mm.

Table 108. Aluminium-silicon-copper alloys
S: 3

No.	Form	Type Alloy	Analysis, %											
			Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Sn	Ti	Cr	Co
55356	D	A-S2U	.70	1.58	.70	.03	.03	.004	.80	.001	.001	.08		
55375	D		1.02	2.20	1.14	.06	.09	.006	1.32	.001	.001	.15		
55379	D		1.30	2.80	1.60	.12	.16	.008	1.85	.002	.001	.21		
64480	C,D	A-S5U	.21	4.20	4.00	.06	.17	.19	.20	.001	.001	.04		
64481	C,D		.36	5.00	3.25	.11	.09	.38	.10	.001	.001	.07		
64483	C,D		.69	5.80	2.50	.21	.04	.76	.05	.001	.001	.13		
64484	C,D	A-S5UZ	.21	4.15	4.00	.39	.010	.19	.20	.19	.20	.04		
64490	C,D		.36	5.00	3.25	.68	.004	.38	.10	.10	.10	.07		
64491	C,D		.69	5.75	2.50	.97	.001	.76	.05	.002	.001	.13		
58140	D	A-S8U3	.18	3.94	1.23	.01	.03	.05	.001	.002	.001	.013		
58150	D		.96	10.50	4.15	.02	.40	.54	.001	.002	.001	.025		
6605	D	A-S9U3	.62	6.80	5.05	.485	.580	.595	.615	.305	.310	.240	.0026	
6609	D		.92	9.30	3.50	.880	.190	.305	.410	.210	.210	.150	.0022	
6602	D		1.33	12.00	2.05	1.250	.040	.161	.205	.051	.053	.065	.0020	
6135	C'	A-S12UN	.214	12.80	.510	.192	.60	.300	.50	.140	.1040	.036	.100	.0030
6137	C'		.470	10.90	1.53	.100	1.18	.105	1.00	.100	.0630	.087	.0015	.0600
6140	C'		.710	8.80	2.50	.027	1.76	.043	1.48	.034	.0320	.161	.0015	.0370
67184	C,D	A-S10UG	.71	8.96	3.00	.19	1.14	.49	.05	.001	.00	.10		
67296	C,D		.48	7.03	4.00	.34	1.49	.70	.12	.002	.00	.10		
5035	D	for re-fining	1.10	2.3	3.00	.61	1.00	1.00	1.90	.90	.40	.010		

Form C, C': discs 55 Ø x 33 mm.

Form D: discs 55 Ø x 4 mm.

Table 109. Aluminium-cobalt alloys
S: 3

No.	Form	Type Alloy	Analysis, %										
			Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Sn	Ti	Co
43751	D	A-S9K7	.33	7.00	.005	.010	.020	.020	.010	.050	.003	.01	8.90
43617	D		.53	9.60	.005	.014	.010	.015	.010	.050	.003	.01	7.00
43620	D		.93	12.00	.005	.006	.005	.010	.020	.050	.003	.01	5.10

Form D: discs 55 Ø x 4 mm.

Table 110. Aluminium-copper alloys
S: 3

No.	Form	Type Alloy	Analysis, %													
			Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Sn	Ti	Cr	Be	Bi	Zr
4025	C,D	A-UG	.06	.05	1.00	.01	.95	.003	.001	.001		.05	.001			
3977-2	C,D		.11	.07	1.00	.02	.92	.020	.010	.05		.01	.01			
3977-1	C,D	A-U2G	.11	.07	1.00	.02	.19	.02	.01	.04		.010	.01			
4027	C,D		.22	.45	2.55	.04	.38	.01	.001	.001		.070	.001			

Form C: discs 55 Ø x 33 mm.
Form D: discs 55 Ø x 4 mm.

Table 110. (continued)
S: 3

No.	Form	Type Alloy	Analysis, % Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Sn	Ti	Cr	Be	Bi	Zr
64307	C,D	A-U2GN	.84	.60	2.80	.13	.78	.030	1.60	.00	.00	.12		.01		.09
64310	C,D		1.22	.98	1.96	.09	1.54	.024	2.16	.00	.00	.20		.005		.06
64461	D	A-U4G	.48	.30	4.51	.03	.70	.48	.00	1.03	.00	.01				
64468	D		.48	.30	4.52	.03	.74	.48	.00	1.64	.00	.01				
64469	D		.22	.14	6.03	.10	.40	.25	.00	.51	.00	.01			.26	.10
64472	D		.48	.30	4.52	.03	.74	.48	.00	1.40	.00	.01				
64475	D		.74	.57	3.01	.25	1.38	.76	.00	.50	.00	.01			.38	.19
64299	C,D		.17	.06	5.32	.30	.56	.20	.37	.20	.001	.17				
3479	C,D	A-U4NT	.82	.60	3.48	.01	1.82	.04	1.60	.003	.002	.19				
51088	D	A-U4SGN	1.10	.40	4.70	.35	.42	.11	1.36	.005	.00	.03	.05			.00
63901	C,D	A-U10G	.38	.10	12.50	.21	.16	.05	.025	.002	.00	.030				
63903	C,D		.69	.30	10.10	.11	.31	.10	.06	.002	.00	.050				
63904	C,D		1.02	.58	7.10	.05	.58	.16	.16	.002	.00	.080				
2801	D'		.99	.70	7.98	.03	.52	.06	.03	.005	.00	.030				
5035	D	for re-fining	1.10	2.30	3.00	.61	1.00	1.00	1.90	.90	.40	.010				
5042	D		.35	.30	7.10	2.95	.15	.31	.43	.35	.00	.0030				
5045	D		.21	.07	11.00	.10	.00	.0075	.004	.010	.096	.200				
46134	D	A-U25	5.56	.53	33.1	1.96	.01	.62	.61	.09	.11	.10				

Form C: discs 55 Ø x 33 mm.
Form D: discs 55 Ø x 4 mm.
Form D': discs 55 Ø x 6 mm.

Table 111. Aluminium-copper alloys
S: 3

No.	Form	Type Alloy	Analysis, %													
			Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Sn	Ti	Cr	Be	V	Zr
67374	D	A-U50	.45	.04	48.4	.006	.02	.02	.002	.001		.00		.002		
67383	D		.16	.08	49.0	.006	.01	.08	.002	.001		.00		.005		
67403	D		.06	.20	50.0	.006	.01	.06	.002	.002		.00		.025		
5450	C'	A-U5GT	.045	.030	3.70	.0140	.370	.069	.0600	.055	.054	.270	.0100	.0010		
5455	C'		.140	.100	4.50	.0240	.260	.125	.0300	.028	.026	.180	.0300	.0025		
5456	C'		.215	.180	5.40	.0520	.130	.205	.0120	.010	.008	.095	.0580	.0045		
5455	C'	A-U6MGT	.140	.100	4.50	.0240	.260	.125	.0300	.028	.026	.180	.0300	.0025		
5456	C'		.215	.180	5.40	.0520	.130	.205	.0120	.010	.008	.095	.0580	.0045		
5468	C'		.350	.270	6.35	.0950	.030	.375	.0020	.00	.00	.038	.0010	.000		
52470	C,D	A-U6MT	.09	.04	5.00	.05	.003	.15	.01	.002	.00	.05	.001			
52472	C,D		.20	.09	6.20	.10	.007	.30	.03	.004	.00	.10	.003			
52476	C,D		.34	.19	7.50	.15	.020	.45	.10	.008	.00	.15	.010			
68060	D'		.44	.07	5.40	.02	.030	.63	.002	.002	.00	.05			.10	.21

Form C, C': discs 55 Ø x 33 mm.
Form D: discs 55 Ø x 4 mm.
Form D': discs 60 Ø x 6 mm.

Table 112. Aluminium-copper-silicon alloys

S: 3

No.	Form	Type Alloy	Analysis, %									
			Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Sn	Ti
69312	D'	A-U10S4	.20	3.27	12.40	.20	.13	.002	.002	.002	.002	.01
44726	C		.20	3.00	12.50	.04	.11	.005	.00	.003	.00	.01
44727	C		.33	4.00	10.00	.03	.24	.010	.00	.002	.00	.01
44730	C		.68	5.00	7.50	.02	.65	.015	.01	.001	.00	.01
5042	D	for re-fining	.35	.30	7.10	2.95	.15	.310	.43	.35	.00	.0030
5046	D		1.10	4.40	9.00	3.90	.30	.032	.004	.005	.31	.015

Form C: discs 55 Ø x 33 mm. Form D: discs 55 Ø x 4 mm. Form D': discs 60 Ø x 6 mm.

Table 113. Aluminium-zinc alloys

S: 3

No.	Form	Type Alloy	Analysis, %											
			Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Ti	Cr	Be	Zr
52539	C,D	A-Z1	.08	.04	.01	.88	.25	.01	.01	.001	.01			
52541	C,D	A-Z2	.20	.08	.03	1.46	.55	.03	.03	.001	.02			
52545	C,D		.30	.16	.10	2.30	.85	.17	.10	.002	.05			
60641	C,D	A-Z4G	.38	.11	.09	4.00	1.55	.08			.10	.07	.008	
4180	C	A-Z8GU	.083	.050	1.95	7.75	2.96	.031	.0010		.160	.050		.050
4139	C	A-Z5GU	.550	.050	.97	5.90	1.85	.790	.0025		.160	.240		
4151	C		.070	.300	1.95	5.85	3.20	.390	.0015		.130	.100		

Form C: discs 55 Ø x 33 mm.

Form D: discs 55 Ø x 4 mm.

Form D': discs 60 Ø x 6 mm.

Table 114. Aluminium-magnesium alloys
S: 3

No.	Form	Type Alloy	Analysis, %						
			Fe	Si	Cu	Zn	Mg	Mn	Ni
6081	C'	A-GS	.170	.250	.0105	.0105	.300	.0120	.0060
6086	C'		.220	.430	.0305	.0230	.500	.0310	.0105
6092	C'		.275	.620	.0890	.0395	.720	.0860	.0300
6096	C'	A-SG	.1050	.8800	.1500	.1540	.920	.7900	.0105
3337-1	C	A-GS	.06	.42	.003	.005	.50	.001	.001
3337-2	C		.06	.42	.003	.005	.50	.001	.001
4120-2	C		.25	.48	.02	.02	.50	.005	
4120-4	C		.25	.48	.02	.02	.50	.005	
4120-5	C		.25	.48	.02	.02	.50	.005	
68501	C,D	A-G3	.06	.04	.00	.20	1.46	.50	.08
68502	C,D		.13	.07	.05	.10	2.04	.25	.04
68503	C,D		.25	.13	.09	.06	2.62	.10	.02
68504	C,D		.48	.25	.16	.02	3.20	.04	.01
A-G3MC	C		.34	.29	.09	.07	2.74	.40	.003
A-G4MC	C		.36	.29	.08	.07	4.16	.38	.003

No.	Analysis, %							
	Pb	Sn	Ti	Cr	V	Na	Be	Zr
6081	.0120	.0120	.0540	.0100				
6086	.0310	.0320	.0090	.0280	.0010			
6092	.0200	.0230	.007	.0775	.0030			
6096	.0600	.0600	.1480	.1520	.0100			
3337-1	.000		.003			.0015		
3337-2	.000		.003			.0005		
4120-2			.01			.0095		
4120-4			.01			.0050		
4120-5			.01			.0030		
68501	.04	.04	.02	.02			.0004	
68502	.02	.02	.18	.12			.0004	
68503	.002	.01	.06	.24			.0003	
68504	.004	.001	.12	.06			.0002	
A-G3MC	.01	.00	.04	.20				
A-G4MC	.01	.00	.04	.17				

Form C, C': discs 55 Ø x 33 mm.
Form D: discs 55 Ø x 4 mm.

Table 114. (continued)
S: 3

No.	Form	Type Alloy	Analysis, %						
			Fe	Si	Cu	Zn	Mg	Mn	Ni
3334-1	C	A-G3	.02	.025	.02	.02	(2.8)	.02	.001
3334-2	C		.02	.025	.02	.02	(2.7)	.02	.001
3334-3	C		.02	.025	.02	.02	(2.6)	.02	.001
3368-1	C		.04	.045	.01	.01	(2.8)	.01	.001
3368-2	C		.04	.045	.01	.01	(2.7)	.01	.001
68520	C,D	A-G10	.07	.07	.01	.00	11.80	.01	.00
68523	C,D		.55	1.06	.20	.26	7.60	.20	.00
68505	C,D	A-G5	.08	.04	.00	.20	3.80	.65	.08
68506	C,D		.14	.07	.05	.10	4.50	.25	.04
68507	C,D		.27	.13	.09	.06	5.30	.10	.02
68508	C,D		.47	.25	.16	.02	6.20	.04	.01
A-G5M	C		.40	.31	.07	.07	5.00	.52	.004
44695	C	A-G4Z	.09	.03	.01	.86	3.20	.005	.002
44699	C		.20	.11	.05	1.20	4.23	.007	.001
44708	C		.51	.44	.10	1.55	5.19	.009	.020

No.	Analysis, %							
	Pb	Sn	Ti	Cr	V	Na	Be	Zr
3334-1	.000		.015			.01		
3334-2	.000		.015			.0044		
3334-3	.000		.015			.0017		
3368-1	.000		.008			.0002		
3368-2	.000		.008			.0001		
68520	.00	.00	.00	.00			.007	.15
68523	.00	.00	.08	.08			.046	.01
68505	.04	.04	.02	.02			.0055	
68506	.02	.02	.18	.12			.0033	
68507	.002	.01	.06	.24			.0022	
68508	.004	.001	.12	.06			.0011	
A-G5M	.01	.00	.04	.08				
44695	.002	.001	.06					
44699	.002	.001	.11					
44708	.002	.001	.16					

Form C, C': discs 55 Ø x 33 mm.
Form D: discs 55 Ø x 4 mm.

Table 115. Aluminium-manganese alloys
S: 3

No.	Form	Type Alloy	Analysis, %										
			Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Sn	Ti	Cr
68401	C,D	A-M1	.20	.07	.05	.18	.10	1.46	.05	.04	.04	.025	.01
68404	C,D		.41	.16	.10	.02	.01	1.15	.02	.02	.02	.065	.03
68403	C,D		.59	.35	.20	.07	.26	.84	.02	.004	.01	.150	.09
68451	C,D	A-M1G	.10	.07	.06	.18	.41	1.45	.04	.04	.04	.02	.01
68453	C,D		.60	.36	.20	.07	1.10	.83	.01	.004	.01	.15	.09
68454	C,D		.42	.26	.004	.02	1.26	1.16	.01	.01	.01	.01	.01
67471	D	A-M2N2	.38	.16	.07	.10	.02	1.98	1.96	.00	.00	.08	.010
67475	D		.62	.32	.05	.05	.01	3.17	1.12	.00	.00	.03	.005

Form C: discs 55 Ø x 33 mm.
Form D: discs 55 Ø x 4 mm.

Table 116. Aluminium-tin alloys
S: 3

No.	Form	Analysis, %									
		Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Sn	Ti
62832	D	.05	.05	.48	.005	.002	.0002	.40	.002	4.00	.02
62833	D	.24	.22	1.00	.005	.002	.0005	.80	.003	6.50	.04
62835	D	.63	.53	1.52	.005	.002	.0040	1.18	.004	9.00	.08
63930	D	.16	3.96	1.65	.018	.09	.12	1.10	.005	5.04	.11
63931	D	.32	2.60	1.00	.016	.01	.01	.50	.005	6.58	.11
63936	D	.64	2.05	.60	.014	.01	.01	.25	.005	8.06	.11

Form D: discs 55 Ø x 4 mm.

Table 117. Aluminium-titanium alloys
S: 3

No.	Form	Type Alloy	Analysis, %									
			Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Sn	Ti
61974	D	A-T4	.43	.20	.01	.01	.05	.010	.008	.002	.00	4.20
62007	D		.88	.36	1.66	.01	.02	.010	.006	.002	.00	3.10
62012	D		.20	.12	.42	.01	.01	.005	.004	.002	.00	1.90

Form D: discs 55 Ø x 4 mm.

Table 118. Aluminium-chromium alloys
S: 3

No.	Form	Type Alloy	Analysis, %								
			Fe	Si	Cu	Zn	Mg	Mn	Ni	Ti	Cr
4435	D	A-C4	.065	.060	.025	.011	.0020	.004	.055	.005	3.0
4436	D		.26	.11	.045	.010	.0020	.002	.011	.009	4.1
4438	D		.59	.20	.080	.011	.0020	.003	.006	.006	5.0

Form D: discs 55 Ø x 4 mm.

Table 119. Aluminium-nickel alloys
S: 3

No.	Form	Type Alloy	Analysis, %						
			Fe	Si	Cu	Zn	Mg	Mn	Ni
4428	D	A-N20	.050	.050	.032	.012	.022	.0030	15.0
4429	D		.32	.11	.56	.009	.008	.0013	20.0
4430	D		.59	.18	.090	.010	.005	.0026	24.0

Form D: discs 55 Ø x 4 mm.

Table 120. Aluminium-mercury alloys
S: 3

No.	Form	Type	Analysis, %							
			Fe	Si	Cu	Zn	Mg	Mn	Ti	Hg
3920	C,D	MERCATAL	.04	.05	.003	.16	6.45	.005	.010	.05
3945	C,D		.08	.07	.006	.27	6.60	.020	.026	.09
3919	C,D	XMERAL	.03	.03	.002	1.30	.006	.09	.01	.02
3935	C,D		.08	.06	.005	1.95	.02	.24	.05	.03

Form C: discs 55 Ø x 33 mm.
Form D: discs 55 Ø x 4 mm.

Table 121. Aluminium
S: 28

No.	Type	Analysis. %															
		Si	Fe	Cu	Mn	Mg	Zn	Ti	Cr	Ni	V	Na	B	Pb	Cd	Sn	Ga
SR5N/20	Al 99,9	.0005	.0009	.0003	<.0005	<.0005	<.001							.0005			
113/01		.001	.002	.0003	<.0002	.0006	<.0003	<.001	<.0005	.0003		.0001	.0075				
114/01		.004	.007	.002	.005	.003	.001	<.001	.001	.0007	.0009	.0005	.020				
115/01		.006	.006	.004	.003	.004	.003	.002	.003	.003	.004	.0008					
116/01		.009	.009	.005	.005	.008	.005	.004	.005	.005	.006	.0015					.0004
116/02		.011	.023	.006	.005	.007	.007	.002	.006	.005	.004	.0002					
121/01	Al 99,7	.018	.031	.009	.008	.011	.008	.009	.009	.008	.0076	.0030		.0034	.002	.005	.0003
122/01		.040	.056	.018	.016	.017	.014	.028	.014	.009	.0134	.0001		.0060	.005	.008	.0062
123/01		.065	.068	.032	.030	.022	.023	.039	.027	.030	.0374	.0038		.010	.008	.009	.007
124/01		.057	.090	.044	.053	.052	.046	.050	.049	.052	.050	.0040		.019	.019	.016	.006
131/01	Al 99,5	.080	.13	.02	.011	.02	.01	.006	.008							.002	.006
133/01		.073	.19	.012	.011	.011	.033	.01	.022	.0205	.024						.035
135/01		.056	.31	.020	.006	.026	.051	.005	.004		.004	.0012	.011				.007

Discs 38 Ø x 30 mm.
" 60 Ø x 25 mm.

Table 122. Aluminium
S: 28

No.	Type	Analysis, %													
		Si	Fe	Cu	Mn	Mg	Zn	Ti	Cr	Ni	V	B	Pb	Sn	Ga
RAl 99,7	Al 99,7-99,3	.050	.15	.011	.010	.006	.026	.024				<.003			
2052/1		.062	.10	.006	.0045	.0057	.0052	.008	.005	.006	.013		.008	.010	.011
RAl 036/2		.040	.047	.005	.004	.0065	.015	.005							
772/1		.014	.015	.0012			.013								
R66/PQ	Al 99,7-98,5	.051	.19	.008	.0045	.010	.019	.0027							
RAl/99,4		.08	.35	.015	.008	.008	.026	.026							
RAl/99,3		.115	.49	.007	.006	.003	.012	.006							
143/02		.18	.60	.003	.001	.029	.007	.005	.020		.005			.002	Na
5401/3		.18	.165	.011	.032	.074	.060	.039	.020	.023					.0003
RAl 30		.31	.25	.053	.050	.04	.062	.025	.022	.024	.02		.0025		
RAl 80		.78	.78	.10	.12	.06	.12	.073	.054	.075	.064		.0036		

Discs 38 Ø x 30 mm.
" 60 Ø x 25 mm.

Table 123. Aluminium
S: 28

No.	Type	Analysis, %										
		Si	Fe	Cu	Mn	Mg	Zn	Ti	Ca	B	Ni	V
F 536	Pure aluminium	.404	.40	.004	.0032		.012	.0045				
F 560		.042	.034	.007								
F 746/1		.018	.018	.016	.0002		<.001					
F 746/2		.048	.040	.0025	.0035		.014	.0025			.0029	.003
F 746/3		.078	.065	.0082	.0077		.029	.007			.0076	.008
822/1		.16	.17	.012	.019	.03	.04	.022	.006			
829/1		.067	.15	.023	.021	.005	.010	.008		.0035		
F 829/2		.15	.35	.043	.043	.008	.030	.019		.0093		
F 829/3		.24	.47	.084	.086	.017	.052	.007		.024		
5172/F		.020	.020	.016	.00005		.0007					

Rods 6 Ø x 250 mm.

Table 124. Aluminium-iron and aluminium-magnesium alloys
S: 28

No.	Type	Analysis, %													
		Si	Fe	Cu	Mn	Mg	Zn	Ti	Cr	Ni	V	Sn	Pb	Be	Na
157/01	Al-Fe	.12	1.74	.009	.007	.021	.012	.003	.0024	.0017	.01		.005		
158/01		.05	2.08	.014	.011	.013	.002	.002	.006		.015	.002			
159/01		.14	3.0	.001	.008	.007	.006	.004	.007		.010	.0035			
Fe/4	Al-Mg	.038	.042	.005	.10	1.345	.005	.005	.0068						
513/01		.34	.22	.017	.031	5.0	.031	.016						.009	
P/7G		1.70	.49	.05	.41	6.86	.11	.15						.008	
P/9G		.39	.39	.05	.305	8.97	.10	.005						.010	
2034/A		.022	.010	.011	.0017	.44	.0025	.0031	.0025	.002					
2034/B		.0034	.0038	.0032	.0011	1.09	.0016	.0017	.001	.001					
2034/C		.031	.0075	.0010		2.42									
2034/D		.022	.021	.022	.0045	.20	.007	.0051	.006	.005					
521/01		.035	.033	.011	.030	.51	.049	.006	.005						.0025
554/01		.26	.30	.04	1.17	2.74	.10	.046	.03						.0079
R69Pe75		1.58	.42	.051	.36	6.50	.11	.15	.027					.007	
563/01		.81	.23	.40	.38	4.5	.02	.15	.08	.007				.015	

Discs 38 Ø x 30 mm.
" 60 Ø x 25 mm.

Table 125. Aluminium-copper alloys
S: 28

No.	Type	Analysis, %														
		Si	Fe	Cu	Mn	Mg	Zn	Ti	Cr	Ni	Ag	Pb	Cd	Bi	Be	Zr
2174/1	Al-Cu	.19	.845	2.1	.053	1.20	.051	.027	.008	.90						.086
6083/4		.10	.15	1.18	.10	.28	.009	.004	.004							
R66/Av		.367	.35	4.12	.715	1.44	.006									
211/01		.10	.05	3.81	.39	.37	.005	.22	.003	<.005	.30					
212/01		.05	.09	4.26	.15	.17	.007	.26	.003	.005	.45					
213/01		.005	.007	4.75	.30	.27	<.001	.048	.001	<.002	.62					
214/01		.012	.006	5.24	.49	.52	<.001	.13	.001	<.002	.92					
224/01		.76	.25	4.60	.90	.57	.055	.052	.08	.011		.020	.018	.0160	.005	.16
226/01		.57	.20	5.31	.69	.81	.026	.152	.12	.030		.010	.010	.0085	.002	.09
241/01		.075	.10	3.38	.10	.10	.01	.11	.01							
251/01		.15	.19	1.95	.022	.55	.018	.064	.010	.50						
S71Dc-500		.38	.32	5.0	.12	.10	.093	.0025	.002	.0095		.38		.48		

Discs 38 Ø x 30 mm.
" 60 Ø x 25 mm.

Table 126. Aluminium-silicon alloys
S: 28

No.	Type	Analysis, %														
		Si	Fe	Cu	Mn	Mg	Zn	Ti	Cr	Ni	Pb	Sn	Na	V	Ca	Sr	Co
411/01	Al-Si	9.6	.12	.007	.02	.02	.010	.015	.009	.01			.009		.005		
412/01		10.4	.42	.026	.09	.31	.066	.12	.030	.02			.0019		.007	.022	
413/01		11.7	.13	<.001	.003	.003	.021	.05	.001	.001			.0003		.002	.014	
414/01		12.2	.50	.083	.25	.50	.10	.03	.01	.10			.0025		.002	.065	.045
416/01		13.5	.8	.12	.5	.80	.15	.06	.05	.01			.009		.01	.038	
421/01		8.6	.10	.024	.145	.41	.114	.08	.033	.03			.002		.007		.57
422/01		9.7	.20	.011	.093	.34	.066	.06	.022	.02			.005		.01		.39
423/01		10.6	.33	.004	.05	.25	.017	.03	.011	.01			.009		.02		.20

Discs 38 Ø x 30 mm, 60 Ø x 25 mm.

Table 127. Aluminium-manganese alloys
S: 28

No.	Type	Analysis, %										
		Si	Fe	Cu	Mn	Mg	Zn	Ti	Cr	Ni	Pb	Na	Be
343/1	Al-Mn	.11	.10	.007	1.47		.036	.013					
AlMg 2.7		.29	.18	.006	.30	2.67	.024	.020					
R69Pe75		1.58	.42	.051	.36	6.50	.11	.15	.027				.007
311/01		.06	.21	.044	.42	.34	.075	.09	.09	.050	.041	.006	
312/01		.106	.36	.19	.52	.60	.055	.032	.048	.030	.027	.005	
313/01		.14	.50	.10	.65	.23	.037	.02	.031	.022	.019	.003	
314/01		.19	.61	.14	.78	.77	.019	.01	.0086	.012	.010	.003	
315/01		.27	.66	.19	.98	.99	.0070	.125	.0095	.0020	.0045	.0016	
316/01		.32	.70	.24	1.15	1.16	.10	.070	.018	.020		.005	

Discs 38 Ø x 30 mm, 60 Ø x 25 mm.

Table 128. Aluminium alloys
S: 28

No.	Type	Analysis, %															
		Si	Fe	Cu	Mn	Mg	Zn	Ti	Cr	Ni	V	Ca	Sr	Pb	Na	Cd	Zr
611/01	Al SiMg	.30	.10	.0016	.0003	.21	.0016	.0020	.001		.002						
612/01		.33	.14	.008	.006	.31	.003	.003	.003		.012						
613/01		.42	.19	.012	.005	.44	.011	.007	.001		.004						
Ac-630		6.20	.14	.010	.054	.18	.093	.052									
Ac-800		7.95	.14	.010	.054	.45	.097	.15									
621/01		2.0	.08	.01	.05	.29	.03	.06	.007	<.001	.005	.006					
622/01		2.9	.15	.03	.15	.41	.04	.08	.01	<.001	.009	.007					
623/01		4.0	.22	.05	.23	.50	.06	.10	.02	<.001	.013	.008					
624/01		5.0	.25	.08	.34	.61	.11	.16	.02	<.001	.017	.010					
431/01	AlSiCuNi	7.9	.11	.77	.05	.54	.02	.008	.01	.47		.004	.094				
432/01		9.3	.28	.93	.08	.78	.05	.035	.022	.73		.01	.069				
631/01	AlMgSiMn	.53	.11	.010	.50	.51	.018	.008	.10	.010					.0005		
634/01		1.0	.43	.071	.68	.82	.030	.072	.03	.027					.0016		
Ac-Cr/15	AlMgSiCr	.69	.31	.23	.070	.62	.12	.004	.15								
S71Ac-Cr25		.60	.32	.25	.0025	.98	.01	.070	.27								
653/01	AlMgSiPb	.98	.39	.026	.43	.75	.018	.010	.002	.002				1.0		.28	
Ur-1	Al-ZnMg	.09	.19	.051	.32	1.15	4.53	.005	.16								.07
Ur-2		.18	.31	.10	.42	1.30	4.55	.010	.235								.11
Ur-4		.038	.16	.007	.015	.67	3.92	<.002									
Ur-5		.10	.27	.047	.04	.91	4.13	.010									
2004/2		.10	.17	.002		2.38	2.24	.020	.03								
2004/3		.18	.085	.003	.003	1.19	3.57	.050	.05								
711/01		.42	.38	.0003	.003	4.5	1.7	.0006	.0015								
712/01		.11	.18	.0003	.004	2.34	2.25	.025	.040								

Discs 38 Ø x 30 mm, 60 Ø x 25 mm.

Table 128. (continued)
S: 28

No.	Type	Analysis, %															
		Si	Fe	Cu	Mn	Mg	Zn	Ti	Cr	Ni	V	Ca	Sr	Pb	Na	Cd	Zr
714/01	AlZnMg	.18	.085	.0032	.003	1.19	3.7	.058	.060								
721/01	AlZnMgZr	.10	.20	.05	.15	.81	3.7	.010	.09	.01							.05
731/01	AlZnMgCu	.15	.19	.58	.15	1.23	4.0	.008	.019								

Discs 38 Ø x 30 mm, 60 Ø x 25 mm.

Table 129. Aluminium alloys
S: 19, 38

No.	Analysis, %										
	Cu	Mg	Si	Fe	Mn	Ni	Zn	Pb	Sn	Ti	Cr
54W14353	.05	.35	6.1	.60	.15	.01	.06	.01	.03	.06	
54TG25H1	1.53	.85	3.06	.69	.01	.29	.17	.10	.21	.29	.20
54TG25H3	.80	.45	6.15	.33	.30	.10	.01	.20	.10	.06	.10
54TG25H4	.39	.66	7.02	.14	.47	.05	.11	.052	.055	.005	.058
54TG25H5	.005	.027	8.02	.027	.71	.001	.05	.004	.005	.20	.001
54TG06H4	.16	.16	12.61	.25	.59	.14	.16	.045	.018	.06	.004
54TG06H5	.003	.036	13.70	.03	.84		.30	.004	.05		.05
54TG13H5	.37	.50	13.48	.21	.84	.50	.012	.003	.005	.06	
54TG231H3	.41	.13	12.51	.37	.41	.055	.17	.006	.005	.16	.07
54TG231H4	.20	.006	13.52	.037	.56	.01		.068	.06	.16	
55TG23H1	2.51	.024	.98	.51	.20	1.97	.21	.002	.21	.006	.002
55TG23H5	.50	.29	2.97	1.53	.02	.53	.025	.22	.01	.34	.24
55TG04H4	2.54	.11	6.52	.278	.62	.15	1.79	.103	.06	.092	.001
55TG04H5	1.52	.021	7.62	.028	.81	.006	2.29	.002	.005	.005	.13

Discs

Table 130. Aluminium alloys
S: 19, 38

No.	Analysis, %											
	Cu	Mg	Si	Fe	Mn	Ni	Zn	Pb	Sn	Ti	Cr	Be
56TG14H1	5.03	.94	.013	.016	.60	1.50	.21	.002	.106	.24	.11	
56TG14H2	4.58	1.22	.71	.15	.46	1.79	.16	.025	.081	.17	.08	.0007
56TG14H3	4.02	1.50	.31	.29	.31	2.01	.11	.053	.061	.11	.05	.0009
56TG14H4	3.56	1.72	.49	.46	.15	2.22	.06	.083	.031	.059	.03	.0015
56TG14H5	3.04	2.02	.64	.63	.01	2.52	.015	153	.005	.005	.001	.0015
56TG11H3	4.35	.31	.39	.40	.40	.11	.01	.15	.083	.21	.002	
56TG11H4	4.69	.13	.20	.61	.19	.25	.17	.002	.067	.06	.05	
57TG12H4	10.18	.16	.93	.32	.51	.16	.29	.005	.019	.056	.069	
57TG01H3	9.11	.008	2.92	.58	.40	.25	1.48	.005	.079	.004	.146	
57TG01H5	8.00	.059	1.00	1.26	.016	.006	4.54	.055	.01	.07	.099	
511TG05H1	.30	2.01	.42	.82	.02	.20	.20	.008	.20	.24	.32	.0007
511TG05H2	.21	3.09	.31	.61	.22	.16	.16	.05	.15	.16	.20	.002
511TG05H3	.11	4.41	.20	.41	.42	.10	.12	.10	.10	.09	.10	.005
511TG05H4	.06	5.31	.12	.21	.62	.05	.06	.15	.05	.05	.05	.004
511TG05H5	.005	7.17		.005	.79			.18				.003
511TG5018J1	.25	2.88	.31	.011	.41	.145	1.60	.005	.065	.20	.094	
511TG5018J4	.005	8.35	.013	.41		.10	.51	.031	.049	.14		
511TG10H1	.22	7.89	.50	.43	.011	.21	.21	.004	.21	.11	.19	.001
511TG10H2	.17	8.81	.44	.54	.067	.16	.16	.20	.15	.06	.15	.002
511TG10H3	.13	9.69	.33	.33	.10		.11	.09	.11	.25	.05	.003
511TG10H4	.055	10.78	.18	.18	.16	.12	.059	.03	.051	.16		.004
511TG10H5		12.03		.015	.22	.055		.14	.005		.093	.006

Discs

Table 131. Aluminium-magnesium alloys
S: 28

No.	Type	Analysis, %							
		Si	Fe	Cu	Mn	Mg	Zn	Ti	Be
F 419	AlMg	.0096	.0077	.0100		2.37			
F 465		.0025	.0045	.0010		1.56			
Q494/1		.006	.0018	.0009		.22			
Q495/1		.006	.0020	.0007		.485			
Q496/1		.006	.0021	.0008		.98			
F 818		.0030	.0028	.0028		.60			
F 429/6						7.74			.002
F 429/7						3.92			.010
F 429/8						7.88			.010
655/1		.10	.10	.003	.008	.93	012	.01	
3123/1		.54	.26	.036	.27	3.37	.01	.09	.0018
3123/2		.70	.32	.022	.34	2.48	.01	.12	.0021

Rods 6 Ø x 250 mm.

Table 132. Aluminium alloys
S: 28

No.	Type	Analysis, %								
		Si	Fe	Cu	Mn	Mg	Zn	Ti	Cr	
P 4	AlMgSi	1.57	.17	.01	1.19	.13	.047			
248/1		1.05	.38	.098	.40	.88	.084	.008		
F 625		1.22	.65	.104	.60	1.00	.13	.005		
F 626		.32	.19	.010		.50	.016	.009	.08	
F 627		.85	.62	.10	.20	.97	.13	.006		
3123/4		5.32	.50	.057	.50	.64	.01	.09		
									Ca	Na
F 608	AlSiCu	11.15	.15	.027	.29	.25		.003		
748/1B	AlSi	9.08	.56	.016	.48	.48	.044		.003	.050
748/2B		10.29	.42	.024	.38	.18	.060		.005	.036
748/4B		13.06	.26	.052	.24	.04	.118		.090	.008
F 590		12.95	.43	1.94	.30	.003		.05		
									Pb	Bi
Q 522	AlCu	.54	.40	.008	1.20	.10	.004	.02		
F 562	AlMn	.315	.40	.12	.80	.003	.057	.087		
F 563		.107	.10	.017	1.50	.001	.028	.010		
5172/C3		.37	.60	5.85	.11	.10	.13	.006	.58	.67

Rods 6 Ø x 250 mm.

Table 133. Aluminium alloys
S: 19, 38

No.	Analysis, %										
	Cu	Mg	Si	Fe	Mn	Ni	Zn	Pb	Sn	Ti	Cr
55TGO2H1	5.18	.017	7.03	1.51	.05	1.18	1.52	.19	.005	.133	.001
55TGO2H4	2.06	.41	10.18	.79	.30	.61	2.00	.004	.005	.013	.102
55TGO2H7	.005	.122	13.36	.028	.63	.004	.99	.25	.11	.085	.02
55W14356	2.00	.44	6.5	.75	.35	.32	.07	.22	.20	.01	
55W14357	4.00	.07	3.7	1.10	.98	.01	.51	.51	.02	.20	

Discs

Table 134. Aluminium alloys
S: 23, 18

No.	Type	Analysis, %													
		Fe	Si	Cu	Ti	Zn	Mg	V	Mn	Ga	Cr	Be	Ni	Pb	Sn
G	Al 99,5	.360	.320	.052	.046	.054	.042	.015	.050	.030	.009				
H		.180	$.16_5$	.026	.022	.025	.022	$.008_5$	.023	.015	.004				
J		.100	.080	.015	.011	.013	.013	.005	.011	$.007_5$	.002				
K		.060	.042	$.009_5$	.0062	.007	$.006_5$	.003	$.006_5$	.003	.001				
L		.0260	.0220	.0060	(.0035)	.0030	.0031	(.0015)	.0035	(.001)	.0005				
HE-1	AlMg2	.500	.600	.150	.020	.240	1.500		.700		.300	.001			
HE-2	AlMg3	.300	.450	.100	.070	.150	2.200		.500		.100	.005			
HE-3		.40	.25	.05	.15	.07	3.10		.30		.05	.01			
HE-4		.200	.100	.015	.240	.020	3.800		.100		.010	.030			
HF-1	ÖAlSi12	.80	7.00	.15	.15	.20	.65		.60				.01	.10	.10
HF-4	ÖAlSi9Mg ÖAlSi12Mg	.10	14.00	.01	.01	.03	.04		.04				.15	.01	.01

Standards G,H,J,K,L: rods 6 mm Ø. Other standards: discs 55 Ø x 4 mm.

Table 134. (continued)
S: 23, 18

No.	Type	Analysis, %													
		Fe	Si	Cu	Ti	Zn	Mg	V	Mn	Ga	Cr	Be	Ni	Pb	Sn
HJ-4	ÖAlSi12NiMg	.10	14.00	.50	.01	.01	.50		.10				.50		
HC-1	AlMg2	.100	.300	.050	.010	.030	2.000		1.500		.008				
HL-1	AlCuMg2 AlCuMg0.5	.90	.20	1.50	.01	.60	2.00		1.20		.02		.15	.04	
HL-4		.250	1.100	3.800	.150	.100	.500		.250		.100		.045	.010	
HL-5		.100	1.400	4.600	.250	.060	.200		.100		.150		.020	.005	B
HH-1	AlMg4	.500	.600	.150	.020	.250	3.500		.700		.500	.005			.070
HH-2	AlMg5 AlMg6	.40	.45	.10	.05	.16	4.10		.55		.30	.01			.04
HH-4		.20	.20	.03	.15	.05	5.30		.25		.06	.04			.01
HH-5		.100	.100	.010	.250	.020	6.000		.100		.020	.070			.005

Discs 55 Ø x 4 mm.

3.2. Copper-base alloys

Table 135. Commercial purity copper
S: 8

No.	Analysis, ppm																
	Ag	As	Bi	Cd	Fe	Ni	O	Pb	S	Sb	Se	Sn	Te	Zn	Mn	H	N
SSC-1	18.8	1.16	1.15	N.F.	39.2	17.6	216	65.3	19.6	2.64	7.28	54.9	4.57	33.3	(2.18)	(.4)	(5.2)
SSC-2	13.9	1.18	.097	10.0	31.9	3.17	176	6.12	28.9	5.80	2.58	10.0	1.24	16.3	(2.75)	(1.3)	(7.1)
SSC-3	16.1	5.45	.59	N.F.	40.0	48.0	176	4.58	16.7	1.63	3.87	12.0	2.53	15.3	(3.25)	(.9)	(4.2)
SSC-4	21.0	2.81	.23	19.2	50.4	24.5	48.5	15.8	88.0	10.8	2.87	21.4	1.35	30.3	(4.33)	(1.1)	(5.3)

N.F. = Not found. Rods 0.3 Ø x 12 in. (8 Ø x 300 mm).

Table 136. Copper-base alloys
S: 20

No.		Type	Analysis, %							
			Cu	Zn	Pb	Fe	Sn	Ni	Al	Sb
1101	C1101	Cartridge brass B	69.50	30.30	.05	.037	.016	.013	.0006	.012
1102		Cartridge brass C	72.85	27.10	.020	.011	.006	.005	.0007	.005
1103	C1103	Free-cutting brass A	59.23	35.7	3.73	.26	.88	.16		
1104	C1104	Free-cutting brass B	61.33	35.3	2.77	.088	.43	.070		
1105	C1105	Free-cutting brass C	63.7	34.0	2.0	.044	.21	.043		
1106	C1106	Naval brass A	59.08	40.08	.032	.004	.74	.025		
1109	C1109	Red brass A	82.2	17.4	.075	.053	.10	.10		
1111	C1111	Red brass C	87.14	12.81	.013	.010	.019	.022		

No.		Analysis, %										
		As	Be	Bi	Cd	Mn	P	Si	Ag	Te	Co	Cr
1101	C1101	.0009	.00055	.0004	.0055	.0055	.0020	(.005)	.003	.0015		
1102		.004	.00003	.0005	.0045	.0045	.0048	(.002)	.0010	.0003		
1103	C1103						.003					
1104	C1104						.005					
1105	C1105						.003					
1106	C1106					.005						
1109	C1109						.006					
1111	C1111											

Chill-cast form (with "C" prefix): blocks 31 mm square x 19 mm.
Wrought form: discs 31 Ø x 19 mm.

Table 136. (continued)
S: 20

No.		Type	Analysis, %							
			Cu	Zn	Pb	Fe	Sn	Ni	Al	Sb
1112	C1112	Gilding metal A	93.38	6.30	.057	.070	.12	.100		
1113	C1113	Gilding metal B	95.03	4.80	.026	.043	.064	.057		
1114	C1114	Gilding metal C	96.45	3.47	.012	.017	.027	.021		
1115	C1115	Commercial bronze A	87.96	11.73	.013	.13	.10	.074		
1116	C1116	Commercial bronze B	90.37	9.44	.042	.046	.044	.048		
1117	C1117	Commercial bronze C	93.01	6.87	.069	.014	.021	.020		
1118	C1118	Aluminium brass A	75.1	21.9	.025	.065			2.80	.010
1119	C1119	Aluminium brass B	77.1	20.5	.050	.030			2.14	.050
1120	C1120	Aluminium brass C	80.1	18.1	.105	.015			1.46	.100
1121	C1121	Beryllium copper CA-172	97.49	(.01)	(.002)	.085	.01	.012	.07	

No.		Analysis, %										
		As	Be	Bi	Cd	Mn	P	Si	Ag	Te	Co	Cr
1112	C1112						.009					
1113	C1113						.008					
1114	C1114						.009					
1115	C1115						.005					
1116	C1116						.008					
1117	C1117						.002					
1118	C1118	.007					.13	.0021				
1119	C1119	.040					.070	.0015				
1120	C1120	.090					.018	.0011				
1121	C1121		1.90			(.004)	(.005)	.11	(.005)		.295	(.002)

Table 137. Phosphor bronzes
S: 7, 19

No.	Type	Analysis, %								
		Cu	Sn	Zn	Pb	P	Ni	Fe	Al	Si
554	Phosphor bronzes	87.4	11.3	.22	.34	.41	.22	.022	.005	.038
555		87.1	12.1	.16	.24	.18	.11	.010	<.005	.036
556		86.4	13.2	.09	.16	.10	.014	.004	<.005	<.005

Discs 38 mm Ø.

Table 138. Copper-base alloys
S: 11

No.	Type	Analysis, %											
		Cu	Sn	Pb	Zn	Fe	Ni	Mn	Al	Si	S	P	Sb
9849	Brass	63.15	.06	.01	34.0	.435	.30	.475	1.00	.62			
9850		63.65	.19	.99	33.85	.01	1.18		.005	.105			
9861		63.00	.40	.50	34.55	.16	.155	.75	.47	.005			
8958		66.12	.052		29.53	1.02	.26	1.12	1.89	.005			
8960		66.85	.09	.94	22.88	2.40	.99	3.01	2.83	.005			
8203-H	Cu-Al-alloy	89.09			.008	.75	.68		9.44	.03			
8578-H		81.5		.01	.01	3.27	3.21	.04	11.72	.025			
869-2	Bronzes	86.6	13.1	.012	.008	.010				.23	<.005	<.01	.003
872-2		83.2	4.5	7.0	3.2	.008	1.94			.039	<.005	.01	.055
944-2		86.0	11.8	.075	.80	.027	.37	.13	.03	.042	<.005	.60	.005

Discs 60 Ø x 6 mm.

Table 139. Brasses
S: 4

No.	Analysis, %										
	Pb	Bi	As	Ni	Fe	Mn	Sb	Sn	Al	Si	Zn	Cu
C38X11	.21	<.0005	.12	.015	.09	.004	.08	.21	<.001	<.001	R	59
C38X12	.11	.003	.075	.035	.049	.016	.05	.10	.01	.009	R	59
C38X13	.05	.005	.035	.060	.019	.008	.024	.051	.025	.024	R	59
C38X14	.018	.005	.006	.11	.009	.017	.009	.021	.042	.060	R	59
C38X15	.005	.01	.003	.18	<.001	.020	.006	.015	.068	.10	R	59
C38X16	.02	.006	.01	.12	.01	.08	.010	.02	.06	.060	R	59
C38X17	.01	.01	.005	.2	.005	.14	.007	.01	.1	.097	R	59

R = remainder
Discs 40 Ø x 10 mm.

Table 139. (continued)
S: 4

No.	Type	Analysis, %												
		Cu	Zn	Pb	Sn	Al	Mn	Fe	Ni	Bi	As	Sb	P	Si
C42X01	Naval brass	66.0	R	.12	.83	.007	.11	.19	.10	.01	.05	~.005	.03	.008
C42X02		71.2	R	.06	1.05	~.002	.055	.07	.05	.01	.01	<.001	.08	.002
C42X03		74.7	R	.04	1.48	<.001	<.005	<.002	.004	<.001	<.002	<.001	.16	<.001

R = remainder
Discs 40 Ø x 10 mm.

Table 140. Bronzes, gunmetals
S: 4

No.	Type	Analysis, %														
		Sn	Pb	As	Zn	Ni	Fe	Sb	Si	Al	P	Mn	Bi	Cr	Ag	Cu
C54X09	Phosphor bronze	5.0	.18	.07	.10	<.01	.23	<.005	.04	.01	.60	~.008				R
C54X13		12.6	.82	<.003	.50	.83	~.01	.01	<.005	<.002	.42	~.005				R
C55X02		10.67	.061	.029	.036	.014	.03	.03	.005	.007	.97					R
C55X10		9.85	.006	<.005	<.005	<.005	~.005	<.005	<.005	<.005	.60					R
C50X20	Leaded bronzes	9.1	11.0	.20	.60	.62	.09	.05	.02	.005	.005	.007	.01			R
C50X21		12.1	8.5	<.005	.57	1.9	.21	.20	.01	.002	.16	.16	.05			R
C71X10	Gunmetals	3.8	5.9	.05	4.0	2.1	.045	.058	.005	.007	.014	.052	.055	.05	.04	R
C71X11		5.9	3.9	.19	6.1	.55	.13	.19	.01	.002	.053	.085	.028	.03	.01	R
C71X13		7.8	2.5	.14	.73	<.01	.13	.097			.016	.065	.016	.01	.05	R

Discs 40 Ø x 10 mm.
R = remainder

Table 141. Copper-nickel alloys
S: 4

No.	Type	Analysis, %										
		Cu	Ni	Nb	Fe	Mn	Si	Co	Pb	Mg	Zn	P
C65X19	Nickel-silvers	56.69	18.0		.37	.28			<.005		24.64	.01
C62X06	Cupro-nickel	R	16.7	.80	1.5	1.25	.28	.06	.01	.01		
C62X07		R	24.7	1.0	.98	.77	.45	.02	.005	.01		
C62X08		R	31.8	<.02	.63	.01	.66					
C62X09		R	31.8	1.0	.49	.01	.70					

R = remainder

Discs 40 Ø x 10 mm.

Table 142. Phosphor bronzes
S: 8

No.	Type	Analysis, %						
		Cu	Sn	Fe	Pb	Zn	P	Al
293	Phosphor bronze	94.89	4.96	.026	.01	.037	.030	
304		86.48	9.67	.035	.46	2.99	.007	.05

Discs 60 Ø x 7 mm.

Table 143. Copper-base alloys
S: 37

Cu-Zn-alloys (discs 33 Ø x 20 mm). Contents of 0.001-0.01% of the following elements are certified: Ag, Al, As, Cd, Fe, Mn, Ni, P, Pb, Si, Sn.

Cu-Zn-Pb-alloys (discs 33 Ø x 20 mm). Contents of 0.001-0.01% of the following elements are certified: Ag, Al, As, Cd, Fe, Mn, Ni, P, Si, Sn.

Table 144. Copper-base alloys
S: 9

See table 63.

3.3. Magnesium-base alloys

Table 145. Magnesium-base alloys
S: 14

No.	Analysis, %							
	Al	Ca	Cu	Fe	Mn	Ni	Si	Zn
84652	1.01	.07	.020	.0011	.063		.01	.42
84653	1.44	.20	.010	.0011	.035		.11	.34
85669	5.94		.0019		.22		.008	3.02
85670	2.8		.0017		.52		.047	1.00
87407	5.95		.007		.09		.047	3.02
94465	1.13	.08	.110	.0035	.10	.004	.01	.55
94466	1.93	.02	.045	.004	.05	.0065		.82
94539				.009		.0002	.09	
96470	6.5			.008	.40	.001	.003	.77
96471	6.4			.009	.43	.006	.004	.80
96472	6.4			.011	.47	.010	.004	.83
96473	4.5		.001		.10		.013	.28
96474	5.9		.005		.20	<.0003	.068	.58
96475	7.3		.010		.31		.11	1.09
96519	6.6			.004	.27	<.001	.001	.79
102903	.80	.06	.038	.0013	.080		.016	.55
102905	.61	.22	.010	.0024	.17	.0042	.033	.26

Discs 2.5 in. Ø.

Table 146. Magnesium-base alloys
S: 14

No.	Analysis, %								
	Al	Ca	Cu	Mn	Ni	Pb	Si	Sn	Zn
66482	5.98		.049	.27	.0105	.010	.21	.0060	3.17
66483	6.18		.035	.22	.0043	.011	.078	.0005	3.05
66484	6.83		.019	.15	.0027	.053	.078	.042	2.59
66485	8.76		.009	.30	.0065	.0275	.15	.033	2.20
66486	9.21		.013	.17	.0064	.0022	.013	.0012	1.99
66487	9.94		.047	.10	.0047	.0076	.22	.011	1.76
66488	8.71		.074	.25	.0008		.28		.96
66489	8.99		.030	.18	.0006		.022		.74
66490	10.02		.268	.08	.0027		.46		.55
66491	2.63	.068	.001	.16	.0089		.0033		.73
66492	3.05	.135	.009	.46	.0038		.0046		.95
66493	3.63	.158	.019	.53	.0015		.003		1.27
66494	5.82			.01					.35
67364	2.89	.151		.01					.94

Sample sizes: extruded bars, 0.75 in. wide, 6 in. long, 0.25 in thick; rods 0.2 in. Ø.

Table 147. Magnesium-beryllium alloys
S: 14

No.	Analysis, %			
	Al	R.E.	Zn	Be
88215	(.0)			.0004
88216	(3.0)			.0002
88217	(6.0)			.0002
88218	(9.0)			.0003
88826	(.0)			.0013
88827	(3.0)			.0019
88828	(6.0)			.0011
88829	(9.0)			.0015
88830	(.0)			.0025
88831	(3.0)			.0022
88832	(6.0)			.0031
88833	(9.0)			.0026
88837	(3.0)			.0100
88838	(6.0)			.0090
88839	(9.0)			.0084
89616		(.5)	(1.0)	.0016
89651		(.5)	(1.0)	.0009
89652		(.5)	(1.0)	.0045
89697		(.5)	(1.0)	.0106

R.E. = rare earths. Discs 2.5 in. Ø. Rods 0.2 in. Ø.

3.4. Nickel-base alloys

Table 148. Nickel-base alloys
S: 20

No.	Type	Analysis, %			
		C	Mn	P	S
1159	Ni48, balance Fe	.007	.305	.003	.003
1160	Ni80, Mo4, balance Fe	.019	.550	.003	.001

No.	Analysis, %						
	Si	Cu	Ni	Cr	Mo	Co	Fe
1159	.32	.038	48.2	.06	.010	.022	51.0
1160	.37	.021	80.3	.05	4.35	.054	14.3

Discs 31 Ø x 19 mm.

Table 149. Nickel-base alloys
S: 7, 19

No.	Type	Analysis, %												
		C	Si	Mn	S	Cr	Mo	Ni	Al	B	Co	Cu	Ti	Fe
363	Nickel base alloys	.11	$.05_5$	1.03	.010			63.8	.005		.19	32.93		1.70
387		.030	.28	.08	.003	12.46	5.83	41.9	.24	.016	.21	.032	2.95	36.0

Discs 38 mm Ø.

Table 150. Nickel-base alloys
S: 32, 33, 19

No.	Type	Analysis, %											
		Si	Cu	Fe	Mn	Cr	Ti	Al	Co	Mg	Ni	Mo	C
F 296	Nickel	.032	.20	.040	.40	$.10_0$	.096	$.10_0$	.025	.004	B		
F 297		$.17_5$	.011	.50	.020	.008	.014	.007	$.06_0$	$.21_0$	B		
B6998	Monel alloy 400	.04	31.3	2.30	.29	.02	.11	.008	.025	.079	B		.09
B7001		.28	31.45	.32	1.66	.05	.025	.040	.25	.010	B		.01
B7002		.15	31.7	.13	2.65	.10	.015	.060	.10	.007	B		.015
E3932	Incoloy alloy DS	2.50	.55	B	.93	18.5	.025	.01	.07		36.4	.49	
E3918	Nimonic alloy 75	1.14	.005	1.57	.85	19.4	.72	.25	.22	.058	B	.49	.05
B7004	Nimonic alloy 80A	.17	.14	.97	.08	19.6	2.63	1.64	.06	.002	B	.06	.01
B7005		.23	.045	.32	.16	19.6	2.52	1.55	1.04	.005	B	.10	.035
B7006		1.03	.075	.61	.25	19.55	2.14	1.19	.35	.008	B	.20	.08
B7009	Nimonic alloy 90	.15	.03	1.13	.015	19.65	2.59	1.63	16.9	.001	B	.05	.025
B7010		.22	.04	.62	.24	19.7	2.48	1.61	16.9	.004	B	.10	.05
B7011		1.02	.065	.34	.16	19.7	2.05	1.20	17.0	.010	B	.20	.095
E3935	Nimonic alloy 105	.20	.04	.28	.52	14.95	1.37	4.85	20.0	.008	B	4.37	.05

B = balance. Size of samples: 1.125 Ø x 1.5 in. (28.6 Ø x 38.1 mm).

Table 151. Nickel-base alloys
S: 5, 19

No.	Type	Analysis, %														
		C	Mn	P	S	Si	Cu	Ni	Cr	Mo	Fe	Al	Co	Ti	Mg	B
40C	Monel 400	.170	1.04	.017	.007	.17	33.00	62.70	.16	(.010)	2.17	.026	.13	.027	.042	
500B	K-Monel 500	.13	.66	.009	.006	.10	30.11	64.21	.08	(.03)	1.19	2.87	.08	.50	.020	
600	Inconel 600	.079	.28	.009	.005	.25	.19	74.11	16.02	.09	8.94	.09	.04	.20	.011	.0016

Discs 1.5-1.75 Ø x 0.5 in.

Table 152. Nickel-base alloys
S: 19, 38

No.	Analysis, %									
	Si	Mn	Cu	Fe	Cr	Mo	Co	Ti	Al	Sn
24W10991	.24	.52	.17	.24	20.24	5.86	19.67	2.45	.54	.0067
26W14182	.01	.02		.08	21.63	10.05	.03	2.64	.83	
27W14184	.31	.38		.25	22.03	10.62	10.20	.01	.01	
27W14188	.29	.37		.35	21.78	10.36	10.04	.03	.01	
27W14387	.31	.42		1.08	21.73	10.42	9.92	.01	.01	

Discs

Table 153. Nickel-base alloys
S: 9

See table 63.

3.5. Lead-base alloys

Table 154. Lead-base alloys
S: 20

No.	Type	Analysis, %							
		Cu	Ni	As	Sn	Sb	Bi	Ag	Fe
1131	Solder Pb60-Sn40	.011	.012	.01	39.3	.43	.06	.01	
1132	Bearing metal	.054	.003	.057	5.84	10.2	.052		<.001

Discs 31.4 Ø x 19 mm.

Table 155. Lead-base alloys
S: 26

No.	Type	Analysis, %					
		Sn	Sb	Pb	Bi	Cu	Fe
TL-9X	Tin 10/Lead 90, ASTM alloy grade 10B	9.10	.018	R	.006	.00095	(.004)
TL-10X		10.06	.048	R	.0097	.0027	(.003)
TL-11X		11.62	.21	R	.034	.0078	(.02)
LS-1.5X	Fed.Alloy Comp. Ag2.5 ASTM alloy grade 2.5S	.05	.40	R	.05	.30	
LS-2.5X		.10	.25	R	.10	.15	
LS-3.5X		.25	.10	R	.25	.08	
LS-4.5X	Fed.Alloy Comp.Ag5.5	.05	.40	R	.05	.30	
LS-5.5X		.10	.25	R	.10	.15	
LS-6.5X		.25	.10	R	.25	.08	

No.	Analysis, %							
	Al	As	Zn	Ag	Au	Cd	In	Ni
TL-9X	(.001)	.002	(.003)	.0010	.010	.001	.0052	.0008
TL-10X	(.005)	.005	(.009)	.0031		.0033	.015	.003
TL-11X	(.01)	.015	(.02)	.010		.0092	.037	.008
LS-1.5X		.005	.001	1.5				
LS-2.5X		.01	.0025	2.5				
LS-3.5X		.02	.005	3.5				
LS-4.5X		.005	.001	4.5				
LS-5.5X		.01	.0025	5.5				
LS-6.5X		.02	.005	6.5				

R = remainder
Discs 1.65 Ø x 0.75 in.

3.6. Tin-base alloys

Table 156. Tin-base alloys
S: 20

No.	Type	Analysis, % Cu	Ni	Co	As	Pb	Sb	Bi	Ag	Zn	Cd
432	Tin B	.097	.020	.011	.075	.094	.095	.0098	.0095	.020	.0095
433	Tin C	.055	.0095	.0045	.047	.055	.050	.0052	.0055	.0095	.0053
434	Tin D	.019	.0044	.0020	.019	.022	.019	.0020	.0018	.0046	.0020
435	Tin E	.0077	.0024	.0011	.0090	.015	.010	.0011	.0010	.0020	.0011

Rods 6.4 Ø x 102 mm.

Table 157. Tin-base alloys
S: 26

No.	Type	Analysis, % Sb	As	Bi	Fe	In	Ni	Al	Cu	Ag	Cd	Zn	Au	Sn	Pb
TA-5X	Fed.alloy comp.Sb5	5.0	.02	.005	.004				.003		<.005	<.0005		R	.025
LTS-33X	Fed.alloy comp.Sn10	.21		.0072					.073	2.86				8.88	R
LTS-35X		.05		.035					.0089	1.06				11.10	R
TL-1X	Fed.comp.Sn40,	.15	.007	.03			.005		.005	.005				40.00	R
TL-2X	ASTM alloy grade 40A, 40B	.43	.01	.06			.012		.011	.01				39.30	R
TLS-38X	Fed.alloy comp.Sn62	.23		.25					.010	1.02				63.60	R
TS-3X	Fed.alloy comp.Sn96	.20	.01	.05					.20	3.0		.001		R	.02
TS-4X		.10	.02	.10					.10	4.0		.0025		R	.05
TS-5X		.05	.05	.25					.03	5.0		.005		R	.10
63A10	Solder standards	.15	.009	.038	(.006)	.005	.001	(.001)	.05	.019	.0057	.0005	.04	63.0	R
63A11		.36	.019	.094	(.016)	.01	.0025	(.0025)	.10	.036	.01	.0013	.10	63.2	R
63A12		.58	.031	.23	(.018)	.022	.007	(.007)	.25	.049	.025	.003	.25	63.5	R

R = remainder. Discs 1.65 Ø x 0.75 in.

3.7. Zinc-base alloys

Table 158. Zinc-base alloys
S: 20

No.	Type	Analysis, %						
		Cu	Al	Mg	Fe	Pb	Cd	Sn
625	Zinc-base A-ASTM AG 40A	.034	3.06	.070	.036	.0014	.0007	.0006
626	" B " AG 40A	.056	3.56	.020	.103	.0022	.0016	.0012
627	" C " AG 40A	.132	3.88	.030	.023	.0082	.0051	.0042
628	" D " AC 41A	.611	4.59	.0094	.066	.0045	.0040	.0017
629	" E " AC 41A	1.50	5.15	.094	.017	.0135	.0155	.012
630	" F " AC 41A	.976	4.30	.030	.023	.0083	.0048	.0040
631	Zinc spelter (modified)	.0013	.50	(<.001)	.005	(.001)	.0002	.0001

No.	Analysis, %								
	Cr	Mn	Ni	Si	In	Ga	Ca	Ag	Ge
625	.0128	.031	.0184	.017					
626	.0395	.048	.047	.042					
627	.0038	.014	.0029	.021					
628	.0087	.0091	.030	.009					
629	.0008	.0017	.0075	.078					
630	.0031	.0106	.0027	.022					
631	.0001	.0015	(<.0005)	<.002	(.0023)	(.002)	<.001	(<.0005)	(.0002)

Discs

Table 159. Zinc-base alloys
S: 34, 19

No.	Type	Analysis, %					
		Al	Mg	Cu	Pb	Cd	Sn
ZAMAK3-1	ZnAl4	4.71	.013	.010	.0010	.0004	.0003
2		4.30	.023	.030	.0032	.0032	.0027
3		3.94	.047	.110	.0052	.0050	.0049
4		3.60	.066	.30	.010	.0098	.0097
5		4.49	.013	.011	.0011	.0011	.0014
ZAMAK5-1	ZnAl4Cu1	4.56	.014	.59	.0012	.001	.0014
2		4.02	.048	1.00	.0029	.0029	.0027
3		3.40	.087	1.44	.009	.01	.0086

Sample size: ZAMAK 3 - rods 10 Ø x 250 mm, discs 65 Ø x 7 mm
ZAMAK 5 - discs 65 Ø x 7 mm.

3.8. Zirconium-base alloys

Table 160. Zirconium-base alloy
S: 20

No.	Type	Analysis, %											
		C	Cr	Cu	Fe	Mn	Mo	Ni	N	Si	Ti	W	U
1212a	Zirconium C	.28	.063	.015	.071	.030	.012	.043	.012	.035	.015	.014	.010

Discs 31 Ø x 9.5 mm.

4. Gases in metals

Table 161. Nitrogen in iron and steel (chip form)
S: 20

No.	Type	Analysis, %
		N
	Irons	
5L	Cast iron	.006
6g	Cast iron	.006
7g	Cast iron(high P)	.004
	Steels	
12h	Basic open hearth,0.4C	.006
32e	Ni-Cr(SAE 3140)	.009
72f	Cr-Mo(SAE 4130)	.009
100b	Manganese(SAE T1340)	.004
139a	Cr-Ni-Mo(AISI 8640)	.008
163	Low alloy, Cr1	.007

Table 162. Oxygen in steel
S: 7, 19

No.	Type	Analysis, %					
		C	Si	Mn	P	S	O
318A	0.01% oxygen	(.08)	(.12)	(.39)	(.018)	(.035)	.0096
318B	0.01% oxygen	(.08)	(.12)	(.39)	(.018)	(.035)	.0103

Table 163. Oxygen in steel
S: 27

No.	Type	Analysis, ppm	No.	Analysis, ppm
		O		O
31	Steels	15	33	46
32		28	34	68

Table 164. Oxygen in steels
S: 29, 24

No.	Type	Analysis, %
		O
181-1	Steels	.0030
182-1		.0045
183-3		.0098

Table 165. Oxygen and nitrogen in iron and steels
S: 20

No.	Type	Analysis, ppm	
		O	N
1092	Vacuum-melted steel	28	(4)
1093	Valve steel	60	(4807)
1094	Maraging steel	4.5	(71)
1095	AISI 4340 steel	9	(37)
1096	AISI 94B17(Mod)steel	10.7	40.4
1097	Cr-V(Mod)steel	6.6	(41)
1098	High carbon(Mod)steel	10	32
1099	Electrolytic iron	61	(13)
1089	Set of 5:1095,1096,1097, 1098, and 1099		

Table 166. Oxygen and nitrogen in steels
S: 6, 17

No.	Type	Analysis, %	
		O	N
ON1	Steels	.0031	.0053
ON1a		.002	.004
ON2		.0084	.0157
ON3		.0113	.0029
ON4		.0312	.0083

Table 167. Oxygen in non-ferrous metals
S: 12

No.	Type	Analysis, ppm
		O
17	Copper, oxygen-free	1.5
18	Copper, phosphorus-deoxidized	70
19	Lead, refined	1.8
20	Zirconium, unalloyed	477; 498
21	" "	1182
22	Copper, electrolytic tough-pitch	138

Table 168. Hydrogen in titanium
S: 20

No.	Type	Analysis, %
		H
352	Unalloyed titanium for hydrogen	.0032
353	Unalloyed titanium for hydrogen	.0098

Table 169. Nitrogen in titanium-base and zirconium-base alloys (chip form)
S: 20

No.	Type	Analysis, %
		N
176	Titanium-base alloy 5Al-2.5Sn	.010
360a	Zircaloy-2	.0043

5. Biological standards

Table 170. Biological standards
S: 20

No.	Type	Analysis, ppm, or where noted, %											
		Ag	Al	As	B	Bi	Br	Ca	Cd	Ce	Cl	Co	Cr
1569	Brewers yeast												2.12
1570	Spinach		870	.15	(30)		(54)	1.35%	(1.5)			(1.5)	4.6
1571	Orchard leaves			14	33	(.1)	(10)	2.09%	.11		(700)	(.2)	(2.3)
1573	Tomato leaves		(.12%)	.27	(30)		(26)	3.00%	(3)	(1.6)		(.6)	4.5
1575	Pine needles		545	.21			(9)	.41%	(<.5)	(.4)		(.1)	2.6
1577	Bovine liver	(.06)		(.055)				(123)	.27		(2600)	(.18)	

Table 170. (continued)
S: 20

No.	Analysis, ppm, or where noted, %												
	Cu	Eu	F	Fe	Hg	K	La	Li	Mg	Mn	Mo	N	Na
1569													
1570	12	(.02)		550	.030	3.56%	(.37)			165		(5.9%)	
1571	12		(4)	300	.155	1.47%		(14)	.62%	91		2.76%	82
1573	11	(.04)		690	(.1)	4.46%	(.9)		(.7%)	238		(5.0%)	
1575	3.0	(.006)		200	.15	.37%	(.2)			675		(1.2%)	
1577	193			270	.016	.97%			605	10.3	(3.2)	10.6%	.243%

No.	Analysis, ppm, or where noted, %												
	Ni	P	Pb	Rb	S	Sb	Sc	Se	Sr	Th	Tl	U	Zn
1569													
1570	(6)	.55%	1.2	12.1		(.04)	(.16)		87	.12	(.03)	.046	50
1571	1.3	.21%	45	12	(2300)			.08	(37)			.29	25
1573		.34%	6.3	16.5			(.13)		44.9	.17	(.05)	.061	62
1575	(3.5)	.12%	10.8	11.7		(.2)	(.03)		4.8	.037	(.05)	.020	
1577			.34	18.3				1.1	(.14)		(.05)	(.0008)	130

6. Environmental standards

6.1. Analysed gases

Table 171. Gases
S: 20

No.	Type	Analysis, ppm			
		O_2	C_3H_8	CO	NO
1604a	Oxygen in nitrogen	1.5			
1607		212			
1665	Propane in air		3		
1666			10		
1667			50		
1668			100		
1677	Carbon monoxide in nitrogen			10	
1678				50	
1679				100	
1683	Nitric oxide in nitrogen				50
1684					100

6.2. Analysed liquids

These SRM's are intended for use in the analysis of liquids for elements that, when liberated, could become environmental pollutants.

Table 172. Liquids
S: 20

No.	Type	Analysis, μg/g or μg/ml	
		Pb, μg/g	Hg, μg/ml
1636	Lead in reference fuel	12; 20; 28; 773	
1637		12; 20; 28	
1641	Mercury in water		1.49
1642			1.18

6.3. Permeation tubes

These SRM's are intended for calibrating air pollution monitoring apparatus, and may be used to verify air pollution analytical methods and procedures. Each tube is individually certified.

Sulfur dioxide

Sulfur dioxide permeation tubes are available in three lengths - 2, 5, and 10 cm. The permeation rates are certified over the temperature range of 20 to 30°C. The following table is provided as a guide in the selection of the appropriate length. The values in the table do not represent certified values for any SRM. The concentrations of SO_2 in ppm are based on an approximate permeation rate of 0.28 μg per cm per minute at 25°C, for flow rates of 1, 5, and 10 liters per minute.

Table 173. Sulfur dioxide permeation tubes
S: 20

No.	Type	Tube length cm	Permeation rate μg per min	Typical concentration, ppm Flow rates, liters per min 1	5	10
1625	Sulfur dioxide permeation tube	10	2.8	1.07	.214	.107
1626		5	1.4	.535	.107	.0535
1627		2	.56	.214	.0428	.0214

Nitrogen dioxide

Nitrogen dioxide permeation device (SRM 1629) are calibrated at 25.0°C only. The temperature coefficient given with each tube provides the means to calculate permeation rates at other temperatures near 25°C. The permeation rates for these tubes are between 0.5 and 1.5 μg per minute at 25°C. A tube with a rate of 1.0 μg per minute, in an air-flow of one liter per minute at 25°C, will produce a concentration of 0.5 ppm of NO_2.

7. Fuels, oils

Table 174. Fuels
S: 20

No.	Type	Analysis, ppm, or where noted, % As	Be	Cd	Cr	Co	Cu	Fe
1632	Coal	5.9	(1.5)	.19	20.2	(6)	18	8700
1633	Coal fly ash	61	(12)	1.45	131	(38)	128	

Table 174. (continued)
S: 20

No.	Analysis, ppm, or where noted, %								
	Pb	Mn	Hg	Ni	K	Rb	Se	Si	Ag
1632	30	40	.12	15			2.9	(3.2%)	(<.1)
1633	70	493	.14	98	(1.72%)	(112)	9.4		

No.	Analysis, ppm, or where noted, %							
	Sr	Te	Tl	Th	Ti	U	V	Zn
1632		(<.1)	.59	(3.0)	(800)	1.4	35	37
1633	(1380)		(4)	24		11.6	214	210

Table 175. Oils
S: 19, 13

CONOSTAN metallo-organic standards are specially prepared organic sulfonates in an oil base. The matrix oil for these standards is a paraffinic hydrocarbon oil with an 80 SSU viscosity at 100°F and a flash point of 340°F.

5000 ppm standards

Individual CONOSTAN standards at 5000 ppm metal in hydrocarbon oil solution are available for each of the following elements: Ag, Al, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, K, La, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Si, Sn, Ti, V, Y, Zn.

Blended standards

CONOSTAN D-12 standards are blends of equal amounts each of the following 12 elements: Ag, Al, Cr, Cu, Fe, Mg, Na, Ni, Pb, Si, Sn, Ti. These elements are blended to approximately 245 cSt. viscosity in a hydrocarbon oil. They are available at the following concentrations: 900, 500, 300, 100, 50, 30, and 10 ppm, packaged in polyethylene bottles.

CONOSTAN D-20 standards are blends of equal amounts each of the following 20 elements: Ag, Al, B, Ba, Be, Cd, Cr, Cu, Fe, Mg, Mn, Mo, Na, Ni, Pb, Si, Sn, Ti, V, Zn. These elements are blended to approximately 245 cSt. viscosity in a hydrocarbon oil. They are available at the following concentrations: 900, 500, 300, 100, 50, 30, and 10 ppm, packaged in polyethylene bottles.

CONOSTAN C-20 blended standards is a series of new blends designed to include calcium at five times the level of other metals in the blend. C-20 also includes phosphorus, not previously included in a CONOSTAN blend. C-20 blends contain equal amounts of the following 19 elements: Ag, Al, Ba, Cd, Cr, Cu, Fe, Mg, Mn, Mo, Na, Ni, P, Pb, Si, Sn, Ti, V, Zn; Ca at 5 times these metals. Each blend in a hydrocarbon oil has a viscosity of approximately 245 cSt. at 100°F. The blends are available at concentrations of 1000, 500, 300, 100, 50, 30 and 10 ppm packaged in polyethylene bottles.

Table 176. Wear metal standards
S: 39

500 ppm standards

These are prepared from NBS standards in a light lubricating oil, and packaged in brown polyethylene bottles to avoid contamination and improve stability.

Al	Aluminium-2-ethylhexanoate
Ba	Barium-cyclohexanebutyrate
B	Menthyl borate
Cd	Cadmium-cyclohexanebutyrate
Ca	Calcium-2-ethylhexanoate
Co	Cobalt-cyclohexanebutyrate
Pb	Lead-cyclohexanebutyrate
Li	Lithium-cyclohexanebutyrate
Mg	Magnesium-cyclohexanebutyrate
Mn	Manganous cyclohexanebutyrate
Hg	Mercuric cyclohexanebutyrate
Ni	Nickel-cyclohexanebutyrate
K	Potassium erucate
Ag	Silver-2-ethylhexanoate
Na	Sodium-cyclohexanebutyrate
Sr	Strontium-cyclohexanebutyrate
Sn	Dibutyltin-bis-(2-ethylhexanoate)
Zn	Zinc-cyclohexanebutyrate

Cr, Cu and Fe are also available
Oil, blank (for dilution purposes).
Silicon Kit: 15 ml each of 20, 50 and 100 ppm.

Oil calibration multi-element standards

Standard - 100 ppm of the following elements in an oil matrix: Al, Cr, Cu, Fe, Mg.

Standard - 50 ppm of the following elements in an oil matrix: Al, Cr, Cu, Fe, Mg.

Standard - 2, 5, 10, or 20 ppm of the following elements in an oil matrix: Al, Cr, Cu, Fe, Mg, Ag.

8. Mineral materials, oxides

8.1. Ores, iron ore sinter, slag

Table 177. Iron ore
S: 7, 19

No.	Type	Analysis, %								
		Fe	SiO_2	Al_2O_3	TiO_2	CaO	MgO	S	P	MnO
175/2	Nimba iron ore	66.1	2.58	1.08	$.09_5$	(.08)	(.03)	.007	.047	(.14)

Table 178. Iron ores and iron ore sinter
S: 6, 17

No.	Type	Analysis, %									
		Fe	Si	Ca	Al	Ti	Mg	Mn	P	S	Fe^{2+}
M05-1	Iron ore	51.59	11.78	(.2)	.33	.013	(.04)	.018	.022	.010	(.4)
M10-1		47.46	3.17	.13	1.96	.015	1.86	.581	.007	.189	
A01-1	Iron ore sinter	62.22	2.07	2.85	.69	.035	.32	1.97	.030	.008	(13.8)

Table 179. Iron ore sinter
S: 5, 19

No.	Type	Analysis, %								
		Fe	CaO	MnO	SiO_2	Al_2O_3	MgO	TiO_2	P_2O_5	S
104	Iron ore sinter	55.04	8.83	.82	7.81	1.26	3.45	.08	.136	.010

Table 180. Iron ore
S: 8

No.	Type	Analysis, %								
		Fe	Si	Al	Ca	Mg	Mn	Ti	S	P
SCH-1	Iron ore	60.73	3.78	.509	.029	.020	.777	.031	.007	.054

Table 181. Iron ores
S: 29, 24

No.	Type	Analysis, %								
		CW	Fe	FeO	SiO_2	Mn	P	S	Cu	TiO_2
800-2	Iron ore	4.50	62.85	3.04	2.61	.22	.042	.075	.064	.09
801-2		2.46	64.66	.34	2.13	.06	.039	.006	.004	.16
803-1		1.88	62.67		5.21	.09	.057	.007		.12
812-1		.33	60.19	24.32	14.39	.03	.042	.021		.06
813-1		1.54	61.15	9.29	6.61	.05	.260	.056	.012	.21
830-2		.35	60.53	22.66	2.27	.61	.125	.006	.011	6.37
860-1		2.54	18.76		10.29	37.61	.065	.005		
870-1			14.33		2.93		.002	.068		

No.	Analysis, %										
	CaO	MgO	Al_2O_3	As	Sn	Zn	Bi	Ni	Cr	V	K_2O
800-2	.02	.22	2.01	.033	.012	.101	.023			.006	
801-2	.03	.02	2.60							.008	
803-1	.04	.04	2.82								.010
812-1	.63	.46	.40						.004	.003	
813-1	1.20	1.08	1.27					.008		.16	
830-2	.66	2.18	2.74							.31	
860-1			.95						Cr_2O_3		
870-1		15.00	12.05						49.01		

Table 182. Slag
S: 27

No.	Type	Analysis, %						
		SiO_2	Al_2O_2	FeO	Fe_2O_3	MnO	CaO	MgO
S5	Acid open hearth slag	57.0	1.7	26.8	1.3	9.8	2.2	1.5

No.	Analysis, %							
	P_2O_5	V_2O_5	TiO_2	Cr_2O_3	S	F	Na_2O	K_2O
S5	.01	.06	.42	.15	.008	.01	.1	.2

Table 183. Zinc-tin-copper-lead ore
S: 8

No.	Type	Analysis, %, or where noted, ppm										
		O	Si	Al	Fe	Mg	Ca	K	Na	Ti	Mn	S
MP-1	Zinc-tin-copper-lead ore	(26.8)	(19.4)	(3.63)	(5.68)	(.04)	(3.36)	(.10)	(.01)	(.07)	(.05)	(11.8)

No.	Analysis, %, or where noted, ppm													
	H_2O[a)]	C	F	Zn	Sn	Cu	Pb	As	In	Bi	Mo	Cd	W	Ag
MP-1	(1.57)	(.10)	(4.04)	16.33	2.50	2.15	1.93	.791	.071	.025	.014	(.07)	(.02)	59.5 ppm

a) at 980°C

8.2. Minerals, rocks

Table 184. Minerals
S: 20

No.	Type	Analysis, %														
		SiO_2	Fe_2O_3	Al_2O_3	TiO_2	MnO	CaO	SrO	MgO	Na_2O	K_2O	BaO	Rb_2O	P_2O_5	CO_2	LOI[a)]
88a	Limestone, dolomitic	1.20	.28	.19	.02	.03	30.1	.01	21.3	.01	.12			.01	46.6	46.7
70a	Feldspar, potash	67.1	.075	17.9	.01		.11			2.55	11.8	.02	.06			.40
99a	Feldspar, soda	65.2	.065	20.5	.007		2.14		.02	6.2	5.2	.26		.02		.26
		Al_2O_3	CaO	P_2O_5	SiO_2	Fe_2O_3	F	CO_2	TiO_2	Na_2O	MgO	K_2O	MnO	CdO		
120b	Phosphate rock (Florida)	1.06	49.40	34.57	4.68	1.10	3.84	2.79	.15	<.35	.28	.090	.28	.002		

a) Loss on ignition

Table 185. Geological materials, rocks
S: 30

Element	Conc. units[a)]	Type							
		W-1	G-1	G-2	GSP-1	AGV-1	PCC-1	DTS-1	BCR-1
Ag	ppm	.081	(.05)	(.049)	(.10)	.11	.005	.008	(.036)
As	ppm	1.9	(.5)	(.25)	(.09)	(.8)	(.05)	(.03)	(.70)
Au	ppm	.0037	.0040	.0010	.0016	.0006	(.0016)	(.0008)	(.00095)
B	ppm	(15)	(1.7)	(2.0)	<3	(5)	(6)	<5	(5)
Ba	ppm	160	(1200)	1870	1300	1208	1.2	2.4	675
Be	ppm	(.8)	(3)	2.6	(1.5)	(3)	---	---	(1.7)
Bi	ppm	.046	.065	.043	.037	.057	.013	.010	.050
Br	ppm	(.4)	(.4)	(.3)	---	(.5)	(.6)	(.2)	(.15)
C	ppm	---	---	---	---	---	---	---	330
Cd	ppm	.15	(.03)	.039	(.06)	(.09)	(.1)	(.12)	(.12)
Ce	ppm	(23)	(170)	(150)	394	63	(.09)	(.06)	53.9
Cl	ppm	(200)	(70)	(50)	(300)	(110)	(60)	(11)	(50)
Co	ppm	47	(2.4)	5.5	6.4	14.1	112	133	(38)
Cr	ppm	114	(20)	(7)	12.5	12.2	2730	4000	17.6
Cs	ppm	.9	1.5	(1.4)	1.0	(1.4)	.006	.006	.95
Cu	ppm	110	13	11.7	33.3	59.7	11.3	7.0	18.4
Dy	ppm	4	2.4	2.6	5.4	3.5	---	.003	6.3
Er	ppm	2.4	1.15	(1.3)	(3.0)	(1.2)	---	<.003	3.59
Eu	ppm	1.11	1.3	1.5	2.4	1.7	.002	.0009	1.94
F	ppm	250	690	(1290)	(3200)	435	(15)	(15)	(470)
Ga	ppm	16	19.6	22.9	(22)	20.5	(.4)	(.2)	(20)
Gd	ppm	(4)	(5)	(5)	(15)	(5.5)	---	<.01	6.6
Ge	ppm	(1.4)	1.1	1.15	(1.3)	(1.3)	.93	.90	1.54
Hf	ppm	2.67	5.2	7.35	15.9	5.2	(.06)	(.01)	4.7
Hg	ppm	(.225)	.097	.039	.0155	.00015	.0072	.0087	.0107
Ho	ppm	.69	.35	(.4)	<.5	(.6)	---	(.003)	(1.2)
I	ppm	<.03	<.03	---	---	---	---	---	<1
In	ppm	.065	(.02)	.034	(.05)	(.04)	(.003)	(.0025)	.095
Ir	pp10^9	.28	(.008)	(.002)	(.012)	(.011)	5.2	(1.0)	(.004)
La	ppm	9.8	101	96	191	(35)	(.15)	(.04)	(26)
Li	ppm	14.5	22	34.8	32.1	12	(2)	(2)	12.8
Lu	ppm	.35	.19	.11	.23	.28	.006	(.002)	.55
Mn	ppm	1278	195	260	331	763	959	969	1406
Mo	ppm	.57	6.5	(.36)	(.90)	(2.3)	(.2)	(.2)	(1.1)
N	ppm	52	59	56	48	44	43	27	30
Nb	ppm	9.5	23.5	13.5	29	15	<2	<3	13.5
Nd	ppm	15	56	60	188	39	---	<.02	29
Ni	ppm	76	(1)	5.1	12.5	18.5	2339	2269	15.8

a) Concentration units, as %, ppm, or pp10^9 (see: O.G.Koch, **Anal.Chim.Acta** 82, 19 (1976).

Values underlined = recommended. Values in parantheses = magnitudes. Other values = average.

Table 185. (continued)
S: 30

Element	Conc. units a)	Type							
		W-1	G-1	G-2	GSP-1	AGV-1	PCC-1	DTS-1	BCR-1
O	%	44.77	---	48.34	47.78	47.24	---	---	45.48
Os	pp10^9	(.25)	(.07)	---	<32	<34	(11)	(1)	(.1)
Pb	ppm	7.8	48	31.2	51.3	35.1	13.3	14.2	17.6
Pd	pp10^9	(25)	(2)	<.5	<.5	<.5	(13)	(1)	(12)
Pr	ppm	(3.4)	(19)	(19)	(50)	(7)	---	(.006)	(7)
Pt	pp10^9	(12)	(19)	<.5	<.5	(1)	(8)	(3)	(2)
Ra	pp10^9	---	---	.71	.66	.69	.0018	.0013	.56
Rb	ppm	21	220	168	254	67	.063	.053	46.6
Re	pp10^9	<2	<2	<7	<2	<5	.07	<.4	.8
Rh	pp10^9	<1	---	---	---	---	1.0	.9	.2
Ru	pp10^9	---	---	---	---	---	9.5	(2.5)	(1)
S	ppm	123	58	24	162	<10	<10	<10	392
Sb	ppm	1.0	.31	(.1)	3.1	4.5	1.4	(.46)	.69
Sc	ppm	35.1	2.9	3.7	7.1	13.4	6.9	(3.6)	33
Se	ppm	(.13)	(.007)	<.7	<.04	<.14	<.18	<.3	(.10)
Sm	ppm	3.6	8.3	7.3	27.1	5.9	(.008)	(.004)	6.6
Sn	ppm	3.2	3.5	(1.5)	6.3	4.2	(1)	(1)	(2.6)
Sr	ppm	190	250	479	233	657	.41	.35	330
Ta	ppm	.50	1.5	.91	1.0	.9	<.1	<.1	.91
Tb	ppm	.65	.54	.54	1.3	.70	(.001)	(.0003)	1.0
Te	ppm	<1	<1	<1	<1	<1	<1	<1	<1
Th	ppm	2.42	50	24.2	104	6.41	(.01)	(.01)	6.0
Ti	ppm	---	---	2780	3990	6190	(70)	(71)	12750
Tl	ppm	.11	1.24	(1.0)	(1.3)	(1)	(.0008)	(.0005)	.30
Tm	ppm	.30	.15	(.3)	---	(.4)	---	(.001)	.6
U	ppm	.58	3.4	2.0	1.96	1.88	(.005)	(.004)	1.74
V	ppm	264	17	35.4	52.9	125	30	10.3	399
W	ppm	(.5)	(.4)	(.1)	(.1)	(.55)	(.06)	(.04)	(.40)
Y	ppm	25	13	12	30.4	21.3	<5	(.05)	37.1
Yb	ppm	2.1	1.06	.88	1.8	1.7	(.02)	(.01)	3.36
Zn	ppm	86	45	85	98	84	36	45	120
Zr	ppm	105	210	300	500	225	(7)	(3)	(190)

a) Concentration units, as %, ppm, or pp10^9 (see: O.G. Koch, Anal. Chim. Acta 82, 19 (1976)).

Values underlined = recommended.

Values in parantheses = magnitudes.

Other values = average.

Table 186. Minerals, rocks[a,b]
S: 25

No.	Type	Analysis, %												
		SiO_2	Al_2O_3	Fe_2O_3[c]	Fe_2O_3[d]	FeO	Na_2O	K_2O	MgO	CaO	F	P_2O_5	BaO	ZrO_2
SARM 1	NIM-G Granite	75.59	12.08	2.02	.72	1.29	3.32	4.98	.10	.80	.38			
SARM 2	NIM-S Syenite	63.72	17.33	1.40	1.19	.29	.43	15.34	.48	.70		.13	.29	
SARM 3	NIM-L Lujavrite	52.52	13.93	9.77	8.76	1.12	8.27	5.54	.36	3.30	.37			1.73
SARM 4	NIM-N Norite	52.43	16.64	9.00	1.05	7.24	2.44	.26	7.43	11.55				
SARM 5	NIM-P Pyroxenite	50.88	4.38	12.29	2.58	9.20	.37	.10	25.19	2.68				
SARM 6	NIM-D Dunite	38.86	.44	16.97	1.30	14.27	.10		43.30	.31				

No.	Analysis, %								Analysis, ppm									
	MnO	TiO_2	SrO	Nb_2O_5	Cr_2O_3	NiO	H_2O	CO_2	Ag	Au	B	Ba	Be	Bi	Br	C	Cd	Ce
SARM 1							.61	.12	<1	.008	<10	200	10	<3			<6	180
SARM 2							.28		<1		<10		<3	<3		230	38	12
SARM 3	.71	.51	.53	.19			2.42	.20	<1	.004	<10	450	20	<3			<6	280
SARM 4	.17	.19					.40	.10	<1	.003	<10	120	<3	<3	.15		<6	14
SARM 5	.21	.20			3.21		.26	.12	1		<10	56	<3	<3			<6	85
SARM 6	.20				.43	.27	.39	.42	<1		<10	20	<3	<3	.3		<6	10

a) Values underlined = average.
b) Other values = magnitude.
c) Total iron expressed as Fe_2O_3.
d) Fe_2O_3 by calculation from total Fe and FeO.

Table 186. (continued)

S: 25

No.	Analysis, ppm																				
	Cl	Co	Cr	Cs	Cu	Dy	Eu	F	Ga	Gd	Ge	Hf	K	La	Li	Lu	Mn	Mo	Nb	Nd	Ni
SARM 1	600	6	12	3	15	17	2		32	10	<6	12		100	10	3	140	<10	50	60	11
SARM 2	200	4	13	6	23	.6	.4	200	11		<6	.6		70	3	.05	108	.3	3	9	8
SARM 3	1000	<10	20	6	15		2		55		<6	275		170	70	1		<10		70	11
SARM 4	100	65	40		13		.6	300	19		<6	5		3	6	.2		<10	2	8	120
SARM 5	100	140		7	17		.2	200	13		<6			4	4			<10	3	40	545
SARM 6	400	206			8		.06	50	<3		<6		160	<3	5			<10	4	<6	

No.	Analysis, ppm																			
	P	Pb	Rb	S	Sb	Sc	Sm	Sn	Sr	Ta	Tb	Th	Ti	U	V	W	Y	Yb	Zn	Zr
SARM 1	75	38	320	125	.4	<5	20	<10	13	4	3	56	532	14	<5		130	12	60	300
SARM 2		13	520	120	.6	<5		<10	85	.3		1	251	.7	10		<10	<3	21	30
SARM 3	300	45	183	600	.3	<5		<10		22	.8	69		13	76		30	4	360	
SARM 4	130	<10	9	100	.4	38		<10	277	.4		.5		.5	225	400	7	<3	80	25
SARM 5	170	<10	4	140	.8	35		<10	40			1		.5	245			<3	100	20
SARM 6	150	<10	<5	100	.6	7		<10	5			<5	225	.5	45			<3	90	50

a) Values underlined = average.

b) Other values = magnitude.

c) Total iron expressed as Fe_2O_3.

d) Fe_2O_3 by calculation from total Fe and FeO.

Table 187. Rocks

S: 8

No.	Type	Analysis, %															
		SiO_2	Al_2O_3	Fe_2O_3	FeO	MgO	CaO	Na_2O	K_2O	H_2O	CO_2	TiO_2	ZrO_2	ThO_2	RE_2O_3[a]	Sc_2O_3	B_2O_3
SY-2	Syenite	60.07	12.15	2.31	3.61	2.66	8.03	4.37	4.52	(.41)	(.49)	.15	.04	(.04)	(.09)		(.03)
SY-3	"	59.71	11.70	2.46	3.61	2.63	8.30	4.17	4.20	(.49)	(.36)	.15	.04	(.11)	(.75)		(.04)
MRG-1	Gabbro	39.22	8.51	8.36	8.61	13.49	14.68	.72	.18	1.02	1.04	3.69	(.01)		(.01)	(.01)	

No.	Analysis, %																
	P_2O_5	V_2O_5	Nb_2O_5	F	S	Cr_2O_3	NiO	CoO	CuO	MnO	BaO	SrO	PbO	ZnO	Li_2O	Rb_2O	U_3O_8
SY-2	.44	.01		(.47)	.01					.32	.05	.03	.01	.03	.02	.02	.03
SY-3	.55	.01	(.02)	.66	.05					.33	.05	.04	.01	.03	.02	.02	.08
MRG-1	.08	.09	(.01)	(.03)	.06	.07	.02	.01	.02	.17	.01	.03		.02			

a) RE_2O_3: Total rare earth oxides.

Table 188. Rocks[a,b)]

S: 10

No.	Type	Analysis, %													
		SiO_2	Al_2O_3	Fe_2O_3	FeO	MnO	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	H_2O	CO_2	F
GR	Granite	65.90	14.75	1.65	2.16	.06	2.40	2.50	3.80	4.50	.65	.28	.10	.26	.10
GA	"	69.90	14.50	1.36	1.32	.09	.95	2.45	3.55	4.03	.38	.12	.09	.11	.05
GH	"	75.80	12.50	.41	.81	.05	.03	.69	3.85	4.76	.08	.01	.06	.14	.30
BR	Basalte	38.20	10.20	5.58	6.57	.20	13.28	13.80	3.05	1.40	2.60	1.04	.50	.86	.10
Mica-Fe	Biotite	34.40	19.40	4.45	19.17	.35	4.60	.45	.30	8.80	2.55	.45	.30	.20	1.56
Mica-Mg	Phlogopite	38.30	15.40	2.00	6.85	.26	20.40	.10	.12	10.00	1.67	.03	.30	.20	2.70
DR-N	Diorite	52.65	17.42	3.89	5.42	.21	4.50	7.08	3.00	1.70	1.11	.27	.23	.13	
UB-N	Serpentine	39.40	2.99	5.52	2.70	.12	35.00	1.12	.10	.02	.12	.03	1.16	.41	
BX-N	Bauxite	7.36	54.30	22.89	.29	.04	.13	.25	.09	.07	2.40	.13	(.42)	(.48)	
DT-N	Disthene	36.45	59.03	.55	.11	.008	.10	.16	.04	.12	1.40	.10	(.22)		

Table 188. (continued)[a,b]
S: 10

Element	Analysis, ppm									
	No.									
	GR	GA	GH	BR	Mica-Fe	Mica-Mg	DR-N	UB-N	BX-N	DT-N
Ag	(.2-<.2)	(.2-<.2)	(.47-.14)	(.2-.1)	(1-.2)		(1- <1)	(1- <1)	(<1)	(<1)
As					(18)					
Au	(.01-.025)				(<2.3)					
B	6	26	(2.3)	(5-11)	(1.7)		(9-14)	(121-146)	(18-60)	(9)
Ba	<u>1050</u>	<u>850</u>	<u>22</u>	<u>1050</u>	140	(4700)	<u>360</u>	(30-65)	(30)	(124)
Be	<u>5.5</u>	4	6	1	10		(2-5)	(3- <1)	(7- <3)	(<2)
Bi	(.15)	(<10-<.3)	(<10-<.3)	(<10-<.3)	(3-2.2)		(<10-<3)	(<10-<3)	(8- <5)	(<5- <3)
Br	(5.01)	(3)	(2)	(.78)	(5-7)					
C		(200)	(500)	(500)	(<690)					
Cd	(<6)	(<6)	(<6)	(<6)	(<6-<2.6)			(<6)	(<10-<6)	(<10-<6)
Ce	(102-82)	(90-55)	(104-30)	(172-130)	(165)					
Cl	(330-100)	300	100	(409-287)	(500-315)					
Co	<u>10</u>	<u>5</u>	1.5	<u>50</u>	<u>20</u>	(15-20)	<u>35</u>	<u>110</u>	(34-70)	(11)
Cr	<u>110</u>	10	6	<u>420</u>	<u>90</u>	(80)	<u>45</u>	<u>2200</u>	(175-330)	(210-242)
Cs	(5-7.2)	5	(1.9-6)	(1-2)	300	(52-80)	(9-20)	(60)		
Cu	<u>345</u>	<u>14</u>	<u>12</u>	<u>70</u>	4	(3-5)	<u>52</u>	30	(18-30)	(4-10)
Dy	(1.8)	(1.3-2.8)	(4.1-10)	(9)	(6.3)					
Er					(.47)					
Eu	(1.52)	(.98)	(.06)		(.87)					
Fe	(620-1340)	(90-180)	(80-120)	(40-130)	(20-710)					
Ga	<u>20</u>	<u>16</u>	<u>22</u>	20	<u>95</u>	(30)	25	(<1-18)	(68-115)	(29-30)
Gd		(3.2)	(6.8)	(7.2)	(3.2)					
Ge	(1-1.7)	1.5	(.7-2)	(.95-3)	(3-7)		(<6-<10)	(<6-<10)	(<6)	(<6)
Hf	(4.4)	(1.8)	(4)		(8.2-11)					

a) Values underlined: recommended values.

b) Values not underlined: proposed values.
Values in parantheses: magnitudes.

Table 188. (continued)[a,b]

S: 10

Element	Analysis, ppm									
	No.									
	GR	GA	GH	BR	Mica-Fe	Mica-Mg	DR-N	UB-N	BX-N	DT-N
Hg					(<3)					
Ho					(.75)					
I	(23)	(28)	(114)	(28)	(<.36)					
In	(<10)				(<8)					
Ir					(<.9)					
La	75	36	25	85	(<100-200)					
Li	55	100	42	12	1400	(53-250)	(29-50)	30		
Lu	(.2)	(.3)	(.6)		(<.28)					
Mo	18	1	4	3	(<1.1-51)		(3-6)	(<3-6)	(<7-12)	(<5-5)
Na					(3300)					
Nb	(~9.5-25)	13	85	(70-100)	(<100-300)	(90)	(4)			
Nd	(38)	(17-35)	(10-29)	(17-50)	(88-115)					
Ni	55	7	3	270	35	(100-110)	16	2000	(180-290)	(13-42)
Os					(1.3)					
Pb	32	26	50	16	17	(10-25)	75	(12-32)	(132-215)	(14-30)
Pd					(<1.2)					
Pr	(8)	(8-16)	(2)		(30-50)					
Pt					(<1.8)					
Rb	175	175	390	45	2300	(1060-1327)	75	(<3-50)		
Re					(<.85)					
Rh		(2)			(<.3)					
S	(80-225)	(<50-316)	(<50-2350)	400	(<2.2)					
Sb	(.268-<3)	(.212-<3)	(.063-<3)	(.138-<3)	(<.7)					
Sc	7	7	(1.5-7.4)	(.6-30)	(12-22)	(2.2)	(31-32)	(15-<31)	(41-60)	(<2)
Se					(<.95)					
Sm	(3-10.7)	(4.4-9)	(5-21)	(4-7.4)	(20-25)					

a) Values underlined: recommended values.

b) Values not underlined: proposed values.
Values in parantheses: magnitudes.

Table 188. (continued)[a,b]
S: 10

Element	Analysis, ppm									
	No.									
	GR	GA	GH	BR	Mica-Fe	Mica-Mg	DR-N	UB-N	BX-N	DT-N
Sn	10	4	10	8	70		(6)	(2-5)	(10-25)	(<2-5)
Sr	550	305	10	1350	6	(25-27.8)	400	10	(89)	(17)
Ta					(<21-35)	(4.2)	(1)		(6)	
Tb					(2.3)					
Th	(35.4-72)	15	(9.5-155)	(12.6-57)	(55-170)	(1)	(22)		(65)	
Tl	(2.1)	(1.9)	(2.2-5)	(<1)	(17.5-19)					
Tm					(.19)					
U	(21.35)	(1.7-4.86)	(10-19.71)	(.9-2.65)	(35-94)	(1.2)	(1-2)			
V	65	36	5	240	135	(75-88)	225	100	(275-450)	(128-180)
W		(12)		(32)	(4.9-16)	(.3)				
Y	19	18	70	27	(10-29)		(19-20)	(15)	(52)	(<10)
Yb	2	2.5	8	4	(<.28-7)		(4-8)	(1.5)	(11)	(<2)
Zn	60	75	80	160	1350	(210-300)	150	(85-89)	(42-113)	(23-70)
Zr	180	140	160	240	(300-940)		(103-153)	(<100)		

a) Values underlined: recommended values.

b) Values not underlined: proposed values.
Values in parantheses: magnitudes.

8.3. Noble metal ores and concentrates

Table 189. Gold ore
S: 8

No.	Type	Analysis, %, or where noted, ppm						
		O	Si	Al	Fe	Ca	Na	K
MA-1	Gold ore	(45)	(24.9)	(5.7)	(5.3)	(4.4)	(1.5)	(4.2)

No.	Analysis, %, or where noted, ppm						
	S	C[a]	C[b]	H_2O[c]	H_2O[d]	L.O.I.[e]	Au
MA-1	(1.5)	(2.1)	(1.8)	(2.0)	(.1)	(6.5)	17.8 ppm

a) Total carbon.
b) Form CO_2.
c) At 1000°C.
d) At 105°C.
e) Loss on ignition.

Table 190. Platiniferous black sand
S: 8

No.	Type	Analysis, %, or where noted, ppm				
		Fe	Ca	Al	Mg	Pt
PTA-1	Platiniferous black sand	(63.0)	(1.20)	(3.63)	(.62)	3.05 ppm

Table 191. Noble-metals-bearing nickel-copper matte
S: 8

No.	Analysis, ppm, or where noted, %								
	Ni	Cu	Fe	S	Pt	Pd	Rh	Au	Ag
PTM-1	(44.8%)	(30.2%)	(1.58%)	(21.6%)	5.8	8.1	.9	1.8	66

Table 192. Noble-metals-bearing sulphide concentrate
S: 8

No.	Analysis, ppm, or where noted, %								
	Fe	S	Cu	Ni	Pt	Pd	Rh	Au	Ag
PTC-1	(26.9%)	(23.5%)	(5.2%)	(9.4%)	3.0	12.7	.62	.65	5.8

Table 193. Precious-metal ore
S: 36, 25

No.	Analysis, %									
	H_2O[a]	H_2O[b]	SiO_2	MgO	FeO	Al_2O_3	CaO	Fe_2O_3	Na_2O	Cr_2O_3
SARM 7	(.15)	(.77)	(51.8)	(20.1)	(8.9)	(8.3)	(5.4)	(2.0)	(.8)	(.60)

No.	Analysis, %, or where noted, ppm									
	S	CO_2	TiO_2	Mn_3O_4	P_2O_5	K_2O	Cu	Ni	V	Ba
SARM 7	(.42)	(.23)	(.21)	(.20)	(.10)	(.11)	(.09)	(.17)	(60ppm)	(50ppm)

No.	Analysis, ppm									
	Sr	Co	Pb	Zn	Zr	F	Y	La	Rb	Nb
SARM 7	(50)	(36)	(24)	(23)	(10)	(5)	(5)	(5)	(4)	(1)

No.	Analysis, ppm								
	Pt	Pd	Au	Ag	Rh	Ru	Ir	Os	PGM[c] + Au
SARM 7	3.74	1.53	.31	.42	.24	.43	.074	.063	5.71

[a]Hygroscopic H_2O. [b]Combined H_2O.

[c]PGM = sum of the precious metals, with the exception of silver, that are determined as a group.

8.4. Refractories, glasses, oxides

Table 194. Refractories
S: 20

No.	Type	Analysis, %						
		SiO_2	Al_2O_3	Fe_2O_3[a]	FeO	TiO_2	ZrO_2	MnO
103a	Chrome refractory	4.6	29.96		12.43	.22	.01	.11
198	Silica refractory		.16	.66		.02	<.01	.008
199	" "		.48	.74		.06	.01	.007

No.	Analysis, %							
	P_2O_5	Cr_2O_3	CaO	MgO	Li_2O	Na_2O	K_2O	L.O.I.[b]
103a	.01	32.06	.69	18.54				
198	.022		2.71	.07	.001	.012	.017	.21
199	.015		2.41	.13	.002	.015	.094	.17

[a]Total iron as Fe_2O_3.

[b]Loss on ignition.

Table 195. Magnesite
S: 7

No.	Type	Analysis, %				
		SiO_2	TiO_2	Al_2O_3	Fe_2O_3	CaO
389	High purity magnesite	.89	$.01_5$	.23	.29	1.66

No.	Analysis, %						
	MgO	K_2O	Na_2O	Li_2O	Cr_2O_3	MnO	B_2O_3
389	(96.7)	.01	.03	(<.02)	.28	.008	.029

Table 196. Glasses
S: 20

No.	Type	Analysis, %								
		SiO_2	PbO	Al_2O_3	Fe_2O_3	ZnO	MnO	TiO_2	ZrO_2	CaO
89	Lead-barium	65.35	17.50	.18	.049		.088	.01	.005	.21
91	Opal	67.53	.097	6.01	.081	.08	.008	.019	.0095	10.48
93a	High-boron	80.8		2.3	.029			.012	.03	<.02

No.	Analysis, %											
	BaO	MgO	K_2O	Na_2O	B_2O_3	P_2O_5	As_2O_5	As_2O_3	SO_3	Cl	F	L.O.I.[a)]
89	1.40	.03	8.40	5.70		.23	.36	.03	.03	.05		.32
91		.008	3.25	8.48		.022	.102	.091		.014	5.72	
93a		<.01	.01	4.0	12.6							

[a)] Loss on ignition.

Table 197. Nickel oxide
S: 20

No.	Type	Analysis, %								
		Mn	Si	Cu	Cr	Co	Ti	Al	Fe	Mg
671	Oxide 1	.13	.047	.20	.025	.31	.024	.009	.39	.030
672	Oxide 2	.095	.11	.018	.003	.55	.009	.004	.079	.020
673	Oxide 3	.0037	.006	.002	.0003	.016	.003	.001	.029	.003

Table 198. Trace element standards
S: 20

No.	Type
607	Trace elements in feldspar
608	" " in glass, set: 2 each 614 and 616
609	" " in glass, set: 2 each 615 and 617
612, 613	" " in glass, 50 ppm
614, 615	" " in glass, 1 ppm
616, 617	" " in glass, 0.02 ppm
618	" " in glass, set: 1 each 610, 612, 614 and 616
619	" " in glass, set: 1 each 611, 613, 615 and 617

No.	Analysis, ppm								
	Sb	Ba	B	Cd	Ce	Cr	Co	Cu	Dy
607									
612-613		(41)	(32)		(39)	(37.8)	(35.5)	(37.7)	(35)
614-615	(1.06)		(1.30)	(.55)		(.99)	.71	1.34	
616-617	(.078)		(.20)					(.65)	

No.	Analysis, ppm								
	Er	Eu	Gd	Ga	Au	In	Fe	La	Pb
607									
612-613	(39)	(36)	(39)		(5)		51	(36)	38.57
614-615		(.99)		(1.3)	(.5)	(.75)	13.5	(.83)	2.32
616-617				(.23)	(.18)	(.26)	(11)	(.034)	1.85

No.	Analysis, ppm								
	Mn	Mo	Nd	Ni	K	Re	Rb	Sm	Sc
607							523.90		
612-613	(39.6)	(36.94)	(36)	38.8	(64)	(6.67)	31.4	(39)	
614-615	(1.41)	(.79)		(.95)	30	(.17)	.855		(.59)
616-617	.62				29	(.004)	.0998		(.026)

No.	Analysis, ppm								
	Ag	Sr	Tl	Ta	Th	Ti	U	Yb	Zn
607		65.485							
612-613	22.0	78.4	15.7	(44)	37.79	(50.1)	37.38	(42)	
614-615	.42	45.8	.269	(.74)	.748	(3.1)	.823		(2.43)
616-617		41.72	(.0082)	(.025)	.0252	(2.5)	.0721		

Glass-nominal composition: 72% SiO_2, 12% CaO, 14% Na_2O, and 2% Al_2O_3.

In addition to the elements listed above, the Glass SRM's contain the following 26 elements: As, Be, Bi, Cs, Cl, F, Ge, Hf, Hg, Li, Lu, Mg, Nb, P, Pr, Se, S, Te, Tb, Tm, Sn, W, V, Y, and Zr.

Size of Glass SRM's: wafers 3 mm and 1 mm thick.

9. High-purity substances

Table 199. Aluminium
S: 3

No.	Form	Analysis, ppm										
		Fe	Si	Cu	Zn	Mg	Mn	Ni	Pb	Ga	Ti	Cr
3306	C	5	15	6	4	3	1	0	7	1	0	0
3315	C	16	20	13	12	8	4	3	8	6	0	4
3320	C	37	50	30	30	15	12	11	13	26	10	12
3326	C	80	100	65	70	11	26	27	35	113	20	28
3333	C	160	200	125	140	130	55	53	65	522	50	56
3295	C	300	400	250	280	210	105	108	130	41	100	115

Form C: discs 55 Ø x 33 mm.

Table 200. Aluminium
S: 24, 35

No.	Analysis, ppm				
	Fe	Si	Cu	Mg	Na
SR-1	1	1	1	2	1
SR-2	2	3	2	1	1
SR-3	4	4	3	1	1
SR-4	7	4	3	5	1
SR-5	18	8	7	10	2
SR-6	16	15	14	1	1
SR-7	20	19	17	15	1
SR-8	27	25	24	2	1

Disc 55 Ø x 33 mm. Pin 6 Ø x 150 mm.

Table 201. Aluminium
S: 28

No. /	Type	Analysis, ppm								
		Si	Fe	Cu	Mn	Mg	Zn	Na	Ca	B
568/2	Al 99,99	8	70	25				110		
568/3		8	98	25				45		
568/4		7	88	25				37		
716/23		12	12	10	6	15	10	7	10	16

Discs 38 Ø x 30 mm.
Discs 60 Ø x 25 mm.

Table 202. Aluminium
S: 28

No.	Type	Analysis, ppm													
		Si	Fe	Cu	Mn	Mg	Zn	Ti	Cr	Ni	V	Na	Ca	B	Ga
SR5N/4	A199,999-	1	2	.8	.1	3	.2	.3	n.d.	n.d.	n.d.	.4	.1	1.3	n.d.
SR5N/20	A199,9	3	8.7	8	<5	<5	<10								
113/01		10	20	3	2	6	<3	<10	<5	3		4		75	
114/01		40	70	20	50	30	10	<10	10	7	9	6		200	
115/01		60	60	30	30	40	30	20	30	30	40	10			
116/01		90	90	50	50	80	50	40	50	50	60	20			4
116/02		110	230	60	40	70	70	20	60	50	40	4			
Raf-130		80	24	20		10				.6					

Discs 38 Ø x 30 mm.
Discs 60 Ø x 25 mm.

Table 203. Aluminium
S: 28

No.	Type	Analysis, ppm									
		Si	Fe	Cu	Mn	Mg	Zn	Ca	Na	B	Cd
F 559	High-purity aluminium (raffinal)	22	14	9.3			70				
F 564		26	6	3							
F 663		16	5.2	2							
F 682		13	5.9	3.6							

Rods 6 Ø x 250 mm.

Table 203. (continued)
S: 28

No.	Type	Analysis, ppm									
		Si	Fe	Cu	Mn	Mg	Zn	Ca	Na	B	Cd
F 682/2	High-purity aluminium (raffinal)	6	5.5	3.2							
716/14		1	3.3	1.9							
716/24		13	12	10	6	20	10	10	5	15	
716/34		39	36	30	17	57	30	10	6	80	
716/44		100	75	72	60	100	110		12	300	
F 720/3		24	36	33		27	32				
F 760/1		11	8	1.9		<2				16	
F 760/2		18	27	12		12	20			58	
F 760/3		47	122	36		19	40			170	
F 760/4		122	390	102		34	110			380	
F 746/R8		320	250	4							
2182/1										60	550
2182/2										15	19
2182/3										5	3

Rods 6 Ø x 250 mm.

Table 204. Iron (chip form)
S: 7

B.C.S.[a] No.	E.S.[b] No.	Type	Analysis, %						
			C	Si	Mn	P	S	Cr	Mo
149/3		High-purity iron	.002	.002	.019	.005	.008	<.001	<.001
260/4	053-1		.0015	.003	.002	.006	.004	.002	<.002

B.C.S. No.	E.S. No.	Analysis, %								
		Ni	Al	As	Co	Cu	N	Sn	V	O
149/3		.004	(<.003)	<.001	.007	<.001		<.002	<.001	
260/4	053-1	.003	(.001)	.009	.007	.003	(.002)			(.11)

a) British Chemical Standards. b) Euro-Standards.

Table 205. Various metals
S: 20

No.	Type	Size	Analysis, ppm															
			Cu	Ni	Sn	Pb	Zr	Ag	Mg	In	Fe	O	Pd	Au	Rh	Ir	Cd	Ti
685W	Gold(wire)	a)	.1					(.1)		.007	.3	(2)						
685R	Gold(rod)	b)	.1					(.1)		.007	.2	(<2)						
680L1	Platinum(wire)	c)	.1	<1		<1	<.1	.1	<1		.7	4	.2	<1	<.2	<.01		
680L2	Platinum(wire)	d)	.1	<1		<1	<.1	.1	<1		.7	4	.2	<1	<.2	<.01		
681L1	Doped-platinum(wire)	e)	5.1	.5		12	11	2.0	12		5	7	6	9	9	11		
681L2	Doped-platinum(wire)	f)	5.1	.5		12	11	2.0	12		5	7	6	9	9	11		
682	Zinc	g)	.042		(.02)			(.02)			(.1)						(.1)	
683	Zinc	h)	5.9		(.02)	11.1		1.3			2.2						1.1	(.2)

a) 1.4 Ø x 102 mm. b) 5.9 Ø x 25 mm. c) 0.51 Ø x 102 mm. d) 0.51 Ø x 1000 mm. e) 0.51 Ø x 102 mm.
f) 0.51 Ø x 1000 mm. g)h) Semicircular segments 57 Ø x 19 mm.

Table 206. Various metals (chip form)
S: 7

No.	Type	Analysis, ppm																				
		Cu	Sn	Zn	Pb	P	Ni	Fe	Al	Mn	Sb	As	Si	Bi	Tl	Ag	Cd	C	In	Te	O	Co
192e	Tin 99.997	.5			3.5		<1	1.5			7	<1		<1				10	<1			
192f	Tin 99.997	.8		.3	3.5		<1	1			7	<.5		<1			<.5	10	<.5			
194e	Zinc 99.99	<5	<1		20			10				<.5			<.5		<5		<5			
195f	Aluminium 99.84	10	<10					850		10			700									
197e	Copper 99.95		<5	<10	<1	<10	4	<10	<10	<10	<2	<10	<10	<1		10	<2	10		<10	190	<1
197f	Copper 99.95		<5	<10	<1	<10	2	<2	<5	<5	<2	<10	<10	<1		8	<1	<15		<10	270	<1
198e	Aluminium 99.996	10						10					20									
210e	Lead 99.996	6	<20	<50			<10	5	<10	<10	<20	<20		8	10	1	<1					<50

Table 207. Zinc
S: 34, 19

No.	Type	Analysis, %				
		Pb	Cd	Fe	Sn	Cu
1	Zinc pure	.0014	.0002	.0006	.000	.0002
2		.0026	.001	.002	.0011	.001
3		.0057	.003	.0035	.0030	.003
4		.012	.0064	.0071	.0064	.0068
5		.029	.0105	.0185	.011	.011

Rods 10 Ø x 250 mm. Discs 65 Ø x 7 mm.

IV. Suppliers of high-purity substances

No.	Supplier	Available substances+)
1	AIRCO Industrial Gases 575 Mountain Avenue Murray Hill, N. J. 07974, USA	3
2	a) L'Air Liquide 57, Avenue Carnot F-94500 Champigny, France b) Deutsche L'Air Liquide Edelgas GmbH Postfach 2711 Karlstrasse 104 D-4000 Düsseldorf, West Germany	3
3	Air Products + Chemicals, Inc. P.O. Box 538 Allentown, Pa. 18105, USA	3
4	Aluminium Pechiney, Service FD/CS B.P. 787-08 / Paris 23 Bis, Rue Balzac 75 Paris 8, France	5
5	Aremco Products,Inc. P.O.Box 429 Ossining, N.Y. 10562, USA	1, 2, 4
6	ASARCO. Inc. 120 Broadway New York, N. Y. 10005, USA	1
7	Atomergic Chemetals Corp. 100 Fairchild Avenue Plainview, N. Y. 11803, USA	1, 2
8	a) J.T.Baker Chemical Co. 222 Red School Lane Phillipsburg, N. J. 08865, USA b) J.T.Baker Postfach 420 H.S.Richardson-Strasse D-608 Gross-Gerau, West Germany	2

No.	Supplier	Available substances+)
9	Brammer Standard Co., Inc. 5607 Fountainbridge Lane Houston, Texas 77069, USA	1
10	Bureau of Analysed Samples, Ltd. Newham Hall, Newby Middlesbrough Cleveland, England	1
11	Callery Chemical Company Callery, Pennsylvania 16024, USA	9
12	a) Cerac, Inc. P.O.Box 1178 Milwaukee, Wis. 53201, USA b) European Representative: see Micropure	1, 2, 4
13	Cristaltec Commissariat à l'Energie Atomique, CEN B.P.No. 85 Avenue des Martyrs F-38041 Grenoble Cedex, France	1, 2
14	Electronic Space Products, Inc. 854 So. Robertson Blvd. Los Angeles, Calif. 90035, USA	1, 2, 4
15	Fairmount Chemical Co., Inc. 117 Blanchard St. Newark, N.J. 07105, USA	1, 2
16	Great Western Inorganics 17400 Highway 72 Golden, Colorado 80401, USA	2, 4
17	Indium Corporation of America 1676 Lincoln Avenue P.O.Box 269 Utica, New York 13503, USA	8
18	Kawecki Berylco Industries, Inc. 220 East 42nd Street New York, N.Y. 10017, USA	1, 2

No.	Supplier	Available substances+)
19	a) Leico Industries, Inc. 250 West 57th Street New York, N.Y. 10019, USA b) European Representative: Franco Corradi Casella Postale 98 I - 20017 RHO (Milano), Italy	1, 4
20	a) Materials Research Corp. (MRC) Orangeburg, N.Y. 10962, USA b) Materials Research Corp. (MRC) Pollinger Strasse 5 D-8000 München 70, West Germany	1, 2
21	a) Matheson Gas Products P.O.Box 85 932 Paterson Plank Rd. E. Rutherford, N.J. 07073, USA b) Matheson Gas Products Nijverheidstraat 23B B-2431 Oevel, Belgium	3
22	J. Matthey Chemicals Ltd. 74 Hatton Garden London EC1P 1AE, England	1, 2, 4, 10
23	Adolf Meller Co. P.O.Box 6001 Providence, Rhode Island 02904, USA	6
24	E. Merck Postfach 4119 D-6100 Darmstadt, West Germany	2
25	Mercure Industrie 13, Rue Saulnier F-92 Puteaux, France	7
26	Messer Griesheim GmbH Industriegase Postfach 4709 Homberger Strasse 12 D-4000 Düsseldorf 1, West Germany	3

No.	Supplier	Available substances+)
27	Metallurgie Hoboken-Overpelt A. Greinerstraat 14 B-2710 Hoboken, Belgium	1, 2
28	Metals Research Ltd. Melbourn Royston Hertfordshire SG8 6EJ, England	1, 2, 4
29	Micropure Valkenkamp 31 Driebergen, Holland	1, 2, 4
30	Office of Standard Reference Materials Room B 311, Chemistry Building National Bureau of Standards Washington, D.C. 20234, USA	1
31	Pierce Inorganics B.V. P.O.Box 1151 Rotterdam, Holland	1, 2, 4
32	Precision Gas Products, Inc. 681 Mill Street Rahway, N.J. 07065, USA	3
33	Reactor Experiments, Inc. 963 Terminal Way San Carlos, California 94070, USA	1
34	Research Chemicals Div. of Nucor Corp. P.O.Box 14588 Phoenix, Ariz. 85063, USA	4
35	Research Organic/Inorganic Chemical Corp. 11686 Sheldon Street Sun Valley, Calif. 91352, USA	1, 2, 4
36	Ringsdorff-Werke GmbH Königswinterer Strasse 1 D-5300 Bonn - Bad Godesberg, West Germany	10

No.	Supplier	Available substances+)
37	Schunk und Ebe GmbH Postfach 6420 D-6300 Giessen, West Germany	10
38	Seishin Trading Co., Ltd. Sanshin Building 43, Sannomiya-cho 1-chome Ikuta-ku, Kobe, Japan	5
39	Serva International Postfach 105260 Karl-Benz-Strasse 7 D-6900 Heidelberg 1, West Germany	1, 2, 4
40	Spex Industries, Inc. 3880 Park Avenue Metuchen, N.J. 08840, USA	1, 2, 4
41	Sumitomo Chemical Co., Ltd. 15, 5-chome Kitahama, Higashiku Osaka 541, Japan	5
42	Swiss Aluminium Ltd. Research and Development Division Dept. FCAL Bad.Bahnhofstrasse CH-8212 Neunausen/Rhf., Switzerland	5
43	Ultra Carbon Corp. P.O.Box 747 Bay City, Mich. 48706, USA	10
44	Union Carbide Corp. Carbon Products Division 270 Park Avenue New York, N.Y. 10017, USA	10
45	a) Ventron Corp. Alfa Division P.O.Box 299 152 Andover Street Danvers, Mass. 01923, USA b) Ventron GmbH Postfach 6540 Benzstrasse 3 D-7500 Karlsruhe 1, West Germany	1, 2, 4

No.	Supplier	Available substances+)
46	Zinc et Alliages B.P.No. 245 34, Rue Collange F-92 Levallois-Perret, France	11

+) 1 = Elements, metals
2 = Compounds of the elements
3 = Gases
4 = Rare earths (metals and/or compounds)
5 = Aluminium
6 = Aluminium oxide
7 = Mercury
8 = Indium (metal and compounds)
9 = Alkali metals (Na, K, Rb, Cs)
10 = Graphite (carbon)
11 = Zinc