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STANDARDIZATION OF STEEL AND STEEL PRODUCTS TO FACILITATE CO-ORDINATION OF NATIONAL, INTERREGIONAL, AND INTERNATIONAL SPECIFICATIONS AND TO PROMOTE TRADE AMONG DIFFERENT COUNTRIES[1/]

by

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1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. The document is presented as submitted by the author, without re-editing.

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by

B. S. Krishnamachar, India

SUMMARY

Rapid changes in the political map of the world during the last two decades or so have stimulated significant developments in the economic and industrial life of many countries. Reconstruction programmes undertaken by newly independent nations have underscored the need for developing national resources and meeting their specific requirements in respect of raw materials as well as industrial products. Instead of following the specifications of a few industrially advanced countries, developing nations have set about the task of laying down their own standards at national as well as regional levels. Steel and steel products as key materials of construction and plant and machine building, have naturally received considerable attention in this regard.

The coming into being of a multiplicity of specifications has thus given rise to new problems in the interchange of steel and steel products between nations.

Since its independence in 1957, India too faced this problem. Rapid industrialization of the country led to the import of technical knowhow, materials and equipment from a number of foreign countries for the establishment of various industries.

* This is a summary of a paper issued under the same title as ID/WG.14/33.

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In almost all cases, equipment, manufacturing schedules and specifications for raw materials were based on practices followed in the donor country, thus leading to the operation of a host of different specifications for engineering materials. As a consequence, most of the manufacturers were compelled to depend heavily on imported materials for their manufacturing programmes.

To deal with the situation, a programme of rationalization and formulation of specifioations for all types of steels including alloy and special steels, was undertaken by the Indian Standards Institution in 1956. The programme resulted in the formulation of the following Indian Standard:

IS: 1570-1961 Schedules for Wrought Steels for General Engineering Purposes

The Standard lists 156 varieties of steel compared to more than 1500 varieties then being used in the country. To achieve further economy, the number of steels has since been reduced to only 86 varieties, thus facilitating creation of indigenous production capability at reduced cost and also easy availability.

As a further aid to the industry, IS: 1871-1962 "Commentary on Indian Standard wrought steels for general engineering purposes" was published with a view to assisting the user to select proper steels for specific purposes. This commentary deals with steels in groups according to their metallurgical behaviour and heat treatment.

Conservation of steel through efficient use of available resources has been achieved through rationalization in the number of steel sections and improvements in their production. Four years of intensive study at ISI as well as by expert committees has resulted in the formulation of Indian Standards on improved and rationalized series of beams, channels, angles, tee bars and bulb angles. All these standards have been based on metric system of measurement.

Member-countries of the European Coal and Steel Community (CECA) have also done similar work by developing a new series of beam sections which are more economical than those earlier rolled in these countries primarily with a view to achieving eoonomy and also competing with other materials of building construction. Similar developments have taken place in the UK and the USSR.

Attempts have also been made to establish regional standards taking into consideration raw materials and techniques available in each region. Standards now being evolved among the Latin American countries and the efforts that have already been put in by the CECA countries and many of the East-European countries are typical examples of regional standardization.

All these developments underline the need for unifying national and regional specifications so as to facilitate interchangeability and mutual exchange of materials between different countries. Taking note of this imperative need, the International Organization for Standardization, through its Technical Committee ISO/TC 17 - Steel, has been making efforts to formulate recommendations on specifications and methods of tests for steels used in industry. The Committee has so far published 47 Recommendations and more are under preparation. India is trying to adopt these Recommendations as far as possible in preparing her national standards. A similar approach by other countries would go a long way in reducing varieties of steel used in industry, leading to greater collaboration between nations and promotion of international trade.

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INTRODUCTION

Intensive programmes of industrial development the world over have given a bigh push to the production of steel and steel products in recent years. World steel production in 1967 approximated 525 million tons, almost double the tonnage produced ten years ago. The types, qualities and shapes of steel and steel products that are produced have also considerably increased during the past several years. A number of countries have already developed standard specifications for steel and steel products, while some others are in the process of doing so to meet their specific requirements.

Standardization and variety reduction of steels and steel products is one of the important methods by which conservation and effective utilization of steel can be made possible. In this article a study of different standards on steels and steel products has been made and the need for co-ordination of the existing national standards at regional and international levels has been stressed.

A general study of the development of specifications current in different countries indicates that industrially advanced countries first developed specifications for steels and these were later adopted by several other countries. For example, the ASTM standards are widely used in Latin American, Middle East and South East countries of Asia. Similarly, the British, German and USSR specifications are also widely used in Middle East, South East and East European countries. The reason for such a trend is obvious. Many of the developing countries have to depend on other countries for their requirements of steels and perforce adopt the specification of the country concerned. This situation, although logical, has created problems for the developing as well as for the developed countries. For example, in India, a number of industrial units have entered into collaboration with different countries from where such assistance was forthcoming. A survey conducted some time ago indicated that over 1500 varieties of steels were in use in India thus posing innumerable problems both from the point of import and indigenous production. On the other hand, similar problems confront the developed countries in as much as they have to cater to a variety of specifications for export purposes. In the following paragraphs, it is proposed to deal with these aspects in greater detail.

Standard Specifications for Steels

A review of the work done in India on formulation of standard specifications for steels would enable appreciation of the need for development of regional and international standards.

Rapid industrialization of the country soon after Independence in 1947 led to the imports of technical know-how, materials and equipment from a number of foreign countries for the establishment of various industries. In almost all cases the equipment manufacturing schedules and the specifications for raw materials were based on the practices followed in the donor country. This led to the operation of a multiplicity of specifications for engineering materials. Furthermore, India had not established an alloy and special steel industry although during the Second World War the manufacture of steels covering practically the entire range from carbon steels to quality aircraft steels and ordnance steels was undertaken in the country. As a consequence, most of the manufacturers were compelled to depend heavily on imported materials for their manufacturing programme.

On the recommendation of the Government, the Indian Standards Institution (ISI) took up in 1956 a programme of rationalization and formulation of specifications for alloy and special steels on a priority basis. A separate technical committee was set up under the Structural and Metals Division of ISI to deal with the subject. As a first step, a detailed questionnaire was issued to all concerned for collecting data regarding the production and use of alloy and special steels in the country. To assist ISI in this work, the services of an expert from UK were made available to the Insitution under the Colombo plan.

A special study group was constituted to scrutinize in detail the data collected and formulate proposals for rationalization keeping in view the importance of using indigenous raw materials and the conservation of some of the most strategic alloying elements in steel such as nickel and molybdenum for which India had to depend entirely on imports.

A detailed study of the information thus collected indicated that instead of restricting the scope of work to the rationalization of alloy and special steels only, it would be advantageous to undertake rationalization of all types of steels. Accordingly, co-ordinated statements were prepared indicating Indian and overseas steel specifications then in vogue under the following broad categories:

a) Steels specified by tensile properties but without detailed chemical composition, and

b) Steels specified by chemical composition.

These were further sub-divided into:

1. Carbon steels,
2. Carbon and carbon-manganese free cutting steels
3. Alloy steels other than stainless and heat resisting steels
4. High alloy steels - stainless and heat resisting steels, and
5. Carbon and alloy tool steels.

In these statements steels of similar chemical and physical properties and end-use were grouped together. After careful scrutiny, the study group recommended certain steels in each group which could meet Indian requirements for all types of machine tools and components. Typical examples of this kind of exercise are illustrated in Annex I (Tables 1 - 6)

On the basis of these recommendations, a document detailing draft Indian Standards Schedules was prepared and circulated to all concerned for eliciting comments. Discussions were held with major steel consuming industries and as a result of these deliberations, IS:1570-1961 Schedules for wrought steels for general engineering purposes, was published. Besides the broad categories mentioned above, an additional schedule for carbon steel wire was also included in this standard at the finalization stage.

Schedule I is applicable to carbon and low alloy steels which are put into service in the hot rolled, normalized or annealed condition in the form of plate, sheet, strip, sections, bars, forgings, and tubes, where the main criterion in selection and inspection of steel is the tensile property. In this group specific mention may be made of structural steels St 42, St 52 and St 55 which replaced a number of British, American and Indian Railway Specifications then in vogue. The Schedule also covers steel St 63 for tramway and railway axles and St 66 for railway wheels and tyres.

Schedule II is applicable to carbon steels which are to be supplied to a definite chemical composition. In addition to the specified mechanical properties, limits for carbon and manganese are laid down. Keeping in view the requirements of the industry, efforts have been made to strike a balance so that an excessive number of steels is not included in the Schedule. The overlapping of carbon ranges is, however, deliberate so as to allow steel producers greater flexibility in the allocation of the material. Further, since some of the carbon steels are also used in the hardened and tempered condition for certain tensile strengths, a range of 0.60 to 0.90 per cent manganese has been kept for steels C35Mn75, C40, C45, C50 and C55Mn75 to ensure satisfactory hardening particularly in heavier sections such as for laminated springs. Rail steel C50Mn1 has also been included in the Schedule. The use of innumerable varieties of carbon steels in terms of British and American specifications has thus been simplified to 27 carbon steels in this group.

Schedule III is applicable to carbon and carbon-manganese free cutting steels supplied to specified composition. The maximum tonnage of carbon-free cutting steel is supplied to steel 13S25 in the country. It corresponds to British En1A, SAE 1112 and German 15S20. Also included in the Schedule are 1.3 to 1.7 manganese free cutting steels to be used in the hardened and tempered condition.

Schedule IV is applicable to alloy steels other than stainless and heat resisting steels supplied to specified composition. The steels covered in this Schedule are silicon, manganese, molybdenum, chromium, chromium-molybdenum (creep resisting) nickel-chromium and nickel-chromium-molybdenum steels. In rationalizing these steels, specific care has been taken to conserve as much nickel and molybdenum as possible and to develop steels using indigenously available alloying elements. For example, chrome steel 40Cr1 would comply with some of the combinations of tensile strengths and ruling sections for which one per cent chromium-molybdenum steel En19 may have to be used, thereby saving molybdenum. Further, manganese-molybdenum steel 35Mn2Mo45 has been included in place of En100 in order to save 0.75 per cent nickel. Another example worth mentioning in this connection is the inclusion of 1.5 per cent nickel-chromium-molybdenum steel 40Ni2Cr1Mo28 which would satisfy some combinations of higher tensile strength and larger ruling sections in place of En30A and En30B with 4.5 per cent nickel. Nickel-chromium-molybdenum steel 2.5 per cent 40Ni3Cr65Mo55 has been included to satisfy the remaining combinations of high nickel steels. Silico-manganese spring steels 37Si2Mn90 and 55Si2Mn90 and chrome-vanadium spring steel 50Cr1V23 are the other important examples of rationalization.

Schedule V is applicable to steels with high alloy content primarily for corrosion and heat resisting purposes and which are supplied to specified composition. In this group also rationalization has been attempted keeping in view the conservation of nickel and molybdenum as far as possible without at the same time impairing the properties or creating any difficulty in production.

Schedule VI is applicable to carbon and alloy steels supplied to specified composition. This Schedule covers water hardening steels, oil hardening steels, non-distorting steels, shock resisting steels, hot working steels, die steels, high speed steels and mould steels. In order to determine which of the many British, American and German tool steels should be included in this Schedule, a detailed study was made essentially on the basis of the types of alloys and rationalization was accordingly carried out in this Schedule. Of course, water hardening carbon steels in Schedule II which are suitable for tools of simple designs and small sections have been included in this Schedule. Where exacting conditions of service are encountered, benefits have been derived by the addition of small quantities of vanadium which slightly increases the thoughness and resistance to shock and fatigue and provides a structure of finer grains. Such steels included in the Schedule are used for cold heading dies, blanking dies, hammer pistons and for similar other applications. A small amount of chromium has been added for providing adequate hardening in larger sections and improving wear.

It is to be noted that the number of steels covered in IS:1570-1961 was only 156 compared to more than 1500 varieties being used in the country. The technical committee responsible for the preparation of this standard also felt that the number of steels included could be further reduced after some time when the industry gained experience with regard to the use of alternate steels.

As a further step, work was initiated by major steel consuming industries for rationalising the use of steel in their field. Here also some encouraging results have been achieved. For example, machine tool industry in the country has been able to rationalize its requirements to one carbon and two low alloy constructional steels.

The Textile Machinery Manufacturers' Association in India studied their requirements of steels as per IS:1570-1961 and some rationalization has been achieved. Similarly, the automobile industry has reduced its requirements to about 28 steels.

To achieve further economy, the number of steels has since been reduced to only 86 varieties.

As a further aid to the industry, IS:1871-1962 Commentary on Indian Standard Schedules for wrought steels for general engineering purposes, has been published with a view to assisting the users to select proper steels for specific purpose. In this Commentary, steels have been discussed in groups according to their metallurgical behaviour and heat treatment. For the benefit of users, some of the typical applications of standard steels have been listed in this Commentary.

Also, a comparison of Indian Standard Specification on steels with overseas standards such as American (SAE, AISI, ASTM, ASM) British, German, Japanese and Russian standards (IS:1870-1965 Comparison of Indian and overseas standards for wrought steels for general engineering purposes) has been published. For ease of reference, steels in this statement have been arranged in the ascending order of maximum carbon content thus bringing together, as far as possible, similar compositions.

In order to facilitate international trade and to co-ordinate various national standards for steel including definitions, specifications and methods of tests, a technical committee at the international level ISO/TC 17 - Steel, was set up in 1948 with UK as its Secretariat.

Under the main Technical Committee, a number of Working Groups and Sub-committees have been set up to deal with the various subjects under its programme of work.

The Technical Committee ISO/Tc 17 has so far published 47 recommendations and many more are under preparation. India is trying to adopt them as far as possible in preparing her national standards. If similar attempts are made by all the countries, the types of steels used in industry would be greatly reduced, thus leading to greater production at reduced cost and easy availability.

Standard Specifications for Steel Products

Steel Sections - Rationalization in number and improvement in the production of sections have been attempted in practically all major steel producing countries. But, improvements effected in the sections through an analysis of their efficiency properties and their redesign were particularly noticeable in countries where there was severe competition in the home and in the export markets, or where the structural steel industry had to face severe competition from reinforced and pre-stressed concrete.

It would be pertinent to briefly explain the work in India on the subject of standardization in the field of steel sections. India has been experiencing steel scarcity for many years but is became particularly acute after the Second World War. It may be interesting to note that the Indian steel industry achieved its peak production of 1.36 millon tons during the War but it came down to about 0.85 million tons in 1948. Production could be stepped up only gradually to about one million tons by 1952 and over 1.5 million tons by 1957. The present production is around 6 million tons.

The need for conservation of steel through efficient use of available resources thus assumed urgent importance for a speedy development of national economy, particularly in the period following India's Independence in 1947.

The realization of this fact led the Government to appoint in May 1949, a special committee to examine the problem in detail and to suggest ways and means of conserving available steel. This Committee after careful study suggested:

a) use of alternate materials to the maximum possible extent,
b) making improvements in design procedures by improving the existing codes,
c) increased use of steel of higher performance and rationalization of steel sections, and
d) promotion of welding in place of riveting.

The recommendations of this Committee were considered by the Planning Commission of the Government of India in December 1950 and the Government was requested to entrust to Indian Standards Institution the responsibility of taking up a Steel Economy Programme involving formulation and implementation of standards relating to production and use of steel.

Many complex problems were involved requiring close study and careful compilation of available data and experience of industrially advanced countries. A critical examination of India's own needs and potentialities was required and answers had to be found to questions of basic engineering importance.

Four years of intensive study at the ISI Directorate General and by the expert committee resulted in the formulation of Indian Standards on improved and rationalized series of beams, channels, angles, tee bars, and bulb angles. For obvious reasons, all these standards have been based on metric system of measurements. In formulating the high efficiency standards, note has been taken of many factors including production standards current in the country at that time, limitations and capabilities of the existing mills and of the new mills being installed, national standards and competitive company standards introduced elsewhere, attempts made in other countries towards improvement of standards for steel sections, efficiency in the utilization of sections in structures and analysis of factors which affect the efficiency and the extent to which it is possible to achieve efficiency in practice under Indian working conditions.

The improvements effected in beam and channel sections, towards which efforts were mainly directed, could be summarized as follows:

1. reduction in web thickness,
2. increase in the width of flanges,
3. reduction in the slope of flanges,
4. rationalization in the number of sections produced and arrangement of sections in more systematic series, and
5. general reduction of weight.

In the case of angles, tee bars, etc., the work has been mostly one of conversion and rationalization of the present production standards to the metric system and additions and deletions of certain sections due to condideration of consumers requirements.

Member Countries of the European Coal and Steel Community (CECA) have also done similar work as India by developing a new series of beam sections which are more economical than those rolled earlier in these countries primarily with a view to achieving economy and also competing with other materials for building construction. This work was initiated around 1948 and completed in 1957.

The United Kingdom also started thinking about developing new sections somewhere around 1957-58 and changed over to the new parallel flange sections around 1960-61. Even at present, beams up to 8 in. having 5^{o} taper flanges are rolled in standard mills. Sections over 8 in. in depth have a 5 per cent slope and are rolled in universal mills or in standard mills with an additional finishing stand. Similar developments have taken place in the USSR resulting in a new series of hot rolled sections which are more economical than those used hitherto in that country. These sections have again been based on scientific approach and after establishing the rolling possibilities in their mills.

Thus, it would be seen that practically every country has attempted development of new sections. Such attempts would naturally bring about a large variety of hot rolled steel sections in the world with the result that interchangeability and mutual exchange of material between different countries would become extremely difficult and quite often impossible.

Annex II (Tables 7 to 12) will illustrate the various types of steel beams, channels and angles commonly used in some of the countries.

Taking note of this wide variety and need to unify and develop efficient steels, a Working Group ISO/TC 17/WG 8 was specially set up under ISO/TC 17 - Steel in 1961. This Working Group has already made considerable headway in formulating recommendations for angles, column sections etc. Work is already under way to formulate draft recommendations for beam and channel sections.

Regional Standards

In addition to the development of national standards in different countries of the world, attempts have also been made to establish regional standards taking into consideration raw materials and the technique available in each region. The standards now being evolved amongst the Latin American Countries and the effort that has already been put in by the CECA countries and many of the East European countries are typical examples of establishing regional standards.

CONCLUSION

The Indian experience over the last decade or so and the work now in progress in different countries in the field of standardization of steel and steel products at national as well as regional levels clearly underlines the need for unification of standards and their alignment as much as possible with International Recommendations. To the extent that individual nations and regional organizations would be able to achieve this unification, they will draw the international trade and industrial community closer together. The developing nations of the world who have to depend on the proper utilization of their own resources have a special interest in this work in as much as commonly accepted standards will help them exchange their goods with the more developed countries of the world and thereby assist in the creation of better living standards for their own people.

ANNEX I

TABLE 1 TYPICAL EXAMPLES OF STEELS SPECIFIED ON THE BASIS OF MECHANICAL PROPERTIES WITHOUT DETAILED CHEMICAL COMPOSITION

Indian Specifications	B.S.	Purpose	Tensile Strength Tons/sq in.	Tensile Strength Kg/sq mm	C, Max Where specified	Condition	Size
IS 961 HTW		Plates, sections, billets		52 Min	0.25 Max		
	785	B (Concrete Reinforcement)	33/38				
IRS R 19		Wheel Centres	35/40				
	468	Wheel Centres	35/40				
	464	Wheel Centres	33/40				
	1113 C	F (Seamless forged drums)	34/38				
	1113 D	F (Boiler drums)	34/38				
St 52			33.0/39.4	52/62			
IS 961 HT		Plates, sections, billets		55 Min	0.30 Max		
	1775 HFS 20	Strutural Tubes	35 Min				
	1775 CDC 20	Structural Tubes	35 Min				
	1775 HFW 20	Structural Tubes	35 Min				
	1775 OAW 20	Structural Tubes	35 Min				
	778	Pipes (Hydraulic purposes)	35 Min				
	8	Traction Poles (S)	35 Min				
IS 1029		Baling Strip	35/40			Heat treated	
IRS R 16		Axles	35/40				
	64	Bolts	35/40				
	24 Pt 1, Sections 2, 3 & 4	Axles	35/40				
	102 Grade A	Tramway Axles	35/40				
	534	Pipes (S) - Water, gas, etc	35/41				
	879	Tubes (S) - Water well casing	35/41				
IS:280		Mild steel wire	35/45				
St 55			34.9/41.3	55/65			

TABLE 2 TYPICAL EXAMPLE OF STEELS SPECIFIED BY CHEMICAL COMPOSITION - CARBON STEELS

Indian Ref.	Foreign Ref. No	Form	Chemical Composition C	Si	Mn	S	P	Ni	Cr	Mo	Condition	Tensile Strength	Size
	BS 1449 En 5	Plate, Sheet	0.25/0.35	0.05/0.35	1.0 Max	0.060	0.060				N	32 Min	5/16 in.
	BS 970 En 5	Bars, billets, forgings	0.25/0.35	0.05/0.35	0.60/1.0	0.060	0.060				N H&T H&T H&T	32 Min 35/45 40/50 45/55	2-1/2 2-1/2 3/4 1/2
	BS 970 En 5K	Bars, billets, forgings	0.25/0.35	0.05/0.35	0.60/1.0	0.050	0.050				N H&T H&T H&T	32 Min 35/45 40/50 45/55	2-1/2 2-1/2 3/4 1/2
	BS 970 En 5K	Bars, billets, forgings	0.25/0.30	0.05/0.35	0.70/0.90	0.060	0.060					-	
	BS 970 En 5B	Bars, billets, forgings	0.28/0.33	0.05/0.35	0.70/0.90	0.060	0.060					-	
	BS 970 En 5C	Bars, billets, forgings	0.30/0.35	0.05/0.35	0.70/0.90	0.060	0.060					-	
	BS 970 En 5D	Bars	0.25/0.35	0.05/0.35	0.60/1.0	0.060	0.060				H&T & CD	45 Min 40 Min 35 Min	1/2 in. Over 1/2 to 3/4 in. Over 3/4
	BS 970 En6 & 6A	Bars	0.35 Max	0.05/0.35	0.50/0.90	0.060	0.060	-	-	-	CD	38/48 35/45 32/45	3/4 Over 3/4 to 2-1/2 Over 2-1/2
	BS 970 En 6K	Bars	0.35 Max	0.05/0.35	0.50/0.90	0.050	0.050	-	-	-	CD	38/48 35/45 32/45	3/4 Over 3/4 to 2-1/2 Over 2-1/2
	BS 6 S 1	Bars	0.25/0.35	0.05/0.35	0.60/0.90	0.050	0.050	-	-	-	CD	35 Min	Over 1-1/8 to 4 in.
	BS S 105	Bars, wire	0.30/0.35	0.35 Max	0.80/1.0	0.050	0.050	-	-	-	A CD	35 Max 40 Max	1/2 1/2
	BS 24 Part 4 Class C	Bars, billets, forgings	0.30/0.35	0.10 Min	0.60/0.90	0.050	0.050	-	-	-	N	32/58	
	SAE 1050	Bars, forgings, tubes (seamless)	0.28/0.34	-	0.60/0.90	0.050	0.040	-	-	-			
	SAE 1050	Plate, sheet, sections, welded tubes	0.27/0.35	-	0.60/0.90	0.050	0.040	-	-	-			
C 30			0.25/0.35		0.60/0.90								

TABLE 3 TYPICAL EXAMPLES OF CARBON AND CARBON MANGANESE FREE CUTTING STEELS WITH SPECIFIED CHEMICAL COMPOSITION AND RELATED MECHANICAL PROPERTIES

Indian Ref	Foreign Ref No.	Form	Chemical Composition C	Si	Mn	S	P	Ni	Cr	Mo	Other	Condition	Tensile Strength	Size
IS:451 Type 6		Wood screws	0.08/0.15	0.25 Max	0.30/0.60	0.08/0.13	0.06					CD	35 Min	16 g & smallar
													30 Min	18 g & larger
IS:451 Type 1		Wood screws	0.10/0.20	0.30 Max	0.70/1.00	0.075/0.15	0.045					CD	35 Min	16 g & smaller
													30 Min	18 g & larger
	BS 970 En 32 M	Billets, bars forgings	0.10/0.18	0.05/0.35	0.90/1.20	0.10/0.15	0.050					Case hardened	32 Min	1-1/8 in.
	BS 970 En 7 A	Bars	0.12/0.18	0.25 Max	1.0/1.5	0.10/0.18	0.060					HR or N	28 Min	6 in.
												CD	35/45	1-1/8 in.
													30/40	Over 1-1/8 to 2-1/2 in.
	BS 970 En 202	Billets, bars forgings	0.18 Max	0.05/0.35	1.20/1.50	0.10/0.18	0.050					Case hardened	38 Min	1-1/8 in.
	SAE 1108		0.08/0.13	-	0.50/0.80	0.08/0.13	0.040							
	SAE 1109		0.08/0.13	-	0.60/0.90	0.08/0.13	0.040							
	SAE 1115		0.13/0.18	-	0.60/0.90	0.08/0.13	0.040							
	SAE 1117		0.14/0.20	-	1.0/1.3	0.08/0.13	0.040							
	SAE 1118		0.14/0.20	-	1.3/1.6	0.08/0.13	0.040							
14Mn1S14			0.10/0.18	0.05/0.30	1.20/1.50	0.10/0.18	0.06 Max							
[illegible] C4			0.12 about	-	-	0.2/0.3	-	-	-	-	Pb 0.2/0.3	CD	30/50	
	BS 970 En 1 A	Billets, bars forgings	0.07/0.15	0.10 Max	0.80/1.20	0.2/0.3	0.07	-	-	-	-	HR or N	23 Min	4 in.
												CD	32 Min	17/32 in.
													28 Min	Over 17/32 to 1-1/2 in.
													25 Min	Over 1-1/2 to 2-1/2 in.
													23 Min	Over 2-1/2 to 4 in.
	SAE 1119		0.14/0.20	-	1.0/1.3	0.24/0.33	0.04	-	-	-				
	DIN 1651/9 S20	Bars	0.12 Max	-	0.50/0.80	0.18/0.24	0.10	-	-	-				
	DIN 1651/9 S27	Bars	0.12 Max	-	0.60/1.0	0.24/0.30	0.10	-	-	-				
	DIN 1651/10 S20	Bars	0.06/0.12	0.10/0.40	0.50/0.80	0.18/0.26	0.07	-	-	-	Thomas P 0.09 Max	Case hardening		
	DIN 1651/15 S20	Bars	0.12/0.18	0.10/0.40	0.50/0.80	0.18/0.26	0.07	-	-	-	Thomas P 0.09 Max	Case hardening		
13S25			0.08/0.18	0.10 Max	0.80/1.20	0.20/0.30								

TABLE 4 TYPICAL EXAMPLE OF ALLOY STEEL (OTHER THAN STAINLESS AND HEAT RESISTING STEEL) WITH SPECIFIED CHEMICAL COMPOSITION

Indian Ref.	Foreign Ref No.	Form	Chemical Composition C	Si	Mn	S	P	Ni	Cr	Mo	Condition	Tensile Strength	Size
	BS 970 En 18A	Bars, billets, forgings	0.27/0.32	0.10/0.35	0.65/0.80	0.050	0.050	-	0.85/1.15	-			
	SAE 5130	Bars, billets, forgings	0.28/0.33	0.20/0.35	0.70/0.90	0.040	0.040	-	0.80/1.10				
	BS 970 En 18 B	Bars, billets, forgings	0.30/0.35	0.10/0.35	0.65/0.80	0.050	0.050	-	0.85/1.15	-			
	SAE 5132	Bars, billets, forgings	0.30/0.35	0.20/0.35	0.60/0.80	0.040	0.040	-	0.75/1.0				
	DIN 17200/34 Cr 4	Bars, forgings	0.30/0.37	0.15/0.35	0.50/0.80	0.035	0.035	-	0.90/1.20				
	DIN 1654/34 Cr 4	Screw steel	0.30/0.37	0.15/0.35	0.50/0.80	0.035	0.035	-	0.90/1.20				
	BS 970 En 18 C	Bars, billets, forgings	0.35/0.38	0.10/0.35	0.65/0.80	0.050	0.050	-	0.85/1.15	-			
	SAE 5135	Bars, billets, forgings	0.33/0.38	0.20/0.35	0.60/0.80	0.040	0.040	-	0.80/1.05				
TEL V/11		Forgings	0.34/0.41	0.15/0.35	0.50/0.80	0.035	0.035	-	0.90/1.20				
	BS 970 En 18 D	Bars, billets, forgings	0.38/0.43	0.10/0.35	0.65/0.80	0.050	0.050	-	0.85/1.15				
	SAE 5140	Bars, billets, forgings	0.38/0.43	0.20/0.35	0.70/0.90	0.040	0.040	-	0.70/0.90				
TEL V/12		Forgings	0.38/0.44	0.15/0.50	0.50/0.80	0.035	0.035	-	0.90/1.20				
TEL III/9		Bars	0.38/0.44	0.15/0.35	0.50/0.80	0.035	0.035	-	0.90/1.20				
	DIN 17210/41 Cr 4	Bars, forgings	0.38/0.44	0.15/0.35	0.50/0.80	0.035	0.035	-	0.90/1.20				
	DIN 17200/41 Cr 4	Bars, forgings	0.38/0.44	0.15/0.35	0.50/0.80	0.035	0.035	-	0.90/1.20				
	DIN 1654/41 Cr 4	Screw steel	0.38/0.44	0.15/0.35	0.50/0.80	0.035	0.035	-	0.85/1.15				
IS:810		Valves	0.35/0.45	0.10/0.35	0.60/0.95	0.035	0.035	-	0.85/1.15		Heat treated	55 Min	
	BS 970 En 18	Bars, billets, forgings	0.35/0.45	0.10/0.35	0.60/0.95	0.050	0.050	-	0.85/1.15	-	H & T	45/55	4 in
											H & T	50/60	2-1/2 in
											H & T	55/65	1-1/8 in
	BS S 115	Bars for bolts	0.35/0.45	0.10/0.35	0.60/0.95	0.050	0.050	-	0.80/1.10		H & T	55/65	
	BS S 115 Grade A	Bars for bolts	0.35/0.40	0.10/0.35	0.60/0.95	0.050	0.050	-	0.80/1.10	-	A	39 Max	
											CD	42 Max	
	BS S 115 Grade B	Bars for bolts	0.40/0.45	0.10/0.35	0.60/0.95	0.050	0.050	-	0.80/1.10	-	A	41 Max	
											CD	44 Max	
	BS S 117	Bars, billets, forgings	0.35/0.45	0.10/0.35	0.60/0.95	0.050	0.050	-	0.80/1.10	-	H & T	55/65	1-1/8 in.
	SAE 5145	Bars, billets, forgings	0.43/0.48	0.20/0.35	0.70/0.90	0.040	0.040	-	0.70/0.90	-			
40 Cr 1			0.35/0.45	0.10/0.35	0.60/0.90	-	-		0.90/1.20				

TABLE 5 TYPICAL EXAMPLES OF HIGH ALLOY STEEL - STAINLESS AND HEAT RESISTING STEEL WITH SPECIFIED CHEMICAL COMPOSITION AND RELATED MECHANICAL PROPERTIES

Indian Ref	Foreign Ref No.	Form	Chemical Composition C	Si	Mn	S	P	Ni	Cr	Mo	Condition	T.S.
IS 810 Type 2		Valves	0.55/0.65	1.40/1.70	0.30/0.60	0.050	0.050	0.50 Max	5.75/6.75	-	H & T	57 Min
	BS 970 En 55	Valves	0.55/0.65	1.40/1.70	0.30/0.60	0.050	0.050	0.50 Max	5.75/6.75	-	H & T	HB 255/285
	BS/DTD 511	Valves	0.55/0.65	1.40/1.70	0.30/0.60	0.050	0.050	0.50 Max	5.75/6.75	-	H & T	HB 255/285
IS 810 Type 1		Valves	0.40/0.50	3.0/3.75	0.30/0.60	0.040	0.040	0.50 Max	7.50/9.50	-	H & T	57 Min
	BS 970 En 52	Valves	0.40/0.50	3.0/3.75	0.30/0.60	0.040	0.040	0.50 Max	7.50/9.50	-	H & T	HB 255/295
	BS/DTD 15B	Valves	0.40/0.50	3.25/3.75	0.40/0.60	0.030	0.030	0.50 Max	7.50/8.50	-	H & T	HB 255/295
IS 810		Valves	0.74/0.84	1.75/2.25	0.20/0.60	0.030	0.030	1.15/1.65	19.0/20.5	-	—	-
	BS 970 En 59	Valves	0.74/0.84	1.75/2.25	0.20/0.60	0.030	0.030	1.15/1.65	19.0/20.5	-	-	-
45Cr9Si4			0.40/0.50	3.25/3.75	0.30/0.60	-	-	0.50 Max	7.50/9.50			

TABLE 6 TYPICAL EXAMPLES OF TOOL STEELS

Indian Ref.	British Ref.	A.S.M.	A.I.S.I.	S.A.E.	Makers' Ref.	Chemical Composition C	Si	Mn	Cr	V	W	Co
		I B				0.60/1.40	0.25	0.25	0.30/0.75			
			W 4			0.60/1.40			0.25			
			W 5			1.10			0.30			
	4 A 1					0.75/0.85		0.35 Max		0.20 opt		
	BD 2					0.90/1.15	0.30 Max	0.30 Max		0.25 opt	0.30 opt	0.30 opt
		I C				0.60/1.40	0.25	0.25		0.20/0.30		
			W 2			0.60/1.40				0.25		
				W 2		0.85/0.95	0.35 Max	0.35 Max		0.15/0.25		
				W 2		0.95/1.10	0.35 Max	0.35 Max		0.15/0.35		
					U A 1	0.80/0.90	0.25	0.25		0.25		
					B B 1	0.95				0.25		
					U C 1	0.95				0.20		
					U A 2	0.90/1.00	0.25	0.25		0.25		
B 1						1.0	0.15			0.20		
					B C 1	1.00	0.20	0.30		0.20		
					U C 2	1.00				0.20		
					BD 1	1.08	0.10	0.20		0.15		
					B B 1	1.05		0.30		0.25		
					U B 1	Variable				0.15/0.25		
			W 8			1.00				0.20		
				W 5		0.95/1.20	0.35 Max	0.35 Max		0.35/0.50		
			W 6			1.00			0.25	0.25		
			W 7			1.00			0.30	0.20		
					U B 2	1.15			0.60	0.20		
T80V23						0.75/0.85	0.10/0.30	0.20/0.35		0.15/0.30		
T90V23						0.85/0.95	0.10/0.30	0.20/0.35		0.15/0.30		
T105V23						0.95/1.20	0.10/0.30	0.20/0.35		0.15/0.30		
T118Cr45						1.10/1.25	0.10/0.30	0.20/0.35	0.30/0.60	0.30 Max		
T133Cr45						1.25/1.40	0.10/0.35	0.20/0.40	0.30/0.60	0.30 Max		

ANNEX II

TABLE 7 COMPARISON OF CHANNEL SECTIONS OF CORRESPONDING DEPTHS

Serial Number	Series of Modulus Grouped	FRANCE (Light And Normal Channels)		GERMANY		INDIA (LC)		INDIA (MC)		JAPAN		UK		USA		USSR		YUGOSLAVIA	
		Depth x Width	Weight	Depth x Width	Weight	Depth x Width	Weight	Depth x Width	Weight	Depth x Width	Weight	Depth x Width	Weight	Depth x Width	Weight	Depth x Width	Weight	Depth x Width	Weight
	mm	mm x mm	Kg/m	mm x mm	Kg/m	mm x mm	Kg/m	mm x mm	Kg/m	mm x mm	Kg/m	mm x mm	Kg/m	mm x mm	Kg/m	mm x mm	Kg/m	mm x mm	Kg/m
1	50	30x15 30x15 35x17.5 40x20 50x25	1.507 1.672 2.158 2.74 3.85	30x15 30x33 40x20 40x35 50x25 50x38	11.74 4.27 2.87 4.87 3.86 5.59											50x32	4.84		
2	65	60x30 70x40	5.28 6.7	60x30 65x42	5.07 7.09											65x36	5.90	65x42	7.09
3	80	80x45	8.64	80x45	8.64	75x40	5.7	75x40	6.8	75x40	6.92	76x38	6.69	76.2x35.81 76.2x38.05 76.2x40.54	6.10 7.44 8.93	80x40	7.05	80x45	8.64
4	100	100x50	10.6	100x50	10.6	100x50	7.9	100x50	9.2	100x50	9.36	102x51	10.41	101.6x40.13 101.6x43.69	8.04 10.79	100x46	8.59	100x50	10.6
5	120	120x55	13.35	120x55	13.4	125x65	10.7	125x65	12.8	125x65	13.4	127x63	14.89	127x44.45 127x47.80	9.97 13.39	120x52	10.4	120x55	13.4
6	140	140x60	16.00	140x60	16.00	150x75	14.4	150x75	16.4	150x70 150x75 150x75 150x90 150x90 150x90	05.8 18.6 24.0 21.1 28.9 36.6					140x58 140x62	12.3 13.3	140x60	16.0
7	160	160x65	18.65	160x65	18.8							152x76 152x89	17.86 23x81	152.4x36.86 152.4x51.66 152.4x54.79	12.20 15.63 19.35	160x64 160x68	14.2 15.3	160x65	18.8
8	180	180x70	22.00	180x70	22.0	175x75	17.6	175x75	19.2	180x75 180x75 180x75 180x90 180x90 180x90	21.4 26.6 33.2 27.1 34.3 41.5	178x76 178x89	20.80 26.79	177.8x53.09 177.8x55.73 177.8x58.39	14.58 18.23 21.95	180x70 180x74	16.3 17.4	180x70	22.0
9	200	200x75	25.30	200x75	25.3	200x75	20.6	200x75	22.2	200x70 200x80 200x80 200x80 200x90 200x90 200x90	21.1 24.6 29.7 34.3 30.3 35.9 42.1	203x76 203x89	23.80 29.76	203.2x57.40 203.2x59.51 203.2x64.19	17.11 20.46 27.90	200x76 200x80	18.4 19.8	200x75	25.3
10	220	220x80	29.40	220x80	29.4	225x90	24.0	225x80	26.0	230x80 230x80 230x80 230x90 230x90 230x90	28.4 35.3 41.6 33.1 39.8 46.4	229x76 229x89	26.04 32.73	228.6x61.72 228.6x63.12 228.6x67.26	19.94 22.32 29.76	220x82 220x87	21.0 22.6	220x80	29.4

Table 7 (contd.)

Serial No	Series of Depth Grouped mm	FRANCE (Light and Normal Channels) Depth x Width mm x mm	FRANCE Weight kg/m	GERMANY Depth x Width mm x mm	GERMANY Weight kg/m	INDIA (LC) Depth x Width mm x mm	INDIA (LC) Weight kg/m	INDIA (MC) Depth x Width mm x mm	INDIA (MC) Weight kg/m	JAPAN Depth x Width mm x mm	JAPAN Weight kg/m	UK Depth x Width mm x mm	UK Weight kg/m	USA Depth x Width mm x mm	USA Weight kg/m	USSR Depth x Width mm x mm	USSR Weight kg/m	YUGOSLAVIA Depth x Width mm x mm	YUGOSLAVIA Weight kg/m
11	240	240x85	33.20	240x85	...	250x100	28.0	250x80	30.4	250x80 250x80 250x80 250x90 250x90 250x90	30.2 36.9 43.5 34.6 40.2 48.5	254x76 254x89	[illegible].26 35.70	254x66.04 254x69.57 254x73.30 254x77.04	22.77 29.76 37.20 44.65	240x90 240x94	24.0 25.8	240x85	33.2
		250x80 250x100	32.43 42.23 } Special Channels																
12	270	270x90	37.90	260x90 280x95	37.9 41.8					2[illegible]0x100 280x100 280x100	38.8 40.2 54.1					270x95	27.7	260x90 280x95	37.9 41.8
13	300	300x100	46.20	300x100	46.2	300x100	33.1	300x90	35.9	300x90 300x90 300x90 300x90 300x100 300x100 300x100	38.1 43.8 48.6 55.3 46.8 54.0 61.2	305x89 305x102	41.65 46.14	304.8x74.68 304.8x77.39 304.8x80.52	30.81 37.20 44.65	300x100	31.8	300x100	46.2
14	330			320x100	59.5											330x105	36.5		
15	360			350x100	60.6	350x100	38.9	350x100	42.2	380x100 380x100 3[illegible]0x100 330x100	54.5 62.0 67.3 79.1					360x110	41.9		
16	400			390x102 400x110	63.1 71.8	400x100	45.8	400x100	49.5	425x100 425x100 425x100	58.2 71.2 84.6	381x102 432x102	55.05 65.48	381x86.36 381x89.41 381x94.39	50.45 59.53 74.41	400x115	48.3		

Table 8 ....

TABLE 8 COMPARISON OF CHANNEL SECTIONS OF CORRESPONDING MODULUS

Serial Number	Section Modulus Group cm^3	FRANCE (Light and Normal Channels) Section Modulus			FRANCE (Special Channels) Section Modulus			GERMANY Section Modulus			INDIA (LC) Section Modulus			INDIA (MC) Section Modulus		
		Section Modulus	Depth x Width	Weight	Section Modulus	Depth x Width	Weight	Section Modulus	Depth x Width	Weight	Section Modulus	Depth x Weight	Weight	Section Modulus	Depth x Width	Weight
		cm^3	mm x mm	kg/m	cm^3	mm x mm	kg/m	cm^3	mm x mm	kg/m	cm^3	mm x mm	kg/m	cm^3	mm x mm	kg/m
1	10	1.59 1.73 2.57 3.78 6.76 10.61	30x15 30x15 35x17.5 40x20 50x25 50x30	1.507 1.672 2.158 2.74 3.85 5.28				1.69 3.79 4.26 6.73 7.05 10.5 10.6	30x15 40x20 30x33 50x25 40x35 60x30 50x38	1.74 2.87 4.27 3.86 4.87 5.07 5.59						
2	12															
3	16	17.67	70x40	6.77				17.7	65x42	7.09	17.6	75x40	5.7			
4	20													20.4	75x40	6.8
5	25	26.5	80x45	8.64				26.5	80x45	8.64						
6	32										32.9	100x50	9.2			
7	40	41.2	100x50	10.60				41.2	100x50	10.6				37.5	100x50	9.2
8	50															
9	63	60.7	120x55	13.40				60.7	120x55	13.4	57.1	125x65	10.7	67.0	125x65	12.[illegible]
10	80	86.4	140x60	16.00				86.4	140x60	16.0						
11	100										93.1	150x75	14.4	104.3	150x75	16.4
12	125	116	160x65	18.80				116	160x65	18.8	131.4	175x75	17.6	140.3	175x75	19.2
13	160	150	180x70	22.00				150	180x70	22.0	172.9	200x75	20.6			
14	200	191	200x75	25.30				191	200x75	25.3				131.5	200x75	22.1
15	250	245	220x80	29.40	282	250x80	32.48	245	220x80	29.4	227.2	225x90	24.0	240.4	225x80	26.0
16	320	300	240x85	33.20				300	240x85	33.2	295.8	250x100	28.0	306.3	250x80	30.4
17	400	371	260x90	37.98	412	250x100	42.23	371 448	260x90 250x95	37.9 41.8	404.4	300x100	33.1	425.6	300x90	35.9
18	500	535	300x100	46.20				535	300x100	46.2	533.2	350x100	38.9			
19	630							679	320x100	59.5	701.1	400x100	45.8	573.3	350x100	42.2
20	800							734 829	350x100 380x102	60.6 63.1				756.2	400x100	49.5

Contd. ...

Table 8 (contd.)

Serial Number	Series of Section Modulus Grouped cm³	JAPAN Section Modulus cm³	JAPAN Depth x Width mm x mm	JAPAN Weight kg/m	UK Section Modulus cm³	UK Depth x Width mm x mm	UK Weight kg/m	USA Section Modulus cm³	USA Depth x Width mm x mm	USA Weight kg/m	USSR Section Modulus cm³	USSR Depth x Width mm x mm	USSR Weight kg/m	YUGOSLAVIA Section Modulus cm³	YUGOSLAVIA Depth x Width mm x mm	YUGOSLAVIA Weight kg/m
1	10										9.10	50x32	4.84			
2	12										15.0	65x36	5.90			
3	16													17.7	65x42	7.09
4	20	20.2	75x40	6.92	19.46	76x38	6.69	18.03 19.66	76.2x35.8 76.2x38.0	6.10 7.44	22.4	80x40	7.05			
5	25							22.94	76.2x40.5	8.93				26.5	80x45	8.64
6	32							31.14	101.6x40.1	8.04	34.8	100x46	8.59			
7	40	37.8	100x50	9.36	40.89	102x51	10.41	37.69	101.6x43.7	10.79				41,2	100x50	10.6
8	50							49.16	127x44.4	9.97	50.6	120x52	10.4			
9	63	68.0	125x65	13.4				57.35 70.46	127x47.9 152.4x48.8	13.39 12.20	70.2	140x58	12.3	60.7	120x55	13.4
10	80				75.99	127x63	14.89	81.94	152.4x51.7	15.63	77.8	140x62	13.3	86.4	140x60	16.0
11	100	96.2	160x70	15.8	111.8	152x76	17.86	95.05 98.32	152.4x54.8 177.8x53.1	19.35 14.58	93.4 103	160x64 160x68	14.2 15.3			
12	125	115 138 140	150x75 150x90 150x75	18.6 21.4 24.0				113.07 126.18 132.74	177.8x55.7 177.8x58.4 203.2x57.4	18.23 21.95 17.11	121 132	180x10 180x74	16.3 17.4	116	160x65	18.8
13	160	154 162 177	180x75 200x70 150x90	21.4 21.1 28.9	150.4 153.0	178x76 152x89	20.82 23.81	174.48 172.06 178.62	203.2x59.5 228.6x61.7 203.2x64.2	20.46 19.94 27.90	152 167	200x76 200x80	18.4 19.8	150	180x70	22.0
14	200	194 195 204 212 219	180x75 200x80 180x90 150x80 180x75	28.6 24.6 27.1 36.6 33.2	192.0 197.2	203x76 178x89	23.80 26.79	185.17 219.59 221.23	228.6x63.1 254x66.0 228.6x67.3	22.32 22.77 29.76	192 212	220x82 220x87	21.0 22.6	191	200x75	25.3
15	250 246	231 246 249 252 261 284 285	200x80 180x90 200x90 230x80 200x80 200x90 180x90	29.7 34.3 30.3 28.4 34.3 35.9 41.5	228.3 245.2 265.1	229x76 203x89 254x76	26.04 29.76 28.26	257.28	254x69.6	29.76	242 265	240x90 240x95	24.0 25.8	245	220x80	29.4

Contd ....

Table 8 (contd.)

Serial No.	Series of Section Modulus Grouped cm^3	JAPAN Section Modulus	JAPAN Depth x Width	JAPAN Weight	UK Section Modulus	UK Depth x Width	UK Weight	USA Section Modulus	USA Depth x Width	USA Weight	USSR Section Modulus	USSR Depth x Width	USSR Weight	YUGOSLAVIA Section Modulus	YUGOSLAVIA Depth x Width	YUGOSLAVIA Weight
		cm^3	mm x mm	kg/m	cm^3	mm x mm	kg/m	cm^3	mm x mm	kg/m	cm^3	mm x mm	kg/m	cm^3	mm x mm	kg/m
16	320	291	250x80	30.2												
		304	230x90	33.1												
		307	230x80	35.3				296.61	254x73.3	37.20						
		323	200x90	42.1	296.4	229x89	32.73	337.57	254x77.0	44.65	308	270x95	27.7	300	240x85	33.2
		335	250x90	34.6	350.2	254x89	35.70	350.68	304.8x74.7	30.81						
		344	250x80	36.9												
		351	230x80	41.6												
		354	230x90	39.8												
17	400	375	250x90	40.2												
		395	250x80	43.5												
		401	230x80	43.4				391.65	304.8x77.4	37.20	387	300x100	31.8	371	260x90	37.9
		423	280x100	35.8				440.81	304.8x80.5	44.65				448	280x95	41.8
		429	300x50	38.1												
		446	250x90	43.5												
18	500	494	300x90	43.8	463.3	305x89	41.65									
		510	280x100	48.2	539.0	305x102	46.14				484	330x105	36.5	835	300x100	46.2
		525	300x90	48.6												
		545	300x100	43.8												
		564	280x100	54.1												
19	630	602	300x90	55.3												
		611	300x100	54.0				603.34	381x86.4	50.45	601	360x120	41.9			
		674	300x100	61.2												
20	800	762	380x100	54.5												
		822	380x100	62.0	781.8	381x102	55.05	757.08	381x89.4	59.53	761	400x115	48.3			
		891	425x100	58.2				878.35	381x94.4	74.41						
21	1000	924	380x100	67.3												
		1060	380x100	79.1												
		1070	425x100	71.2	991.1	432x102	65.48									
		1250	425x100	84.6												

Table 9 ....

TABLE 2 COMPARISON OF BEAM SECTIONS OF CORRESPONDING DEPTHS

Sl.No.	Series of Depths Grouped	Draft ISO Proposal Depth x Width		CECA Depth x Width		INDIA (LB) Depth x Width		INDIA (MB) Depth x Width		INDIA (WB) Depth x Width		JAPAN Depth x Width		UK Depth x Width			USA Depth x Width			USSR Depth x Width	
	mm	mm x mm	Weight Kg/m	mm x mm	Weight	mm x mm	Weight Kg/m	mm x mm	Weight Kg/m	mm x mm	Weight Kg/m	mm x mm	Weight Kg/m	in x in	mm x mm	Weight Kg/m	in x in	mm x mm	Weight	mm x mm	Weight Kg/m
1.	80	80x50	6.35	80x46	6.0	75x50	6.1					75x75	11.9	3x2	76.2x50.8	6.70	3x2.3 3x2.5	76.2x59.2 76.2x63.7	8.48 11.16		
2.	100	100x60	8.46	100x55	8.1	100x50	8.0	100x75	11.5			100x75	12.9	4x2½	101.6x63.5	9.66	4x2.7 4x2.8	101.6x67.6 101.6x71.0	11.46 14.14	100x55	9.46
3.	120	120x70	10.9	120x64	10.4	125x75	11.9	125x75	13.0			125x75	16.1	5x3	127.0x76.2	13.39	5x3.0 5x3.3	127x76.2 127x83.4	14.88 22.35	120x64	11.5
4.	140	140x75	13.[illegible]	140x73	12.9															140x73	13.7
5.	150					150x80	14.2	150x80	14.9	150x100	17.0	150x75 150x125	17.1 36.2	6x3½	152.4x88.9	17.10	6x3.3 6x3.6	152.4x84.6 152.4x90.6	18.60 25.67		
6.	160	160x85	15.[illegible]	160x82	15.1															160x81	15.9
7.	180	180x95	17.2	180x91	16.8	175x90	16.7	175x85	19.3	175x125	22.1	180x100	23.6	7x4	177.8x101.6	21.56	7x3.7 7x3.9	177.8x93.0 177.8x98.0	22.77 29.76	180x90 180x100	18.4 19.9
8.	200	200x105 202x105.3 205x105	21.5 23.6 26.9	200x100	22.4	200x100	19.8	200x100	25.4	200x140	28.8	200x100 200x150	26.0 50.4	8x5¼ 8x4 8x5¼	203x133 203.2x101.6 207x134	25 25.30 30	8x4.0 8x4.2	203.2x101.6 203.2x105.9	27.38 34.23	200x100 200x110	21.0 22.7
9.	220	230x120	25.8	220x110	26.2	225x100	23.5	225x110	31.2	225x150	33.9	230x100	30.7							220x110 230x120	24.0 25.8
10.	240	232x120.3 235x120.8	29.2 32.0	240x120	30.7															240x115 240x125	27.3 29.4
11.	250					250x125	27.9	250x125	37.3	250x200	40.9	250x125 250x125	38.3 55.5	10x5¾ 10x4	251x146 254x101.6	31 22	10x4.7 10x4.9	254x118.4 254x125.6	37.80 52.09		
12.	260	260x135 263x135.5 266x136	30.6 34.8 39.1	270x135	36.1									10x5¾ 10x4 10x4 10x5¾	256x146.4 257x101.9 260x102.1 260x147	37 25 28 43				270x125 270x135	31.5 33.9
13.	280					275x140	33.0														
14.	300	300x150 303x150.5 306x151	36.7 41.4 46.1	300x150	42.2	300x150	37.7	300x140	44.2	300x200	48.1	300x150 300x150	48.3 76.8	12x5 12x6½ 12x4 12x5 12x6½ 12x4 12x5	304x124 304x165 305x101.6 307x124 307x166 309x101.9 310x125	37 40 25 42 46 28 48	12x5.0 12x5.1 12.5.2 12.5.5	304.8x127.0 304.8x129.0 304.8x133.4 304.8x139.1	47.32 52.09 60.72 74.41	300x175 300x145	36.5 39.2
15.	320			330x160	49.1	325x165	43.1							12x6½ 12x4	311x167 313x102.4	54 33				331x140	42.2
16.	340	350x170	44.0			350x165	49.5			350x200	56.9	350x150 350x150	58.5 87.2	14x5	348x125.4	33					

Continued........

Table 9 (contd.)

Sl No.	Series of Depth Grouped mm	Draft ISO Proposal Depth x Width mm x mm	Draft ISO Proposal Weight Kg/m	CECA Depth x Width mm x mm	CECA Weight	INDIA (LB) Depth x Width mm x mm	INDIA (LB) Weight Kg/m	INDIA (MB) Depth x Width mm x mm	INDIA (MB) Weight Kg/m	INDIA (WB) Depth x Width mm x mm	INDIA (WB) Weight Kg/m	JAPAN Depth x Width mm x mm	JAPAN Weight Kg/m	UK Depth x Width in x in	UK Depth x Width mm x mm	UK Weight kg/m	USA Depth x Width in x in	USA Depth x Width mm x mm	USA Weight kg/m	USSR Depth x Width mm x mm	USSR Weight Kg/m
17.	360	35x170.5 356x171	49.4 54.8	360x170	571			350x140	52.4					14x6¾ 14x5 14x6¾ 14x6¾ 14x6¾	352x171 353x126.0 356x171.5 359x172 364x173	45 39 51 57 67				360x145	48.6
18.	400	400x180 403x180.5 406x181	52.3 56.2 64.0	400x180	66.3	400x165	56.9	400x140	61,6	400x200	66.7	400x150 400x150	72.0 95.8	15x6 15x6 15x6 16x5½ 16x5½ 16x7 16x7 16x6 16x7 16x6 16x7 16x6	380x152 385x153 389x154 397x141.8 402x142.4 403x178 406x178 408x152 409x179 412 x153 413x180 416x415	52 60 67 39 46 54 60 59 67 67 74 74	15x5.5	381x139.7	63.84	400x155	56.1
19.	450	450x190 453x190.5 456x191	63.3 69.5 75.6	450x190	77.6	450x170	65.3	450x150	72.4	450x200	79.4	450x175 450x175	91.7 115.0	18x7½ 18x6 18x7½ 18x7½ 18x6 18x7½ 18x6 18x7½	454x190 457x152 457x190.5 460x191 461x153 464x192 465x153 467x193	67 67 74 82 74 89 82 98	18x6.0 18x6.3	457.2x152.4 457.2x158.8	81.40 104.17	450x160	65.2
20.	500	500x200 503x200.5 507x201.2	74.6 81.3 90.4	500x200	90.7	500x180	75.0	500x180	86.9	500x250	95.2	500x190 500x190	111.0 145				20x6.2 20x6.4 20x7.1 20x7.2	500x158.8 508x162.3 508x179.1 508x182.9	97.33 111.63 126.50 141.38	500x170	76.8
21.	550	550x215 554x215.7 558x216.4	87.3 97.0 106.9	550x210	106	550x190	86.3	550x190	103.7	550x250	112.5			21x8¼ 21x8¼ 21x13 21x8¼ 21x8¼ 21x13 21x8¼ 21x13	528x209 533x209 533x330 537x210 539x211 539x332 545x212 545x334	82 92 167 101 109 189 122 211				550x180	89.8
22.	600	600x230 605x230.9 610x231.7	103.1 116.4 129.3	600x220	122	600x210	99.5	600x210	122.6	600x250 600x250	133.7 145.1	600x190 600x190	133.0 176.0	24x9 24x9 24x12 24x9 24x9 24x12	602x228 607x228 610x305 612x229 617x230 617x307	101 113 149 125 140 179	24x7.0 24x7.1 24x7.2 24x7.9 24x8.0	609.6x177.8 609.6x180.9 609.6x184.1 609.6x200.0 609.6x204.4	118.91 133.94 148.82 157.60 178.58	600x190	104.0
23.	650													24x12	633x312	238				650x200	120.0
24.	700	680x250 685x250.8 690x251.6	123.7 137.8 151.9											27x10 27x10 27x10 27x10	678x253 684x254 688x25[illegible].5 693x[illegible]	125 140 152 170				700x2[illegible] 700x21[illegible] 700x21[illegible]	138.0 158.0 184.0

Continued......

Table 9 (contd.)

Sl.No.	Series of Depths Grouped mm	Draft ISO Proposal Depth x Width mm x mm	Draft ISO Proposal Weight Kg/m	CECA Depth x Width mm x mm	CECA Weight	INDIA (LB) Depth x Width mm x mm	INDIA (LB) Weight Kg/m	INDIA (MB) Depth x Width mm x mm	INDIA (MB) Width Kg/m	INDIA (WB) Depth x Width mm x mm	INDIA (WB) Weight Kg/m	JAPAN Depth x Width mm x mm	JAPAN Weight Kg/m	UK Depth x Width in.xin.	UK Depth x Width mm x mm	UK Weight Kg/m	USA Depth x Width in.xin.	USA Depth x Width mm x mm	USA Weight Kg/m	USSR Depth x Width mm x mm	USSR Weight Kg/m
25.	800	760x265	148.4											30x10½	754x265	147					
		765x255.6	163.6											30x10½	762x267	173					
		770x266.5	178.8											30x10½	770x268	196					
		840x290	175.9											33x11½	835x292	176					
		845x290.8	192.6											33x11½	841x292	194					
		850x291.6	209.4																		
26.	900	920x305	205.7											33x11½	851x294	226					
		925x305.8	223.5											36x12	903x303	201					
		930x306.6	241.3											36x12	910x304	223					
														36x16½	911x418	343					
														36x12	918x305	253					
														36x16½	920x420	387					
														36x12	927x308	289					
27.	1000	988x316	233.3																		
		994x319	256.1																		
		1000x320	279.0																		
		1006x321	301.9																		
		1012x322	325.0																		

Table 10 ....

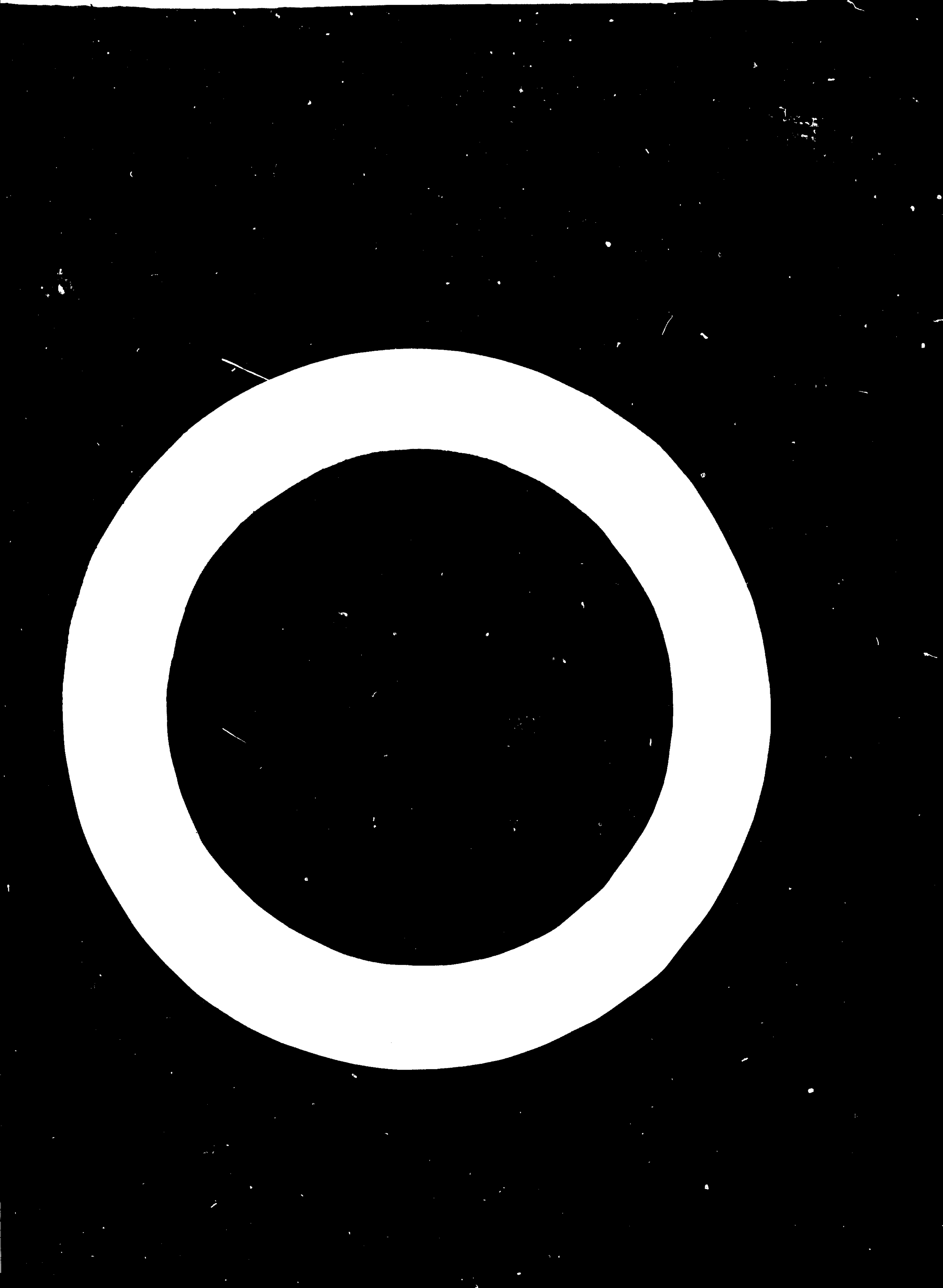

TABLE 10 COMPARISON OF BEAM SECTIONS OF CORRESPONDING SECTION MODULUS

Sr. No.	Series of Section Modulus Grouped mm	ISO Draft Proposal (Metric Series) Section Modulus cm³	ISO Depth x Width mm x mm	ISO Weight Kg/m	CECA 19-57 Section Modulus cm³	CECA Depth x Width mm x mm	CECA Weight Kg/m	INDIA (LB) Section Modulus cm³	INDIA (LB) Depth x Width mm x mm	INDIA (LB) Weight Kg/m	INDIA (MB) Section Modulus cm³	INDIA (MB) Depth x Width mm x mm	INDIA (MB) Weight Kg/m	INDIA (WB) Section Modulus cm³	INDIA (WB) Depth x Width mm x mm	INDIA (WB) Weight Kg/m
1.	20	22	80x50	6.33	20.0	60x46	6.0	19.4	75x50	6.1						
2.	32	36	100x60	8.46	34.2	100x55	8.1	33.6	100x50	8.0						
3.	50	57	120x70	10.9	53.0	120x64	10.4				51.5	100x75	11.5			
4.	80	78	140x75	13.0	77.3	140x73	12.9	65.1 91.8	125x75 150x80	11.9 14.2	71.8 96.9	125x75 150x80	13.0 14.9			
5.	125	111	160x85	16.0	109	160x82	15.8	12[illegible].3	[illegible]	16.7				111.9	150x100	17.0
6.	160	151	180x95	19.2	146	180x91	18.8	169.7	200x100	19.8	145.4	175x90	19.3	172.5	175x125	22.1
7.	200	186 207	200x105 202x105.3	21.5 23.6	194	200x100	22.4	222.4	225x100	23.5	223.5	200x100	25.4			
8.	250	240 259	205x105 230x120	26.9 25.8	252	220x110	26.2							262.5	200x140	28.8
9.	320	287 330 351	232x120.3 235x120.8 260x135	28.2 32.0 30.6	324	240x120	30.7	297.4	250x125	27.9	305.9	225x110	31.2	384.5	225x150	33.9
10.	400	405	263x135.5	34.8	429	270x135	36.1	392.4	275x140	33.0	410.5	250x125	37.3			
11.	500	460 484 554	266x136 300x150 303x150.5	39.1 36.7 41.4	557	300x150	42.2	488.9	300x150	37.7				475.4	250x200	40.9
12.	630	625 681	306x151 350x170	46.1 44.0				607.7	325x165	43.1	573.6	300x140	44.2	654.8	300x200	48.1
13.	800	775 870	353x170.5 356x171	49.4 54.8	713	330x160	49.1	751.9	350x165	49.5	778.9	350x140	52.4	887.0	350x200	56.9

Sr. No.	JAPAN Section Modulus cm³	JAPAN Depth x Width mm x mm	JAPAN Weight Kg/m	UK Section Modulus cm³	UK Depth x Width mm x mm	UK Weight Kg/m	USA Section Modulus cm³	USA Depth x Width mm x mm	USA Weight Kg/m	USSR Section Modulus cm³	USSR Depth x Width mm X mm	USSR Weight Kg/m
1.				21.80	76.2x50.8	6.70						
2.	38.9	75x75	11.9				27.86 31.14	76.2x59.2 76.2x63.7	8.48 11.16	39.7	100x55	9.46
3.	56.5	100x75	12.9	42.95	101.6x63.5	9.66	49.16 54.06	101.6x67.6 101.6x71.0	11.46 14.14	58.4	120x64	11.5
4.	86.4	125x75	16.1	75.12	127.0x76.2	13.38	78.66 98.32	127.0x76.2 127.0x83.4	14.88 21.95	81.7	140x73	13.7
5.	109	150x75	17.1	115.9	152.4x88.9	17.10	118.65	152.4x84.6	18.60	109	160x81	15.9
6.				171.2	177.8x101.6	21.56	142.57 170.45	152.4x90.6 177.8x95.0	25.67 22.77	145 159	180x90 180x100	18.4 19.9
7.	186 218	180x100 200x100	23.6 26.0	225	254x101.6	22	186.65	177.8x98.0	29.76	184 203	200x100 200x110	21.0 22.7
8.	237 291	150x175 230x100	36.2 30.7	225.8 231 265 279	203.2x101.6 203x133 257x101.9 207x134	25.30 25 25 30	232.70 262.19	203.2x101.6 203.2x105.9	27.38 34.23	232 254	220x110 220x120	24.0 25.8
9.				287 308 351 352	305x101.6 260x102.1 309x101.9 251x146	25 28 28 31				289 317	240x115 240x125	27.3 29.4
10.	415 449	250x125 200x150	38.3 50.4	415 455	315x102.4 256x146.4	33 37	399.85	254.0x118.4	37.60	371 407	270x125 270x145	31.5 35.9
11.				468 470 504 530 560	348x125.4 304x124 260x147 307x124 304x165	33 37 45 42 40	478.50	254.0x125.6	52.09	472 518	300x135 300x145	36.5 39.2
12.	587 633	250x125 300x150	55.5 48.3	570 611 625 646 695	355x128 310x125 307x141.8 307x166 352x171	39 48 50 46 45	589.94 619.45	304.8x127.0 304.8x129.0	47.52 52.09	597	330x140	48.[illegible]
13.	871	350x150	58.5	752 778 794 842 894	311x187 402x142.4 356x171.5 381x152 352x172	54 46 51 52 57	754.14 824.27	304.8x133.4 304.8x139.1	60.72 74.41	743	360x145	48.6

Continued..

Table 10 (contd.)

Sl. No.	Series of Section Modulus Grouped mm	ISO Draft Proposal Metric Series			CICA 19-57			INDIA (LB)			INDIA (MB)		
		Section Modulus cm³	Depth x Width mm x mm	Weight Kg/m	Section Modulus cm³	Depth x Width mm x mm	Weight Kg/m	Section Modulus cm³	Depth x Width mm x mm	Weight Kg/m	Section Modulus cm³	Depth x Width mm x mm	Weigh Kg/m
14.	1000	909 1022	400x180 403x180.5	52.3 58.2	904	360x170	57.1	965.3	400x165	56.9	1022.9	400x140	61.6
15.	1250	1130 1213 1350	406x181 450x190 453x190	64.0 63.3 69.5	1160	400x180	66.5	1223.8	450x170	65.3	1350.7	450x150	72.4
16.	1600	1480 1567 1729	456x191 500x200 503x200.5	75.8 74.6 81.3	1500	450x190	77.6	1543.2	500x180	75.0			
17.	2000	1947 1997	507x201.2 550x215.1	90.4 87.3	1930	500x200	[illegible]	1933.2	550x190	86.3	1808.7	500x180	86.9
18.	2500	2255 2514 2572	554x215.7 558x216.4 500x230	97.0 106.9 103.1	2440	550x210	106	2428.9	600x210	99.5	2357.7	550x190	103.7
19.	3200	2951 [illegible]	605x230.9 610x231.7	116.4 129.3	3070	600x220	122				3060.4	600x210	122.6
20.	3600	3137	680x250	123.7									
21.	4000	3900	685x250.8	137.8									
22.	4500	4364 4548	690x251.6 760x265.0	151.9 148.4									
23.	5000	5100	765x265.8	163.6									

	INDIA (NB)			JAPAN			UK			USA			USSR		
…ight Kg/m	Section Modulus cm^3	Depth x Width mm x mm	Weight Kg/m	Section Modulus cm^3	Depth x Width mm x mm	Weight Kg/m	Section Modulus cm^3	Depth x Width mm x mm	Weight Kg/m	Section Modulus cm^3	Depth x Width mm x mm	Weight Kg/m	Section Modulus cm^3	Depth x Width mm x mm	Weight Kg/m
.6				981	300x150	76.8	923 968 1011 1056 1071 1095	403x178 385x153 408x152 406x178 364x173 389x154	54 60 59 60 67 87	965.20 1052.05	381.0x139.7 381.0x143.3	63.84 74.41	947	400x155	56.1
4	1171.3	400x200	66.7	1200 1280	400x150 350x150	72.0 87.2	1155 1188 1248 1293 1294 1322 1404	412x153 409x179 457x152 454x190 416x415 413x180 461x153	67 67 67 87 74 74 74				1220	450x180	65.2
	1558.1	450x200	79.4	1580 1740	400x150 450x175	95.8 91.7	1458 1555 1810 1767 1793	457x190.5 465x153 460x191 464x192 528x209	74 82 82 89 82	1448.62 1889.85	457.2x152.4 457.2x158.8	81.40 104.17	1570	500x170	76.8
9	2091.6	500x250	95.2	2170	450x175	115.0	1954 2072	467x193 533x209	98 92	1915.65 2069.89	508.0x158.8 508.0x162.3	97.33 111.62	2000	550x180	89.8
.7	2723.9	550x250	112.5	2380	500x190	111.0	2293 2489 2509 2784	537x210 539x211 802x228 545x212	101 109 101 122	2461.34 2621.94 2849.72	508.0x179.1 508.0x182.9 609.6x177.8	126.50 141.38	2510	600x190	104.0
.6				3030 3270	500x190 600x190	145.0 133.0	2874 3217	60[illegible]x228 812x229	113 125	3044.72 3238.09	609.6x180.9 609.6x184.1	133.94 148.82	3120	850x200	120.0
	3540.0	600x250	133.7				3472 3620	678x253 617x230	125 140						
	3854.2	600x250	145.1				3979 4079 4091	684x254 610x305 533x330	140 149 187	3839.50 4111.52	609.8x200.0 609.8x204.4	157.60 178.58	3840	700x210	138.0
				4330	600x190	176.0	4364 4471 4657	688x254.5 754x264 539x332	152 147 189				4560	700x210	158.0
							4901 4902 5199 5374	617x307 693x256 545x334 762x267	179 170 211 173				5010	700x210	184.0

Contd......

Table 10 (contd.)

Sl.No.	Series of Section Modulus Grouped mm	ISO Draft Proposal (Metric Section) Section Modulus cm3	Depth x Width mm x mm	Weight Kg/m	CECA 19-57 Section Modulus cm3	Depth x Width mm x mm	Weight Kg/m	INDIA (LB) Section Modulus cm3	Depth x Width mm x mm	Weight Kg/m	INDIA (HB) Section Modulus cm3	Depth x Width mm x mm	Weight Kg/m	INDIA (WB) Section Modulus cm2	Depth x Width mm x mm	Weight Kg/m	JAPAN Section Modulus cm3	Depth x Width mm x mm	Weight Kg/m	UK Section Modulus cm3	Depth x Width mm x mm	Weight Kg/m	USA Section Modulus cm3	Depth x Width mm x mm	Weight Kg/m	USSR Section Modulus cm3	Depth x Width mm x mm	Weight Kg/m
24.	6000	5524 5913	770x266.6 840x290	178.8 175.9																5879 6225	835x292 770x268	176 196						
25.	7000	6582 7254	845x290.8 850x291.6	192.6 209.4																6549 6655 7192	633x312 841x292 903x303	238 194 201						
26.	8000	7504 8279	920x305 925x305.6	205.7 223.5																7971 8241	851x294 910x304	226 225						
27.	9000	9057 9154	950x306.6 988x318	241.3 233.3																9490	918x305	253						
28.	10000	10010	994x315	256.1																								
29.	11000	11250	1000x320	279.0																10874	927x308	289						
30.	12000	12320	1006x321	301.9																								
31.	13000	13390	1012x322	325.0																15691 15586	911x418 920x420	343 387						

Table 11

TABLE 11 COMPARISON OF EQUAL LEG ANGLES

Sl. No.	Designation	Draft ISO Recommendations Size mm x mm	Thick-ness mm	Sectional Area cm²	CECA Size mm x mm	Thick-ness mm	Sectional Area cm²	INDIA Size mm x mm	Thick-ness mm	Sectional Area cm²	JAPAN Size mm x mm	Thick-ness mm	Sectional Area cm²	UK Size mm x mm	Thick-ness mm	Sectional Area cm²	USA Size mm x mm	Thick-ness mm	Sectional Area cm²	USSR Size mm x mm	Thick-ness mm	Sectional Area cm²
1.	20x20	20x20	3 4	1.12 1.45	20x20	3 4	1.12 1.45	20x20	3.0 4.0	1.12 1.45	20x20	3	1.127							20x20	3 4	1.13 1.46
2.	25x25	25x25	3 4 5	1.42 1.35 2.26	25x25	3 4 5	1.42 1.85 2.26	25x25	3.0 4.0 5.0	1.41 1.84 2.25	25x25	3 5	1.427 2.246	25.4 x25.4 (1x1)	3.15 4.70 6.35	1.52 2.19 2.84	25.4 x25.4 (1x1)	3.15 4.70 6.35	1.52 2.19 2.84	25x25	3 4	1.43 1.86
3.	30x30	30x30	3 4 5	1.74 2.27 2.78	30x30	3 4 5	1.74 2.27 2.78	30x30	3.0 4.0 5.0	1.73 2.26 2.77	30x30	3 5	.727 .746	31.8 x31.8 (1¼x1¼)	3.10 4.62 6.25	1.90 2.75 3.61	31.8 x31.8 (1¼x1¼)	3.10 4.62 6.25	1.90 2.75 3.61	28x28 32x32	3 3 4	1.62 1.86 2.43
4.	35x35	35x35	3 4 5	2.04 2.67 3.28	35x35	3 4 5	2.04 2.67 3.28	35x35	3.0 4.0 5.0 6.0	2.03 2.66 3.27 3.86	35x35	3 5	2.036 3.255							36x36	3 4	2.10 2.75
5.	40x40	40x40	3 4 5 6	2.35 3.08 3.79 4.48	40x40	4 5 6	3.06 3.79 4.48	40x40	3.0 4.0 5.0 6.0	2.34 3.07 3.78 4.47	40x40	3 5	2.336 3.755	38.1 x38.1 (1½x1½)	4.72 6.32 7.85	3.41 4.46 5.40	38.1 x38.1 (1½x1½)	4.72 6.32 7.85	3.41 4.46 5.40	40x40	3 4	2.35 2.75
6.	45x45	45x45	3 4 5 6	2.66 3.49 4.30 5.09	45x45	4 5 6.	3.49 4.30 5.09	45x45	3.0 4.0 5.0 6.0	2.64 3.47 4.26 5.07	45x45	4 6 8	3.492 5.044 6.564	44.5 x44.5 (1¾x1¾)	4.67 6.12 7.90	3.99 5.12 6.45	44.5 x44.5 (1¾x1¾)	4.67 6.12 7.90	3.99 5.12 6.45	45x45	3 4 5	2.65 3.48 4.29
7.	50x50	50x50	3 4 5 6 7 8	2.96 3.89 4.80 5.69 6.56 7.41	50x50	4 5 6 7 8	3.85 4.80 5.69 6.56 7.41	50x50	3.0 4.0 5.0 6.0	2.95 3.88 4.79 5.68	50x50	4 6 8	3.892 5.644 7.364	50.8 x50.8 (2x2)	4.65 6.32 7.82 9.40	5.11 6.08 7.39 8.72	50.8 x50.8 (2x2)	4.65 6.32 7.82 9.40	4.56 6.08 7.39 6.72	50x50	3 4 5	2.96 3.89 4.80
8.	55x55							55x55	5.0 6.0 8.0 10.0	5.27 6.26 6.18 10.02				57.2 x57.2 (2¼x2¼)	4.60 6.25 7.77 9.32	5.11 6.82 8.35 9.86	57.2 x57.2 (2¼x2¼)	4.60 6.25 7.77 9.32	5.11 6.82 8.35 9.86	56x56	3.5 4 5	3.86 4.38 5.41
9.	60x60	60x60	4 5 6 8 10	4.71 5.82 6.91 9.03 11.1	60x60	5 6 8 10	5.82 6.91 9.03 11.1	60x60	5.0 6.0 6.0 10.0	5.75 6.84 8.96 11.00	60x60	5 7 9	5.802 7.914 9.994									

(Continued).......

Table 11 (contd.)

Sl. No.	Designation	Draft ISO Recommendations Size mm x mm	Thick-ness mm	Sectional Area cm²	CSCA Size mm x mm	Thick-ness mm	Sectional Area cm²	INDIA Size mm x mm	Thick-ness mm	Sectional Area cm²	JAPAN Size mm x mm	Thick-ness mm	Sectional Area cm²	UK Size mm x mm	Thick-ness mm	Sectional Area cm²	USA Size mm x mm	Thick-ness mm	Sectional Area cm²	USSR Size mm x mm	Thick-ness mm	Sectional Area cm²
10.	65x65							65x65	5.0 6.0 6.0 10.0	6.25 7.44 9.76 12.00	65x65	6 8 10	7.527 9.761 12.00	63.5 x63.5 (2½x2½)	6.22 7.90 9.45 11.05 12.52	7.59 9.48 11.18 12.89 14.41	63.5 x63.5 (2½x2½)	6.22 7.90 9.45 11.05 [illegible].52	7.59 9.48 11.18 12.89 14.42	63x63	4 5 6	4.96 6.13 7.26
11.	70x70	70x70	5 6 7 8 10	6.84 8.13 9.40 10.6 13.1				70x70	5.0 6.0 8.0 10.0	6.77 8.06 10.58 13.02	70x70	6 8 10	8.127 10.56 13.00							70x70	4.5 5 6 7 8	6.20 6.86 8.15 9.42 10.7
12.	75x75							75x75	5.0 6.0 6.0 10.0	7.27 8.66 11.38 14.02	75x75	6 9 12 14	6.727 12.69 16.56 19.04	76.2 x76.2 (3x3)	6.22 7.65 9.40 10.97 12.60 14.27	9.12 11.37 13.47 15.55 17.64 19.74	76.2 x76.2 (3x3)	4.76 6.22 7.65 9.40 10.97 12.60	7.03 9.12 11.37 13.47 15.55 17.64	75x75	5 6 7 8 9	7.39 8.78 10.1 11.5 12.8
13.	80x80	80x80	6 8 10 12	9.35 12.3 15.1 17.9				80x80	6.0 8.0 10.0 12.0	9.29 12.21 15.05 17.81	80x80	6 9 12	9.327 13.59 17.76							80x80	5.5 6 7 8	8.63 9.38 10.8 12.3
14.	90x90	90x90	6 6 10 12	10.6 13.9 17.1 20.3				90x90	6.0 6.0 10.0 12.0	10.47 13.79 17.03 20.19	90x90	7 10 13 15	12.22 17.00 21.71 24.75	88.9 x88.9 (3½x3½)	6.27 7.90 9.42 11.00 12.60 14.22 15.77	10.81 13.47 15.92 18.40 20.87 23.32 25.61	88.9 x88.9 (3½x3½)	6.27 7.90 9.42 11.00 12.60	10.81 13.47 15.92 18.40 20.87	90x90	6 7 8 9	10.6 12.3 13.9 15.6
15.	100x100	100x100	6.5 8 10 12 15	12.7 15.5 19.2 22.7 27.9				100x100	6.0 6.0 10.0 12.0	11.67 15.39 19.03 22.59	100x100	7 10 13 15 17	13.62 19.00 24.31 27.75 31.11	101.6 x101.6 (4x4)	7.82 9.45 11.02 12.60 14.22 15.65 17.42 19.02	15.37 18.39 21.27 24.09 26.96 29.78 32.45 35.12	101.6 x101.6 (4x4)	6.35 7.82 9.45 11.02 12.60 15.65 19.02	12.52 15.37 18.39 21.27 24.09 29.78 25.12	100x100	6.5 7 8 10 12 14 16	12.8 13.8 15.6 19.2 22.8 26.3 29.7
16.	110x110	120x120	8 10 12 15	18.7 23.2 27.5 33.9				110x110	8.0 1.0 1.2 1.5	17.08 21.12 25.06 32.73										110x110	7 8	15.2 17.2

Continued....

Table 11 (contd.)

Sl. No.	Designation	Draft ISO Recommendations Size mm x mm	Thick-ness mm	Sectional Area cm2	CECA Size mm x mm	Thick-ness mm	Sectional Area cm2	INDIA Size mm x mm	Thick-ness mm	Sectional Area cm2	JAPAN Size mm x mm	Thick-ness mm	Sectional Area cm2	UK Size mm x mm	Thick-ness mm	Sectional Area cm2	USA Size mm x mm	Thick-ness mm	Sectional Area cm2	USSR Size mm x mm	Thick-ness mm	Sectional Area cm2
17.								130x130	8.0	20.28	130x130	9	22.74	127.0	9.47	23.31	127x127	7.94	19.55	125x125	8	19.7
									10.0	25.12		12	29.76	x127.0	11.02	26.93		9.47	23.31		9	22.0
									12.0	29.88		15	36.75		12.60	30.56		11.02	26.93		10	24.3
									16.0	39.16		17	41.31		14.17	34.14	(5x5)	12.60	30.56		12	26.9
														(5x5)	15.60	37.78		15.60	37.78		14	33.4
															17.42	41.37		19.00	44.80		16	37.8
															19.00	44.60		22.22	51.48	140x140	9	24.7
																					10	27.3
																					12	32.5
18.	150x150	150x150	10	29.3				150x150	10.00	29.21	105 x150	11	32.00	152.4	9.42	26.06	152.4	7.94	23.61	160x160	10	31.4
			12	34.8					12.0	34.77		15	42.74	x152.4	11.02	32.61	x152.4	9.42	26.06		11	34.4
			15	43.0					16.0	45.65		19	53.58		12.60	37.03		11.02	32.61		12	37.4
			18	51.0					20.0	56.21		22	61.15	(6x6)	14.22	41.55	(6x6)	12.60	37.03		14	43.3
															15.82	45.95		14.22	41.55		16	49.1
															17.35	50.09		15.82	45.95		18	54.8
															18.97	54.45		18.97	54.45		20	60.4
															20.55	58.63		22.15	62.83			
															22.15	62.83		25.4	70.97			
19.	200x200	180x180	15	52.1				200x200	12.0	46.94	200x200	15	57.75	203.2	15.77	62.02	203.2	12.7	50.00	180x180	11	38.8
			18	61.9					16.0	61.62		20	76.00	x203.2	17.35	67.89	x 203.2	14.29	56.00		12	42.2
			20	68.3					20.0	76.38		25	93.75		18.95	73.82		15.77	62.02			
									25.0	94.13		27	100.7	(8x8)	20.55	79.60	(8x8)	18.95	73.82	200x200	12	47.1
		200x200	16	61.8								29	107.6		22.12	85.42		22.12	85.42		13	50.9
			18	69.1											23.70	91.09		25.30	96.81		14	54.6
			20	76.3											25.30	96.81		28.58	107.94		16	62.0
			24	90.6																	20	76.5
																					25	94.3
																					30	111.5
																				220x220	14	60.4
																					16	66.6
20.	250x250																			250x250	16	76.4
																					18	87.7
																					20	97.0
																					22	106.1
																					25	119.7
																					28	133.1
																					30	142.0

Table 12.......

TABLE 12 COMPARISON OF UNEQUAL LEG ANGLES

Sl. No.	Designation	Draft ISO Recommendations Size mm x mm	Thickness mm	Sectional Area cm²	CECA Size mm x mm	Thickness mm	Sectional Area cm²	INDIA Size mm x mm	Thickness mm	Sectional Area cm²	JAPAN Size mm x mm	Thickness mm	Sectional Area cm²	UK Size mm x mm	Thickness mm	Sectional Area cm²	USA Size mm x mm	Thickness mm	Sectional Area cm²	USSR Size mm x mm	Thickness mm	Sectional Area cm²
1.	30x20	30x20	3 4 5	1.43 1.86 2.27	30x20	3 4 5	1.42 1.85 2.26	30x20	3.0 4.0 5.0	1.41 1.84 2.25										25x16 32x20	3 3 4	1.16 1.49 1.94
2.	40x25	40x20 20x25	3 4 5 4 5	1.73 2.26 2.77 2.43 3.02	40x20 40x25	3 4 5 4 5	1.72 2.25 2.76 2.46 3.02	40x25	3.0 4.0 5.0 6	1.86 2.46 3.02 3.56	40x20	3 5	1.747 2.751							40x25	3 4	1.39 2.47
3.	45x30	45x30	4 5	2.36 3.52	45x30	4 5	2.87 3.53	45x30	3.0 4.0 5.0 6.0	2.18 2.86 3.52 4.16							44.4 x 31.8 (1¾x1¼)	3.18 4.76 6.35	2.32 3.42 4.45	45x28	3 4	2.14 2.80
4.	50x30	50x30	4 5 6	3.07 3.76 4.47	50x30	5 6	3.78 4.47	50x30	3.0 4.0 5.0 6.0	2.34 3.07 3.76 4.47	50x35	4 6	3.292 4.744	50.8 x 38.1 (2x1½)	4.67 6.12 7.90	3.99 x 5.12 6.45	50.8 38.1 (2x1½)	3.18 4.67 6.12	2.71 3.99 5.12	50x32	3 4	2.42 3.17
5.	60x40	60x30 60x40	5 6 5 6 7	4.29 5.08 4.79 5.68 6.55	60x30 60x40	5 6 5 6 7	4.29 5.08 4.79 5.68 6.55	60x40	5.0 6.0 8.0	4.76 5.65 7.37	60x50	5.--- 7	5.302 7.214							56x36	3.5 4 5	3.16 3.58 4.41
6.	65x45	65x45	5 6 7 8	5.54 6.56 7.60 8.60	[illegible]		[illegible]	65x45	5.0 6.0 8.0	5.26 6.25 8.17	65x50	5 7 9	5.552 7.564 9.544	63.5 x 38.1 (2½x1½) 63.5 x50.8 (2½x2)	4.65 6.32 7.82 4.60 6.25 7.77 9.32	4.56 6.08 7.39 5.11 6.82 8.35 9.86	63.5 x38.1 (2½x1½) 63.5 x50.8 (2½x2)	4.65 6.32 7.82 9.52 4.60 6.25 7.77 9.32	4.56 6.08 7.39 8.77 5.11 6.82 8.35 9.86	63x40	4 5 6 8	4.04 4.98 5.90 7.68
7.	70x50	70x	5 6 7 8	5.79 6.88 7.95 9.00	70x50	6 7 8	6.88 7.95 9.00	70x45	5.0 6.0 8.0 10.0	5.52 6.56 8.58 10.52	70x60	6 8 10	7.527 9.761 12.00							70x45	4.5 5	5.07 5.59

(Continued)......

Table 12 (contd.)

Sl. No.	Designation	Draft ISO Recommendations Size mm x mm	Thick-ness mm	Sectional Area cm²	CMEA Size mm x mm	Thick-ness mm	Sectional Area cm²	INDIA Size mm x mm	Thick-ness mm	Sectional Area cm²	JAPAN Size mm x mm	Thick-ness mm	Sectional Area cm²	UK Size mm x mm	Thick-ness mm	Sectional Area cm²	USA Size mm x mm	Thick-ness mm	Sectional Area cm²	USSR Size mm x mm	Thick-ness mm	Sectional Area cm²
8.	75x50	75x50	5	6.05				75x50	5.0	6.02	75x50	6	7.227	76.2x 50.8	4.75	5.88	76.2x	4.75	5.88	75x50	5	6.11
			6	7.19					6.0	7.16		8	9.361	(3x2)	6.22	7.59	(3x2)	6.22	7.59		6	7.25
			7	8.31					8.0	9.38		10	11.50		7.90	9.48		7.90	9.48		8	9.47
			8	9.41					10.0	11.52	75x65	6	8.127		9.45	11.18		9.45	11.18			
												8	10.56		11.05	12.89		11.05	12.89			
												10	13.00	76.2 x63.5	6.25	8.36		12.7	14.52			
														(3x2½)	7.90	10.43	76.2 x63.5	6.25	8.36			
															9.45	12.33	(3x2½)	7.90	10.43			
															11.05	14.23		9.45	12.33			
																		11.05	14.23			
																		12.7	16.13			
9.	80x50	80x40	5	5.80	80x40	6	6.89	80x50	5.0	6.27	80x60	6	8.127							80x50	5	6.36
			6	6.89		8	9.01		6.0	7.46		8	10.56								6	7.55
			7	7.96	80x60	6	6.09		8.0	9.78		10	13.00									
			8	9.01		7	9.36		10.0	12.02	80x70	6	8.727									
		80x60	6	8.11		8	10.6					9	12.69									
			7	9.58								12	16.56									
			8	10.6																		
10.	90x60	90x65	6	9.01	90x65	6	9.01	90x60	6.0	8.65	90x60	6	8.727	88.9 x63.5	6.22	9.12	88.9 x63.5	6.22	9.12	90x56	5.5	7.86
			7	10.4		7	10.4		6.0	11.37		9	12.69		7.85	11.37		7.85	11.37		6	8.54
			8	11.8		8	11.8		10.0	14.01		12	16.56	(3½x2½)	9.40	13.47	(3½x2½)	9.40	13.47		8	11.18
			10	14.6		10	14.7		12.0	16.57	90x75	6	9.627		10.97	15.55		10.97	15.55			
												9	14.04					12.7	17.74			
												12	18.36									
11.											90x80	7	11.52	88.9 x76.2	6.30	10.05	88.9 x76.2	6.30	10.05			
												10	16.00		7.82	12.35		7.82	12.35			
												13	20.41		9.47	14.79		9.47	14.79			
														(3½x3)	11.05	17.07	(3½x3)	11.05	17.07			
															12.67	19.36		12.67	19.36			
															14.17	21.44						
12.	100x65	100x50	6	8.73	100x50	6	8.73	100x65	6.0	9.55	100x65	7	11.17	101.6 x63.5 (4x2½)	6.30	10.05				100x63	6	9.59
			7	10.1		7	10.1		8.0	12.57		9	14.04		7.82	12.35					7	11.1
			8	11.4		8	11.5		10.0	15.51		12	18.36		9.47	14.79					8	12.6
			10	14.1		10	14.1								11.05	17.07					10	15.5
		100x65	7	11.2	100x65	7	11.2													110x70	6.5	11.4
			8	12.7		8	12.7														7	12.3
			10	15.6		10	15.6														8	13.9
13.	100x75	100x75	8	13.5				100x75	6.0	10.14	100x75	7	11.87	101.6 x76.2	7.90	13.48	101.6 x76.2 (4 x 3)	6.35	10.90			
			10	16.6					8.0	13.36		10	16.50		9.42	15.92		7.90	13.48			
			12	19.7					10.0	16.50		13	21.06		11.00	18.40		9.42	15.92			
									12.0	19.56	100x80	7	12.22	(4x3)	12.60	20.87		11.00	18.40			
												10	17.00		14.22	23.32		12.60	20.87			
												13	21.71					15.88	23.68			

(continued)......

Table 12 (contd.)

Sl. No.	Designation	Draft ISO Recommendations Size mm x mm	Thick-ness mm	Sectional Area cm²	CECA Size mm x mm	Thick-ness mm	Sectional Area cm²	INDIA Size mm x mm	Thick-ness mm	Sectional Area cm²	JAPAN Size mm x mm	Thick-ness mm	Sectional Area cm²	UK Size mm x mm	Thick-ness mm	Sectional Area cm²	USA Size mm x mm	Thick-ness mm	Sectional Area cm²	USSR Size mm x mm	Thick-ness mm	Sectional Area cm²
14.											100x90	7	12.92	101.6	7.85	14.41	101.6	6.35	11.68			
												10	19.00	x88.9	9.50	17.27	x88.9	7.85	12.41			
												13	32.01		11.05	19.90	(4x3½)	9.50	12.27			
															12.65	22.57		11.05	19.90			
														(4x3½)	14.17	25.06		12.65	22.57			
															15.82	27.71		15.82	27.71			
15.	125x75	120x80	8	15.5	120x80	8	15.5	125x75	6.0	11.66	125x75	7	13.62	127x76.2	7.82	15.37	127x76.2	6.35	12.52	125x80	7	14.1
			10	19.1		10	19.1		8.0	15.38		10	19.00		9.45	18.39		7.82	15.37		8	16
			12	22.7		12	22.7		10.0	19.02		13	24.31		11.02	21.27		9.45	18.39		10	19.7
		125x75	8	15.5	130x65	8	15.1							(5 x 3)	12.60	24.09	(5 x 3)	11.02	21.27		12	23.4
			10	19.1		10	18.6								14.22	26.96		12.60	24.09			
			12	22.7		12	22.1															
16.	125x95	135x65	8	15..				125x95	6.0	12.92	125x90	7	14.67	127.0	7.67	16.48	127x	6.35	13.29			
			10	18.6					8.0	17.04		10	20.50	x88.9	9.42	19.56	88.9	7.87	16.48			
			12	22.1					10.0	21.08		13	26.26		11.07	22.79		9.42	19.66			
									12.0	25.04					12.65	25.81	(5x3½)	11.07	22.79			
															14.25	28.84		12.65	25.81			
															15.77	31.67		15.77	31.67			
																		19.05	37.48			
17.	150x75	150x75	9	19.6	150x90	9	21.0	150x75	8.0	17.48	150x75	7	15.46	152.4	7.85	17.44	152.4	6.35	14.90	140x90	8	18
			10	21.6		10	23.2		10.0	21.62		9	19.44	x76.2	9.47	20.87	x88.9	7.82	18.40		10	22.2
			12	25.7		12	27.5		12.0	25.68		12	25.56		11.02	24.10	(6x3½)	9.42	21.99			
			15	31.6		15	33.9							(6 x 3)	12.60	27.33		12.62	29.00			
											150x90	9	20.94		14.20	30.56						
												12	27.36		15.82	33.78						
												15	33.75									
18.		150x90	10	23.2										152.4	7.82	18.40						
			12	27.5										x88.9	9.72	21.99						
			15	33.9											11.07	25.63						
														(6x3½)	12.62	29.00						
															14.22	32.43						
															15.75	35.66						
19.	150x115							150x115	8.0	20.72	150x100	9	21.84	152.4	9.47	23.31	152.4	7.94	19.55	160x100	9	22.9
									10.0	25.66		12	28.56	x101.6	11.02	26.93	x101.6	9.47	23.31		10	25.3
									12.0	30.52		15	35.25		12.60	30.56		11.02	26.93		12	30
									16.0	40.00	175x90	9	23.19		14.17	34.14		12.60	30.56		14	34.7
												12	30.36		15.80	37.78		14.17	34.14			
												15	37.50	(6 x 4)	17.42	41.37		15.80	37.78			
											175x100	10	26.60		19.00	44.80		19.00	44.80			
												12	31.56					22.22	51.48			
												14	36.54									

Continued......

Table 12 (contd.)

Sl. No.	Designation	DRAFT ISO Recommendations Size mm x mm	Thick-ness mm	Sectional Area cm²	CECA Size mm x mm	Thick-ness mm	Sectional Area cm²	INDIA Size mm x mm	Thick-ness mm	Sectional Area cm²	JAPAN Size mm x mm	Thick-ness mm	Sectional Area cm²	U.K. Size mm x mm	Thick-ness mm	Sectional Area cm²	USA Size mm x mm	Thick-ness mm	Sectional Area cm²	USSR Size mm x mm	Thick-ness mm	Sectional Area cm²
20.	200x100	200x100	10 12 15	29.2 34.8 43.0	200x100	10 12 15	29.2 34.8 43.0	200x100	10.0 12.0 16.0	29.21 34.77 45.65	200x90	11 13 15	30.84 36.00 41.24	177.8 x88.9 (7x3½)	9.45 11.07 12.62 14.20 5.82	24.48 28.48 32.24 36.02 39.87	177.8 x101.6 (7x4)	9.52 11.11 12.70 14.29 15.88 19.05 22.22	25.68 29.81 33.87 33.87 41.81 49.61 57.16	180x110	10 12	28.3 33.7
21.											200x100	11 13 15	31.94 37.30 42.74	203.2 x101.6 (8x4)	12.60 14.22 15.82 17.35 18.97	37.03 41.55 45.95 50.09 54.45	203.2 x101.6 (8x4)	11.11 12.60 14.22 15.82 18.97 22.22 25.40	32.65 37.03 41.55 45.95 54.45 62.77 70.97	200x125	11 12 14 16	34.9 37.9 43.9 49.8
22.	200x150	200x150	10 12 15 18	34.2 40.8 50.5 60.0				200x150	10.0 12.0 16.0 20.0	34.29 40.85 53.73 66.29				203.2 x152.4 (8 x 6)	12.57 14.20 15.77 17.35 18.95 20.52 22.10	43.44 48.78 53.91 58.99 64.10 69.07 74.00	203.2 x152.4 (8 x 6)	11.11 12.57 14.20 15.77 18.95 22.10 25.40	38.25 43.44 48.78 53.91 64.10 74.00 83.87			
23.	250x150													228.6 x101.6 (9 x 4)	12.57 14.20 15.80 17.37 18.92 20.57 22.15	40.20 45.13 49.93 54.61 59.17 63.97 68.49	228.6 x101.6 (9 x 4)	12.70 14.20 15.80 18.92 22.15 25.40	40.32 45.13 49.93 59.17 68.49 77.42	250x160	12 16 18 20	48.3 73.6 71.1 78.5

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