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FUEL RESEARCH INSTITUTE

OF SOUTH AFRICA.

ONDERWERP:
SUBJECT: THE CLASSIFICATION OF SOUTH AFRICAN COALS

ACCORDING TO INTERNATIONAL CLASSIFICATION OF HARD COALS

BY TYPE.

AFDELING:
DIVISION: CHEMISTRY

NAAM VAN AMPTENAAR:
NAME OF OFFICER: W.H.D. Savage.

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FUEL RESEARCH INSTITUTE OF SOUTH AFRICA.

REPORT NO. 26 OF 1957.

THE CLASSIFICATION OF SOUTH AFRICAN COALS ACCORDING TO INTERNATIONAL CLASSIFICATION OF HARD COALS BY TYPE

By:- W.H.D. Savage

The "International Classification of Hard Coals by Type", published by the United Nations in 1956, consists of primary classification by volatile matter content up to 33% volatile matter(dry ash free) and by calorific value (moist ash free) for coals with higher volatile matter contents. The primary classes are further subdivided according to caking and coking properties, parameters being the swelling number or the Roga index, and the Gray-King coke type or Audibert-Arnu dilatation. "Where the ash content of coal is too high to allow classification according to the present systems, it must be reduced by laboratory float-and-sink method (or any other appropriate means). The specific gravity selected for flotation should allow a maximum yield of coal with 5 to 10% of ash."[x]

Coal produced for sale in South Africa generally contains more than 10% ash. This report is based mainly on the data appearing in Annexure B2(a) of the 1956 Annual Report of the Fuel Research Board. Only three anthracite collieries listed therein have coal with ash contents below 10%. Of the remaining collieries about half have less than 15% ash in their products, about a quarter 15 to 20% ash, and the rest more than 20% ash.

To reduce the ash contents of South African coals to less than 10% by float and sink methods - even on minus 1mm. coal - would in many cases involve discarding more than half of the

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[x] Quoted form Note (1) on pages 6 and 10 of " International Classification of Hard Coals by Type".

actual coal substance. This would cause a considerable concentration of bright components (mainly vitrain) at the expense of dull coal which contains a very large proportion of inerts. Such an alteration in the petrographic composition of the coal would mean that the floated coal tested could have very different properties from the coal as sold. For this reason some other method of reducing the ash content of the coal would have to be used. It has been shown[1] that the ash contents of South African coals can be reduced to low values by very fine grinding and the addition of oil, the major portion of the mineral matter being capable of removal by leaching with water without loss of coal substance. This procedure involves much time, and no coals have recently been subjected to this treatment. It has therefore been decided to apply the methods of the International Classification to the actual colliery products analysed.

The dry ash free volatile matter contents calculated from the data in Annexure B2(a) have been used. These volatile matter contents are rather higher than would have been obtained from the same coals, if the ash content had been reduced without affecting the coal substance. As, however, (as will be shewn later) the discrepancies that occur in classifying our coals by volatile matter are due to the relatively low volatile matter contents of some medium to low rank South African coals, the use of dry ash free volatile matter contents of coals high in ash content will not cause any increase in these discrepancies.

The dry ash free basis has not been used for calorific values. In order to approach the "pure coal" values a simplified mineral matter free basis has been used, with mineral matter taken as being 1.08 times ash. The results given in Table 1 at the end of the report are actually expressed on the dry, mineral matter free basis as no determinations of moisture holding capacity according to the prescribed methods have been done on South African coals.

Capacity/.......

Capacity moisture contents have been determined[2] by a different method, and from these results it appears that the moisture holding capacity of South African coals is approximately 1.8 times the air-dried moisture content as normally determined in the Institute's laboratories at Pretoria. The moisture holding capacity values on the mineral matter free basis for all the collieries listed in Annexure B2(a) have been estimated, using the following equation:-

Mineral matter free capacity moisture% =

$$\frac{1.8\ H_2O \times 100}{100 - 1.08\ Ash\left(\frac{100 - 1.8\ H_2O}{100 - H_2O}\right)}$$

Where Ash and H_2O are the percentages of ash and moisture on the air dried coal.

These values have been incorporated in Table 1, as have the moist mineral matter free calorific values derived from them. It is pointed out that these figures cannot be regarded as accurate, as a small change in the factor of 1.8 can make large differences in the estimated capacity moisture contents of the higher moisture coals, and the formula given above disregards any moisture which may be associated with the mineral matter; this latter moisture may be significant for the higher ash coals. It thus appears likely that the capacity moisture values given will tend to be high and the moist mineral matter free calorific values correspondingly low.

Only one calorific value is given for each colliery. Dry mineral matter free calorific values were calculated for each product, and the average taken. This was done because the calorific values were reported only to the nearest 0.1 lb/lb in Annexure B2(a) and the second decimal place would have no significance at all for the individual products.

Compared with normal European and American coals, South African coals are generally sub-hydrous. Associated with the lower

hydrogen/............

hydrogen content one gets a reduction in volatile matter and calorific value and reduction or complete absence of caking and coking properties. The extent to which these changes occur is dependent on the relative shortfall of hydrogen. South African coals are sub-hydrous due to their petrographic composition. In practically all South African coals the inert opaque constituents are more highly concentrated, and often very much more highly concentrated, than in European coals. Of all the Transvaal and Orange Free State collieries only those mining exclusively the C Seam of Ermelo or the No. 5 Seam of Witbank approach the constitution of European coals but the Natal coals in general are more nearly normal by overseas standards. South African coal can be broadly described in the lump as bright or dull, or somewhere between these two types. Vitrain is the characteristic component of the bright coal, clarain being of very minor importance, and the dull coal is dull because of inerts and not spores. In fact, in general exinite is a relatively scarce component in South African coal. Selected dull coals may be 1% lower in hydrogen and 10% lower in volatile matter (d.a.f.) than selected bright coals from the same seam at the same place. This difference can be illustrated to a certain extent by the Witbank South Colliery: Originally only the lower portion of the No. 2 Seam which contained a fairly high proportion of bright coal, was extracted, whereas the upper portion of the seam now mined is mainly dull. The dry ash free volatile matter contents are 33.3% and 28.9% respectively and the moist mineral matter free calorific values 14.49 and 14.11 lb/lb. (assuming capacity moistures of 5.2% for both coals).

South African coals that are mined today and that are likely to be mined in the future, are found in the Ecca Series of the Karroo System, which corresponds to the Permian or possibly late Carboniferous, and are generally very nearly horizontally disposed.

The coal/.....

The coal is not naturally very high in rank, with dry ash free carbon contents not exceeding about 85%. Much coal, however in some undeveloped fields and also in Natal has been affected to a varying degree by igneous intrusions, which have enhanced the rank of the coal. All the anthracitic and low and medium volatile coals of Natal have been matured by dolerite.

The effects of igneous intrusions depend on various factors such as distance, thickness and temperature at intrusion and some Natal collieries mine coal of widely varying volatile matter content in different sections of the mine. The volatile matter content of the output is thus an average, and can fluctuate up or down. An illustration of the changes that can occur over a period of nine months is given by the following dry ash free volatile matter contents of composite average monthly samples from one Natal colliery:-

June 1942	July	August	Sept.	Oct.	Nov.	Dec.	Jan.	Feb 1943
24.3	23.4	22.5	20.5	20.6	18.2	15.3	14.6	14.0

Volatile matter contents (d.a.f.) of over 30% have been attained both before and after this period. This colliery has thus produced in a relatively short time coal varying in class (I.S.O. classification) from the upper limit of class 2 to class 5 Normal variations are not so wide, but many collieries which normally produce coal of class 4 can and do produce coal of class 3 at times.

In table 1 - at the end of the report - are given the dry ash free volatile matter contents of the various grades from the collieries reported in Annexure B2(a), the size of coal being indicated by a suffix. A single dry "mineral matter" free calorific value is given for each colliery, together with an estimated capacity moisture content, and the moist "mineral matter" free calorific value in the following column is calculated from the data in the previous two columns.

The coals/......

The coals are grouped according to origin under Natal, Witbank-Middelburg, Ermelo, and Heidelberg and Orange Free State. In each group the collieries are arranged by increasing volatile matter up to 33% (i.e. class 5) and by decreasing moist calorific value for higher volatile coals. The classification given in the last column but one is in accordance with the International Classification, and that in the last column is the class according to calorific value of sub-hydrous relatively low rank coals. (d.a.f. carbon less than 85%) that have less than 33% volatile matter. No separate classification is given in this last column where the coal would be listed as class 6, which is the case of several Witbank collieries and of Utrecht colliery.

Considering first the Natal coals there is not much fault that can be found with the International classification. The only discrepancy is that Utrecht colliery is wrongly placed if rank* is the criterion. The coal is higher in moisture content and lower in calorific value than either Durban Navigation or Natal Coal Exploration coal. The carbon content is very similar to that of Durban Navigation (about 85.5% d.m.m.f.) but the coal is sub-hydrous with only 4.9% hydrogen. It is therefore considered that the coal is slightly lower in rank than Durban Navigation and about equal to Natal Coal Exploration coal. No analysis of coal from the Kilbarchan colliery is reported in Annexure B2(a). This coal has a d.a.f. volatile matter content of about 33.8%, estimated capacity moisture (m.m.f.) of 4.3% and moist m.m.f. calorific value of about 14.8 lb/lb, the coal thus being placed in class 6. A new anthracitic colliery namely Impati Anthracite, has recently opened up and it has a d.a.f. volatile matter content of about 8.6%, the coal therefore being in class 1.

Before discussing the remaining collieries it is as well to

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*Quotation from International classification, page 5:- "The expression "by type" means the distinction that is made between coals in respect of their inherent properties as a whole. The differences between one type of coal and another are understood to be the result of diffences in their degree of coalification in the natural series, peat to anthracite."

give the limiting calorific values for the higher classes in evaporative units. They are as follows:-

Limiting Calorific Value in

	Cals/gm	lb/lb
Class 6	7,750	14.38
Class 7	7,200	13.36
Class 8	6,100	11.32
Class 9	5,700	10.58

Coal from the Witbank - Middelburg collieries is placed in classes 5 to 7 (or according to calorific value to class 8). These coals are practically all sub-hydrous and none of them exceeds 85% carbon (d.m.m.f.). It appears incorrect to place any of these coals in class 5, in view of their relatively low rank. If the moist calorific values (m.m.f.) in Table 1 are studied, it will be seen that relatively few of them are high enough to place the coals in class 6, and the highest value is 14.48 lb/lb, only 0.1 lb/lb above the limit of the class. Further, no Witbank - Middelburg coals can be considered as being higher in rank than any Natal coals listed in Table 1, though some may be considered as equivalent to Ballengeich and possibly Natal Coal Exploration coal.

As far as the individual coals are concerned, many collieries show different classification for different size grades. In these cases it is consistently the larger coal that tends to be higher in volatile matter and thus be placed in class 6 or 7 while the smalls tend to be placed in class 5, due to their having not more than 33% volatile matter. Instances of striking differences in volatile matter content above and below 33% are Waterpan and Klipportje with differences of more than 2%. These differences must be mainly ascribed to selective breakage of certain petrographic components to give different petrographic compositions in the size grades, although relative concentration of minerals such as carbo-

nates/.......

nates in particular size grades may also occur. Navigation washed coal and middlings give a striking illustration of the statement already made about the effect of specific gravity separation on petrographic composition and thus on volatile matter. Although the middlings had twice as much ash as the washed coal, the dry ash free volatile matter was only 31.5% compared with 36.1% for the washed coal. Durban Navigation middlings show a similar but less marked effect.

If one considers the classification according to calorific value in the last column of Table 1, it is apparent that most of the class 5 collieries are listed as class 7, and two, namely New Largo and Alpha Consolidated, are listed as class 8. New Largo only just falls within class 8, and slight error in the estimation of capacity moisture could place this colliery in class 7, but Alpha Consolidated is probably a true class 8 coal according to calorific value. No ultimate analyses of New Largo coal are available, but two analyses of Alpha Consolidated nuts and peas gave a dry "mineral matter" free carbon content of only 82.2%, showing that this coal is very badly misplaced by being classified as class 5.

The coals from Ermelo listed in Table 1 give no difficulty. They are all derived from the C seam. The Spitskop colliery has recently started production and also mines the C Seam. Average data on seven samples of various grades gave 39.6% d.a.f. volatile matter, 7.5% mineral matter free capacity moisture (estimated), and 13.58 lb/lb moist m.m.f. calorific value, placing Spitskop in class 7 below Union colliery. No data for Satmar colliery are given in Table 1. The coal mined comes from the B seam and is inferior and dull. This coal has a relatively low d.a.f. volatile matter content (30.9% on three samples) placing it in class 5. The capacity moisture content (m.m.f.) is estimated at 8% and the moist mineral matter free calorific value at 13.15 lb/lb, which would place it in class 8. The dry "mineral matter" free carbon

content/....

content is about 82.8%, indicating that the latter classification is more reasonable.

The coal from Heidelberg and the Orange Free State is the lowest rank coal mined in South Africa, dry mineral matter free carbon contents of the former being just over 80% and the latter less than 80%. Nevertheless coal from three of these collieries is listed according to the International Classification as belonging to class 5, due to the low volatile matter content of these coals. All these coals would be listed as class 8 or 9 (Bertha No. 2, which may well be in class 8, due to the uncertainty of the capacity moisture figure) according to calorific value, which is more reasonable. No analyses of product samples from Sigma colliery are available, but a composite face sample over the whole of the No. 2 seam had a d.a.f. volatile matter content of 32.6%, placing the coal in class 5; the estimated m.m.f. capacity moisture was 17.5% and the corresponding moist m.m.f. calorific value was 11.06 lb/lb which would place the coal in class 9.

To illustrate just how far the petrographic constitution of the coal can reduce the volatile matter content of low rank coals, the analysis of the bottom 79" of the No. 1 seam from a borehole in the Heilbron district of the Orange Free State is given as follows:-

Cal.Val. lb/lb.	H_2O %	Ash %	Vol.Mat. %	Fix. Carb. %
8.68	6.8	27.4	18.3	47.5

Using the methods applied in deriving the data in Table 1, the volatile matter content (d.a.f.) is 27.8%, placing the coal in class 4; the estimated m.m.f. capacity moisture is 17.0% and the moist m.m.f. calorific value is 11.33 lb/lb, which would place the coal just within the lower limits of class 8. This coal almost certainly has a carbon content (d.m.m.f.) of less than 80%, making it entirely out of place in class 4.

It is not intended to discuss the subdivision of the classes

into groups/..........

into groups and subgroups in any detail, partly due to lack of data. In general it may be stated that most South African coals fall into the 00 to 11 subsidiary classification, thus falling into statistical groups I, II, III and VII of the International classification. All Orange Free State and Heidelberg coals are 00, and all other Transvaal coals vary from 00 to 11, except for three collieries, namely Navigation Blesbok and Springbok (No. 5 Seam), which produce blend coking coal which normally falls into the 22 category. In Natal coals in classes 1, 2 and 3, and also in the lower volatile portion of class 4 are likely to fall within the 00 to 11 groups. The highest category of any Natal coals at present mined is probably 33. It has already been shown in how far the volatile matter content of Natal coal can vary, and the caking and coking properties tend to follow this volatile matter variation, so that it is in any case not easy to classify correctly the output of some Natal collieries.

SUMMARY AND CONCLUSIONS.

South African coal is well classified according to its origin in the various coalfields. In Natal, anthracite and low, medium and high volatile bituminous coals are distinguished. In the other coalfields the distinction is mainly on quality (within a particular field) with a tendency in the Witbank coalfield for the lower quality coals to be of somewhat lower rank. The International Classification is not applicable to many of the lower rank South African coals. This is due to the fact that, because of their petrographic constitution, South African coals are mainly sub-hydrous, and thus abnormally low in volatile matter content, compared with coals of equivalent rank from Europe and North America. The strict application of the International Classification leads to many anomalies, which can be very well ilustrated by the case of Bertha No. 2 Colliery. Here nuts are placed in class 5 and the mixed smalls and crushed coal in class 9, although

the various/.......

the various grades of this coal are almost exactly the same in their general properties. By modifying the International Classification to allow for the classification of class 5 coals according to calorific value a reasonable classification could be obtained It is suggested that this could be done, for example for Bertha No. 2 Colliery, by classifying the grades as follows:-

Nuts	900
Mixed smalls	5/9 00
Crushed coal	5/9 00

It is felt that a distinction should also be drawn between a normal class 5 coal and a South African class 5/6 coal, by introduring a lower limiting calorific value for class 5, which on the moist mineral matter free (or ash free if ash content is less than 10%) basis may be of the order of 14.7 to 15.0 lb/lb (7,900 to 8,100 calories/gm).

PRETORIA.

6th August, 1957.

NOTE:

The mineral matter content used in calculating dry mineral matter free carbon contents is the same as for calorific values, namely ash times 1.08. The carbon contents quoted are mostly taken from a Confidential Technical Memorandum of the Institute, being No. 5. of the year 1955.

References:

1. Vogel J.C. and Quass F.W. Jnl. Chem. Metal. Mining Soc. S. Africa. Volume 41 page 262.

2. Sevenster P.G. Idem Vol. 53 page 163.

TABLE 1

Primary Classification of South African Coals according to the International System Based on Annexure B2(a) of the 1956 Annual Report of the Fuel Research Board.

Colliery:	Dry ash free Volatile Matter% 1.	2.	3.	4.	5.	D.m.m.f.C.V. lb./lb.	Estimated m.m.f. Cap. H_2O%	Estimated moist m.m.f. C.V. lb/lb	Class	Class by c.v.
NATAL										
Jackson's Anthra.	7.5D*					15.66	3.7	15.08	1	
Natal Anthra	10.3N	10.1P	10.6D			15.94	3.2	15.43	2	
Carnarvon Anthra.	10.5N	10.8D				15.80	3.3	15.28	2	
Natal Ammon.	10.8N	10.7P	11.0D			15.88	3.0	15.40	2	
Alpha Anthra.	11.8N	11.7P	12.0D			16.01	3.2	15.50	2	
Zuinguin	20.0R	19.6N	20.0P	20.9D	18.7MS	15.77	3.9	15.15	3(P,4)	
Natal Steam.	21.0R	20.2N	20.9D	20.9MS		16.03	3.3	15.50	4	
Enyati.	23.4R	23.2N	22.7P	23.3D	21.5MS	15.97	2.9	15.51	4	
Tshoba	22.6R	25.9P	22.7D			15.92	4.1	15.27	4	
Hlobane	23.7R	23.6N	24.2P	26.2D	26.0MS	15.98	3.1	15.48	4	
Natal Nav.	25.0N	25.5P	25.3D	24.8MS		16.02	2.6	15.60	4	
Newcastle Plat-berg.	24.9R	25.2N	25.2P	25.3D	27.2MS	16.02	3.0	15.54	4	
Cambrian.	26.2R	25.4N	24.9P	25.7D	25.7MS	15.85	3.0	15.37	4	
Utrecht.	29.4N	30.6P	31.1D	31.0MS		15.39	4.5	14.70	5	
Durban Nav.	35.4R	33.9M	36.8CC			15.74	3.0	15.27	6	
Natal Coal Ex.	35.3R	37.0N	37.7GN	36.6P	36.1D	15.60	4.1	14.96	6	
Ballengeich	35.0N	35.6P	36.4MS			15.34	4.6	14.63	6	

* The grades of coal are indicated as follows:- R Round, N Nut, P Pea, D Duff, MS Mixed Smalls, PD Pea-Duff, W Washed coal, M Middlings, CC Coking coal, LN Large Nuts, SN Small Nuts, GN Gas Nuts, C Cobbles.

TABLE 1 (Contd.)

Colliery:	Dry ash free Volatile Matter% 1.	2.	3.	4.	5.	D.m.m.f.C.V. lb./lb.	Estimated m.m.f. Cap. H_2O%	Estimated moist m.m.f. C.V. lb/lb	Class	Class by C.V.
WITBANK - MIDDELBURG.										
Witbank South	28.9MS					14.88	5.2	14.11	5	7
New Schoonge.	30.4R	29.0N	29.1MS			14.98	5.4	14.17	5	7
Wolvekrans	31.5R	29.9N	29.3P	29.2D		15.09	4.9	14.35	5	7
Landau	31.3R	31.4N	30.9P	30.3D		15.11	4.5	14.43	5	
Coronation	31.2R	30.8N	30.7PD			15.09	5.4	14.28	5	7
New Largo	31.6LN	31.1SN	31.5MS			14.58	8.5	13.34	5	8
Alpha Cons.	31.2N	31.4P	31.5D	32.0MS		14.32	8.7	13.07	5	8
Tavistock+Uitspan	31.3C	32.4N	31.9P	31.6D	31.2MS	14.80	6.6	13.82	5	7
Douglas	32.4R	31.4N	31.3P	32.2D		15.16	4.5	14.48	5	
Van Dyks Drift	32.9R	31.6N	31.7MS			15.14	4.9	14.40	5	
Albion	33.1R	31.8N	31.6MS			14.91	5.5	14.09	5(R7)	7
Koornfontein	32.7R	32.3N	32.2P	31.6D		15.24	5.2	14.45	5	
Springbok	33.5R	32.4N	32.0MS			15.11	4.5	14.43	5(R6)	
Waterpan	33.7R	33.6N	31.6P	31.5D		14.98	5.5	14.16	5(RN7)	7
Klipportje	35.4N	33.5P	30.9D	31.8MS		14.57	7.2	13.52	5(NP7)	7
Greenside	34.1R	33.4N	33.1P	32.8D		15.12	4.4	14.45	6(D5)	
Navigation	36.1WC	31.5M				15.18	5.3	14.38	6(M5)	
Blesbok	37.7N	37.7MS				15.28	6.1	14.35	7	
New Clydesdale	33.6R	32.8N	32.8MS			15.11	5.2	14.32	5(R7)	7
Tweefontein	34.5R	33.8N	32.7P	33.2D		15.02	5.2	14.24	7(P5)	
Tvl. Nav.	34.0R	33.7N	33.4P	33.2D		15.03	5.5	14.20	7	

TABLE 1 (Contd.)

Colliery	Dry ash free Volatile Matter% 1.	2.	3.	4.	5.	D.m.m.f.C.V. lb./lb.	Estimated m.m.f. Cap. H_2O%	Estimated moist m.m.f. C.V. lb/lb	Class	Class by C.V.
WITBANK - MIDDELBURG										
Phoenix	34.4R	33.6N	32.7P	33.3D		14.99	5.9	14.11	7(P5)	
Witbank Cons.	35.9R	34.4N	33.9P			14.76	6.9	13.74	7	
Kendal	38.3N	38.4MS				14.80	7.5	13.69	7	
South Witbank.	34.8R	33.9N	33.5P	31.7D		14.49	7.8	13.36	7(D5)	
ERMELO										
Marsfield	39.3R	41.0N	40.1MS			14.94	6.0	14.04	7	
Consolidated	36.3R	36.2N	36.2P	35.8D		14.97	6.6	13.98	7	
Union	38.0R	38.3N	37.9P	37.1D	37.3MS	14.84	6.4	13.89	7	
Bellevue	39.0R	39.2N	40.0P	39.7D		14.61	8.6	13.35	8	
HEIDELBERG AND ORANGE FREE STATE.										
Springfld. North	35.6C	32.0N	31.2MS			13.81	12.7	12.06	5(C8)	8
Springfld. South	32.4MS					13.85	13.0	12.05	5	8
Bertha No. 2	33.1N	32.4MS	33.0(crushed Coal)			13.69	18.5	11.16	5(N9)	9
Bertha No. 1	36.9C	35.6N	36.6(crushed Coal)			14.02	15.8	11.80	8	
Coalbrook North	36.9N	37.6MS				13.92	18.1	11.40	8	
Betty	37.4C	37.3N	36.2MS			13.81	17.5	11.39	8	
Vierfontein	38.3C	36.2N	34.2MS			14.09	19.2	11.38	8	

Table 2 (Taken from International Classification of Hard Coals by Type) Tableau 2

Statistical grouping of hard coals

(Coals with gross calorific value over 5,700 kcal/kg on moist, ash-free basis)

Groupement statistique des houilles

(Charbons d'un pouvoir calorifique brut supérieur à 5.700 kcal/kg sur échantillon humide, exempt de cendres)

GROUPS — GROUPES (determined by caking properties) (déterminés d'après le pouvoir agglutinant)			CODE NUMBERS — NOMBRES CONVENTIONNELS										SUB-GROUPS — SOUS-GROUPES (determined by coking properties) (déterminés d'après le pouvoir cokéfiant)		
Group number / N° du groupe	Alternative group parameters / Paramètre de détermination du groupe (au choix): Crucible-swelling number / Indice du gonflement au creuset	Roga index / Indice Roga	The first figure of the code number indicates the class of the coal, determined by volatile matter content up to 33% V.M. and by calorific parameter above 33% V.M. The second figure indicates the group of coal, determined by caking properties. The third figure indicates the sub-group, determined by coking properties.					Le premier chiffre du nombre conventionnel indique la classe, déterminée d'après l'indice M.V. (Charbons contenant jusqu'à 33% de M.V.) ou par paramètre du pouvoir calorifique (charbons contenant plus de 33% M.V.) Le deuxième chiffre indique le groupe, déterminé d'après le pouvoir agglutinant. Le troisième chiffre indique le sous-groupe, déterminé d'après le pouvoir cokéfiant.					Sub-group number / N° du sous-groupe	Alternative sub-group parameters / Paramètre de détermination du sous-groupe (au choix): Dilatometer / Essai dilatométrique	Gray-King / Essai Gray-King
3	>4	>45					435	535	635 (VC)				5	>140	>G8
						334	434	534	634				4	>50 – 140	G5 – G8
						333 (VA)	433 (VB)	533	633	733 (VD)			3	>0 – 50	G1 – G4
						332 a / 332 b	432	532	632	732	832		2	⩽0	E – G
2	2½ – 4	>20 – 45				323	423	523	623	723	823		3	>0 – 50	G1 – G4
						322 (IV)	422	522	622 (VIA)	722	822		2	⩽0	E – G
						321	421	521	621 (VIB)	721	821		1	Contraction only / Contraction seulement	B – D
1	1 – 2	>5 – 20			212	312	412	512	612	712	812		2	⩽0	E – G
					211	311 (III)	411	511	611 (VII)	711	811		1	Contraction only / Contraction seulement	B – D
0	0 – ½	0 – 5		(I) 100 A / B	(II) 200	300	400	500	600	700	800	900	0	Non-softening / Ne se ramollissant pas	A
Class number — N° de la classe →			0	1	2	3	4	5	6	7	8	9	As an indication, the following classes have an approximate volatile matter content of: Class 6 ..... 33 – 41 %; 7 ..... 33 – 44 %; 8 ..... 35 – 50 %; 9 ..... 42 – 50 %	A titre d'indication, les classes ci-après ont environ l'indice M.V. (matières volatiles) suivant: Classe 6, 7, 8, 9	
Class parameters / Paramètre de détermination de la classe	Volatile matter (d.a.f.) / Matières volatiles (produit sec exempt de cendres) →		0 – 3	>3 – 10 (>3 – 6.5 / >6.5 – 10)	>10 – 14	>14 – 20	>20 – 28	>28 – 33	>33	>33	>33	>33			
	Calorific parameter[a] / Paramètre du pouvoir calorifique[a] (Produit humide exempt de cendres) →		–	–	–	–	–	–	>7 750	>7 200 – 7 750	>6 100 – 7 200	>5 700 – 6 100			

CLASSES

(determined by volatile matter up to 33% V.M. and by calorific parameter above 33% V.M.) — (déterminées d'après l'indice de matières volatiles (charbons contenant jusqu'à 33% de M.V.) ou par paramètre de pouvoir calorifique (charbons contenant plus de 33% de M.V.)

Note. — (i) Where the ash content of coal is too high to allow classification according to the present systems, it must be reduced by laboratory float-and-sink method (or any other appropriate means). The specific gravity selected for flotation should allow a maximum yield of coal with 5 to 10% of ash.

(ii) 332a . . . > 14-16 % V.M.
332b . . . > 16-20 % V.M.

Gross calorific value on moist, ash—free basis (30° C, 96 % humidity) kcal/kg.

Note. — (i) Lorsque la teneur en cendres du charbon est trop élevée pour que sa classification soit effectuée selon les principes de la méthode, cette teneur en cendres doit être réduite, au laboratoire, par traitement aux liqueurs denses (ou tout autre traitement approprié). La densité de coupure devra être choisie de manière à assurer le rendement maximum en charbon d'une teneur en cendres comprise entre 5 et 10 %.

(ii) 332a . . . >14-16 % M.V.
332b . . . >16-20 % M.V.

[a] Pouvoir calorifique supérieur de produit humide, exempt de cendres en kcal/kg. Humidité correspondant à l'eau de rétention dans une atmosphère à 30 °C et 96 % d'humidité.