THE PRINCIPAL REQUIREMENTS OF THE PORTLAND CEMENT SPECIFICATIONS OF VARIOUS COUNTRIES

Collection of specifications was begun in 1915, was interrupted by the war, and resumed in 1920. For countries indicated by * there are available no recent reports, but only the replies to first inquiry. Such data is included, although some may now be obsolete.

Chemical Requirements, Specific Gravity, Fineness of Grinding, Setting Time

COUNTRIES	Chemical – Max. %: Insoluble Residue	Ignition Loss	SO_3	MgO	Al_2O_3	Add. after Burning	Chemical – Miscellaneous	Specific Gravity	Fineness: Minimum % Passing Sieve	Description of Sieve Used – Mesh per Unit	Nearest Sieve in U.S. Std. Screen Scale	Setting Time (Vicat): Initial – Minimum Time (Minutes)	Final – Min.-Max. (Hours)
ARGENTINE	a	a	2.0	4		3a	(a) Not over 3% foreign useful material $\frac{CaO}{SiO_2+Al_2O_3+Fe_2O_3}$ = Not less than 1.7	3.05	95 70	30 cm 70	80 170	35	3-10
AUSTRALIA New South Wales - Public Works	2		2.0-b				(b) Total SO_3	3.00	87 75	120 in 180	120 A 170 A	60	3-12
Victoria State - Public Works								3.10	90	50 in	50 A	20	2-7
Melbourne & Metropolitan Bd. of Wks.			2.0	3	5-10		Combined SiO_2 = 20 to 27%. Max. Fe_2O_3 = 6.0 Lime = 58-64; not over 61% unless rotary kiln.	3.00	95 80	50 in 17,000 sq. in	50 A 120-140 A		
Melbourne City Council uses British Stds.													
*AUSTRIA			2.5	5		3	$\frac{CaO}{SiO_2+Al_2O_3+Fe_2O_3}$ = 1.7 minimum	3.10	95 70	30 cm 70	60-70 170	30	
BELGIUM	1.5	3	2.5	3		o	(a) Plaster only. CaO = 61% minimum after calcination.	3.07	95	30 cm	80	45	4-12
BRAZIL This is not a standard, but is a railway spec. which is sometimes used	1.5	3	1.5	3			Alkali not over 3%	3.10	97	30 cm	80 A	?	?
CANADA Spec. used by Dept. of Pub. Wks.			1.75	4				3.10	92 75	100 in 200	100 200	30	1 - 10
*CHINA A Railway Specification. The Dept. of Public Works at Shanghai, and also of Hong Kong use British Stds.	1.5	2 a	2.75-b	3-b		a	(a) Not over 2% water. (b) Total SO_3. Hydraulic Modulus = 2 to 2.85	3.15 3.10 at 4 wks.	97 82	76 in 180	70 A 170 A	Rapid 02 Med. 10 Slow 20	1/4 - 1/2 1/2 - 2 2 - 7
*CUBA			2.0	4		3		3.05	90	100 in	100	Gillmore 30-90	10
DENMARK German specs. also used.						3			97 ?	30 cm 5000 sq. cm	70 A 170 A	60	2-15
ENGLAND	1.5	3	2.75-c	3		b	(a) Total S calc. as SO_3. (b) Water or gypsum only. No slag permitted. After deducting CaO required for SO_3, and calc. by chem. equivalents, $\frac{CaO}{SiO_2+Al_2O_3}$ = 2 to 2.85.		99 86	76 in 180	70 170	20 Rapid 02	10 1/2
FRANCE			3.0-a	5	10	b	(a) No appreciable sulphides. (b) No foreign materials.		90 70	30 cm 70	80 170	20	2-12
Special requirements for sea water work →			1.5-a	2-c	8-c	b	(c) Ratio $SiO_2+Al_2O_3$ to $CaO+MgO$ = 0.47 minimum; variation of 0.02 for each % less Al_2O_3		90	30	80	20	3-12
GERMANY			2.5	5		3	$\frac{CaO}{SiO_2 (soluble)+Al_2O_3+Fe_2O_3}$ = 1.7 minimum.		95	30 cm	70	60	
*HUNGARY				3		2		3.10 ?	90 55	30 cm 70	60-70 170	Rapid 10 Slow 30	
*ITALY		5 a	1.2	3		a	(a) A Govt. R.R. spec. of 1915, which prohibited any inert or injurious materials.	3.05	98 80	30 cm 70	70 170	60	5-12
JAMAICA		2-a	2.0			b	(a) Not over 2% water. (b) Only water or gypsum; of latter, only 2% calc. as SO_3	3.15 3.10 at 4 wks.	97 82	76 in 180	70 170		
JAPAN		5 (Sea Water Work → 1.5)	2.5	3		3 a	(a) No addition to cement except gypsum, which is not to exceed 3% by weight.	3.05	90	30 cm	60-70	60	10
MADAGASCAR General details essentially as for France, except as shown here													
MALTA						None			90	50 in	50 A		
MARTINIQUE			3-a	5	10		(a) No appreciable sulphides.		90 70	30 cm 70	80 A 170 A	20	2-12
MEXICO	a		1.75	4		3-a	(a) Not over 2% sand or inert material. The following ratio must be complied with $\frac{2.8 \times \% SiO_2 + 1.1 \times \% Al_2O_3 + 0.7 \times \% Fe_2O_3}{\% CaO + 1.4 \times \% MgO}$ = 1 to 1.2	3.05	96 80	100 in 200	100 200	20	2-7
MOROCCO Used for Govt. work in the French zone. No standard specification is used by the Moorish Govt.									90 70	30 cm 70	80 170	30 05 ← Rapid for Sea Water	3-12 1/6 - 1/4
*NETHERLANDS Army Engineers; Reinf. Concrete (Engrs.); Dept. of Water Ways	1.5	3-a 2.2	2.5			a a	(a) No slag.	3.10 3.10	{95 70 90	30 cm 70 30	60-70 170} 60-70	135 {120 60 Sea Water 120	10 3}
NORWAY	1.5	4	2.5	4		a	(a) Water or gypsum only. $\frac{CaO}{SiO_2+Al_2O_3+Fe_2O_3}$ = 1.7 min.	3.05	96 70	30 cm 5,000 sq. cm.	60-70 170	60	10
PORTUGAL			2.5-a	3			(a) No appreciable sulphides. Hydraulic Index = 0.42 to 0.50.	3.00	90 70	30 cm 5,000 sq. cm.	70 A 170 A	30	3 12
*RUSSIA			1.75	3		2	$\frac{CaO}{SiO_2+Fe_2O_3+Al_2O_3}$ = 1.7 to 2.2.	3.05	90 50	30 cm 70	60-70 170	20	1 12
SPAIN	1.5	4.6	2.5-a c	3-a		3	(c) Total S not over 1%. (b) Not over 2% water. (a) SO_3+MgO not over 5%. $\frac{CaO}{SiO_2+Al_2O_3}$ = 1.8 to 2.3. $\frac{SiO_2}{Al_2O_3}$ = 2.5 min.	3.05	97 75	30 cm 70	80 A 170 A	30	4 14
SWEDEN			2.5	5		3	$\frac{CaO}{SiO_2+Al_2O_3+Fe_2O_3}$ = 1.7 minimum.		95	30 cm	70	60	
SWITZERLAND						4	$\frac{CaO}{SiO_2+Al_2O_3+Fe_2O_3}$ = 1.7 minimum.		98 ?	30 cm 70	60-70 170	60	
SYRIA			1.0										
TUNISIA For sulphate lands			2.0-a 0.8-a	3 2	15 1.5		(a) No appreciable sulphides. For sulph. lands comb. SiO_2 = 25% min. Ferrous oxide = 1% max.		90 70	30 cm 70	80 170	20	2-12
UNITED STATES	0.85	4	2.0	5		a	(a) Only gypsum or water.	3.10	78	200 in	200	45 Vicat 60 Gillmore	-10 -10
URUGUAY	a	a	2.0	4		3a	$\frac{CaO}{SiO_2+Al_2O_3+Fe_2O_3}$ = 1.7 minimum (a) Foreign useful matl. not over 3%	3.10	98 85	30 cm 70	80 A 170 A	35	3-10

"A" = Approximate No. - Information insufficient for close comparison.

Soundness, Minimum Strength (lbs/sq. in.), Standard Sand, Packing

Soundness key: P = Pat, B = Ball, s = Steam, b = Boil, m = Moist, d = Dry.
Strength Miscellaneous key: M = Machine Moulding; C.S. = Combined Storage - 1-day moist air, 6 days water, 21 days air.

COUNTRIES	Soundness: Air	Water	Accelerated	Le Chatelier – Max. Expans. mm	Tensile Neat: Days 7	Tensile Neat 28	Tensile 1:3 Mortar 7	Tensile 1:3 Mortar 28	Compressive Neat 7	Compressive Neat 28	Compressive 1:3 Mortar 7	Compressive 1:3 Mortar 28	Strength – Miscellaneous	Standard Sand – Sizes in Nearest Sieve Nos. U.S. Std. S.S.	Packing – Marking, Weights, General Notes
ARGENTINE	Pm	P	P Faija	10	427	498 a	171	228 b					(a) Gain 42.7 unless 7-d = 568, when 28-d. should show no decrease (b) Gain = 14.2 lbs. M.	14-18	Gross wt., Name, where made, trade mark. Waterproof paper-lined bbls. for Imports.
AUSTRALIA New South Wales - Public Works	P	P	P Deval Bor. Exp. 0.1%		585 715 ← Deval		165 250 ← Deval	250				2250 3570 c.s.	M.	20-30	Brand on bbls. Dept. seal on bags. Bags = 125-lb. net; bbl. = 375-lb. net.
Victoria State - Public Works	P	P	P s		400	a	150	250 b					2-d. neat = 160; 4-d. = 250. (a,b) Gains over 7-d strength from 5 to 25%, per sliding scale.		Brand, maker. Bbl. = 375-lb. net. Bags = aliquot parts of bbl.
Melbourne & Metropolitan Bd. of Wks.			P 38° S. or b.		450	c							(c) To exceed 7-d.		Bbl. = 375-lb. net, and is unit of purchase. Bags also used.
Melbourne City Council uses British Stds.															
*AUSTRIA		P	P d.				171	285 356 cs			1708	2846 3558 cs	28-d. is decisive; 7-d for control. M.	20-30	bbl. = 200-kg. gross; bag = 50-kg. 100-kg. is unit of purchase. Mark-Gross wt., name, where made, "Port.C."
BELGIUM			P b	6			185 157 a	285 228 a			1850 1565 a	2846 2277 a	M. (a) Acceptable under special conditions. Comp. test not always required.	20-30	Bbl. = 170-Kg. net. Specs. cover packing details.
BRAZIL			B b												bbls = 140 or 170-kg. net, 150 or 180-gross.
CANADA	P	P	P s. Warm Water 46°		500	600	200	275	3500	6000	1000	2500	1-day neat = 200 lbs. tens; 1500 comp. A.S.T.M. moulding methods. Comp. test optional.	20-30	Brand and maker. Bag. = 87½ lb. net.
*CHINA	After 7-day aeration → 5			10	400	a	150	250 a					(a) 28-d. to gain 5% over 7-d. strength	20-30	
*CUBA		P	P b.		450	550	140	200 a					A standard hand hammer is used. (a) To gain 10% over 7-d.	20-30	Maker, brand, Dept. of Pub. Wks. insp. stamp. Bbls = 170 kg. net; bags 42.5 to 85 kg net. Specs. cover details.
DENMARK		P		10			171 a	228			1708 a	2846	Machine moulding usually; sometimes hand. (a) 7-d for control only.	14-(20-25)	Gr. wt., brand or maker, factory, "Portland Cement." Bbls = 90 or 180 kg. gr., 83 or 170 net; bags approx 85 net.
ENGLAND	After 7-day aeration → 5			10	450	a	200	b					(a) = 7-d + $\frac{40,000}{7\text{-}d}$ (b) = 7-d + $\frac{10,000}{7\text{-}d}$ where "7-d" = 7-day strength. A standard spatula is used in moulding mortars.	20-30	Maker.
FRANCE				10	356	498 a	114	213 b					(a) Gain 42.7-lbs. (b) Gain 28.4-lbs over 7-d.	10, 14, 18, 35 Three sizes equal wts. of each size	Maker, net wt. on bbls; maker on bags. Bags = 25 or 50 kg. net.
Special requirements for sea water work →	P sea water For Sea Water Work → 5														
GERMANY		P					171				1708	2846 3558 cs	M. 28-d is decisive test.	14-(20-25)	"Portland Cement," gr. wt., firm or trademark.
*HUNGARY	P	P	B b.				a	228 a				2277	M. or trowel moulding; former preferable. (a) 7-d. and tens tests for control only.	20-30	"Portland Cement," Gr. wt., factory, address, lead seal on bag with foregoing data. Bbl. = 180-kg; bag = 60.
*ITALY		P	B b.	?			228	285 b			2561	3131 b	(b) 28-d is decisive test. Values of 228 and 2561 allowed for 28-d. tens and comp. strength under certain conditions for small lots. M.	14-18	Name and mark of maker.
JAMAICA	After 7-day aeration → 5			10	400	500 b	150	250 a					(a) Gain 20% over 7-d. (b) Gain to be in accordance with sliding scale, 5 to 25%.	20-30	Maker.
JAPAN		P	P b		427 b		142	256 a				1991	Mach. moulding; spatula permitted. (a) Gain over 7-d. (b) If mortar test too long	20, 30, 35 Equal pts., 2 sizes	
MADAGASCAR					427	498 a	171	256 b					(a) Gain 42.7-lbs (b) Gain 28.4-lbs over 7-d.	As for France	Net wt., maker, Bbl. = 200-kg. gross. Specifications cover construction of bbls.
MALTA					444										Bbls used. Their construction is described in specifications.
MARTINIQUE					356	498 a	114	213 b					(a) Gain 42.7 lbs. (b) Gain 28.4-lbs.		Bbl.
MEXICO	P	P	P b		541	640	157	228					1-d. Neat = 199-lbs. Moulding methods approximately the same as in U.S.	20-30	Bbl. = 167-kg. net; bag = 50-kg. net. Factory, where made.
MOROCCO		P		5	285 356 142	398 a 498 a 228 a	100 114 85	185 b ← For Bldgs. 213 c ← Marine, Slow 171 c ← Marine, Rapid					(a) Gain 42.7-lbs over 7-d. (b) Gain 42.7-lbs (c) Gain 28.4-lbs.	As for France	Bbl. or bag.
*NETHERLANDS	P	P P P	P b.	10	356 356	498 498	199 171 142	285 285 b 228			1708 1423	2846 b	M. (b) Gain:- tensile 10%; compressive 25%.	German Sand?	Maker, pkgs. sealed. Certificate of origin with shipment. Bbl. or bag.
NORWAY		P	B b	5			199	285			1992	2846	M. 28-d. is decisive test.	As for Germany	"Portland Cement," factory or trade mark, gross. wt. Bbl. = 170 kg. net; bag = 56⅔ kg. net.
PORTUGAL				5	356	498 a	114	213 b		4981		2277	Gains of 28-d. over 7-d.: (a) 57; (b) 42.7 lbs.		
*RUSSIA		P	P d.		285	356	85	142				1423	Specs. require certain ratios of comp. to tens. strengths. M. for comp.; hammer for tens.	As for Japan	"Portland Cement," factory, supply number, year made. Bbl. = 370-lb. net; approx 397-gross.
SPAIN	Pm.	P	P				228	285			1992	2561	M. for comp; hammer for tens	14-18	
SWEDEN		P		12			199				1992	3558 cs 2846	Tens. and 7-d. comp. tests not decisive. M.	German Sand	"Portland Cement," factory or trade mark, gross wt. Bbl. or bag used.
SWITZERLAND		B P	B b. Dry location For damp location					313				3700	28-d. compressive is decisive test. M.	20-30	Brand and maker, gross wt. on pkgs. other than bags. Bags = 50-kg. gross.
SYRIA				5			171								
TUNISIA For sulphate lands				10 5		498		157						As for France	
UNITED STATES			Ps.				200	300 a					(a) To exceed 7-d. strength.	20-30	Maker and brand. Bbl. = 376, bag = 94-lb. net.
URUGUAY	Pm.	P		10	427	498 a	171	228 b					(a) 42.7-lbs. above 7-d. unless 7-d = 568, when 28-d must show no decrease. (b) 14.2-lb. above 7-d.	14-18	Imports in waterproof-paper lined bbls, with gross wt., place of origin, maker's mark.

FOLLOWING COUNTRIES USE SPECIFICATIONS DESCRIBED.

*ARABIA - Aden Govt. uses British Specs.
AZORES - Probably Portuguese Specs.
BALLEARIC Is. - A Spanish Spec.
BOLIVIA - Sometimes Argentine
BURMA - Govt. uses British Specs.
CEYLON - British Specs.
CHOSEN - Tests made; details unknown.
EGYPT - Cairo Dept. of Pub. Wks uses British
FINLAND - No Std. - German specs. used.
FORMOSA - Japanese Specs.
GREECE - No Std; usually German.
GUIANA (BRITISH) - No Std. - Some Depts use British
*HAITI - No Std; sometimes A.S.T.M.
INDIA - Dept. of Pub. Wks uses British
INDO-CHINA - French Specs.
IRELAND - British
KENYA COLONY (AFRICA) - British
PALESTINE - British
PARAGUAY - No Std; sometimes Argentine
ROUMANIA - Tests per I.A.T.M.
SANTO DOMINGO, D.R. Pub. Wks. Dept. uses U.S.
SIAM - A Govt. Dept. - British Specs.
SOCIETY Is. - A French Spec.
SOUTH AFRICA - Union Govt. Pub. Wks. - British
TRINIDAD, B.W.I. - British Specs.

NO STD. SPECS.

ALGERIA
BAHAMA
BULGARIA
*CHILE
*COLOMBIA
COSTA RICA
ECUADOR
GUADALOUPE
GUATEMALA
HONDURAS
LIBERIA
NICARAGUA
PANAMA
*PERSIA
PERU
TURKEY
VENEZUELA

Some of these countries use specs. of country from which cement is bought, consider reputation of brand, and sometimes tests are made by them, or for them by another country.

SPECIAL REQUIREMENTS.

APPARENT DENSITY ~ France requires 1100 grams min. wt. per liter for medium and slow cements and 850 for quick. Portugal, Tunisia for wt. per liter require 1000-g. In Australia, Melbourne & Metropolitan Bd. of Wks requires 116-lb per struck bushel; Victoria Public Wks Dept. requires 114-lb. Some countries prescribe the method of filling the measures.

MISCELLANEOUS ~ Some countries have requirements for such properties as color, reputation, packing details, variation and loss in weight, residence of the manufacturer's representative, certificates, and country where made.

GENERAL NOTES.

Any close comparison of the specifications of various countries requires consideration of their respective methods of testing. There will be found much variation in such important details as the following:

SPECIFIC GRAVITY ~ Treatment before test.

FINENESS ~ Measurements of sieve, wires and openings, size of sample, method of sieving, point of terminating test.

SETTING TIME ~ Apparatus used, storage of test piece, condition considered as the "set," percentage of water.

SOUNDNESS ~ Test pieces, storage prior to test, rate of raising temperature of accelerated tests, degree and duration of the temperature; interpretation of results; if more than one test, which is decisive.

STRENGTH ~ Moulding and storage of test pieces, their dimensions and shapes, rate of applying load, number of specimens broken at one period, method of computing average strength, increases of strength required in certain intervals.

MIXING ~ Percentage and kind of water, manner and time of mixing, apparatus size of batch.

STORAGE WATER ~ Kind of water, temperature, renewal periods.

STANDARD SANDS ~ Kind, size or sizes, how prepared; if more than one size, what proportions of each.

CHEMICAL REQUIREMENTS ~ Limits of composition for special classes of cements; methods of computing; special ratios to be complied with; such details of analytical methods as are included in some specifications.

U.S. DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
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JRO