SPECIFICATION OF BPCL MAKE MINERAL TURPENTINE/LAWS

SR. NO	CHARACTERISTICS	TEST METHOD IS:1448	REQUIRMENTS
1.	Colour (Saybolt), Min.	P =14	+20 to +30
2.	Density at 15^{0}C, g/ml(Typical)	P =16	0.795
3.	Flash Point (Abel),^{0}C, Min.	P =20	>=35
4.	Distillation range:		
	a) Initial boiling point,^{0} C, Min.	145	
	b) 50% V, recovered at ^{0}C (typical)	169	
	c) 95% V, recovered at ^{0}C (typical)	190	
	d) Final Boling Point, ^{0}C , Max.	215	
5.	Aromatic Content, % v, Max.	P: 23 or 48	<=30
6.	Copper Strip Corrosion For 3 hours at 50'C	P: 15	Not worse than No.1
7.	Residue on Evaporation m/100 ml, Max. (Air-Jet)	P:29	<=5
8.	Sulphur, Mercaptans	P:109/P:342	<=0.0015

KOCHI REFINERIEES LIMITED

AMBALAMUGAL

CERTIFICATE OF QUALITY : MINERAL TURPENTINE OIL

(TEXTILE GRADE)

Certificate No. : 33/03 Tank No. : 420

Batch No.: 104 Date:17/06/2003

SI.NO	Test	Test Method	Specification	Result
1.	Appearance	Visual	Colourless Clear Liquid	Colourless Clear Liquid
2.	Density at 15° gm/ml	P:16	To be reported	0.7762
3.	Flash point (Abel)°C	P:20	Min 35	37
4.	Residue on Evaporation Mg/100ml	P:29	Max 5	14
5.	Aromatic Content Vol%	P:23	Max 40	18
6.	Distillation : IBP °c	P:18	Min 145	148
	Final Bolling Pont °C	"	Max 205	192

CERTIFICATE OF QUALITY : MINERAL TURPENTINE OIL

(PAINT GRADE)

Certificate No.: 41/03 Tank No.:430

Batch No.: 112 Date : 13/07/2003

SI.NO.	Test	Test Method	Specification	Result
1.	Appearance	Visual	Colourless Clear Liquid	Colourless Clear Liquid
2.	Density at 15° gm/ml	P:16	0.79+0.01	0.7854
3.	Flash point(Abel)°C	P:20	Min 35	45
4.	Residue on Evaporation Mg/100ml	P:29	Max 5	16
5.	Aromatic Content Vol %	P:23	Max 22	18.1
6.	Distillation : IBP °C	P:18	Min 150	154
	Final Boiling Pont °C	"	Max 250	239

INDUSTRIAL LUBRICANTS OIL

1.TURBINE OILS	TURBINOL 32,46,57,68,77	TURBINOL XT 32.46.68
2.BEARING OILS	HP FILM OIL 46,68,100,150,220	
3.BEARING OILS	HP STEEL 257,460,680	
4.BEARING OILS	HP STEEL EP 100	
5.HYDRAULIC&CIRCULATING OILS	ENKLO32,46,57,68,N68,100,121,150,176,220,320,460,(ANTI-WEAR TYPE)	
6.HYDRAULIC&CIRCULATING OILS	ENKLO HLP 22,32,46,68 (SPECIAL PURPOSE ANTI-WEAR TYPE)	
7.HYDRAULIC&CIRCULATING OILS	ENKLO HL P T 32,46,68 (SPECIAL PURPOSE ANTI-WEAR TYPE)	
8.HYDRAULIC&CIRCULATING OILS	ENKLO HL 32,46,68,100 (R & O TYPE)	
9.FIRE RESISTANT HYDRAULIC FLUIDS	ENKLO FRIE 68,100,150	ENKLO FRWG 22,46,68
10.COMPRESSOR OILS	HYCOM C 100,150,220,320	HYCOM 32,46,68,100,150
11.COMPRESSOR OILS	HYCOM NH 32,46,57	
12.COMPRESSOR OILS	HYCOM VDL T 32,46,68,100,150,220,320	
13.MACHINE TOOL WAY OILS	WAYLUBE 68, N68, 220	
14.INDUSTRIAL GEARBOX OIL	PARTHAN EP 68,100,150,220,257,320,460,680,1000	
15.SPINDLE OILS	SPINTEK 5,12,15,22	
16.GENERAL PURPOSE MACHINERY OIL	YANTROL 32,68,100,150,220,320	YANTROL 32,68,100,150,220,320,460
17.TEXTILE OILS	YANTROL TS 32,68,100,220	YANTROL C 32
18.STEAM CYLINDER OILS	CYNDOL 680,1000,1500,TC460,TC530,TC680	
19.REFRIGERATION COMPRESOR OIL	SEETUL 15,22,32,46,68,100,N32,N68	
20.PNEUMATICS TOOL OILS	NU-MATIC 100,220	
21.SUGAR MILL ROLL BEARING OILS	CRUSHWELL 2,3,4	
22.OPEN GEAR OILS	HYTAK 0,1,2,5,F3,F4,F5	
23.DEFENCE GRADES	HP OIL OM 33, OM 100	HP PROTECTIVE PX-100
24.DEFENCE GRADE	HP OIL C 70, C 660	
25.DEFENCE GRADES	HP OIL OX 52	

BITUMEN 60/70 GRADE

PROPERTIES	METHOD	UNIT	RESULT
FOAM ON HEATING TO 175°C	Visual	-	Nil
PENETRATION (25.0°c,5 sec 100g)	ASTM D 5/97	mm	65
DUCTILITY AT 25°C	ASTM D 113/99	cm	>100
FLASH PONT, DOC	ASTM D 92/02b	°C	348
SOLUBILITY IN TRICHLOROETHYLENE	ASTM D 2042/01	%wt	99.9
THIN – FILM OVEN TEST LOSS ON HEATING DROP IN PENETRATION AFTER HEATING DUCTILITY OF RESIDUE AT 25°C	ASTM D 1754/02	% % CM	0.01 7 >100
DENSITY AT 25°C	ASTM D 70/97	Kg/L	1.0193
DENSITY AT 15°C	ASTM D 70/97	Kg/L	1.0274
SPOT TEST	AASHTO T 102/93	-	Negative
SOFTENING POINT	ASTM D 36/100	C	49.2
WAX CONTENT	DIN 52015	%WT	1.9

SPECIFICATION OF PAVING BITUMEN

Sr.No	CHARACTERISTICS	REQUIREMENTFOR GRADES						METHOD OF TEST
		s35	s45	s55	s65	s90	s200	
1	Specific gravity at 27 °C. min	0.99	0.99	0.99	0.99	0.99	0.99	IS 1202 : 1978
2.	Water, % by mass, max.	0.2	0.2	0.2	0.2	0.2	0.2	IS 1211 : 1978
3.	Flash Ponits, Cleveland open Cup, °C min	175	175	175	175	175	175	IS 1209 : 1978
4.	Softening open cup, °C, min	50 to 65	45to 60	45to60	45to 55	35to 50	30to 22	IS 1205 : 1978
5.	Penetration at 25°C, 100g, 5,sec., in 1/10 mm	30 to 40	40to 50	50to 60	60to70	80to 100	125to 225	IS 1203 :1978
6.	Penetration ratio (1),min	35	35	35	35	35	35	-
7.	Ductility at 27 °C,cm, min	50	75	75	75	75	-	IS 1208 : 1978
8.	Paraffin wax content, % by mass,max.	4.5	4.5	4.5	4.5	4.5	4.5	IS 10512 : 1983
9.	Frass breaking point, °C, min	-4	-4	-6	-6	-8	-10	IS 9381 : 1979
10.	Loss on heating, thin film oven test, % by masss, max.	1	1	1	1	1	1	IS 1212 : 1978
11.	Retained penetration after thin film oven test, 25°C 100g. 5sc, 1/10 mm,%of original, min	55	55	52	52	47	42	IS 9382 : 1979
12.	Matter soluble in trichoroenthylene,	99	99	99	99	99	99	IS 1216 : 1978

	% by mass,min.							
13.	Viscosity at : a.60°C, Poise	2500+/-500	2000+/-400	1500+/-300	1000+/-200	500+/-100	250+/-50	IS1206(Part2) : 1978
	b.135°C,Poise	220	210	180	150	110	20	IS1206(Part3) :1978

(1) Penetration ratio = Penetration at 4°C,200g,60ś

_____ X 100

Penetration at 25 °C,100g,5

Paving bitumen Type 1 shall be classified into six grades according to their penetration and ach grade shall be given designation as given in the table with letter "S" denoting the type and a numeral representing the mean of the limits of the penetration specified foe=r the grade.

CONFORMS TO IS : 73-1992 SPECIFICATIONS FOR PAVING BITUMEN

(TYPE 1) FROM NON-WAXY CRUDE

CHEMICAL CONVERSION FACTORS

Tons of raw material required for 1 ton of product under world average conditions, not necessarily representative of best modern technology.

ACETALDEHYDE TO :		**CUMENE TO :**	
Acetic Acid	0.75	Phenol	1.35
Ethyl Acetate	1.10	Acetone	2.25
ACETIC ACID TO :		**CYCLOHEXANE TO :**	
Butyl Acetate	0.53	Adipic Acid	0.72
Ethyl Acetate	0.69	Coprolactam	1.03
Vinyl Acetate	0.75	**DICHLOROETHANE (EDC) TO:**	
ACETONE TO:		VCM	1.62
Acetone cyanohydrins	0.76	**DMT TO :**	
Bisphenol A	0.29	PES Filament	1.08
ACRYLONITRILE TO :		PES fIlm	1.10
ABS	0.25	PET Resin / PES Staple	1.02
Acrylic Fibre	0.97	**ETHYLBENZENE TO :**	
Nitrile Rubber	0.35	Styrene	1.08
ADIPIC ACID TO:		**ETHYLENE TO :**	
Nylon 66 Resin	0.66	Acetaldehyde	0.67
BENZENE TO:		Ethanol	0.63
Alkylbenzene	0.38	Ethylbenzene	0.26
Aniline	0.38	EDC	0.29
Curnene	0.70	Ethylene Oxide	0.84
Cyclohexone	0.94	MEG (only)	0.60
Ethylbenzene	0.76	Polythene – HD	1.05

Styrene	0.79	Polythene –LD	1.03
Moleic Anhydride	1.15	Styrene	0.29
BISPHENOL TO :		Vinyl Acetate	0.32
Epoxy Resin	0.75	Vinyl Chloride	0.49
Polycarbonate Resin	0.91	**2 –ETHYLHEXANOL TO:**	
BUTADIENE TO :		Dioctyl Phthalate	0.69
ABS Resins	0.25	**ETHYLENE OXIDE TO:**	
Chloroprene	0.80	MEG (only)	0.72
Nitrile Rubber	0.66	Ethanolamines	0.82
Polybutadiene Rubber	1.00	**PROPYLENE OXIDE TO** :	
SBR	0.60	MPG (only)	0.80
HMDA TO :		Polyether Polyols	0.85
Nylon 66 Resin	0.52	**PTA TO:**	
ISOCYANATES TO :		PES Filament	0.92
Rigid PU FOAM (MDI)	0.60	PES Film	0.94
Flex PU foam (TDI)	0.35	PET Resin/PES Staple	0.87
CAPROLACTAM TO:		Polypropylene	1.02
Nylon 6 Resin	1 .02	Propylene Oxide	0.85
ORTHOXYLENE TO:		MPG (only)	0.68
Phthalic anhydride	0.96	**STYRENE TO :**	
PARAYLENE TO:		ABS Resins	0.55
DMT	0.64	Polystyrene GP/HI	0.95
PTA	0.67	Polystyrene Expandable	1.00
PHENOL TO :		SB Rubber	0.35
Bisphenol A	0.88	UPE Resins	0.33

Caprolactam	0.89	**TOLUENE TO :**	
Phenoloc Resin	0.82	Benzene	1.20
PHTHALIC ANHYDRIDE TO :		Coprolactam	1.10
Dioctyl Phthalate	0.39	Phenol	1.15
UPE Resins	0.25	TDI	0.65
PROPYLENE TO :		**VINYL ACETATE TO :**	
Acrylonitrite	1.10	Polyvinylacetate	1.02
Butyraldehyde	0.88	**VINYL CHLORIDE TO:**	
Cumene	0.36	Polyvinylchloride (PVC)	1.03
2-Ethylhexanol	0.80		
Isopropanal	0.75		

METRIC VERSUS US MEASURES

	Crude Oil average	Naphtha average	Benzene	Toluene	Xylenes	O-Xylene	P-Xylene
Pounds per US Gallon US Gallons	7.191	6.000	7.365	7.260	7.230	7.367	7.209
Per metric ton	306.6	367.5	299.3	303.7	305	299.3	305.8
Barrels per metric ton	7.30	8.75	7.126	7.231	7.26	7.126	7.281
$ 100 per metric ton	13.70 $/bbl	11.43 $/bbl	33.41 c/gal	32.93 c/gal	32.79 c/gal	4.536 c/lb	4.536 c/lb

ENERGY FACTORS

		TCE	TOE	TFOE	TGE	NG $10^3 m^3$	10^6 BTU	10^9Cal	10	MWN
Tons of Coal equiv	TCE	1.00	0.64	0.66	0.62	0.76	27.3	6.9	28.8	8.0
Tons of Crude Oil equiv	TOE	1.57	1.00	1.04	0.98	1.20	43.0	10.8	45.4	12.6
Tons of Fuel Oil equiv	TFOE	1.51	0.96	1.00	0.94	1.16	41.4	10.4	43.7	12.1
Tons of Gasoline equiv	TGE	1.61	1.03	1.07	1.00	1.22	44.1	11.1	48.3	12.9
Thous cu.m.Not Gas	NG$10^3 m^3$	1.13	0.83	0.86	0.82	1.00	35.7	9.0	37.7	10.5
Million BTU	10^6BTU	0.037	0.023	0.024	0.023	0.028	1.00	0.25	1.055	0.293
Million Kg Colories	10^9Col	0.145	0.093	0.096	0.090	0.111	3.97	1.00	4.19	1.163
Giga Joules	10^9J	0.035	0.022	0.023	0.022	0.027	0.948	0.24	1.00	0.28
Megawatt-hours	MWh	0.125	0.079	0.083	0.078	0.095	3.41	0.86	3.60	1.00
TOE (IEA Conversion Unit)		1.45	0.92	0.96	0.90	1.11	39.68	10.0	41.87	11.63

Seam	**Approx 10Tons**	**1.31**	**0.83**	**0.87**	**0.82**	**1.01**	**36.0**	**9.0**	**38.0**	**10.5**

CONVERSION TABLE

VOLUME & CAPACITY	LENGTH	WEIGHT
U.S.Gallons	1 Inch	1 Pound
= 231 Cubic Inches	= 0.254 Metres	=0.453592 Kilograms
=3.7854 Litres		=0.009 CWT
=0.83268 Imperial Gallons	1 Foot	= 16 Oz.
=0.133681 Cubic Feet	=0.333 Yards	
=0.238095 U.S.Barrels	= 12 inches	1 Kilogram
=0.0037854 Cubic Metres	=0.305 Merres	=2.20462 Lbs.
		=0.01 Quintal
U.S.Barrels	1 Yard	
= 9702 Cubic Inches	= 3 Feet	1 CWT
=158.99 Litres	= 36 Inches	= 112 Lbs.
=42 U.S.Gallons	=0.914 Metres	=50.802 Kilograms
=34.9726 Imperial Gallons		
=5.6146 Cubic Feet	1 Metre	1 Metric Ton
=0.15899 Cubic Metres	=1.094 Yards	= 0.98421 Long Ton
	=3.281 Feet	= 1.10231 Short Ton
Imperial Gallons	=39.37 Inches	=2204.6
= 277.42 Cubic Inches	=0.001 Kilometres	
=4.5461 Litres		
= 0.160544 Cubic Feet	1 Kilometre	
= 1.20094 U.S. Gallons	= 1000 Metres	TEMPERATURE
=0.028594 U.S.Barrels	= 0.621 Miles	
= 0.0045461 Cubic Metres		$^{o}K = {}^{o}C + 273.2$

Litres **= 1000 Cubic Centimetres** **= 61.024 Cubic Inches** **= 1.7597 Pints** **=0.26417 U.S.Gallons** **= 0.21997 Imperial Gallons** **= 0.035314 Cubic Feet** **Kilolitre** **= 1000 Litres** **= 6.2898 U.S.Barrels**	**1 Statute Mile** **= 1760 Yards** **= 1.609 Kilometres** **1 Nautical Mile** **= 6080 Feet** **= 1.15152 Statute Miles**	**$^{o}R = {}^{o}F + 459.7$**