

Laboratory **Quality Control Laboratory, Indian Oil Corporation Limited, Paradip Refinery, P.O. Jhimani, Via: Kujanga, Dist: Jagatsinghpur, Odisha**

Accreditation Standard **ISO/IEC 17025: 2005**

Certificate Number **TC-7180**

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Validity **09.12.2018 to 08.12.2020**

Last Amended on --

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CHEMICAL TESTING

I.	PETROLEUM AND PRODCUTS			
1.	Fuel Oil	Density at 15 °C	IS1448 (Part 16): 2014	800 kg/m ³ to 1100 kg/m ³
		Kinematic Viscosity at 50 °C	IS1448 (Part 25): 2018 ASTM D445: 2017a	20 mm ² /s to 500 mm ² /s
		Kinematic Viscosity at 100 °C		
		Ash Content	ASTM D 482-2013/ IS 1448 (Part 4): 2013	0.001 % mass to 0.18 % mass
		Flash Point (PMCC)	ASTM D 93- 2018 Procedure A & B IS 1448 (Part 21): 2014	40 °C to 200 °C
		Pour Point	IS1448 (Part 10): 2017 ASTM D 97-2017b	(-)15 °C to 45 °C
		Total Sulphur	ASTM D 4294- 2016	0.0017 % mass to 4.6 % mass
		Total Sediments	IS1448 (Part 30): 2013 ASTM D 473-2017e1	0.01 % mass to 40 % mass
		Acidity (Inorganic)	IS1448 (Part 2): 2013 ASTM D974 -2014e2/ IP 139-2017	0.00 to 250 mgKOH/g
		Water Content	ASTM E203-2016	30 mg/kg to 1000 mg/kg
		Calorific value	IS1448 (Part 7): 2016	5000 cal/g to 12000 cal/g
2.	Naphtha	Density at 15°C	IS1448 (Part 16): 2014 ASTM D1298-2017 ASTM D4052-2018	650 kg/m ³ to 800 kg/m ³
		Chloride content	ASTM D4929 Method B-2017	0.1 µg/g to 100 µg/g
		Aromatic Content	ASTM D 6730-2016	0.01 % V to 35 % V
		Olefin Content	ASTMD 6730-2016	0.01 % V to 45 % V

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Convenor

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		Distillation	ASTM D 86-2017/ IS1448 (Part 18): 2016	Boiling range – 20 °C to 250 °C Recovery Residue and Loss- 0.1 % vol to 5.0 % vol
		Total Sulphur	ASTM D 5453-2016e1	1 mg/kg to 100 mg/kg
		Reid Vapour Pressure	ASTM D 5191-2018 IS1448 (Part 39): 2012	7 kPa to 130 kPa 7 kPa to 130 kPa
		Sulphur Mercaptan	ASTM D 3227-2016 IS1448 (Part 109): 2016	0.0003 % mass to 0.01 % mass
		Existent Gum	ASTM D 381-2017 IS1448 (Part 29): 2016	5 g/m ³ to 100 g/m ³
3.	Motor Gasoline	Density at 15°C	ASTM D 4052-2018 IS1448 (Part 16): 2014	680 kg/m ³ to 850 kg/m ³
		Oxidation Stability	ASTM D525- 2012a / IS 1448 (Part 28): 2013	200 min to 600 min
		Aromatic Content Olefin Content	ASTM D6730- 2016 ASTM D1319-2015 IS1448 (Part 23): 2016	Aromatic= 5 % vol. to 99 %vol. Olefins= 0.3 % vol. to 55 % vol. Saturate= 1 % vol. to 95 %vol.
		RON	ASTM D2699-2018 / IS 1448 (Part 27): 2013	70 to 100
		MON	ASTM D2700-2018a / IS 1448 (Part 26): 2013	70 to 100
		Benzene	ASTM D 3606-2017e1	0.1 % vol. to 5 % vol.
		Oxygenates	ASTM D 4815-2015b	Ethers 0.2 to 20 %mass Alcohols 0.2 to 12.0 %mass
		Distillation	ASTM D 86-2017 IS1448 (Part 18): 2016	Boiling range – 20 °C to 250 °C Recovery Residue and loss-

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		Existent Gum	IS1448 (Part 29): 2016 ASTM D 381-2017	0.1 % vol. to 5.0 % vol. 5 g/m ³ to 100 g/m ³
		Copper Strip Corrosion - 3hrs at 50°C	IS1448 (Part 15): 2016 ASTM D 130-2018	Rating: 1 to 4
		Total Sulphur	ASTM D 5453-2016e1	1 mg/kg to 100 mg/kg
		Reid Vapour Pressure	ASTM D 5191-2018 IS1448 (Part 39): 2012	7 kPa to 70 kPa
		Lead content (as Pb)	ASTM D 5059:2014	0.0026 g Pb/L to 1.32 g Pb/L
4.	Aviation Turbine Fuels, JET- A-1	Density at 15°C	ASTM D1298-2017 IS1448 (Part 16): 2014 ASTM D 4052-2018 ISO 12185-1996	750 kg/m ³ to 850 kg/m ³
		Distillation	IS1448 (Part 18): 2016 ASTM D 86-2017	Boiling range - 20 °C to 300 °C Recovery-Residue and Loss - 0.1 % vol to 100 % vol
		Acidity	ASTM D 3242-2017/ IS 1448 (Part 113): 2016	0.000 to 0.1000 mg KOH/gm
		Kinematic Viscosity at (-) 20°C	ASTM D 445-2017a IS1448 (Part 25): 2018	2 mm ² /s to 10 mm ² /s
		Lubricity by Ball-on-Cylinder Lubricity Evaluator (BOCLE)	ASTM D 5001-2014	0.50 mm to 1.00 mm
		Particulate contamination	ASTM D 5452-2012 IP 423-2010	0.1 mg/L to 1.5 mg/L
		Particulate at the point of manufacture, cumulative channel particle counts.	IP 565-2013	0 to 60,000 counts per ml
		Aromatic Content	IS1448 (Part 23): 2016 ASTM D1319- 2015	Aromatic= 5 % vol to 99 % vol Olefins=

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				0.3 % vol to 55 % vol Saturate= 1 % vol to 95 % vol
		Freezing Point	ASTM D7153-2015e1 IS1448 (Part 11): 2016	(-) 60 °C to (-) 42 °C
		Naphthalene Content	IS1448 (Part 118): 2013 ASTM D1840-2017	0.03 to 4.25 %vol
		JFTOT at 260°C a) Filter Pressure Deferential, b) Tube rating Visual	ASTM D 3241-2018a IP 323-2016 IS 1448 (Part 97): 2015 ISO 6249-1999	a) 0 to 25 mm Hg b) Rating:0 to 4
		Water Separation Characteristics: Micro Separometer rating (MSEP)	ASTM D 3948-2014 IS1448 (Part 142): 2016	50 to 100
		Electrical Conductivity	IP 274-2017 / ISO 6297-1997	1 pS/m to 1000 pS/m
		Water reaction, Interface Rating	ASTM D 1094-2013 IS1448 (Part 42): 2015	Rating:1 to 4
		Specific energy	ASTM D 3338-D 3338 M-2014e2	40.19 MJ/kg to 44.73 MJ/kg
		Aniline point	ASTM D 611-2016/ IS1448 (Part 3): 2013	25 to 95°C
		Flash Point (Abel)	IP 170:2014 IS1448 (Part 20): 2013	10.0 to 65.0 °C
		Silver Corrosion	IP 227-1999	Rating: 0 to 4
		Copper Strip Corrosion- 2hrs	ASTM D130 – 2018 IS1448 (Part 15): 2016	Rating: 1 a to 4 c
		Total Sulphur	ASTM D 4294-2016 e1	0.0017 % mass to 4.6 % mass
		Colour (Saybolt)	ASTM D 6045-2017	(-)16 to (+)30
		Smoke Point	IS1448 (Part 31): 2017 ASTM D1322-2018e1 ISO 3014:1993/IP 598:2018	11 to 50 mm

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		Sulphur Mercaptan	ASTM D 3227-2016 IS1448 (Part 109): 2016	0.0003 % mass to 0.01 % mass
		Existent Gum	ASTM D 381-2017 IS 1448 (Part 29): 2016	0.5 mg/100ml to 10 mg/100ml
5.	Kerosene	Density at 15°C	ASTM D 1298-2017 IS1448 (Part 16): 2014 ASTM D 4052-2018 ISO 12185-1996	750 kg/m ³ to 850 kg/m ³
		Distillation	ASTM D 86-2017 IS1448 (Part 18): 2016	Boiling range- 20 °C to 400 °C Recovery Residue and Loss- 0.1 % vol to 100 % vol
		Acidity (Total)	ASTM D 974-2014 IS1448 (Part 2): 2013	0.01 mgKOH/g to 250 mgKOH/g
		Flash Point, (Abel)	IS1448 (Part 20): 2013 IP 170:2014	10.0 °C to 65.0 °C
		Total Sulphur	ASTM D4294-2016e1/ ISO 8754-2003	0.0017 % mass to 4.6 % mass
		Colour (Saybolt)	ASTM D 6045-2017	(-)16 to (+) 30
		Smoke Point	IS1448 (Part 31): 2017 ASTM D1322-2018e1 ISO 3014-1993/ IP 598-2018	11 mm to 50 mm
		Burning test a) char valve b) bloom on glass chimney	IS 1448 (Part 5): 2013	a) 0 to 30 mg/kg b) Brown, Greyish brown or Grey
		Sulphur Mercaptan	ASTM D 3227-2016 IS1448 (Part 109): 2016	0.0003 % mass to 0.01 % mass
6.	Automotive Diesel Fuel	Density at 15°C	ASTM D 1298-2017/ IS1448 (Part 16): 2014 ASTM D 40502-2018 / ISO 12185-1996	800 kg/m ³ to 900 kg/m ³

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		Distillation	ASTM D 86-2017/ IS1448 (Part 18): 2016	Boiling range – 20 °C to 400°C, Recovery-Residue and Loss- 0.1 % vol to 100 % vol
		Ramsbottom Carbon Residue (on 10% residue)	ASTM D 524-2015 IS1448 (Part 8): 2012	0.03 % mass to 20 % mass
		Cetane Number	ASTM D 613-2018 IS1448 (Part 9): 2013	30 to 65
		Cetane Index	ASTM D 4737- 2016	32.5 to 56.5
		Cold Filter Plugging Point	ASTM D 6371- 2017a IS1448 (Part 110): 2013	25 °C to (-)20 °C
		Kinematic Viscosity at 40 °C	ASTM D 445-2017a/ IS1448 (Part 25): 2018	1 mm ² /s to 10 mm ² /s
		Poly Aromatic Hydrocarbons (PAH)	IP 391-2007	0.1 % mass to 12 % mass
		Total Contaminations	EN 12662-2014	6 mg/kg to 30 mg/kg
		Lubricity by High-Frequency Reciprocating Rig (HFRR) Method	ISO 12156-2017/ ASTM D 6079-2018	300 to 550 micron
		Oxidation Stability	ASTMD 2274-2014	0.1 to 3.0 mg/100ml
		ASTM Colour	ASTM D 6045-2017	0.0 to 8.0
		Acidity (Inorganic)	ASTM D974-2014 e2/ IS1448 (Part 2): 2013/ IP 139-2017	0.00 to 250 mgKOH/g
		Acidity (Total)	IS1448 (Part 2): 2013 ASTM D 974-2014e2	0.01 mgKOH/g to 250 mgKOH/g
		Ash Content	ASTM D 482-2013	0.001 % mass to 0.18 % mass
		Flash Point (PMCC)	ASTM D 93-2018 / IS 1448 (Part 21): 2012	40 °C to 200 °C
		Pour Point	ASTM D 97-2017b IS1448 (Part 10): 2013	(-)15 °C to 45 °C

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		Total Sulphur	ASTM D 2622-2016	0.0003 % mass to 4.6 % mass
		Water Content	ISO 12937 -2000(17) ASTM D6304-2016e1	30 to 1000 mg/kg
		Flash Point, (Abel)	IS1448 (Part 20): 2013 IP 170:2014	10.0 C to 65.0 °C
		Copper Strip Corrosion 3hrs at 50°C	ASTM D 130-2018/ IS1448 (Part 15): 2016	Rating: 1a to 4c
7.	Liquefied Petroleum Gases	Density at 15°C	ASTM D1657-2017	500 to 650 kg/m ³
		Copper Strip Corrosion 1hr at 38°C	ASTM D1838-2016	Rating: 1 to 4
		Total volatile sulphur	ASTM D 6667-2014	1.0 mg/kg to 100 mg/kg
		Vapour Pressure	ASTM D 1267-2018	350 kPa to 1300 kPa
		Volatility	ASTM D 1837-2017	(-)50 to 5 °C
		Hydrogen Sulphide	ASTM D 2420-2018	Qualitative (Negative-Pass/Positive-Fail)
		Free Water Content	IOCL/PDR/SOP-091, Issue No 03, Dt 01-09-2018	Present/Absent
		Composition	UOP -539-2012	C2: 0.01 % mol to 5.0 % mol C2: 0.01 mol to 5.0 % mol C3: 0.01 % mol to 70.0 % mol C3: 0.01 % mol to 50 % mol i-C4 : 0.01 % mol to 50 % mol n-C4 : 0.01 % to 70 % mol i-C5: 0.01 % mol to 5.0 % mol n-C5: 0.01 % mol to

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				5.0 % mol C6: 0.01 % mol to 5.0 % mol
8.	Crude Oil	Total Sediments	ASTM D473-2017e1 IS1448 (Part 30): 2013	0.01 % mass to 40 %mass
		Reid Vapour Pressure	ASTM D323-2015a	10 kPa to 180 kPa
		Chloride content	ASTM D 4929-2017	1.0 µg/g to 100 µg/g
		Acid Number	ASTM D 664-2017	0.1 mgKOH/g to 150 mgKOH/g
II.	SOLID FUELS			
1.	Petroleum Coke	Moisture Content	IS1448 (Part 132): 2018 ASTM D 7582-2015	0.1 to 15 % mass 0.1 to 1.0 % mass
		Total Sulphur	ASTM D 4239-2017	0.6 to 6.71 % mass
		Volatile Matter	ASTM D 7582-2015	1.0 to 11.5% mass
		Hard Groove Grindability Index	ASTM D 409-2016	38.0 to 52.0
		Calorific Value	ASTM D 5865-2013	5000 cal/g to 12000 cal/g
		Ash Content	ASTM D 7582-2015	0.1 % mass to 99.0 % mass
III.	INDUSTRIAL AND FINE CHEMICALS			
1.	Sulphur	Moisture	IS 6655:2015	0.01 % mass to 1.00 % mass
		Ash Content	IS 6655:2015	0.001 % mass to 0.25 % mass
		Colour	IS 6655:2015	Qualitative (Yellow/ Not yellow)
		Purity	IS 6655:2015	70 % mass to 100 % mass

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		Elemental Carbon	IS 6655:2015	0.01 % mass to 0.10 % mass
		Acidity as H ₂ SO ₄	IS 6655:2015	0.01 % mass to 0.10 % mass
		Chloride as Cl	IS 6655:2015	1 mg/kg to 10 mg/kg
IV.	WATER			
1.	Surface Water/ Ground Water/ Drinking Water/ Industrial Water	Colour	IS 3025 (Part 4): 2017	1 Hazen to 100 Hazen
		Odour	IS 3025 (Part 5): 2018	Qualitative (Agreeable/Disagreeable)
		pH value	IS 3025 (Part 11): 2017	2 to 12
		Turbidity	IS 3025 (Part 10): 2017	0.05 NTU to 400 NTU
		Conductivity	IS 3025 (Part 14): 2013	1 µmhos/cm to 10,000 µmhos/cm
		Total Dissolved Solids	IS 3025 (Part 16): 2017	1 mg/L to 10,000 mg/L
		Total Suspended Solid	IS 3025 (Part 17): 2017	5 mg/L to 1000 mg/L
		Total Alkalinity as CaCO ₃	IS 3025 (Part 23): 2014	1 mg/L to 1000 mg/L
		Total, Hardness as CaCO ₃	IS 3025 (Part 21): 2014	1 mg/L to 5000 mg/L
		Aluminum (as Al)	IS 3025 (Part 65): 2014 ICP-MS	0.02 mg/L to 1.0 mg/L
		Silica as SiO ₂	IS 3025 (Part 35): 2014	0.01 mg/L to 100 mg/L
		Dissolved Oxygen	IS 3025 (Part 38): 2014	1.0 mg/L to 8.5 mg/L
		Sodium (as Na)	IS 3025 (Part 65): 2014	0.5 mg/L to 100 mg/L
		Potassium (as K)	IS 3025 (Part 65): 2014	0.5 mg/L to 100 mg/L
		Boron (as B)	IS 3025 (Part 57): 2017 Curcumin Method	0.1 mg/L to 20 mg/L
		Calcium (as Ca)	IS 3025 (Part 65): 2014	1 mg/L to 500 mg/L
		Chlorides (as Cl)	IS 3025 (Part 32): 2014	1 mg/L to 500 mg/L
	Copper (as Cu)	IS 3025 (Part 65): 2014	0.01 mg/L to 5.0 mg/L	
	Fluorides (as F)	APHA 4110B 23rd ed. 2017 (Ion Chromatography)	0.2 mg/L to 10 mg/L	

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		Free Residual Chlorine	IS 3025 (Part 26): 2014	0.1 mg/L to 1.0 mg/L
		Iron (as Fe)	IS 3025 (Part 65): 2014	0.01 mg/L to 10 mg/L
		Magnesium (as Mg)	IS 3025 (Part 65): 2014	1 mg/L to 500 mg/L
		Manganese (as Mn)	IS 3025 (Part 65): 2014	0.01 mg/L to 5 mg/L
		Nitrates (as NO ₃)	APHA 4110B 23rd ed. 2017 (Ion Chromatography)	0.2 mg/L to 50 mg/L
		Nitrites (as NO ₂)	APHA 4110B 23rd ed. 2017 (Ion Chromatography)	0.2 mg/L to 5.0 mg/L
		Phenolic Compounds as C ₆ H ₅ OH	IS 3025 (Part 43): 2014	0.1 mg/l to 10 mg/L
		Selenium (as Se)	IS 3025 (Part 65): 2014	0.01 mg/L to 5.0 mg/L
		Sulphates (as SO ₄)	IS 3025 (Part 24): 2014	1 mg/L to 40 mg/L
		Zinc (as Zn)	IS 3025 (Part 65): 2014	0.01 mg/L to 5.0 mg/L
		Cadmium (as Cd)	IS 3025 (Part 65): 2014	0.003 mg/L to 5.0 mg/L
		Lead (as Pb)	IS 3025 (Part 65): 2014	0.01 mg/L to 5.0 mg/L
		Mercury (as Hg)	IS 3025 (Part 65): 2014	0.001 mg/L to 5.0 mg/L
		Total Arsenic (as As)	IS 3025 (Part 65): 2014	0.01 mg/L to 5 mg/L
		Total Chromium (as Cr)	IS 3025 (Part 65): 2014	0.01 mg/L to 5.0 mg/L
		Oil & Grease	IS 3025 (Part 39): 2014	5 mg/L to 500 mg/L