

## Testing facilities in M&C Directorate

### **A. Non-Destructive Testing (NDT) Section:**

1. Preparation of code of procedure for Ultrasonic Testing of axles, armature shafts, wheels and other rolling stock components.
2. Preparation of procedures for Ultrasonic Testing of Rails, Rail Welds/ SEJ/ISEJ etc.
3. Evaluation of Radiographs.
4. Consultancy rendered to Railway Board, Zonal Railways, Production Unites, Workshop, Sheds, within the Directorate and Inter Directorate of RDSO in the field of Non Destructive Testing (UST, DPI, MPI and Radiography etc) of components used in Indian Railways.
5. Vendor development for Ultrasonic equipment for testing of Axles, Rails and Rail-welds.
6. Certification of Ultrasonic Testing equipment for testing of Rails and welds as per IRS of Outsourcing agencies involved in Ultrasonic Testing of Rails and welds.
7. Framing/Reviewing the Specifications related to NDT.
8. Preparation of statistical report (Six monthly) on rejection of axle during Ultrasonic Testing.
9. Preparation of statistical report (Yearly) on rejection of axle on account of Ultrasonic Testing, Mechanical, Online failure cause of derailment and Online failure not cause of derailment.

### **B. Metallurgical Investigation & Testing (MIT) Section:**

1. Fracture analysis & qualitative analysis in Scanning Electron Microscope and EDS (Energy Dispersive Spectroscopy)
2. Chemical Analysis: Spectrometer and by Wet Analysis.
3. Hardness testing
  - a. Brinell Hardness
  - b. Rockwell Hardness
  - c. Vickers Hardness
4. Tensile Testing
5. Impact Testing - Up to @-40°C.
6. Bend Test
7. Macro Examination of casting defects
  - a. Seam
  - b. Lap
  - c. Folds
  - d. Surface imperfections
  - e. Shrinkage Cavities
  - f. Blow and pin holes etc.
8. Micro Examination by Optical Microscope:
  - a. Depth of decarburisation
  - b. Measurement of case depth
  - c. Inclusion rating
  - d. Grain Size determination
  - e. Coating thickness.
  - f. Examination of Microstructures
  - g. Examination of Nodularity in SGCI

### **C. Welding Research Section**

- (a) Performance test
- (b) Hardness test
- (c) Moisture content test for fluxes
- (d) Storage stability test

- (e) Hydrogen determination test
- (f) Grain Size distribution test.
- (g) Cast and helix test
- (h) Fillet weld test
- (i) Deposition Efficiency test
- (j) Tap density test

#### **D. Rubber & Plastic (R&P) section**

1. Visual Examination
2. Dimensional check
3. Hardness (Shore 'A')
4. Tensile Strength & Elongation at Break
5. Modulus
6. Compression set
7. Tension Set
8. After Ageing i) Tensile Strength & Elongation at break ii) Modulus iii) Hardness (Shore 'A')
9. Electrical Resistance
10. Resistance to fluids & Chemicals (by volume)
11. Specific gravity
12. Polymer Identification By flame test
13. Load deflection
14. Adhesion
15. Extended ageing
16. Extraction
17. Ash content
18. Tear Strength
19. Dynamic properties of rubber pad
20. Stretch test for 'O' ring
21. Stretch test for Rolling ring
22. Secant stiffness
23. Shear bond test
24. Impact attenuation test.
25. Inclined repeated load test.

#### **PLASTICS**

1. Visual Examination
2. Hardness (Rockwell 'R')/Shore 'D'
3. Dimensional check
4. Melting Point
5. Specific gravity/Density/Bulk density
6. Water absorption
7. Resistance to boiling water
8. Inherent viscosity/MFI

9. Tensile Strength & Elongation at break
10. Cross breaking strength
11. Fire resistance/ flammability
12. Oxygen index
13. Izod impact strength
14. Compressive strength Proof Load
15. Compressibility & Recovery
16. Ash content (%) Glass content
17. Electrical resistance
18. Internal cavity
19. Crushing test on bush
20. Annealing test

### **FRP & OTHER COMPOSITE MATERIALS**

1. Visual Examination
2. Dimensional check
3. Hardness (Rockwell 'R')
4. Ash content (%) Glass content
5. Specific gravity
6. Insert pull out
7. Bolt pull out
8. Bending test
9. Impact strength/Indentation
10. Tensile strength & Elongation at break
11. Resistance to boiling water
12. Fire resistance/flammability
13. Adhesion
14. Resistance to flexing
15. Dynamic fatigue test
16. Full belt tensile strength
17. Weight square meter
18. Construction/Count/No. of plies
19. Breaking strength of treated fabric
20. Adhesion of laminated or treated fabric
21. Annealing Test
22. Staining Test
23. Weldability Test in PVC
24. Mandrel flexibility
25. Crushing Test on Bush

### **TEXTILE**

1. Weight/Square meter
2. Construction/Count/No. of plies
3. Adhesion

## **E. Composite Development Centre (CDC) Section**

### **1. Non-asbestos Composite Brake Block/Organic Brake Pad**

- a) Hardness (Rockwell )
- b) Cross Breaking Strength
- c) Modulus of Elasticity
- d) Acetone Extraction
- e) Ash content
- f) Density
- g) Shear Strength (for CBB)
- h) Bending Strength (for CBB)
- i) Flammability (for Brake Pad)
- j) Thermogravimetric analysis by TGA
- k) Thermal Properties by Anter Flashline Thermal Analyzer
- l) Frictional properties by Tribometer
- m) Smoke Density – Flaming and Non flaming (by Optical Density Smoke Chamber)
- n) Checking of samples through Polarizing Microscope

### **2. Fire test (FST Properties) of coach furnishes material**

- a) Limiting Oxygen Index (LOI)
- b) Toxicity Index
- c) Deterioration of visibility due to smoke
- d) Resistance to spread of flame

### **3. Plastics, Rubber and Composite material**

- a) Tensile Strength & Elongation at Break (for Plastics & Composite)
- b) Density/ Specific Gravity (for Plastics & Composite)
- c) Ash/Glass Content (for Plastics & Composite)
- d) Hardness (Rockwell 'R') (for Plastics & Composite)
- e) Flexural Strength (for Composite)
- f) Falling Weight Impact Test (for Composite & Wood)
- g) Izod and Charpy Impact Test (for Plastics)
- h) Melt Flow Index (for Plastics)
- i) Meting point by Capillary method (for Plastics)
- j) Thermal properties by DSC (for Plastics)
- k) Polymer Identification by FTIR (for rubber and Plastics)
- l) Dynamic properties by DMA(for rubber and Plastics)

## **F. Paint Testing & Corrosion Engineering Lab**

- 1 Drying Time
- 2 Hard Dry @ 70<sup>0</sup>C
- 3 Consistency
- 4 Viscosity
- 5 Finish
- 6 Colour
- 7 Gloss
- 8 Spreading Capacity

9	Flexibility & adhesion
10	Dry Film Thickness
11	Fineness of Grind
12	Pot life
13	Mass in kg/10Litrs
14	Flash Point (Two components)
15	Scratch Hardness
16	Resistance to salt Spray for 500 Hrs.
17	Resistance to salt Spray for 2000 Hrs.
18	Resistance to salt Spray for 3000 Hrs.
19	% Volume Solids
20	Pigment Content
21	Wt. per epoxy equivalent on volatile vehicle content
22	Volatile Matter
23	Identification of Poly isocyanate
24	% Poly isocyanate by mass in Hardener
25	Resistance to Acid
26	Resistance to Alkali
27	Resistance to Solvent
28	Resistance to Oil
29	Resistance to water
30	Resistance to tap water for 3000 hrs
31	Abrasion Resistance for 1000 cycles
32	Impact Resistance
33	Cathodic Disbondment Test
33	Resistance to Humidity for 3000 Hrs.
34	Resistance to Humidity for 2000 Hrs.
35	Resistance to Humidity for 500 Hrs.
36	Resistance to Humidity for 168 Hrs.
37	Resistance to Chemical for 1800 Hrs.
38	Stopping property
39	Rubbing Property
40	Hold Out Property
41	Adhesion & Compatibility of Paint System
42	% Solids
43	Pigment Analysis
44	Flash Point (Single component)
45	Non-Volatile Vehicle Content
46	Resistance to Kerosene
47	Presence of Rosin & Rosin derivative
48	Water Content
49	Accelerated storage Stability
50	Phathalic anhydride content
51	Stripping test

52	Ash Content
53	Wet Abrasion resistance, 5000 cycles
54	Pull off adhesion test
55	Anti-graffiti test
56	Pencil hardness test
57	% Zinc Phosphate test
58	% Fe <sub>2</sub> O <sub>3</sub>
59	% CrO <sub>3</sub> & % ZnO
60	Flattening property
61	Resistance to chlorine
62	Freedom from lead
63	Reaction with white paint
64	Resistance to heat
65	Resistance to Varnish exterior
66	Fitness to take a coat of primer & cellulose finish
67	% CaCO <sub>3</sub> as CaO by mass
68	Fire Resistance test
69	Resistance to Lube Oil
70	Water absorption
71	Resistance to warm water
72	Resistance to salt water
73	% BaSO <sub>4</sub> by mass
74	% Cr <sub>2</sub> O <sub>3</sub> by mass
75	Leafing Property
76	Acid Value
77	Settling Property
78	Residue on sieve
79	Grease content
80	Aluminum powder content
81	Thinning property
82	Wet opacity
83	Odour
84	Specific Gravity
85	pH Value
86	Corrosion test for 24 hrs.
87	Rinsability/ Miscibility
88	Freedom from acidity & Alkalinity
89	Determination of free chlorine
90	Evaporation loss
91	Effect of solvents on insulating materials
92	Hot Zinc & Manganese Phosphating test
93	Skin irritation
94	Demulsifying capacity
95	Immersion test

96	Foaming power
97	Lab performance test for cleaning efficiency of liquid cleaning composition
98	Effect on metals of liquid cleaning composition
99	Field performance test of liquid cleaning composition
100	Corrosion test of butt welded test pieces
101	Salt spray test of six pin emergency plug for S&T
102	Corrosion test for engine coolant in glassware

## **G. Fuel & Lubricant Section**

### **(a) Grease:**

S. No.	Name of the Tests
1.	Acidity/ alkalinity
2.	Ash content
3.	Cu- strip corrosion
4.	Drop Point
5.	Evaporation loss of grease
6.	Flash point of extracted oil
7.	Graphite content
8.	K.V. and VI of extracted oil
9.	Mineral oil content/Oil extraction
10.	Moisture content /volatility
11.	Non graphite carbon content
12.	Oil separation on storage
13.	Penetration at 25 C
14.	Resistance to break down
15.	Soap base by flame test
16.	Structural stability
17.	Sulphated ash
18.	Visual Examination
19.	Water Content
20.	Oxidation Stability of Lubrication Grease by the Oxygen Bomb for 500 Hrs.

### **(b) Lubricating oil:**

S. No. Name of the Test

1. Aniline Point
2. Ash content
3. ASTM Colour test
4. Carbon residue Ramasbottom
5. Cast iron corrosion test
6. Emulsion characteristics
7. Flash Point (ABEL), °C
8. Flash Point(COC), °C
9. Flash Point (PMCC), °C
10. Foaming characteristics
11. Frothing test
12. Insoluble Hexane & Toluene
13. Kinematic Viscosity at 100°C, cst
14. Kinematic Viscosity at 40°C, cst
15. Neutralization Number (pH, TAN, TBNE)
16. Pour Point °C
17. Rust Preventive Characteristics
18. Saponification value
19. Shear stability
20. Specific Gravity
21. Sulphated Ash
22. Thermal stability
23. Total acidity inorganic & organic
24. Viscosity Index
25. Visual Examination
26. Water content
27. Evaporation loss by nocks' method
28. Air Release Value
29. RBOT
30. Demulsibility
31. Conradson C-Residue
32. Low temperature pumping viscosity of Engine oil
33. Low temperature cranking viscosity
34. Incipient wear of engine components in used engine oil



35. Wear debris pattern of engine components in used engine oil
36. Oxidation Stability of Inhibited Mineral Oils for 1000 Hrs
37. Miscibility of Lubricating oil
38. Density
39. Saponifiable matter
40. Homogeneity Test as per IS:13656 (ANNEX B) for one fresh oil with one reference oil only
41. Volatility
42. Volatile matter
43. Copper strip corrosion test

**(c) HSD:**

- | <b>S. No.</b> | <b>Name of the Test</b>         |
|---------------|---------------------------------|
| 1.            | Visual examination              |
| 2.            | Density                         |
| 3.            | Flash Point                     |
| 4.            | Pour Point                      |
| 5.            | Carbon Residue (Rams bottom)    |
| 6.            | Distillation (Atmospheric)      |
| 7.            | Distillation (Vacuum)           |
| 8.            | Diesel Index                    |
| 9.            | Aniline Point                   |
| 10.           | Cetane Index                    |
| 11.           | Ash Content                     |
| 12.           | Water Content                   |
| 13.           | Copper Strip Corrosion          |
| 14.           | Acidity Organic                 |
| 15.           | Acidity Inorganic               |
| 16.           | Calorific Value (P7 of IS:1448) |
| 17.           | Kinematic Viscosity             |

18. Oxidation stability of HSD Oil
19. Sulphur in HSD
20. Cetane No.

**(d) Bio-diesel & its blends:**

<b>S. No</b>	<b>Name of the Test</b>
1.	Visual examination
2.	Density
3.	Kinematic Viscosity
4.	Flash Point
5.	Sulphur
6.	Carbon Residue (Rams-bottom)
7.	Sulphated Ash
8.	Water Content
9.	Total contamination
10.	Copper Strip Corrosion
11.	Cetane No.
12.	Acid Value
13.	Oxidation Stability of Bio-diesel
14.	Moisture content in Bio-diesel
15.	Methanol % by mass, Max
16.	Ethanol % by mass, Max
17.	FAME content % by mass, Max
18.	Free Glycerol % by mass, Max & Total Glycerol % by mass, Max
19.	Iodine value

## H. Tribology Section

### (a) GREASE:

S.No	Name Of Test
1	2
1.	SKF-V2F test
2.	760 Hrs Rig Test
3.	Four ball weld load test
4.	EMCOR Test
5.	ETRS Test

### (b) LUBRICATING OIL:

S.No	Name Of Test
1	2
1.	Four ball weld load test

### (c) HSD/KEROSENE/PETROL:

S.No	Name Of Test
1	2
1	CFPP
2	Total Contamination
3	Sediment Content In HSD Oil
4	Total Sediment In HSD
5	Gum Content

### (d) LUBE OIL FILTER:-

S.No	Name Of Test
1	2
1	Rig life of filter element for ALCO /DLW locomotive
2	Rig life of filter element for EMD locomotive
3	End Load
4	Fabrication Integrity
5	High Temperature for ALCO/DLW locomotive
6	High Temperature for EMD locomotive
7	Resistance To Water
8	Bursting Strength Of Filter
9	Pore Size Of Filter Paper
10	Tensile Strength Of Paper
11	Thickness Of Filter Paper
12	Ash Content Of Filter Paper
13	Basic Weight Of Filter Paper
14	Visual Examination & Dimension