Fax : (0522)-2452581 Telephone: (0522)-2465737 Email : dsetplgroup@gmail.com	सत्यमेव जयते	भारत सरकार – रेल मंत्रालय अनुसंधान अभिकल्प और मानक संगठन लखनऊ – 226011 Government of India - Ministry of Railways Research, Designs & Standards Organization, LUCKNOW - 226011

No. EL/11.5.5/21 Date: 11.09.2018

1. Principal Chief Electrical Engineers:

- Central Railway, HQs Office, 2nd floor, Parcel Office Bldg., Mumbai-400 001
- East Central Railway, Hajipur (Bihar)-844 101
- Eastern Railway, Fairlie Place, Kolkata - 700 001
- East Coast Railway, Railway Complex, Bhuvneshwar - 751 023
- Northern Railway, Baroda House, New Delhi-110 001
- North Central Railway, Allahabad - 211 001
- South East Central Railway, Bilaspur-495 004
- South Central Railway, HQs Office, Rail Nilayam, Secunderabad-500 071
- South Eastern Railway, Garden Reach, Kolkata- 700 043
- Southern Railway, Park Town, Chennai - 600 003
- West Central Railway, HQs Office, Opp. Indira Market, Jabalpur-482 001
- Western Railway, Churchgate, Mumbai - 4000 020
- Chittaranjan Locomotive Works, Chittaranjan - 713 331(WB)

2. General Manager (Design), Diesel Locomotive Works, Varanasi - 221 004

SPECIAL MAINTENANCE INSTRUCTION NO. RDSO/2018/EL/SMI/0325 (REV. '0')

1.0 Title:

Flushing, filling and testing of coolant to be used in IGBT based WAP5, WAP7, WAG9 and WAG9-H locomotives.

2.0 Background:

2.1 Indian Railway is manufacturing 3-phase electric locomotives i.e. WAP5, WAP7, WAG9 and WAG9-H locomotives at Chittaranjan Locomotive Works (CLW), Diesel Loco Works (DLW) and other manufacturing units. These locomotives are equipped with two nos. IGBT based traction converters. Each traction converter has 9 nos. IGBTs power modules which are connected in closed loop by means of coolant circuit along with heat exchanger. Power modules are cooled by coolant which is a mixture of Water (70%) & Ethylene Glycol (30%).

2.2 Numbers of cases have been reported by Railways across different makes of traction converters which used the conventional Inorganic Acid Technology (IAT) based coolant. The problem is attributed to incompatible coolant which chemically reacts with the radiators inner walls which leads to following problems:

(i) Radiator failures,
(ii) Coolant overflowing,
(iii) Blockade in cooling circuit,
(iv) Discoloration of coolant,
(v) Bad smell from coolant,
(vi) Gas formation,
(vii) Stutchi coupler failure,
(viii) Pressures switch failure.

2.3 M/s BHEL has initially used coolant with Polypropylene Glycol 30% and demineralized water (70%). Subsequently, while standardizing the coolant, CLW has finalized Ethylene Glycol (30%) and demineralized water (70%) based coolant. Incorrect use of coolant created above mentioned problems mentioned in Para-2.2. Meanwhile CLW vide letter no. C-D&D/T/24 dated 06.07.2018 advised converter manufacturers to use only type Antifrogen-N water mixture 30% coolant which is based on Organic Acid Technology (OAT)/Hybrid Organic Acid Technology (HOAT).

3.0 Object:

To provide detailed procedure for flushing of hydraulic loop to replace the coolant in existing locos, to fill the coolant in new locos at manufacturing units and to test the coolant quality.

4.0 Maintenance Instructions: Procedure for flushing of hydraulic loop by Electric Loco Sheds (ELS) holding 3-phase locomotives, procedure for filling up the coolant in new locos at manufacturing units and testing procedure of coolant is detailed in following paragraphs and shown in Figure-1:

4.1 Procedure for flushing of hydraulic loop of Converter & heat exchanger by ELS for replacement of coolant: The proposed sequence for flushing of hydraulic loop has been decided as below. Concern ELS shall extend support for the below activities along with firm's representatives:

(i) Converter shall be cleaned at the locomotive fitment position itself with cleaning agent containing organic acid with suitable inhibitor like Alstaclean

RCX Plus or equivalent. Cleaning agent shall be prepared by mixing 1 part cleaning agent with 20 to 25 part Demineralized (DM) Water.

(ii) Heat exchanger shall be dismantled from locomotive and cleaned thoroughly in the collecting tray for proper flushing with cleaning agent specified in (i) above,

(iii) After this, proper neutralization and passivation with Protodin HBL or equivalent with a concentration of 500 ml in 100 litre DM water shall be done.

(iv) Secondary flushing shall be done using Antifrogen-N/HOAT coolant in small quantity.

(v) After thorough flushing & cleaning, fresh Antifrogen-N/HOAT coolant shall be filled in the entire hydraulic loop within 12 hrs. to avoid oxidation.

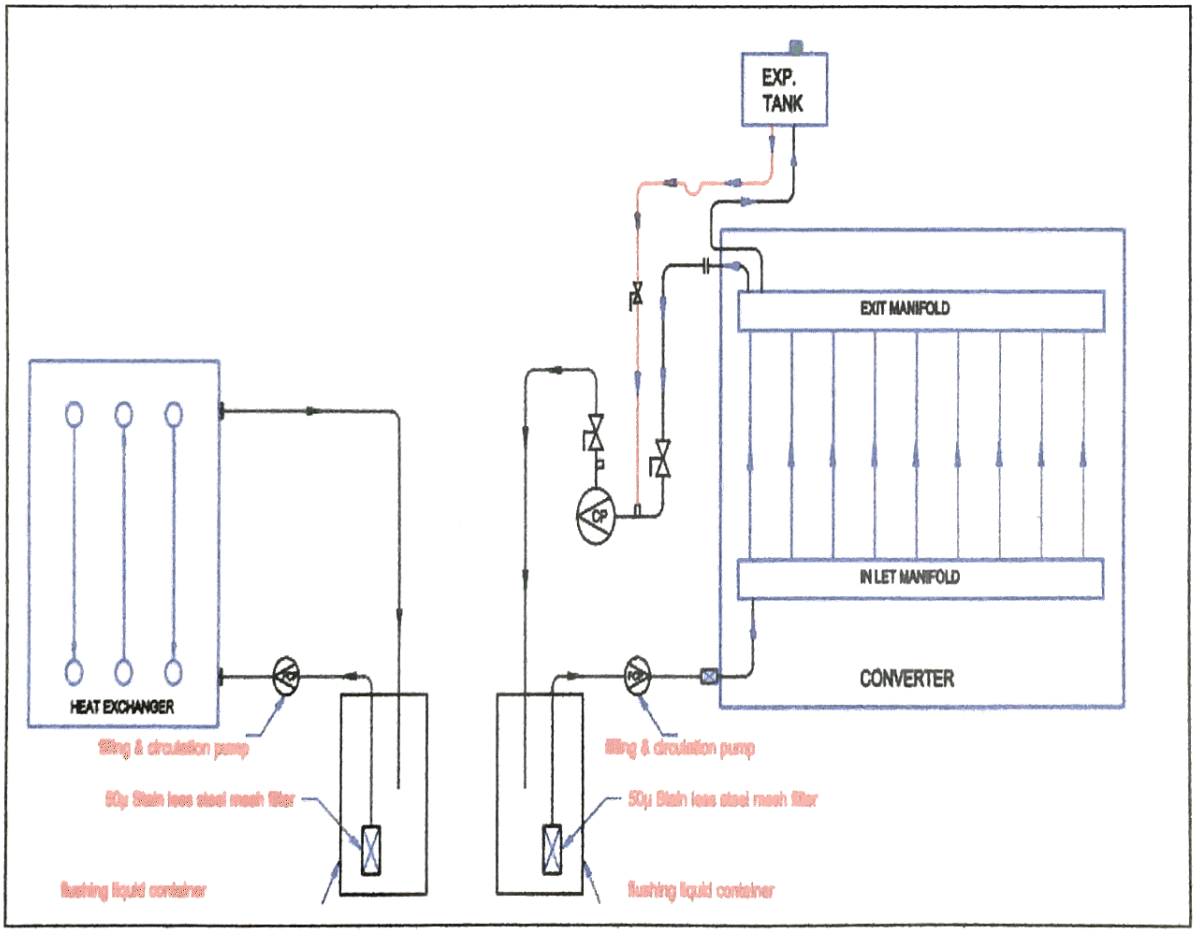


Figure-1: General Layout of hydraulic loop in traction converter

4.2 Procedure for filling up the coolant in new loco at CLW:

(i) The new loco radiator during commissioning has to be flushed because the new system may contain some metal working fluids, soldering deposits, dirt and oil which later on may affect the system efficiency and life of coolant/equipment. Contaminants in a cooling system may cause abrasion, scaling and foaming in the system.

(ii) The system should be flushed with a 4% solution of Neutral pH Emulsifying Cleaner and DM water followed with flushing with Antifrogen-N/HOAT Coolant prior to charging of final Coolant.

4.3 Testing of coolant: Following course of actions have been decided regarding testing of Fresh Coolant and coolant filled in Traction Converter:

(i) Fresh Coolant: Fresh coolant shall be type tested before its use in traction converter by converter manufacturers as per Indian Standard IS 5759:2006 or with American Standard ASTM D1384: 01. Only after getting satisfactory test results, coolant shall be used in Traction Converter or shall be given to Loco Sheds. CLW and Converter manufacturer shall ensure quality check of coolant by type testing the same once in 5 year. The type tests can be performed at any of the following laboratories or any other Government approved laboratories:-

a. **CIRT** - Central Institute of Road Transport, Pune, Nasik Road, Pune-411026

b. **ARAI** - Automotive Research Association of India, Survey No.102, Paud Road, Rambaug Colony, Kothrud, Pune, Maharashtra 411038

(ii) Coolant already filled in Traction Converter: The quality of coolant already filled in Traction Converter shall be ensured by concern Electric Loco Shed itself by checking Ethylene-Glycol %age, Reserve alkalinity and pH value. This check shall be carried out in every TOH. Comprehensive analysis kit or Portable instruments that are required to test the coolant periodically is given in Annexure-1.

(iii) Coolant shall follow following properties:

SN	Characteristics	Property
1.	Consistence at 20 Deg. C	Liquid
2.	Color at 20 Deg. C	Green

3.	Ethylene-Glycol %age	30%
4.	pH value	7.7 - 8.5
5.	Reverse Alkalinity (ml 0.1N HCL)	Min. 1.00
6.	Specific gravity	As per manufacturer's specification.

5.0 Application to the Class of Locomotives:

WAP5, WAP7, WAG9 and WAG9H class of locomotives.

6.0 Agency of Implementation:

Electric Loco Sheds Holding WAP5, WAP7, WAG9 and WAG9H class of locomotives and PUs/Workshops.

7.0 Periodicity of Implementation:

Coolant replacement is one-time activity and to be performed as early as possible, thereafter its maintenance as mentioned.

11/09/18

(Suresh Kumar)
for Director General (Elect.)

Encl: Nil

Copy to:
Secretary (Electrical),
Railway Board, Rail Bhawan,
New Delhi - 110 001

14/09/18

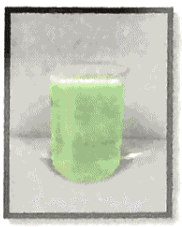
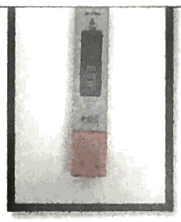
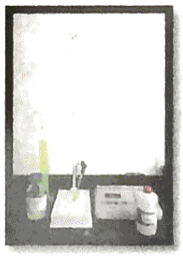
(Suresh Kumar)
for Director General (Elect.)

Encl: Nil

Annexure-1

Comprehensive Analysis Kit

A comprehensive analysis kit consists of the following items to perform the given test in simple method. The kit also contains a detailed method of analysis for each test to be performed.

SN	Parameter	Test Instrument / Article	Image
1.	Consistence at 20 Deg. C	Glass Beaker	
2.	Color at 20 Deg. C	Glass Beaker	
3.	Ethylene Glycol %age	Portable Digital Instrument	
4.	pH value	Portable Digital pH meter	
5.	Reverse Alkalinity (ml 0.1N HCL)	RA Reagent and Titration Lab-ware	
6.	Specific Gravity	Hydrometer and Measuring Cylinder