भारतीय रेल
Indian Railways

पटियाला रेलइंजन कारख़ाना, पटियाला

PATIALA LOCOMOTIVE WORKS, PATIALA

LOCO TESTING & DISPATCH REPORT OF IGBT BASED WAG9HC ELECTRIC LOCOMOTIVE

LOCO NO. :	**41870**
TYPE:	**WAG9HC**
RAILWAY SHED:	**WR/VTAD**
PROPULSION SYSTEM:	**CGL**
DATE OF DISPATCH:	**21.05.2024**

लोको निर्माण रिकार्ड

पटियाला रेलइंजन कारख़ाना, पटियाला

PATIALA LOCOMOTIVE WORKS, PATIALA

LOCO NO.: 41870
RAILWAY/SHED:WR/VTAD
DOD: May-2024

INDEX

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 - CGIPSL Type of Locomotive: WAP-7/WAG-9HC

1.0 Continuity *Test of the cables*

1.1 Continuity Test of Traction Circuit Cables

As per cable list given in Para 1.3 of document no. 3 EHX 410 124, check the continuity with continuity tester and megger each cable to be connected between following equipment with 1000V megger.

From	To	Continuity (OK/Not OK)	Prescribed Megger Value (min)	Measured Megger Value
Filter Cubicle	Transformer	OK	100 MΩ	1500
Filter Cubicle	Terminal Box of Harmonic Filter Resistor (Roof)	OK	100 MΩ	1500
Filter Cubicle	Earthing Choke	OK	100 MΩ	1500
Earthing Choke	Earth Return Brushes	OK	100 MΩ	1500
Transformer	Power Converter 1	OK	100 MΩ	1500
Transformer	Power Converter 2	OK	100 MΩ	1500
Power Converter 1	TM1, TM2, TM3	OK	100 MΩ	1500
Power Converter 2	TM4, TM5, TM6	OK	100 MΩ	1500
Earth	Power Converter 1	OK	100 MΩ	2000
Earth	Power Converter 2	OK	100 MΩ	2000

1.2 Continuity Test of Auxiliary Circuit Cables

As per cable list given in Para 1.4 of document no. 3 EHX 410 124, check the continuity with continuity meter and megger each cable to be connected between following equipment with the help of 1000V megger.

Signature of the JE/SSE/Harness

Signature of the JE/SSE/Loco Cabling

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

From	To	Continuity(OK/ Not OK)	Prescribed Megger Value (min)	Measured Megger Value MΩ
Transformer	BUR1	OK	100 MΩ	500
Transformer	BUR2	OK	100 MΩ	500
Transformer	BUR3	OK	100 MΩ	500
Earth	BUR1	OK	100 MΩ	500
Earth	BUR2	OK	100 MΩ	500
Earth	BUR3	OK	100 MΩ	500
BUR1	HB1	OK	100 MΩ	1500
BUR2	HB2	OK	100 MΩ	1500
HB1	HB2	OK	100 MΩ	1500
HB1	TM Blower 1	OK	100 MΩ	200
HB1	TM Scavenge Blower 1	OK	100 MΩ	120
HB1	Oil Cooling Unit 1	OK	100 MΩ	140
HB1	Compressor 1	OK	100 MΩ	120
HB1	TFP Oil Pump 1	OK	100 MΩ	181
HB1	Converter Coolant Pump 1	OK	100 MΩ	200
HB1	MR Blower 1	OK	100 MΩ	150
HB1	MR Scavenge Blower 1	OK	100 MΩ	159
HB1	Cab1	OK	100 MΩ	176
Cab1	Cab Heater 1	OK	100 MΩ	181
HB2	TM Blower 2	OK	100 MΩ	200
HB2	TM Scavenge Blower 2	OK	100 MΩ	150
HB2	Oil Cooling Unit 2	OK	100 MΩ	155
HB2	Compressor 2	OK	100 MΩ	133
HB2	TFP Oil Pump 2	OK	100 MΩ	154
HB2	Converter Coolant Pump 2	OK	100 MΩ	159
HB2	MR Blower 2	OK	100 MΩ	200
HB2	MR Scavenge Blower 2	OK	100 MΩ	155
HB2	Cab2	OK	100 MΩ	171
Cab2	Cab Heater 2	OK	100 MΩ	183

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

1.3 Continuity Test of Battery Circuit Cables

Check continuity of following cables as per Para 2.3 of document no. 3 EHX 610 299

From	To	Condition	Continuity (OK/Not OK)
Battery (wire no 2093)	Circuit breakers 110-2, 112.1-1, 310.4-1	By opening and closing MCB 112	OK
MCB 110	Connector 50.X7-1	By opening and closing MCB 110	OK
Battery (Wire no. 2052)	Connector 50.X7-2	----	OK
SB2 (Wire no 2050)	Connector 50.X7-3	----	OK

Close the MCB 112, 110, 112.1, and 310.4 and measure the resistance of battery wires 2093, 2052, 2050 with respect to the loco earth.	Prescribed value > 0.5 MΩ	Measured Value 7 MΩ
Measure the resistance between 2093 & 2052, 2093 & 2050, 2052 & 2050	Prescribed value: > 50 MΩ	Measured Value 65 MΩ

Commission the indoor lighting of the locomotive as per Sheet No 7A & 7B.

1.4 Continuity Test of Screened Control Circuit Cables

Check the continuity and isolation of the screen cable of the following circuits with the help of sheet no. mentioned against each as per document no. 3 EHX 610 299.

Screened control circuit cables for	Corresponding Sheet Nos.	Continuity & Isolation (OK/Not OK)
Battery voltage measurement	04B	OK
Memotel circuit of cab1 &2	10A	OK
Memotel speed sensor	10A	OK
Primary voltage detection	01A, 12A	OK
Brake controller cab-1 & 2	06F, 06G	OK

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

Master controller cab-1 &2	08C, 08D	OK
TE/BE meter bogie-1 & 2	08E, 08F	OK
Terminal fault indication cab-1 & 2	09F	OK
Brake pipe pressure actual BE electric	06H	OK
Primary current sensors	12B, 12F	OK
Harmonic filter current sensors	12B, 12F	OK
Auxiliary current sensors	12B, 12F	OK
Oil circuit transformer bogie 1	12E, 12I	OK
Magnetization current	12C, 12G	OK
Traction motor speed sensors (2 nos.) and temperature sensors (1 no.) of TM-1	12D	OK
Traction motor speed sensors (2nos) and temperature sensors (1 no.) of TM-2	12D	OK
Traction motor speed sensors (2nos) and temperature sensors (1 no.) of TM-3	12D	OK
Traction motor speed sensors (2 nos.) and temperature sensors (1 no.) of TM-4	12H	OK
Traction motor speed sensors (2nos) and temperature sensors (1 no.) of TM-5	12H	OK
Traction motor speed sensors (2nos) and temperature sensors (1 no.) of TM-6	12H	OK
Train Bus cab 1 & 2 (Wire U13A& U13B to earthing resistance= 10KΩ± ± 10%)	13A	OK
UIC line	13B	OK
Connection FLG1-Box TB	13A	OK

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

2.0 Low Tension test

2.1 Measurement of resistor in OHMS (Ω)

Measure the resistances of the load resistors for primary voltage transformer, load resistors for primary current transformer and Resistor harmonic filter as per Para 3.2 of the document no. 3 EHX 610 279.

Name of the resistor	Prescribed value	Measured value
Load resistor for primary voltage transformer (Pos. 74.2).	3.9KΩ ± 10%	3.9KΩ
Resister to maximum current relay.	1Ω ± 10%	1Ω
Load resistor for primary current transformer (Pos. 6.11).	3.3 Ω ± 10%	3.3Ω
Resistance harmonic filter (Pos 8.3). Variation allowed ± 10%	WAP7	WAP7
Between wire 5 & 6	0.2 Ω	0.2Ω
Between wire 6 & 7	0.2 Ω	0.2Ω
Between wire 5 & 7	0.4 Ω	0.4Ω
For train bus, line U13A to earthing.	10 kΩ± 10%	10.0KΩ
For train bus, line U13B to earthing.	10 kΩ ± 10%	10.0KΩ
Insulation resistance of High Voltage Cable from the top of the roof to the earth (by1000 V megger).	200 MΩ	300MΩ
Resistance measurement earth return brushes Pos. 10/1.	≤0.3 Ω	0.3Ω
Resistance measurement earth return brushes Pos. 10/2.	≤0.3 Ω	0.28Ω
Resistance measurement earth return brushes Pos. 10/3.	≤0.3 Ω	0.29Ω
Resistance measurement earth return brushes Pos. 10/4.	≤0.3 Ω	0.29Ω
Earthing resistance (earth fault detection) Harmonic Filter –I; Pos. 8.61.	2.2 kΩ± 10%	0.3Ω
Earthing resistance (earth fault detection) Harmonic Filter –II; Pos 8.62.	2.7 kΩ± 10%	2.7KΩ
Earthing resistance (earth fault detection) Aux. Converter; Pos. 90.3.	3.9 kΩ ± 10%	3.9KΩ
Earthing resistance (earth fault detection) 415/110V; Pos. 90.41.	1.8 kΩ± 10%	1.8KΩ
Earthing resistance (earth fault detection) control circuit; Pos. 90.7.	390Ω ± 10%	39Ω
Earthing resistance (earth fault detection) Hotel load; Pos. 37.1*(in case of WAP5).*	3.3 kΩ± 10%	NA
Resistance for headlight dimmer; Pos. 332.3.	10Ω ± 10%	10Ω

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

Note:

Make sure that the earthing brush device don't make direct contact with the axle housing, earth connection must go by brushes.

2.2 ***Check Points***

Items to be checked	**Remarks**
Check whether all the earthing connection in roof and machine room as mentioned in sheet no. 22A is done properly or not. These earthing connections must be flexible and should be marked yellow & green	checked ok
Check whether all the earthing connection between loco body and bogie is done properly or not. These cables must be flexible having correct length and cross section	checked ok

2.3 ***Low Tension Test Battery Circuits (without control electronics)***

These tests are done with the help of the special type test loop boxes as per procedure given in Para 3.6 of the document no. 3 EHX 610 279

Name of the test	**Schematic used.**	**Remarks**
Test 24V supply	Sheet 04F and other linked sheets	checked ok
Test 48V supply	Sheet 04F & sheets of group 09	Fan supply to be checked. ok
Test traction control	Sheets of Group 08.	ok
Test power supply bus stations.	Sheets of Group 09.	Fan supply to be checked. ok
Test control main apparatus	Sheets of Group 05.	ok
Test earth fault detection battery circuit by making artificial earth fault to test the earth fault detection	Sheet 04C	ok
Test control Pneumatic devices	Sheets of Group 06	ok
Test lighting control	Sheets of Group 07	ok
Pretest speedometer	Sheets of Group 10	ok
Pretest vigilance control and fire system	Sheets of Group 11	ok
Power supply train bus	Sheets of Group 13	ok

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

3.0 ***Downloading of Software***

3.1 Check Points.	***Yes/No***
Check that all the cards are physically present in the bus stations and all the plugs are connected.	Yes
Check that all the fibre optic cables are correctly connected to the bus stations.	Yes
Make sure that **control electronics off relay** is not energized i.e. disconnect Sub-D 411.LG and loco is set up in simulation mode.	Yes
Check that battery power is on and all the MCBs (Pos. 127.*) in SB1 &SB2 are on	Yes

3.2 Download Software

The software of Traction converter, Auxiliary converter and VCU should be done by commissioning engineer of the firm in presence of supervisor. Correct software version of the propulsion equipment to be ensured and noted:

Traction converter-1 software version:	28
Traction converter-2 software version:	28
Auxiliary converter-1 software version:	5.0
Auxiliary converter-2 software version:	4.0
Auxiliary converter-3 software version:	4.0
Vehicle control unit -1 software version:	1600
Vehicle control unit -2 software version:	1600

3.3 ***Analogue Signal Checking***

Check for the following analogue signals with the help of diagnostic tool connected with loco.

Description	**Signal name**	**Prescribed value**	**Measured Value**
Brake pipe pressure	FLG2;01--_01XPrAutoBkLn	100% (= 5 Kg/cm2)	OK
Actual BE electric	FLG2; AMSB_0201- Wpn BEdem	100% (= 10V)	OK
TE/BE at 'o' position from both cab	FLG1; AMSB_0101- Xang Trans FLG2; AMSB_0101- Xang Trans	Between 9% and 11 %	10%
TE/BE at 'TE maximal' position from both cab	FLG1; AMSB_0101- Xang Trans FLG2; AMSB_0101- Xang Trans	Between 99 % and 101 %	100%
TE/BE at 'TE minimal' position from both cab	FLG1; AMSB_0101- Xang Trans FLG2; AMSB_0101- Xang Trans	Between 20 % and 25 %	24%

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

TE/BE at 'BE maximal' position from both cab	FLG1; AMSB_0101-XangTrans FLG2; AMSB_0101-XangTrans	Between 99% and 101%	100%
TE/BE at 'BE Minimal' position from both cab	FLG1; AMSB_0101-XangTrans FLG2; AMSB_0101-XangTrans	Between 20% and 25%	25%
TE/BE at '1/3'position in TE and BE mode in both cab.	HBB1; AMS_0101-LT/BDEM>1/3 HBB2; AMS_0101-LT/BDEM>1/3	Between 42 and 44%	44%
TE/BE at '1/3'position in TE and BE mode in both cab.	HBB1; AMS_0101-LT/BDEM>2/3 HBB2; AMS_0101-LT/BDEM>2/3	Between 72 and 74%	74%
Both temperature sensor of TM1	SLG1; AMSB_0106-XAtmp1Mot	Between 10% to 11.7% depending upon ambient temperature 0°C to 40°C	13°C
Both temperature sensor of TM2	SLG1; AMSB_0106-Xatmp2Mot	Between 10% to 11.7% depending upon ambient temperature 0°C to 40°C	12.5°C
Both temperature sensor of TM3	SLG1; AMSB_0106-Xatmp3Mot	Between 10% to 11.7% depending upon ambient temperature 0°C to 40°C	12°C
Both temperature sensor of TM4	SLG2; AMSB_0106-XAtmp1Mot	Between 10% to 11.7% depending upon ambient temperature 0°C to 40°C	12°C
Both temperature sensor of TM5	SLG2; AMSB_0106-Xatmp2Mot	Between 10% to 11.7% depending upon ambient temperature 0°C to 40°C	13°C
Both temperature sensor of TM6	SLG2; AMSB_0106-Xatmp3Mot	Between 10% to 11.7% depending upon ambient temperature 0°C to 40°C	13°C

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 4/870 **Type of Locomotive: WAP-7/WAG-9HC**

3.4 *Functional test in simulation mode*

Conduct the following functional tests in simulation mode as per Para 5.5 of document no.3EHX 610 281. through the Diagnostic tool/laptop :

Test Function	Result desired in sequence	Result obtained
Emergency shutdown through emergency stop switch 244	VCB must open. Panto must lower.	checked ok
Shut Down through cab activation switch to OFF position	VCB must open. Panto must lower.	checked ok
Converter and filter contactor operation with both Power Converters during Start Up.	FB contactor 8.41 is closed. **By moving reverser handle:** • Converter pre-charging contactor 12.3 must close after few seconds. • Converter contactor 12.4 must close. • Converter re-charging contactor 12.3 must opens. **By increasing TE/BE throttle:** • FB contactor 8.41 must open. • FB contactor 8.2 must close. • FB contactor 8.1 must close.	checked ok
Converter and filter contactor operation with both Power Converters during Shut Down.	**Bring TE/BE to O .** Bring the cab activation key to "O" • VCB must open. • Panto must lower. • Converter contactor 12.4 must open. • FB contactor 8.1 must open. • FB contactors 8.41 must close. • FB contactor 8.2 must remain closed.	checked ok

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

Contactor filter adaptation by isolating any bogie	Isolate any one bogie through bogie cut out switch. Wait for self-test of the loco. • Check that FB contactor 8.1 is open. • Check that FB contactor 8.2 is open. After raising panto, closing VCB, and setting TE/BE • FB contactor 8.1 closes. • FB contactor 8.2 remains open.	Checked ok
Test earth fault detection battery circuit positive & negative	By connecting wire 2050 to earth, create earth fault negative potential. • message for earth fault • By connecting wire 2095 to earth, create earth fault positive potential. • message for earth fault	Checked ok
Test fire system. Create a smoke in the machine room near the FDU. Watch for activation of alarm.	When smoke sensor-1 gets activated then • Alarm triggers and fault message priority 2 appears on screen. When both smoke sensor 1+2 gets activated then • A fault message priority 1 appears on screen and lamp LSF1 glow. • Start/Running interlock occurs and TE/BE becomes to 0.	Checked ok
Time, date & loco number	Ensure correct date time and Loco number	ok

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

4.0 *Sensor Test and Converter Test*

4.1 *Test wiring main Transformer Circuits*

Apply $198V_p/140V_{RMS}$ to the primary winding of the transformer (at 1u; wire no. 2 at surge arrestor and at 1v; wire no. 100 at earthing choke). Measure the output voltage and compare the phase of the following of the transformers.

Output Winding nos.	**Description of winding.**	**Prescribed Output Voltage & Polarity with input supply.**	**Measured output**	**Measured polarity**
$2U_1$ & $2V_1$	For line converter bogie 1 between cable 801A-804A	$10.05V_p$ and same polarity	10.04Vp	OK
$2U_4$ & $2V_4$	For line converter bogie 1 between cable 811A-814A	$10.05V_p$ and same polarity	10.04Vp	OK
$2U_2$ & $2V_2$	For line converter bogie 2 between cable 801B-804B	$10.05V_p$ and same polarity	10.05Vp	OK
$2U_3$ & $2V_3$	For line converter bogie 2 between cable 811B-814B	$10.05V_p$ and same polarity	10.05Vp	OK
$2U_B$ & $2V_B$	For aux. converter 1 between cable 1103-1117 (in HB1) For Aux converter 2 between cable 1103-1117 (in HB2)	$7.9V_p$, $5.6V_{RMS}$ and same polarity.	7.9Vp 5.6VRms	OK
$2U_F$ & $2V_F$	For harmonic filter between cable 4-12 (in FB)	$9.12V_p$, $6.45V_{RMS}$ and same polarity.	9.12Vp 6.44VRms	OK

4.2 *Test wiring auxiliary transformer 1000V/415V-110V (pos. 67)*

Apply $141V_p$ / $100V_{RMS}$ to input of the auxiliary transformer at cable no 1203 –1117 and measure the output at

Description of wire no.	**Prescribed Output Voltage & Polarity with input supply.**	**Measured output**	**Measured polarity**
Cable no. 1218 - 1200	$58.7V_p$, $41.5V_{RMS}$ and opposite polarity.	58.7Vp 41.5VRms	OK
Cable no. 1218 – 6500	$15.5V_p$, $11.0V_{RMS}$ and opposite polarity.	15.5Vp 11.0VRms	OK

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

4.3 Primary Voltage Transformer

Apply $250V_{eff}/350V_p$ by variac to roof wire 1 and any wire 0 and measure the magnitude and polarity of the output of the primary voltage transformer for both bogies as per the procedure specified and suggested by the traction converter manufacturer. Primary voltage measurement converters (Pos. 224.1/*) & catenary voltmeter (Pos. 74/*)

This test is to be done for each converter.

Activate cab in driving mode and supply $200V_{RMS}$ through variac to wire no 1501 and 1502. Monitor the following parameters through Diagnostic tool and in catenary voltmeter.

Signal name	Prescribed value in catenary voltmeter	Prescribed value in Micview	Monitored value in catenary voltmeter	Monitored value in SR diagnostic tool
SLG1_G 87-XUPrim	25kV	250%	25KV	250%
SLG2_G 87-XUPrim	25 kV	250%	25KV	250%

Decrease the supply voltage below 140 V_{RMS}. VCB must open at this voltage. In this case the readings in Diagnostic Tool and catenary voltmeter will be as follows.

Signal name	Prescribed value in catenary voltmeter	Prescribed value in Micview	Monitored value in catenary voltmeter	Monitored value in SR diagnostic tool
SLG1_G 87-XUPrim	17kV	170%	17KV	170%
SLG2_G 87-XUPrim	17 kV	170%	17KV	170%

Reactivate VCB to on by increasing this voltage to 175% (17.5 kV).

Increase the supply to 240 V_{RMS} through variac. VCB must open at this voltage, In this case the readings in **diagnostic tool** and catenary voltmeter will be as follows:

Signal name	Prescribed value in catenary voltmeter	Prescribed value in Micview	Monitored value in catenary voltmeter	Monitored value in SR diagnostic tool
SLG1_G 87-XUPrim	30kV	300%	30KV	300%
SLG2_G 87-XUPrim	30 kV	300%	30KV	300%

Reactivate VCB to on by decreasing this voltage to 290% (29 kV).

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

4.4 Minimum voltage relay (Pos. 86)

Functionality test:

Minimum voltage relay (Pos. 86) must be adjusted to approx 68%	
Activate loco in cooling mode. Check Power supply of 48V to minimum voltage relay. Disconnect primary voltage transformer (wire no. 1511 and 1512) from load resistor (Pos. 74.2) and connect variac to wire no. 1501 and 1502. Supply 200V_{RMS} through variac. In this case; *Minimum voltage relay (Pos. 86) picks up*	✓(Yes/No)
Try to activate the cab in driving mode: *Contactor 218 do not close; the control electronics is not be working.*	✓(Yes/No)
Turn off the variac : *Contactor 218 closes; the control electronics is be working*	✓(Yes/No)
Test Under Voltage Protection;	
Activate the cab in cooling mode; Raise panto; Supply 200V_{RMS} through variac to wire no. 1501 & 1502; Close the VCB; Interrupt the supply voltage *The VCB goes off after 2 second time delay.*	✓(Yes/No)
Again supply 200V_{RMS} through variac to wire no. 1501 & 1502; Decrease the supply voltage below 140V_{RMS} ± 4V; Fine tune the minimum voltage relay so that VCB opens.	✓(Yes/No)

4.5 Maximum current relay (Pos. 78)

Disconnect wire 1521 & 1522 of primary current transformer; Connect variac to wire 1521 &1522 (including the resistor at Pos. 6.11); Put loco in simulation for driving mode; Open $R_3 - R_4$ on contact 136.3; Close VCB; supply 3.6A_{RMS} at the open wire 1521; Tune the drum of the maximum current relay Pos. 78 for correct over current value;	
VCB opens with Priority 1 fault message on display.	✓(Yes/No)
Keep contact $R_3 - R_4$ of 136.3 closed; Close VCB; Tune the resistor 78.1 for the current of 7.0A_{RMS} /9.9A_p at the open wire 1521;	
VCB opens with Priority 1 fault message on display.	✓(Yes/No)

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

4.6 Test current sensors

Name of the sensor	Description of the test	Prescribed value	Set/Measured value
Primary return current sensor (Test-1,Pos.6.2/1 & 6.2/2)	Activate cab in driving mode supply 10A. Measure the current through **diagnostic tool** or measuring print.	(Variation allowed is ± 10%)	—
Primary return current sensor (Test-2, Pos.6.2/1 & 6.2/2)	Supply 90mA$_{DC}$ to the test winding of sensor through connector 415.AA/1or 2 pin no. 7(+) & 8(-)	—	—
	Supply 297mA$_{DC}$ to the test winding of sensor through connector 415.AA/1or 2 pin no. 7(+) & 8(-)	—	299mA
Auxiliary winding current sensor (Pos. 42.3/1 & 42.3/2)	Supply 90mA$_{DC}$ to the test winding of sensor through connector 415.AC/1or 2 pin no. 7(+) & 8(-)	—	—
	Supply 333mA$_{DC}$ to the test winding of sensor through connector 415.AC/1 or 2 pin no. 7(+) & 8(-)	—	337mA
Harmonic filter current sensors (Pos.8.5/1 &8.5/2)	Supply 90mA$_{DC}$ to the test winding of sensor through connector 415.AE/1or 2 pin no. 7(+) & 8(-)	—	—
	Supply 342mA$_{DC}$ to the test winding of sensor through connector 415.AE/1or 2 pin no. 7(+) & 8(-)	—	346mA
Hotel load current sensors (Pos. 33/1 & 33/2)	Switch on hotel load. Supply 90mA$_{DC}$ to the test winding of sensor through connector 415.AG/1or 2 pin no. 7(+) & 8(-)	NA	NA
	Supply 1242mA$_{DC}$ to the test winding of sensor through connector 415.AG/1or 2 pin no. 7(+) & 8(-)	NA	NA

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

4.7 Test DC Link Voltage Sensors (Pos 15.6/*)

This test is to be done by the commissioning engineer of the firm if required.

4.8 ***Verification of Converter Protection Circuits (Hardware limits) -***

This test is to be done as per para 6.17 of the document no. 3EHX 610 282 for both the converters.

Protection circuits	Limit on which shutdown should take place	Measured limit
Current sensors (Pos 18.2/1, 18.2/2, 18.2/3, 18.4/4, 18.5/1, 18.5/2, 18.5/3) for Power Converter 1	Increase the current quickly in the test winding of the current sensors, VCB will off at 2.52A with priority 1 fault for each sensor.	For 18.2/1= OK For 18.2/2= For 18.2/3= For 18.4/4= For 18.5/1= For 18.5/2= For 18.5/3=
Current sensors (Pos 18.2/1, 18.2/2, 18.2/3, 18.4/4, 18.5/1, 18.5/2, 18.5/3) for Power Converter 2	Increase the current quickly in the test winding of the current sensors, VCB will off at 2.52A with priority 1 fault for each sensor.	For 18.2/1= OK For 8.2/2= For 18.2/3= For 18.4/4= For 18.5/1= For 18.5/2= For 18.5/3=
Fibre optic failure In Power Converter1	Remove one of the orange fibre optic plugs on traction converter. VCB should trip	OK
Fibre optic failure In Power Converter2	Remove one of the orange fibre optic plugs on traction converter. VCB should trip	OK

4.9 ***Sequence of BUR contactors***

The sequence of operation of BUR contactors for 'ALL BUR OK' BUR 1 out BUR 2 out and BUR 3 out condition has to be verified by putting the Loco in driving mode (VCB should not be closed) and isolating the BURs one by one. In these condition following will be the contactor sequence.

Status	52/1	52/2	52/3	52/4	52/5	52.4/1	52.4/2	52.5/1	52.5/2
Al BUR OK	Close	Open	Close	Open	Close	Open	Close	Close	Open
BUR1 off	Close	Open	Close	Close	Open	Close	Open	Open	Close
BUR2 off	Open	Open	Close	Close	Close	Close	Open	Open	Close
BUR3 off	Open	Close	Open	Close	Close	Close	Open	Open	Close

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

Monitored contactor sequence

Status	52/1	52/2	52/3	52/4	52/5	52.4/1	52.4/2	52.5/1	52.5/2
Al BUR OK	close	open	close	open	close	open	close	close	open
BUR1 off	close	open	close	close	open	close	open	open	close
BUR2 off	open	open	close	close	close	close	open	open	close
BUR3 off	open	close	open	close	close	close	open	open	close

5.0 Commissioning with High Voltage

5.1 *Check List*

Items to be checked	Yes/No
Fibre optic cables connected correctly.	Yes
No rubbish in machine room, on the roof, under the loco.	Yes
All the electronic Sub-D and connectors connected	Yes
All the MCBs of the HB1 & HB2 open.	Yes
All the three fuses 40/* of the auxiliary converters	Yes
The fuse of the 415/110V auxiliary circuit (in HB1) open.	Yes
Roof to roof earthing and roof to cab earthing done	Yes
Fixing, connection and earthing in the surge arrestor done correctly.	Yes
Connection in all the traction motors done correctly.	Yes
All the bogie body connection and earthing connection done correctly.	Yes
Pulse generator (Pos. 94.1) connection done correctly.	Yes
All the oil cocks of the gate valve of the transformer in open condition.	Yes
All covers on Aux & Power converters, Filter block, HB1, HB2 fitted	Yes
KABA key interlocking system.	Yes

5.2 Safety test main circuit breaker

Prepare to switch off the catenary supply during the first charging of the locomotive in case of any unexpected behavior of the electrical component of the loco. Charge the loco for the first time by closing BLDJ switch. The VCB will trip after certain time as no oil/coolant pumps are running yet.

Perform the following safety test of main circuit breaker through both the cabs of the locomotive.

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

Name of the test	Description of the test	Expected result	Monitored result
Emergency stop in cooling mode	Raise panto in cooling mode. Put the brake controller into RUN position. Close the VCB. Push emergency stop button 244.	VCB must open. Panto must lower. Emergency brake will be applied.	Checked OK
Emergency stop in driving mode	Raise panto in driving mode in. Put the brake controller into RUN position. Close the VCB. Push emergency stop button 244.	VCB must open. Panto must lower. Emergency brake will be applied.	Checked OK
Under voltage protection in cooling mode	Raise panto in cooling mode. Close the VCB. Switch off the supply of catenary by isolator	VCB must open.	Checked OK
Under voltage protection in driving mode	Raise panto in driving mode. Close the VCB. Switch off the supply of catenary by isolator	VCB must open with diagnostic message that catenary voltage out of limits	Checked OK
Shut down in cooling mode.	Raise panto in cooling mode. Close the VCB. Bring the BL-**key in O** position.	VCB must open. Panto must lower.	Checked OK
Shutdown in driving mode	Raise panto in driving mode. Close the VCB. Bring the BL-**key in O** position.	VCB must open. Panto must lower.	Checked OK
Interlocking pantograph-VCB in cooling mode	Raise panto in cooling mode. Close the VCB. Lower the pantograph by ZPT	VCB must open.	Checked OK
Interlocking pantograph-VCB in driving mode	Raise panto in driving mode. Close the VCB. Lower the pantograph by ZPT	VCB must open.	Checked OK

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 4/870 **Type of Locomotive: WAP-7/WAG-9HC**

5.3 *Auxiliary Converter Commissioning*

Switch on the high voltage supply and set up the loco in driving mode. Raise the panto. Close the VCB. Check that there is no earth fault in the auxiliary circuit, Switch off the VCB. Lower the panto. Create the earth fault in auxiliary circuit by making connection between wire no 1117(in HB2 cubicle) and earth. After 3 minutes a diagnostic message will come that "Earth fault auxiliary circuit."

5.3.1 Running *test of 3 ph. auxiliary equipments*

Switch on the 3 ph. auxiliary equipment one by one. Check the direction of rotation of each auxiliary machine and measure the continuous current and starting current drawn by them.

Name of the auxiliary machine	Typical phase current	Measured continuous phase current	Measured starting phase current
Oil pump transformer 1	9.8 amps	10.7	12.3
Oil pump transformer 2	9.8 amps	10.3	11.8
Coolant pump converter 1	19.6 amps	7.0	10.3
Coolant pump converter 2	19.6 amps	6.9	15.5
Oil cooling blower unit 1	40.0 amps	40.0	63.0
Oil cooling blower unit 2	40.0 amps	39.0	58.5
Traction motor blower 1	34.0 amps	27.0	52.5
Traction motor blower 2	34.0 amps	27.4	56.0
Sc. Blower to Traction motor blower 1	6.0 amps	6.7	11.3
Sc. Blower to Traction motor blower 1	6.0 amps	6.9	11.8
Compressor 1	25 amps at 0 kg/ cm^2 40 amps at 10 kg/ cm^2	27.8	89.0
Compressor 2	25 amps at 0 kg/ cm^2 40 amps at 10 kg/ cm^2	27.5	60.8

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 Type of Locomotive: WAP-7/WAG-9HC

5.3.2 Performance of Auxiliary Converters

Measure the performance of the auxiliary converters through software and record it.

BUR1 (Condition: Switch off all the load of BUR 1)- to be filled by commissioning engineer of the firm.

Signal name	Description of the signal	Prescribed value	Monitored value	Value under Limit (Yes/No)
BUR1 7303 XUUN	Input voltage to BUR1	75% (10%=125V)	1002V	Yes
BUR1 7303 XUUZ1	DC link voltage of BUR1	60% (10%=100V)	636V	Yes
BUR1 7303 XUIZ1	DC link current of BUR1	0% (10%=50A)	1 Amp	Yes

BUR2 (Condition: Switch off all the load of BUR 2, Battery Charger on) to be filled by commissioning engineer of the firm.

Signal name	Description of the signal	Prescribed value by the firm	Monitored value	Value under Limit (Yes/No)
BUR2 7303-XUUN	Input voltage to BUR2	75% (10%=125V)	1004V	Yes
BUR2 7303-XUUZ1	DC link voltage of BUR2	60% (10%=100V)	637V	Yes
BUR2 7303-XUIZ 1	DC link current of BUR2	1% (10%=50A)*	7Amp	Yes
BUR2 7303-XUILG	Current battery charger of BUR2	3% (10%=100A)*	22Amp	Yes
BUR2 7303-XUIB1	Current battery of BUR2	1.5%(10%=100A)*	12Amp	Yes
BUR2 7303 –XUUB	Voltage battery of BUR2	110%(10%=10V)	110V	Yes

* Readings are dependent upon charging condition of the battery.

BUR3 (Condition: Switch off all the load of BUR 3, Battery Charger on) to be filled by commissioning engineer of the firm.

Signal name	Description of the signal	Prescribed set value by the firm	Monitored value	Value under limit (Yes/No)
BUR3 7303-XUUN	Input voltage to BUR3	75% (10%=125V	1005V	Yes
BUR3 7303-XUUZ1	DC link voltage of BUR3	60% (10%=100V)	637V	Yes
BUR3 7303-XUIZ 1	DC link current of BUR3	1% (10%=50A)*	7Amp	Yes
BUR3 7303-XUILG	Current battery charger of BUR 3	3% (10%=100A)*	22Amp	Yes
BUR3 7303-XUIB1	Current battery of BUR 3	1.5%(10%=100A)*	12Amp	Yes
BUR3 7303-XUUB	Voltage battery of BUR 3	110%(10%=10V)	110V	Yes

* Readings are dependent upon charging condition of the battery.

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 4872 **Type of Locomotive: WAP-7/WAG-9HC**

5.3.3 Performance of BURs when one BUR goes out

When any one BUR goes out then rest of the two BURs should take the load of all the auxiliaries at ventilation leve1 3 of the locomotive.

Condition of BURs	Loads on BUR1	Loads in BUR2	Loads in BUR3
All BURs OK	Oil Cooling unit 1&2	TM blower1&2, TFP oil pump 1&2, SR coolant pump 1&2.	Compressor 1&2, Battery charger and TM Scavenger blower 1&2
BUR 1 out	------	Oil Cooling unit 1&2, TM blower1&2, TM Scavenger blower 1&2	Compressor 1&2,TFP oil pump 1&2, SR coolant pump 1&2 and Battery charger.
BUR 2 out	Oil Cooling unit 1&2, TM blower 1&2, TM Scavenger blower 1&2	-------	Compressor 1&2, TFP oil pump 1&2, SR coolant pump 1&2 and Battery charger.
BUR 3 out	Oil Cooling unit 1&2, TM blower1&2, TM Scavenger blower 1&2	Compressor 1&2, TFP oil pump 1&2, SR coolant pump 1&2 and Battery charger.	-------

5.4 Auxiliary circuit 415/110

For checking earth fault detection, make a connection between wire no. 1218 and vehicle body. On switching on VCB, Earth fault relay 89.5 must pick up and after 3 minutes a message will come in the Diagnostic display that Earth Fault 415/110V Circuit

Switch on the 1 ph. auxiliary equipment one by one. Check the direction of rotation of each auxiliary machine and measure the continuous current and starting current drawn by them.

Name of the auxiliary machine	Typical phase current	Measured phase current	Measured starting current
Machine room blower 1	15.0 amps*	6.9	13.6
Machine room blower 2	15.0 amps*	5.9	11.7
Sc. Blower to MR blower 1	1.3 amps	2.3	4.5
Sc. Blower to MR blower 2	1.3 amps	1.8	3.9
Ventilator cab heater 1	1.1 amps	1.7	1.9
Ventilator cab heater 2	1.1 amps	1.7	1.8
Cab heater 1	4.8 amps	5.3	5.4
Cab heater 2	4.8 amps	5.3	5.4

* For indigenous MR blowers.

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

5.5 Hotel load circuit (Not applicable for WAG-9HC)

For WAP-7 locomotive with Hotel load converter refer to **Annexure-HLC**

5.6 Traction Converter Commissioning

This test is carried out in association with Firm.

Traction converter commissioning is being done one at a time. For testing Converter 1, switch off the traction converter 2 by switch bogie cut out switch 154. For testing Converter 2, switch off the traction converter 2 by switch bogie cut out switch 154. Isolate the harmonic filter also by switch 160. Start up the loco by one converter. Follow the functionality tests.

For Converter 1

Test Function	Results desired	Result obtained
Measurement of charging and pre-charging and charging of DC Link of Converter 1	Traction converter manufacturer to declare the successful operation and demonstrate the same to the PLW supervisor.	Checked ok
Measurement of discharging of DC Link of Converter 1	Traction converter manufacturer to declare the successful operation and demonstrate the same to the PLW supervisor.	Checked ok
Earth fault detection on positive potential of DC Link of Converter 1	Traction converter manufacturer to declare the successful operation and demonstrate the same to the PLW supervisor.	Checked ok
Earth fault detection on negative potential of DC Link of Converter 1	Traction converter manufacturer to declare the successful operation and demonstrate the same to the PLW supervisor.	Checked ok
Earth fault detection on AC part of the traction circuit of Converter 1	Traction converter manufacturer to declare the successful operation and demonstrate the same to the PLW supervisor.	Checked ok
Pulsing of line converter of Converter 1	Traction converter manufacturer to declare the successful operation and demonstrate the same to the PLW supervisor.	Checked ok
Pulsing of drive converter of Converter 1	Traction converter manufacturer to declare the successful operation and demonstrate the same to the PLW supervisor.	Checked ok

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870

Type of Locomotive: WAP-7/WAG-9HC

For Converter 2

Test Function	Results desired in sequence	Result obtained
Measurement of charging and pre-charging and charging of DC Link of Converter 2	Traction converter manufacturer to declare the successful operation and demonstrate the same to the PLW supervisor.	checked ok
Measurement of discharging of DC Link of Converter 2	Traction converter manufacturer to declare the successful operation and demonstrate the same to the PLW supervisor.	checked ok
Earth fault detection on positive potential of DC Link of Converter 2.	Traction converter manufacturer to declare the successful operation and demonstrate the same to the PLW supervisor.	checked ok
Earth fault detection on negative potential of DC Link of Converter 2.	Traction converter manufacturer to declare the successful operation and demonstrate the same to the supervisor/v	checked ok
Earth fault detection on AC part of the traction circuit of Converter 2.	Traction converter manufacturer to declare the successful operation and demonstrate the same to the PLW supervisor.	checked ok
Pulsing of line converter of Converter 2.	Traction converter manufacturer to declare the successful operation and demonstrate the same to the PLW supervisor.	checked ok
Pulsing of drive converter of Converter 2	Traction converter manufacturer to declare the successful operation and demonstrate the same to the PLW supervisor.	checked OK

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

5.7 *Test protective shutdown SR*

Test Function	Results desired in sequence	Result obtained
Measurement of protective shutdown by Converter 1 electronics.	Start up the loco with both the converter. Raise panto. Close VCB. Move Reverser handle to forward or reverse. Remove one of the orange fibre optic feedback cable from converter 1Check that converter 1 electronics produces a protective shut down. • VCB goes off • Priority 1 fault mesg. on DDU appears ***Disturbance in Converter 1***	checked ok
Measurement of protective shutdown by Converter 2 electronics.	Start up the loco with both the converter. Raise panto. Close VCB. Move Reverser handle to forward or reverse. Remove one of the orange fibre optic feedback cable from converter 2. Check that converter 2 electronics produces a protective shut down. • VCB goes off • Priority 1 fault mesg. on diagnostic display appears ***Disturbance in Converter 2***	checked ok

5.8 *Test Harmonic Filter*

Switch on the filter by switch 160

Test Function	Results desired in sequence	Result obtained
Measurement of filter currents	Start up the loco with both the converter. Raise panto. Close VCB. Move Reverser handle to forward or reverse. Apply a small value of TE/BE by moving the throttle. • FB contactor 8.41 must open.	checked ok

Signature of the JE/SSE/Loco Test

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

	• FB contactor 8.2 must close. • FB contactor 8.1 must close • Check the filter current in diagnostic laptop **Bring the TE/BE throttle to O** Switch off the VCB • FB contactor 8.1must open. • FB discharging contactor 8.41 must close • Check the filter current in diagnostic laptop	Checked OK
Test earth fault detection harmonic filter circuit.	Make a connection between wire no. 12 and vehicle body. Start up the loco. Close VCB. • Earth fault relay 89.6 must pick up. • Diagnostic message comes that - ***Earth fault in harmonic filter circuit***	Checked OK
Test traction motor speed sensors for both bogie in both cabs	Traction converter manufacturer to declare the successful operation and demonstrate the same to the supervisor/ PLW	OK

5.9 ***Test important components of the locomotive***

Items to be tested	**Description of the test**	**Monitored value/remarks**
Speedometer	VCU converter manufacturer to declare the successful operation and demonstrate the same to the supervisor/ PLW	Checked OK
Time delay module of MR blower	The time after which the starting capacitor for MR blower should go off the circuit should be set to 10-12 seconds	Checked OK
Ni-Cd battery voltage	At full charge, the battery voltage should be 110V DC.	Checked OK
Flasher light	From both cab flasher light should blink at least 65 times in one minute.	Checked OK
Head light	Head light should glow from both cabs by operating ZLPRD. Dimmer operation of headlight should also occur by operating the switch ZLPRD.	Checked OK

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

Marker light	Both front and tail marker light should glow from both the cabs	checked ok
Cab Light	Cab light should glow in both the cabs by operating the switch ZLC	checked ok
Spot lights	Both Drivers and Asst. Drivers Spot light should glow in both cabs by operating ZLDD	checked ok
Instrument lights	Instrument light should glow from both cab by operating the switch ZLI	checked ok
Illuminated Push button	All illuminated push buttons should glow during the operation	checked ok
Contact pressure of the high rating contactors	The contact pressure of FB contactors (8.1, 8.2) is to be measured **Criteria**: *The minimum contact pressure is 54 to 66 Newton.*	For contactor 8.1: For contactor 8.2: } ok
Crew Fan	All crew fans should work properly when VCB of the loco is switched on. The airflow from each cab fan is to be measured. **Criteria:** *The minimum flow of air of cab fan should be 25 m^3/minute*	Cab 1 LHS: Cab 1 RHS: Cab 2 LHS: Cab 2 RHS: } ok

6.0** Running **Trial of the locomotive

SN	Description of the items to be seen during trail run	Action which should take place	Remarks
1	Cab activation in driving mode	No fault message should appear on the diagnostic panel of the loco.	checked ok
	Loco charging	Loco to be charged and all auxiliaries should run. No fault message to appear on the diagnostic panel of the loco. Raise MR pressure to 10 Kg/cm^2, BP to 5 Kg/cm^2, FP to 6 Kg/cm^2.	checked ok
3.	Check function of Emergency push stop.	This switch is active only in activated cab. By pushing this switch VCB should open & pantograph should be lowered.	checked ok
4.	Check function of BPCS.	• Beyond 5 kmph, press BPCS, the speed of loco should be constant. • BPCS action should be cancelled by moving TE/BE throttle, by dropping BP below 4.75 Kg/cm^2, by pressing BPCS again.	checked ok
5.	Check train parting operation of the Locomotive.	Operate the emergency cock to drop the BP Pressure LSAF should glow.	checked ok

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870 **Type of Locomotive: WAP-7/WAG-9HC**

6.	Check vigilance operation of the locomotive	Set the speed more than 1.5 kmph and ensure that brakes are released i.e. BC < 1 Kg/cm^2. For 60 seconds do not press vigilance foot switch or sanding foots switch or TE/BE throttle or BPVG switch then • Buzzer should start buzzing. • LSVW should glow continuously. Do not acknowledge the alarm through BPVG or vigilance foot switch further for 8 seconds then:- • Emergency brake should be applied automatically. • VCB should be switched off. Resetting of this penalty brake is possible only after 180 seconds by bringing TE/BE throttle to 0 and acknowledge BPVR and press & release vigilance foot switch.	Checked OK
7.	Check start/run interlock	• At low pressure of MR (< 5.6 Kg/cm^2). • With park brake in applied condition. • With direct loco brake applied (BP< 4.75Kg/cm^2). • With automatic train brake applied (BP<4.75Kg/cm^2). • With emergency cock (BP < 4.75 Kg/cm^2).	Checked OK N/A Checked OK
8.	Check traction interlock	Switch of the brake electronics. The Tractive /Braking effort should ramp down, VCB should open and BP reduces rapidly.	Checked OK
9.	Check regenerative braking.	Bring the TE/BE throttle to BE side. Loco speed should start reducing.	Checked OK
10.	Check for BUR redundancy test at ventilation level 1 & 3 of loco operation	In the event of failure of one BUR, rest of the two BURs can take the load of all the auxiliaries. For this switch off one BUR. Auxiliaries should be catered by rest of two BURs. Switch off the 2 BURs; loco should trip in this case.	Checked OK
11.	Check the power converter isolation test	Create disturbance in power converter by switching off the electronics. VCB should open and converter should get isolated and traction is possible with another power converter.	Checked OK

Signature of the JE/SSE/Loco Testing

PATIALA LOCOMOTIVE WORKS, PATIALA

Testing & Commissioning Format For 3-Phase Locomotive fitted with IGBT based Traction Converter, Auxiliary Converter and TCN based VCU

Locomotive No.: 41870

Type of Locomotive: WAP-7/WAG-9HC

7.0 Final check list to be verified at the time of Loco dispatch

Condition /Operations of the following items are to be checked:

SN	Item	Cab-1	Cab-2	Remarks
1	Head lights	OK	OK	
2	Marker Red	OK	OK	
3	Marker White	OK	OK	
4	Cab Lights	OK	OK	
5	Dr Spot Light	OK	OK	
6	Asst Dr Spot Light	OK	OK	Checked working OK
7	Flasher Light	OK	OK	
8	Instrument Lights	OK	OK	
9	Corridor Light	OK	OK	
10	Cab Fans	OK	OK	
11	Cab Heater/Blowers	OK	OK	
12	All Cab Signal Lamps Panel 'A'	OK	OK	

Signature of the JE/SSE/Loco Testing

Status of RDSO modifications

LOCO NO: 41870

Sn	Modification No.	Description	Remarks
1.	RDSO/2008/EL/MS/0357 Rev.'0' Dt 20.02.08	Modification in control circuit of Flasher Light and Head Light of three phase electric locomotives.	✓ Ok/Not Ok
2.	RDSO/2009/EL/MS/0377 Rev.'0' Dt 22.04.09	Modification to voltage sensing circuit in electric locomotives.	✓ Ok/Not Ok
3.	RDSO/2010/EL/MS/0390 Rev.'0' Dt 31.12.10	Paralleling of interlocks of EP contactors and Relays of three phase locomotives to improve reliability.	✓ Ok/Not Ok
4.	RDSO/2011/EL/MS/0399 Rev.'0' Dt 08.08.11	Removal of interlocks of control circuit contactors no. 126 from MCPA circuit.	✓ Ok/Not Ok
5.	RDSO/2011/EL/MS/0400 Rev.'0' Dt 10.08.11	Modification sheet for shifting the termination of $GKW, 1.8 KV, 70 sq mm cables and 2x2.5 sq mm cables housed in lower portion of HB2 panel and provision of Synthetic resin bonded glass fiber sheet for three phase locomotives.	✓ Ok/Not Ok
6.	RDSO/2011/EL/MS/0401 Rev.'0' Dt 10.08.11	Modification sheet for relaying of cables in HB-2 panel of three phase locomotives to avoid fire hazards.	✓ Ok/Not Ok
7.	RDSO/2011/EL/MS/0403 Rev.'0' Dt 30.11.11	Auto switching of machine room/corridor lights to avoid draining of batteries in three phase electric locomotives.	✓ Ok/Not Ok
8.	RDSO/2012/EL/MS/0408 Rev.'0'	Modification of terminal connection of heater cum blower assembly.	✓ Ok/Not Ok
9.	RDSO/2012/EL/MS/0411 Rev.'1' dated 02.11.12	Modification sheet to avoid simultaneous switching ON of White and Red marker light in three phase electric locomotives.	✓ Ok/Not Ok
10.	RDSO/2012/EL/MS/0413 Rev.'1' Dt 25.04.16	Paralleling of interlocks of EP contactors and auxiliary contactors of three phase locomotives to improve reliability.	✓ Ok/Not Ok
11.	RDSO/2012/EL/MS/0419 Rev.'0' Dt 20.12.12	Modification sheet to provide rubber sealing gasket in Master Controller of three phase locomotives.	✓ Ok/Not Ok
12.	RDSO/2013/EL/MS/0420 Rev.'0' Dt 23.01.13	Modification sheet to provide mechanical locking arrangement in Primary Over Current Relay of three phase locomotives.	✓ Ok/Not Ok
13.	RDSO/2013/EL/MS/0425 Rev.'0' Dt 22.05.13	Modification sheet for improving illumination of head light in dimmer mode in three phase electric locomotives.	✓ Ok/Not Ok
14.	RDSO/2013/EL/MS/0426 Rev.'0' Dt 18.07.13	Modification sheet of Bogie isolation rotary switch in three phase electric locomotives.	✓ Ok/Not Ok
15.	RDSO/2013/EL/MS/0427 Rev.'0' Dt 23.10.13	Modification sheet for MCP control in three phase electric locomotives.	✓ Ok/Not Ok
16.	RDSO/2013/EL/MS/0428 Rev.'0' Dt 10.12.13	Modification sheet for relocation of earth fault relays for harmonic filter and hotel load along with its resistors in three phase electric locomotives.	✓ Ok/Not Ok
17.	RDSO/2014/EL/MS/0432 Rev.'0' Dt 12.03.14	Removal of shorting link provided at c-d terminal of over current relay of three phase electric locomotives.	✓ Ok/Not Ok
18	RDSO/2017/EL/MS/0464 Rev.'0' Dt 25.09.17	Provision of Auxiliary interlock for monitoring of Harmonic filter ON (8.1)/adoption (8.2) Contactor in GTO/IGBT locomotives.	✓ Ok/Not Ok
19.	RDSO/2017/EL/MS/0467 Rev.'0' Dt 07.12.17	Modification in blocking diodes to improve reliability in three phase electric locomotives.	✓ Ok/Not Ok
20	RDSO/2018/EL/MS/0475 Rev.'0'	Modification in existing Control Electronics (CE) resetting scheme of 3 phase electric locomotives.	✓ Ok/Not Ok

Signature of JE/SSE/ECS

PLW/PATIALA **Loco No.: 41870**

PNEUMATIC TEST PARAMETERS OF 3-PHASE ELECTRIC LOCOMOTIVES

(As per DG/RDSO/LKO's letter No.-EL/3.2.19/3phase, dated-29.03.2012)

SN	Parameters	Reference	Value	Result
	Brake Panel: M/s Knorr			
1.0	**Auxiliary Air supply system (Pantograph & VCB)**			
1.1	Ensure, Air is completely vented from pantograph Reservoir (Ensure Panto gauge reading is Zero)			0
1.2	Turn On BL Key. Now MCPA starts. Record pressure Build up time (8.0 kg/cm2)		60 sec. (Max.) 120 sec (knorr)	 118 sec
1.3	Auxiliary compressor safety Valve 23F setting	Faiveley Doc. No. DMTS-014-1, 8 CLW's check sheet no. F60.812 Version 2	8.5±0.25kg/cm2 -	8.4
1.4	Check VCB Pressure Switch Setting	CLW's check sheet no. F60.812 Version 2	Opens 4.5±0.15 kg/cm2, closes 5.5±0.15 kg/cm2	4.50 Kg/cm2 5.55 Kg/cm2
1.5	Set pantograph Selector Switch is in Auto, Open pan-1&2 Isolating Cocks & KABA cock by Key (KABA Key)			
1.6	Set Cab-1 Pan UP in Panel A.		Observed Pan-2 Rises.	OK
1.7	Close Pan-2 isolating Cock Open Pan -2 isolating Cock		Panto-2 Falls Down Panto-2 Rises	OK
1.8	Record Pantograph Rise time		06 to 10 seconds	9.5Sec
1.9	Record Pantograph Lowering Time		06 to 10 seconds	8 Sec
1.10	Panto line air leakage		0.7 kg/cm2 in 5 Min.	0.3 kg/cm2 in 5 Min.
1.11	High Reach Panto emergency test and reset.			ok
2.0	**Main Air Supply System**			
2.1	Ensure, Air is completely vented from locomotive. Drain out all the reservoirs by opening the drain cocks and then closed drain cocks. MR air pressure build up time by each compressor from 0 to 10 kg/cm2. i) with 1750 LPM compressor ii) with 1450 LPM compressor	Theoretical calculation and test performed by Railways.	 i) 7 mins Max. ii) 8.5 mins Max.	 6 min. & 45 sec.
2.2	Drain air below MR 8 kg/cm2 to start both the compressors		Check Starting of both compressors	ok
2.3	Drain air from main reservoir up to 7 kg/cm2. Start compressors, Check pressure build time of individual compressor from 8 kg/cm2 to 9 kg/cm2		30 Sec. (Max)	CP1-27 Sec CP2-28 Sec
2.4	Check Low MR Pressure Switch Setting (37)	D&M test spec. MM3882 & MM3946	Closes at 6.40±0.15 kg/cm2 Opens at 5.60±0.15kg/cm2	6.5 Kg/cm2 5.5 Kg/cm2
2.5	Check compressor Pressure Switch RGCP setting (35)	D&M test spec. MM3882 & MM3946	Opens at 10±0.20 kg/cm2, Closes at 8±0.20 kg/cm2	10.1 Kg/cm2 8 Kg/cm2
2.6	Run both the compressors Record Pressure build up time	Trial results	3.5 Minutes Max.	3.35 minute

PLW/PATIALA

Loco No.: 41870

2.7	Check unloader valve operation time					Approx. 12 Sec.	11 sec.
2.8	Check Auto Drain Valve functioning (124 & 87)					Operates when Compressor starts	ok
2.9	Check CP-I delivery safety valve setting (10/1). Run CP Direct by BLCP.				D&M test spec. MM3882 & MM3946	11.50±0.35 kg/cm2	11.4 Kg/cm2
2.10	Check CP-2 delivery safety valve setting (10/2). Run CP direct by BLCP				D&M test spec. MM3882 & MM3946	11.50±0.35 kg/cm2	11.45 Kg/cm2
2.11	Switch 'OFF' the compressors and ensure that the safety valve to reset at pressure 1.2 kg/cm2 less than opening pressure.				D&M test spec. MM3882 & MM3946		
2.12	BP Pressure: Switch 'OFF' compressor, Drain MR Pressure by drain cock of 1" Main Reservoir, Start Compressor, check setting pressure of Duplex Check Valve 92F.				CLW's check sheet no. F60.812 Version 2	5.0±0.10kg/cm2	5.0 Kg/cm2
2.13	FP pressure: Fit Test Gauge in Test point 107F FPTP. Open isolate cock 136F. Check pressure in Gauge.				CLW's check sheet no. F60.812 Version 2	6.0±0.20kg/cm2	6.05 Kg/cm2
3.0	**Air Dryer Operation**						
3.1	Open Drain Cock 90 of 2nd MR to start Compressor, leave open for Test Check Air Dryer Towers to change.					Tower to change every minute	ok
3.2	Check Purge Air Stops from Air Dryer at Compressor stops						
3.3	Check condition of humidity indicator					Blue	Blue
4.0	**Main Reservoir Leakage Test**						
4.1	Put Auto Brake (A-9) in full service, Check MR Pressure air leakage from both cabs.				D&M test spec. MM3882 & MM3946	Should be less than 1 kg/cm2 in 15 minutes	0.7 Kg/cm2 in 15 minutes
4.2	Check BP Air leakage				D&M test spec. MM3882 & MM3946	0.15 kg/cm2 in 5 minutes	0.05 Kg/cm2 in 5 minutes
5.0	**Brake Test (Automatic Brake operation)**						
5.1	Record Brake Pipe & Brake Cylinder pressure at Each Step						
	Check proportionality of Auto Brake system				CLW's check sheet no. F60.812 Version 2		
	Auto controller position	BP Pressure kg/cm2		BC (WAG-9 & WAP-7) Kg/cm2		BC (WAP-5) Kg/cm2	
		Value	Result	Value	Result	Value	Result
	Run	5±0.1	**5.0 Kg/cm2**	0.00	**0.00 Kg/ cm2**	0.00	-
	Intial	4.60±0.1	**4.6 Kg/cm2**	0.40±0.1	**0.40Kg/ cm2**	0.75±0.15	-
	Full service	3.35±0.2	**3.35 Kg/cm2**	2.50±0.1	**2.5Kg/ cm2**	5.15±0.30	-
	Emergency	Less than 0.3	**0.25 Kg/cm2**	2.50±0.1	**2.5Kg/ cm2**	5.15±0.30	-

PLW/PATIALA

Loco No.: 41870

5.2	Record time to BP pressure drop to 3.5 kg/cm2 Ensure Automatic Brake Controller handle is Full Service from Run	D&M test spec. MM3882 & MM3946	8±2 sec.	8.9 Sec
5.3	Operate Asst. Driver Emergency Cock,	D&M test spec. MM3882 & MM3946	BP pressure falls to Below 2.5 kg/cm2	OK
5.4	Check brake Pipe Pressure Switch 69F operates	CLW's check sheet no. F60.812 Version 2	Closes at BP 4.05- 4.35 kg/cm2 Opens at BP 2.85- 3.15 kg/cm2	4.25 Kg/cm2 3.0 Kg/cm2
5.5	Move Auto Brake Controller handle from Running to Emergency BC filling time from 0.4 kg/cm2 i.e. 95% of Max. BC developed WAP5 – BC 5.15 ± 0.3 kg/cm2 apply time WAP7 - BC 2.50 ± 0.1 kg/cm2 **WAG9 - BC 2.50 ± 0.1 kg/cm2**	D&M test spec. MM3882 & MM3946	4±1 sec. 7.5±1.5 sec. **21±3 sec.**	**20 sec**
5.6	Move Auto Brake Controller handle to full service and BP pressure 3.5 kg/cm2. Move Brake controller to Running position BC Release time to fall BC Pressure up to 0.4 kg/cm2 i.e. 95% of Max. BC developed BC release Time WAP7 **WAG9**	D&M test spec. MM3882 & MM3946	17.5±25 sec. **52±7.5 sec**.	**56 sec**.
5.7	Move Auto Brake Controller handle to Release, Check BP Pressure Steady at 5.5± 0.2 kg/cm2 time.	CLW's check sheet no. F60.812 Version 2	60 to 80 Sec.	75 Sec
5.8	Auto Brake capacity test : The capacity of the A9 valve in released condition must conform to certain limit in order to ensure compensation for air leakage in the train without interfering with the automatic functioning of brake. * Allow The MR pressure to build up to maximum stipulated limit. * Close brake pipe angle cock and charge brake pipe to 5 kg/cm2 by A (Automatic brake controlling) at run position. * Couple 7.5 dia leak hole to the brake hose pipe of locomotive. Open the angle cock for brake pipe. The test shall be carried out with all the compressors in working condition.	RDSO Motive power Directorate report no. MP Guide No. 11 July, 1999 Rev.1	BP pressure should not fall below 4.0 kg/cm2 with in 60 Sec.	4.7 Kg/cm2
5.9	Keep Auto Brake Controller (A-9) in Full Service. Press Driver End paddle Switch (PVEF)		BC comes to '0'	**0**
6.0	**Direct Brake (SA-9)**			
6.1	Apply Direct Brake in Full Check BC pressure **WAG9**/WAP7 WAP5	CLW's check sheet no. F60.812 Version 2	3.5±0.20 kg/cm2 5.15±0.3 kg/cm2	3.55 Kg/cm2
6.2	Apply Direct Brake, Record Brake Cylinder charging time	D&M test spec. MM3882 & MM3946	8 sec. (Max.)	7.5Sec

PLW/PATIALA

Loco No.: 41870

6.3	Check Direct Brake Pressure switch 59 (F)	D&M test spec. MM3882 & MM3946	0.2.±0.1 kg/cm2	0.25 kg/cm2
6.4	Release direct brake & BC Release time to fall BC pressure up to 0.4 kg/cm2		10 -15 Sec.	14 Sec
7.0	**Modified System Software (only for CCB)**	RDSO letter no. EL/3.2.19/3-phase (CCB), dtd 30.01.2023		
7.1	Bail-off de-activated during emergency by any means			Now De-activated
7.2	DPWCS and Non-DPWCS mode enabled		Multi Loco	Presently not happening in PLW
7.3	TCAS and Non-TCAS mode enabled		Not Yet Launched	
7.4	Penalty brake application deactivated for Fault code 113 (FC 113) and CCB health signal will not drop to avoid loco detention/failure. The Brake Electronics Failure "message will not generate on DDS.		Pressure Setting Needed is12 kg/sqcm Causing mismatching with standard Pr Setting	
7.5	CCB health signal logic revised (Now will remain high) for penalty condition occurring with FC 108 due to wrong operation/not affecting operation/ Not a CCB Fault (i.e Both controllers selected as LEAD etc) The Brake electronic failure message will not generate on DDS			Brake electronic failure message not generate on DDS
7.6	CCB health signal logic for FC 102 (In case of BC request from VCU is more than 90 %-above 9V DC) is changed i.e CCB health signal will not drop for FC 102 which will avoid loco detention/failure. The brake electronic failure message will not generate on DDS.		Could not performed by M/s Knorr	Presently not happening in PLW
7.7	Booting time for CCB with TCAS/TPM/PTWS/DPWCS mode 15-20 sec. However, in case of absence of either one or both system booting time subsequently increased to 40-50 sec.			50 sec
8.0	**Sanding Equipment**			
8.1	Check Isolating Cock-134F is in open position. Press sander paddle Switch. (To confirm EP valves Operates)		Sand on Rail	Ok
9.0	Test Vigilance equipment : As per D&M test specification			Ok

Signature of SSE/Shop

41870						
ROOF COMPONENT CAB 1 & 2						Warranty
S.No.	Description	PL NO.	QPL /Nos.	Supplier	Sr. no.	
1	Pantograph	29880014(HR), 29880026	2	FAIVELEY, GENERAL STORES	D24-3064,APR-2024,12990-06-23	
2	Servo motor	29880026	2	GENERAL STORES	12992-06/2023	
3	Air Intake filter Assly	29480103	2	**PARKER**	O/C 1445P/A/02, O/C/1445P/A/01 (PLW)-03-24	
4	Insulator Panto Mtg.	29810127	8	IEC	09/23,09/23	
MIDDLE ROOF COMPONENT						
5	High Voltage Bushing	29731021	1	EIPL	5328-02-2023	
6	Voltage Transformer	2965028	1	SADTEM	2023-N-663146	
7	Vacuum Circuit Breaker	25712202	1	SCHNEIDER	2265/2066-09N2-20-03-2024	
8	Insulator Roof line	29810139	9	IEC	05-23, 06-23	
9	Harmonic Filter	29650033	1	RESITECH	02/24/232496/03	AS Per PO/IRS Conditions
10	Earth Switch	29700073	E	ARIHANT	ES/1/0005-03-2024	
11	Surge Arrester	29750052	2	CG POWER & INDUSTRIAL	54826-2023,54828-2023	
	Air Brake Components					
12	Air Compressor (A,B)	29511008	2	ELGI	EXKS 922075 -A, EXKS 922060 -B	
13	Air Dryer	29162051	1	TRIDENT	LD2-02-9737-24	
14	Babby compressor	25513000	1	CEC	140-04-24	
15	Air Brake Panel	29180016	1	KNORR	23-10-CO-3131	
16	Contoller (A,B)	29180016	2	KNORR	24-01-FO-3284 A, 24-01-FO-3284 B	
17	Breakup Valve	29180016	2	KNORR		
18	wiper motor	29162026	4	ELGI		

SSE/ABS

PLW/PTA

ELECTRIC LOCO HISTORY SHEET (ECS)

ELECTRIC LOCO NO: 41870 **RLY: WR** **SHED: VTAD** **PROPULSION SYSTEM: CGL**

LIST OF ITEMS FITTED BY ECS

SN	DESCRIPTION OF ITEM	ITEM PL NO.	ITEM SR. NO CAB-1/CAB-2		MAKE/SUPPLIER
1	LED Based Flasher Light Cab I & II	29612937	22790	22646	ALTOS
2	Led Marker Light Cab I & II	29612925	2607/2692/2505/2595		KEPCO
3	Cab Heater Cab I & II	29170011	819	815	ELECOS
4	Crew Fan Cab I & II	29470080	5392/5378/5933/5459		SARIA
5	Master Controller Cab I	29860015	6443		WOAMA
6	Master Controller Cab II		6448		
7	Complete Panel A Cab I & II	29178265	460A	460B	HIND
8	Complete Panel C Cab I & II	29170539			
9	Complete Panel D Cab I & II	29178265	463A	463B	
10	Complete Cubicle- F Panel Cab I & II	29178162	CGKF/24042323	CGKF/24042330	CG
11	Speed Ind.& Rec. System	29200040	MTELS2404022/MTELS2404022		AAL
12	Battery (Ni- Cd)	29680025	B43		HBL
13	Set of Harnessed Cable Complete	29600420			KAYSONS
14	Transformer Oil Pressure Sensor (Cab-1) (Pressure Sensor Oil Circuit Transformer)	29500047	24/1519 & 02/24	24/1502 & 02/24	TROLEX
15	Transformer Oil Pressure Sensor (Cab-2)		24/1579 & 02/24	24/1424 & 02/24	
16	Transformer Oil Temperature Sensor (Cab-1) (Temperature Sensor Oil Circuit Transformer)	29500035	BG/TFP/4492-FEB-23		BG INDUSTRIES
17	Transformer Oil Temperature Sensor (Cab-2)		BG/TFP/4480-FEB-23		
18	Roof mounted Air Conditioner I	29811028	24B/RMPU/DC/02/979		DAULAT RAM
19	Roof mounted Air Conditioner II		24B/RMPU/DC/02/977		

SSE/ECS

JE/ECS

P.L.W. प.ल.क.

PATIALA LOCOMOTIVE WORKS, PATIALA						
LOCO NO-41870/WAG-9HC/WR/VTAD						
S.No.	Equipment	PL No.	Equipment Serial No.		Make	
1	Complete Shell Assembly with piping	29171027	Sr. 379, 04/2024		BHILAI	
2	Side Buffer Assly Both Side Cab I	29130050	1587, 10/23	019,01/24	KM	KM
3	Side Buffer Assly Both Side Cab II		160, 01/24	057,01/24	KM	KM
4	CBC Cab I & II	29130037	B57, 02/24	B44, 02/24	RIL	RIL
5	Hand Brake		11/23-16421		Modified Mechwel	
6	Set of Secondry Helical Spring	29045034 29041041			ABOKE	
7	Battery Boxes (both side)	29680013	179, 03/2024	16, 03/24	BRITE METALLOY	D R STEEL
8	Traction Bar Bogie I		648, 05/23		NIKE	
9	Traction Bar Bogie II		682, 05/23		NIKE	
10	Centre Pivot Housing in Shell Bogie I side	29100057	2706, 12/23		CU	
11	Centre Pivot Housing in Shell Bogie II side		2693, 12/23		CU	
12	Elastic Ring in Front in Shell Bogie I side	29100010	Sr. 56, Batch 02, Mfg 12/23		SSPL	
13	Elastic Ring in Front in Shell Bogie II side		Sr. 23, Batch 02, Mfg 12/23		SSPL	
14	Main Transformer	29731008 for WAG 9 29731057 for WAP-7	HVE-65-04-24-3264, 2024		HVE	
15	Oil Cooling Radiator I	29470031	02/24, FG415002/M1/23-24/519		APOLLO INDUSTRIAL CORPS	
16	Oil Cooling Radiator II		02/24, FG415002/M1/23-24/515		APOLLO INDUSTRIAL CORPS	
17	Main Compressor I with Motor	29511008	EXKS 922060, 02/24		ELGi	
18	Main Compressor II with Motor		EXKS 922075, 02/24		ELGi	
19	Transformer Oil Cooling Pump I		4905, 09/23		SAMAL HARAND	
20	Transformer Oil Cooling Pump II		4940, 09/23		SAMAL HARAND	
21	Oil Cooling Blower OCB I	29470043	03/24, AC-58180, LHP1001472135		ACCEL	
22	Oil Cooling Blower OCB II		03/24, AC-58186, LHP1001472145		ACCEL	
23	TM Blower I	29440075	03/24, 23P2601AF24, 23P2601/24		SAINI ELECTRICAL PVT LTD	
24	TM Blower II		03/24, 23P2601AF12, 23P2601/12		SAINI ELECTRICAL PVT LTD	
25	Machine Room Blower I	29440105	MF-24.02.76 , 02/24		G.T.R CO(P) LTD	
26	Machine Room Blower II		MF-24.02.53 , 02/24		G.T.R CO(P) LTD	
27	Machine Room Scavenging Blower I	29440129	D25-6327, CF25/D6689 , 02/24		SAMAL HARAND PVT LTD\	
28	Machine Room Scavenging Blower II		D25-6302, CF25/D6664 , 02/24		SAMAL HARAND PVT LTD\	
29	TM Scavenging Blower Motor I	29440117	ST-23.12.24, 12/23		G.T.R CO(P) LTD	
30	TM Scavenging Blower Motor II		ST-24.02.99, 02/24		G.T.R CO(P) LTD	
31	Traction Convertor I	29741075	04/24, CGP12441618-P728		C.G.L	
32	Traction Convertor II		04/24, CGP12441617-P728			
33	Vehicle Control Unit I		04/24, T2404553-P728			
34	Vehicle Control Unit II		04/24, T2404554-P728			
35	Aux. Converter Box I (BUR 1)		CGA10012441141-P728, 03/24			
36	Aux. Converter Box 2 (BUR 2 + 3)		CGA10022441141-P728, 03/24			
37	Axillary Control Cubical HB-1	29171180	06/23, SLHB10022306195		STESALIT LTD	
38	Axillary Control Cubical HB-2	29171192	HB2/2024/C/0087/613, 05/23		HIND RECTIFIERS LTD	
39	Complete Control Cubicle SB-1	29171209	SB1/2024/C/0656/977, 02/23		HIND RECTIFIERS LTD	
40	Complete Control Cubicle SB-2	29171210	~~FB/2024/B/0590/526, 01/23~~ SB2/2024/C/0653/1641		HIND RECTIFIERS LTD	
41	Filter Cubical (FB) (COMPLETE FILTER CUBICLES)	29480140	FB/2024/B/0590/526, 01/23		~~STESALIT LTD~~ RECTIFIER	
42	Driver Seats	29171131	07/23- 109, 110, 147, 173		Tarudeep	
43	Transformer oil steel pipes	29230044	.....		RANSAL PIPES	
44	Conservator Tank Breather	29731057	23-14452, 23-14451		YOGYA ENETRPRISES LTD	
45	Ballast Assembly (only for WAG-9)	29170163	33,32		AKM	
46	Head Light		502/469		M/S ENSAVE	
47	Ducting Assembly	29470067	.....		GOSPHEL	
48	Filter Frame Assly.	29480103	.....		PARKER	

NAME..SATISH KUMAR
SSE/LAS

NAME..SHUBHAM SHARMA
JE/LAS/UF

NAME..ANKIT UPPAL
JE/LAS

पटियाला रेलइंजन कारखाना, पटियाला

PATIALA LOCOMOTIVE WORKS, PATIALA

ELECTRIC LOCO CHECK SHEET

LOCO NO: 41870 Rly: WR Shed: VTAD

S. No.	ITEM TO BE CHECKED	Specified Value	Observed Value
1.1	Check proper Fitment of Hotel Load Converter & its output contactor.	OK	— NA —
1.2	Check proper Fitment of MR Blower 1 & 2, MR Scavenging Blower 1 & 2, TM Blower 1 & 2, TMB Scavenging Blower 1 & 2. TM scavenging blower 1 & 2 & Oil Cooling unit.	OK	O/K
1.3	Check proper of Fitment of oil cooling unit (OCU).	OK	O/K
1.4	Check proper Fitment of HB 1 & 2 and its respected lower part on its position.	OK	O/K
1.5	Check proper Fitment of FB panel on its position.	OK	O/K
1.6	Check proper Fitment of assembled SB1 & SB2 panel.	OK	O/K
1.7	Check proper Fitment of Auxiliary converter 1, 2 & 3-(BUR-1, 2 & 3).	OK	OK
1.8	Check proper Fitment of Traction converter 1 & 2 (SR-1 & 2).	OK	OK
1.9	Check proper fitment, torquing & Locking of Main Transformer bolt.	OK	O/K
1.10	Check proper fitment of Main compressor both side with the compressor safety wire rope.	OK	O/K
1.11	Check proper resting of Secondary Helical Springs between Bogie & Shell body.	OK	OK
1.12	Check proper fitment of Bogie Body Safety Chains.	OK	O/K
1.13	Check proper fitment of Cow catcher.	OK	OK
1.14	Check coolant level in SR 1 & 2 Expansion Tank.	OK	O/K
1.15	Check Transformer Oil Level in both conservators Tank (Breather Tank).	OK	O/K
1.16	Check proper fitment and maintain required gaps from Loco Shell Body of all metallic pipes to avoid any damage during online working of Locomotives.	OK	O/K
1.17	Check proper fitment of both battery box.	OK	O/K
1.18	Check for any gap between Main Transformer mounting base & Loco Shell.	OK	O/K
1.19	Check proper fitment of Push Pull rod its bolt torquing and fitment of fixing cable. As per Drg No 1209-01-113-001	OK	O/K
1.20	Secondary Vertical and Lateral Clearance on leveled track at the time of Loco Dispatch. *ELRS/TC/ 0082 (Rev 1) dated 17.09.2015*	Vertical-Std :35-60 mm Lateral Std-45-50 mm	CAB-1 LP: 55 / 42; CAB-1 ALP: 52 / 51; CAB-2 LP: 54 / 54; CAB-2 ALP: 54 / 45
1.21	Buffer height: Range **(1090, +15,-5)** **Drg No IB031-02002.**	1085-1105 mm	FRONT L/S: 1098, R/S: 1103; REAR L/S: 1098, R/S: 1099
1.22	Buffer Length: Range (641 mm + 3 to 10 mm with buffer face) **Drg No-SK.DL-3430.**	641 mm	FRONT L/S: 645, R/S: 644; REAR L/S: 645, R/S: 644
1.23	Height of Rail Guard. (114 mm + 5 mm,-12 mm). ***As per RDSO Pamphlet Important Bogie Clearances of Electric Locomotives.***	114 mm + 5 mm,-12 mm	FRONT L/S: 119, R/S: 115; REAR L/S: 115, R/S: 113
1.24	CBC Height: Range (**1090, +15,-5**) **Drg No- IB031-02002.**	1090, +15 -5 mm	FRONT: 1103 REAR: 1097

(Signature of SSE/Elect. Loco (~~UF~~))
NAME SATISH KUMAR
DATE 21/05/24

(Signature of SSE/JE/Elect Loco)
NAME SHUBHAM SHARMA
DATE 21/05/24

(Signature of JE/UF)
NAME ANKIT UPPAL
DATE 21/05/24

Loco No. 41870

1. BOGIE FRAME:

BOGIE	FRAME NO	Make	PL No.	PO No. & dt.	Warranty Period
FRONT	SL-22	CRG	29100689	101846	As per PO/IRS conditions
REAR	SL-0062	ECBT	29100677	100366	

2. Hydraulic Dampers (PL No. 29040140) Make: KNOOR, ESCORT

3. AXLES:

AXLE POSITION NO	1	2	3	4	5	6
MAKE/ S.NO	PLW 26181	PLW 26417	PLW 26438	PLW 26338	PLW 25757	PLW 26436
Ultrasonic Testing	OK	OK	OK	OK	OK	OK

4. WHEEL DISCS NO. AND TYPE & BULL GEAR

AXLE POSITION NO	1	2	3	4	5	6
GEAR END	56125	56222	56186	56805	56809	55359
Make	D.P.	D.P.	D.P.	D.P.	D.P.	D.P.
FREE END	56452	56800	56068	56048	56178	01124
Make	D.P.	D.P.	D.P.	D.P.	D.P.	D.P.
Bull Gear No.	23-A-03	24-B-02	23-B-26	23-D-19	23-F-15	23-B-13
Bull Gear Make	LMS	LMS	LMS	LMS	LMS	LMS

5. AXLE ROLLER BEARING (CRU) **(PL No. 29010020, Warranty: As per PO/IRS conditions)**

AXLE POSITION NO		1	2	3	4	5	6
Gear End	MAKE	FAG	FAG	FAG	FAG	FAG	FAG
	PO NO. & dt	2312	2312	2312	2312	2312	2312
Free End	MAKE	FAG	FAG	FAG	FAG	FAG	FAG
	PO NO. & dt	2312	2312	2312	2312	2312	2312

6. WHEEL DISC PRESSING PRESSURE IN KN: (SPECIFIED 80-105 T)

AXLE POSITION NO	1	2	3	4	5	6
BULL GEAR END	1006	885	879	1008	971	871
FREE END	1021	912	1021	970	799	867

Loco No. 41870

7. DIAMETER AFTER PROFILE TURNING: SPECIFIED 1092 + 5 mm – 0 mm

AXLE POSITION NO	1	2	3	4	5	6
DIA IN mm GE	1092.5	1092.5	1092.5	1092.5	1092.5	1092.5
DIA IN mm FE						
WHEEL PROFILE GAUGE (1596±0.5mm)	OK	OK	OK	OK	OK	OK

8. SUSPENSION TUBE & ITS TAPER ROLLER BEARING:

AXLE POSITION NO		1	2	3	4	5	6
S.T. PL 29100288	MAKE	IN	KPE	KPE	KPE	KPE	KPE
GE Brg. PL 29030110	MAKE	FAG	FAG	FAG	FAG	FAG	FAG
FE Brg. PL 29030110	MAKE	FAG	FAG	FAG	FAG	FAG	FAG

9. GEAR CASE (PL No. 29030018) & BACKLASH:

AXLE POSITION NO	1	2	3	4	5	6
MAKE	EEE	EEE	EEE	EEE	EEE	EEE
BACKLASH (0.254 – 0.458mm)	0.380	0.350	0.320	0.450	0.310	0.290

10 A/BOX TO BOGIE FRAME LATERAL CLEARANCES (SPECIFIED 15.0 to 19.0mm):

AXLE POSITION NO	1	2	3	4	5	6
RIGHT SIDE	17.60	17.83	17.26	15.26	15.53	15.26
LEFT SIDE	15.62	15.52	15.94	16.21	17.60	17.31

11. TRACTION MOTOR : (PL No. 29940606, Warranty: As per PO/IRS conditions)

AXLE POSITION NO	MAKE	PO No. & date	S. NO.
1	PLW	-	PLW-2645
2	BHEL	102297	201240896
3	BHEL	102297	201240908
4	PLW	-	PLW-2614
5	PLW	-	PLW-2661
6	PLW	-	PLW-2654

SSE/ Bogie Shop

TOP 12 COSTLIEST ITEMS OF WAG9HC LOCO WITH WARRANTY CONDITIONS AS PER TENDERS

S No	PL No	DESCRIPTION	Warranty Period
1	29741075	IGBT BASED 3-PHASE DRIVE PROPULSION EQUIPMENT	60 months after commissioning or 72 months from date of supply whichever earlier as per special conditions given by CLW
2	29731057	MAIN TRANSFORMER 7775 KVA TYPE LOT 7500 FOR WAP7 3- PHASE ELECTRIC LOCOMOTIVE TO CLW SPECN NO.CLW/ES/3/0660/C	AS PER IRS CONDITIONS OF CONTRACT [i.e. 30 MONTHS FROM THE DATE OF SUPPLY OR 24 MONTHS FROM THE DATE OF COMMISSIONING, WHICHEVER IS EARLIER] WILL BE APPLICABLE.
3	29171064	COMPLETE SHELL ASSLY (PIPED & PAINTED) FOR WAP-7 LOCO TO CLW SPEC. NO. CLW/MS/3/152 ALT-8	AS PER IRS CONDITIONS-30 MONTHS FROM THE DATE OF SUPPLY OR 24 MONTHS FROM THE DATE OF COMMISSIONING, WHICHEVER IS EARLIER.
4	29600418	SET OF HARNESSED CABLE FOR 3-PHASE ELECTRIC LOCOMOTIVES TO CLW SPECN. NO. CLW/ES/03/646 ALT-NIL WITH DMW REQUIREMENT OF HARNESSED CABLE FOR WAP-7, ALT-A1 DATED 27/11/2018.	As per clause no.9 of CLW Specn. CLW/ES/3/0458 & Clause No.10 of CLW Specn.-CLW/ES/3/0459. [18 months after commissioning or 20 months from date of supply for single core & 18 months after commissioning or 24 months from date of supply for multi core]

5	29180016	BRAKE CONTROL SYSTEM INCLUDING DRIVER'S VIGILANCE CONTROL DEVICE TO SET LIST NO.EL29180016.	As per specification no. CLW/MS/3/001 Alt. 16 i.e. the manufacturer is required to guarantee that the brakevalves/equipment work satisfactorily for a period of five (5) years after commissioning. Any equipment/part which failsduring the guarantee period shall be replaced free of cost by the manufacturer. The replaced components shallfurther be under warranty for five (5) years from the date of their fitment and should the replaced components proveunsatisfactory in service, they shall be replaced by modified and improved components by the supplier free of cost.
6	29480140	COMPLETE FILTER CUBICLE ALONG WITH ALL EQUIPMENTS AND CABLING TO DRG./SPEC NO. [1] CLW/ES/3/0193 ALT-F OR LATEST AND CLW DRG. NO. 1209-15-143-004 ALT-10 AND PART DRG./SPEC NO AS PER ANNEXURE-A ATTACHED.	AS PER IRS CONDITIONS OF CONTRACT [i.e. 30 MONTHS FROM THE DATE OF SUPPLY OR 24 MONTHS FROM THE DATE OF COMMISSIONING, WHICHEVER IS EARLIER] WILL BE APPLICABLE.
7	29942007	3-PHASE ASYNCHRONOUS TRACTION MOTOR (RESISTANCE RING MECHANICALLY INTERLOCKED TO END PLATE DESIGN ROTOR, SCHEME-II), TYPE 6FRA-6068 FOR WAP-7 ELECTRIC LOCO WITHOUT ACTIVE SPEED SENSOR TO SPECIFICATION NO. 4TMS.096.081 ALT-2 AND STR NO. CLW/2008/3PHTM/STR/0001.	AS PER IRS CONDITIONS OF CONTRACT [i.e. 30 MONTHS FROM THE DATE OF SUPPLY OR 24 MONTHS FROM THE DATE OF COMMISSIONING, WHICHEVER IS EARLIER] WILL BE APPLICABLE.

8	29105146	Bogie Frame Complete for WAP-7 for 3 Phase Co Co Locomotive to CLW specification No. CLW/MS/3/Bogie/003 alt-1 and CLW Drg.No.1209.01.112-202 Alt-Nil	As per clause 16 of Spec.No.CLW/MS/3/Bogie/003 Alt-1. [60 months after commissioning or 72 months from date of supply]
9	29171192	COMPLETE AUXILIARY CUBICLE HB2 ALONG WITH ALL EQUIPMENTS AND CABLING TO CLW SPEC.NO.CLW/ES/3/0192 ALT-E OR LATEST FOR WAP7 LOCO WITH HOTEL LOAD WITH BARE CUBICLE AS PER CLW SPEC.NO.CLW/MS/3/155 ALT-NIL.	AS PER IRS CONDITIONS OF CONTRACT [i.e. 30 MONTHS FROM THE DATE OF SUPPLY OR 24 MONTHS FROM THE DATE OF COMMISSIONING, WHICHEVER IS EARLIER] WILL BE APPLICABLE.
10	29171210	COMPLETE CONTROL CUBICLE SB2 ALONG WITH ALL EQUIPMENTS AND CABLING (EXCLUDING CONTROL ELECTRONICS) TO CLW SPECN. NO. CLW/ES/3/0195/A ALT-H OR LATEST FOR WAP7 LOCO WITH HOTEL LOAD	AS PER IRS CONDITIONS OF CONTRACT [i.e. 30 MONTHS FROM THE DATE OF SUPPLY OR 24 MONTHS FROM THE DATE OF COMMISSIONING, WHICHEVER IS EARLIER] WILL BE APPLICABLE.
11	29171209	COMPLETE CONTROL CUBICLE SB1 (PUSH PULL SCHEME COMPLIANT) ALONG WITH ALL EQUIPMENTS AND CABLING (EXCLUDING CONTROL ELECTRONICS) TO CLW SPECN. NO. CLW/ES/3/0194 ALT-G OR LATEST FOR WAP7 LOCO WITH HOTEL LOAD	AS PER IRS CONDITIONS OF CONTRACT [i.e. 30 MONTHS FROM THE DATE OF SUPPLY OR 24 MONTHS FROM THE DATE OF COMMISSIONING, WHICHEVER IS EARLIER] WILL BE APPLICABLE.
12	29171180	COMPLETE AUXILIARY CUBICLE HB1 ALONG WITH ALL EQUIPMENTS AND CABLING TO CLW SPEC.NO.CLW/ES/3/0191 ALT-D OR LATEST FOR WAP7 LOCO WITH HOTEL LOAD WITH BARE CUBICLE AS PER CLW SPEC.NO.CLW/MS/3/155 ALT-NIL.	AS PER IRS CONDITIONS OF CONTRACT [i.e. 30 MONTHS FROM THE DATE OF SUPPLY OR 24 MONTHS FROM THE DATE OF COMMISSIONING, WHICHEVER IS EARLIER] WILL BE APPLICABLE.

भारत सरकार
GOVERNMENT OF INDIA
रेल मंत्रालय
MINISTRY OF RAILWAYS
पटियाला रेलइंजन कारखाना
PATIALA LOCOMOTIVE WORKS

Email: dyceeloco.dmw@gmail.com
फैक्स/Fax No.: 0175-2397244
फोन/ Phone: 0175- 2396422
मोबाईल: 9779242310
पटियाला, 147003, भारत्
PATIALA, 147003, INDIA

आज़ादी का अमृत महोत्सव

(An ISO 9001, ISO 14001, ISO 45001 & ISO 50001, 5S & Green Building certified Organization)

संख्या. PLW/M/ECS/Tech/Kavach **तिथि: 02.07.2024**

(Through Mail)

Sr. Div. Mechanical Engineer,
Electric Loco Shed, Vatva.

Email: srdmedvta@gmail.com

विषय:- Fitment of KAVACH in three Phase Electric Loco. No. 41870 WAG9-HC.

संदर्भ:- (i)Director General Stds./Electrical/RDSO letter no. EL/0.1.3/3 dated 21.08.2023.
(ii)Director General Stds./Electrical/RDSO letter no. EL/0.1.3/3 dated 26.09.2023

In ref. to the above letter's Loco No. 41870 has been dispatched with fittings for implementation of KAVACH system in locomotive at home shed in Zonal Railway. This Loco was dispatched to DLS/VTA/WR on 21.05.2024. The details of fittings are attached as Annexure-A (pneumatic fittings), Annexure-B (Kavach equipment mounting Brackets) & Annexure-C (Wago with harnessed lay out).

This is for your information & necessary action please.

2.7.24
(निशांत बंसीवाल)
उप मुख्य विद्युत अभियंता/लोको

प्रतिलिपि:-

CEE/Loco & CEE/D&Q, CMM, CELE/WR:- for kind information please
Dy CME/Design, Dy. CMM/Depot: for information & necessary action please
WM/LAS, AWM/LFS&ABS, AWM/ECS: for necessary action please

Annexure- A

Loco No. 41870

List of balance items of KAVACH pneumatic pipes & fitting yet to be supplied later on. These items are currently under procurement process at PLW. The same will be advised to the shed for collection of the material as soon as it will be received at PLW.

SN	PL No.	Description of item	Qty.
1	29163341	ISOLATING COCK 3/8" (FEMALE) LEGRIS TYPE WITH VENT	04 nos.
		ISOLATING COCK 3/8" (FEMALE) LEGRIS TYPE WITHOUT VENT	02 nos.
2	29611994	TEE UNION 3/8"X3/8"X3/8" BRASS FITTINGS	02 nos.
		MALE CONNECTORS 3/8" TUBE OD X 3/8" BSPT, BRASS FITTINGS	09 nos.
		MALE CONNECTORS 1/2" TUBE OD X 1/2" BSPT, BRASS FITTINGS	06 nos.
		FEMALE CONNECTORS (NYLON TUBE) DIA 6 TUBE X 3/8" BSPP BRASS FITTINGS	01 no.
		MALE CONNECTOR (NYLON TUBE) DIA 6 TUBE X 3/8" BSPP BRASS FITTINGS	03 nos.
		FEMALE TEE 3/8" BSPP – BRASS	06 nos.
		HEX PLUG -3/8" BSPT – BRASS	02 nos.
		FEMALE TEE 1/2" BSPP – BRASS	04 nos.
		HEX NIPPLE 3/8X3/8" BSPT – BRASS	04 nos.
		RED HEX NIPPLE 3/8X1/2" BSPT - BRASS	02 nos.
		HEX PLUG – 1/2" BSPT – BRASS	04 nos.
		MALE ELBOW CONNECTORS 3/8" TUBE OD X 3/8) BSPT. BRASS FITTINGS	02 nos.
3	29170114	Copper Tube OD 9.52mm (3/8") X 1.245 Mm W.T X 6 Mtr	1.2 Mtr

AWM/ABS

SSE/G/ABS

Loco No. 41870

Annexure-B

SN	PL No.	Description of item	Quantity
1.	29611945	Mounting bracket arrangement provided for RF Antenna on the roof top of both driver cabs.	04 nos.
2.		Mounting bracket arrangement provided for GPS/GSM Antenna on the roof top of both driver cabs.	02 nos.
3.		Protection Guards for RFID reader provided behind the cattle guards of both side.	04 nos.
4.		Inspection door with latch provided on the both driver desk covers (LP side) in each cab to access isolation cock.	02 nos.
5.		Cable Entry Plate fitted for routing of cable with RF Antenna & GPS/GSM Antenna bracket.	06 nos.
6.	-	WAGO bracket fitted in Machine room at back side of SB-1.	01 no.
7.	-	One circular hole of 80 mm dia. provided in each cabs on LP side behind the driver desk toward the wall for routing of OCIP (DMI) cables.	02 nos.
8.	-	80 mm holes provided on TM1 and TM6 Junction box inspection cover hole for drawing of RFID reader cables.	02 nos.
9.	-	DIN Rail fitted inside the driver desk (LP Side)	02 nos.

AWM/LFS

SSE/G/LFS

Annexure-C

SN	PL No.	Description of item	Quantity
1.	42310301	Flexible conduit size 25mm^2 provided for RF-1, 2 & GPS Antenna cable layout from CAB-1&2 to Machine room.	06 nos.
2.	29611982	Wago terminals in CAB-1&2 (25 nos. in each CAB).	50 nos.
3.	29611982	Wago terminal in Machine room at back side of SB-1.	75 nos.
4.	-	Harness provided from KAVACH SB to SB-1	05 wires
5.	-	Harness provided from KAVACH SB to SB-2	05 wires
6.	-	Harness provided from KAVACH SB to Pneumatic Panel	12 wires
7.	-	Harness provided from KAVACH SB to CAB-1	24 wires
8.	-	Harness provided from KAVACH SB to CAB-2	16 wires

AWM/ECS

SSE/G/ECS

पी.एल.डब्ल्यू

P. L. W