

Claue no.	Description	M/s Lotus comments	M/s Medha comments	RDSO Comments
Part-0				
0	Introduction This document is part of set of documents specifying equipment for the deployment of Distributed Power Control System (DPCS). Kindly see the list of referenced documents for locating other documents of the set. DPCS allows multiple locomotives to be used at different locations over entire train consist. Such a system leverages the existing rolling stock and allows much longer trains to be run by minor up gradation of the locomotives. This document provides the overview and the functional requirements of a set of specifications that aim to deployment of DPCS.	noted and firm shall comply	Nil	No change in Para Required
1	Objectives and Scope of the specification MP.0.0400.02 Part-3 This document outlines the scope of requirements and the inter-relationships of sub- systems for setting up DPCS for different locomotive classes. Indian Railways requires interoperability as it is expected that without this feature these systems can pose a constraint in the railway operations. There is no global standard for interoperability of DPCS. The systems in operation on the various world railways are of proprietary design and do not interoperate. It shall be understood that interoperability features are currently experimental and shall be used only for trials under controlled conditions. To achieve interoperability among different makes of distributed power control systems so that all locomotives to work together as one integrated set of distributed power control system, following stages are to be implemented.	Noted	Nil	No change in Para Required
2	Terminology/ Abbreviations/ Definitions	Noted	Nil	No change in Para Required
2.1	Abbreviations		Nil	No change in Para Required
2.2	Definition	Noted	Nil	No change in Para Required
2.2.1	Master Locomotive consist		Nil	No change in Para Required
2.2.2	Remote Locomotive Consist	Noted	Nil	No change in Para Required
2.2.3	Lead Locomotive	Noted	Nil	No change in Para Required
2.2.4	Trail Locomotive	Noted	Nil	No change in Para Required
2.2.5	Synchronous Remote Control	Noted	Nil	No change in Para Required
3	Referred standards The following standards are referred by this specification. It is requested to kindly ensure operational understanding of all the referred standards. AAR S-5702 for environmental conditions IEEE 802.3 10baseT 100base Tx M12 D-Coding IEC 60297 for 19" equipment rack. IEC 60571 for design and manufacture guidelines. IEC 60812 for Failure Modes Effect and Criticality Analysis	RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO.	Nil	
4	Pre-requisites			
4.1	Manufacturer's qualifications This equipment is complex locomotive control equipment. The manufacturer shall meet the pre-requisites as specified. Kindly see pre-requisites specific to the locomotive type in the relevant part of the specification.	DPCS is basically an electronics product with critical wireless control system for Locomotives (Rolling stock) application, manufacturer's qualification should be in accordance to DPCS requirement and should not be linked with LCC/MBCS. Considering the above DPCS manufacturer qualification to be modified as "DPCS shall be supplied by Manufacturer who has successfully supplied the product based on electronics with wireless control system for Locomotives (Rolling stock) application or previously supplied the DPCS for ALCo/HHP Locomotives.	Nil	No change in Para Required

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4.2	<p>General equipment pre-requisites The equipment supplied against this specification shall meet the following general requirements.</p> <p>The equipment supplied shall be of good quality, rugged and reliable and capable to withstand environmental and use conditions. The individual components shall meet the lifecycle for that category of equipment.</p> <p>Wherever outsourced equipment is used care shall be taken to ensure that the equipment is sourced from reputed manufacturers. The supplier of equipment supplied under this specification shall ensure proper interfacing and connectivity between equipment / software.</p> <p>The equipment described shall be designed / manufactured in conformance to IEC 60571 excluding the clauses for environmental conditions and its verification, testing.</p> <p>The control voltage of 72 V DC supply source normally consisting of accumulator battery and/or an auxiliary generator is available. The nominal and limits of voltage in which the equipment shall operate satisfactorily are as under. Voltage fluctuations lying between 0.6 to 1.4 times of Nominal voltage and not exceeding 0.1 second shall not cause any deviation in functioning of DPCS (Clause 5.1.1.2 of IEC 60571).</p> <p>Voltage fluctuations lying between 1.25 to 1.4 times of Nominal voltage and not exceeding 1 second shall not cause damage to the unit. The unit may not be fully functional during these fluctuations (Clause 5.1.1.2 of IEC 60571).</p> <p>The equipment shall be in conformance to AAR S-5702 for environmental conditions.</p> <p>Failure Mode Effects and Criticality Analysis of the equipment shall be done during the design process in conforma</p>	<p>Noted. RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO. The para "The equipment shall be in conformance to AAR S-5702 for environmental conditions" may be removed and one single specification of IEC 60571 to followed for better clarity.</p>	Nil	No change in Para required.
5	<p>Brief requirements overview</p> <p>The complete DPC system shall consist of locomotive on-board equipment (including radio antenna) wireless communication, Stand Alone HMI/DIALS, along with an inbuilt system which shall communicate with the Pen drive / PC/ Laptop for configuration and data downloading.</p> <p>The complete deployment of DPCS requires the following sub components as listed below:</p>	noted and firm shall comply	Nil	No change in Para Required
5.1	Locomotive onboard equipment for DPCS			
5.2	Implementation of HMI with DIALS screen	noted and firm shall comply	Nil	No change in Para Required
5.3	Common wireless communication protocol for interoperability Feature of interoperability between different make of DPCS is also required, which will be detailed in separate part of specification. Till the development and standardization of interoperability, manufacturers can implement their own protocol and control strategy	noted and firm shall comply	Hardware and communication Interface control document between Radio and DPCS shall be defined by RDSO in case of interoperability operation is required.	No change in Para Required

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5.4	<p>RF Modem and antenna for ensuring seamless communication All systems shall use a rugged and proven radio modem being used for such or similar operation to keep loss of communications to minimum. DPCS supplier shall ensure compatibility for all their future supply as well. The radio module shall be fitted in the electrical control cabinet/control Panel of the locomotive. The antennae shall be fitted on the roof of the locomotive. The antennae shall be of such type that when fitted they shall not infringe the MMD of the Indian Railways. Note: A diesel electric locomotive is expected to be equipped with GPS, GPRS and RF antennae. The use of tri-band antennae is suggested. The radio module shall meet the following functional requirements</p> <p>a) The range of reliable communication shall be better than 3.0 km under normal operating environments of Indian Railways at 10W Radio Power. The reliable communication is expected in all possible terrains including cuttings, tunnels and densely occupied yards and station sections.</p> <p>b) The equipment provider shall ensure that the equipment shall be configured for correct radio frequency. The details of the allotted frequency shall be provided by the purchaser.</p> <p>c) The whole radio communication setup is expected to provide reliable data communication with a link budget of better than 15dB.</p> <p>d) The radio communication system shall be manageable through HMI/DIALS.</p> <p>e) The radio module shall have failover</p>	<p>noted and firm shall comply a) noted and firm shall comply b) noted and firm shall comply c) noted and firm shall comply d) What is expected by HMI Control to in relation to DPCS to be elaborated. e) Noted and we shall comply f) Noted and we shall comply g) Noted and we shall comply h) Nos of Operating licenses shall be as per WPC governing policies, a statutory body of Govt of India. "Only one Rx antenna will be provided if no space diversity is required by Railways.</p>	<p>a)- Communication cannot be guaranteed in steep cutting and in tunnels. e)- Medha sent Letter (MDP:RDSO:6759:15 dated 07/10/15) to RDSO on Redundancy scheme. Based on RDSO reply, further will be discussed. f & g)- Radio Frequency Operating Licenece will be taken by Indian Railways. And also purchaser shall have Distributor Possession Licence(DPL) from WPC.</p>	<p>In reference to Failover redundancy of Radio Modem, it is required as also stated in earlier specification. Hence no change in related sub para (e) is required. In reference to M/s Lotus Comments, HMI/DIALS should be interactive to manage the setting of parameter, diagnosis for radio communication through HMI. Regarding space diversity, the functional requirement at para (a) explains the reliable communication in terrains, densely occupied yards, stations, etc., this requires the radio modem having diversity scheme. For clarity additional sub para added as <u>(i) the radio modem should have space diversity scheme.</u> <u>Para (h) is amended as below in reference to M/s Lotus Comments."h) It is desired that the equipment so selected should require only one operating license per locomotive".</u></p>
6	Future Developments The following requirements are planned for future developments and are only provided here as a roadmap			
	Standardization of interoperability requirements with different make DPCS.	Noted, however RDSO needs to get the A. Open communication protocol for CCB 1.5 and 2.0 or any other brake system adapted by Indian Railway. B. The required up gradation of hardware software on any brake system should be available as a pre-fit on the locomotives for DPCS requirement	Nil	This is kept as future development and will be dealt separately during further update of revision.
	Implementation of Cab Display Unit (CDU) functionality for EOTT	Implementation of Cab Display Unit (CDU) functionality for EOTT is beyond the scope of DPCS.	Nil	
	Trackside devices for boosting RF signals in areas of low signal strength.	Noted	Nil	
7	Detailed equipment requirements		Nil	No change in Para Required

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7.1	Equipment functional requirements The Distributed Power Control System (DPCS) shall provide features on the locomotive that shall enable one locomotive pilot in the master loco consist to control up to four remote loco consists on the same train.(One master consist + upto 4 remote consists). Each locomotive consist can be either single or multiple locomotives that are directly coupled and controlled through MU coupler. This control shall be implemented through robust RF communication and the master and remote locomotives shall not be in direct electrical communication through train lines. However the train lines shall be monitored for safety features. DPCS shall also monitor the train brake pipe, for ensuring safety of operations. DPCS shall meet the following functional requirements. These features shall be implemented in fail safe manner such that inadvertent, undesirable operations do not occur.	Noted and shall comply	Nil	No change in Para Required
7.1.1	Communication and loco configuration functions		Nil	
7.1.1.1	Secure wireless communication The equipment provider shall ensure that the wireless communications are secure to prevent unauthorized access and control.	Noted and shall comply.	Nil	No change in Para Required
7.1.1.2	Selection of master or remote Each DPCS unit shall be capable of working as master or remote unit. The mode of operation shall be selectable from through the DPCS HMI/DIALS.	Noted and shall comply	Nil	No change in Para Required
7.1.1.3	Interface with locomotive controls The system shall interface and control the locomotive control system including the air brake system and transmit the information to the other DPC systems through wireless transmission for synchronized/Asynchronised (Manual Override) running of the train formation. The DPCS equipment is an add-on to the locomotive control architecture. The equipment manufacturer shall ensure that all interfaces with the existing equipment are done in a robust and reliable manner such that the original functionality of the equipment is not degraded.	The para to be modified as "RDSO/Railway will provide interfacing protocol and required hardware port for brake system on the locomotives and DPCS system shall interface and control the locomotive control system including the air brake system and transmit the information to the other DPC systems through wireless transmission for synchronized/Asynchronised (Manual Override) running of the train formation. The DPCS equipment is an add-on to the locomotive control architecture. The equipment manufacturer shall ensure that all interfaces with the existing equipment are done in a robust and reliable manner such that the original functionality of the equipment is not degraded.	Nil	DPCS manufacturer has to integrate with the associated system as per the governing specification to meet the functional requirement. Railways do not own the interface protocol of different electronic systems. To mitigate the issues of interfacing with LCC and DPCS in HHP loco, DPCS has been made under the scope of AC-AC Traction Control System.
7.1.1.4	Communication to drivers display DPC system shall communicate with the driver's display to provide the information regarding the status of the locomotives in the formation for controlling and operation of train formation. The DPCS HMI /DIALS shall be provided on all control consoles of the locomotive such that it shall be possible to operate the locomotive in DP mode from any driving control stand.	The para to be modified as DPC system shall communicate with the driver's display provide the information regarding the status of the locomotives in the formation for controlling and operation of train formation Through LCC for HHP Loco where dial is provided. DPCS HMI where dial is not provided. The DPCS HMI /DIALS shall be provided on all control consoles of the locomotive such that it shall be possible to operate the locomotive in DP mode from any driving control stand.	Nil	The points raised by M/s Lotus is already addressed at Clause 5.2 stating implementation of HMI for DPCS using DIALS. Separate HMI is considered where DIALS is not provided. Hence No change in Para required.

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7.1.1.5	Distance for control transmission DPCS is expected to operate reliably with separation of upto 3.0 km or beyond between any two communicating units in normal railway working environment. Radio signals between any two DPCS shall not be affected by the overhead traction of 25 kV AC or 1500V DC supply of any other electric locos operating in the near vicinity of the train being operated with remote-control system including any other radio based systems as TCAS/TPWS with any type of Locomotives. System shall not cause interference to colour light signaling equipment or any other signaling installation provided on Indian Railways. Any deviation from these requirements shall be clearly brought out.	Noted and shall comply	Nil	No change in Para Required
7.1.1.6	Effect of adjacent units on other trains DPCS shall provide failsafe arrangement in master and remote control units such that the systems on the same train are not affected by similar units in other trains available in near vicinity on same or adjacent tracks.	Noted and shall comply	Nil	No change in Para Required
7.1.1.7	Pairing before movement Failsafe and secure arrangement shall be provided to prevent starting of train from master unit unless the equipment in remote units has been paired and the confirmation is received in master unit. In case of multiple remote units, all remotes shall be paired with the master. Brake pipe pressure drop test shall also be conducted before movement to verify All paired units are in the same train consist Are in proper working order (no errors reported) Are correctly configured and paired. BP air flow shall be sensed and datum level fixed. The system shall inform the crew to confirm the detected leakage level. The HMI interaction and the step by step process for pairing shall be approved by RDSO prior to use on the locomotive.	Noted and shall comply	Nil	No change in Para Required
7.1.1.8	Setting of loco orientation The system shall have suitable menu / switch on the HMI that shall make it possible to select the locomotive orientation for both master and remote units. The orientation setting of remote and master together shall be used to determine the correct direction of movement of the remotes. This is essential to ensure that all locomotives move in the selected direction.	All the Locomotives orientation entry shall be done by loco pilot through HMI/Dial.	Nil	No change in Para Required
7.1.1.8.1	For Master Locomotive The system shall allow setting the following options for locomotive orientation: Loco with short hood leading (Cab-1 for dual cab locos) Loco with long hood leading (Cab2 for dual cab locos)	Noted and shall comply	Nil	No change in Para Required
7.1.1.8.2	For Remote Locomotive The system shall provide options to set locomotive orientation with respect to the master locomotive. Unambiguous terms shall be used for selection like Master loco towards short-hood (Cab 1 for dual cab locos) Master loco towards long-hood (Cab2 for dual cab locos)	Noted and shall comply	Nil	No change in Para Required
7.1.1.9	Synchronization of system RTC (Real time clock) The DPCS systems shall synchronize the system RTC at time of pairing. If paired for longer durations RTC's shall be synchronized at least once in 24 hours. The RTC of the master DPCS unit shall be taken as reference.	Noted & shall comply, GPS may be used for time synchronization.	Nil	No change in Para Required
7.1.1.10	Logging of commands The DPCS shall log all commands sent / received and implemented including communication failure with the time stamp using time from local RTC for every last 90 days. Command logging shall be done on all working units irrespective of whether the unit is the master or remote. The data can be downloaded through USB port using Pen drive directly and through Laptop/PC.	Noted & shall comply	Number of commands and date will be sent/receive for every second, it will require huge memory to maintain last 90 days log. It can be given for last 48 hrs.	90 days data logging is kept in view of Diagnosis purposes when the loco arrives at shed. With the Hence, No change in para required.
7.1.2	Control of locomotive functions The following paragraphs detail how important locomotive controls & indications shall be relayed and executed between the master and the remote locomotives in case of synchronous control/ Asynchronous control. The details provided here are not exhaustive and it is recommended that the developer of the equipment shall read the respective locomotive control system design operations and maintenance documents for a comprehensive understanding.	Nil	Nil	No change in Para Required
7.1.2.1	Command characterization for locomotive control The DPCS shall implement the following different methodology for command characterization and execution on the remote units.	Nil	Nil	No change in Para Required

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1.2.1.1	Synchronous control methodology Under this methodology all operations on the master control systems shall be mirrored on the remote controllers in a deterministic manner in real-time.	Noted and shall comply	Nil	No change in Para Required
1.2.1.2	Independent control /Asynchronous Control methodology This methodology shall permit operator to select individually the controls for each remote unit independently from the master unit. e.g. Driver can keep the lead in traction mode and remote in dynamic mode to reduce the coupler force on camel hump type track on requirement. This feature shall be provided with password security feature	Noted and shall comply	Nil	No change in Para Required
7.1.2.2	Direction of movement The direction of movement shall be decided by the master locomotive from the setting of the reverser handle on the operative control stand. The remote locomotives shall be provided with this data and the DPCS controller shall determine automatically determine the correct direction of movement based on the orientation setting of the locomotive (described under configuration settings)	Noted and shall comply	Nil	No change in Para Required
7.1.2.3	Throttle control	Noted and shall comply	Nil	No change in Para Required
7.1.2.4	Dynamic brake control	Noted and shall comply	Nil	No change in Para Required
7.1.2.5	Automatic brakes	Noted and shall comply	Nil	No change in Para Required
7.1.2.6	Locomotive independent brakes	Noted and shall comply	Nil	No change in Para Required
7.1.2.7	Automatic Emergency Brake System	Noted and shall comply	Nil	No change in Para Required
7.1.2.8	Wheel slip: It shall be possible to provide automatic sanding in case of wheel slip on remote unit without any action by the driver on the master unit. When automatic sanding is taking place on the remote unit, indication shall come on the master unit.	Sanding operation on wheel slip is the function of locomotives, DPCS shall not have any contribution on this however the indication of same shall be provided on master unit.	Nil	No change in Para Required
7.1.2.9	Sanding: In case, sanding switch is operated from the master unit, it shall be possible to operate sanding gear on the remote unit automatically with its indication being displayed on master unit. Locomotive shall sand only in the direction of travel, even during emergency sanding. There shall not be any sanding whenever the locomotive is in standstill position. Furthermore, if the locomotive is moving and the reverser handle is centered, all four sanding valves shall sand.	The direction of sanding is the function of locomotives, DPCS shall only give commands to initiate Sanding and the same will be controlled by loco pilot.	Nil	No change in Para Required
1.2.10	Override control It shall be possible to over-ride the controls of remote unit when so desired by the master unit driver or in case of discontinuity or loss of communication between master and remote units or when the master unit driver feels that he can operate the train with master unit only	Isolation switch is provided to de-activate all the DP system at Remote	Nil	No change in Para Required
1.2.11	MU Operation	Noted and shall comply	Nil	No change in Para Required
1.2.12	Tractive effort limiting	Noted and shall comply	Nil	No change in Para Required
1.2.13	Automatic Switching on of Flasher Light	This is a Locomotives functionality	Nil	DPCS should initiate the command. No change in Para Required
1.2.14	Operation of vigilance control device (VCD)	Noted and shall comply	Nil	No change in Para Required
1.2.15	Operation of Anti-Collision Device (ACD)/TCAS/TPWS The DPCS shall check and ensure that the ACD (where provided) be operational on the master locomotive and disabled on all other locomotives on the train.	Operation status of any train safety system should not be linked with DPCS system, same should be activated or de-activated by loco pilot as it is safety equipment.	Presently there is no interface between ACD/TPWS/TCAS and DPCS. If communication is established, this point can be complied.	This is not linked with DPCS to interfere the functioning of ACD/TCAS/TPWS. It is to obtain the status from the safety System of lead and remote loco and display on master loco through DPCS. However, it is amended as below. <u>"The DPCS shall check and ensure that the ACD (where provided) be operational on the master locomotive and disabled on all other locomotives on the train provided that the Digital input from ACD on enable/disable to DPCS is available"</u> .
1.2.16	Alerts & Alarms	Noted and shall comply	Nil	No change in Para Required
7.1.3	Operational Safety Features			
7.1.3.1	Loss of Communication	Noted and shall comply	Nil	No change in Para Required

Claus e no.	Description	M/s Lotus comments	M/s Medha comments	RDSO Comments
7.1.3.2	Unintended loss of BP pressure or BP air flow	Noted and shall comply	Nil	No change in Para Required
7.1.3.3	Break-in-two protection	Noted and shall comply	Nil	No change in Para Required
7.1.3.4	Fire in remote unit In case of any fire taking place in the remote unit, indication to the master unit driver shall be provided with an alarm.	The locomotives should be pre-fit with fire detection system and status of the same to provide be provided as a 72 V digital input to the DPCS on the occurrence of the event the same shall be intimated to the master unit by DPCS.	Nil	Para is modified as below" <u>In case of any fire taking place in the remote unit, indication to the master unit driver shall be provided with an alarm. DPCS shall interface with Fire sensor through Digital input from Fire sensor (Where provided)</u> ".
7.1.3.5	Fail Safe Feature	Noted and shall comply	Nil	No change in Para Required
7.1.3.6	Self-test	Noted and shall comply	Nil	No change in Para Required
8	Environmental/Climatic requirements			
8.1	Minimum temperatures The minimum temperatures listed in the AAR standard S-5702 is -40°C. Such temperatures are not encountered on the Indian Railway system. Hence the lower temperatures listed in the standard shall be interpreted as -20°C in lieu of -40°C as stipulated in the standard.	RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO.	Nil	No change in Para required.
8.2	Reference environmental conditions	Noted and shall comply	Nil	No change in Para Required
9	Safety requirements	Noted and shall comply	Nil	No change in Para Required
10	Life cycle management	Noted and shall comply	Nil	No change in Para Required
10.1	Expected life	Noted and shall comply	Nil	No change in Para Required
10.2	Support during lifetime The equipment manufacturer shall ensure that the following support is available on demand during the equipment lifetime: 10.2.1 Service / spares support for the equipment 10.2.2 Options for comprehensive maintenance contracts 10.2.3 Modifications in equipment design to meet new requirements or to improve reliability 10.2.4 Support on implementing common RF Protocol through hardware/software when standardized by RDSO for achieving interoperability. The options for demanding these support services shall be reserved by the Indian Railways and the equipment manufacturer shall provide the same on demand. The equipment manufacturer shall submit an undertaking to support the equipment during its declared lifetime. This undertaking shall be provided during type testing and design approval and also while entering into purchase contracts.	10.2.1 & 10.2.2 Noted and we shall comply,10.2.3 Para to be modified as "Modifications in equipment design to meet new requirements or to improve reliability",Modification/ Change in hardware and software to meet the new requirement shall be on chargeable basis.10.2.4 Para to be modified as " Support on implementing common RF Protocol" through hardware/software when standardized by RDSO for achieving interoperability.In implementation of common RF protocol if Modification/ Change in hardware and software required it shall be on chargeable basis.	Nil	It is basic requirement. No change in Para Required
10.3	End of equipment life management	Noted and shall comply	Nil	No change in Para Required
11	Accessories & spares	Noted and shall comply	Nil	No change in Para Required
12	Drawings	Noted and shall comply	Nil	No change in Para Required
13	Documentation required	Noted and shall comply	Nil	No change in Para Required
14	Training	Noted and shall comply	Nil	No change in Para Required
15	Tests & Verification	Noted and shall comply	Nil	No change in Para Required
16	Painting, labeling and marking	Noted and shall comply	Nil	No change in Para Required
17	Packaging and delivery/shipment	Noted and shall comply	Nil	No change in Para Required
18	Intellectual property rights			
18.1	Undertaking by equipment manufacturer	Noted and shall comply	Nil	No change in Para Required
18.2	Declaration of confidentiality of submitted documents by manufacturers	Noted and shall comply	Nil	No change in Para Required
ANNE XURE 1:	Handling Loss of Communication			
	Overview of communication loss handling The overall process of handling loss of communication is summarized bellow			
1	In case of no communication for 10 seconds, loss of communication is identified	Noted and shall comply	Nil	No change in Para Required
1.1	Master DPCS shall declare a communication loss and alert operator. Loss of communication to continue till recovered or DPCS disabled / restarted	Noted and shall comply	Nil	No change in Para Required

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1.2	DPCS Master shall try to contact remote via trackside devices(where available) for next 10 seconds 1.2.1 If communication is resumed it shall revert to normal.	Noted and shall comply	Nil	No change in Para Required
1.3	Remote continues in same mode for another 10 seconds and during this period the following shall apply. 1.3.1 Communication loss is Indicated on HMI. 1.3.2. If communication restored it shall revert to normal. 1.3.3 If in braking 1.3.3.1 Remote shall gradually cutout brake pipe control, close feed valve and prevent BP charging. 1.3.4 If in motoring it shall continue on same level watch air flow 1.3.4.1 If BP air flow is sensed. 1.3.4.1.1 Remote shall Idle down 1.3.4.1.2 Remote shall cutout brake pipe control and close feed valve and prevent BP Charging. 1.3.5 If in DB, it stays in DB.	Noted and shall comply	Nil	No change in Para Required
1.4	After 10 seconds, remote to continue in resultant mode for another 45 seconds	Noted and shall comply	Nil	No change in Para Required
	1.4.1 If communication restored it revert to normal	Noted and shall comply	Nil	No change in Para Required
	1.4.2 Motoring to continue on same level and air flow is watched.1.4.2.1 If BP Air flow is sensed 1.4.2.1.1 Remote Idle down.	Noted and shall comply	Nil	No change in Para Required
1.5	At the end of 45 seconds	Noted and shall comply	Nil	No change in Para Required
	1.5.1 Remote loco idles down	Noted and shall comply	Nil	No change in Para Required
	1.5.2 If in DB remote loco shall gradually idle down and remove DB.	Noted and shall comply	Nil	No change in Para Required
	1.5.3 It waits forever to restore communication or manual intervention on HMI.	Noted and shall comply	Nil	No change in Para Required
Part-1				
0	Introduction	Noted	Nil	No change in Para Required
1	Objectives and Scope of the specification	Noted	Nil	No change in Para Required
2	Terminology/Abbreviations	Noted	Nil	No change in Para Required
3	Definitions (Optional)	Noted	Nil	No change in Para Required
4	Brief description of the system/equipment/components The locomotive on-board equipment (OBE) consists of hardware components and associated modification and integration of software for making the equipment functional and interfaced to the locomotive computer. The following shall be considered as part of this equipment: Interface for locomotive computer. RF data modem and associated hardware 8-port Ethernet switch compliant to IEEE 802.3 10 BaseT and 100 BaseTx with M12, D-coding. Connectors / cables and wiring accessories required for making the equipment functional. Software for enabling all equipment features on the locomotive computer Service support required for fitment, integration, software modification for making the features fully operational. Training for operations and maintenance of the equipment.	 Noted and shall comply Noted and shall comply Not required Noted and shall comply In the scope of LCC supplier to be ensured by Railways during the purchase. Service support for Software limited to DPCS Noted and shall comply	Supplier shall provide items to ensure that functional / operational requirements are fulfilled.	No change in Para Required No change in Para Required No change in Para Required No change in Para Required No change in Para Required <u>In reference to Lotus comments, the para is revised as follows "Software for enabling all equipment features for the functionality of DPCS".</u> No change in Para Required No change in Para Required
5	General requirements			

Claus e no.	Description	M/s Lotus comments	M/s Medha comments	RDSO Comments
5.1	Manufacturers qualification Manufacturer of the equipment shall be an RDSO approved supplier of the MBCS/LCC for diesel-electric locomotives. In case of third party supply, the DPCS manufacturer shall have a formal MoU with: 1. RDSO approved MBCS/LCC manufacturer and approval to supply DPCS modules must be provided by the concerned MBCS/LCC manufacturer. Manufacturer should have experience in wireless technology and embedded control system. 2. CCB manufacturer, where required, for control brakes by the DPCS through LCC/MBCS. (LCC/MBCS has interface with both CCB and DPCS).	Manufacturers qualification: To be modified as Manufacturer of the equipment shall be an RDSO approved supplier of the MBCS/LCC for diesel-electric locomotives. In case of third party supply, the DPCS manufacturer shall have a formal MoU with: RDSO approved MBCS/LCC manufacturer and approval to supply DPCS modules must be provided by the concerned MBCS/LCC manufacturer. Manufacturer should have experience in wireless technology and embedded control system	Nil	Para to be modified as below. " Manufacturer of the equipment shall be an RDSO approved supplier of the MBCS/LCC for diesel-electric locomotives. In case of third party supply, the DPCS manufacturer shall have a formal MoU with: RDSO approved MBCS/LCC manufacturer and approval to supply DPCS modules must be provided by the concerned MBCS/LCC manufacturer. <u>The MoU should cover the integration of CCB with DPCS through LCC/MBCS for required DPCS functionality.</u> Manufacturer should have experience in wireless technology and embedded control system.
	NOTE: In all cases responsibility of interfacing with locomotive systems shall be of the DPCS supplier.	To be modified as NOTE 1: Interfacing of DPCS with LCC is joint responsibility of DPCS & LCC manufacturer, and NOTE 2: Interfacing of LCC with CCB should be joint responsibility of LCC and CCB manufacturer. NOTE 3: The rectification/ trouble shooting in LCC or brake system shall be responsibility of LCC / brake system supplier	Nil	No change in Para Required. DPCS is made under the scope of supply of AC-AC Traction Control System, which has interfacing with DPCS and CCB Both. Further the para is added as below. <u>DPCS supplier means the end supplier of DPCS to Railway.</u>
5.2	Equipment Requirements	Noted and shall comply	Nil	No change in para required
5.3	Training	Noted and shall comply	Nil	No change in para required
6	Functional requirements	Noted and shall comply	Nil	No change in para required
6.1	Locomotive system interfaces	Noted and shall comply	Nil	No change in para required
6.1.1	DPCS controller	Noted and shall comply	Nil	No change in para required
6.1.1.1	Real time clock	Noted and shall comply GPS may be used for time synchronization	Nil	No change in para required
6.1.2	Radio module and antennae	Noted	Nil	No change in para required
6.1.3	Train Line Interface Module (TLIM)	We shall comply & provide integrated modules within DPCS controller for train line integration and no separate equipment is supplied for separate mounting on electrical control cabinet.	Nil	No change in para required
6.1.4	Air Flow Sensor (AFS)	Noted and we shall comply as per requirement.	Nil	No change in para required
6.1.5	Electro-magnetic Brake Pipe Vent Valve (EMBPVV)	We may use the valve arrangement of CCB by providing the electrical interfacing.	Nil	No change in para required
6.1.6	Computer Controlled Brakes The CCB is already fitted on the class of locomotives specified in this document. However, the CCB system needs software/hardware modification to enable DP control functions. The DPCS equipment manufacturer shall ensure that the requisite modifications are done on the CCB for meeting the functional requirements	IR/RDSO/Zonal Railways to ensure that CCB installed on the locomotives to be compatible for DPCS operation. Individual supplier procuring CCB upgrade parts on smaller quantity shall impose huge financial loss on Indian Railways, same can be avoided by bulk procurement by Indian Railway or as a standard fitment on all the brake system procured.	Nil	No change in Para required.

Claus e no.	Description	M/s Lotus comments	M/s Medha comments	RDSO Comments
6.1.7	Locomotive Control Computer (LCC)/Microprocessor based control system (MBCS)	Noted and we shall comply as per requirement	Nil	No change in Para Required.
6.2	Equipment form and size	Noted and shall comply	Nil	No change in Para Required.
6.3	Communication media for communicating with RF modems The locomotive DIALS units shall be connected to DPCS through LCC/MBCS. DP Controller will communicate with RF Modem and LCC/MBCS. Interface Control Document between DP Controller and RF Modem shall be provided to RDSO. Note: However, the integration of HMI of DPCS through LCC/MBCS is not applicable in case of standalone HMI of DPCS. The whole arrangement of connections shall enable the DIALS, MBCS equipment and DPCS to share each other.	Noted and shall comply	More clarity to be given in requirement.	<u>In which aspect clarity is required as raised by M/s Medha,</u> is not understood. No change in Para required.
7	Technical requirements	Noted and shall comply	Nil	No change in para required.
8	Applicable drawings	Noted and shall comply	Nil	No change in para required.
9	Safety requirements	Noted and shall comply	Nil	No change in para required.
10	Life cycle management	Noted and shall comply	Nil	No change in para required.
11	Environmental/Climatic requirements	Noted and shall comply	Nil	No change in para required.
12	Documents required from supplier	Noted and shall comply however software flow chart is IP of the Industry and not of any use for Indian Railways.	Nil	No change in para required. Flow chart is related to logic of the DPCS operation not the internal software program. The para is elaborated as follows " <u>Block diagram and the flow charts of the DPCS operation and trouble shooting covering hardware and software</u> "
13	Accessories	Noted and shall comply	Nil	No change in para required.
13.1	Tools	Noted and shall comply	Nil	No change in para required.
13.2	Spares	Noted and shall comply	Nil	No change in para required.
14	Guarantee/Warranty	Noted and shall comply	Nil	No change in para required.
15	Tests & Verification	Noted and shall comply	Nil	No change in para required.
15.1	Standards for testing	RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO.	Nil	<u>In reference to Lotus comments, the Type test parameter has been elaborated at Annexure-1 of Part -1.</u>
15.2	Sampling plan.	Noted and shall comply	Nil	No change in para required.
16	Types of tests	Noted and shall comply	Nil	No change in para required.
16.1	Type Tests	RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO.	Nil	Same comments as given at Para 15.1
16.2	Field trials	Noted	Nil	No change in Para required.
16.3	Acceptance test	Noted	Nil	No change in Para required.
16.4	Routine test	Noted	Nil	No change in Para required.
16.5	Makers test certificate for outsourced item	Noted	Nil	No change in Para required.
16.6	3rd Party test certificates and reduction of inspection requirements	RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO.	Nil	No change in Para required.
17	Painting, labeling and marking	Noted and shall comply	Nil	No change in Para required.
18	Packaging and delivery	Noted and shall comply	Nil	No change in Para required.
19	Information to be supplied by supplier	Noted and shall comply	Nil	No change in Para required.
Part-2				
0	Introduction	Noted	Nil	No change in Para required.
1	Objectives and Scope of the specification	Noted	Nil	No change in Para required.
2	Terminology/Abbreviations / Definitions	Noted	Nil	No change in Para required.
3	Referred standards	RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO.	Nil	No change in Para required.
4	Pre-requisites			

Claus e no.	Description	M/s Lotus comments	M/s Medha comments	RDSO Comments
4.1	Equipment manufacturers qualification Manufacturer of the equipment shall be an RDSO approved supplier of the MBCS for diesel-electric locomotives. In case of third party supply, the DPCS manufacturer shall have a formal MoU with: 1. RDSO approved MBCS manufacturer and approval to supply DPCS modules must be provided by the concerned MBCS manufacturer, if the system is integrated with MBCS. In case the DPCS is stand alone for μ P based traction control system, such MOU may not require. Manufacturer should have experience in wireless technology and embedded control system. 2. For analog traction system, stand-alone DPCS system is required and manufacturer should have experience in wireless technology and embedded control system. NOTE: In all cases responsibility OF interfacing with locomotive systems shall be of the DPCS supplier	Considering the DPCS requirement in ALCo locomotives manufacturer qualification Para to be modified as "Manufacturer of the equipment shall be an RDSO approved supplier of DPCS or who has successfully supplied DPCS on Alco type Locomotive."	Nil	No change in Para required.
4.2	Equipment requirements	Noted and shall comply	Nil	No change in para required.
5	Brief requirements overview	Noted and shall comply	Nil	No change in para required.
6	Detailed requirements			
6.1	Component form, fit & function	Noted and shall comply	Nil	No change in para required.
6.1.1	DPCS controller	Noted and shall comply	Nil	No change in para required.
6.1.1.1	Real-time clock	Noted and shall comply. GPS may be used for time synchronization	Nil	No change in para required.
6.1.2	Radio module and antennae	Noted	Nil	No change in para required.
6.1.3	Distributed Power HMI (DP-HMI)	Noted and shall comply	HMI interface to DPCS can be with Ethernet/RS485/CAN.	As per medha comments, the para is modified as below. <u>In case DIALS has been provided, the DPCS supplier has to interface with DIALS as unified HMI through Ethernet /RS485/CAN.</u>
6.1.3	Train Line Interface Module (TLIM)	We shall provide integrated modules within DPCS controller for train line integration and no separate equipment is supplied for separate mounting on electrical control cabinet.	Nil	No change in Para required.
6.1.4	Air Flow Sensor (AFS)	Noted and shall comply	Nil	No change in Para required.
6.1.6	ELECTRO-MAGNETIC BRAKE PIPE VENT VALVE (EMBPVV)	Noted and shall comply	Nil	No change in Para required.
6.1.7	Brake Interface Unit (BIU)	Noted and shall comply	Nil	No change in Para required.
6.1.8	Microprocessor based control system (MBCS)	Noted	Nil	No change in Para required.
6.2	Equipment form and size	Noted and we shall comply, however RDSO to release the outer dimension details.	Nil	No change in Para required.
6.3	Function	Noted and shall comply	Nil	No change in Para required.
6.4	Interface	Noted and shall comply	Nil	No change in Para required.
7	Environmental/Climatic requirements	RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO.	Nil	Same comments as given at Para 15.1
8	Safety requirements	Noted and shall comply	Nil	No change in Para required.
9	Life cycle management	Noted and shall comply	Nil	No change in Para required.
10	Accessories & spares	Noted and shall comply	Nil	No change in Para required.
10.1	Diagnostic aids	Noted and shall comply	Nil	No change in Para required.
10.2	Special Maintenance tools	Noted and shall comply	Nil	No change in Para required.
10.3	Spares	Noted and shall comply	Nil	No change in Para required.
11	Drawings	Noted and shall comply	Nil	No change in Para required.
12	Documentation required	Noted and shall comply	Nil	No change in Para required.
13	Training	Noted and shall comply	Nil	Para has been modified regarding flow chart in ref. to Lotus comments at para 12 of part-1 of the spec. <u>"Block diagram and the flow charts of the DPCS operation and trouble shooting covering hardware and software"</u>

Clause no.	Description	M/s Lotus comments	M/s Medha comments	RDSO Comments
14	Tests & Verification	RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO.	Nil	Same comments as given at Para 15.1
14.1	Sampling plan	Noted and shall comply	Nil	No change in Para required.
14.2	Types of tests	RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO.	Nil	Same comments as given at Para 15.1
14.2.1	Type tests	RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO.	Nil	Same comments as given at Para 15.1
14.2.2	Field trials	Noted and shall comply	Nil	No change in Para required.
14.2.3	Acceptance test	RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO.	Nil	Same comments as given at Para 15.1
14.2.4	Routine test	RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO.	Nil	Same comments as given at Para 15.1
14.2.4.1	Makers test certificate for outsourced item	Noted and shall comply	Nil	No change in Para required.
14.3	3rd Party test certificates and reduction of inspection requirements	RDSO to specify in detail all the type test and routine test parameter as specified in other specification of RDSO.	Nil	Same comments as given at Para 15.1
15	Painting, labeling and marking	Noted and shall comply	Nil	No change in Para required.
16	Packaging and delivery/shipment	Noted and shall comply	Nil	No change in Para required.