GOVERNMENT OF INDIA - MINISTRY OF RAILWAYS
RESEARCH DESIGNS & STANDARDS ORGANISATION
MANAK NAGAR, LUCKNOW – 226 011
(Motive Power Directorate)
EXPRESSION OF INTEREST

No. SD.DFM.Battery.1 Date: As signed

Ministry of Railways, Research, Designs & Standards Organization (RDSO), Lucknow, India is interested in developing specification for the item, detailed as below:

S.No.	Subject	Contact Person
1	Development of specification for battery having Low maintainability better energy density intended for engine starting application on WDG4/WDP4 series HHP diesel locomotives.	**Director/Motive Power (EC & EM),** Motive Power Directorate, Annexe-I Building, Research Designs & Standards Organization (RDSO), Manak Nagar, Lucknow – 226 011, Uttar Pradesh, India Ph. No. 9794863352 Email address: mp.directorec@gmail.com

Due to advancement of technologies in Battery, RDSO intends to develop the specification for battery having low maintainability better energy density intended for engine starting application on WDG4/WDP4 series HHP diesel locomotives. The Functional Requirement Specification (FRS) for battery having low maintainability better energy density intended for engine starting application on WDG4/WDP4 series HHP diesel locomotives with proforma for response has been enclosed.

The firms, who have enough experience and capabilities in the above field, having necessary accreditation for such work and are interested in carrying out above work, are requested to see the functional requirements specification (FRS) for above work uploaded on RDSO website http://rdso.indianrailways.gov.in or contact concerned RDSO person on any working day.

The interested firms may submit their details of the willingness for undertaking the above work in prescribed format attached herewith within one month from the date of publication of EOI. The interested firms are requested to submit details in the prescribed format available on RDSO website www.rdso.indianrailways.gov.in >Vendor Interface>Expression of Interest (EOI)

The interested firms/organizations are requested to submit details in the prescribed format attached herewith within period of 30 days from the date of publication of EOI, to the address mentioned below:

Contact Details:

Director/Motive Power (EC & EM),
Motive Power Directorate,
Annexe-I Building,
Research Designs & Standards Organization (RDSO),
Manak Nagar, Lucknow – 226 011,
Uttar Pradesh, India
Ph. No. 9794863352
Email address: mp.directorec@gmail.com

The selection criteria for short listing the firms for further finalization of the specification and development of item is as below. The shortlist will be done by a standing committee.

S.No.	Item	Marks	Remarks
1	Turnover of the firm during last 3 years	20	Firm having maximum be given full marks and other as percentile.
2.	Details of supplies made in the field of item under EOI	30	This is the turnover of supplies made in the field of item under EOI. The firm having maximum be given full marks & other as percentile.
3.	Experience & expertise for item proposed under EOI	20	It is based on years of experience in such products 7 firm having maximum be given full marks & other as percentile.
4.	Manpower & their qualification	10	No. of persons with profession qualification on firms direct role and percentile
5.	Details of patent held & MoU/agreement with OEM	20	Number of such items & percentile thereof.

Enclosure: 1. Proforma for response
2. Functional Requirement Specification

Digitally Signed by Vikas Verma
Date: 19-02-2025 16:13:24
Reason: Approved

(Vikas Verma)
Director/Motive Power (EC & EM)
RDSO

FORMAT FOR LETTER OF RESPONSE

Respondents Ref No.: Date:

Director Motive Power (EC & EM),
Motive Power Directorate, Annexe-I Building,
Research Designs & Standards Organization,
Ministry of Railways
Manak Nagar
Lucknow – 226 011
Uttar Pradesh, India

Dear Sir,

Subject: RESPONSE TO – EOI FOR PARTICIPATION _____

1. We, the undersigned, offer the following information in response to the Expression of Interest sought by you vide your Notification No._____, dated _____.

2. We are duly authorized to represent and act on behalf of _____ (hereinafter the "respondent")
3. We have examined and have no reservations to the EOI Document including Addenda No(s) _____.

4. We are attaching with this letter, the copies of original documents defining: -
   a) the Respondent's legal status;
   b) its principal place of business;
   c) its place of incorporation (if respondents are corporations); or its place of registration (if respondents are cooperative institutions, partnerships or individually owned firms);
   d) Self certified financial statements of Last three years, clearly indicating the financial turn over and net worth.
   e) Copies of any market research, business studies, feasibility reports and the like sponsored by the respondent, relevant to the project under consideration

5. We shall assist MoR and/or its authorized representatives to obtain further clarification from us, if needed.
   a) RDSO and/or its authorized representatives may contact the following nodal persons for further information on any aspects of the Response:

S.No.	Contact Name	Address	Telephone	e-Mail

6. This application is made in the full understanding that:
   a) Information furnished in response to EOI shall be used confidentially by RDSO for the purpose of development of the project.

   b) RDSO reserves the right to reject or accept any or all applications, cancel the EOI and subsequent bidding process without any obligation to inform the respondent about the grounds of same.

c) We confirm that we are interested in participating in development of the project.

7. We certify that our turnover and net worth in the last three years is as under:

Financial Year	**Turnover**	**Net Worth**

8. In response to the EOI we hereby submit the following additional details annexed to this application.
   8.1 Details of various items being manufactured/consultancy undertaken.
   8.2 Details of customer(s) and supplies made in the field of item under EOI.
   8.3 Experience and expertise for the items proposed in EOI.
   8.4 Details of man-power with their qualification and experience.
   8.5 Detailed proposal for items proposed in EOI including alternative proposal, if any.
   8.6 Details of Intellectual Property Rights (IPR) held, patent filed/held and MoU/agreement signed.
   8.7 Details of ISO certification
   8.8 Undertaking as per Annexure-A

9. The undersigned declare that the statements made and the information provided in the duly completed application are complete, true, and correct in every detail. We also understand that in the event of any information furnished by us being found later on to be incorrect or any material information having been suppressed, RDSO may delete our name from the list of qualified Respondents. We further understand that RDSO will give first preference to the applicants considered relevant for the purpose.

10. Our response is valid till (date in figures and words):_____.

Yours sincerely,

(Sign)
NAME
In the Capacity of
Duly authorized to sign the
response for and on behalf
of
Date

Annexure-A

(To be taken on non-judicial stamp paper of appropriate value as applicable in the respective state and dully notarised & witnessed)

UNDERTAKING

I, son of ..... aged about ..... Years resident of ..... do hereby solemnly affirm as under –

1. That the deponent is the Authorised signatory of *(Name of the Sole Proprietorship Concern/ Partnership Firm/ Registered Company/ Joint Venture).*

2. That the deponent declares on behalf of *(Name of the Sole Proprietorship Concern/ Partnership Firm/ Registered Company/Joint Venture)* that:

   a) In regard to matters relating to the security and integrity of the country, no charge sheet has been filed by an agency of the Government / conviction by a Court of Law for an offence committed by the ---------- (name of the entity)or by any sister concern of the ---------- (name of the entity) would result in disqualification.

   b) In regard to matters other than the security and integrity of the country, ------- (name of the entity) has not been convicted by a Court of Law or indicted / passed any adverse order by a regulatory authority against it or it's any sister concern which relates to a grave offence, or would constitute disqualification. Grave offence is defined to be of such a nature that it outrages the moral sense of the community.

DEPONENT

VERIFICATION

I declare that the contents of para 1 to 2 above are true as per my knowledge and nothing has been hidden.

DEPONENT

भारत सरकार - रेल मंत्रालय

GOVERNMENT OF INDIA - MINISTRY OF RAILWAYS

अनुसंधान अभिकल्प और मानक संगठन

RESEARCH DESIGNS AND STANDARDS ORGANISATION

डब्ल्यूडीजी4/डब्ल्यूडीपी4 श्रृंखला एचएचपी डीजल लोकोमोटिव पर इंजन शुरू करने के लिए कम रखरखाव, बेहतर ऊर्जा घनत्व वाली बैटरी के लिए कार्यात्मक आवश्यकता विशिष्टता (एफआरएस)

Functional Requirement Specification (FRS) for battery having low maintainability better energy density intended for engine starting application on WDG4/WDP4 series HHP diesel locomotives.

FRS No. MP.0.2400.86 Rev.0 February-2025

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Functional Requirement Specification (FRS) for battery having low maintainability better energy density intended for engine starting application on WDG4/WDP4 series HHP diesel locomotives.

1.0 Background

The main purpose of the battery is to crank the Diesel locomotive engine and feed the power to control circuit of Diesel Electric Loco.

At present, Freight version of HHP locomotives are fitted with 8 Nos. of 8V, 500Ah Low Maintenance Lead Acid (LMLA) batteries whereas passenger versions of HHP locomotives are fitted with 10 Nos. of 6V, 150 Ah Ni-Cd batteries.

Due to advancement of technologies in Battery, RDSO intends to develop the battery having low maintainability better energy density meant for engine starting application for Goods and Passenger HHP diesel loco.

2.0 Technical Parameters of existing battery

The existing LMLA battery fitted in WDG4 series HHP diesel locomotives have following technical parameters.

SN	Description	LMLA Battery (8V, 500Ah)
1.	Class of locomotive	WDG4
2.	Battery Voltage	64V
3.	Battery capacity	500Ah
4.	Voltage of each battery unit	8V
5.	Voltage of each cell	2V
6.	No. of battery units	8
7.	No. of cells in battery box	32
8.	No. of cells per battery unit	4
9.	Initial cranking current	2300A
10.	Sustained cranking current	1400A
11.	Minimum initial cranking cycle requirement	10 cranking cycles at ambient 27±2ºC electrolyte temperature
12.	Rest pause between initial cranking cycle	15 seconds

For Goods HHP loco Battery Box size for LMLA battery (in inch) is 74.38”(L) x 30.87”(W) x 32.81”(H) and weight of battery box is 560 lbs (254 Kg) and LMLA Battery size is 723±5 mm (L) x 200±5 mm (W) x 494±5 mm (H) and total weight of battery is 153 x 8=1224 Kg.

For Passenger HHP loco Battery Box size (in inch) for Ni-Cd battery is 74.12”(L) x 23.20”(W) x 25.82”(H) and weight of battery box is 560 lbs (254 Kg). Ni-Cd Battery size is 523 mm (L) x 170 mm (W) x 343 mm (H) and total weight of battery is 44 x 10 = 440 Kg.

3.0. Functional Requirements

3.1 General Requirements

The proposed battery system shall meet the following general requirements:

- **Capacity:** The battery system shall provide a capacity that is equivalent to the capacity of the existing LMLA battery specified above for goods HHP Loco ie. 500 Ah. For Passenger HHP Loco, the capacity of the battery should be at least 250 Ah.
- **Voltage:** The nominal voltage of the battery system shall be 72V volts with higher and lower voltage limit as per operational requirement in diesel HHP locomotives.
- **Design Life:** The design life of the battery shall be a minimum 12 years or 3500 charge-discharge cycles at 80% DoD at 25°C.
- **Charging:** The proposed battery must be compatible with the 72 V DC supply from the existing battery charger, allowing it to charge without any modification.

3.2 Battery Performance

The battery system shall meet the following performance criteria:

- **Energy Efficiency:** The battery system should provide an energy efficiency of over 95%, significantly higher than LMLA batteries.
- **Charge/Discharge Cycles:** The system must support a minimum of 3500 charge -discharge cycles at 80% DoD at 25°C.
- **Temperature Range:** The battery must operate within a temperature range of -10°C to +55°C without degradation in performance.
- **Self-Discharge Rate:** The self-discharge rate must not exceed 3% per month.

3.4 Mechanical Requirements

The mechanical aspects of the proposed battery system shall include:

a) Dimensions: The battery dimensions must be compatible with the existing space available for battery in diesel HHP locomotive (firm should submit the fitment and OGA of the newer proposed battery).

b) Weight: The weight of the battery system including Battery Management System should not be more than 1224 kg for Goods HHP Loco and should not be more than 440 kg for passenger HHP Loco.

c) Mounting: The battery system including Battery Management System should be designed for ease of installation and should be within the envelope of the existing battery box for LMLA

batteries for Goods HHP loco and for Ni-Cd batteries for Passenger HHP Loco respectively as indicated in para 2.0.

d) Test for shock and vibration: The proposed battery system should be tested for shock and vibration compliance according to IEC 61373 (latest) for Class I, Category B, "Components mounted in an under frame cubicle, which is fixed to the car body" prior to installation in the locomotive.

3.5 Safety Features

The proposed battery system must include the following safety measures:

a) Battery Management System (BMS):

The Battery Management System (BMS) provided with the battery pack must incorporate advanced monitoring and diagnostic capabilities. The Battery Management System (BMS) in the battery should be highly reliable, with redundant functionality and designed to ensure fail-safe operation, meeting stringent safety and reliability standards. The system should be equipped with data logging and communication functionalities to ensure continuous monitoring of the battery performance, predictive maintenance, and operational efficiency. These features are crucial for ensuring real-time visibility into battery health, usage patterns, and any potential issues that may arise during operation.

The system must include a BMS that manages following functions:

- Monitor voltage of every cell or every cell block.
- Monitor current of every cell block or every battery branch.
- Monitor temperature of representative cells.
- Disconnect or isolate battery packs, battery branches if abnormal operating parameters (voltage, current and temperature) are detected.
- Calculate state of charge (SOC), etc. from the data obtained by the monitoring function.
- Individual monitoring of current for each parallel path.
- Communicate the data obtained to the outside of the battery system.
- Should be reliable, fail-safe and redundant for protection and safety operations.

b) Isolation and disconnection for faults: The proposed battery system should include a reliable isolation and disconnection and protection system. To avoid the case of internal short circuit, fuse on -ve bus & +ve bus should also be provided to isolate the loop in case of short circuit between parallel paths. Battery disconnector switch should also be provided.

c) Battery system design safety: To prevent internal short circuit the design of the battery system should be such that battery terminals are not exposed. Insulation should be provided on the battery terminals insulator to prevent any short circuit even if some

foreign material falls. Isolation should be provided between two parallel paths to avoid any short circuit between adjacent terminals of two parallel paths also. Proper covering and isolation of all electrical conducting elements should be ensured to prevent them from coming into contact with any part of the battery box.

d) Fire Safety: The proposed battery shall be non-flammable under normal and fault conditions. Compliance to IEC standards and EN shall be provided.

e) Thermal Management: The battery system should include thermal management provisions to prevent overheating.

f) Certification of cells: The cells/modules used for battery pack should be compliant and tested as per IEC 62620 and IEC 62619 before installation in locomotives.

g) Interconnection between cells: The interconnection between cells or cell blocks shall be made using high-conductivity, corrosion-resistant materials to ensure minimal voltage drop and thermal stability. The connections shall be achieved through laser welding, ultrasonic welding, or other internationally recognized methods in accordance with relevant standards, ensuring strong mechanical bonding and low-resistance electrical connections. These interconnections must withstand vibration, shock, and thermal cycling, providing reliable and durable contact throughout the battery's operational life. All connections must comply with applicable safely, insulation, and welding standards to prevent short circuits and other electrical hazards.

4.0. Testing and Validation

The proposed battery system shall undergo the following tests to ensure compliance with Indian Railways standards before installation into locomotive:

i. **Initial Testing:** Performance, capacity, safely standards certification and testing for rolling stock use.

ii. **Cells Validation and testing:** The cells used must be compliant and tested as per tests mentioned in IEC 62620, IEC 62619, IEC 62973-1, IEC 62973-5, IEC 62928 from NABL approved or other Govt. accredited Labs.

iii. **Endurance Testing:** Long-term performance testing for cycles as mentioned in IEC 62620.

iv. **Safety tests:** The proposed battery system must undergo safety tests as per IEC 62619 and IEC 62928.

v. **Thermal and Vibration Testing:** Testing for operating within Indian climatic and track conditions.

vi. **Test on BMS electronics:** BMS electronics should be compliant and tested as per IEC 60571.

vii. Cranking Current Test

a) Initial Cranking Current Test:

After standing an open circuit for not less than 12 hours and not more than 24 hours from the completion of a full charge, the battery unit shall be subjected to cycles of discharge at the rate of initial cranking current 2300A. Each discharge shall be of 15 seconds duration with an intermittent rest of 15 seconds.

Requirements: The battery unit tested shall meet the minimum requirements specified in below table:

Initial Temperature of the Battery	Discharge current (15 sec with 15 sec rest)	Minimum no. of 15 sec. cycles (Nos.)	Battery Terminal Voltage	
			Initial at 5 to 7 seconds	Final Voltage
27±2ºC	2300A	10	1.1 x n	0.8 x n
			Where n = no. of cells in series per battery unit.	

b) Sustained cranking test:

After standing on open circuit for not less than 12 hours and not more than 24 hours on the completion of a full charge, the battery unit shall be subjected to a continuous discharge at the rate of sustained cranking current 1400A.

This discharge may not be taken immediately after initial cranking current test but may be preceded by one C10 discharge.

Requirements: The battery unit tested shall meet the minimum requirements specified in below table:

Initial Temperature of the Battery	Discharge current	Minimum discharge time	Battery Terminal Voltage	
			Initial at 5 to 7 seconds	Final Voltage
27±2ºC	1400A	4 minutes	1.4 x n	1 x n
			Where n = no. of cells in series per battery unit.	

viii) Field Trials: The battery system must be installed and tested in operational HHP locomotives for a period of not less than period as decided by competent authority (typically 6 months).

4.1 Type routine and acceptance test on proposed Battery system

Type, Acceptance, Routine test on proposed battery will be conducted at firm's premises. During Type test, some tests for which facility is not available at the firm premises, will be carried out at any Govt. Lab or NABL accredited LAB.

4.2 Type Tests: Type tests shall be carried out on proposed battery of given design to verify the requirements specified. In addition, the manufacturer shall repeat the type test to be witnessed by representative of RDSO/PUs or purchaser either totally or in part in following cases without any additional cost for following cases:

- Modification of equipment likely to affect its function.
- Repeated failure of equipment or variations established during routine tests
- Resumption of production after an interruption of more than two years.
- In any other condition where RDSO/PUs/Purchaser felt necessity of the type test.
- In case of any change in Bill of Material (BOM), drawings or design of unit.

4.3 Routine Tests: These tests are to be carried out to verify the properties of the proposed battery corresponding to those measured during type test. Routine tests are to be conducted by the manufacturer on each set and all the records of test results shall be maintained with traceability. The same shall be produced before the Railway's inspecting officer/ representative for verification.

Complete battery system i.e. cells, modules, strings with BMS should be tested as per tests mentioned in IEC 62928, IEC 62973-1, IEC 62973-5. IEC 62619 and IEC 62620.

4.4 Acceptance Tests: The acceptance tests are to be conducted in the presence of Railways nominated representative on the samples selected at random or on all as agreed between purchaser and manufacturer to establish conformity of the lot to be supplied with the requirements of the specification. The following shall constitute the acceptance tests:

a) Initial cranking current test.

b) Sustained cranking current test.

5.0. Documentation

The supplier of the proposed battery system must provide the following:

- Detailed user manual including installation, operation, and maintenance guidelines.
- Test reports from certified laboratories.
- Warranty documentation for a period of not less than 8 years.

6.0. Training and Support

The supplier must provide training to Indian Railways maintenance staff on:

- Battery management and operation.
- Troubleshooting and diagnosis of battery issues.
- Preventive maintenance and lifecycle management of the proposed system.