GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS

DRAFT

TECHNICAL REQUIREMENTS

FOR

DROP PIT SYSTEM

FOR

CHANGING OF MOTORISED WHEEL-SET OF ELECTRIC LOCOMOTIVES

Spec No:   RDSO/2013/EL/SPEC/xxxx (Rev 0)
Mar ’2013

Approved by: Sr. EDSE/RDSO

Signature

Prepared by: SSE/SE&AM
Checked by: ADE/SE&AM/RDSO
Issued by: DSE/SE&AM/RDSO

Issued by
Electrical Directorate
Research, Designs and Standards Organisation
Manak Nagar, Lucknow-226011
### Status of revision

<table>
<thead>
<tr>
<th>S.N.</th>
<th>Date of Revision</th>
<th>Page No.</th>
<th>Revision</th>
<th>Reasons for Revision</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td>All</td>
<td>0</td>
<td>First issue</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Prepared by:**

<table>
<thead>
<tr>
<th>SSE/SE&amp;AM</th>
<th>ADE/SE&amp;AM/RDSO</th>
<th>DSE/SE&amp;AM/RDSO</th>
<th>DSE/SE&amp;AM/RDSO</th>
</tr>
</thead>
</table>

---

**Checked by:**

<table>
<thead>
<tr>
<th>SSE/SE&amp;AM</th>
<th>ADE/SE&amp;AM/RDSO</th>
<th>DSE/SE&amp;AM/RDSO</th>
<th>DSE/SE&amp;AM/RDSO</th>
</tr>
</thead>
</table>

---

**Issued by:**

<table>
<thead>
<tr>
<th>SSE/SE&amp;AM</th>
<th>ADE/SE&amp;AM/RDSO</th>
<th>DSE/SE&amp;AM/RDSO</th>
<th>DSE/SE&amp;AM/RDSO</th>
</tr>
</thead>
</table>

---
# INDEX

<table>
<thead>
<tr>
<th>SN</th>
<th>Item</th>
<th>Page Nos</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Technical details</td>
<td></td>
</tr>
</tbody>
</table>

**Annexures**

| Annexure-I | Salient data & Schematic of WAM4 Locomotive                          |          |
| Annexure-II | Salient data & Schematic of WAG5HR Locomotive                        |          |
| Annexure-III | Salient data & Schematic of WAG7 Locomotive                        |          |
| Annexure-IV | Salient data & Schematic of WAP4 Locomotive                        |          |
| Annexure-V | Salient data & Schematic of WAG9/WAP7 Locomotive                     |          |
| Annexure-VI | Summarized Technical Details to be furnished by tenderer along with offer |          |
| Annexure-VII | Meaning and definitions of the terms used                           |          |

Page nos. will be put after finalization of specification.
TECHNICAL REQUIREMENTS FOR DROP PIT SYSTEM FOR
CHANGING OF MOTORISED WHEEL-SET OF ELECTRIC LOCOMOTIVES

1.0 Introduction

During maintenance of electric locomotives, need for replacement of motorized wheel-set often arises. At present the wheel-sets are replaced after disconnecting necessary connections/linkages between locomotive body & bogie and between bogie & concerned wheel-set and then lifting of locomotive body and placing it on shop floor. The process involved is time consuming and also requires additional shop floor area for keeping locomotive body.

It is possible to drop the concerned wheel-set, after disconnecting necessary connections/linkages, in a drop pit from where it can be carried to a release track. Almost reverse procedure can be followed for fitment of motorized wheel-set in the locomotive. Such arrangement for facilitating replacement of motorized wheel-set without lifting of locomotive is termed as "Drop pit system for changing motorized wheel-set" and also referred hereinafter in brief as “drop pit”.

This specification covers the basic requirements & guidelines for the development of drop pit to facilitate replacement of one motorized wheel-set, at a time, for WAM4, WAG5, WAG7, WAP4 and WAG9/WAP7 class of electric locomotives while ensuring safety of working personnel and the locomotive/its equipments during the process.

2.0 Instructions to Tenderers

2.1 Tenderers are advised to study the basic design features of the WAM4, WAG5, WAG7, WAP4 and WAG9/WAP7 locomotives as also the existing method of wheel-set changing so that they clearly understand the requirement before submitting their offer. Prospective tenderers may do so by visiting any of the Electric Loco sheds under advise to RDSO.

2.2 Description of the drop pit arrangement given in this specification is only conceptual in nature. It will be the responsibility of contractor to design the complete arrangement so as to achieve intended purpose efficiently & safely.
3.0 Scope of supply
3.1 The scope of supply includes designing, testing, transporting, delivering testing and commissioning of the drop pit at the concerned electric loco shed along with all its concomitant accessories.
3.2 The scope also includes training of IR personnel for safe & efficient use of the drop pit as per provisions given hereinafter in this spec.
3.3 Execution of civil engineering work of construction of pit and foundation is beyond the scope of supply. However, the contractor shall be responsible for preparing & submitting pit, foundation and other related drawings for the civil Engg works of the drop pit for execution by concerned railway unit. The pit should be water proof to avoid seepage of ground water into it. Contractor shall consider this requirement while developing engineering drawings for the pit.
3.4 The power supply during testing & commissioning of the drop pit at concerned electric loco shed shall be given by concerned railway unit free of cost.
3.5 The Rail pieces required for the split rails on drop table and for racking track shall be provided free of cost by concerned railway unit at the time of commissioning of drop pit at the facility.

4.0 Description of drop pit system
4.1 The schematic representation of the drop pit system is given below.
4.2 The locomotive shall be placed on ‘Service Track’ so that the wheel-set to be replaced is positioned over the ‘Drop Table’. After disconnecting necessary connections/linkages, the motorized wheel-set can be dropped and hold/supported on the drop table by means of “Traction motor dolly” fitted on drop table. This drop table, along with the motorized wheel-set placed on it, can be lowered in the deep pit by electrically operated hoisting mechanism and then traversed horizontally in ‘Cross pit’, by means of an electrically operated “Racking mechanism”, to another location and then raised vertically to clear the motorized wheel-set to “Release track”.

For fitment of new wheel-set to the locomotive, the wheel-set shall be placed on drop table at Release track, followed by lowering of the drop table into the deep pit and then traversing up to ‘Service track’ and then raising the drop table for fitment of motorized wheel set in the locomotive.

Except for the disconnection/connection of electrical & mechanical connections/linkages of motorized wheel-set from the bogie/body, all other operations involved in removal/fitment of motorized wheel set shall be possible by operation from a “Control stand Pendant”. During the operation of dropping of wheel-set & till the new wheel-set is fitted back in the locomotive, the suitable points on locomotive bogie/body will have to be supported to bear the load which was on the affected wheel-set. The

<table>
<thead>
<tr>
<th>Prepared by:</th>
<th>Checked by:</th>
<th>Issued by</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSE/SE&amp;AM</td>
<td>ADE/SE&amp;AM/RDSO</td>
<td>DSE/SE&amp;AM/RDSO</td>
</tr>
</tbody>
</table>
points which will need support/hold shall be different for different types of locomotives as their bogie design are different. The schematic diagram & leading parameters of different types of locomotives are given in enclosed Annexure-I to IV for general guidance. However, the contractor shall have to study the design of various classes of locos for deciding such support points and arrangement shall be such that the system is capable of working without any need for manually adjusting/removing/fitting any accessories whenever there is change in the type of loco being handled. The arrangement shall include necessary devices for holding/supporting various parts of the locomotive bogie/body during the wheel-set removal/fitment operation and all other concomitant accessories to make the system fully functional. The design of the drop pit shall be got approved from RDSO prior to commence of manufacture.

4.3 The drop pit shall essentially comprise of following sub-assemblies.

(i) Drop table system with traction motor dolly & hoisting arrangement.
(ii) Racking mechanism for horizontal transfer of drop table
(iii) Support mechanism for providing support to Bogie/body during wheel changing operation.
(iv) Control stand
(v) Concomitant accessories

5.0 Suggested method for changing motorized wheel-set by drop pit.
The suggested method of removal and fitment of motorized wheel-set in their sequential steps is briefly mentioned in following clauses merely for general guidance of the renderers. It is the responsibility of contractor to study the arrangement of locomotive and design the drop pit system for efficient & safe removal & fitment of motorized wheel-set in locomotive. During the wheel-set removal & fitment, the activity of disconnection/connection of various linkages/connections to the motorized wheel-set shall be carried out manually by the Rly staff and rest activities of wheel-set changing should generally be possible from operation from control stand. The contractor shall design the drop pit system considering this aspect.
5.1 Wheel-set changing of WAM4 & WAG5 locomotives

(i) Place the loco over service track so that wheel-set to be removed is correctly positioned over drop table and provide wedges on both sides to avoid rolling of locomotive.

(ii) Open Traction motor power connections cables leads, bellow connections, sand bracket assembly and the brake pull rod on both side and remove the brake blocks.

(iii) Open pedestal caps on both side of wheel-set to be removed

(iv) Support the traction motor by Traction motor dolly jack.

(v) Tighten the nose pad so that it gets compressed.

(vi) Remove the vertical pins from the nose pad after removing the pin keepers and then remove nose pad.

(vii) Further lift the motor with same jack to clear the safety lug & simultaneously provide support at the base of motor.

(viii) In case of middle axle, support the both end equalizer beams near spring seat by means of support mechanism.
In case of end axle, provide support at bogie frame end and equalizer beam near spring seat.

(ix) Now lower the drop table along with wheel-set assembly and traverse to release track location. Raise the drop table to clear the wheel-set to release track.

(x) Place the repaired or new wheel-set on the drop table split rail and then lower the drop table, traverse it to service track location below the locomotive. Clamp the axle box with the drop table to avoid its rotation.

(xi) Raise the drop table so that the split rail of the drop table and rail on the floor comes in same level.

(xii) Clear the motor safety lug with the help of TM dolly jacks and provide the nose pad in compressed condition and then release it. Provide nose pad vertical pins and pin keepers.
(xiii) Provide the pedestal caps and then remove the support from appropriate points.

(xiv) Connect TM leads, Bellow connections, sand brackets, brake pull rod and provide the brake blocks.

5.2 Wheel-set changing of WAG7 locomotives

(i) Place the loco over service track so that wheel-set to be removed is correctly positioned over drop table and provide wedges on both sides to avoid rolling of locomotive.

(ii) Open Traction motor power connections cables leads, bellow connections, dampers, brake rigging items to make the wheel-set free of any obstruction for dropping.

(i) In case of middle axle, provide support at both end equalizers near spring seat by means of support mechanism followed by uncoupling of damper and then remove pins from compensating beam from both ends. In case of end axle, provide support at end of bogie frame and remove equalizer beam along with spring at other end.

(iii) Support the traction motor by Traction motor dolly jack.

(iv) Tighten the nose pad so that it gets compressed. Remove the vertical pins from the nose pad after removing the pin keepers and then remove nose pad.

(v) Further lift the motor with same jack to clear the safety lug & simultaneously provide support at the base of motor.

(vi) Now lower the drop table along with wheel-set assembly and traverse to release track location. Raise the drop table to clear the wheel-set to release track.

(vii) Place the repaired or new wheel-set on the drop table split rail and then lower the drop table, traverse it to service track location below the locomotive. Clamp the axle box with the drop table to avoid its rotation.

(viii) Raise the drop table so that the split rail of the drop table and rail on the floor comes in same level.

(ix) Clear the motor safety lug with the help of TM dolly jacks and provide the nose pad in compressed condition and then release it. Provide nose pad vertical pins and pin keepers.

(x) Provide equalizer beam/pins and then release the support from appropriate points.
(xi) Connect TM leads, Bellow connections, and brake rigging items.

5.3 Wheel-set changing of WAP4 locomotives

(i) Place the loco over service track so that wheel-set to be removed is correctly positioned over drop table and provide wedges on both sides to avoid rolling of locomotive.

(ii) Open Traction motor power connections cables leads, bellow connections, sand bracket assembly and the brake pull rod on both side and remove the brake blocks.

(iii) Open pedestal caps on both side of wheel-set to be removed

(iv) Support the traction motor by Traction motor dolly jack.

(v) Tighten the nose pad so that it gets compressed.

(vi) Remove the vertical pins from the nose pad after removing the pin keepers and then remove nose pad.

(vii) Further lift the motor with same jack to clear the safety lug & simultaneously provide support at the base of motor.

(viii) In case of middle axle, no support is required. However, in case of end axle, provide support at bogie frame below secondary spring seat.

(ix) Now lower the drop table along with wheel-set assembly and traverse to release track location. Raise the drop table to clear the wheel-set to release track.

(x) Place the repaired or new wheel-set on the drop table split rail and then lower the drop table, traverse it to service track location below the locomotive. Clamp the axle box with the drop table to avoid its rotation.

(xi) Raise the drop table so that the split rail of the drop table and rail on the floor comes in same level.

(xii) Clear the motor safety lug with the help of TM dolly jacks and provide the nose pad in compressed condition and then release it. Provide nose pad vertical pins and pin keepers.

(xiii) Provide the pedestal caps and then remove the support from appropriate points.

(xiv) Connect TM leads, Bellow connections, sand brackets, brake pull rod and provide the brake blocks.

5.4 Wheel-set changing of WAG9/WAP7 locomotives

(i) Place the loco over service track so that wheel-set to be removed is correctly positioned over drop table and provide wedges on both sides to avoid rolling of locomotive.

(ii) Open Traction motor power connections cables leads, sensor connection, bellow connections, and brake rigging items.

(iii) In case of middle axle, uncouple the axle guide link from guide mount and remove bogie to axle box link. No support is required for middle axle. In case of end axle, support the bogie frame at end, uncouple guide link from guide mount and remove bogie to axle box damper.
(iv) Support the traction motor by Traction motor dolly jack.
(v) In case of TM 3 & 4, open top & bottom bolt of TM torque arm and lift the motor by means of TM dolly jack and then remove the TM torque arm. in case of TM 1, 2, 5 or 6, uncouple bottom fixing bolt of torque arm. Pull bottom side of TM torque arm to disengage from TM.
(vi) Now lower the drop table along with wheel-set assembly and traverse to release track location. Raise the drop table to clear the wheel-set to release track.
(vii) Place the repaired or new wheel-set on the drop table split rail and then lower the drop table, traverse it to service track location below the locomotive. Clamp the axle box with the drop table to avoid its rotation.
(viii) Raise the drop table so that the split rail of the drop table and rail on the floor comes in same level.
(ix) Make TM torque arm connection. Then release the support from appropriate points.
(x) Connect TM leads, Bellow connections, brake rigging items, guide link, damper etc.

6.0 Requirements of Design & Construction

6.1 Drop Table System

6.1.1 The drop table shall be designed utilizing inherently self locking, electrically activated mechanical screw jacks. The screws shall rotate for the drop table to move up and down. All screws, jacking nuts and gear boxes used for the lifting shall be interchangeable requiring only the minimal spares of each type. The screws shall be designed to work under compression

6.1.2 The Lifting and Lowering motor of the Drop Table shall be of—min 15 HP reversible and totally enclosed ac Induction motor with suitable starter or VVVVF control drive. The motor shall have an integral disc brake mounted on the shaft. The tenderer shall furnish the calculations for arriving at the rating of the motor offered.

6.1.3 The split rails on the Drop Table shall be positioned flush with the floor tracks at the facility. Provision of a lock-bar or other suitable device shall be made to ensure that split rails are properly positioned flushed with floor tracks. Suitable control mechanism by employing limit switches or other means shall be incorporated so as to prevent next operation if the split rails are not in correct position.

6.1.4 Skid mechanism shall be provided in drop table system for holding the wheel-set in position and preventing it from rotation on the split rails.
6.1.5 The Traction Motor Dolly of the drop table system shall contain an electrically operated hydraulic jack with minimum 20 Ton capacity to position and support the traction motor. The dolly shall be easily positioned and lockable at 50 mm (2") increments. The surface of the Traction Motor Dolly shall be a checkered plate design providing suitable roughness to prevent slipping. Moreover, the dolly jack shall have suitable arrangement so that traction motor does not slip after resting on it.

6.1.6 All shafts, jacking screws and thrust bearings shall be greased through an automatic lubrication system. Grease fittings shall be provided in the screws for all other areas requiring lubrication such as shafts, bearings etc. Speed reducing gear boxes shall be lubricated by a suitable system.

6.1.7 The Drop Table system shall be made from very strong material like fabricated steel. The jack nuts that cause the lift beam to raise shall be easily accessible and replaceable. Each screw shall be supported by a common beam structure at both bottom and top of the screw.

6.1.8 The drop table shall automatically center itself as it approaches the flush floor.

6.1.9 The Drop Table shall be designed to "drop" into the pit into place. It shall not be designed to hang off the pit walls or floor structure.

6.1.10 Stress calculations shall use a safety factor of 5 (minimum) based on Ultimate tensile strength.

6.2 Racking mechanism

6.2.1 The drop table shall traverse horizontally in cross pit by means of racking mechanism. Gear wheel arrangement driven by electric motor shall be provided so that drop table system traverse on the rails laid in deep pit.

6.2.2 There shall be minimum 4 wheels for providing stability to the horizontal movement of drop table system. The contractor shall decide the gauge of the racking track considering stability of movement and same shall be got approved from RDSO before commencement of manufacture.

6.2.3 The motor used in the racking mechanism shall be a 3/4 HP (minimum) reversible and totally enclosed ac induction motor with integral disc brake mounted on shaft and with a suitable starter or VVVF drive. Hydraulics shall not be used in any of the Drop Table lift or traversing system. The tenderer shall furnish the calculations for arriving at the rating of the motor offered.
6.2.4 Suitable means shall be provided to prevent over-travel or bumping of the drop table at the end of movement to location of service/release track.

6.2.5 Stress calculations shall use a safety factor of 5 (minimum) based on Ultimate tensile strength

6.3 **Support Mechanism**

6.3.1 Support mechanism shall consist of a number of hydraulic jacks which can move in all three dimensions i.e. longitudinal, lateral and vertical directions so as to be positioned at appropriate points for providing support to the bogie/body during the wheel changing process.

6.3.2 The arrangement shall be such that it can be used for all types of locos mentioned in scope of this specification without needing any manual adjustments.

6.3.3 As the points needing support shall be different for different class of locomotives, the movement settings may be predefined which can be selected from control panel. Once the type of loco is selected from control panel, the support mechanism should enable positioning to provide support at appropriate points for that class of loco.

6.3.4 Details of support mechanism shall be designed by contractor and shall be got approved from RDSO prior to commencement of manufacture.

6.3.5 Stress calculations shall use a safety factor of 5 (minimum) based on Ultimate tensile strength.

6.4 **Requirements of Operational Controls**

6.4.1 The operation of the machine shall be by push buttons or levers. Touch pad type electronic buttons shall not be accepted. The basic rules for the direction of movements of the machine tools shall be as per IS:2987 – 1985

6.4.2 The control devices shall be

- Clearly visible and identifiable
- Ergonomically positioned for safe & efficient operation without hesitating or loss of time and without ambiguity

6.4.3 All movements of the Drop Table mechanisms shall be controllable from a control stand. In addition a push button type pendant control located at a suitable location which will be at a safe distance from the mechanism shall also be provided. Suitable cabling for this purpose shall be provided.
6.4.4 The controls shall have suitable interlocking to prevent operation of horizontal movement till vertical movement has been fully completed. Similarly vertical movement shall be prevented until the horizontal movement has been completed fully.

6.4.5 All controls, pendants, control cabinets and cabling shall be moisture and dust proof. The cables shall have high quality insulation capable of withstanding prolonged periods of high relative humidity of 100%.

6.5 Requirements of Safety features & Controls

6.5.1 The machine shall incorporate safety devices to provide protection to the operator, locomotive & wheel-set being handled and machine itself against all possible operational machinery failures. Suitable interlocks shall be provided to prevent machine operations in the event of

- Faulty sequence of operation
- Fluctuation in supply voltage
- Resumption of power supply after power failure
- Non-positioning of safety guards
- Failure of hydraulic system (where applicable)
- Failure of lubricating system (In case of automatic including drop in pressure lubrication)

6.5.2 A fault or damage in the control circuit or interruption re-establishment after an interruption of fluctuation in whatever manner in the power supply to the machinery must not lead to dangerous situations in particular.

- The machinery must not start unexpectedly
- No moving part of the machinery or piece held by the machinery shall fall or be ejected
- The protection devices must remain effective

6.5.3 The machine shall be fitted with an emergency stop device to enable actual or impending danger to be averted. This device should become active as soon as drop pit system is energized. This device must be

- Conveniently located
- Clearly identifiable
- Stop the machine as quickly as possible without causing additional hazards

The emergency stop must remain engaged: It should be possible to disengage it only by appropriate operation. Disengaging the control must not restart the machinery automatically but only permit restarting.
6.5.4 Safety features shall also include:

- Safety device against overload for all mechanical and electric items to the extent possible
- Safety stops against over-running of slides

6.5.5 Guard and protection devices shall protect exposed persons against risks to moving transmission parts (such as pulleys, belts, gears, rack, pinion and shafts etc.) and moving parts directly involved in the process to the extent possible. This shall meet the following requirements.

- Be of robust construction
- Not give to any additional risk
- Not be easy to bypass or render non-operational
- Be located at an adequate distance from danger zone
- Cause minimum obstruction to the view of the production process
- Rigidly connected and not prone to rattling
- Enable essential work to be carried out without the guard or protection device having to be dismantled.

6.5.6 A load meter shall be provided to indicate the load on the machine. The meter shall have a suitable mark to indicate the maximum load the machine can take.

6.5.7 Audio-visual indicators shall be provided to indicate that a drop table is in operation.

6.5.8 The Drop Table shall be provided with high and low limit switches as well as auxiliary mechanical stops and run-out provision to protect the Drop Table if the low limit switch fails. In case of the failure of the low limit switch, the nut shall automatically dis-engage from the lifting beam guide pocket before the lifting beam touches and damages the gear box or other parts. A lifting beam dis-engagement limit switch and indicator light shall also be provided.

6.5.9 The drop table shall be designed to sustain load without collapse if both high and low limit switches as well as the emergency switch fails.

6.5.10 Four adjustable wheel stops shall be provided that clamp on the running horizontal rail of the table.

6.5.11 The drop table motors, shall be equipped with brakes that activate when power is shut off to the motor. In case of a power failure the Brakes shall activate.
6.5.12 A flashing indication light shall be provided at convenient location. This light shall remain red while an operation is in process and shall become green only when the operation has been successfully completed and command for next operation can be given.

6.5.13 Supplier’s design shall provide necessary features for the safe operation of the Drop Table and shall advise the Railways of Safety concerns that they become aware of during the Installation of the Drop Table system.

6.6 Requirements of Lighting

6.6.1 Integral lighting suitable for the operations concerned where its lack is likely to cause a risk despite ambient lighting of normal intensity shall be provided.

6.6.2 The manufacturer must ensure that there is no area of shadow likely to cause nuisance, that there is no irritating dazzle and that there are no dangerous stroboscopic effects due to lighting provided by the manufacturer.

6.6.3 Integral parts requiring frequent inspection and adjustment and maintenance areas must be provided with appropriate lighting.

6.6.4 The machine lighting should be low voltage (i.e. 110V or 24V) so as to prevent any hazard to the operator.

6.7 Requirements of Coolant System (if used)

6.7.1 Suitable coolant system with pump, motor, tank, filter etc. shall be provided. The coolant pump shall be as per IS: 2161-1962. The filter shall be of reusable type and filter cartridge shall be readily available in India. Source of supply shall be indicated. Adequate no. of filters for 2 years working on double shift basis shall be offered as spare. The supply of coolant shall be in ample volume. Provision to re-circulate the coolant shall be available. A chip and coolant tray shall be provided. The volume of coolant flow shall be indicated.

6.8 Requirements of Lubrication System (if used)

6.8.1 The machine shall be provided with an automatic lubricating system for ensuring delivery of adequate quantity of lubricant to areas requiring continuous lubrication. Suitable arrangements must be provided for indication of failure of the lubricating system.

6.8.2 The system shall be provided with interlock to prevent machine operating/starting in the event of the failure of the lubricating system.

6.8.3 Reusable filters capable of filtering chips, dust particles etc. shall be provided. Indicators for showing clogged condition of filters shall be provided.

<table>
<thead>
<tr>
<th>Prepared by:</th>
<th>Checked by:</th>
<th>Issued by</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSE/SE&amp;AM</td>
<td>ADE/SE&amp;AM/RDSO</td>
<td>DSE/SE&amp;AM/RDSO</td>
</tr>
</tbody>
</table>
available. The filter shall be indigenously available. If reusable filter cannot be offered the filter cartridge shall be readily available in India. Source of supply shall be indicated. Adequate no. of filters for two years working on double shift basis shall be offered as spare.

6.8.4 Lubrication and filter cleaning chart shall be displaced on a metal plate at a conspicuous location on the machine indicating:

   a) Specific location of points on the machine to be oiled lubricated/greased.
   b) Periodicity of lubrication of these points
   c) Location of Filter to be cleaned
   d) Periodicity of cleaning filters
   e) Periodicity of replenishing lubricating oil for the centralized system
   f) Any other similar relevant information

6.8.5 Points where manual lubrication is needed shall be separately indicated. Frequency of lubrication shall be also clearly mentioned

6.8.6 Lubricating Oils used in the machine shall be available in India. Successful tenderer will be indicating brand names of approved oils manufactured by various Indian Oil Companies

6.8.7 First full of lubricating oils used in the machine shall be provided with the machine.

6.8.8 Details of lubricating system provided shall be indicated.

6.9 Requirements of Pneumatic System( if used)

6.9.1 The compressed air supply will be provided by the customer at the machine within pressure range of 4.5 – 7.5 Kg/sq.cm and moisture content of 1000 PPM. The pneumatic system of the machine should be designed accordingly. An alarm shall be provided for low air pressure.

6.9.2 Suitable filter/moisture trap shall be provided by the contractor in the system of pneumatic air intake. The filter shall be of reusable type and indigenously available. If reusable filter cannot be offered, the filter cartridge shall be easily available in India. Source of supply shall be indicated: Adequate no. of filters for two years working on double shift basis shall be offered as spare.
6.9.3 Air pressure regulator, if necessary, shall be provided.
6.9.4 The maker of pneumatic control equipment shall be of reputed make. The makes shall be indicated

6.10 Requirements of Hydraulic System (if used)
6.10.1 Hydraulic circuit must be equipped with the following safety and inspection equipments:
   a) Pressure gauges at all places, where pressure has to be set up or inspected
   b) Safety valves for hydraulic circuit if relief valve does not fulfill this function.
   c) Equipment for checking of temperature in the circuit on the pump wherever necessary
   d) Arrangement to show if the filters (including those in the pump set) are chocked and need cleaning. The filter shall be of reusable type and indigenously available. If reusable filter cannot be offered, the filter cartridge shall be readily available in India. Source of supply shall be indicated. Adequate no. of filters for two years working on double shift basis shall be offered as spare.
   e) Alarm for low oil level.
6.10.2 The sump aggregate shall have the following:
   a) Oil level sight gauges or any other equipment showing the minimum and maximum oil levels in pump
   b) A drain plug at the lowest position of the tank
   c) It shall be possible to drain the oil from the tank without disconnecting any pipes or other fittings
6.10.3 The temperature of Oil in hydraulic circuits shall not exceed 60 degrees C in any case. Suitable arrangements shall be incorporated to ensure that the oil is not overheated under local weather conditions at continuous normal working of the machine.
6.10.4 Facilities for bleeding of air in case of air lock shall be provided
6.10.5 The hydraulic reservoir, pump and allied equipment shall be suitably segregated from machine in order to remove major source of heat.
6.10.6 Hydraulic oils used on the machine shall be available in India, successful tenderer will be required to indicate brand names of approved oils supplied by various Oil Companies of India.
6.10.7 First fill of hydraulic oils used on the machine shall be provided with the machine

<table>
<thead>
<tr>
<th>Prepared by:</th>
<th>Checked by:</th>
<th>Issued by</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSE/SE&amp;AM</td>
<td>ADE/SE&amp;AM/RDSO</td>
<td>DSE/SE&amp;AM/RDSO</td>
</tr>
</tbody>
</table>
6.10.8 The hydraulic system elements shall be from reputed manufacturers. The make of different elements shall be clearly indicated. Details of Hydraulic system shall be indicated.

6.11 Requirements of Rigidity & Stability

6.11.1 The machine shall be robust, rigid and sturdy construction. It shall be designed to meet heavy duty demands of various operations on the machine under normal workshop environment for such machines. It shall be free from vibrations even when working at full capacity.

6.11.2 All machines castings shall be made of close grained high grade cast iron or equivalent materials meeting IS:210 Standards to ensure durability and rigidity. The casting shall be thermal stress relieved to ensure stability and continued accuracy.

6.11.3 All machine fabrication of critical load bearing assemblies like beds, columns etc. shall be adequately strengthened and stress relieved.

6.11.4 Change in ambient temperature shall not affect the performance of the machine.

6.11.5 There shall be no change in the performance of the machine either on switching on the machine or after continuous running.

6.11.6 There shall be no resonant vibrations throughout the working range of the machine at all load levels.

6.12 Requirements of Maintainability

6.12.1 The drop pit system shall be so designed as to require minimum possible maintenance and to give trouble free service.

6.12.2 All assemblies/parts of the system shall be easily accessible for maintenance.

6.12.3 The system shall not require major dis-assembly for checking and replacement of a particular part, especially for parts requiring periodical check up and replacement.

6.12.4 The manufacturer must provide means of access e.g. stairs ladders etc. to allow access safely to all areas used for operational adjustments and maintenance.

6.13 Requirements for Wear Compensation Adjustment

6.13.1 The original built in accuracy of the drop pit shall be capable of being maintained conveniently and economically by suitable adjustments for taking up wear on slides bearings and load screws.
6.14 Power Supply & Other Electrical Requirements

6.14.1 The Drop pit shall be designed to operate on 415 Volts, 50 Hz, 3 phase AC supply. The voltage and frequency may vary up to ±10% and ±3% respectively. However, rating of the motors shall be decided considering the lower voltage so that rated power is available at lower voltage.

6.14.2 Control Circuit shall be designed to operate at 230V ac (single phase). The system should be operated by contactor logic as well as PLC based logic. Normally the operation shall be made through PLC logic but in case of failure of PLC logic, the operation shall be switched over to contactor logic.

6.14.3 All electrical equipments and material shall comply with appropriate Indian Standard (latest) or National Standards of the country of origin provided the latter are equivalent to or better than the former. For items for which Indian Standards are not published, National Standards shall be acceptable. The tenderer shall indicate the standard applicable.

6.14.4 Protection Arrangements:

6.14.4.1 No Voltage Protection – No voltage protection shall be provided so that machine will not start up again by itself when, following an interruption the supply is restored.

6.14.4.2 Short circuit protection – To protect against short circuit due to insulation failure of faulty connections HRC fuses shall be provided for each motor. The rating of the fuse shall be such as to take care of the over current during motor starting.

6.14.4.3 Over Load Protection – Three phase motors shall be equipped with overload tripping devices on each phase.

6.14.4.4 The drop pit system should be energy efficient with harmonic suppression & power factor improvement features.

6.14.4.5 Single Phase protection – A separate current sensitive delayed action single phasing preventer shall be provided for each motor separately. Overload protection shall not be treated as single phasing preventer.

6.14.5 Control equipments shall be mounted in separate drip proof enclosures. Control enclosures and compartments are to be so designed as to give adequate protection against ingress of dust, oil, coolant or chips. All control devices like contactors etc shall be front mounted on a rigidly fabricated metal panel for ease of operations. All other electrics shall be so installed that they are readily accessible when the doors and covers are opened.
Hinged covers shall be interlocked with the machine tool control to prevent operation of the machine when cover is open.

6.14.6 All electrical equipments shall comply with the requirement of Indian Electricity Act and Rules.

6.14.7 The supplier shall furnish complete electrical and electronic wiring diagrams in full details to enable the maintenance staff to locate faults in the circuits: catalogues, maintenance manuals operating instructions with details of coils and windings, used in the equipment to facilitate repairs and manufacture and maintenance should also be supplied.

6.14.8 The motors shall be totally enclosed fan cooled in standard frame size having minimum Class “F” insulation. Motors shall be designed to withstand frequent starts, stops and reversals as demanded in the operation of the machine. Two earthing terminals shall be provided on all electric motors including the control gear.

6.14.9 In case input voltage goes beyond the range specified above the protective relay shall be provided as a concomitant accessory to trip the A.C. power supply to the machine instantaneously and to give audio and visual indication to the operator. Rating of the protective relay for low and high voltage shall be 320 volts and 460 volts respectively.

7.0 SPECIAL DESIGN & CONSTRUCTION FEATURES

7.1 Supplier shall provide a listing of all the Special Features incorporated in Drop pit, clearly indicating advantages of these features.

8.0 DEVIATIONS

8.1 Supplier shall certify that their quoted Drop pit fully meets the specifications by enclosing a statement showing compliances and deviations to each clause of specification. In addition, supplier shall enclose a summary explanation of the technical and design features / parameters incorporated in their offered Product that meets the Customer technical performance requirements as specified in this specification. Tenderers must note that minor deviations from this specification which do not affect or in any way interfere with the stipulated performance standards or would result in

<table>
<thead>
<tr>
<th>Prepared by:</th>
<th>Checked by:</th>
<th>Issued by</th>
</tr>
</thead>
<tbody>
<tr>
<td>SSE/SE&amp;AM</td>
<td>ADE/SE&amp;AM/RDSO</td>
<td>DSE/SE&amp;AM/RDSO</td>
</tr>
</tbody>
</table>
improved safety / reliability or would reduce recurring maintenance / operating cost of the machine, shall be considered for acceptance if the details of the variations are clearly indicated with their implications.

9.0 Design approval, Inspection, Testing, Erection & Commissioning

9.1 Contractor shall furnish complete design details including make/datasheet of bought out parts/equipments to RDSO for examination and approval.

9.2 Contractor shall also submit a test & inspection chart, indicating the tests to be carried out during various stages of manufacture of drop pit at his works and before dispatch of the system, for examination and approval of RDSO.

9.3 The Contractor shall commence manufacture only after obtaining approval of design and stage wise Inspection plan from RDSO.

9.4 The drop pit shall be dispatched only after successful completion of inspection and clearance from authorized Inspection agency as per approved inspection plan.

9.5 Supplier shall arrange to supply the Drop pit system at the premises of the consignee. Erection shall be carried out by and under supervision of contractor's qualified staff. Railway shall provide necessary assistance of making available the power supply, material handling facilities etc during erection of the drop pit.

9.6 After erection of the drop pit at the facility, complete functional tests as per provision of this specification and accepted deviations if any shall be carried out jointly by contractor staff and authorized representative of the Railways. In addition, Supplier shall arrange to have their Qualified Technical staff person jointly carry out a proving test for the Drop Table system, with the authorized representative of the Railways. The test shall consist of removal and fitment of motorized wheel-set of WAM4, WAG5, WAG7 & WAP4 locomotive. Only on completion of the proving test to the complete satisfaction of the Railways, the commissioning certificate will be issued.

10.0 TRAINING

10.1 Supplier's qualified technical staff, during commissioning of the Drop Table system shall fully and adequately train the Railway's Operations and Prepared by: | Checked by: | Issued by |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SSE/SE&amp;AM</td>
<td>ADE/SE&amp;AM/RDSO</td>
<td>DSE/SE&amp;AM/RDSO</td>
</tr>
</tbody>
</table>
Maintenance staff, nominated by the concerned Railway unit at the premises of the installation.

11.0 FOUNDATION & RELATED DRAWINGS

11.1 For the Drop Table system, supplier shall supply the Railways the foundation drawings and the related in-floor mechanical and electrical rough-in foundation requirements, indicating equipment weight, over all dimensions, after receipt of acceptance of tender. Railways will provide the requisite design documents of locomotives to supplier for designing the drop pit system to suit the wheel-set removal from locomotives. The support points of locomotive in case of removal of a wheel-set shall be decided by the supplier as per drawings of locomotives furnished by the Railways. Drawing, Manufacturing and Delivery schedules shall be provided to Railways, so that Railway can arrange necessary plans in advance at the site for installation & commissioning. Supplier will perform all civil engineering calculations of the pit Requirements including any necessary pit drainage concerns.

12.0 COLOUR SCHEME

14.1 The Drop Table equipment and its accessories shall be painted in colour no. -------------(Yellow black strips like ZEBRA crossing) to Indian Standard specification IS:5-1978 or a standard international equivalent specification.

15.0 Warranty

15.1 Any part of the drop pit failing or proving unsatisfactory in service due to defective design, material or workmanship within 36 months from the date of receipt or 24 months from the date of commissioning, whichever is earlier, shall be replaced by the supplier free of cost.

15.2 All consumable shall be arranged by the supplier for carrying out alterations/modification during warranty period.

15.3 The contractor shall be required to make available the services of his engineer/engineers free of cost to watch performance of the drop pit in service periodically and also carry necessary repairs or replacement under warranty obligations. In case of failure of drop pit, the contractor shall ensure
that his service engineers reach the facility within 24 hours of receipt of advise by him/his representative through fax/phone/email etc.

16.0 INFRINGEMENT OF PATENT RIGHT
16.1 Indian Railways shall not be responsible for infringement of Patent rights arising due to similarity in design, manufacturing process, and use of components in design/development/manufacturing of drop pit and/or any other factor, which may cause such dispute. The responsibility to settle any such issue will rest with the manufacturer.

17.0 Details to be furnished by Tenderers in their offer
17.1 Following details shall be furnished by tenderer in his offer.

- Clause by Clause comments against provision of this specification giving broad technical details wherever required.
- List of deviations to the provisions of this specification giving reasons & implications thereof.
- Summary of technical details of the system offered as per Annexure-VI.

18.0 Annual Maintenance Contract
The tenderer should also quote for 3 and 5 years Annual Maintenance Contract (AMC) including consumables and spare parts with cost break-up. Railway will take decision regarding acceptance of AMC and its period while placing purchase order.
Annexure-I

Salient data & Schematic of WAM4 Locomotive

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Loco Weight</td>
<td>112.8 ton</td>
</tr>
<tr>
<td>2</td>
<td>Axle Load</td>
<td>18.8 ton</td>
</tr>
<tr>
<td>3</td>
<td>No of bogie</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>No of axle per bogie</td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Wheel base</td>
<td>3810</td>
</tr>
</tbody>
</table>

Prepared by: SSE/SE&AM
Checked by: ADE/SE&AM/RDSO
Issued by: DSE/SE&AM/RDSO
### Salient data & Schematic of WAG5HR Locomotive

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Loco Weight</td>
<td>126 ton</td>
</tr>
<tr>
<td>2</td>
<td>Axle Load</td>
<td>21 ton</td>
</tr>
<tr>
<td>3</td>
<td>No of bogie</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>No of axle per bogie</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Wheel base</td>
<td>3810 mm</td>
</tr>
</tbody>
</table>

---

Prepared by: SSE/SE&AM  
Checked by: ADE/SE&AM/RDSO  
Issued by: DSE/SE&AM/RDSO
Annexure-III

Salient data & Schematic of WAG7 Locomotive

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Loco Weight</td>
<td>123 ton</td>
</tr>
<tr>
<td>2</td>
<td>Axle Load</td>
<td>20.5 ton</td>
</tr>
<tr>
<td>3</td>
<td>No of bogie</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>No of axle per bogie</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Wheel base</td>
<td>3800 mm</td>
</tr>
</tbody>
</table>
Annexure-IV

Salient data & Schematic of WAP4 Locomotive

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Loco Weight</td>
<td>112.8 ton</td>
</tr>
<tr>
<td>2</td>
<td>Axle Load</td>
<td>18.8 ton</td>
</tr>
<tr>
<td>3</td>
<td>No of bogie</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>No of axle per bogie</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Wheel base</td>
<td>3895 mm</td>
</tr>
</tbody>
</table>

Prepared by: SSE/SE&AM  
Checked by: ADE/SE&AM/RDSO  
Issued by: DSE/SE&AM/RDSO
Annexure-V

Salient data & Schematic of WAG9/WAP7 Locomotive

<table>
<thead>
<tr>
<th>Sr No</th>
<th>Item</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Loco Weight</td>
<td>123 ton</td>
</tr>
<tr>
<td>2</td>
<td>Axle Load</td>
<td>20.5 ton</td>
</tr>
<tr>
<td>3</td>
<td>No of bogie</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>No of axle per bogie</td>
<td>3</td>
</tr>
<tr>
<td>6</td>
<td>Wheel base</td>
<td>1850 mm</td>
</tr>
<tr>
<td>7</td>
<td>Bogie base</td>
<td>15700 mm</td>
</tr>
</tbody>
</table>

Prepared by: SSE/SE&AM
Checked by: ADE/SE&AM/RDSO
Issued by: DSE/SE&AM/RDSO
Annexure-VI

**Technical Details to be furnished by tenderer along with offer**

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Drop Table</td>
<td>Size over jacking screws(Length X Width X Height)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motor Rating</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motor Control-Gear wheel or VVVF or Both</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Screw jack to motor shaft Gear ratio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Length of split rail</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Load capacity (tons)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Traction motor Dolly-jack capacity and max travel</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Lowering/lifting speed (Min &amp; Max)</td>
</tr>
<tr>
<td>2</td>
<td>Racking mechanism</td>
<td>Racking Track Gauge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Racking wheel diameter &amp; Gauge</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motor rating</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Motor control-Gear wheel or VVVF or both</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Racking speed (Min &amp; Max)</td>
</tr>
<tr>
<td>3</td>
<td>Lubrication System</td>
<td>Grease/Oil types</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Qty for full fill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rate of consumption of lubricants</td>
</tr>
<tr>
<td>4</td>
<td>Hydraulic System</td>
<td>Type of fluid used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Qty for full fill</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rate of consumption of fluid</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Rating and type of pump</td>
</tr>
<tr>
<td>5</td>
<td>Compression System</td>
<td>Type, rating and make of compressor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Reservoir capacity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Working pressure and safety valve settings</td>
</tr>
<tr>
<td>6</td>
<td>Control Stand</td>
<td>Type, rating and no of contactor/Relays</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Name of Operator controls</td>
</tr>
<tr>
<td>7</td>
<td>Support Mechanism</td>
<td>No and capacity of Jacks.</td>
</tr>
<tr>
<td>8</td>
<td>Electrical Load</td>
<td>Connected load (KW)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Full load KW</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pf at full load</td>
</tr>
<tr>
<td>9</td>
<td>Concomitant accessories</td>
<td>Name, type and purpose.</td>
</tr>
<tr>
<td>10</td>
<td>Total weight of the system</td>
<td></td>
</tr>
</tbody>
</table>
Meaning and definitions of the terms

1. **Service Track**: The track on which loco shall be placed for changing of wheel set.

2. **Release Track**: The track from which the removed wheel set shall be cleared and new/repaired wheel set shall be placed on drop table for further fitment in locomotive.

3. **Cross pit**: Portion of deep pit between the service track and release track and at 90 degree to these tracks. The drop table shall traverse horizontally in the cross pit.

4. **Service Pit**: The pit provided on service track portion.

5. **Drop table**: The arrangement which can lift or lower in deep pit and traverse horizontally in cross pit. The arrangement shall be used for carrying the affected wheel set on it for removal/fitment in the locomotive.

6. **Traction motor dolly**: A mechanism of drop table having hydraulic jacking system for supporting traction motor on the drop table.

7. **Split rail**: Portion of the rails which can move along with drop table. These rails are positioned flush with service/release track when drop table is fully raised. The wheels of the affected wheel set shall rest on these split rails during wheel-set changing process.

8. **Racking mechanism**: A mechanism provided in cross pit and drop table to facilitate horizontal movement of drop table in cross pit.

9. **Racking track**: The track laid in cross pit for facilitating the horizontal movement of drop table.