

Specn. No. RDSO/2006/EL/SPEC/0041 (Rev '0')



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**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**

**DRAFT
PROCUREMENT SPECIFICATION FOR BOGIE, WHEEL SET AND
TRACTION MOTOR FOR ELECTRIC LOCOMOTIVES**

**RESEARCH DESIGNS AND STANDARDS ORGANISATION
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63199

C O N T E N T

SN	Description	Page No
1.	Assembled bogies with Hitachi Traction Motor for WAG5 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearings, bull gear, axle box with bearings	1
2.	Assembled bogies with TAO-659 traction motor for WAG5 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearings, bull gear (15:62), axle box with bearings	2
3.	Assembled bogies with TAO-659 traction motor for WAG5 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearings, bull gear (17:77), axle box with bearings	3
4.	Assembled bogies with traction motor for WAG7 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearings, bull gear, axle box with bearings	4
5.	Assembled bogies and bolster with traction motor for WAP4 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearings, bull gear, axle box with bearings as per following drawings and specification	5
6.	Wheel set of WAG5 locos (suspension roller bearing suitable for TAO-659 gear ratio 15:62) complete with MSU and bearings, bull gear, axle box with bearings	6
7.	Wheel set of WAG5 locos (suspension roller bearing suitable for TAO-659 gear ratio 17:77) complete with MSU and bearings, bull gear, axle box with bearings as per following drawings and specification	7
8.	Assembled bogie for WAG5 loco with brake rigging, brake cylinder and pneumatic pipelines	8
9.	Assembled bogie for WAG7 loco with brake rigging, brake cylinder and pneumatic pipelines	8
10.	Assembled bogie and bolster for WAP4 loco with brake rigging, brake cylinder and pneumatic pipelines	8
11	Traction Motor Complete TAO-659 suitable for roller suspension bearing assembly	9
12	Traction Motor Complete and armature for HS- 15250	9
13	Special Terms, Conditions & Guidelines to Tenderers	10 -14
14	Annexure I- Minimum requirement of infrastructure and manufacturing facilities for wheel set	15
15	Annexure II-Minimum requirement of infrastructure for assembly of bogie with wheel sets & traction motors	16

P63209

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SN	Description	Page No
1.	Assembled bogies with Hitachi Traction Motor for WAG5 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearings, bull gear, axle box with bearings	1
2.	Assembled bogies with TAO-659 traction motor for WAG5 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearings, bull gear (15:62), axle box with bearings	2
3.	Assembled bogies with TAO-659 traction motor for WAG5 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearings, bull gear (17:77), axle box with bearings	3
4.	Assembled bogies with traction motor for WAG7 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearings, bull gear, axle box with bearings	4
5.	Assembled bogies and bolster with traction motor for WAP4 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearings, bull gear, axle box with bearings as per following drawings and specification	5
6.	Wheel set of WAG5 locos (suspension roller bearing suitable for TAO-659 gear ratio 15:62) complete with MSU and bearings, bull gear, axle box with bearings	6
7.	Wheel set of WAG5 locos (suspension roller bearing suitable for TAO-659 gear ratio 17:77) complete with MSU and bearings, bull gear, axle box with bearings as per following drawings and specification	7
8.	Assembled bogie for WAG5 loco with brake rigging, brake cylinder and pneumatic pipelines	8
9.	Assembled bogie for WAG7 loco with brake rigging, brake cylinder and pneumatic pipelines	8
10.	Assembled bogie and bolster for WAP4 loco with brake rigging, brake cylinder and pneumatic pipelines	8
11.	Traction Motor Complete TAO-659 suitable for roller suspension bearing assembly	9
12.	Traction Motor Complete and armature for HS- 15250	9
13.	Special Terms, Conditions & Guidelines to Tenderers	10 -14
14.	Annexure I- Minimum requirement of infrastructure and manufacturing facilities for wheel set	15
15.	Annexure II-Minimum requirement of infrastructure for assembly of bogie with wheel sets & traction motors	16

A. Material Description and specification:

Assembled bogies with Hitachi Traction Motor for WAG5 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearing, bull gear, axle box with bearings as per following drawings and specification.

SN	Equipment	Description	Drawing No.	Specification no.
1.	Bogie frame	Bogie frame assembly	KPA's Drg. No. ER/KPA/ELA/BE-1003 & ER/KPA/ELA/BE-1004	MP.0.4900.04 Rev 01 – Oct'2004
2.	Primary suspension assembly		KPA's Drg. No. ER/KPA/ELA/BE-1004A	
3.	Brake rigging		KPA's Drg. No. ER/KPA/ELA/AR-294 Sheet No. 1 and ER/KPA/ELA/AR-294 Sheet No. 2	
4.	Wheel and axle assembly for Hitachi Traction Motor	Wheel and axle assembly	KPA's Drg. No. ER/KPA/ELA/WL-068	Wheel specn. no. IRS-R-34 (2003) Axle specn. no. R-43-92
		Solid rolled wheel	CLW Drg. No. 01/1/11/17	- do -
		Axle box with roller bearing	KPA's Drg. No. ER/KPA/EL/AB-151 (Ref NEI's drawing no. 92-4271C) ER/KAP/EL/AB-152 (Ref FAG's drawing no. 901-02-101)	
5.	Gear Case	Gear case assly.	CLW's Drg. No. 05/1/13/166, 06/1/13/167 and 06/1/13/169	
6.	Bull Gear	Pinion (18 t)	RDSO Drg. No. SKDP-3460	MP.0.2800.09 Rev '02' – June'2005
		Gear (64 t)	RDSO Drg. No. SKDP-3459	--do--
7.	MSU	General Arrangement motor suspension unit	CLW Drg. No. IOP701-897	
8.	Traction motor	Traction motor Hitachi 15250A for 25KV.50Hz AC BG electric locomotive		4T CLW / TM/HITACHI-15250A June-1992

10739

B. Material Description and specification

Assembled bogies with TAO-659 traction motor for WAG5 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearing, bull gear (15:62), axle box with bearings as per following drawings and specification.

SN	Equipment	Description	Drawing No.	Specification no.
1.	Bogie frame	Bogie frame assembly	KPA's Drg. No. ER/KPA/ELA/BE-1003 & ER/KPA/ELA/BE-1004	MP.0.4900.04 Rev 01 – Oct'2004
2.	Primary suspension assembly		KPA's Drg. No. ER/KPA/ELA/BE-1004A	
3.	Brake rigging		KPA's Drg. No. ER/KPA/ELA/AR-294 Sheet No. 1 & ER/KPA/ELA/AR-294 Sheet No. 2	
4.	Gear Case	Gear case assly.	CLW's Drg. No. 05/1/13/166, 06/1/13/167 and 06/1/13/169	
5.	Wheel and axle assembly	Wheel and axle assembly	KPA's Drg. No. ER/KPA/ELA/WL-068	Wheel specn. no. IRS-R-34 (2003) Axle specn. no. R-93-92
		Mod. Axle (for TAO-659 with roller bearing)	SKEL – 4511 & SKEL – 4516	- do -
		Solid rolled wheel	CLW Drg. No. 01/1/11/17	- do -
		Axle box with roller bearing	KPA's Drg. No. ER/KPA/EL/AB-151 (Ref NEI's drawing no. 92-4271C) ER/KAP/EL/AB-152 (Ref FAG's drawing no. 901-02-101)	
6.	MSU	MSU - General arrangement of motor suspension unit for traction motor type TAO-659	SKEL 4510	RDSO Specification : Tech specification no. E-7/20
7.	Bull Gear	Pinion (15t)	RDSO Drg. No. DDO-296	MP.0.2800.09 Rev '02' – June'2005
		Gear (62 t)	RDSO Drg. No. SKDL-4455	--do--
8.	Traction motor	Technical specification for traction motor type TAO-659 along with roller suspension bearing assembly and gear case for 25KV AC BG CO-CO locomotive		RDSO Specification : Tech specification no. E-7/20

C. Material Description and specification

Assembled bogies with TAO-659 traction motor for WAG5 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearing, bull gear (17:77), axle box with bearings as per following drawings and specification.

SN	Equipment	Description	Drawing No.	Specification no.
1.	Bogie frame	Bogie frame assembly	KPA's Drg. No. ER/KPA/ELA/BE-1003 & ER/KPA/ELA/BE-1004	MP.0.4900.04 Rev 01 - Oct'2004
2.	Primary suspension assembly		KPA's Drg. No. ER/KPA/ELA/BE-1004A	
3.	Brake rigging		KPA's Drg. No. ER/KPA/ELA/AR-294 Sheet No. 1 and ER/KPA/ELA/AR-294 Sheet No. 2	
4.	Gear Case	Gear case assly.	CLW's Drg. No. 05/1/13/166, 06/1/13/167 and 06/1/13/169	
5.	Wheel and axle assembly	Wheel and axle assembly	KPA's Drg. No. ER/KPA/ELA/WL-068	Wheel specn. no. IRS-R-34 (2003) Axle specn. no. R-93-92
		Mod. Axle (for TAO-659 with roller bearing)	SKEL - 4511 & SKEL - 4516	- do -
		Solid rolled wheel	CLW Drg. No. 01/1/11/17	- do -
		Axle box with roller bearing	KPA's Drg. No. ER/KPA/EL/AB-151 (Ref NEI's drawing no. 92-4271C) ER/KAP/EL/AB-152 (Ref FAG's drawing no. 901-02-101)	
6.	MSU	MSU - General arrangement of motor suspension unit for traction motor type TAO-659 -	SKEL 4510.	RDSO Specification : Tech specification no. E-7/20
7.	Bull Gear	Pinion (17t)	RDSO Drg. No. DDO-299	MP.0.2800.09 Rev '02' - June'2005
		Gear (77 t)	RDSO Drg. No. DDO-300	--do--
8.	Traction motor	Technical specification for traction motor type TAO-659 along with roller suspension bearing assembly and gear case for 25KV AC BG CO-CO locomotive		RDSO Specification : Tech specification no. E-7/20

163202

D. Material Description and specification

Assembled bogies with traction motor for WAG7 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearing, bull gear, axle box with bearings as per following drawings and specification.

SN	Equipment	Description	Drawing No.	Specification no.
1.	Bogie frame	Bogie frame assembly.	CLW's Drg. No. 06/1/12/78 and 06/1/10/2	VL.Spec-6 (Rev 01) – Jan'2001
2.	Brake rigging	Brake gear arrgt.& Details	CLW's Drg. No. 06/1/19/108	
3.	Suspension arrangement	Suspension Arrgt.	CLW's Drg. No. 06/1/15/1	
4.	Wheel axle, axle box arrangement	Wheel, axle, axle box arrangement (Hitachi TM -15250A)	CLW's Drg. No. 06/1/11/1	Wheel specn. no. IRS-R-34 (2003) Axle specn. no. R-43-92
		Solid rolled wheel	CLW's Drg. No. 01/1/11/17	--do--
		Axle box assembly	CLW's Drg. No. 06/1/11/4	
5.	Gear Case	Gear case assly.	CLW's Drg. Nos. 05/1/13/166, 06/1/13/167 and 06/1/13/169	
6.	Bull Gear	Gear(65)	RDSO Drg. no. SKDL-4372	MP.0.2800.09 (Rev '02') – June'2005
		Pinion(16)	RDSO Drg. no. SKDL-4373	---do---
7.	MSU	General Arrangement motor suspension unit	CLW's Drg. No. IOP701-897	
8.	Traction motor	Traction motor Hitachi 15250A for 25KV.50Hz AC BG electric locomotive		4T CLW/TM/HITACHI-15250A June-1992

E. Material Description and specification

Assembled bogies and bolster with traction motor for WAP4 loco with brake rigging, pneumatic pipelines, wheel set complete with MSU and bearing, bull gear, axle box with bearings as per following drawings and specification.

SN	Equipment	Description	Drawing No.	Specification no.
1.	Bogie frame assembly	General arrangement of Bogie(sheet no:1).	CLW's Drg. No. 03/1/10/1	MP.0.4900.04 Rev 01 – Oct'2004
		Bogie Frame Assly	CLW's Drg. No. 03/1/12/38	- do -
		Bolster Assly-	CLW's Drg. No. 03/1/12/40	- do -
2.	Brake gear arrangement	Brake Gear arrangement	CLW's Drg. No. 03/1/19/36, 03/1/19/37 and 03/1/19/38	
3.	Suspension Arrangement	Primary Suspension Arrgt.	CLW's Drg. No. 03/1/15/5	
		Secondary Suspension Arrangement	CLW's Drg. No. 03/1/16/5	
4	Wheel, axle and axle box	Axle For 630KW TM Arrangement(Axle roller bearing type)	CLW's Drg. No. 03/2/11/47	Wheel specn. no. IRS-R-34 (2003) Axle specn. no. R-43-92
		Roller bearing Axles box for flexi coil locos	CLW's Drg. No. 03/1/11/7	
		Solid rolled wheel	CLW's Drg. No. 01/1/11/17	Wheel specn. no. IRS-R-34 (2003)
5	Gear Case	Gear case assly.	CLW's Drg. No. 05/1/13/166, 06/1/13/167 and 06/1/13/169	
6.	Bull Gear	Gear(58)	RDSO Drg. no. SKDL-4355	MP.0.2800.09 Rev '02' – June'2005
		Pinion(23)	RDSO Drg. no. SKDL-4356	---do---
7.	MSU	General Arrangement motor suspension unit	CLW's Drg. No. IOP701-897	
8.	Traction motor	Traction motor Hitachi 15250A for 25KV.50Hz AC BG electric locomotive		4TCLW/TM/HITACHI-15250A June-1992

163203

F. Material Description and specification

Wheel set of WAG5 locos (suspension roller bearing suitable for TAO-659 gear ratio 15:62) complete with MSU and bearings, bull gear, axle box with bearings as per following drawings and specification.

SN	Equipment	Description	Drawing No.	Specification no.
1.	Wheel and axle assembly	Wheel and axle assembly	KPA's Drg. No. ER/KPA.ELA WL-068	Wheel specn. no. IRS-R-34 (2003) Axle specn. no. R-93-92
		Mod. Axle (for TAO-659 with roller bearing)	SKEL - 4511 & SKEL - 4516	- do -
		Solid rolled wheel	CLW Drg. No. 01/1/11/17	Wheel specn. no. IRS-R-34 (2003)
		Axle box with roller bearing	KPA's Drg. No. ER/KPA.EL AB-151 (Ref NEI's drawing no. 92-4271C) ER/KAP.EL AB-152 (Ref FAG's drawing no. 901-02-101)	
2.	MSU	MSU General arrangement of motor suspension unit for traction motor type TAO-659 -	SKEL 4510	RDSO Specification : Tech specification no. E-7/20
3.	Bull Gear	Pinion (15t)	RDSO Drg. No. DDO-296	MP.0.2800.09 Rev '02' - June'2005
		Gear (62 t)	RDSO Drg. No. SKDL-4455	-do-

G. Material Description and specification

Wheel set of WAG5 locos (suspension roller bearing suitable for TAO-659 gear ratio 17:77) complete with MSU and bearings, bull gear, axle box with bearings as per following drawings and specification.

SN	Equipment	Description	Drawing No.	Specification no.
1.	Wheel and axle assembly	Wheel and axle assembly	KPA's Drg. No. ER/KPA/ELA/WL-068	Wheel specn. no. IRS-R-34 (2003) Axle specn. no. R-93-92
		Mod. Axle(for TAO-659 with roller bearing)	SKEL - 4511 & SKEL - 4516	- do -
		Solid rolled wheel	CLW Drg. No. 01/1/11/17	Wheel specn. no. IRS-R-34 (2003)
		Axle box with roller bearing	KPA's Drg. No. ER/KPA/EL/AB-151 (Ref NEL's drawing no. 92-4271C) ER/KAP/EL/AB-152 (Ref FAG's drawing no. 901-02-101)	
2	MSU	MSU - General arrangement of motor suspension unit for traction motor type TAO-659 -	SKEL 4510	RDSO Specification : Tech specification no. E-7/20
3.	Bull Gear	Pinion (17t)	RDSO Drg. No. DDO-299	MP.0.2800.09 Rev '02' - June'2005
		Gear (77 t)	RDSO Drg. No. DDO-300	-do-

063204

H. Material Description and specification:

Assembled bogie for WAG5 loco with brake rigging, brake cylinder and pneumatic pipelines as per following drawings and specification.

SN	Equipment	Description	Drawing No.	Specification no.
1.	Bogie frame	Bogie frame assembly	KPA's Drg. No. ER/KPA/ELA/BE-1003 & ER/KPA/ELA/BE-1004	MP.0.4900.04 Rev 01 – Oct'2004
2.	Brake rigging		KPA's Drg. No. ER/KPA/ELA/AR-294 Sheet No. 1 and ER/KPA/ELA/AR-294 Sheet No. 2	

I. Material Description and specification

Assembled bogie for WAG7 loco with brake rigging, brake cylinder and pneumatic pipelines as per following drawings and specification.

SN	Equipment	Description	Drawing No.	Specification no.
1.	Bogie frame	Bogie frame assembly.	CLW's Drg. No. 06/1/12/78 and 06/1/10/2	VL.Spec-6 (Rev 01) – Jan'2001
2.	Brake rigging	Brake gear arrgt.& Details	CLW's Drg. No. 06/1/19/108	

J. Material Description and specification

Assembled bogie and bolster for WAP4 loco with brake rigging, brake cylinder and pneumatic pipelines as per following drawings and specification.

SN	Equipment	Description	Drawing No.	Specification no.
1.	Bogie frame assembly	General arrangement of Bogie(sheet no:1).	CLW's Drg. No. 03/1/10/1	MP.0.4900.04 Rev 01 – Oct'2004
		Bogie Frame Assly	CLW's Drg. No. 03/1/12/38	- do -
		Bolster Assly-.	CLW's Drg. No. 03/1/12/40	- do -
2.	Brake gear arrangement	Brake Gear arrangement	CLW's Drg. No. 03/1/19/36, 03/1/19/37 and 03/1/19/38	

K. Material Description and specification

Traction Motor Complete TAO-659 suitable for roller suspension bearing assembly as per following specification

SN	Equipment	Description	Specification no.
1.	Traction motor TAO-659	Technical specification for traction motor type TAO-659 along with roller suspension bearing assembly and gear case for 25KV AC BG CO-CO locomotive	RDSO Specification : Tech specification no. E-7/20

L. Material Description and specification

Traction Motor Complete and armature for HS- 15250 as per following specification.

SN	Equipment	Description	Specification no.
1.	Traction motor Hitachi	Traction motor Hitachi 15250A for 25KV.50Hz AC BG electric locomotive	4TCLW/TM/HITACHI- 15250A June-1992
2.	Traction motor Armature for Hitachi TM	Traction motor armature for TM Hitachi 15250A for 25KV.50Hz AC BG electric locomotive	4TCLW/TM/HITACHI- 15250A June-1992

63205

SPECIAL TERMS, CONDITIONS & GUIDELINES TO TENDERERS

1.0 Details of items:

Tenderers should submit their rate/tenders for –

- a) Wheel set complete fitted with MSU and bearings, bull gear and axle box with bearing.
- b) Bogie frame complete with brake rigging and pneumatic pipes, brake cylinder.
- c) Traction motor as per description suitable for roller suspension bearing.
- d) Assembled bogies with wheel sets and traction motor and its testing.
- e) Assembled bogies without traction motor but with wheel set.
- f) Charges for assembly of bogie with wheels and traction motor and its testing.
- g) Charges for assembly of bogie with wheel set without traction motor.
- h) Transportation, packing and forwarding charges to the nominated destination for each of the items from a to e.

- 1.1 All the above items will form a bogie assembly with and without traction motors as a unit. However, purchaser reserves the right to order any one/some/all the items individually or as a set i.e complete motorised bogie as per item given (a to e) as above. The order can be placed either for a entire or part quantity for any item given as serial no: a to h as above.
- 1.2 Railways also reserve the right to increase/decrease the ordered quantity by 30%, if required.
- 1.3 Tenderers must submit their offer separately in two sealed envelopes. The first part of the bid, marked as packet 'A' will contain all the technical details of the assemblies/items given in 1.0 (a to h) as well as their past credentials along with testing facilities and also the technical man power. The second part, marked as packet 'B' will contain the commercial details including the rate of all the cost elements. However, both the part of the offer duly sealed would be in one more sealed cover as per practice in vogue.
- 1.4 The offer should be valid for 180 days from the date of opening of the technical offer. However, any price variation clause based on the raw materials cost should be mentioned separately and explicitly. The base price index should also be mentioned.
- 1.5 All the raw materials, items, spares and components required for manufacturing/equipping of all the assemblies as well as bogies with and without traction motor should be arranged / purchased by the tenderers irrespective of any reference in this regard in any specifications or drawings as mentioned above from approved sources of CLW/RDSO only. In case there is no approved source of CLW or RDSO for any of the components/items tenderers should obtain RDSO's clearance for procuring such items from other sources.

2.0 Drawings/Specifications:

- 2.1 All the drawings and specifications as mentioned for individual items should be followed. The above drawings and specifications are main/assembly drawings. The part drawing numbers are given in the drawing for sub-assembly/assemblies. For any clarifications or queries with respect to drawings, specifications, sources of items and discrepancy if any may be sought from Sr. Executive Director Standards Electrical or Director Standard Electrical-1, RDSO.
- 2.2 Drawings for items/components as referred to in the assembly/sub-assembly drawings mentioned in the specn. should be obtained on payment from Dy. CEE/Design/CLW for CLW's drawing, Dy. CEE/P&D, E. Railway/Kanchrapara Workshop for KPA's drawing and RDSO for RDSO's drawing.
- 2.3 The latest alterations/modifications in all the relevant drawings/specifications should be followed by all the Tenderers.
- 2.4 The prospective vendor should acquaint himself with the various items, equipments, testing methods and other facilities required by visiting Electric Loco Sheds, workshops dealing with the POH of electric locomotives.

3.0 Infrastructures & Credentials:

- 3.1 Tenderers should have minimum facilities of infrastructure, manufacturing, testing and quality control requirements as given in RDSO STR No. IL-45:2003 Rev '0' for 3 axle cast steel trimount and flexi-coil bogie frame & bolster for locomotives, MP Guide No. 17 (Rev '01') for fabricated bogie frame and bolster assembly for locomotives and in annexure I for wheel set and annexure II for bogie assembly.
- 3.2 Along with technical offer, the details of infrastructural facilities as given in relevant STR, organization, man power available with the tenderer shall be enclosed with technical bid. This includes details of machinery and plants, jigs and tools, testing facilities, lab facilities for raw materials testing, measuring tools and instruments and qualification of man power available with them.
- 3.3 Tenderers must submit their Quality Assurance Programme (QAP) for complete process of manufacturing of assemblies including assembly and testing of motorised bogie. The QAP would be approved by RDSO.
- 3.4 Tenderers must submit their credentials for supply of same or similar items to various Railway Units. The details of supplies should be given along with proof of purchase orders and delivery details (copy of receipt note/inspection note etc).

63206

4.0 **Sub-vendors:**

- 4.1 The details of activities where tenderer would take assistance from others should also be furnished.
- 4.2 In all such cases the QAP of sub-vendors should also be submitted as a part of QAP of the tenderer.

5.0 **Inspection:**

- 5.1 The inspection of the sub-assembly/assembly and bogie with and without traction motor would be done as follows –

Stage 1: Bogie frame 100%.

Stage 2: Bogie frame with brake rigging, pneumatic pipeline, brake cylinder etc 50%.

Stage 3: Wheel sets 100%.

Stage 4: Traction motor 100%.

Stage 5: Complete bogie with and without traction motor in assembled condition 100%.

- 5.2 Testing of above items can be arranged at the premises of the tenderer or their sub-vendors/agencies of repute/Govt. approved.
- 5.3 At the time of inspection the bill of materials (BoM) indicating the source of supply, internal test certificate etc would also be shown to the Inspecting Authority. A record to this effect should be maintained by the tenderers.
- 5.4 Tenderers should provide free of cost all the facilities required for testing of all the items including motorised bogie at the time of inspections.
- 5.5 Railways reserve the right for carrying out any surveillance inspection at any stage in the premises of tenderers as well as in its sub-vendor during any stage of manufacturing/assembly of sub-assemblies as well as bogies with traction motor or without traction motor.
- 5.6 Railways reserve the right to reject any sub-assembly, equipment, spares and items during the stage inspection if not found conforming to the drawing/specn. The decision of Railways would be final in this respect.
- 5.7 During the course of various stages of inspection approved QAP of the tenderers will be followed. For any deviation from the QAP, changes in material, testing procedure, process will have to be informed by the tenderers well in advance and should be approved by RDSO.
- 5.7 The inspection of 1st one loco set of each type will be carried out by RDSO and balance by inspecting agency nominated by purchaser.
- 5.8 All the cost incurred for testing including from outside agencies would be borne by the tenderers.

6.0 **Delivery:**

6.1 Tenderers should clearly give their delivery schedule as follows –

- a) Date of commencement of supply of assemblies/items given in 1.0 (a to e).
- b) The rate of supplies per month.
- c) The date of completion of the supply of total quantity as per order.

6.2 All the sub-assemblies/assemblies should be properly packed to avoid damage during transit.

6.3 The transportation of assemblies/assembled bogie with or without traction motor including safe transshipment and unloading in good condition at the nominated consignee should be responsibility of the tenderers. Any damage occurred during the process to the motorised bogie will be on tenderers account.

6.4 Delivery would only be deemed as completed after receipt of all material at the consignee's end in good condition.

6.4 The Tenderer would ensure the insurance cover for all the items during transit as per the cost given in the final purchase order. The cost of insurance will be borne by the tenderer.

6.5 Tenderers should quote for delivery upto destination by road transport

7.0 **Field Trials:**

7.1 Railways reserve the right to put 1st lot on 10% of the total ordered quantity or minimum 2 nos. of the motorised bogie (1 loco set) for field trials for 3 months.

7.2 The field trials would be conducted by the nominated consignee along with the representative of the tenderers.

7.3 Various parameters like temperature rise, clearances and other conditions as per specifications would be monitored, recorded and jointly signed by the consignee and the tenderers for further evaluation and records.

7.4 During the course of field trials, the delivery would not be deemed as completed.

7.5 The decisions made on the observations during the field trials by the Railways would be final and binding to the tenderers.

8.0 **Warranty/Guarantee:**

8.1 Warranty/Guarantee of assemblies/sub-assemblies except bogies with traction motor or without traction motor for 24 months from the date of commissioning or 30 months from the date of supply whichever is earlier is to be given by the

tenderer. The recommended warranty period for bogie frame and bolster will be 5 years.

- 8.2 The guarantee would cover free replacement of all the items/spares against any defect due to poor quality of materials or bad workmanship.
- 8.3 The warranty repairs and replacement of items should be done by the tenderers in its own premises or at the consignees end if permitted by the Railways.
- 8.4 After the warranty repairs, the successful warranty repairs would be certified by the consignee and its decision would be final.

9.0 Terms of payment:

- 9.1 Payment shall be made after receipt of materials in good condition at consignee's end as per clause 6.0. Along with the bill valid ITCC and STCC, inspection certificate, copy of challan duly received by the consignee (not below JA grade officer of Railways) should be submitted.

10.0 Liquidated damage for delay in completion:

If the tenderers fail to execute and complete the work within the time as specified in the purchase order/agreement except in so far as the delay is on purchasers account, the tenderer shall accept the levy of liquidated damages as per extent IRS condition of contract.

11.0 Other terms & conditions:

- 11.1 In general the contract will be governed by the IRS terms & conditions of stores contract.

**MINIMUM REQUIREMENT OF INFRASTRUCTURE AND MANUFACTURING
FACILITIES FOR WHEEL SET**

1. Axle turning lathe (CNC) with grinding and polishing facilities of sufficient capacity.
2. Axle Journal Turning and burnishing (AJTB) lathe
3. Wheel disc boring machine (vertical turret lathe).
4. Wheel press (hydraulic press) machine of 400 t capacity.
5. Surface wheel lathe.
6. EOT crane 5 tonne and 1 tonne capacity.
7. Induction heater/oil bath heater for fitment of bearing.
8. Proper jigs and fixtures for handling wheel disc, suspension tube and wheel set.
9. Measuring instruments for checking dimension/clearances and wheel profile, surface finish etc.
10. Material handling facilities like fork lifter, mobile crane of adequate capacity.
11. Testing facilities like ultrasonography of axle, wheel disc.
12. Dust free environment/cover space for bearing storage and handling.
13. Sufficient cover space for assembly of wheel set.

063208

**MINIMUM REQUIREMENT OF INFRASTRUCTURE FOR ASSEMBLY OF BOGIE
WITH WHEEL SETS & TRACTION MOTORS**

1. EOT crane of 25 t and 5 t capacity.
2. Necessary jigs and fixtures suitable for bogies for checking its squareness, mounting/fitting of brake rigging, pneumatic pipe lines.
3. Sufficient nos. of portable grinders, welding sets, oxy cutting arrangements.
4. Bogie pedestal for mounting of traction motor, gear case and sandwich pads etc.
5. Light run testing arrangement of all 03 motors at a time after mounting the motors on axle, bogie frame and fitment of gear case.
6. Measuring instrument for measurement of clearance, tolerances like filler gauges, micro meter.
7. General purpose tools torque wrenches, pneumatic grinders etc for mounting of motors, brake rigging etc.
8. Sufficient cover space for assembly and testing of bogies.