

**Specification No. : ICF/ELEC/163**  
**No. of Pages : 9**

***Specification for 40 KVA DA Set for use in  
Self Propelled Inspection Car (SPIC)***

**Issued By**

***Integral Coach Factory, Chennai - 38***

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INTEGRAL COACH FACTORY, CHENNAI: 38	ICF/ELEC/163 REV.00 DT: 14.07.2018
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## 1.0 SCOPE:

Design, manufacture, supply, Installation, testing and commissioning of Diesel Alternator set, Underslung mounted, rated for 40 kVA, 415V, AC, 3 Phase, 50 Hz, 0.8 pf and alongwith associated control, instrumentation, protective devices, accessories, fuel pipe lines, exhaust piping, etc., for use in Self Propelled Inspection Car (SPIC).

## 2.0 SERVICE CONDITIONS:

- i. Maximum ambient temperature : 55 deg.C
- ii. Minimum ambient temperature : - 5 deg. C
- iii. Humidity : up to 100%
- iv. Altitude : Max.1200 metres above sea level
- v. Atmosphere : Extremely dusty and desert weather,  
Atmosphere with fog, synthetic dust of brake block shoe, flying ballast etc. The dust contents in air may reach as high as 1.6mg/m<sup>3</sup>.
- vi. Annual Rainfall : Very heavy in certain areas between 1750 to 6250 mm.
- vii. Coastal area : The DA set shall be designed to work in coastal area, humid, salt laden and corrosive atmosphere
- viii. Max. Train speed : 120 Kmph


- ix. DA set as well as accessories to be mounted on the coach shall be designed to withstand service vibrations and buffing shocks as defined below.

- a) Maximum vertical acceleration 3 g
- b) Maximum lateral acceleration 3 g
- c) Maximum longitudinal acceleration 3 g

(corresponding to shunting shocks)

("g" being the "value of acceleration due the gravity)

Sinusoidal form of vibrations, the frequency lies between 1Hz and 50 Hz and their amplitude 'a' expressed in mm, is given as a function of 'f' by the following equations.

		
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- a = 25/f for values of 'f' between 1 Hz and 10 Hz  
a = 250/f<sup>2</sup> for values of 'f' between 10 Hz and 50 Hz

### 3.0 DIMENSIONAL REQUIREMENTS

The Maximum dimensions of the DA set in assembled condition with mounting brackets shall not exceed 2670 mm (L) x 1300 mm (W) x 860 mm – 900 mm (H)\*. Details of mounting bracket dimensions shall be verified from ICF before participation in tender. The weight of the DA set in assembled condition shall not exceed 1800kgs (without fuel)



\*Height shown is only tentative. Actual height will be decided during detail design stage. The manufacturer shall reduce the height of DA set if required.

### 4.0 SCOPE OF SUPPLY:

- DA set in assembled condition along with base frame with stainless steel mounting hardware
- AVM of adequate capacity
- Starter battery box made of stainless steel to SS 304 grade with starter battery of adequate capacity of sealed type lead acid battery.
- Inter-connecting pipes and fittings made of SS between DA set and fuel tank (common fuel tank for DA set and Traction engine).
- Control panel for local operation
- Control panel for remote operation including all controls, protection and indication devices.
- Interconnecting cables between DA set and control panel for remote operation with suitable connectors at the ends.
- Tools for maintenance and major overhauls
- List of consumable spares and recommended critical spares with part numbers and prices shall be provided separately in the offer.

### 5.0 GENERAL REQUIREMENTS:

- The engine shall be of robust and reliable design of the original manufacturers. It should be 4 stroke cycles, air/water cooled, naturally aspirated/turbo charged (as per manufacturer standard), electric start diesel engine developing suitable BHP for giving a power rating as per ISO 8528- Part-1 in KVA at the load terminals of alternator at 1500

			
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rpm at service conditions given in clause 3. The rating of the engine shall be after deration to site conditions. The engine shall be capable of instant start even at cold conditions.

2. Open type DA set is only required. Hence, no acoustic enclosure for DA set is required, however, suitable shielding arrangement to protect against ballast hitting shall be provided.
3. The scope of supply of DA set covers installation and commissioning at ICF as well in zonal Railways.
4. Adequate measures shall be taken while designing the DA set to keep minimum vibration and noise level. The supplier and ICF shall mutually decide the requirement.
5. Engine and alternator shall be directly coupled or coupled by means of flexible coupling as per manufacturer standard design and both units shall be mounted on a common base frame of together with all auxiliaries to ensure perfect alignment of engine and alternator to balance vibration and shock as specified. The mounting frame of DA set shall have corrosion resistant finish. It is recommended that mild steel to IS: 2062 with copper bearing quality or SS304 grade material shall be used. All the hardware and accessories used for assembly of DA set shall be of stainless steel or equivalent material.
6. The engine shall normally be required to operate on diesel fuel grade 'HSD' (High Speed Diesel Oil) to IS: 1460 "Diesel Fuels".
7. All the power and control cables used for interfacing of DA set to local control panel and remote control panel shall be to RDSO spec. NO. RDSO/PE/SPEC/0019. The cables shall be procured from RDSO approved sources only.
8. All the cable terminations shall be done with proper crimping lugs/wire end ferrules.
9. The interconnecting cables shall be supplied in pre-harnessed condition, duly fitted with connectors at both ends. The exact requirement shall be jointly evolved in consultation with the purchaser.
10. The drawings for Engine model, Alternator, Assembly frame, Battery box, Electric schematic, Fuel Schematic, accessories and Bill of Material shall be submitted for approval from ICF before manufacturing.

		
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11. The DA set assembly frame shall be provided with 2 nos stainless steel earthing bosses diagonally for earthing along with stainless steel hardware and accessories.

12. All surfaces of metals, which are to be painted shall be carried out for proper surface preparation.

#### 6.0 Local DA set control panel

Local control panel shall have provision for Start/Stop of DA set for the purpose of repair and maintenance.

#### 7.0 Remote DA Set Control Panel:

7.1 The control panel shall be fabricated out of 1.6 mm thick CRCA steel sheet suitable for integration into on-board electrical. The overall dimensional requirement will be jointly decided between ICF and supplier. The degree of protection required shall be IP- 54 conforming to IEC:60529.

7.2 Terminal blocks of screw less gauge clamp type similar to WAGO type shall be used.

7.3 The control panel shall have integrated 3 phase current measurement, 3 phase voltage measurement, power and frequency measurement instruments, voltage adjusting potentiometer and circuit breaker to protect the alternator.

7.4 The control panel shall be designed to have suitable start/stop controls, alarms for engine and alternator and over current, under voltage and short circuit protections.

7.5 The supplier shall submit complete power and control scheme for approval.

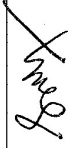
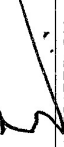
#### 8.0 Starter battery and its battery box.

8.1 The starter battery shall be of sealed type of sufficient capacity and battery set shall be capable of giving 10 starts of 6 seconds duration with the battery 20% discharged.

8.2 The starter battery charging shall be made automatically when DA set is switched on.

8.3 Battery box shall be designed for easy removal of batteries for inspection and maintenance. Tools required for battery maintenance shall be provided.

8.4 Battery box shall be made out of SS304 grade material with suitable locking arrangement.

			
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## 9.0 Fuel tank and fuel pipelines

9.1 Fuel shall be tapped from main fuel tank of traction engine. Necessary fuel pipelines from main tank to DA set including non-return valve shall be provided by the supplier. Separate fuel tank is not required.

9.2 Fuel pipe line connected from engine to fuel tank, flexible hoses pipe fitting (brass), Non-return valves as required at site etc. are under the scope of supplier. The fuel pipe line shall be seamless stainless steel heavy duty pipes grade SS 316 and flexible hoses (SAE 100R1 or better) of appropriate size and length with necessary pipe and end fittings, isolating cocks, union sockets etc. as needed shall be provided by the supplier. The exact quantity shall be verified at site. No banjo type fitting to be used.

9.3 In order to ensure positive flow of fuel in the engine circuit, priming pump shall be provided if required, which shall be under the scope of supplier.

9.4 Drawing for fuel oil suction and return from the engine pump to engine shall be submitted by firm for prior approval of ICF.

## 10.0 Acceptable Make

10.1 Acceptable makes of Engine:

CUMMINS / GREAVES COTTON / KIRLOSKAR OIL ENGINE LIMITED (KOEL) / CATTERPILLAR or any other makes used in Indian Railway rolling stock application.

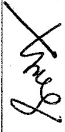
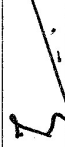
10.2 Acceptable makes of Alternator:

CRMOPTON GREAVES / KEC / BHEL EML / STAMFORD / NIDEC INDUSTRIAL AUTOMATION INDIA (LEROY SOMER) or any other makes used in Indian Railway rolling stock application.

## 11.0 TESTS AND PERFORMANCE

### 11.1 Type test:

All type tests mentioned in table A & B shall be carried out on Diesel engine and alternator at the works of the manufacturer.

			
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**11.1.1.** Testing of one engine and one alternator of each make shall be carried out at the discretion of the purchaser respectively. All facilities for testing as per relevant standard shall be provided by the manufacturer of the respective equipment.

**11.1.2.** If any charges for the type tests are leviable and same may be separately indicated. In the event of equipment failing to comply with the provisions of the relevant standards of this specification, the test charges will not be payable for the first as well as subsequent type tests.

#### **11.1.3. Routine/Acceptance tests:**

The purchaser reserves the right to perform the routine/acceptance tests through the authorised agents or accept the equipment's based on manufacturer's internal test results. In any case, with each equipment, two copies of the internal test/routine/acceptance test result shall be submitted separately.

#### **11.2 TEST ON DIESEL ENGINE**

Prototype, acceptance and routine tests as mentioned in the table given below shall be conducted on the diesel engine:-

**TABLE FOR TESTS ON DIESEL ENGINE :**

SN	Tests	Type test	Acceptance test	Routine test	Cl.of standards As per this specification
1	Verification of overall dimensions and weight of diesel engine and radiator	Y	Y	N	
2	Rating test During the test the following recordings shall be made				ISO:3046, ISO:8528 or latest international standard.
	a) Fuel consumption rate	Y	Y	Y	CPCB certification as per the latest guidelines/ norms will have to be provided by the manufacturer to substantiate the compliance of emission norms.
	b) Lube oil pressure	Y	Y	Y	
	c) Lube oil consumption	Y	N	N	
	d) Cooling water inlet and outlet temperature	Y	N	N	
	e) Exhaust gas temperature	Y	Y	N	
	f) Smoke test	Y	Y	Y	
	g) Torque	Y	Y	Y	
	h) Speed	Y	Y	Y	

		
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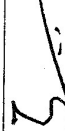

3	Governing test	Y	N	N	ISO:3046, ISO:8528 or latest international standard.
4	Specific fuel consumption (SFC) test	Y	Y	Y	ISO:3046, ISO:8528 or latest international standard.
5	Special test				ISO:3046, ISO:8528 or latest international standard.
	i) Engine heat balance	Y	N	N	
	ii) Sound level	Y	N	N	
	iii) Exhaust gas emission characteristics	Y	N	N	

### 11.3 TESTS FOR ALTERNATOR

Prototype, acceptance and routine tests as mentioned in the table given below shall be carried out on the alternator:-

TABLE OF TESTS FOR ALTERNATOR

Sn	Tests	Type test	Acceptance test	Routine test	Clause of relevant IS/IEC
1	Verification of dimensions of alternator assembly	Y	Y	Y	As per approved drawing
2	Measurement of resistances	Y	Y	Y	Clause 8 of IS: 7132-73
3	Phase sequence test	Y	Y	Y	Clause 11 of IS: 7132-73
4	Regulation test	Y	Y	Y	Clause 7 of IS: 7306-74.
5	Measurement of leakage reactance and potier reactance	Y	N	N	Clause 5.2 & 5.3 of IS: 7306-74.

		
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6	Measurement of OCC (Open circuit characteristics)	Y	Y	Y	Clause 21 of IS: 7132-73
7	Measurement of short circuit characteristics	Y	Y	Y	Clause 21 of IS: 7132-73
8	Efficiency test	Y	N	N	Clause 6.2 of IS:4889-68
9	Temperature rise test for windings	Y	N	N	Clause 25 of IS: 7132-73
10	Temperature rise test on rotating diodes	Y	N	N	10.2.4, 10.2.5 of IEC: 60571-2006
11	Overload test	Y	Y	N	Clause 16 of IS: 7132-73
12	Over speed test	Y	Y	N	Clause 13 of IS: 7132-73
13	Insulation resistance test	Y	Y	Y	Clause 22 of IS: 4722-2001 or latest
14	High Voltage test	Y	Y	Y	Clause 9 of IS: 7132-73
15	Determination of wave form deviation factor	Y	N	N	Clause 12.1 of IS: 7132-73.
16	Determination of wave form distortion factor	Y	N	N	Clause 12.2 of IS: 7132-73.
17	Determination of harmonic factor	Y	N	N	Clause 12.3 of IS: 7132-73

#### 11.4 NOISE MEASUREMENT ON DA SET:

S no	Tests	Type test	Acceptance test	Routine test	Clause of relevant IS/IEC
1	Measurement of Noise level at ICF after completing the installation	Y	Y	Y	As per ISO 8528 (part-10)

		
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#### 11.5 DOCUMENTATION REQUIRED:

- A. O & M Manual of Diesel Engine
- B. O & M Manual of Alternator
- C. Spare parts catalogue of diesel engine
- D. Spare parts catalogue of Alternator
- E. Test Certificate of diesel engine
- F. Test Certificate of Alternator
- G. Test Certificate of D.A. Set

#### 12.0 SPARE PART SUPPORT:

The manufacturer shall provide a priced spare part catalogue along with the supply of DA set and thereafter it shall be updated annually and at intervals as per Railways request.

#### 13.0 GUARANTEE/ WARRANTY

The 40 kVA DA set complete system shall guaranteed for a period of 24 months from the date of commissioning or 36 months from the date of supply whichever is earlier. Type defect, if any shall continue to attract guarantee obligation till the same is successfully overcome. The successful tenderer shall offer prompt free after sales services during the guarantee period in Railways.

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