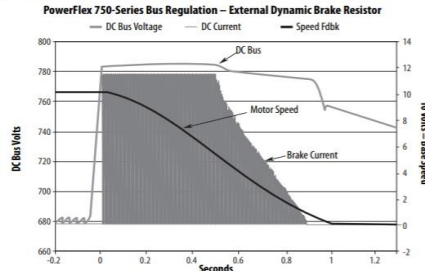


Technical Specification for DC resistance Load Bank (DNA-43-HTSTR-DCRB-19-02)

S. No	Parameter	Specification	Vendor Compliance/Remarks															
1	Application	BHEL is establishing a test rig with 180 KW regenerative drive. The intended resistive load bank is required to dissipate the power generated during braking, deceleration and shutting down.																
2	Type of load bank	- DC Resistor bank - Resistor bank will be connected to the DC bus of the VFD																
3	Total capacity	250 KW																
4	Overloading requirement	Nil																
5	Resolutions/No of steps	Not required																
6	Tolerance of loading from cold to operating temperature	≤20%																
7	DC Voltage and current	- Drive DC bus default regulation is 750VDC, max is 780VDC - Max limit 1000 VDC 400A max P375 [Bus Reg Level] Bus Regulation Level - Sets the turn-on bus voltage level for the bus voltage regulator and the dynamic brake. Turn On Bus Voltage <table><tr><th>P20 [Rated Volts] =</th><th>Default Turn On Volts =</th><th>Min/Max Setting =</th></tr><tr><td>< 252V</td><td>375V</td><td>375V / 389V</td></tr><tr><td>252...503V</td><td>750V</td><td>750 / 779V</td></tr><tr><td>504...629V</td><td>937V</td><td>937 / 974V</td></tr><tr><td>> 629V</td><td>1076V</td><td>1076 / 1118V</td></tr></table>	P20 [Rated Volts] =	Default Turn On Volts =	Min/Max Setting =	< 252V	375V	375V / 389V	252...503V	750V	750 / 779V	504...629V	937V	937 / 974V	> 629V	1076V	1076 / 1118V	
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8	Total Current and Load steps required	- The DB resistor continues to fire throughout the deceleration or braking time. - Resistor needed range is 1.65Ω-2.96Ω with a maximum energy of 115 MJ Watt/heat. - No Load steps required PowerFlex 750-Series Bus Regulation – External Dynamic Brake Resistor 																

9	Duty	• Continuous • Dynamic breaking for a period of 18 minutes to bring the speed of the drive from 3600 RPM to 0 RPM	
10	Sudden loading	Yes	
11	Protections requirements	• Semiconductor DC protection • Individual fuse protection for resistor • Incoming Breaker	
12	Type of cooling	Forced air cooling	
13	Air flow	Horizontal/vertical	
14	Service	Indoor	
15	IP Rating	IP 30 for resistor cubicle	
16	Manual Operation by Push button	Yes	
17	Display meters/parameters	• The control panel shall be accompanied with the following metering: 1. An hour run meter(mechanical/electrical) to record the operation timing. 2. Independent Digital volt meter and ammeter. 3. RS 485 interface for data acquisition of critical parameters such as voltage, current, temperature and equipment operating status . 4. Data logger for temp, voltage, current and fan status etc. to the system 5. An application software to be supplied with the load bank. The basic features required are: a. User friendly GUI. b. Should have provision for remote ON/OFF of the load. c. Should acquire Parameters such as Source voltage, Load Current, Temperature, Load bank status, time (accumulated hours run) etc. d. Should have provision to store the data in the external computer . e. Should have provision to take hard copy print of the data for the selected duration. f. Provision for graphical trending of the acquired data. • The control panel shall be accompanied with the following Indication: 1. Main On indication. 2. Load On indication. 3. Trip indication (separate for over loads and temperature) 4. The indication lamp used shall be of LED / Neon lamp type. 5. Should have provision for emergency switching OFF of the load.	
18	Remote Operation	Shall be able to operate remotely from control room	
19	Standard followed	BS 587 for resistor cubicle	

20	Interlocks / Safety controls	• The heating element of the load bank shall have back up protection with HRC fuse of suitable rating. • The load banks shall be provided with thermal over load relay, such way that the load current exceeds the set value should safe guard the system. • The load bank shall be switched on only when DC voltage is active more than 24V. • Fans shall be on once the DC voltage is detected. and shall be off with a delay even after voltage has come to less than 24V. • A thermostat shall be provided in the load bank enclosure to avoid the excess heat in the resistor. It shall be connected in such a way that, if the heat raises beyond set limit the system should trip.	
21	Mounting arrangement	• Resistor bank enclosure shall be mounted on a frame with wheels for movement. • Load bank bottom frame shall be fitted with suitable castor with build in stop-lock for front wheels.	
22	Enclosure	• The Load bank shall be housed firmly in an M.S enclosure of sheet thickness not less than 1.6 mm • All the sides of the enclosure shall be stuffed with thermal insulating material so that the skin temperature of the enclosure will be restricted to the given body temperature (OR) Separate internal hot air ducting to be provided to avoid heating of the cubicle surface / panels. • The body temperature shall be ≤ 55 deg.C. • The enclosure shall have an adequate ventilation arrangement. And it shall be operated with separate supply of 3-Phase 415 V AC 50Hz. • The capacity of ventilation fan shall be so sufficient to expel the hot air without any local circulation. • The enclosure shall have provision to attach a ventilation duct, so that the hot air will be expelled to the atmosphere through a ventilation duct • Noise Level shall be ≤ 75 dBA, measured at a distance of 1 meter from the equipment. • The enclosure shall be of IP30 in all sides except ventilation air inlet and out let side.	
23	Power cables and control cables	• Power cables and control cables for the equipment shall be in the scope of vendor. (minimum 10 mts for both cable) • Load cables shall be of suitable rating for 400 A, 1000V DC maximum • Adequate rating of Load (power) cable or bus bar shall be supplied along with the control cable to interconnect the load bank with input VFD bus (minimum 5 mts).	
24	Miscellaneous	• Vendor shall supply any of the miscellaneous items which are missed in this document and are required for successful and safe operation of the system based on industry standard. • If vendor quotes against this line item, vendor shall give the list of the items and the quantity of the same along with technical bid.	
25	Painting	• The interior & exterior part of load bank enclosure and frames shall be powder coated with RAL 9002 (White) and RAL 5013 (Blue) • The bottom-mounting frame shall be painted suitably to avoid rusting.	

26	Grounding	All electrical equipment shall be grounded with two numbers of bare copper wires of adequate capacity with external earth connections.	
27	Spares	• Adequate Quantity of Spare parts required for further five-year trouble free operation from the date of I&C shall be included in the offer along with unit particulars. • Detailed list of spares and quantity shall be submitted along with technical offer. • Price of the spares shall be quoted as separate line item with price breakup for the total spares.	
28	Operating Conditions	• Ambient temperature: 0-45 deg.C • Relative humidity upto 90%	
29	Drawings and Documents	<u>Folloowing details shall be subitted along with technical bid</u> • Bill of materials. • Gross dimesnions (LXBXH) and weight of the load bank. <u>The following drawings/Documents shall be submitted for approval</u> a. General Arrangement drawing indicating the detail of load bank and control panel with overall dimensions of load bank. b. Single line diagram and schematic diagram for Power and Control circuits. c. Detailed wiring diagram clearly indicating the wire numbers, terminal numbers, terminal chart and sequence of wiring/looping d. Layout of front panel and main & control contactor e. Cable entry with gland plate details <u>The following documents shall be submitted at appropriate time</u> f. The supplier shall submit comprehensive service and spare part manuals for all the equipment under the scope of this order in addition to standard operating & maintenance manuals along with shipment. h. Three sets of commissioning manual, factory tests, type test, bought out item test certificates and stage inspection test reports (at factory and at vendors) reports shall be handed over as spiral bounded copies after completion of Inspection. • The Supplier shall be responsible for the correct performance of the entire items supplied, irrespective of whether own manufacturing or bought out . BHEL approval of design and component choice does not release the supplier from his responsibility.	
30	Delivery	• The required delivery period for supply 6 weeks from the date of purchase order and the E&C shall be completed in 2 weeks from site readiness. • Vendor shall complete the all the Erection and commissioning (including fabrication if any) after site readiness intimation from BHEL.	
31	Warranty	• Vendor has to provide the on-site warranty (labour, parts) for a period of minimum 12 months from the date of successful commissioning or minimum 18 months from the date of supply and acceptance whichever is earlier for the load bank with control panel and its accessories • The warranty shall be against any manufacturing defects for trouble free performance. During this period any defects arising out of faulty accessories, design or workmanship shall be repaired/replaced by supplier at free of cost. • Vendor shall attend the fault within 48 hours from the reporting time in case of failure of the system or component. • Vendor shall furnish the report by giving details of fault, action taken and steps to prevent occurrence. • Warranty certificates shall be submitted for along with the shipment or after E&C.	

32	Manufacturing test certificates	• Vendor shall submit the manufacturing test certificates for all the components such as resistor, ventilator fan and switchgears if any etc. along with the supply.	
33	Pre-dispatch Inspection	• All routine tests on main equipment and auxiliary equipment as mentioned in this specification shall be carried out in the presence of BHEL representative. The following tests shall be conducted as part of routine tests at their works. a. Dimensional Check b. Physical verification of components c. Insulation resistance tests of load bank with power and control circuits d. High voltage tests on Power & Control wiring – 2.5 kV for One Minute on Power with all meters and instrument transformers in circuit. e. Functional tests including sequence of operation interlocks, speed of operation (sudden loading). f. Verification of test certificates for other bought out items. g. Routine tests on Current Transformers. CTs will be inspected at C.T. manufacturers works h. Continuity test and Polarity test on all coils and circuits. i. Supplier shall make looping of RS 485 ports of multifunction meters separately. This looping shall be tested during pre-dispatch inspection. • Vendor shall give a PDI call 7 days before PDI	
34	Packing And Transport	• The supplier is responsible for the packing and transport to BHEL Corp R&D, Hyderabad. • The equipment shall be packed in wooden crates to preserve the quality defined by the specifications in spite of all jerk, vibrations, exposure to environment, etc. which it may experience during transit. The following shall be clearly given in each box. i) Purchaser ii) Purchase order number iii) Equipment code number if any. • They shall ensure that the equipment is delivered to BHEL without damage and any possible deterioration in the performance due to transport condition.	
35	Installation and commissioning	• Installation and commissioning of the resistance bank shall be completed within 2 weeks from the intimation of site readiness. • The following tests shall be conducted a. Insulation resistance tests of Power and Control circuits b. High voltage tests on Power & Control wiring – 2.5 kV for One Minute on Power and 2 kV for one minute on Control Circuit with all meters and instrument transformers in circuit. c. Functional tests including sequence of operation interlocks. d. Continuity test and Polarity test on all resistance and circuits. e. Supplier shall make looping of RS 485 ports of Incomer & multifunction meters separately. This looping shall be tested after installation and commissioning of PDP • If any discrepancies w.r.t specification, SLD and standards found during installation/commissioning/after erection at site, the tenderer shall rectify the discrepancies at no extra cost.	
36	Safety during Installation and commissioning	• The contractor shall take all the necessary measures to prevent accidents. It is the responsibility of the contractor not to allow any worker to work in an unsafe condition nor with unsafe equipment. • The contractor shall provide adequate and suitable Personal Protective Equipment's (PPEs), wherever they are required, to all concerned personnel. The quality of this safety equipment's shall conform to National (BIS) or International Standards.	