

Sub: Reasoned document based on comments given by M/s Mersen, M/s Industrial Products & M/s ACPL on Final Draft revised specification no.MP.0.2400.60 (Rev.-06) for Specification for procurement of Carbon Brush consisting of carbon block, glue, flexible shunt, terminals, insulated top and tamping powder etc.

Cl. No.	Final Draft Revised Specification No. MP.0.2400.60 (Rev.-06), January'2021	M/s Mersen	M/s Industrial Products	M/s ACPL	RDSO Remarks
1.0	INTRODUCTION: This specification governs various grades of Carbon brushes used in traction machines of diesel-electric locomotives._	No comments	Agreed	No comments	No change required
1.1	SCOPE: This specification covers manufacturing and testing of carbon blocks & brushes used in traction machines of diesel electric locomotives. It also covers properties and testing of various components used in manufacturing of carbon brushes viz. flexible shunt, tamping powder, insulated top, terminals etc.	No comments	Agreed	No comments	No change required
2.0	OBJECTIVE: The objective of the specification is to lay down guidelines for manufacturing and supply of carbon brushes consisting of carbon block, glue, flexible shunt, terminals, insulated top and tamping powder etc.	No comments	Agreed	No comments	No change required
3.0	VENDOR CHANGES IN APPROVED STATUS: All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-8.1-11 dated 01.07.2020 (Title "Vendor-Changes in approved status") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways.	No comments	Agreed	No comments	No change required
4.0	PREFERENCE TO MAKE IN INDIA: The Government of India policy on make in India shall apply.	No comments	Agreed	No comments	No change required
5.0 & 5.1	GENERAL REQUIREMENTS: The firm shall have valid ISO-9001 certification issued by an approved agency with the activity desired clearly mentioned in the scope of certification. The firm shall have a Quality Manual indicating the extent of control over production.	No comments	Agreed	No comments	No change required
5.2	QUALITY ASSURANCE PLAN (QAP):	No Comments	Agreed	No comments	No change required
6.0 & 6.1	SCOPE OF SUPPLY: The scope covers supply of carbon brushes consisting of carbon block, glue, flexible shunt, terminals, insulated top and tamping powder etc.	No Comments	Agreed	No comments	No change required

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6.2	The recommended grade of carbon block with size is furnished as Table-A.	No Comments	Agreed		Para revised as: "The references drawing of Carbon Brush along with applicable machines and locos is furnished as Table-A". More machinery have been also added in Table-A as per the approved grade list. The same is incorporated in 2 nd final draft spec.																								
6.3	Firm shall have to furnish all data given in the Table A & B and get approval of RDSO to qualify for supply of carbon brushes.	No Comments	Agreed	Table-A: Firm shall have to furnish grade data sheet of each approved grade.	No change required																								
6.4	If procurement of carbon block, tamping power and glue is to be done, in form of kit, then Table-A & Table- B to be complied.Sufficient working allowances should be added to the estimated quantity while tendering. The relevant part nos., for tamping powder & glue are given in Table-B for both the firms: <table border="1" data-bbox="159 1011 875 1437"> <thead> <tr> <th>Items → Parameters ↓</th> <th>Tamping Powder</th> <th>Glue</th> </tr> </thead> <tbody> <tr> <td>Type of Powder</td> <td>Silver Coated Copper Tamping Powder/ Graphite Copper Tamping Powder</td> <td>NA</td> </tr> <tr> <td>Packing Condition</td> <td>Powder should be supplied in Sealed condition</td> <td>It contains 02 different Components to be mixed in recommended proportions as declared by the firm.</td> </tr> <tr> <td>Part No.</td> <td>To be furnished by firm in QAP</td> <td>To be furnished by firm in QAP</td> </tr> <tr> <td>Condition</td> <td>Sealed Open</td> <td>Sealed Open & Un-mixed Mixed</td> </tr> </tbody> </table>	Items → Parameters ↓	Tamping Powder	Glue	Type of Powder	Silver Coated Copper Tamping Powder/ Graphite Copper Tamping Powder	NA	Packing Condition	Powder should be supplied in Sealed condition	It contains 02 different Components to be mixed in recommended proportions as declared by the firm.	Part No.	To be furnished by firm in QAP	To be furnished by firm in QAP	Condition	Sealed Open	Sealed Open & Un-mixed Mixed	If procurement of carbon block, tamping power and glue is to be done, in form of kit, then Table-A & Table- B to be complied.Sufficient working allowances should be added to the estimated quantity while tendering. The relevant part nos., for tamping powder & glue are given in Table-B for both the firms: <table border="1" data-bbox="887 1082 1429 1492"> <thead> <tr> <th>Items → Parameters ↓</th> <th>Tamping Powder</th> <th>Glue</th> </tr> </thead> <tbody> <tr> <td>Type of Powder</td> <td>Silver Coated Copper Tamping Powder</td> <td>Bakelite Powder</td> </tr> <tr> <td>Packing Condition</td> <td>Powder should be supplied in Sealed condition (5 Kg/Pack)</td> <td>It contains one component to be mixed Butyl Alcohol in recommended properties as declared by the firm. Butyl Alcohol can be purchase locally as it is highly</td> </tr> </tbody> </table>	Items → Parameters ↓	Tamping Powder	Glue	Type of Powder	Silver Coated Copper Tamping Powder	Bakelite Powder	Packing Condition	Powder should be supplied in Sealed condition (5 Kg/Pack)	It contains one component to be mixed Butyl Alcohol in recommended properties as declared by the firm. Butyl Alcohol can be purchase locally as it is highly	Agreed	No comments	Cl. 6.4 - Since procurement of carbon block, tamping power and glue has been stoped due to closure of Carbon brush manufacturing shop at DMW so this cl. is chaged as below: Procurement of tamping power and glue is to be carried out adhereing to parameters mentioned in Table- B. To make this table
Items → Parameters ↓	Tamping Powder	Glue																											
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	Minimum Shelf Life	06 months	1 Day	06 months	06 months	04 days			inflammable to transport.					is generic.					
							Part No.	To be furnished by firm in QAP		To be furnished by firm in QAP					<p>Table-B is revised & attached as Annex-I</p> <p>For Tamping Powder & Glue Overall Shelf Life is no relevance as minimum shelf life completely justifies the same. Hence no change required in this cl.</p>				
							Condition	Sealed	Open	Sealed	Open & Un-mixed	Mixed							
							Overall Shelf Life	12 months	NA	12 months	NA	NA							
							Minimum Shelf Life	06 months	30 Days	06 months	06 months	04 days							
							Justification for changes: Production details added. The details are also attached as Annexure-A.												
6.5	The requirement of carbon block, tamping powder and glue should be tendered as a kit so that the offers are evaluated as a kit. Since the tamping powder /glue have a limited shelf life, the supply of these items should be staggered in such a way so as to limit the inventory.						As the demand of block have reduced drastically, supply of glue as a kit is difficult since there is a standard production batch size and packing size. Due to less number of block being produced it is not possible to manufacture and pack in smaller units to import and dispatch. It is suggested to buy tamping powder and glue as a separate item kit with minimum quantity. Justification for changes: Production details added.						Agreed	No comments	<p>The para needs to be changed. As a kit has got no relevance in present context so changed as below to justify the carbon brush and its ingredients:</p> <p>"The requirement of carbon block brush, tamping powder, glue, flexible shunt & other ingredients should be evaluated by firm as per requirement considering the limited shelf life of tamping powder & glue".</p> <p>The same is incorporated in 2nd final draft</p>				

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7.0 & 7.1	TESTING: Testing of Tamping Powder: The tamping powder shall be tested against the parameters given below:				Testing of Tamping Powder: The tamping powder shall be tested against the parameters given below: Acceptance test to be incorporated for Rites Inspection. Acceptance of material based on supplier TC.				Agreed	Testing of Tamping Powder: Copper content -accepted based on the suppliers certificate. Justification for changes: We manufacture copper powder ourselves and basic raw material certificate being obtained from supplier on copper content etc.	Spec. Table revised for Bulk density and Flow Rate to make it generic. Following changes to be incorporated in 2nd final draft spec. "The tamping powder shall be tested against the parameters given below in Table-C" The revised Table-C is attached as Annex-II. Description of Type Tests & Acceptance tests have been added in Cl.7.0. The same is incorporated in 2 nd final draft spec.						
	SN	Type of test	Acceptance Criteria for Tamping Powder		Specification of Testing	Type Test	Route Test	SN				Type of test	Acceptance Criteria for Tamping Powder	Specification of Testing	Type Test	Route Test	
	1	Bulk Density	1.80-2.90 gm/cc		IS-4848, 1981	√	√	1				Bulk Density	2.20-3.20 gm/cc	IS-4848, 1981	√	√	
	2	Flow Rate	24-40 sec		for 50 gms powder IS-4840, 2006	√	√	2				Flow Rate	15-35 sec for 50	gms powder IS-4848, 1981	√	√	
		Sieve Analysis (If applicable)	Above #40 Passed	Nil through #40 and retained on #100 Min 75 %	BS-410-1, 2000 and BS-410-2, 2000	√	√	3				Sieve Analysis	Plus	28# 650 microns) Max 0.2 %	BS-410-1, 2000 and BS-410-2, 2000	√	√
			Passed through #100 and retained on #200	Max 20 %		√	√										
			Passed	through #200 Max 5 %		√	√										
	4	Copper Content (If applicable)	80-95%		IS-440,1964	√	√	4 & 5				Copper content & Grain size	No Comments				
	5	Grain Size			50 microns (Max.) BS-410	√	√	Justification for changes:New specification added.									

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7.2	Testing of Glue:— The glue shall be accepted on the test certificate issued by the OEM conforming to their specification or the firm shall produce an under taking for its suitability.					The powder component shall be accepted based on the firm's undertaking for its suitability. Justification for changes: Mixing procedure will submit later.	Agreed	No comments	No change required
7.3	Testing of Carbon block: The Carbon block shall be tested against IS: 13584-1993. The tests shall be carried out on the carbon blocks of different grades as per table given below:					SN. 2 & 6: SN. 2 - Porosity (only for EG Grades). SN. 6 – Ash content (only for EG Grades). Justification for changes: Porosity and Ash content is not applicable for other than EG grades (e.g- BE14Z1, LFC554(I) as these grades belongs to different family. Details are attached as Annexure- C.	Agreed	No comments	Carbon brush is the final product used in various machineries. But testing to be done on carbon block sample only. Hence clause has minor change as: “Testing of Carbon block: The Carbon block sample shall be tested against IS: 13584-1993. The tests shall be carried out on the carbon block of different grades as per Table-D given below”: Table-D is attached as Annex-III. Agreed to: SN 2. Porosity (only for EG grades). SN 6. Ash content (only for EG grades). Changes incorporated in 2 nd final draft spec.
	SN	Tests	Governing Specification	Acceptance limits	Type Test	Routine Test			
	1	Bulk Density	Clause no. 6.0 of IS 13584:1993	As per relevant standards/drawings	√	√			
	2	Porosity	Clause no. 6.0 of IS 13584:1993	As per relevant standards/drawings	√	√			
	3	Hardness	Clause no. 7.0 of IS 13584:1993	As per relevant standards/drawings	√	√			
	4	Resistivity	Clause no. 8.0 of IS 13584:1993	As per relevant standards/drawings	√	√			
	5	Transverse Strength	Clause no. 9.0 of IS 13584:1	93 As per relevant standards/drawings	√	√			
	6	Ash Content	Clause no. 10.0 of IS	13584:1993 As per relevant standards/drawings	√	√			
7.4	Tests of Copper Wire:					Justification for changes: Acceptance test to be incorporated for Rites inspection.	Agreed	SN-2: Measurement of weight-	It is an out sourced item and parameters are
	SN	Tests/parameters	Governing Specification	on Acceptance	Type test	Routine			

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			limit		Test	Details are attached as Annexure- D.		<p>We are accepting based on the supplier's certificate.</p> <p>SN-3:Chemical composition for ETP copper- We are accepting based on the supplier's certificate.</p> <p>Justification for changes: We do not have in house facility. We get it verified with 3rd part NABL approved laboratory.</p> <p>SN-4: Conductivity at 20°C (min.)- We are accepting based on the suppliers certificate. Justification for changes: We do not have in house</p>	<p>verified from Supplier's TC or Test report of NABL/Govt. approved lab only. Changes made in Table-E & placed at Annex-IV. Changes incorporated in 2nd final draft spec.</p>
1	Visual test	Clause 5.4 & 3.1 of IS:13525-92	No abnormality	√	√				
2	Measurement of weight	Clause 6.3.5	f IS:13525-1992	√	√				
3	Chemical composition for ETP copper	IS:191 (Part-5):2007		√	√				
4	Conductivity at 20°C (minimum)	Cl. 6.3.6 of IS13525-92	As per Table	1 of IS-13525 : 1992	√				
5	Electric resistance Test	Cl. 6.3.4 of IS 10810 (Part5)-1984		√	√				
6	Annealing test Before stranding)	Cl. 6.3.3 of IS 13525:1992	As per Table-1 of IS-13525: 1992	√	√				

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				<p>facility. We get it verified with 3rd part NABL approved laboratory.</p> <p>SN-5:Electric resistance Test- We are accepting based on the supplier's certificate.</p> <p>Justification for changes: We do not have in house facility. We get it verified with 3rd part NABL approved laboratory.</p> <p>SN-6:Annealing test- We are accepting based on the supplier's certificate.</p> <p>Justification for changes: We do not have in house</p>	

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									facility. We get it verified with 3rd part NABL approved laboratory.	
7.5	Tests on Flexible Shunt:						Justification for changes: Acceptance test to be incorporated for Rites inspection. Details are attached as Annexure- D.	Agreed	SN-4: Electrical resistance- We are accepting based on the supplier's certificate. Justification for changes: We do not have in house facility. We get it verified with 3rd part NABL approved laboratory. SN-5: Measurement of weight- We are accepting based on the suppliers certificate.	It is an out sourced item and parameters are verified from Supplier's TC or Test report of NABL/Govt. approved lab only. Changes made in Table-F & placed at Annex-V. Changes incorporated in 2 nd final draft spec.
	SN	Tests/parameters	Governing Specificat	on Acceptance limit	Type test	Routine Test				
	1	Visual test	Clause 6.4.1 of IS:13525-92	No abnormality	√	√				
	2	C	nstruction Product Drg.	As per product Drg.	√	√				
	3	Measurement of dia.	Cl	se 6.4.3 of IS:13525-92 As per	product Drg. √	√				
	4	Electrical resistance	Clause 6.4.	of IS:13525-9 IS10810 , Part-5	√	√				
	5	Measurement of weight	Clause 6.4.5 of IS:1352	-92	√	√				
7.6	Tests on Rubber Top:						Justification for changes: Acceptance test to be incorporated for Rites inspection. Details are attached as Annexure- D.	Agreed	SN-2: Tensile Strength- We are accepting based on the suppliers certificate.	It is an out sourced item and parameters are verified from Supplier's TC or Test report of
	SN	Tests/parameters	Governing Sp	cification Acceptance limit	Type test	Routine Test				
	1	Hardness (Shore 'A')	RDSO/M&C/ RP-130/84	70±5	√	√				

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	2	Tensile Strength (Kg)	sq.cm) -do-	50 (min)	√	x			<p>SN-3: longation at Break %- We are accepting based on the suppliers certificate.</p> <p>SN-4: Compression set- We are accepting based on the suppliers certificate.</p> <p>SN-5: Accelerated Ageing Test- We are accepting based on the suppliers certificate.</p>	<p>NABL/Govt. approved lab. only.</p> <p>Changes made in Table-G & placed at Annex-VI.</p> <p>Changes incorporated in 2nd final draft spec.</p>
	3		longation Break % -do-	125 (min)	√	x				
	4	Compression set (%)	-do-	25 (max)	√	x				
	5	Accelerated Ageing Test Hardness (Shore A) max. Tensile strength Elongation at Break	-do-	+7/-0 ± 25% ±	0% √	x				
7.7	Testing of Carbon Brush:						SN-7: Brush Wear	Testing of Carbon Brush:	No comments	<p>Brush wear & Co-efficient of friction are mandatory as per IS:13584-1993 and acceptance limit of grades has to be declared by the firm in QAP.</p> <p>Changes made in Table-H & placed at Annex-VII.</p> <p>Changes incorporated in 2nd final draft spec.</p>
	SN	Tests/parameters	Governing Specification	Acceptance limit	Type test	Routine Test	The test is done as per firms test procedure (confidential) as defined in Annexure- E and not as per clause no. 11.3 of IS 13584:1993.	SN-7: Brush wear- Actual brush wear rate can be measured from the field performance or on actual machine. It can be measured in-house also but data obtained is indicative not actual. So it should be kept optional and to be measured by OEM.		
	1	Work	anship Cl. 16.4 of IS 13466-1992	No abnormality	√	√	Justification for changes: IS 13584 does not give much clarity on the test bench and its procedure. Firm is already having a proven and established test bench with laid procedure (confidential) from its parent company.			
	2	Dimensional	As per relevant drawing	As per drawing	√	√				
	3	Millivolt Drop test	Cl.16.6 of IS:13466-1992	As	Table-2 of IS:13466-1992 √	√				
	4	Pull Out Strength test	Cl.16.7 of IS:13466-1992	As per Table-3 of IS:134	-1992 √	√				
	5	Endurance test	As per cl. No. 7.8 of Spec no-	As per cl. No. 7.8 of Spec no-	√	x	Justification for changes: IS 13584 does not give much clarity on the test bench and its procedure. Firm is already			

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			MP.0.2400.60 Rev-06	MP.0.2400.60 Rev-06			having a proven and established test bench with laid procedure (confidential) from its parent company.	SN:8 Co-efficient of friction-COF can be calculated on Actual machine by OEM, their help is required for COF. It should be done by OEM or from outsourced agency or OEM source. It is difficult to find out without actual machine.		<p>Note- This specification covers carbon brush & its ingredients, But not cover carbon brush assembly. So this Note has got no relevance in present context so deleted. The same change is incorporated in 2nd final draft spec.</p>
6	Test of	Effect of temperature As per clause no. 7.9 of this spec no. MP.0.2400.60 Rev-	6 As per clause no. 7.9 of this spec. no. MP.0.2400.60 Rev-06	√	x					
7	Brush wear	Clause no. 11.3 of IS 13584:1993		√	x					
8	Co-efficient of friction	Clause no. 11.2 of IS 13584:1993		√	x					
	<p>Note : In case of purchase inspection for complete Carbon Brush Assembly, acceptance test will be carried out as per Clause no. 7.7 applicable for Routine test and Internal routine test report of components given above (Para 7.1 to 7.6) may be verified.</p>									
7.8	<p>Endurance test of Carbon Brush (To be conducted during Type Test and at periodic interval as per firm's QAP):</p> <ol style="list-style-type: none"> 1). Select 15 carbon brushes at random from the lot. 2). From the 15 selected brushes, subject 5 brushes to initial millivolt drop test followed by pigtail pullout strength. Average values of mV drop and pigtail pull out strength shall be used for evaluating performance of remaining 10 brushes subjected to endurance. 3). Subject the balance 10 carbon brushes to mV drop test. 100 heating and cooling cycles. The heating/cooling cycles shall consist of passing 1.7 times the normal machine current per flexible for 2 minutes followed by 4 minutes cooling under natural environment. A small hole will be drilled near pigtail into the brush, to determine the temperature rise during this test. 4). During the test, record following for each above 10 brushes:- <ol style="list-style-type: none"> i. Millivolt drop test at each pigtail. ii. Pull out strength of each pigtail. 5). Criteria for Acceptance: 						No Comments	Agreed	No comments	No change required

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	<p>a) The millivolt drop of each brush, subjected to endurance test, shall not exceed five times the average millivolt drop as observed in Test –ii.</p> <p>b) The average value of pull out strength of the 10 brushes, after the test, shall not be less than 70% of the average value of five brushes subjected to Test-ii.</p>				
7.9	<p>Test for Effect of Temperature of Carbon Brush (To be conducted during Type Test and at periodic interval as per firm's QAP):</p> <p>Two samples out of every lot of finished carbon brushes shall be taken and hardness of insulating rubber measured. The samples shall then be put inside oven at 180°C for 2 hours. The hardness of insulating rubber shall not vary by more than $\pm 5\%$ from the value measured before putting the samples in oven. The insulated top joint shall not be removable with normal effort.</p>	<p>Two samples of rubber top out of every lot of finished carbon brush shall be taken and hardness (Shore A) of insulating rubber measured. The samples shall then be put inside oven at 180°C for 2 hours. The hardness of insulating rubber shall not vary by more than +5% from the value measured before putting the samples in oven. The insulated top joint shall not be removable with normal effort.</p> <p>Justification for changes: This test is applicable for the brushes with Rubber Top Design.</p>	Agreed	No comments	No change required
8.0	<p>TERMINALS: Terminals shall be made of electrolytic grade copper. The type and size of the terminals shall be as per drawing. The joints between terminals and flexible shunt of carbon brushes shall be crimped and soldered unless specified otherwise in product drawing.</p>	No Comments	Agreed	No comments	No change required
9.0	<p>INSULATED TOP:</p> <p>Carbon brushes shall be provided with insulated top wherever specified in the product drawing. Dimension & tolerances of the insulated top shall be as per specified product. The insulating material of the insulated top shall be suitable grade of silicon rubber compound and conform to the requirements of RDSO specification no-RDSO/M&C/RP-130/84 (Copy enclosed).</p> <p>A suitable hard top made of hard material bonded with the silicon rubber insulation shall be provided wherever specified in the product drawing. The hard top should not break, crack and the bonding between the hard top and insulating rubber should not fail due to the mechanical forces encountered in service.</p> <p>Insulated top shall be properly fixed on carbon brush top surface by good quality of adhesive. The adhesive shall not adversely affect the properties of rubber of carbon. The joint</p>	<p>INSULATED TOP: Carbon brushes shall be provided with insulated top wherever specified in the product drawing. Dimension & tolerances of the insulated top shall be as per specified product. The insulating material of the insulated top shall be suitable grade of silicon rubber compound and conform to the requirements of RDSO specification no-RDSO/M&C/RP-130/84 2020 (Copy enclosed).- Need a copy of this specs before confirmation- specs was not attached alongwith this document.</p> <p>A suitable hard top made of hard material bonded with the silicon rubber insulation shall be provided wherever specified in the product drawing. The hard top should not break, crack and the bonding between the hard top and insulating rubber should not fail due to</p>	Agreed	No comments	<p>Copy of M&C Spec. no. RDSO/M&C/RP-130/84 2020 is attached along with revised spec.</p> <p>"The joint formed shall not be removable with normal effort" The above line has been removed as there is no procedure to ascertain a normal force during</p>

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	formed shall not be removable with normal effort.	<p>the normal mechanical forces from the brush holder spring as encountered in service. However, there is no procedure to check in case of purchase inspection.</p> <p>Insulated top shall be properly fixed on carbon brush top surface by good quality of adhesive as per firm;s internal procedure. The adhesive shall not adversely affect the properties of rubber of carbon. This line (The joint formed shall not be removable with normal effort) to be remove. There is no procedure to ascertain a normal force during checking and may be misinterpreted by the inspector in case of purchase inspection.</p> <p>Justification for changes: Missing specification added.</p>			checking and may led to misinterpretation during inspection.
10.0	<p>MARKING: The following particulars shall be legibly and indelibly engraved/pad printed on each carbon brushes on two wider faces above the condemning mark:</p> <p>a) Grade of carbon brush. b) Identification of source of manufacturer. c) Batch no, month and year of manufacture.</p>	<p>MARKING: The following particulars shall be legibly and indelibly engraved/pad printed on each carbon brushes as specified in the product drawing, if not specified in the drawing the supplier will mark on two wider faces above the condemning mark:</p> <p>a) Grade of carbon brush. b) Identification of source of manufacturer. c) Batch no, month and year of manufacture.</p> <p>Smaller brushes on which marking is not possible are exempted from marking as per IS 13466:1992 clause 14.</p> <p>Marking Carbon Blocks shall be legibly and indelibly engraved/pad printed on one wider face with</p> <p>a) Grade of carbon brush. b) Identification of source of manufacturer. c) Batch no, month and year of manufacture.</p> <p>Justification for changes: Marking of carbon block was not mentioned hence included.</p>	Agreed	No comments	<p>Para revised as "The following particulars shall be legibly and indelibly engraved/pad printed on each carbon brushes on two wider faces or as specified in the product drawing above the condemning mark":</p> <p>a) Grade of carbon brush. b) Identification of source of manufacturer. c) Batch no, month and year of manufacture</p> <p>The same is incorporated in 2nd final draft spec.</p>

Cl. No.	Final Draft Revised Specification No. MP.0.2400.60 (Rev.-06), January'2021	M/s Mersen	M/s Industrial Products	M/s ACPL	RDSO Remarks
11.0	PACKING: Carbon brushes shall be suitably packed so as to avoid any damage during transit.	No Comments	Agreed	No comments	No change required
12.0	FIELD TRIAL SCHEME: The specified Quantities shall be subjected to field trials for specified period before clearance is given for bulk supply. The Quantity and period of Field trials shall be governed by RDSO Document no. MP-M-8.1-1(Latest). Field trial of Carbon Brushes shall be carried out and performance to be monitored as per following format:	Condition of commutation. Justification for changes: Condition of commutation * It is difficult measure this parameter as there is no deffined procedure. It is recommended to measure the commutator ovality, bar to bar raise, brush holder spring force, film/patina contion, commutator surface roughness as specified in the specs by OEM against each motor or alternator.	Agreed	No comments	Already Instruction Bulletin No.MP.IB.EM.02.08.17 Rev.00 July'18 has been issued in this regard to zonal Rlys, so no change required in this clause.
13.	APPLICABLE STANDARDS: The specification refers to the following standards				Cl. 13 – Applicable standards has been added. The same is incorporated in 2 nd final draft spec.

Tamping Powder & Glue

(Table-B)

→ Items ↓ Parameters	Tamping Powder		Glue		
Type of Powder	Silver Coated Copper Tamping Powder / Graphite Copper Tamping Powder		Bakelite Powder or any other type of glue given by OEM duly approved by RDSO.		
Packing Condition	Powder should be supplied in Sealed condition.		It contains 01/02 different Components to be mixed in recommended proportions as declared by the firm.		
Part No.	To be furnished by firm in QAP		To be furnished by firm in QAP		
Condition	Sealed	Open	Sealed	Open & Un-mixed	Mixed
Minimum Shelf Life	06 months	1 Day	06 months	06 months	04 days

Testing of Tamping Powder:

Annexure-II

Table-C

SN	Type of test	Acceptance Criteria for Tamping Powder	Specification of Testing	Type Test	Acceptance Test	
1	Bulk Density	1.80- 3.2 gm/cc	IS-4848, 1981	√	√	
2	Flow Rate	24-40 sec for 50 gms powder	IS-4840, 2006	√	√	
		15-35 sec for 50 gms powder	IS-4848, 1981			
		or any other powder given by OEM duly approved by RDSO	As per relevant IS			
3	Sieve Analysis (If applicable)	Method-A				
		Above 40#	Nil	BS-410-1,2000 & BS-410-2, 2000	√	√
		Passed through 40# and retained on 100#	Min. 75%		√	√
		Passed through 100# and retained on 200#	Max. 20%		√	√
		Passed through 200#	Max. 5%		√	√
		Method-B				
		28# (650 microns)	Max. 0.2%		√	√
		+200# (75 microns)	Min. 85%		√	√
		-200# (75 microns)	Max. 15%		√	√
		or Any other Method /Acceptance Criteria furnished by OEM in QAP duly approved by RDSO				√
4	Copper Content (If applicable)	80-95%	IS-440,1964		√	√
5	Grain Size	50 microns (Max.)	BS-410	√	√	

Testing of carbon brush

Table-D

Annexure-III

SN	Tests	Governing Specification	Acceptance limits	Type Test	Acceptance Test
1	Bulk Density	Clause no. 6.0 of IS 13584:1993	As per relevant standards/drawings	√	√
2	Porosity (only for EG Grades)	Clause no. 6.0 of IS 13584:1993	As per relevant standards/drawings	√	x
3	Hardness	Clause no. 7.0 of IS 13584:1993	As per relevant standards/drawings	√	√
4	Resistivity	Clause no. 8.0 of IS 13584:1993	As per relevant standards/drawings	√	√
5	Transverse Strength	Clause no. 9.0 of IS 13584:1993	As per relevant standards/drawings	√	√
6	Ash Content (only for EG Grades)	Clause no. 10.0 of IS 13584:1993	As per relevant standards/drawings	√	x

Note: All tests marked with (x) are to be verified from Supplier's TC or Internal Test Report/Test report of NABL/Govt. Approved Lab. only.

Annexure-IV

Tests of Copper Wire:

Table-E

SN	Tests/parameters	Governing Specification	Acceptance limit	Type test	Acceptance Test
1	Visual test	Clause 5.4 & 3.1 of IS:13525-92	No abnormality	√	√
2	Measurement of weight	Clause 4.1.4 & 6.3.5 of IS:13525-1992	As per Table-1 of IS:13525-1992	√	√
3	Chemical composition for ETP copper	Clause 3.3 of IS:191 (Part-5): 2007	Copper purity = 99.85% (Min.)	x	x
4	Conductivity at 20°C (minimum)	Cl. 6.3.6 of IS13525-92	As per Table-1 of IS-13525: 1992	x	x
5	Electric resistance Test	Cl. 6.3.4 of IS IS:13525-1992	As per Table-1 of IS:13525-1992	x	x
6	Annealing test Before stranding)	Cl. 6.3.3 of IS 13525:1992	As per Table-1 of IS-13525: 1992	x	x

Note: All tests marked with (x) are to be verified from Supplier's TC or Internal Test Report/Test report of NABL/Govt. Approved Lab. only.

Annexure-V

Tests on Flexible Shunt:

Table-F

SN	Tests/ parameters	Governing Specification	Acceptance limit	Type test	Acceptance Test
1	Visual test	Clause 6.4.1 of IS:13525-1992	No abnormality	√	√
2	Construction	Product Drg.	As per product Drg.	√	√
3	Measurement of dia.	Clause 6.4.3 of IS:13525-1992	As per product Drg.	√	√
4	Electrical resistance	Clause 6.4.4 of IS:13525-1992	As per Table-2 of IS:13525-1992	√	x
5	Measurement of weight	Clause 6.4.5 of IS:13525-1992	As per Table-2 of IS:13525-1992	√	√

Note: All tests marked with (x) are to be verified from Supplier's TC or Internal Test Report/Test report of NABL/Govt. Approved Lab. only.

Annexure-VI

Tests on Rubber Top:

Table-G

SN	Tests/parameters	Governing Specification	Acceptance limit	Type test	Acceptance Test
1	Hardness (Shore 'A')	RDSO/M&C/ RP-130/84 2020	70±5	x	x
2	Tensile Strength (Kg/sq.cm)	-do-	50 (min)	x	x
3	Elongation at Break %	-do-	125 (min)	x	x
4	Compression set (%)	-do-	25 (max)	x	x
5	Accelerated Ageing Test Hardness (Shore A) max. Tensile strength Elongation at Break	-do-	+7/-0 ± 25% ± 30%	x	x

6	Test for Effect of Temperature	Clause 7.9 of this spec	As per clause 7.9 of this spec	√	x
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Note: (x) All tests marked with (x) are to be verified from Supplier's TC or Internal Test Report/Test report of NABL/Govt. approved Lab. Only.

Annexure-VII

Tests on Carbon brush:

Table-H

SN	Tests/parameters	Governing Specification	Acceptance limit	Type test	Acceptance Test
1	Workmanship	Cl. 16.4 of IS 13466-1992	No abnormality	√	√
2	Dimensional	As per relevant drawing	As per drawing	√	√
3	Millivolt Drop test	Cl.16.6 of IS:13466-1992	As per Table-2 of IS:13466-1992	√	√
4	Pull Out Strength test	Cl.16.7 of IS:13466-1992	As per Table-3 of IS:13466-1992	√	√
5	Endurance test	As per cl. No. 7.8 of Spec no-MP.0.2400.60 Rev-06	As per cl. No. 7.8 of Spec no-MP.0.2400.60 Rev-06	√	x
6	Test of effect of temperature	As per clause no. 7.9 of this spec no. MP.0.2400.60 Rev.06	As per clause no. 7.9 of this spec. no. MP.0.2400.60 Rev.06	√	x

7*	Brush wear	Clause no. 11.3 of IS 13584:1993	As per firm's declaration on grade property chart	√	x
8	Co-efficient of friction	Clause no. 11.2 of IS 13584:1993	As per firm's declaration on grade property chart.	√	x

Note: (x) All tests marked with (x) are to be verified from Supplier's TC or Internal Test Report/Test report of NABL/Govt. approved Lab. Only.

***Brush wear obtained on Test Setup is indicative. Actual brush wears is to be obtained from field performance of actual machines.**