







TD-106-1 Rev No. 5	Form No.		<b>PRODUCT STANDARD</b> HYDERABAD PROJECT ENGINEERING & SYSTEMS DIVISION		<b>PY 55053</b>
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<div data-bbox="180 552 269 1568" data-label="Text"> <p> <b>COPYRIGHT AND CONFIDENTIAL</b>            The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED,            It must not be used directly or indirectly in any way detrimental to the interest of the company.         </p> </div> <div data-bbox="431 865 1344 1117" data-label="Section-Header"> <h1> <u>Technical Specification</u>  <u>For</u>  <u>Electrical Insulating Mats</u> </h1> </div>					
Ref. Doc		Revisions :  Refer to record of revisions :	Prepared :  (-Sd-)  Suresh.P	Approved :  (-Sd-)  J.K Pattanaik	Date :  01-11-2013

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<div>COPYRIGHT AND CONFIDENTIAL</div> <div>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</div>		<div>Table of Contents</div> <div><div>1</div><div>Scope .....</div><div>3</div></div> <div><div>2</div><div>Applicable standards .....</div><div>3</div></div> <div><div>3</div><div>Service/Application .....</div><div>3</div></div> <div><div>4</div><div>Requirements .....</div><div>3</div></div> <div><div>5</div><div>BHEL Material Codification .....</div><div>4</div></div> <div><div>6</div><div>Documentation .....</div><div>4</div></div> <div><div>6.1</div><div>Bidding stage documentation .....</div><div>4</div></div> <div><div>6.2</div><div>Order execution stage documentation .....</div><div>5</div></div> <div><div>6.3</div><div>As-shipped documentation (Final) .....</div><div>5</div></div> <div><div>7</div><div>Guarantee .....</div><div>5</div></div> <div><div>8</div><div>Tests and Inspection .....</div><div>5</div></div> <div><div>9</div><div>BIS Certification Marking .....</div><div>5</div></div> <div><div>10</div><div>Packing .....</div><div>6</div></div> <div><div>11</div><div>Standard Formats.....</div><div>7</div></div> <div><div>11.1</div><div>Check list for bidder .....</div><div>7</div></div> <div><div>11.2</div><div>Deviation Schedule (Technical) .....</div><div>8</div></div> <div><div>11.3</div><div>Standard price format .....</div><div>9</div></div> <div><div>11.4</div><div>Technical Data Sheets .....</div><div>10</div></div> <div><div>12</div><div>Record of Revisions .....</div><div>16</div></div>		
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<div style="display: flex; justify-content: space-between;"> <div style="width: 20%;"> <p style="writing-mode: vertical-rl; transform: rotate(180deg);"> <b>COPYRIGHT AND CONFIDENTIAL</b>            The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED .            It must not be used directly or indirectly in any way detrimental to the interest of the company.         </p> </div> <div style="width: 80%;"> <h2 style="text-align: center;">Technical Specification for Electrical Insulating Mats</h2> <h3>1 Scope</h3> <p>This specification governs the quality requirements of design, Manufacture, Inspection &amp; Testing, packing at manufacturer's works and delivery to site of insulating mats (up to 33kV) as specified hereafter for enclosed BHEL Enquiry.</p> <h3>2 Applicable standards</h3> <p>IS 15652 Insulating Mats for Electrical Purposes (Latest revisions including all the amendments as applicable)</p> <h3>3 Service/Application</h3> <p>For placing of insulating MATS in front/rear side of Electrical Switchgears for the purpose of Human Safety.</p> <h3>4 Requirements</h3> <p>Electrical insulating mats as per below specifications is in bidders scope.</p> <table border="1" style="width: 100%;"> <tr> <td style="width: 10%;">4.1</td> <td colspan="3">Insulating Mat Material including composition, Design, Workmanship &amp; Finish, Physical Properties and all other features shall be strictly comply to the IS 15652.</td> </tr> <tr> <td>4.2</td> <td style="width: 20%;">Size</td> <td style="width: 10%;">:</td> <td>10M (L) X 1M (W) Sheet. Any other dimension is not acceptable.</td> </tr> <tr> <td>4.3</td> <td>Class, Thickness &amp; Voltage</td> <td>:</td> <td>           a) Class-A            Thickness: 2.0mm (Min)            Voltage up to 3.3kV ac (rms)            b) Class-B            Thickness: 2.5mm (Min)            Voltage up to 11kV ac (rms) (i.e &gt;3.3kV &amp; ≤11kV)            c) Class-C            Thickness: 3.0mm (Min)            Voltage up to 33kV ac (rms) (i.e &gt;11kV &amp; ≤ 33kV)         </td> </tr> <tr> <td>4.4</td> <td>Category</td> <td>:</td> <td>Category-III Acid, alkali, oil and low temperature resistance</td> </tr> <tr> <td>4.5</td> <td>Preferred Colors</td> <td>:</td> <td>           a) Red Colour for Class-A Insulating Mat            b) Yellow Colour for Class-B Insulating Mat            c) Orange Colour for Class-C Insulating Mat         </td> </tr> </table> <p><b>Note:</b> The supply of adhesive is in purchaser (BHEL) scope, after completion of erection and commissioning of electrical switchgear. However vendor have to recommend suitable type and quantity of adhesive required for pasting of insulating mats to Switchgear room floor.</p> </div> </div>					4.1	Insulating Mat Material including composition, Design, Workmanship & Finish, Physical Properties and all other features shall be strictly comply to the IS 15652.			4.2	Size	:	10M (L) X 1M (W) Sheet. Any other dimension is not acceptable.	4.3	Class, Thickness & Voltage	:	a) Class-A Thickness: 2.0mm (Min) Voltage up to 3.3kV ac (rms) b) Class-B Thickness: 2.5mm (Min) Voltage up to 11kV ac (rms) (i.e >3.3kV & ≤11kV) c) Class-C Thickness: 3.0mm (Min) Voltage up to 33kV ac (rms) (i.e >11kV & ≤ 33kV)	4.4	Category	:	Category-III Acid, alkali, oil and low temperature resistance	4.5	Preferred Colors	:	a) Red Colour for Class-A Insulating Mat b) Yellow Colour for Class-B Insulating Mat c) Orange Colour for Class-C Insulating Mat
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COPYRIGHT AND CONFIDENTIAL The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.	<b>5 BHEL Material Codification</b>													
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	<p><b>6.1 Bidding stage documentation</b></p> <p>Bidder shall submit one set of following documents along with the Technical Bid, otherwise technical bid shall not evaluate further.</p> <p>6.1.1 Dually signed and stamped copy of check list. (As per Format-11.1)</p> <p>6.1.2 Dually signed and stamped copy of Deviation schedule (As per format-11.2)</p> <p>6.1.3 Filled in Technical Data sheets in enclosed format (As per format-11.4)</p> <p>6.1.4 Technical Catalogues</p> <p>6.1.5 Valid test report as per IS-15652 which are listed below, not older than 5yrs, from CPRI/ERDA/NABL accredited testing laboratories shall be submitted for review. In case any valid test reports are not available, same shall be conducted without any time and cost implication. Same shall be clearly mentioned in the technical offer &amp; deviation schedule</p> <ul style="list-style-type: none"> <li>i) Shape, Dimensions, thickness, Workmanship and finish</li> <li>ii) Tensile strength and elongation at break</li> <li>iii) Insulation resistance with water</li> <li>iv) Leakage current</li> <li>v) ac Di-electric strength,</li> <li>vi) ac proof voltage</li> <li>vii) Ageing Properties</li> <li>viii) Flame Retardance</li> <li>ix) Low temperature resistance</li> <li>x) Acid and alkalis and oil resistance</li> </ul> <p>6.1.6 Valid BIS Certification as per cl no 9.0.</p> <p>6.1.7 Duly signed and stamped unpriced price format. (As per format-11.3)</p>													


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<p style="text-align: center;"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p>6.2 <u>Order execution stage documentation</u></p> <p>Successful bidder shall submit three sets of following documents with in 7day after receipt of LOI/Purchase order from purchaser.</p> <p>6.2.1 Filled in Technical Data sheets in enclosed format for approval.</p> <p>6.2.2 Valid test report as per IS-15652 which are not submitted along with technical bid.</p> <p>6.2.3 Quality Assurance Plan (QAP).</p> <p>Purchase will furnish Approval/Comments within 7 Days after receipt of satisfactory documents from manufacturer. However vendor is responsible for completion of approval cycle and minimizing number of revisions.</p> <p>6.3 <u>As-shipped documentation (Final)</u></p> <p>Final documentation in 8 sets in bound volumes along with a softcopy (2 Nos CD) shall be submitted and shall consist of following,</p> <ul style="list-style-type: none"> <li>i) Technical Data Sheets</li> <li>ii) BIS Certification</li> <li>iii) QA reports</li> <li>iv) All type test Certificates</li> <li>v) All routine test Certificates</li> <li>vi) Contact details</li> </ul> <p><b>7 Guarantee</b></p> <p>Guarantee against any Manufacturing defects for period of 24 months from date of supply.</p> <p><b>8 Tests and Inspection</b></p> <p>8.1.1 Stage &amp; Final Inspection shall be done by Purchaser/End user/Third party as per approved QAP. Twenty days advance notice along with two sets of data sheets approved by BHEL with factory test reports shall be furnished along with the inspection call.</p> <p>8.1.2 All Type Test Reports/Certificates as per IS 15652(Refer Cl.6.2 above) shall be furnished on demand to the Inspecting Agency for verification.</p> <p>8.1.3 All Routine &amp; Sample Tests shall be carried-out as per IS 15652 which will be witnessed by BHEL/Customer/Authorized Agency during Inspection.</p> <p><b>9 BIS Certification Marking</b></p> <p>The product should be marked with the BIS Standard Mark*.</p> <p>*The use of the Standard Mark is governed by the provisions of the Bureau of Indian Standard Act, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the license for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian standards.</p>		
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Ref. Doc	<p><b>10 Packing</b></p> <p>The mats shall be packed either in rolls or flats and shall not be distorted mechanically. In case of rolls material should be rolled smoothly on hollow mandrel made of either hard cardboard or waste plastic, of diameter 50 mm or higher. The material shall be wound tightly and the edges of top most layer should not shift from the edge of 1st bottom layer by more than 75 mm. The roll should be clamped at 2 places with the help of plastic unidirectional tape and clamps. Gunny/jute material should be used, to avoid any kind of damage to the material. Over the gunny/jute material, proper plastic bag having lining of suitable fabrics should be used.</p>		


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<b>COPYRIGHT AND CONFIDENTIAL</b> The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.			<p>11.2 <u>Deviation Schedule (Technical)</u></p> <p>Enquiry No. Date : _____</p> <p>Name of the Bidder : _____</p> <p>Project : _____</p> <p>Specification No : PY55053 REV-01</p> <p>Item : Electrical Insulating Mats</p> <ol style="list-style-type: none"> <li>1. Deviation to tender documents, if any, shall be indicated only in this schedule.</li> <li>2. Deviation listed elsewhere will be summarily rejected and shall be ignored.</li> <li>3. Attach more sheets in this format, if required.</li> <li>4. If there are no deviations the same shall be mentioned in the format and submitted.</li> <li>5. Bidder may give a consolidated list of deviations in this form only.</li> <li>6. Bidder shall state reason for the deviations in the remark column.</li> <li>7. Only the deviations listed herein, in conjunction with the original tender, shall constitute the contract document for the award of the job to the Bidder.</li> </ol> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 20px;"> <thead> <tr> <th style="width: 10%;">Sl.No.</th> <th style="width: 15%;">Cl.No./Page No./Sec No.</th> <th style="width: 30%;">Description as specified</th> <th style="width: 20%;">Deviation taken</th> <th style="width: 25%;">Remarks</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td><td> </td><td> </td></tr> </tbody> </table> <p style="text-align: right; margin-top: 20px;">(Signature of the Bidder with Seal)</p>			Sl.No.	Cl.No./Page No./Sec No.	Description as specified	Deviation taken	Remarks																																																		
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11.3 Standard price format

Item No.	Description	Qty ( Nos.)	Quoted / Not Quoted	Unit Price (in Rs.)	Total Price (in Rs.)
1.	INSULATING MAT FOR VOLTAGE GRADE UP TO 3.3KV (CLASS-A, Category-III) Size: 1Metre(W) x 10Metre (L)				
2.	INSULATING MAT FOR VOLTAGE GRADE GREATER THAN 3.3KV & LESS THAN OR EQUAL TO 11KV (CLASS-B, Category-III) Size: 1Metre(W) x 10Metre (L)				
3.	INSULATING MAT FOR VOLTAGE GRADE GREATER THAN 11KV & LESS THAN OR EQUAL TO 33KV (CLASS-C, Category-III) Size: 1Metre(W) x 10Metre (L)				

**Notes:**

- Bidder shall strictly fill up the above price format only. No other format will be accepted. No cognizance will be taken of any changes made by vendor with respect to format issued by BHEL in the description of any item in price format.
- Duly signed & stamped unpriced price format shall be submitted by vendor as a token of their concurrence that the price schedule is submitted in this format. If not submitted in this format or any field is left blank, the offer will be liable for rejection.
- All the blank fields shall be filled irrespective of applicability of any item for this project. If any item is not in bidder's manufacturing range then ""Not Applicable"" shall be mentioned in the field.

(Signature of the Bidder with Seal)

Ref. Doc	
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11.4 Technical Data Sheets

[Column No (5) TO BE FILLED BY BIDDER]


**A. Data Sheet for Insulating Mat (Class-A, Category-III, up to 3.3kV, BHEL Material Code: PY9755053018)**


Bidder Name:


Enquiry No:

Sl.No	Parameter	Unit	Acceptable Value	Offered Value by Bidder
1	2	3	4	5
<b>General:</b>				
1.0	Thickness (Min)	mm	2.0	
2.0	Dimension	Mtrs	10M (L) X 1M (W)	
3.0	Color	--	RED	
<b>Mechanical Properties:</b>				
4.1	Tensile Strength at break (Amp Temp range -10 to 55 deg C)	N/mm <sup>2</sup>	15(Min)	
4.2	Elongation at break (Temp range -10 to 55 deg C)	%	250	
<b>5.0</b>	<b>Ageing Properties (subject to 168hrs @70deg C)</b>			
5.1	Tensile Strength	N/mm <sup>2</sup>	Shall not be less than 75% of values on unaged piece	
5.2	Elongation	%	-do-	
<b>6.0</b>	<b>Thermal Properties</b>			
6.0	Flame Retardance	sec	Extinguish with in 5sec after removal of Blue Flame	
6.1	Low temperature resistance	--	As per IS 15652 (Cl.No.8.4.2)	
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7.1	Tensile Strength	N/mm <sup>2</sup>	Shall not be less than 80% of values on unaged piece	
7.2	Elongation	%	-do-	
<b>8.0</b>	<b>Effect to Alkaline</b>			
8.1	Tensile Strength	N/mm <sup>2</sup>	Shall not be less than 80% of values on unaged piece	
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Sl.No	Parameter	Unit	Acceptable Value	Offered Value by Bidder
9.2	Elongation	%	-do-	
10.0	<b>Effect to Transformer Oil</b>			
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12.0	Leakage Current	mA	10	
13.0	AC Di-Electric Strength	kV (rms)	45	
14.0	AC Proof Voltage	kV (rms)	22	
15.0	Marking	--	BIS Marking: Class: Category: Thickness: Lot No.: Roll No.: Manufactures Identity:	



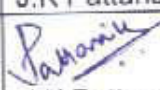
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TD-106-2 Rev No. 5 Form No.		<b>PRODUCT STANDARD</b> HYDERABAD <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b>		<b>PY 55053</b>																																																								
				Rev No. 01																																																								
				PAGE 15 of 16																																																								
<p style="text-align: center;"> <b>COPYRIGHT AND CONFIDENTIAL</b>          The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED .          It must not be used directly or indirectly in any way detrimental to the interest of the company.       </p>		<table border="1"> <thead> <tr> <th>Sl.No</th> <th>Parameter</th> <th>Unit</th> <th>Acceptable Value</th> <th>Offered Value by Bidder</th> </tr> </thead> <tbody> <tr> <td>9.2</td> <td>Elongation</td> <td>%</td> <td>-do-</td> <td></td> </tr> <tr> <td>10.0</td> <td colspan="4"><b>Effect to Transformer Oil</b></td> </tr> <tr> <td>10.1</td> <td>Tensile Strength</td> <td>N/mm<sup>2</sup></td> <td>Shall not be less than 80% of values on unaged piece</td> <td></td> </tr> <tr> <td>10.2</td> <td>Elongation</td> <td>%</td> <td>-do-</td> <td></td> </tr> <tr> <td colspan="5"><b>Electrical Properties</b></td> </tr> <tr> <td>11.0</td> <td>Insulation Resistance with water</td> <td>Mega ohms</td> <td>10,00,000Mohms with 500V meggar (or) 1,00,000Mohms with 5000V meggar</td> <td></td> </tr> <tr> <td>12.0</td> <td>Leakage Current</td> <td>mA</td> <td>10</td> <td></td> </tr> <tr> <td>13.0</td> <td>AC Di-Electric Strength</td> <td>kV (rms)</td> <td>65</td> <td></td> </tr> <tr> <td>14.0</td> <td>AC Proof Voltage</td> <td>kV (rms)</td> <td>36</td> <td></td> </tr> <tr> <td>15.0</td> <td>Marking</td> <td>--</td> <td>           BIS Marking:            Class:            Category:            Thickness:            Lot No.:            Roll No.:            Manufactures Identity:         </td> <td></td> </tr> </tbody> </table>				Sl.No	Parameter	Unit	Acceptable Value	Offered Value by Bidder	9.2	Elongation	%	-do-		10.0	<b>Effect to Transformer Oil</b>				10.1	Tensile Strength	N/mm <sup>2</sup>	Shall not be less than 80% of values on unaged piece		10.2	Elongation	%	-do-		<b>Electrical Properties</b>					11.0	Insulation Resistance with water	Mega ohms	10,00,000Mohms with 500V meggar (or) 1,00,000Mohms with 5000V meggar		12.0	Leakage Current	mA	10		13.0	AC Di-Electric Strength	kV (rms)	65		14.0	AC Proof Voltage	kV (rms)	36		15.0	Marking	--	BIS Marking: Class: Category: Thickness: Lot No.: Roll No.: Manufactures Identity:	
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Ref. Doc

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	Rev. No.	Date	Revision Details	Revised By	Approved By
	00	01-11-2013	ORIGINAL ISSUE	---	(-Sd-) J.K Pattanaik
	01	10-06-2015	Generally Revised. Deviation format & check list for bidder added.	 Seshu Kiran.G	 J.K Pattanaik
	Ref. Doc.				



TD-201 Rev No. 00 Form No.	 HYDERABAD	<b>PRODUCT STANDARD</b> PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	ANNEXURE - 1
			Rev No. 00
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<b>COPYRIGHT AND CONFIDENTIAL</b> The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.	<div>QAP GUIDELINES &amp; FORMAT</div> <div>( ANNEXURE-1 TO PY55033 )</div> <p>The QAP format and guidelines for filling up the format shall be used by vendor for preparation and submission of QAP after order placement.</p> <p><b>Note :</b></p> <ol style="list-style-type: none"><li>1. Typical /Indicative /Standard QAP(s) for equipment /package attached is reference document and to use by successful bidder in future for preparation and submission of QAP for BHEL /CUSTOMER approval.</li><li>2. No deviation to reference document is acceptable.</li></ol>		


Form No.	 HYDERABAD	<b>PRODUCT STANDARD</b> PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	ANNEXURE-1
			Rev No. 00
			Page 2 of 3
<p style="text-align: center;"><b><u>GUIDELINES TO VENDORS FOR PREPARATION OF QUALITY ASSURANCE PLAN</u></b></p> <ol style="list-style-type: none"> <li>QAP shall be made in landscape mode on A4 size paper as per the format enclosed. Font size shall be minimum 10.</li> <li>Each page of QAP shall contain the following information.           <ol style="list-style-type: none"> <li>Vendor's name &amp; address.</li> <li>Customer: BHEL, Hyderabad.</li> <li>Project.</li> <li>BHEL Product Standard Number/revision number as referred in P.O.</li> <li>BHEL Purchase Order Number &amp; Date.</li> <li>Product as per P.O. description.</li> <li>QAP Number (unique and shall not repeat)/revision number/date.</li> <li>Page number and number of pages</li> </ol> </li> <li>QAP shall contain four parts / stages as follows.           <ol style="list-style-type: none"> <li>Raw materials and bought out items.</li> <li>In process Control / Inspection.</li> <li>Final assembly, Inspection &amp; Testing.</li> <li>Painting, preservation &amp; packing.</li> </ol> </li> <li>Under 'Component', indicate name of the component (say casing, rotor, pressure gauge, etc).</li> <li>Under 'Characteristics', indicate appropriately (say chemical analysis, mechanical properties, NDT (UT,DP etc.), hydrostatic test, calibration check etc.)</li> <li>Under 'Class', indicate minor, major or critical depending on the importance of characteristic.</li> <li>Under 'Type of check', indicate appropriately (say chemical, mechanical, UT, DP etc.)</li> <li>Under 'Quantum of check', indicate appropriately (say 100%, 10%, sample, per melt, per heat, all pieces etc.)</li> <li>Under 'Reference document' and 'Acceptance norms', appropriate National &amp; International standards, BHEL standards, approved drawing references etc. should be indicated. It is not correct to mention as "Vendor's internal standards or Vendor's standard practice etc.". If vendors' internal standards are referred, same shall be in line with BHEL Spec. indicated in the P.O. These may require review &amp; approval by our Engineering dept.</li> <li>Under 'Format of record', indicate appropriately supplier's test certificate, calibration certificate, lab report, inspection report etc.</li> <li>Please refer 'Agency' in QAP format.            Under P: Perform, W: Witness, V: Verify            Indicate against each characteristic 1: (BHEL CQS/Nominated inspection agency), OR            2: (Vendor / Sub vendor)</li> </ol>			
<p style="writing-mode: vertical-rl; transform: rotate(180deg);"> <b>COPYRIGHT AND CONFIDENTIAL</b>          The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED .          It must not be used directly or indirectly in any way detrimental to the interest of the company.       </p>			
Ref. Doc			

	Form No.	 HYDERABAD	<p align="center"><b>PRODUCT STANDARD</b></p> <p align="center">PROJECT ENGINEERING &amp; SYSTEMS DIVISION HYDERABAD</p>	ANNEXURE-1
		Rev No. 00		
		Page 3 of 3		
<p align="center"><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p align="center">The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED . It must not be used directly or indirectly in any way detrimental to the interest of the company.</p>		<p>Note: Performing agency is normally vendor or his sub vendor (Legend 2). Where witness points are indicated in specification, P.O., Drawing etc., for such operations, under Witness (W) column use 1. Under 'Verify' column, use code1.</p> <p>12. Under 'D' please put ( <input type="checkbox"/> Tick) against each characteristic where vendor proposes to submit test certificate/report etc. OR as required as per BHEL Specification.</p> <p>13. Vendor's signature &amp; stamp should be available on each page of QAP.</p> <p>14. Vendor should read the BHEL Product Standard thoroughly and QAP should be made only inline and relevant to the Specification &amp; Approved Drawings.</p> <p>15. The following operations/characteristics/check points may be included (AS APPROPRIATE)</p> <ul style="list-style-type: none"> <li>a) Visual check</li> <li>b) Dimensional check</li> <li>c) Mechanical and Chemical properties.</li> <li>d) Surface preparation before painting (by chemical cleaning, sand blasting, shot blasting etc. as the case may be.)</li> <li>e) Painting check for shade, Dry Film Thickness (DFT), Adhesion/ peel off test etc.</li> <li>f) Check for correctness for all components mounted as per General arrangement Drawing, Bill Of Materials (BOM), etc. for range, rating, make, color, size, location as per GA, quantity, label description including tag nos., annunciator facia, loose components, accessories, spares etc.</li> <li>g) Verification of test certificate for protection class for the enclosures.</li> <li>h) Mechanical functioning of switches.</li> <li>i) Continuity of earthing and provision of earth points.</li> <li>j) Colour coding of wiring, size, tightness &amp; dressing of wiring.</li> <li>k) Review of test certificates of assembled items, raw materials, internal test reports etc.</li> <li>l) Witness of functional checks, which may include mechanical run &amp; electrical run, H.V.test, IR measurement, Electrical and Mechanical tests etc.</li> <li>m) PQR, WPS, Welder Qualification Record, welding records (fit up, DP) etc.</li> <li>n) Material identification ( for punch marks of serial numbers, Heat No, Melt No, Inspector's stamp etc.)</li> <li>o) Hydraulic Pressure Test, Pneumatic Pressure Test, Liquid Penetration Examination and other Non Destructive Tests.</li> <li>p) Tests on Galvanised items (Visual, Hammer Test, Knife Test, Thickness, Pierce Test (Copper sulphate test), Hydrogen evaluation test, Stripping test (for Mass of Zinc coating)</li> <li>q) All tests as per BHEL Product Standard &amp; approved drawings including Type tests and Routine tests on individual items and on System as a whole.</li> <li>r) Packing and Preservation.</li> </ul> <p>16. <b>QAP Format enclosed.</b></p> <p>17. <b>Typical Manufacturing QAP is attached.</b></p>		
		Ref. Doc		

VENDOR'S NAME & ADDRESS:			<b>MANUFACTURING QUALITY PLAN</b>						QP. NO.:				
			CUSTOMER: BHEL, HYDERABAD – 32. PROJECT: PRODUCT:			BHEL P.O.NO.: P.O.DATE: BHEL SPEC: REV:			REV NO:		DATE:		
									PAGE 1 OF 1				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY P W V			REMARKS
1.0	<b>RAW MATERIALS &amp; BOUGHT OUT ITEMS</b>												
2.0	<b>INPROCESS INSPECTION</b>												
3.0	<b>FINAL INSPECTION &amp; TESTING</b>												
4.0	<b>PRESERVATION &amp; PACKING</b>												

**VENDOR TO NOTE:** THIS FORMAT IS IN MICROSOFT WORD. HEADER & FOOTER SHALL BE AVAILABLE IN EACH PAGE OF QP. QP SHALL BE IN LANDSCAPE & A4 SIZE ONLY. FONT SIZE SHALL BE MIN 10. VENDOR SHALL SIGN & STAMP IN EACH PAGE OF QP. LOI REF. & DATE ARE NOT ACCEPTABLE. P.O.NO. & DATE SHALL BE INDICATED. QP NO. SHOULD BE UNIQUE AND SHALL NOT REPEAT. ALL THE TESTS / CHECKS INDICATED IN THE BHEL SPEC. SHALL BE INDICATED IN THE QP.

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	VENDOR'S SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP

TD-201 Rev No. 00	Form No.		<b>PRODUCT STANDARD</b> PROJECT ENGINEERING & SYSTEMS DIVISION HYDERABAD	
<div><div><div><b>COPYRIGHT AND CONFIDENTIAL</b> The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED, It must not be used directly or indirectly in any way detrimental to the interest of the company.</div></div><div><div><h2><u>QUALITY ASSURANCE REQUIREMENTS</u></h2><p><b>The vendor shall prepare &amp; submit Quality Assurance Plan (QAP) for respective package /equipment in customer QAP format.</b></p><p>A customer standard QAP/typical QAP in customer format /BHEL format attached for respective equipment /package is a reference document for the vendor for future use by vendor for preparation and submission of QAP in customer format. <b>Hence, no deviation to such document is acceptable.</b></p><p>Any, additional type or special tests or routine tests or acceptance test if found necessary to establish the intended quality after detailed engineering then the same shall have to be incorporated in the QAP without any commercial implication.</p><p>Customer QAP format is enclosed along with this document.</p><p><b>Note : Vendor shall submit QAP with in 07 days from PO receipt date.</b></p></div></div></div>				



**BHARAT HEAVY ELECTRICALS LIMITED**  
**RAMACHANDRAPURAM:: HYDERABAD – 502032**  
**PROJECT ENGINEERING & SYSTEMS DIVISION**  
**QUALITY & BUSINESS EXCELLANCE DEPARTMENT**  
**Format for inspection call**

Ref: BHEL/PESD/QA/11

Dt: 28.07.2020

Due to unavailability of all BHEL/Customer, approved documents TPIAs visits are being wasted .To avoid this it is mandatory that vendor should arrange all the approved reference documents and then only raise the inspection call in portal. Vendor has to fill the below details and upload this documents in portal while raising the inspection call.

Sr.No	Approved Documents	Approved Documents date
	Approved QAP No with revision	
	Approved Drawing No with revision	
	Approved Data Sheet No with revision	
	Purchase specification	
	Purchase Order/BBU	

**Note:** While raising inspection call vendor has to take care of below points.

1. **Purchasing Unit:** Purchasing Unit should be PE & SD.
2. **Joint Inspection:** Joint inspection means that BHEL and BHEL client both are jointly attending the inspection.
3. **CQ Center:** CQ center is a TPIA nearest region, suppose inspection is in Mumbai than CQ center will be either of TUV Mumbai or BVI Mumbai.

Vendor Signature

**PROJECT ENGINEERING & SYSTEMS DIVISION****RC PURAM, HYDERABAD.****QUALITY & BUSINESS EXCELLENCE****INSPECTION / TC REVIEW FORMAT**

1	Vendor's Name:		5	Applicable BHEL Spec No:	
2	Project:		6	Approved Drawing No:	
3	PO No:		7	Approved Data Sheet No:	
4	Item Description:		8	Approved QAP No:	

**OFFER LIST**

S.No	BBU/ PO Sr. No.	Item Description	Total Qty as per PO/BBU	Qty. already accepted	Qty offered for TC review	Cumulative Qty	Balance Qty
A							
B							
C							
D							

**TC REVIEW REQUISITION**

BBU / PO Sr. No.	QAP Clause No.	Format of Record	Certificate No. & Date	Page No.	REMARKS
<b>A. Item Description:</b>					
<b>B. Item Description:</b>					
<b>C. Item Description:</b>					
<b>D. Item Description:</b>					
<b>E. Item Description:</b>					

**SUPPLIER / VENDOR SIGNATURE WITH SEAL****BHEL/ BHEL's TPIA SIGNATURE WITH SEAL****Dt:****Dt:**


<div><div>बी एच ई एल</div><div></div></div>		STANDARD MANUFACTURING QUALITY PLAN							MQP. NO.:				
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PRODUCT: ELECTRICAL INSULATION MAT				REV NO: 00		DATE:		
									PAGE 1 OF 5				
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
1.0	RAW MATERIALS & BOUGHT OUT ITEMS												
	SYNTHETIC RESIN	APPERANCE, BULK DENSITY,PARTICLE POROSITY,SIEVE ANALYSIS	MAJOR	PHYSIC AL & CHEMI CAL	AS PER IS 2500	AS PER BHEL SPECIFICATI ON/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATIO N/APPD DRG/APPD DATA SHEET	TEST CERTIFICAT E/LOG BOOK/REPO RT	√	2		1	
	PLASTICIZERS	APPEARANCE,FLAS H POINT,THERMAL STABILITY,SPECIFIC GRAVITY	MAJOR	PHYSIC AL & CHEMI CAL	AS PER IS 2500	AS PER BHEL SPECIFICATI ON/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATIO N/APPD DRG/APPD DATA SHEET	TEST CERTIFICAT E/LOG BOOK/REPO RT	√	2		1	
	CHEMICALS	APPERANCE,THERM AL STABILITY	MAJOR	PHYSIC AL & CHEMI CAL	AS PER IS 2500	AS PER BHEL SPECIFICATI ON/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATIO N/APPD DRG/APPD DATA SHEET	TEST CERTIFICAT E/LOG BOOK/REPO RT	√	2		1	
2.0	INPROCESS INSPECTION												
	SHEETING PROCESS	VISUAL CHECK	MAJOR	PHYSIC AL	AS PER IS 2500	AS PER BHEL SPECIFICATI ON/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATIO N/APPD DRG/APPD DATA SHEET	TEST CERTIFICAT E/LOG BOOK/REPO RT	√	2		1	
		THICKNESS(WITH IN RANGE)	MAJOR	PHYSIC AL	AS PER IS 2500	AS PER BHEL SPECIFICATI ON/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATIO N/APPD DRG/APPD DATA SHEET	TEST CERTIFICAT E/LOG BOOK/REPO RT	√	2		1	


LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICAT REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	BHEL QA SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)



		<b>STANDARD MANUFACTURING QUALITY PLAN</b>							MQP. NO.:				
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032				PRODUCT: ELECTRICAL INSULATION MAT			REV NO: 00		DATE:		
		PAGE 2 OF 5											
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
									P	W	V		
		WIDTH(WITH IN RANGE)	MAJOR	PHYSICAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2		1	
		COLOUR (AS PER ORDER)	MAJOR	VISUAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2		1	
3.0	<b>FINAL INSPECTION &amp; TESTING</b>												
	<b>TYPE TEST:-</b>												
		VISUAL	CRITICAL	PHYSICAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2	1		
		THICKNESS	CRITICAL	PHYSICAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2	1		
		WIDTH	CRITICAL	PHYSICAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2	1		

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICATE REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	BHEL QA SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)

		<b>STANDARD MANUFACTURING QUALITY PLAN</b>							MQP. NO.:				
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032				PRODUCT: ELECTRICAL INSULATION MAT			REV NO: 00		DATE:		
		PAGE 3 OF 5											
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
		TENSILE STRENGTH	CRITICAL	PHYSICAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2	1		
		ELONGATION	CRITICAL	PHYSICAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2	1		
		INSULATION RESISTANCE WITH WATER	CRITICAL	ELECTRICAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2	1		
		LEAKAGE CURRENT	CRITICAL	ELECTRICAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2	1		
		AC DIELECTRIC STRENGTH	CRITICAL	ELECTRICAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2	1		
		AC PROOF VOLTAGE	CRITICAL	ELECTRICAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2	1		
LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICATE REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.						PREPARED BY  BHEL QA SIGNATURE & STAMP		APPROVED BY  BHEL QA SIGNATURE & STAMP		APPROVED BY  CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)			

<div><div>बी एच ई एल</div><div></div></div>		STANDARD MANUFACTURING QUALITY PLAN							MQP. NO.:				
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PRODUCT: ELECTRICAL INSULATION MAT		REV NO: 00		DATE:				
							PAGE 4 OF 5						
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
		AGEING PROPERTIES	CRITICAL	PHYSICAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2	1		
		FLAME RETARDANCE	CRITICAL	THERMAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2	1		
		LOW TEMPERATURE RESISTANCE	CRITICAL	THERMAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2	1		
		ACID/ALKALI & OIL RESISTANCE	CRITICAL	CHEMICAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2	1		
4.0	PRESERVATION & PACKING												
	MARKING	CLASS, LOT NO, ROLL NO., MANUFACTURING IDENTITY, ISI MARKS	CRITICAL	PHYSICAL	AS PER IS 2500	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATION/APPD DRG/APPD DATA SHEET	TEST CERTIFICATE/LOG BOOK/REPORT	√	2		1	

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICATE REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	BHEL QA SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)

<div><div>बी एच ई एल</div><div>BHEL</div></div>		STANDARD MANUFACTURING QUALITY PLAN						MQP. NO.:					
		PROJECT ENGINEERING & SYSTEMS DIVISION BHEL, RC PURAM, HYD-502032			PRODUCT: ELECTRICAL INSULATION MAT			REV NO: 00		DATE:			
								PAGE 5 OF 5					
SL NO	COMPONENTS	CHARACTERISTICS	CLASS	TYPE OF CHECK	QUANTUM OF CHECK	REFERENCE DOCUMENT	ACCEPTANCE NORMS	FORMAT OF RECORD	* D	AGENCY			REMARKS
										P	W	V	
	PACKING	GUNNY/JUTE,PAPER TUBE,CROWN PAPER	CRITIC AL	PHYSIC AL	AS PER IS 2500	AS PER BHEL SPECIFICATI ON/APPD DRG/APPD DATA SHEET	AS PER BHEL SPECIFICATIO N/APPD DRG/APPD DATA SHEET	TEST CERTIFICAT E/LOG BOOK/REPO RT	√	2		1	

**NOTE:-**

1. This standard MQP should be read along with specification (latest revision), approved drawings & approved data sheet.
2. Drawing/data sheet shall prevail over quality plan for contradiction if any between quality plan and drawing/specification.
3. All test certificates/reports reviewed and certified by TPI/BHEL shall be submitted to BHEL as documentation package.
4. All type test reports submitted shall not be older than 5 yrs from the date of purchase order.
5. Any project/customer specific requirements which shall be notified have to be fulfilled by the vendor at the time of execution of order.

LEGEND: P: PERFORM, W: WITNESS, V: TEST CERTIFICATE REVIEW. INDICATE 1 FOR BHEL / BHEL NOMINATED INSPECTION AGENCY/END USER/END USER'S REPRESENTATIVE & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.	PREPARED BY	APPROVED BY	APPROVED BY
	BHEL QA SIGNATURE & STAMP	BHEL QA SIGNATURE & STAMP	CUSTOMER'S SIGNATURE & STAMP (IF APPLICABLE)