

**TECHNICAL DELIVERY CONDITION  
FOR  
TITANIUM CLADDED CARBON STEEL  
PLATES TO SPECIFICATION  
ASTM B898**

|                 |               |
|-----------------|---------------|
| DOC No:         | TDC: RTS: 003 |
| Effective Date: | 20/05/2019    |
| Rev:            | 01            |
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| <b>1.0</b>                 | <b>Scope</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>1.1</b>                 | This TDC specifies the additional requirements for the delivery of titanium clad on one side of carbon steel plates conforming to ASTM B898-11 and to the latest edition.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>1.2</b>                 | The size and Quantity shall be as specified in the Enquiry/ Purchase order                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>2.0</b>                 | <b>Chemical composition and process</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>2.1</b>                 | Titanium as per ASTM B265 Gr. 2 (UNS R50400)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>2.2</b>                 | Carbon steel as per ASTM A36/ IS 2062 Gr. A/ IS 2062 E 250 Gr. BR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>2.3</b>                 | The method of bonding of cladding metal to base plate shall be Explosion bonding or Hot rolling or combination of both to achieve the required quality as per ASTM B898-11.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>2.4</b>                 | In the clad plate, there shall not be more than one number of joints in cladding metal sheet before cladding and no joint in Carbon steel base plate. 100% Radiographic testing of all such joints shall be done by vendor as per ASME, Sec. VIII, Div.1, UW-51. Weld seam location and orientation shall be provided by manufacturer before cladding.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>3.0</b>                 | <b>Dimensional tolerances</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>3.1</b>                 | <p>The plates shall be supplied to the dimensions specified in the enquiry/PO. Enquiry/PO shall state the following</p> <ol style="list-style-type: none"> <li>1) Length and width of plate.</li> <li>2) Base metal thickness</li> <li>3) Clad metal thickness</li> </ol> <p>The following dimensional tolerances shall apply</p> <table border="1"> <tr> <td>a) Thickness</td><td>As per Enquiry/ PO</td></tr> <tr> <td>b) Cladded plate Thickness</td><td>Composite thickness should not be less than the specified thickness.<br/>(+) 3mm (or) (+)10% of composite thickness (whichever is greater), (-) 0mm</td></tr> <tr> <td>c) Clad Metal thickness</td><td><b>Thickness should not be less than the specified thickness.</b> Over tolerance on clad metal thickness shall be as per clad metal specification. Thickness of clad metal in Ti clad plate shall be measured as per ASTM E 376 or any other equivalent ASTM/ASME/ISO/EN/DIN standard. For the purpose of measurement, the Ti clad plate shall be divided into 4 equidistant grid lines (perpendicular to longitudinal axis) and 3 equidistant grid lines (parallel to longitudinal axis). Thickness of clad metal in Ti clad plate shall be measured at the intersection points of above referred grid lines.</td></tr> <tr> <td>d) Base metal thickness</td><td>Tolerance on thickness shall be as per Base plate specification and should fulfill sl no. (b) specified above</td></tr> <tr> <td>e) Length</td><td>(+) 5mm, (-) 0 mm</td></tr> <tr> <td>f) Width</td><td>(+) 5mm, (-) 0 mm</td></tr> <tr> <td>g) Flatness</td><td>5mm/m and 8mm/2m (max)</td></tr> <tr> <td>h) Requirement</td><td>Titanium plate shall be clad with carbon steel base plate with uniform gap of 5mm all around for welding at corners. (Refer Annexure-1 for specific requirements)</td></tr> </table> | a) Thickness    | As per Enquiry/ PO                                                                                       | b) Cladded plate Thickness | Composite thickness should not be less than the specified thickness.<br>(+) 3mm (or) (+)10% of composite thickness (whichever is greater), (-) 0mm | c) Clad Metal thickness | <b>Thickness should not be less than the specified thickness.</b> Over tolerance on clad metal thickness shall be as per clad metal specification. Thickness of clad metal in Ti clad plate shall be measured as per ASTM E 376 or any other equivalent ASTM/ASME/ISO/EN/DIN standard. For the purpose of measurement, the Ti clad plate shall be divided into 4 equidistant grid lines (perpendicular to longitudinal axis) and 3 equidistant grid lines (parallel to longitudinal axis). Thickness of clad metal in Ti clad plate shall be measured at the intersection points of above referred grid lines. | d) Base metal thickness | Tolerance on thickness shall be as per Base plate specification and should fulfill sl no. (b) specified above | e) Length | (+) 5mm, (-) 0 mm | f) Width | (+) 5mm, (-) 0 mm | g) Flatness | 5mm/m and 8mm/2m (max) | h) Requirement | Titanium plate shall be clad with carbon steel base plate with uniform gap of 5mm all around for welding at corners. (Refer Annexure-1 for specific requirements) |
| a) Thickness               | As per Enquiry/ PO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| b) Cladded plate Thickness | Composite thickness should not be less than the specified thickness.<br>(+) 3mm (or) (+)10% of composite thickness (whichever is greater), (-) 0mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| c) Clad Metal thickness    | <b>Thickness should not be less than the specified thickness.</b> Over tolerance on clad metal thickness shall be as per clad metal specification. Thickness of clad metal in Ti clad plate shall be measured as per ASTM E 376 or any other equivalent ASTM/ASME/ISO/EN/DIN standard. For the purpose of measurement, the Ti clad plate shall be divided into 4 equidistant grid lines (perpendicular to longitudinal axis) and 3 equidistant grid lines (parallel to longitudinal axis). Thickness of clad metal in Ti clad plate shall be measured at the intersection points of above referred grid lines.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| d) Base metal thickness    | Tolerance on thickness shall be as per Base plate specification and should fulfill sl no. (b) specified above                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| e) Length                  | (+) 5mm, (-) 0 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| f) Width                   | (+) 5mm, (-) 0 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| g) Flatness                | 5mm/m and 8mm/2m (max)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| h) Requirement             | Titanium plate shall be clad with carbon steel base plate with uniform gap of 5mm all around for welding at corners. (Refer Annexure-1 for specific requirements)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>4.0</b>                 | <b>Heat Treatment</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>4.1</b>                 | Unless otherwise specified, the plates shall be supplied in heat- treated condition.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>4.2</b>                 | Cladded plates shall be stress relieved by Heat treatment (as per supplier's procedure)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>5.0</b>                 | <b>Mechanical Test</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| <b>5.1</b>                 | Test samples shall be selected and prepared as per ASTM A265. Number of tests and re-tests shall be carried out as per ASTM A265.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
|                            | <table border="1"> <tr> <td>a) Tensile test</td><td>The tensile test to be conducted as per Clause 7.1 of ASTM A265 with acceptance norms specified therein.</td></tr> </table>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | a) Tensile test | The tensile test to be conducted as per Clause 7.1 of ASTM A265 with acceptance norms specified therein. |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |
| a) Tensile test            | The tensile test to be conducted as per Clause 7.1 of ASTM A265 with acceptance norms specified therein.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                                                                                          |                            |                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                                                                                                               |           |                   |          |                   |             |                        |                |                                                                                                                                                                   |

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|            | b) Ductility                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Two bend tests for ductility of clad plate shall be done, one with the cladding metal in compression and other with the cladding metal in tension. Specimen preparation and procedure for ductility bend test shall be as per ASTM E290 with bend angle and diameter as per Bend test. The convex surface of specimen shall withstand bending without cracking. Any cracks within one thickness of the edge of the specimen are not considered a bend test failure. Cracks occurring in the corners of the bent portion shall not be considered significant. |
|            | c) Bond Strength:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|            | c.1) Shear strength test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | The shear strength test shall be carried out as per clause 7.2.1 of ASTM A265. The shear strength of the clad plate shall not be less than 140 MPa.                                                                                                                                                                                                                                                                                                                                                                                                          |
|            | <b>Vendor has the option of carrying out either Shear Strength Test (or) Bend Test</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|            | c.2) Bend test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Three bend tests shall be made with the cladding metal in compression to determine the quality of the bond. These bend tests shall be made in the manner of the tension tests indicated in Fig.2 of ASTM A265 and shall be bent through an angle of 180° to the bend diameters provided in either ASTM A6/A6M or specification ASTM A20/A20M. At least two of the three tests shall show not more than 50% separation on both edges of the bent portion.                                                                                                     |
|            | d) Ultrasonic test                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | The clad plate shall be examined ultrasonically as per ASTM A578/A578 M, with acceptance level C. For the location of detonator in explosion bonded clad plate, acceptance level A shall be applicable.                                                                                                                                                                                                                                                                                                                                                      |
| <b>6.0</b> | <b>Freedom from defects</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 6.1        | The material shall be clean, smooth, sound and free from injurious defects.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 6.2        | Any repair work on the clad plate is not allowed as such.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>7.0</b> | <b>Inspection at Supplier's works</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 7.1        | BHEL's representative shall have free access at all times until work on contract of BHEL is being performed, to all parts of the manufacturer's works. The supplier shall offer BHEL's representative all reasonable facilities without any financial implication to satisfy the latter that the material is being furnished in accordance with this specification.                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>8.0</b> | <b>Packing and Marking</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 8.1        | <p>The material shall be separated by size and prepared for shipment in such a manner as to ensure acceptance by common carrier transportation and to afford protection from the normal hazards of transportation by sea. Packing shall be of sea worthy packing.</p> <p>Each package shall be suitably marked with the following details. A metal label shall be securely attached to each package and shall bear the following information:</p> <ol style="list-style-type: none"> <li>1. Titanium clad Carbon steel plates</li> <li>2. BHEL PO no:</li> <li>3. Consignment and Identification No.</li> <li>4. Size, number and Weight</li> <li>5. Supplier's name</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 8.2        | <b>Painting-</b> Non-clad portion of Carbon steel base plate shall be coated with one coat of Inorganic Zinc silicate primer, DFT- 20μ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>9.0</b> | <b>Dispatch</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 9.1        | It is the responsibility of the supplier to ensure that no damage occurs during transit.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |

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| <b>10.0</b> | <b>Inspection and Certification</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 10.1        | All tests shall be complied as per the specification for each heat and dimensional reports containing all elements of cl.3.1 & cl.5.1 shall be furnished for our verification. Despatch clearance will be issued after verification of reports and is mandatory before effecting despatch to BHEL stores.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 10.2        | <p>The test certificates shall be furnished with the following details legibly in English language only</p> <ol style="list-style-type: none"> <li>1. BHEL reference <ol style="list-style-type: none"> <li>a) BHEL PO no</li> <li>b) Titanium cladded carbon steel plates</li> </ol> </li> <li>2. Supplier's reference: <ol style="list-style-type: none"> <li>a) Supplier's name</li> <li>b) Test certificate no</li> <li>c) Quantity and Weight</li> <li>d) Identification marks</li> <li>e) Process of manufacture</li> </ol> </li> <li>3. Test results: <ol style="list-style-type: none"> <li>a) Material test certificates of base plate and cladding metal sheet</li> <li>b) RT report</li> <li>c) Heat treatment Batch no and details</li> <li>d) Clad metal thickness in cladded plate</li> <li>e) Mechanical properties</li> <li>f) Bond strength</li> <li>g) Ultrasonic test report</li> <li>h) Dimensional report</li> </ol> </li> </ol> |
| <b>11.0</b> | <b>End use</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| 11.1        | These are intended for lining of ducts from absorber outlet to bypass duct in FGD system.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>12.0</b> | <b>Rejection and replacement</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 12.1        | In the event of any cladded plate proving defective in the course of rolling (forming), machining, testing, assembly or erection, such plates shall be rejected notwithstanding, any previous certification of satisfactory testing and/or inspection.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 12.2        | The supplier shall undertake to replace the rejected plates at his own cost and the rejected plates shall be sent back to the supplier after fulfilling the commercial terms and conditions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |





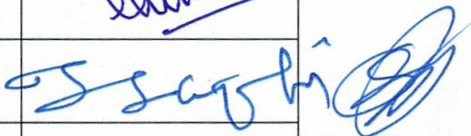
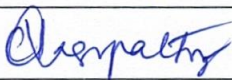
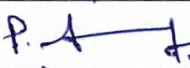
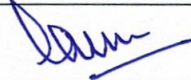
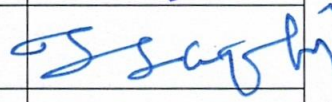

Ranipet

TECHNICAL DELIVERY CONDITION  
FOR  
TITANIUM CLADDED CARBON STEEL  
PLATES TO SPECIFICATION  
ASTM B898

|                 |               |
|-----------------|---------------|
| DOC No:         | TDC: RTS: 003 |
| Effective Date: | 20/05/2019    |
| Rev:            | 01            |
| Page:           | 4 of 4        |

RECORD OF REVISIONS

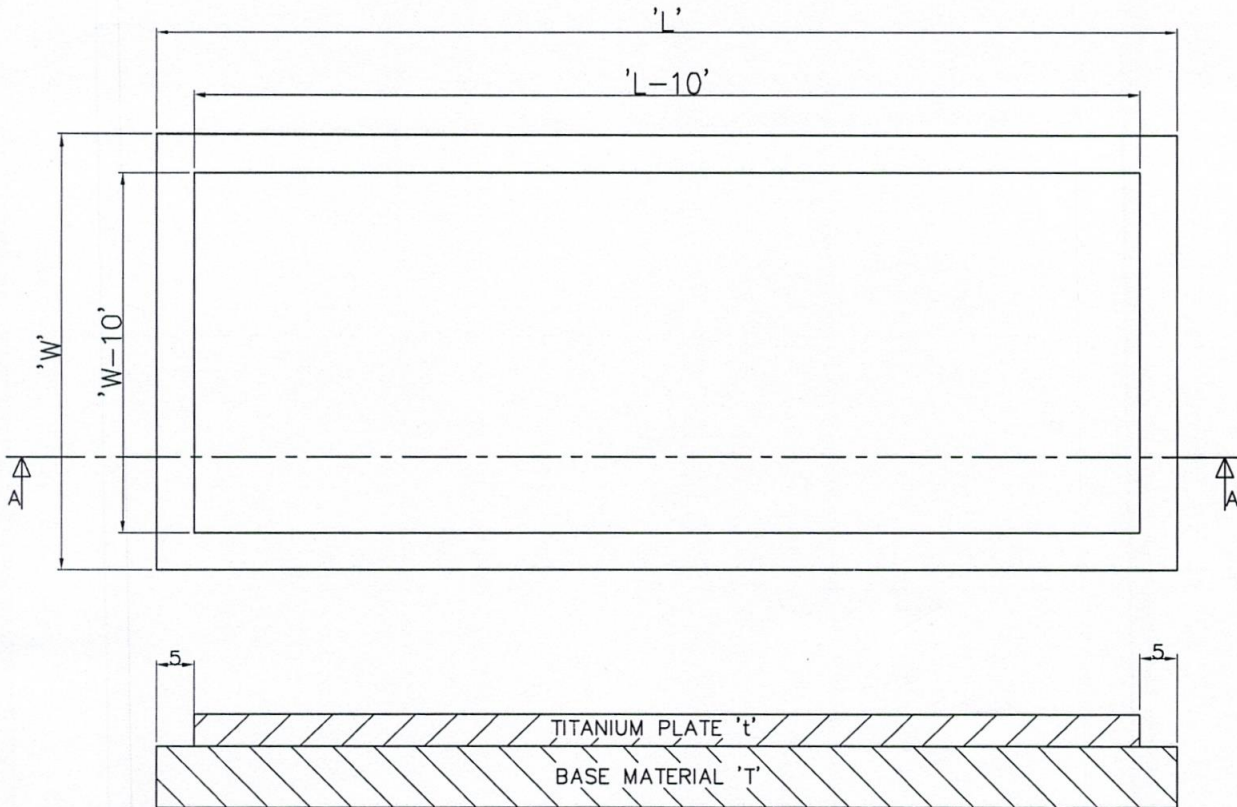
| REV. NO | Clause revised | Details of revision                            | Date       |
|---------|----------------|------------------------------------------------|------------|
| 00      | --             | Original issue                                 | 26.02.2019 |
| 01      | 1.1, 2.1 & 3.1 | Revised Issue- Based on the feedback from Engg | 20.05.2019 |

| Prepared by                                                                                                         | Reviewed by       |                                       | Signature                                                                            | Approved by                                                                                                               |
|---------------------------------------------------------------------------------------------------------------------|-------------------|---------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                     | Department        | Name and Desig.<br>(Shri/ S)          |                                                                                      |                                                                                                                           |
| <br>Rajamanickam.M<br>Dy. Mgr/ QA | ENGG (FGD)        | Kumuda Ballav Padhi<br>DGM/ EDC- AQCS |  | <br>K.C. Gandhi Parimalam<br>DGM / QA |
|                                                                                                                     | PURCHASE          | V. Ragupathy<br>SM/ Purchase          |  |                                                                                                                           |
|                                                                                                                     | MATERIAL PLANNING | P. Annamalai<br>Sr. Mgr/ MPL          |  |                                                                                                                           |
|                                                                                                                     | QC/Proc.          | R. Kesavan<br>DGM/ QC- Proc           |  |                                                                                                                           |
|                                                                                                                     | QC/Shops          | K. Karunanidhi<br>DGM/QC- Shops       |  |                                                                                                                           |
|                                                                                                                     | QC/OLI            | R. Arunachalam<br>DGM/QC-OLI          |  |                                                                                                                           |
| Issued by Quality Assurance                                                                                         |                   |                                       |                                                                                      |                                                                                                                           |

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## ANNEXURE -1

- NOTE: 1. CLADDED PLATE OF TITANIUM & CARBON STEEL  
2. ALL ROUND 5MM GAP BETWEEN BASE MATERIAL AND TITANIUM SHEET



SECTION-AA

L : LENGTH OF PLATE  
W : WIDTH OF PLATE  
t : THICKNESS OF BASE PLATE  
T : THICKNESS OF TI PLATE

AS PER ENQUIRY/PO

TYPE OF PRODUCT  
OR NAME  
COSTOMER/PROJECT



BHARAT HEAVY ELECTRICALS LTD.  
UNIT: BOILER AUXILIARIES PLANT.  
RANIPET - 632 406.

| DRN  | NAME SURYA | SIGN | DATE       |
|------|------------|------|------------|
| CHD  | FELIX      |      | 10.05.2019 |
| APPD | K.B.PADHI  |      | 10.05.2019 |

|           |                                |             |                    |
|-----------|--------------------------------|-------------|--------------------|
| DEPT AQCS | GRADE OF UNTOL.DIM PR: QA: 500 | SCALE N.T.S | WEIGHT (KG). ***** |
| CODE 862  |                                |             |                    |

REF TO ASSY / OLD DWG

TITLE  
TITANIUM CLADDED PLATE

DRAWING NO :  
4-FW-000-00790

REV  
00

Size A4