

BASED ON DLW SPECN. NO.  
MISC-119 REV. R4.

ALTERNATION	DATED	
	VALIDATED	27/11/09
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ALT. NO	SPECIFICATION REVISED AND RETYPED. (VIDE DLW REV. R4)	
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**MATERIAL STANDARDS**  
DIESEL LOCO MODERNISATION  
WORKS

NUMBER

Misc.119

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Steel Plates

**Weldable Micro-Alloyed Structural Steel Plates for fabrication of Engine-Blocks, Crank-cases, Under-frames etc.**

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**1. SCOPE:**

This specification covers the Technical and Metallurgical requirements of 'Weldable Micro-Alloyed Structural Steel Plates' for manufacture of 'Engine-Blocks', 'Crank-Cases', 'Under-Frames' etc of DLW built Locomotives to Designs of M/s ALCO (for Engine-Blocks) and M/s GM/EMD (for Crank-Cases and Under-Frames).

**2. REQUIREMENTS:**

**2.1 STEEL MAKING PROCESS:** Through Electric Arc Furnace/Basic Oxygen/ Basic Open Hearth Route. The Steel shall be 'Fully killed' (by Al + Si and with minimum Al & Si Contents of 0.01% & 0.10% - respectively, in the finished products), routed through VAD/RHD and made to Fine Grain Practice.

**2.2 FREEDOM FROM DEFECTS:**

The finished Plates shall be free from Surface-flaws like Lamination, Pittings, Rolled-in-Scaling, Deep Scratches, Grooves, Piping, Hairline-Cracks, Rough/ Jagged/ Imperfect edges or any other Detrimental defect; which can deteriorate the quality of the Plates and/or adversely effect the end-use.

**2.3** Minor surface defects may be removed by the manufacturer by grinding; provided the thickness is not Reduced by more than 4% of the Minimum Specified Limit.

**3. CHEMISTRY:** To conform to the following composition:

(a) Ladle analysis should conform to the following Chemistry: -

Elements	Limits (%)	Elements	Limits (%)
C	0.15 (max.)	Al	0.01(min.)
Mn	1.50(max.)	S & P	0.04(max., each)
Si	0.15-0.45		

Micro-Alloying is to be resorted to by adding Nb, V & Ti; singly or in combination and up to 0.25%.

**Alternate Material:**

**First Choice:** Steel Plates to Grade Fe 440 B of IS: 8500, 91 or to the corresponding latest Grade;

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Boran shall not be used for Micro Alloying and S & P shall be up to 0.04 % (Max each) the items being 'Flat Rolled' Wrought Products and with C.E. of the finished Plates as  $\leq 0.40$ . All other requirements shall comply with the requirements of this DMW Standard.

**Second Choice:** The second choice shall be Steel Plates with C.E. values similar to the first choice of finished Plates and all other requirements shall comply with the requirements of DLW Standard/Specification No.MISC-104 (except the requirements against E%, Impact Strength and Bend Test as specified therein. The same shall be as mentioned hereunder at Cl.5.1)

(b) Permissible variations in Product Analysis:-

<u>Elements</u>	<u>Limits (%)</u>	<u>Elements</u>	<u>Limits (%)</u>
C	0.02	Si	0.03
Mn	0.05	S & P	0.005, each

**3.1 CARBON EQUIVALENT:**

Over the above Chemistry, the C.E. Value of the Finished Plates must not exceed 0.40, for any type of the said materials.

**4.0 HEAT-TREATMENT:**

All Plates are to be supplied in "TEMPERATURE CONTROLLED ROLLED/NORMALIZED" condition.




**5.0 MICRO. STRUCTURE:**


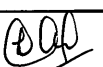
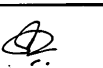
Microstructure shall reveal Matrix of 'Uniform Equiaxed Grains' of "Ferrite" & "Pearlite", with ASTM Grain Size no.6 to 8 and shall not reveal any Banding/Widman Statten Pattern/Lamination/Dendrites or any other harmful defect.




**5.1 MECHANICAL PROPERTIES OF THE FINISHED PLATES:**

- a) Y.S (Mpa) : 300 (Min.)
- b) U.T.S (Mpa) : 440 -560
- c) E % (on G.L.= $5.65 \sqrt{SO}$ ) : 22 ( Min.)
- d) Impact Strength [ CVN, average of three (3) values]:-  
50J (Min), at Room Temperature (i.e.  $25 \pm 2^{\circ}C$ ) or 40J (Min), at  $0^{\circ}C$ .

**Note:** No individual impact value shall be less than 30% of the Min. Specified average limit. Higher Impact Strength (if required), shall be subject to mutual agreement.

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<p>e) <u>Bend Test</u> Mandrel Dia.</p> <p>Thickness:-</p> <p>≤ 12mm. : 2 t (t: Thickness of Plates)</p> <p>&gt; 12mm. &amp; up to 25 mm. : 3t (t: Thickness of Plates)</p> <p>Above 25 mm. thickness; Bend Test is not mandatory.</p> <p><b>6.0 SAMPLING RATE:</b></p> <p>a) <b>Chemistry:-</b> Each Heat/Melt</p> <p>b) <b>Mech. Testing:-</b> To be carried out as per relevant specification and in the following pattern: -</p> <p>i) 'Tensile test' shall be conducted with samples, taken Transverse to the Rolling Direction.</p> <p>ii) 'Bend test' shall be conducted with samples similar to the above type.</p> <p>iii) 'Impact test' shall be conducted with samples-taken out along the Rolling Direction, with Notch-axis Perpendicular to Rolling Direction. In case of Sub-Sized Test Specimens, the obtained Impact strength Values shall be converted to standard sample size values, taking pertinent, 'Correction Factor' into account.</p> <p>iv) Every Thermally- treated Batch shall have to be checked or as follows:-</p> <p>@ One sample per Thermally- treated Batch or @ One sample per Batch of 5 Tons whichever is more.</p> <p><b>7.0 NON DESTRUCTIVE EXAMINATION:-</b></p> <p>All plates shall be subjected to Ultrasonic Scanning. The Plates shall be in conformity to the requirements of level 'B' to ASTM A- 578/578-M of 1996 or to the corresponding Current Standard. Acceptance shall have to be mentioned invariably as ' Satisfactory' in the test Certificates; provided that the Plates are in conformity to the said requirements.</p> <p><b>8.0 DIMENSIONAL TOLERANCES:</b></p> <p><u>Thickness:</u> <u>Limits</u></p> <p>UP to 40mm - As per ASTM A-6</p> <p>&gt; 40mm - As per IS- 1852</p> <p><u>Length &amp; Width:</u> As per ASTM A-6</p> <p><u>Flatness / Waviness:</u></p> <p>Up to 40mm - As per ASTM A-6 M</p> <p>&gt; 40 mm - 50% over the limits specified in ASTM A-6, as per the applicable width of plates.</p>			
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<p><b>9.0 CARBON EQUIVALENT:</b> Shall be <math>\leq 0.40</math>, as already mentioned and shall be checked on every Thermally- treated Batch.</p> <p><b>10.0 RE-TESTING (of Matl. Aspects):</b></p> <p>a) If any sample; selected first in accordance with the provisions of Cl.Nos. 6, 7 &amp;9; fails to pass any of the said tests/checks, two samples shall be selected further, against each failure, per Thermal-treatment Batch. If these additional samples pass the very test, the material/Batch represented by these additional samples shall be deemed to comply with the requirement of that particular test. If either of these additional samples fails to pass the test, the material represented by these additional samples shall be rejected.</p> <p>b) Against failures of the first selected samples fails more than one test/check; rate of sampling shall be similar but @ two more samples per failure shall be selected. Acceptance criteria, would be similar; per failure.</p> <p><b>11.0 INSPECTION:</b></p> <p>The plates shall be inspected, checked, tested and certified by manufacturer's in house Quality Assurance Agency, as also by the nominated External Inspection Agency and Test certificates- furnishing all the relevant details, shall have to be submitted to Chief Inspection Officer DMW. However, Consignee reserves the right to Crosscheck any Plate, subsequent to receipt of the Consignment at Consignee-end or during any stage of manufacture.</p> <p><b>12.0 PRODUCT TRACEABILITY:</b></p> <p>The plates shall have suitable and adequate identity with Manufacturer's Name, Grade, Specification of the material, Heat-Number, Plate Number, Plate size and year &amp; month of manufacture.</p>			
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