WELDING PROCEDURE SPECIFICATION

WPS - 1000-Rebar/4140  REV. NO.: 0  DATE: 9/15/2006  **APPLICABILITY**

WELDING PROCESS: SMAW- and SMAW-  ASME:  AWS: X  OTHER: 1000-R/4140

SUPPORTING PQR: 1000-R/4140

**APPLICABILITY**

This WPS shall be used in conjunction with the General Welding Standards (GWS) and Welding Fabrication Procedure (WFP) sections and criteria for joint details, repairs, NDE, inspection etc.

**JOINT:**

- **Weld Joint Type:** Flare Bevel
- **See GWS 1-06 and WFP's for joint details**
- **Class:** Partial Penetration
- **Preparation:** Remove loose rust and scale
- **Root Opening:** N/A
- **Backing:** Metal
- **Backgrind root:** N/A
- **Backing Mat.:** Rebar or splice plate
- **Bkgrd Method:** N/A
- **GTAW Flux:** N/A
- **Backing Retainer:** N/A

**FILLER METALS:**

- **A No:** N/A
- **SFA Class:** 5.5 and 5.5
- **F No:** 4 and 4
- **Size:** 3/32 1/8 1/8
- **Class:** E8018 and E9018
- **Weld Metal Thickness Ranges:**
  - **AWS Root Pass:** .0125 thru 0.187
  - **AWS Balance:** 0.221 thru 1.250
  - **ASME Root Pass:** thru
  - **ASME Balance:** thru

**BASE MATERIAL**

- **Spec. A-706 Grade 60 Rebar**
- **Grade:**
- **to:** Spec. A-193 Grade B7/AISI 4140
- **Gr No.:**
- **to P/S No.:** N/A
- **P/S No.:** N/A
- **ASME:**
- **ASME:**

**QUALIFIED POSITIONS:**

- **ASME:** 2G, 3G, 4G,
- **Vert. Prog.:** Vertical Up
- **Vert. Prog.:** N/A

**QUALIFIED POSITIONS:**

- **Preheat Min. Temp.:** 500 °F
- **GAS: Shielding:** N/A
- **or:** N/A
- **Interpass Max. Temp.:** 700 °F
- **Gas Composition:** / / %
- **/ / %
- **Preheat Maintenance:** 500 °F
- **Gas Flow Rate cfh:** to
- **to
- **PWHT: Time @ °F Temp. * **Backin Gas/Comp:** N/A%
- **Temp. Range:** * °F
- **Backing Gas Flow cfh:** to
- **to ** °F
- **Trailing Gas/Comp:** N/A
- **0 %

**APPROVAL:** Signatures on file at ENG  DATE: 9/15/2006
WPS NO: 1000-Rebar/4140

WELDING CHARACTERISTICS:

<table>
<thead>
<tr>
<th>Current:</th>
<th>DCEP</th>
<th>and</th>
<th>DCEP</th>
<th>Tungsten Type:</th>
<th>N/A</th>
<th>Transfer Mode:</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranges:</td>
<td>Amps</td>
<td>75</td>
<td>to</td>
<td>150</td>
<td>N/A</td>
<td>Pulsing Cycle:</td>
<td>N/A</td>
</tr>
<tr>
<td></td>
<td>Volts</td>
<td>14</td>
<td>to</td>
<td>24</td>
<td>N/A</td>
<td>Background Current:</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Fuel Gas: | N/A |
Flame: | N/A |
Braze temp. °F: | N/A |

WELDING TECHNIQUE:

For fabrication specific requirements such as fittup, cleaning, grinding, PWHT and inspection criteria refer to Volume 2, Welding Fabrication Procedures

Technique: Manual
Cleaning Method: Grind, Chip, Wire brush
Single Pass or Multi Pass: M
Stringer or Weave bead (S/W): S or S
Oscillation: N/A
GMAW Gun Angle °: to
Forehand or Backhand for GMAW (F/B): N/A
No Pass >1/2": True
GMAW/FCAW Tube to work distance: N/A
Maximum K/J Heat Input: N/A
Travel speed: Varies
Gas Cup Size: N/A

PROCEDURE QUALIFIED FOR:

Charpy "V" Notch: N/A
Nil-Ductil Transition Temperature: N/A
Dynamic Tear: N/A

Comments: * Immediately after completion of welding, heat the weld and 1 inch each side to 650 °F hold for 5 minutes, then cool slowly until temperature is 300 °F.

<table>
<thead>
<tr>
<th>Weld Layer</th>
<th>Manual Process</th>
<th>Filler Metals</th>
<th>Size</th>
<th>Amp Range</th>
<th>Volt Range</th>
<th>Travel/ipm</th>
<th>Nozzle Angle</th>
<th>Other</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>SMAW-</td>
<td>E8018</td>
<td>3/32</td>
<td>75 to 100</td>
<td>14 to 18</td>
<td>4 to 6</td>
<td>to</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>SMAW-</td>
<td>E9018</td>
<td>1/8</td>
<td>98 to 120</td>
<td>16 to 20</td>
<td>5 to 7</td>
<td></td>
<td></td>
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<tr>
<td>3</td>
<td>SMAW-</td>
<td>E9018</td>
<td>1/8</td>
<td>118 to 140</td>
<td>18 to 24</td>
<td>5 to 7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>SMAW-</td>
<td>E9018</td>
<td></td>
<td>to</td>
<td>to</td>
<td>to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>SMAW-</td>
<td>E9018</td>
<td></td>
<td>to</td>
<td>to</td>
<td>to</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>SMAW-</td>
<td>E9018</td>
<td></td>
<td>to</td>
<td>to</td>
<td>to</td>
<td></td>
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</tr>
</tbody>
</table>

REM. * Weld layers are representative only - actual number of passes and layer sequence may vary due to variations in joint design, thickness and fitup.

Use of LANL Welding Procedures and Welder Qualifications for non-LANL work shall be at the sole risk and responsibility of the Subcontractor, and the Subcontractor shall indemnify and save LANL and the Government harmless from any and all claims, demands, actions or causes of action, and for any expense or loss by reason of Subcontractor's and their employees possession and use of LANL procedures and qualifications.