Our studies have proven that the ER90S-B3* electrode, low heat input, and pulse spray transfer mode results in a lower porosity rating. The higher manganese content within the ER90S-B3* has proven that the higher levels of deoxidizers (Mn) will reduce the level of porosity in GMA welds. 

### Variables for Experiment

- **Heat Input**
  - Low
  - High

- **CTWD**
  - Long 0.75 inch
  - Short 0.375 inch

- **Voltage**
  - High
  - Low

- **Transfer Modes**
  - Short Arc
  - 75-25 Ar/CO2 Mix
  - 98-2 Ar/CO2 Mix
  - Spray
  - 98-2 Ar/CO2 Mix
  - Pulse Spray
  - 98-2 Ar/CO2 Mix

### Results

X-ray results from first welding task are show below. Porosity varied greatly depending on the variables used.

<table>
<thead>
<tr>
<th>Electrode Transfer Mode</th>
<th>Plate ID</th>
<th>Shielding Gas</th>
<th>Electrode</th>
<th>Heat Input (kJ/in)</th>
<th>Porosity Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-Circuit LNM 20</td>
<td>A5</td>
<td>75% Ar-25% CO2</td>
<td>LNM 20</td>
<td>119.8</td>
<td>1</td>
</tr>
<tr>
<td>Pulse LNM 20</td>
<td>C2</td>
<td>98% Ar-2% CO2</td>
<td>LNM 20</td>
<td>351.9</td>
<td>0</td>
</tr>
</tbody>
</table>

ER90S-B3* wire produced cleaner x-rays than the AWS classified ER90S-B3 wire. The graphs also show that the pulsed GMAW shows promise for further research as this process produced the best x-ray results.

ER90S-B3*, 98%Ar2%CO2, Pulsed spray transfer mode

ER90S-B3*, 75%Ar25%CO2, Short circuit transfer mode

### Conclusions

Our studies have proven that the ER90S-B3* electrode, low heat input, and pulse spray transfer mode results in a lower porosity rating. The higher manganese content within the ER90S-B3* has proven that the higher levels of deoxidizers (Mn) will reduce the level of porosity in GMA welds.

### Acknowledgements

We would like to thank the Lincoln Electric Company and our sponsor Mike Barrett for the material, filler wire, and support during this project. We would also like to give a special thanks to our advisors Professor Babu and Professor Farson.