NSRP | National Shipbuilding Research Program

High Deposition, Out of Position, Mechanized GMAW-Pulse

September 12-13, 2017

Newport News Shipbuilding

Newport News, Virginia

Project Overview

Evaluate selected processes to determine if they meet the following requirements:

- Higher deposition than baseline
- Mechanized GMAW-Pulse
- Out of position capable
- Maintain current heat input
- Structural applications
- Robust process and equipment

Current Process

The current process below is our baseline to improve upon:

- GMAW-Pulse
- Uses 0.045” welding consumable
- Single arc
- Mechanized
- Out of position
- 55 kJ Heat input maximum

Processes to Evaluate

The following processes will each be evaluated for deposition improvements vs. the current process:

- Larger diameter welding consumable (0.052” or 1/16”)
  - With or without Spin Arc® technology
- Twin or Tandem arc process
  - Two arcs in the same weld pool
- Hot or Cold wire method
  - Adding additional wire to the weld pool
- Hybrid LASER or Plasma arc with GMAW-Pulse
- Existing power supplies offering High Deposition modes

Evaluation Process Steps

The evaluation will be a two part process:

- Part 1
  - Evaluate available application/process data eliminating those technologies that do not meet the application needs
    - This is being done to reduce project costs, and to stay within budget.
- Part 2
  - Trial remaining processes in a lab environment for full evaluation
    - This will involve vertically welded samples to optimize the process parameters, so that the process efficiencies can be accurately measured.

Larger Welding Consumable

Lincoln Electric

- Trialed both 0.052” and 1/16” wires
- Both wire sizes yielded a lower deposition rate than our current baseline
- No process improvement established

NNS- O37 Weld Lab

- Trialed both 0.052” and 1/16” wires
- The 0.052” wire yielded a lower deposition rate than our current baseline
- The 1/16” wire is still in testing

Larger Welding Consumable with Spin

SpinArc® by Weld Revolution-Abicor Binzel

- Trialed 1/16” wire
- The joint design designated did not align with the process needs of this technology
- Various plate thicknesses (3/4-1 ½”T) and orientations (1G and 4G) were trialed with varying degrees of success
- This process was not a match for the intended joint but showed promise for other potential applications

Twin and Tandem arc processes

Twin and Tandem Arc

- Sources: Lincoln Electric, Fronius, tech. articles
- Large nozzle creates joint obstruction
- Sensitive to CTWD and Electrode spacing, yielding turbulent puddle
- Typically robotic not mechanized, too high TS for human control
- Large puddle not easily taken out of position
- Not pursued at this time

Hot and Cold wire processes

Hot Wire

- Sources: Lincoln Electric, NNS
- Large nozzle creates joint obstruction
- NNS previous experience results- lots of porosity, cold ropey welds
- Large puddle is not easily taken out of position
- Not pursued at this time

Cold Wire

- Sources: Lincoln Electric, NNS
- Given the known results of the Hot Wire process it was strongly recommended to not pursue this technology
- Thought to be even colder, resulting in more ropey welds creating worse lack of fusion
- Not pursued at this time

Hybrid Process: LASER or PAW/GMAW

LASER/GMAW

- Sources: Lincoln Electric, Fronius
- Higher safety concerns and standards require specific protection measures
- Process tolerances are not sustainable for the current production process
- Potentially costly system
- Not pursued at this time

PAW/GMAW

- Source: Weld-O-bot with CTC
- Able to be mechanized and maintain current Heat Input
- Testing is currently being carried out, results pending

High Dep. Power Supplies

Lincoln Electric

- Precision Pulse 0.052”
- Yielded a lower deposition rate than our current baseline
- No process improvement established

Miller Electric

- HD MIG 0.035”, 0.045”, 0.052” 1/16” wires trialed
- Some deposition rate increase was found, but marginal
- No significant process improvement established

OTC

- Nanotechnology
- Various wire diameters and gas blends were tested
- Testing still in progress but showing promising results thus far

Questions