Rev: 0
June 10, 2015

Fermilab
In-Process Weld Examination Form

Filled by engineer:

Project: LCLS-II pCM 2-Phase Weld Type: _____ WPS #: _____

Drawing #: F10009950 - Pipe #1 Size: 4" x .083 Wall Engineer: C. Grimm

Weld #: _____ Pipe #2 Size: 4" x .083 Wall Date: _____

Filled by inspector:

Welder: _____ Inspector: C. Grimm

WPQ Qualified? YES ☑ Other ☐

Filled by examiner in field:

Date: _____ Examiner: C. Grimm

In-Process Visual Examination (see more info on the next page)	***Check if OK***
a) joint preparation and cleanliness Joint surfaces are free of chips, particles, dust, rust, scale, oil, grease, etc.	
b) pre-heating: (N/A if ambient temperature ≥ 50° F [10° C]) ambient temp._____ pre-heat temp._____	
c) AWS Filler Metal Specification_____ Manfacturer_____ Filler rod: Class_____ Diameter(s)_____ Is filler certified?_____Is a copy of CMTR or COA available_____ Heat #(s)_____Lot#(s)_____ gap_____ type of purge gas_____ purge flow-rate & duration_____ or O_2 reading _____	_____ _____ _____
c)(1) for butt welds: confirm ID at end preparation is within ± 1/32" and OD is aligned properly	
d) for brazing: position, flux, brazing temperature, wetting, and capillary action	
e) for welding: condition of root pass (after cleaning) – external and/or internal	
e)(1) for SMAW (stick welding): slag removal and weld condition between passes	
f) appearance of finished joint: No visible cracks, lack of fusion, porosity, obvious imperfections, incomplete penetration Filler material is fused to edges of parent material Depth of undercut (< 1/32", N/A if non-existent)_____	_____ _____ _____

Best welding practices

a) Joint Preparation and Cleanliness:

Use scotch bright or Aluminum oxide to clean the joint. Use only wire brushes dedicated for stainless steel on stainless steel. Carbon steel brushes can leave carbon particles in the joint.

b) Preheating:

Minimum temperature for P1 (carbon steel) and P8 (304/316 stainless steel) is 50° F [10° C]. For all other materials or atypical stainless steels, refer to para. 330 of B31.3.

c) Variable specified by WPS (Welding Procedure Specification):

* Welding Machine:
  - Remote foot pedal required
  - DC straight machine required.
* Filler rod must be AWS A5.9 designation (for stainless)
* Record diameter and class (308SS or 304LSS ... etc.) of filler rod
* Required Filler Rod Class

If connecting	304SS to 304SS	use 308 filler rod
If connecting	304SS to 304LSS	use 308L filler rod
If connecting	304LSS to 304LSS	use 308L filler rod
If connecting	316SS or 304 SS to 316SS	use 316 filler rod

For any other combination consult with the Fermilab weld shop.

* CMTR--Certified Material Test Report, COA-Certificate of Analysis, COC-Certificate of Conformonce

* Purge Gas

  Purge gas must be 99.995% pure welding grade Argon. Boil off gas from a liquid argon dewar is acceptable.
* Purge Flow

  Purge gas must flow through the pipe, past weld joint to remove oxygen. As a general rule the pre-weld purge should give 5-6 volume changes.
* Oxygen concentration

  Oxygen concentration must be less than 1%. If available, use an oxygen monitor to measure the O2 concentration of the exhausting purge gas.
* Joint Clearance (gap)

  Butt weld: per WPS

  * Socket weld: 1/16" (+1/16", -none) clearance between socket base and adjoining piece.

  End Preparation: Align inside surfaces of joint within ± 1/32" or WPS requirement (whichever is smaller). For unequal pipe diameters or thicknesses, refer to design drawing.
* Internal Alignment:

  Butt Weld: If the two pieces have the same OD and wall thickness, alignment can be confirmed using a straight edge on the OD.

(e) Inspection:

Repeat inspection after every pass (does not need a separate form)