

MTA transfer line assembly

9/11/2008

1. Clear access to the area.
2. Refrigerator room.
 - a. Measure height of the round valve box relative to the refrigeration room wall penetration.
 - b. Discuss with Mike Geynisman how far the valve box should be from the refrigerator room wall.
 - c. Insert line section B-C into the wall penetration until a few feet is left in the refrigeration room.
 - d. Align section A-B and connect joint B.
 - e. Insert sections A-B and B-C into the wall until it is convenient to connect joint A.
 - f. Anchor the valve box in it's final location.
3. Detector Hall
 - a. Align the expansion box with section B-C. Flex line preloading is very important. Check with Bob Woods regarding relative positions of the lines.
 - b. Support the expansion box with temporary supports.
 - c. Connect joint C.
 - d. Check that the valve box stand is in the correct position.
 - e. Mount the valve box on the stand.
 - f. Assemble the elbow in section E-F. This portion of the transfer line is being laid out by Vic Madjanski. Make sure that joint E is aligned with joint D and at the same elevation.
 - g. Connect joint F.
 - h. Suspend line section D-E with adjustable hangers. Bob Woods will provide hanger design.
 - i. Connect joint E.
 - j. Align the expansion box with section D-E. Flex line preloading is very important. Check with Bob Woods regarding relative positions of the lines.
4. General Rules
 - a. Make sure lines are not crossed. Check as assembly progresses by flowing gas through the lines.
 - b. Keep a log of all activities and tests.
 - c. Check the calibration of the leak detector. Bag the joints when testing to prevent contaminating the adjacent MLI with helium.
 - d. Use socket weld fittings where possible. 5% of butt weld joints must be examined with radiography or in-process inspection.
 - e. One inch tubes may be bent away from the centerline to facilitate welding. The maximum distance is ¼ inch if the nearest G10 spacer is 24 inches away. The maximum distance is ½ inch if the nearest spacer is 30 inches away.

- f. Make sure joints are held straight. One possible procedure is to partially weld the joint in normal position, then deflect it out for welding the back side.
- g. Cold shock and leak check each of the four inner lines before proceeding with the shield assembly.
- h. Check that the inner tubing is straight and can not possibly touch the shield.
- i. Split the shield piping and weld in place. 5% of circumferential butt welds must be radio graphed or documented with in-process examination.
- j. Cold shock and leak check the joint.
- k. Insulate the joint with 40 layers of MLI.
- l. Cover the insulation adjacent to the weld joints with fire resistant blanket to protect the insulation during welding.
- m. Split the vacuum jacket and weld it in place.
- n. Leak check the vacuum jacket.

In-Process Weld Inspection Guidelines

MTA Transfer Line Assembly

MTA Service Building

Start date 9-23-2008

This procedure is only valid for: GTAW welding of 304SS, 304LSS, 316SS pipe, tube or pipe components such as valves by Fermilab certified welders.

Fermilab welders are certified to weld in any position so there is no need to verify the position when welding. An In-process weld inspection must reflect the WPS for an individual welder.

(1) Joint Preparation and Cleanliness:

Internal and external surfaces to be welded are to be clean and free from rust, oil, grease, dirt, paint, etc. Cleanliness is very important. Even dried residue from a coffee spill is unacceptable and can cause problems. Use Scotch Bright or Aluminum oxide to clean the joint. Do not use a carbon steel wire brush because it could leave carbon steel particles on the joint.

(2) Welding Machine

- (a) Remote foot pedal required
- (b) DC straight machine required

(3) Joint Fit-up, and Internal Alignment

(a) Internal Alignment:

Butt Weld: The inside surfaces of the two pieces being welded together must be aligned to within 1/32" of each other. If the two pieces are the same outside diameter and wall thickness, then this alignment can be confirmed by using a straight edge on the outside surface.

(b) Joint Clearance

Butt weld: the gap between the two pieces should be less than 1/16".

Socket weld: 1/16" clearance inside the socket.

(c) End Preparation

This project will be completely 1" schedule 10.

(4) Filler material

(a) Certification

Filler rod must be AWS designation A5.9 (for stainless).

- (b) Record diameter and class (308SS or 304LSS...etc) of filler rod

(c) 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 304SS to 316SS	use 316 filler rod

For any other combination, consult with the Fermilab weld shop.

(5) Purge Gas

(a) Purity

Pure gas must be 99.995% pure welding grade Argon. Boiloff gas from a liquid argon dewar is acceptable.

(b) Purge Flow

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

(c) 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.

(6) Inspection of the Root Pass

(a) No visible cracks

(b) No suck holes, which are small holes in middle of weld.

(c) No porosity or obvious imperfections

(d) Filler material fused along edges of weld to parent material. Ideally the weld should be concave.

(7) Repeat inspection #6 above after every pass

(8) Final Pass

Final pass should have a convex shape. Maximum buildup should be less than 1/16" above surface of pipe or tube.

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 9-29-08 Project: MTA Transfer Line Assy.

Pipe Section: 1" TRANS (IN WALL) Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) _____ (other) PIPE + UNION SOCKET
(1) Pipe #1 Size, Schedule and Material: _____
(2) Pipe #2 Size, Schedule and Material: _____

(1) Joint Preparation and Cleanliness
Joint Preparation and Cleanliness acceptable?

(2) Welding Machine
(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment
(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod
(a) AWS A5.9 stainless steel filler rod?
(b) Filler rod: Class 316 Diameter 1035

(5) Purge Gas
(a) type of purge gas: Argon
(b) time length of purge: 15 min purge flow rate: 20 scfh
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?
(d) What was "Check-Weld" meter reading at time of weld? 0.09

(6) Inspection After Root Pass
(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass?

5K SUP 1.6×10^{-9}
14K SUP 1.8×10^{-9}
20K 6.2×10^{-10}
5K R&T 3.2×10^{-10}

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 9-24-08 Project: MTA Transfer Line Assy.

Pipe Section: 1st 20' to 20' section Weld Number: 2

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____

(1) Pipe #1 Size, Schedule and Material: 3 1/2" SCH 10

(2) Pipe #2 Size, Schedule and Material: _____

(1) Joint Preparation and Cleanliness

Joint Preparation and Cleanliness acceptable?

(2) Welding Machine

(a) Remote foot pedal?

(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment

(a) Internal alignment acceptable?

(b) Joint clearance acceptable?

(c) End preparation acceptable?

(4) Filler Rod

(a) AWS A5.9 stainless steel filler rod?

(b) Filler rod: Class 308 Diameter .035

(5) Purge Gas

(a) type of purge gas: Argonne

(b) time length of purge: _____ purge flow rate: 1.0

(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?

(d) What was "Check-Weld" meter reading at time of weld? 00.0

(6) Inspection After Root Pass

(a) No visible cracks.

(b) No suck holes, which are small holes in middle of weld.

(c) No porosity or obvious imperfections:

(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass? ~~1.1 x 10⁻¹⁰~~ 1.1 x 10⁻¹⁰

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 9-25-08 Project: MTA Transfer Line Assy.

Pipe Section: 15 + 20' to 20' section Weld Number: 3

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____
(1) Pipe #1 Size, Schedule and Material: 4" SCH 10
(2) Pipe #2 Size, Schedule and Material: _____

(1) Joint Preparation and Cleanliness
Joint Preparation and Cleanliness acceptable?

(2) Welding Machine
(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment
(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod
(a) AWS A5.9 stainless steel filler rod?
(b) Filler rod: Class 308 Diameter 1.035

(5) Purge Gas
(a) type of purge gas: Argonne
(b) time length of purge: _____ purge flow rate: 1.0
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?
(d) What was "Check-Weld" meter reading at time of weld? 00.0

(6) Inspection After Root Pass
(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass? ~~0.9 x 10^-10~~
.9 x 10^-10

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 9-26-08 Project: MTA Transfer Line Assy.

Pipe Section: 15' to 20' to 20' section, outer vacuum jacket Weld Number: 4

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____
(1) Pipe #1 Size, Schedule and Material: 6" SCH. 5
(2) Pipe #2 Size, Schedule and Material: _____

(1) Joint Preparation and Cleanliness
Joint Preparation and Cleanliness acceptable?

(2) Welding Machine
(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment
(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod
(a) AWS A5.9 stainless steel filler rod? 308L
(b) Filler rod: Class _____ Diameter .035

(5) Purge Gas
(a) type of purge gas: Argonne
(b) time length of purge: _____ purge flow rate: 1.0
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?
(d) What was "Check-Weld" meter reading at time of weld? 00.0

(6) Inspection After Root Pass
(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld. _____

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass? ~~1.1 x 10⁻¹⁰~~
1.1 x 10⁻¹⁰

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 10-27-08 Project: MTA Transfer Line Assy.

Pipe Section: 1" TRANS/CAN Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) _____ (other)

(1) Pipe #1 Size, Schedule and Material: 316 UNION

(2) Pipe #2 Size, Schedule and Material: 304 SS 1"

(1) Joint Preparation and Cleanliness

Joint Preparation and Cleanliness acceptable?

(2) Welding Machine

(a) Remote foot pedal?

(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment

(a) Internal alignment acceptable?

(b) Joint clearance acceptable?

(c) End preparation acceptable?

(4) Filler Rod

(a) AWS A5.9 stainless steel filler rod?

(b) Filler rod: Class 316 Diameter .035

(5) Purge Gas

(a) type of purge gas: Argon

(b) time length of purge: 20 min purge flow rate: 20 scfh

(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?

(d) What was "Check-Weld" meter reading at time of weld? 4.9%

(6) Inspection After Root Pass

(a) No visible cracks.

(b) No suck holes, which are small holes in middle of weld.

(c) No porosity or obvious imperfections:

(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass?

5K SUP .04 x 10⁻¹⁰
14K SUP .04 x 10⁻¹⁰
20K 2.2 x 10⁻¹⁰
5K RET .06 x 10⁻¹⁰

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 10-28 Project: MTA Transfer Line Assy.

Pipe Section: LN2 INNER Weld Number: # 2

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____
(1) Pipe #1 Size, Schedule and Material: 3 1/2 Sch 40
(2) Pipe #2 Size, Schedule and Material: 3 1/2 Sch 40

(1) Joint Preparation and Cleanliness

Joint Preparation and Cleanliness acceptable?

(2) Welding Machine

(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment

(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod

(a) AWS A5.9 stainless steel filler rod? 308
(b) Filler rod: Class 308 Diameter 1/16

(5) Purge Gas

(a) type of purge gas: Argon
(b) time length of purge: 20 min purge flow rate: 20 SCFH
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?
(d) What was "Check-Weld" meter reading at time of weld? 5.9%

(6) Inspection After Root Pass

(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass? 1.2 x 10⁻¹⁰

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 10/28/06 Project: MTA Transfer Line Assy.
CAN-TROL OUTER
Pipe Section: LN2 Weld Number: # 3

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____
(1) Pipe #1 Size, Schedule and Material: 4" SCH 10
(2) Pipe #2 Size, Schedule and Material: _____

(1) Joint Preparation and Cleanliness

Joint Preparation and Cleanliness acceptable?

(2) Welding Machine

(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment

(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod

(a) AWS A5.9 stainless steel filler rod? 308
(b) Filler rod: Class 308 Diameter 1/16

(5) Purge Gas

(a) type of purge gas: Argonne
(b) time length of purge: 1/2 hr. purge flow rate: 20 SCFH
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?
(d) What was "Check-Weld" meter reading at time of weld? < 1%

(6) Inspection After Root Pass

(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass? 1/4 x 10⁻¹⁰

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 10/28/08 Project: MTA Transfer Line Assy.
CAN/TRANS
Pipe Section: VAC Weld Number: # 4

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____
(1) Pipe #1 Size, Schedule and Material: 6" SCH 10
(2) Pipe #2 Size, Schedule and Material: _____

(1) Joint Preparation and Cleanliness
Joint Preparation and Cleanliness acceptable?

(2) Welding Machine
(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment
(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod
(a) AWS A5.9 stainless steel filler rod? 308
(b) Filler rod: Class 308 Diameter 1/6

(5) Purge Gas
(a) type of purge gas: Argonne
(b) time length of purge: 1/2 HR purge flow rate: 20 SCFH
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?
(d) What was "Check-Weld" meter reading at time of weld? < 1%

(6) Inspection After Root Pass
(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass? 1.2×10^{-10}

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 11/13/08 Project: MTA Transfer Line Assy.

Pipe Section: 1" EXP CAS / TRANS Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) _____ (other)

(1) Pipe #1 Size, Schedule and Material: 1" 304 1/16" wall

(2) Pipe #2 Size, Schedule and Material: 1" 304 .049

(1) Joint Preparation and Cleanliness

Joint Preparation and Cleanliness acceptable?

(2) Welding Machine

(a) Remote foot pedal?

(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment

(a) Internal alignment acceptable?

(b) Joint clearance acceptable?

(c) End preparation acceptable?

(4) Filler Rod

(a) AWS A5.9 stainless steel filler rod?

(b) Filler rod: Class 304 Diameter .045

(5) Purge Gas

(a) type of purge gas: Argon

(b) time length of purge: 15 min purge flow rate: 20 scf/h

(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?

(d) What was "Check-Weld" meter reading at time of weld? 5.9%

(6) Inspection After Root Pass

(a) No visible cracks.

(b) No suck holes, which are small holes in middle of weld.

(c) No porosity or obvious imperfections:

(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass?

1. 5K SUP 1.89×10^{-10}
2. 14K SUP 2.14×10^{-10}
3. 20K 3.68×10^{-10}
4. 5K SUP 1.7×10^{-10}

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 11-15-08 Project: MTA Transfer Line Assy.

Pipe Section: LN2 INN#2 Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____
(1) Pipe #1 Size, Schedule and Material: 3.5 SCH 10 304
(2) Pipe #2 Size, Schedule and Material: 3.5 SCH 10 304

(1) Joint Preparation and Cleanliness

Joint Preparation and Cleanliness acceptable?

(2) Welding Machine

(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment

(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod

(a) AWS A5.9 stainless steel filler rod?
(b) Filler rod: Class 308 Diameter .045

(5) Purge Gas

(a) type of purge gas: Argonne
(b) time length of purge: 30 min purge flow rate: 50 scfh
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?
(d) What was "Check-Weld" meter reading at time of weld? 4.9

(6) Inspection After Root Pass

(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass?

3.87 x 10⁻¹⁰

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 11-14-08 Project: MTA Transfer Line Assy.

Pipe Section: LN² OUTER Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____
(1) Pipe #1 Size, Schedule and Material: 4" SCH 10
(2) Pipe #2 Size, Schedule and Material: _____

(1) Joint Preparation and Cleanliness
Joint Preparation and Cleanliness acceptable?

(2) Welding Machine
(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment
(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod
(a) AWS A5.9 stainless steel filler rod? _____
(b) Filler rod: Class 308 Diameter 10.35

(5) Purge Gas
(a) type of purge gas: Argonne
(b) time length of purge: 15 purge flow rate: 30 SCFH
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance? _____
(d) What was "Check-Weld" meter reading at time of weld? 0.01

(6) Inspection After Root Pass
(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass? 2.3×10^{-10}



In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 11/16/08 Project: MTA Transfer Line Assy.

Pipe Section: VAC. STEEL ^{TRANS/CAN} Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____
(1) Pipe #1 Size, Schedule and Material: 6" SCH 10 304
(2) Pipe #2 Size, Schedule and Material: _____

(1) Joint Preparation and Cleanliness
Joint Preparation and Cleanliness acceptable?

(2) Welding Machine
(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment
(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod
(a) AWS A5.9 stainless steel filler rod? _____
(b) Filler rod: Class ~~308~~ 308 Diameter 1/16

(5) Purge Gas
(a) type of purge gas: Argonne
(b) time length of purge: 30 min purge flow rate: 30 scfh
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance? _____
(d) What was "Check-Weld" meter reading at time of weld? _____

(6) Inspection After Root Pass
(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass?

→ AFTER INSTALL

3.64 x 10⁻¹⁰

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 12/03/08 Project: MTA Transfer Line Assy.

Pipe Section: 1" CAN/BOX TRUNK Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) _____ (other) ✓ 1" 304 SCKET

(1) Pipe #1 Size, Schedule and Material: _____

(2) Pipe #2 Size, Schedule and Material: _____

(1) Joint Preparation and Cleanliness

Joint Preparation and Cleanliness acceptable? ✓

(2) Welding Machine

(a) Remote foot pedal? ✓

(b) DC straight machine? ✓

(3) Joint Fit-up, and Internal Alignment

(a) Internal alignment acceptable? ✓

(b) Joint clearance acceptable? ✓

(c) End preparation acceptable? ✓

(4) Filler Rod

(a) AWS A5.9 stainless steel filler rod? 316

(b) Filler rod: Class 316 Diameter .035

(5) Purge Gas

(a) type of purge gas: Argon

(b) time length of purge: 30 min purge flow rate: 30 SCFH

(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance? ✓

(d) What was "Check-Weld" meter reading at time of weld? 1.9%

(6) Inspection After Root Pass

(a) No visible cracks. ✓

(b) No suck holes, which are small holes in middle of weld. ✓

(c) No porosity or obvious imperfections: ✓

(d) Filler material fused along edges of weld. ✓

(7) Repeat inspection after every pass: ✓

(8) Final Inspection: ✓

(9) Cold Shock weld before leak check? ✓

(10) Leak Check Rate/pass? ✓

- 1. SK SUP 9.8×10^{-10}
- 2. 3.3×10^{-10}
- 3. 1.3×10^{-10}
- 4. 2.8×10^{-10}

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 12/05/08 Project: MTA Transfer Line Assy.

Pipe Section: CAN/BOT. TRANS
LN₂ INNER Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) 3 1/2 304 SS SCH 10
(1) Pipe #1 Size, Schedule and Material: _____
(2) Pipe #2 Size, Schedule and Material: _____

(1) Joint Preparation and Cleanliness
Joint Preparation and Cleanliness acceptable?

(2) Welding Machine
(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment
(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod
(a) AWS A5.9 stainless steel filler rod? 308
(b) Filler rod: Class _____ Diameter .045

(5) Purge Gas
(a) type of purge gas: Argonne
(b) time length of purge: 45 min purge flow rate: 20 SCFH
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?
(d) What was "Check-Weld" meter reading at time of weld? <.9%

(6) Inspection After Root Pass
(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass?

1.4 x 10⁻⁹

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 12/10/08 Project: MTA Transfer Line Assy.

Pipe Section: L₂ OUTER Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____
(1) Pipe #1 Size, Schedule and Material: 304 sch 10
(2) Pipe #2 Size, Schedule and Material: _____

(1) Joint Preparation and Cleanliness

Joint Preparation and Cleanliness acceptable?

(2) Welding Machine

(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment

(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod

(a) AWS A5.9 stainless steel filler rod?
(b) Filler rod: Class 308 Diameter 1/16

(5) Purge Gas

(a) type of purge gas: Argonne
(b) time length of purge: 30 min purge flow rate: 30 scfd
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?
(d) What was "Check-Weld" meter reading at time of weld? < 0.9

(6) Inspection After Root Pass

(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass? 3.2 x 10⁻⁴

2

In-Process Weld Inspection Form

(As per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 12/17/08 Project: MTA Transfer Line Assy.

Pipe Section: VAC. Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____
(1) Pipe #1 Size, Schedule and Material: Sch 10 304
(2) Pipe #2 Size, Schedule and Material: _____

(1) Joint Preparation and Cleanliness
Joint Preparation and Cleanliness acceptable?

(2) Welding Machine
(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment
(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod
(a) AWS A5.9 stainless steel filler rod?
(b) Filler rod: Class 308 Diameter 1/16

(5) Purge Gas
(a) type of purge gas: Argonne
(b) time length of purge: 1 hr. purge flow rate: 30 scfm
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?
(d) What was "Check-Weld" meter reading at time of weld? 0.8

(6) Inspection After Root Pass
(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass?

3.6×10^{-10}

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 12/18/08 Project: MTA Transfer Line Assy.

Pipe Section: 90° 4 line Weld Number: 4

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) _____ (other) ✓ 1" union

(1) Pipe #1 Size, Schedule and Material: 1" union

(2) Pipe #2 Size, Schedule and Material: 1" union

(1) Joint Preparation and Cleanliness

Joint Preparation and Cleanliness acceptable? ✓

(2) Welding Machine

(a) Remote foot pedal? ✓

(b) DC straight machine? ✓

(3) Joint Fit-up, and Internal Alignment

(a) Internal alignment acceptable? ✓

(b) Joint clearance acceptable? ✓

(c) End preparation acceptable? ✓

(4) Filler Rod

(a) AWS A5.9 stainless steel filler rod? _____

(b) Filler rod: Class 316 Diameter 048

(5) Purge Gas

(a) type of purge gas: Argonne

(b) time length of purge: 1.5 hr purge flow rate: 30 SCFH ✓

(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance? ✓

(d) What was "Check-Weld" meter reading at time of weld? 0.00

(6) Inspection After Root Pass

(a) No visible cracks. ✓

(b) No suck holes, which are small holes in middle of weld. ✓

(c) No porosity or obvious imperfections: ✓

(d) Filler material fused along edges of weld. ✓

(7) Repeat inspection after every pass: ✓

(8) Final Inspection: ✓

(9) Cold Shock weld before leak check? ✓

(10) Leak Check Rate/pass? _____

1 5k sup 1.6×10^{-9}
 2 14k sup 2.3×10^{-9}
 3 20k 2.1×10^{-9}
 4 5k ret 1.9×10^{-9}

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 12/19/08 Project: MTA Transfer Line Assy.

Pipe Section: 7c VALVE BOX Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) _____ (other) ✓ 1" union
(1) Pipe #1 Size, Schedule and Material: _____
(2) Pipe #2 Size, Schedule and Material: 1" UNION

(1) Joint Preparation and Cleanliness

Joint Preparation and Cleanliness acceptable? ✓

(2) Welding Machine

(a) Remote foot pedal? ✓
(b) DC straight machine? ✓

(3) Joint Fit-up, and Internal Alignment

(a) Internal alignment acceptable? ✓
(b) Joint clearance acceptable? ✓
(c) End preparation acceptable? ✓

(4) Filler Rod

(a) AWS A5.9 stainless steel filler rod? _____
(b) Filler rod: Class 316 Diameter 048

(5) Purge Gas

(a) type of purge gas: Argonne
(b) time length of purge: 1 hr purge flow rate: 30 SCFH ✓
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance? ✓
(d) What was "Check-Weld" meter reading at time of weld? 0.01

(6) Inspection After Root Pass

(a) No visible cracks. ✓
(b) No suck holes, which are small holes in middle of weld. ✓
(c) No porosity or obvious imperfections: ✓
(d) Filler material fused along edges of weld. ✓

(7) Repeat inspection after every pass: ✓

(8) Final Inspection: ✓

(9) Cold Shock weld before leak check? ✓

(10) Leak Check Rate/pass? _____

1 SK SUP 5.2×10^{-10}
2 SK Ret 5.1×10^{-10}
3 20K 2.8×10^{-10}
4 14K SUP 3.2×10^{-10}

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 12/22/08 Project: MTA Transfer Line Assy.

Pipe Section: LN2 IN. V. Box Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____
(1) Pipe #1 Size, Schedule and Material: 3, SSCH 10
(2) Pipe #2 Size, Schedule and Material: 3, SSCH 10

(1) Joint Preparation and Cleanliness
Joint Preparation and Cleanliness acceptable?

(2) Welding Machine
(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment
(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod
(a) AWS A5.9 stainless steel filler rod? _____
(b) Filler rod: Class 308 Diameter 045

(5) Purge Gas
(a) type of purge gas: Argonne
(b) time length of purge: 2 hr purge flow rate: 35 SCFH
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?
(d) What was "Check-Weld" meter reading at time of weld? 0.04

(6) Inspection After Root Pass
(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass? 2.3×10^{-9}

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 12-23-08 Project: MTA Transfer Line Assy.

Pipe Section: LN2 outerv Valve Box Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____

(1) Pipe #1 Size, Schedule and Material: 4" SCH. 10

(2) Pipe #2 Size, Schedule and Material: _____

(1) Joint Preparation and Cleanliness

Joint Preparation and Cleanliness acceptable?

(2) Welding Machine

(a) Remote foot pedal?

(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment

(a) Internal alignment acceptable?

(b) Joint clearance acceptable?

(c) End preparation acceptable?

(4) Filler Rod

(a) AWS A5.9 stainless steel filler rod?

(b) Filler rod: Class 308 Diameter .035

(5) Purge Gas

(a) type of purge gas: Argonne

(b) time length of purge: 2 Hours purge flow rate: 20

(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?

(d) What was "Check-Weld" meter reading at time of weld? 00.0

(6) Inspection After Root Pass

(a) No visible cracks.

(b) No suck holes, which are small holes in middle of weld.

(c) No porosity or obvious imperfections:

(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass? 8.9×10^{-9}

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 01/05/09 Project: MTA Transfer Line Assy.

Pipe Section: VAC TO VALVE BOX Weld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) (other) _____
(1) Pipe #1 Size, Schedule and Material: 6" SCH 10
(2) Pipe #2 Size, Schedule and Material: 6" SCH 10

(1) Joint Preparation and Cleanliness
Joint Preparation and Cleanliness acceptable?

(2) Welding Machine
(a) Remote foot pedal?
(b) DC straight machine?

(3) Joint Fit-up, and Internal Alignment
(a) Internal alignment acceptable?
(b) Joint clearance acceptable?
(c) End preparation acceptable?

(4) Filler Rod
(a) AWS A5.9 stainless steel filler rod? _____
(b) Filler rod: Class 308 Diameter 1/16

(5) Purge Gas
(a) type of purge gas: Argonne
(b) time length of purge: 3 hr purge flow rate: 40 SCFH
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance?
(d) What was "Check-Weld" meter reading at time of weld? 0.05

(6) Inspection After Root Pass
(a) No visible cracks.
(b) No suck holes, which are small holes in middle of weld.
(c) No porosity or obvious imperfections:
(d) Filler material fused along edges of weld.

(7) Repeat inspection after every pass:

(8) Final Inspection:

(9) Cold Shock weld before leak check?

(10) Leak Check Rate/pass? 1.9×10^{-9}

In-Process Weld Inspection Form

(as per In-Process Weld Inspection Guidelines, NML Cryogenic System, 9/29/06)

Date: 01/08/09 Project: MTA Transfer Line Assy.

Pipe Section: 90° ELBOW TO VALVE BoxWeld Number: _____

Weld Location: MTA Service Building

Welder: Lenny Harbacek

Inspector: Andrew Lathrop

Before Welding:

Type of weld: (butt) ✓ (other) _____
(1) Pipe #1 Size, Schedule and Material: 10" SCH 10
(2) Pipe #2 Size, Schedule and Material: 10" SCH 10

(1) Joint Preparation and Cleanliness

Joint Preparation and Cleanliness acceptable? ✓

(2) Welding Machine

(a) Remote foot pedal? ✓
(b) DC straight machine? ✓

(3) Joint Fit-up, and Internal Alignment

(a) Internal alignment acceptable? ✓
(b) Joint clearance acceptable? ✓
(c) End preparation acceptable? ✓

(4) Filler Rod

(a) AWS A5.9 stainless steel filler rod? _____
(b) Filler rod: Class 308 Diameter 1/16

(5) Purge Gas

(a) type of purge gas: Argonne
(b) time length of purge: 2 hr purge flow rate: 40 SCFH
(c) Use of "Check-Weld" meter to measure Oxygen rate for purge acceptance? ✓
(d) What was "Check-Weld" meter reading at time of weld? 0.01

(6) Inspection After Root Pass

(a) No visible cracks. ✓
(b) No suck holes, which are small holes in middle of weld. ✓
(c) No porosity or obvious imperfections: ✓
(d) Filler material fused along edges of weld. ✓

(7) Repeat inspection after every pass: ✓

(8) Final Inspection: ✓

(9) Cold Shock weld before leak check? ✓

(10) Leak Check Rate/pass? 1.9×10^{-9}