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UNIT DATE

RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ENGINEERING SPECIFICATION

FOR

Low Activity Waste Melters

Content applicable to ALARA? ☒ Yes ☐ No

ADR No.
24590-LAW-ADR-ML-05-0001

Rev
1

Specification changes retroactive? ☐ Yes ☒ No ☐ N/A (alpha revision or revision 0)

Note: Contents of this document are Dangerous Waste Permit affecting.

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Q

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6	5/1/15	Originator By: Rich Peters - rpeters1 Org Name: LAW Melter Lead Placed: Apr 14, 2015, 11:26 am	Checked By: Matt Meyer - mfmeyer1 Org Name: LAW - Mechanical Systems Placed: Apr 16, 2015, 2:56 pm	N/A	N/A	~~S. Kretzschmar Sr.~~ P. RAJAGOPALAN 5/1/15
5	12-6-09	L. Curtis	R. Figley	N/A	N/A	T. Hughes
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Rev
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Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA) are regulated at the U. S. Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts that pursuant to AEA, it has sole and exclusive responsibility and authority to regulate source, special nuclear, and byproduct materials at DOE-owned nuclear facilities. Information contained herein on radionuclides is provided for process description purposes only.

Revision History

Revision	Reason for Revision	Q Specification Revision Only Margin Reduced?		CM Only
		YES	NO	N/A
A		N/A	N/A	N/A
0	Initial Issue - Supercedes SP0W375LV-M00001, Rev D	☐	☒	☐
1	Reissued with technical requirement changes and clarifications	☐	☒	☐
2	Reissued with general editing, minor requirement changes to reflect current design, and design interface details	☐	☒	☐
3	Reissued to update references in Section 2, incorporate SCNs 24590-LAW-3PN-AE00-00001, 24590-LAW-3PN-AE00-00002 and 24590-LAW-3PN-AE00-00003, and update Appendices A and B to reflect P&IDs.	☐	☒	☐
4	Reissued to incorporate 24590-LAW-3PN-AE00-00004, 24590-LAW-3PN-AE00-00005, 24590-LAW-3PN-AE00-00006, 24590-LAW-3PN-AE00-00007, and 24590-WTP-SDDR-ML-07-00117. Appendix A: Added Celsius temperatures and removed part number from connection style.	☐	☒	☐
5	Updated to align with the Basis of Design, Section 1.2: Edited/added definitions.	☐	☒	☐
6	Updated to align with current project specifications and state of the design. Clarified wording at the front of Appendices. Incorporates 24590-LAW-3PN-AE00-00009. Complete revision, change bars not required.	☐	☒	☐

Contents

Appendices

1 General

1.1 Scope

A This Specification provides performance requirements for the design of Low Activity Waste (LAW) vitrification melters for the River Protection Project - Waste Treatment Plant (RPP-WTP) at the Hanford, Washington Site of the Department of Energy (DOE).

B Deleted.

C The melters include, but are not limited to, the following major structures, systems and components (SSCs): glass containment, radiation shielding, glass and glass discharge heating, refractory cooling, radiation shield cooling, instrumentation, offgas cooling and collection, waste and glass feed, glass frit addition for startup, agitation, and glass discharge.

D Deleted.

E Not Used.

F The unit tested during the LAW pilot melter program (see description in Ref 2.2Q) provides the technological basis for the LAW melter design.

1.2 Definitions

A Annular Space – In the melter and the discharge chambers, the void space between enclosure and gas barrier walls. Does not include the void space within the melter lid itself.

B Base – Structural platform that supports the melter during transport and operation. Base includes structural steel and bracing, and cooling water panel structures. Base also includes plates that provide a portion of the gas barrier. The base has transport and restraint interface points.

C Contractor – Bechtel National, Inc.

D Design Life – The baseline time, based on calculation, analysis, experience or testing, over which the SSC will safely maintain its original function.

E Enclosure – Consists of the outermost steel plate of the containment system that includes the walls, lid covers of the melter and discharge chamber lids, and removable panels for accessing melter components. The enclosure also includes the lid portion of the structural bracing and guide tubes for components penetrating the melter lid. The enclosure serves as radiation shielding and structurally supports the shell function to provide bulk confinement of glass and offgas.

F Transportation System – Melter components that aid in the transport and positioning of the melter during transportation, installation and operation, decommissioning, and disposal.

G Lid – Structural cover over the top of the melter plenum space that supports lid plenum refractory and all components mounted through it. Lid also includes plates that provide a portion of the gas barrier.

H Normal Operation – Constitutes all regular and scheduled melter activities geared towards production of glass product at or near design throughput, i.e., feeding, pouring, idling, and scheduled SSC change-out.

I Structure – Melter and discharge chamber structural steel, including bracing that support the gas barrier walls, wall cooling water panel structures and enclosure. Melter structure also supports the melter lid.

J Subcontractor – Duratek, Inc. Note: BNI and EnergySolutions continue to support design modifications after the melter design was initially provided by Duratek (bought out by EnergySolutions).

K Vendor – A manufacturer or supplier providing materials and/or services to the subcontractor.

L Gas Barrier – Comprised of the internal surfaces of the melter walls, lid and base, supporting the offgas-related functions of the shell.

M Frit – Glass particulate of a size and geometry suitable for direct feed into the melter.

N Shell - System of structural elements that performs the credited safety functions of the melter shell. These are to provide a bulk confinement boundary for both the glass and offgas and to direct the offgas into the melter offgas system when the melter is operating. The shell is comprised of the base, external walls, lid, and lid covers, (gas barrier plates) which are to be structurally supported by the enclosure.

O Walls - The vertical plate assemblages that support the lid and lid portion of the enclosure. The exterior surfaces form part of the enclosure, the interior surfaces form part of the gas barrier.

P Containment System - The containment system provides bulk confinement of glass during normal and abnormal conditions. The containment system includes the melter shell, refractory, cooling panels, and jackbolts. Of these components, the shell is quality level Q and the refractory, cooling panels, and jackbolts are quality level CM.

1.3 Acronyms

CCTV	Closed Circuit Television
DOE	Department of Energy
ICD	Interface Control Document
LAW	Low Activity Waste
SC	Seismic Category
SSC	Systems, Structures, and Components
RPP-WTP	River Protection Project - Waste Treatment Plant
w.g.	Water Gage (pressure measurement)

2 Applicable Documents

2.1 Referenced Codes and Industry Standards

Unless otherwise noted, all codes and standards referenced herein, and in the documents referenced in Section 2.2, shall be to the latest editions, addenda, and supplements at the time of award.

A Not Used.

B American National Standards Institute/Institute of Electrical and Electronics Engineers (ANSI/IEEE)

1 IEEE Std 141, *Recommended Practice for Electric Power Distribution for Industrial Plants* (1986)

2 IEEE Std 260.1, *American National Standard Letter Symbols for Units of Measurement* (1993)

3 IEEE Std 315, *Graphic Symbols for Electrical and Electronics Diagrams* (reaffirmed 1993)

4 IEEE Std 399, *Recommended Practice for Industrial and Commercial Power Systems Analysis* (1997)

5 IEEE Std 1202, *Standard for Flame Testing of Cables for Use in Cable Tray in Industrial and Commercial Occupancies* (1991)

6 IEEE Std 384, *Standard Criteria for Independence Class 1E Equipment and Circuits, Table 2 "Enclosed to open Configuration"*, (1992)

C American Society of Civil Engineers (ASCE)— ASCE-7, *Minimum Design Loads in Building and Other Structures* (1998)

D American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)

1 ASME B31.3, *Process Piping, Normal Service* (1996)

2 Not Used.

3 ASME Section VIII, Division 1, *Rules for Construction of Pressure Vessels*, 2001 Edition, (2002 Addenda)

4 ASME NQA-1, *Quality Assurance Requirements for Nuclear Facility Facilities* (1989)

5 Deleted.

6 ASME Section VIII, Division 2, *Rules for Construction of Pressure Vessels*, 2001 Edition, 2002 Addenda)

7 ASME, Section VIII. 2001. *Boiler and Pressure Vessel Code*.

8 ANSI/AISC N690-1994, Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities.

E Code of Federal Regulations (CFR)

1 29 CFR 1910, Subpart D, *Occupational Safety and Health Administration, 1970, Walking – Working Surfaces* (most current revision)

2 29 CFR 1910, Subpart S, *Occupational Safety and Health Administration, 1970, Electrical* (most current revision)

F International Conference of Building Officials (ICBO)— *Uniform Building Code* (UBC), (1997)

G National Electrical Manufacturers Association (NEMA)

1 NEMA WC, *Wire and Cable Standards* (1999)

2 NEMA/ICEA (Insulated Cable Engineers Association), *Power Cable Ampacities* (1999)

H National Fire Protection Association (NFPA)

1 NFPA 70, *National Electrical Code* (1999)

2 NFPA 497, *Recommended Practice for Classification of Hazardous Locations for Electrical Installations in Chemical Process Areas* (1997)

I Underwriters Laboratories Inc. (UL)— UL 508, *Standard for Safety Electrical Industrial Control Equipment* (1999)

J American Institute of Steel Construction (AISC) - AISC M016-89, Manual of Steel Construction - Allowable Stress Design, Ninth Edition

K American Welding Society (AWS)

1. AWS D1.1:2000, Structural Welding Code – Steel
2. AWS D1.6: 1999, Structural Welding Code – Stainless Steel

2.2 Other Reference Documents/Drawings

References listed below show revisions in effect at the time melter design was completed. Review of subsequent revisions indicate no impact to the LAW melter design.

A Not Used.

B Document No. 24590-WTP-3PS-J000-T0001, Rev 1, *Engineering Specification for Melter Systems C&I Work Specification*

C Not Used.

D Not Used.

E Deleted.

F Document No. 24590-WTP-DC-ST-01-001, Rev 13, *Structural Design Criteria*

G Document No.24590-WTP-DC-PS-01-001, Rev 8, *Pipe Stress Design Criteria*

H Document No. 24590-WTP-DC-ST-04-001, Rev 4A, *Seismic Analysis and Design Criteria*

I Document No. 24590-WTP-3PS-FB01-T0001, Rev 6, *Engineering Specification for Structural Design Loads for Seismic Category III and IV Equipment and Tanks*

J 24590-WTP-PSAR-ESH-01-002-03, Rev 05H, Preliminary Documented Safety Analysis to Support Construction Authorization; LAW Facility Specific Information.

K 24590-LAW-M0Q-LMP-00003, Rev 0, Equipment Qualification Datasheet for Low Activity Waste (LAW) Melters

L 24590-WTP-RPT-OP-01-001, Rev 4, Operations Requirements Document

M 24590-WTP-3PS-MQR0-T0004, Rev 1, ENGINEERING SPECIFICATION FOR LAW FACILITY MELTER RAILS

N 24590-101-TSA-W000-0010-409-1137, Rev 00A, LAW MELTER LIFE REPORT

O 24590-WTP-3PS-MEEM-T0001, Rev 0, ENGINEERING SPECIFICATION FOR MELTER START-UP FRIT

P 24590-101-TSA-W000-0009-172-00001, Rev 00A, FINAL REPORT - REVIEW OF PROPERTIES OF SIMULATED FEEDS USED FOR MELTER TESTING

Q 24590-QL-HC4-W000-00094-03-00020, Rev 00A, RPP-WTP LAW PILOT MELTER DISASSEMBLY REPORT

R 24590-LAW-N1D-LMP-00001, Rev 0., LAW Melter 1 and Melter 2 Gas Barrier and Cooling Panels

3 Design Requirements

The body of this specification identifies the functional design requirements for the LAW melter. Appendices A and B, "Melter Services and Connections Interface Details" and "Melter Design Interface Details" respectively, provide requirements and interfaces that were used in the initial development of the melter design.

3.1 General Functional Requirements

A Deleted.

B Containment System: The containment shall incorporate the following design features.

1 Enclosure: Design shall incorporate the following:

a Penetrations and removable panels to facilitate removal and replacement of consumable melter components. Provide guide tubes around penetrations (through to the melter) and coordinate with contractor to optimize in-leakage to the annular space.

b Means to prevent leakage of offgas into the surrounding melter gallery, and be glass-tight up to the maximum operating level of glass in the melter.

c External surfaces configured to limit contamination buildup.

d Routing and containment of feed and service lines, both radioactive and nonradioactive.

e Ability to contain the full melter volume of spilled glass.

f Lid portion of the enclosure shall be strong enough to prevent loss of confinement or operational integrity in the event of dropped loads as specified in section 3.5.D.2.b.

2 Jack bolts: Design jack bolt system to prevent formation of significant gaps between refractory bricks during startup and operation. Bolt self-adjustment shall allow for:

a Compression of refractory during melter assembly and installation.
b Adjustment of the compressive force on the refractory to correct for uneven movement.
c Re-compression of refractory.

3 Melter Lid: Design shall include, but not be limited to, the following functions:

a Support all melter components mounted on and through it.
b Support refractory overhanging melter plenum, and allow thermal expansion of refractory during operation.

c Provide a continuous gas barrier in conjunction with wall and base gas barrier plates.

d Provide refractory and lid surface cooling through the incorporation of a cooling cavity.

e The lid cooling cavity shall confine the cooling water to prevent it from entering the melter plenum and shall ensure adequate cooling of the of the inconel plate that forms the top of the Gas Barrier.

f The water inlet and outlet penetrations into and out of the Melter Lid Cooling Cavity shall be elevated near the top of the cavity to limit the loss of water mass should a leak develop in the cooling water circuit (Ref 2.2J).

g The melter lid design shall allow for placement of four (4 Ea.) resistance temperature detectors (RTDs), two (2Ea.) of which will be considered Safety Significant (SS) as they will be supporting the credited safety function of monitoring the melter lid cooling cavity temperatures as defined 2.2J. The placement of the RTDs and cabling shall be per ref. 2.1B6.

h The melter lid design shall allow for periodic replacement of the RTDs.

4 Not Used.

5 Melter Base: Base will perform the following functions:

a Support melter during transport, operation and maintenance, decommissioning and disposal phases.

b Accommodate integrated transportation system.

c Provide structurally sound interfaces with facility and seismic transporter restraints.

d Provide refractory cooling.

e Provide support for refractory during melter assembly, transport, installation, and operation.

f House melter services including drains, refractory cooling panels and electrode bus connectors.

g Provide flatness tolerances for refractory installation.

6 Shell: The design of the elements of the melter Shell shall meet the following requirements:

a. The shell must remain intact when exposed to its environmental and operating loadings.

b. The shell must be designed to withstand the effects of maximum credible offgas exhauster suction at the melter and pressurization upsets. (see 3.5D4a)

c. The shell shall function as the offgas and glass confinement boundary.

C Heating System

1 Heating system includes the electrodes (including extensions), electrode buses, power supplies, startup heaters, discharge chamber heaters, and thermocouples.

2 After initial melter heating with startup heaters, glass is direct joule-heated.

3 Thermocouples shall be designed to provide continuous temperature monitoring while the melter is in service.

D Feed System

1 Feed system includes temporary configuration for frit addition at startup, feed nozzles and associated feed lines (internal to shielding only) for operation, and plenum thermocouples.

2 Subcontractor shall use the best available information for locating feed nozzles over the glass pool to optimize processing rates.

E Glass Pour System

1 Glass pour system includes glass pool level detectors, risers and airlift lances, troughs, dams, and discharge chamber structures.

2 Metallic Membrane (dam): Dam between the glass pool and discharge chamber is designed to prevent leakage of glass from the melt pool to the discharge chamber. Dam shall also limit leakage of air directly into the melter plenum through refractory seams over the melter lifetime.

3 Discharge Trough: Optimize trough slope and cross section for pouring and reduction of glass fiber formation.

F Agitation System

1 Bubblers provide agitation.

2 Arrangement and configuration of bubblers is for achieving optimized throughput while limiting refractory wear.

3 Each bubbler assembly, in coordination with the contractor, shall be designed for individual removal and replacement.

G Melter Disposal and Decommissioning: Specific design requirements for melter disposal and decommissioning are not defined.

H Melter Controls and Instrumentation: See Ref 2.2B for specific melter-related functional requirements for controls and instrumentation.

I Transportation System:

1 Support roller/wheel bogies for melter transport on facility rails.

2 Guide and position melters on facility rails.

3 Deleted

4 Provide interfaces with contractor-supplied drive systems that conform to subcontractor-defined melter movement tolerances for import and export of melter.

5 Deleted

J General Melter Component Design

1 Components requiring replacement during the design life of the melter shall be designed for ease of replacement and disposal. Where required, provide installed spare capacity.

2 Use of commercially available components and equipment, without modifications, will be optimized to the extent possible, except for components requiring optimization/value engineering studies per the contract.

3 Subcontractor shall coordinate with contractor to determine applicability of modular design to minimize assembly and replacement times.

4 Modular components and equipment requiring removal and replacement during startup and operation shall not weigh more than the safe working load of the largest overhead maintenance crane (10 tons).

5 Conductive individual components and equipment in contact with molten glass shall be electrically isolated from the melter structure, base, lid, enclosure, and from SSCs physically connecting the melter to the rest of the facility.

6 All components shall be designed to withstand thermal expansion during normal operations and function within established design parameters (such as, interface locations and positioning features).

7 Components and/or utility and service connections specified by the subcontractor that protrude from the enclosure shall be subject to review and approval by the contractor.

8 Design of the melter must prevent accumulation of water between the cooling panels and the melter shell or refractory. No sealed cavities shall exist between the cooling panels and the melter shell or refractory.

9 A water-sulfate steam explosion could cause a modest localized pressure pulse within the melter. The melter, including the feed nozzle cooling jacket components below the melter lid, will maintain its confinement boundary following a steam explosion from a water sulfate layer interaction.

K Restraint System

1 Melter assembly shall be restrained to prevent motion during a seismic event.

2 In coordination with the contractor, subcontractor shall be responsible for the design of the restraint components integral to or attached to the melter structure, including clamps and brackets interfacing with the facility rail system.

3.2 Performance Requirements

A Design Life

1 The facility is expected to operate for approximately 40 years.

2 The melters, excluding consumable SSCs specified by the subcontractor, shall have a minimum 5-year design life.

3 Design life of subcomponents shall be per Ref 2.2 N.

4 Not Used.

5 Deleted.

B Melter Throughput and Availability

1 Baseline throughput shall be 15 metric tons of glass per day, per melter. This is based on the conditions in section B 2.

2 Melter shall transform a slurry mixture of pretreated low activity waste and blended glass formers into a homogeneous glass melt. The glass and feed properties are as follows:

Glass properties: conductivity = 0.1 S/cm @ 1100 C to 0.7 S/cm @ 1200 C; viscosity = 10 to 150 Poise @ 1100 C with 30 to 50 Poise @ 1150 C optimal.

Glass melt pool operating temperature: 1100 to 1200 C with set point at 1150 C

Glass start-up frit: In accordance with Ref 2.2 O.

Feed Properties: Refer to 2.2 P

3 Target baseline availability for the melters is 83% (working number – will be confirmed when the operational research model is released). Subcontractor shall interface with contractor to ensure that melter design supports goal.

3.3 Design Conditions

A Deleted

B Facility Data

1 Guidance for melter and subcomponent dimensional envelope allowances are shown in Appendix B. Note that this data was used as the initial interface between the melter and the facility (see note at front of Appendix B).

2 Melter Ventilation:

a Melter will be operated as part of a cascaded ventilation system.

b Melter gallery will be a tertiary confinement zone, held at a nominal 0.4-in. w.g. negative pressure with respect to surrounding facility confinement zones.

c Contractor will provide melter annular space ventilation and exhaust. The melter annular space will be held at a nominal 2-in. w.g. negative pressure relative to the melter gallery.

d The pressure in the melter plenum, the confinement zone for offgas, will be maintained at a nominal 5-in. w.g. negative pressure with respect to the melter annular spaces.

e For design plenum pressures, see 3.5 D 4 a below.

3 Deleted

4 Indoor Temperatures: Maximum melter gallery temperature will be 95°F (80°F for personnel occupancy).

5 Radiation Dosages: Enclosure plate thicknesses for permitting personnel access are defined in Section 3.5.B1.

6 Melter Utility Services:

a Contractor is currently providing the following services to the melters: electrical power, steam, cooling water, process water, ventilation air (annular space ventilation and controlled melter-in-leakage), demineralized water, purge air, instrument air, and argon.

b Pressure, flow, conditioning, and other control requirements will be adjusted by contractor to suit application at the delivery point.

c Subcontractor shall identify any other liquids or gases required over the melter lifetime.

d Subcontractor shall coordinate with contractor to define utilities that require normal service or backup services.

e Deleted.

f Subcontractor shall specify required service operating parameters at contract boundary, with contractor input on selected design operating criteria.

7 Deleted.

3.4 Mechanical Requirements

A Discharge Chamber and Glass Pour Spout

1 For baseline discharge chamber operation, glass discharge will alternate between the two chambers for every other canister. The switch between chambers will not occur until a canister has been filled.

2 Each discharge chamber shall be designed for a throughput of 15 metric tons per day.

3 Each melter discharge chamber can be enclosed in refractory.

4 Discharge chamber is designed to accommodate a pour spout assembly which is an enclosure that provides transition between melter and ILAW container.

5 Pour spout housing is designed to accommodate a viewing CCTV for monitoring glass pour stream and with an infrared camera to monitor glass fill level in the container.

B Feed Nozzles

1 Location and capacity of paired nozzles over each designated glass pool zone shall permit continued baseline throughput with only one of each pair of nozzles in operation, until scheduled maintenance is performed.

2 Contractor will provide the following for each feed nozzle:

a A dedicated feed line and pump.

b Cooling water.

c Air and water purge through the feed line.

3 Subcontractor shall coordinate with contractor to design glass frit addition system, for use during melter startup. Subcontractor shall be responsible for design of frit discharge "nozzle" that will penetrate enclosure and lid.

C Bubblers

1 Bubbler assemblies shall be isolated from the melter lid and lid jumpers to prevent electrical short-circuiting.

2 Coordinate with Contractor to define air/gas supply requirements.

D Plenum Viewing (Note: Plenum CCTVs are future components, not installed in melter at startup.)

1 Design four (4) closed circuit televisions (CCTVs) and associated systems for viewing plenum area and cold cap during operation.

2 CCTVs will be used on an intermittent basis, as operation and maintenance requirements dictate. Design CCTVs to be removable and replaceable using standard maintenance equipment with manual interface.

3 Viewing ports shall be purged to prevent buildup of solids and other contaminants.

4 Cool CCTV ports as required.

E Refractory Expansion Control System

1 Design jack bolts to actively control refractory expansion without operator intervention. Manual operation of, and safe access to, the bolts shall be maintained.

2 Coordinate with Contractor to provide a means of locally monitoring bolt movement.

F Melter Cooling Water System

1 A cooling system will be used to meet enclosure surface temperature limit of 140 F. Contractor will be responsible for water supply to the panels.

2 Cooling panels shall be designed and fabricated in accordance with Ref 2.1 D3 and 2.1 D7.

3 Cooling panel design shall be such that internal pressure and/or temperature induced distortions will not place undue stress on the melter refractory.

4 Design cooling panels to be emptied at melter change-out or decommissioning.

5 Coordinate with contractor for overall cooling water system design, including instrumentation and controls, external to the melter enclosure.

G Melter Ventilation Systems

1 The overall design objective for the ventilation and associated cooling system is to maintain melter enclosure surface temperature at or below 140 F. Discharge chamber lid design objective is to be at or below 210 F.

2 Subcontractor may take credit for ventilation cooling in achieving enclosure surface temperature requirements.

3 Provide melter air in-leakage requirements and total supply air flow rates to the melter annular spaces.

4 Coordinate melter design with contractor achieve adequate ventilation of discharge chambers during operation.

5 In coordination with contractor, optimize air in-leakage requirements:

a From the melter operating gallery (C3) to the melter and discharge chamber annular spaces (C5), accounting for access panel removal requirements.

b Account for "non-design" leakage paths into the melter plenum.

6 Provide a means for introducing passive air purges between the melter annular spaces and the melter plenum to lower concentration of corrosive plenum gases adjacent to metallic lid components.

H Melter Offgas System

1 Main and standby offgas lines are nominal 10-inch diameter.

2 Deleted.

3 Offgas pipe routing from the melter enclosure to the submerged bed scrubber will be defined by the contractor.

4 The film cooler design and configuration will reduce the offgas temperature and minimize solids deposition during the various modes of operation to support downstream offgas system operation.

5 Film cooler design shall incorporate a means for internal cleaning. This operation may be assisted with handling equipment in the melter gallery.

6 Discharge chambers shall be vented back to the melter plenum.

7 Provide means for measuring pressure in melter plenum and melter discharge chambers. Redundant pressure measurement shall be provided for the plenum.

8 Standby Film Cooler:

a Design standby film cooler for alternate ventilation path of melter exhaust during upset conditions.

b Provision shall be made for addition of up to 150 scfm of quench air to standby film cooler.

c Design standby film cooler to prevent solids buildup during slurry feeding (when melter exhaust flows through the primary film cooler).

d Standby film cooler shall endure radiant shine from the glass pool during melter idling.

I Piping

1 All cooling water piping, feed piping, pour flanges and offgas pipe downstream of film cooler shall be per Ref 2.1D1. Piping seismic design shall be in accordance with Ref 2.2G. Subcontractor shall provide documentation for justification of service class selected where different from what is shown.

2 To the extent practical, all joints shall be butt-welded.

3 Pipe Routing: Minimize abrupt changes in direction for pipe routed through the annular spaces of the melter, particularly feed lines.

4 Piping Slopes: Offgas piping within melter enclosure shall be sloped away from film cooler.

5 Deleted

6 Drains: Provide low-point "floor" drains between the gas barrier and enclosure and between the gas barrier and refractory to accommodate leaks from cooling water piping. Coordinate with contractor to provide leak detection equipment at the drains.

J Material Requirements

1 Subcontractor shall define all melter SSC material requirements in accordance with this Specification and applicable codes and standards. Where deviations are required, subcontractor shall notify contractor before proceeding with design.

2 Materials of construction shall be able to withstand the radioactive, thermal, and corrosive environment caused by the melter feed, glass, and offgases to ensure adequate performance and lifetime. Corrosion allowances for major structural components exposed to corrosive environments are as follows (2.2R):

Gas barrier Lid bottom plate, hot side (against refractory), 1/8"

Gas barrier Walls, 1/8"

Base plate, 1/8"

Cooling panels inside gas barrier, 1/32"

3 Subcontractor shall consider environmental, durability, corrosion and erosion factors during material selection with consideration of the following characteristics:

a Surface finish

b Chemical resistance

c Radiation resistance

d Pressure effects (cyclical)

e Temperature effects

f Hardness (possibility of galling and fretting)

g Fatigue (cyclic stresses both with and without the presence of aggressive chemicals).

4 Refractories shall be selected to meet melter design life based on experience from pilot melters and other operating units.

5 Deleted

3.5 Structural Requirements

A. General

1 Structural design of the melter shall be per 2.1D8, 2.1J, 2.2H and 2.2I.

2 The values of the parameters in *Seismic Analysis and Design Criteria* (2.2H) not specified therein shall be as follows:

a $R_p = 3.0$

b $h_x = 3.0$ ft

c $h_r = 68$ ft

d w_p = weight of SSC being analyzed

3 Deleted

4 Deleted

5 Deleted

6 Deleted

7 The design of the electrodes and the melter dam shall address creep over the life of the component.

B. Melter Enclosure

1 Enclosure Plate:

a Enclosure plate thickness over the top of film cooler and discharge chambers is 2 inch. On all other areas of melter, enclosure plate thickness is 1 inch.

b Not Used.

c Deleted.

d Provide suitable shielding barriers where no continuous structural weld is required.

e Top surface plates shall support all maintenance activities staged from the enclosure surface. See Ref 2.1E1.

2 Enclosure Penetrations:

a Where possible, design access panels to reach multiple components.

b Seat panels on lap joints for flush exterior surfaces.

c Coordinate with contractor for designing means for panel removal.

d Where possible, standardize penetration sizes to simplify operations and increase operating flexibility.

e Removable access panels have gaskets to minimize air in-leakage and shall include a means of lifting via crane of other lifting device. Coordinate with contractor for design and operation of access panels positioned below glass containment level.

f Install steel guide tubes between enclosure and melter structure for component positioning and air flow control.

C. Transportation System

1 Rollers/Wheels:

a Deleted

b Provide vertical adjustment capability (passive and/or active) to accommodate slight differences in transport rail elevation. The combined deflection and surface discontinuities are 0.0625 inch.

2 Fasteners, Anchors, and Positioning Devices: Coordinate with contractor to establish design and interface requirements for all phases of melter life.

3 Lifting Lugs: Subcontractor shall design and locate lifting lugs. Contractor will assume spreader bars will be used to carry out the lifts.

4 Refer to 2.2 M for interface details with rails.

D. Loadings

1 Dead Loads: Design shall consider the combined weight of all melter SSCs. Other static loads to be considered include:

a Temporary rigging equipment during transport.

b Weight corresponding to maximum glass volume during operations.

c Circulated cooling fluids during operations.

d Deleted.

2 Live Loads:

a Design top surface of melter enclosure for two localized loads of 6000 pounds each (representing two bubbler change-out arrangements or other comparably sized equipment) being placed on the melter adjacent to each other and in addition, a distributed load of 50 pounds per square foot, per Ref 2.1C.

b Analyze effects of drop loads on melter enclosure using a worst-case scenario of a loaded consumable change-out box corner impacting the lid after being dropped from a height of three (3) feet (total weight of 3,500 pounds). Enclosure shall retain confinement and operational integrity for this and lesser drop loads (Ref 2.2J).

c Subcontractor shall coordinate with contractor to develop loading requirements and limits related to transport, maintenance, decommissioning, and jumper attachment.

d Design the top enclosure surface of each discharge chamber to support a uniformly distributed load of 5,000 pounds.

3 Seismic loads: Melter seismic loads shall be determined as described in Section A2 above.

4 Pressure Gradients:

a The gas barrier walls, lid and base shall be designed to withstand a plenum pressure range of -40 inch w.g to +40 inch w.g.

b Deleted.

5 Other Loads:

a Thermal induced loads to be experienced during startup, normal operations, and idling.

b Piping reaction loads during normal operation.

c Lifting attachment locations for disposal and resulting load paths shall be designed with a minimum safety factor of 3, based on yield strength, or a safety factor of 5 based on ultimate strength.

d Not Used.

e Deleted.

f Loads imposed by contractor-supplied access platforms. The line loads for the east and west sides of the melter will be 300 lb/ft. The line load for the south side of the melter will be 320 lb/ft. No loads for the north side of the melter.

6 Not Used.

E. Load Combinations shall be per Section 5 of 2.2 I.

F. Deleted.

G. Deleted

H. Deleted.

I. Gas Barrier Lid

1 Section VIII, Divisions 1 and 2 of the ASME boiler and pressure vessel code shall be used as a guide for fabrication.

2 The lid water reservoir enclosure shall be rated for a maximum pressure of 14.5 psig.

3 Under normal operating conditions, cooling water expected flow is 25 gpm and 100°F at inlet. For thermal analysis of lid under flowing conditions, 15 gpm at 115°F inlet shall be used as a conservative basis.

4 The lid shall be designed to maintain structural integrity for a minimum of 2 hours after a loss of cooling upset event.

5 The inlet and outlet of the melter lid cooling cavity must be elevated near the top of the cavity, to limit loss of water mass in the lid cooling cavity should a leak develop in the cooling water circuit

3.6 Electrical Requirements

See Appendix A for melter service and connection details and Appendix B for the balance of melter design interface details.

NOTE: The electrical-related information in these appendices were used initially as a basis for design. Refer to melter electrical drawings for final design configuration and component details. These drawings may be found under the following general document numbering systems:

24590-101-TSA-W000-0010-409-[3 and 4 digit indexing]
24590-QL-HC4-W000-00011-03-[2, 3, and 5 digit indexing]

24590-LAW-MX-LMP-[8 digit indexing]

A General

1 The following code references apply to this section: Refs 2.1B1 through 2.1B6, 2.1E2, 2.1G1, 2.1G2, 2.1H1, 2.1H2, and 2.1I.

2 Subcontractor shall specify the following:

a Wave form, frequency and current density for electrical power supplied at electrodes.

b Deleted.

c Electrode firing configuration.

d Instrumentation and control requirements for the power source to the electrodes, discharge heaters, and startup heaters.

B Electrode Power

1 Electrodes, extension buses, and bus jumpers shall be capable of carrying the current at the voltage required for all modes of melter operation.

2 Minimize connection resistance between extension bus and bus jumper, as well as between the extension bus and electrode if they are two separate components.

3 Connections between extension buses and bus jumpers shall allow for expansion and contraction of the extension bus.

4 Bus jumpers shall be designed with provisions for installing a connector on the end passing through the melter shielding.

5 Extension buses shall be electrically isolated from the melter enclosure and structure.

6 Bus jumpers shall be insulated over their entire length and shall be electrically isolated from the melter enclosure and structure.

7 Electromagnetic Coupling: Coupling between extension buses, bus jumpers and the materials they pass through shall be limited to prevent negative effects on melter life or performance.

8 Electromagnetic Interference: To the extent practical, bus jumpers shall be routed to maximize magnetic field cancellation.

9 Cooling:

a Electrode extensions shall be air cooled

b Deleted.

C Discharge Heater Power

1 Maximum discharge heater operating voltage is 480 VAC.

2 Discharge heaters shall be matched to the extent practical with respect to resistance, operating current, and voltage.

3 Each discharge heater assembly shall be designed with a plug-type connector integral to the heater assembly.

4 Discharge heaters shall be electrically isolated from each other and from the melter enclosure and structure.

5 The discharge heater jumpers shall have plug-type connectors on each end.

6 Connectors on the heater side of the discharge heater jumpers shall mate with the connector integral to the heater.

7 The junction box design shall include a metal bracket suitable for rigid mounting of discharge heater jumper connectors.

8 The junction box shall be sized to contain the required number of incoming and outgoing cables with their associated connectors.

9 Penetration through the melter shielding shall be sized to contain all the discharge heater jumpers, and sealed for contamination and radiation containment.

D Startup Heater Power

1 Startup heaters shall be matched to the extent practical with respect to resistance, operating current, and voltage.

2 Each startup heater shall be designed with a plug-type connector with a three foot flying lead integral to the heater assembly.

3 Startup heaters shall be electrically isolated from each other and from the melter enclosure and structure.

4 Startup heater jumpers shall have plug-type connectors on each end.

5 Connectors on the heater side of the startup heater jumpers shall mate with connectors integral to the heater.

6 Connectors on the shielding side of the startup heater jumpers shall be suitable for mounting to metal inserts in shielding penetrations. The integral connector and insert design shall seal the penetration, for contamination and radiation containment.

E Cable

1 Refer to Ref 2.1G1 for general cable design standards.

2 Cables routed within the melter enclosure and structure shall be rated for the maximum ambient temperature encountered.

3 Cable insulation and jacket material shall be of the low-flammability type, per Ref 2.1B5.

4 Cable insulation and jacket material shall be resistant to heat, moisture, impact, radiation, and ozone, as required for the expected operating environment.

5 Cables shall be supported or routed in raceway within the melter enclosure.

6 Power cables of size # 2/0 and larger will be single conductor or triplexed.

7 Instrument cables shall be single pair, triad-twisted and shielded, or multi pair with shielded pair and overall shield and drain wire.

8 Control cables shall be multi-conductor and color coded in accordance with Ref 2.1G2, Standard Method. Coordinate with contractor to determine requirements for spare conductors in multi-conductor control and instrumentation cables.

9 Instrument and thermocouple cables shall be single pair twisted, shielded, or multi-pair cable with individual pair shielded and overall shield.

10 Minimum Conductor Sizes:

a #12 AWG for power circuits.

b #14 AWG for control circuits (120 VAC, 125 VDC) and instrument power circuits.

c #18 AWG for instrumentation – single pair cable.

d #20 AWG for instrumentation – multi pair cable.

Note: Instrumentation conductors include low-level voltage, current, or digital electrical signal connections to sensing and actuating devices.

11 Cables shall be physically separated in accordance with the function and voltage class as follows:

a Low-voltage power AC and DC cables.

b High-level signal and control or discrete on/off control cables (120 V AC, 125 V DC).

c Controls with critical safety requirements as determined by contractor.

d Cables for general instrumentation (i.e., low-level analog and digital signals and data communication).

F Raceway Within Melter Envelope

1 To the extent practical, cable trains for different power source groups shall be routed in separate raceways. Raceways shall be physically separated in accordance with the function and voltage class of the cables contained within, as follows:

a Low-voltage power AC and DC-600 V cables.

b High-level signal and control or discrete on/off control cables (120 V AC, 125 V DC).

c Controls with critical safety requirements as determined by contractor.

d Cables for general instrumentation (i.e., low-level analog and digital signals, building evacuation, data communication, environmental surveillance system fiber for digital data communication)

2 Raceways shall be rigid metallic conduit and shall be a minimum of 1/2 inch in size. Wire trough or other approved wiring methods may be used where necessary.

3 Raceways shall be supported as required, per Ref 2.1H1.

4 Raceway designated for a single class of cables shall contain only cables of the same class.

G Junction Boxes

1 Junction boxes are used to connect jumpers from the instrumentation and discharge heaters within the enclosure to cabling external to the melters.

2 Boxes shall be supported as required, and sized and bonded to the shielding in accordance with Ref 2.1H1.

H Grounding

1 Metal sections of the melter enclosure and structure shall be electrically interconnected.

2 Provisions at four (4) locations on the melter shall be made to allow connection to the facility ground system.

3 Ground connections shall be made with pressure-type connectors.

3.7 Controls and Instrumentation Requirements

A Controls Requirements

For melter design requirements related to control logic, sequence of operations, and control software and hardware, see Ref 2.2B. Controls system design is in contractor's scope unless stated otherwise in Ref 2.2B.

B Instrumentation Requirements.

For melter design requirements related to instrumentation, see Ref 2.2B.

3.8 Maintenance Requirements

A General

1 All nonstructural SSCs are designed for safe and effective maintenance per 24590-WTP-RPT-OP-01-001, *Operations Requirements Document*. To the extent practical, the design of the melter and its ancillary components will utilize techniques for minimizing maintenance labor to reduce the time, number and type of crafts required to perform work:

a Minimize downtime, and impacts to overall operation of the facility.

b Keep maintenance activities simple and straightforward.

c Minimize requirement for special tools and equipment for maintenance.

d Modularize SSCs for maintenance, access, and replacement.

e Demonstrate best possible access to controls, protective interlocks, and SSCs for maintenance.

f Minimize impact on interfacing SSCs while performing maintenance on targeted SSCs.

g Allow for the gathering of diagnostic information where possible to determine melter life.

h Incorporate features to aid in replacement of SSCs that do not meet the melter design life of 5 years. Contractor will be providing a consumable changeout box for replacement of most consumables mounted in the melter lid.

2 Subcontractor shall perform failure modes and effects analyses on the critical SSCs identified in the contract:

a Specify what critical SSCs need to be maintained and inspected, specify maintenance and inspection requirements, and provide data on predicted availability.

b Identify potential failures for critical SSCs, and recovery sequences.

c Identify and implement sufficient redundancy requirements to minimize impact on glass production.

3 Melter maintenance operations, planned or unplanned, shall not compromise enclosure containment (assuming ventilation system is functioning normally) and will allow for access to equipment for maintenance operations where hands-on operations do not compromise worker safety. Subcontractor shall interface with contractor to ensure that access around melters is sufficient for daily visual inspection of all melter enclosure surfaces.

4 Subcontractor shall identify all special tools and equipment for maintenance.

5 Components and equipment exceeding 42 pounds, or a temperature of 110 °F, or having excessive sharp edges shall have lifting bails designed to interface with overhead maintenance crane/manipulator.

6 Subcontractor shall coordinate with contractor to optimize melter maintenance access, taking into account facility layout and maintenance support equipment and services outside of the subcontractor's scope of work.

B Baseline Component Design Lives

Refer to 2.2N

4 Quality Assurance Requirements

4.1 General

A Subcontractor and sub-tier vendors shall perform all design work in accordance with a contractor-approved quality assurance plan which meets the applicable requirements of Ref 2.1D4.

B Subcontractor shall be responsible for all sub-tier vendor quality assurance requirements during design.

C Refer to the contract for quality assurance requirements pertaining to specific melter SSCs (24590-QL-HC4-W000-00011).

D The contractor reserves the right to review design work in progress to assess the effectiveness of the subcontractor's quality system at any time during the design process. Assessments performed by the contractor shall in no way relieve the subcontractor of any contractual responsibilities.

5 Documentation and Submittals

5.1 General Documentation Requirements

A. Refer to the contract for submittal format, transmission, and review requirements.

5.2 Submittals

A. Refer to the contract for specific melter system submittal requirements.

Appendix A- Melter Services and Connections Interface Details

Melter Engineering Specification Appendix Note:

The data in this appendix are based on experience from pilot melters and other operating units. This data was gathered early in the project and used as a guide for design of surrounding utilities. The values should not be used directly as input since in many cases the design has continued to evolve and there may be inconsistencies between issued design documents and values in these tables. Instead, refer to the appropriate design media, e.g. P&IDs, melter design drawings, melter design calculations, or other system calculations. These data may be used as an assumption for performing calculations but the assumption will require verification by the calculation where it was used or other design media.

Tag	Description	Temp Conn ID	Melter Nozzle Tag	Line/ Wire Size (in)	Ops Mode (13)	Service Type (12)	Nominal Flow/Amp	Nom F/A Unit	Nominal Pres/Volt	Nom P/V Unit	Nom Temp F (C)	Design Flow/Amp	Des F/A Unit	Design Pres/Volt	Des P/V Unit	Des Temp F (C)	Critical Srvc	Connect Box Number	Externl Style (10)	Internal Style	Notes
agi19	air supply - bubbler #01	WB1	WB1	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi20	air supply - bubbler #02	WB2	WB2	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi21	air supply - bubbler #03	WB3	WB3	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi22	air supply - bubbler #04	WB4	WB4	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi23	air supply - bubbler #05	WB5	WB5	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi24	air supply - bubbler #06	CB6	CB6	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi25	air supply - bubbler #07	CB7	CB7	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi26	air supply - bubbler #08	CB8	CB8	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi27	air supply - bubbler #09	CB9	CB9	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi28	air supply - bubbler #10	CB10	CB10	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi29	air supply - bubbler #11	CB11	CB11	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi30	air supply - bubbler #12	CB12	CB12	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi31	air supply - bubbler #13	CB13	CB13	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi32	air supply - bubbler #14	EB14	EB14	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi33	air supply - bubbler #15	EB15	EB15	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi34	air supply - bubbler #16	EB16	EB16	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi35	air supply - bubbler #17	EB17	EB17	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
agi36	air supply - bubbler #18	EB18	EB18	1/2	C	IA-2	0.75	scfm	4	psig	113 (45)	0.1-3	scfm	10	psig	150 (66)	TRUE	LWA	Staubli	Custom Pitless Fitting	45
clg01	water return - cooling, base	NEB-1	NEB-1	2	C	CW-1	40	gpm	100	psig	99 (37)	40	gpm	150	psig	360 (182)	TRUE	NEB-1	Hiltap	N/A	12 48
clg02	water supply - cooling, base	NWB-1	NWB-1	2	C	CW-1	40	gpm	100	psig	84 (29)	40	gpm	150	psig	360 (182)	TRUE	NWB-1	Hiltap	N/A	1 48
clg03	water return - cooling, east discharge	N/A	clg03	2	C	CW-1	15	gpm	100	psig	95 (35)	15	gpm	150	psig	360 (182)	TRUE	SE-1	Hiltap	N/A	12 48
clg04	water supply - cooling, east discharge	N/A	clg04	2	C	CW-1	15	gpm	100	psig	84 (29)	15	gpm	150	psig	360 (182)	TRUE	SE-1	Hiltap	N/A	1 48
clg05	water return - cooling, east wall	N/A	clg05	1	C	CW-1	10	gpm	100	psig	105 (41)	10	gpm	150	psig	360 (182)	TRUE	EN-1	Hiltap	N/A	12 48
clg06	water supply - cooling, east wall	N/A	clg06	1	C	CW-1	10	gpm	100	psig	84 (29)	10	gpm	150	psig	360 (182)	TRUE	EN-1	Hiltap	N/A	1 48
clg07	water return - cooling, northeast wall	N/A	clg07	1	C	CW-1	10	gpm	100	psig	99 (37)	10	gpm	150	psig	360 (182)	TRUE	NE-1	Hiltap	N/A	12 48
clg08	water supply - cooling, northeast wall	N/A	clg08	1	C	CW-1	10	gpm	100	psig	84 (29)	10	gpm	150	psig	360 (182)	TRUE	NE-1	Hiltap	N/A	1 48
clg09	water return - cooling, northwest wall	NW-1	clg09	1	C	CW-1	10	gpm	100	psig	99 (37)	10	gpm	150	psig	360 (182)	TRUE	NW-1	Hiltap	N/A	12 48
clg10	water supply - cooling, northwest wall	NW-1	clg10	1	C	CW-1	10	gpm	100	psig	84 (29)	10	gpm	150	psig	360 (182)	TRUE	NW-1	Hiltap	N/A	1 48
clg11	water return - cooling, southeast wall	N/A	clg11	1	C	CW-1	10	gpm	100	psig	93 (34)	10	gpm	150	psig	360 (182)	TRUE	SE-1	Hiltap	N/A	12 48

Tag	Description	Temp Conn ID	Melter Nozzle Tag	Line/ Wire Size (in)	Ops Mode (13)	Service Type (12)	Nominal Flow/Amp	Nom F/A Unit	Nominal Pres/Volt	Nom P/V Unit	Nom Temp F (C)	Design Flow/Amp	Des F/A Unit	Design Pres/Volt	Des P/V Unit	Des Temp F (C)	Critical Srvc	Connect Box Number	Externl Style (10)	Internal Style	Notes
clg12	water supply - cooling, southeast wall	N/A	clg12	1	C	CW-1	10	gpm	100	psig	84 (29)	10	gpm	150	psig	360 (182)	TRUE	SE-1	Hiltap	N/A	1 48
clg13	water return - cooling, southwest wall	N/A	clg13	1	C	CW-1	10	gpm	100	psig	93 (34)	10	gpm	150	psig	360 (182)	TRUE	SW-1	Hiltap	N/A	12 48
clg14	water supply - cooling, southwest wall	N/A	clg14	1	C	CW-1	10	gpm	100	psig	84 (29)	10	gpm	150	psig	360 (182)	TRUE	SW-1	Hiltap	N/A	1 48
clg17	water return - cooling, west discharge	N/A	clg17	2	C	CW-1	15	gpm	100	psig	95 (35)	15	gpm	150	psig	360 (182)	TRUE	SW-1	Hiltap	N/A	12 48
clg18	water supply - cooling, west discharge	N/A	clg18	2	C	CW-1	15	gpm	100	psig	84 (29)	15	gpm	150	psig	360 (182)	TRUE	SW-1	Hiltap	N/A	1 48
clg19	water return - cooling, west wall	N/A	clg19	1	C	CW-1	10	gpm	100	psig	105 (41)	10	gpm	150	psig	360 (182)	TRUE	WN-1	Hiltap	N/A	12 48
clg20	water supply - cooling, west wall	N/A	clg20	1	C	CW-1	10	gpm	100	psig	84 (29)	10	gpm	150	psig	360 (182)	TRUE	WN-1	Hiltap	N/A	1 48
clg21	water supply - cooling, lid	N/A	clg21	1-1/2	C	CW-1	25	gpm	14.5	psig	84 (29)	25	gpm	14.5	psig	140 (60)	TRUE	NW-2	Hiltap	N/A	1 48
clg22	water return - cooling, lid	N/A	clg22	1.5	C	CW-1	25	gpm	14.5	psig	90 (32)	25	gpm	14.5	psig	140 (60)	TRUE	NE-2	Hiltap	N/A	12 48
clg23	water supply - cooling, plenum	N/A	clg23	2	C	CW-1	70	gpm	100	psig	84 (29)	70	gpm	150	psig	360 (182)	TRUE	WS-1	Hiltap	N/A	1 48
clg24	water return - cooling, plenum	N/A	clg24	2	C	CW-1	70	gpm	100	psig	85 (29)	70	gpm	150	psig	360 (182)	TRUE	ES-1	Hiltap	N/A	12 48
clg26	water supply - cooling, west offgas shielded lid panel	NW-2	clg26	3/4	C	CW-1	10	gpm	100	psig	84 (29)	10	gpm	150	psig	360 (182)	FALSE	NW-2	Hiltap	N/A	1 48
clg27	water return - cooling, west offgas shielded lid panel	NW-2	clg27	3/4	C	CW-1	10	gpm	100	psig	90 (32)	10	gpm	150	psig	360 (182)	TRUE	NW-2	Hiltap	N/A	12 48
clg28	water return - cooling panel total return based on 84F supply	N/A	clg28	N/A	N/A	CW-1	245	gpm	N/A		105.4 (41)	245	gpm	N/A		N/A	TRUE	N/A	N/A	N/A	
clg29	water supply - cooling, east offgas shielded lid panel	NE-2	clg29	3/4	C	CW-1	10	gpm	100	psig	84 (29)	10	gpm	150	psig	360 (182)	FALSE	NE-2	Hiltap	N/A	1 48
clg30	water return - cooling, east offgas shielded lid panel	NE-2	clg30	3/4	C	CW-1	10	gpm	100	psig	90 (32)	10	gpm	150	psig	360 (182)	TRUE	NE-2	Hiltap	N/A	12 48
clg31	water supply - cooling, west film cooler cover panel	NE-2	clg31	3/4	C	CW-1	2	gpm	100	psig	84 (29)	10	gpm	150	psig	360 (182)	TRUE	NE-2	Hiltap	Staubli	
clg32	water return - cooling, west film cooler cover panel	NE-2	clg32	3/4	C	CW-1	2	gpm	100	psig	84 (29)	10	gpm	150	psig	360 (182)	TRUE	NE-2	Hiltap	Staubli	
clg33	water supply - cooling, east film cooler cover panel	NW-2	clg33	3/4	C	CW-1	2	gpm	100	psig	84 (29)	10	gpm	150	psig	360 (182)	TRUE	NW-2	Hiltap	Staubli	
clg34	water return - cooling, east film cooler cover panel	NW-2	clg34	3/4	C	CW-1	2	gpm	100	psig	84 (29)	10	gpm	150	psig	360 (182)	TRUE	NW-2	Hiltap	Staubli	
clg35	water return, cooling, west seal head panel	Lower	clg35	1	C	CW-1												N/A	Hiltap		38
clg36	water supply, cooling, west seal head panel	Upper	clg36	1	C	CW-1												N/A	Hiltap		38
clg37	water supply, cooling, east seal head panel	Upper	clg37	1	C	CW-1												N/A	Hiltap		38
clg38	water return, cooling, east seal head panel	Lower	clg38	1	C	CW-1												N/A	Hiltap		38
drn01	drain - gas barrier annulus	N/A	drn01	2	Rare	DR	N/A		N/A		N/A	N/A		+10/-40	in wc	113 (45)	FALSE	N/A	B16.6 150#	N/A	
drn02	drain - melter shielding	N/A	drn02	2	Rare	DR	N/A		N/A		N/A	N/A		+10/-40	in wc	113 (45)	FALSE	N/A	B16.5 150#	N/A	
fed01	water return - feed nozzle #1 cooling	WF1-B	WF1-B	3/4	C	CW-1	5.5	gpm	100	psig	86 (30)	7.5	gpm	150	psig	360 (182)	TRUE	LWW	Hiltap	Swagelok	13 48
fed02	water supply - feed nozzle #1 cooling	WF1-A	WF1-A	3/4	C	CW-1	5.5	gpm	100	psig	84 (29)	7.5	gpm	150	psig	360 (182)	TRUE	LWW	Hiltap	Swagelok	1 48
fed03	feed supply - feed nozzle #1	WF1	WF1	3/4	I	Normal	1	gpm	30	psig	113 (45)	1	gpm	100	psig	150 (66)	FALSE	FEED	Hiltap	Swagelok	
fed05	water return - feed nozzle #2 cooling	WF2-B	WF2-B	3/4	C	CW-1	5.5	gpm	100	psig	86 (30)	7.5	gpm	150	psig	360 (182)	TRUE	LWW	Hiltap	Swagelok	13 48
fed06	water supply - feed nozzle #2 cooling	WF2-A	WF2-A	3/4	C	CW-1	5.5	gpm	100	psig	84 (29)	7.5	gpm	150	psig	360 (182)	TRUE	LWW	Hiltap	Swagelok	1 48
fed07	feed supply - feed nozzle #2	WF2	WF2	3/4	I	Normal	1	gpm	30	psig	113 (45)	1	gpm	100	psig	150 (66)	FALSE	FEED	Hiltap	Swagelok	
fed08	water return - feed nozzle #3 cooling	CF3-B	CF3-B	3/4	C	CW-1	5.5	gpm	100	psig	86 (30)	7.5	gpm	150	psig	360 (182)	TRUE	LWW	Hiltap	Swagelok	13 48

Tag	Description	Temp Conn ID	Melter Nozzle Tag	Line/ Wire Size (in)	Ops Mode (13)	Service Type (12)	Nominal Flow/Amp	Nom F/A Unit	Nominal Pres/Volt	Nom P/V Unit	Nom Temp F (C)	Design Flow/Amp	Des F/A Unit	Design Pres/Volt	Des P/V Unit	Des Temp F (C)	Critical Srvc	Connect Box Number	Externl Style (10)	Internal Style	Notes
fed09	water supply - feed nozzle #3 cooling	CF3-A	CF3-A	3/4	C	CW-1	5.5	gpm	100	psig	84 (29)	7.5	gpm	150	psig	360 (182)	TRUE	LWW	Hiltap	Swagelok	1 48
fed10	feed supply - feed nozzle #3	CF3	CF3	3/4	I	Normal	1	gpm	30	psig	113 (45)	1	gpm	100	psig	150 (66)	FALSE	FEED	Hiltap	Swagelok	
fed12	water return - feed nozzle #4 cooling	CF4-B	CF4-B	3/4	C	CW-1	5.5	gpm	100	psig	86 (30)	7.5	gpm	150	psig	360 (182)	TRUE	LWW	Hiltap	Swagelok	13 48
fed13	water supply - feed nozzle #4 cooling	CF4-A	CF4-A	3/4	C	CW-1	5.5	gpm	100	psig	84 (29)	7.5	gpm	150	psig	360 (182)	TRUE	LWW	Hiltap	Swagelok	1 48
fed14	feed supply - feed nozzle #4	CF4	CF4	3/4	I	Normal	1	gpm	30	psig	113 (45)	1	gpm	100	psig	150 (66)	FALSE	FEED	Hiltap	Swagelok	
fed15	water return - feed nozzle #5 cooling	EF5-B	EF5-B	3/4	C	CW-1	5.5	gpm	100	psig	86 (30)	7.5	gpm	150	psig	360 (182)	TRUE	LWW	Hiltap	Swagelok	13 48
fed16	water supply - feed nozzle #5 cooling	EF5-A	EF5-A	3/4	C	CW-1	5.5	gpm	100	psig	84 (29)	7.5	gpm	150	psig	360 (182)	TRUE	LWW	Hiltap	Swagelok	1 48
fed17	feed supply - feed nozzle #5	EF5	EF5	3/4	I	Normal	1	gpm	30	psig	113 (45)	1	gpm	100	psig	150 (66)	FALSE	FEED	Hiltap	Swagelok	
fed19	water return - feed nozzle #6 cooling	EF6-B	EF6-B	3/4	C	CW-1	5.5	gpm	100	psig	86 (30)	7.5	gpm	150	psig	360 (182)	TRUE	LWW	Hiltap	Swagelok	13 48
fed20	water supply - feed nozzle #6 cooling	EF6-A	EF6-A	3/4	C	CW-1	5.5	gpm	100	psig	84 (29)	7.5	gpm	150	psig	360 (182)	TRUE	LWW	Hiltap	Swagelok	1 48
fed21	feed supply - feed nozzle #6	EF6	EF6	3/4	I	Normal	1	gpm	30	psig	113 (45)	1	gpm	100	psig	150 (66)	FALSE	FEED	Hiltap	Swagelok	
fed22	frit addition funnel #1	N/A	fed22	custom	Rare	M	N/A		-5	in wc	113 (45)	N/A		+10/-40	in wc	113 (45)	FALSE	N/A	Custom	Custom	6 30
fed23	frit addition funnel #2	N/A	fed23	custom	Rare	M	N/A		-5	in wc	113 (45)	N/A		+10/-40	in wc	113 (45)	FALSE	N/A	Custom	Custom	6 30
fed48	water supply - feed nozzle flush (each nozzle)	N/A	fed48	N/A	I	PW	1/4	gph	30	psig	84 (29)	1/4	gph	150	psig	360 (182)	FALSE	N/A	N/A	N/A	50
fed49	water supply - feed nozzle start up from idle (each nozzle)	N/A	fed49	N/A	I	PW	1	gpm	30	psig	84 (29)	1	gpm	150	psig	360 (182)	FALSE	N/A	N/A	N/A	51
grd01	melter ground (4 locations)	N/A	grd01	N/A	C	E	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	N/A	cable lug	N/A	
htd01	heater - east discharge auxiliary	N/A	htd01	#10	Rare	E	0	A	0	V	N/A	17.5	A	240	V	N/A	FALSE	EDH	Lemo	N/A	11
htd02	heater - east discharge #01	N/A	htd02	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	EDH	Vantage	Vantage	
htd03	heater - east discharge #02	N/A	htd03	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	EDH	Vantage	Vantage	
htd04	heater - east discharge #03	N/A	htd04	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	EDH	Vantage	Vantage	
htd05	heater - east discharge #04	N/A	htd05	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	EDH	Vantage	Vantage	
htd06	heater - east discharge #05	N/A	htd06	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	EDH	Vantage	Vantage	
htd07	heater - east discharge #06	N/A	htd07	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	EDH	Vantage	Vantage	
htd08	heater - east discharge #07	N/A	htd08	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	EDH	Vantage	Vantage	
htd09	heater - east discharge #08	N/A	htd09	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	EDH	Vantage	Vantage	
htd10	heater - east discharge #09	N/A	htd10	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	EDH	Vantage	Vantage	
htd11	heater - east discharge #10	N/A	htd11	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	EDH	Vantage	Vantage	
htd12	heater - east discharge #11	N/A	htd12	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	EDH	Vantage	Vantage	
htd13	heater - east discharge #12	N/A	htd13	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	EDH	Vantage	Vantage	
htd14	heater - west discharge auxiliary	N/A	htd14	#10	Rare	E	0	A	0	V	N/A	17.5	A	240	V	N/A	FALSE	WDH	Lemo	N/A	11

Tag	Description	Temp Conn ID	Melter Nozzle Tag	Line/ Wire Size (in)	Ops Mode (13)	Service Type (12)	Nominal Flow/Amp	Nom F/A Unit	Nominal Pres/Volt	Nom P/V Unit	Nom Temp F (C)	Design Flow/Amp	Des F/A Unit	Design Pres/Volt	Des P/V Unit	Des Temp F (C)	Critical Srvc	Connect Box Number	Externl Style (10)	Internal Style	Notes
htd15	heater - west discharge #01	N/A	htd15	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	WDH	Vantage	Vantage	
htd16	heater - west discharge #02	N/A	htd16	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	WDH	Vantage	Vantage	
htd17	heater - west discharge #03	N/A	htd17	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	WDH	Vantage	Vantage	
htd18	heater - west discharge #04	N/A	htd18	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	WDH	Vantage	Vantage	
htd19	heater - west discharge #05	N/A	htd19	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	WDH	Vantage	Vantage	
htd20	heater - west discharge #06	N/A	htd20	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	WDH	Vantage	Vantage	
htd21	heater - west discharge #07	N/A	htd21	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	WDH	Vantage	Vantage	
htd22	heater - west discharge #08	N/A	htd22	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	WDH	Vantage	Vantage	
htd23	heater - west discharge #09	N/A	htd23	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	WDH	Vantage	Vantage	
htd24	heater - west discharge #10	N/A	htd24	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	WDH	Vantage	Vantage	
htd25	heater - west discharge #11	N/A	htd25	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	WDH	Vantage	Vantage	
htd26	heater - west discharge #12	N/A	htd26	#2	C	E	25-30	A	70-85	V	N/A	59	A	480	V	N/A	FALSE	WDH	Vantage	Vantage	
htm01	power - electrode bus, northcenter	N/A	htm01	2" bus	C	E	989-5761	A	103-440	V	N/A	6500	A	480	V	N/A	TRUE	N/A	Custom	Custom	67
htm04	TC - northcenter electrode extension cooling air exhaust	N/A	htm04	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	NCE	Lemo	Lemo	
htm05	air supply - electrode extension cooling, northcenter	CE-1	CE1	3/4	C	IA-2	10	scfm	10	psig	113 (45)	10	scfm	15	psig	150 (66)	FALSE	NE-1	Staubli	Staubli	
htm06	TC - northcenter electrode extension	N/A	htm06	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	NCE	Lemo	Lemo	
htm07	power - electrode bus, northeast	N/A	htm07	2" bus	C	E	989-5761	A	103-440	V	N/A	6500	A	480	V	N/A	TRUE	N/A	Custom	Custom	67
htm10	TC - northeast electrode extension cooling air exhaust	N/A	htm10	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	ENE	Lemo	Lemo	
htm11	air supply - electrode extension cooling, northeast	EE-1	EE1	3/4	C	IA-2	10	scfm	10	psig	113 (45)	10	scfm	15	psig	150 (66)	FALSE	EN-2	Staubli	Staubli	
htm12	TC - northeast electrode extension	N/A	htm12	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	ENE	Lemo	Lemo	
htm13	power - electrode bus, northwest	N/A	htm13	2" bus	C	E	989-5761	A	103-440	V	N/A	6500	A	480	V	N/A	TRUE	N/A	Custom	Custom	67
htm16	TC - northwest electrode extension cooling air exhaust	N/A	htm16	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	WNE	Lemo	Lemo	
htm17	air supply - electrode extension cooling, northwest electrode	WE-1	WE1	3/4	C	IA-2	10	scfm	10	psig	113 (45)	10	scfm	15	psig	150 (66)	FALSE	WN-2	Staubli	Staubli	
htm18	TC - northwest electrode extension	N/A	htm18	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	WNE	Lemo	Lemo	
htm19	power - electrode bus, southcenter	N/A	htm19	2" bus	C	E	989-5761	A	103-440	V	N/A	6500	A	480	V	N/A	TRUE	N/A	Custom	Custom	67
htm22	TC - southcenter electrode extension cooling air exhaust	N/A	htm22	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	SCE	Lemo	Lemo	
htm23	air supply - electrode extension cooling, southcenter electrode	CE-2	CE2	3/4	C	IA-2	10	scfm	10	psig	113 (45)	10	scfm	15	psig	150 (66)	FALSE	SW-1	Staubli	Staubli	

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htm24	TC - southcenter electrode extension	N/A	htm24	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	SCE	Lemo	Lemo	
htm25	power - electrode bus, southeast	N/A	htm25	2" bus	C	E	989-5761	A	103-440	V	N/A	6500	A	480	V	N/A	TRUE	N/A	Custom	Custom	67
htm28	TC - southeast electrode extension cooling air exhaust	N/A	htm28	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	ESE	Lemo	Lemo	
htm29	air supply - electrode extension cooling, southeast electrode	EE-2	EE2	3/4	C	IA-2	10	scfm	10	psig	113 (45)	10	scfm	15	psig	150 (66)	FALSE	ES-2	Staubli	Staubli	
htm30	TC - southeast electrode extension	N/A	htm30	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	ESE	Lemo	Lemo	
htm31	power - electrode bus, southwest	N/A	htm31	2" bus	C	E	989-5761	A	103-440	V	N/A	6500	A	480	V	N/A	TRUE	N/A	Custom	Custom	67
htm34	TC - southwest electrode extension cooling air exhaust	N/A	htm34	N/A	C	TC	N/A		N/A	in wc	N/A	N/A		N/A		N/A	FALSE	WSE	Lemo	Lemo	
htm35	air supply - electrode extension cooling, southwest electrode	WE-2	WE2	3/4	C	IA-2	10	scfm	10	psig	113 (45)	10	scfm	15	psig	150 (66)	FALSE	WS-2	Staubli	Staubli	
htm36	TC - southwest electrode extension	N/A	htm36	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	WSE	Lemo	Lemo	
hts01	heater - startup #01	WB-1	hts01	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts02	heater - startup #02	WB-2	hts02	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts03	heater - startup #03	WB-3	hts03	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts04	heater - startup #04	WB-4	hts04	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts05	heater - startup #05	WB-5	hts05	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts06	heater - startup #06	CB-6	hts06	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts07	heater - startup #07	CB-7	hts07	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts08	heater - startup #08	CB-8	hts08	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts09	heater - startup #09	CB-9	hts09	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts10	heater - startup #10	CB-10	hts10	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts11	heater - startup #11	CB-11	hts11	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts12	heater - startup #12	CB-12	hts12	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts13	heater - startup #13	CB-13	hts13	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts14	heater - startup #14	EB-14	hts14	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts15	heater - startup #15	EB-15	hts15	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts16	heater - startup #16	EB-16	hts16	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts17	heater - startup #17	EB-17	hts17	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
hts18	heater - startup #18	EB-18	hts18	#1	Rare	E	99-124	A	94-117	V	N/A	142	A	480	V	N/A	FALSE	N/A	Cooper Crouse Hinds	N/A	6 29
lkd08	leak detector - gas barrier annulus	N/A	lkd08	#16	C	E	0	A	12	V	N/A	1	A	120	V	N/A	FALSE	NE	Lemo	N/A	
lkd11	leak detector - shielding annulus	N/A	lkd11	#16	C	E	0	A	12	V	N/A	1	A	120	V	N/A	FALSE	NE	Lemo	N/A	
lvl01	argon supply - level detector, density leg	WL1-B	WL1-B	3/8	C	Ar	1.8	scfh	2	psig	113 (45)	1.8	scfh	5	psig	150 (66)	TRUE	LWA	Staubli	Staubli	66
lvl02	argon supply - level detector, level leg	WL1-C	WL1-C	3/8	C	Ar	1.8	scfh	3	psig	113 (45)	1.8	scfh	5	psig	150 (66)	TRUE	LWA	Staubli	Staubli	66

Tag	Description	Temp Conn ID	Melter Nozzle Tag	Line/ Wire Size (in)	Ops Mode (13)	Service Type (12)	Nominal Flow/Amp	Nom F/A Unit	Nominal Pres/Volt	Nom P/V Unit	Nom Temp F (C)	Design Flow/Amp	Des F/A Unit	Design Pres/Volt	Des P/V Unit	Des Temp F (C)	Critical Srvc	Connect Box Number	Externl Style (10)	Internal Style	Notes
lvl03	air supply - level detector, reference leg (R1)	WL1-A	WL1-A	3/8	C	IA-1	0.2	scfh	1	psig	113 (45)	0.2	scfm	15	psig	150 (66)	FALSE	LWA	Staubli	Staubli	
lvl04	spare - level detector, density leg	ES8-B	ES8-B	3/8	Rare	Ar	1.8	scfh	2	psig	113 (45)	1.8	scfh	5	psig	150 (66)	TRUE	LWA	Staubli	Staubli	66
lvl05	spare - level detector, level leg	ES8-C	ES8-C	3/8	Rare	Ar	1.8	scfh	3	psig	113 (45)	1.8	scfh	5	psig	150 (66)	TRUE	LWA	Staubli	Staubli	66
lvl06	spare - level detector, reference leg	ES8-A	ES8-A	3/8	Rare	IA-1	0.2	scfm	1	psig	113 (45)	0.2	scfm	15	psig	150 (66)	FALSE	LWA	Staubli	Staubli	
ogp01	air supply - primary offgas film cooler. see ogp09, ogp14	EO-2	ogp01	3																	
ogp02	water supply - primary offgas film cooler wash, same connection as ogp11, ogp12	EO-2	ogp02	3/4	I	PW	3-4	gpm	50	psig	84 (29)	10	gpm	150	psig	360 (182)	FALSE	NE-2	Staubli	Staubli	
ogp05	water supply - primary offgas line wash, same connection as ogp10, ogp15	EO-2	ogp05	3/4	I	PW	3-4	gpm	50	psig	84 (29)	10	gpm	150	psig	360 (182)	FALSE	NE-2	Staubli	Staubli	
ogp06	power - primary offgas film cooler cleaner	EO-2	ogp06	N/A	Rare	E	5	A	480	V	N/A	N/A		N/A		N/A	FALSE	N/A	Lemo	N/A	
ogp08	offgas - primary line/film cooler	EO-2	ogp08	10 sch 80	C	OG	1056	scfm	-5	in wc	572 (300)	5154	scfm	+10/-40	in wc	1112(600)	FALSE	N/A	Hiltap	Hiltap	
ogp09	air supply - primary offgas melter pressure control, same connection as ogp01, ogp14	EO-2	ogp09	3	C	PA	300	scfm	5	psig	113 (45)	400	scfm	150	psig	150 (66)	FALSE	NE-2	Hiltap	Graylok	
ogp10	air supply - primary offgas line wash nozzle blowdown, same connection as ogp05, ogp15	EO-2	ogp10	3/4	I	PA	10	scfm	100	psig	113 (45)	10	scfm	150	psig	150 (66)	FALSE	NE-2	N/A	N/A	
ogp11	air supply - primary film cooler wash nozzle purge, same connector as ogp02, ogp12	EO-2	ogp11	3/4	I	PA	4	scfm	20	psig	113 (45)	10	scfm	150	psig	150 (66)	FALSE	NE-2	N/A	N/A	
ogp12	air supply - primary film cooler wash nozzle blowdown, same connection as ogp02, ogp11	EO-2	ogp12	3/4	I	PA	10	scfm	100	psig	113 (45)	10	scfm	150	psig	150 (66)	FALSE	NE-2	N/A	N/A	
ogp14	air supply - primary film cooler, same connection as ogp01, ogp09	EO-2	ogp14	3	C	PA	155	scfm	100	psig	302 (150)	600	scfm	150	psig	302 (150)	FALSE	NE-2	Hiltap	Graylok	68
ogp15	air supply - primary offgas line wash nozzle purge, same connection as ogp05, and ogp10	EO-2	ogp15	3/4	I	PA	4	scfm	20	psig	113 (45)	10	scfm	150	psig	150 (66)	FALSE	NE-2	N/A	N/A	
ogs01	air supply - standby film cooler	WO-1	ogs01	3	C	PA	30/150	scfm	5	psig	113 (45)	150	scfm	150	psig	150 (66)	FALSE	NW-2	Hiltap	Graylok	
ogs02	water supply - standby film cooler wash nozzle, same connection as ogs08 ogs12	WO-1	ogs02	3/4	I	PW	3-4	gpm	50	psig	84 (29)	10	gpm	150	psig	360 (182)	FALSE	NW-2	Staubli	Staubli	
ogs03	air supply - standby offgas melter pressure measurement (R2)	WO-1	R2	3/8	C	IA-1	0.2	scfm	1	psig	113 (45)	0.2	scfm	150	psig	150 (66)	FALSE	NW-2	Staubli	Staubli	27
ogs06	water supply - standby offgas line wash, same connection as ogs11, ogs13	WO-1	ogs06	3/4	I	PW	3-4	gpm	50	psig	84 (29)	10	gpm	150	psig	360 (182)	FALSE	NW-2	Staubli	Staubli	
ogs07	power - standby offgas film cooler cleaner	WO-1	ogs07	N/A	Rare	E	5	A	480	V	N/A	N/A		N/A		N/A	FALSE	N/A	Lemo	N/A	
ogs08	air supply - standby film cooler wash nozzle blowdown, same connection as ogs02, ogs12	WO-1	ogs08	3/4	I	PA	10	scfm	100	psig	113 (45)	10	scfm	150	psig	150 (66)	FALSE	NW-2	N/A	N/A	
ogs09	offgas - standby line/film cooler	WO-1	ogs09	10 sch 80	CIU	OG	0	scfm	-5	in wc	113 (45)	4860	scfm	+10/-40	in wc	1112	FALSE	N/A	Hiltap	Hiltap	
ogs11	air supply - standby offgas line wash nozzle blowdown, same connection as ogs06, ogs13	WO-1	ogs11	3/4	C	PA	32	scfm	5	psig	113 (45)	50	scfm	150	psig	150 (66)	FALSE	NW-2	N/A	N/A	
ogs12	air supply - standby film cooler wash nozzle purge, same connection as ogs02, ogs08	WO-1	ogs12	3/4	I	PA	4	scfm	20	psig	113 (45)	10	scfm	150	psig	150 (66)	FALSE	NW-2	N/A	N/A	
ogs13	air supply - standby offgas line wash nozzle purge, same connection as ogs06, ogs11	WO-1	ogs13	3/4	I	PA	4	scfm	20	psig	113 (45)	4	scfm	150	psig	150 (66)	FALSE	NW-2	N/A	Staubli	
ogs15	air supply - melter ITS plenum pressure (R5)	WS-1	WS1	3/8	C	IA-1	0.2	scfm	1	psig	113 (45)	0.2	scfm	15	psig	113 (45)	FALSE	LWA	Staubli	Staubli	
ogs16	air supply - melter ITS shielding pressure reference (R6)	RB-6	RB6	3/8	C	IA-1	0.2	scfm	1	psig	113 (45)	0.2	scfm	15	psig	113 (45)	FALSE	LWA	Staubli	N/A	
por01	air supply - air lift/riser purge gas, east	EA-2	EA2	1/2	I	IA-2	3	scfm	2	psig	113 (45)	3	scfm	5	psig	150 (66)	FALSE	LWA	Staubli	Staubli	14 52
por02	port - east discharge lid	N/A	por02	N/A	N/A	M	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	N/A	N/A	N/A	

Tag	Description	Temp Conn ID	Melter Nozzle Tag	Line/ Wire Size (in)	Ops Mode (13)	Service Type (12)	Nominal Flow/Amp	Nom F/A Unit	Nominal Pres/Volt	Nom P/V Unit	Nom Temp F (C)	Design Flow/Amp	Des F/A Unit	Design Pres/Volt	Des P/V Unit	Des Temp F (C)	Critical Srvc	Connect Box Number	Externl Style (10)	Internal Style	Notes
por04	port - east discharge lid cleanout/inspection plug	N/A	por04	N/A	Rare	M	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	N/A	N/A	N/A	
por05	port - west discharge lid cleanout/inspection plug	N/A	por05	N/A	Rare	M	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	N/A	N/A	N/A	
por06	port - east discharge lid spare plug	N/A	por06	N/A	Rare	M	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	N/A	N/A	N/A	
por07	port - west discharge lid spare plug	N/A	por07	N/A	Rare	M	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	N/A	N/A	N/A	
por08	vent - east discharge lid return to plenum	E04	EO4	2	C	OG	58	acfm	-5	in wc	932 (500)	58	acfm	+10/-40	in wc	1112(600)	FALSE	N/A	N/A	Graylok	
por09	air supply - air lift/riser purge gas, west	WA-1	WA1	1/2	I	IA-2	3	scfm	2	psig	113 (45)	3	scfm	5	psig	150 (66)	FALSE	LWA	Staubli	Staubli	14 52
por10	port - west discharge lid	N/A	por10	N/A	N/A	M	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	N/A	N/A	N/A	
por14	argon supply - air lift/riser purge gas, east, same connection as por01	EA-2	por14	3/8	I	Ar	0.2	scfh	2	psig	113 (45)	0.2	scfh	5	psig	150 (66)	TRUE	LWA	N/A	N/A	14 66
por15	argon supply - air lift/riser purge gas, west, same connection as por09	WA-1	por15	3/8	I	Ar	0.2	scfh	2	psig	113 (45)	0.2	scfh	5	psig	150 (66)	TRUE	LWA	N/A	N/A	14 66
prm01	air supply - pressure measurement, east discharge chamber	ED-1	ED1	3/8	C	IA-2	0.2	scfh	1	psig	113 (45)	1	scfh	150	psig	150 (66)	FALSE	SE-1	Staubli	Staubli	
prm02	air supply - pressure reference, east discharge chamber	ED-2	ED2	3/8	C	IA-2	0.2	scfm	1	psg	113 (45)	0.2	scfm	150	psig	150 (66)	FALSE	SE-1	Staubli	N/A	
prm03	air supply - shielding annulus reference leg (R3)	R3	R3	3/8	C	IA-1	0.2	scfm	1	psig	113 (45)	0.2	scfm	1	psig	150 (66)	FALSE	LWA	Staubli	Staubli	
prm04	air supply - shielding annulus reference leg (R4)	R4	R4	3/8	C	IA-1	0.2	scfm	1	psig	113 (45)	0.2	scfm	1	psig	150 (66)	FALSE	LWA	Staubli	N/A	
prm05	air supply - pressure measurement, west discharge chamber	WD-1	WD1	3/8	C	IA-2	0.2	scfh	1	psig	113 (45)	1	scfh	150	psig	150 (66)	FALSE	SW-1	Staubli	Staubli	
prm06	air supply - pressure reference, west discharge chamber	WD-2	WD2	3/8	C	IA-2	0.2	scfh	1	psig	113 (45)	1	scfh	150	psig	150 (66)	FALSE	SW-1	Staubli	N/A	
tmp01	TC - east discharge assembly #1	N/A	tmp01	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	EDT	Lemo	Lemo	
tmp02	TC - east discharge assembly #2	N/A	tmp02	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	EDT	Lemo	Lemo	
tmp03	TC - glass pool/plenum assembly #01	WB-1	tmp03	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LWT	Lemo	Lemo	
tmp04	TC - glass pool/plenum assembly #10	CB-10	tmp04	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LWT	Lemo	Lemo	
tmp05	TC - glass pool/plenum assembly #11	CB-11	tmp05	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LET	Lemo	Lemo	
tmp06	TC - glass pool/plenum assembly #12	CB-12	tmp06	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LET	Lemo	Lemo	
tmp07	TC - glass pool/plenum assembly #13	CB-13	tmp07	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LET	Lemo	Lemo	
tmp08	TC - glass pool/plenum assembly #14	EB-14	tmp08	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LET	Lemo	Lemo	
tmp09	TC - glass pool/plenum assembly #16	EB-16	tmp09	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LET	Lemo	Lemo	
tmp10	TC - glass pool/plenum assembly #17	EB-17	tmp10	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LET	Lemo	Lemo	
tmp11	TC - glass pool/plenum assembly #18	EB-18	tmp11	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LET	Lemo	Lemo	
tmp12	TC - glass pool/plenum assembly #02	WB-2	tmp12	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LWT	Lemo	Lemo	
tmp13	TC - glass pool/plenum assembly #03	WB-3	tmp13	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LWT	Lemo	Lemo	
tmp14	TC - glass pool/plenum assembly #04	WB-4	tmp14	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LWT	Lemo	Lemo	

Tag	Description	Temp Conn ID	Melter Nozzle Tag	Line/ Wire Size (in)	Ops Mode (13)	Service Type (12)	Nominal Flow/Amp	Nom F/A Unit	Nominal Pres/Volt	Nom P/V Unit	Nom Temp F (C)	Design Flow/Amp	Des F/A Unit	Design Pres/Volt	Des P/V Unit	Des Temp F (C)	Critical Srvc	Connect Box Number	Externl Style (10)	Internal Style	Notes
tmp15	TC - glass pool/plenum assembly #05	WB-5	tmp15	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LWT	Lemo	Lemo	
tmp16	TC - glass pool/plenum assembly #06	CB-6	tmp16	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LWT	Lemo	Lemo	
tmp17	TC - glass pool/plenum assembly #07	CB-7	tmp17	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LWT	Lemo	Lemo	
tmp18	TC - glass pool/plenum assembly #08	CB-8	tmp18	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LWT	Lemo	Lemo	
tmp19	TC - glass pool/plenum assembly #09	CB-9	tmp19	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LET	Lemo	Lemo	
tmp20	TC - refractory	CT-1	CT-1	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LET	Lemo	Lemo	
tmp21	TC - startup #1	CS-3	CS3	N/A	CIU	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LWT	Lemo	Lemo	6
tmp22	TC - startup #2	CS-6	CS6	N/A	CIU	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LWT	Lemo	Lemo	6
tmp23	TC - west discharge #1	N/A	tmp23	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	WDT	Lemo	Lemo	
tmp24	TC - west discharge #2	N/A	tmp24	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	WDT	Lemo	Lemo	
tmp25	TC - glass pool/plenum assembly #15	EB-15	tmp25	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	LET	Lemo	Lemo	
tmp26	T/C - east discharge auxiliary heater	N/A	tmp26	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	EDT	Lemo	N/A	
tmp27	T/C - west discharge auxiliary heater	N/A	tmp27	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	WDT	Lemo	N/A	
vew01	air supply - cctv cooling, northwest plenum	WV-2	WV2	3/8	C	IA-2	10	scfm	5	psig	113 (45)	20	scfm	5	psig	150 (66)	TRUE	WN-2	Staubli	Staubli	
vew02	power - cctv, northwest plenum	N/A	vew02	N/A	C	E	1	A	24	V	N/A	1	A	120	V	N/A	FALSE	WNE	Lemo	Lemo	
vew03	air supply - cctv purge, northwest plenum	WV-1	WV1	3/4	C	IA-2	17	scfm	5	psig	113 (45)	20	scfm	15	psig	150 (66)	FALSE	WN-2	Staubli	Staubli	
vew04	signal - cctv, northwest plenum	N/A	vew04	N/A	C	E	note		1	V	N/A	N/A		N/A		N/A	FALSE	WNE	Lemo	Lemo	57
vew05	air supply - cctv cooling, northeast plenum	EV-2	EV2	3/8	C	IA-2	10	scfm	5	psig	113 (45)	20	scfm	5	psig	150 (66)	TRUE	EN-2	Staubli	Staubli	
vew06	power - cctv, northeast plenum	N/A	vew06	N/A	C	E	1	A	24	V	N/A	1	A	120	V	N/A	FALSE	ENE	Lemo	Lemo	
vew07	air supply - cctv purge, northeast plenum	EV-1	EV1	3/4	C	IA-2	17	scfm	5	psig	113 (45)	20	scfm	15	psig	150 (66)	FALSE	EN-2	Staubli	Staubli	
vew08	signal - cctv, northeast plenum	N/A	vew08	N/A	C	E	note		1	V	N/A	N/A		N/A		N/A	FALSE	ENE	Lemo	Lemo	57
vew09	air supply - cctv cooling, southwest plenum	WV-4	WV4	3/8	C	IA-2	10	scfm	5	psig	113 (45)	20	scfm	5	psig	150 (66)	TRUE	WS-2	Staubli	Staubli	
vew10	power - cctv, southwest plenum	N/A	vew10	N/A	C	E	1	A	24	V	N/A	1	A	120	V	N/A	FALSE	WSE	Lemo	Lemo	
vew11	air supply - cctv purge, southwest plenum	WV-3	WV3	3/4	C	IA-2	17	scfm	5	psig	113 (45)	20	scfm	15	psig	150 (66)	FALSE	WS-2	Staubli	Staubli	
vew12	signal - cctv, southwest plenum	N/A	vew12	N/A	C	E	note		1	V	N/A	N/A		N/A		N/A	FALSE	WSE	Lemo	Lemo	57
vew13	air supply - cctv cooling, southeast plenum	EV-4	EV4	3/8	C	IA-2	10	scfm	5	psig	113 (45)	20	scfm	5	psig	150 (66)	TRUE	ES-2	Staubli	Staubli	
vew14	power - cctv, southeast plenum	N/A	vew14	N/A	C	E	1	A	24	V	N/A	1	A	120	V	N/A	FALSE	ESE	Lemo	Lemo	
vew15	air supply - cctv purge, southeast plenum	EV-3	EV3	3/4	C	IA-2	17	scfm	5	psig	113 (45)	20	scfm	15	psig	150 (66)	FALSE	ES-2	Staubli	Staubli	
vew16	signal - cctv, southeast plenum	N/A	vew16	N/A	C	E	note		1	V	N/A	N/A		N/A		N/A	FALSE	ESE	Lemo	Lemo	57

Tag	Description	Temp Conn ID	Melter Nozzle Tag	Line/ Wire Size (in)	Ops Mode (13)	Service Type (12)	Nominal Flow/Amp	Nom F/A Unit	Nominal Pres/Volt	Nom P/V Unit	Nom Temp F (C)	Design Flow/Amp	Des F/A Unit	Design Pres/Volt	Des P/V Unit	Des Temp F (C)	Critical Srvc	Connect Box Number	Externl Style (10)	Internal Style	Notes
vew17	power - cctv purge air heater, northwest	N/A	vew17	#10	C	E	27.3	A	220	V	N/A	27.3	A	220	V	N/A	FALSE	WNE	Lemo	Lemo	
vew18	TC - northwest cctv purge heater temperature	N/A	vew18	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	WNE	Lemo	Lemo	
vew19	TC - northeast cctv purge heater temperature	N/A	vew19	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	ENE	Lemo	Lemo	
vew20	power - cctv purge air heater, southwest	N/A	vew20	#10	C	E	27.3	A	220	V	N/A	27.3	A	220	V	N/A	FALSE	WSE	Lemo	Lemo	
vew21	TC - southwest cctv purge heater temperature	N/A	vew21	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	WSE	Lemo	Lemo	
vew22	power - cctv purge air heater, southeast	N/A	vew22	#10	C	E	27.3	A	220	V	N/A	27.3	A	220	V	N/A	FALSE	ESE	Lemo	Lemo	
vew23	TC - southeast cctv purge heater temperature	N/A	vew23	N/A	C	TC	N/A		N/A		N/A	N/A		N/A		N/A	FALSE	ESE	Lemo	Lemo	
vew24	power - cctv purge air heater, northeast	N/A	vew24	#10	C	E	27.3	A	220	V	N/A	27.3	A	220	V	N/A	FALSE	ENE	Lemo	Lemo	
vew25	air supply - west discharge, west air knife	lower	vew25																		38
vew26	air supply - east discharge, east air knife	lower	vew26																		38
vew27	air supply - east discharge, west air knife	upper	vew27																		38
vew28	air supply - west discharge, east air knife	upper	vew28																		38
vew29	air supply - gamma detector cooling, west seal head	N/A	vew29																		38
vew30	air supply - gamma detector cooling, east seal head	N/A	vew30																		38
vew31	air supply - cctv purge, west discharge pour stream	N/A	vew31																		38
vew32	air supply - cctv cooling, west discharge pour stream	N/A	vew32																		38
vew33	air supply - cctv purge, west seal head	N/A	vew33																		38
vew34	air supply - cctv cooling, west seal head	N/A	vew34																		38
vew35	air supply - ir cctv cooling, west seal head	N/A	vew35																		38
vew36	air supply - ir cctv purge, west seal head	N/A	vew36																		38
vew37	air supply - cctv purge, east discharge pour stream	N/A	vew37																		38
vew38	air supply - cctv cooling, east discharge pour stream	N/A	vew38																		38
vew39	air supply - cctv purge, east seal head	N/A	vew39																		38
vew40	air supply - cctv cooling, east seal head	N/A	vew40																		38
vew41	air supply - ir cctv cooling, east seal head	N/A	vew41																		38
vew42	air supply - ir cctv purge, east seal head	N/A	vew42																		38
vnt01	vent - west discharge lid return to plenum	W03	W03	2	C	OG	58	acfm	-5	in wc	932 (500)	58	acfm	+10/-40	in wc	1112 (600)	FALSE	N/A	N/A	Graylok	
vnt04	vent - annular space contamination control, exhaust	N/A	vnt04	12 x 17	C	Vent	1360	scfm	-2	in wc	59-113 (15-45)	1500	scfm	-2	in wc	59-113 (15-45)	FALSE	N/A	Cutsom 12 x 17 flange with bolts. See WTP-M-11751-14	N/A	18
vnt05	vent - annular space contamination control, supply	N/A	vnt05	12 x 17	C	Vent	1500	scfm	-2	in wc	59-113 (15-45)	1500	scfm	-2	in wc	59-113 (15-45)	FALSE	N/A	Cutsom 12 x 17 flange with bolts. See WTP-M-11751-14	N/A	18

Notes (numbers not shown have been deleted and are not referenced in the table):

1 Cooling water supply temperature is to be greater than melter gallery air temp to prevent condensation.
6 Installed only during melter startup
10 See assembly drawings for connector details and part numbers.
11 Discharge chamber auxiliary heaters not normally connected. Heater to be used for pour flange glass blockage recovery only.
12 Nominal return temperature for normal feeding mode late in melter life with 50% glass contact refractory loss, range for all 5 PFD operating modes in parenthesis.
13 Nominal return temperature for normal melter idling mode.
14 Air lift discharges are operated intermittently one at a time. Argon is purged through the air lift at 0.2 SCFH when glass is not being discharged.
18 Shielded lid and wall module contamination control air exhausts are combined as "shield vent" exhaust air. vnt05 comes from wet process cell, vnt04 goes to C5 exh
19 See list below for description of service types and associated service qualities.
24 N/A = Not Applicable
27 Attached to standby offgas port.
28 Cooling air will be exhausted into the melter cave
29 Bubbler and start-up heaters fit same lid nozzles
30 Frit addition and feed nozzles fit same lid nozzles
33 Maximum temperature
35 May include water flush for film cooler
36 Included in pressure control air injection
37 Temperature may be higher if film cooler and air injection stops during pressure trip
38 Data is determined by Bechtel and defined in other design documents.
39 Routing of air injection may be through the melter lid in which case it is an interface. If it is conncted to the off-gas jumper its is not an interface.
40 Seal pot or trap required
44 Temperatures assume 50 scfm cooling to side electrodes, 50 scfm to bottom electrode if cooled (bottom electrode normally not cooled), and 10 scfm cooling for side and bottom electrode extensions.
45 Design pressures based on maximum system pressures developed in the IA system, will need to get from SD or contractor P&ID (Project Reference)
48 Design temperature of the pipe/connection, with the potential for water to boil to create steam
49 Based on strict definition of B31.3. The cooling water system is "suspect radioactive" and may require more rigorous fabrication and inspection requirements.
50 Once every four hours the feed lines are flushed - once through. This occurs for each of the six ADS pumps/feedlines or 1.5gph per melter.
51 Startup from idle, once through water (for 30 min. use w/ 2 nozzles), use about once per month per melter (this is a guess based on bubbler replacement schedule)
52 Air flows during pours only, approximately 1 hour every 3 hours. Argon used as a continuous purge, even during pours (about 1 scfh).
53 Air flows during pours only, approximately 30 minutes every 3 hours. Argon used as a continuous purge, even during pours (about 1scfh).
54 Water used to "cool" plenum after an idle condition. Flow from only 1 nozzle required, duration approximately 30 minutes.

55 Signal is digital. RS 485 or 232.
57 Video signal format is "S-Video".
58 Criteria for this service defined by contractor, not subcontractor.
60 This is not a design interface between the contractor and subcontractor.

62 Vendor product shown is prefered. However, a contractor-approved equal may be acceptable.
63 See subcontractor assembly drawings for precise locations. Locations shown are for quick reference on the connections deemed the most critical.

64 Process values are based on pilot melter data and design development by subcontractor. Actual melter operating/design criteria may vary based on final services system design by project.
65 Service connection with no "CONN ID" were not given a unique tag number by the subcontractor.
66 This critical service can be halted long enough to change the supply source.
67 This critical service can be halted for a maximum of 3 hrs before irreparable damage may occur.
68 Not considered a critical service. However, loss of air may result in component failure after roughly 8-12 hours.

Operations Modes:

C Continuous
CIU Continuous if used
I Intermittent and likely use
Rare Not used except under special conditions or very infrequently

Service Types:

Ar Argon. Welding grade
CW-1 Cooling Water. Demineralized, filtered <2 microns, biocide additions allowed, no corrosion inhibitors, chlorides <40 ppm, sulfate <100ppm, TDS <340ppm, TSS <300ppm, total hardness <170ppm
CW-2 Cooling Water. Same as CW-1 except for having a specific conductivity <200 micromhos/cm.
DR Drain
E Electrical
Feed Melter Feed
IA-1 Instrument Air. Per ANSI/ISA-S7.0.01-1996.
IA-2 Instrument Air. Same as IA-1 with final point-of-use filter to remove water, particulate, aerosols, and reduce total hydrocarbon content to <1ppm v/v methane basis.
LS Limit Switch
M Mechanical
OG Off-Gas
PA Plant Service Air. Oil free, dew point 33-39F, filter to 2 microns.
PW Process Water. Raw river water filtered to 2 microns. Recommend analysis for various times of the year be reviewed so dissolved species contents are known.
TC Thermocouple
Vent C5 Ventilation.

Appendix B- Melter Design Interface Details

Melter Engineering Specification Appendix Note:

The data in this appendix are based on experience from pilot melters and other operating units. This data was gathered early in the project and used as a guide for design of surrounding utilities. The values should not be used directly as input since in many cases the design has continued to evolve and there may be inconsistencies between issued design documents and values in these tables. Instead, refer to the appropriate design media, e.g. P&IDs, melter design drawings, melter design calculations, or other system calculations. These data may be used as an assumption for performing calculations but the assumption will require verification by the calculation where it was used or other design media.

Tag	Component (2, 3)	Interface Detail(2, 3)	Interface Criteria	System/Area	Comments
enc65	access panel - cooling water	weight of component	170 lb maximum	LSH	several cooling panel covers exist, the maximum value is used
enc63	access panel - discharge chamber shielded lid	weight of component	1020 lb approximate	LSH	
enc64	access panel - electrode bus	weight of component	100 lb maximum	LSH	several electrode panels exist, the maximum value is used
enc62	access panel - offgas, film cooler, primary and standby	weight of component	1000 lb approximate	LSH	
enc68	access panel - shielded lid large port	weight of component	175 lb approximate	LSH	
agi11	access panel - shielded lid large port (including bubblers)	shielded lid interface detail with project replacement equipment	dowel pins 1.5" dia. - 6UNC, spacing and hole locations per the project reference drawings, alignment via two, 3/8" alignment rods 175 degrees apart to match the CCB, gamma gate (exception - bubbler port EB18 has 2, 1-1/4" - 7 UNC)	LSH	
enc69	access panel - shielded lid small port	weight of component	20 lb approximate	LSH	
enc67	access panel - shielded lid vent cover	weight of component	210 lb approximate	LSH	
enc66	access panel -jack bolt (maximum)	weight of component	160 lb approximate	LSH	several jack bolt cover sizes exist, the maximum value is used
enc41	access panels- feed line junction box	weight of component	75 lb approximate	LSH	
agi13	bubbler	dimensions - envelope	20" dia. X 117" long	LSH	length from bottom of bubbler to top of cover (106.5") plus length of ball lock on top of cover plate (6")
agi03	bubbler	maintenance handling criteria	Bubbler to be replaced via CCB/gamma gate after manually unplugging thermocouple. Use of ball lock assembly to match CCB device. Air to be supplied continuously during insertion into melt pool.	LSH	required to meet the bubbler orientation established in agi12. Glass contact consumable
agi02	bubbler	operating life (predicted)	6 months (incl. thermocouples)	LSH	
agi12	bubbler	orientation	E-W direction, 180 degrees apart	LSH	
agi09	bubbler	shielded lid inner guide tube inside diameter	20.5" I. D.	LSH	
agi10	bubbler	shielded lid large port counter bore inner diameter	21.5" I. D. at 1/2" depth	LSH	
agi07	bubbler	weight of component	760 lb approximate	LSH	Bubbler weight provided without addition of air cylinder and subsequent equipment
vew07	cctv - for melter plenum	dimensions - envelope	14" dia. X 36" long	LSH	
vew03	cctv - for melter plenum	maintenance handling criteria	CCTV and view port to be independently replaceable (non-routine). Maintenance to be hands-on.	LSH	no specific lifting features incorporated into the design

Tag	Component (2, 3)	Interface Detail(2, 3)	Interface Criteria	System/Area	Comments
vew02	cctv - for melter plenum	operating life (predicted)	life of melter	LSH	
vew09	cctv - for melter plenum	weight of component	85 lb approximate	LSH	
enc55	consumables	weight of component	650 lb (maximum - for melter lid components only, excluding film cooler assemblies)	LSH	
enc56	consumables	dimensions - maximum (lid components only, excluding film cooler assemblies)	20" dia. X 125" long	LSH	Maximum envelope dimensions imposed on Duratek consumable design to accommodate project replacement equipment for lid components only (excluding film cooler assemblies). Based on a 1/4" radial clearance
fed28	consumables - small consumables	shielded lid inner guide tube counter bore	8.5" I.D. at 1/2" depth	LSH	includes feed nozzles, level detector, pressure probe (ITS), glass riser air lift lance, spare plugs, refractory thermowell/thermocouple, startup thermowell/thermocouple
fed27	consumables - small consumables	shielded lid inner guide tube inside diameter	7.5" I.D.	LSH	see fed28, dimension taken from the feed line nozzle, same dimension for all other small consumables
enc24	datum point - melter reference	melter datum point - description of physical location (x,y,z location from which all melter dimensions originate from)	centerline of the melter north-west seismic pin, top of rail, physical dimensions from column lines shown on project drawing reference	20	
enc92	discharge chamber	shielding thickness requirements	enclosure plate thickness (including penetration access panels) on all external faces of melter discharge chambers shall be a minimum of 2 inches.		
enc59	discharge chamber lid	maintenance handling criteria	a changeout box, built exclusively for the discharge chamber consumables, will be provided by contractor. Part of the weight of the changeout box will rest on the melter shielded lid. The vertical distance from top of the discharge chamber shielded lid to the melter shielded lid is 36.75"	LSH	
por39	discharge chamber lid with heaters	dimensions - envelope	42" (N-S) X 32.5" (E-W) X 80" high	LSH	height includes the lifting bail
por06	discharge chamber lid with heaters	maintenance handling criteria	four pick points, one on each corner of the lid	LSH	definition of specialty lifting equipment unknown, issues with guides and other equipment not resolved
por05	discharge chamber lid with heaters	operating life (predicted)	life of melter	LSH	based on continuous heater operation
por41	discharge chamber lid with heaters	weight of component	1170 lb approximate	LSH	
por110	discharge chamber pressure probe - lid plug, 4"	dimensions - envelope	7" dia. X 26.15" long	LSH	length does not include the wire rope lifting bail, lid plug used to measure the pressure in the discharge chamber
env85	discharge chamber shielded cover plate	maintenance handling criteria	4 pick points (folding bails) one in each corner	LSH	

Tag	Component (2, 3)	Interface Detail(2, 3)	Interface Criteria	System/Area	Comments
ogs53	discharge chamber vent insert	dimensions - envelope	7" dia. X 72.5" long	LSH	
ogs51	discharge chamber vent insert	maintenance handling criteria	vertical lift with overhead device, lifting bail on component after removal of vent line	LSH	
ogs50	discharge chamber vent insert	operating life (predicted)	life of melter	LSH	
ogs52	discharge chamber vent insert	weight of component	70 lb approximate	LSH	
ogs57	discharge chamber vent line	dimensions - envelope	discharge chamber section - 28" X 16" X 12", middle section - 48" X 12" X 12", lid section - 36" X 18" X 12"	LSH	dimension does not include the lifting bail
ogs54	discharge chamber vent line	operating life (predicted)	life of melter	LSH	
ogs56	discharge chamber vent line	weight of component	discharge chamber section - 62 lb, middle section - 55 lb, lid section - 48 lb (all approximate weights)	LSH	
ogs55	discharge chamber vent line - discharge chamber section, middle section, plenum section	maintenance handling criteria	welded lug attachments to accommodate overhead lifting device	LSH	vent line sections attached with graylok flanges
enc61	discharge chamber, shielded lid	shielded lid interface detail with project replacement equipment	dowel pins 1.5" dia. - 6 UNC, spacing and hole locations per the project reference drawings	LSH	restraint point locations on the shielded lid for the discharge chamber CCB, support provided by the shielded lid
enc49	drain for annulus space	location from datum	center of flange, raised face from datum: gas barrier - 137.76"E, 8.15" S, 15.81" up; annular space - 115.51"E, 8.15"S, 15.81" up	RLD	
env56	facility rails	centerline to centerline dimension	28'-4"	LMH	
env54	facility rails	deflection limits - maximum wheel travel	0.0625" - combined deflection and surface discontinuities	LMH	
env55	facility rails	finish/coating/heat treating/physical properties	Alloy steel 4340 (100 ksi yield) head hardened, 55-60 Rc	LMH	
env59	facility rails	maximum rail gap	1/4"	LMH	
env60	facility rails	size	rail height - 3'-11.125" elevation, rail width - 6"	LMH	
env61	facility rails	tolerance, straightness	rails shall be straight to within 0.040" per 16' of rail length in both directions	LMH	
fed12	feed nozzle	dimensions - envelope	7.5" dia. X 68.65" long	LSH	envelope length includes ball lock lifting assembly, envelope diameter includes the tadpole gasket (.25" dia.)
fed08	feed nozzle	maintenance handling criteria	ball lock assembly, 1" diameter, 4-ball	LSH	equipment used for removal determined by project, this component is not a glass contact item
fed07	feed nozzle	operating life (predicted)	life of melter	LSH	water cooled feed nozzle
fed16	feed nozzle	weight of component	149 lb approximate	LSH	
fed19	feed nozzle - glass frit addition	dimensions - envelope	12" dia. X 78" long	LSH	length does not include the lifting bail , diameter does not include the valve

Tag	Component (2, 3)	Interface Detail(2, 3)	Interface Criteria	System/Area	Comments
fed22	feed nozzle - glass frit addition	maintenance handling criteria	vertical lift with overhead device, lifting bail on component	LSH	equipment used for removal determined by project, this component is not a glass contact item
fed03	feed nozzle - glass frit addition	operating life (predicted)	temporary component, can be re-used since it is not exposed to radioactive material	LSH	
fed21	feed nozzle - glass frit addition	weight of component	110 lb approximate	LSH	
ogs13	film cooler - primary and standby	dimensions - envelope	28" X 50" X 64"	LSH	
ogs65	film cooler - primary and standby	maintenance handling criteria	non-routine maintenance activity, use of temporary rigging and strapping methods	LSH	
ogs03	film cooler - primary and standby	operating life (predicted)	life of melter	LSH	based on proper operation of the spray nozzles
ogs15	film cooler - primary and standby	weight of component	1300 lb approximate	LSH	weight includes transition piece, film cooler, wash nozzle, and bellows assembly. Will replace entire assembly rather than individual components
ogs66	film cooler - standby	functional requirements	1) keep port clean during slurry feeding so it is available to ventilate gases in upset. 2) provide cooling air for bypass idling.	LMP/LOP	
ogs47	film cooler - transition piece	maintenance handling criteria	non-routine maintenance activity, use of temporary rigging and strapping methods	LSH	transition piece to be replaced with the film cooler (one unit) if necessary. Life of melter component. Considered non-routine maintenance activity.
ogs46	film cooler - transition piece	operating life (predicted)	life of melter	LSH	
ogs17	film cooler cleaner	dimensions - envelope	4' X 4' X 15' high	LSH	
ogs08	film cooler cleaner	maintenance handling criteria	to be verified after completion of actual melter design	LSH	film cooler cleaner to be installed above the film cooler after removal of the water spray nozzle. Cleaner is only to be installed if persistent clogging cannot be resolved by other methods.
ogs07	film cooler cleaner	operating life (predicted)	temporary component, used only when film cooler is blocked	LSH	installed to the film cooler only if necessary
ogs19	film cooler cleaner	weight of component	less than 5500 lb	LSH	
ogs45	film cooler spray nozzle	dimensions - envelope	10.12" dia. X 49" long, excludes pipe elbows on the top flange	LSH	envelope diameter includes 1" long shoulder screws to attach the lifting bail, actual flange diameter is 8.12". Pipe elbows are excluded from the overall assembly length
ogs43	film cooler spray nozzle	maintenance handling criteria	vertical lift with overhead device, lifting bail on component	LSH	
ogs42	film cooler spray nozzle	operating life (predicted)	12 months	LSH	
ogs44	film cooler spray nozzle	weight of component	150 lb maximum	LSH	
plv07	glass pool level detector/density probe/primary pressure probe	dimensions - envelope	7.5" dia. X 122.12" long	LSH	includes glass level detector, density probe and primary pressure probe in one consumable assembly. Length includes the ball lock lifting assembly, envelope diameter includes the tadpole gasket (.25" thick)

Tag	Component (2, 3)	Interface Detail(2, 3)	Interface Criteria	System/Area	Comments
plv03	glass pool level detector/density probe/primary pressure probe	maintenance handling criteria	ball lock assembly, 1" diameter, 4-ball, project to utilize CCB/gamma gate for replacement	LSH	includes glass level detector, density probe and primary pressure probe in one consumable assembly. Equipment used for removal to be determined by project. This component is glass contacting
plv02	glass pool level detector/density probe/primary pressure probe	operating life (predicted)	12 months	LSH	includes glass level detector, density probe and primary pressure probe in one consumable assembly
plv09	glass pool level detector/density probe/primary pressure probe	weight of component	131 lb approximate	LSH	includes glass level detector, density probe and primary pressure probe in one consumable assembly
por48	glass riser airlift lance	dimensions - envelope	6.9" dia. X 109 " long	LSH	envelope diameter includes the tadpole gasket (.25" thick), envelope length includes ball lock assembly and ball lock support structure.
por12	glass riser airlift lance	maintenance handling criteria	ball lock assembly, 1" diameter, 4-ball, project to utilize CCB/gamma gate for replacement	LSH	Equipment used for removal to be determined by project. This component is glass contacting
por96	glass riser airlift lance	operating life (predicted)	life of melter	LSH	
por50	glass riser airlift lance	weight of component	110 lb approximate	LSH	
por112	lid plug, 4", discharge chamber	maintenance handling criteria	vertical lift with overhead device, lifting bail on component	LSH	device used to monitor pressure within the discharge chamber. Not a glass contact component
por111	lid plug, 4", discharge chamber pressure probe	weight of component	40 lb approximate	LSH	lid plug used for measuring the pressure in the discharge chamber
por97	lid plug, 6", discharge chamber	dimensions - envelope	8.25" dia. X 30 " long	LSH	envelope length includes the wire rope lifting bail, plug to be used for inserting camera if necessary
por99	lid plug, 6", discharge chamber	maintenance handling criteria	vertical lift with overhead device, lifting bail on component	LSH	device used as a spare port for insertion of camera if necessary, not a glass contact component
por98	lid plug, 6", discharge chamber	weight of component	73 lb approximate	LSH	
env86	lifting bails	jackbolt cover plates	threaded insert for eye bolt	LSH	this is typical for the jack bolt covers
env35	lifting lugs on melter shell	configuration	lifting lugs (10) to be located on melter base on each end at the wheel support assemblies (5 per side).	LMP/LMH	
enc91	melter - enclosure	shielding thickness requirements	enclosure plate thickness (including penetration access panels) on all external faces of the melter shall be a minimum of 1 inch, except for the top surface plates directly above the film coolers, which shall be a minimum of 2 inches. The thicker plate above the film coolers shall extend a minimum of 1 foot from the centerline of the film coolers in all directions.		
env28	melter - general	castable refractory - allowable sit times before bakeout	1 year minimum with green castables	LMP	

Tag	Component (2, 3)	Interface Detail(2, 3)	Interface Criteria	System/Area	Comments
env21	melter - general	center of gravity	empty melter, W - 170", S - 116", Up - 82"; glass-filled melter, W - 170", S - 116", Up - 81"; grouted melter, W - 170", S - 114", Up - 95"	LMP/LMH	all dimensions with respect to the centerline of the east seismic pin at the top of the rail. (W - west, S - south)
gls10	melter - general	corrosion rate limits - refractory	<1.0 in/yr of K-3, measured at refractory coupon half down coupon at ~1200°C by the modified ASTM C621 method	LMP	
env22	melter - general	dimensions - envelope	262" long X 367" wide X 190" high	LMP/LMH	overall melter dimensions when the melter is in its final location, includes the seismic restraints, bus bars, and discharge chambers.
env19	melter - general	external loads induced on melter shell and structure	feed lines (slurry) routed in enclosure (tray) to be mounted to the face of the melter shield at north-east corner.	LMP/LFP	
enc19	melter - general	use of common nozzles between operating modes	spare exterior small ports used for frit addition, spare interior small ports used for startup thermocouples, bubbler ports used for start-up heaters during melter start-up	LMP	
env01	melter - general	weight of melter	empty - 594,319 lb; max glass level - 632,819 lb; grouted - 953,927 lb (all approximate)	LMH	
mab01	melter - general	welding of melter lid to melter wall modules	approximate: C-276 or alloy 690 - 110' scam weld 1/8" fillets (non-structural); A36 - 200' full pen welds 1" base metal; A36 - 45' 1/4" fillet weld on 1/4" base metal; A36 to SS (300 series) 200' fillet welds up to 1/4"	LMP	
env93	melter - lid	lifting/flipping attachment configuration	lifting lugs attached to lid suitable for flipping	LMH	
env92	melter - lid	lifting/flipping criteria	lid must be designed to be flipped 180 degrees after castable refractory is installed without damage to refractory.	LMH	based on the castables formed and poured with the lid flipped 180 degrees
env94	melter - lid	lifting/flipping loads	Lifting lug design and lifting and handling methods must comply with WTP site rigging and handling requirements.	LMH	
enc18	melter - lid	number and sizes of spare ports	8 spare ports (6" dia.) provided on the lid.	LMP	5 ports for refractory viewing, 2 ports for start up thermocouples, 1 port for spare pressure indicator with utilities. TQ-143 identifies 9 spare ports but one of these (WS-1) will be utilized for the ITS pressure probe
env95	melter - lid	top surface elevation	19'-9"	LMH	
vnt04	melter - operation	C5 ventilation system supply air flow during normal operations (see comments)	1500 ACFM	C5V	air flow only required for contamination control. Normal operations defined as start up, feeding, pouring, and idle melter conditions
gls01	DELETED				
gls07	DELETED				

Tag	Component (2, 3)	Interface Detail(2, 3)	Interface Criteria	System/Area	Comments
gls11	DELETED				
gls13	DELETED				
por42	DELETED				
htg26	DELETED				
gls16	DELETED				
ogs62	melter - operation	injection gases to primary film cooler during idling, (normal mode)	30-50 scfm (cold) air	LMP/PSA	
ogs63	melter - operation	injection gases to primary film cooler during slurry feeding	steam flow =200 kg/h; air flow =325 kg/h. Mixed gas shall be conditioned to avoid condensed water. Maximum mixed gas volume = 450 ACFM, approx. 150°C	LMP/PSA/SCW	
ogs64	melter - operation	injection gases to standby film cooler during slurry feeding, idling, bypass idling	air only: 30-50 scfm (cold air) during slurry feeding and idling; 100-150 scfm (cold air) during idling bypass mode.	LMP/PSA	
ogs30	melter - operation	offgas airflow - nominal airflow downstream of film cooler	1056 acfm @ 315 deg C	LOP	airflow for worst case envelope C
ogs28	melter - operation	offgas airflow - nominal airflow upstream of film cooler	760 scfm @ 400 deg C	LOP	worst case with envelope C
ogs41	melter - operation	offgas in-leakage	289 scfm at -5" w.c. for new melter	LOP/C5V	
ogs21	DELETED				
ogs23	melter - operation	offgas temperature in plenum - during idle conditions	~2100°F (1150°C) nominal	LOP	this is the glass temperature at idle conditions
ogs22	melter - operation	offgas temperature in plenum - normal feeding operations - before film cooler	752°F (400°C) nominal	LOP	plenum temperature, off-gas entering film cooler
tmp03	melter - operation	temperature of melter lid surface (maximum)	95°F. Small surface areas (less than 2' square) immediately above the film coolers that exceed 95°F are acceptable.	LSH	
tmp04	melter - operation	temperature of melter surfaces other than lid (maximum)	140°F, except the discharge chamber lid which is at 210°F (maximum)	LSH	
vnt08	melter - operation	ventilation - air in-leakage from gallery into melter annular spaces	none - access ports are provided with seals	C3V/C5V	
vnt11	melter - operation	ventilation - air in-leakage from melter annular spaces into plenum	296 ACFM, 254 SCFM	C5V/LOP	
vnt03	melter - operation	ventilation - airflow face velocity through penetrations	200 linear feet per minute - minimum	C3V/C5V	
vnt01	melter - operation	ventilation - melter annular space ventilation criteria	sufficient air extraction rate to maintain inflow rate requirement of VNT03 while a single shielded lid plug is removed (bubbler, etc). Discharge heater or film cooler replacement (non-routine maintenance) require temporary containment. This criteria does not apply during startup for jack-bolt panels.	C5V	to maintain sufficient face velocity (200 fpm) across the melter shielded lid openings during maintenance activities
vnt22	melter - operation	ventilation system (C5) exhaust air flow during normal operations (see comments)	1200 ACFM exhaust flow, 1500 ACFM supply to melter annulus	C5V	air flow only required for contamination control. Normal Operations defined as start up, feeding, pouring, and idle melter conditions

Tag	Component (2, 3)	Interface Detail(2, 3)	Interface Criteria	System/Area	Comments
vnt06	melter - operation	ventilation system (C5) exhaust air flow during other modes w/high demands	1893 ACFM; 1060 SCFM	C5V	air flow only required for contamination control. Based on offgas failure case noted in the reference
vnt10	melter - operation	ventilation system (C5) exhaust air flow from panel removal/ component changeout	1606 SCFM, 1676 ACFM	C5V	air flow only required for contamination control. Based on an opening size of 1400 in^2
res02	melter - seismic	loads on seismic restraints	176,162 lbs. For the N-S and E-W direction, total load each direction, includes 10% contingency	20	Seismic loads developed in melter must be conveyed to project for design of building restraints
res03	melter - seismic	location of seismic restraints	N-S seismic restraints to be located on the north end of the melter wheel trucks (total of 2 locations). E-W seismic restraints located along wheel trucks between wheels (total of 10 locations).	LMH	Seismic
res04	melter - seismic	quantity of seismic restraints	total of 12; 10 east-west, 2 north-south	LMH	
enc90	melter - seismic	seismic restraint bracket envelope	E-W seismic restraints clamp to outside of rails, and accommodate maximum thermal growth between rails of 0.25". N-S seismic restraint brackets are pinned to rail at 15'-5.68" from building grid F on rail centerlines. Shim packs will be used to hold the north face of the wheel truck assembly nominally 8"south of the pin centerline. Bracket shall allow for maximum of +1/2" adjustment from nominal dimension.	LMH	
res01	melter - seismic	seismic restraint interface configuration	N-S: pin in rail through slotted hole in bracket on north end of melter truck. Bracket is attached (on east side replaces guide roller bracket) once melter is rolled into place. Gap between end truck and bracket is filled with shims and bolts are tightened. E-W: Belleville Spring-loaded clamps on rails are fitted to melter chassis after melter is in position and tightened after final N-S position is fixed.;	LMH	
res08	melter - seismic	seismic restraint N-S pin size	3.5" X 3.5" square pin, utilize a 4.5" slotted hole. Pin projection above rail 2 7/8".	LMH	pin size and shape changed from 3" diameter to 3.5" square configuration
env38	melter - transport	clearance criteria for transport through facility	8" minimum under the melter, 2" minimum clearance under the melter transport pulley assembly	LMH	
env43	melter - transport	max allowable acceleration/ deceleration x/y/z (new melter only)	0.1 g	LMH	
env44	melter - transport	max relative vertical racking during transport (new melter only)	1/16 inch (corner to corner)	LMH	
env87	melter - transport	maximum melter width dimension for transport through facility, i.e.- door clearance	358.5"	LMH	Maximum dimension includes guide rollers, does not include seismic restraints. Seismic restraints installed when melter is in place.
env29	melter - transport	melter drive system - attached loads for pulling melter	43,000 lbs.	LMH	actual load is 41,152 lbs. Weight used bounds the actual weight
env30	melter - transport	melter drive system attachment interface to melter	pulleys/brackets with removable connections. Pulley centerline elevation at 3'-5" elevation connected to the melter base. Two pulleys in the front and the back located 102.88" in from the respective rail centerline	LMH	

Tag	Component (2, 3)	Interface Detail(2, 3)	Interface Criteria	System/Area	Comments
env31	melter - transport	melter drive system positioning tolerance in facility (north-south)	plus, minus 1/4"	LMH	
env50	melter - transport	transporter load distribution criteria	two linear pads, 300 inches apart (outside edges) tolerance +0.00"/-0.50", width not to exceed 12" (6" nominal), thickness between 1" and 2"	LMH	Required to spread the transport load as close to the wheels as possible to avoid reverse deflection of the refractory. Design requirement for the melter and the project transporter.
env51	melter - transport	transporter rigging criteria	hold down lugs attached to the melter base are not required	LMH	
enc44	piping - all nozzles except for offgas	thermal movement (maximum) of any nozzle, from centroid of melter	+/- 1"	LMP	
clg03	piping - cooling water	cooling panel/pipe pressure differential	15 psig per loop, maximum differential	PCW	pressure drop across panel must be minimized
clg02	piping - cooling water	slope	no slope required. Panels to be emptied through air "blow-down".	PCW	
fed18	piping - feed	attachment to melter	the melter feed line will be routed in a secondary enclosure (tray), tray attached to melter wall with a sealed connection	LFP	
enc45	piping - offgas nozzles	thermal movement from centroid of melter	+/- 1/2"	LMP	
ogs61	plenum vent insert	dimensions - envelope	11.5" diameter X 36" long	LSH	
ogs59	plenum vent insert	maintenance handling criteria	vertical lift with overhead device, lifting bail on component after removal of vent line	LSH	
ogs58	plenum vent insert	operating life (predicted)	life of melter	LSH	discharge chamber vent system to plenum
ogs60	plenum vent insert	weight of component	70 lb approximate	LSH	
plv18	pressure probe - primary (ITS)	dimensions - envelope	7.5" dia. X 52" long	LSH	
plv16	pressure probe - primary (ITS)	maintenance handling criteria	ball lock assembly to mate with project reference drawings, project to utilize CCB/gamma gate for replacement	LSH	
plv15	pressure probe - primary (ITS)	operating life (predicted)	12 months	LSH	
plv17	pressure probe - primary (ITS)	weight of component	130 lb maximum	LSH	
enc58	shielded lid access covers	maintenance handling criteria	folding bail, inset to preclude tripping hazards (flush with top surface)	LSH	
enc60	small diameter holes, shielded lid (feed nozzles, air lift lances, refractory thermocouple, level detectors, ITS pressure probe, spare plugs, start up ports)	shielded lid interface detail with project replacement equipment	dowel pins 1" dia. - 8 UNC, spacing and hole locations per the project reference drawings	LSH	
enc54	spare lid plug - small	dimensions - envelope	7.5" dia. X 36.37" long	LSH	envelope diameter includes the tadpole gasket (.25" thick), envelope length includes the ball lock assembly

Tag	Component (2, 3)	Interface Detail(2, 3)	Interface Criteria	System/Area	Comments
enc52	spare lid plug - small	maintenance handling criteria	ball lock assembly to mate with project reference drawings, project to utilize CCB/gamma gate for replacement	LSH	Equipment used for removal to be determined by project. This component is glass contacting
enc51	spare lid plug -small	operating life (predicted)	life of melter	LSH	
enc53	spare lid plug -small	weight of component	85 lb approximate	LSH	
htg28	startup heater	dimensions - envelope	19.5" dia. X 68" long	LSH	diameter includes the tadpole gasket (.25"), length does not include the lifting bail
htg03	startup heater	maintenance handling criteria	vertical lift with overhead device, lifting bail on component	LSH	equipment used for removal determined by project, not a glass contact component
htg02	startup heater	operating life (predicted)	temporary component used at melter startup only, can be re-used for subsequent melter start ups.	LSH	operations decision for subsequent re-use
htg31	startup heater	weight of component	518 lb approximate	LSH	
tmp11	thermocouple - discharge chamber	dimensions - envelope	7" dia. X 71" long	LSH	envelope length includes the lifting bail
tmp07	thermocouple - discharge chamber	maintenance handling criteria	vertical lift with overhead device, lifting bail on component	LSH	
tmp06	thermocouple - discharge chamber	operating life (predicted)	12 months	LSH	type "N" or type "S" material
tmp13	thermocouple - discharge chamber	weight of component	19 lb approximate	LSH	
tmp21	thermocouple - melter electrode extension	dimensions - envelope	53" long	LSH	
tmp17	thermocouple - melter electrode extension	maintenance handling criteria	no specific handling features incorporated in the design, hands on replacement only	LSH	thermocouple manually removed through access port on side of melter after disconnecting lemo connector
tmp16	thermocouple - melter electrode extension	operating life (predicted)	12 months	LSH	type "N" or type "S" material
tmp23	thermocouple - melter electrode extension	weight of component	not to exceed 25 lb	LSH	
tmp68	thermocouple - melter electrode extension cooling air exhaust	dimensions - envelope	20" long, dia. not to exceed 6"	LSH	
tmp67	thermocouple - melter electrode extension cooling air exhaust	maintenance handling criteria	no specific handling features incorporated in the design, hands on replacement only	LSH	thermocouple manually removed through access port on side of melter after disconnecting lemo connector
tmp66	thermocouple - melter electrode extension cooling air exhaust	operating life (predicted)	life of melter	LSH	
tmp70	thermocouple - melter electrode extension cooling air exhaust	weight of component	not to exceed 25 lb	LSH	

Tag	Component (2, 3)	Interface Detail(2, 3)	Interface Criteria	System/Area	Comments
tmp26	thermocouple - melter glass pool and plenum	operating life (predicted)	6 months	LSH	thermocouples designed integral to bubblers, changed out with bubblers, no specific mechanical handling required
tmp41	thermocouple - melter refractory	dimensions - envelope	7" dia. X approximately 119" long	LSH	
tmp37	thermocouple - melter refractory	maintenance handling criteria	vertical lift with overhead device, lifting bail on component	LSH	
tmp36	thermocouple - melter refractory	operating life (predicted)	12 months	LSH	
tmp43	thermocouple - melter refractory	weight of component	not to exceed 25 pounds	LSH	
tmp74	thermocouple - melter view port	dimensions - envelope	20" long, dia. not to exceed 6"	LSH	
tmp73	thermocouple - melter view port	maintenance handling criteria	no specific handling features incorporated in the design, hands on replacement only	LSH	thermocouple manually removed through access port on side of melter after disconnecting lemo connector
tmp72	thermocouple - melter view port	operating life (predicted)	life of melter	LSH	
tmp75	thermocouple - melter view port	weight of component	not to exceed 25 lb	LSH	
tmp52	thermocouple - startup	dimensions - envelope	7" dia. X 131.9" long	LSH	overall thermocouple assembly plus, ball lock lifting assembly plus the lifting assembly support stand
tmp47	thermocouple - startup	maintenance handling criteria	vertical lift with overhead device, lifting bail on component	LSH	Equipment used for removal to be determined by project. This component is glass contacting
tmp46	thermocouple - startup	operating life (predicted)	used for start-up only - should last through multiple melters	LSH	
tmp54	thermocouple - startup	weight of component	45 lb approximate	LSH	
tmp77	thermowell - discharge chamber	dimensions - envelope	10.25" dia. X 58" long	LSH	diameter includes shoulder screws (.625" long) to attach lifting bail, length does not include the lifting bail
tmp79	thermowell - discharge chamber	maintenance handling criteria	vertical lift with overhead device, lifting bail on component	LSH	
tmp57	thermowell - discharge chamber	operating life (predicted)	life of melter	LSH	
tmp76	thermowell - discharge chamber	operating life (predicted)	life of melter	LSH	
tmp78	thermowell - discharge chamber	weight of component	67 lb approximate	LSH	
tmp60	thermowell - startup	dimensions - envelope	6.91" dia. X 110.94" long	LSH	envelope length includes the ball lock lifting assembly, envelope diameter includes the tadpole gasket (.25" dia..)
tmp63	thermowell - startup	maintenance handling criteria	ball lock assembly to mate with project reference drawings, project to utilize CCB/gamma gate for replacement	LSH	Equipment used for removal to be determined by project. This component is glass contacting
tmp64	thermowell - startup	operating life (predicted)	potentially reusable for other melters - used for start up only	LSH	
tmp59	thermowell - startup	weight of component	105 lb approximate	LSH	weight obtained from total weight of thermowells (208.9 lbs.) from reference and divided by 2

Tag	Component (2, 3)	Interface Detail(2, 3)	Interface Criteria	System/Area	Comments
env88	wheels	clearance envelope for melter wheels/guide roller assemblies	guide roller assemblies may not exceed 5.4" below the top of the rail elevation established in env60	LMH	
env10	wheels	maintenance handling criteria	N/A - life of melter component	LSH	so long as the wheel loads do not exceed allowables, no maintenance is required. Project responsible for handling non-routine maintenance requirements.
env69	wheels	maximum wheel loading	Does not exceed load limits as defined by wheel supplier, thurst bearing capacity of 66,400 pounds limiting thrust static load of 196,000 pounds, and a radial bearing capacity of 138,000 pounds, radial static load of 276,000 pounds.	LMH	
env71	wheels	quantity and location	12 total, 6 per side evenly spaced along ~15' width of melter	LMH	
env75	wheels	type/materials	Osborn International, Plain Yoke Roller PLRY-10, Heavy Duty Shaft SHB-4250	LMH	
env76	wheels	vertical displacement criteria	maximum wheel vertical displacement = 1/16" over any 150" length	LMH	

Notes:

1 Column Descriptions
"Tag" - Detail identifier. Not to be reused.
"Component" - Description of specific melter SSC for which the interface detail is associated, use as a sorting column.
"Interface Detail" - Description of interface/design detail in question. Use "Component" column for complete detail description.
"Interface Criteria" - Interface/design data, based on requirements in the specification.
"System/Area Locators" - developed in accordance with project procedures, identifies impacted discipline.
"Comments" - For providing status and/or additional clarification.
2 Write key words first, followed by secondary description if necessary.
3 Use these columns together to fully define interface detail.
4 N/A - not applicable
5 Interproject interface detail, not a subcontractor/project interface detail.

Appendix C - CSA Concurrence for Use of R_p

From: Theriault, Philippe
Sent: Wednesday, February 04, 2015 2:07 PM
To: Vincent, Travis R
Cc: Peters, Richard D (WTP); Wilcox, Wade
Subject: RE: Request for the Rp=3.0 for the Qualification of the LAW Melters

I concur with the use of Rp = 3.0 in this application.

Thank you

Philippe Thériault | WTP CS&A Functional Manager
Bechtel National Inc. | 2435 Stevens Center, Richland, WA, 99354
MPF-01-B141 | M64-B1
T: 509-371-5911 | M: 509-521-0220 | E: prtheris@bechtel.com

From: Vincent, Travis R
Sent: Wednesday, February 04, 2015 12:58 PM
To: Theriault, Philippe
Cc: Peters, Richard D (WTP); Wilcox, Wade
Subject: Request for the Rp=3.0 for the Qualification of the LAW Melters

Philippe,
Per Section 4.3.1 of 24590-WTP-3PS-FB01-T0001 Rev 6, I'm requesting the use of Rp=3.0 in UBC-97 section 1632, equation (32-2), for the seismic qualification of the LAW Melters.

The LAW melters are seismically supported by the LAW melter rails that are support by the +3 elevation of the LAW building.

Please advise.

Regards,
Travis Vincent
WTP – PD Functional Manager
Main K-121
509-371-8597