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RPP-WTP PDC

RIVER PROTECTION PROJECT – WASTE TREATMENT PLANT

ENGINEERING SPECIFICATION

FOR

High Level Waste Melters

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STRUCTURAL	ELECTRICAL	MECHANICAL & OTHER

Content applicable to ALARA? ☒ Yes ☐ No

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

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Notice

Please note that source, special nuclear, and byproduct materials, as defined in the Atomic Energy Act of 1954 (AEA), are regulated at the US Department of Energy (DOE) facilities exclusively by DOE acting pursuant to its AEA authority. DOE asserts, that pursuant to the 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.

Contents

Appendices

1 General

1.1 Scope

A. This Specification provides performance requirements for the design of High Level Waste (HLW) vitrification melters for the River Protection Project - Waste Treatment Plant (RPP-WTP) at the Hanford, Washington Site of the Department of Energy (DOE). The performance requirements cover all phases of melter life, including assembly, transport, startup, commissioning, operation and maintenance, decommissioning, and disposal.
B. This Specification has been written for Contract No. 24590-101-TSA-W-000-0010 and is supported by Ref 2.2D. Controls and instrumentation requirements for melter design have been incorporated into Ref 2.2B.
C. The melters include, but are not limited to, the following major structures, systems, and components (SSCs): glass containment, glass and glass discharge heating, refractory cooling, instrumentation, offgas cooling and collection, waste and glass feed, glass frit addition for startup, glass discharge, and seismic restraint.
D. The subcontractor shall base the design on the information provided in this Specification, the referenced documents herein and the current contract documents.
E. See Ref 2.2D for melter design scope of work.
F. Additional research and technology testing by the subcontractor, to aid in the design, shall be in accordance with the contract documents.

1.2 Definitions

A. 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 elements that restrain the melter during operation.
B. Contractor - Bechtel National, Inc.
C. Design Life - The baseline time, based on calculation, analysis, experience or testing, over which the SSC will safely maintain its original function.
D. Transportation System - Melter components that aid in the transport and positioning of the melter during transportation, installation, operation, decommissioning and disposal.
E. 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.
F. 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 changeout.
G. Walls - Melter and discharge chamber exterior structural steel.
H. Overpack - Portable structural enclosure mounted on rail wheels that will be used for transporting new melters and disposing of failed or spent melters. Overpack will provide restraint, containment, contamination control, and radiation shielding during melter transport and disposal activities.
I. Subcontractor - Duratek, Inc.
J. Vendor - A manufacturer or supplier providing materials and/or services to the subcontractor.
K. Gas Barrier - Structural steel plate consisting of the walls and the internal surfaces of the lid and base. The gas barrier serves to support the offgas-related function of the shell, while providing controlled air in-leakage to the melter plenum.
L. Frit - Glass particulate of a size and geometry suitable for direct feed into the melter.

M. Shell - Structural elements of the melter that ensure confinement of bulk molten glass, should it migrate through the refractory. Also supports the offgas system by providing a confinement boundary to direct offgas into the melter offgas system. The shell is comprised of the base, walls, and lid.

1.3 Acronyms

Acronyms used in this Specification include:

CCTV	Closed Circuit Television
DOE	Department of Energy
ICD	Interface Control Document
HLW	High Level Waste
RPP-WTP	River Protection Project-Waste Treatment Plant
SC	Seismic Category
SSC	Systems, Structures, and Components
wg	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. Deleted
B. Deleted
C. 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)
D. American National Standards Institute/American Society of Mechanical Engineers (ANSI/ASME)
   1. ASME B31.3, Process Piping (1996)
   2. ASME Section III, Division I, Subsection NC, Rules for Construction of Nuclear Facility Components (2001)
   3. ASME Section VIII, Division I, Rules for Construction of Pressure Vessels (2001)
   4. ASME NQA-1, Quality Assurance Program Requirements for Nuclear Facilities(1989)
   5. ASME NQA-2a, Part 2.7, Quality Assurance Requirements of Computer Software for Nuclear Facility Applications (1990)

6. ASME Section II, Material Specifications (2001)

E. Code of Federal Regulations (CFR) - 29 CFR 1910, Subpart S, *Occupational Safety and Health Administration, Electrical* (most current revision)
F. National Electrical Manufacturers Association (NEMA):
   1. NEMA WC, *Wire and Cable Standards* (1999)
   2. NEMA/ICEA (Insulated Cable Engineers Association), *Power Cable Ampacities* (1999)
G. 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)
H. Underwriters Laboratories Inc (UL) - UL 508, *Standard for Safety Electric Industrial Control Equipment* (1999)
I. American Welding Society (AWS)
   1. AWS D1.1, *Structural Welding Code; Steel*
   2. AWS D1.6, *Structural Welding Code; Stainless Steel*
J. American National Standards Institute/American Institute of Steel Construction (ANSI/AISC)
   1. AISC N690, Specification for the Design, Fabrication, and Erection of Steel Safety-Related Structures for Nuclear Facilities (1994)
K. American Institute of Steel Construction (AISC) -AISC M016-89, Manual of Steel Construction - Allowable Stress Design, Ninth Edition (as tailored in Appendix C of Ref. N)

2.2 Other Reference Documents/Drawings

A. Deleted
B. Document No. 24590-WTP-3PS-J000-T0001, Rev 1, *Engineering Specification for Melter Systems C&I Work Specification*
C. Deleted
D. Statement of Work for Subcontract No. 24590-CM-SRA-HM00-00001, *Modeling and Design of Melters*
E. Deleted
F. Deleted
G. Contractor Correspondence No. 025802, *Contract No. DE-AC27-01RV14136 - Letter Subcontract Number 24590-101-TSA-W000-0010, Comments to Duratek's 30 % Design Package Submittal*
H. Document No. 24590-HLW-S0C-S15T-00009, Rev 0C, *HLW Vitrification Building Seismic Analysis-In-Structure Response Spectra (ISRS)*
I. Document No. 24590-WTP-3PS-SS90-T0001, Rev. 1, *Engineering Specification for Seismic Qualification of Seismic Category I/II Equipment and Tanks*
J. Document No. 24590-WTP-DC-ST-04-001, Rev. 1, *Seismic Analysis and Design Criteria*
K. Drawing No. 24590-HLW-DD-S13T-00071, Rev. 2, *HLW Vitrification Building Structural Melter Seismic Restraint Embed Sections and Details*
L. Calculations No. 24590-HLW-DDC-S13T-00034, Rev. A, *Melter Seismic Restraint Embeds*
M. Document No. 24590-WTP-3PS-FB01-T0001, Rev. 1, *Engineering Specification for Structural Design Loads for Seismic Category III & IV Equipment and Tanks*
N. Document No. 24590-WTP-SRD-ESH-01-001-02, Rev ~~1~~, *Safety Requirements Document, Volume II* 3I 2/1/05

3 Design Requirements

The body of this specification identifies the functional design requirements for melter design. Appendices A and B, "Melter Services and Connections Interface Details" and "Melter Design Interface

Details" respectively, identify detailed design requirements and interfaces that have evolved from the functional design requirements for achieving the specified melter operating life and availability. The detailed design requirements and interfaces also provide a basis for designing the services and facilities that will support melter handling and operations.

3.1 General Functional Requirements

A. Other Functional Requirements - Other design requirements are defined in the melter design work performed in accordance with Contract No. 24590-101-TSA-W-000-0010 and submitted as the 30 percent design package, and contractor comments to the 30 percent design package (Ref. 2.2G). The package is referred to as the baseline design in this Specification. See also Ref 2.2D.

B. Containment System: The containment system will serve to support the credited safety functions of the melter shell, which are to ensure bulk confinement of radioactive materials during normal, abnormal and accident conditions, and to prevent exposures that may result in consequences to the co-located worker and facility worker above radiation exposure standards in the SRD. The containment system includes the melter shell and other elements: the refractory (and refractory thermocouples), cooling panels, jack bolts, and offgas ventilation.
   1. Coordinate with contractor to include design features for simplifying remote disassembly of a failed melter.
   2. The melter shell shall provide bulk confinement of glass in the event of refractory failure. The melter is not required to operate after a seismic event exceeding certain lateral acceleration limits, as defined in section 3.5; however, the shell shall maintain structural integrity and remain in place in accordance with the structural requirements outlined herein.
   3. Jack bolts: Design jack bolt system to prevent formation of significant gaps between refractory bricks. Bolt adjustment shall allow for:
      a. Remote operation in the melter cave.
      b. Support and adjustment of cooling panels and refractory during assembly, installation, startup, and operation.
   4. 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 thermal expansion of refractory during operation.
      c. Provide a continuous gas barrier in conjunction with wall and base gas barrier plates.
      d. Provide refractory cooling.
   5. Deleted.
   6. 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 contractor-coordinated interfaces with overpack and facility restraints.
      d. Provide flatness tolerances for refractory installation.
      e. Provide refractory cooling.
      f. Provide support for refractory during melter assembly, transport, installation, and operation.
      g. House melter services including drains and refractory water-cooling panels.
   7. Confinement of offgas is provided by the gas barrier portions of the shell, with engineered inbleeds. Inbleed openings shall be limited so that bulk flow of glass will be controlled should it leak from the refractory.

C. Heating System
   1. Heating system includes the electrodes (including extensions), startup heaters, discharge chamber heaters, and thermocouples.

2. After melter startup, glass shall be direct joule-heated.
3. Thermocouples shall 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, associated feed lines (internal to melter only) for operation, and plenum thermocouples.
2. Subcontractor shall use 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 shall 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: Design trough to aid in maintaining glass temperature during pouring. Optimize trough slope and cross section for pouring and reduction of glass fiber formation.

F. Melter Disposal and Decommissioning: Coordinate with contractor to define general design requirements for melter disposal and decommissioning. Contractor will define specific disposal and decommissioning criteria after design is complete.

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

H. Transportation System: System will perform the following functions:
1. Support roller/wheel assemblies for melter transport on facility and overpack rails.
2. Guide and position melter on facility and overpack rails.
3. Interface with contractor-supplied drive systems that conform to subcontractor-defined melter movement criteria (see Appendix B).
4. Remain functional after an operational earthquake event as defined in Section 3.5A5: roller/wheel bearings shall remain functional and the rollers/wheels shall remain on the rails.
5. Allow for replacement by an identical melter after end-of-life or failure.

I. General Melter Component Design
1. Components requiring replacement during the design life of the melter shall be designed for ease of remote 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 practical, except for components requiring optimization/value engineering studies per Ref 2.2D.
3. Subcontractor shall coordinate with contractor to determine applicability of modular design to minimize assembly and replacement times.
4. A power manipulator and an overhead maintenance crane will accommodate remote removal/replacement of modular components and equipment during startup and operation. Subcontractor shall coordinate with contractor to determine individual handling, routing, and access requirements so as not to exceed the operating parameters of the handling equipment.
5. Conductive individual components and equipment in contact with the molten glass shall be electrically isolated from the melter structure, base and lid, 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 (e.g., interface locations and positioning features).
7. Deleted.

J. Agitation System
1. Agitation system includes bubblers and glass pool viewing system.
2. Arrangement and configuration of bubblers shall aid in optimizing melter throughput.

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

K. Restraint System
1. Subcontractor shall design an anchor system, per the structural requirements below, to lock melter in place during operation, including pin, restraint, and interface to building embedments as shown in Ref. 2.2 K.
2. In order to fully account for construction tolerances, interfacing dimensions shall be placed on hold for fabrication until after placement of the embedments in the field. As-built dimension will be provided by the project when available.

3.2 Performance Requirements

A. Design Life
1. The facility is expected to operate for approximately 40 years.
2. The melter, excluding consumable SSCs specified by the subcontractor, shall have a minimum 5-year design life.
3. Refer to Appendix B for predicted subcontractor-defined design lives of selected SSCs to support target availability.
4. Deleted.
5. Subcontractor shall document bases for declaring the design lives of the melter and all associated SSCs.

B. Melter Throughput and Availability
1. Baseline throughput shall be one and one half (1.5) metric tons of glass/day, per melter. The melter shall be designed to allow production rates of three (3.0) metric tons of glass/day with an increase in agitation/bubbling rate.
2. Melter shall transform a slurry mixture of pretreated high level waste (HLW) and blended glass formers into a homogeneous glass melt. See Appendix B for waste and test feeds and glass composition data. Contractor will be responsible for controlling the feed chemistry composition within referenced boundary limits.
3. Target baseline availability for the melter is 83%. Subcontractor shall interface with contractor to ensure that melter design supports goal.

3.3 Design Conditions

A. Site Data (Applicable to Melter Transport in Overpack)
1. Elevation: 662 to 684 feet above mean sea level.
2. Site Climatological Data:

Ambient Air Temperature	Minimum: - 23 °F, Maximum: 113 °F
Rate of Increase	Maximum: 26 °F per 20 min
Rate of Decrease	Maximum: 24 °F per hour
Relative Humidity	Maximum: 100 %, Minimum 5 %

B. Facility Data

1. Building layouts and equipment general arrangements are predicated on the melter and melter component dimensions shown in Appendix B. Subcontractor shall notify contractor of any changes to dimensions and/or equipment maintenance envelope requirements.
2. Melter Ventilation:
   a. Melter will be operated as part of a cascaded ventilation system.
   b. Melter cave will be a primary confinement zone, held at a nominal 1 to 1.4-in. wg negative pressure with respect to surrounding secondary confinement zones.
   c. Melter plenum pressure will be maintained at a nominal 5-in wg negative pressure with respect to the cave.
3. Indoor Temperatures: See Appendix B for melter cave temperature range.
4. Radiation Dosages: See Appendix B for radiation design interface requirements impacting melter design.
5. Melter Utility Services:
   a. Contractor is currently providing the following services to the melters: electrical power, cooling water, process water, 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. Subcontractor shall identify critical melter services where stoppage would result in rapid failure of associated component or melter system (see Appendix B). Include estimates of time to failure.
   f. Subcontractor shall specify required service operating parameters at contract boundary, with contractor input on selected design operating criteria.
6. Deleted

3.4 Mechanical Requirements

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

A. Discharge Chamber
   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 three (3) metric tons per day.

B. Feed Nozzles
   1. Feed nozzles shall be designed for a throughput of three (3) metric tons per day, with all nozzles operating.
   2. Contractor will provide the following to each feed nozzle:
      a. A dedicated feed line and pump.
      b. Cooling water.
      c. Air and water purge.
   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 the melter lid.

C. Viewing Systems
   1. Design one (1) closed circuit television (CCTV) and associated system for viewing plenum area and cold cap.

2. CCTV will be used on an intermittent basis, as operation and maintenance requirements dictate. It will be removed from the melter when not in use. Design CCTV to be removable and replaceable with remote handling equipment.
3. Coordinate with contractor for design and incorporation of glass discharge viewing equipment, to be supplied by contractor.
4. Viewing ports shall be purged to prevent buildup of solids and other contaminants.
5. Cool CCTV ports as required.

D. Refractory Expansion Control System
1. Design jack bolts to actively control refractory expansion without operator intervention. Remote operation of, and access to, the bolts shall be maintained.
2. Coordinate with Contractor to provide a means of locally monitoring cooling panel and refractory movement with visual indicators.

E. Melter Cooling Water System
1. Provide water cooling using panels around the glass pool, plenum, and discharge chambers as required. Contractor will be responsible for water supply to the panels.
2. Cooling panels shall be designed in accordance with Ref 2.1D3.
3. Cooling panel design shall be such that internal pressure and/or temperature induced distortions will not place undue stress against the melter refractory.
4. Design cooling panels to be emptied at melter changeout or decommissioning.
5. Coordinate with contractor for overall cooling water system design, including instrumentation and controls, external to the melter.

F. Melter Offgas System
1. See Appendix A for sizes of primary and standby offgas pipes.
2. Each pipe shall accommodate anticipated melter in-leakage and purge streams. In-leakage streams include, but are not limited to, room air inflow from lid-mounted component removal/replacement operations, and inflow from the discharge chambers. Purges include gas inflows from the film coolers, feed nozzles, bubblers, and airlift lance.
3. Offgas pipe routing from the melter to the submerged bed scrubbers will be defined by the contractor.
4. Design and configuration of the primary offgas film cooler will reduce the offgas temperature and minimize solids deposition during the various modes of operation to support downstream offgas system operation. See Appendix B for additional requirements affecting film cooler design.
5. Film cooler design shall incorporate a means for internal cleaning. This operation may be assisted with remote handling equipment in the melter cave.
6. Provide redundant pressure measurement for the melter plenum.

G. Piping
1. All cooling water piping, feed piping and pour flanges shall be per Ref 2.1D1. Piping seismic design shall be in accordance with Ref 2.1D2, Appendices N and F. See Appendix A for piping fluid service categories. Subcontractor shall provide documentation for justification of service class selected where different than what is shown.
2. Joints: Use of all joints other than butt-welded shall be submitted for contractor review and approval.
3. Piping Nozzle Slopes: See Appendix B for slopes of selected utility and service lines.
4. Disconnects: Coordinate with contractor to define remote disconnect requirements at the melter-facility boundaries.
5. Drains: Provide low-point "floor" drains between the gas barrier and the refractory for the maximum credible leak from a complete break of one cooling water panel pipe. Coordinate with contractor to provide leak detection equipment at the drains. Design drains to prevent clogging from particle waste and to minimize inflow of air due to the melter operating at a vacuum.

H. 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 selected shall be able to withstand the corrosive environment caused by the melter feed, glass, and offgases for SSC lifetimes given in Section 3.2A2 and Appendix B. Combustible materials shall not be used without prior approval from contractor.
3. Subcontractor shall consider environmental, durability, corrosion and erosion factors during material selection. At a minimum, subcontractor shall evaluate 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. Corrosion monitoring capability during operations is not required.

I. 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.

3.5 Structural Requirements

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

A. General
1. In order to perform its credited safety function, the melter shell must maintain structural integrity and remain in place to preclude potential impacts to SC-I items during and after a seismic event. Thus the melter shell and restraints are SC-II, and shall be seismically qualified in accordance with Ref. 2.2.I.
   a. The "appropriate in-structure response spectra" cited by Ref. 2.2.I for dynamic analysis shall envelope the 3 % damped ISRS at building lines 10 & C and 11 & M from reference 2.2.H.
   b. Subcontractor shall submit a Seismic Qualification Report consistent with the requirements of Ref. 2.2.I.
2. Maintaining structural integrity as required above does not preclude limited yielding of the gas barrier portion of the melter shell during a seismic event, providing the following general and safety requirements are met:
   a. Permanent effects resulting from SC-II loading shall not prevent the melter from being removed from the facility and placed in its overpack.
   b. Permanent effects resulting from SC-II loading shall not allow for the bulk flow of molten glass.
   c. In order to maintain the integrity of the offgas system, which is an SC-III system, the shell shall maintain an appropriate factor of safety against yield when subjected to appropriately combined SC-III loadings.
3. During transport and normal operating conditions, the deflection under load shall be limited to allow for proper refractory performance.
4. Subcontractor shall design an anchor system, per SC-II, to lock melter in place, including pin, restraint, and interface to building embeds.

5. Subcontractor shall verify through analysis that the melter will remain capable of normal operation after a lateral seismic acceleration at the base of the melter of 0.061g in any horizontal direction.
6. For melter transport into the facility, subcontractor shall conduct analyses and provide documentation to ensure that refractory arrangement and integrity is maintained. Notify contractor if additional or temporary means of refractory restraint are advantageous.
7. The design of the electrodes and the melter dam shall address creep over the life of the component.

B. Melter Base
   1. See Appendix B for additional structural related interface details.

C. Transportation System
   1. Rollers/Wheels:
      a. Subcontractor shall consider worst potential load type combination in determining roller/wheel load capacity.
      b. Provide vertical adjustment capability (passive and/or active) to accommodate slight differences in transport rail elevation.
   2. Fasteners, Anchors, and Positioning Devices: Coordinate with contractor to establish design and interface requirements for all phases of melter life.
   3. See Appendix B for transportation system interface details.

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. Encasement of all voids with grout during decommissioning.
   2. Live Loads: Subcontractor shall coordinate with contractor to develop loading requirements and limits related to transport, maintenance, decommissioning, and jumper attachment.
   3. Seismic loads:
      a. For SC-II systems and components, seismic loads shall be determined in accordance with Ref 2.2.I.
      b. For SC-III systems and components, the seismic loading shall be determined in accordance with the Ref 2.2.M using the following parameters:
         i. Rp=3.0
         ii. hx=3.0
         iii. hr=68
      c. Alternately, SC-III seismic response may be determined by means of scaling the response from the SC-II analysis
         i. The scale factor shall be the ratio of the static base shear of the melter as determined by ref 2.2.M to the largest base shear value determined in the SC-II analysis
   4. Pressure Gradients: The gas barrier walls shall be evaluated to withstand the operating pressure range of the offgas lines identified in Appendix A.
   5. Other Loads:
      a. Thermal induced loads to be experienced during startup, normal operations, and idling.
      b. Piping reaction loads during normal operation.
      c. Impact wrench load. Maximum design load is 450 ft-lbs.
   6. See Appendix B for melter static and live load detail requirements.
   7. Load Combinations: .
      a. The melter is to be analyzed for the loads and combined loads appropriate to the seismic category (SC) of the component being considered as listed below.

i. SC-II elements: load combinations are based on the Structural Analysis and Design Criteria (Ref. 2.2.J) and ANSI/AISC N690 (Ref. 2.1.J.1)

ii. SC-III elements: load combinations are based on the Engineering Specification for Structural Design Loads for Seismic Category III & IV Equipment and Tanks (Ref. 2.2.M)

b. Notations

i. D = Dead Load

ii. L = Live Load

iii. E = Earthquake

iv. Fμ = Inelastic Energy Absorption Factor

v. To = Thermal Loads during Operating Conditions

vi. Ro = Operating Pipe Reaction Load

vii. S = Allowable Stress per Allowable Stress Design Method

c. SC-II load combinations

i. Non-earthquake load combinations, all elements

(a) S = D + L

(b) S = D + L+ Ro + To

(c) For primary plus secondary stresses, the allowable limits above are increased by a factor of 1.5

ii. All elements except those in compression and shear, or for bolted connections

(a) 1.6S = D + L +Ro + To + E / Fμ

iii. For elements in compression and shear, and for bolted connections

(b) 1.4S = D + L +Ro + To + E / Fμ

d. SC-III load combinations

i. S = D + L

ii. S = D + L+ Ro + To

iii. For primary plus secondary stresses, the allowable limits above are increased by a factor of 1.5

iv. S = 0.75 (D + L + Ro + To + E / 1.4)

8. Allowable Stresses

a. Allowable stresses for plate and prismatic elements shall be determined using methods consistent with good structural engineering practice and the applicable Code, regardless of the method of analysis.

i. SC-II allowable stresses are per Ref. 2.1.J.1

ii. SC-III allowable stresses are per Ref. 2.1.K

9. Analysis: For 3D finite element analyses (FEA), in absence of code language governing allowable stresses, the following analysis approach shall be utilized:

a. Criteria for stresses in SC-II elements

i. Stress in elements loaded in tension, compression or bending shall be maximum principal stress criteria

ii. Stress in elements loaded in shear shall be Tresca stress (maximum shear stress)

b. Criteria for stresses in SC-III elements

i. Stress in all elements, regardless of loading, may be Von Mises (maximum distortion energy) criteria

c. Combined responses may be determined by superposition of responses from individual finite element models, provided appropriate explanation and justification is given.

10. Support Reactions

a. Support reactions for all SC-II load cases and combinations shall be submitted in accordance with section 7.2 of reference 2.2 I.

b. SC-II seismic reactions at the interface of the melter base seismic pin and lug shall not exceed the following limits, per Ref. 2.2.L. Loads may act in all directions concurrently.
   i. 250 kip east-west
   ii. 250 kip north-south
   iii. 100 kip vertical
c. SC-II seismic reactions at each "tailhook" bracket shall not exceed 90 kips vertically, per Ref. 2.2.L. No other loads are permitted on the tailhooks.

E. Other
1. Buckling
   a. To ensure that elements in the load path maintain their structural integrity, appropriate methods of analysis shall be employed to analyze elements subject to buckling and other failure modes that are not predictable by FEA
      i. To preclude buckling due to shear loads, plate elements shall be stiffened as required in the Code
      ii. The allowable stress of elements subject to buckling due to compressive loads shall be reduced appropriately as required by the Code.
   b. Highly localized areas of stress determined by FEA to be above the allowable stress, are to be considered according to the Code commentary (Reference 2.1.J.1, section CQ1.5), providing that engineering judgments are documented and justified where used.
2. Structural welding shall be per Refs. 2.1.I.1 and 2.1.I.2
3. Material properties for structural analysis shall be per Ref. 2.1.D.6

3.6 Electrical Requirements

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

A. General
1. The following code references apply to this section: Refs 2.1C1 through 2.1C5, 2.1E, 2.1F1, 2.1F2, 2.1G1, 2.1G2, and 2.1H.
2. Subcontractor shall specify the following:
   a. Minimum and maximum values of the following electrical parameters associated with the Joule heating process for HLW glass envelopes: AC/DC power, voltage, current, waveform, and frequency.
   b. Melter protective interlocks required on the power source to the melter electrodes.
   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 and extension buses shall be capable of carrying the current at the voltage required for all modes of melter operation.
2. Minimize connection resistance if the extension bus and electrode are two separate components.
3. Connector for making external connections to the extension buses shall allow for expansion and contraction of the extension bus.
4. Magnetic Coupling: Extension buses shall not cause magnetic coupling with the materials through which they pass.
5. Electromagnetic Interference: To the extent practical, the configuration of the extension buses shall maximize magnetic field cancellation.

C. Discharge Heater Power

1. Discharge heaters shall be matched to the extent practical with respect to resistance, operating current, and voltage.
2. Each discharge heater assembly shall be designed with a plug-type connector integral to the heater assembly.
3. The discharge heaters shall be electrically isolated from each other and from the melter structure.

D. Startup Heater Power

1. Startup heaters shall be matched to the extent practical with respect to resistance, operating current, and voltage.
2. Design power connectors to each heater assembly, with coordination from Contractor.
3. The startup heaters shall be electrically isolated from each other and from the melter structure.

E. Cable

1. Refer to Ref 2.1F1 for general cable design standards.
2. Cables routed within the melter envelope shall be rated for the maximum ambient temperature encountered.
3. Cable insulation and jacket material shall be of the low flammability type, per Ref 2.1C5.
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 structure.
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 2.1F1, Standard Method. Coordinate with contractor to determine requirements for spare conductors that shall be included in multi-conductor control and instrumentation cables.
9. Instrument and thermocouple cables will be single pair twisted and 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. See Appendix A on conductors for normal and instrument power circuits, control circuits, and instrumentation (both single pair cable and multi pair cable). Instrumentation conductors include low level voltage, current, or digital electrical signal connections to sensing and actuating devices.
12. 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 VAC, 125 VDC).
    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. Deleted

G. Grounding

1. Metal sections of melter lid, base, structure, and containment system shall be electrically interconnected.
2. The HLW melters are grounded via contact between the facility rails and the wheels of the melter base.
3. Deleted

4. Deleted.

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 of work unless stated otherwise in Ref 2.2B.
B. Instrumentation Requirements
   1. For melter design requirements related to instrumentation see Ref 2.2B.
   2. Appendix A contains instrumentation connection interface details related to specific melter SSCs.

3.8 Maintenance Requirements

A. General
   1. Design of all nonstructural SSCs shall be optimized for safe and effective remote maintenance. To the extent practical, the design will:
      a. Minimize downtime, and impacts to overall operation of the facility.
      b. Keep maintenance activities simple and straightforward, suitable for a power manipulator and an overhead maintenance crane.
      c. Minimize requirement for special tools and equipment for maintenance.
      d. Modularize SSCs for remote 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 requirement of five years.
   2. Subcontractor shall perform failure modes and effects analyses on the critical SSCs identified in Ref 2.2D:
      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. Subcontractor shall interface with contractor to ensure that access around melters is sufficient for inspection of all external melter surfaces, per Appendix B.
   4. Subcontractor shall identify all special tools and equipment for maintenance.
   5. All removable or replaceable components and equipment shall have lifting bails designed to interface with the overhead maintenance crane or power manipulator. See Appendix B for maintenance handling criteria.
   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: See Appendix B for melter component design lives. Subcontractor shall advise contractor of changes, including component additions and deletions as well as improvements in baseline lifetimes.

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, and in accordance with Ref. 2.1D5.
B. Subcontractor shall be responsible for all sub-tier vendor quality assurance requirements during design.
C. See Ref 2.2D for quality assurance requirements pertaining to specific melter SSCs.
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

A. See Ref 2.2D for submittal format, transmission, and review requirements.

5.2 Submittals

A. See Ref 2.2D for specific melter system submittal requirements not specified herein.

Appendix A

Melter Services and Connections Interface Details (4 pages total)

Appendix A - Melter Services and Connections Interface Details

ITEM IDENTIFIER	DESCRIPTION	CONNECTION NUMBER	LINE SIZE, INCH	OPS MODE	SERVICE TYPE	NOMINAL FLOW / AMPS	NOMINAL PRESSURE / VOLTS AT POINT OF USE	NOMINAL TEMPERATURE, F	DESIGN LIMIT FLOW / AMPS (NOTE 59)	DESIGN LIMIT PRESSURE / VOLTS (NOTE 59)	DESIGN LIMIT TEMPERATURE, F	CRITICAL SERVICE	FLUID SERVICE CATEGORY (NOTE 59)	CONNECTION TYPE	NOTES
por18	AIR SUPPLY - AIR LIFT/RISER PURGE GAS (TYPICAL OF 2)	N12, N13	3/8	INTERMITTENT	IA-2	3 SCFM	3 PSIG	113	N/A	<15 PSIG	240	NO	D	STAUBLI	14, 53, 24
agi13	AIR SUPPLY - BUBBLER (TYPICAL OF 5)	N05, 6, 7, 8, 9	1/2	CONTINUOUS	IA-2	3 SCFM	10 PSIG	113	N/A	<15 PSIG	240	YES	D	STAUBLI	14, 15, 24
agi08	AIR SUPPLY - BUBBLER OR STARTUP HEATER, SPARE	N11	1/2	SPARE	IA-2	3 SCFM	10 PSIG	113	N/A	<15 PSIG	240	NO	D	STAUBLI	29
htm18	AIR SUPPLY - ELECTRODE COOLING (TYPICAL OF 2)	N/A	1	CONTINUOUS	IA-2	50 SCFM	N/A	113	N/A	25 PSIG	113	NO	D	STAUBLI	
htm19	AIR SUPPLY - ELECTRODE EXTENSION COOLING (TYPICAL OF 2)	N/A	1	CONTINUOUS	IA-2	10 SCFM	N/A	113	N/A	25 PSIG	113	YES	D	STAUBLI	
ogp12	AIR SUPPLY - FUTURE STANDBY FILM COOLER	N03B	2	SPARE	IA-1	N/A	N/A	113	N/A	<15 PSIG	240	YES	D	SPECIAL	
ogp13	AIR SUPPLY - ITS PLENUM PRESSURE TAP	N10A	1/2	CONTINUOUS	IA-1	0.2 SCFH	5 PSIG	113	N/A	5 PSIG	240	YES	D	STAUBLI	
ogs03	AIR SUPPLY - LINE PURGE, STANDBY OFFGAS	N/A	2	CONTINUOUS	IA-1	30 - 160 SCFM	5 PSIG	113	N/A	<15 PSIG	240	NO	D	SPECIAL	
ogp09	AIR SUPPLY - PLENUM (STAND BY OFF GAS) VACUUM MEASUREMENT	N56	3/8	CONTINUOUS	IA-2	0.2 SCFH	0 PSIG	113	N/A	<15 PSIG	240	NO	D	STAUBLI	34
vew01	AIR SUPPLY - PLENUM CCTV COOLING (IF INSTALLED)	N36	1/2	CONTINUOUS (IF CCTV INSTALLED)	IA-1	15 SCFM	10 PSIG	113	N/A	<15 PSIG	240	YES	D	STAUBLI	28
ogp03	AIR SUPPLY - FILM COOLER	N03A	2	CONTINUOUS	IA-1	309 SCFM	0 PSIG	113	N/A	<15 PSIG	240	NO	D	SPECIAL	35
lkd01	AIR SUPPLY - SHELL LEAK DETECTOR (REDUNDANT PLENUM VACUUM)	N33	3/8	CONTINUOUS	IA-1	0.2 SCFH	1	113	N/A	<15 PSIG	240	NO	D	STAUBLI	
por19	ARGON SUPPLY - AIR LIFT/RISER PURGE GAS (TYPICAL OF 2)	N12, N13	3/8	CONTINUOUS	IA-2	0.2 SCFH	0 PSIG	113	N/A	<15 PSIG	240	YES	D	STAUBLI	14
lvl01	ARGON SUPPLY - LEVEL DETECTOR, DENSITY LEG	N34B	3/8	CONTINUOUS	Ar	1 SCFH	2 PSIG	113	N/A	<15 PSIG	240	YES	D	STAUBLI	
lvl02	ARGON SUPPLY - LEVEL DETECTOR, LEVEL LEG	N34A	3/8	CONTINUOUS	Ar	1 SCFH	3 PSIG	113	N/A	<15 PSIG	240	YES	D	STAUBLI	
drn01	DRAIN - MELTER SHELL	N32	1	RARE (ONLY IF LEAK OCCURS)	N/A	N/A	0 PSIG	113	N/A	N/A	113	NO	N/A	N/A	40
fed16	FEED SUPPLY - FEED NOZZLE (TYPICAL OF 2)	P01, P02	3/4	CONTINUOUS	N/A	1 GPM	35 PSIG	113	N/A	166 PSIG	360	NO	D	STAUBLI	64
fed07	FRIT ADDITION FUNNEL	P02	3	STARTUP ONLY	N/A	N/A	N/A	N/A	N/A	N/A	N/A	NO	N/A	3-BOLT FLANGE	6, 30
htd21	POWER - DISCHARGE CHAMBER HEATER (TYPICAL OF 8 FOR EAST & WEST, PAIRED CONNECTIONS)		N/A	CONTINUOUS	ELECTRICAL	30-50 A	0 - 202 V	N/A	50 A	600 V	500	NO	N/A	MULTI-CONTACT	

ITEM IDENTIFIER	DESCRIPTION	CONNECTION NUMBER	LINE SIZE, INCH	OPS MODE	SERVICE TYPE	NOMINAL FLOW / AMPS	NOMINAL PRESSURE / VOLTS AT POINT OF USE	NOMINAL TEMPERATURE, F	DESIGN LIMIT FLOW / AMPS (NOTE 59)	DESIGN LIMIT PRESSURE / VOLTS (NOTE 59)	DESIGN LIMIT TEMPERATURE, F	CRITICAL SERVICE	FLUID SERVICE CATEGORY (NOTE 59)	CONNECTION TYPE	NOTES
htd22	POWER - DISCHARGE CHAMBER HEATER, AUXILIARY, TYPICAL OF 2		N/A	RARE	ELECTRICAL	20 A	208 V	N/A	35 A	600 V	500	NO	N/A	MULTI-CONTACT	11
hts06	POWER - STARTUP HEATER (TYPICAL OF 5)	P05, 6, 7, 8, 9	N/A	STARTUP ONLY	ELECTRICAL	115 A	320 V	N/A	150 A	600 V	113	NO	N/A	NONE	6, 29
ogp11	OFFGAS - MAIN PORT	P03	8	CONTINUOUS	N/A	N/A	-5 IN W.G.	400 - 1000	N/A	-100 IN. W.G.	1000	NO	M	3-BOLT FLANGE	37
ogs02	OFFGAS - STANDBY PORT	P04	8	RARE	N/A	N/A	-5 IN W.G.	400 -1000	N/A	-100 IN. W.G	1000	NO	M	3-BOLT FLANGE	37
ogp10	POWER - FILM COOLER CLEANER	N58	N/A	RARE	ELECTRICAL	5 A	480 VAC	N/A	N/A	N/A	N/A	NO	N/A	LEMO	
vew02	POWER - CCTV. PLENUM	N59	N/A	CONTINUOUS (IF CCTV INSTALLED)	ELECTRICAL	3 A	120 VAC	N/A	N/A	N/A	N/A	NO	N/A	LEMO	
htm20	POWER - ELECTRODE (TYPICAL OF 2)	N/A	N/A	CONTINUOUS	ELECTRICAL	1500 - 6000 A	75 - 320 VAC	N/A	6300	350 VAC	N/A	YES	N/A	SPECIAL	
vew05	SIGNAL - CCTV, PLENUM	N60	N/A	CONTINUOUS (IF CCTV INSTALLED)	ELECTRICAL	N/A	1 V	N/A	N/A	N/A	N/A	NO	N/A	LEMO	
ogp01	SIGNAL - FILM COOLER CLEANER LIMIT SWITCH, DOWN	N59	N/A	RARE	SIGNAL	2 A	120 VAC	N/A	N/A	10 PSIG	N/A	NO	N/A	LEMO	
ogp02	SIGNAL - FILM COOLER CLEANER LIMIT SWITCH, UP	N59	N/A	RARE	SIGNAL	2 A	120 VAC	N/A	N/A	25 PSIG	N/A	NO	N/A	LEMO	
ogs07	SPARE SERVICE - CONNECTION TO STANDBY OFFGAS	N57	3/8	RARE	IA-2	N/A	-5 IN W.G.	113	N/A	N/A	150	NO	D	STAUBLI	
agi14	SPARE SERVICE - PORT (TYPICAL OF 4)	N/A	1/2	N/A	N/A	N/A	N/A	N/A	N/A	N/A	150	NO	N/A	STAUBLI	
tmp49	TC - EAST DISCHARGE CHAMBER, THERMOWELL #1 (TYPICAL OF 2 VIA COMMON CONNECTION)	N/A	N/A	CONTINUOUS	THERMOCOUPLE SIGNAL	N/A	N/A	N/A	N/A	N/A	N/A	NO	N/A	LEMO	
tmp50	TC - EAST DISCHARGE CHAMBER, THERMOWELL #2 (TYPICAL OF 2 VIA COMMON CONNECTION)	N/A	N/A	CONTINUOUS	THERMOCOUPLE SIGNAL	N/A	N/A	N/A	N/A	N/A	N/A	NO	N/A	LEMO	
tmp45	TC - EAST ELECTRODE, (3 FOR ELECTRODE, 2 FOR COOLING AIR EXHAUST ALL VIA COMMON CONNECTION)	N/A	N/A	CONTINUOUS	THERMOCOUPLE SIGNAL	N/A	N/A	N/A	N/A	N/A	N/A	NO	N/A	LEMO	
tmp53	TC - EAST REFRACTORY THERMOWELL (TYPICAL OF 5 VIA COMMON CONNECTION)	N/A	N/A	CONTINUOUS	THERMOCOUPLE SIGNAL	N/A	N/A	N/A	N/A	N/A	N/A	NO	N/A	LEMO	
tmp47	TC - GLASS POOL & PLENUM, EAST THERMOWELL (TYPICAL OF 5 VIA COMMON CONNECTION)	N/A	N/A	CONTINUOUS	THERMOCOUPLE SIGNAL	N/A	N/A	N/A	N/A	N/A	N/A	NO	N/A	LEMO	
tmp48	TC - GLASS POOL & PLENUM, WEST THERMOWELL (TYPICAL OF 5 VIA COMMON CONNECTION)	N/A	N/A	CONTINUOUS	THERMOCOUPLE SIGNAL	N/A	N/A	N/A	N/A	N/A	N/A	NO	N/A	LEMO	

ITEM IDENTIFIER	DESCRIPTION	CONNEC-TION NUMBER	LINE SIZE, INCH	OPS MODE	SERVICE TYPE	NOMINAL FLOW / AMPS	NOMINAL PRESSURE / VOLTS AT POINT OF USE	NOMINAL TEMPER-ATURE, F	DESIGN LIMIT FLOW / AMPS (NOTE 59)	DESIGN LIMIT PRESSURE / VOLTS (NOTE 59)	DESIGN LIMIT TEMPER-ATURE, F	CRITICAL SERVICE	FLUID SERVICE CATEGORY (NOTE 59)	CONNEC-TION TYPE	NOTES
tmp51	TC - WEST DISCHARGE CHAMBER, THERMOWELL #1 (TYPICAL OF 2 VIA COMMON CONNECTION)	N/A	N/A	CONTINUOUS	THERMO-COUPLE SIGNAL	N/A	N/A	N/A	N/A	N/A	N/A	NO	N/A	LEMO	
tmp52	TC - WEST DISCHARGE CHAMBER, THERMOWELL #2 (TYPICAL OF 2 VIA COMMON CONNECTION)	N/A	N/A	CONTINUOUS	THERMO-COUPLE SIGNAL	N/A	N/A	N/A	N/A	N/A	N/A	NO	N/A	LEMO	
tmp46	TC - WEST ELECTRODE (3 FOR ELECTRODE, 2 FOR COOLING AIR EXHAUST, ALL VIA COMMON CONNECTION)	N/A	N/A	CONTINUOUS	THERMO-COUPLE SIGNAL	N/A	N/A	N/A	N/A	N/A	N/A	NO	N/A	LEMO	
tmp54	TC - WEST REFRACTORY THERMOWELL (TYPICAL OF 5 VIA COMMON CONNECTION)	N/A	N/A	CONTINUOUS	THERMO-COUPLE SIGNAL	N/A	N/A	N/A	N/A	N/A	N/A	NO	N/A	LEMO	
por06	VENT - EAST DISCHARGE CHAMBER	N47A	2	CONTINUOUS	N/A	17 SCFM	N/A	907	17 SCFM	-5 PSIG	1000	NO	N/A	3 BOLT FLANGE	33
por14	VENT - WEST DISCHARGE CHAMBER	N46A	2	CONTINUOUS	N/A	17 SCFM	N/A	907	17 SCFM	-5 PSIG	1000	NO	N/A	3 BOLT FLANGE	33
clg32	WATER RETURN - COOLING PANEL TOTAL BASED ON 95 F SUPPLY	N/A	N/A	N/A	CW	45 GPM	N/A	120	45 GPM	150 PSIG	366	YES	NS		
clg01	WATER RETURN - COOLING BASE	N21	1	CONTINUOUS	CW	10 GPM	50 PSIG	120	10 GPM	150 PSIG	366	YES	NS		
clg24	WATER RETURN - COOLING, EAST WALL	N25	1	CONTINUOUS	CW	10 GPM	50 PSIG	120	10 GPM	150 PSIG	366	YES	NS		
clg26	WATER RETURN - COOLING, NORTH WALL	N24	1	CONTINUOUS	CW	10 GPM	50 PSIG	120	10 GPM	150 PSIG	366	YES	NS		
clg28	WATER RETURN - COOLING, SOUTH WALL	N23	1	CONTINUOUS	CW	5 GPM	50 PSIG	120	5 GPM	150 PSIG	366	YES	NS		
clg30	WATER RETURN - COOLING, WEST WALL	N22	1	CONTINUOUS	CW	10 GPM	50 PSIG	120	10 GPM	150 PSIG	366	YES	NS		
clg02	WATER SUPPLY - COOLING, BASE	N16	1	CONTINUOUS	CW	10 GPM	50 PSIG	95	10 GPM	150 PSIG	366	YES	NS	STAUBLI	
clg25	WATER SUPPLY - COOLING, EAST WALL	N20	1	CONTINUOUS	CW	10 GPM	50 PSIG	95	10 GPM	150 PSIG	366	YES	NS	STAUBLI	
clg27	WATER SUPPLY - COOLING, NORTH WALL	N19	1	CONTINUOUS	CW	10 GPM	50 PSIG	95	10 GPM	150 PSIG	366	YES	NS	STAUBLI	
clg29	WATER SUPPLY - COOLING, SOUTH WALL	N18	1	CONTINUOUS	CW	5 GPM	50 PSIG	95	5 GPM	150 PSIG	366	YES	NS	STAUBLI	
clg31	WATER SUPPLY - COOLING, WEST WALL	N17	1	CONTINUOUS	CW	10 GPM	50 PSIG	95	10 GPM	150 PSIG	366	YES	NS	STAUBLI	
fed14	WATER SUPPLY - FEED NOZZLE FLUSH TYPICAL OF 2	N/A	N/A	INTERMITTENT	DIW	2 GPM	35 PSIG	95	2 GPM	150 PSIG	366	NO	N/A	N/A	

ITEM IDENTIFIER	DESCRIPTION	CONNEC-TION NUMBER	LINE SIZE, INCH	OPS MODE	SERVICE TYPE	NOMINAL FLOW / AMPS	NOMINAL PRESSURE / VOLTS AT POINT OF USE	NOMINAL TEMPER-ATURE, F	DESIGN LIMIT FLOW / AMPS (NOTE 59)	DESIGN LIMIT PRESSURE / VOLTS (NOTE 59)	DESIGN LIMIT TEMPER-ATURE, F	CRITICAL SERVICE	FLUID SERVICE CATEGORY (NOTE 59)	CONNEC-TION TYPE	NOTES
ogp04	WATER SUPPLY - FILM COOLER WASH (INJECTED VIA FILM COOLER AIR LINE)	N/A	N/A	INTERMITTENT	DIW	1 GPM	25 PSIG	95	1 GPM	135 PSIG	366	NO	N/A	N/A	
fed06	WATER SUPPLY -PREFEED PLENUM COOLING WATER, EAST FEED	N01B	3/4	INTERMITTENT	DIW	1 GPM	25 PSIG	95	1 GPM	135 PSIG	366	NO	N/A	STAUBLI	
fed09	WATER SUPPLY -PREFEED PLENUM COOLING WATER, WEST FEED	N02B	3/5	INTERMITTENT	DIW	1 GPM	25 PSIG	95	1 GPM	135 PSIG	366	NO	N/A	STAUBLI	
ogs01	WATER SUPPLY - STANDBY OFFGAS PIPE SPRAY, SAME CONNECTION AS ogs03	N/A	N/A	INTERMITTENT	DIW	1 GPM	25 PSIG	95	1 GPM	135 PSIG	366	NO	NS	STAUBLI	

SERVICE TYPE

Ar	WELDING GRADE ARGON
CW	COOLING WATER, DEMINERALIZED, FILTERED TO <2 MICRON, NO CORROSION INHIBITORS, CL < 40 PPM, SULFATE <100 PPM, TDS <340 PPM, TOTAL SUSPENDED SOLIDS, <300 PPM, TOTAL HARDNESS < 170 PPM
IA-1	INSTRUMENT AIR PER ANSI/ISA-S7.0.01-1996
IA-2	INSTRUMENT AIR WITH EXTRA FILTRATION FOR PARTICULATE, WATER, AND HYDROCARBONS
DIW	DEMINERALIZED WATER

1 COOLING WATER SUPPLY TEMPERATURE IS TO BE GREATER THAN MELTER GALLERY AIR TEMP TO PREVENT CONDENSATION

6 INSTALLED DURING MELTER STARTUP

11 DISCHARGE CHAMBER AUX HEATERS NOT NORMALLY CONNECTED. HEATER TO BE USED FOR POUR FLANGE GLASS BLOCKAGE RECOVERY

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

24 N/A = NOT APPLICABLE

28 COOLING AIR WILL BE EXHAUSTED INTO MELTER CAVE

29 BUBBLER AND STARTUP HEATERS FIT THE SAME LID NOZZLES

30 FRIT ADDITION AND FEED NOZZLES FIT SAME LID NOZZLES

34 LEVEL DETECTOR REFERENCE LEG AND MELTER PLENUM PRESSURE COMBINED MEASUREMENT FROM STANDBY OFGFGAS PORT

35 MAY INCLUDE WATER FLUSH FOR FILM COOLER

37 TEMP MAY BE HIGHER IF FILM COOLER AND AIR INJECTION STOPS DURING PRESSURE TRIP

40 SEAL POT OR TRAP REQUIRED

50 ONCE PER 4 HOURS THE FEED LINES ARE FLUSHED. THIS OCCURS FOR EACH OF THE 6 ADS PUMPS/FEEDLINES, OR 1.5 GPH PER MELTER. APPROX ONCE PER MONTH, FLUSH EACH FEED NOZZLE FOR APPROX 30 MIN.

53 AIR FLOWS DURING POURS ONLY, APPROX. 30 MIN EVERY 3 HR. ARGON USED AS A CONTINUOUS PURGE, EVEN DURING POURS (ABOUT 1 SCFH)

54 WATER USED TO COOL PLENUM AFTER IDLE FLOW FROM ONLY 1 NOZZLE IS SUFFICIENT, DURATION APPROX 30 MIN.

59 UNLESS OTHERWISE NOTED, THE OPERATING DESIGN LIMITS MUST BE BASED ON PROCESS VALUES DEFINED BY RPP-WTP ENGINEERING. WHERE PROCESS VALUES DIFFER FROM THE B31.1 PIPING/TUBING SERVICE CLASS, THE SERVICE CLASS IS GOVERNING.

64 PROCESS VALUES ARE BASED ON PILOT MELTER DATA AND DESIGN DEVELOPMENT. ACTUAL MELTER OPERATING/DESIGN CRITERIA MAY VARY DEPENDING ON FINAL SYSTEM DESIGN BY RPP-WTP

Appendix B

Melter Design Interface Details (10 pages total)

Tag	Component (2, 3)	Interface Detail (2, 3)	Interface Criteria	System/ Area Locators	Comments
agi07	bubbler	component weight	290.31 lb.	HSH	
agi08	bubbler	intermediate in-facility storage criteria	consumable template has storage positions for 8 consumables with 11 in dia. bases	HSH	note 5
agi02	bubbler	operating life	MTTF - 2 mos	HSH	
agi03	bubbler	remote handling requirements	3 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook	HSH	
vew09	cctv - for melter plenum	component weight	250 lb. max	HSH	
vew07	cctv - for melter plenum	dimensions - envelope	16.75" dia. X 34.31" tall	HSH	
vew14	cctv - for melter plenum	intermediate in-facility storage criteria	consumable template has storage positions for 8 consumables with 11 in dia. bases	HSH	note 5
vew02	cctv - for melter plenum	operating life	MTTF - 12 mos	HSH	
vew05	cctv - for melter plenum	remote handling requirements	2 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook	HSH	
enc49	cooling panel expansion indicators	adjustment interface/connection	adjustments to indicators not necessary	HSH	
enc46	cooling panel expansion indicators	quantity	*21 total - 6 on east wall, 9 on north wall, 6 on west wall*	HSH	
enc48	cooling panel expansion indicators	viewing criteria	need to view a 4" diameter wheel at a steep viewing angle. Approximately 60-90 degrees	HSH	jumper placement by project may affect view
enc17	datum point - facility reference	coordinates of melter datum in plant coordinate system	*melter 1*: N. 3806' - 7 1/4" E. 10149' - 1" Elev. 2' - 11" *melter 2*: N. 3806' - 7 1/4" E. 10042' - 1" Elev. 2' - 11"	30	*note 5.*
enc18	datum point - facility reference	description of physical location	located 7.75 inches to south of pour spouts center line on west rail center line at elev. 2'-11"	30	
enc38	datum point - facility reference	dimensional tolerance for locating datum point in melter cave	to be determined by project after completion of melter design	HSH	note 5
enc21	datum point - melter reference	description of physical location (x,y,z location from which all melter dimensions originate from)	point on top center of west rail, on centerline of seismic restraint pin. See enc18 and res04	30	
enc41	datum point - melter reference	fabrication/ assembly dimensional tolerances	+/- 0.031" (0.0156" for the hole on the end truck and 0.0156" for the holes(s) in the restraint	30	
por24	discharge chamber lid	component weight	1642 lb.	HSH	
por23	discharge chamber lid	dimensions - envelope	33.125" x 40.0" plan, 19.125" high from bottom of refractory to top of cover, 34.25" high from bottom of refractory to top of lifting lugs	HSH	
por06	discharge chamber lid	operating life	MTTF - 30 mos	HSH	
por05	discharge chamber lid	remote handling requirements	5 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook; alignment device will protect heater elements from damage during installation (see maintenance tools)	HSH	

Tag	Component (2, 3)	Interface Detail (2, 3)	Interface Criteria	System/ Area Locators	Comments
enc26	drain - for annulus spaces	drain configuration	elbow directed downward with "flapper valve" on end, drains onto pour cave cover	HMP	
enc36	drain - for annulus spaces	leak detection configuration for drain	shell leak detector level probe will be located with its tip roughly in elbow of drain. If leak develops, water will build up to about 5" wc, then any additional water will drip out of flapper valve.	HMP	
enc51	drain - for annulus spaces	physical location	lower northwest corner of melter	HMP	
enc52	drain - for annulus spaces - leak detection equipment	operating life	MTTF - life of melter	HSH	
env32	facility rails	configuration	rectangular, 2.5" wide, flat, top of rail elevation 2'-11", east/west rail stops 11-3/4"/11-3/4" north of building grid K	HMH	
env33	facility rails	load limits - horizontal	Design anchorage of rail for 10% of vertical load on wheel	HMH	conforms to wheel vendor design recommendations and Crane Manufacturers Association of America (CMAA)
env67	facility rails	load limits - vertical	Assume 2 times wheel rating in env52 for occasional overload	HMH	
env36	facility rails	material/finish/coating/heat treating	17-4PH stainless, condition H900, yield stress = 183ksi, RMS 63 to 125, no coating.	HMH	
env39	facility rails	maximum rail gap	8 inches	HMH	Subcontractor comfortable crossing any rail gap smaller than 20.5 inches (wheel spacing), less 2 inches (load distribution per CMAA 70, 3.3.2.3), less any rail tapers used. A 7.5 inch rail gap between the HLW melter overpack and the HLW vitrification facility rails will be acceptable.
env40	facility rails	size/configuration	2.5" wide, must be flat, no more than a 1/32" chamfer (or radius) on edges, at least 1" tall for rail flange clearance. Top of rail elevation 2'-11", rails stop 11-3/4" north of building grid K.	HMH	
env41	facility rails	tolerances - horizontal lateral /parallel	horizontal lateral deviation +/- 0.04" over a 6 foot rail span, parallelism of rails in horizontal plane +/- 0.04" for each 16 foot span (non-cumulative)	HMH	
env34	facility rails	vertical/levelness tolerance	0.060"	HSH/HMH	Requirement driven by facility rail flatness tolerance
fed14	feed nozzle	component weight	108 lb.	HSH	
fed11	feed nozzle	dimensions - envelope	13" dia. flange X 23.88" long	HSH	
fed21	feed nozzle	intermediate in-facility storage criteria	consumable template has storage positions for 8 consumables with 11 in dia. bases	HSH	note 5. Feed nozzle to be stored in Consumable Template
fed03	feed nozzle	operating life	MTTF - life of melter	HSH	

Tag	Component (2, 3)	Interface Detail (2, 3)	Interface Criteria	System/ Area Locators	Comments
fed07	feed nozzle	remote handling requirements	5 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook	HSH	
fed19	feed nozzle - glass frit addition	component weight	132 lb.	HSH	
fed16	feed nozzle - glass frit addition	configuration	project design requirement. Will be configured to interface with subcontractor port design.	HSH	shall interface with consumable bucket with gate valve on bottom to accept bulk charge of frit w/o metering
fed20	feed nozzle - glass frit addition	intermediate in-facility storage criteria	consumable template has storage positions for 8 consumables with 11 in dia. bases	HSH	note 5. Storage location will be determined by project operations
fed05	feed nozzle - glass frit addition	remote handling requirements	4 inch across flats for captive fasteners, 1 1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook	HSH	
ogs13	film cooler	component weight	251 lb.	HSH	
ogs11	film cooler	dimensions - envelope	22" dia. flange x 23.5" long, from bottom to top of flange	HSH	
ogs36	film cooler	intermediate in-facility storage criteria	consumable template has storage positions for 8 consumables with 11 in dia. bases	HSH	note 5
ogs03	film cooler	operating life	MTTF - 36 mos	HSH	
ogs05	film cooler	remote handling requirements	2 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook	HSH	
ogs17	film cooler cleaner	component weight	1000 lb. max	HSH	
ogs16	film cooler cleaner	dimensions - envelope	to be verified after melter design is complete	HSH	
ogs37	film cooler cleaner	intermediate in-facility storage criteria	consumable template has storage positions for 8 consumables with 11 in dia. bases	HSH	note 5. On hold
ogs06	film cooler cleaner	operating life	MTTF - 12 mos	HSH	
ogs08	film cooler cleaner	remote handling requirements	3 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook	HSH	
plv05	glass pool level detector	component weight	102 lb.	HSH	
plv07	glass pool level detector	dimensions - envelope	76.2" long to bottom of flange, 87.22" long to top of fixed lifting bail, 13" dia flange, total width is 13.94"	HSH	
plv09	glass pool level detector	intermediate in-facility storage criteria	consumable template has storage positions for 8 consumables with 11 in dia. bases	HSH	note 5
plv02	glass pool level detector	operating life	MTTF - 9 mos	HSH	
plv04	glass pool level detector	remote handling requirements	4 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook	HSH	
por28	glass riser airlift lance	component weight	81 lb.	HSH	
por27	glass riser airlift lance	dimensions - envelope	87.75" long to top of plug, 95.71" long to top of fixed lifting bail, 13" dia flange	HSH	

Tag	Component (2, 3)	Interface Detail (2, 3)	Interface Criteria	System/ Area Locators	Comments
por31	glass riser airlift lance	intermediate in-facility storage criteria	consumable template has storage positions for 8 consumables with 11 in dia. bases	HSH	note 5
por10	glass riser airlift lance	operating life	MTTF - life of melter	HSH	
por12	glass riser airlift lance	remote handling requirements	6 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook	HSH	
enc45	jackbolt	adjustment interface/connection	PaR 3000 with parallel grip hand interfaces directly with adjuster. Max torque 185 in-lb.	HSH	
enc27	jackbolt	monitoring plan during startup and for general maintenance	final plan to be determined. May only need periodic (monthly basis) monitoring using in-cave cctv's	HSH	
enc44	jackbolt	quantity	21 total - 6 on east wall, 9 on north wall, 6 on west wall	HSH	
enc28	jackbolt	viewing criteria	direct visual with in-cave camera	HSH	Direct visibility or visibility with melter cave CCTV
enc03	melter - castable refractory	allowable sit times before bakeout	12 months+	BOF	Subcontractor design objective
enc54	melter - general	bolt torque limit for use of remote impact wrench	450 ft-lb. max	HSH	
env08	melter - general	clearance criteria for maintenance and equipment access	limited or no access at sides or under jumpers to east. Items on east side requiring visual monitoring to be angled to north or south.	HSH	Cable attachment points front and rear. Accessible with 300-750 ft-lb. variable torque impact wrench at jackbolt sites and jumper sites
env61	melter - general	clearance criteria for services under melter	no services or obstructions to exist between top of rails up to bottom of melter base (cross beams), except for tailhooks.	HSH	
env55	melter - general	component/consumable lifting design criteria	lifting bales/devices designed to 3 times yield	HSH	
enc10	melter - general	design for remote breakdown of melter in event of catastrophic failure	lid designed to be removed for decontamination and for access to pool for glass removal using remote operated in-cave equipment. Actual process for lid removal to be defined by project after melter design is complete.	HSH	Open Issue for alternate molten glass removal; drawings cited do not include cradle concept
enc31	melter - general	dimensions - envelope	172" N-S x 164" E-W x 146" high (installed component height from top of rail). 157" high to top of extended lifting bails, 134" high to top of melter shell.	HMH	
env13	melter - general	electrical grounding connections - location and connection details	use off-gas jumper, standby off-gas jumper, and two feed jumpers, requires that the submerged bed scrubber and feed tank be grounded.	GRE	
env14	melter - general	guard rails and safety barriers - configuration and loads for startup	guard rails and safety barriers are not a project requirement	HSH	note 5
enc16	melter - general	lifting bail design for consumables/ replaceable equipment	listed separately for each component - see remote handling criteria	HSH	
env05	melter - general	maintenance tool needs	discharge heater assembly handling stands, spreader bar and installation alignment/ guide tool; cover plates; melter wheel power package; electrode thermocouple installation and guide tool; commissioning glass pool sampler	HSH	

Tag	Component (2, 3)	Interface Detail (2, 3)	Interface Criteria	System/ Area Locators	Comments
env68	melter - general	Radiation dose rate - external	sides: 39.6 rem/hr, front/back: 65.3 rem/hr, bottom: 12.5 rem/hr, top (no decon): 84.0 rem/hr, top (w/ decon) 4.50 rem/hr	HSH	Combined dose for 0" shielding. For other cases, see reference p. 33 of 36.
enc39	melter - general	thermal movement (maximum) of any nozzle, from centroid of melter	0.156"	HSH	
enc42	melter - general	tolerances - fabrication/assembly dimensional tolerances for flexible connections from melter datum point	+/- 0.078" (includes melter datum point location tolerance, +/- 0.032" for positioning lid wrt melter datum, 0.015" for position tolerance for each hole from machining)	HMH/HMP	specific tolerances defined on Subcontractor melter assembly drawings
enc43	melter - general	tolerances - fabrication/assembly dimensional tolerances for hard connections from melter datum point	+/- 0.078" (includes melter datum point location tolerance, +/- 0.032" for positioning lid wrt melter datum, 0.015" for position tolerance for each hole from machining)	HMH/HMP	specific tolerances defined on Subcontractor melter assembly drawings
enc15	melter - general	use of common ports between operating modes	bubblers and startup heaters are the only consumables that utilize a common port	HMP	
enc01	melter - general	weight - empty and operating	176,695 lb. without glass, 199,029 lb. with glass	HMH	tolerances not included
env58	melter - lid	handling cradle configuration	handling cradle will be attached to melter lid for flipping and shipping. *Lifting/ transportation devices to bolt to cradle.*	BOF	
env62	melter - lid	handling cradle requirements for assembly/transport	accommodates flipping of melter lid 180 degrees; does not interfere with castable refractory installation; protects lid studs, lid and refractory *during bake-out and transportation; supports* discharge chamber top surface to prevent buckling of lid side walls	BOF	
env63	melter - lid	handling cradle requirements for decommissioning	imported into cave via overpack; interfaces with in-cave embeds; is handled in cave with 12' lifting beam and remote tooling (impact wrench, etc.); able to be decontaminated; designed for high-cycle vibration from jackhammer during refractory breakout	HSH	
env57	melter - lid	handling criteria	melter lid must be safely flipped during assembly, transportation, and decommissioning (see env62 and env63 for specific requirements)	BOF	
env59	melter - lid	lifting/flipping loads	total lifted weight not to exceed 17 tons (capacity of in-cave crane)	HSH	
ogs18	melter - operation	annular space in-leakage air quality	unfiltered cave air	HOP	
gls01	melter - operation	glass composition - forming chemicals by waste envelope	*reference composition for envelope* D tank AZ101 is glass 98-31	HMP	
gls07	melter - operation	glass electrical conductivity	0.1 – 0.7 S/cm @ 1100 – 1200°C	HMP	
gls13	melter - operation	glass frit composition	Al2O3 - 13.57%, CaO - 0.40%, K2O - 2.01%, MgO - 2.11%, P2O5 - 3.42%, ZnO - 3.12%, B2O3 - 17.29%, Fe2O3 - 0.70%, Li2O - 2.51%, Na2O - 15.88%, SiO2 - 38.99%; Viscosity ~ 50 poise @ 1125°C, Conductivity ~0.35 S/cm @ 1125C, Liquidus < 900°C	HMP	**Composition subject to change based on long term idling requirements during commissioning.**
por26	melter - operation	glass pool level range during operation	43" - 43.8"	HMP	
gls09	melter - operation	glass pool liquidus temperature, range	<950°C	HMP	
htg13	melter - operation	glass pool temperature range	1100 - 1200° C w/ setpoint at 1150° C	HMP	

Tag	Component (2, 3)	Interface Detail (2, 3)	Interface Criteria	System/ Area Locators	Comments
gls11	melter - operation	glass viscosity @ operating temp, range	10 to 150 Poise at 1100°C	HMP	
vnt04	melter - operation	heat loss through melter shell to cave, feed mode	78 kW	C5V	
vnt05	melter - operation	heat loss through melter shell to cave, idle mode	85kW	C5V	
env60	melter - operation	maximum/minimum ambient temperatures in melter cave	113F / 59F	C5V	
ogs24	melter - operation	offgas temperature downstream of film cooler - during feed - normal and design ranges	207 - 249 C	HOP	
ogs25	melter - operation	offgas temperature downstream of film cooler - during idle - normal and design ranges	313 C	HOP	
ogs20	melter - operation	offgas temperature in plenum - during feed - normal and design ranges	400 - 550 C	HOP	
ogs21	melter - operation	offgas temperature in plenum - during idle - normal and design ranges	1000 C	HOP	
wst06	melter - operation	waste feed characteristics - normal waste	per simulated waste used in pilot melter tests. will depend on actual composition of tank waste delivered to project. Tank AZ101 with 98-31 glass adequately defines waste composition for melter design purposes	HMP	
wst07	melter - operation	waste feed characteristics - range of feed variation	will depend on actual composition of tank waste delivered to *project. Tank AZ101 with 98-31 glass adequately defines waste* composition for melter design purposes	HMP	
fed12	melter - operation	waste feed distribution through feed *nozzles with respect to operating modes*	two nozzles are required for proper plenum pool cold cap *distribution, regardless of operating mode*	HMP	
env54	melter - seismic	in-structure seismic response spectra	Ref. 2.2.H, Plots 106, 107, 108 @ 0' elevation, Joint J-12-1, Node 5423	30	"Seismic Qualification of Seismic Category I/II Equipment and Tanks"
env66	melter - seismic	remote handling requirements for seismic restraints	hex head bolt, 2" across flats for engaging seismic pin with remote impact wrench.	HSH	pins are provided with each melter
res03	*melter - seismic*	*restraint loads*	west pin 180,317 lb. east/west, 109,012 lb. north/south, 210,708 lb. resultant. East pin 0 lb. east/west, 109,012 lb. north/south, 109,012 lb. resultant applied at 1'-5 1/2" above top of embedded plate (elev. 4'-2"). Vertical load at each tailhook restraint: 56,870 lb. upward	HSH	
res04	melter - seismic	restraint location	pins: 7.75" South of Col. Line K, on centerlines of rails; Tailhooks: pin centerlines 8.25" inboard of rail centerlines at elev. 2'-11.395" (0.395" above rail), south face mounts at 136.23" north of melter datum. North face of facility pin receiver plate to be 135.5" north of melter datum.	HSH	
res05	melter - seismic	restraint quantity	four restraints, including two "tailhooks" for overturning	HSH	

Tag	Component (2, 3)	Interface Detail (2, 3)	Interface Criteria	System/ Area Locators	Comments
env56	melter - seismic	seismic restraint bracket envelope	pins: east embed horiz mounting surface - 1'-8" x 4'-6" at elev. 2'-8 1/2"; West horiz - 1'-8" x 4'-6" at elev. 2'-8 1/2", vertical surface 1'-6" high x 4'-6" at 7'-2" from melter centerline.North edge of east/west embed at 10 3/4" / 4 1/4" south of building grid K. Tailhook: 6" wide bracket with pin hangs below melter 2.605" below top of rail just inside of wheels. Tailhook receiver dimension: 7.5" wide bracket w/ 3"dia. hole and 3.75" edge distance (including at clipped corners). Mat'l: 1.5" thk. 304L SS.	HSH	
env69	melter - seismic	seismic restraint embedment tolerances for manufacture	East embed: top of plate at flat to within 0.015"; West embed: top of plate east of vertical plate flat to within 0.015"; perpendicularity and flatness of east face if vertical plate: +/- 1/16" of 90 degree plane. Excluded from above areas of horizontal and vertical surfaces: A 45 degree dianonal 3/8" fillet plane at the intersection corner of the two plates. Fillet weld build-up shall not penetrate this plane. Plate length dimensions not listed above +/- 1/8".	CS&A	tolerances are needed to ensure that no additional modification of seismic lug assemblies is required in field.
env 70	melter - seismic	seismic restraint embedment tolerances for placement in field	East embed: location of north and west edges of plate +/- 1/8". Top of plate elevation +0", -1/8" and level within 1/16"; West embed: location of north and east edges of plate +/- 1/8". Top of plate at lug base area (east of vertical plate): elevation +0", -1/8" and level within 1/16", location of east foace of vertical plate +1/8", -0" of indicated distance from melter centerline and parallel to melter centerline within 1/16"	CS&A	
res06	melter - seismic	seismic restraint installation requirements	Restraint lug base north edge to be installed 5.5" south of melter datum; center of tongue to align with rail centerline. Hole in lug is marked with melter moved into position, then removed from base for machining hole. Lug base is welded in place and lug is realigned horizontally using shims on sides; belleville spring washers are used to lock in final vertical position. Lug base welds are bevel welds along pour cave walls and at top edge of west base, fillets elsewhere.	HSH	one-time set up required for first melter in cave will not apply to subsequent melters
res02	melter - seismic	seismic restraint interface configuration	Subcontractor designed pin attachment (WTP-M-21730) welds to embed in melter cave. Tailhook for uplift on north end: 2.5" dia. 3" long pins facing south and fitting into 3" dia. receiving holes. See env56	HSH	
env51	melter - transport	guidance system - criteria for locating and setting melter in facility	guidance and location tolerances of flanged wheels on west rail and seismic pins	HMH	
env28	melter - transport	loads and moments transferred to melter	Towing lug on north side of melter designed for 0.23 times melter weight	HMH	load is to drag full melter with some, but not all wheels seized up.

Tag	Component (2, 3)	Interface Detail (2, 3)	Interface Criteria	System/ Area Locators	Comments
env65	melter - transport	loads and moments transferred to melter	Towing lug on south side of melter designed for 0.5 times melter weight	HSH	load is to drag full melter from overpack with all of the wheels seized. Must overcome static friction of wheels on overpack rails. Lubrication will be applied to overpack rails prior to insertion of spent melter.
env19	melter - transport	max acceleration/deceleration x/y/z during transport (new melter only)	0.1 g	HMH	
env27	melter - transport	remote handling requirements for cave import	use PaR installed "shepherds hook" with capacity to drag melter from overpack.	HSH	
env31	melter - transport	stop/deceleration mechanism for melter *import (into cave)*	proximity switch/stop switch mounted on in-cave wall	HSH	
clg02	piping - cooling water	slope of cooling water piping	no slope required for operational purposes	PCW	must have the ability to blow out dry with air
enc40	*piping - offgas nozzle*	*thermal movement*	0.076"	HMP	
ogs38	piping - standby offgas	operating life	MTTF - life of melter	HSH	
prm05	plenum pressure sensor	component weight	170 lb., about the same as a blank plug	HSH	
prm07	plenum pressure sensor	dimensions - envelope	26" dia. x 64" tall	HSH	
prm09	plenum pressure sensor	intermediate in-facility storage criteria	consumable template has storage positions for 16 consumables with 7 in dia. bases	HSH	note 5
prm02	plenum pressure sensor	operating life	MTTF - life of melter	HSH	
prm04	plenum pressure sensor	remote handling requirements	7 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook	HSH	
enc53	plugs - lid spares	operating life	MTTF - life of melter	HSH	
htg18	startup heater	component weight	1074 lb. for 5 heaters, 215 lb. each	HSH	
htg14	startup heater	dimensions - envelope	16.75" dia. flange x 64.0" to top of cable enclosure	HSH	
htg19	startup heater	intermediate in-facility storage criteria	consumable bucket and template to be devised by project	HSH	note 5
htg02	startup heater	operating life	MTTF - 3 mos	HSH	operating life is for heater elements. Rest of heater should last life of melter
htg04	startup heater	remote handling requirements	6 inch across flats for captive fasteners, 1-1/4 inch ACME thread, nut retainer, standard lifting bail for 5 ton and 17 ton crane hook	HSH	
htg21	thermocouple - discharge chamber	component weight	16 lb.	HSH	
htg24	thermocouple - discharge chamber	intermediate in-facility storage criteria	consumable template has storage positions for 16 consumables with 7 in dia. bases	HSH	note 5
tmp29	thermocouple - discharge chamber	operating life	MTTF - 12 mos	HSH	

Tag	Component (2, 3)	Interface Detail (2, 3)	Interface Criteria	System/ Area Locators	Comments
htg25	thermocouple - discharge chamber	remote handling requirements	use standard lifting bail for 5 ton and 17 ton crane hook	HSH	
htg22	thermocouple - discharge chamber thermowell	dimensions - envelope	5.25" dia plug x 58.19" from bottom of thermocouple to top of lifting bail	HSH	
tmp31	thermocouple - electrode extensions	component weight	16 lb.	HSH	
tmp32	thermocouple - electrode extensions	dimensions - envelope	5.25" dia plug x 61.69" from bottom of thermocouple to top of lifting bail	HSH	
tmp33	thermocouple - electrode extensions	intermediate in-facility storage criteria	consumable template has storage positions for 16 consumables with 7 in dia. bases	HSH	note 5
tmp34	thermocouple - electrode extensions	operating life	MTTF - 12 mos	HSH	
tmp35	thermocouple - electrode extensions	remote handling requirements	horizontal insertion	HSH	
tmp17	thermocouple - plenum/pool	component weight	16 lb.	HSH	
tmp26	thermocouple - plenum/pool	intermediate in-facility storage criteria	consumable template has storage positions for 16 consumables with 7 in dia. bases	HSH	note 5
tmp37	thermocouple - plenum/pool	operating life	MTTF - 9 mos	HSH	
tmp06	thermocouple - plenum/pool	remote handling requirements	use standard lifting bail for 5 ton and 17 ton crane hook	HSH	
tmp19	thermocouple - refractory	component weight	16 lb.	HSH	
tmp27	thermocouple - refractory	intermediate in-facility storage criteria	consumable template has storage positions for 16 consumables with 7 in dia. bases	HSH	note 5
tmp07	thermocouple - refractory	operating life	MTTF - greater than 12 mos	HSH	
tmp09	thermocouple - refractory	remote handling requirements	use standard lifting bail for 5 ton and 17 ton crane hook	HSH	
tmp30	thermowell - discharge chamber	operating life	MTTF - 12 mos	HSH	
tmp39	thermowell - plenum/pool	component weight	99 lb.	HSH	
tmp15	thermowell - plenum/pool	dimensions - envelope	13" dia flange x 94.52" long from bottom to top of fixed lifting bail	HSH	
tmp38	thermowell - plenum/pool	operating life	MTTF - 9 mos	HSH	
tmp18	thermowell - refractory	dimensions - envelope	7.0" dia x 113.84" long	HSH	

Tag	Component (2, 3)	Interface Detail (2, 3)	Interface Criteria	System/ Area Locators	Comments
vnt07	vent insert - discharge chamber	operating life	MTTF - 30 mos	HSH	
vnt06	vent line - discharge chamber	operating life	MTTF - 30 mos	HSH	
env42	wheels	friction coefficient between melter and facility melter rails	0.23	HMH	estimated value
env11	wheels	remote handling requirements	no remote adjustments required	HSH	
env47	wheels	type/materials	Demag Model DRS315, cast iron	HMH	
env52	wheels	wheel load capacity	48,500 lb. for Demag Model DRS315.	HMH	
env43	wheels	wheel load distribution - over all wheels	Max - 26,800 lb.	HMH	
env44	wheels	wheel location and spacing	outside, 148" rail span (c-c), east/west side: south wheel centerline 22.5"/24.5" from seismic pin respectively	HMH	
env45	wheels	wheel quantity	7 wheels per side, spaced approximately 20.55" center-to-center	HMH	

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.