7 DAY SEVEN – AUTOMATING THE EQUIAX PROCESS I

7.1 Summary

Day one of two discussing equiax process steps and the content of sub-cycles in each process step.

No.	Classroom Topic	Diagram(s)/Other Materials
1.	Review of Previous Day	
2.	The Equiax Process Step I	Equiax Process Diagram: The Vacuum Cycle Step (eqx_proc_vac.doc)
3.	Vacuum System Concepts	Vacuum System Quiz I
		Vacuum System Quiz II
		Vacuum System Concepts I
		Vacuum System Concepts II
		Vacuum Map Screen (vacmapfoil.doc)
		Vacuum Gauge Display (vgaugefoil.doc)
		Vacuum Setpoint Screen (vacsetpfoil.doc)
4.	Vacuum Cycle Step of the Furnace Process	Anatomy of a Vacuum Sub-Cycle (vac_sub2.doc)
		Overview of Furnace Control During a Vacuum Sub-Cycle (vac_cyc_ovrvw.doc)
5.	The Equiax Process Step II	Equiax Process Diagram: The Load Charge Step (eqx_proc_ldchg.doc)
6.	Charge Loading Concepts	Charge Loading Quiz I
		Charge Loading Quiz II
		Charge Loading Concepts
		The Pour Control Screen (prcntrlfoil.doc)
7.	Load Charge Step of the Furnace Process	Anatomy of a Load Charge Sub-Cycle (ld_chrg2.doc)
		Overview of Furnace Control During a Load Charge Sub-Cycle (ld_chg_ovrvw.doc)
Break		
No.	**Furnace Demo Topic**	**Comment**
8.	Vacuum Cycle Process Step	Each student manually performs each step of the Vacuum Cycle (starts with DP hot & all chambers at atmospheric pressure).
9.	Load Charge Process Step	Each student manually does each step of the Load Charge Sub-Cycle. Complete during afternoon furnace session if necessary.
Lunch Break		
No.	**Classroom Topic**	**Diagram(s)/Other Materials**
10.	The Equiax Process Step III	Equiax Process Diagram: The Melt Temp Step (eqx_proc_mlt.doc)
11.	Melt Step Concepts	Melt Step Concepts I
		Melt Step Concepts II
		Melt Step Concepts III
		Melt Power Supply Control Screen (mltpsctrlfoil.doc)
		Melt Power Supply Status Screen (mpsstatfoil.doc)
		Melt Temperature Setpoint Screen (mltmpsetfoil.doc)
12.	Melt Temp Process Step of the Furnace Process	Anatomy of the Melt Temp Process Step (meltsubcycle.doc)
		Closed Loop Temperature Control Logic (cloopTC_log.doc)
		Closed Loop Temperature Control Block Diagram (cloopTC.doc)

Break		
No.	**Furnace Demo Topic**	**Comment**
13.	Load Charge Process Step	Continued from the morning furnace session if necessary.
14.	Melt Temp Process Step	While at the Operator's Console, each student explains verbally to the instructor how to perform each step of the Melt Temp Process Step.

7.2 Handouts for Students

- Daily curriculum sheet
- Equiax Process Diagram (eqx_proc.doc)
- Anatomy of a Vacuum Sub-Cycle (vac_sub2.doc)
- Furnace Control During a Vacuum Sub-Cycle (vac_cyc_ovrvw.doc)
- Anatomy of a Load Charge Sub-Cycle (ld_chg2.doc)
- Furnace Control During a Load Charge Sub-Cycle (ld_chg_ovrvw.doc)
- Anatomy of the Melt Temp Process Step (meltsubcycle.doc)
- Closed Loop Temperature Control Logic
- Closed Loop Temperature Control Block Diagram (cloopTC.doc)
- Vacuum System Terms (vac_trm.doc)
- Melt Process Step Terms (melt_trm.doc)
- Furnace Operating Manual

7.3 Attendance

- Furnace operators

7.4 Instructor Materials and Notes

- Diagrams listed above as overhead transparencies and hard copies in a binder
- All Student Handouts
- Furnace Operating Manual
- Vacuum system must be fully operational (and capable of achieving high vacuum) before startup/shutdown participation by students
- Instructor to heat Diffusion Pump ahead of time (before on-furnace demonstrations)
- Instructor to ensure prior to on-furnace demonstration that Immersion TC is capable of motion in Immersion TC Auto Mode without damaging Crucible
- Slides that contain questions only are meant to stimulate a classroom discussion. Instructor should pose the questions and let students answer them.
- The Bar Feeder must be set up for use prior to the start of class on this day.