

 LCI Furnaces DIVISION OF LOCHABER CORNWALL INC CONTINUOUS BELT IR FURNACE	EQUIPMENT SPECIFICATIONS	DOC NBR: 16-0xx - 802-101401 R0
		MODEL: LA-309P CUSTOMER:
		SERIAL NBR: 1303091xxx SHT 1 OF 1 PRNT 06/15/16

Equipment Model		Application: LOW O2			
Model	Base Equipment	Control Zones	Furnace Heated Length		Nominal Furnace Belt Width
LA-309P	Continuous Belt Controlled Atmosphere Furnace	3	30 in	76 cm	9.5 in 24 cm

Equipment Arrangement						
Phase	Process	Max	Length		Process Gas	Temperature (range)
Phase 1	IR Furnace, 3 Zones	1000 °C	30 in	76 cm	N2	100-960 C
Phase 2	Transition Tunnel		15 in	38 cm	N2	100-850 C
	Gas Convective Cooling, Exterior Fan Heat Removal		30 in	76 cm	N2	25-360 C

Process Sections						
Function	Name	Location	Length		Process Gas	Temperature (typ)
	Load Station	Entrance load area	15.0 in	38 cm		ambient
IR Furnace	ENTRANCE BAFFLE	Entrance barrier	15.0 in	38 cm	N2	650 °C
	ZONE 1	Heating chamber 1	7.5 in	19 cm	N2	850 °C
	ZONE 2	Heating chamber 1	15.0 in	38 cm	N2	850 °C
	ZONE 3	Heating chamber 1	7.5 in	19 cm	N2	850 °C
Cooling	TRANSITION TUNNEL	Exhaust Transition	15.0 in	38 cm	N2	706 °C
	CACT-COOLING TUNNEL	Cooling section	30.0 in	76 cm	N2	260 °C
Product Unload	Unload Station	Exit station	15.0 in	38 cm		ambient
	Frame Adjustment		1.0 in	3 cm		
	Total		121.0 in	307 cm		

Process Gas							
	Actual Conditions		Typical		Typ Annealing (pos atmos)		Max (all flowmeters open)
Furnace Replenishment Rate			2.0 rep/min		3.2 rep/min		7.4 rep/min
	Temp °C	Press psi	Min Flow scfh	Min Flow sL/m	Typical scfh	Typical sL/m	Max Compressor sL/m
N2 Supply	21	70	238	112	389	183	833
TOTAL PROCESS GAS			238	112	389	183	833

Exhaust Gas							
	Temp °C	Press in H ₂ O	Min Flow scfh	Min Flow sL/m	Typical scfh	Typical sL/m	Maximum Exhaust sL/m
N2 & none mix	200	6	120	57	389	183	3 282

Cabinet Ventilation			
Cabinet Ventilation Fans (vent to room or exhaust system)	Flowrate	1100 cfm	1870 m3/h
	Temperature	<86°F	<30°C


Transport System			
Belt width	9.5 in	24.1 cm	Belt Edge Heater(s): 30-inch, pair
Belt type	Balanced spiral weave		Motor: Bison 1/10 HP
Product height	2 in (5.1 cm) above belt level.		Baffle plate clearance: 0.25" above belt
Belt speed range	.5-10 ipm, 1-20 ipm, or 2-40 ipm		
Conveyor height	36.0 in	+/- 1.5 in adjustable	91.4 cm +/-3.8 cm adjustable

Electrical System	
Voltage required	480 Vac, 60 Hz, 3 Ph
Maximum power required	25.4 kW, 30.5 A
Typical (operating) power required	13.9 kW, 16.7 A

Materials of Construction			
Heating Chamber	Aluminum, aircraft	Cooling	Aluminum, aircraft
Baffle & Eductor	304 Stainless steel	Belt support	Quartz rod, Quartz tube
Heating element	Quartz, near infrared	Belt Return	UHMW-PE
		Belt	Nichrome V, 80%Ni,20%Cr, <1% Fe
		Frame	Steel, 2-prt urethane or powder coated
		Cover Panels	18GA Steel, urethane or powder coated

Furnace Dimensions							
		Length	Width	Height (floor to stack)	Furnace Sect	Coolg Sectn	Weight
Furnace, English	Net	121 in	29 in	68 in +/- 1.5 in	1650 LB		1650 LB
Furnace, Metric	Net	3.07 m	0.74 m	1.73 m +/- 0.04 mm	749 kg		750 kg
On Skid, English	Gross	130 in	36 in	77 in	2000 LB	Gross Wt:	1800 LB
On Skid, Metric	Gross	3.30 m	0.91 m	1.96 m	908 kg	Gross Wt:	820 kg
Crate, English	Gross	133 in	40 in	85 in	2200 kg	Gross Wt:	2200 LB
Crate, Metric	Gross	3.38 m	1.02 m	2.15 m	998 kg	Gross Wt:	1000 kg

Standard Conditions		
Pressure	14.7 psia	101.3 kPa
Temperature	70 °F	21 °C

 LCI Furnaces DIVISION OF LOCHABER CORNWALL INC	DATA SHEET			DOC NBR: 16-0xx	802-101501-1	RO
	IR FURNACE SYSTEM POWER & CURRENT			MODEL: LA-309P	APVL: SLB	3/30/16
				SERIAL NBR: 1303091xxx	CONF: JMC	3/30/16
	Customer:	PRINT: 06/15/16			SHT	1

INPUT TABLE	Entry OK?	VALID
Enter Line Voltage: (208,220,380,400,415,480)	480 Vac	TRUE
Limit Lamps to Max Rating? (Y/N)	Y	TRUE
Line Frequency (50/60)	60 Hz	TRUE
Number of Phases:	3 Φ	TRUE
Lamp Length (6, 9, 15, 24, 36)	9 inches	TRUE
Typical Operating %	54 %	TRUE

SUMMARY OF RESULTS	
Max Power:	25.3 kW
Max Current:	30.5 A
Typical Power:	13.9 kW
Typical Current:	16.7 A


HARDWARE	
Lamps: 28	SCRs: 8
EMs: 12 LEDs	TCs: 3
EM IDC5: n/a	
Nbr strings 12	
Nbr Lamps in 10" zone: 6	AOV-25: none AITM: none

Standard Power configuration

CONFIGURATION	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Totals
Length (6,6,7,5,10,14,3,15,20,30) in.	7.5	15	7.5										30 in.
Length Entry OK?	TRUE	TRUE	TRUE										
(F)urn., (F)urn. (1) SCR-Zn, (D)ryer	F	F	F										3
Zone Type OK?	TRUE	TRUE	TRUE										
No. Lamps in Series/String (1-5)	2	3	2										
Lamps/String OK?	TRUE	TRUE	TRUE										
No. Lamps in Top/Bottom Power	4/4	6/6	4/4										Plenum: 120
SCR PHASE	Zone Entry OK?	VALID	VALID	VALID									Lamp Balance (kW)
Top Lamp Phase (1/2/3):	1	2	3										Phase 1: 7.2
Bottom Lamp Phase (1/2/3):	1	2	3										Phase 2: 6.8
													Phase 3: 7.2
													<-- Vrms
SCR POWER													
Rated Lamp Voltage	216	216	216										
Max. Lamp Wired Voltage	216	160	216										
50% Power SCR Cal Span Setting	305	339	305										
Max. Lamp Wired Power (W)	900	567	900										
No. Strings per SCR	2	2	2										
Max. Current per String (A)	4.2	3.5	4.2										
No. Lamps in Zone	8	12	8										28
No. SCRs in Zone	2	2	2										6
No. Strings in Furnace Zones	4	4	4										12
													Nbr. lamp strings per element monitor: 4
Top Lamp Power (kW)	3.6	3.4	3.6										
Bottom Lamp Power (kW)	3.6	3.4	3.6										
Total Power/Zone (kW)	7.2	6.8	7.2										21.2
Current Required Top SCR (A)	8.3	7.1	8.3										
Current Required Bottom SCR (A)	8.3	7.1	8.3										
Color Temp (K) (nominal: 2500K)	2500	2237	2500										
Peak Wavelength (µm)	1.16	1.29	1.16										
Estimated Lamp Life (hrs)	6000 hr	Long	6000 hr										
Lumen Output vs. Rated (%)	100	38	100										

Furnace Total	Number of Item?	Voltage (Vac)	Current (Amps)	Power (kW)		Phase Assigned	EH in EM? (y/n)	Other Items
				Max	Typical			
Lamps	28	480	as above	21.2	11.4	as above	N	10" Cabinet or CACT Fans, 117 Vac, 0.30/029 A for 50/60 Hz
PC, Monitor	0	117	1.3			1	TRUE	4" Box (Muffin) Fans, product cooling, 117 Vac, 0.16 A
Belt, Opto22, EM	1	117	2.1	0.2	0.2	1		Cross-flow Fans, product cooling, 230 Vac, 1.27 A max
UC (Pump & Gen)		117	10.0					Lower Cabinet Blowers (Impellers), 230 Vac, 0.72 A max
UC (Tank Heater)		117	8.4					H2 Igniters, 120 Vac, 5 A 24 Vdc PS, 120 Vac, 2 A
UCD (Blower)		117	2.0					No more than 8 SCRs/phase per TRx xfmr 24 Vac secondary
UCD (Heater)		480	16.0					TR1: 2 TR2: 4 TR3: 2
Edg Htr 1 Length	30	480	7.8	3.7	2.0	2	OK	EH1 Ω: 124 Current: 3.9 A Cal Span: 339 Vac
Edg Htr 2 Length								EH2 Ω: Current: Cal Span:
Edg Htr 3 Length								EH3 Ω: Current: Cal Span:
Cabinet Vent Fan 10"	2	117	0.29	0.1	0.1	3	OK	Cabinet/CACT/Control Box Fans: 1.16 A
CACT Fans 10"	2	117	0.29	0.1	0.1	3	OK	
CACT Fans 4"	0	117	0.16					
Control Box Fans 4"	0	117	0.16					
Prod Cooling fans		117	0.16					
Furnace Totals:				25.3	13.9			

PHASE	PHASE BALANCING			TOTAL
	1	2	3	
LAMP PWR, kW	7.2	6.8	7.2	21.2
EH/OTHER	0.2	2.0	0.1	2.4
TOTAL	7.4	8.8	7.3	23.6

 LCI Furnaces DIVISION OF LOCHABER CORNWALL INC	DATA SHEET			DOC NBR: 16-0xx	802-101501-2	RO
	IR FURNACE SYSTEM POWER & CURRENT			MODEL: LA-309P	APVL: SLB	3/30/16
				SERIAL NBR: 1303091xxx	CONF: JMC	3/30/16
				PRINT: 06/15/16	SHT: 1	of 1
Customer:						

INPUT TABLE	Entry OK?	VALID
Enter Line Voltage: (208,220,380,400,415,480)	480 Vac	TRUE
Limit Lamps to Max Rating? (Y/N)	Y	TRUE
Line Frequency (50/60)	60 Hz	TRUE
Number of Phases:	3 Φ	TRUE
Lamp Length (6, 9, 15, 24, 36)	9 inches	TRUE
Typical Operating %	54 %	TRUE

SUMMARY OF RESULTS	
Max Power:	29.3 kW
Max Current:	35.3 A
Typical Power:	16.0 kW
Typical Current:	19.3 A

HARDWARE	
Lamps: 28	SCRs: 8
EMs: 14 LEDs	TCs: 3
EM IDC5: n/a	
Nbr strings: 14	
Nbr Lamps in 10" zone: 6	AOV-25: none AITM: none

High Power configuration

CONFIGURATION	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	Zone 6	Zone 7	Zone 8	Zone 9	Zone 10	Zone 11	Zone 12	Totals
Length (6,6,7,5,10,14,3,15,20,30) in.	7.5	15	7.5										30 in.
Length Entry OK?	TRUE	TRUE	TRUE										
(F)urn., (F)urn. (1) SCR-Zn, (D)ryer	F	F	F										3
Zone Type OK?	TRUE	TRUE	TRUE										
No. Lamps in Series/String (1-5)	2	2	2										
Lamps/String OK?	TRUE	TRUE	TRUE										
No. Lamps in Top/Bottom Power	4/4	6/6	4/4										Plenum: 120
F	F	F											
SCR PHASE	Zone 1	Zone 2	Zone 3										Lamp Balance (kW)
Top Lamp Phase (1/2/3):	1	2	3										Phase 1: 7.2
Bottom Lamp Phase (1/2/3):	1	2	3										Phase 2: 10.8
													Phase 3: 7.2
SCR POWER													<-- Vrms
Rated Lamp Voltage	216	216	216										
Max. Lamp Wired Voltage	216	216	216										
50% Power SCR Cal Span Setting	305	305	305										
Max. Lamp Wired Power (W)	900	900	900										
No. Strings per SCR	2	3	2										
Max. Current per String (A)	4.2	4.2	4.2										
No. Lamps in Zone	8	12	8										28
No. SCRs in Zone	2	2	2										6
No. Strings in Furnace Zones	4	6	4										14
													Nbr. lamp strings per element monitor: 4
Top Lamp Power (kW)	3.6	5.4	3.6										
Bottom Lamp Power (kW)	3.6	5.4	3.6										
Total Power/Zone (kW)	7.2	10.8	7.2										25.2
Current Required Top SCR (A)	8.3	12.5	8.3										
Current Required Bottom SCR (A)	8.3	12.5	8.3										
Color Temp (K) (nominal: 2500K)	2500	2500	2500										
Peak Wavelength (µm)	1.16	1.16	1.16										
Estimated Lamp Life (hrs)	6000 hr	6000 hr	6000 hr										
Lumen Output vs. Rated (%)	100	100	100										

Furnace Total	Number of Item?	Voltage (Vac)	Current (Amps)	Power (kW)		Phase Assigned	EH in EM? (y/n)	Other Items
				Max	Typical			
Lamps	28	480	as above	25.2	13.6	as above	N	10" Cabinet or CACT Fans, 117 Vac, 0.30/029 A for 50/60 Hz
PC, Monitor	0	117	1.3			1	TRUE	4" Box (Muffin) Fans, product cooling, 117 Vac, 0.16 A
Belt, Opto22, EM	1	117	2.1	0.2	0.2	1		Cross-flow Fans, product cooling, 230 Vac, 1.27 A max
UC (Pump & Gen)		117	10.0					Lower Cabinet Blowers (Impellers), 230 Vac, 0.72 A max
UC (Tank Heater)		117	8.4					H2 Igniters, 120 Vac, 5 A 24 Vdc PS, 120 Vac, 2 A
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UCD (Heater)		480	16.0					TR1: 2 TR2: 4 TR3: 2
Edg Htr 1 Length	30	480	7.8	3.7	2.0	2	OK	EH1 Ω: 124 Current: 3.9 A Cal Span: 339 Vac
Edg Htr 2 Length								EH2 Ω: Current: Cal Span:
Edg Htr 3 Length								EH3 Ω: Current: Cal Span:
Cabinet Vent Fan 10"	2	117	0.29	0.1	0.1	3	OK	Cabinet/CACT/Control Box Fans: 1.16 A
CACT Fans 10"	2	117	0.29	0.1	0.1	3	OK	
CACT Fans 4"	0	117	0.16					
Control Box Fans 4"	0	117	0.16					
Prod Cooling fans		117	0.16					
Furnace Totals:				29.3	16.0			

PHASE	PHASE BALANCING			TOTAL
	1	2	3	ALL
LAMP PWR, kW	7.2	10.8	7.2	25.2
EH/OTHER	0.2	2.0	0.1	2.4
TOTAL	7.4	12.8	7.3	27.6

**FLOWMETER
SETTINGS**

DOC NBR:	16-0xx - 802-101460-02	R0
MODEL:	LA-309P	DWN: SLB 03/31/16
SERIAL NBR:	1303091xxx	APVL: JMC 03/31/16
PRINT:	15Jun16	PM: JMC 03/31/16

PROCESS GAS

GAS1 Nitrogen

GAS2 none

SETTINGS FOR LOW O2 FLOW: SINGLE GAS MODEL
Very Low O2

Replenish Rate is the number of times/minute that the furnace (or a section of the furnace) evacuates its gas

Replenish Rate	Furnace or Section Replenishes/Hour	Time to Refresh Furnace or Section
1 times/minute	60 times/hour	60 seconds
2 times/minute	120 times/hour	30 seconds
3 times/minute	180 times/hour	20 seconds
4 times/minute	240 times/hour	15 seconds

Different sections of the furnace can be replenished at different rates, if required

Flowmeters graduated in:

sL/m (lg=RMC flowmeters, sm=small RMA flowmeters)

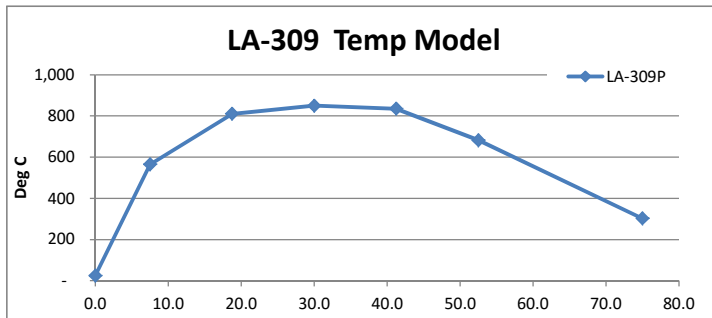
1 per Minute Replenish Rate Flow Setting

BALANCE

scfh difference => Positive pressure in furnace to purge O2
 sL/m grad incr (decr) of inflows over outflows

No.	Location	Label	deg C	Metered Gas	Size L/m	Flowmeter Rate Flow Setting sL/m grad	Desired Replenish Rate per Minute	Initial Flowmeter Setting scfh grad	Initial Flowmeter Setting sL/m grad
1	BESE Entrance barrier	ENTRANCE BAFFLE		N2	100	4.9	1.4	15	7
2	Z1 Heating chamber 1	ZONE 1	850	N2	100	3.1	16.5	107	50
3	Z2 Heating chamber 1	ZONE 2 & 3	850	N2	100	9.2	5.5	107	50
4	TTSE Exhaust Transition	TRANSITION TUNNEL	705.5	N2	100	4.6	1.5	15	7
5	CACT Cooling section	COOLING		N2	100	13.6	2.8	81	38
6	HC Heat chamber sides	LAMP SEALS		N2	100	13.6	2.8	81	38
						49	3.9	404	191

EXHAUST						distr %	scfh grad	sL/m grad
7	EEBE Entrance Stack	ENTRANCE STACK		N2	100	55%	2.7	1.3
8	EETT Transition tunnel ed	TRANS TUNNEL STACK		N2	100	45%	2.2	1.0
						100%	11.7	5.5



Furnace Balance		
Gas Inflow to furnace	426	201
Gas to Eductors	12	6
Total Gas Required	437	206
- Stack Exhaust Flow	187	88
Net inflow	250	118
Furnace internal volume	4	108

PROCESS GAS SUPPLY REQUIREMENTS				Temp °C	Press psi	Gas	scfh	sL/m
1	Gas 1	All furnace areas except CDA Mix		21	70	N2	389	183
2	Gas 2	Z2 & 3		21	70	none	0	0
				STP = 21C, 1 atm		Total	389	183