



WATKINS - JOHNSON COMPANY

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Microwave Device Products • Easylink 62602190  
Production Equipment Products • Easylink 62887411

PROCUREMENT SPECIFICATION NO. 265316  
Watkins-Johnson Model 10CR-135(S)  
Controlled Atmosphere Conveyor Furnace

January 1986

1.0 Scope This specification shall cover the manufacture of a controlled atmosphere conveyor furnace capable of operating to 600 Degrees C in an atmosphere of nitrogen. This specification shall include all items necessary to deliver a complete furnace ready for installation and connection to utilities.

2.0 Specifications

2.1 Temperature The furnace shall be capable of continuous operation to 600 Degrees C.

2.2 Muffle

2.2.1 Vertical Clearance A minimum vertical clearance of 2 inches shall be provided above the conveyor belt.

2.2.2 Heated Section A 10-3/4 inch wide muffle of 309 Stainless Steel alloy, or equal, shall be provided in the heated section. Sectioned hearth plates shall be provided in the floor of the muffle.

2.2.3 Cooling Section A 10-3/4 inch wide by 110 inch long stainless steel muffle shall be provided in the cooling section. Heat exchange shall be through clamp-on water-cooled heat sinks. The cooling section shall be provided with a water temperature/flow regulating valve and a water discharge thermometer and shall be capable of operating with either high or low pressure water systems. A water flow switch shall be provided to shut off conveyor and element power in the event of a water flow failure. The cooling section shall be insulated to prevent external condensation.

2.3 Atmosphere The furnace shall be capable of operation with nitrogen.

2.3.1 Atmosphere Inlet The furnace shall be provided with an atmosphere inlet located in the roof of the muffle in the center of the heated section.

- 2.3.2 Nitrogen Curtains The furnace shall be provided with nitrogen gas curtains at both the entry and exit ends of the furnace.
- 2.3.3 Cooling Shower A nitrogen cooling shower shall be provided in the cooling section. The cooling section shall be divided into four sections, each provided with a separate flowmeter and shall be introduced above and below the belt.
- 2.3.4 Flowmeters The furnace shall be provided with seven flowmeters; one for control of the atmosphere flow in the muffle section; one flowmeter calibrated for nitrogen shall be provided for each gas curtain, and four flowmeters calibrated for nitrogen shall be provided for the cooling shower.
- 2.3.5 Doors The furnace shall be provided with multiple flapper doors throughout the entry section and approximately 24 inches of the water-cooled exit section. Flapper door assemblies shall be designed for easy removal.
- 2.3.6 Exhaust System The furnace shall be equipped with a Venturi exhaust system providing variable exhaust capability from the exhaust outlet located at the entry end of the muffle. The exhaust system shall be provided with a binder trap and cleanout. A 4 inch diameter exhaust duct extends through the top cover near the entry end of the furnace. An air flow switch shall be provided in the exhaust duct.
- 2.3.7 Atmosphere Sample System The furnace shall be provided with atmosphere sample ports located in the pre-heat, high heat, cooling section, and the nitrogen supply to the furnace. The sample system shall consist of the following:
- o Metal bellows pump with appropriate filter.
  - o Selector valves for each location.
  - o Hygrometer, Ondyne Model #1441-D.
  - o Oxygen analyzer, Teledyne Model #316.

2.4 Furnace Chamber The furnace chamber shall be divided into the following zones.

Entry		24 inches
Zone 1	Rise	19-1/4 inches
Zone 2	Rise	19-1/4 inches
Zone 3	Rise/Stabilize	19-1/4 inches
Zone 4	Stabilize	19-1/4 inches
Zone 5	Stabilize	19-1/4 inches
Zone 6	Stabilize/Reflow	19-1/4 inches
Zone 7	Reflow	9-5/8 inches
Zone 8	Reflow	9-5/8 inches
Total Heated Length		134-3/4 inches

Cooling Section

Insulated Pre-Cooling	2 inches
Water Cooling	110 inches

2.5 Temperature/Power Controls

2.5.1 Thermocouples Three Chromel/Alumel (Type K) thermocouples shall be provided in each heated zone. Control and recording thermocouples shall be located under the hearth and shall be individually removable from the ends of the furnace. Overtemperature thermocouples shall be spring loaded under the muffle and shall be removable from the bottom of the furnace.

2.5.2 Process Controller The furnace shall be provided with a multi-channel microprocessor based temperature controller. The controller shall provide three mode temperature control with keyboard entry of setpoint, power level, proportional band, reset, rate and high-low process alarm settings for each individual zone. Belt speed control shall be accomplished through the Model WJ-988 Microprocessor Controller. Up to eight different profiles (recipes) can be stored and recalled through the keyboard. An alphanumeric one line readout is provided for belt speed, temperature, setpoint, power level, proportional band, reset, rate and high-low process alarm settings for each zone.

2.5.3 Power Controls Power to the heating elements shall be controlled through zero-firing optically isolated SCR power controllers. Separate power control shall be provided for the top/bottom and side elements.

- 2.5.4 Overtemperature Control A WJ-979 Thermoguard II Overtemperature Controller shall provide overtemperature protection in each zone.
- 2.5.5 Temperature Recorder A Leeds & Northrup Series 1650 Multipoint Recorder shall be provided to monitor each zone.
- 2.6 Heating Elements The furnace shall be provided with high temperature heating elements of Kanthal A-1 alloy, or equal. Elements shall be helically wound in shaped ceramic backplates.
- 2.7 Conveyor System
- 2.7.1 Conveyor Belt A nominal 10 inch wide Type 304 Stainless Steel alloy conveyor belt shall be provided (balanced spiral BS 48-40-17-18).
- 2.7.2 Conveyor Speed The furnace shall be provided with a variable speed conveyor drive system capable of control between 2 to 30 inches per minute. Tachometer feedback closed loop control shall be provided. Speed control accuracy shall be  $\pm 1/4\%$  over the full range. A digital readout shall be provided.
- 2.7.3 Drive System The conveyor drive system shall provide positive traction and belt alignment throughout the furnace and shall be controlled through a dc shunt wound motor.
- 2.7.4 Conveyor Belt Return The conveyor belt return shall be a roller conveyor.
- 2.7.5 Conveyor Overload Protection An adjustable slip clutch shall be provided in the drive system. A belt stop alarm system shall be provided.
- 2.7.6 Belt Cleaner The furnace shall be provided with a single brush belt cleaner.
- 3.0 Construction
- 3.1 Frame The furnace shall be constructed on a welded steel frame. Leveling pads shall be provided.

- 3.2 Panels The furnace shall be enclosed with removable panels.
- 3.3 Insulation Babcock & Wilcox K23 insulating brick and Eagle Picher PV Supertemp insulation, or equal, shall enclose the heated section of the muffle.
- 3.4 Loading/Unloading Tables A 24 inch long loading table and unloading table shall be provided. Table surfaces shall be stainless steel.
- 3.5 Control Panel All control equipment with the exception of the SCR power controllers and fuses shall be mounted in a NEMA 12 enclosure. The enclosure shall be mounted in the furnace frame near the exit end.
- 3.6 Emergency Power-Off Red mushroom emergency off switches shall be provided at both ends of the furnace, front and back, and one on the control panel.
- 3.7 Dimensions The furnace shall have the following approximate overall dimensions:
- |                      |                               |
|----------------------|-------------------------------|
| Length               | 27 feet                       |
| Width                | 40 inches                     |
| Height               | 57 inches                     |
| Conveyor belt height | 36 inches + 1 inch adjustable |
- 3.8 Convenience Outlets Two duplex 115 volt receptacles, one at each end of the furnace with 15 amp circuit breaker shall be provided.
- 3.9 Weight Approximate shipping weight is 4000 pounds.
- 4.0 Utilities The following utilities shall be provided by the customer.
- 4.1 Electrical 30 KVA maximum connected load, 440 volts, three-phase, 50/60 Hz.
- 4.2 Water 120 gph minimum at 50-70 psig.

4.3 Atmosphere

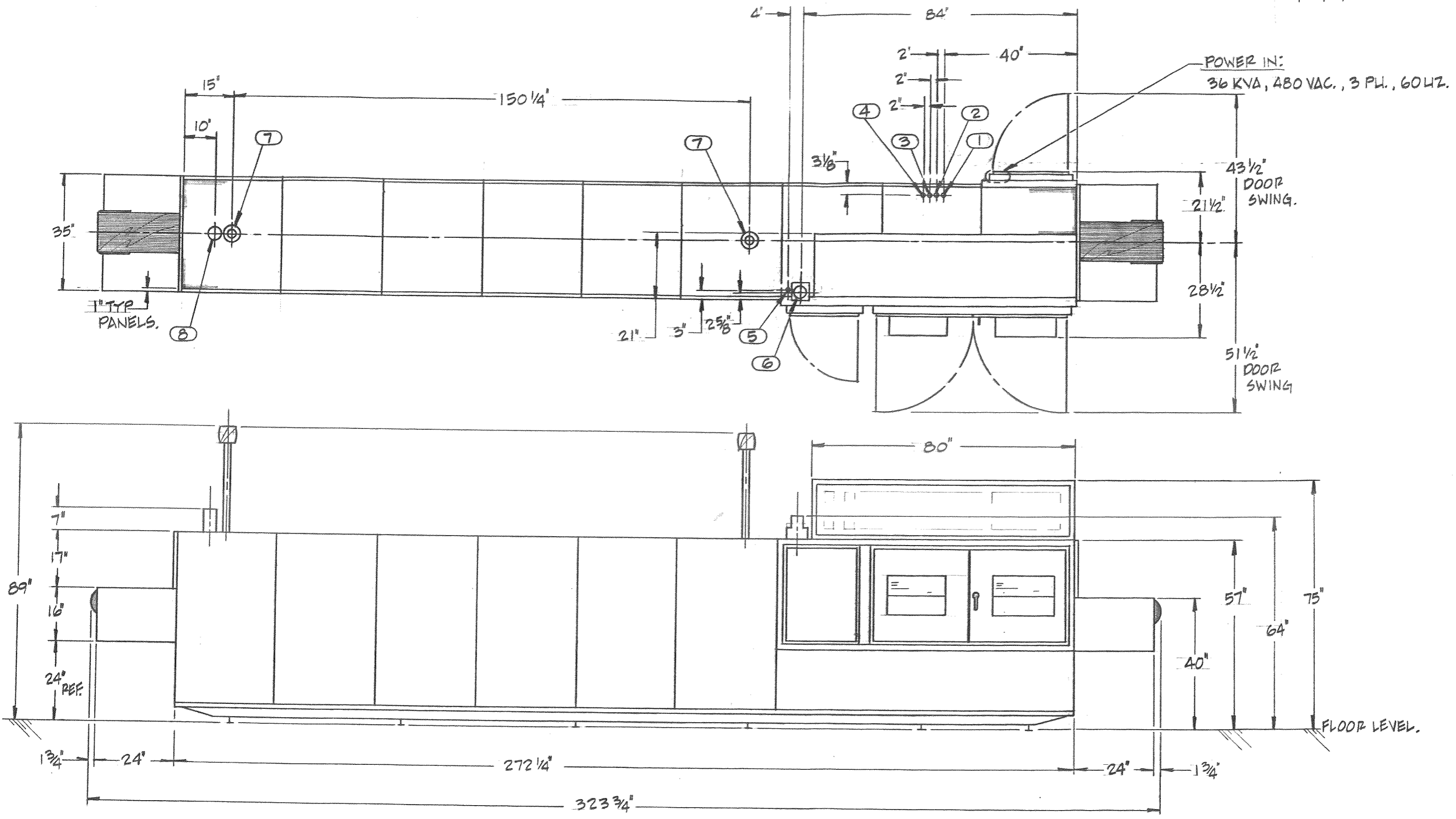
Nitrogen 800 scfh maximum at 20 psig

4.4 Utility Connections Electrical, atmosphere and water connections shall be located at the exit end of the furnace, rear side.

NOTE: Supply requirements in Paragraph 4.0 are recommended supplies and may exceed actual furnace requirements.

5.0 Documentation Three sets of Installation, Operation and Maintenance manuals shall be provided.

6.0 Codes The furnace shall comply with IBM Safety Standard CB3-0502-202, NEC and OSHA standards.



ITEM#	UTILITY IDENTIFICATION:	CONN'TN.
1	H2O IN, 60 GPH @ 50 PSIG.	3/8" FPT
2	H2O OUT.	3/8" FPT
3	N2, 800 SCFH @ 20 PSIG.	3/8" FPT
4	AUX. N2, 800 SCFH @ 20 PSIG.	3/8" FPT
5	H2, 100 SCFH @ 20 PSIG.	3/8" FPT
6	HYDROGEN ENCLOSURE VENTILATION.	4" O.D. TUBE
7	H2 BURN-OFF.	3 1/2" DIA.
8	EXHAUST VENTING.	4" O.D. TUBE

NOTES (UNLESS OTHERWISE SPECIFIED):

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES		CONTRACT NO.		NOMENCLATURE OR DESCRIPTION		MATERIAL SPECIFICATION		ITEM NO.	
TOLERANCES ARE:		APPROVALS		PARTS LIST					
FRACTIONS ± 1/32		DRAWN RRV 5/86		10CR-135 (H) FURNACE OUTLINE & UTILITY LOCATION.		WJW WATKINS-JOHNSON COMPANY		ELECTRON DEVICES, ELECTRONIC SYSTEMS	
DECIMALS ± .005		CHECKED E.T. 5-16-86		ISSUED J.C. 5-20-86		PALO ALTO, CALIFORNIA			
ANGLES ± .005		MATERIAL		SIZE		FSCM NO.		DWG. NO.	
		FINISH		D		14482		975247	
DASH NO.		NEXT ASSY		USED ON		SCALE		SHEET	
				10CR-135 (H)		3/4" = 1'-0"		23 OF 1	
APPLICATION		DO NOT SCALE DRAWING							