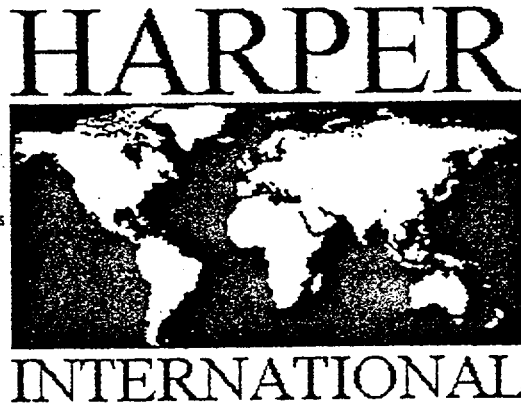


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Contract Specifications
for
Baotou Nuclear Fuel Plant
P.R. China



HARPER Tunnel Kiln Thermal System

Model No. MG-12677-PTKA-20-PR-EDD

HARPER Reference No. 961010-3

December 9, 1999

HARPER INTERNATIONAL CORPORATION

West Drullard Avenue

Lancaster, New York 14086
USA

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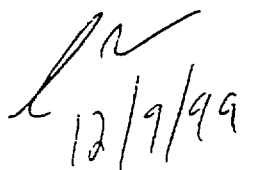
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4.0 PROCESS AND PRODUCTION PARAMETERS

- 4.1 Process Description Sintering
- 4.2 Process Material Uranium Oxide Fuel Pellets for
..... Candu style fuel
- 4.3 Process Containers, Fixtures, Furniture, Etc.

All of the listed data below was used in our assumption for sizing.

- 4.3.1 Container Molybdenum bent sheets (i.e
..... separators)
- Material Molybdenum
- Dimensions
- Width 280 mm 11 inches
- Length 133 mm 5.25 inches
- Thickness 1 mm .040 inches
- 4.3.2 Fixtures and/or Furniture Molybdenum bent sheets
- 4.3.3 Pusher Plate Per HARPER Recommendation
- Material Molybdenum
- Dimensions
- Width 305 mm 12 inches
- Length 305 mm 12 inches
- Thickness 16 mm .625 inch

4.4 Load or Charge Description

The following is a description of the individual load or charge being processed.

- 4.4.1 Dimensions, Overall
- Width 305 mm 12 inches
- Length 305 mm 12 inches
- Height 153 mm 6.0 inches

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4.4.2 Loading per Pusher Plate

Separators are placed on the pusher slab, 2 per layer, and stacked to a maximum 8 layers high. This gives a maximum boat capacity of 1344 pellets.

4.5 Process Requirements

- 4.5.1 Atmosphere Hydrogen
- 4.5.1.1 Dewpoint - 20.6°C - 5°F
- Temperatures Per sample below

4.5.2.1 Zone Profiles

The following are the design operating profiles, as measured by the zone thermocouples, for normal operation. The actual product temperature in each zone will be a function of furnace operating techniques. Based on experience and sound design practice, Harper International expects the product to achieve and be at the temperatures stated through most of the zone lengths.

Zone 1	.....	750 °C to 900 C
Zone 2	.....	750 °C to 900 C
Zone 3	.....	1650 °C to 1750 C
Zone 4	.....	1650 °C to 1750 C
Zone 5	.....	1650 °C to 1750 C

4.6 Production Requirements

Hourly 20 to 24 kg/hr

4.7 NOTE: The proposed HARPER Thermal System is based upon the above information. Further customer discussion will be required to verify that this information and the requirements specified are correct.




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*Harper Confidential Information***6.0 SUMMARY OF EQUIPMENT SPECIFICATIONS**

The proposed HARPER Thermal System shall have the following overall specifications.

6.1 HARPER Model MG-12677-PTKA-20-PR-EDD Tunnel Kiln

The proposed heating equipment shall be designed and fabricated to process material and carriers of the size, weight and configuration described in Section 4.

The proposed tunnel kiln shall consist of the following major sections and assemblies:

6.1.1 General Configuration

The kiln shall consist an entrance purge chamber, pre-heat section, high heat section, insulated cooling section, water-jacketed cooling section, exit chamber, exit purge chamber, and a material handling system. The latter does not include a return conveyor.

The kiln shall be designed and fabricated for operation under a controlled atmosphere at temperatures up to a maximum of 1800°C.

6.1.2 Entrance Purge Chamber

Material of Construction	Carbon steel
Door Locations	
Entrance Door	Right-hand side of chamber
Door Operation	Pneumatic
Flame Seal system.....	Included

6.1.3 Preheat Chamber (Zones 1 and 2)

The preheat section will incorporate a high temperature alloy muffle to effectively handle the burn-off of binders from the product. A high temperature bellows is employed to accommodate thermal expansion of the muffle assembly.

6.1.3.1 Thermal Control Zones

Number Of Individual Control Zones	Two (2)
Nominal Length of Zones(ea)	762 mm 30 inches
Nominal Length Total.....	1524 mm 60 in
Temperature Rating	900°C Maximum

6.1.3.1.1 Heat Sources

Type	NiCr resistance elements
Number of Elements	To be determined at final design

6.1.3.1.2 Thermal Insulation

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Type Insulating Fire Brick

6.1.3.1.3 Thermocouples There shall be provisions for a dual-type thermocouple through the approximate center of the sidewall in the control zone

6.1.4 Heating Chamber (Zones 3 through 5)

In order to achieve optimum temperature uniformity within the process load space, the heating chamber shall be designed with sufficient room over, under and on both sides of the load for excellent cross-radiation and reflection of heat.

6.1.4.1 Thermal Control Zones

Number Of Individual Control Zones	Three (3)	
Length Zone -3 762.0	1547 mm	30 inches
Length Zone -4 546.1	775 mm	21.5 inches
Length Zone -5 546.1	775 mm	21.5 inches
Baffles	76 mm / 3 inches thick between each control zone for good temperature control	

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Temperature Rating 1800°C Maximum

6.1.4.1.1 Heat Sources

Type Molybdenum resistance elements
Location of Elements Side walls

6.1.4.1.2 Thermal Insulation

Type 99.8% alumina hot face brick
Insulation Thickness, Nominal 368 mm 14.5 inches

High alumina insulation shall be used for the inner "hot" lining of the heating chambers to resist the effects of the reduction of silica from the use of a hydrogen atmosphere at elevated chamber temperatures.

6.1.4.1.3 Load Supporting Hearths Alumina, high purity

6.1.4.1.4 Thermocouples There shall be provisions for a single thermocouple through the approximate center of the roof in each control zone

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6.1.5 Insulated Cooling Section

The insulated cooling section shall be provided with 2-stage insulation to achieve a gradually increasing level of product cooling in order to minimize thermal shock.

6.1.5.1 1st Stage Insulated Cooling

Thermal Insulation, 1st Stage high alumina hot face

6.1.5.2 2nd Stage Insulated Cooling

Thermal Insulation, 2nd Stage high alumina hot face

6.1.5.3 Insulated Cooling Section Length

Length of 1 st Stage	406 mm	16 inches
Length of 2 nd Stage	457 mm	18 inches
Total Length of Insulated Cooling Section	864 mm	34 inches

6.1.6 Water-Jacketed Cooling Section

The final cooling stage shall be water-jacketed to reduce the product temperature to a satisfactory level before discharge into the room environment.

Material of Construction	Carbon steel
Refractory Hearth	Included
Material	Alumina, high purity
Total Length of Water-Jacketed Cooling Section	1803 mm 71 inches

6.1.7 Exit Chamber

Material of Construction Carbon steel

6.1.8 Exit Purge Chamber

Material of Construction	Carbon steel
Door Locations	
Exit Door	Right-hand side parallel to the centerline of the kiln tunnel
Door Operation	Pneumatic
Flame Seal system.....	Included

6.1.9 Material Handling

The pusher plates with their process material shall be automatically loaded into the entrance chamber, pushed through the kiln at a preset speed, and finally discharged from the exit chamber. Operation of the entrance and exit doors shall also be controlled automatically. The Purchaser shall be responsible for providing the mechanisms required to feed the raw

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product into position to be loaded into the kiln, and to remove the fired process material from the exit end discharge position.

- 6.1.9.1 Entrance Loading Pusher**
- Type of Pusher Mechanism Mechanical, roller chain and sprocket, fixed speed
- 6.1.9.2 Main Pusher**
- Type of Pusher Mechanism Heavy duty ball screw with parallel ball bushing guides rods
- Operation Adjustable, variable-speed pusher. High-speed approach & retract. SCR controlled DC drive motor and speed reducer combination *12/9/99*
- Speed, Nominal Effective Mid-range Nominal 12"/hr
- Pusher Safety Overload Device *Approx. Range. 2"/hr to 20"/hr. Included*
- 6.1.9.3 Exit Cross Pusher**
- Type of Pusher Mechanism Mechanical, roller chain and sprocket, fixed speed
- 6.1.9.4 Exit Discharge Pusher**
- Type of Pusher Mechanism Mechanical, roller chain and sprocket, fixed speed
- 6.1.9.5 Automation Control**
- 6.1.9.5.1 Graphic Status Display** Designed to provide a visual indication of electro-mechanical pusher devices within the Windows PC based system
- 6.1.9.5.2 Process Logic Controller (PLC)** Texas Instruments 545 Series (or equal)
- 6.1.9.5.3 Location** Temperature control cubicle
See Section 6.3 below
- 6.1.10 Cooling Water System**

The kiln shall be equipped with a complete cooling water distribution and drain system with individual flow control valves for each cooling circuit. The drain shall consist of one or more open, gravity receptacles. The latter provide unrestricted release of any steam pressure re-

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sulting from a water supply failure. Open drains receptacles also facilitate the measurement of effluent water flow rates and temperatures.

6.1.11 Atmosphere System

The kiln shall be equipped with a complete atmosphere distribution system. Inclusive with the package are individual flowmeters for each atmosphere inlet into the kiln. The system shall also include appropriate pressure regulators and gauges for both gases.

The system shall include a safety shut-off valve in the hydrogen input line together with a provision to replace the hydrogen flow with nitrogen in the event of a hydrogen supply failure, loss of electrical service, or a loss of adequate hydrogen supply pressure.

A humidifier is included to humidify the process gas delivered to the main tunnel inlet.

The atmosphere system shall be mounted, piped and wired on a separate, free-standing, open backed panel.

6.1.12 Tunnel Kiln Dimensions, Overall Approximate

Width	2400 mm	8 ft	
Height	2100 mm	7 ft	
Length	Approximately	13m	(To be confirmed)

Refer to General Arrangement Drawing #S-961010-03

6.2 Power System, Proportional

The power system shall be mounted and wired by HARPER in the base of the tunnel kiln, complete with all interconnecting wiring to the heating element terminals. The system shall include all circuit breakers, switches, ammeters, fusing, etc., necessary for a safe, reliable and responsive system.

6.2.1 Power System Configuration

Zone 1 & 2(Preheat two zones)	SCR/Transformer
Zones 3 through 5 (High Heat).....	SCR/Transformer

6.2.2 Power System Rating

Zone 1& 2	12 kVA (to be confirmed upon final design)
Zones 3 through 5	35 kVA (to be confirmed upon final design)
Total Connected Load	130 kVA (to be confirmed upon final design)

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6.3 PC Based Temperature Control System

Complete kiln control, monitoring, and temperature data acquisition is provided to the customer. This system will be mounted and wired by HARPER within a separate, free-standing enclosure together with all required relays, switches, status lights, alarms, etc. Thermocouples and leadwire shall also be provided as a part of the system.

- 6.3.1 Control Cubicle Nema 12, free-standing with cubicle power disconnect switch
- 6.3.2.1 PC: Human Machine Interface Pentium based PC with Windows operating system , 17" Color Monitor and large capacity hard drive.
- 6.3.2.2 Harper's Total Thermal Processing System
- The following capabilities are enabled through the PC:
- Temperature Control Set Points
 - Atmosphere System Display
 - Materials Handling Display
 - Display temperatures, target and measured values
 - Supervisory Control
 - Complete Data Acquisition, Trending and display
 - Alarm Display and Record
- 6.3.3 Thermocouples and Leadwire
- 6.3.3.1 Thermocouples
- Zone 1 & 2 One (1) Type "K", dual element thermocouple with alloy protection tube per each zone
- Zones 3 through 5 One (1) Type C thermocouple per zone for temperature control. One (1) Type "C" thermocouple with molybdenum protection tube per zone for overtemperature protection.
- 6.3.3.2 Leadwire 15 meters 49.2 ft per each thermocouple element.

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6.4 Additional Items Included

6.4.1 Spare Parts

Although HARPER makes every effort to maintain a stock of the most commonly requested spares, the diversity of components used in our equipment does not allow us to stock replacements for all components. Therefore, in order to minimize the likelihood of start-up delays or subsequent extended production stoppages, we recommend that you maintain an on-site stock of selected spares for your HARPER EQUIPMENT. The following preliminary list represents parts that will be supplied with the equipment. A complete list with pricing will be supplied on completion of the final design of the equipment.

The following quantities of components will be supplied with the contract:

- One(1) Preheat nickel-chromium heating elements
- Two (2) Firing molybdenum heating elements
- One (1) Preheat SCR
- One (1) Firing SCR
- Two (2) Dual Type "K" T/C
- Two (2) Single Type "C" T/C
- One (1) Preheat Temp Controller
- Two (2) Firing Temp Controller
- Two (2) Hearth Tiles
- One (1) Miscellaneous Fuse Kit
- One (1) High Temperature Gasket Kit

6.4.2 Customer Training at Harper International

HARPER shall train client's personnel in general maintenance and operation of the kiln system. The package includes all travel to and from Beijing and living expenses for four (4) persons of the client's selection for two (2) weeks at Harper International's Lancaster, New York plant site.

6.4.3 Start-Up Supervision

The HARPER Technician shall test all equipment systems and "fine tune" them to ensure that they are functioning smoothly and properly. Our Supervisor shall also oversee the purging (when required) and the dryout of the heating equipment. Purging involves the removal of all residual air from the interior of the heating equipment and its thermal insulation. Dryout is the process of slowly removing residual moisture from the thermal insulation. Purging (when required) and dryout are essential for successful long-term operation of the equipment. While some of these operations must be performed sequentially, others may be performed simultaneously. Our quoted price includes two (2) trips each for two (2) weeks to accomplish above. The client is responsible to provide transportation to and from the work site as well as ~~living accommodations~~ during the work.

6.5 Service and Utilities Required

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The following services and utilities are required for the proper operation of the proposed HARPER Thermal System:

6.5.1 Electric Power Requirements

Primary Power Supply	380 volts, 50 hz, 3 phase
Connected Load, Total	To be confirmed upon final Design

6.5.2 Atmosphere Requirements

Type of Atmosphere	H ₂	
Quality, Dew Point	-20.6°C	- 5°F
Supply Pressure at Equipment Site	0.35 kg/cm ²	5 psi
Flow Capacity, Combined Maximum	28.3 cmh	1000 scfh
Purge Gas	N ₂	
Quality, Oxygen and water vapor	< 5 ppm	
Supply Pressure at Equipment Site	0.35 kg/cm ²	5 psi
Flow Capacity, Combined Maximum	56.6 cmh	2000 scfh

6.5.3 Compressed Air Requirements

Supply Pressure	5.0 kg/cm ²	100 psi
Usage	7.03 kg/cm²	Nominal

6.5.4 Cooling Water

Quality	Filtered	
Supply Pressure	2.81 kg/cm ²	40 psi
Flow Capacity Recommended, Minimum	7.6 lpm	2 gpm

Note: The cooling water flow rate specified above is based upon operation at maximum rated temperatures and production levels. It is further based upon a nominal 22°C (40°F) water temperature rise together with ideal theoretical heat transfer. Water discharge temperature should not exceed 54°C (130°F) in any water-cooled circuit.

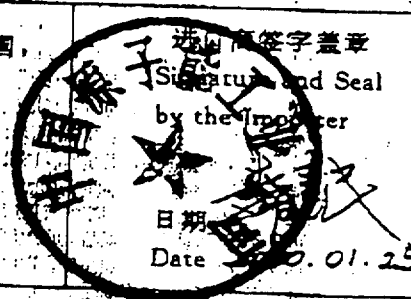
Note:

The details and dimensions specified above are subject to minor revisions upon completion of the final design.

TO: Chuck Miller

Jack Feb. 17/2000. 最终用户和最终用途说明 N° 0003210 B

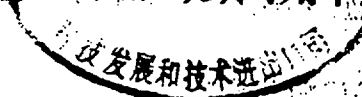
IMPORTER STATEMENT ON END-USER AND END-USE

序号 Serial No.	000097		出口国别 Country of Exporter	United States
合同类别 Title of Contract	Purchase Contract			
合同号 Contract No.	99CMAE/JF48202US	签字日期 Date of Sign.	Dec. 9, 1999	
进口商名称 Name of Importer	China Nuclear Energy Industry Corporation			
出口商名称 Name of Exporter	Harper International Corporation			
最终用户 End-user	Baotou Nuclear Fuel Element Plant			
最终用途 End-Use	Sintering CANDU Fuel Pellet for the use of Nuclear Power Plant			
说明 Statement	<p>下列商品用于中华人民共和国， 不向第三国转口 The commodities listed below is for use in the People's Republic of China and not for re-export to the third country.</p>		<p>进口商签字盖章 Signature and Seal by the Importer 日期 Date 2000.01.25</p> 	
序号 No.	商品名称 Commodities and Descriptions	数量 Quantity	金额 Value	
1	Harper Tunnel Kiln Thermal System MG-12677-PTKA-20-PR-EDD	2	USD.1,220,000.	
		总金额 Total	USD.1,220,000.	

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司长(副司长)

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