



BHA do Brasil Ltda.

64 Q 31

64 Q 34



## CELULOSA ARAUCO Y CONSTITUCIÓN

Rua da Barra, 517 - Cotia - SP - CEP 06700-000 - Brasil  
Fone +55 11 4616 3656 - Fax +55 11 4616 0168  
BHA Kansas City - Fone toll free 000 811 524 0552



**Arauco**

Celulosa Arauco y  
Constitución S.A.  
PLANTA CONSTITUCION

Nº SII/212/98

## MEMORANDUM

A Jefe Abastecimiento y Bodega  
DE Superintendente de Ingeniería

DIA	MES	AÑO
20	05	98

Ref P-AUMENTO DE CAPACIDAD PRECIPITADORES  
ELECTROSTATICOS.

En relación con la referencia adjunto, para su información y archivo, copia de Orden de Compra N°064-4561 C1 por aumento de capacidad de precipitadores electrostáticos Caldera Recuperadora.

Atentamente,

Héctor Moreno V.



HMV/jmr

Memo Anexo

cc:	GPC	✓	
	SGP-SGM-SGA	✓	
	SIM-SIEC-SIER	✓	✓
	SII	✓	✓
	R. Anabalón	✓	✓
	Archivo	✓	



DISTRIBUTION LIST

1/28

DATE: 12/05/98.

Area 064

PURCHASE ORDER N° 064-4561 c 1

DISTRIBUTION:

Hernán Arriagada  
Max Constanzo  
Patricio Henríquez  
Carlos López

✓  
...  
✓  
...  
✓  
...

Arauco Mill  
Guillermo Riedel

...

Constitución Mill  
Hector Moreno

✓  
...

Purchasing PO file

✓  
...

Circle Freight Int'l., by fax (Toronto)  
Circle Int'l. Chile (Santiago)

✓  
...  
✓  
...

U. Tryggvesson  
D. Whelan  
R. Salvo  
B. Besteman

...  
✓  
...  
✓  
...





CELULOSA ARAUCO Y CONSTITUCION S.A.  
AVDA. VITACURA 2771 - OF.:905 SANTIAGO-CHILE  
Phone (56 2) 560-6700 FAX (56 2) 236-5090

PURCHASE ORDER N° 064-4561 C1

DATE 11 MAY 1998  
PAGE 1 OF 2

PLEASE SUPPLY FOR THE ACCOUNT OF AND INVOICE IN THE NAME OF:

CELULOSA ARAUCO Y CONSTITUCION S.A.  
AVDA. VITACURA 2771 - OF.:905  
SANTIAGO-CHILE  
PROJECT N°1421  
RUT: 93.458.000-1

TO BHA GROUP, INC.  
8800 EAST 63RD STREET  
KANSAS CITY, MO 64133  
U.S.A.

P.R.No 064 4561 00 P.I. REF No561

Atn: Mr. José J. Suárez  
Tel: 816-356-8400  
Fax: 816-353-1873

SHIP VIA: OCEAN FREIGHT  
AS DIRECTED BY FREIGHT  
FORWARDER DESIGNATED

SHIP TO:  
CELULOSA ARAUCO Y CONSTITUCION S.A.  
CONSTITUCION PRECIPITATORS UPGRADE  
PROJECT  
CONSTITUCION MILL

HEREIN CIRCLE INTERNATIONAL  
2385 MATHESON BOULEVARD, EAST  
MISSISSAUGA, ONTARIO, CANADA  
L4W 5B3  
PHONE: 905-2380302  
FAX: 905-2381666  
Atn: Mr. Klaus Joerg

P.R. ITEM	<p>PLEASE SUPPLY THE FOLLOWING, SUBJECT TO CONDITIONS INDICATED ON ACCOMPANYING PAGES OF TERMS AND CONDITIONS, ENCLOSURES, SPECIFICATIONS AND DRAWINGS:</p> <p style="text-align: center;"><u>CONFIRMING NOTICE OF AWARD DATED</u></p> <p>This Procurement Agreement is dated as of the 28 April '98, by and between Celulosa Arauco and Constitución S.A. (hereinafter called "OWNER") and BHA Group, Inc. (hereinafter called "VENDOR").</p> <p>OWNER and VENDOR, in consideration of the mutual covenants hereinafter set forth, agree as follows: To supply and deliver Ex-works BHA Group, Inc. warehouse, for installation in Constitución Plant.</p> <p>1. <u>PROCUREMENT AGREEMENT DEFINED</u></p> <p>This Procurement Agreement together with the procurement documents listed below and annexed hereto:</p> <p>- Proposal N°: I-00463A9 revised 29 April '98</p> <p>shall constitute together the entire agreement between the parties for the Goods to be supplied and shall be together hereinafter referred to as the "Purchase Order" or "P.O."</p> <p>This Procurement Agreement shall have precedence over all other Procurement Documents.</p>
-----------	---

ACKNOWLEDGEMENT AND ACCEPTANCE BY VENDOR:

I (WE) \_\_\_\_\_  
(AUTHORIZED REPRESENTATIVE)

hereby accept this Purchase Order solely on the terms and conditions set forth herein  
FORM HAS-3451C-1

BY

  
CELULOSA ARAUCO Y CONSTITUCION S.A.

PLEASE ACKNOWLEDGE BY SIGNING AND RETURNING A PHOTOCOPY OF THIS PURCHASE ORDER.



CELULOSA ARAUCO Y CONSTITUCION S.A.  
AVDA. VITACURA 2771 - OF.:905 SANTIAGO-CHILE  
Phone (56 2) 560-6700 FAX (56 2) 236-5090

PURCHASE ORDER N° 064-4561 C1

DATE 11 MAY 1998  
PAGE 2 OF 2



P.R. ITEM	PLEASE SUPPLY THE FOLLOWING, SUBJECT TO CONDITIONS INDICATED ON ACCOMPANYING PAGES OF TERMS AND CONDITIONS, ENCLOSURES, SPECIFICATIONS AND DRAWINGS		
	<u>SCOPE OF SUPPLY</u>	<u>UNIT PRICE</u>	<u>TOTAL PRICE</u>
1 1 lot	GOODS AND SERVICES TO UPGRADE Q-31 AND Q-34 PRECIPITATORS AS PER BHA PROPOSAL N° I-00463A9 REVISED APRIL 29, 1998	800,000.00	800,000.00
	TOTAL PRICE EX-WORKS		USD800,000.00
	<u>DELIVERY</u> : TO BE ON SITE BY JULY 24, 1998 <u>SHIPDATE</u> : JUNE 17, 1998 IN U.S. PORT		
	<u>TERMS OF PAYMENT</u>  NET 30 DAYS ON INVOICE DATE , IN ACCORDANCE WITH THE FOLLOWING SCHEDULE:  30% ON COMPLETION OF ENGINEERING AND SUBMISSION OF CFC (INSTALLATION) DRAWINGS. 10% ON ALL MATERIALS IN THE SHOPS. 40% ON SHIPMENT AND PRESENTATION OF FREIGHT FORWARDERS RECEIPT. 20% ON SUCCESSFUL START-UP AND ACCEPTANCE BY CLIENT (IN THE EVENT THE EQUIPMENT FAILS TO MEET THE SPECIFICATIONS SET FORTH IN THIS PROPOSAL WITHIN FOUR (4) MONTHS AFTER START-UP THIS 20% WILL BE RETAINED AS PAYMENT FOR NON COMPLIANCE. TEN (10%) OF THIS AMOUNT WILL BE PAID, IF ONLY ONE UNIT DOES NOT MEET THE SPECIFIED PERFORMANCE).		

8800 EAST 63RD STREET  
KANSAS CITY, MO 64133

Phone: 816-356-8400  
Fax: 816-353-1873

4/

PROJECT: CELULOSA ARAUCO Q31 AND Q34 ESP'S

DATE: 4/29/98

TO: SIMONS - CADE  
C/O CELULOSA ARAUCO Y CONSTITUCION  
SIMONS - CADE  
SANTIAGO,

REF: 509-2076

ATTN: Brian Besteman

WE ARE SENDING:	SUBMITTED FOR:	ACTION TAKEN:
<input type="checkbox"/> Shop Drawings	<input type="checkbox"/> Approval	<input type="checkbox"/> Approved as Submitted
<input type="checkbox"/> Letter	<input checked="" type="checkbox"/> Your Use	<input type="checkbox"/> Approved as Noted
<input type="checkbox"/> Prints	<input type="checkbox"/> As Requested	<input type="checkbox"/> Returned After Loan
<input type="checkbox"/> Change Order	<input type="checkbox"/> Review and Comment	<input type="checkbox"/> Resubmit
<input type="checkbox"/> Plans		<input type="checkbox"/> Submit
<input type="checkbox"/> Samples	SENT VIA:	<input type="checkbox"/> Returned
<input type="checkbox"/> Specifications	<input checked="" type="checkbox"/> Attached	<input type="checkbox"/> Returned for Corrections
<input checked="" type="checkbox"/> Other: Answers & Revised prop	<input type="checkbox"/> Separate Cover Via:	

ITEM NO.	COPIES	DATE	ITEM	NUMBER	DESCRIPTION	STATUS
1	1	4/29/98	ANS		Verification of performance guarantee with 18 g/Nm3 loading	
2	1	4/29/98	ANS		Electrical loadings for Q31 & Q34 precipitators	
3	1	4/29/98	CHU		Revised proposal inlet loading changes	

Remarks: Attached you will find the electrical loadings for precipitators Q31 & Q34 as well as the revised performance for an inlet loading of 18 g/Nm3. Please call if you have any questions.

Signed:

*Bob Round*  
Bob Round





# MEMO

5/

To: Bob Round  
From: Bob Taylor  
CC: Phil Roberts, Jose Suarez, Claudio Perez-Korinko, Brian Phelan  
Date: April 29, 1998  
Subj: Celulosa Aracuo increased inlet dust loading

We have reviewed the estimated outlet emissions based on increasing inlet dust loading from 14 g/Nm<sup>3</sup> as stated in our proposal to 18 g/Nm<sup>3</sup>.

Our data indicates that a non-contact recovery boiler precipitator with an SCA of 407 ft<sup>2</sup>/1000 ACFM should provide collections efficiencies in the range of 99.7% to 99.91%. To achieve an outlet emission of 50 mg/Nm<sup>3</sup> at the new inlet dust loading, we need a collection efficiency of over 99.72%. If we provide a safety margin beyond the minimum required efficiency, our efficiency will still occur towards the lower end of the expected values. For this reason we agree that the inlet dust loading can increase without affecting our performance warranty.

Bob Taylor

[illegible]



Celulosa Arauco y Constitución S.A.

[illegible]

load

4/29/98

4/29/98



April 29, 1998

Celulosa Arauco y Constitución S. A.  
C/O Simons-Cade  
Vitacura 2771 PISO9  
Las Condes  
CHILE

BHA Group, Inc.  
8800 East 63<sup>rd</sup> Street  
Kansas City, Missouri USA 64133-4883  
+1 816 356 8400  
Fax +1 816 353 873  
[www.bhagroup.com](http://www.bhagroup.com)  
SALES 800 821 2222

Attn: Mr. Brian Besteman, Gerente De Compras

Proposal No: I-00463A9  
Revised April 29, 1998

Dear Mr. Besteman:

This confirming proposal summarizes the agreements that were made during the meetings that were held at the Constitucion plant and your offices between April 22 to April 24, 1998. Based on our verbal notice to proceed on April 24, 1998, we are proceeding with engineering, procurement, and manufacturing of components for the Q-31 and Q-34 precipitators.

It is our understanding that a written contract will be received from Celulosa y Constitucion, S.A. not later than May 4, 1998.

This proposal includes an option for the Q-35 precipitator. As discussed with plant and engineering and construction personnel.

Per our conversations this morning, the following are additional commitments that we have made for this order, in regards to engineering data:

- Provide the estimated electrical loads for the precipitators: April 30, 1998
- Provide estimated material take - off for items to be fabricated in Chile by Celulosa Arauco y Constitucion, S.A.: May 31, 1998 (Latest)
- Provide structural drawings for items to be fabricated in Chile by Celulosa Arauco y Constitucion, S.A.: June 15, 1998

The schedule for the project is shown in appendix II. The agreed price for engineering, goods, and services the Q - 31 and the Q - 34 precipitators is \$ 800,000 USD. This price includes:

- BHA engineering
- Materials for the Q - 31 and the Q - 34 precipitators

- One - hundred and eight (108) on site days for erection and supervisor assistance (i.e. - Construction Management Services). Assistance over one - hundred and eight (108) days will be billed per the rates listed in appendix III.

The above listed price does not include freight (including in land consolidation in the U.S.), duties, and/or taxes.

### Scope of Supply

To collect particulate from the recovery boiler precipitator, BHA proposes to furnish controls, energization, and key components to re-build the existing electrostatic precipitators. Our scope of supply includes engineering furnished by BHA, to enable Celulosa Arauco to locally fabricate the casing extension panels, hot roof, cold roof, roof beams, insulator compartments access ladders and stairs, and the inlet and outlet nozzles/ducts/ expansion joint modifications.

### Process Parameters

The design conditions used for the rebuilt precipitators are as follows

Description	Q31 & Q34	Q35
Gas Volume, Am <sup>3</sup> /hr.	151,500 each	229,000
Gas Temperature, °C	200	200
Gas Moisture content, %	22	22
ESP inlet dust concentration, g/Nm <sup>3</sup> (wet)	<u>18</u>	<u>18</u>
ESP outlet dust emission, mg/Nm <sup>3</sup>	100	100

The "expected" combined stack outlet emissions without rebuilding the Q-35 precipitator will be 150 mg/Nm<sup>3</sup>. Due to the unknown condition of the Q-35 precipitator we cannot guarantee this value.

### Existing configurations vs. modified configurations

#### Existing Precipitator Configurations:

This proposal is based on the following assumptions regarding the size of the existing precipitators:

Description	Q31 & Q34	Q35
Number of precipitators	2	1
Number of chambers per precipitator	1	1
Gas passage width, mm.	250	250/300
Number of gas passages	24	24/20





Number of mechanical fields	2	3
Collecting plate dimensions	3.5m W x 7.2m T	4.0m W x 7.2m T
Number of electrical sections	2 total	3 total
Number of T/R sets	2 total	3 total
T/R set ratings	64kV, 800 mA all	70kV, 400 mA 1 80kV, 600 mA 2 80kV, 600 mA 3

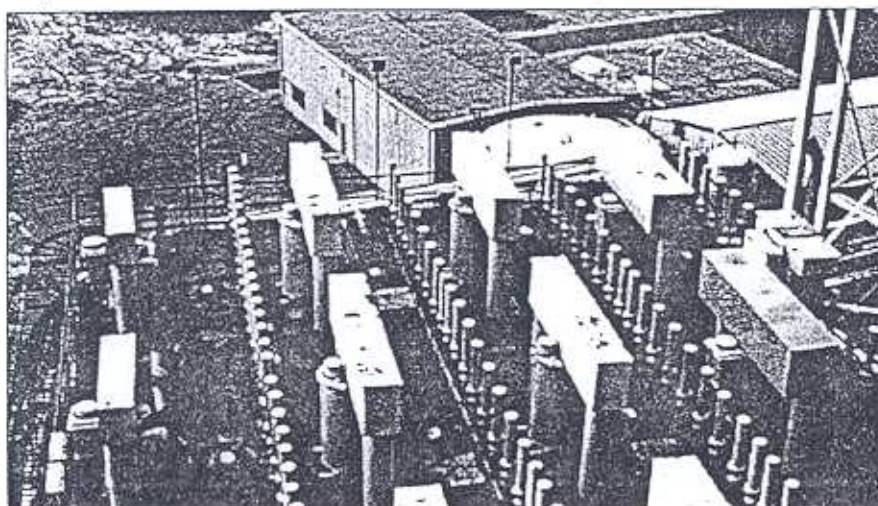
Key Operating Parameters		
SCA, m <sup>2</sup> / (m <sup>3</sup> /sec) @ 300 mm	50	75
Gas velocity, m/sec	0.90	1.2
Treatment length, m	7	12
Treatment time, sec.	7.5	10
Aspect ratio	0.97	1.67

### BHA Rebuilt Precipitator Configurations:

The proposed configurations for the rebuilt precipitators are:

Description	Q31 & Q34	Q35
Number of precipitators	2	1
Number of chambers per precipitator	1	1
Gas passage width, mm.	300	300
Number of gas passages	20	20
Number of mechanical fields	2	3
Collecting plate dimensions	4mWx10.4mT	4.5mWx10.4mT
Number of electrical sections	4 total	6 total
Number of T/R sets	4 total	6 total

Key Operating Parameters		
SCA, m <sup>2</sup> / (m <sup>3</sup> /sec) @ 300 mm	80	87
Gas velocity, m/sec	0.7	1.1
Treatment length, m	8	13.3
Treatment time, sec.	12	13.25
Aspect ratio	0.8	1.3



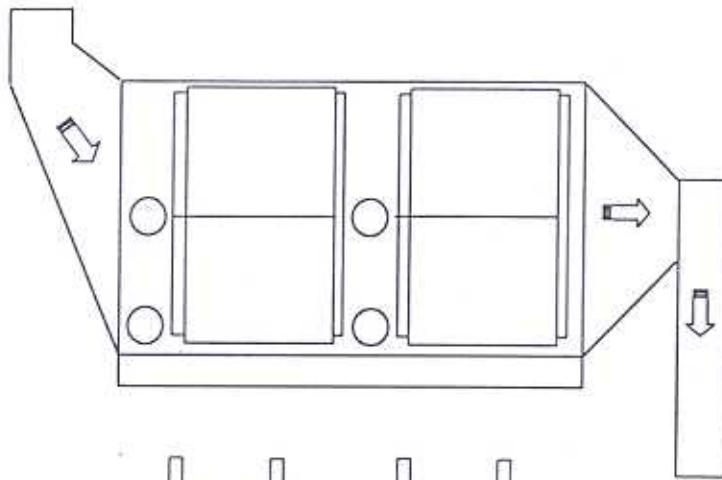


### Conceptual modification schematics

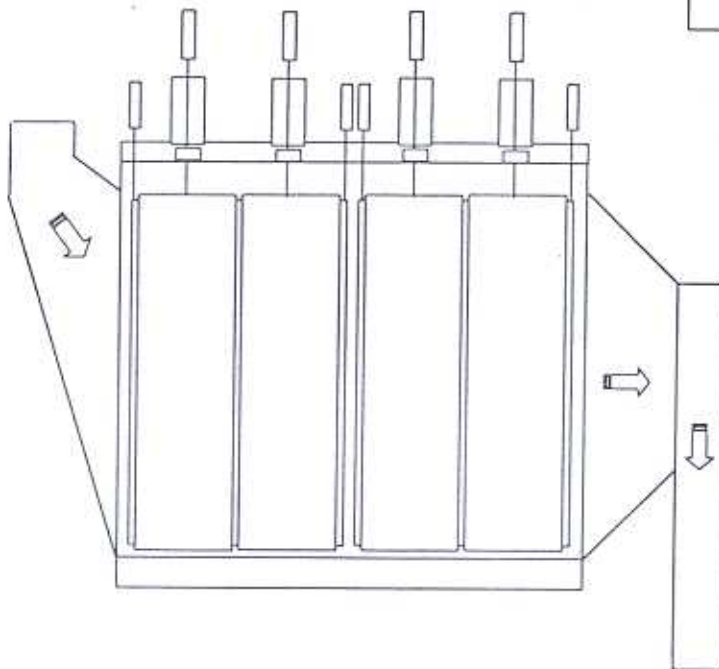
Below, both existing and proposed architectures are shown. As it can be seen, all internal space is utilized, plate heights are increased, and a sectionalization is only possible through the top rapping architecture.

Maintenance is achieved through the upper compartment and through the lower pan. Access is provided through roof mounted access hatches.

Existing  
Configuration



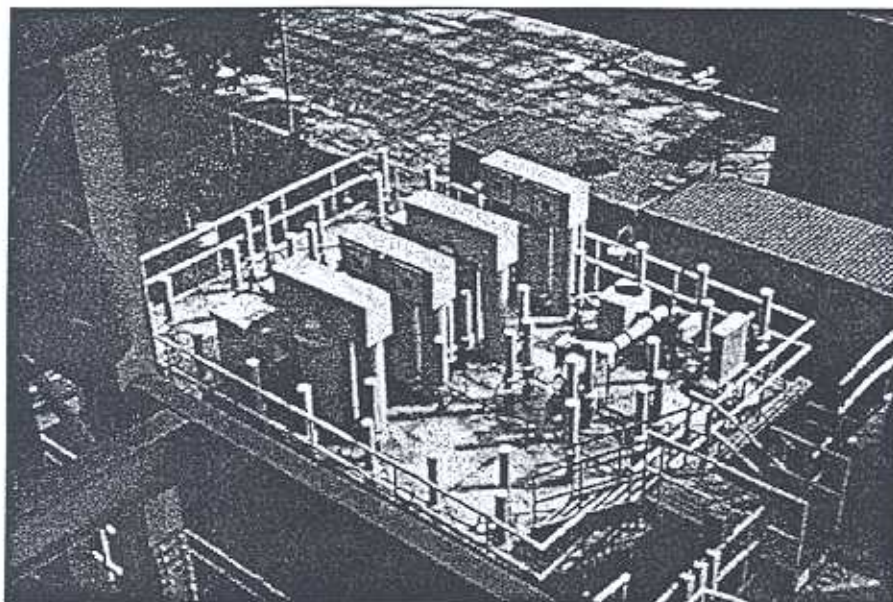
Modified  
Configuration



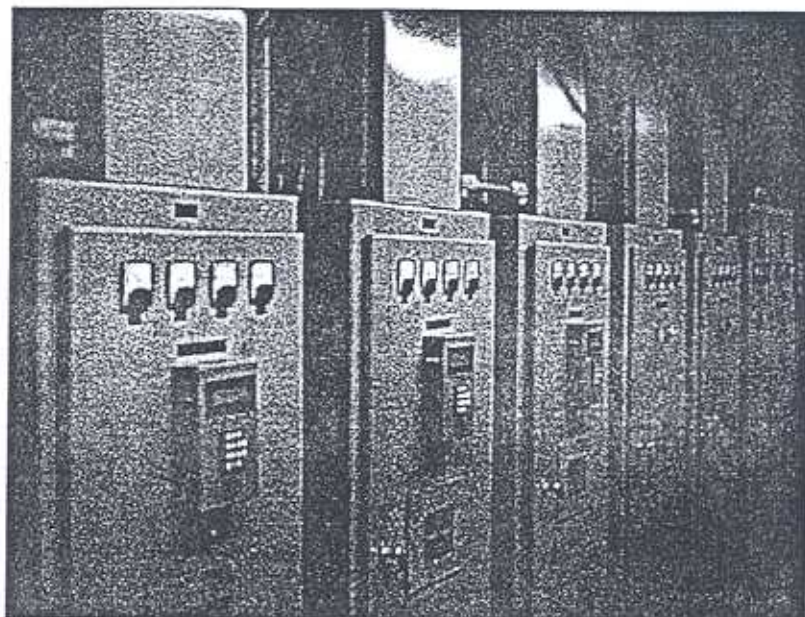


12/

Top Mounted Rapping Systems and Transformer Rectifiers



Centralized State-of-the-Art Energization & Rapping Supervisory Control System





13/

### Engineering and Materials Sourcing

It is our intent to furnish all design engineering and smart parts for the rebuilding of the existing precipitators. Celulosa Arauco shall be responsible for all structural steel, foundation/footing design, installation, electrical load centers, electrical wiring, thermal insulation and cladding, installation labor and equipment, and locally fabricated steel components as detailed below.

#### **Base Proposal Scope Per Precipitator**

1. Engineering & Design Scope	By BHA	By Arauco Or Reuse
• Precipitator Internals	X	
• Precipitator Casing Modifications	X	
• Precipitator Hoppers	X	
• Precipitator Conveyors	X	
• Precipitator Supports	X	
• Precipitator Nozzles	X	
• Precipitator Insulation		X
• Precipitator Electrical High Voltage	X	
• Precipitator Electrical Low Voltage Interconnection diagrams and single line drawings	X	
• Precipitator Lighting		X
• Electrical Power Installation Drawings		X
• Electrical Power Supply		X
• Purge Air System	X	
• Foundations/Supports	X	

14/

2. Equipment Supply Scope (continued)	By BHA	By Arauco Or Reuse
<ul style="list-style-type: none"> <li>Collector Plate System                             <ul style="list-style-type: none"> <li>Collecting plates</li> <li>Bolts, Nuts, Washers</li> <li>Collecting surface suspension frame.</li> <li>Collecting surface suspension bars.</li> <li>Hanger bolts, anvil beams</li> <li>Collecting surface steadying frames</li> <li>Adjusting bolt, side spacers</li> <li>Anti-sneak, leading/trailing edges</li> </ul> </li> </ul>	X	
<ul style="list-style-type: none"> <li>Collector Plate Rapper System                             <ul style="list-style-type: none"> <li>EGR with plunger 120 volt coil</li> <li>Adjusting bolts. 13"</li> <li>Nipple with flange, 83in. tall</li> <li>Seal plate 6 x 6 4.625" hole</li> <li>Cast guide, rapper shaft</li> <li>Boot seal, Hypalon</li> <li>Clamp stainless steel</li> <li>Clamp stainless steel</li> <li>Ground strap, 2-leg</li> <li>Anvil shoe, cast steel</li> <li>Shaft single taper</li> <li>Safety Wire</li> </ul> </li> </ul>	X	
<ul style="list-style-type: none"> <li>Roof Access Doors</li> </ul>	X	
<ul style="list-style-type: none"> <li>Key Interlocks</li> </ul>	X	
<ul style="list-style-type: none"> <li>High Voltage Bus and Guard</li> </ul>	X	
<ul style="list-style-type: none"> <li>Purge Air System</li> </ul>	X	
<ul style="list-style-type: none"> <li>Precipitator Gas Distribution Devices</li> </ul>	X	

15/

2. Equipment Supply Scope (continued)	By BHA	By Arauco Or Reuse
<ul style="list-style-type: none"> <li>• High Voltage Discharge System               <ul style="list-style-type: none"> <li>• RDE-1 rigid electrode, V-pin</li> <li>• RDE-1 rigid electrode, opposed pin</li> <li>• Mounting hardware</li> <li>• High Voltage Support Frame</li> <li>• High Voltage Support Frame Hanger</li> <li>• Hanger Bolts</li> <li>• Lower Stabilizer frame</li> <li>• Support Insulator mounting plate</li> <li>• Support Insulators</li> <li>• Support Insulator gaskets</li> <li>• High Voltage hanger support plates</li> <li>• Cover Plates with purge nozzles</li> <li>• Lower Frame Stabilizers</li> <li>• Lifting bolts</li> </ul> </li> </ul>	X	
<ul style="list-style-type: none"> <li>• High Voltage Rapping System               <ul style="list-style-type: none"> <li>• EGR with plunger 120 volt coil</li> <li>• Adjusting bolts. 13"</li> <li>• Nipple with flange, 6" tall</li> <li>• Seal plate 6 x 6 4.625" hole</li> <li>• Cast guide, rapper shaft</li> <li>• Boot seal, Hypalon</li> <li>• Clamp stainless steel</li> <li>• Clamp stainless steel</li> <li>• Ground strap, 3-leg</li> <li>• Anvil shoe, cast steel</li> <li>• Shaft double taper, 4'-10 3/4"</li> <li>• Adapter, double taper</li> <li>• Shaft, rapper insulator shaft, G-10 30</li> <li>• Retainer wire</li> <li>• Shaft, single taper</li> </ul> </li> </ul>	X	



16/

2. Equipment Supply Scope (continued)	By BHA	By Arauco Or Reuse
<ul style="list-style-type: none"> <li>Transformer/Rectifiers                             <ul style="list-style-type: none"> <li>All actual 7 T/Rs will be used</li> <li>2 new T/Rs for Q-31</li> <li>2 new T/Rs for Q-34</li> <li>3 new T/Rs for Q-35</li> </ul> </li> </ul>	X	Reuse existing
<ul style="list-style-type: none"> <li>T/R Controllers - SQ-300                             <ul style="list-style-type: none"> <li>7 to replace all existing controllers</li> <li>7 for the 7 new T/Rs</li> </ul> </li> </ul>	X	
<ul style="list-style-type: none"> <li>Control Cabinets                             <ul style="list-style-type: none"> <li>1 complete double stack cabinet for Q-31</li> <li>1 complete double stack cabinet for Q-34</li> <li>1 complete double stack cabinet for Q-35</li> <li>1 half filled double stack cabinet for Q-35</li> </ul> </li> </ul>	X	
<ul style="list-style-type: none"> <li>Rapper Control System, PRC-100                             <ul style="list-style-type: none"> <li><u>One PRC-100 Rack mounted computer for all three Precipitators</u></li> </ul> </li> </ul>	X	
<ul style="list-style-type: none"> <li>VI-CLRs/CLRs                             <ul style="list-style-type: none"> <li>2 VI-CLRs for Q-35 Fields 1 &amp; 2</li> <li>1 CLR for Q-35 Field 3</li> <li>Reuse 3 exist. CLRs for Q-35 Fields 4,5 &amp; 6</li> <li>2 VI-CLRs for Q-31 Fields 1 &amp; 2</li> <li>Reuse 2 exist. CLRs for Q-31 Fields 3 &amp; 4</li> <li>2 VI-CLRs for Q-34 Fields 1 &amp; 2</li> <li>Reuse 2 exist. CLRs for Q-34 Fields 3 &amp; 4</li> </ul> </li> </ul>	X	Reuse existing
<ul style="list-style-type: none"> <li>Supervisory Computer System, Win DAC                             <ul style="list-style-type: none"> <li><u>One Win DAC Rack mounted computer for all three Precipitators</u></li> </ul> </li> </ul>	X	
<ul style="list-style-type: none"> <li>Precipitator Supports</li> </ul>		X
<ul style="list-style-type: none"> <li>Precipitator Hoppers</li> </ul>		X

17/

2. Equipment Supply Scope (continued)	By BHA	By Arauco Or Reuse
• New Precipitator Inlet Nozzle		X
• New Precipitator Outlet Nozzle		X
• Inlet gas turning vanes		X
• Precipitator Wall Extensions		X
• Precipitator Hot Roof		X
• Precipitator Insulator Compartments		X
• Precipitator Cold Roof		X
• Precipitator Top End Frames		X
• Precipitator Intermediate Roof Beams		X
• Precipitator Hopper Conveying System		X
• Precipitator Hopper Discharge Valves		X
• Precipitator Access Ladder Extensions, Platforms, Stairways, Bracing		X
• Precipitator Foundations		X
• Precipitator Insulation		X
• High /Low Voltage Wiring, Grounding etc.		X
• Precipitator Construction		X
• Electrical Power Supply		X
• Electrical & Controls Training	X	



## **Main Systems description**

### **Collecting System**

Collecting plates fabricated from 18 gauge cold rolled low carbon steel shall be furnished for this project. The top support beam for each plate assembly shall bolt at the leading and trailing edge to reinforced rapping channels. The channels are suspended from the roof beams by means of high strength support rods, two per channel.

Each field of collecting plates is guided at the bottom leading and trailing edge by means of a side spacer bar. This will maintain the electrical clearances.

### **Collecting Rapping System**

Rapping is introduced through the support channels at both the leading and trailing edge of each panel assembly. A tapered steel shaft inserted into a tapered cast steel receptor welded to the top of the support channel extends upwards through the hot and cold roof. At each point of penetration, a nipple and Hypalon boot seal assembly is provided. Each of the rapper positions utilizes a 120V EGR electromagnetic impact rapper.

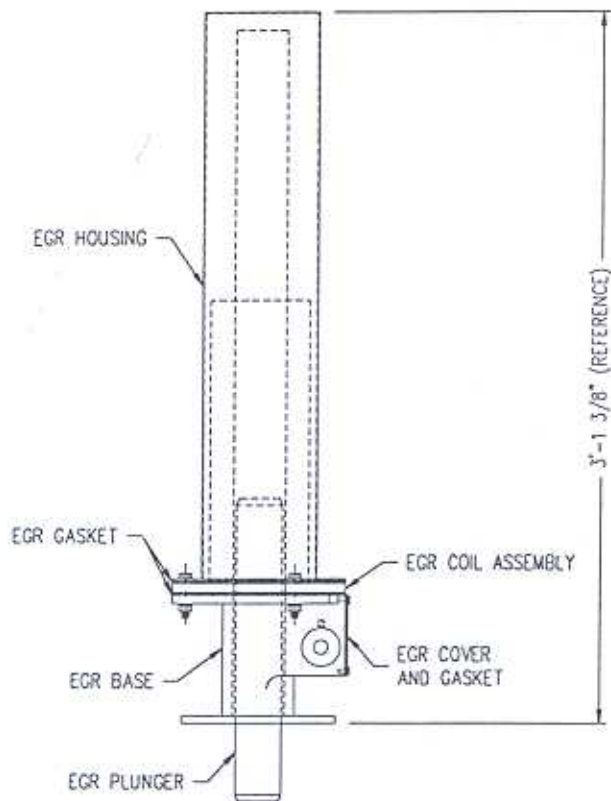
### **Electromagnetic Gravity Impact Rappers**

One of the most commonly applied methods for cleaning collecting surfaces and rigid electrodes is the electromagnetic gravity impact rapper. Reliable in service and able to provide consistent, adjustable cleaning force, the impact rapper is an excellent choice. The BHA Group Inc. design of this rapper is called an EGR. Our EGR is built around a coil wound from copper wire encapsulated in epoxy. The phenolic tube around which the coil is wound furnishes a uniform low friction guide for the plunger. The coil assembly is mounted in a cast iron base that serves as a mounting flange and termination enclosure for the interconnecting wiring. A removable top cover encloses the coil. Gaskets seal all covers. If a coil should fail, the defective coil can be replaced without disturbing the mounting bolts. This prevents the need to readjust the rapper. Other manufacturers provide a throwaway impact rapper. If the coil fails, the entire rapper assembly, as well as the mounting bolts, needs to be replaced. This will require the coil to be leveled and the height to be re-established whenever the replacement is performed.

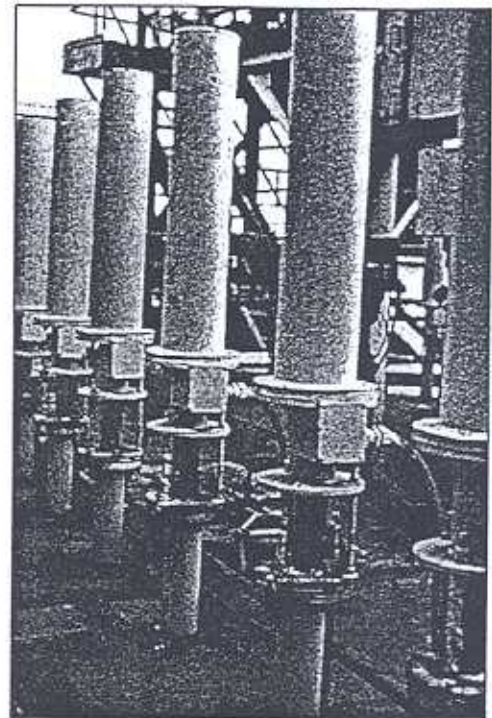
The EGR BHA Group Inc. is offering a unit built for reliability and durability with provisions incorporated for its repair and adjustment.



19/



ELECTROMAGNETIC GRAVITY RAPPER



## High Voltage System

The RDE-1 rigid electrode is utilized to generate high voltage corona in this design. It is intended to provide "V" pin configuration electrodes in the first electrical field and opposed pin electrodes in the remaining fields. Each electrode is suspended at the top from a high voltage support frame. Two high voltage frames are provided for each mechanical field. Each high voltage frame is suspended from two pipe hangers that extend through alumina support insulators.

## RDE-1 Rigid Electrode

The RDE-1 rigid electrode is fabricated from 16-gauge cold rolled steel round mechanical tubing. Copper coated, fully annealed low carbon steel emitter pins (each individually formed with a precise corona generation surface) are automatically welded to the tubular body of the electrode. The microprocessor-based automatic welding machine utilizes a drawn arc capacitor discharge welding technique to fuse the pins to the tube. This method consistently produces superior quality welds when compared to a capacitor discharge weld. The equipment controls (rather than the geometry of the components, as in a capacitor discharge-welding device)

determine the weld integrity of a drawn arc capacitor discharge weld. BHA Group manufacturing standards allow "zero" missing pins on electrodes prior to shipment.

Computerized controls on the welding machine allow the relative geometry and spacing of the emitter pins to be tailored to the process requirements. In this manner, a rigid electrode can be produced that matches the varying current density requirements in precipitator electrical fields.

Special consideration has been given to the mounting technique used at the lower end of the electrode. While a rigid bolted connection at the top of the electrode poses no major concerns, a similar connection at the bottom can create serious problems. Rigid electrodes are, as their name implies, not flexible. When subjected to linear loads (thermal expansion, for example) and fixed at each end, the electrode will deflect away from its center line. This deflection reduces electrical clearances. To avoid bowing, BHA Group Inc. incorporates a slotted mounting hole at the bottom connection. The slot, in conjunction with a bolted connection that is only snug and not tight, allows for the electrode to grow and relieve linear stresses.

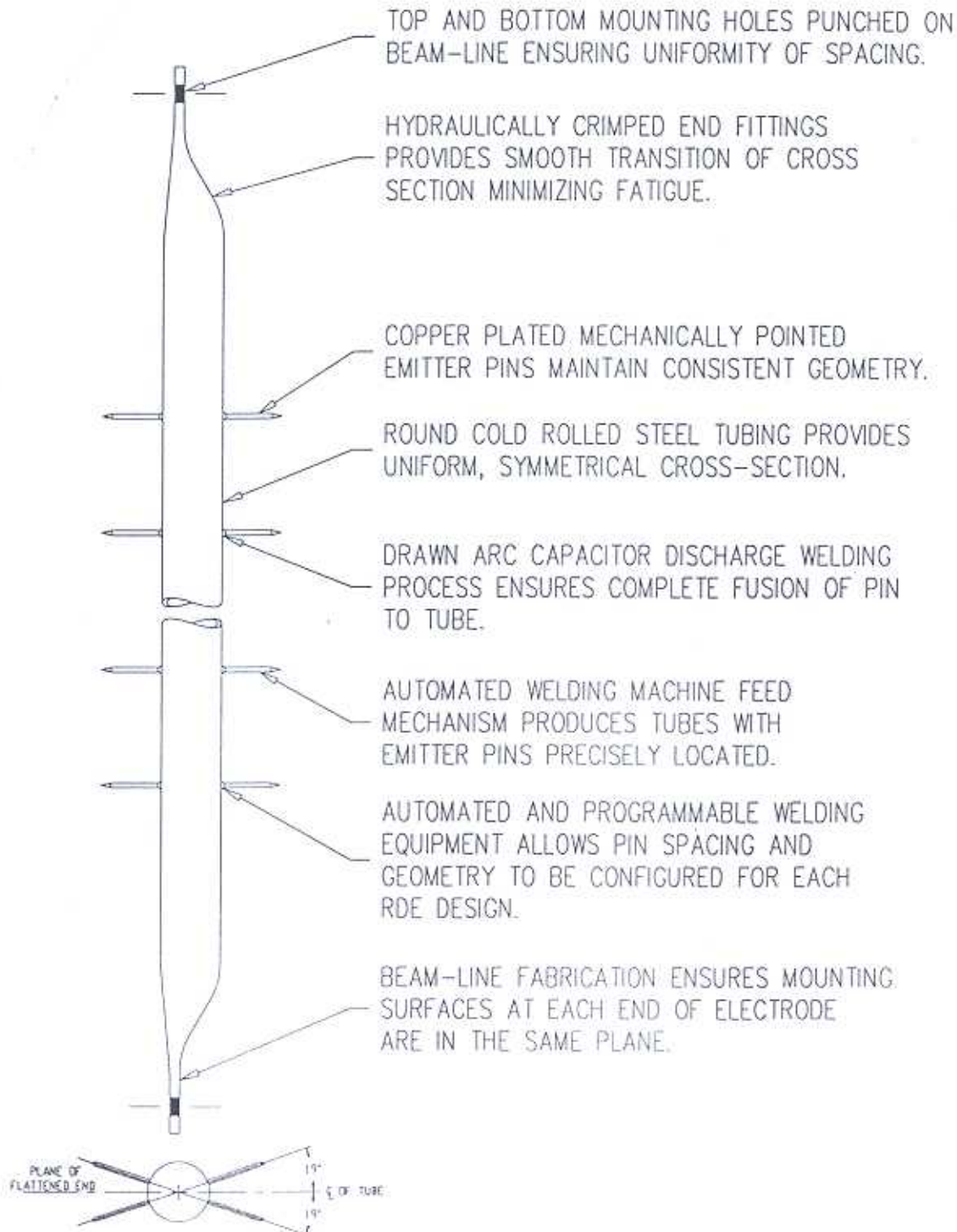
At the high voltages experienced in a precipitator, electrical erosion or split arcing is a common problem at electrical connections that are not solid. This is shown to be a problem on some rigid electrodes that were installed with loose bottom connections. Electrical erosion between the bolt and the electrode causes the electrode to eventually break loose from the stabilizer frame and to ground the field. BHA Group Inc. includes a bonding jumper at the bottom connection of our RDE-1 electrode. The welded jumper ensures equal potential between the frame and electrode, eliminating electrical erosion, yet allows the lower connection to move, thereby accommodating thermal expansion.

As in a collecting surface, symmetry is an important factor in satisfactory electrode operation. Internal stresses resulting from welding or rolling, when relieved, should resist one another. This will be true in a symmetrical shape, but not in an asymmetrical one. In a non-uniform cross section, normal operation may cause the electrode to deflect towards the collecting surface or towards a stiffener; in either case, reducing electrical clearances.

BHA Group Inc. can design, manufacture, deliver, and install rigid electrodes that maximize unit efficiency and offer extended operating life.



RDE-1 RIGID ELECTRODE





## High Voltage Rapping System

Rapping is introduced at each high voltage frame hanger point. The rapper train is similar to the collecting system rappers with the exception of a G-10 fiberglass insulator shaft that is installed to isolate the high voltage discharge from ground.

## Electrical Equipment

Three (3) new transformer rectifiers shall be furnished for precipitator Q35 and two (2) new transformer rectifiers for each of Q 31 and Q34. BHA assumes that all the existing T/R sets can be reused, and are in proper working conditions so as to be reused. In terms of capacity, we have already analyzed their ratings and concluded that all of them can be reused.

The secondary voltage rating of the new transformer rectifiers shall be 60 kV D.C. average for the 300-mm gas passage spacing.

The first two electrical fields in each precipitator shall receive a VI-CLR, Variable Inductance Current Limiting Reactor. This device varies the transformer rectifier circuit inductance to minimize waveform distortion and maximize collection efficiency. Improving waveform allows the T/R set to operate more efficiently, increasing potential power output or decreasing power consumption. Proper circuit inductance reduces the intensity of sparks and minimizes potential damage to internal components resulting from spit arcing.

The T/R set for the third electrical field of Q35 shall be supplied with a current limiting reactor only. The rest of the existing transformer rectifiers are assumed to have existing current limiting reactors.

## Controls

Q31 and Q34 precipitators shall each be supplied with one (1) new double stack control cabinet to contain two (2) BHA SQ-300 Automatic Voltage Controls, contactors, SCRs, breakers, and analog meters for the new T/R sets. Two (2) new SQ-300 AVCs for each precipitator will be retrofitted into the existing control cabinets for the existing T/R sets.

Q35 precipitator shall be furnished with two (2) new control cabinets to contain three (3) BHA SQ-300 Automatic Voltage Controls, contactors, SCRs, breakers, and analog meters for the new T/R sets. Three (3) new SQ-300 AVCs for this precipitator will be retrofitted into the existing control cabinets for the existing T/R sets.

A state-of-the-art PRC-100 microprocessor rapper control shall drive all the EGR rappers on all three precipitators. The CPU and monitor will be rack mounted with separate output card enclosures furnished on the roof of each precipitator.

The precipitator control system will include a data acquisition and control system, Win DAC, to allow recording and trending of operational parameters of all three precipitators. The CPU and monitor will be rack mounted. The BHA furnished software for the data acquisition system will be Windows® based.

As part of our customer service approach for our electrical and electronic products, BHA has included "off site Real Time" technical support during air load, and/or operational testing and start - up, in this proposal/order. This covers the proper set - up of the equipment, answers to typical set - up and operational questions, and in the unlikely event of a warranty problem with our equipment, the actions required to address these problems during the start-up period.

Subsequent to startup, required electrical/electronic support services and "Real Time" diagnostic services, will be offered at our standard rates as follows: BHA offer a Remote Diagnostics Services contract at \$3,000.00 per year, and customers who purchase this Contract will be billed at \$150.00 per hour. Non contract customers will be billed at \$300.00 per hour.

#### **Dust removal system**

BHA assures that the existing system (understood by chain conveyors and rotary valves) can handle (from the design point of view) the additional dust load being imposed to them by the higher collection efficiency that will result from this reconstruction. Any operational defects due to their age or actual condition are not covered by this assessment.

#### **Key Interlock System**

A bronze Superior Key Interlock System is provided for each precipitator electrical equipment and access doors.

#### **Purge Air System**

Each precipitator will be furnished with one (1) skid mounted forced air system that supplies heated air to each insulator compartment of the three chambers to keep the insulators clean and dry. Distribution pipes and orifice plates will allow equal airflow to each insulator location. A local control panel mounted to the skid will control the heaters and fan, thermostatically, and give on/off control.

#### **Gas Distribution System**

BHA will provide the materials for the gas distribution system for the new inlet nozzles. BHA will also supply the electromagnetic rapping system. The new devices are anticipated to be a perforated plate, along with a flow-straightening device for each inlet nozzle. Celulosa Arauco



will supply the inlet/outlet nozzles. As part of our engineering visit, our engineer will provide recommendations on additional repairs that will be required for the precipitators. Travel costs from the U. S. to Chile, return and wages will be the responsibility of B H A Group, Inc. We will also have a preliminary trip, for engineering evaluation, prior to the outage.

Local transportation in Chile, berthing, and meals will be the responsibility of Celulosa Arauco for these services.

### Utilization of existing Equipment

#### **Utilization of existing Automatic Voltage Controls**

A maximized field energization over time, is as much important as any mechanical improvement made to the Precipitators. BHA's SQ-300 Automatic Voltage Controllers are the most advanced devices available in the Market for this purpose.

Therefore, the only way we can guarantee the specified dust collecting performance is by replacing the existing automatic voltage controllers.

#### **Utilization of the Transformer Rectifiers**

As stated in the electrical section chapter, all the T/Rs will be reused, unless they present any maintenance-functioning problem that would prevent their well functioning. As per their ratings, they can all be fit in the new power distribution.

#### **Utilization of Collecting Plates and Discharge Electrodes Arauco acquired from FLS**

We have configured our rebuild design to achieve an emission level of 100 mg/Nm<sup>3</sup>. To achieve this level, we are increasing the height of the collecting plates to approximately 10 meters. For this reason, the existing components, collecting plates and discharge electrodes cannot be incorporated into the rebuild project. They are too short to accommodate the required emissions level.

#### **Utilization of Electric Control Cabinets**

Our Automatic Voltage Controllers were designed respecting our Customers desires to maximize the use of their financial resources. Therefore, they are easily adaptable to most of the existing control cabinets (since the power controls are equipped with Silicon Controlled Rectifiers, or "Thyristors" as power switching devices).



In the case of this job, it is perfectly feasible to make use of all existing control cabinets. We would only remove the existing Automatic Voltage Controllers and make the necessary adaptations to install our SQ-300 (one per T/R).

The existing Rapping Control cabinets will not be necessary anymore, since a PRC-100 rack mounted-computerized command will be installed.

In terms of room, the available space would be somewhat restricted, especially before the removal of the panels presently commanding units Q-31 and Q34.

In terms of room, the available space would be somewhat restricted, specially before the removal of the panels presently commanding units Q-31 and Q-34.

### Pricing

#### Units Q31 and Q34 (Prices shown are for both units)

Engineering:	US\$ 36,600.00
Material: (excluding the items listed below)	US\$685,465.00
Construction Management:	US\$ 77,935.00
<b>Total price for Q-31 and Q-34</b>	<b>US\$ 800,000.00</b>

#### Unit Q35

Engineering:	US\$ 30,750.00
Material: (excluding the items listed below)	US\$ 638,437.00
Construction Management:	TBD

**Total price for Q-35: US\$669,187 (plus C.M. - T.B.D.)**

The price for engineering and materials for the Q-35 precipitator will be fixed for a period of 30-90 calendar days after the commissioning of the Q-31, and the Q-34 precipitators. These prices for the Q-35 precipitator will be increased by 7%, if an order is placed within one year of the commissioning of the Q-31/Q-34 precipitators, and by 10% if an order is placed within two years of the commissioning of the Q-31/Q-34 precipitator..

**Local steel fabrication information (Optional):** (Note: \*Components description and weights are based on pre-engineering estimates. These may vary based on completed final engineering.)

<b>Component Weights - Q31 - Q34 combined</b>	<b>Weight (kg)</b>
Top End Frame:	4,500
Intermediate Roof Beam:	2,500
Baffle Plates:	3,500

267

<b>Component Weights - Q31 - Q34 combined</b>	<b>Weight (kg)</b>
Side Wall Panels:	13,000
Hot Roof Panels:	11,000
Cold Roof Panels:	8,500
Insulator Compartments:	3,500
Inlet Nozzles:	20,000*
Outlet Nozzles:	20,000*
Internal Bracing:	3,500

<b>Component Weights - Q35</b>	<b>Weight (kg)</b>
Top End Frame:	2,500
Intermediate Roof Beam:	2,500
Baffle Plates:	3,000
Side Wall Panels:	11,000
Hot Roof Panels:	9,000
Cold Roof Panels:	7,000
Insulator Compartments:	3,000
Inlet Nozzles:	10,000*
Outlet Nozzles:	10,000*
Internal Bracing:	3,000

#### Additional optional services

The following services are important for the efficient achievement of the targeted time reductions. Please find a scope description and corresponding pricing of each service.

#### **Gas Flow Model Study**

The assumptions made by BHA regarding gas flow to each precipitator in order to meet the 100 mg/Nm<sup>3</sup> emission level will require a model study for verification of flows. This model study and the modification of the ductwork is in Celulosa Arauco scope of work.

It is highly recommended that this study be performed to the completion of the design work.

BHA can offer a Model Study at additional cost if desired.

#### Terms of Payment

The terms are net 30 calendar days via electronic transfer, in accordance with the following schedule:

- 30% on completion of engineering and submission of CFC (Installation) drawings.
- 10% on all materials in the shops.



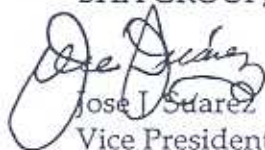
- 40% on shipment and presentation of freight forwarders receipt.
- 20% on successful start - up and acceptance by client (In the event the equipment fails to meet the specifications set forth in this proposal within four (4) months after start - up this 20% will be retained as payment for non compliance. Ten (10%) of this amount will be paid, if only one unit does not meet the specified performance).

The above products are quoted EX-WORKS shipping points, freight collect. All freight (including in land consolidating in the U.S.), taxes, duties and insurance are the responsibility of the customer. A proposal defining prices C.I.F. Celulosa Arauco will be provided shortly, and invoiced at cost if selected.

The equipment and the performance warranty is shown in Appendix I. The revised project schedule is shown in Appendix II. The revised construction management services proposal is shown in Appendix III.

Sincerely,

BHA GROUP, INC.



Jose I. Suarez

Vice President- Project Operations

Appendix I: Equipment and performance guarantee

Appendix II: Revised project schedule

Appendix III: Revised terms for the construction management services



**Annex I**

**Recovery Boiler Precipitator  
Performance Warranty For Dust Emissions**

**1. General Statement**

Seller warrants that the equipment specified in this Contract, will meet the performances stated in this Performance Warranty, provided that the equipment of this Contract is completely assembled, installed, maintained and working under the General Conditions, Operating Conditions and Parameters as defined by BHA Group Inc..

The provided BHA Group, Inc. mechanical and electrical components will be guaranteed against all manufacturing defects and workmanship for one year from the date of unit commissioning.

**2. General Conditions**

2.1 All items not furnished by Seller must be properly installed and satisfactorily operating so as not to limit the operation of the warranted equipment.

2.2 After erection of the equipment and the verification by the Seller of the erection of the equipment, a protocol will be established by Seller stating that the equipment is erected properly. Immediately after, there will be a preliminary operational period, of up to thirty (30) days in length. During the preliminary operational period, the Seller will have the opportunity to recommend modifications or adjustment of the equipment, which is to be operated by Buyer's personnel. The purpose of this preliminary operational period is to assure proper operation of the equipment and compatibility with the operational conditions.

The performance tests should begin no later than at the end of this preliminary operational period for a maximum period of seven (7) days.

If, after the performance tests are completed, the equipment as supplied by the Seller fails to meet the Performance Warranty specified in paragraph 3 below, Buyer must notify Seller in the next two (2) days by fax.

2.3 If, during the performance tests, the Performance Warranty figures mentioned herein are not attained, Seller shall be given an additional term of up to thirty (30) days from Buyer's notice by fax of the failure to meet the Performance Warranty. During this time, Seller shall have access and opportunity to recommend modifications or adjustments of the equipment and also improvements of possible manufacturing defects, as related to Seller's contractual obligation, in order to meet the Performance Warranty. Within

221

ten (10) days after the thirty (30) day additional term, the performance tests will be repeated. If the warranted values are not reached during this ten (10) day period, then the remedies required under paragraph 4 below will apply.

- 2.4 The Buyer shall provide competent personnel to properly run the plant and equipment concerned free of charge to seller. The Buyer shall also furnish all materials and equipment required to conduct the performance test(s) at no charge to Seller.
- 2.5 The Buyer agrees to supply free of charge to Seller, sufficient and suitable raw materials, gases, water, electric power, lubricants and similar materials in such a way and at such time as to ensure continuous operation over the duration of each performance test.
- 2.6 The Buyer will ensure that the plant and all equipment is properly operated, serviced and maintained.
- 2.7 The Buyer shall prepare and maintain adequate operating data records showing the Operative Conditions and Parameters in accordance with Seller's recommendations. These records shall be made available to Seller at all times.
- 2.8 The Buyer will not make any changes or modifications on the equipment supplied by Seller without its prior written consent.

### 3. Operating Conditions and Parameters and Performance Warranty

#### 3.1 Operative Conditions and Parameters

Precipitator Number	Q31 & Q34	Q35
a. Location:	Celulosa Arauco, Chile	
b. Ambient Temperature:	5°C-35°C	
c. Inlet Dust Concentration (Wet):	<u>18 g/Nm<sup>3</sup></u>	<u>18 g/Nm<sup>3</sup></u>
d. Inlet Gas Volume, Am <sup>3</sup> / hr :	151,500	229,000
e. Gas Temperature:	200°C	200°C
f. Humidity in the Dust at the inlet of the Precipitator:	Minimum 22%	



30

- 3.2 Provided that the General Conditions and Operating Conditions and Parameters are complied with, Seller warrants that the maximum dust emission of the precipitator is 100 mg/Nm<sup>3</sup> or at the Sellers option an efficiency of 99.28%. These values will be measured as an average of a series of three (3) tests in one (1) day of continuous operation.

The dust emission will be measured by the Buyer's personnel under the supervision of the Seller's personnel, at the outlet of each precipitator using the EPA Method No. 5, (excluding backhalf condensables), or by ASME Power Test Code method. The measurement will be done either with equipment that the Buyer has at the Buyer's Plant, or by a mutually agreed upon independent testing firm.

4. **Seller's Obligation:**

4.1 **Electrostatic Precipitator**

In the event that the performance guarantee is not achieved, the seller will provide materials and engineering required to meet the guarantee. This effort will be limited to 50% of the material portion of the contract value of the affected unit.

5. **Methods for Finalizing the Obligation of the Performance Warranty by the Seller**

The Performance Warranty will expire and have no further force or effect, upon the occurrence of any one of the following:

- 5.1 If Buyer fails to start the preliminary operation period within twelve (12) months after the delivery, or  
5.2 If, during the performance tests, the Performance Warranty values are attained, or  
5.3 If the maximum limit of liability is exceeded.  
5.4 If acceptance testing is delayed due to unforeseen reasons for more than a period of ~~30~~ (10) days from equipment startup.

61 month.

HB



Activity ID	Activity Description	Early Start	Early Finish	98	AUG	SEP	OCT	NOV	DEC	J										
00	START PROJECT	24APR98	29MAY98		27/4	11/5	18/5	25/5	31/5	27/6	3/7	10/7	17/7	24/7	31/7	7/8	14/8	21/8	28/8	A
010	COMPLETE MECH/ELECT.	24APR98	29MAY98																	
020	ISSUE TAKE - OFF'S FOR	24APR98	29MAY98																	
030	ISSUE FABRICATION	24APR98	15JUN98																	
040	MECHANICAL	29MAY98	15JUN98																	
050	ELECTRICAL	01MAY98	29JUN98																	
060	MECHANICAL SHIPMENT	17JUN98	11JUL98																	
070	ELECTRICAL SHIPMENT	29JUN98	27JUL98																	
080	CLEAR CUSTOMS	12JUL98	18JUL98																	
090	TRANSPORT MECHANICAL	18JUL98	24JUL98																	
0100	PRE - OUTAGE Q - 31	25JUL98	08AUG98																	
0110	CLEAR CUSTOMS	27JUL98	02AUG98																	
0120	TRANSPORT ELECTRICAL	02AUG98	08AUG98																	
0130	OUTAGE Q - 31	08AUG98	28AUG98																	
0140	PRE - ASSEMBLE	14AUG98	28AUG98																	
0150	OUTAGE FOR Q - 34	28AUG98	14SEP98																	
0160	COMPLETE REBUILDS FOR		14SEP98																	

COMPLETE REBUILDS FOR Q31 AND Q34

APPENDIX II

32

**BHA Group, Inc. - Construction Management Proposal - Celulosa Arauco - Constitucion, Chile - Conversion of the Q - 31 and the Q - 34 Precipitators)**

**Project Plan**

In order to maximize the available time for the actual shutdown, and the work scope, the conversion of the Q - 31 precipitator will be performed in estimated outage duration of 19 - 21 calendar days. The outage for the Q - 34 precipitator will be performed following the Q - 31 outage, and it is estimated that the outage will last 17 to 21 calendar days.

The work for the Q - 31 outage will include a 14 calendar day pre - outage period. The pre-outage period for the Q - 34 precipitator will be performed during the Q - 31 outage.

With the exception of the Q - 31 pre - outage work, which will be performed on a single shift schedule, all work schedules will be performed on two shifts, working 12 hours per shift.

It should be noted that the actual outage durations will depend on the crew productivity, weather, and any additional work that will be identified during the outages. This proposal only includes one - hundred and eight (108) on site days for our technical advisors. Any additional days will be per the below listed rate schedule.

**Mission Statement**

The construction management services will assist the customer's selected work force (in house, or contractor), in the execution of the installation of BHA Group, Inc. provided parts and components.

The services will bring together all parties (customer, the work force (in house forces or contractor), and BHA Group, Inc.) to ensure a quality final product, while completing the work on schedule.

**Methodology for Services**

The BHA Group, Inc. Construction Management team will be composed of three technical advisors. The services will center around field advice on the BHA Group, Inc. provided parts/components by our technical advisors, and a construction-planning book prepared by our scheduler. This is accomplished through the use of a Primavera (P3)-scheduling program. The following are the stages for the Construction Management Services:

1. Provide Primavera (P3) construction schedule. The schedule sequence, and durations will be based on our vast knowledge of air pollution control equipment





(apc - e.g.c systems, baghouses, and precipitators) maintenance, and construction. As part of the construction management services, the customer will be provided with a project-planning book, which will contain the following features:

- (1) Primavera (P3) Project Schedule
- (2) Recommended Manpower and Resource Levels
- (3) Recommended Tools and Equipment
- (4) Bills Of Materials
- (5) Installation Drawings

} dates to be scheduled  
AS

NOTE: The scheduler will NOT deploy on site during the execution of the project. A scheduler can be added to the project staff, per the below listed rate schedule.

2. Provide advice to the customer and to the work forces (customer in house forces or contractor) on the resources (personnel, equipment, etc.) required to meet the desired schedule completion. This advice is given at least twice a day, or as frequently as required by the customer.

The technical advisors will compliment the project planning portion of the services, by advising the contractor on the proper installation of BHA Group, Inc. parts, and performing quality control evaluations on the on going work.

#### Definitions

The following are the definitions for the technical advisory work, and the project planning work, that make up the BHA Group, Inc. Construction Management Services:



34

1. Technical Advisory Work:

The technical advisor will provide advice on the proper handling of the provided BHA Group, Inc. parts, and the proper installation of the provided BHA Group, Inc. parts, to achieve the standards described in the provided BHA Group, Inc. drawings.

The technical advisor will not be responsible for the methods, means, and procedures for the installation of the BHA Group, Inc. parts, crew safety management and monitoring, crew scheduling and management, welding inspections, and installation of non- BHA Group, Inc. parts and equipment.

2. Project Planning Phase:

The project planning phase portion of the construction management (C.M.) services will assist the customer in the preparation of the project work requirements.

A primavera (P3) construction schedule, based on BHA Group, Inc. labor productivities and construction approach, will be provided as part of these services, to assist in the planning of the work activities for the project.

Since BHA Group, Inc. does not have responsibility for the labor portion of the project, BHA Group, Inc. is not responsible for adherence to the provided construction schedule, completion of the project as shown in the provided construction schedule, additional labor costs (personnel, equipment, tooling, miscellaneous materials, etc.) required to meet the sequence of work, and the completion dates shown in the provided construction schedule.

BHA Group, Inc. is not responsible for crew safety management and monitoring.

Cost

The cost for the Construction Management (C.M.) Services is <sup>included in price.</sup> ~~\$ 77,935.00~~. The following clarifications are made relative to these cost:

The above listed price includes the following:

- Travel costs (Airline, etc.)
- Wages

DATE: APRIL 28, 1998  
 PAGE 4 OF 5  
 REV. 03

- Preparation of C.M. planning book (as described previously)
- One - three (3) day trip by the project manager, to review the project planning documentation, kick - off the project, and assist the customer on the organization and the planning of the outage. This trip will be executed shortly before the start of the project.
- Fifty - one (51) calendar days on site by the lead technical advisor.
- Thirty - Seven (37) calendar days on site for a mechanical technical advisor (night shift).
- Twenty (20) calendar days on site for the electrical technical advisor.

*Schedule to be submitted. HB*

NOTES:

- (1) Each technical advisor will work a maximum of twelve (12) hours per shift
- (2) The schedule is based on working seven (7) days per week.
- (3) The pre - outage work will be performed on seven days per week on one shift, for a period of fourteen (14) days. The lead technical advisor will be on site for this work.

Options

- (1) Charges above twelve (12) hours per day:  
\$ 100.00 usd/hr for T.A.'s..
- (2) Daily rates for T.A.'s in excess of the one hundred and eight (108) days listed above:  
\$ 800.00 usd/day/person.

THE FOLLOWING CHARGES ARE FOR ADDITIONAL MOBILIZATION  
 OF PERSONNEL, AS REQUESTED BY CUSTOMER

- (4) Mobilization cost for additional technical advisors (if required by work schedule, or for support): COST OF AIRLINE TICKET AT COST, PLUS  
\$ 800.00 usd/per travel day/person.

24/20

DATE: APRIL 28, 1998  
PAGE 5 OF 5  
REV. 03

- (5) Daily charges (up to 12 hrs/day) for additional technical advisors (if required by work schedule, or for support): \$ 800.00 usd/day/person.

#### Clarifications

- The customer is responsible for providing berthing, meals, and ~~in-country~~ transportation (local - Constitucion). *RB*

#### Terms

Net 30 days, after submittal of invoice (with progress payments, based on the project phase/duration)