

FLUID DYNAMICS

Memtec America Corporation
1750 Memtec Drive
DeLand, FL 32724-2045 USA
Telephone: (904) 822-8000
Fax: (904) 822-8010

December 12, 1996

Royal Oak Mines Inc.
Northwest Division - Giant Mine

ATTENTION: Mr. Bryan Cross

REFERENCE: FLUID DYNAMICS Quotation BS-9676

Dear Mr. Cross:

This budgetary quotation is for blowback filter elements and complete filter system for your Warox Project. The equipment we have offered is designed in accordance with practices we have developed through many years of experience in hot gas filtration. We have studied the Pilot Test Report from RPC's pilot roasting plant. For sizing the system we have used the recommended face velocity, established in the pilot test.

We understand the operating conditions to be:

PROCESS:

Fluid	= Hot air from Roaster
Flow rate	= 8227 ACFM
Pressure	= -1 psig (<i>Please confirm</i>)
Temperature	= 842°F
Density at conditions	= 0.0176 lb/cu.ft. (<i>Please confirm</i>)
Viscosity at temperature	= 0.035 CP (<i>Please confirm</i>)

BLOW BACK CONDITIONS:

Fluid	= Air
Temperature	= T.B.D. (68°F for design)
Pressure	= 87 psig



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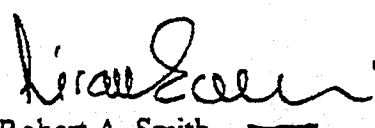
DESIGN FEATURES:

- ▶ Vessel I.D.: 94"
- ▶ Up-flow design
- ▶ Removable tube sheet
- ▶ Vessel is divided into five (5) sections with twenty-two (22) filter elements per section.
- ▶ Filter elements are 3.5" diameter by 118" long FLUID DYNAMICS® Blowback elements
Filter elements will have NPT connection for mounting on the tube sheet.
- ▶ Filter media is specially designed for 1 micron absolute for gas application.
Media formulation includes Inconel® 600 fibers with Inconel® 600 support mesh and stainless steel hardware.
- ▶ Filter area is 8.6 ft² per element for a total of 946 ft² per housing.
- ▶ At the given flow rate, the face velocity across the media is 8.7 FPM and the estimated clean pressure drop is 0.1 PSID across the elements.
- ▶ Blowback duration is 0.4 sec per section
- ▶ Blowback gas consumption per pulse per section is 31 SCF. *5 sections*
- ▶ Recommended accumulator size is 17 cu.ft.
- ▶ Estimated element weight is 25 lbs.

This quotation covers the scope of supply of the hot gas filtration system per the indicated conditions and parameters. It should be noted that there are many key parameters relative to the design and layout of the equipment which are critical to its performance. It will be necessary, during overall process layout development, for Memtec to review and interface with your team to ensure that proper arrangement of filtration equipment is provided and transfer necessary technology for successful operation.

We are grateful for the opportunity to quote this equipment and look forward to developing a lasting business as well as technical relationship. For any further assistance, please do not hesitate to call me at 904/822-8000, Ext. 330 or Mr. Kiran Emmi at Ext. 203.

Sincerely,

for 
Robert A. Smith
V.P. of Fluid Dynamics Business Group
MEMTEC AMERICA CORPORATION

RS/np/231

MEMTEC AMERICA CORPORATION1750 Memtec Drive, DeLand, FL 32724-2045 USA
(904) 822-8000 FAX: (904) 822-8040**FLUID DYNAMICS**
Memtec Group**QUOTATION**TO: Royal Oak Mines Inc.
Northwest Division - Giant Mine

DATE: December 12, 1996

INQUIRY:

PROPOSAL NO.: BS-9676

DELIVERY: 20 to 22 weeks

☐ AFTER RECEIPT OF ORDER☒ AFTER DRAWING
APPROVAL

F.O.B. DeLand, Florida Terms - Net 30

ATTENTION OF: Mr. Bryan Cross
Phone: 403/669-3733
FAX: 403/920-2627

ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
1	110 ea.	FLUID DYNAMICS® Filter Element ▶ Type: Blowback ▶ Micron rating: 1 micron absolute ▶ Size: 3.5" diameter x 118" long ▶ Adapter: 2.5" NPT ▶ Material of construction: Media: Inconel® 600 fibers with Inconel® 600 mesh Hardware: 316 stainless steel ▶ Area per element: 8.6 ft² ▶ Collapse pressure: 25 PSID	\$ 1,164.00	\$ 128,040.00

VALIDITY: PRICE AND DELIVERY
ARE FIRM FOR THIRTY (30) DAYS
AND ARE SUBJECT TO CHANGE THEREAFTER.TERMS AND CONDITIONS: THIS QUOTATION
IS MADE SUBJECT TO THE TERMS AND
CONDITIONS SHOWN ON THE REVERSE SIDE.MEMTEC AMERICA CORPORATION
Registered No. 34-022ISO 9001:2000
MEMTEC AMERICA CORPORATION
Registered No. FM 2207WE APPRECIATE THE OPPORTUNITY OF QUOTING AND
ARE LOOKING FORWARD TO YOUR ORDER.Robert A. Smith
V.P. of Fluid Dynamics Business Group
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ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
BUDGETARY PRICE				
2	1 ea.	Filter Housing <ul style="list-style-type: none"> ▶ Blowback filter housing designed for FV - 25 psig @ 900°F ▶ Filter housing will hold 110 filters arranged in 5 sections. ▶ Vessel includes tube sheet and baffles ▶ Vessel is 94" diameter x 320" O.A. height (approx.) ▶ Design and engineering costs are included in the housing ▶ Housing is designed per ASME, Sec. VIII, Div. 1, with "U" stamp ▶ Supports: Lugs ▶ Material of construction: <ul style="list-style-type: none"> Vessel: Carbon steel Gasket: Grafoil ▶ Paint: Inorganic zinc primer 	\$ 162,858.00	\$ 162,858.00
3	5 ea.	FLUID DYNAMICS® Blowback Valves <ul style="list-style-type: none"> ▶ 4", full port, flanged butterfly valve with pneumatic actuator and solenoid valve ▶ Material of construction: <ul style="list-style-type: none"> Body and trim: Carbon steel Seal and seat: TFE All brackets and couplings: Stainless steel (85 psig clean plant air to be arranged by customer)	\$ 5,200.00	\$ 26,000.00

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Registered No. 201-0155ISO 9000:2000
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ITEM	QUANTITY	DESCRIPTION	UNIT PRICE	TOTAL
4	1 ea.	FLUID DYNAMICS® Control System <ul style="list-style-type: none"> ▶ Wall mount control system will be designed to operate and control blowback sequence and frequency ▶ Control system will be based on Allen-Bradley programmable controller ▶ The Delta-P and gauge pressure will be from 4-20 mA transmitters into an analog card on SLC ▶ To set pressures, times, etc., an operator interface will be provided on the front of the panel ▶ Control panel is per NEMA 12 and to be mounted in a safe area 	\$ 12,000.00	\$ 12,000.00
TOTAL:				\$ 328,898.00

EXCEPTIONS

Following items are not included in our scope of supply:

- 1) System insulation
- 2) Roots blower
- 3) Discharge valve
- 4) Electrical wiring
- 5) Erection and commissioning
- 6) Packing and shipping

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FLUID DYNAMICS SYSTEM DATA SHEET

12/11/96

CUSTOMER : ROYAL OAK MINES INC.
RFQ # : BS- 9676
PROJECT : WAROX PROJECT

Memtec America Corp.
1750 Memtec Drive
DeLand, FL 32724-2045

PROCESS CONDITIONS

Gas Composition	=	GAS FROM ROASTER
Flow Rate	=	8227.0 ACFM
Gas Temperature	=	842.0 Deg F
Gas Pressure	=	-1.00 PSIG *
Density	=	0.0176 Lb/Ft ³
Viscosity	=	0.035 CP *

BLOWBACK CONDITIONS

Gas Composition	=	AIR *
Gas Temperature	=	68 Deg F
Gas Pressure	=	87 PSIG
Density	=	0.5203 Lb/Cu.

SYSTEM SPECIFICATIONS

A)	Element Type	=	FLUID DYNAMICS BLOWBACK ELEMENTS
	Dimensions & Media	=	3.5 " Dia X 118 "LG. , DO34 , NPT
	Elements Per Housing	=	110
	Area Per Element	=	8.60 SQ.FT
	Area Per Housing	=	946.00 SQ.FT
	Face Velocity	=	8.70 FPM
	Minimum Collapse Pressure	=	25 PSID
	Total Clean Pressure Drop	=	0.10 PSID (69 MM WC)

all units in operation -

B)	# of Blowback Sections	=	5	22 Elements per section
	Blowback Gas Per Pulse	=	31 SCF	
	Blowback Time	=	0.4 SEC	
	BB To FF Ratio	=	3	
	Recommended Accumulator Size	=	17.00 Cu.Ft	
	Recommended BB Valve Size	=	4.00 Inch	

HOUSING SPECIFICATIONS

Design Pressure	=	FV - 25 PSIG
Design Temperature	=	900 ° F.
Design Code	=	ASME SECTION VIII, DIV 1
Material Of Construction	=	CARBON STEEL
Gasket	=	GRAFOIL
Vessel I. D.	=	94 "
Nozzle:		
Inlet:	=	18" ANSI B 16.5
Outlet:	=	18" ANSI B 16.5
Blowback:	=	4
Discharge:	=	12 " ANSI
Discharge Valves	=	BY CUSTOMER
Control Panel & wiring	=	OPTIONAL (NOT INCLUDED IN HOUSING PRICE)

NOTE : * ASSUMED FOR SIZING PURPOSE, PLEASE CONFIRM.