OWNER SPECIFICATIONS

BOOK I OF II

AMERICAN SMELTING & REFINING COMPANY

EL PASO, TEXAS

BE 1114

* *

BOWEN ENGINEERING, INC.
SOMERVILLE, N. J.

PLAINTIFF'S EXHIBIT

ASA-1203

BOWEN ENGINEERING, INC. BE 1114

OWNER SPECIFICATIONS

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OWNER SPECIFICATIONS

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OWNER SPECIFICATIONS

SECTION I - ERECTION

1. General Description

This specification provides for the furnishing of equipment for the installation of a Bowen Spray Drying System for the American Smelting & Refining Company, El Paso, Texas.

2. Definition of Terms

Where the word "Owners" is used, it shall refer to:

American Smelting & Refining Company
New York City, New York

or its designated contractor.

Where the word "Engineers" is used, it shall mean:

Bowen Engineering, Inc.
Somerville, New Jersey

3. Labor

All labor necessary for the erection of any equipment mentioned herein shall be furnished by the "Owner."

4. Dimensions, Levels, etc.

The Owner shall be solely responsible for all locations, dimensions and levels and no plea as to instructions or order received from any source other than the information contained in the drawings and specifications, or in written orders from the Engineers, shall justify departure from the dimensions and levels required by the drawings.

He shall take his own measurements at the site, verifying same with the drawings and at the building site and will be responsible for the proper fit of the completed work in position.

All locations and points of support should be strictly adhered to as shown on Dwg. 76-D-65. Levels should be held to $\pm$ 1/8" of grade and diagonals held to $\pm$ 1/4" in square or rectangular sections.

5. Scope of Work

The following outlines the materials and work to be supplied by the Owner and by the Engineers to result in a complete operating system. Engineers (Bowen) will not be responsible for any misfits or errors in assembling the system unless there is a definite error in the drawings or the fabrication of equipment supplied by the Engineers. In order for the Engineers to be responsible for any corrective backcharges, the Owners must get prior approval from the Engineers before any corrective work is done.

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OWNER SPECIFICATION

SECTION I - ERECTION

5. Scope of Work (con't)

This does not supersede prior contractural agreements and in case of conflict, the prior agreements will control. Rather, this is intended to clarify and elaborate on the work required to promote a full understanding and to insure efficient and timely completion of the project.

There are two books per set of Owner Specifications. Book I has the Equipment Schedule and Book II gives the Manufacturer's description and installation instruction for the various equipment (Item Nos.). The use of these Owner Specifications will make for an orderly installation of the system.

6. Drawings Furnished to Construction Engineer

The Engineers shall furnish three (3) sets of reproducible drawings (latest revisions) as listed on Pg. I-1 and six (6) sets of Owner Specifications. Drawings or Owner Specifications in excess of this number will be supplied at an extra cost.

7. Supplied by Engineers

All the equipment as shown on the General Assembly Dwg. 76-D-91 (latest revision), and all equipment listed on the Equipment Schedule, Section II of these Specifications shall be supplied by the Engineers.

8. Supplied by Owner

A. Foundations and structural steel to support the Spray Dryer System as noted on Loads & Points of Support, Dwg. No. 76-D-65.

B. Materials and labor to insulate the system.

C. All labor to install the equipment supplied by the Engineers.

9. Welding and Finishing

The tungsten inert gas method of welding is recommended for the field assembly of the stainless steel sections. A TIG weld using a #40 Tungsten tip and Argon gas can provide a surface that requires only nominal finish. Hand held filler wire may be used where necessary.

Arc welding using coated electrodes may be used if the experience of the men prefer this. Perhaps a combination of TIG and electrode welding may be used according to the capabilities of the men. It is suggested to limit the rod size to 3/32" diameter. This method will result in build-up of the weld bead and require more grinding. Here again, it is suggested that a small section be welded and ground down to determine the best and proper method of welding and grinding to give

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9. Welding and Finishing (con't)

a smooth surface with no pit holes at the welded section. Anti-splatter compounds may be used to minimize subsequent finishing.

In all cases, the lowest welding heat possible should be used that will insure full penetration. The recommended type of welding wire is 308 or 309 Type stainless.

The interior of the chamber must be kept smooth and free of abrasions, nicks, pits and slag or other imperfections which would tend to trap contaminating materials or cause product hangup.

Welded joints on the interior of the chamber should be ground to a minimum of 80 grit with a P.G. wheel or aluminum oxide disc wheel. The initial grinding should be done with a coarse wheel and very near the parent metal, then using a 50 grit wheel and finally using the 80 grit.

Use only new wheels which have never been used on carbon steel.

The grinding should be done along the weld seam, not across the seam keeping the ground area as narrow as possible in order to avoid marring the remainder of the surface. Excess grinding requires much more labor to get the required finish, therefore, good judgement should be used.

If a disc grinding and polishing wheel is used care should be taken not to obtain a half moon curvature at the welded joint.

The PG wheels are obtained through 3M Suppliers.

All interior surfaces of the chamber, ductwork, etc. should be thoroughly cleaned before the dryer startup. It may be preferable to do some or all of this prior to or during erection. If it is desirable to avoid surface staining from the corrosion of surface contaminants, areas that have been ground, scuffed or otherwise may have picked up corrodible materials can be "passivated" with a cleaning solution.

Note that many of the sections that make up the chamber and ductwork assemblies are seemingly identical. However, there are slight differences because they have been match assembled in the shop, and it is of the utmost importance that the sections are put together in exactly the same way. It will not be difficult to do this, because the parts have been marked and oriented but reasonable care and close attention to the drawings is required at all times.

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9. Welding and Finishing (con't)

It is extremely important that adjoining sections of flanges and the interior surfaces of all joints are as nearly flush as possible. As an aid in field alignment roll pins have been provided for the chamber vertical joints and welded alignment pins for the horizontal.

10. Erection

In any method of erection, the fabrication must be handled carefully, avoiding bumping, racking or other stress that would tend to distort the shape of the sections. Provide as many lift points as is practical, lift evenly and provide spreader bars or other means to prevent undue stress.

IMPORTANT: Don't fasten down major components of this system on initial setting, slight adjustments may be necessary to make up all the duct work. All major components should be set but not permanently fastened down until all connecting duct work is made up to permit slight adjustments to give a proper fit up.

This does not guarantee complete alignment, and field adjustment may be required before drawing the bolts up fully. Partial tightening of the joints of the chamber should be made only sufficiently to give the joint a snug fit and softer material can be placed at the joint section only. By using a hammer blow on the softer material at the joint section only an acceptable joint can be obtained. As each point along the seam is made flush the bolts can be tightened and then tack welded at intervals of about one (1) foot spacing until a complete seam is completed. Hammer blows should not be used without a softener because it will damage the finish and marr and dent the chamber sheets at the joints. Here again, the experience of the men should be used. Perhaps strong back can be used to obtain a smooth finish at the joint.

In the procedure following, the chamber will be preassembled in circular sections and joined to mating sections in place. Preassembly of the chamber sections should take place on a level area adjacent to the erection site. Dunnage and shims should be placed under the vertical stiffener points or columns and the subassembly carefully leveled.

Leave the internal shipping braces in place. These are intended to maintain the shape of the section during shipping and erection. The bracing may be left in place after erection for use, at the discretion of the Owner, as scaffolding supports for the welding and finishing operation.

In hoisting the sections into place, steps must be taken to avoid distortion. Provide as many lift points as is practical, lift evenly and provide spreader bars or other means to prevent undue stress.

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OWNER SPECIFICATIONS

SECTION I - ERECTION

10. Erection (con't)

When setting the support columns and the major pieces of equipment such as the chamber, cyclones and fan, the importance of accuracy in levels and orientations cannot be over emphasized. Any error will be reflected throughout the entire system assembly, and might cause a great deal of unnecessary work. Transit leveling to within 1/16" is suggested along with careful measurement to be sure that the equipment locations agree with the dimensions on the plans.

The method of erection enumerated below is a suggested procedure and will depend upon the manpower and equipment available to perform such work economically. It is the intention of this section to amplify the drawings and present an understanding of the assembly of the Bowen Spray Dryer.

Reference Drawings:

1. All nuts, bolts and gaskets referred to in the instructions and associated drawings will be listed on the bolt and gasket schedule.

2. The completed system is essentially as shown on the General Assembly Drawing # 76-D-91.

3. Check to determine that the equipment support points are in their proper location and elevation in accordance with 76-D-65.

4. All the field joints are shown on drawing 70-D-570.

5. The chamber assembly is essentially as shown on these drawings. Depending on head room and method of hoisting, the chamber can be assembled in circumferencial sections and as many vertical sections as possible before hoisting in place, or set in place one piece at a time. Preassembly at ground level will require less scaffolding and as large a piece as possible should be hoisted in place. Proper orientation is a must in either preassembled sections or by individually hoisting sections in place. (76-D-63) (See Note #21).

6. After the chamber is set, the hot air duct MK72-1 can be set in place properly orientated and field joint #19 can be completed. If so arranged the operating deck steel can be installed.

7. Angle ring MK72-2 furnished by others should rest on operating deck beams between the beam and the operating deck floor plate or grating depending on situation in order to give support to the head plate.

8. The vane ring MK75-1, inlet grating MK185-1 and Spray Machine support MK74-1 can be installed using gasket 72-G1 and bolts EB-51. Install the circular spray machine rings MK562-1 and MK562-2 as shown on the inlet head arrangement on the General Assembly drawing. Do not install the Spray Machine until a Bowen start-up Engineer is present. Install circular checkered cover furnished by others and cover MK563-1. Do not weld either piece.

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SECTION I - ERECTION

10. Erection (con't)

Reference Drawings:

9. Erect collector support drawing no. 76-D-173.

10. Install product storage hopper (F8F-010) and Cyclone Collectors on support 76-D-173. Connect two (2) Rotary Airlock (F8E-011), four (4) Collector Outlet Ducts (MK85-1), using 85G1 and EB12 bolts, and two (2) flexible connectors. Install cover (F8F-011).

11. Install the main fan (F14A-010- F14B-010) according to drawing 76-D-68 and orientate properly. Connect damper Item F14A-020).

12. Install MK89-1 duct from scrubber, furnished by others. Connect flexible coupling Item (F15C-020 to MK 89-1) with two (2) Item (F15C-005).

13. Install hot air duct transition MK73-1. Duct to rest on support steel furnished by others. To allow for expansion, do not secure to support steel.

14. Install the duct work MK83-1, 2, 3, 4, & 5 from cyclone. Support MK83-1, & 2 from hangers furnished by others.

15. Install outlet elbow MK81-1 and supports MK81-2.

16. Install ductwork MK82-1, 2, 3, 4, 5, 6, and 7 between chamber outlet elbow and cyclone. Support MK82-7 and 6 by hangers furnished by others.

17. Install the electrical circuits instrumentation according to drawings 76-D-70, 76-D-71 & 76-D-361.

Panel board Item (F16A-002, chamber light ports MK545-1, terminal board dwg. no. 70-D-894.

18. Install valve SV-1 on main floor within easy access of operating personnel.

19. Install 6" nipples temporarily to prevent insulator from plugging up the instrumentation outlet ports.

20. Install 908 G1 gasket on access door 70-D-908 using Dow Corning silastic RTV 732 silicone adhesive (clear) and Dow Corning 1200 primer. Follow Dow Corning instructions for application.

21. To install the vane ring MK-75-1, the vane ring well in MK-76 may have to be made into a true circular shape from an elliptical shape by means of a hydraulic jack or by shiming the two half sections.

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OWNER SPECIFICATIONS

SECTION I - ERECTION

INSULATION

Owner shall supply and install the insulation in the following manner. These are general specifications and can be arranged to fit the application.

Recommended Thickness

8# cu. ft. density mineral wool blanket, rigid mineral fiber board or rigid fiber glass board able to withstand temperatures of the hot face. (°F).

100°-200° - 1"
201°-500° - 2"
501°-750° - 3"
751°-900° - 4"
901°-1000°- 5"
1001°-1100°- 6"

Temperature areas (1400°F max. temp) require glass or mineral wool insulation with thermal conductivity of less than .8 at 800°F mean temperature.

1. Heater Shell, Hot Air Duct and Chamber Head Plate

   Insulation should cover all stiffeners and flanges, particularly on an outdoor installation. This is to prevent the insulation from absorbing moisture which settles between the stiffeners after a rain or snow. The insulation on the chamber head plate should be pitched toward the outside so there is suitable run off of the water. The space between the hot air duct and the head plate should be filled with insulation material to prevent a hot spot on the chamber head plate.

2. Chamber Cylindrical and Cone Sections

   Usually 2 inches of insulation should be sufficient since this and the remainder of the system is no longer to conserve the heat, but rather to prevent condensation, and to provide personnel protection. It is advisable to insulate all stiffeners and may be more economical to increase the insulation thickness, rather than box out the stiffeners and support.

3. Connection Duct Work

   Same as paragraph 2, except where flange disassembly is anticipated for maintenance and cleaning, the finishing materials should extend over the flanges.

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OWNER SPECIFICATIONS

SECTION I - ERECTION

INSULATION (con't)

4. Bag or Cyclone Type Collectors

Same as paragraph no. 2.

APPLICATION

The mineral wool blanket, mineral fiber board or rigid fiber glass board should be secured in place with 12 gauge Nelson or KSM pins of stainless steel material and speed washers on approximately 12" centers, after which all voids and cracks are pointed up with hydraulic set cement.

FINISH

Before the finish to the insulation is applied, care should be taken to see that sufficient insulation is provided at the areas of the stiffeners to prevent hot spots that might ignite the finishing material. Also finishes such as canvas should not come in contact with exposed flanges or areas of high temperatures that might cause burning of the finish.

MASTIC WEATHER-PROTECTIVE COATING

Before applying the weather-protective coating it is preferable to apply mesh chicken wire over the insulation then place 1/2" layer of hydraulic setting cement. A layer of 1" hexagonal mesh chicken wire shall be applied over the cement. Over this trowel or spray to approximately 1/4 to 1/2" thickness of mastic cement. This procedure renders a weather-protective installation. Proper customer maintenance (periodic pointing of areas where metal is exposed, such as doors and ports, repair of damages) will perpetuate this weather-protective condition. Recommend contacting insulation contractor for specific recommendations for particular installations.

CANVAS COVERING FOR INDOOR INSTALLATION

After all voids and cracks have been pointed up, apply a 1/2" layer of asbestos fibre cement. After drying, the cement shall be covered with 8 oz. canvas, cemented in place with a weather-protective lagging adhesive and sized with Foster 30-36 Sealfas Coating or equal (this is good for temperatures up to 180°). For higher temperatures special adhesives will be required.

METAL FINISH

1. Since there are a number of ways that an aluminum covering may be applied, several suggested methods are given.

A. Stainless steel KSM pins may be used with speed washers to hold aluminum bands or strips around the insulated parts at a maximum of 24" centers and the aluminum covering attached to these bands using

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SECTION I - ERECTION

INSULATION (con't)

1/2 x #8 aluminum screws. All laps on the aluminum covering should be at least 2" minimum and possibly sealed with suitable mastic to inhibit the entrance of water.

B. Another method of applying the aluminum covering is the "Standing Seam" Method. This is a fairly expensive method but gives a long lasting, as well as a good looking job. If this method is used stainless steel L bars should be used for the standing seam.

2. If a metal finish is applied, the metal should be isolated (especially from mineral wool blanket or mineral fiber board) by an air space or paper barrier between the insulation and the metal covering. This is important to prevent the interior of the metal covering from corroding.

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SECTION II - EQUIPMENT SCHEDULE

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ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F2G-010	1	ALARM HORN Mfgr: Edwards Cat. No. 870 N5 flush type industrial horn with grill front and back box, 120V,60Hz.	Alarm Control
F3A-011	1	AIR FLOW SWITCH Mfgr: Dwyer Model 1823-1 differential pressure switch, 0.2 to 1.0 in. W. C. range, set to actuate switch at 0.5 in. rising differential. Enclosure: Weatherproof	Air Flow Switch
F3B-010	1	TEMPERATURE SWITCH Mfgr: Burling Model F-2C 648 Style 6 thermal limit switch, SPDT. Range: 1000°F to 1700°F preset at 1600°F 1 " SS compression fitting located 14 inches from end of tube. Second switch preset at 1500°F.	Chamber Inlet Temperatur Limit
F3C-010	1	TEMPERATURE SWITCH Mfgr: Burling Model F-1C- 217 Style 3 thermal limit switch, SPDT. Range: -200°F to 700°F preset at 400°F 3/4" SS compression fitting located 14" inches from end of tube.	Chamber Outlet Temperatur Limit
F4A-010	2	POSITIVE DISPLACEMENT PUMP. Mfgr: Robbins & Myers Moyno Frame 2L6 Type SSQ progressing cavity pump complete with Reeves "Motodrive" variable speed drive "Airtrol" Pneumatic speed control for 3-15 PSI signal, flexible coupling and guard all mounted on a structural steel base, conforming to the following specifications:	Feed Pump

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SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F4A-010 (con't)		Materials of Construction	
		Wetted Parts 316 S.S. Rotor 316 S.S.	
		Stator Liner BUNA N Boot Seal none	
		Gland mechanical with water flush	
		Modifications:	
		Drive:	
		Size 122 HP 2 HP	
		For 460 V 3 Ph 60 Hz Enclosures Chem. TEFC	
		Speed Range 45 To 450 RPM	
F5A-020	1	RECORDING CONTROLLER RECEIVER Mfgr: Foxboro Model 40R-C55 Chart No. 898439C Two-pen recording controller receiver with proportional, reset and derivative, 3-15 PSI output, rectangular case for flush panel mounting, 24 hour chart drive for 120 V 60 Hz. First System: (Tag: "Inlet," Pen Color Red) Range: 0-2000°F Action: Increasing Temp. decreases air pressure. Source of Signal: Item F5B-020 Auto/Manual subpanel mounted in upper location. Second System: (Tag: "Outlet," Pen Color Blue). Range: 0-500 °F Action: Increasing Temp. increases air pressure. Source of Signal: Item F5C-020 Auto/Manual subpanel mounted in lower position. Supplies: 400 charts Ink	Temp. Control

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OWNER SPECIFICATIONS

SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F5B-020	1	PNEUMATIC TEMPERATURE TRANSMITTER Mgr: Foxboro Model 33 B EMF-To-Pneu. Case description sheet steel, output 3-15PSIG Thermocouple: Mounting threaded Thermal System Type K Temperature Rnage: 0-2000°F Bulb: Chromel-Alumel, Length 18" Rating: Class II, Division II, Group D Connection: Type thd., Mat'l. S.S. ,Size 3/4 NPT Bulb Well: Type W-LTS Well: S.S. to suit 1" NPT T = 6" U = 18"	Inlet Temp.
F5C-010	4	FILTER REGULATOR Mfgr: Foxboro Part No. B-110-XR filter regulator, ¼" connections, with P-103-YN 2" Pressure gage.	Instrument Air Supply
F5C-020	1	PNEUMATIC TEMPERATURE TRANSMITTER Mgr: Foxboro Model 12A Case Description: Alum. case Mounting: Element, threaded Thermal System: Type J Temperature Range: 0-500°F	Outlet Temp.

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OWNER SPECIFICATIONS

SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F5C-020 (con't)		Bulb: filled; Length - 18" non reqd. Tubing: S.S.; Length - 3-1/2 ft. Connection: Type thd, Mat'l. - S.S., Size - 3/4 NPT Bulb Well: Type W-LTS Well: S.S. to suit 1" NPT T = 6" U = 18"	
F5C-021	1	SELECTOR STATION Mfgr: Foxboro Model B5425 Remote panel control selector valve. Part No. 39465 Double Angle Plug 2 Position 4 part with Automatic-Manual name-plate.	Selector Feed/ Auxillary
F5D-010	1	CONTROLLER STATION Mfgr: Foxboro B-107-YM station with pressure regulator and 0 - 30 psig gage. Complete for panel mounting.	Feed Control
F7A-010	1	SPRAY MACHINE Mfgr: Bowen Engineering Type BB-6 high speed spray machine, 316 S.S. feed contact parts. Serial No. 101 Modifications:	Spray Machine
F7B-010	1	CENTRIFUGAL ATOMIZER Mfgr: Bowen Engineering Type CSE, No. 141, Nominal Size 9" Constructed of 316 S.S.	Atomizer

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OWNER SPECIFICATIONS

SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F7C-010	1	FREQUENCY CONVERTER SET Mfgr: Louis Allis Equipment No. LA4402 consisting of converter and drive motor mounted on a common base, with V-belt drive and OSHA guard. Drive Motor: Type COG4B, Hp 60, Frame 364T, RPM 1800 For 460 V,3 ph, 60 Hz. ,Enclosure open Converter: (Open Construction) Type COGFC ,Kw at 0.8pf 50, Frame 444U ,RPM (Max) 3600, Line Voltage (Primary) 460 V, 3PH, 60 Hz, Output Voltage(Secondary) 275 V, 3ph 300 Hz. (at max. RPM) V-Belt Drive: For 2850 RPM of converter. Beltguard dimensions to permit sheave changes for 1800 to 3600 RPM converter speeds. Furnish equipment nameplate #29966, stamped LA 4402, Mfg. No. AB-6MCB-C2. mounted above regular nameplate.	Spray Machi Power Suppl
F7F-010	1	CURRENT RELAY Mfgr: Allen Bradley. Cat. No. 809-B13-E instantaneous trip relay for 60 HZ current, adjustable trip setting, 600V maximum, in NEMA Type 1 enclosure.	Over-curren Protec tion

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OWNER SPECIFICATIONS

SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F7G-010	1	CIRCUIT BREAKER Mfgr: ITE Cat No. EF3-L050 -EE12 ETI circuit breaker 3 pole, EF frame, instantaneous magnetic trip adjustable from 160 to 470 amps, for 35 amps continuous current, with "A" contact auxiliary switch, in NEMA 12 enclosure.	Over-current Protection
F7H-020	1	SOLENOID VALVE Mfgr: ASCO Cat. No. 8025B16 2-way solenoid valve, general purpose enclosure, IPS 3/4", 120 V., 60 Hz., for water at 60 psi. Normally closed lever type, manual reset with brass body and soft seat. C_V factor 6 Pressure drop 15 psig at 21 gpm	Feed Interlock
F7J-010	1	RUNNING TIME INDICATOR Mfgr: Hamilton Model 591 elapsed time indicator for 120 V, 60 Hz.	Run Time Indicator
F7J-011	1	AC AMMETER Mfgr: Simpson Model #59 5 A range calibrated for 150 amps. 330 cycles flush mounting square bakelite case, for use with 5A current transformer.	Spray Machine Ammeter
F7Q-010	4	SPRAY NOZZLE Mfgr: Bete Single fluid nozzle No. TF14N, Type 304 S.S. hollow cone 50° pattern with 3/8" male pipe tap. Operation: 7.0 GPM at 30 PSIG clean water.	Quench Nozzles

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OWNER SPECIFICATIONS

SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F8A-010	1	CYCLONE COLLECTOR Mfgr: Ducon Model No. 2-225 Type VM 700/150 Materials of Construction: Product Contact Carbon Steel Clean Air Contact Carbon Steel Externals C/S, Bolting C/S Gaskets Silicone, Painting Prime Arrangement: Air Inlet common Air Outlet common Hopper individual Access Quick acting cone doors	Product Collectio
F8E-011	2	ROTARY AIRLOCK Mfgr: Butler Size 98 Type MD No. of Blades 10 TYPE beveled RPM 20, Drive Type Gearmotor HP 3/4, For 460 V, 3 ph, 60 HZ Enclosure TEFC Chemical MATERIALS OF CONSTRUCTION: Rotor Steel, Body and End Bells C.I. Blades Steel Seals External	

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OWNER SPECIFICATIONS

SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F8F-010	1	PRODUCT HOPPER MFG. As Approved.	Hopper Bi

Conical bin 10 ft. dia. carbon steel plate with:
straight side: 7'-0"
Two inlets: 8" stub type to match Butler 98 MD airlock; located 52 3/8" apart centered.
Top 5"ø stub for bin-d-cator 3 ft. C.L. Two req.
Side 24" dia. bolted access panel.
Two 2' lg. 3" channels with mounting pads for vibrators located 90° apart.
All stubs 6" high.
Discharge 12" dia. with ½ bar flange 2" wide (12) 5/8" holes on 1'-3½" B.C. straddle C-L.

Four saddle support lugs.

Finish: cleaned, primed and enamel suitable for material at 250°F.

Fabrication to be high quality:
inside to be smooth finish.
Flange faces flat to 1/16".

F8F-011 1 ROTARY BIN LEVEL SWITCH MFGR: Bin-d-cator — High le Switch

Model RA Type 6

for 120 Volt, Single Phase, 60 Hz. operation

with Two SPDT switches,

Materials of Construction:

Housing Al. Mounting Flange C.S.

Paddle S.S. Shaft S.S. 2'6"

Mounting Fitting Flange

Mounting Position Vertical

Type four paddle, .5 inch diameter.

For use at 250 °F on material with bulk

density of 35 lbs/cu.ft.

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OWNER SPECIFICATIONS

SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F10A-011	1	TERMINAL BOARD Mfgr: Bowen Terminal Board for Type BB Spray Machine, including lubrication and auxiliary equipment and terminal connections for the Spray Machine. Equipment and specifications in accordance with Bowen Dwg. 1114 - 70-D-894 .	Spray Machine Terminals
F14A-010	1	CENTRIFUGAL FAN Mfgr: New York Blower Heavy duty industrial fan, arrangement 1 as follows: Fan: Model 452 Type HPE Rotation CCW Discharge Position UB Inlet Connection Sleeve Outlet Connection Flanged Type of Drive V-Belt AMCA Motor Position 2 Quick Opening Cleanout Door at 4 o'cl, bottom drain Materials of Construction C.S. epoxy coated Temperature Modification for 200°F Other Modifications: Shaft guard per OSHA standards. Drive: (By others) Fan Speed 1833 RPM, Motor HP 125 , RPM 1750	Main Fan
F14A-020	1	FAN DAMPER Mfgr: New York Blower Heavy duty parallel blade outlet damper for above.	Main Fan Damper

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OWNER SPECIFICATIONS

SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F14B-010	1	AC INDUCTION MOTOR Mfgr: U.S. Motors Type CJ4B HP 125 RPM 1800 Frame 444T Enclosure TEFC Volts 460 PH 3 Hz 60 for horizontal floor mounting Position F-1, including sliding base.	Main Fan
F14C-010		AC AMMETER Mfgr: Simpson Model #59 5 A. range calibrated for 300 amps flush mounting square bakelite case, for use with 5 A. current transformer.	Fan Ammeter
F14C-011	1	CURRENT TRANSFORMER Mfgr: Marshall Model 5 Ratio 300 :5	Fan Ammeter
F14D-010	1	V-BELT SHEAVE Mfgr: Dodge Cat. No. Dyna V Belt Section 5V No. of Grooves 8 O.D. 10.9" Bushing No. 3535 Bore 3-3/8" Keyway 7/8" x 7/16"	Motor Sheave
F14D-011	1	V-BELT SHEAVE Mfgr: Dodge Cat. No. Dyna V Belt Section 5V No. of Grooves 8 O.D. 10.3" Bushing No. 9D Bore 3-15/16" Keyway 1" x 1/2"	Fan Sheave
F14D-012	1 set	V-BELTS Mfgr: Dodge Cat. No. 5V 1180 Section 5V Length 118" Matched Set (8 belts) Ctr. Dist. 42.4"	Fan V-Belts

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OWNER SPECIFICATIONS

SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F14E-014	1	PNEUMATIC LEVER ACTUATOR Mfgr: Honeywell Model 01-11 #30686936-114 with positioner Model 30686891-006 Signal Range: 3 - 15 PSIG Action: reverse Supply Pressure: 150 psig	Damper Operator
F14G-012	1	VIBRATION BASE Mfgr: Vibration Eliminator Co. Inertia mass Type SN frame fan and motor base with Type S isolators, including necessary stiffeners and template. Concrete fill installed in field by others. Refer to Bowen Drawing 76-A-184 for data and mounting dimensions.	Fan Vibration Base
F15A-010	3	LAMPHOLDER Mfgr: Stonco Cat. No. V-4400 lampholder, 1/2" male thread.	Chamber Light
F15B-011	2	NAMEPLATE Mfgr: Quality Engr. 6 1/2" x 10" nameplate, Bowen P/N 0050-04 Engrave and fill in black per Bowen Drawing 76-C-88. one for chamber one for control panel	Nameplate
		BAND CLAMPS Mfgr: Breeze Corp. Type Q-S 100 St. Steel band clamps listed below. Two or more clamps per assembly as required.	Duct Connections
		Diameter	
F15C-005	2	26" diameter (82" long)	
	4	9" diameter (28" long)	

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OWNER SPECIFICATIONS

SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F15C-020 p/n 0047-o1	1 roll	FLEXIBLE DUCT MATERIAL Mfgr: 1/16" woven asbestos with Silicone impregnation, 6" wide x 30 ft. long.	Duct Connection
F16A-002	1	CONTROL PANEL Mfgr: As approved Control Panel containing instruments and electrical controls prepiped and prewired to terminals, in accordance with Bowen Drawing No. 76-D-76.	Main Control Panel
F16A-004	1	ELECTRICAL ENCLOSURE Mfgr: Hoffman Cat. No. A724818 FSD Two door free standing NEMA 12 enclosure, 72" H, 48" W x 18" D nominal dimensions, complete with the following: One (1) Cat. No. A72P48F2 half panel, 30" H x 44" W. One (1) Cat. No. A-72FSCPS center panel support.	Control Panel Enclosure
		DRAFT GAGE Mfgr: Dwyer Instruments, Inc. 2000 Series Magnehelic Gage, as follows:	Panel Gage
		Model No. / Range (in. W. C.)	
F16A-013	2	2006 / 0-6	
F16A-014	1	2010 / 0-10	
F16A-015	1	2015 / 0-15	
F16A-017	1	2025 / 0-25	
F16A-038	1	DIAL THERMOMETER Mfgr: Moeller Model 4000-S12 Bimet dial thermometer 5" dial, 12" stem, back connected. Range 50°F to 300°F	Fan Temperature Indicator

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OWNER SPECIFICATIONS

SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F16F-010	12	PUSHBUTTON Mfgr: Allen Bradley Cat. No. 800T-A1A green pushbutton, 1 NO-1 NC, labeled "Start".	Panel Controls
F16F-011	12	PUSHBUTTON Mfgr: Allen Bradley Cat. No. 800T-A6A red pushbutton, 1 NO-1 NC, labeled "Stop".	Panel Controls
F16F-012	1	PUSHBUTTON Mfgr: Allen Bradley Cat. No. 800T-A6A Red pushbutton, 1 NO - 1NC Label Silence.	Panel Controls
F16G-001	2	SELECTOR SWITCH Mfgr: Allen Bradley Cat. No. 800T-H2B selector switch 2 NO-2 NC, labeled "Off-On".	Panel Controls
F16G-002	1	SELECTOR SWITCH Mfgr: Allen Bradley Cat. No. 800T-H2H selector switch, 3 N.C.-3 N.O; label auto-off.	Panel Controls
F16H-010	14	PILOT LIGHT Mfgr: Allen Bradley Cat. No. 800T-P16R red pilot unit, 120 V., no label.	Panel Indicator
F16H-011	8	PILOT LIGHT Mfgr: Allen Bradley Cat. No. 800T-P16G green pilot unit, 120 V. no label.	Panel Indicator
F16H-012	1	PILOT LIGHT Mfgr: Allen Bradley Cat. No. 800T-P16A amber pilot unit, 120 V. no label.	Panel Indicator
F16H-014	1	PILOT LIGHT Mfgr: Allen Bradley Cat. No. 800T-P16B Blue pilot unit, 120 V., label none.	Panel Indicator

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OWNER SPECIFICATIONS

SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F16J-011	3	CONTROL RELAY Mfgr: Allen Bradley Cat. No. 700-N-400 A1 control relay, 4 pole, convertible contacts, open construction, for 120 V., 60 Hz.	Panel Control
F16K-010	1	FLOW RATE INDICATOR Mgr: Foxboro Model 65PS-JT milliameter dial indicator for 4-20 mA dc input, 0-50 square root scale with legend GPM. Case 4-1/2" wide for flush panel mounting.	Feed Rate
F16L-010	1	PANEL ANNUNCIATOR Mfgr: Ronan Series X2, Model 1031 annunciator system, sequence 1038 including: One (1) Model 44X2 cabinet, 4 high, 4 wide, general purpose, flush mounting. Eight (8) Model X21038 plug in modules, 120V/60 Hz. Thirteen (13) Type 14/3 engraved nameplates per Drawing No. 76-D-67 to follow. Three (3) blank nameplates. One (1) Model X14D101 flasher, 120V/60 Hz. mounted in cabinet.	Alarm
F16L-011	1	ELECTRICAL ENCLOSURE Mfgr: Hoffman Cat. No. A723018 FS one-door free standing NEMA 12 enclosure, 72" H, 30" W x 18"D nominal dimensions	Control Panel Enclosure

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OWNER SPECIFICATIONS

SECTION II - EQUIPMENT SCHEDULE

ITEM NO.	QUAN.	DESCRIPTION & MANUFACTURER	FUNCTION
F16M-010	1	ROTARY BIN LEVEL SWITCH MFGR: Bin-d-cator Model RA Type 6 for 120 Volt, Single Phase, 60 Hz. operation with two SPDT switches. Materials of Construction: Housing Al. Mounting Flange C.S. Paddle S.S. Shaft S.S. 9'-0" Mounting Fitting Flange Mounting Position Vertical Type four paddle, 5 inch diameter. For use at 250 °F on material with bulk density of 35 lbs/cu.ft.	Low level Switch LSL-1

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BOWEN ENGINEERING, IN

Instrument List
COVER PAGE
SECTION II-A

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Rev. 4 Date 3/14/77

Instrument No. and Item No.	Description	Function	Locati

Instrument number appears on flow sheet.
Item number is listed in sequential order in Equipment Schedule, Section II.

Brief description of instrument. See Equipment Schedule for details.

Function of instrument in the drying system, including reference to associated instruments in loop.

Physical location in plant, coded as follows:

CP = Main Control Panel
TB = Terminal Board, Chamber Top
BP = Burner Panel
F-XX = Field mounted with further coding for general vicinity as follows:
- BU = Burner
- FP = Feed Pump
- OD = Operating Deck
- CH = Drying Chamber
- MC = Multiclone
- RO = Rotoclone
- FC = Frequency Converter

Instrument No. and Item No.	Description	ALARM	Location
IAL-1	Annunciator	Burner Flame Current Low	CP
LAH-1	Annunciator	Dry Bin Level High	CP
LAH-2	Annunciator	Electrolyle Level High	CP
LAH-3	Annunciator	Venturi Sump Level High	CP
LAL-1	Annunciator	Dry Bin Level Low	CP
LAL-2	Annunciator	Dlectrolyle Level Low	CP
LAL-3	Annunciator	Venturi Sump Level Low	CP
MAL-1	Annunciator	Spray Machine Motor Failure	CP
MAL-2	Annunciator	Main Fan Motor Failure	CP
MAL-3/4	Annunciator	Airlock Motor Failure	CP
PAL-1	Annunciator	Dryer Air Flow Low	CP
TAH-1	Annunciator (Red)	Inlet Temperature High	CP
TAH-2	Annunciator (Red)	Outlet Temperature High	CP
TAH-3	Annunciator	Inlet Temperature Warning	CP
XAH-1	Terminals	Opens Customer's Alarm Circuit	CP

Instrument No. and Item No.	Description	Function	Location
A-1, A-2 F7J-011	Ammeter	Indicates Spray Machine Current	CP
A-3 F14C-010	Ammeter	Indicates Fan Motor Current	CP
DPI-1 F16A-015	Differential Pressure Indicator	Indicates Cyclone Pressure Drop	CP
E/P-1 F5B-020	Electro Pneumatic Converter	Converts MV to 3-15 # Signal	FM
ET-1 F7J-010	Elapsed Time Indicator	Spray Machine Running Time	CP
FCV-1 F14E-014	Damper Operator	Controls System Air Flow	FM
FI-1 F16K-010	Flow Indicator	Indicates Evaporated Flow Rate (Customers Signal 4-20 ma.)	F-FP
FI-2 & 3 F10A-011	Flow Indicator	Indicates Drop Flow Rate- Lube Oil to Spray Machine	TB
FI-4 & 5 F10A-011	Flow Indicator	Indicates Aspirated Air/Oil Flow Rate from Spray Machine	TB
FI-6 F10A-011	Flow Indicator	Indicates Air Purge Flow Rate to Spray Machine	TB
FI-7 F10A-011	Flow Indicator	Indicates Flush Water Flow Rate	TB
FSL-1 F10A-011	Flow Switch	Spray Machine Interlock Sensing Water Flow	TB
HIC-1 F5D-010	Hand Control Station	Controls Feed Pump	CP
HS-1 F5C-021	Hand Switch	Selects TIC-2 for Auxillary or Feed	CP
ISL-1 HAUCK	Burner Relay	Senses Burner Flame Failure	F-BU
LI-1 F10A-011	Level Indicator	Indicates Oil Lube Level	TB
LSH-1 F8F-011	Level Switch	Closes on High Level in Hopper	FM
LSH-2 (Customer)	Level Switch	Senses High Electrolyte Level	

BOWEN ENGINEERING, INC.	INSTRUMENT LIST FOR THE INSTRUMENT CONTROL & FLOW DIAGRAM	DR. 1114 PG. 4 OF 5 REV. 4 DATE 3/14/7

Instrument No. and Item No.	Description	Function	Location
LSH-3 (Customer)	Level Switch	Senses High Venturi Sump Level	FM
LSL-1 F16M-010	Level Switch	Senses Low Dry Salt Bin Level	FM
LSL-2 (Customer)	Level Switch	Senses Low Electrolyte Level	FM
LSL-3 (Customer)	Level Switch	Senses Low Venturi Sump Level	FM
PCV-1 F10A-011	Pressure Control Valve	Regulates Flush Water Pressure	TB
PCV-2 F10A-011	Pressure Control Valve	Regulates Purge Air Pressure	TB
PCV-3 F10A-011	Pressure Control Valve	Limits Vacuum of Aspiration on Spray Machine	TB
PI-1-4 F16A-011 to 017	Pressure Indicator	Indicates Static Pressures at Critical Points	CP
PI-5 F10A-011	Pressure Indicator	Indicates Cooling Water Pressure	TB
PI-6 By Customer	Pressure Indicator	Indicates Pump Discharge Pressure	F-FP
PSL-1 F3A-011	System Interlock	Senses Air Flow	F-CH
PSV-1 By Customer	Pressure Relief Valve	Unloads Pump	F-FP
SV-1 F7Q-010	Solenoid Valve	Controls Water Quench on Over Temp.	F-CH
TC-1 By Customer	Temperature Control	S.M. Cooling Water Temperature Controller	F-OD
T/E-1 F5B-020	Temperature Element	Senses Inlet Temperatures	FM
TI-1, TI-2 F10A-011	Temperature Indicator	Indicates Temperature of Cooling water to and from Spray Machine	TB
TI-3 F10A-011	Temperature Indicator	Indicates Temperature of Feed	TB
TI-4 F16A-038	Temperature Indicator	Indicate Fan Inlet Temperature	FM
TI-5 By Customer	Temperature Indicator	Indicate Outlet Temperature	FM

BOWEN ENGINEERING, INC.	INSTRUMENT LIST FOR THE INSTRUMENT CONTROL & FLOW DIAGRAM	BE 1114 PG. 5 OF 5 REV. 4 DATE 3/14/77

Instrument No. and Item No.	Description	Function	Location
TRC-1 F5A-020	Temperature Recorder Controller	Controls Customer Dilution Fan	CP
TRC-2 F5A-020	Temperature Recorder Controller	Controls Customer Auxillary Burner	CP
TSH-1 F3B-010a	System Interlock	Senses Inlet Over Temperature	FM
TSH-2 F3C-012	System Interlock	Senses Outlet Over Temp.	FM
TSH-3 F3B-010b	System Interlock Warning	Senses Inlet Over Temperature	FM
TSL-1 Customer	Burner Interlock	Starts and Stops Burner	FM
TT-1 F5C-020	Temperature Transmitter	Senses Outlet Temperature	FM
V-1 F10A-011	Voltmeter	Indicates S.M. Voltage	TB
XA-1 F2G-010	Alarm Horn	Sound on System Failure	CP
SV-2 PT/F4A-010	Solenoid	Opens pneumatic on motor starting	FM

OWNER SPECIFICATIONS

SECTION III

DESCRIPTION OF EQUIPMENT

This section is intended to describe the function of each portion of the system along with the controls and interlocks that affect their operation. It is helpful to have at hand the General Assembly and Instrument Control Diagram while studying this description.

Equipment

The principal items of the Spray Dryer are:

Inlet Duct
Drying Chamber
Atomizing System
Feed System
Product Collection
Main Fan
Instrumentation
Annunciator

Inlet Duct

Diluted products of combustion from the antimony furnace enters the duct which routes and distributes the flow into the chamber. Dilution of the combustion gases is varied to control the inlet gas temperature at 1450°F by means of the inlet temperature controller TRC-1.

The duct includes an access cover for inspecting the duct interior and cleaning, if required. Provisions are included for mounting the thermocouple temperature element, high temperature switch and inlet pressure connection for PI-1.

Drying Chamber

Furnace gases pass through a hot air duct and enters the chamber through a vaned ring that surrounds the atomizing disc. The air is now travelling at high speed in a spiral path and immediately comes in contact with the atomized feed. The intimate mixing of the hot air and the finely divided feed causes most of the evaporation to take place almost instantaneously. Residual moisture continues to evaporate as the powder swirls downward with the air and leaves the chamber through the lower tip of the cone.

The primary indication of maximum operating conditions is the amount of product that is building up on the chamber walls. To permit observing this, internal lighting is provided and a sight port is located near the chamber access doors. This door should be opened only when the dryer is not in operation.

ASARCO ELP 0002062

OWNER SPECIFICATIONS

SECTION III

DESCRIPTION OF EQUIPMENT

Drying Chamber (continued)

The chamber head plate includes four (4) water quench nozzles F7Q-010 which spray water into the chamber to protect the structure against excessive temperature. This water quench system is set off by the high outlet temperature switch F3C-010 energizing a solenoid valve. When the solenoid valve SV-1 (manual reset valve) is tripped, the valve will remain open until the handle is reset, even though the outlet temperature drops below the high outlet setting.

The outlet elbow includes provisions for mounting the outlet temperature transmitter TT-1, high outlet temperature switch TSH-2, an outlet pressure connection for PI-2 and a clean-out access cover.

Atomization System

The liquid feed is atomized in the drying chamber by flowing onto a disc which is rotating at extremely high speed. The liquid is accelerated and disintegrated into the fine mist that is essential for rapid drying. The disc, or "atomizer" is driven by a Bowen Spray Machine, a highly specialized motor which has been designed to operate continuously at high speeds. Section V of this manual contains a full description of the standard Spray Machine and system components, such as Frequency Converter, Cooling and Lubricating System.

The atomization machinery consists of a 50 KW frequency converter set, a Bowen high speed BB-6 spray machine and a centrifugal atomizer. The frequency converter steps up the "house current" from 60 cycles to the required frequency, and delivers this power to the spray machine. Refer to Section V, "BB" Spray Machine in the Owner Specifications Manual.

The Spray Machine is a high speed 2-pole electric motor with a dynamically balanced rotor running in high precision ball bearings. The housing is water cooled and oil is fed to the bearings and removed from them by a force feed lubricator and vacuum pump respectively. Proper lubrication is essential for good bearing life. Section V of this manual, pertaining to the spray machine in detail, should be read and thoroughly understood before any attempt to operate the spray machine. Initial start-up of the spray machine must be under the direct supervision of a Bowen engineer, or the warranty on it may become null an void.

The spray machine is interlocked with the lubricator, air circuit breaker, and water flow switch and cannot be started unless these interlocks are satisfied. The spray machine is to be started only at the terminal board area.

ASARCO ELP 0002063

OWNER SPECIFICATIONS

SECTION III

DESCRIPTION OF EQUIPMENT

Atomization System (continued)

Attached to the spray machine is a specially designed, dynamically balanced atomizer. Feed passes from the terminal board through the spray machine housing onto the atomizer. Rotating at a high speed, the disc flings out and distributes the feed as a uniform, fine mist into the hot air stream entering the drying chamber.

The air purge is designed to prevent the migration of feed material up the shaft and into the lower bearings, and to provide clean venting air to the spray machine housing. The operating range for the air purge should be between 0.3 to 0.5 SCFM at 15 psig. The air purge system should always be on when the spray machine is in operation.

A terminal board is provided for mounting on the operating platform near the spray machine well. The assembly provides a convenient terminus for cooling water and feed piping to the spray machine. In addition, a force-feed lubricator and vacuum pump for spray machine lubrication is provided with the terminal board. Flexible hoses are supplied for piping above services from the terminal board to the spray machine. Also provided, mounted on panel are: voltmeter, ammeter, a water flow switch and a pressure gauge from the spray machine cooling water, three (3) thermometers, an air purge meter and regulator gauge set and two (2) start/stop pushbuttons.

Feed System

Two (2) Moyno progressing cavity type feed pumps are provided for feeding either water or feed slurry to the dryer. The pumps will be used on an alternating basis with only one in use at any one time. The system is normally started up and shutdown while running on water. Also, if there is trouble with the feed supply, the system can be run on water until the trouble is corrected. A pneumatic signal solenoid valve connected across the motor lead prevents the variable drive from operating when the motor is not running. The pressure relief prevents the pump from overloading due to line blockage.

CAUTION: NEVER RUN THE PUMPS DRY, THIS COULD DAMAGE THE STATOR.

The feed pump cannot run unless the spray machine is running. This latter interlock may be removed from the circuit to permit test running of the pump or flushing lines by switching the selector switch on the main panel to "hand" which lights a Red Pilot Light. Normal operation should however always be in the "automatic" position.

Whichever pump is connected will also be connected to the panel and its speed controlled by either manual or automatic 3-15# pneumatic signal, based on dryer outlet temperature, from TRC-2. This is accomplished through the pneumatically operated variable speed pump drives. This temperature is recorded by TRC-2 (Blue Pen).

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OWNER SPECIFICATIONS

SECTION III

DESCRIPTION OF EQUIPMENT

Feed System (continued)

The feed or water flow rate to the dryer is indicated on the main panel board on meter FI-1. The feed pressure can be read on locally mounted pressure gauge PI-6. The feed temperature is indicated on the terminal board on thermometer TI-3.

Product Collection

The air and entrained product is split into two streams and enters two Ducon cyclones. The tangential entry causes the air to spin in the cyclone. The rotational speed increases as the air travels in a swirling path down the sides, and then returns up the center in high velocity vortex. The product is thrown out of the air stream by centrifugal force, and fall into a hopper below. The air along with a small percentage of finer particles of product leaves the cyclone through the top outlet. The air streams rejoin in the top manifold of the cyclone. The dried product from the cyclone falls to the bottom of the hopper where it is removed by a rotary airlock and enters the dry salt hopper.

The sytem pressure at the cyclone outlet is indicated on PI-3. The pressure drop through the cyclone shown by DPI-1 can be used as an indication of the airflow rate.

Inspection doors are provided at the top of each cyclone collector. Cleaning rod out connections are included in the sides of each knock-out hopper at the bottom of each cyclone.

The dry salt hopper includes an inspection door in the top plate and a clean-out manhole in the hopper side wall. Hammering channels are mounted on the cone section in case the dry salts require vibrators to discharge the powder.

Bindicators are provided to alarm on high or low level in the dry salt hopper.

Main Fan

The main fan draws air through the system and since proper operation of the dryer depends on good fan performance at all times, inspection should be made periodically.

A damper is located on the fan outlet and has a pneumatic operator that can be positioned from the furnace control panel. The damper will normally be set at the point that results in the correct system airflow under operating conditions. However, it will probably be necessary to close the damper somewhat at start-up when the system is cold because cold air is more dense and will tend to overload the fan drive motor. An ammeter is provided on the control panel and should be marked with the motor full load current. This current level should not be exceeded.

System pressure gauge PI-4 is connected at the fan inlet as well as a temperature indicator TI-4 locally mounted on the inlet duct.

ASARCO ELP 0002065

OWNER SPECIFICATIONS

SECTION III

DESCRIPTION OF EQUIPMENT

Instruments

The control panel includes all the remote dryer controls and gauges. System pressure gauges follow the airflow through the dryer from inlet to outlet. These are arranged from left to right.

The system temperature recorder records both the inlet and outlet temperatures. The inlet controller adjusts the dilution air control to maintain inlet temperature setting.

The outlet controller varies with either the auxiliary burner or the feed pump to control the outlet temperature. The selection of these functions is switched by hand switch HS-1 which is pneumatic hand valve. The manual position connects the feed pump to the manual indicating controller HIC-1 which will maintain a constant feed flow rate. At the same time the automatic outlet controller is connected to vary the auxiliary burner firing rate. Increasing the auxiliary burner input would increase the furnace outlet pressure and cause the furnace pressure controller to decrease the main fan damper opening and airflow through the system.

The inlet and outlet controller include manual override as well as automatic selector stations and indicating manual controllers.

The panel also houses the auxiliary burner control cabinet. This cabinet includes terminals for the field connections to the burner valves and limits.

The feed flow rate is indicated on the panel by a 4/20 ma signal from a transmitter furnished by others. The feed flow is varied by changing the speed of the feep pump which is controlled by a pneumatic operator mounted on the variable speed drive unit.

The spray machine operating time is recorded by an Elapsed Time Clock on the panel. The spray machine current is indicated on the panel to permit observation of any change in spray machine motor load that could result due to changes in feed flow rate, feed characteristics, operating problems with the frequency converter or drive and feed build-up on the motor shaft.

Terminal Board oil bubble bottles are provided for the top and bottom spray machine motor bearings. A vacuum drawn through the bubble bottles oil level allowsobservation of the evacuated air bubble flow rate, the condition of the oil withdrawn from the bearings, observation of any water and foreign material entering the lubrication system.

ASARCO ELP 0002066

OWNER SPECIFICATIONS

SECTION III

DESCRIPTION OF EQUIPMENT

Annunciator

Mounted on the dryer control panel, the annunciator indicates which alarm has actuated on a first out basis. The first alarm point that sounds will show a flashing lighted window. Subsequent alarms are shown steady on lighted windows. After silencing the alarm horn all abnormal alarm points are shown as steady on lighted windows.

After alarm points are returned to normal, the lighted windows will remain steady on lighted until the reset is actuated. After reset, normal alarm point window lights will shut off.

The lamp test pushbutton allows the window lamp to be tested while the unit is in operation without upsetting the alarms.

A MAIN ALARM contact is provided to open the contact at the PLANT MAIN CONTROL panel should any limit alarm.

THE HIGH INLET TEMPERATURE alarm TAH-1 trips a contact through relay CR-3 for the customers, "STACK BY-PASS"solenoid should the inlet temperature become excessive and endanger the inlet duct structure. This stack by-pass is to vent the furnace gases when the inlet temperature is excessive.

NOTE: Before this alarm point would trip the HIGH INLET TEMPERATURE WARNING alarm TAH-3 would sound, since it is operated at a lower temperature, this will allow corrective action before the HIGH INLET TEMPERATURE alarm would trip the furnace stack by-pass.

THE HIGH OUTLET TEMPERATURE alarm TAH-2 trips a manual reset "water quench" solenoid to spray water into the chamber should the outlet temperature become excessive and endanger the chamber structure. This water quench solenoid will continue to feed water spray into the chamber until the trip handle is manually reset. For this reason, the water quench solenoid and the quench water valve should be field located for ready access by the operator.

All other alarm points only alarm at the panel to alert the operator of abnormal conditions.

ASARCO ELP 0002067

DESIGN PARAMETERS

BE 1114 DATE 4/15/77

CUSTOMER ASARCO Incorporated P.O.# 16H-0198

ADDRESS El Paso, Texas

SYSTEM Spray Dryer 16' Dia.

SPRAY MACHINE BB-6 RPM 15,000 MAX AMPS. 104 SEC. VOLTS 218

ATOMIZER 9" CSE F.C.Drive: 50 KW MAX. ITR Setting 57 AMPS.

PRODUCT Dry Salts

PRODUCT RATE 2847 #/Hr., PRODUCT MOISTURE 5%

FEED RATE 12710 #/HR., FEED MOISTURE 77.6 %, FEED SOLIDS 22.4

EVAPORATION RATE 9863 #/HR.

INLET TEMPERATURE 1450 °F., OUTLET TEMPERATURE 240 °F.

AIRFLOW 17,376 CFM AT 240 °F., 23 "W.C. 110 BHP

MOTOR HP 125, FULL LOAD AMPS. 150

P_1- CHAMBER INLET 1.0 "W.C.

P_2- CHAMBER OUTLET 3.0 "W.C.

P_2- INLET TO COLLECTOR 3.0 "W.C.

P_3- DELTA P CYCLONE 4.0 "W.C.

P_3- DELTA P BAG FILTER 11 "W.C.

P_4- FAN INLET 21 "W.C.

P_5- FAN DISCHARGE 0.5 "W.C.

STACK 0.5 "W.C.

R.C. Nawrocki

9/76
MAH

OWNER SPECIFICATIONS

SECTION IV

OPERATING INSTRUCTIONS

The following is a step-by-step procedure intended to assist the operating personnel in understanding the function and operation of the Spray Dryer System. Operating instructions in their final form should be incorporated modifications to procedures required for auxiliary equipment provided by the Owner.

A. General

Before any attempt is made to operate the dryer, operating personnel should become thoroughly acquainted with all sections of this manual. In addition, the logic sequence of the Instrument Control Diagram per drawing no. 76-D-66 and the Electrical Control Diagram per drawing no. 76-D-70, should be thoroughly studied and understood.

A complete inspection and checkout of the wiring and piping should proceed any attempt to start the dryer for the first time. All mechanical components should likewise be checked.

The initial start-up of the equipment must be done in the presence of a Bowen Engineer. Otherwise, the warranty on the equipment may become null and void.

Make sure that all components of the dryer are supplied with the proper utilities and plant services (compressed air, natural gas, etc.) as called for on drawing no. 76-D-66.

NOTICE: The dryer has two modes of operation.

Mode 1 - Constant feed rate, varying the auxiliary burner.

Mode 2 - Constant auxiliary burner rate. Varying the feed rate to control temperature.

B. Starting the Dryer - Mode 1

1. General

a) Turn on all services such as electrical power, natural gas, oil fuel, compressed air and water to the feed pump.

2. At the Furnace Control Panel

a) Check that the furnace draft control is at a setting that will not overload the main fan motor.

ASARCO ELP 0002069

OWNER SPECIFICATIONS

SECTION IV

OPERATING INSTRUCTIONS

3. At the Operating Platform

Start-up the spray machine in the following manner:

a) See that the atomizer is clean and rotates freely. Lower the spray machine into the well making sure the hoses are not touching the sides of the well.

b) Turn on the cooling water checking for correct pressure and temperature.

c) Start the lubricator/vacuum pump. Check the oil level in the resevoir and see that 2-3 drops of oil per minute are being fed to each bearing. Airflow in the bubbling bottles should be flowing at roughly six (6) bubbles per second. Confirm that oil is reaching the machine and being aspirated from it. After periods of idleness or maintenance, be sure the oil supply hoses have been filled. The lubricator/vacuum pump can also be started at the control panel.

d) Start the spray machine by pressing and holding the start button until current and voltage readings reach normal operating levels.

NOTE: If the voltage does not rise uniformly within a few seconds, release the start button immediately. Locate the trouble before attempting a restart.

4. At the Control Board

a) Set the Outlet Temperature Controller in the manual position and adjust the output air signal to zero.

b) Set the Inlet Temperature Controller and Feed Rate Controller in the manual position and adjust the output air signal to zero.

c) Turn on panel power. Silence the alarm horn.

d) Start one spent electrolyte pump.
e) Start one scrubber pump.
f) Start the main fan watching the ammeter to see that it returns to a safe current level. Note: system pressures.

With all levels within the operating range, all annunciator alarms should be off except the Auxiliary Burner Flame Failure.

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5. At the Furnace Area

a) Bring the furnace gases over to the dryer.

Allow the chamber to heat up, this may not take too long.

As the inlet temperature reaches 1450°F, transfer the inlet controller to automatic.

Allow the outlet temperature to reach 300°F, (this over temperature is desirable to heat up the chamber. If the chamber metal is not heated above about 160°F the drying moisture will condense on the cold metal and leak into the dry salt hopper).

b) Start one of the feed pumps (note the feed flow rate, this should be about 5 GPM).

c) Increase the feed rate controller to control the outlet temperature. Work the outlet temperature down to about 275°F, (check the furnace outlet pressure, spray machine and main fan current).

d) Start the collector airlocks, (any solids in the water supply are being collected).

e) Start the combustion blower.

6. At the Auxiliary Burner Cabinet (with fuel selected)

a) Turn on burner power. (The Limits Set lamp should be on).

After the "purge complete" comes on, the light off should cycle and show "flame on."

7. At the Panel Board

The annunciator should show all points as normal, no lamps on. If any are lighted, the reset and silence should be cycled.

a) Increase the outlet signal to match the temperature signal and switch over to automatic control.

Normal Mode 1 Operation: With feed rate holding the outlet temperature.

Assume the outlet temperature drops below 275°F, the auxiliary burner will light main fuel and increase the outlet temperature.

8. At the Feed Pumps

a) Change over to salt feed flow. This will cause an increase in the outlet temperature due to lower cooling of the salt feed liquid.

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8. At the Feed Pumps (continued)

b) Increase the feed flow signal to prevent the outlet temperature increasing above 300°F.

c) Slowly increase the feed rate to reduce the outlet temperature to the operating temperature of about 240°F.

The dryer is now in normal operation for Mode 1.

C. Mode 2 Operation

Operation is the same as Mode 1 except the pneumatic hand switch is set to auxiliary burner which will be controlled by the manual controller. The feed pump control will then be the outlet temperature. Operating changes begin at No. 7 - At the Panel Board (a) Increase the feed rate by increasing the outlet signal. Slowly work the outlet temperature down to about 270°F. (b) Start the collector airlock, (c) Start the combustion blower.

No. 8A - At the Auxiliary Burner Cabinet (a) Turn on burner power.

No. 9A - At the Panel Board (a) Bring the outlet temperature down to below 203°F (which is the operating temperature).

No. 10A - At the Feed Pumps (a) Change over to salt feed flow, (b) Increase the feed flow to hold the outlet temperature down near normal operating temperature of 240°F, (c) Switch the outlet controller (which controls the feed) over to automatic.

Dryer is now in normal Mode 2 Operation.

NOTE: If the higher outlet temperatures does not affect the dry salt powder in the dryer, the change over to salt liquid feed can be made at higher temperature.

D. Shutting Down the Dryer

1) Switch outlet to manual control.
2) Shut off auxiliary burner power.
3) Gradually reduce outlet temperature.
4) Gradually change from feed to water.
5) At Furnace By-pass Stock

a) Switch gas flow to stack. (Check main fan current as colder air could overload the fan.

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D. Shutting Down the Dryer (continued)

6) At the Dryer Panel Board

a) Shut down the feed pump.
b) Allow inlet to cool down.
c) Shut down airlocks.
d) Shut down spray machine.
e) Shut down main fan.
f) Shut down scrubber pumps.
g) Shut down electrolyle pump.
h) Shut off panel power.
i) Shut down services not required.

7) At Operating Platform - When spray machine has stopped, remove from inlet well.

a) Shut down the lubricator.
b) Turn off cooling water and purges. NOTE: If freezing temperatures are expected, remove both cooling water drain plugs from spray machine body. Drain all water from unit. Install plugs.

E. Difficulties That May Be Encountered and How To Overcome Them

Slow Drying Materials

Gums and gels are likely to cake in the hopper bin. This is an indication that the product is slow drying. The particles dry on the surface but when they come to rest in the hopper, the moisture will continue to diffuse to the surface of the particles causing them to cake. Usually this caking can be overcome by diluting the feed with water.

Product Adheres to Chamber Walls

1) Too High Feed Rate

Too high a feed rate which implies too low an outlet temperature will cause only partial drying of the particles and the wet particles will plaster the walls. A slower feed rate and higher outlet temperature is the remedy for this. Hygroscopic and slow drying materials require slower feed rates. All feed rates after once being established, should be kept constant.

2) A High Percentage of Non-Volatile Liquids

A high percentage of fats, oil or other non-volatile liquids in the feed will also cause the product to adhere to the walls. About the only way to correct this trouble is to reduce the percent of fat in the material to be dried, or else plan to collect the product by sweeping the chamber with a brush at the end of the run.

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E. Difficulties that May Be Encountered and How To Overcome Them (continued)

3) Decomposition

In a very few cases decomposition of the product may produce sticky decomposition products. A lower hot air inlet temperature will correct this.

4) Super Cooling

A few chemicals will dry in the form of liquids and crystalize only slowly. There is no simple correction to this difficulty.

5) Insufficient Atomization

Incorrect air or liquid pressures, a slurry with large particles and feed material with a high viscosity can cause insufficient atomization. If such difficulty is encountered these items must be carefully checked for the atomizer being used.

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