Florida Rock Industries, Inc.
Newberry, Florida

ELECTROSTATIC PRECIPITATOR OPERATION AND MAINTENANCE PLAN

September 5, 2006

File: ESP O&M Plan.doc

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1. Introduction

Florida Rock Industries, Inc. (FRI) operates a limestone quarry and a cement production facility at this location. Limestone is mined and stockpiled. It is then mixed with other raw materials that provide an additional source of mainly iron and aluminum, in designed proportions. The mixture is ground to produce kiln feed. The additional raw materials used will include fly ash, sand and mill scale. The kiln feed will have sufficient chemical properties to produce clinker when subjected to the high temperatures in the preheater stages, precalciner and rotary kiln. The clinker produced by the pyroprocess process is ground into finished cement. As clinker is introduced into the finish (grinding) mill, a small percentage of gypsum is added to produce Portland cement.

FRI is committed to operating the facility in a manner that will comply with applicable federal, state, and local environmental regulations and in harmony with the surrounding community. FRI expects to operate at this location for many years. To accomplish this, FRI has made regulatory compliance a corporate commitment. This commitment is vigorously disseminated throughout the company from the top down.

2. Purpose

The purpose of this plan is to effectively operate and maintain Electrostatic Precipitators (ESP) so as to minimize process emissions and in a manner to meet or exceed the requirements of federal state and local environmental regulations.

It is a regulatory requirement for FRI to develop and implement an ESP Operation & Maintenance Plan (O&M Plan) to ensure the effective operation of the Kiln/Raw Mill and Clinker Cooler ESP's. The routine monitoring and maintenance of emission control units is essential for the optimum performance/capture efficiency of the units. The O&M plan will describe the measures and procedures that FRI has implemented to ensure that the emission control units will achieve their designed operating efficiency throughout the life of the ESP.

3. Electrostatic Precipitator Operating Principle

An ESP, from an operational standpoint, is a relatively simple device comprised of an insulated shell (box), discharge electrodes, collection plate, transformer/rectifiers and electrodes rappers and a collection hopper. Dust laden gas, with positively and negatively charged particles, passes through the box via a fan; forced draft (FD) or induced draft (ID). The airflow is channeled into the box through a dispersion plate; for even distribution of the gas stream. The discharge electrodes are centered between the collection plates and are negatively charged. The collection plates are earth grounded and considered to positive. They will act as a magnet for negatively charged particles. Between the electrode and the collecting surfaces is a unidirectional, high-potential field of rectified (DC) high voltage. Electrons emitted by the discharge electrode migrate toward the collection plates and attach to dust particles in the gas stream and imparting a

negative charge. All remaining, positively charged particles will be collected by the discharge electrode. Each group of discharge electrodes and collection plates are attached to connecting rod, through the top of the ESP to a rapper (magnetic hammer). On a predetermined sequence, each rapper is actuated remove accumulated dust from the collection plates and electrodes. This dust collects in the hopper of the ESP and the material is returned to the process via an enclosed, material-transport system.

The ability of a particle to attract and hold a charge is termed the resistivity of the particle and is dependent upon the gas properties, size of the particles, physical and chemical properties of the particle and the relative humidity/moisture content of the gas stream. In the kiln/raw mill ESP, this moisture is provided by a gas-conditioning tower (GCT) in direct operation and by the raw mill and the GCT, if needed, in compound operation. In the clinker cooler ESP, moisture content is provided by the clinker cooler water sprays.

The maintenance requirements for the mechanical and electrical aspects of the ESP and the associated material-handling devices are incorporated into the plant wide preventative maintenance (PM) program. This program has been established based on manufacturer's suggested maintenance and the process experience of FRI personnel.

4. Electrostatic Precipitator Arrangement

The ESP is divided into four, distinct areas that are designated as (1) precipitator roof; (2) penthouse; (3) treatment zone; and (4) collection/disposal zone. The treatment zone is composed of a single chamber with 23 gas passages on 16-inch centers and has four mechanical and electrical fields that are independently powered and monitored. The mechanical fields contain twenty-four collecting surfaces that are 38-ft tall and 10.6-ft wide, which provide in total a 42.5-ft long treatment zone composed of 74,290-sq-ft of collection surface (see Figures 1 & 2.). The discharge electrodes are 38 feet long and 1.5 inch in diameter. There are 644 discharge electrodes with a total, effective length of 24,472 feet.

A. The precipitator-roof area of the ESP contains the following components:
   1. Transformer/Rectifier (T/R) - Supplies the high voltage with unidirectional current to the discharge electrode system.
   2. Automatic Rapping System - The rappers automatically, at prescribes intervals, strike the connecting rod for the plates and electrodes to dislodge the accumulated dust layer.

B. Penthouse (located between the roof and the treatment zone):
   1. Pressurization and heating system of the penthouse prevents moisture buildup and dust entering this area where the high voltage system insulators are located. Dust and/or condensation on the insulators can cause arc-over and seriously damage the ESP electrical system.
   2. The insulators isolate the high voltage system from the ESP housing, which is at ground potential.

C. Treatment Zone:

This box-like structure comprises the largest area of the ESP and is where the collecting surfaces are located. Process gases enter and travel the length of the compartment. The size of the area is sufficient to provide the collecting surface area needed and reduce the gas velocity for efficient particle removal. An ESP capable of a 99+% removal efficiency.

D. Collection/Disposal Zone:

Hoppers at the bottom of the ESP receive the dust that accumulates and slides downward (under rapper vibration) on the collection surfaces. Screw conveyors empty the hoppers and return material to the process with rotary airlocks or flop gates.

5. Gas Conditioning

The gas-conditioning tower (GCT) is a spray tower for gross particle removal and evaporative cooling of the gas stream. This evaporative cooling is essential for temperature control and for the addition of moisture to the gas stream. The GCT system utilizes high pressures water pumps, compressed air, spray lances and specialized nozzles to deliver atomized water into the kiln system exhaust gases. Due to a velocity decrease and the effects of the evaporative cooling, in the tower, a significant removal of particles also takes place at this point. The materials that collect in the GCT are returned to the process via an enclosed material transport system. When in operation, the volume of water added to the GCT system is automatically regulated by the temperature feed back from the inlet and outlet temperature sensors.

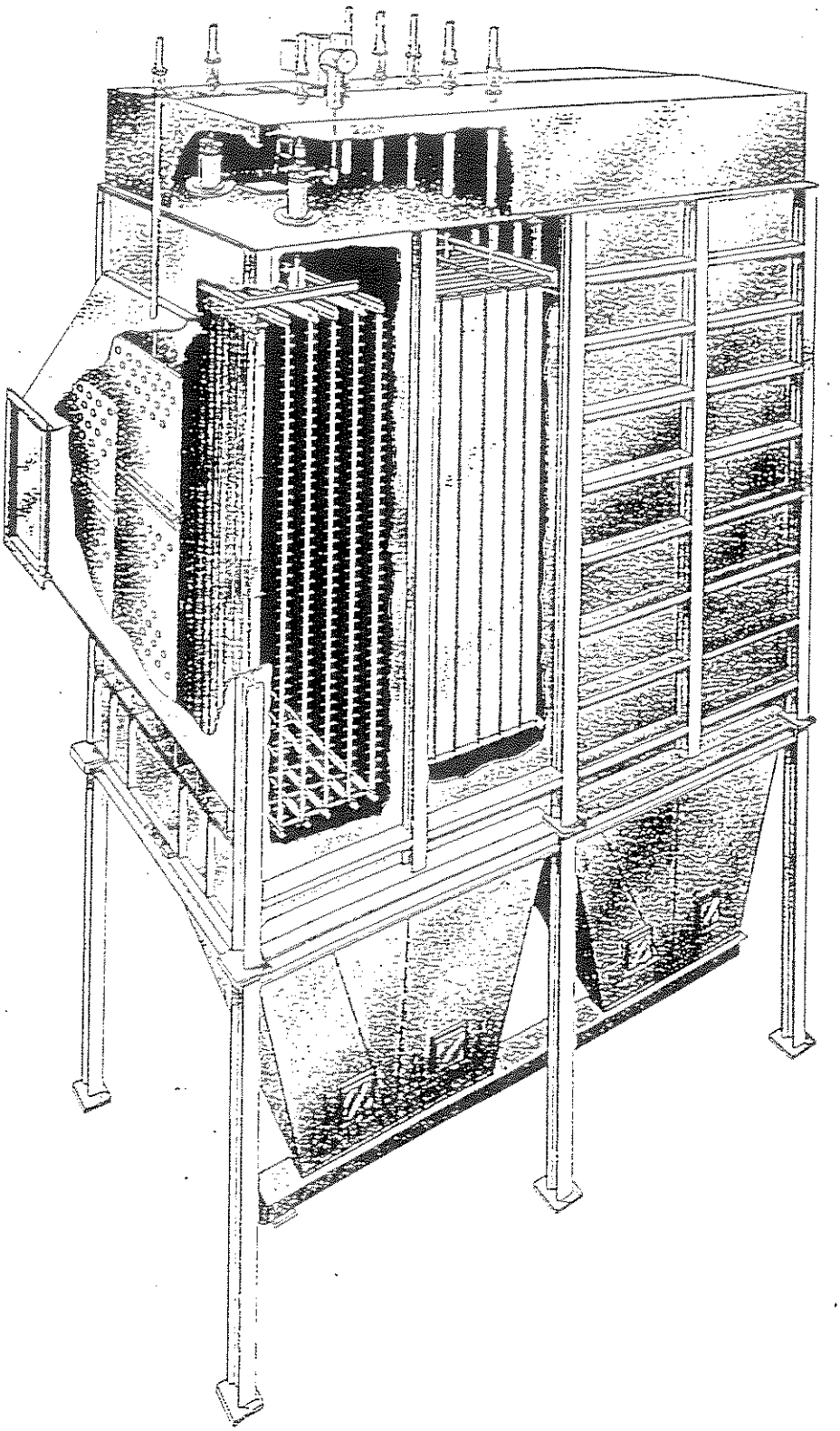

Figure 1. Typical ESP Arrangement

6. ESP Gas Flow

The ESP's are equipped with suction or induced draft (ID) fans, where the fan is downstream of the baghouse. The ID fan system is preferable because it maintains a negative pressure (vacuum) on the entire system upstream of the fan and air is drawn into the system at any point of potential leakage. Where the forced draft system will blow air/dust out at any point of leakage, downstream of the fan.

Gas flow through the box is relatively low velocity at ~2.5 – 3.0 feet per second and a pressure drop of ~1.0" wg., or less, to allow for efficient collection the dust particles.

7. Particle Collection

The discharge electrodes are of negative polarity, while the collecting surfaces are at ground potential and considered positive polarity. At and above a specified voltage, a corona discharge forms near the surface of the discharge electrode. This corona is a visible indication that positive and negative ions are being discharged into the gas near the discharge electrode. The positively and negatively charged gas ions are attracted to surfaces of opposite polarity. While moving toward these surfaces, the ions attach themselves to the solid or liquid particles entrained in the gas stream. This process charges the particles either positive or negative.

Because the ionization takes place near the discharge electrode, the negative ions have a greater distance to travel, which in turn, charges more particles negative than positive. This causes in a greater volume of particle collection on the collection plates (+) than on the discharge electrode (-).

Upon reaching the collecting surface, the particles give their charge and serve as conductors for additional deposition of charged particles. The collection plate groups (see Figure 2.) and discharge electrodes groups (see Figure 3.) are connected to rappers for particle removal. After a sufficient layer of particles has accumulated on the collection surfaces, the rappers dislodge the dust buildup, which falls into the hopper. The dust removal system continually removes the dust from the hoppers and returns it to the process.

The four fields will progressively clean the gas stream. The first field (Field No. 1) will collect the larger particles and will build dust layer quicker than successive fields. Therefore, the inlet field will need to be cleaned (rapped) more often the successive fields (2, 3 & 4). If the dust cake is allowed to get to thick, it will electrically insulate the collection surfaces and reduce the efficiency of the field. The smaller particles migrate slower and collect on the remaining fields. The smaller particles do not form a good dust cake that falls apart very easily. Sometime this will occur on the last field and the re-entrain dust will cause a momentary increase in opacity.

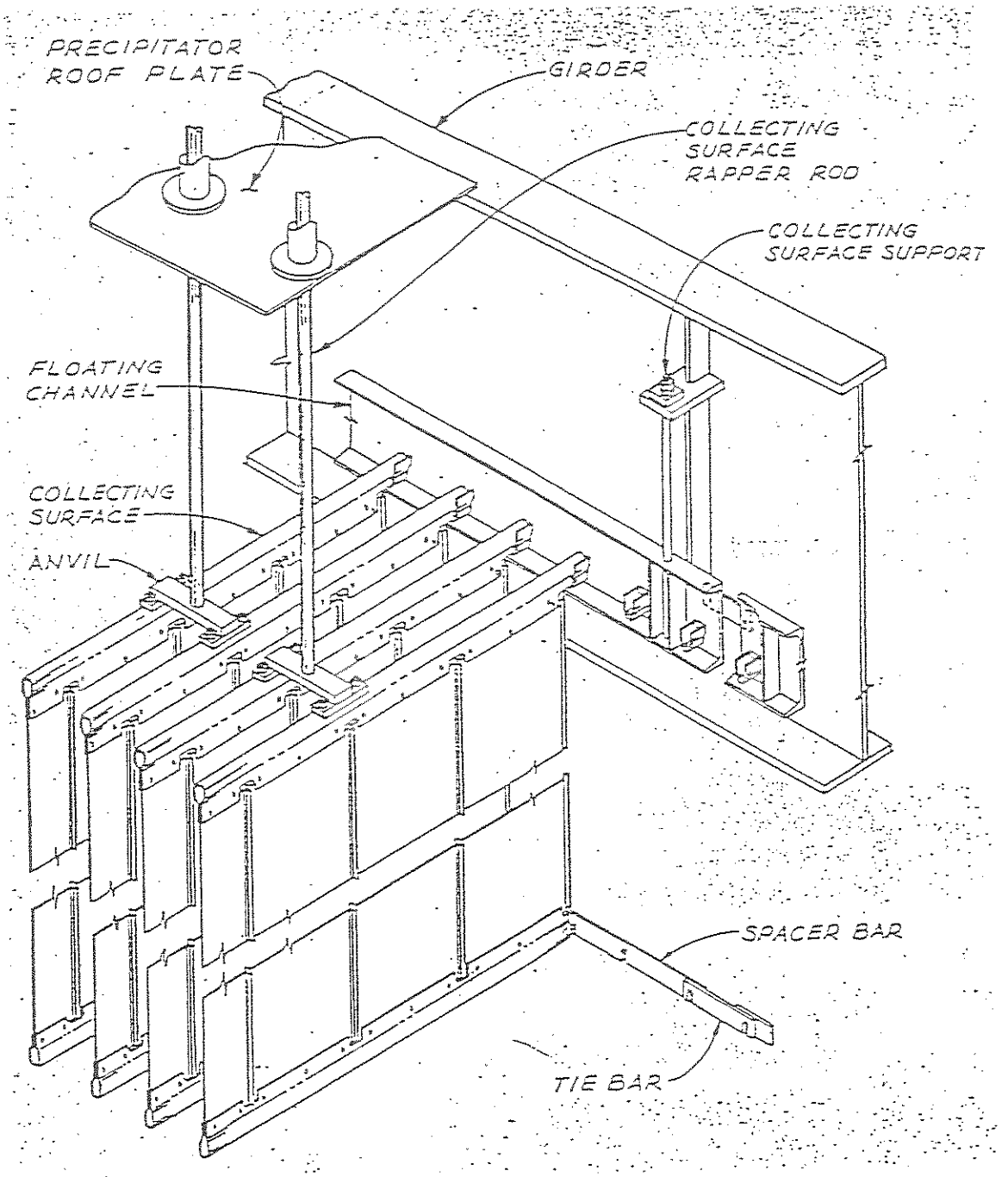

Figure 2. Collection Plates

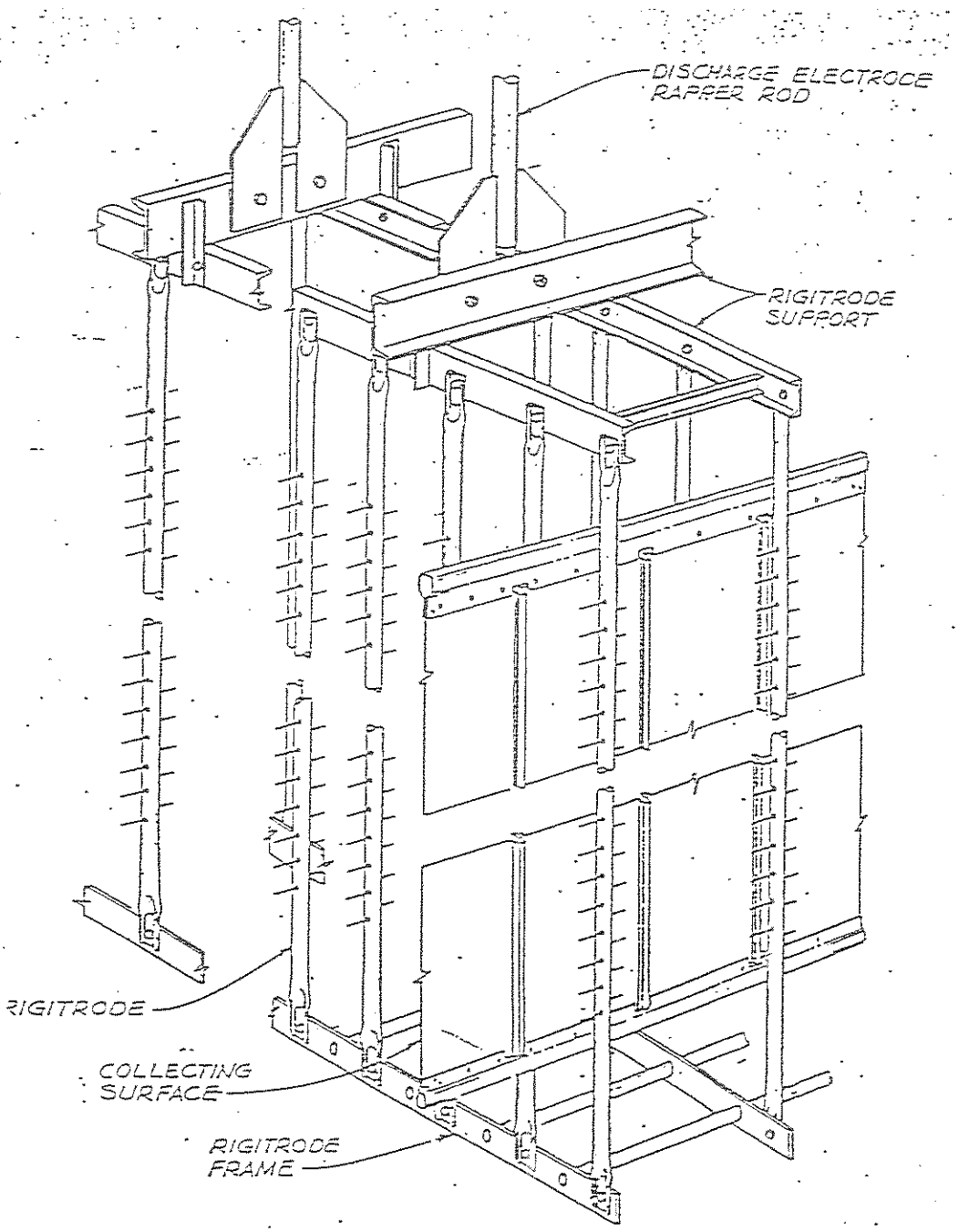

Figure 3. Discharge Electrodes

8. Rappers

Rappers serve as the cleaning device for the collection plates and discharge electrodes. The rappers are single impact magnetic induced piston and anvil type mechanisms with a microprocessor based controller to establish the rapping cycles. Rappers are individually, controlled to permit adjustment of rapping intensity and cycle time for each field.

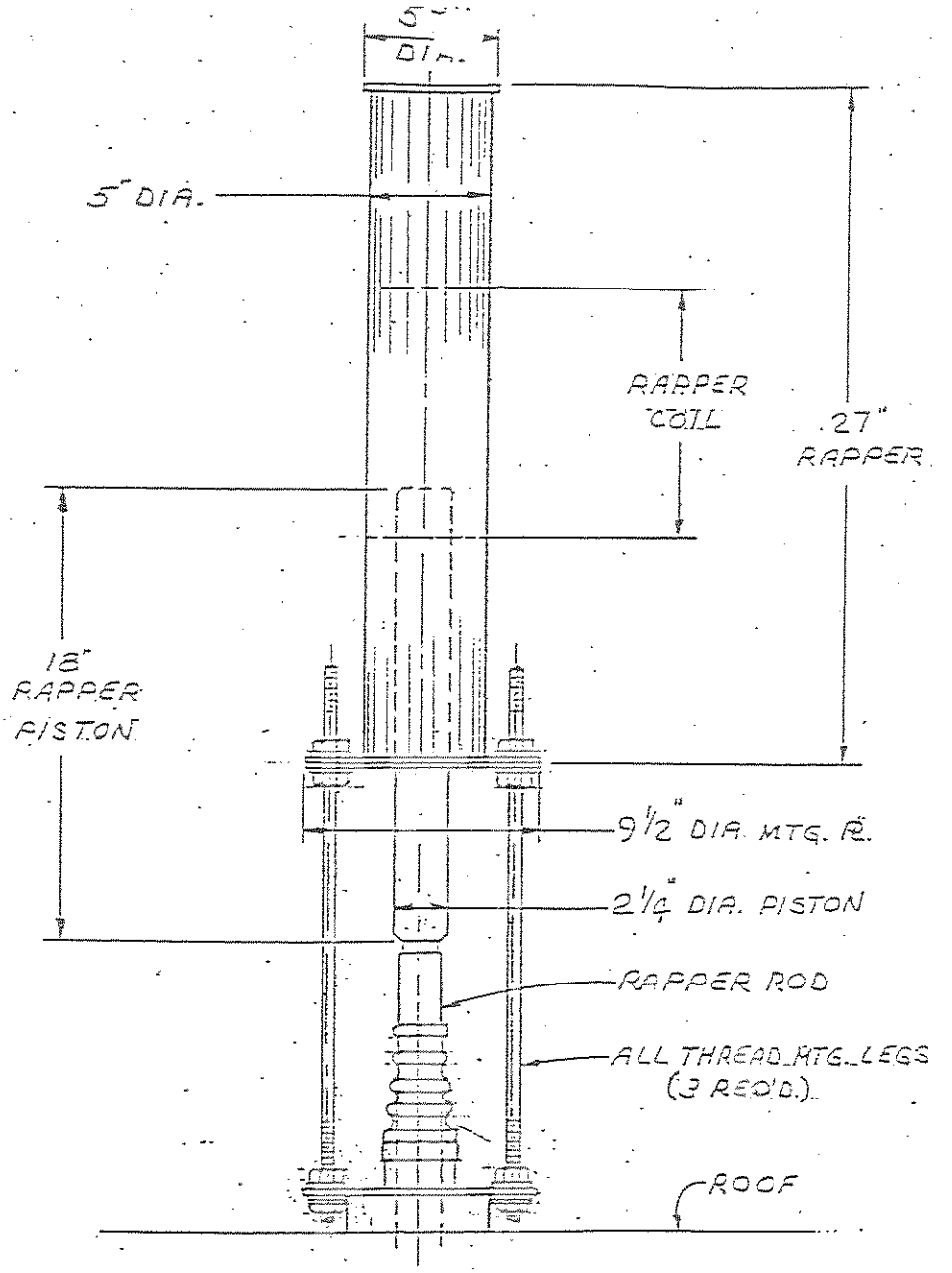

Figure 4. Rapper Assembly

9. Power Supply

An ESP typically requires 480 VAC to the transformer/rectifier set (T/R) of each field. The T/R reduces the line voltage to 120 VAC for control power, primary/secondary voltage and primary/secondary current required for particle collection. Each T/R set is equipped with a logic controller to manage the power supply and provides readout and feedback on the electrical operation of the ESP. The primary voltage for ESP operation is 480 VAC with a secondary voltage of 70 KV and the controller. These voltages as well as the corresponding primary and secondary current will vary with inlet loading and gas properties.

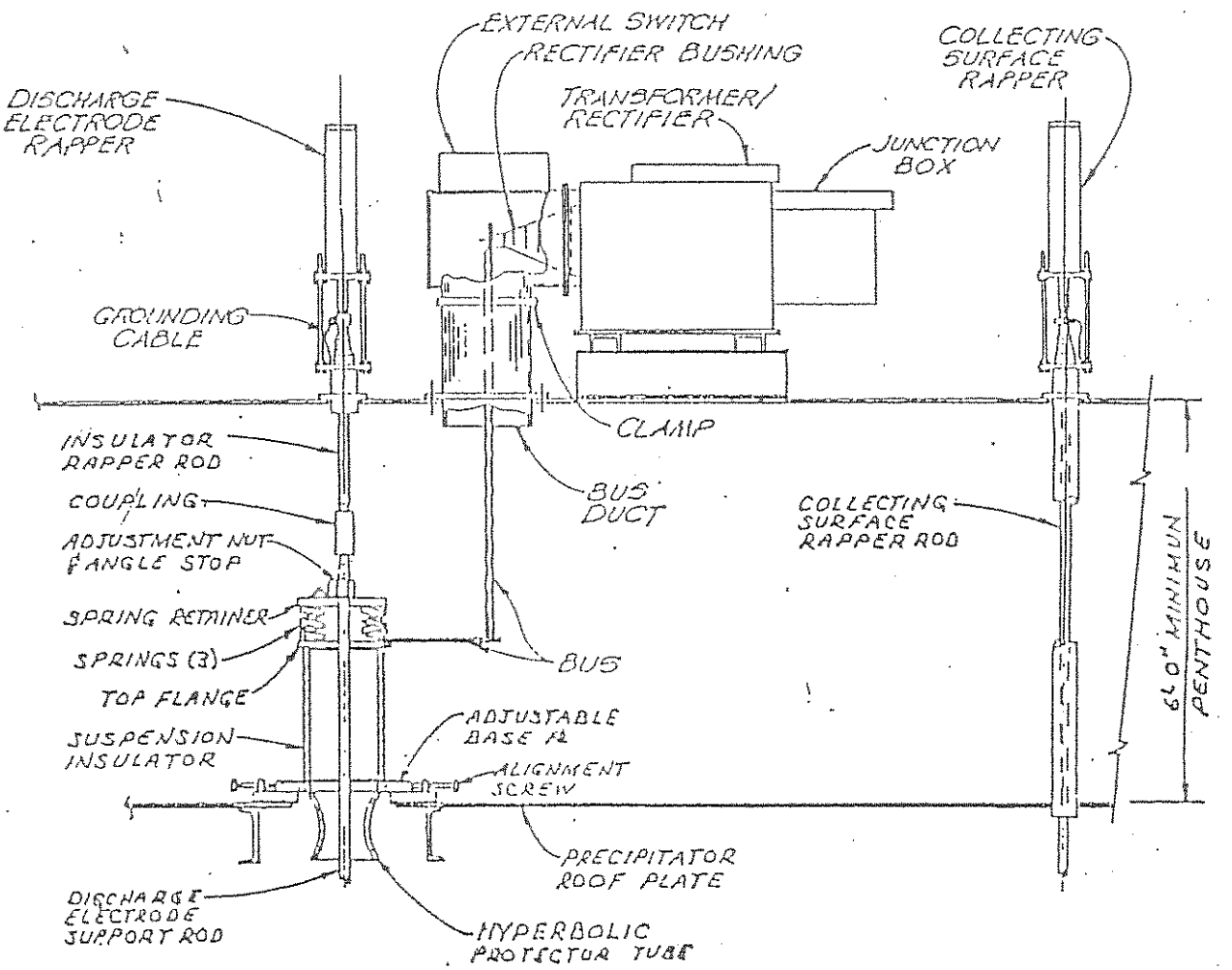

Figure 4. High Voltage – T/R Set

10. ESP Inspection & Maintenance

The maintenance discussed in the following section is preventative maintenance. The goal of the plan is to maintain the long-term performance of the ESP and to minimize the failure of various components that effect ESP performance. An important aspect of the preventive maintenance is scheduled inspection and PM of the ESP, both internally and externally. These inspections include daily, weekly, monthly, quarterly, semiannually, and annually. Semiannual and annual inspections are conducted during scheduled outages.

11. Record of Maintenance

A record of maintenance activity is required following each job on an electrostatic-precipitator dust collector, which is both a product-recovery device and an air-pollution control device. Federal rules require a record of the date of maintenance, equipment type and ID, type of maintenance (preventive, routine repair, unscheduled repair), description of work done, and signature of maintenance technician or supervisor. The record may be made via the automated maintenance-record system (such as Datastream) or handwritten on the form provided in Attachment 11. Each record must be retained five years and be made available if requested by an air-pollution regulatory agency.

12. Daily ESP Inspections/Preventative Maintenance (PM)

The purpose of daily inspections/PM is to identify the existence of and correct any operating conditions and/or function that may develop into malfunctions or failures.

The ESP is continuously monitored for inlet temperature, corona power levels (secondary Kv and mA levels) and hopper levels. Activated alarm conditions, in the control room, will alert the operator to a loss of power, high temperatures and high hopper levels. This information is stored in the plant's data acquisition system (Polcid) for seven days and provides data/trends for unit performance evaluation and troubleshooting.

Along with the continuous monitoring, daily visual inspections of the ESP are also conducted. (see Attachment 1, PM #E490-DY-A). The daily inspection/PM consists of following:

- Check T/R oil temperatures. Listen for sounds of arcing around the T/R set. Check the corona power readings. Verify that the DOC II controllers are working properly.

- Verify the accuracy of the continuously monitored electrically data points.

- Verify that the penthouse blower is operating properly and that belts are in a good operating condition.

- Verify that the penthouse heater is operating properly.
- Verify rapper operation.
- Verify T/R sets are leak free and—if there is a leak—that it is properly addressed.
- Visually check expansion joints and structure are leak free and in good operating condition.

13. Weekly ESP Inspections/Preventative Maintenance

A weekly inspection/PM of the units is conducted verify the electrical performance and operational effectiveness. Weekly inspection/PM (see Attachment 2, PM E490-WK-A) will consist of:

- Reviewing of daily information, attempting to identify any apparent trends in the key operating parameters, to determine whether changes are needed in the operating practices or maintenance procedures. In addition, this review will confirm that all requested work orders have been satisfactory scheduled and/or completed in a timely manner.
- Visual and thermo check of all motor bearings for high temperature and signs of excessive wear or vibration
- Verify that all blower filters are clean and in place. Check all belts for condition and tension. Inspect the condition and operation of all rappers. Inspect condition of all T/R sets
- Inspections of the integrity of the access doors/seals and note any signs of in leak, for follow up.
- V/I analysis (see Attachment 3, PM EK50-WK-B) which will be recorded and filed for use in continuous ESP performance evaluation and improvement

14. Quarterly Inspections/Preventative Maintenance

Quarterly inspection (see Attachment 4, PM EK50-3M-C) of the ESP will be an in depth evaluation of all major operational component. The quarterly inspection/PM will include:

- The penthouse/roof equipment
- Inside the upper treatment area

- Inside the lower treatment area
- The collection and disposal zone of the ESP
- Internal inspection maybe postponed until the semiannual shutdown if no potential problems are noted by the daily or weekly inspection/PM

15. Semiannual Inspections/Preventative Maintenance

Semiannual inspection (see Attachment 5, PM E490-6M-A) consists of a compressive internal inspection of the ESP and will include:

- Penthouse/roof equipment
- Inside the upper treatment area
- Inside the lower treatment area and the collection
- Dust removal system

16. Annual Inspections/Preventative Maintenance

Annual inspection (see Attachment 6, PM E490-1Y-A) consists of a compressive internal inspection of the ESP and the electrical system. The annual inspection/PM will include:

- Penthouse/roof equipment
- Inside the upper treatment zone, collection plate and electrode condition & alignment
- Inside the lower treatment zone, collection plate and electrode condition & alignment
- Dust removal system
- T/R's and High Voltage controller and evaluation of the plate thickness of the plates and degree of corrosion
- This inspection may include the services of vendor experienced in ESP operation, performance and maintenance

17. Corrective Measures

The opacity limit for the kiln/raw mill and clinker cooler stacks is 10% for each six-

minute averaging period, and this should be maintained during normal operation. In the event the opacity moves above—or appears likely to move above—10%, then the cause must be determined. Refer to the facility's Startup Shutdown & Malfunction Plan for guidance, and if the opacity is not reduced to less than 10% within a two-hour period, the process may have to be shut down. Due to the process and the high temperatures involved, shut down may not take place immediately. Under a controlled shut down, the units should remain in operation if they are in an electrical and mechanical condition to do so. The ID fan for either the kiln/raw mill ESP and/or the clinker cooler ESP must operate until the process is sufficiently cooled to prevent heat related damage to the system.

In an effort to correct or avoid an exceedence associated with the ESP of either stack, the operator should at a minimum:

1. Check the ESP's inlet temperature.
2. Verify the electrical operation of each field for the unit.
3. Check the primary voltage and current for the unit. The primary voltage and current of the fields will vary with the inlet loading and there should be ascending levels from field 1 to field 4.
4. Check operation of the GCT, compressed air and water pressure at the spray lances, water flow rate and the GCT control panel for errors (on kiln/raw mill ESP).
5. Check the operation of the clinker cooler water sprays system, compressed air and water pressure at the spray lances and water flow rate.

If these measures do not correct the exceedance, refer the Troubleshooting Flow Chart (see Attachment 7), Troubleshooting Guide (see Attachment 8) and the facility's Startup, Shutdown & Malfunction Plan.

The loss of one field in the clinker-cooler ESP may still allow operation within the compliance limit. However, in the event of the loss of one field in the kiln/raw mill ESP, kiln feed rate may have to be reduced until compliance is achieved. The operator will have to make the appropriate process adjustments for temperature or water-flowrate related causes.

Electrical malfunction must be immediately relayed to the electrical department. The electrical department will review previous troubleshooting efforts and follow the electrical troubleshooting procedures (see Attachment 9) to correct electrical malfunction.

18. Shutdown and Entry Procedures

This section outlines the procedures used for shutdown of precipitators for off-line inspections or maintenance. All procedures—other than emergency—assume that the kiln has been taken off-line and cooled before the precipitator is shutdown. Review Attachment 10, General Precautions, during planning and preparation for shutdown or maintenance.

A. Emergency shutdown

To shut down the transformer/rectifier completely, open the circuit breaker

B. Brief-Period Shutdown

When the precipitator is to be off line for a brief period (fewer than 48 hours) and we do not plan on going into the collection area of the box, use the following preliminary procedure:

a. Confirm the kiln system is shutdown.
b. Close the fan isolation gates.
c. Turn off all fields, except the outlet field.
d. Rap down collector plates for at least 4 hours, using Clean Down Program #2.
e. After the rappers are shutdown, continue to operate the dust-removal equipment for at least two hours.
f. Shut off all equipment.

- Opening the penthouse

Before opening the penthouse or allowing any personnel to enter, perform the following:

a. Confirm completion of steps a through f of the brief-period shutdown procedure.
b. Turn off the penthouse heaters. To allow the area to cool, keep the blower in operation.
c. Follow all appropriate lockout procedures for grounding the T/Rs.
d. Open the access doors in the penthouse roof.
e. Follow plant confined space entry procedure.

C. Extended Period Shutdown

When the precipitator is to be off line for an extended period (more than 48 hours)—and plans are made to go into the collection area for a dirty inspection—use the following procedure:

a. Confirm the kiln system has been shutdown and cooled properly.
b. Shutdown ID fans.
c. Close isolation gates to prevent dusts and gases from exiting the precipitator.
d. Turn off all fields.
e. Shutdown the rappers.
f. Run the dust-removal equipment for at least two hours.
g. Follow the "opening the penthouse" procedure above.
h. Allow the penthouse to cool to an acceptable temperature for entry.

i. Check for hazardous gases and verify that sufficient oxygen is present in the precipitator. Continue with the plant's Confined-Space Entry Procedure.
j. Enter and install all high-voltage bus-bar grounding devices.
k. Open a hot-roof door to check for hot material. If any is present, SHUT THE DOOR IMMEDIATELY AND EXIT PENTHOUSE. Restart equipment to cool out the penthouse.
l. If no hot material is present, continue opening doors and check each one carefully.
m. After all doors are open, exit the penthouse.
n. Mark all doors to prevent unauthorized entry.
o. Work may begin.

D. Opening Hooper Doors

Before opening any hopper doors, the person assigned the task should understand and be familiar with hazards of hot dust. If a proper shutdown procedure was followed, the hoppers should be completely empty. But before personnel enter the hopper area it is crucial that the following procedures are completed.

a. Verify from the top with a light that no dust is built up in the hoppers
b. Strike the hopper door with a hammer. If the hopper is empty, you will hear a resounding ring. If it is full, the dust on the surface will muffle the blow.
c. If the hopper appears empty, open the outer door but leave the interlock in place to prevent the door from springing open.
d. If or after any dust spills out, close the door and unlock the interlock
e. Open the door away from you.
f. Proceed to open the inner door by use of the "U" shaped bar and bracket (this arrangement is designed to prevent the door from falling into the screw and any heavy buildup of dust from flushing out.
g. Remove door after all the dust has come out, and apply this procedure as the other doors are opened.
h. Follow all plant entry and lockout requirement—including setup of ground cables before entering the hopper. (During cleaning, the dust should be removed using positions outside the precipitator whenever possible).
i. Work may begin after safe-entry precautions are completed.

Attachment 1

Daily ESP Inspection/PM

Workorder : E490-DY-A

Group: xxxxxxxxxx
Start Date: 06/04/2003
Priority: xxxxxxxxxx
Shift: xxxxxxxxxx
Supervisor: xxxxxxxxxx

Machine ID: xxxxxxxxxx
Description: xxxxxxxxxx
Area: xxxxxxxxxx

Action Summary: ELEC - ESP Daily PM Inspections
Interval: 0

Labor Class: xxxxxxxxxx
Employee:

Parts Needed:

! ! Safety Information ! !

1. PRIOR TO PERFORMING ANY MAINTENANCE ACTION, THOROUGHLY INSPECT THE ENTIRE WORK AREA FOR UNSAFE CONDITIONS - CORRECT OR REPORT.
2. ALWAYS ADHERE TO ESTABLISHED SAFETY PROCEDURES AND PRACTICES.
3. THOROUGHLY REVIEW MANUFACTURER'S INSTRUCTIONS AND OBSERVE ALL WARNINGS, CAUTIONS AND NOTES.
4. ENSURE APPROPRIATE LOCKOUT & TAGOUT PROCEDURES ARE OBSERVED.
5. PRIOR TO PERFORMING THIS TASK, COORDINATE WITH CONTROL CENTER.
6. REPORT ANY CONDITIONS REQUIRING MAINTENANCE THAT ARE BEYOND THE SCOPE OF THIS PM TO MAINTENANCE SUPERVISION.

Detailed Description

PM TASK: E490-DY-A ESP DAILY PM INSPECTIONS

TOOLS AND MATERIALS:
1. STANDARD TOOLS - BASIC
2. PRESCRIBED SAFETY EQUIPMENT

WORK INSTRUCTIONS:
1. ( ) Visually verify that all rappers are operating properly.
2. ( ) Check all T/R oil temperatures. (Note the highest temperature recorder by the red "memory" needle.)
3. ( ) Listen for sounds of arcing in and around the T/R sets.
4. ( ) Check T/R readings :
   NOTE: The following readings indicate trouble and should be investigated:
   = low voltage and high current
   = normal voltage and low current
5. ( ) Verify that the automatic T/R controllers (DOCs) are functioning properly.
6. ( ) Observe readings given by the metering system in the control room. Note any radical variations from the normal pattern.
7. ( ) Verify that the stack opacity monitor is functioning properly.
8. ( ) Verify that all blowers are operating properly. Check penthouse blower filters and replace if necessary.
9. ( ) Verify that the penhouse pressurization/heating system is operating properly.
10. ( ) Check for any new casing gas leaks or worsening of known leaks.
11. ( ) Check for any liquid leaks.
12. ( ) Check all expansion joints during a routine walk-down. Observe signs of leakage and ensure that leaks are repaired at the earliest opportunity.
13. ( ) Verify that the dust removal equipment is functioning properly.

Attachment 2

Weekly ESP Inspection/PM

Workorder : E490-WK-A

Group: xxxxxxxxxx
Start Date: 06/04/2003
Priority: xxxxxxxxxx
Shift: xxxxxxxxxx
Supervisor: xxxxxxxxxx

Machine ID: xxxxxxxxxx
Description: xxxxxxxxxx
Area: xxxxxxxxxx

Action Summary: ELEC - ESP Weekly PM Inspections
Interval: 0

Labor Class: xxxxxxxxxx
Employee:

Parts Needed:

! ! Safety Information ! !

1. PRIOR TO PERFORMING ANY MAINTENANCE ACTION, THOROUGHLY INSPECT THE ENTIRE WORK AREA FOR UNSAFE CONDITIONS - CORRECT OR REPORT.
2. ALWAYS ADHERE TO ESTABLISHED SAFETY PROCEDURES AND PRACTICES.
3. THOROUGHLY REVIEW MANUFACTURER'S INSTRUCTIONS AND OBSERVE ALL WARNINGS, CAUTIONS AND NOTES.
4. ENSURE APPROPRIATE LOCKOUT & TAGOUT PROCEDURES ARE OBSERVED.
5. PRIOR TO PERFORMING THIS TASK, COORDINATE WITH CONTROL CENTER.
6. REPORT ANY CONDITIONS REQUIRING MAINTENANCE THAT ARE BEYOND THE SCOPE OF THIS PM TO MAINTENANCE SUPERVISION.

Detailed Description

PM TASK: E490-WK-A / ESP WEEKLY PM INSPECTIONS

TOOLS AND MATERIALS:
1. STANDARD TOOLS - BASIC.
2. PRESCRIBED SAFETY EQUIPMENT;

WORK INSTRUCTION:
1. ( ) Check all motors bearings for high temperature and signs of excessive viberation.
2. ( ) Verify that all blower filters are clean. Replace dirty filters when necessary. Maintain a record of filter changes to diagnose possible problems.
3. ( ) Check all drive belts for tightness and general condition.
4. ( ) Check the overall condition of individual rappers, including ground straps, boots, and rapper body.
5. ( ) Check for loose nuts or broken track welds on rapper all-thread rods.
6. ( ) Visually inspect the general condition of aaaall T/Rs.
7. ( ) Inspect the outer accwss doors and gaskets, Note any signs of leakage. Repair leaks at the earliest opportunity.

Attachment 3

Weekly V/I Evaluation

Workorder : EK50-WK-B

Group: xxxxxxxxxx
Start Date: 02/11/2003
Priority: xxxxxxxxxx
Shift: xxxxxxxxxx
Supervisor: xxxxxxxxxx

Machine ID: xxxxxxxxxx
Description: xxxxxxxxxx
Area: xxxxxxxxxx

Action Summary: Elec - Precipitator VI Curve - Weekly
Interval: 0

Labor Class: xxxxxxxxxx
Employee:

Parts Needed:

! ! Safety Information ! !

1. PRIOR TO PERFORMING ANY MAINTENANCE ACTION, THOROUGHLY INSPECT THE ENTIRE WORK AREA FOR UNSAFE CONDITIONS - CORRECT OR REPORT.
2. ALWAYS ADHERE TO ESTABLISHED SAFETY PROCEDURES AND PRACTICES.
3. THOROUGHLY REVIEW MANUFACTURER'S INSTRUCTIONS AND OBSERVE ALL WARNINGS, CAUTIONS AND NOTES.
4. ENSURE APPROPRIATE LOCKOUT & TAGOUT PROCEDURES ARE OBSERVED.
5. PRIOR TO PERFORMING THIS TASK, COORDINATE WITH CONTROL CENTER.
6. REPORT ANY CONDITIONS REQUIRING MAINTENANCE THAT ARE BEYOND THE SCOPE OF THIS PM TO MAINTENANCE SUPERVISION.

Detailed Description

PM TASK: EK05-1M-C

1) Preform VI curve
2) Check ring heaters
3) Tag or label equipment

E1E01 - Field 1 Volts
E1E02 - Field 2 Volts
E1E03 - Field 3 Volts
E1E04 - Field 4 Volts

E1I05 - Field 1 Amps
E1I06 - Field 2 Amps
E1I07 - Field 3 Amps
E1I08 - Field 4 Amps

K1E01 - Field 1 Volts
K1E02 - Field 2 Volts
K1E03 - Field 3 Volts
K1E04 - Field 4 Volts

K1I17 - Field 1 Amps
K1I18 - Field 2 Amps
K1I19 - Field 3 Amps
K1I20 - Field 4 Amps

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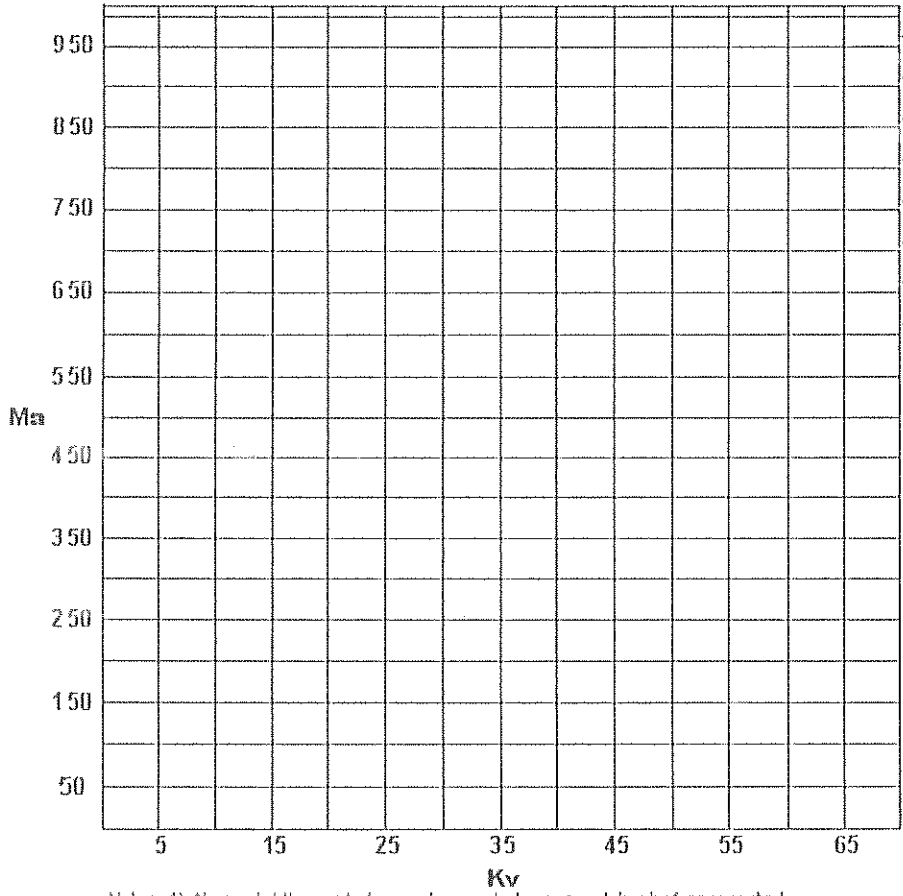

DATE

TIME

T.P.H.

INL.PESS.

INL.TEMP

G.P.M.

S.C.F.M.

OPP.

Step 1: Call the control to get values for the process information listed above

Step 2: Decrease Kv down to 5 Kv.

Step 3: Incrementally increase the voltage 5 Kv at a time up to 70Kv recording the readings onto the graph

Notes: 1) Always let the control room know what you are doing before you start.

2) Stop recording if any of the four parameters reach their limit.(Kv,Sec. Ma,Pri. V,Pri. Amps) also stop recording if a spark occurs. (Once either it reaches a limit or a spark occurs, that is the most the field will do.) Indicate a spark with a star (*)

Attachment 4

Quarterly ESP Inspection/PM

Workorder : EK50-3M-C

Group: xxxxxxxxxx
Start Date: 02/11/2003
Priority: xxxxxxxxxx
Shift: xxxxxxxxxx
Supervisor: xxxxxxxxxx

Machine ID: xxxxxxxxxx
Description: xxxxxxxxxx
Area: xxxxxxxxxx

Action Summary: Elec - 3 Month PM Precip. Pm
Interval: 0

Labor Class: xxxxxxxxxx
Employee:

Parts Needed:

! ! Safety Information ! !

1. PRIOR TO PERFORMING ANY MAINTENANCE ACTION, THOROUGHLY INSPECT THE ENTIRE WORK AREA FOR UNSAFE CONDITIONS - CORRECT OR REPORT.
2. ALWAYS ADHERE TO ESTABLISHED SAFETY PROCEDURES AND PRACTICES.
3. THOROUGHLY REVIEW MANUFACTURER'S INSTRUCTIONS AND OBSERVE ALL WARNINGS, CAUTIONS AND NOTES.
4. ENSURE APPROPRIATE LOCKOUT & TAGOUT PROCEDURES ARE OBSERVED.
5. PRIOR TO PERFORMING THIS TASK, COORDINATE WITH CONTROL CENTER.
6. REPORT ANY CONDITIONS REQUIRING MAINTENANCE THAT ARE BEYOND THE SCOPE OF THIS PM TO MAINTENANCE SUPERVISION.

Detailed Description

PM TASK: EK08-3M-C

Check rapper grounds to ensure they are tight

Attachment 5

Semiannual ESP Inspection/PM

Workorder : E490-6M-A

Group: xxxxxxxxxx
Start Date: 06/03/2003
Priority: xxxxxxxxxx
Shift: xxxxxxxxxx
Supervisor: xxxxxxxxxx

Machine ID: xxxxxxxxxx
Description: xxxxxxxxxx
Area: xxxxxxxxxx

Action Summary: ELEC - ESP 6 Month PM Inspections
Interval: 0

Labor Class: xxxxxxxxxx
Employee:

Parts Needed:

! ! Safety Information ! !

1. PRIOR TO PERFORMING ANY MAINTENANCE ACTION, THOROUGHLY INSPECT THE ENTIRE WORK AREA FOR UNSAFE CONDITIONS - CORRECT OR REPORT.
2. ALWAYS ADHERE TO ESTABLISHED SAFETY PROCEDURES AND PRACTICES.
3. THOROUGHLY REVIEW MANUFACTURER'S INSTRUCTIONS AND OBSERVE ALL WARNINGS, CAUTIONS AND NOTES.
4. ENSURE APPROPRIATE LOCKOUT & TAGOUT PROCEDURES ARE OBSERVED.
5. PRIOR TO PERFORMING THIS TASK, COORDINATE WITH CONTROL CENTER.
6. REPORT ANY CONDITIONS REQUIRING MAINTENANCE THAT ARE BEYOND THE SCOPE OF THIS PM TO MAINTENANCE SUPERVISION.

Detailed Description

6/3/03
PM TASK: E490-6M-A ESP 6 MONTH PM INSPECTIONS

TOOLS AND MATERIAL:
1. STANDARD TOOLS - BASIC
2. PRESCRIBED SAFETY EQUIPMENT

WORK INSTRUCTIONS:

PENTHOUSE ROOF

1. ( ) Verify that all rapper boot clamps are in place.
2. ( ) Verify that seals are tight on all cold roof doors.
3. ( ) Check bus bar path and connections for dirt and close clearances.

PENTHOUSE AREA

1. ( ) Check for evidence of tracking or cracks in high voltage support insulators.
2. ( ) Verify that venturi holes are clear on high voltage support insulator top plate.
3. ( ) Verify that the 2" nut retainer on the high voltage frame support rod is in position.
4. ( ) Check for sigms of tracking on or warping of the melamine rapper rods. Wipe down where necessary.
5. ( ) Check rapper tube purge holes for plugging or corrosion. Ensure that holes are open to allow purge air to flow.
6. ( ) Check for accumulation of dust in penthouse. Vacuum clean if necessary. Determine the cause of excessive accumulations and take corrective action.
7. ( ) Check ceiling insulation or floor block insulation for damage or uncovered areas. Repair uncovered areas as required.
8. ( ) Check the bus bar jumper connections and welds to the top plate of the high voltage support insulator.
9. ( ) (If applicable) Verify that insulator band heaters are tight around perimeter of the high voltage insulator. Test heaters for proper omhic value.
10. ( ) (If applicable) Check thermal tape around joints of the casing heat piping.
11. ( ) Look for signs of wall buckling, condensation, air inleakage, or corrosion.
12. ( ) Check melamine rods for tightness in lower sockets.
13. ( ) Check the intergrity of the expansion joints in the heater purge air system.

INSIDE UPPER TREATMENT AREA

1. ( ) Check for excessive bridging or buildups that might cause grounding or close clearances.
2. ( ) Check inside bell housing for tracking or buildups.
3. ( ) Verify that the nozles are pointed in the proper direction.
4. ( ) Clean between plate support channel and wall, and support beams.
5. ( ) Measure distance from the bottom of the bell house to the hanger rod, ensuring that at least the minimum clearance recommended by the manufacturer is maintained.
6. ( ) Check for loose Rigitrodes and tighten ehere necessary.
7. ( ) Check mine bolts for wear where the mine bolt passes through the upper toe of the place support channel.
8. ( ) Verify that the channel spacer bar is loose but secure.
9. ( ) Verify that the rapper rods are positioned properly in the raqpper rod locators.

INSIDE LOWER TREATMENT AREA

1. ( ) Check for loose Rigitrodes.
2. ( ) Verify that perforated plate rapper is intact.
3. ( ) Check perforated plates for binding on sides or bottom.
4. ( ) Check inlet/outlet plenum perforated plates for pluggage and buildups.
5. ( ) Check for excessively loose plate tadpole pins and worn guide strips.
6. ( ) At several points, observe and map clearance between walls and baffles to the plate and alectrode frames.
7. ( ) Inspect access doors and gaskets for tight seals or corrosion.
8. ( ) Check the condition of the Teflon anti-sway bars if applicable. Verify that the Teflon is clean and flexible.

COLLECTION/DISPOSAL ZONE

1. ( ) Inspect the access doors and gaskets for tight seals or corrosion.
2. ( ) Inspect the screw conveyor for bent flights.
3. ( ) Inspect hopper walls for warping or evidence of corrosion.
4. ( ) Check for pluggage in the dust removal system.
5. ( ) Inspect rotary / double flap valve.

Attachment 6

Annual ESP Inspection/PM

Workorder : E490-1Y-A

Group: xxxxxxxxxx
Start Date: 06/03/2003

Machine ID: xxxxxxxxxx
Description: xxxxxxxxxx
Area: xxxxxxxxxx

Priority: xxxxxxxxxx
Shift: xxxxxxxxxx
Supervisor: xxxxxxxxxx

Action Summary: ELEC - ESP Yearly PM Inspections
Interval: 0

Labor Class: xxxxxxxxxx
Employee:

Parts Needed:

! ! Safety Information ! !

1. PRIOR TO PERFORMING ANY MAINTENANCE ACTION, THOROUGHLY INSPECT THE ENTIRE WORK AREA FOR UNSAFE CONDITIONS - CORRECT OR REPORT.
2. ALWAYS ADHERE TO ESTABLISHED SAFETY PROCEDURES AND PRACTICES.
3. THOROUGHLY REVIEW MANUFACTURER'S INSTRUCTIONS AND OBSERVE ALL WARNINGS, CAUTIONS AND NOTES.
4. ENSURE APPROPRIATE LOCKOUT & TAGOUT PROCEDURES ARE OBSERVED.
5. PRIOR TO PERFORMING THIS TASK, COORDINATE WITH CONTROL CENTER.
6. REPORT ANY CONDITIONS REQUIRING MAINTENANCE THAT ARE BEYOND THE SCOPE OF THIS PM TO MAINTENANCE SUPERVISION.

Detailed Description

6/3/03

PM TASK: E490-1Y-A ESP 1 YEAR PM INSPECTION

TOOLS AND MATERIALS:

1. STANDARD TOOLS - BASIC
2. PRESCRIBE SAFETY EQUIPMENT

WORK INSTRUCTIONS:

WHEATHER ENCLOSURE (or Roof)

1. ( ) Verify that rapper rods are free in their exit bushings.
2. ( ) Verify that the air switch is functioning properly.
3. ( ) Verify that the T/R switch blade is in good condition.
4. ( ) Run carbon and dielectric tests on T/R oil.
5. ( ) Check the T/R oil level. Add oil if necessay.
6. ( ) Check the operation of the key interlock system: lubricate locks with dry graphite.

INSIDE UPPER TREATMENT AREA

1. ( ) Check for separation of tadpole pins from the plate's top edge.
2. ( ) Perform general alignment check and re-align as necessary.
3. ( ) By shining a flashlight down the length of the plate, check for:
   * bowing plates or Rigitrodes.
   * bent pins
   * possible close clearances
   * general alignments

   Note any significant differences in the field maps.

INSIDE LOWER TREATMENT AREA

1. ( ) Take random pin-to-baffle and pin-to-plate measurements.
2. ( ) Check above baffle between fields for buildups.
3. ( ) Check for bowed plates by measuring from plate to plate.
4. ( ) Look for corrosion on collecting plates. possible thinning of plates or holes in plates.
5. ( ) Check for signs of excessive heat.
6. ( ) Verify that the "J" hooks holding the perforated plates in position are fixed to the casing wall.

COLLECTION/DISPOSAL ZONE

1. ( ) Check tightness and condition of bearings and couplings.

RAPPER CONTROLS

1. ( ) Confirm the system timing sequence for each field from reference sheet.
2. ( ) Confirm the impact rapper lift from the reference sheet.

OUTSIDE THE PRECIPITATOR SHELL

1. ( ) Check the external condition of insulation and lagging for any missing pieces or areas in need of repair.

PRECIPITATOR

1. ( ) Verify balanced draw and correct current level on all phases of all motors and heaters.
2. ( ) Check piston exposure on all rappers, and verify that all rapper bodies are true to plumb.
3. ( ) Measure field clearances to determine whether realignment is required.
4. ( ) Check inside the T/R controllers and rapper panel for dust buildup.
5. ( ) Megger T/Rs and compare recorder readings against equipment baseline data.
6. ( ) Check hopper corners for buildups and corrosion.
7. ( ) Megger hopper heaters (if applicable(, replace if necessary.

HIGH VOLTAGE CONTROLLER

1. ( ) Check accuracy of all control console meters.
2. ( ) Calibrate primary current overload relay.
3. ( ) Test all alarm and trip functions by simulation.
4. ( ) Torque check all wiring connections on both high voltage and low voltage systems.
5. ( ) Inspect the precipitator ground grid and ground connections. Inspect connections to T/Rs, control consoles and structure to earth.

AREAS FOR TRIENNIAL INSPECTION

1. ( ) Check plate thickness to determine the degree of corrosion.
2. ( ) Check duct work approaching and exiting the precipitator for areas of buildup or failed turning vanes.

Attachment 7

Troubleshooting Flowchart

Attachment 8

Troubleshooting Guide

SECTION 6 - TROUBLESHOOTING and MAINTENANCE

6.1 Introduction

This section contains procedures to identify and correct problems that may occur in the T/R Control Console, T/R set or precipitator. Refer to the T/R Control Console electrical schematic diagrams, and the figures used in Sections 2 and 3 to reference components and assemblies used in this section.

In addition, it is strongly recommended that the description of operation given in Section 2 be read thoroughly to gain an understanding of the principles behind the operation. The troubleshooting techniques assume that the user is familiar with the basic operation and physical arrangement of the equipment.

6.2 How to Use This Section

The various problems that may occur are grouped into three subject areas:

Start-up problems: This area includes symptoms such as inability to turn the T/R Control Console on, no power, "hard starts", and similar problems.

Trip-out problems: This area covers problems that have caused the T/R Control Console to trip out.

Operating problems: This area covers operating problems such as high spark rates, questionable meter indications and so on.

After each problem, a probable cause, and corresponding corrective action is presented. When warranted, a brief discussion of the theory or principles involved may be given to augment the understanding of the troubleshooting procedures.

If a problem is suspected with the DOC II Controller, it may be necessary to replace the DOC II Controller Main Control Board.

6.3 Safety Information

VOLTAGES AND CURRENTS WHICH COULD CAUSE SERIOUS OR FATAL INJURIES ARE PRESENT IN THE T/R CONTROL CONSOLE, TRANSFORMER/RECTIFIER, AND PRECIPITATOR

OBSERVE THE FOLLOWING PRECAUTIONS:

1. Only qualified personnel should be allowed access to precipitator equipment.
2. Only qualified personnel should perform inspection, adjustment, and maintenance procedures on precipitator equipment.
3. Extreme caution must be exercised when making measurements in an energized T/R Control Console.
4. ALL power must be removed from the T/R Control Console before components are replaced.
5. Never bypass the Safety Key Interlock system.

6.4 Conventions Used in This Section

1. All voltage measurements are made with respect to ground, unless otherwise noted. Any wire labeled X2 can be considered as a ground reference.
2. All AC measurements are given as true RMS values, unless otherwise noted.
3. All DC measurements are given as average values.
4. Line voltage is assumed to be 480 VAC.
5. When applicable, references to terminal strip points will be in capital letters, such as TB4-3.
6. When a wire number is referenced, it will be enclosed in square brackets such as in the following example:

   Measure the DC voltage at TB10-13 [71]

6.5 Equipment Required

For most of the procedures in this section, a multimeter is the only piece of equipment required. When making AC measurements, other than line voltage, a true RMS responding voltmeter or ammeter must be used. Making these measurements using a conventional VOM or multimeter will result in erroneous readings, due to the nature of the SCR waveforms in use.

Although not required, the DOC II Controller Main Control Board test fixture is an extremely useful test instrument. This device will test all functions of the DOC II Controller in a lab or bench environment. See Section 7 for ordering information.

6.6 Servicing the DOC II Controller

IMPORTANT

BEFORE REMOVING OR INSTALLING CONNECTORS ON THE DOC II CONTROLLER, THE POWER TO THE DOC II CONTROLLER MUST BE REMOVED BY OPENING THE CIRCUIT BREAKER. FAILURE TO DO SO MAY DAMAGE THE DOC II CONTROLLER.

If the Main Control Board is replaced, the EPROM chip (U3) should be transferred to the replacement board. In addition, the EEPROM chip (U4) should be transferred if the DOC II Controller is part of a Data Management System or if any changes have been made to the program using either the Hand-held terminal or Supervisory Controller.

When replacing the board be sure to set the shorting plugs on the replacement board to the proper configuration. Refer to section 3.6.2. Also, the replacement board will need to be calibrated using the calibration procedure outlined in Sections 4.6 and 2.6.

6.7 START UP PROBLEMS

6.7.1 No Power - CONTROL ON light doesn't come on.

This is an indication that there is no 120 VAC present in the T/R Control Console. The 120 VAC is derived from control transformer T1. Note that T1 is fused on both sides.

1. Check that the main breaker is ON.
2. Check fuses F7, F8, and F9; replace if required.
3. Check for 480 VAC on the primary and 120 VAC across the secondary (X1 and X2). If 120 VAC is not present on the secondary, T1 is defective.

6.7.2 CONTROL ON light comes on, but DOC II Controller doesn't power up, or powers up incorrectly.

The DOC II Controller receives its power from the power supply built into the Main Control Board.

1. Check for 120 VAC to the power supply input on connector J6-12 [1] to J6-13 [X2]. If not present, trace the wiring from T1.
2. If 120 VAC is present to the power supply, check the output voltages (5V, 12V and -12V) at TP13, TP11 and TP12, respectively. The measured voltage should be within 5% of the given values. If the voltages are not correct, try adjusting the appropriate resistor (R77, R81 or R85) to adjust the voltage. If the voltages are still not correct, replace the Main Control Board.

6.7.3 The DOC II Controller powers up but fails the self-test.

In most cases, this indicates an internal problem with the DOC II Controller. The interpretation of the failure messages, displayed on the LCD on the Indicator Panel, follows:

START SEQ.	The DOC II Controller has powered up and immediately detects that the main contactor is closed. This could occur if the ON/OFF switch "S1" is in the ON position when the DOC II Controller is powered up, if the DOC II Controller sustained a temporary loss of power during normal operation, or if the key interlock or alarm circuitry is defeated.
MEMORY ERROR	The memory check has failed; replace the Main Control Board.
REPL. EEPROM	The EEPROM is defective. Replace the EEPROM, U4 on the Main Control Board. If the problem persists, replace the Main Control Board.
I/O COMM	The main processor cannot communicate with the I/O processor. Replace the Main Control Board.
A/D ERROR	The calibration check of the A/D has failed. Replace the Main Control Board.
INPUT xx	The DOC II Controller has detected a non-zero input on the primary current (Ip), the secondary current (Is), the primary voltage (Ep), or the secondary voltage (H1 or H2), with the main contactor open. Replace the Main Controller Board. If the problem still occurs, then there is a stray voltage on the respective input. Disconnect the DOC II Controller, and trace the wiring to determine the source. In some cases the problem may be in the Indicator Panel itself, replace the Indicator Panel. If the problem still occurs, replace the Main Controller Board.

6.7.4 The main contactor does not close when "S1" is closed.

In order for the main contactor to close, alarm relay K3 must be energized. If K3 is not energized, then this problem must be corrected before the main contact will close. In addition, the 120 VAC used to energize the contactor coil also must pass through a normally closed contact in the DOC II Controller Main Control Board. This contact is held open if the DOC II Controller does not pass the self test.

1. Check to see if relay K3 is energized. If not, go to step 3. If K3 is energized, measure across the DOC II Controller internal contact at J5-6 [2] and J5-7 [3]. If there is 120 VAC across this contact, it indicates that the DOC II Controller contact is open. If the DOC II Controller is connected to a Supervisory Controller, check to see if the REMOTE LED on the DOC II Controller Indicator Panel is lit. If so, it indicates that the T/R Control Console has been shut down remotely. If not, the Main Control Board is probably defective.

2. If no voltage appears across the DOC II Controller contacts, measure the voltage at the contactor coil [6]. If 120 VAC is present here, the contactor is defective.

3. If K3 is not energized, then one of the normally closed contacts in the alarm string is open, or there may be a loose wire or connection to K3. If one of the normally closed alarm contacts is open, the annunciation should appear on the DOC II Controller Indicator Panel LCD display, if connected. If there is no reading on the LCD display and K3 is open, the problem may be in the DOC II Controller Main Control Board. Refer to Section 6.8 for a description of the trip out problems. Also, measure the voltage at the coil of K3 [27]. If 120 VAC is present, but K3 does not close, replace K3.

6.7.5 The main contactor closes, but power does not come up.

First, it should be determined if this condition exists in both AUTO and TEST modes. If power cannot be brought up in either mode, then the problem is in the SCR assembly. The firing circuit also receives a lockout signal from the DOC II Controller [89]. If the signal is not present, then power will not come up in either mode.

1. First, check to see if power can be brought up in the TEST mode. Make sure the TEST control is fully counterclockwise, and turn the AUTO/TEST switch to the TEST position. Slowly advance the TEST control, if power comes up in the TEST mode, but not in the AUTO mode, check for the CSI input (120 VAC) to the DOC II Controller at J5-2. If the voltage is present, then the DOC II Controller is defective. If power does not come up in either mode, proceed to the next step.

2. Remove power, and check the SCR fuse F1. Replace if defective. (See 6.7.6 also).

NOTE: If the 120 VAC wiring to the firing circuit is reversed, or if the wiring from the firing circuit to the SCRs is reversed, the firing circuit will not operate.

3. Check to see that the power supply on the DOC II Controller Main Control Board is operational by measuring all output voltages as described above. Replace the Main Controller Board if defective.

4. Check for the lockout signal from the DOC II Controller Main Control Board J5-1 [89] at the firing circuit J1-4 [89]. This signal should be at least 3 VDC. If the lockout signal is not present, then the DOC II Controller Main Control Board is defective and should be replaced.

5. If power still does not come up either the firing circuit or SCRs on the power block are defective.

6.7.6 Power jumps up rapidly when "S1" is switched on (hard start).

This condition will usually blow the SCR fuse F1, as a result of the high surge current, and is caused by a defective firing circuit, shorted SCRs, or a defective DOC II Controller.

To troubleshoot this condition, it is highly recommended that the T/R be disconnected, and the dummy load resistors be connected as described in Section 4.4. In this way, the problem can be isolated without heavy current surges occurring, which could continue to blow fuses, or damage the T/R or SCR assembly.

1. As in the preceding set, the problem should be first isolated between the AUTO and TEST modes. If the problem occurs in both modes, then the SCR assembly is defective. IF the problem only occurs in the AUTO mode, then the DOC II Controller is defective.

2. If the SCR assembly is defective, then the problem is either shorted SCRs or a defective firing circuit. Replace the firing circuit first.

6.7.7 Power ramps up, falls to zero, and current limit occurs at half scale.

This symptom indicates that the DOC II Controller is not receiving the proper primary voltage signal. If the primary voltage is less than 90 VAC, see Section 6.8.4 below, undervoltage trip. This signal is derived from transformer T3 and resistors R122 and R123 on the DOC II Controller Main Control Board. Check the following:

1. Check to see that the primary voltage signal is present on wire [70], if not present skip to step 3.

2. Check the calibration of resistor R122 on the DOC II Controller Main Control Board, refer to Section 4.6 for the calibration procedure.

3. Check fuses F4, F5, and F6.

4. Check fuse F10, located in the T/R set low voltage junction box (IF PRESENT).

7. Test Mode Trip

This trip is initiated by the DOC II Controller when the T/R Control Console is operated in the TEST mode. The trip will occur if any of the following conditions occur during TEST mode operation:

a. Exceeding the secondary voltage limit as set by the switches or the high limit set in the firmware.
b. Exceeding either primary or secondary current limit.

6.9 Operating Problems

This section describes problems that may be encountered during operation of the T/R Control Console.

6.9.1 DOC II Controller Problems

This section describes conditions which may be symptomatic of a problem with the DOC II Controller. However, before troubleshooting the DOC II Controller, check the power supply outputs (5V, 12V, -12V) to ascertain if the power supply is functioning correctly. Also check that all the wiring and connections are good. The name of the board that is most likely the cause of the problem is also shown. (MC = Main Controller Board, IP = Indicator Panel, FC = Firing circuit).

A. LCD display malfunction (IP, MC)
B. LEDs not lighting (IP, MC)
C. Switches read incorrectly (IP, MC)
D. No response to sparks (MC)
E. Voltage or current limits incorrect (MC)
F. Trips not reported (IP, MC)
G. Erratic operation (MC, FC)

6.9.2 Other Operating Problems

A. Secondary voltage exceeds limit set on secondary voltage limit switches.

1. DOC II Controller Indicator Panel defective.
2. DOC II Controller Main Controller Board defective.
3. If the Remote LED is lit, a supervisory controller has set the limit.

B. No secondary voltage indication.

1. Surge arrestor E2 (E3 or E4 for double bushing T/R sets) in low voltage junction box defective.
2. 20 kilohm resistor located either in the T/R low voltage junction box or inside the T/R tank is defective.
3. 80 megohm resistor in the T/R tank is defective, contact ENELCO Field Engineering.

4. 20 kilohm, resistor on DOC II Controller Main Control Board defective.
5. Secondary voltage meter defective.
6. An open on the ground side of the KV meter.

C. No secondary current indication.

1. Surge arrestor E1 (E1 or E2 for double bushing T/R sets) in the T/R low voltage junction box is defective.
2. Secondary current meter defective.
3. Defective T/R set. Consult ENELCO Field Engineering.

D. Trip indication in error or missing.

1. DOC II Controller Indicator Panel defective.
2. DOC II Controller Main Control Board defective.
3. Defective wiring to the DOC II Controller.

E. Voltage readings low, current readings high.

1. Short in precipitator or bus duct.
2. Hoppers full.
3. T/R may be defective. Consult ENELCO Field Engineering.

F. Primary current high, other readings low.

1. T/R defective.
2. Shorted primary wiring.

G. Voltage readings very high, current readings low.

1. High particulate loading from the process.
2. Rappers inoperative or set at too low intensity.
3. Defective bus bar (T/R disconnected).
4. Faulty 80 megohm resistor in the T/R tank.
5. Faulty 20 kilohm resistor in the T/R tank or low voltage junction box.

Attachment 10

General Precautions for Electrostatic Precipitators

General Precautions for Electrostatic Precipitators

Common Hazards:
Electrostatic precipitators (ESPS) can pose the following hazards to personnel performing inspection, maintenance or repairs:

* Electrical shock
* Fire or explosion
* Oxygen deficiency
* Toxic chemicals and gases
* Hot dust
* Hopper-related hazards

General Precautions:
The precipitator is considered a confined space and a permit may be required to enter for the purposes of inspection cleaning and or maintenance and servicing.

Before attempting to open or enter the precipitator, you must observe the following precautions:

* Shut down the precipitator using the key interlock system.
* Ground the transformer-rectifier with safety ground devices.
* Verify that no dust has accumulated behind the hopper doors. Verify that no harmful gas is present in the precipitator. Shutdown the dust-removal equipment.

Preventing Electrical Shock:
An electrostatic precipitator uses extremely dangerous high voltage! While the key interlock system prevents contact with energized parts of the high-voltage system, this feature does not replace established safety measures.

Using the Key Interlock System:
An electrostatic precipitator uses extremely dangerous high voltage! While the key interlock system prevents contact with energized parts of the high voltage system, this feature does not replace established lockout/tagout procedures. YOU MUST USE THE KEY INTERLOCK SYSTEM TO SHUTDOWN THE PRECIPITATOR. Use the following procedure:

1. Turn the OFF/RESET/ON switch (SI) in the control console to "Off'. This de-energizes the associated transformer-rectifier (T/R) and frees an interlock key, which is then used to ground the T/R set. This must be done for each T/R set. Note: The Key Interlock System schematic (Drawing D-81 0) details the key interlock system and grounding procedure.
2. Manually ground all high voltage components of the precipitator before making any attempt to enter the precipitator, the insulator compartments or bus ducts. Safety grounding devices are available for this purpose.

Safety Grounding Devices:
Use the following procedure to attach the grounding devices to the precipitator discharge electrodes in the insulator compartment (penthouse).

1. Clamp one end of the safety-grounding device to a metal part of the precipitator structure that is connected to the station ground.
2. Attach free end of cable to the high-voltage system member nearest the point of access. Continue with this procedure using other cables until all bus sections are grounded.

Before Welding Rigitrode:
Observe the following precautions before performing any welding on the Rigitrode system.

- Verify that all bus bars are disconnected at the insulator top plates, disconnecting the T/R from the field.

- Provide a visible ground wire from the insulator top plate to ground. This disconnects the T/R from the field, giving a welding ground and protecting the T/R from damage.

Preventing Fire or Explosion:
Fires can occur in any precipitator or ductwork during startup, operation, or shutdown! This table lists possible causes of fire and explosion, along with methods for prevention:

Cause	Prevention
•Fuel feed problem or turbine trip	Monitor kiln operation closely. Use established plant procedures to prevent kiln upset or trip conditions.
•Unstable operation during startup	Observe safe startup procedures. Attend to all high-level alarms immediately.
•Improper purging during shutdown	Observe safe shutdown procedures.
•Flammable gas contacting a source purging of ignition (e.g., cigarettes, static electricity, etc.)	Control combustible and oxygen levels by thoroughly ventilating prior to hot work or entry by personnel to the precipitator. Maintain ventilation of work area. Establish a monitoring program to guard against pockets of flammable gas.

Hopper Fire:
If a fire or explosion occurs, the precipitator should be shutdown to contain the damage. Fires should be allowed to burn out. If the fire is in the hopper, however, the collected particulate should be removed via the dust-conveying system.

Process Indicators of Fire or Explosive Conditions:

The following table lists recommended process variables that should be monitored in order to reduce the possibilities of fires in the system. The levels given in this table are suggested starting set points. The plant should continuously evaluate set points to ensure they reflect realistic conditions.

Process Variable	Action
•Oxygen levels in flue gas entering precipitator	If the oxygen level is detected to reach 6%, then the DCS should provide a high oxygen-level alarm. If the oxygen level reaches 7%, the plant DCS should de-energize the precipitator to eliminate sources of sparking and should initiate the high-intensity rapping program to remove material built up on the precipitator internals.
•Difference in temperatures of flue flue gas entering and exiting the precipitator.	If the temperature of the flue gas exiting the precipitator is higher than the temperature of the gas entering, it could indicate the presence of a fire inside the precipitator. This temperature difference could be as low as a few degrees Fahrenheit. The plant should also recognize that during periods of precipitator cool down, there could be instances where the outlet temperature would be higher than the inlet due to the heat stored in the precipitator steel.
•Temperature of the hopper wall	If temperatures higher than the temperature of the flue gas are detected on the hopper walls, then ash inside the hoppers should be removed promptly as it could signify the presence of a fire in the hopper.

Attachment 11

Report of Maintenance on Air-Pollution Control Device

Report of Maintenance on Air-Pollution Control Device

Subpart LLL (40 CFR 63.10) Recordkeeping--Florida Rock Industries, Inc., Baker Cement Plant

Date of Maintenance: _____

Equipment Type and ID:

(check one)

Baghouse(s) _____ _____ _____

Precipitator(s) *(name or ID)* *(name or ID)* *(name or ID)*

Maintenance Type: Preventive

(check one) Routine Repair

Unscheduled Repair

Description of Work: _____

_____

_____

_____

_____

_____

I hereby certify that, to the best of my knowlede, the data and comments on this page are true.

_____ _____

Name (print) Signature

_____

Date

Notes regarding maintenance:

1. Replacement of an air-pollution control device (such as an entire baghouse) requires notification of the regulatory agency. Contact the environmental manager if such replacement is needed

2. It is a violation of the air permit to circumvent (bypass) any air-pollution control device or to allow the emission of air pollutants without the applicable air-pollution control device operating properly.

3. Failures of air-pollution control devices caused by poor maintenance, careless operation, or preventable equipment breakdown are not considered malfunctions and are prohibited.

Retain this original or a copy for five years from date of maintenance.

File: Report of Maintenance on APCD