

PRECIPITATOR SHUTDOWN REPAIR GUIDE

K-1803

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STANDARD OIL COMPANY OF CALIFORNIA
ENGINEERING DEPARTMENT-SAN FRANCISCO

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DECEMBER 21, 1965
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SPECIFICATION NO. EG-1048 -A

SMALL TOOLS AND EQUIPMENT

1.0 SCOPE

This specification lists the types of items that COMPANY classes as "small tools and equipment" whether recoverable, non-recoverable or consumable. Such items shall be furnished complete, including accessories and expendable operating parts such as blades, bits, abrasive wheels, etc., and shall be maintained in good condition including replacement of parts as may be necessary.

2.0 SMALL TOOLS AND EQUIPMENT

Adapter, Hose, -Pipe, Thread
Adze
Anvil, Blacksmith
Apron
Arbor
Auger
Awl
Axe

Brooms
Brush, Wire, Paint, etc.
Puckets

Bar, Claw, Crow, Pinch, etc.
Barrel, Trash
Belt, Safety w/strap
Bender, Hydraulic, Manual
Bevel
Beveler, Transite
Binder, Load
Bit, Auger, Carpenter
Blades, All Types
Blanket, Wool, Rubber
Block, Chain, Rope, Cable,
etc.
Boots, Rubber
Box (Bag), Tool
Brace, Ratchet

Cable, Welding, Electrode, Ground,
etc.
Calipers
Cans
Cart, Concrete, etc.
Casters
Caulking Tool (Yarning Iron)
Chain, Surveyor, Measuring, Steel
Loading
Charger, Battery
Chisels, All Types-Hand, Pneumatic
Chuck, Taper, Drill
Clamp, Pipe Aligning, Saw,
Carpenter, etc.
Clip, Wire Rope
Clipper, Bolt
Coat, Rain
Connector, Welding Cable
Conveyor, Gravity Roller
Cooler, Drinking Water
Cord, Electric Extension
Coupling, Hose
Crimper, Electrician's
Cutter, Bar, Wire, Pipe-Hand,
Pipe-Geared, Gasket, etc.

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Lanterns, All Types
Lead Joint Runner
Level, Hand, Line, etc.
Light, Portable Flood
Lighter, Torch
Line, Mason, Chalk, etc.
Lubricator, Air Line

Pouch, Tool
Protractor
Puller, Nail, Wire, Spike, Rod
Pulley
Pump, Hand, Barrel, Sump, Test
Punch, Center, Back out, Hob,
Gasket, etc.

Mallet
Manometer, Portable Field
Mandrel, All Types
Mattock
Maul
Mender, Hose
Meter, Vibration, Volt, Amp, etc.
Micrometer
Mover, Freight Car, Hand

Radio, Portable, Two Way Intercom
Rake
Rasp
Reamer, Pipe, Bridge, Burring, etc.
Regulator, Welding Gas
Respirator, Dust (incl. refill)
Roller, Riggers
Rope, Manila, Wire
Rules, All Types

Nipper
Nozzle, Hose, Weld, etc.
Nut, Die
Nut, Driver

Oiler, Can
Oven, Welding Rod

Pail
Paving Breaker, Pneumatic
Peavey
Pick
Pin, Drift, Barrel, Bull
Pincer
Plane
Pliers
Plumb Bob
Point, Trammel
Pole, Pike, Range
Pot, Melting, Fire

Salamander
Sander, Disc, Belt
Saw, Portable, All Types-Hand, Power
Scraper, Bearing, Miscellaneous
Screwdriver
Screw stop
Screw plate (set)
Scriber
Set, Nail, Rivet
Shackle
Shear, Bar, Tinners
Sheave
Sheeting, Plastic, Paper
Shield, Face
Shovel
Sleeve, Morse Taper Shank
Sling, Canvas Pipe, Wire Rope,
Nylon
Snip, Tinners
Socket Set
Soldering Iron
Spade
Spike, Marline
Square, Combination, Framing, etc.
Staple, Tacker
Star Drill
Stencil, Steel, Brass, Paper

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SPECIFICATION NO. EG-1049-C

SUPPLIES

1.0 SCOPE

This specification lists the types of items COMPANY classifies as "supplies," whether incorporated into the finished work or used in the course of construction.

2.0 SUPPLIES

Acid	Nails
Adhesive	Oil, All Types (except for lubrication and fuel for construction equipment and tools).
Alcohol	Paint (for Erection Marking)
Antifreeze (not for construction equipment)	Paper, Sand
Babbitt	Paper, Toilet
Carbide	Paste, Solder
Carbon Tetrachloride	Putty
Chalk	Rag
Coal and Coke	Rust Preventive
Compound, Cleaning, Pipe, Thread, Grinding	Salt Tablets
Cotter Pin	Screen Cloth, Wire
Crayon	Screws
Creosote	Shim
Cup, Drinking	Soap
Disinfectant	Soap Stone
Emery Cloth	Solder
Explosives	Stake, Survey
First-Aid Supplies	Staples
Flux, Brazing, Welding	Tape, Adhesive, Masking, Friction, Rubber, Plumbers, etc.
Fuse (except for permanent plant use)	Tacks
Gasket Paste	Towel, Paper
Glue	Twine
Glycerine	Washing Powder
Graphite	Waste, Cotton
Grease (except for construction equipment and tools)	Weld Rod
Ice	Welding Gases
Keel (Lumber Crayon)	Wire, Tie, and Miscellaneous
Kerosene	Wool, Steel
Lamp, 120 V Electric	
Litharge	
Lubricant, Thread Cutting, Electric	
Wire Pulling	

SPECIFICATION NO. E-1073

DEFINITION OF "EQUIPMENT RENTAL RATES"

IN CONSTRUCTION CONTRACTS

1.0 SCOPE

This specification defines the costs included and excluded in rental rates for construction equipment and specifies the method of application of these rates.

2.0 DEFINITION OF RENTAL RATES

2.1 Operating Period

Equipment rental rates shall be based on operating periods of 8 hours per day, 56 hours per week and 240 hours per month.

2.2 Costs Included

Equipment rental rates shall include all maintenance, painting, and incidental repairs on the equipment throughout the construction period.

2.3 Costs Excluded

Equipment rental rates do not include the following items of expense:

2.31 Freight from shipping point to destination and the return freight at the expiration of the rental period.

2.32 Loading and unloading charges if necessary for loading on a car or unloading from a car.

2.33 Wages of Operators

2.34 Cost of fuel and lubricant and wages paid for fueling and lubricating.

3.0 APPLICATION OF RENTAL RATES

3.1 Rental Period

The rental rates shall apply only during the time the equipment is actually operated at the construction site.

I. PRE-SHUTDOWN ITEMS

- A. Make pressure survey of all insulator housings. May need to replace air filters to get sufficient supply air. Note any housings with low pressure. Check regulators by swapping positions.

Order parts for shutdown.

- B. Arrange for service engineer if desired.
- C. Check gear reducer drives. Check oil level, chains, and overall condition.
- D. Inspectors note gas leak locations.

VI. INITIAL INSPECTION - PRECIPITATOR DIRTY

A. Large and Small Insulators and Housings

1. Note degree of dust buildup and condensation in housings. (The air purge is designed to prevent both conditions.)
2. Note degree of corrosion to housing.
3. Note the problems to be corrected.

B. High Voltage Cable

1. Note extent of dust buildup and signs of condensation.
2. Check for corrosion damage to housing and cable.
3. Open all the inspection plates in the high voltage cable system. Check for dust buildup. Examine all the insulators for cracks and tracking.

C. Gas Inlet and Outlet Distribution Plates

1. Open side manways and obtain Entry Permit.
2. Check and note pattern of dust buildup. Also check for plugging. The distribution plates are designed to provide a uniform flow across the unit.
3. Check for cracks, distortion and overall corrosion.
4. Check for accumulation of catalyst debris in the inlet pipe and note whether any of the distribution holes are covered.

Note - Inspectors may want manways opened.

D. Precipitator Housing

1. Note dust buildup on the interior members of the housing. There should be an even distribution showing a balanced flow.
2. Note the dust buildup on collector plates. They should have a slight buildup. Large buildups suggest rapping problems.

CAUTION: Avoid stepping on the emitting frame and shock bars. Add wooden planks for walking support before entering.

III. CLEANING OPERATION

A. Insulators and Housings

1. Remove the old packing from the packing groove.
Install new packing.
2. Power wire brush the entire compartment interior EXCEPT for the insulators. Vacuum all the catalyst dust and scale from the compartment.
3. Gently clean the insulators. Use caution so as not to chip or scratch the ceramic materials.
Clean the insulators with a soft cloth and solvent.
4. Just before closing the lids - rewire the insulators with denatured alcohol on a soft cloth to remove dirt particles and moisture.
5. Set yard air to purge system and check that each housing holds air pressure.
6. Test eight purge relief valves (3.5 psi) and re-install.

B. High Voltage Cables

1. Vacuum or air blow the high voltage cable housing of all loose scale and catalyst dust.
2. Clean all the insulators with the solvent soft cloth system.
3. Just prior to closing the units, dry the insulators with the denatured alcohol wash.

C. Precipitator Internals

1. Water wash the entire interior of the precipitator. Use fire water to rinse the unit as clean as possible.

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IV. POST CLEANING INSPECTION AND REPAIRS

A. Large and Small Insulators and Housings

1. Inspect the insulator housings. Look for holes and potential leakage sites.
2. Make a close thorough examination of all insulators for cracks, rough spots, absence of glaze, tracking, etc. A bright light will help locate insulator flaws.
3. Mark damaged units for removal and replacement.
4. Check packing on grid rapper shafts to prevent excessive leakage of purge air. (Orifice is sized for 0.5 CFM/housing).

B. High Voltage Cables

1. Check the wires and conduit for mechanical problems.
2. Inspect the insulators for cracks, tracing, etc.
3. Mark areas for repair or replacement.

C. Collector and Emitter Rappers

Expect considerable wear requiring welding repairs or new parts. Hopper work platforms may be needed.

1. Repair worn or bent guide fingers and pipe sleeves over guide fingers.
2. Check for eccentric wear of anvils and hammers (wheels) which indicates poor alignment. Hammer hits below center of anvil 1" - 1½" when cold. Straighten shock bars if bent.
3. Check and if necessary replace worn bolts through plate extensions. Shock bars must clear bars supporting guide fingers by 2" minimum when cold.
4. Each shock bar and related plates should swing freely. (It may be necessary to remove temporary planks to check). Shock bars should contact each plate at rest, so that each plate is impacted at the same time. Shock bars should return to this position after each rap.
5. Check rapper pillow block bearings. Replace if there is excessive play.
6. Check emitting rappers. Expect to build-up, hard face, and grind smooth the cams and trip arms. Check shaft collars and split bearings.
7. Run all systems before starting and check operation.

IV. POST CLEANING INSPECTION AND REPAIRS (continued)

D. Precipitator Housing

1. Inspect the shell for cracks and holes. Define repairs as required.
2. Note the condition of the structural members and the welds.

E. Emitter Electrodes (Wires)

NOTE: Discharge electrode failures are the most frequent failure made in the precipitator. Failures are typically caused by corrosion, fatigue, or electrical arcing.

1. Check for broken or loose wires. Proper tension is 15-30 lbs.
2. Replace all wires in rows. This will be done sequentially south in the West Bank and then north in the East Bank to periodically replace all electrode wires. Spread adjacent plates to provide access room. Installation of wires requires extreme care to avoid kinks or strains. Wires must be prestretched to 8'-0" to 8'-3" with anti-kinking device shown in Sketch A. A hooking tool to aid in removing and installing wires is shown on Dwg. 4MSK-516.

Carefully inspect removed wires for evidence of metal loss. This must be in Inspection records as a guide for replacement rate. Cut off one end so wire cannot be accidentally reused.
3. Note the condition of existing wires. Look for notches, wear points or obvious failure points. Especially check the J hangers on both ends of the wires.
4. Examine the entire support frame especially the welds and support hooks.
5. Check that the entire frame is level and that the wires are parallel to the collector plates. The wires should be centered between the two adjacent plates. (Plate to wire distance $4\frac{1}{2}'' \pm \frac{1}{4}''$.) Mark faulty sections for repair. Tack weld nuts on diagonal bracing.

(See the attached Drawing #3ESK-8)

NOTE: According to Buell, 10% is the upper limit on scattered missing wires. Replace wires if many wires are missing within a row or section. Spread adjacent plates to provide access room.

6. Replace rows of emitter wires as a step toward complete replacement, Stock No. KP-B1-4. Check the hooks and hook welds on each end of wires replaced. Pre-stretch new wire per drawing to 8'-3" (+0" or -3"). The force required to do this is about 50 lbs. If overstretched or kinked, the wire is ruined. Inspect removed wires carefully for end wear, notches and burns as a guide to replacement schedule of others. Junk old wires.

POST CLEANING INSPECTION AND REPAIRS (continued)

F. Gas Inlet Distribution Plates

1. Check for plugging of the distribution holes, corrosion, or distortion of the plates.
2. Note any items that could prevent an even flue gas distribution within the inlet section.

G. Transformer

Sample transformer oil and test insulation level. If it is below 22,000 volts replace or filter oil. Retest. Add oil if necessary.

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A. The following items must be checked by the Unit Operator and the Inspector or Engineer prior to final closing.

1. Insulators & Housings (Ready to Close)
 - a. Check that all units are clean and dry. All repairs are complete.
 - b. Check that gaskets and seals are in place.
 - c. Trial run air purge.
2. Collector & Emitter Rappers (Complete)
 - a. Check all internal repairs.
 - b. Check external system - motors, oil levels, etc.
 - c. Turn on the rappers for a trial run. Check inside and out for proper operation.
3. High Voltage Cable & Housing (Ready to Close)
 - a. Check that all repairs are complete.
 - b. Insulators should be clean and dry.
 - c. Check all gaskets and seals.
4. Emitter Electrodes - Wires (Ready to Close)
 - a. Check that the frames are level and the wires are centered between the plates ($4\frac{1}{2}'' \pm \frac{1}{4}''$ distance).
 - b. Check that all hook and wire replacement work is complete.
 - c. Check that there are no materials to cause a plate to wire short.
5. Collector Electrodes - Plates (Ready to Close)
 - a. Check that the plates are plumb and parallel. All plates must be straight.
 - b. Check that the plates are resting against the shock bar for proper rapping.

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V. STARTUP CHECK LIST - FINAL INSPECTION AND TEST (continued)

- c. Check that the plates have 2" for expansion at the plate bottom.
- d. Check that overall repair work is complete.
- 6. Inlet Distribution Plates (Ready to Close)
 - a. Check that the plates are unplugged and all repairs are complete.
- 7. Housing & Hoppers (Ready to Close)
 - a. Check that the shell and support work has been completed.
 - b. Check that all work materials have been removed and door seals are in good condition.
 - c. Replace hopper dump valves.

Initials	Date

B. Air Load Test

- 1. After all work is complete make an "AIR LOAD" test. Push doors closed, but have electrician on side door platform. Energize power supplies, observe operation of fast and slow voltage ramps, and record operating data without rappers, and with rappers operating. If sparking occurs below volts try to locate sparking by looking through doors. DO NOT ENTER. This check is easier after dark.
- 2. Shutdown and secure electric power and attempt to locate and correct spark-over problem. Retest if any changes are made.

- 3. Get operator approval of final Air Load Test.

Initials	Date