Care Of Unitized Emulsion Treaters

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INTRODUCTION

Unitized Emulsion Treaters have been a reality for over 20 years. They have been employed in the Permian Basin for over 18 years. This type of surface equipment has become almost a necessity and is therefore considered standard equipment on most leases. The present day vessel is an efficient, pressure operated, automatic treating plant. Contrast this with the early day methods of treating oil in a pit with steam coils, or spreading the oil out in a thin layer and letting the sun warm and treat the oil. The present day practice of using Unitized Emulsion Treaters is an example of the oil industry's desire to conserve our natural resources.

Since all the types and designs of treaters are too numerous for the scope of this paper we will limit our discussion to one type and one locale.

This paper is developed in the following order and is based on experience in the Permian Basin with vertical pressure operated treaters.

1. Purpose
2. Economics
3. Sizing
4. Operation
5. Care

Purpose

The primary purpose of a treater is to economically remove water which is produced with the crude oil and gas, and do this so as to provide the operator with the highest oil gravity and stock tank liquid recovery.

Economics

Much of the popularity of the treater is due to the low initial cost and the ability to conserve gravity and volume.

The average cost of a treater installation may be as much as 60 percent less than a comparable installation using the individual components of a unitized emulsion treater. These individual components are:

1. Free water knockout.
2. Oil and gas separator.
3. Heater.
4. Gun barrel or settling tanks.
5. Heat exchanger.

Sizing A Treater

Conditions which determine the size of treater required are:

1. Rate oil is produced.
2. Rate water is produced.
3. Gravity of the oil and water.
4. Viscosity of the oil.
5. Temperature at which the oil and water emulsion will break.
6. Amount of foreign material produced.
7. Degree of emulsification.
8. Rapidity of break created by treating compound.

OPERATION

Pre-Heating

The well products, emulsion, oil, water and gas enter the treater thru the coil side of heat exchanger. During the travel through the coils agitation allows mixing of injected chemicals and aids in the heat exchange with the outgoing warm oil to stock.

Separation

From the heat exchanger the well products enter the separator compartment where the gas is separated and is either flared or delivered to a gas sales line. In this type treater the separator compartment is separated from the rest of the vessel by a built in head over which the oil, water and emulsion pass before entering the downcomer pipe. This head is cooled by the relatively cold products passing across it. This cold head plays an important role in the conservation of oil gravity. More discussion of the point follows.

Free Water

The free water is separated at the point of entry to the free water knockout section. It is conducted horizontally and down through a series of baffles to assist in the removel of entrained particles of oil before the water enters siphon line where it is automatically discharged to the pit. The emulsified oil is conducted horizontally and up through a series of baffles.

Heating and Wash Section

The emulsion is spread out beneath and along the entire length of the firetube. From this point the emulsion travels upward around the firetube and through the heating and wash section where a great portion of the emulsion is separated. The water falls down and is discharged with the rest of the water.

Oil Settling Section

The relatively clean oil is then conducted horizontally and upwardly through the settling section where complete separation is accomplished. During the normal heating process which aids in the treating of emulsions certain saleable hydrocarbons are vaporized. These vapors rise off the surface of the oil settling section and contact the bottom of the cold head, to which we have previously referred, and are condensed into droplets. The condensed hydrocarbons fall back into the outgoing oil stream while the non-condensable vapors leave the oil treating compartment through an equalizing line. The uncondensable vapors leave the separator compartment with the other gases out the vent line.

Cooling

The warm clean oil leaves the settling section and enters the shell side of the heat exchanger. The outgoing water-free oil is cooled by the incoming stream so that the losses that occur during storage are reduced to a minimum. The losses from storing hot oil are much greater than those experienced in storing cold oil.

Mechanics

The treater siphon acts as a "U" tube. A column of water is balanced against a column of oil and water. The oil level is constant at the level of the oil outlet connection. The water-oil contact depends on the height of the holes in the adjustable siphon nipple in the outside water siphon. Water and oil are discharged through control valves. All parts of the treater are equalized for pressure. To keep gas from bleeding out the oil and water lines, a liquid seal must be kept on the valves. The diaphragm controllers control the liquid discharge valve to maintain these seals. The diaphragm controller is sensitive to the height of the liquid in contact with the underneath side of its diaphragm. The height of the liquid column it maintains is controlled by the length of the weight lever and the amount of weight one hangs on the lever.

When operating properly the number of weights hanging on these levers should have no effect on the water-oil contact in the treater vessel, unless of course, too many weights are placed on these levers.

CARE

Like any other equipment, your treater requires some care. The more care it is given the less trouble will be encountered in its lifetime, of treating oil.

I. Always follow the instructions mounted on the burner box when lighting the fire. These instructions bear repeating at this time. Unless these instructions are followed in detail an injury may result. The instructions always start with the word "Caution." The do's and don'ts are listed as follows:

1. Be sure all fuel gas valves are closed and all gas is vented from heater tube before lighting burner.
2. Always light pilot before opening fuel gas valves to burner.
3. Do not stand directly in front of heater tube when inserting torch, for lighting pilot, stand to one side.
4. Be sure there is sufficient fluid in vessel to cover heater tube before firing burner.
5. Keep pilot and burner free from soot.

II. Check the operation of the thermostat before leaving the vessel unattended.

This is of particular importance when a temperature controller is being placed in service for the first time. This check may be made by setting the temperature adjustment at a setting slightly above the present temperature, of the treater. The treater should then start firing. When the temperature demanded by the new setting is reached the thermostat should then shut off the fuel. At that time the setting should be changed back to its normal position. This procedure may be reversed or a combination used, however, the first procedure set forth is considered the best.

III. Each Day

A. Make grind out to determine if oil leaving treater is clean. (One taken on the inlet to the treater is often helpful to predict treater performance).

B. Check for proper chemical injection.

C. Drain scrubbers and drip traps.

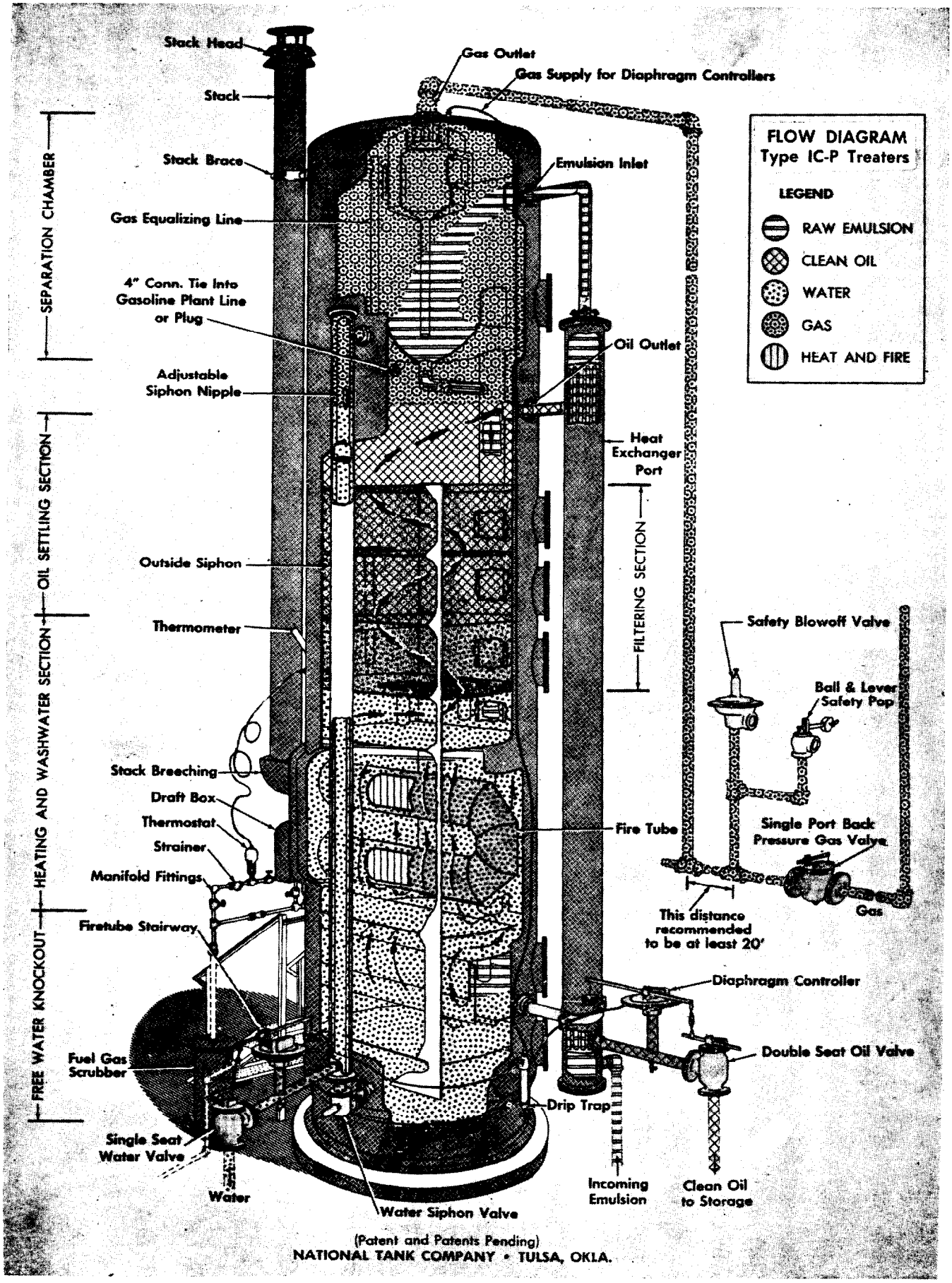
D. Check for proper operating pressure.

E. Check for proper operating temperature.

F. Check for proper liquid levels.

IV. Each Week

A. Open bottom drain and let it run


Stack Head
Stack
Stack Brace
Gas Equalizing Line
4" Conn. Tie Into Gasoline Plant Line or Plug
Adjustable Siphon Nipple
Outside Siphon
Thermometer
Stack Breeching
Draft Box
Thermostat
Strainer
Manifold Fittings
Firetube Stairway
Fuel Gas Scrubber
Single Seat Water Valve
Water
Water Siphon Valve
Gas Outlet
Gas Supply for Diaphragm Controllers
Emulsion Inlet
Oil Outlet
Heat Exchanger Port
Fire Tube
Drip Trap
Incoming Emulsion
Clean Oil to Storage
Diaphragm Controller
Double Seat Oil Valve
Safety Blowoff Valve
Ball & Lever Safety Pop
Single Port Back Pressure Gas Valve
Gas
This distance recommended to be at least 20'
SEPARATION CHAMBER
OIL SETTLING SECTION
HEATING AND WASHWATER SECTION
FREE WATER KNOCKOUT
FILTERING SECTION
FLOW DIAGRAM
Type IC-P Treaters
LEGEND
RAW EMULSION
CLEAN OIL
WATER
GAS
HEAT AND FIRE
(Patent and Patents Pending)
NATIONAL TANK COMPANY • TULSA, OKLA.

until water going to pit is clean but do not drain over 12" from vessel. The maximum draw-down figure of 12" is set to prevent lowering of the oil-water interface below the top of the firetube, thus covering at least a portion of the firetube with oil. Most all material that can be flushed from the bottom of the treater by draining will be moved by the initial 12" of draw downs.

B. Check gauge cocks. They should be kept free from clogging.

V. Each Month

A. Check burner and pilot for prap-er performance. Be sure the burner is centered in the firetube where it it cannot blast against the side of the furnace.

B. Check fuel supply—rust or dirt may cut down the supply.

VI. Quarterly.

A. Lubricate stuffing boxes of valves and diaphragm controllers.

B. If scaling conditions are present, the firetube should be inspected at least three months after start-up. This will require draining down the treat-er below the firetube. Then the cover on the inspection can be removed for convenient inspection. The degree of scaling will regulate how often in-spections should be made in the fu-ture.

VII. Source of Trouble and What To Do.

A. If the water-oil contact level has changed look for:

1. Failure of proper chemical in-jection (Pump not running or empty).

2. Plugged salt water siphon, either in the siphon line or at the inlet from the treater. Periodic draining of the treater will help prevent a build up of sediment in the bottom.

3. Valves operating improperly such as hanging open or sticking shut. Manual operation will determine which. If a valve won't close, it is possible that something is on the seat. Take the top cover off the valve and take the inner valve out. Cleaning of seat and inner valve and stem will usually correct any valve trouble.

4. Insufficient pressure will cause levels to become high. Pressure on treater should be sufficient to over-come pressure loss in line to tanks.

5. Failure of a liquid valve to close with the resulting loss of the liquid seal may be the results of a ruptured liquid level controller diaphragm or it may be caused by oil or condensate getting into the liquid level control-lers upper case through the 3/8" tub-ing gas pressure equalizing line. To check, first drain the drip trap in the pressure equalizing system. If fluid continues to come from the drip trap then disconnect the 3/8" line from the source of gas supply. Liquid continu-ing to come from the disconnected line indicates trouble is a carryover from separator section into equalizing tubing or into gas vent line which tub-ing is tied into. If gas from tubing is dry, open drain cock on liquid level controller. If oil continues to come from drain after having worked lever of liquid controller up and down a number of times, indications are that the diaphragm is bad and needs re-placing. The same procedure applies to the water liquid level controller. It is rather easy to determine the cause of the trouble if the hole in the diaphragm is large or if liquid col-lects in the pressure equalizing system from the gas source rapidly. Determ-ining the source of trouble can be more difficult when it requires a length of time for enough liquid to collect to give trouble.

B. If B.S.& W. content of oil to stor-age is high and/or rapid build up of tank bottoms occur look for:

1. Improper chemical injection—wrong chemical or not enough.

2. If a high tank bottom is present determine its composition. Determine percent paraffin, water, and emulsion.

3. The build up of paraffin tank bottoms may possibly be due to too high a treating temperature. When heat is applied to crude oil a portion of the light liquid hydrocarbons and in particular propane and butane are vaporized and leave the treater as gas. The higher the temperature to which the oil is heated the greater the vol-ume of light hydrocarbons driven off. These light hydrocarbons in the oil, in effect, act as a solvent and help keep the paraffin in solution. With a portion of them driven off the oil may lose its ability to carry the same a-mount of paraffin in solution thus the paraffin which the oil cannot keep in solution settles out in the stock tank. Therefore, treat oil at the lowest possible temperature. Most West Tex-as oils can be treated in the 110 - 125 degree range. In most cases, once a satisfactory treating temperature is reached an increase in temperature beyond this level does more harm than good.

4. Check the volume of oil going through the treater. It may well be over the treaters capacity.

5. When a circulating pump is be-ing used an emulsion much tighter and harder to break than the normal emulsion found in the well-stream may be created by the pump. This is par-ticularly true when using a centrifu-gal pump as it is one of the best known emulsifying devices. Treating compound should always be injected ahead of such pump so as to derive the benefit of the mixing that can be obtained within the pump.

C. Pressure down on treater.

1. Gas valve leaking—clean plug and seat.

2. Water valve or oil valve leaking, gas going out these valves because of no liquid seal.

D. Oil going to pits.

1. Valve on flow line is closed or line plugged.

2. Filter section completely plug-ged.

3. On a treater the water level has not been allowed to build up high enough before water valve was allow-ed to open.

4. Insufficient pressure on treat-er to move oil to stock tank.

E. Don't.

1. Produce freshly acidized wells through a treater. Heat neutralizes acid inhibitors leaving acid free to at-tach the shell. (Acid causes the ex-celsior to shatter and break into fine pieces which then float out with the oil).

2. Produce reconditioned wells through your treater until the well has been cleaned of extraneous ma-terials.

3. Circulate tank bottoms at a rate that will exceed the established ca-pacity of the treater. If circulating tank follows along with normal pro-duction be sure that the combined vol-umes do not exceed treater capacity as an excess of normal capacity will result in improper treating of the combined oils.

4. Light pilot until the entire pro-cedure as set out by the "Caution" plate has been followed.