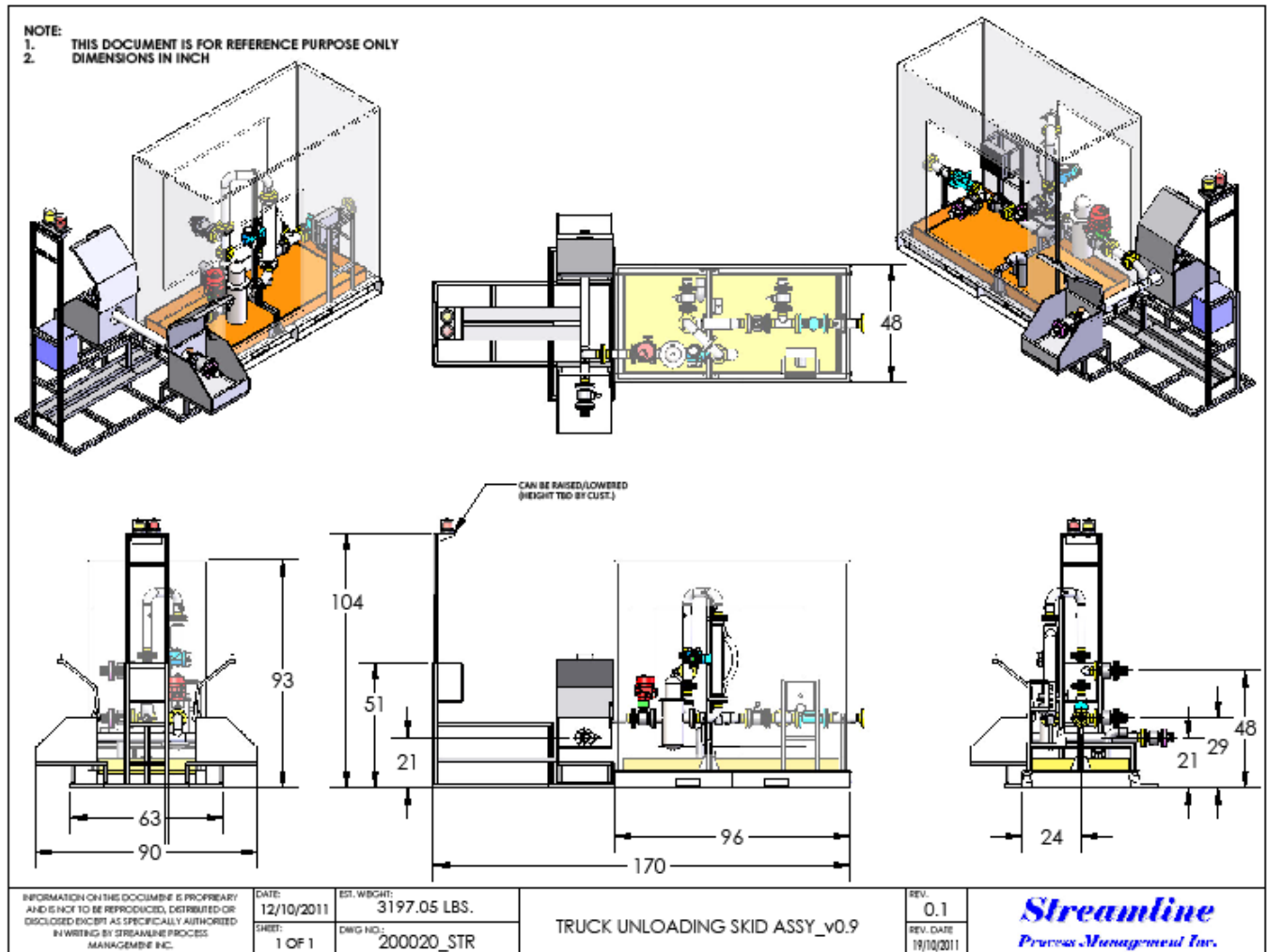


The system described will measure the total flow and density of crude oil emulsion as it is pumped off the truck, and loaded onto a rail car, calculate the proportions of oil and water in the emulsion, and report the volumes of oil and water corrected to 15° C. The system will track and report the amounts delivered by each truck, and the total amounts loaded onto each railcar.

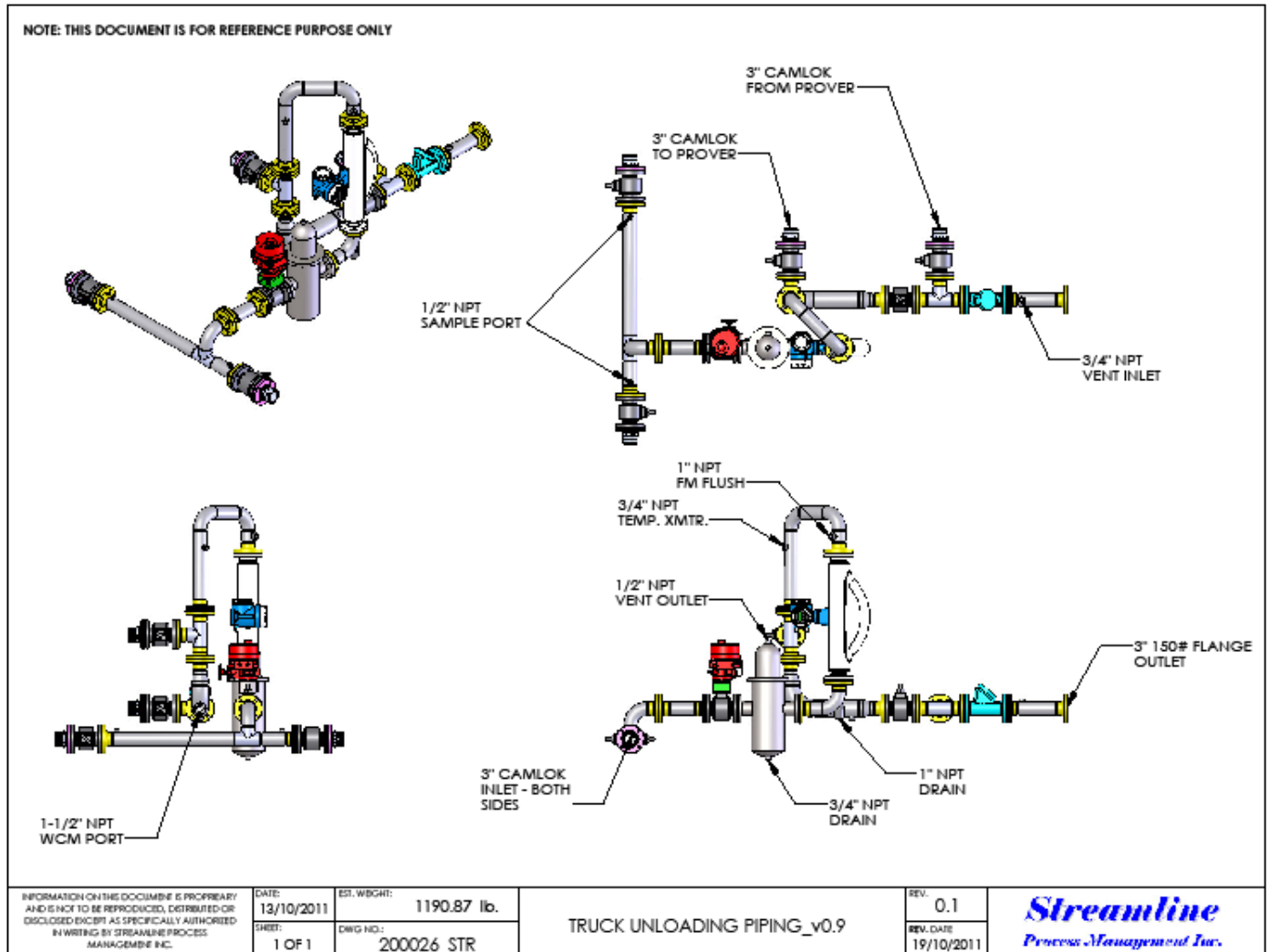
- The measurement skid will be enclosed within a heated and insulated utilidor type structure approximately 4 feet wide x 7.75 feet high x 14.4 feet long. The two 3” Camlock inlet connections and the 3” 150ANSI Flanged outlet connection will be external to the structure. The inlet enviroboxes are extended so as to be accessible from the ground when the skid is mounted on an 8’ wide trailer. The insulating structure will be constructed of 1 ½” thick polyurethane foam core sandwiched between 26 gauge galvanized steel inner and outer panels with an insulation value of R10. Large doors will permit access to the equipment on the skid, and to the proving manifold.
- The heater will a propane fuelled Catadyne catalytic type and will be rated explosion proof for Class I, Group D, Division 1 area. The propane supply hose will be 25 feet long, and the 12 volt DC heater ignition cable will be 30 feet long, to enable these connections to be made outside the hazardous area.
- All electrical equipment on measurement skid will be wired to an external junction box. This box will be outside of the Class 1 Div 1 area. Four cables, each 30 feet in length, and equipped with quick connectors will be wired to this junction box. These cables will be used to connect to the Truck Operator Interface in the cab of the pickup.
- The skid ground will be connected to an auto-rewind reel containing 150’ of 4 ga.wire with a ground clamp attached.
- An amber and a red strobe beacon will be mounted above the junction box. The height of these beacons will be field adjustable to ensure 360° visibility.
- All piping spools will be manufactured and tested in accordance with ASME B31.3.

Measurement Skid



Process equipment on measurement skid includes:

- Inlet selector block valves
- Automated inlet block valve
- Strainer/Air eliminator
- Flowmeter/densitometer
- Delta-C Capacitance water cut monitor
- Test Thermowell
- Sample port
- Prover manifold
- Back pressure control valve
- Drip tray sized to accommodate entire volume of process piping. Drip tray beneath inlet and prover connections ensures no product spills.



Process Piping

- The Truck Operator Interface will be supplied loose, to be located in the cab of the operator's pickup. It will be pre-wired with electrical quick connects to mate with the cables from the process skid

Truck Unloading – Driver Interface Requirements

Databases required:

- Driver – I.D.#, name, company
- Truck – Company, I.D. Number, Truck type, Capacity
- Well – I.D.#, Dry oil density, Produced water density

Operating Sequence:

1. **Operator** connects discharge hose to railcar
2. **Operator** enters data
 - ✓ Operator ID
 - ✓ Railcar # (Screen displays “ Please Ensure Railcar Vent is Open”
 - ✓ Preset quantity based on total emulsion volume (or mass)
3. **Driver** positions truck and makes connections
4. **Operator** or **Driver** enters data:
 - ✓ Driver I.D. – driver selects from list
 - ✓ Select Well #
 - ✓ Enter Waybill # (may be automatically generated)
5. **System** checks for permissive input (grounding, overfill, etc)
 - ✓ displays fault message if fault condition (Optional – inhibits unloading)
 - ✓ displays “Proceed” if no fault
6. **Operator or Driver** presses “Start”
 - ✓ Inlet valve opens
7. **Driver** starts Pumping - Display shows
 - ✓ Start Time
 - ✓ Duration of unloading
 - ✓ Current flow rate
 - ✓ Volume unloaded
 - ✓ Volume remaining in railcar batch
 - ✓ Water Cut %
 - ✓ Density
 - ✓ Temperature
 - ✓ Inlet Pressure
 - ✓ Strainer downstream pressure

8. When load complete, flow stops, **Operator or Driver** presses “Stop”
 - ✓ Inlet valve closes
 - ✓ Ticket prints
 - Date and time
 - Waybill #
 - Well #
 - Trucking Company
 - Truck I.D.
 - Driver I.D.
 - Operator ID
 - Railcar #
 - Total Emulsion m³ (corrected to 15° C)
 - Average Density
 - Average Temperature
 - Total Oil m³ (corrected to 15° C)
 - Total Water m³ (corrected to 15° C)
 - Water Cut %
9. **Next truck** proceeds from item 3
10. At any time, **operator** may press “Batch complete” which will close inlet valve and print ticket (Truck driver should be warned to stop pumping)
 - ✓ Inlet valve closes
 - ✓ Ticket prints
 - Date and time
 - Railcar #
 - Operator I.D.
 - Total Emulsion m³ (corrected to 15° C)
 - Total Emulsion mass kg.
 - Average Density
 - Average Temperature
 - Total Oil m³ (corrected to 15° C)
 - Total Water m³ (corrected to 15° C)
 - Water Cut %
11. When railcar batch reaches 90% of preset quantity, **System** will actuate an amber strobe beacon to alert operator.
12. When railcar batch reaches 95% of preset quantity, **System** will actuate a red light to alert operator.
13. When railcar batch reaches 100% of preset quantity, **System** will perform “Batch Complete” function as item 10.
14. “Batch complete” function will also print truck ticket as item 8.

Processing Unit Operation

- Maintains databases – populate databases from touch screen or PC
- Prompts and accepts operator inputs from touch screen
- Uses permissives as a process interlock, prompts to correct permissive faults

Inputs required:

- Touch screen
- Permissives
- Emulsion Flow
- Density
- Temperature
- Operator ID (optional)

Outputs required:

- Printer
- Inlet valve control

Computer connection: USB Port

- May be used to populate databases
- May be used to download tickets

Software Features included

➤ Permissives

In addition to the truck grounding system, a number of additional permissives are possible. These could include, for example, driver ID, ground connection, inlet strainer differential pressure, and railcar high level. Any or all of these permissives may be configured to activate an alarm, or to inhibit the unloading process.

➤ Records Storage

All transactions are stored in redundant non-volatile memory. The number of transactions stored is dependent on file size, but as a minimum, several hundred transactions would be archived.

➤ Density Trending

In addition to the average density over each load, the system will capture and store the highest and lowest density measured for each load. Over time, this will provide data regarding dry oil and produced water densities for each well.

Description of Truck Operator Interface

Industrial Grade Enclosure approximately 24 x 24x 12 inches, c/w

- ✓ Internal swing-out panel
- ✓ Locking external door
- ✓ Quick connect terminals for electrical connection with process skid

Industrial controller/PAC:

- ✓ High speed data acquisition, calculations and data storage
- ✓ Inputs/Outputs for permissives, valves, etc
- ✓ Interfaces to user interface display/keypad
- ✓ Interfaces to ticket printer

User Interface display/keypad

- ✓ Industrial grade panel mount graphics display with durable touchscreen and function keys
- ✓ Rugged, backlit, sunlight readable

Ticket Printer

- ✓ Compact “kiosk style” panel mount thermal printer
- ✓ Prints on widely available 2.5 inch wide paper rolls
- ✓ Quick, easy replacement of paper rolls



Truck Operator Interface

Uninterruptible Power Supply

- ✓ A UPS may be provided of sufficient capacity to finish the unloading sequence and close the inlet block valve when complete, in the event of a power failure while unloading.