

**SPECIFICATION - HEAT EXCHANGER**

**GENERAL**

|                |                            |          |  |
|----------------|----------------------------|----------|--|
| ITEM NO.:      | E-537                      | SERVICE: | FUSEL OIL COOLER                               |
| TYPE:          | SHELL & TUBE TYPE NEN      |          |  |
| CODE:          | TEMA B - ASME SECTION VIII | STAMP:   | IF REQUIRED                                    |
| DESIGN PRESS.: | PSIG (kPa)                 | SHELL:   | 150 (1035) / FULL VAC. TUBES: 120 (828)        |
| DESIGN TEMP.:  | °F (°C)                    | SHELL:   | 400 (204) TUBES: 250 (121)                     |
| TUBES:         | No., IN (mm), BWG (mm)     | No:      | 36 SIZE: 0.75 (20) O.D. GAUGE: # 18 BWG (1.24) |
|                | FT-IN (mm), IN (mm)        | LENGTH:  | 6' - 7" (2,000) PITCH: 0.938 (23.8) Triangular |

**PROCESS DATA**

|                         | SHELL SIDE                              | TUBE SIDE      |
|-------------------------|---|----------------|
| FLUID CIRCULATED        | FUSEL OIL DRAW                          | COOLING WATER  |
| ENTERING VAPOR          | LB/HR (kg/HR)                           |                |
| ENTERING LIQUID         | LB/HR (kg/HR)                           | 2,500 (1,134)  |
| ENTERING STEAM          | LB/HR (kg/HR)                           |                |
| ENTER. NON-CONDEN.      | LB/HR (kg/HR)                           |                |
| FLUID VAPOR. OR CONDEN. | LB/HR (kg/HR)                           |                |
| STEAM CONDENSED         | LB/HR (kg/HR)                           |                |
| DENSITY                 | LB/FT <sup>3</sup> (kg/m <sup>3</sup> ) | 62.0 (993)     |
| VISCOSITY-LIQUID/VAPOR  | cp (Pa x SEC)                           | 1.00 (0.00073) |
| MOL. WT.-VAPORS         |   |                |
| SPECIFIC HEAT           | Btu / (LB x °F) [kJ / (kg x K)]         | 1.00 (4)       |
| LATENT HEAT-VAPOR       | Btu/LB (kJ/kg)                          |                |
| TEMP. IN                | °F (°C)                                 | 90 (32)        |
| TEMP. OUT               | °F (°C)                                 | 105 (41)       |
| OPERATING PRESSURE      | PSIA (kPa)                              | 65 (347)       |
| NO. OF PASSES           |   | 4              |
| VELOCITY                | FT/SEC (m/SEC)                          | 5.9 (1.8)      |
| PRESS. DROP             | PSI (kPa)                               | 7.2 (49.3)     |

|                 |                                 |                     |                |               |
|-----------------|---------------------------------|---------------------|----------------|---------------|
| SURFACE:        | SQ. FT. (SQ. m)                 | 46 (4)              | SHELLS / UNIT: | 1             |
| HEAT EXCHANGED: | Btu/HR (kJ/HR)                  | 410,000 (432,600)   | MTD, °F (°C):  | 74.51 (41.39) |
| TRANSFER RATES: | Btu/(HR x FT <sup>2</sup> x °F) | DESIGN: 119 (2424)  | CORRECTED      |               |
|                 | [kJ/(HR x M <sup>2</sup> x K)]  | SERVICE: 135 (2745) | CLEAN:         | 209 (4250)    |

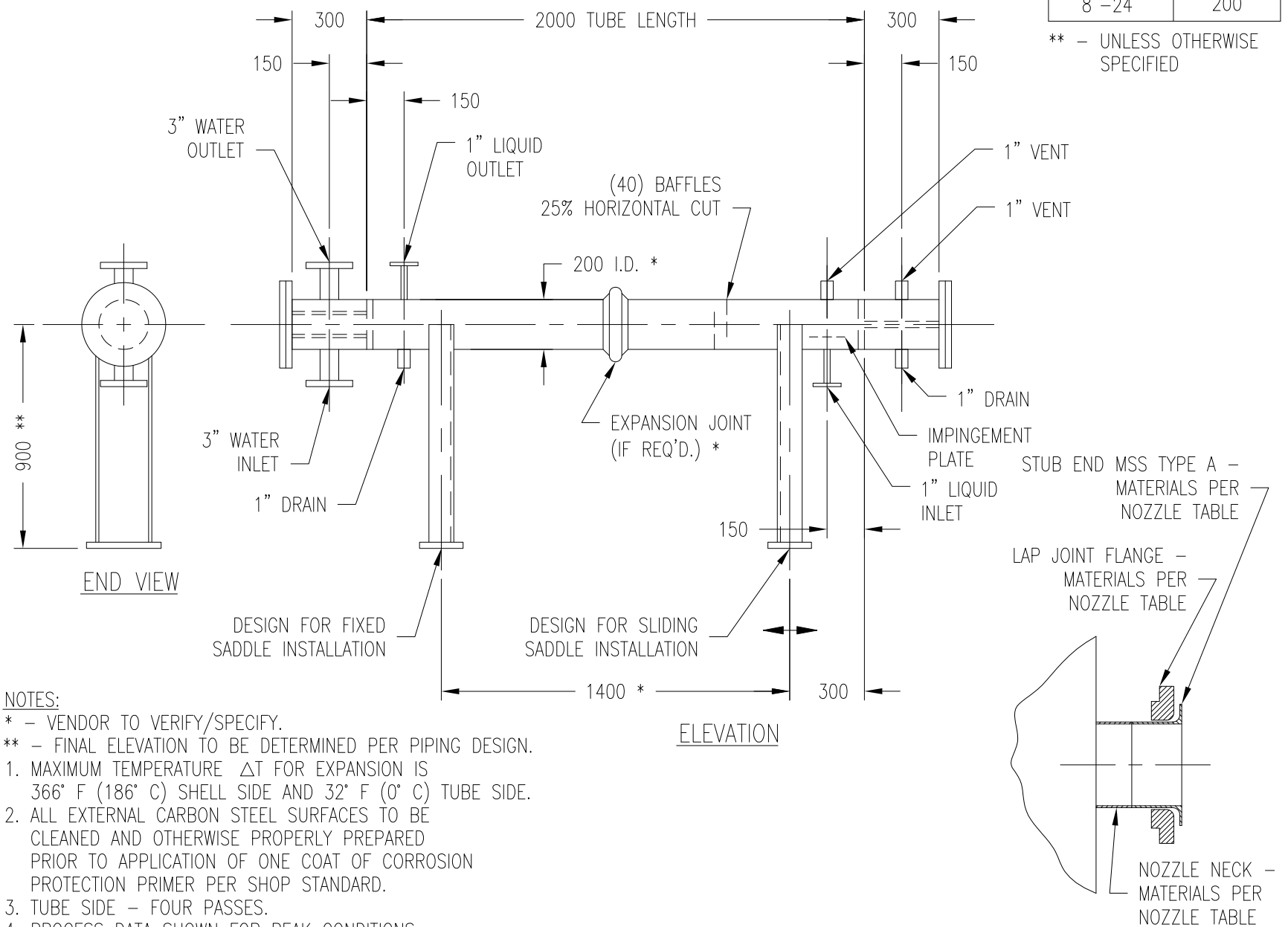
**MATERIALS**

|                         |   |            |
|-------------------------|---|------------|
| SHELL:                  | A312 TP-304L OR A240 TP-304L STAINLESS STEEL        |            |
| TUBES:                  | A249 TP-304L STAINLESS STEEL - AVERAGE WALL         |            |
| CHANNEL:                | A106 GRADE B OR A516 GR. 70 CARBON STEEL            |            |
| CHANNEL COVER:          | A516 GR. 70 CARBON STEEL                            | LINER: --- |
| TUBE SHEETS - STAT.:    | A240 TP-304L STAINLESS STEEL                        |            |
| TUBE SHEETS - FLOATING: | ---   |            |
| FLOATING HEAD COVER:    | ---   |            |
| TUBE SUPPORTS:          | ---   |            |
| BAFFLES:                | STAINLESS STEEL (40 REQUIRED) - 25 % HORIZONTAL CUT |            |
| TIE RODS & SPACERS:     | STAINLESS STEEL                                     |            |
| SUPPORTS:               | CARBON STEEL W/ STAINLESS STEEL ISOLATION PADS      |            |
| EXPANSION JOINT:        | IF REQUIRED   |            |
| GASKETS, IN (mm):       | 1/16" (2mm) NON-ASBESTOS                            |            |
| BOLTING:                | A193 B7 WITH A194 2H HEX NUTS                       |            |

|                      | SHELL SIDE                           | TUBE SIDE                          |
|----------------------|--------------------------------------|------------------------------------|
| NOZZLES:             |                                      |                                    |
| NECK:                | A312 TP-304L S. STL. PIPE            | A106 GR. B. CARBON STEEL PIPE      |
| FLANGE:              | A105 FORGED STEEL 150# LAP JOINT     | A105 FORGED STEEL 150# SLIP-ON     |
| COUPLING:            | A182 F-304L S. STL. 3000# THR'D FULL | A105 FORGED STEEL 3000# THR'D FULL |
| CORROSION ALLOWANCE: | IN (mm)                              | 1/16" (2mm) (EXCEPT TUBES)         |

| NOZZLE SIZE | NOZZLE ** EXTENSION |
|-------------|---------------------|
| 1 1/4"-6"   | 150                 |
| 8"-24"      | 200                 |


\*\* - UNLESS OTHERWISE SPECIFIED



**NOTES:**

- \* - VENDOR TO VERIFY/SPECIFY.
- \*\* - FINAL ELEVATION TO BE DETERMINED PER PIPING DESIGN.
- 1. MAXIMUM TEMPERATURE ΔT FOR EXPANSION IS 366° F (186° C) SHELL SIDE AND 32° F (0° C) TUBE SIDE.
- 2. ALL EXTERNAL CARBON STEEL SURFACES TO BE CLEANED AND OTHERWISE PROPERLY PREPARED PRIOR TO APPLICATION OF ONE COAT OF CORROSION PROTECTION PRIMER PER SHOP STANDARD.
- 3. TUBE SIDE - FOUR PASSES.
- 4. PROCESS DATA SHOWN FOR PEAK CONDITIONS
- 5. 304L STAINLESS STEEL MAY BE SUBSTITUTED WITH DUAL GRADE 304/304L STAINLESS STEEL.

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|                       |  |  |  |  |  |   |   |
|-----------------------|--|--|--|--|--|---|---|
|                       |  |  |  |  |  |  <b>BIOETANOL PAYSANDÚ</b> |   |
|                       |  |  |  |  |  | <b>UTE ABENER</b><br><b>TEYMA PAYSANDÚ</b>  |   |
| 0                     |  |  |  |  |  | Scale   | 211,200 LITERS/DAY MOTOR FUEL GRADE ETHANOL PLANT EQUIPMENT SPECIFICATION |
| 3/1/13                |  |  |  |  |  | NONE  |   |
| REV. 0 ISSUE          |  |  |  |  |  | Nº Plano: 0003-PLN-KAT-05-62-0219   |   |
| WLB NJK NJK           |  |  |  |  |  | Sheets: 1 Sheet Nº: 1   |   |
| Description           |  |  |  |  |  | Client Nº: 1132-01 Dwg Nº: 05-219   |   |
| Dwn By Ckd By Appd By |  |  |  |  |  | ITEM: E-537 FUSEL OIL COOLER  |   |