DOD STANDARD DESIGN AW 78-24-27
ABOVEGROUND VERTICAL STEEL FUEL TANKS WITH FIXED ROOFS
APRIL 2015

INDEX OF DRAWINGS
GENERAL DESIGN NOTES

A. APPLICABILITY

1. THIS STANDARD DESIGN APPLIES TO VERTICAL STEEL TANKS IN JET A, JP-5 OR JP-8 FOR THE PURPOSES OF THIS STANDARD, WHEN A TANK SIZE IS GIVEN, THAT TERM SHALL BE INTERPRETED TO MEAN "HOST NATION, IN ACCORDANCE WITH THE FINAL GOVERNING STANDARDS OF THE NATION THE TANK IS LOCATED IN".

B. NOTES ON USE OF THIS STANDARD

1. ALL NOTES ON SHEETS 03 AND 04 ARE DESIGN NOTES.

2. FOR THE PURPOSES OF THIS STANDARD, WHEN A TANK SIZE IS GIVEN, THAT TERM SHALL BE INTERPRETED TO MEAN "HOST NATION, IN ACCORDANCE WITH THE FINAL GOVERNING STANDARDS OF THE NATION THE TANK IS LOCATED IN".

3. THE TANK DESIGN DETAILS SHALL BE USED AS PROVIDED UNLESS THERE ARE SPECIFIC CONDITIONS (SAFETY OR ENVIRONMENTAL RELATED) THAT WARRANT A MODIFICATION. ANY MODIFICATIONS TO SHEET C.01 AND THROUGHOUT THE TANK DETAIL SHEETS MUST BE APPRVED BY THE ENGINEER OF RECORD.

4. Tank shall be in accordance with API Standard 650, except where it conflicts with this standard, in which cases this standard shall govern.

5. To avoid confusion, all terms in this standard shall be defined where used first in this standard unless otherwise specified.

6. Tank foundation design shall be in accordance with API Standard 650, except where it conflicts with this standard, in which cases this standard shall govern.

7. All piping, valves (except DBB valves), and fittings 2.5" and larger shall be interior and exterior coated carbon steel. All piping, valves, and fittings 2" and smaller shall be interior coated carbon steel. Provide stainless steel float pilot chamber, level switch housings, probe holders, and associated piping. Piping, valves, and connections for float pilot and level switches.

8. In non Corrosive environments, as defined by service headquarters. All piping, valves, and fittings 2" and larger shall be stainless steel for the purpose of this standard.

9. The following requirements shall be addressed using the waivers described in UFC 3-460-01. Service headquarters shall be in accordance with the final governing standards of the nation the tank is located in.

10. Service headquarters is defined in UFC 3-460-01 Design: Petroleum Fuel Facilities.

11. Ensure that the design complies with local, state, and federal codes and regulations for fire and explosion resistance. At certain locations this may require the tank roof vent be fitted with a pressure vacuum relief device for tanks without floating pan, but also less often for tanks with floating pan.

12. Field service headquarters is defined in UFC 3-460-01 Design: Petroleum Fuel Facilities. Service headquarters shall be addressed using the waivers and exceptions process described in UFC 3-460-01. Service headquarters shall be addressed in the approval process.

13. Interpreters, waiver, and exemptions shall be addressed using the waivers and exceptions process described in UFC 3-460-01. Service headquarters shall be addressed in the approval process.

14. When requested by the facility and approved by service headquarters, provide a sidestream filtration system with a 100 GPM filter/separator and a 100 GPM pump in addition to the water drain-off system. Include instructions to the operators to turn off the water drain-off system and sidestream filtration system pumps and to close related service valves when the tanks are not in use.

15. When available, provide warning devices to warn personnel in the immediate vicinity of the tanks. Consider making all high-level alarms visible from a distance.

16. Provide and install all material in accordance with the manufacturer's specifications.

17. Provide high-point vents and low-point drains on piping in accordance with UFC 3-460-01.

18. Provide and install all material in accordance with the manufacturer's specifications.

19. Provide and install all material in accordance with the manufacturer's specifications.

20. Provide and install all material in accordance with the manufacturer's specifications.

C. DESIGN PARAMETERS

1. THE FOLLOWING DESIGN PARAMETERS/METRICS SHALL BE CONSIDERED BY THE ENGINEER OF RECORD AND SHALL BE IN ACCORDANCE WITH UFC 3-460-01. PROVIDE STAINLESS STEEL FLOAT PILOT CHAMBER, LEVEL SWITCH HOUSINGS, PROBE HOLDERS, AND ASSOCIATED PIPING. PIPING, VALVES, AND CONNECTIONS FOR FLOAT PILOT AND LEVEL SWITCHES. PROVIDE STAINLESS STEEL FLOAT PILOT CHAMBER, LEVEL SWITCH HOUSINGS, PROBE HOLDERS, AND ASSOCIATED PIPING. PIPING, VALVES, AND CONNECTIONS FOR FLOAT PILOT AND LEVEL SWITCHES.

2. ALL PIPING, VALVES, AND FITTINGS 2" AND SMALLER SHALL BE INTERIOR COATED CARBON STEEL. ALL PIPING, VALVES (EXCEPT DBB VALVES), AND FITTINGS 2" AND SMALLER SHALL BE INTERIOR COATED CARBON STEEL. PROVIDE STAINLESS STEEL FLOAT PILOT CHAMBER, LEVEL SWITCH HOUSINGS, PROBE HOLDERS, AND ASSOCIATED PIPING. PIPING, VALVES, AND CONNECTIONS FOR FLOAT PILOT AND LEVEL SWITCHES.

3. ANCHORAGE, ORIENTATION OF THE NOZZLES, MANHOLES, ETC., ARE SITE SPECIFIC AND SHALL BE DETERMINED BY THE ENGINEER OF RECORD.

4. THE FOLLOWING DESIGN PARAMETERS/METRICS SHALL BE CONSIDERED BY THE ENGINEER OF RECORD AND SHALL BE IN ACCORDANCE WITH UFC 3-460-01. SERVICE HEADQUARTERS SHALL BE IN ACCORDANCE WITH THE FINAL GOVERNING STANDARDS OF THE NATION THE TANK IS LOCATED IN.

5. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

6. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

7. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

8. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

9. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

10. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

11. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

12. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

13. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

14. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

15. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

16. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

17. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

18. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

19. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

20. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

D. SPECIFICATIONS

1. SPECIFICATIONS. TO BE USED AS A PART OF THIS STANDARD.

2. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

3. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

4. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.

5. PROVIDE INSTRUCTIONS TO THE OPERATOR TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL HIGH-LEVEL ALARMS VISIBLE FROM A DISTANCE.
GENERAL DESIGN NOTES (CONTINUED)

F. DESIGN CONSIDERATIONS FOR TANKS WITHOUT FLOATING PANS:

THIS STANDARD IS INTENDED PRIMARILY FOR TANKS WITH FLOATING PANS BUT MAY BE USED TO DESIGN TANKS WITHOUT FLOATING PANS. PREVIOUS NOTES APPLY EXCEPT FOR THOSE DEALING SPECIFICALLY WITH FLOATING PANS. SOME OF THE DIFFERENCES IN DESIGN THAT SHALL BE CONSIDERED ARE AS FOLLOWS:

1. THE DIAMETER AND SHELL HEIGHT OF A TANK WITHOUT A FLOATING PAN SHALL BE THE SAME AS THAT FOR THE SAME NOMINAL SIZE TANK WITH A FLOATING PAN.

2. TANKS WITHOUT FLOATING PANS ARE NOT REQUIRED TO HAVE ROOF INSPECTION HATCHES, ROOF PERIMETER VENTS, COMBINATION ROOF PERIMETER VENT/INSPECTION HATCHES, OVERFLOW, PAN INSTALLATION HATCHES, UPPER SHELL MANHOLES, LOWER STAIRWAY LANDINGS, OR MANHOLES COVERED WITH TILLER CRAWLS.

3. CONSULT APPLICABLE FIRE CODES AND STANDARDS TO ADDRESS EMERGENCY VENTING. EMERGENCY VENTING FOR TANKS WITHOUT FLOATING PANS SHALL BE PROVIDED BY GREEN/NAT FUELS WITH EMERGENCY VENTING DEVICES, ALTHOUGH TANK DESIGNS GREATER THAN 90 IN DIAMETER MAY REQUIRE THE EMERGENCY VENTING REQUIREMENTS BY USE OF A FIREPROOF ROOF-TOSH SHELL ATTACHMENT AS ALLOWED BY API STANDARDS.

4. TANKS WITHOUT FLOATING PANS MAY BE REQUIRED TO HAVE ADDITIONAL FIRE PROTECTION SUCH AS FIRE-FIRED OR FIXED-FIRED APPARATUS SYSTEMS.

5. THE INTERNAL LADDER IN A TANK WITHOUT A FLOATING PAN SHALL BE MADE OF CARBON STEEL, FLAT BAR AND ROUND ROD AND ATTACHED TO THE SHELL BY WELDING.

6. THE ABOVE MENTIONED INTERNAL LADDER IS NOT ATTACHED TO THE INWARD SIDE OF A ROOF OPENING ON A NON-FLOATING PAN TANK. THE OSHA REQUIRED CLEARANCE BEHIND THE ROOF LADDERS IS NOT LIMITED BY THE NECK OF THE OPENING; THEREFORE, A STANDARD 36 INCH ROUND ROOF MANHOLE MAY BE PROVIDED TO ACCESS THE LADDER FROM THE ROOF RATHER THAN THE RECTANGULAR HATCH REQUIREDS ON TANKS WITH FLOATING PANS.

7. TANKS WITHOUT FLOATING PANS DO NOT REQUIRE UPPER SHELL MANHOLES FOR ACCESSING THE TOP OF THE PAN. THEREFORE, LOWER PLATFORMS ARE NOT REQUIRED. THE OCCIDENTRAL LENGTH OF THE STAIRWAY WILL DIFFER FROM THAT FOR A TANK WITH A FLOATING PAN AND INTERFERANCE WITH OTHER TANK APPIANCEMENTS WILL NEED TO BE CONSIDERED.

8. THE LLS SHOULD BE LOCATED SO THAT IT ACTUATES AT LEAST 1 MINUTE BEFORE THE LEVEL OF THE FUEL REACHES LOSS OF SUCTION WHEN ISSUING FUEL. LOSS OF SUCTION IS TYPICALLY CONSIDERED TO BE 6 INCHES ABOVE THE TOP OF THE SUCTION ELBOW INSIDE THE TANK.


G. TANKS DESIGN SEQUENCE/PROCEDURE FOR TANKS WITH FLOATING PANS:

1. THE TANK DESIGN WILL VARY WITH THE INLET AND OUTLET FLOWRATES AND NOZZLE SIZES. THE TANK HEIGHT (BASED ON HEIGHT RESTRICTIONS, ETC.) THE PRESENCE OR NON-PRESENCE OF A FLOATING PAN AND OTHER FACTORS THE TANK FLOATING PAN ELATION, THE LEVEL SWITCHES, AND THE HLV SETPOINT ELEVATIONS IN PARTICULAR DEPENDED ON THESE. THESE VALUES SHOULD BE CALCULATED FOR TANK SIZES, HEIGHTS, CONFIGURATIONS, AND NOZZLE COMBINATIONS NOT SHOWN ON TABLE C-1 SHEET C-1.

2. THE FOLLOWING IS THE PHILOSOPHY USED TO LAY OUT THE TANKS IN THIS STANDARD. IT CAN BE APPLIED TO TANK SIZES AND CONFIGURATIONS NOT INCLUDED HEREIN:

a. CHOOSE THE NOMINAL TANK SIZE. FOR THE MOST COMMON TANK SIZES, THE TABLE ON DRAWING P-1 WILL SHOW THE TANK SIZE (FIXED AS AN EVEN PRODUCT OF 8' SHELL COURSES.

b. THE FLOATING PAN LOW LEG POSITION IS BASED ON NOZZLE SIZES. LEVEL SWITCH SETPOINT ELEVATIONS ARE BASED ON THE FLOATING PAN LOW LEG POSITION AND THE NUMBER OF MINUTES BETWEEN THE LOW LEVEL SWITCH ACTUATION AND THE FLOATING PAN LEGS REMAINING LIFTED. THE LEVEL SWITCHES, AND THE HLV SETPOINT ELEVATIONS IN PARTICULAR DEPENDED ON THESE. THE VALUES SHOULD BE CALCULATED FOR TANK SIZES, HEIGHTS, CONFIGURATIONS, AND NOZZLE COMBINATIONS NOT SHOWN ON TABLE C-1 SHEET C-1.

3. THE FOLLOWING DESIGN PARAMETERS/SETS ARE A PARTIAL LIST OF THOSE OTHER ITEMS THAT WILL ALSO NEED TO BE TAKEN INTO ACCOUNT AT EACH BLOCK WHEN DESIGNING TANKS FOR A SPECIFIC PROJECT:

   - LOCAL CODES (LEVEL ALARM SETPOINT)
   - SEISMIC DESIGN, AIR QUALITY
   - FLOOD LINE CLEARANCES (TANK HEIGHT)
   - DEPARTMENT OF JUSTICE ON STAIRWAYS AND LANDINGS
   - MAINTENANCE ACCESS
NOTES:

1. SEE DESIGNER NOTES, SEQUENCE OF OPERATION, AND LEVEL SETPOINT TABLE FOR LEVEL, SWITCHES AND HLS SETPOINT ELEVATIONS.

2. PROVIDE A WATER DRAIN-OFF SYSTEM. AS AN OPTION, PROVIDE, IN ADDITION, A SIDESTREAM FILTRATION SYSTEM. SEE NOTE 2, FIG 0.53

3. PROVIDE LIMIT SWITCHES ON THE TANK FILL LINE, TANK ISSUE LINE DBB, 4" LOW AND SUCTION LINE DBB, AND HLS. AS AN OPTION, PROVIDE DBB LISTED HERE WITH MOTOR OPERATIONS WITH LIMIT SWITCHES (ONLY WHEN APPROVED BY SERVICE HEADQUARTERS). HLS RETURN ITS LIMIT SWITCH IN THIS CASE

4. HLS AND HHLS CHAMBER AND HLS CONTROL FLOAT CHAMBER SHALL SHARE COMMON TANK NOZZLES AS INDICATED ON DETAILS; THEY ARE SHOWN SEPARATE TO HERE FOR CLARITY. MOUNT PIPING AND TUBING TO HLS CHAMBER AND HLS CONTROL FLOAT CHAMBER ALONG THE SIDE OF THE RINGWALL, PRIOR TO RISING UP THE TANK SHELL

5. HEAT TRACE IN COLD CLIMATES ONLY

6. IF SIDESTREAM FILTRATION SYSTEM IS NOT PROVIDED, PROVIDE OUTLET INDICATED WITH BLIND FLANGE.

7. OPERATION FULL FILL LEVEL SHALL BE DETERMINED BY THE USER AFTER THE TANK IS IN SERVICE.

8. OPERATION FULL FILL LEVEL SHALL BE DETERMINED BY THE USER AFTER THE TANK IS IN SERVICE.
Typical Concrete Containment Dike Site Plan

**Designer Notes:**

1. Site plan shown is a typical 20k bbl tank without a mounded tank foundation. Dimensions shown in table 1 are for planning purposes only and are intended to indicate the approximate amount of area required for secondary containment.
2. For planning purposes, the secondary containment area size shown here is based upon 4' x 4' (maximum allowable height) temp. (1.5' of freeboard with a slope of 2:1). See UFGS 3-499-07 for detailed tank and containment requirements.
3. Groups of tanks with no tank larger than 10k bbl and not exceeding 10k bbl in aggregate capacity, may be enclosed in a single direct containment enclosure. Subdivide each direct containment enclosure containing two or more tanks by intermediate walls or dike no less than 15' in height to provide separate drainage area for each tank. See sheet C.03 for intermediate wall detail.
4. Unsurfaced and aggregate surfaced dikes shall be sloped no greater than 3:1. Concrete surfaced dikes have a preferred maximum slope of 2.5:1. With an average surface maximum of 1.5 to 2.5' (type course to ground). Maximum slope of 2.5:1 is retired. A 2.5:1 type course to ground is recommended. Secondary containment area design shall comply with UFGS 3-499-07. 50th SPC 1913 TFL, NPA 30 and other federal, state, county, and local regulations.
5. A concrete access ramp is permitted in dike areas for 20k bbl or greater ASTs. Vehicle access should be strictly controlled with a lockable barrier (chain gate) and sign. The sign should read: access restricted to authorized vehicles only. Vehicles must be light-duty and rated for use in Class 1, Division 2 hazardous locations. Chain down access points and marking to understand the vehicle traffic. Vehicle traffic shall not be allowed on exposed liners.
6. Secondary containment shall be provided by a fuel impermeable liner. The liner should be a chlorinated polyethylene liner system (Chloroprene). Thickness of the liner shall be 60 mil minimum. A minimum of 12" of freeboard. Vertical concrete dike walls are an acceptable alternative when there is not enough land available for trapezoidal berms. Secondary containment area design shall comply with UFGS 3-499-07.
7. Provide concrete or steel stairways over the dike berms. No less than two dike stairways shall be provided over dike berms or walls for emergency egress. See details (on Sheet C.06 & C.07).
8. Provide concealed or steel stairways over the dike berms. No less than two dike stairways shall be provided over dike berms or walls for emergency egress. See details (on Sheet C.06 & C.07).
9. Provide fire hydrants to protect additional facilities in accordance with UFGS 3-499-07. 8k bbl fuel line system for materials.
10. Provide fire hydrants to protect fuel storage facilities in accordance with UFGS 3-499-07. 8k bbl fuel line system for materials.
11. A minimum of two hydrants spaced a maximum of 200 ft apart. Locate hydrants such that ASTs can be reached by hose lays not exceeding 500 ft in length. Fire hydrants must be accessible to fire department pump vehicles.
12. For exposed containment, skid-resistant walkways should be provided at exposed foot traffic paths, including the top of the dikes. See UFGS section 3-59-03 fuel impermeable liner system for materials.

**Table 1:**

<table>
<thead>
<tr>
<th>Nominal Tank Volume (K BBL)</th>
<th>Nominal Tank Height (FT)</th>
<th>Shell Volume (K BBL)</th>
<th>Usable Volume (K BBL)</th>
<th>LLLA Height (FT)</th>
<th>LLLA Volume (K BBL)</th>
<th>Secondary Containment Dimensions (FT) (1925 SPC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>30</td>
<td>6.0</td>
<td>6.0</td>
<td>165</td>
<td>165</td>
<td>155</td>
</tr>
<tr>
<td>10</td>
<td>50</td>
<td>10.0</td>
<td>10.0</td>
<td>155</td>
<td>165</td>
<td>155</td>
</tr>
<tr>
<td>20</td>
<td>60</td>
<td>20.0</td>
<td>20.0</td>
<td>145</td>
<td>165</td>
<td>155</td>
</tr>
<tr>
<td>30</td>
<td>70</td>
<td>28.9</td>
<td>28.9</td>
<td>255</td>
<td>255</td>
<td>205</td>
</tr>
<tr>
<td>40</td>
<td>80</td>
<td>33.9</td>
<td>33.9</td>
<td>255</td>
<td>255</td>
<td>205</td>
</tr>
<tr>
<td>50</td>
<td>90</td>
<td>41.1</td>
<td>41.1</td>
<td>3390</td>
<td>3390</td>
<td>310</td>
</tr>
<tr>
<td>60</td>
<td>100</td>
<td>50.0</td>
<td>50.0</td>
<td>3390</td>
<td>3390</td>
<td>310</td>
</tr>
<tr>
<td>70</td>
<td>110</td>
<td>60.1</td>
<td>60.1</td>
<td>8805</td>
<td>8805</td>
<td>600</td>
</tr>
<tr>
<td>80</td>
<td>120</td>
<td>64.6</td>
<td>64.6</td>
<td>930</td>
<td>930</td>
<td>600</td>
</tr>
<tr>
<td>90</td>
<td>130</td>
<td>83.1</td>
<td>83.1</td>
<td>11560</td>
<td>11560</td>
<td>600</td>
</tr>
</tbody>
</table>

**Notes:**

- Nominal tank vol. - approximate usable volume = volume from LLA to ULA.
- Shell volume = volume inside all of the shell.
- Usable volume = volume inside all of the shell.
- Secondary containment area size shown here is based upon 4' x 4' (maximum allowable height).
1. SITE PLAN SHOWN IS A TYPICAL 20K BBL TANK WITHOUT A MOUNDED TANK FOUNDATION. DIMENSIONS SHOWN IN TABLE 1 ARE FOR PLANNING PURPOSES ONLY AND ARE INTENDED TO INDICATE THE APPROXIMATE AMOUNT OF AREA REQUIRED FOR SECONDARY CONTAINMENT.

2. FOR PLANNING PURPOSES, THE SECONDARY CONTAINMENT AREA SIZE SHOWN HERE IS BASED UPON A 4’-0” MAXIMUM ALLOWABLE HEIGHT VERTICAL DRAIN WALLS AS SHOWN IN FIGURE 17 TO PROTECT A 1/4” RANGE OF FREEBOARD WITH A WALL THICKNESS OF 1/2”. SEE UFC 3-460-01 FOR DETAILED DRAIN AND CONTAINMENT REQUIREMENTS.

3. THE MAXIMUM ALLOWABLE WALL HEIGHT IS 3-1/4” UFC 3-460-01 REQUIRES A MINIMUM OF 12” OF FREEBOARD. VERTICAL CONCRETE DRAIN WALLS ARE AN ACCEPTABLE ALTERNATIVE WHEN THERE IS NOT ENOUGH LAND FOR TRAPEZOIDAL WALLS.

4. THE MAXIMUM ALLOWABLE WALL HEIGHT IS 3-1/4” UFC 3-460-01 REQUIRES A MINIMUM OF 12” OF FREEBOARD. VERTICAL CONCRETE DRAIN WALLS ARE AN ACCEPTABLE ALTERNATIVE WHEN THERE IS NOT ENOUGH LAND FOR TRAPEZOIDAL WALLS.

5. NO VEHICLE ACCESS IS PERMITTED WHEN VERTICAL DRAIN WALLS ARE UTILIZED.

6. SECONDARY CONTAINMENT SHALL BE PROVIDED BY A FUEL IMPERMEABLE LINER. THE LINER SHOULD BE A FLEXIBLE MEMBRANE LINER. UTF-1040-01 SPECIFIES IMPERMEABLE LINER SYSTEM. A 60 MIL HIGH DENSITY POLYETHYLENE (HDPE) LINER MAY BE USED IF THE LINER IS COMPLETELY COVERED WITH CONCRETE. BALLAST MATERIAL NEEDED TO BE PROVIDED TO PREVENT WIND UPLIFT DAMAGE TO THE LINER. BALLAST MATERIALS INCLUDE CONCRETE SURFACING, SMOOTH COBBLE STONES, SAND TUBES, AND PRECAST CONCRETE BLOCKS. WIND UPLIFT CALCULATIONS ARE REQUIRED P TO THE SURFACE AREA OF THE IM AND IS EXPOSED. SEE UFUS 33-56-63 FOR CURTAIN WALL GUIDANCE.

7. CONCRETE DIKE SURFACING SHALL BE PER UFGS SECTION 32-13-15 CONCRETE PAVEMENT FOR CONTAINMENT DIKES. THE CONCRETE DIKE AND CONTAINMENT REQUIREMENTS.

8. SLOPE DIKE BASIN SURFACES MUST HAVE A SLOPE OF 1% FOR DRAINAGE. DRAINAGE SWALES SHOULD BE SLOPED NO FLATTER THAN 0.5%.

9. PROVIDE FIRE HYDRANTS TO PROTECT POL STORAGE FACILITIES IN ACCORDANCE WITH UFC 3-460-01 & 3-600-01, INCLUDING A MINIMUM OF TWO HYDRANTS SPACED A MAXIMUM OF 300 FT APART. LOCATE HYDRANTS SUCH THAT ASTS CAN BE REACHED BY HOSE LAYS NOT EXCEEDING 350 FT IN LENGTH. FIRE HYDRANTS MUST BE ACCESSIBLE TO FIRE DEPARTMENT PUMPER VEHICLES.

10. CONSTRUCT A CONTAINMENT DRAIN LINE FROM THE DRAINAGE INLET TO THE CONTAINMENT DRAIN VALVE USING DUCTILE IRON PIPING.

11. DO NOT USE BURIED CONTAINMENT DRAIN VALVES IN CLIMATES WITH LOWEST ONE-DAY MEAN TEMPERATURE BELOW -15°F PER API 860. USE EXPOSED GEOMEMBRANES, SKID-RESISTANT WALKWAYS SHOULD BE PROVIDED AT EXPECTED FOOT TRAFFIC PATHS. SEE UFUS 33-56-63 FOR FURTHER GUIDANCE.

12. PROVIDE MEANS TO CONTROL DRAINAGE THAT WILL NOT NORMALLY REMAIN FROZEN AFTER THAW OF THE UNDERLYING GEOMEMBRANE. THIS DESIGN FEATURE MAY BE MODIFIED WITH THE APPROVAL OF SERVICE HEADQUARTERS.

13. PROVIDE SUMP VOLUME TO PROVIDE A SEPARATE DRAINAGE AREA FOR EACH TANK. SEE TABLE 2 FOR INTERMEDIATE WALL DETAIL.

14. FOR EXPOSED GEOMEMBRANES, SKID-RESISTANT WALKWAYS SHOULD BE PROVIDED AT EXPECTED FOOT TRAFFIC PATHS. SEE UFUS 33-56-63 FOR TYPICAL PIPING LAYOUT PLAN SEE SHEET C.05.

TABLE 1

<table>
<thead>
<tr>
<th>NOMINAL SHELL VOLUME (K BBL)</th>
<th>SHELL (FT)</th>
<th>VERTICAL CONTAINMENT WALL DIMENSIONS (HT)</th>
<th>SHELL (FT)</th>
<th>VERTICAL CONTAINMENT WALL DIMENSIONS (HT)</th>
<th>SHELL (FT)</th>
<th>VERTICAL CONTAINMENT WALL DIMENSIONS (HT)</th>
<th>SHELL (FT)</th>
<th>VERTICAL CONTAINMENT WALL DIMENSIONS (HT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>10</td>
<td>10</td>
<td>20</td>
<td>20</td>
<td>30</td>
<td>30</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>20</td>
<td>20</td>
<td>20</td>
<td>30</td>
<td>30</td>
<td>40</td>
<td>40</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>30</td>
<td>30</td>
<td>30</td>
<td>40</td>
<td>40</td>
<td>50</td>
<td>50</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>40</td>
<td>40</td>
<td>40</td>
<td>50</td>
<td>50</td>
<td>60</td>
<td>60</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>50</td>
<td>50</td>
<td>50</td>
<td>60</td>
<td>60</td>
<td>70</td>
<td>70</td>
<td>80</td>
<td>80</td>
</tr>
</tbody>
</table>

NOTE 1: TYPICAL SUMP VOLUME TO PROVIDE A SEPARATE DRAINAGE AREA FOR EACH TANK.
NOTE 2: SHELL VOLUME = VOLUME INSIDE ALL SHELLS, SHELL EXCISION VOLUME = SHELL VOLUME - INTERMEDIATE WALL VOLUME.
1. Joint layout panels should be as close to square as possible with a minimum joint spacing of 10 feet.

2. Expansion joints shall be placed around the tank foundation; at the dike footers; on each side of the concrete stairways; at the area inlet; and at the quarter sections of the basin, as indicated.

3. Odd shaped panels shall be reinforced with WWF.

4. Spot elevations shall be provided at the locations indicated and at other applicable change of grade points.

5. The top of the tank foundation shall be one foot above the containment basin, as indicated.

6. Provide positive drainage away from the tank foundation perimeter.

7. Project specifications shall use UFC 32-13-20 Concrete Pavement for containment dikes.

8. Provide positive drainage away from the tank foundation perimeter.

9. Spot elevations shall be provided at the locations indicated and at other applicable change of grade points.

10. Provide positive drainage away from the tank foundation perimeter.

11. Project specifications shall use UFC 32-13-20 Concrete Pavement for containment dikes.

12. Provide positive drainage away from the tank foundation perimeter.

13. Spot elevations shall be provided at the locations indicated and at other applicable change of grade points.

14. Provide positive drainage away from the tank foundation perimeter.

15. Project specifications shall use UFC 32-13-20 Concrete Pavement for containment dikes.

16. Provide positive drainage away from the tank foundation perimeter.

17. Spot elevations shall be provided at the locations indicated and at other applicable change of grade points.

18. Provide positive drainage away from the tank foundation perimeter.

19. Project specifications shall use UFC 32-13-20 Concrete Pavement for containment dikes.

20. Provide positive drainage away from the tank foundation perimeter.

21. Spot elevations shall be provided at the locations indicated and at other applicable change of grade points.

22. Provide positive drainage away from the tank foundation perimeter.

23. Project specifications shall use UFC 32-13-20 Concrete Pavement for containment dikes.
TYPICAL PIPING LAYOUT

SCALE: 1" = 10'-0"

LEGEND:
- ANCHOR SUPPORT
- SADDLE SUPPORT
- FLANGE BALL JOINT
- GUIDED SUPPORT
- FREE SUPPORT

DESIGNER NOTES:
1. LOCATION AND CONFIGURATION SHOWN FOR PIPING IS GENERAL AND IS NOT INTENDED TO LIMIT OR RESTRICT PIPING LOCATION, CONFIGURATION OR PIPE SUPPORT ARRANGEMENT.
2. PIPE SUPPORT TYPES SHOWN ARE TYPICAL, IN GENERAL, WITHIN CONTAINMENT AFTER THE FIRST SUPPORT, WHICH IS AN ANCHOR SUPPORT USE OF AN ADJUSTABLE PIPE SADDLE SUPPORT (SEE SHEET CD.11) OR FIXED SUPPORT (SEE SHEETS CD.12 & CD.18) IS COMMON. ON THE PERIMETER OF THE DIKE, USE OF A GUIDED SUPPORT (SEE SHEETS CD.12 & CD.18) IS COMMON. ACTUAL PIPE LAYOUT, SITE CONDITIONS, REGULATIONS OF PIPE STRESS ANALYSIS, AND HYDRAULIC transient analysis shall dictate actual support types and locations.
3. PROVIDE BALL JOINTS. BALL JOINTS MAY BE USED IN EXTREME NORTHERN CLIMATES (E.G. ALASKA) PROVIDED SUITABLE SEAL MATERIALS FOR LOW TEMPERATURES ARE SPECIFIED. A PAIR OF BALL JOINTS SHOULD BE PLACED INTO THE PIPING RUN AND SHALL BE A MINIMUM OF 8' APART. PLACE A THIRD BALL JOINT INTO THE PIPING RUN SUCH THAT LINEAR MOVEMENT FROM THE PIPING WITH THE TWO BALL JOINTS SUPPORTED BY IS ABSORBED. THE THIRD BALL JOINT SHOULD BE MOUNTED IN PIPING RUNNING PERPENDICULAR TO THE TWO BALL JOINTS SUPPORTED BY IT. USE FLEXIBLE BALL JOINT DETAIL ON SHEET CD.11.
4. AT LOCATIONS EXHIBITING FREEZING CONDITIONS, ALL DRAIN PIPE ON THE PROJECT DRAIN TANK AND FILTER SEPARATOR. IF PROVIDED, SHALL BE HEATED WITH APPROPRIATE HAZARD RATED TAPE AND INSULATED.
5. LOCATE EXTERIOR PIPE SUPPORTS TO PROVIDE ADEQUATE PIPE FLEXIBILITY FOR TANK SETTLEMENT. SEE DETAIL ON SHEET CD.12. (SEE SHEETS CD.12 & CD.13) IS COMMON. ACTUAL PIPE SUPPORT TYPES AND CONFIGURATION OR PIPE SUPPORT ARRANGEMENT, USE OF AN ADJUSTABLE PIPE SADDLE SUPPORT (SEE SHEET CD.12 & CD.13) IS COMMON. ACTUAL PIPE LAYOUT, SITE CONDITIONS, REGULATIONS OF PIPE STRESS ANALYSIS, AND HYDRAULIC transient analysis shall dictate actual support types and locations.
6. ALL FUEL PIPING SHALL BE ABOVE GRADE (ONLY ISSUE PIPING IS ALLOWED TO RUN THROUGH EARTHER WELLS). FACILITY REQUIREMENTS (FORCE PROTECTION, VANDALISM, BLAST DAMAGE, FIRE PROTECTION, ETC. MAY REQUIRE UNDERGROUND PIPING).
7. PENETRATIONS THROUGH FIREWALLS SHALL BE MADE THROUGH PIPE SLEEVES WITH BUNA-N COMPRESSION SEALS. SLEEVES SHALL BE PROVIDED WITH LEAK TESTING CAPABILITY. SEE SHEET CD.12.
8. PENETRATIONS THROUGH THE FML SHALL BE MADE WITH A BOOT MADE BY THE MANUFACTURER OF THE FML FOR THAT PURPOSE AND SEALED TO THE PENETRATION SLEEVE. SEE CD.12.
9. IN LOCATIONS SUBJECT TO ICE AND SNOW, ORIENT STAIRWAYS AND HIGH LEVEL PIPING TO RECEIVE WINTER SUN SO AS TO MINIMIZE ACUMULATIONS. IF PIPING AT TANK IS NOT BELOW A STAIRWAY, PROVIDE ICE SHIELD OVER PRODUCT PIPING AND VALVES AT TANK. ICE SHIELDS HAVE SUFFICIENT CLEARANCE ABOVE VALVES TO ALLOW MAINTENANCE OF VALVES AND VALVE OPERATIONS OR PROVES MEANS TO MOVE SHIELDS OUT OF THE WAY AND PROVIDE CATEGORIES OVER OTHER VALVES AND EQUIPMENT.
10. WHEN THE TANK FOUNDATION IS ELEVATED, Maintain ELEVATION OF PIPING IN Dike AREA so that PIPING IS NOT CONNECTED TO THE TANK NOZZLES AND TO ALLOW MOVEMENT TO A MINIMUM PIPING WHEN TANK FOUNDATION IS THE NON-ELEVATED TYPE USE PIPE SLEEVES WITH A BUNA-N COMPRESSION Seals. MAINTAIN ELEVATION OF PIPING IN Dike AREA so that PIPING IS SLOPED CONTINUOUSLY TO THE TANK NOZZLES AND PERSONEL MAY STEP MORE EASILY OVER PIPING. WHEN THIS REQUIREMENTS TO PENETRATE THE DIKE BERM PIPING DESIGN SHALL ADDRESS FORCE TO THE REQUIREMENTS.
11. PIPING DESIGN SHALL ADDRESS REQUIREMENTS OF PIPING SUPPORT OF THE TANK SHALL BE AN ANCHOR WITH THE CONCRETE TANK SHELL, SPRING PIPE SUPPORTS MAY BE USED IN HIGH SEISMIC AREAS WHEN DIRECTED BY THE FACILITY. SEE DETAIL ON SHEET CD.12.

DRAWING REVISION: 10 MAY 2014

NAVFAC DRAWING NO.
CONSTR. CONTR. NO.
PROJECT NO.
SCALE:

NAVAL FACILITIES ENGINEERING COMMAND - ALANTIC

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

DOD STANDARDS DESIGN AW78-24-27

CCH

APPROVED FOR COMMANDER NAVFAC

FOR COMMANDER NAVFAC

S. P. WILSON

CONTRACTOR SIGNATURE

11.1.2.1

FUEL TANKS WITH FIXED ROOFS
ABOVE GROUND VERTICAL STEEL FUEL TANKS WITH FIXED ROOFS

DOD STANDARD DESIGN AW78-24-27

NAVAL FACILITIES ENGINEERING COMMAND - ATLANTIC
OMAHA DISTRICT OF ENGINEERS
US ARMY CORPS OF ENGINEERS

SUBMITTED BY:
DATE: APRIL 2015

DIKE AND BASIN - 4"
6" COMPACTED SUBGRADE (95% ASTM 1557)
RAMP - 6"
6" COMPACTED SUBGRADE (95% ASTM 1557)

GEOMEMBRANE LAYER
GEOTEXTILE LAYER

GEOMEMBRANE LINER
GEOMEMBRANE SHEET

GENERAL NOTES:
1. ALL CONCRETE SHALL BE REINFORCED WITH SYNTHETIC FIBER REINFORCEMENT. ADDITIONAL STEEL REINFORCEMENT SHALL BE PROVIDED, WHERE INDICATED ON THE JOINT LAYOUT PLAN. SEE SPECIFICATIONS SECTION 32 13 15.20 CONCRETE PAVEMENT FOR CONCRETE AND REINFORCEMENT REQUIREMENTS.
2. PROVIDE GEOMEMBRANE BOOT FOR ALL CIRCULAR GEOMEMBRANE PENETRATIONS. ALL SMALL LINER PENETRATIONS SHALL BE CIRCULAR TO ACCOMMODATE A BOOT SEAL.
3. ALL JOINTS SHALL BE SEALED PER SPECIFICATIONS SECTION 32 01 19 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS. SEE SHEET C.04 FOR THE JOINT LAYOUT PLAN.
4. A GEOTEXTILE SHALL BE INSTALLED BELOW AND ABOVE THE GEOMEMBRANE. SEE SPECIFICATION SECTION 33 56 63 FUEL IMPERMEABLE LINER SYSTEM. THE GEOMEMBRANE AND GEOTEXTILE SHALL BE PROTECTED FROM DAMAGE AT ALL TIMES, AS SPECIFIED.
5. THE SURFACE UNDERLYING THE GEOTEXTILE/GEOMEMBRANE SHALL BE SMOOTH AND FREE OF ROCKS LARGER THAN 5 INCH IN DIAMETER OR ANY OTHER MATERIAL WHICH COULD DAMAGE THE GEOMEMBRANE LINER.
6. GEOMEMBRANE ANCHORAGE/EMBEDMENT STRIP MATERIALS AND INSTALLATION SHALL BE AS RECOMMENDED BY THE MANUFACTURER OF THE GEOMEMBRANE.

DESIGNER NOTES:
1. THE GEOTEXTILE LAYERS ARE PROVIDED TO PROTECT THE GEOMEMBRANE DURING AND AFTER CONSTRUCTION. THE BOTTOM GEOTEXTILE LAYER MAY BE OMITTED IF THE SUBGRADE SOIL IS KNOWN TO BE FREE OF ROCKS OR OTHER MATERIALS THAT COULD POTENTIALLY DAMAGE THE GEOMEMBRANE.

NOTE: SEE SHEET CD.08 FOR PIPE PENETRATIONS OVER 2-INCHES IN DIAMETER.

TYPICAL CONDUIT OR SMALL PIPE PENETRATION DETAIL (CONCRETE)

SCALE: NONE
REINFORCE SLABS MARKED "R" ON JOINT PLAN WITH 4X4 WIRE 2.9X2.9 OR 6X6 WIRE 4.0X4.0 WELDED WIRE FABRIC DISCONTINUOUS AT JOINTS

T = PAVEMENT THICKNESS

NOTE:
1. WELDED WIRE FABRIC SHALL BE OVERLAPPED FOR A DISTANCE EQUAL TO AT LEAST ONE SPACING OF THE WIRE IN THE FABRIC IN THE LAP. SHALL BE WIRED OR OTHERWISE SECURELY FASTENED OR 32 WIRE DIAMETERS, WHICHEVER IS GREATER. THE WIRES EQUAL TO AT LEAST ONE SPACING OF THE WIRE IN THE FABRIC

2. JOINT SEALANT RECOMMENDED AS DEPICTED IN THE RESERVOIR AS DEPTHE OF SEALANT

CONSTRUCTION JOINT DETAIL

CONTRACTION JOINT DETAIL

JOINT SEALANT DETAIL

CONCRETE FOOTING DETAIL

CONSTRUCTION JOINT DETAIL

CONTRACTION JOINT DETAIL

JOINT SEALANT DETAIL

COMPLETED CONSTRUCTION JOINT SEALANT DETAIL

COMPLETED EXPANSION JOINT SEALANT DETAIL

CONTRACTION JOINT SAWCUT DETAILS

JOINT SEALANT DETAIL

SCALE: NONE

SCALE: NONE

SCALE: NONE

SCALE: NONE

SCALE: NONE
1. The geotextile layers are provided to protect the geomembrane during and after construction. The bottom geotextile layer may be omitted if the subgrade soil is known to be free of rocks or other materials that could potentially damage the geomembrane.

2. All concrete shall be reinforced with synthetic fiber reinforcement. Additional steel reinforcement shall be provided, where indicated, on the joint layout plan. See specifications section 32 13 19.20 concrete pavement for containment dikes for concrete and reinforcement requirements.

3. All concrete joints shall be sealed per specifications section 32 13 18 field molded sealants for sealing joints in rigid pavements. See sheet C.04 for the joint layout plan.

4. A geotextile shall be installed below and above the geomembrane. See specification section 32 36.3.1 flexible folder system. The geomembrane and geotextile shall be protected from damage at all times, as specified.

5. The surface underlying the geotextile/geomembrane shall be smooth and free of rocks larger than 1/4" in diameter or any other material which would cause damage to the geomembrane liner.

6. Geotextile anchorage/embankment strip materials and installation shall be as recommended by the manufacturer of the geomembrane.

7. Rock ballast material shall be clean, 1/4" to 3" smooth cobble stones. The rock ballast layer shall be compacted to two passes of a walk-behind vibratory roller.

GENERAL NOTES:

- 12" SEALANT - JET FUEL-RESISTANT SEALANT
- STAINLESS STEEL BAND CLAMPS
- PIPE PENETRATION DETAIL (GRAVEL)
- GEOMEMBRANE LINER PENETRATION SCALES CIRCULAR TO ACCOMMODATE A BOOT SEAL.

PIPE PENETRATING LINER

DIKE DETAIL - GRAVEL BALLAST
1. The geotextile layers are provided to protect the geomembrane during and after construction. The bottom geotextile layer may be omitted if the subgrade soil is known to be free of rocks or other materials that could potentially damage the geomembrane.

2. Other ballast materials may be specified. Wind uplift calculations must be performed regardless of the ballast materials used. Specification section 33 56 63 fuel impermeable liner system provides wind uplift design guidance.

3. All concrete shall be reinforced with synthetic fiber reinforcement. Additional steel reinforcement shall be provided where indicated on the joint layout plan. See specifications section 32 13 15 20 concrete pavement for containment dikes for concrete and reinforcement requirements.

4. A geotextile shall be installed below and adjacent to the geomembrane where the geomembrane is exposed on the surface. See specification section 33 56 63 fuel impermeable liner system. The geomembrane and geotextile shall be protected from damage at all times, as specified.

5. The surface underlying the geotextile/geomembrane shall be smooth and free of rocks larger than 1/2" in diameter or any other material which would cause damage to the geomembrane liner.

6. Geomembrane anchorage (if emplaced strip materials and installation shall be as recommended by the manufacturer of the geomembrane).

7. Rock material shall be clean, well graded 9" to 1 1/2" river rock. The rock layer shall be compacted two passes of a walk-behind vibratory roller.

8. A 3" thick resistant walkway shall be provided along the 3-foot top of the containment dikes and on pathways within the tank basins, as indicated on the site plan. See specification section 33 56 63 fuel impermeable liner system for walkway materials.

9. Sand tubes shall be provided on the exposed geomembrane for ballast to prevent wind uplift. See specification section 33 56 63 fuel impermeable liner system for additional details.

DESIGNER NOTES:

1. The geotextile layers are provided to protect the geomembrane during and after construction. The bottom geotextile layer may be omitted if the subgrade soil is known to be free of rocks or other materials that could potentially damage the geomembrane.

2. Other ballast materials may be specified. Wind uplift calculations must be performed regardless of the ballast materials used. Specification section 33 56 63 fuel impermeable liner system provides wind uplift design guidance.
TYPICAL GEOMEMBRANE TERMINATION
DETAIL - EXISTING STRUCTURE
SCALE: NONE

TYPICAL GEOMEMBRANE TERMINATION
DETAIL - NEW STRUCTURE
SCALE: NONE

DESIGNER NOTES:
1. The geotextile layers are provided to protect the geomembrane during and after construction. The bottom geotextile layer may be omitted if the subgrade soil is known to be free of rocks or other materials that could potentially damage the geomembrane.

NOTE: Geomembrane insert to be manufacturer's standard.
CONCRETE STAIRS PLAN

SECTION

SCALE: NONE

BASE PLATE DETAIL

STAIR DETAIL

CONCRETE STAIRS PLAN

SCALE: NONE

TABLE OF STAIR DIMENSIONS

<table>
<thead>
<tr>
<th>STAIR NUMBER</th>
<th>INTERIOR RISERS</th>
<th>INTERIOR TREADS</th>
<th>EXTERIOR RISERS</th>
<th>EXTERIOR TREADS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1'-6&quot;</td>
<td>2'-10&quot;</td>
<td>1'-6&quot;</td>
<td>2'-10&quot;</td>
</tr>
<tr>
<td>2</td>
<td>1'-6&quot;</td>
<td>2'-10&quot;</td>
<td>1'-6&quot;</td>
<td>2'-10&quot;</td>
</tr>
<tr>
<td>3</td>
<td>1'-6&quot;</td>
<td>2'-10&quot;</td>
<td>1'-6&quot;</td>
<td>2'-10&quot;</td>
</tr>
<tr>
<td>4</td>
<td>1'-6&quot;</td>
<td>2'-10&quot;</td>
<td>1'-6&quot;</td>
<td>2'-10&quot;</td>
</tr>
<tr>
<td>5</td>
<td>1'-6&quot;</td>
<td>2'-10&quot;</td>
<td>1'-6&quot;</td>
<td>2'-10&quot;</td>
</tr>
</tbody>
</table>

NOTES:

1. PIPE HANDRAILS SHALL HAVE WELDS GROUNDED SMOOTH AND BE HOT DIPPED GALVANIZED AFTER FABRICATION.
2. ALL STAIR METALLIC COMPONENTS INCLUDING BUT NOT LIMITED TO STRUCTURAL STEEL, HANDRAILS AND REBAR, SHALL BE GROUNDED. ALL METALLIC COMPONENTS SHALL BE MADE CONTINUOUS VIA #4 BARE COPPER JUMPERS AS REQUIRED. GROUNDING SHALL BE BY CONNECTING METALLIC COMPONENTS TO TANK GROUNDING SYSTEM VIA #4 BARE COPPER CONDUCTOR BELLOW LINER. BELOW GRADE CONNECTIONS SHALL BE PERFORMED VIA EXOTHERMIC WELD PROCESS.
3. HANDRAILS SHALL BE EXPOSED GALVANIZED. PAINTING IS NOT ALLOWED.

DESIGNER NOTES:

1. PER SSC AND ADA GUIDELINES RISERS HAVE A MINIMUM HEIGHT = 4" AND A MAXIMUM DEPTH OF 7".
2. PER ADA GUIDELINES, TREADS SHALL HAVE A MINIMUM WIDTH OF 11", AS MEASURED FROM RISER TO RISER.
3. HANDRAILS SHALL BE EXPOSED GALVANIZED. PAINTING IS NOT ALLOWED.
TYPICAL SECTION - SPILL CONTAINMENT WALLS

1. Containment walls shall be designed by a structural engineer based upon required loads and soil conditions.
2. Provide vertical routed joints as necessary to control cracking.

DESIGNER NOTES:

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

SLEEVE SEAL
NITRILE BOOT
SEAL (TYP)

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.

CONCRETE WALL PENETRATION DETAIL

NOTE: For pipes 2" in diameter or less, see detail on Sheet CD.01.
1. STANDARD CONSTRUCTION SHALL BE CAST IN PLACE REINFORCED CONCRETE. PRECAST CONSTRUCTION SHALL NOT BE ALLOWED.
2. REINFORCING STEEL FY = 60 KSI.
3. MINIMUM CLEAR COVER OF CONCRETE OVER REINFORCING STEEL SHALL BE 3 INCHES FOR CONCRETE PLACED AGAINST THE SOIL.
4. CAST IRON GRATE AND FRAME SHALL BE HEAVY-DUTY NEENAH R-1878-B3G (WHERE NOT SUBJECT TO POSSIBLE WHEEL LOADS), OR APPROVED EQUAL.
5. MINIMUM 6" COMPACTED (95%) SUBGRADE REQUIRED UNDER INLETS.

NOTE: 100% PORT ECCENTRIC PLUG VALVE SHALL CONFORM TO AWWA C517 ACTUATOR BOX WITH HANDWHEEL SHALL BE LOCKABLE.
AND BE RESISTANT TO HYDROCARBONS (NITRILE RUBBER SEALS). GEAR ACTUATOR PLUS VALVE (SEALED) 4x4'x4'' CONC PAD W/ 4x4 W2.9xW2.9 WWF
DIRECT PRESSURE

INDICATOR
SEATED END
EXTRUSION WELD
NITRILE BOOF SEAL W/ SS CLAMPS
SEGMENTED ELASTOMERIC SEAL (TYP OF 2)
SEGMENTED ELASTOMERIC SEAL (TYP OF 2)

100% PORT ECCENTRIC PLUG VALVE
DIRECT PRESSURE

GEOMEMBRANE INSERT
CONTINUOUS

EXTRUSION WELD
NITRILE WATERSTOP (TYP. ALL SIDES)

GEOMEMBRANE INSERT
CONTINUOUS

GEOMEMBRANE LINER
GEOTEXTILE

CONCRETE SURFACE
GEOTEXTILE
FUEL IMPERMEABLE
GEOMEMBRANE LINER

ECCENTRIC PLUG VALVE
EXTENDED BONNET (SEALED)

CONCRETE SURFACE
GEOTEXTILE
W/SS IMPERMEABLE GEOMEMBRANE LINER

CONCRETE SURFACE
GEOTEXTILE

CONCRETE SURFACE
GEOTEXTILE
W/SS IMPERMEABLE GEOMEMBRANE LINER

CONCRETE SURFACE
GEOTEXTILE

CONCRETE SURFACE
GEOTEXTILE

CONCRETE SURFACE
GEOTEXTILE
W/SS IMPERMEABLE GEOMEMBRANE LINER

CONCRETE SURFACE
GEOTEXTILE

CONCRETE SURFACE
GEOTEXTILE

CONCRETE SURFACE
GEOTEXTILE
W/SS IMPERMEABLE GEOMEMBRANE LINER

CONCRETE SURFACE
GEOTEXTILE

CONCRETE SURFACE
GEOTEXTILE
W/SS IMPERMEABLE GEOMEMBRANE LINER

CONCRETE SURFACE
GEOTEXTILE

**DESIGNER NOTES:**

1. Pipe support types and locations shall be calculated by pipe stress analysis and hydraulic transient calculations. Pipe support shown in this detail is for information only. Change the support type as necessary based upon calculation results.

2. See chart for carrier and sleeve pipe dimension combinations for mechanically adjustable segmented elastomeric seal. Confirm dimensions with selected mechanically adjustable segmented elastomeric seal manufacturer before selecting sleeve pipe size.

3. For containment berm and FML penetration information, see civil sheets.

4. Support carrier pipe in sleeve with non-conductive supports spaced a maximum of 10' apart.

5. Slope sleeve piping to allow for drainage through sleeve drain.

**CARRIER PIPE SIZE (IN):**

<table>
<thead>
<tr>
<th>Size</th>
<th>Casing Pipe Size (In)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54</td>
</tr>
<tr>
<td>3</td>
<td>6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54</td>
</tr>
<tr>
<td>4</td>
<td>6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48, 50, 52, 54</td>
</tr>
</tbody>
</table>

**SLEEVE SEAL:**

- Stainless steel boot clamps
- Buna-N boot seal (typ)
ADJUSTABLE PIPE SADDLE SUPPORT DETAIL (PS-1)

DESIGNER NOTES:
1. OTHER PIPE SUPPORTS AND SUPPORT LOCATIONS SHALL BE CALCULATED BY A PIPE STRESS ANALYSIS AND HYDRAULIC TRANSIENT COMPUTATIONS.

TYPICAL EXPANSION LOOP

MANUAL AIR VENT

ABOVEGROUND LOW POINT DRAIN

SIZES OF LETTERS AND BANDS

DESIGNER NOTES:
1. ENSURE THAT THE ABOVEGROUND LOW POINT DRAIN HAS ADEQUATE CLEARANCE TO ALLOW FOR FULL ROTATION OF THE BALL VALVE HANDLE.

PRODUCT FLOW SYMBOL DETAIL

DESIGNER NOTES:
1. DISTANCE TO THIRD BALL JOINT AFTER THE ELBOW SHOULD BE AS LONG AS PIPING LAYOUT ALLOWS WHILE MAINTAINING DROOP, BUT NOT TO EXCEED 8 FEET OR MAXIMUM ALLOWABLE PIPE SUPPORT DISTANCE.

FLEXIBLE BALL JOINTS

VALIDATION DRAWING:

DRAWFORM REVISION: 10 MAY 2014

CONTRACTOR NO.

SUBMITTED BY:

SCALE:

DATE: APRIL 2015

NAVFAC DRAWING NO.

EPROJECT NO.

APPROVED

ACTIVITY FOR COMMANDER NAVFAC

US ARMY CORPS OF ENGINEERS

OMAHA DISTRICT

UNCLASSIFIED//FOR OFFICIAL USE ONLY

---

**ADJUSTABLE PIPE SUPPORT DETAIL (PS-2)**

**DESIGNER NOTES:**
1. OTHER PIPE SUPPORTS AND SUPPORT LOCATIONS SHALL BE CALCULATED BY A PIPE STRESS ANALYSIS AND HYDRAULIC TRANSIENT COMPUTATIONS.

**PRODUCT FLOW SYMBOL DETAIL**

**DESIGNER NOTES:**
1. OTHER PIPE SUPPORTS AND SUPPORT LOCATIONS SHALL BE CALCULATED BY A PIPE STRESS ANALYSIS AND HYDRAULIC TRANSIENT COMPUTATIONS.
PIPE SUPPORT NOTES:

1. PROVIDE CARBON STEEL PIPE SUPPORTS INCLUDING STRAPS, PLATES, GUIDES AND TEES WHERE CARBON STEEL PIPE IS USED. ALL CARBON STEEL ELEMENTS SHALL HAVE THE SAME MECHANICAL PROPERTIES PROVIDED STAINLESS STEEL PIPE SUPPORTS, INCLUDING STRAPS, PLATES, GUIDES AND TEES WHERE STAINLESS STEEL PIPE IS USED. ALL STAINLESS STEEL ELEMENTS SHALL HAVE THE SAME MECHANICAL PROPERTIES. DO NOT WELD CARBON STEEL PLATES OR TEES TO STAINLESS STEEL PIPE.

2. THE 16" X 1/2" HORIZONTAL PLATE BETWEEN SADDLES SHALL HAVE 1" X 1" TRAPEZIUM CUT OFF OF ALL 4 CORNERS. THE PLATE SHALL NOT BE SQUARE IN SHAPE SO AS TO AVOID 3 WELDS INTERSECTING IN THE CORNERS, WHICH CAUSES AREAS OF HIGH RESTRAINT AND INCREASED POTENTIAL FOR CRACKING.
1. If electronic type level alarms are to be used instead of the mechanical fluid type indicated on the storage tank electrical elevation detail, then modify the detail with requirements applicable to the electronic level alarms.

2. If an ATG system other than the ENRAF 854 type depicted here is to be used, the storage tank electrical elevation detail shall be modified to show appropriate conduits and conductors for that type of ATG system.

3. Remote EPDS station to be placed immediately outside of containment area. See this sheet for details.

4. Cathodic protection terminal cabinet to be placed outside of containment and hazardous locations. It may be placed immediately outside of containment area or near rectifier. See sheet for details.

NOTES:

1. See tank drawings for exact location of level switches and product return pump.

2. Include conduit support structures (Unistrut or equal) to tank wall. Do not weld conduit support structures directly to tank wall.

3. Remote EPDS station to be used in place of containment area. See this sheet for details.

4. Cathodic protection terminal cabinet to be placed outside of containment area. See this sheet for details.
TANK GROUNDING SYSTEM

GROUND ROSE BOX DETAIL

TANK GROUNDING LUG

10'-0" LONG x 3/4" DIA. GROUND ROD. MATERIAL INDICATED IN SPECIFICATIONS

#4/0 AWG BARE COPPER WIRE TO TANK GROUNDING SYSTEM. SEE 4/D.11 FOR STAIRWAY GROUNDING
ON GRADE TANKS CATHODIC PROTECTION

SCALE: NONE

DESIGNER NOTES:
1. ENSURE ALL CATHODICALLY PROTECTED PIPING IS ISOLATED FROM THE TANK WITH AN ISOLATION FLANGE.
2. ALL PIPING WITH ELECTRICAL COMPONENTS CONNECTED TO THE ELECTRICAL GROUND SYSTEM SHALL BE ISOLATED FROM THE TANK.
3. PROVIDE ETCHED LABELS BY EACH TERMINAL INDICATING THE NUMBER AND/OR FUNCTION E.G. ANODE, REFERENCE CELL 1, RECTIFIER POS, ETC.

NOTES:
1. PROVIDE ETCHED LABELS BY EACH TERMINAL INDICATING THE NUMBER AND/OR FUNCTION E.G. ANODE, REFERENCE CELL 1, RECTIFIER POS, ETC.
2. ALL TERMINALS SHALL BE OF THE SOLDERLESS TYPE. WIRE SHALL HAVE RING OR LUG TERMINATIONS.
3. SIZE RECTIFIER PER TANK SIZE AND NUMBER OF ANODES.
4. RUN 2#8 AWG, HMWPE CABLES IN 0.75 INCH RIGID STEEL CONDUIT FOR THE TWO STRUCTURE CONNECTIONS TO THE TANK FROM THE TERMINAL CABINET. SEE J-BOX 1 DETAIL 1, THIS SHEET.
5. ANODE CABLES SHALL BE NO. 6 AWG, HMWPE INSULATION. RUN 3#6 IN 0.75 INCH COATED RIGID STEEL CONDUIT BETWEEN TANK AND TERMINAL CABINET. SEE J-BOX 2 & 3 DETAIL 2, THIS SHEET.
6. REFERENCE CELL CABLES SHALL BE RUN IN 1" COATED RIGID STEEL CONDUIT (10#14) BETWEEN TANK AND TERMINAL CABINET. SEE J-BOX 1 DETAIL 1, THIS SHEET.
7. RECTIFIER UNIT NEGATIVE CABLE AND POSITIVE CABLE SHALL BE NO. 6 AWG, HMWPE INSULATION. RUN 2#6, 0.75 INCH COATED RIGID STEEL CONDUIT BETWEEN TANK AND TERMINAL CABINET. CONDUIT BETWEEN RECTIFIER AND TERMINAL CABINET.
8. TERMINAL CABINET SHALL HAVE 0.01 OHM, 10 AMP SHUNT IN SERIES FOR EACH ANODE CONNECTION.
9. TERMINAL CABINET SHALL BE LOCATED OUTSIDE OF THE CONTAINMENT BASIN.
10. ALL UNDERGROUND CONNECTIONS SHALL BE ENCASED IN A WATERTIGHT SPLICE.
11. SEE CONTRACTOR OPTION NOTE ON SHEET ED.04.

CERAMIC ANODE SYSTEM BLOCK DIAGRAM IMPRESSED CURRENT CATHODIC PROTECTION AREA UNDER STORAGE TANK

SCALE: NONE

NOTES:
1. PROVIDE ETCHED LABELS BY EACH TERMINAL INDICATING THE NUMBER AND/OR FUNCTION E.G. ANODE, REFERENCE CELL 1, RECTIFIER POS, ETC.
2. ALL TERMINALS SHALL BE OF THE SOLDERLESS TYPE. WIRE SHALL HAVE RING OR LUG TERMINATIONS.
3. SIZE RECTIFIER PER TANK SIZE AND NUMBER OF ANODES.
4. RUN 2#8 AWG, HMWPE CABLES IN 0.75 INCH RIGID STEEL CONDUIT FOR THE TWO STRUCTURE CONNECTIONS TO THE TANK FROM THE TERMINAL CABINET. SEE J-BOX 1 DETAIL 1, THIS SHEET.
5. ANODE CABLES SHALL BE NO. 6 AWG, HMWPE INSULATION. RUN 3#6 IN 0.75 INCH COATED RIGID STEEL CONDUIT BETWEEN TANK AND TERMINAL CABINET. SEE J-BOX 2 & 3 DETAIL 2, THIS SHEET.
6. REFERENCE CELL CABLES SHALL BE RUN IN 1" COATED RIGID STEEL CONDUIT (10#14) BETWEEN TANK AND TERMINAL CABINET. SEE J-BOX 2 & 3 DETAIL 2, THIS SHEET.
7. RECTIFIER UNIT NEGATIVE CABLE AND POSITIVE CABLE SHALL BE NO. 6 AWG, HMWPE INSULATION. RUN 2#6, 0.75 INCH COATED RIGID STEEL CONDUIT BETWEEN TANK AND TERMINAL CABINET. CONDUIT BETWEEN RECTIFIER AND TERMINAL CABINET.
8. TERMINAL CABINET SHALL HAVE 0.01 OHM, 10 AMP SHUNT IN SERIES FOR EACH ANODE CONNECTION.
9. TERMINAL CABINET SHALL BE LOCATED OUTSIDE OF THE CONTAINMENT BASIN.
10. ALL UNDERGROUND CONNECTIONS SHALL BE ENCASED IN A WATERTIGHT SPLICE.
11. SEE CONTRACTOR OPTION NOTE ON SHEET ED.04.
TANK ON GRADE CERAMIC ANODE CATHODIC PROTECTION PLAN

NOTE: THIS PLAN IS FOR GRAPHICAL REPRESENTATION ONLY AND DOES NOT NECESSARILY MATCH ACTUAL SPACING OF ITEMS. READ ON SHEET ED.03 FOR THE SPACING REQUIREMENTS.

LIGHTNING SURGE ARRESTER DETAIL

NOTES:
1. PROVIDE LIGHTNING SURGE ARRESTER DETAIL ON EACH SHEET.

TERMINAL CABINET

NOTE: THE SYSTEM SHOWN IS BASED ON A GRID SYSTEM WITH THE DISTANCES SHOWN. THE ANODES HAVE A MAXIMUM 5 mA/FT RATING WITH A TARGET OF 4 mA/FT. THE CONTRACTOR HAS THE OPTION OF USING OTHER SYSTEMS WHICH MEET THE FOLLOWING:

1. SPIRAL SYSTEM: ONE CONTINUOUS SPIRAL WITH A LINEAR ANODE. THE SPIRALS SHALL BE PLACED A MAXIMUM OF 3 FT APART. USE SAME SPACING BETWEEN SPIRALS. THE ANODES SHALL HAVE BETWEEN 5 mA/FT TO 25 mA/FT RATING. THE SPIRAL ANODE IS PLACED ON THE TANK BOTTOM. PROTECTIVE COVERAGE SHALL BE 1.5 MA/SQ.FT OF SURFACE. MINIMUM 25 YEAR LIFE IS REQUIRED. THE MAXIMUM INDIVIDUAL ANODE LENGTH WAS ASSUMED TO BE 1000 FT. THE ANODE SHALL HAVE BETWEEN 5 mA/FT TO 25 mA/FT RATING.

2. LAYOUT OF TERMINALS CAN BE ADJUSTED. NOTE THAT IF ANOTHER ANODE CONFIGURATION IS USED, THE NUMBER OF ANODES AND CONDUCTORS COULD CHANGE. CABINET SHALL BE SHOWN TO 6 TIMES WHAT IS SHOWN AND ACCORDINGLY.

3. PROVIDE 24" X 24" "X" PVC PROTECTOR WITH HINGED COVER AND LOCKABLE STAINLESS STEEL HARDWARE.

4. ALL TERMINALS SHALL BE SOLDERLESS TYPE AND ALL WIRES SHALL HAVE RING OR LUG TERMINATIONS.

5. PROVIDE 24" X 24" PVC PROTECTOR WITH HINGED COVER AND LOCKABLE STAINLESS STEEL HARDWARE.

6. LAYOUT OF TERMINALS CAN BE ADJUSTED. NOTE THAT IF ANOTHER ANODE CONFIGURATION IS USED, THE NUMBER OF ANODES AND CONDUCTORS COULD CHANGE. CABINET SHALL BE SHOWN TO 6 TIMES WHAT IS SHOWN AND ACCORDINGLY.

7. LOCATE TERMINAL CABINET OUTSIDE OF CONCRETE CONTAINMENT AREA AND HAZARDOUS LOCATIONS. TERMINAL CABINET MAY BE LOCATED NEXT TO RECTIFIER.

8. LOCATE TERMINAL CABINET NEXT TO RECTIFIER. TERMINAL CABINET MAY BE LOCATED NEXT TO RECTIFIER.
1. ELECTRONIC AUTOMATIC TANK GAUGING (ATG) SYSTEM:

   WATER (BS&W) PROBE MOUNTED IN SEPARATE STILLING WELLS. THE ATG SHALL TRANSMIT LEVEL DATA TO A POSITION INDICATOR LIGHTS. INDICATOR LIGHTS SHALL INDICATE VALVE POSITION AT ALL TIMES.

   DEPENDING ON THE SETTING OF THE LOCAL-OFF-REMOTE SWITCH.

   PUMP/OCEAN GOING TANKER, ETC.

   LEVEL VALVE. EVERY TANK HAS A WATER DRAW-OFF SYSTEM WITH AN INTEGRAL CONTROL PANEL.

   DEPENDING ON THE SETTING OF THE LOCAL-OFF-REMOTE SWITCH.

   STOPPED AT ANY TIME BY EITHER THE LOCAL CONTROL STATION OR THE MOV CONTROL PANEL, UNLESS ACTUATED BY THE MOV.

   4. PROVIDE HLV WITH QUICK OPENING SPEED CONTROL TO MINIMIZE THE EFFECT OF PUMPING INTO A CLOSED VALVE AT THE START OF RECEIPT.

   PROVIDE HLV, INCLUDING AUXILIARY AND ALARMS, WHICH SHALL BE ANNUNCIATED ON THE TANK ANNUNCIATOR PANEL AND AN AUDIBLE AND UNIQUE VISUAL ALARM SHALL BE ANNOUNCED ON THE DESEEBRICATION FILTER SYSTEM PANEL, AND THE PUMP SHALL BE DE-ENERGIZED. THE ALARM CONDITION REMAIN UNTIL THE LEVEL IN THE TANK DROPS BELOW THE HIGH LEVEL.

   3. PROVIDE EAG WITH INTEGRAL SIDESTREAM FILTRATION CONTROL SYSTEM CONTROL PANEL, AND THE PUMP SHALL BE DE-ENERGIZED. THE ALARM CONDITION REMAIN UNTIL THE LEVEL IN THE TANK DROPS BELOW THE HIGH LEVEL.

   EMERGENCY POWER DOWN SWITCH (EPDS) SYSTEM:

   NOTE: OTHER CONTROLS NEEDED: ONLY TANK INTERLOCKS CONSIDERED HERE.

   5. WHEN THE WATER LEVEL IN THE TANK RISES TO THE HIGH-HIGH LEVEL, A TROUBLE ALARM SHALL BE ANNUNCED ON THE TANK ANNUNCIATOR PANEL, AND AN AUDIBLE AND UNIQUE VISUAL ALARM SHALL BE ANNOUNCED ON THE DESEEBRICATION FILTER SYSTEM PANEL, AND THE PUMP SHALL BE DE-ENERGIZED. THE ALARM CONDITION REMAIN UNTIL THE LEVEL IN THE TANK DROPS BELOW THE HIGH LEVEL.

   1. PROVIDE SYSTEM WITH INTEGRAL SIDESTREAM FILTRATION CONTROL SYSTEM CONTROL PANEL, AND THE PUMP SHALL BE DE-ENERGIZED. THE ALARM CONDITION REMAIN UNTIL THE LEVEL IN THE TANK DROPS BELOW THE HIGH LEVEL.

   1. PROVIDE EACH TANK WITH A LEVEL ALARM SYSTEM WITH LOW, LOW-LOW, HIGH AND HIGH-HIGH LEVEL SETPOINT AS SENSED BY THE HIGH-HIGH LEVEL SWITCH.

   2. WHEN THE LEVEL IN THE STORAGE TANK DESCENDS TO THE LOW LEVEL SETPOINT AS SENSED BY THE LOW-LOW LEVEL SWITCH, AN ALARM SHALL BE ANNUNCIATED AT THE LEVEL ALARM PANEL. THE ALARM CONDITION REMAIN UNTIL THE LEVEL IN THE TANK DROPS BELOW THE LOW-LOW LEVEL.

   4. WHEN THE WATER LEVEL IN THE FILTER/SEPARATOR SUMP RISES TO THE HIGH LEVEL SETPOINT AS SENSED BY THE CONDUCTANCE PROBE IN THE FILTER/SEPARATOR SUMP, A TROUBLE ALARM SHALL BE ANNUNCIATED ON THE TANK ANNUNCIATOR PANEL AND AN AUDIBLE AND UNIQUE VISUAL ALARM SHALL BE ANNOUNCED ON THE DESEEBRICATION FILTER SYSTEM PANEL, AND THE PUMP SHALL BE DE-ENERGIZED.
5,000 BBL Tank

1. See nozzle/equipment schedule on sheet 5.02 for size, elevation and orientation of nozzles and appurtenances.
2. Provide guardrail all around perimeter of roof except at stairway top platform.
3. Provide 6"x18" opening in intermediate landing for piping and conduit.
4. Lap roof plate seams to shed water (inner plates on top).
5. See level set-point table 4/D.12 for elevations of alarms and controls.
6. Rafters not shown for clarity.
7. Space internal pipe supports per interior pipe support 60 DB.
8. Provide a roof with slope of 15/12.
1. Distance values shown on table for shell nozzles are as measured from the center of the tank to the centerline of the sump.

2. Shell manholes (lower) are measured from the bottom of the shell to the centerline of the sump.

3. Provide a pan installation hatch on the fixed roof in accordance with the pan manufacturer's requirements.

4. Size of fill and issue nozzles and piping must be determined by the designer. Refer to UFC 3-460-01 for design flowrates when sizing tank piping.

5. Distance values shown on table for roof nozzles are as measured from the center of the tank to the centerline of roof nozzles. Distance value shown on table for tank bottom sump is measured from the center of the tank to the centerline of the sump.

6. Provide at least one overflow for every 1200 gpm of receipt. Do not locate overflows over stairs or shell manholes. Overflows should be similar to an overflow circulation vent but 1'-0" higher in elevation at tank location and ensure the remaining overflows and adequate.

7. Provide at least one pan installation hatch on the fixed roof in accordance with the pan manufacturer's requirements.

8. Mount the 6" ATG water probe well over the tank bottom sump through an 8" flanged roof nozzle per the type reinforcing plates. Fill and issue nozzle sizes smaller than 12" shall be as low as allowed by API STD 650 using type reinforcing plates.

9. The maximum distance from the shell, manholes reinforcing plate to the backside of the manhole flange, as measured horizontally on the vertical centerline, shall be not more than 8'.

10. Distances values shown on table for shell nozzles are as measured from the bottom of the shell to the centerline of the sump.

11. All shell and roof nozzles shall be flanged unless otherwise indicated.

12. Interstitial piping for elevated tank foundation is shown for non-elevated tank bottom, foundation, and interstitial piping plan, see 3/D.01.

13. Interstitial piping for elevated tank foundation is shown for non-elevated tank bottom, foundation, and interstitial piping plan, see 3/D.01.

14. All shell and roof nozzles shall be flanged unless otherwise indicated.

15. Interstitial piping for elevated tank foundation is shown for non-elevated tank bottom, foundation, and interstitial piping plan, see 3/D.01.
1. See nozzle equipment schedule on sheet 10.02 for size, elevation and orientation of nozzles and appurtenances.

2. Provide guardrail all around perimeter of roof except at stairway top platform.

3. Provide 6"x18" opening in intermediate landing for piping and conduit.

4. Lap roof plate seams to shed water (inner plates on top).

5. See level set-point table 4/D.12 for elevations of alarms and controls.

6. Rafters not shown for clarity.

7. Space internal pipe supports per interior pipe support schedule.

8. Provide a roof with slope of 1/12.

9. Circumferential stairs not shown for clarity. Items shown on elevation are shown without regard to orientation. See Note 1.

10.000 BBL TANK

Scale: 1/4"=1'-0"
1. PROVIDE NOZZLE EQUIPMENT SCHEDULE ON SHEET 20.02 FOR SIZE, ELEVATION AND ORIENTATION OF NOZZLES AND APPURTENANCES.

2. PROVIDE GUARDRAIL AROUND PERIMETER OF ROOF EXCEPT AT STAIRWAY TOP OF TANK.

3. PROVIDE 6"x18" OPENING IN INTERMEDIATE LANDINGS FOR PIPING AND CONDUIT.

4. LAP ROOF PLATE SEAMS TO SHED WATER (INNER PLATES ON TOP).

5. PROVIDE A ROOF WITH SLOPE OF 1/12.

6. RAFTERS NOT SHOWN FOR CLARITY.

7. SPACE INTERNAL PIPE SUPPORTS PER INTERIOR PIPE SUPPORT NO. 06.
### 20,000 BBL Tank Nozzle/Equipment Schedule

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
<th>Size (In)</th>
<th>Angle (Degrees)</th>
<th>Distance (Note 1)</th>
<th>Detail Shown (Sheet/Det)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Issue</td>
<td>0.105</td>
<td>-</td>
<td>24'-6&quot;</td>
<td>1/D.09</td>
<td>1.0</td>
</tr>
<tr>
<td>B</td>
<td>Fill</td>
<td>4X4</td>
<td>-</td>
<td>1'0&quot;</td>
<td>1/D.12</td>
<td>2.0</td>
</tr>
<tr>
<td>C</td>
<td>Low Suction</td>
<td>4</td>
<td>1'-15&quot;</td>
<td>24'-6&quot;</td>
<td>6/D.07, 6/D.10</td>
<td>3.0</td>
</tr>
<tr>
<td>D</td>
<td>Water Draw-Off</td>
<td>2</td>
<td>1'-15&quot;</td>
<td>24'-6&quot;</td>
<td>6/D.07, 6/D.10</td>
<td>3.0</td>
</tr>
<tr>
<td>E</td>
<td>Product Return Pin</td>
<td>2</td>
<td>1'-15&quot;</td>
<td>24'-6&quot;</td>
<td>6/D.07, 6/D.10</td>
<td>3.0</td>
</tr>
<tr>
<td>F</td>
<td>Shell Manhole (Lower)</td>
<td>38</td>
<td>3'-6&quot;</td>
<td>3/D.12</td>
<td>6/D.07, 6/D.10</td>
<td>4.0</td>
</tr>
<tr>
<td>G</td>
<td>Shell Manhole (Upper)</td>
<td>38</td>
<td>9'-0&quot;</td>
<td>3/D.12</td>
<td>6/D.07, 6/D.10</td>
<td>4.0</td>
</tr>
<tr>
<td>H</td>
<td>ATV Observe Well</td>
<td>10</td>
<td>2'-11&quot;</td>
<td>24'-6&quot;</td>
<td>3/D.10</td>
<td>5.0</td>
</tr>
<tr>
<td>I</td>
<td>ATV Water Probe Well</td>
<td>8</td>
<td>3'-0&quot;</td>
<td>24'-6&quot;</td>
<td>3/D.10</td>
<td>5.0</td>
</tr>
<tr>
<td>J</td>
<td>Mechanical Tape Level Gauge</td>
<td>5</td>
<td>1'-15&quot;</td>
<td>24'-6&quot;</td>
<td>6/D.07, 6/D.10</td>
<td>3.0</td>
</tr>
<tr>
<td>K</td>
<td>Low &amp; Low &amp; High Level Alarm &amp; Bell Nozzles</td>
<td>1</td>
<td>2'-11&quot;</td>
<td>24'-6&quot;</td>
<td>3/D.10</td>
<td>5.0</td>
</tr>
<tr>
<td>L</td>
<td>High &amp; High Liquid Level Alarm &amp; Bell Nozzles</td>
<td>1</td>
<td>6'-0&quot;</td>
<td>24'-6&quot;</td>
<td>3/D.10</td>
<td>5.0</td>
</tr>
<tr>
<td>M</td>
<td>Sample Gauge Well</td>
<td>10</td>
<td>2'-11&quot;</td>
<td>24'-6&quot;</td>
<td>3/D.10</td>
<td>5.0</td>
</tr>
<tr>
<td>N</td>
<td>Roof Manhole Add-Off Hatch</td>
<td>39.46</td>
<td>2'-11&quot;</td>
<td>24'-6&quot;</td>
<td>3/D.10</td>
<td>5.0</td>
</tr>
<tr>
<td>O</td>
<td>Center Roof Vent</td>
<td>24</td>
<td>-</td>
<td>2'-0&quot;</td>
<td>3/D.10</td>
<td>5.0</td>
</tr>
<tr>
<td>P</td>
<td>Circulation Vent/Inspection Hatches</td>
<td>18 X 24</td>
<td>90°</td>
<td>3'-0&quot;</td>
<td>24'-6&quot;</td>
<td>6/D.07</td>
</tr>
<tr>
<td>Q</td>
<td>Overfill Circulation Vent</td>
<td>12 X 36</td>
<td>90°</td>
<td>3'-0&quot;</td>
<td>24'-6&quot;</td>
<td>6/D.07</td>
</tr>
<tr>
<td>R</td>
<td>Pan Installation Hatch</td>
<td>-</td>
<td>45°</td>
<td></td>
<td></td>
<td>6/D.07</td>
</tr>
<tr>
<td>S</td>
<td>Pump</td>
<td>20</td>
<td>4'-0&quot;</td>
<td>2'-0&quot;</td>
<td>3/D.10</td>
<td>5.0</td>
</tr>
<tr>
<td>T</td>
<td>Grounding Lugs</td>
<td>3 X 3 X 12</td>
<td>90°</td>
<td>3'-0&quot;</td>
<td>24'-6&quot;</td>
<td>6/D.07</td>
</tr>
<tr>
<td>U</td>
<td>Floating Pan Low Level</td>
<td>-</td>
<td>4'-0&quot;</td>
<td>2'-0&quot;</td>
<td>3/D.10</td>
<td>5.0</td>
</tr>
<tr>
<td>V</td>
<td>Scarpaul Cable Supports</td>
<td>16 X 36</td>
<td>90°</td>
<td>3'-0&quot;</td>
<td>24'-6&quot;</td>
<td>6/D.07</td>
</tr>
</tbody>
</table>

### Notes:

1. Distance values shown on Table for shell nozzles are as measured from the bottom of the shell to the centerline of shell nozzles. Distance values shown on Table for roof nozzles are as measured from the opening of the roof nozzle to the centerline of the nozzle on Table for tank bottom sump is measured from the center of the tank to the centerline of the sump.

2. Align lower shell manholes 180° apart and parallel, with previous windings.

3. Provide a pan installation hatch on the fixed roof in accordance with the pan manufacturer’s requirements.

4. Size of fill and issue nozzles and piping must be determined by the designer. Refer to UFC 5-460-01 for design flows when sizing tank piping.

5. Adjust size of fill, issue, and low suction nozzles to suit site conditions such as distance to pumps and operational requirements.

6. Locate upper shell manhole 3'-0" above upper surface of floating pan at high leg position.

7. High level, shut-off valve float pilot assembly, as well as high and high high level alarm sensors, shall be accessible from open stairway intermediate platforms.

8. Mount the top of the water probe well over the tank bottom sump through any flanged roof nozzle per the indicated details.

9. The top of water draw-off nozzle shall be aligned as allowed by API STD 600 using type low reinforcing plates. Fill and issue nozzle sizes smaller than 12" shall be as low as allowed by API STD 600 using regular type reinforcing plates.

10. Floating pan (low level), shall provide a minimum of 6" clearance from the top of any internal nozzle flange to the bottom of the floating pan.

11. Provide at least one contraction for every 20" X 10" of remain. Do not locate over pipe over stands or shell nozzles isolation valves, where the pattern of open pipes over isolation valves shall result in an overflow/or circulation vent over project piping on the standpipe. Provide a shell circulation vent constructed similar to an overfill circulation vent but 1'-0" higher in elevation at that location and ensure the remaining overflows are adequately drained.

12. Install low suction and water drain-off nozzles parallel to the issue nozzle.

13. For design flowrates when sizing tank piping.

14. All shell and roof nozzles shall be flanged unless otherwise indicated.

15. Interstitial piping for elevated tank foundation is shown, for non-elevated tank bottom, foundation, and interstitial piping plan see detail 20.01.

16. Mount the top of the water probe well over the tank bottom sump through any flanged roof nozzle per the indicated details.

17. The maximum distance from the shell manhole reinforcing plate to the backside of the manhole flange, as measured horizontally on the vertical centerline, shall not be more than 3'-0".
30,000 BBL TANK

NOTES:

1. SEE NOZZLE EQUIPMENT SCHEDULE ON SHEET 30.02 FOR SIZE, ELEVATION AND ORIENTATION OF NOZZLES AND APPURTENANCES.

2. PROVIDE GUARDRAIL ALONG PERIMETER OF TANK EXCEPT AT STAIRWAY TOP PLATFORM.

3. PROVIDE 6"x18" OPENING IN INTERMEDIATE LANDING FOR PIPING AND CONDUIT.

4. LAP ROOF PLATE SEAMS TO SHED WATER (INNER PLATES ON TOP).

5. PROVIDE A ROOF WITH SLOPE OF 1/12.

6. RAFTERS NOT SHOWN FOR CLARITY.

7. SPACE INTERNAL PIPE SUPPORTS PER INTERIOR PIPE SUPPORT 10/8.

8. PROVIDE ROOF WITH SLOPE OF 1/12.

9. CUT LEVEL SET-POINT TABLE 4/D.12 FOR ELEVATIONS OF ALARMS AND CONTROLS.

10. SEE NOZZLE EQUIPMENT SCHEDULE ON SHEET 30.02 FOR SIZE, ELEVATION AND ORIENTATION OF NOZZLES AND APPURTENANCES.
### 30,000 BBL TANK NOZZLE/EQUIPMENT SCHEDULE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>SIZE (IN)</th>
<th>ANGLE (DEGREES)</th>
<th>DISTANCE (IN)</th>
<th>DETAIL SHOWN (DETAIL SHEET)</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ISSUE</td>
<td>16</td>
<td>270</td>
<td>1'-45&quot;</td>
<td>4/D.08</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>FILL</td>
<td>6</td>
<td>180</td>
<td>1'-15&quot;</td>
<td>1/D.04</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>LOW SUCTION</td>
<td>4</td>
<td></td>
<td>1'-15&quot;</td>
<td>13/D.10, 12/D.10</td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>WATER DRAIN OFF</td>
<td>2</td>
<td>360</td>
<td>1'-36&quot;</td>
<td>10/D.12, 11/D.13, 12/D.14</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>PRODUCT RETURN</td>
<td>2</td>
<td>257</td>
<td>&quot;</td>
<td>5/D.13</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>SHELL MANHOLE (LOWER)</td>
<td>36</td>
<td>-</td>
<td>2'-6&quot;</td>
<td>3/D.12, 6/D.10</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>SHELL MANHOLE (UPPER)</td>
<td>36</td>
<td>180</td>
<td>9'-6&quot;</td>
<td>10/D.10, 8/D.10</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>ATG GAUGE WELL</td>
<td>10</td>
<td>240</td>
<td>3'-3&quot;</td>
<td>4/D.07</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>ATG WATER PROBE WELL</td>
<td>6</td>
<td>225</td>
<td>2'-3&quot;</td>
<td>3/D.07</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>MECHANICAL TAP LEVEL GAUGE</td>
<td>10</td>
<td>131</td>
<td>&quot;</td>
<td>5/D.07</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>LOW &amp; LOW-LOW LEVEL ALARM NOZZLE</td>
<td>1</td>
<td>255</td>
<td>X'-X&quot;</td>
<td>3/D.12</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>HIGH &amp; HIGH-LOW LEVEL ALARMS AND HV NOZZLES</td>
<td>1</td>
<td>255</td>
<td>X'-X&quot;</td>
<td>3/D.12</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>SAMPLE GAUGE WELL</td>
<td>10</td>
<td>250</td>
<td>3'-3&quot;</td>
<td>3/D.07</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>ROOF MANHOLE LADDER HATCH</td>
<td>36 X 48</td>
<td>200</td>
<td>3'-0&quot;</td>
<td>3/D.10</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>CENTER ROOF VENT</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td>4/D.07</td>
</tr>
<tr>
<td>P</td>
<td>CIRCULATION VENT/INSPECTION HATCHES</td>
<td>15 X 34</td>
<td>0.90, 180, 270</td>
<td>6/D.10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>OVERFLOW/CIRCULATION VENT</td>
<td>10 X 36</td>
<td>45</td>
<td>44'-8&quot;</td>
<td>6/D.07</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>PAN INSTALLATION HATCH</td>
<td>-</td>
<td>45</td>
<td></td>
<td>3/D.07</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>SUMP</td>
<td>30</td>
<td>225</td>
<td>3'-6&quot;</td>
<td>5/D.07</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>GROUNDING LUG</td>
<td>3 X 3 X 3</td>
<td>46, 135, 225, 315</td>
<td>2'-0&quot;</td>
<td>3/D.14</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>FLOATING PAN LOW LEVELE</td>
<td>-</td>
<td>3/D.11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>SCAFFOLD CABLE SUPPORTS</td>
<td>-</td>
<td>135, 315</td>
<td>6'-0&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>SHELL CIRCULATION VENTS</td>
<td>15 X 36</td>
<td>135, 225, 315</td>
<td>45'-0&quot;</td>
<td>6/D.07</td>
<td></td>
</tr>
</tbody>
</table>

### NOTES:
1. Distance values shown on table for shell nozzles are as measured from the bottom of the shell to the center of shell nozzles. Distance values shown on table for roof nozzles are as measured from the center of the tank to the centerline of the sump. Distance values shown on table for tank bottom sump is measured from the center of the tank to the centerline of the manifold.
2. ALIGN LOWER SHELL MANHOLES 180° APART AND PARALLEL WITH PREVAILING WINDS.
3. PROVIDE A PAN INSTALLATION HATCH ON THE FIXED ROOF IN ACCORDANCE WITH THE PAN MANUFACTURER'S REQUIREMENTS.
4. SIZE OF ISSUE ROOF NOZZLES AND PIPING MUST BE DETERMINED BY THE DESIGNER. REFER TO UFG 5-400-01 FOR DESIGN FLOORPLANS WHEN DESIGNING TANK PIPING.
5. PROVIDE A PAN INSTALLATION HATCH WITH THE FIXED ROOF IN ACCORDANCE WITH THE PAN MANUFACTURER'S REQUIREMENTS.
6. LOCATION OF POOL ISOLATION VALVES, AS INDICATED ON THE FLOORPLANS, WHEN DESIGNING TANK PIPING.
7. INSTALL THE HATCH FOR ROOF NOZZLE WELL OVER THE TANK BOTTOM SWEEP THROUGH AN 8'-3" FLANGED ROOF FLANGE PER THE INDICATED DETAILS.
8. THE 2" WATER DRAIN-OFF NOZZLE SHOWN IN THE STANDARD IS BASED ON THE SMALLEST DOUBLE BLOCK AND BLEED VALVE AVAILABLE AT THE TIME THIS STANDARD WAS WRITTEN. FOR TANKS THAT ARE EXPECTED TO RECEIVE A MINIMUM AMOUNT OF WATER AND EXPECT TO PRODUCE MINIMUM CONDENSATE, PROVIDE INTERNAL WATER DRAIN-OFF PIPING REDUCED TO 1" SIZE NEAR THE INTERNAL NOZZLE FLANGE TO LIMIT THE AMOUNT OF WATER THAT IS RETAINED IN THE INTERNAL PIPING.
9. FLOATING PAN LOW LEVEL SHAL PROVIDE A MINIMUM OF 6" CLEARANCE FROM THE TOP OF ANY INTERNAL NOZZLE FLANGE TO THE BOTTOM OF THE FLOATING PAN.
10. THE ELEVATION OF FILL AND ISSUE NOZZLE SIZES 12" AND LARGER SHALL BE AS LOW AS ALLOWED BY API STD 650 USING LOW TYPE REINFORCING PLATES. FILL AND ISSUE NOZZLE SIZES SMALLER THAN 12" SHALL BE AS LOW AS ALLOWED BY API STD 650 USING REGULAR TYPE REINFORCING PLATES.
11. ALL SHELL AND ROOF NOZZLES SHALL BE FLANGED UNLESS OTHERWISE INDICATED.
12. INSTALL LOW SUCTION AND WATER DRAIN-OFF NOZZLES PARALLEL TO THE ISSUE NOZZLE.
13. INSTALL LOW SUCTION AND WATER DRAIN-OFF NOZZLES PARALLEL TO THE ISSUE NOZZLE.
14. INSTALL LOW SUCTION AND WATER DRAIN-OFF NOZZLES PARALLEL TO THE ISSUE NOZZLE.
15. INTERSTITIAL PIPING FOR ELEVATED TANK FOUNDATION IS SHOWN, FOR NON-ELEVATED TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING.
16. MOUNT THE ATG AND SAMPLE GAUGE WELLS THROUGH 1'-3" FLANGED ROOF NOZZLE PER THE INDICATED DETAILS.
17. THE MAXIMUM DISTANCE FROM THE SHELL MANHOLE REINFORCING PLATE TO THE BACKSIDE OF THE MANHOLE FLANGE, AS MEASURED HORIZONTALLY ON THE VERTICAL CENTERLINE, SHALL NOT BE MORE THAN 3'-0".

### 30,000 BBL TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING PLAN

[Diagram of 30,000 BBL TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING PLAN]
1. See nozzle equipment schedule on Sheet 30.02 for size, elevation and orientation of nozzles and appurtenances.
2. Provide guardrail all around perimeter of roof except at stairway top platform.
3. Provide 6"x18" opening in intermediate landing for piping and conduit.
4. Lap roof plate seams to shed water (inner plates on top).
5. See level set-point table 40.12 for elevations of alarms and controls.
6. Rafters not shown for clarity.
7. Space internal pipe supports per interior pipe support 60 G8.
8. Provide a roof with slope of 15/12.

NOTE 1: Circumferential stairs not shown for clarity. Items shown on elevation, are shown without regard to orientation, see Note 1.

ELEVATION

PLAN

40,000 BBL TANK Data Plate

scale: 1\(\text{in.}\):12\(\text{ft.}\)

Low level of floating pan
Low level of floating pan top

Top of tank bottom

CIRCUMFERENTIAL STAIRS NOT SHOWN FOR CLARITY. ITEMS SHOWN ON ELEVATION, ARE SHOWN WITHOUT REGARD TO ORIENTATION. SEE NOTE 1.

NOTES:
1. See nozzle equipment schedule on Sheet 30.02 for size, elevation and orientation of nozzles and appurtenances.
2. Provide guardrail all around perimeter of roof except at stairway top platform.
3. Provide 6"x18" opening in intermediate landing for piping and conduit.
4. Lap roof plate seams to shed water (inner plates on top).
5. See level set-point table 40.12 for elevations of alarms and controls.
6. Rafters not shown for clarity.
7. Space internal pipe supports per interior pipe support 60 G8.
8. Provide a roof with slope of 15/12.

NOTE 3: Provide 6"x18" opening in intermediate landing for piping and conduit.
40,000 BBL TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING PLAN

40,000 BBL TANK NOZZLE/EQUIPMENT SCHEDULE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>SIZE (IN)</th>
<th>ANGLE (DEGREES)</th>
<th>DISTANCE (NOTES)</th>
<th>TOTAL SHOWN (DETAIL/ SHEET)</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>PIPE</td>
<td>24</td>
<td>270°</td>
<td>2'-0&quot;</td>
<td>40'-08&quot;</td>
<td>4, 5, 10</td>
</tr>
<tr>
<td>B</td>
<td>FALL</td>
<td>16</td>
<td>160°</td>
<td>1'-45&quot;</td>
<td>10'-00&quot;</td>
<td>4, 5, 10</td>
</tr>
<tr>
<td>C</td>
<td>LOW SUCTION</td>
<td>4</td>
<td>-</td>
<td>2'-0&quot;</td>
<td>50'-07, 110'-15</td>
<td>6, 15</td>
</tr>
<tr>
<td>D</td>
<td>WATER DRAIN OFF</td>
<td>2</td>
<td>-</td>
<td>-11'-15&quot;</td>
<td>30'-10, 110'-13, 160'-13</td>
<td>9, 15</td>
</tr>
<tr>
<td>E</td>
<td>PRODUCT RETURN</td>
<td>2</td>
<td>260°</td>
<td>7'</td>
<td>50'-13</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>SHELL MANHOLE (LOWER)</td>
<td>36</td>
<td>-</td>
<td>2'-0&quot;</td>
<td>10'-10, 150'-12</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>SHELL MANHOLE (UPPER)</td>
<td>30</td>
<td>167°</td>
<td>9'-10&quot;</td>
<td>10'-10, 150'-16, 160'-16</td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>ATG GAUGE WELL</td>
<td>10</td>
<td>221°</td>
<td>3'-2&quot;</td>
<td>40'-07</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>ATG WATERPROOF SHELL</td>
<td>8</td>
<td>225°</td>
<td>3'-2&quot;</td>
<td>30'-07</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>MECHANICAL-TAPE GAUGE</td>
<td>13</td>
<td>137°</td>
<td>-</td>
<td>10'-07</td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>LOW &amp; LOW-LEVEL ALARM NOZZLES</td>
<td>1</td>
<td>217°</td>
<td>X'-X', X'-X'</td>
<td>10'-12</td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>HIGH- &amp; HIGH-LEVEL ALARM AND FLY NOZZLES</td>
<td>1</td>
<td>217°</td>
<td>X'-X', X'-X'</td>
<td>20'-12</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>SAMPLE GAUGE WELL</td>
<td>10</td>
<td>218°</td>
<td>4'-4&quot;</td>
<td>20'-07</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>ROOF MANHOLE LOADER WELL</td>
<td>247°</td>
<td>36'-6&quot;</td>
<td>-</td>
<td>30'-09</td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>CENTER ROOF VENT</td>
<td>24</td>
<td>-</td>
<td>-</td>
<td>20'-09</td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>CIRCULATION VENT INSPECTION HATCHES</td>
<td>10'-10, 108'-252, 324</td>
<td>0'-10, 54, 72, 106, 324</td>
<td>46'-06&quot;</td>
<td>60'-07</td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>OVERFLOW/CIRCULATION VENT</td>
<td>24</td>
<td>-</td>
<td>-</td>
<td>50'-07</td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>PIPE INSTALLATION HATCH</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>BUMP</td>
<td>30</td>
<td>225°</td>
<td>4'-4&quot;</td>
<td>30'-07</td>
<td></td>
</tr>
<tr>
<td>T</td>
<td>GROUNDING LUGS</td>
<td>3 X 3 X 1&quot;</td>
<td>18', 198', 288</td>
<td>1'-0&quot;</td>
<td>30'-14</td>
<td></td>
</tr>
<tr>
<td>U</td>
<td>FLOATING PAN LOW-LEVEL</td>
<td>-</td>
<td>-</td>
<td>5'-17&quot;</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>ROOF CABLE SUPPORTS</td>
<td>-</td>
<td>-</td>
<td>0'-0&quot;</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>W</td>
<td>SHELL CIRCULATION VENTS</td>
<td>-</td>
<td>144', 216', 288</td>
<td>57'-07&quot;</td>
<td>60'-07</td>
<td></td>
</tr>
</tbody>
</table>

NOTES:
1. DISTANCE VALUES SHOWN ON TABLE FOR SHELL NOZZLES ARE AS MEASURED FROM THE BOTTOM OF THE SHELL TO THE CENTERLINE OF SHELL NOZZLES. DISTANCE VALUES SHOWN ON TABLE FOR ROOF NOZZLES ARE AS MEASURED FROM THE CENTER OF THE TANK TO THE CENTERLINE OF ROOF NOZZLES. DISTANCE VALUE SHOWN ON TABLE FOR TANK BOTTOM BUMP IS MEASURED FROM THE CENTER OF THE TANK TO THE CENTER OF THE BUMP.
2. ALIGN LOWER SHELL MANHOLES 180° APART AND PARALLEL WITH PREVAILING WINDS.
3. PROVIDE A PANEL INSTALLATION HATCH ON THE FIXED ROOF IN ACCORDANCE WITH THE PAN MANUFACTURER’S REQUIREMENTS.
4. SIZE OF FILL AND ISSUE NOZZLES AND PIPING MUST BE DETERMINED BY THE DESIGNER. REFER TO UFC 3-460-01 FOR DESIGN FLOWS WHEN SIZEING TANK PIPING.
5. ADJUST SIZE OF FILL, ISSUE AND LOW SUCTION NOZZLES TO SUIT SITE CONDITIONS SUCH AS DISTANCE TO PUMPS AND OPERATIONAL REQUIREMENTS.
6. LOCATE UPPER SHELL MANHOLE 3'-0" ABOVE UPPER SURFACE OF FLOATING PAN AT HIGH LEAD POSITION.
7. HIGH-LEVEL SHUT-OFF VALVE PLACE AT 7-8 FT OF ASSEMBLED V, AS WELL AS HIGH-HIGH HIGH-LEVEL ALARM SENSORS, SHALL BE ACCESSIBLE FROM SPIRAL STAIRWAY INTERMEDIATE PLATFORM.
8. MOUNT THE 4" ATG WATER PROOF WELL OVER THE TANK BOTTOM BUMP THROUGH AN 8" FLANGED ROOF NOZZLE FOR THE INDICATED DETAILS.
9. THE 8" WATER DRAIN-OFF NOZZLE SHOWN IN THIS STANDARD IS BASED ON THE SMALLEST DOUBLE-BLOCK AND BLEED VALVE AVAILABLE AT THE TIME THE STANDARD WAS WRITTEN. FOR TANKS THAT ARE EXPECTED TO RECEIVE A MINIMUM AMOUNT OF WATER AND EXPECTED TO PRODUCE MINIMUM CIRCUITING WATER FROM PRODUCT PIPING ON THE STARBOARD, PROVIDE A CIRCULATION VENT CONSTRUCTED SIMILAR TO AN OVERFLOW CIRCULATION VENT BUT 1'-0" HIGHER IN ELEVATION AT THAT LOCATION AND THE RESIDING OVERFLOW PLATES ARE ADEQUATE.
10. PROVIDE AT LEAST ONE OVERFLOW FOR EVERY 1200 GPM OF RECEIPT. DO NOT LOCATE OVERFLOW OVER STAIRS OR SHELL NOZZLE ISOLATION VALVES. WHERE THE PATTERN OF ROOF PERIMETER CIRCULATION VENTS WOULD RESULT IN AN OVERFLOW/CIRCULATION VENT OVER STAIRWAY, PROVIDE A SHELL CIRCULATION VENT CONSTRUCTED SIMILAR TO AN OVERFLOW CIRCULATION VENT BUT 1'-0" HIGHER IN ELEVATION AT THAT LOCATION AND THE RESIDING OVERFLOW PLATES ARE ADEQUATE.
11. INSTALL LOW SUCTION AND WATER DRAIN-OFF NOZZLES PARALLEL TO THE ISSUE NOZZLE.
12. PROVIDE AT LEAST ONE SAMPLE GAUGE WELL PER TANK.
13. INSTALL LOW SUCTION AND WATER DRAIN-OFF NOZZLES PARALLEL TO THE ISSUE NOZZLE.
14. ALL SHELL AND ROOF NOZZLES SHALL BE FLANGED UNLESS OTHERWISE INDICATED.
15. INTERSTITIAL PIPING FOR SIZED TANK FOUNDATION IS SHOWN. FOR SIZED TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING PLAN SEE 3/D.01.
1. See nozzles equipment schedule on sheet 50.02 for size, elevation and notes.
2. Provide guardrail all around perimeter of roof except at stairway or orientation of nozzles and appurtenances.
3. Provide 6"x18" opening in intermediate landing for piping and conduit.
4. Lap bottom plate seams to shed water (inner plates on top).
5. See level set-point table 4/D.12 for elevations of alarms and controls.
6. Rafters not shown for clarity.
7. Space internal pipe supports per interior pipe support 6/D.08.
8. Provide roof with slope of 1/12.
50,000 BBL TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING PLAN

SCALE: 1"=1' 0"

NOTES:
13. THE ELEVATION OF FILL AND ISSUE NOZZLE SIZES 25'S OR LARGER SHALL BE AS LOW AS ALLOWED BY API STD 650 USING LOW TYPE ISOLATION VALVES. WHERE THE PATTERN OF ROOF PERIMETER CIRCULATION VENTS WOULD RESULT IN AN OVERFLOW/CIRCULATION VENT OVER A HIGHER IN ELEVATION AT THAT LOCATION AND ENSURE THE REMAINING OVERFLOWS ARE ADEQUATE.

14. ALL SHELL AND ROOF NOZZLES SHALL BE FLANGED UNLESS OTHERWISE INDICATED.

15. INTERSTITIAL PIPING FOR ELEVATED TANK FOUNDATION IS SHOWN FOR NON-ELEVATED TANK BOTTOM FOUNDATION, AND INTERSTITIAL PIPING PLAN, SEE 3/D.01.

16. MOUNT THE 6" ATG AND SAMPLE GAUGE WELLS THROUGH 10" FLANGED ROOF NOZZLES PER THE INDICATED DETAILS.

17. THE MAXIMUM DISTANCE FROM THE SHELL MANHOLE REINFORCING PLATE TO THE BACKSIDE OF THE MANHOLE FLANGE, AS MEASURED FROM THE CENTER OF THE TANK TO THE CENTERLINE OF ROOF NOZZLES. DISTANCE VALUE SHOWN ON TABLE FOR SHELL BOTTOM SUMP IS MEASURED FROM THE CENTER OF THE TANK TO THE CENTERLINE OF THE SUMP.

18. PROVIDE AT LEAST ONE OVERFLOW FOR EVERY 1200 GPM OF RECEIPT. DO NOT LOCATE OVERFLOWS OVER STAIRS OR SHELL NOZZLE PLATE ON TOP OF THE FLOATING PLATE.

19. FLOATING PAN LOW-LEG LEVEL SHALL PROVIDE A MINIMUM OF 6" CLEARANCE FROM THE TOP OF ANY INTERNAL NOZZLE FLANGE TO THE BOTTOM OF THE FLOATING PLATE.

20. PROVIDE AT LEAST ONE OVERFLOW FOR EVERY 1200 GPM OF RECEIPT. DO NOT LOCATE OVERFLOWS OVER STAIRS OR SHELL NOZZLE PLATE ON TOP OF THE FLOATING PLATE.
1. See nozzle equipment schedule on sheet 80.02 for size, elevation and orientation of needles and appurtenances.

2. Provide guardrail all around perimeter of roof except at stairway platform.

3. Provide 12x12 opening in intermediate landing for piping and conduit.

4. Lap bottom plate seams to shed water (inner plates on top).

5. See level set-point table 40.12 for elevations of alarms and controls.

6. Rafters not shown for clarity.

7. Space internal pipe supports per interior pipe support 6/8.

8. Provide roof with slope of 15/12.
### 80,000 BBL TANK NOZZLE/EQUIPMENT SCHEDULE

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
<th>SIZE (IN)</th>
<th>ANGLE (DEGREES)</th>
<th>DISTANCE (NOTE 1)</th>
<th>DETAIL SHOWN (DETAILSHEET)</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>ISSUE</td>
<td>24</td>
<td>206</td>
<td>2'-5&quot;</td>
<td>45D.06</td>
<td>4, 5, 10</td>
</tr>
<tr>
<td>B</td>
<td>FIU</td>
<td>18</td>
<td>180</td>
<td>4'-0&quot;</td>
<td>102.06</td>
<td>5, 6, 10</td>
</tr>
<tr>
<td>C</td>
<td>LOW SUCTION</td>
<td>4</td>
<td>-</td>
<td>2'-5&quot;</td>
<td>5/8, 12, 12, 12.12</td>
<td>5, 13</td>
</tr>
<tr>
<td>D</td>
<td>WATER DRAIN-OFF</td>
<td>2</td>
<td>241</td>
<td>7&quot;</td>
<td>5/8, 12, 12, 12.12</td>
<td>5, 13</td>
</tr>
<tr>
<td>E</td>
<td>PRODUCT RETURN</td>
<td>2</td>
<td>241</td>
<td>7&quot;</td>
<td>5/8, 12, 12, 12.12</td>
<td>5, 13</td>
</tr>
<tr>
<td>F</td>
<td>SHELL MANHOLES (LOWER)</td>
<td>36</td>
<td>-</td>
<td>3'-6&quot;</td>
<td>3/16, 16, 16, 16</td>
<td>2, 17</td>
</tr>
<tr>
<td>G</td>
<td>SHELL MANHOLES (UPPER)</td>
<td>36</td>
<td>152</td>
<td>3'-6&quot;</td>
<td>3/16, 16, 16, 16</td>
<td>2, 17</td>
</tr>
<tr>
<td>H</td>
<td>ATG GAUGE WELL</td>
<td>10</td>
<td>212</td>
<td>3'-5&quot;</td>
<td>5/8, 12, 12, 12.12</td>
<td>16</td>
</tr>
<tr>
<td>I</td>
<td>ATG WATER PROBE WELL</td>
<td>6</td>
<td>225</td>
<td>3'-5&quot;</td>
<td>3/16, 12, 12, 12.12</td>
<td>8</td>
</tr>
<tr>
<td>J</td>
<td>MECHANICAL TAP GAUGE</td>
<td>1/2&quot;</td>
<td>58</td>
<td>-</td>
<td>1'-0&quot;</td>
<td>6</td>
</tr>
<tr>
<td>K</td>
<td>LOW &amp; LOW-LOW LEVEL ALARM NOZZLES</td>
<td>1</td>
<td>200</td>
<td>X'-X&quot;, X'-X&quot;</td>
<td>1'-12&quot;</td>
<td>7</td>
</tr>
<tr>
<td>L</td>
<td>HIGH &amp; HIGH-HIGH LEVEL ALARM AND PIP NOZZLES</td>
<td>1</td>
<td>200</td>
<td>X'-X&quot;, X'-X&quot;</td>
<td>2'-12&quot;</td>
<td>7</td>
</tr>
<tr>
<td>M</td>
<td>SAMPLE GAUGE WELL</td>
<td>10</td>
<td>278</td>
<td>3'-0&quot;</td>
<td>3/8, 12, 12, 12.12</td>
<td>16</td>
</tr>
<tr>
<td>N</td>
<td>ROOF WATER PROBE WELL</td>
<td>36 X 48</td>
<td>225</td>
<td>50'-0&quot;</td>
<td>3/8, 12, 12, 12.12</td>
<td>16</td>
</tr>
<tr>
<td>O</td>
<td>CENTER ROOF VENT</td>
<td>24</td>
<td>-</td>
<td>-</td>
<td>1'-0&quot;</td>
<td>9</td>
</tr>
<tr>
<td>P</td>
<td>CIRCULATION VENT/INSPECTION VENT</td>
<td>16 X 24</td>
<td>15, 15, 15, 15, 15, 15, 15</td>
<td>-</td>
<td>1'-0&quot;</td>
<td>12</td>
</tr>
<tr>
<td>Q</td>
<td>OVERFLOW CIRCULATION VENT</td>
<td>12 X 36</td>
<td>15, 15, 15, 15, 15, 15</td>
<td>1'-0&quot;</td>
<td>3/8, 12, 12, 12.12</td>
<td>12</td>
</tr>
<tr>
<td>R</td>
<td>PAN INSTALLATION HATCH</td>
<td>-</td>
<td>45</td>
<td>-</td>
<td>3/8, 12, 12, 12.12</td>
<td>3</td>
</tr>
<tr>
<td>S</td>
<td>SUMP</td>
<td>30</td>
<td>200</td>
<td>4'-0&quot;</td>
<td>3/8, 12, 12, 12.12</td>
<td>11</td>
</tr>
<tr>
<td>T</td>
<td>GROUNDING LUGS</td>
<td>3 X 3 X 3/8&quot;</td>
<td>45, 135, 225, 315</td>
<td>1'-0&quot;</td>
<td>3/8, 12, 12, 12.12</td>
<td>11</td>
</tr>
<tr>
<td>U</td>
<td>FLOATING PAN LOW-LOW LEVEL</td>
<td>3 X 3 X 3/8&quot;</td>
<td>15, 315</td>
<td>1'-0&quot;</td>
<td>3/8, 12, 12, 12.12</td>
<td>11</td>
</tr>
<tr>
<td>V</td>
<td>SCAFFOLD CABLE SUPPORTS</td>
<td>135, 315</td>
<td>6'-0&quot;</td>
<td>-</td>
<td>3/8, 12, 12, 12.12</td>
<td>11</td>
</tr>
<tr>
<td>W</td>
<td>SHELL CIRCULATION VENTS</td>
<td>12 X 36</td>
<td>195, 285</td>
<td>82'-10&quot;</td>
<td>3/8, 12, 12, 12.12</td>
<td>12</td>
</tr>
</tbody>
</table>

**NOTES:**
1. DISTANCE VALUES SHOWN ON TABLE FOR SHELL NOZZLES ARE AS MEASURED FROM THE BOTTOM OF THE SHELL TO THE CENTERLINE OF SHELL NOZZLES. DISTANCE VALUES SHOWN ON TABLE FOR ROOF NOZZLES ARE AS MEASURED FROM THE CENTER OF THE TANK TO THE CENTERLINE OF ROOF NOZZLES. DISTANCE VALUE SHOWN ON TABLE FOR SHELL BOTTOM SUMP IS MEASURED FROM THE CENTER OF THE TANK TO THE CENTERLINE OF THE BUMP.
2. ALIGN LOWER SHELL MANHOLES 180° APART AND PARALLEL WITH THE PREVAILING WINDS.
3. PROVIDE A SAMPLE INSTALLATION HATCH ON THE FIXED ROOF IN ACCORDANCE WITH THE PAN MANUFACTURER'S REQUIREMENTS.
4. PROVIDE A WATER DRAIN-OFF VALVE ON THE FIXED ROOF TO DRAIN EXCESS WATER AND OPERATIONAL REQUIREMENTS.
5. ADJUST SIZE OF FULL, ISSUE, AND LOW SUCTION NOZZLES TO SUIT SITE CONDITIONS SUCH AS DISTANCE TO PUMPS AND OPERATIONAL REQUIREMENTS.
6. LOCATE UPPER SHELL MANHOLE 3'-0" ABOVE THE UPPERSURFACE OF FLOATING PAN AT THE HIGH LEG POSITION.
7. HIGH LEVEL SHUT-OFF VALVE FLOAT VARY ASSEMBLY AS WELL AS HIGH AND LOW LEVEL ALARM SENSORS, SHALL BE ACCESSIBLE FROM SPIRAL STAIRWAY INTERMEDIATE PLATFORM.
8. MOUNT THE ATG WATER PROBE WELL OVER THE TANK BOTTOM BUMP THROUGH ANY FLANGED ROOF NOZZLE FOR THE INDICATED DETAILS.
9. THE WATER DRAIN-OFF NOZZLE SHOWN IN THIS STANDARD IS BASED ON THE SMALLEST DOUBLE BLOCK AND BLEED VALVE AVAILABLE AT THE TIME THIS STANDARD WAS WRITTEN. FOR TANKS THAT ARE EXPECTED TO RECEIVE A MINIMUM AMOUNT OF WATER AND EXPECTED TO PRODUCE MAXIMUM CONDENSATE, PROVIDE INTERIOR, WATER DRAIN-OFF PIPING REDUCED TO 1'-0" NEAR THE INTERNAL CIRCULATION VENT TO LIMIT THE AMOUNT OF WATER THAT IS RETAINED IN THE INTERNAL PIPING.

---

**80,000 BBL TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING PLAN**

**SCALE:** 1/8" = 1'-0"
NOTES:
1. SEE NOZZLE EQUIPMENT SCHEDULE ON SHEET 80.02 FOR SIZE, ELEVATION AND ORIENTATION OF NOZZLES AND APPURTENANCES.
2. PROVIDE GUARDRAIL ALL AROUND PERIMETER OF ROOF EXCEPT AT STAIRWAY PLATFORM.
3. PROVIDE 6"x18" OPENING IN INTERMEDIATE LANDING FOR PIPING AND CONDUIT.
4. LAP BOTTOM PLATE SEAMS TO SHED WATER (INNER PLATES ON TOP).
5. PROVIDE ROOF WITH SLOPE OF 1/8.
6. RafterS NOT SHOWN FOR CLARITY.
7. SPACE INTERNAL PIPE SUPPORTS PER INTERIOR PIPE SUPPORT #100.08.
8. PROVIDE ROOF WITH SLOPE OF 1/8.
9. CIRCUMFERENTIAL STAIRS NOT SHOWN FOR CLARITY - ITEMS SHOWN ON ORIENTATION OF NOZZLES AND APPURTENANCES.
10. SEE LEVEL SET-POINT TABLE #100.08 FOR ELEVATIONS OF ALARMS AND CONTROLS.
11. SHELL OF SHELL BOTTOM SUMP
12. 100% LEVEL OF TANK BOTTOM
13. 57'-0" FUEL TANKS WITH FIXED ROOF

100,000 BBL TANK
SCALE 1"=7'-0"
1. Distance values shown on table for shell nozzles are as measured from the bottom of the shell to the centerline of shell nozzles. Distance values shown on table for roof nozzles are as measured from the center of the tank to the centerline of roof nozzles.

2. Locate upper shell manhole 3'-6" above upper surface of floating pan at high leg.

3. Provide a pan installation hatch on the fixed roof in accordance with the pan manufacturer's requirements.

4. Size of fill and issue nozzles and piping must be determined by the designer. Refer to UFC 3-460-01 for design flowrates when sizing tank piping.

5. Adjust size of fill, issue and low suction nozzles to suit site conditions such as distance to pumps and operational requirements.

6. Locate upper shell manholes 197'-0" apart and parallel with prevailing winds.

7. Provide a pan installation hatch on the fixed roof in accordance with the pan manufacturer's requirements.

8. Size of roof manholes and roof filling equipment shall be determined by the designer. Refer to UFC 3-460-01 for design flowrates when sizing tank piping.

9. The 2" water draw-off nozzle shown in this standard is based on the smallest double shell and block size available at the time this standard was written. For tanks that are expected to receive a minimum makeup of water and expected to produce rainbow condensate, provide internal water draw-off piping reduced to 1" size near the internal nozzle flange to limit the amount of water that is retained in the internal piping.

10. The elevation of fill and issue nozzles on the roof shall be as low as allowed by API STD 650 using low type reinforcing plate. Fill and issue nozzle sizes smaller than 12" shall be as low as permitted by API STD 650 using regular type reinforcing plates.

11. Floating pan (low-leg level) shall provide a minimum of 6' clearance from the 10° of any internal nozzle flange to the bottom of the float in panic.

12. Provide at least one overflow 1000 gpm for every 1000 gpm of installed capacity. Do not locate overflows over stairs or shell nozzle isolation valves. Where the pattern of roof ventilation circulation vents would result in an insufficient circulation vent over overflow piping or on the foreground, provide a shell circulation vent. The shell circulation vents are constructed similar to an overlow circulation vent but 1° higher in elevation at that location and ensure the remaining overflows are adequate.

13. Install low suction and water draw-off nozzles parallel to the issue nozzle extension.

14. All shell and roof nozzles shall be flanged unless otherwise indicated.

15. Interstitial piping for elevated tank foundation is shown. For non-elevated tank foundation and interstitial piping plan, see 3/D.14.

16. Mount the 4' ATG and sample gauge wells shall be 10'-0" flanged roof nozzle per the indicated details.

17. The maximum distance from the shell manhole reinforcing plate to the backside of the manifold flange, as measured horizontally on the vertical centerline will not be more than 6'.
1. Detail is based on typical 80,000 BBL tank. Other tank sizes are similar.

2. Slope top of concrete tank foundation BERM 1:20 to outside.

3. On side furthest from sump, slope tank bottom from shell to off-center sump at a slope of not less than 1:20. See Tank 'Elevation', note 2.

4. For tanks without an elevated tank foundation, see detail 1 on this sheet.

5. Foundation extension for concrete pipe support pier and pipe anchor. Shown rotated out of position for clarity.
**Description**

DRW 2-3

**Date**

April 2015

**Notes:**

1. 10,000 BBL TANK IS SHOWN. OTHER TANK SIZES ARE SIMILAR.
2. TANK BOTTOM FOUNDATION SEAL FOR ANCHORED TANK IS SHOWN.

**Scale:**

1" = 1'-0"
ANCHORED TANK BOTTOM-TO-Foundation Grouting

Scale: 1/8=1'-0"

- Tank anchor to be designed by tank manufacturer. Locate 1'-0" minimum from ringwall control joints. Minimum size of anchor bolt shall be 1" dia and fully developed into foundation in accordance with the provisions of the latest edition of ACI 318 "Building Code and Commentary".

- Notch corner of vertical members of chair to clear shell-bottom to bottom joint. Do not weld notched corner of chair.

- Tank bottom to be gasketed with "Buna-N Tank Bottom Caulk". Do not apply mechanical sealant caulks. Do not apply polysulfide mastic sealant at top of foundation ringwall. 2" of concrete ringwall foundation is shown for visualization purposes only.

- Tank bottom foundation seal is shown for visualization purposes only.

- Typical slab mat foundation design is shown for visualization purposes only. Other tank foundation designs may be provided. Tank foundation design will be determined by the site-specific data at each site.

TYPICAL SLAB MAT FOUNDATION

Scale: 1/8=1'-0"

- Reinforce as required.
ROOF SUPPORT PLAN - NO COLUMNS

- Scale: 1"=1'-0"
- HSS or W Shape Rafter (Typ)
- Compression Ring (Typ)
- Moment Connection at Compression Ring (Typ)
- Tank Shell
- Steel Plate

NOTES:
1. Slope of roof shall be consistent and continuous. Tank roof shall be designed with a roof slope of 15 inches in 12 inches. Slope of finished tank roof plate shall be puzzle tested as specified. Puddles of water deeper than 3/16 inch anywhere on the tank roof plates shall not be accepted.

2. Number of rafters at compression ring can be reduced by installing headers or additional framing between rafters.

3. Tanks greater than 91 feet in diameter and equal or less than 126 feet in diameter shall have no more than one column located at center of tank. Jigger smaller diameter tanks shall have no interior column supports.

- Slope of roof shall be consistent and continuous. Tank roof shall be designed with a roof slope of 15 inches in 12 inches. Slope of finished tank roof plate shall be puzzle tested as specified. Puddles of water deeper than 3/16 inch anywhere on the tank roof plates shall not be accepted.

- Number of rafters at compression ring can be reduced by installing headers or additional framing between rafters.

- Tanks greater than 91 feet in diameter and equal or less than 126 feet in diameter shall have no more than one column located at center of tank. Jigger smaller diameter tanks shall have no interior column supports.
SUPPORTS.
TANKS SHALL HAVE NO INTERIOR COLUMN LOCATED AT CENTER OF TANK. LESSER DIAMETER SHALL HAVE NO MORE THAN ONE COLUMN AND, EQUAL OR LESS THAN 126 FEET IN DIAMETER 3. TANKS GREATER THAN 91 FEET IN DIAMETER FRAMING BETWEEN RAFTERS. REDUCED BY INSTALLING HEADERS OR ADDITIONAL

WATER DEEPER THAN PUDDLE TESTED AS SPECIFIED. PUDDLES OF SLOPE OF FINISHED TANK ROOF PLATE SHALL BE CONSTANT ROOF SLOPE OF 2 INCHES IN 12 INCHES. 1. SLOPE OF ROOF SHALL BE CONSISTENT AND

NOTES:
STEEL PLATE
TANK SHELL
HSS RAFTER (TYP) SEE NOTE 1
D.06
RAFTER-SHELL CONNECTION
SCALE: 1"=1'-0"

TOP OF CENTER COLUMN PROVIDE VENT HOLE NEAR STEEL BEARING PLATE REQUIRED. WELD TO SHELL STIFFENER PLATE (AS REQUIRED TO RESIST BUCKLING UNDER THERMAL LOADS AND TO PERMIT MOVEMENT OF MEMBER PROVIDE SUITABLE BEARING LENGTH. RAFTER SEAT, SHIM TO PROVIDE TANK SHELL
DEAD AND LIVE LOADS PLATE DUE TO VERTICAL BUCKLING OF SHELL AS REQUIRED TO RESIST SHELL STIFFENER PLATE (AS REQUIRED TO RESIST BUCKLING OF SHELL PLATE DUE TO THERMAL MOVEMENT OF ROOF PLATE) PROVIDE SLIP CONNECTION AT BEARING OF RAFTER TO PERMIT MOVEMENT OF MEMBER DUE TO THERMAL CHANGES. HEADS AS REQUIRED.

PROVIDE SLEEVING PLATE EACH SIDE OF HSS RAFTER (TYP) OR PROVIDE BOLTED CONNECTION AS DESIGNED BY TANK MANUFACTURER HSS OR W SHAPE RAFTER (TYP)
RAFTER-SHELL CONNECTION
SCALE: 1"=1'-0"

PLATE-TO-RIM ANGLE WELD NO LARGER THAN 3/16" FOR TANKS WITHOUT FLOATING PANS, PROVIDE ROOF PLATE DUE TO THERMAL CHANGES, PERMIT EXPANSION DUE BEARING OF RAFTER TO CONNECTION AT PROVIDE SLIP MOVEMENT OF ROOF PLATE) REQUIRED TO PERMIT MOVEMENT OF MEMBER OR FRAMING WHERE PENETRATIONS OR EQUIPMENT TO PASS THROUGH ROOF FRAME.

RAFTER-SHELL CONNECTION
SCALE: 1"=1'-0"
CENTER ROOF VENT

PLAN

CIRCULATION VENT/INSPECTION HATCH

SECTION A-A

ROOF MANHOLE/LADDER HATCH
NOTE: TANK DATA/NAMEPLATE SHALL INDICATE THE DIAMETER OF THE TANK, JOINT EFFICIENCY, NOMINAL THICKNESS, AND MATERIAL FOR EACH SHELL COURSE IN ADDITION TO INFORMATION REQUIRED BY AN STANDARD 999. LOCATE MANHOLE ON MOST USED APPROACH SIDE AND AT EYE LEVEL.

NOTE: COUPLING NUT SHALL BE COATED WITH TANK. INSTALL MOUNTING CHANNEL ASSEMBLY ON FOUNDATION, EXCEPT THE STAND-OFF IS NOT REQUIRED. BOLT SUPPORTS ON THE SIDE OF TANK SHELL OR ROOF.

NOTE: PROVIDE FILLER DRUM ON SHELL MANHOLES OF TANKS WITH FLOATING PANS.

NOTE: TANK SHELL PENETRATION SHALL BE TO THE TANK SIDE

NOTE: TANK MANHOLE PLATE IS SHOWN CUT FOR CLARITY. MANHOLE PLATE SHALL NOT BE WELDED TO THE DAVIT HINGE.

NOTE: PROVIDE DRAW-OFF NOZZLES PROVIDE WATER PLATE ON ALL NOZZLES REQUIREMENT BY API STANDARD 650. LOCATE NEAR MANHOLE ON MOST USED APPROACH SIDE

NOTE: PANEL VIEW FOR SUPPORTS ON TANK SHELL. ELEVATION VIEW FOR SUPPORTS ON TANK ROOF.

NOTE: USE SIMILAR DETAIL FOR SUPPORTS MOUNTED ALONG THE TANK'S CONCRETE RINGWALL THE CONCRETE RINGWALL NOT THE TOP.

NOTE: AFTER TANK IS COATED; DO NOT COAT MOUNTING CHANNEL.

NOTE: TITLE BLOCK FOR OFFICIAL USE ONLY

NOTE: UNCLASSIFIED/ FOR OFFICIAL USE ONLY
1. SET POINT IS DEFINED AS THE DISTANCE ABOVE THE BOTTOM OF THE LEVEL SWITCH AND LCV.

2. SEE SHEET G.03 FOR DESIGNER NOTES; LEVELS SHALL BE SITE ADAPTED.

3. FOR TANKS WITH FLOATING PAN, LOW AND LOW-LOW ALARM SHELL NOZZLES WILL BE HIGHER. ENSURE

TEST DRAIN IS NEVER LOWER THAN AS INDICATED AND TEST VENT IS NEVER HIGHER THAN AS INDICATED.

LEVEL SET-POINT TABLE

<table>
<thead>
<tr>
<th>Tank Size (BBLs)</th>
<th>LL</th>
<th>LLS</th>
<th>HHLS</th>
<th>HLV</th>
</tr>
</thead>
<tbody>
<tr>
<td>XX.01</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>XX.02</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes:
1. EQUIPMENT, PIPE, FITTINGS, CHAMBERS AND VALVES SHALL BE STAINLESS STEEL.
2. NOT TO EXCEED DISTANCE SHOWN PLUS ONE STAIR RISE.
3. SEE SHEET G.03 FOR DESIGNER NOTES; LEVELS SHALL BE SITE ADAPTED TO ALLOW SUFFICIENT OPERATOR RESPONSE TIME.

HIGH AND HIGH-HIGH LEVEL SWITCHES AND HIGH LIQUID LEVEL SHUT-OFF VALVE (HLV)

Notes:
1. SIZE AS SHOWN IS BASED ON AN 8" FILL NOZZLE (8" PIPE). OTHER SIZES ARE SIMILAR.
2. COORDINATE WITH PIPELINE FACILITY OPERATOR TO CONFIRM HLV IS STANDARD AT FACILITY AND PROVIDE HLV UNLESS DIRECTED OTHERWISE BY SERVICE HEADQUARTERS.
3. THE SOLENOID VALVE IS Normally_DISENGAGED ENABLING THE HLV TO REMAIN OPEN AND FUNCTION NORMAL. WHEN DE-ENERGIZED, THE SOLENOID CONTROL SHALL CAUSE THE VALVE TO CLOSE. SEE SEQUENCE OF OPERATION ON G.06.
1. **Identify Tanks as to Product Service by Color Coding, Banding, or Product Marking**

2. **Sample Tank Labeling Shown is for Jet A Turbine Fuel. For Other Fuels, Refer to MIL-STD-161G. Dimensions Vary Based on Tank Size.**

3. **Provide Hazard Identification System Labeling in Accordance with NFPA 704.**

4. **Provide Equipment Grounding.**

5. **Provide outside view of JET FUEL JET A INTEGRAL SIDESTREAM FILTRATION SYSTEM.**

**NOTES:**

1. System shall be factory assembled, skid mounted, and factory run.

2. Provide only Class 1, Division 1 rated electrical components.

3. Heat Trace Drain Piping (and Slow Fill Piping to First Valve) in Cold Climates.

4. Piping Arrangement Shown is Conceptual Only.

5. Coordinate Location of Concrete Housekeeping Pad with Paving Joints to Prevent Cracking.

**OPTIONAL SIDESTREAM FILTRATION SYSTEM**

**SCALE:** 1:128 (4"

**NOTES:**

1. Select spring supports to provide for maximum tank settlement.

2. Provide heat tracing on drain piping where indicated when required by cold climates.

3. Option: Pipe 1" Product Return Line into the Issue Nozzle on the Pumphouse Side of the Tank Skin (instead of into the indicated shell nozzle).

4. Provide Level Switches (HHLS & HLS) Only if Sidestream Filtration Is Provided.

5. Coordinate Location of Concrete Housekeeping Pad with Paving Joints to Prevent Cracking.