

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, OVERFLOWS, PAN INSTALLATION HATCHES, UPPER SHELL MANHOLES, LOWER STAIRWAY LANDINGS, OR MANHOLE COVERS WITH FILLER DRUMS.
 3. CONSULT APPLICABLE FIRE CODES AND STANDARDS TO ADDRESS EMERGENCY VENTING. EMERGENCY VENTING FOR TANKS WITHOUT FLOATING PANS SHALL BE PROVIDED BY OPENINGS FITTED WITH EMERGENCY VENTING DEVICES; ALTHOUGH, TANK DESIGNS GREATER THAN 50' IN DIAMETER MAY MEET THE EMERGENCY VENTING REQUIREMENTS BY USE OF A FRANGIBLE ROOF-TO-SHELL ATTACHMENT AS ALLOWED BY API STANDARD 650.
 4. TANKS WITHOUT FLOATING PANS MAY BE REQUIRED TO HAVE ADDITIONAL FIRE PROTECTION SUCH AS FIXED OR SEMI-FIXED AFFF 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 INSIDE OF A ROOF OPENING ON A NON-FLOATING PAN TANK. THE OSHA REQUIRED CLEARANCE BEHIND THE LADDER RUNGS 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 REQUIRED 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 CIRCUMFERENTIAL LENGTH OF THE STAIRWAY WILL DIFFER FROM THAT FOR A TANK WITH A FLOATING PAN AND INTERFERENCE WITH OTHER TANK APPURTENANCES WILL NEED TO BE CONSIDERED.
 8. THE LLLS 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. DO NOT MOUNT THE LLLS LOWER THAN THAT ALLOWED BY THE MOUNTING DETAIL INDICATED.
 9. SET THE LLLS, THE HLS, THE HLV, AND THE HHLS SETPOINT ELEVATION SIMILARLY TO TANKS WITH FLOATING PANS. NOTE THAT THE RESULTING UNUSED HEIGHT OF THE SHELL ABOVE THE HHLS WILL BE SOMEWHAT GREATER THAN THAT FOR A TANK WITH A FLOATING PAN DUE TO THE LACK OF OVERFLOW PORTS.

G. TANK SIZING SEQUENCE/PROCEDURE (TANKS WITH FLOATING PANS):

1. THE TANK DESIGN WILL VARY WITH THE INLET AND OUTLET FLOWRATES AND NOZZLE SIZES, THE TANK HEIGHT (AIRFIELD HEIGHT RESTRICTIONS, ETC.), THE PRESENCE OR NON-PRESENCE OF A FLOATING PAN, AND OTHER FACTORS. THE FLOATING PAN ELEVATION, THE LEVEL SWITCHES, AND THE HLV SETPOINT ELEVATIONS IN PARTICULAR DEPEND ON THESE. THESE VALUES SHOULD BE CALCULATED FOR TANK SIZES, HEIGHTS, CONFIGURATIONS, AND/OR NOZZLE COMBINATIONS NOT SHOWN ON TABLE 1 ON SHEET C.01.
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 C.01 WILL SHOW THE SHELL HEIGHT (FIXED AS AN EVEN PRODUCT OF 8' SHELL COURSES) AND THE TANK DIAMETER. FOR OTHER SIZES, USE THE GENERAL PROPORTIONS SHOWN HEREIN AND EXTRAPOLATE OR INTERPOLATE AS REQUIRED; UNLESS IMPRACTICABLE, USE TANK HEIGHTS THAT ARE ALSO A 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 NOZZLE FLOWRATES. NOZZLE SIZES FOR EACH TANK SIZE COVERED IN THIS STANDARD HAVE BEEN SELECTED BASED ON THE EXPECTED TYPICAL FLOWRATES AND NOZZLE SIZES FOR THAT SIZE TANK AND ARE AS INDICATED ON TABLE 1 ON SHEET C.01. IF FLOWRATES ARE DIFFERENT THAN THOSE INDICATED, USE PIPING VELOCITIES IN UFC 3-460-01 TO SIZE THE NOZZLES. FOR LARGER NOZZLE SIZES THAN THOSE INDICATED, THE TANKS MAY HAVE TO BE RE-SIZED (INCREASED HEIGHT OR DIAMETER OR BOTH) TO ACCOMMODATE THE LARGER NOZZLES, OR A SMALLER USABLE VOLUME ACCEPTED. FOR SMALLER NOZZLE SIZES THAN THOSE INDICATED, USE THE SAME TANK DIMENSIONS, LOWER THE FLOATING PAN LOW LEG POSITION AND THE HLV, OVERFLOW PORT, AND LEVEL SWITCH SETPOINT ELEVATIONS.
 - c. SET THE 0% ELEVATION AT THE BOTTOM OF THE SHELL.
 - d. SET THE LOW LEG POSITION OF THE FLOATING PAN SUCH THAT THE BOTTOM OF THE PAN CLEARS THE LARGEST TANK NOZZLE INTERIOR FLANGE BY 6".
 - e. USING THE DESIGN OUTLET FLOWRATE, SET THE ELEVATION OF THE LOW-LOW LEVEL SWITCH SUCH THAT IT ACTUATES 1 MINUTE BEFORE THE FLOATING PAN BOTTOMS OUT WHEN THE FLOATING PAN LEGS ARE SET IN THE LOW POSITION.
 - f. USING THE DESIGN OUTLET FLOWRATE, SET THE ELEVATION OF THE LOW LEVEL SWITCH SUCH THAT IT ACTUATES 5 MINUTES BEFORE ACTUATING THE LOW-LOW LEVEL SWITCH.
 - g. USING THE NOMINAL TANK VOLUME, CALCULATE THE DISTANCE BETWEEN THE LOW LEVEL AND HIGH LEVEL SWITCHES. THIS ELEVATION IS THE SETPOINT OF THE HIGH LEVEL SWITCH AND DEFINES THE 95% FUEL LEVEL. CONFIRM THE 95% WITH THE LOCAL AND/OR FEDERAL CODES AND REGULATIONS FOR THAT LOCATION AS THIS SOMETIMES VARIES.
 - h. SET THE ELEVATION OF THE HIGH-HIGH LEVEL SWITCH SUCH THAT IT ACTUATES WHEN THE LEVEL OF THE FUEL REACHES THE CALCULATED 98% FUEL LEVEL. CONFIRM THE 98% WITH THE LOCAL AND/OR FEDERAL CODES AND REGULATIONS FOR THAT LOCATION AS THIS SOMETIMES VARIES.
 - i. SET THE ELEVATION OF THE HLV FLOAT PILOT SUCH THAT IT ACTUATES WHEN THE LEVEL OF THE FUEL REACHES A POINT MIDWAY BETWEEN THE HIGH AND HIGH-HIGH LEVEL SWITCH SETPOINTS (TYPICALLY 96.5%).
 - j. SET THE OVERFLOW/CIRCULATION VENT AT THE ELEVATION OF THE CALCULATED 100% FUEL LEVEL. CHECK THAT THE FLOATING PAN WILL ADEQUATELY CLEAR THE ROOF STRUCTURE. CONSIDER THE ROOF STRUCTURE DEPTH, ALLOWANCES AGAINST SLOSHING DURING A SEISMIC EVENT, THE HEIGHT OF THE FLOATING PAN PERIMETER SEALS, AND A REASONABLE CLEARANCE (6" MINIMUM) BETWEEN THE FLOATING PAN PERIMETER SEAL ASSEMBLY AND THE ROOF STRUCTURE. THE DISTANCE FROM THE OVERFLOW AND THE ROOF-TO-SHELL JOINT WILL VARY DEPENDING ON THE ABOVE AND OTHER FACTORS.
 - k. USING THE DESIGN INLET FLOWRATE, CALCULATE THE NUMBER OF MINUTES BETWEEN ACTUATION OF THE HIGH LEVEL SWITCH AND THE HLV, THEN BETWEEN THE HLV AND THE HIGH-HIGH LEVEL SWITCH, AND THEN BETWEEN THE HIGH-HIGH LEVEL SWITCH AND THE OVERFLOW PORT. IT IS RECOMMENDED THAT THE TIME BETWEEN THESE EVENTS BE BETWEEN 5 AND 12 MINUTES APART.
3. THE FOLLOWING DESIGN PARAMETERS/LIMITS ARE A PARTIAL LIST OF THOSE OTHER ITEMS THAT WILL ALSO NEED TO BE TAKEN INTO ACCOUNT AT EACH SITE WHEN DESIGNING TANKS FOR A SPECIFIC PROJECT:
 - LOCAL CODES (LEVEL ALARM SETPOINTS, SEISMIC DESIGN, AIR QUALITY)
 - FLIGHT LINE CLEARANCES (TANK HEIGHT)
 - ORIENTATION WITH SUN (MELT ICE ON STAIRWAYS AND LANDINGS)
 - PREVAILING WINDS (ORIENT SHELL MANHOLES WITH)
 - MAINTENANCE ACCESS

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SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND - ATLANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

GENERAL NOTES

SCALE: AS NOTED

PROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAFAC DRAWING NO. XXXXX

SHEET 4 OF 57

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DRAWING REVISION: 10 MAY 2014

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