DOD STANDARD DESIGN AW 78-24-27

ABOVEGROUND VERTICAL STEEL FUEL TANKS WITH FIXED ROOFS

APRIL 2015

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APPR | DATE | DESCRIPTION | CTM

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ATLANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TITLE SHEET

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 1 OF 57

G.01

DRAWFORM REVISION: 10 MAY 2014

ABBREVIATIONS

AAV	AUTOMATIC AIR VENT
ACI	AMERICAN CONCRETE INSTITUTE
AFFF	AQUEOUS FILM FORMING FOAM
AFHE	AUTOMATED FUEL HANDLING EQUIPMENT
API	AMERICAN PETROLEUM INSTITUTE
ATG	AUTOMATIC TANK GAUGE
AWG	AMERICAN WIRE GAUGE
BBL	BARREL
BE	BOTH ENDS
BS	BASKET STRAINER
BS&W	BOTTOM SEDIMENT AND WATER
CB	CATCH BASIN
CL	CLASS
CLR	CLEARANCE
CFR	CODE OF FEDERAL REGULATIONS
COE	CORPS OF ENGINEERS
CONC	CONCRETE
CONT	CONTINUOUS
CP	CATHODIC PROTECTION
CS	CARBON STEEL
CU	COPPER
CV	CHECK VALVE
EFSO	EMERGENCY FUEL SHUT-OFF
DBB	DOUBLE BLOCK AND BLEED PLUG VALVE
DIA	DIAMETER
DIP	DUCTILE IRON PIPE
DIV	DIVISION
ECC	ECCENTRIC
EPDS	EMERGENCY POWER DOWN SYSTEM
ETC	ET CETERA
FCC	FEDERAL COMMUNICATIONS COMMISSION
FB	FLAT BAR
FML	FLEXIBLE MEMBRANE LINER
FOB	FLAT ON BOTTOM
FRP	FIBERGLASS REINFORCED PIPE
F/S	FILTER/SEPARATOR
FS	FLOW SWITCH
FSC	FUEL SAMPLE CONNECTOR
FSCV	FILTER SEPARATOR CONTROL VALVE
FT	FOOT OR FEET
GA	GAUGE
GAL	GALLON
GALV	GALVANIZED
GND	GROUND
GPM	GALLONS PER MINUTE
HDPE	HIGH DENSITY POLYETHYLENE
HHLA	HIGH-HIGH LEVEL ALARM
HHLS	HIGH-HIGH LEVEL SWITCH
HLA	HIGH LEVEL ALARM
HLS	HIGH LEVEL SWITCH
HLV	HIGH LIQUID LEVEL SHUT-OFF VALVE
HMWPE	HIGH MOLECULAR WEIGHT POLYETHYLENE
HPV	HIGH-POINT VENT
HS	HAND SWITCH
HSS	HOLLOW STRUCTURAL SECTION
IBC	INTERNATIONAL BUILDING CODE
ID	INNER DIAMETER
K BBL	THOUSAND BARREL
LB	ELBOW
LLA	LOW LEVEL ALARM
LLLA	LOW-LOW LEVEL ALARM
LLLS	LOW-LOW LEVEL SWITCH
LLS	LOW LEVEL SWITCH
LPD	LOW-POINT DRAIN
MAX	MAXIMUM
MAV	MANUAL AIR VENT
MIN	MINIMUM
MOV	MOTOR OPERATED VALVE
NFPA	NATIONAL FIRE PROTECTION AGENCY
NPT	NATIONAL PIPE THREAD
NTS	NOT TO SCALE
OC	ON CENTER
OD	OUTSIDE DIAMETER
OSHA	OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION
PDI	PRESSURE DIFFERENTIAL INDICATOR
PI	PRESSURE INDICATOR
PIV	POST INDICATOR VALVE
PLC	PROGRAMMABLE LOGIC CONTROLLER
PSI	POUNDS PER SQUARE INCH
PST	PRODUCT SAVER TANK
PVC	POLYVINYL CHLORIDE
QTY	QUANTITY
REQ'D	REQUIRED
SCH	SCHEDULE
SRV	SAFETY RELIEF VALVE
SS	STAINLESS STEEL
STD WT	STANDARD WEIGHT
SV	SOLENOID VALVE
THRD	THREAD

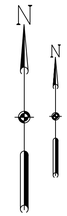
ABBREVIATIONS

THWN	THERMOPLASTIC HIGH WATER-RESISTANT NYLON-COATED
TRV	THERMAL RELIEF VALVE
TYP	TYPICAL
UFC	UNIFIED FACILITIES CRITERIA
UFGS	UNIFIED FACILITIES GUIDE SPECIFICATIONS
UON	UNLESS OTHERWISE NOTED
WNF	WELD NECK FLANGE
XXS	DOUBLE EXTRA STRONG
℄	CENTERLINE
PL	PLATE
@	AT
WWF	WELDED WIRE FABRIC
W/	WITH

LEGEND

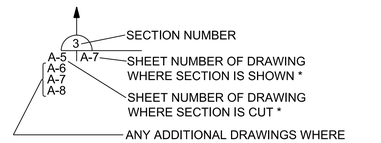
- BALL VALVE
- CHECK VALVE
- CONTROL VALVE (IF PROVIDED, ARROW INDICATES INTEGRAL BYPASS RELIEF AND DIRECTION)
- DOUBLE BLOCK & BLEED VALVE (DBB) (IF PROVIDED, ARROW INDICATES INTEGRAL BYPASS RELIEF AND DIRECTION)
- BALL JOINT
- CAM TYPE CONNECTION WITH DUST PLUG/CAP
- MOTORIZED VALVE
- SLIP ON FLANGE (SO)
- OR WELD NECK FLANGE (WNF)
- OR WELD NECK FLANGE WITH BLIND FLANGE
- OR REDUCER
- UNION
- PIPE CAP
- PUMP
- PIPE SECTION
- OR RELIEF VALVE
- JUNCTION BOX
- LS LEVEL SWITCH
- LI LEVEL INDICATOR
- ZS VALVE LIMIT SWITCH
- NEW CATHODIC CABLE OR CONDUIT
- ELEVATION
- CONCRETE
- SAND
- GASKET OR NON-SHRINK GROUT
- EXISTING GRADE OR COMPACTED EARTH
- WIRE MESH
- STEEL PLATE

STANDARD NORTH ARROWS

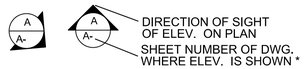


SECTION IDENTIFICATION

* SHEET NUMBERS OMITTED IF SECTION IS CUT AND DETAILED ON SAME DRAWING.



ELEVATION IDENTIFICATION



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NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS
ABOVEGROUND VERTICAL STEEL

LEGEND & ABBREVIATIONS

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 2 OF 57

G.02

DRAWFORM REVISION: 10 MAY 2014

GENERAL DESIGN NOTES

A. APPLICABILITY:

1. THIS STANDARD DESIGN APPLIES TO VERTICAL STEEL FUEL TANKS IN JET A, JP-5 OR JP-8 SERVICE BUT MAY BE ADAPTED FOR USE WITH OTHER PRODUCTS.

2. THIS STANDARD DESIGN APPLIES TO TANKS WITH FLOATING PANS. FLOATING PANS ARE REQUIRED FOR JET A, JP-5 AND JP-8 SERVICE ONLY WHEN REQUIRED BY UFC 3-460-01: DESIGN: PETROLEUM FUEL FACILITIES. FOR TANK DESIGNS WITHOUT FLOATING PANS, CONSIDER THE ISSUES MENTIONED IN THE NOTES TITLED "F. DESIGN CONSIDERATIONS FOR TANKS WITHOUT FLOATING PANS" ON SHEET G.04.

3. THE GENERAL INTENT OF THIS STANDARD IS FOR NEW CONSTRUCTION, BUT THE DETAILS CAN BE USED FOR TANK UPGRADES OR REHABILITATION.

4. THIS STANDARD APPLIES TO CONUS AND OCONUS LOCATIONS, UNLESS OTHERWISE INDICATED. WHERE THE TERMS LOCAL, STATE, OR FEDERAL ARE USED, THIS SHALL ALSO 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 G.03 AND G.04 ARE DESIGNER NOTES.

2. FOR THE PURPOSES OF THIS STANDARD, WHEN A TANK SIZE IS GIVEN, THAT TERM SHALL MEAN NOMINAL TANK SIZE, WHICH IS DEFINED AS THE VOLUME BETWEEN THE LOW LEVEL AND THE HIGH LEVEL ALARMS OF THE TANK. SEE TABLE 1 ON SHEET C.01.

3. THE TANK DESIGN DETAILS SHALL BE USED AS PROVIDED UNLESS THERE ARE SPECIFIC CONDITIONS (SAFETY OR ENVIRONMENTAL RELATED) THAT WARRANT A MODIFICATION. ANY MODIFICATION SHALL BE APPROVED BY SERVICE HEADQUARTERS.

4. THESE DRAWINGS ARE NOT CONSTRUCTION DRAWINGS. THE ENGINEER OF RECORD MUST INCLUDE APPURTENANCES AND ADDRESS OTHER ISSUES INCLUDING, BUT NOT LIMITED TO, AFFF, HIGH-POINT VENTS, LOW-POINT DRAINS, COATINGS, AND ELECTRICAL CODES. THE ENGINEER OF RECORD MUST ALSO SELECT THE APPLICABLE DRAWINGS AND DETAILS BASED UPON A SITE SPECIFIC INVESTIGATION AND DESIGN IN ACCORDANCE WITH THE FOLLOWING UNIFIED FACILITIES CRITERIA:

   UFC 3-301-01 STRUCTURAL ENGINEERING
   UFC 3-460-01 DESIGN: PETROLEUM FUEL FACILITIES
   UFC 3-600-01 FIRE PROTECTION ENGINEERING FOR FACILITIES

   THE INFORMATION SHOULD BE INCLUDED IN THE CONSTRUCTION DOCUMENTS PREPARED BY THE ENGINEER OF RECORD.

5. THIS STANDARD DOES NOT INCLUDE FINAL DETAILS FOR THE STRUCTURAL DESIGN OF THE TANK AND ITS APPURTENANCES. THE STRUCTURAL DESIGN ITEMS (FOUNDATION, TANK SHELL PLATE THICKNESSES, ROOF SUPPORT STRUCTURE, WIND GIRDERS, TANK ANCHORAGE, ORIENTATION OF THE NOZZLES AND MANHOLES, ETC), ARE SITE SPECIFIC AND CAN ONLY BE DETERMINED BY THE ENGINEER OF RECORD.

6. TANK DESIGN SHALL BE IN ACCORDANCE WITH API STANDARD 650, EXCEPT WHERE IT CONFLICTS WITH THIS STANDARD; IN THOSE CASES THIS STANDARD WILL GOVERN.

7. TANK FOUNDATION DESIGN SHALL BE IN ACCORDANCE WITH API STANDARD 650, EXCEPT WHERE IT CONFLICTS WITH THIS STANDARD; IN THOSE CASES THIS STANDARD WILL GOVERN. A GEOTECHNICAL REPORT SHALL BE REQUIRED FOR EVERY TANK FOUNDATION DESIGN. TANK FOUNDATION DESIGN SHALL, AT A MINIMUM, INCORPORATE A RINGWALL, AND SHALL EXCEED THAT MINIMUM WHEN REQUIRED BY THE GEOTECHNICAL REPORT.

8. MODIFY THE TANK HEIGHT AS REQUIRED WHERE THE SITE IS NEAR A FLIGHT LINE AND THE HEIGHT CONFLICTS WITH AVIATION FLIGHT LINE GUIDELINES AND REQUIREMENTS. RECALCULATE THE DIAMETER TO KEEP THE SAME USABLE VOLUME.

9. THE GOVERNMENT SHALL DETERMINE PRIOR TO DESIGN IF THE FACILITY HAS, OR WILL INCORPORATE, AN AUTOMATED FUEL HANDLING EQUIPMENT (AFHE) CONTROL SYSTEM. THE TYPE OF INSTRUMENTATION AND THE SEQUENCE OF OPERATION VARIES DEPENDING ON THE TYPE OF CONTROL SYSTEM.

10. ENSURE THAT THE DESIGN, INCLUDING THE LEVEL ALARM SETTINGS, LEVEL ALARM LOCATIONS, AND THE MATERIAL OF SECONDARY CONTAINMENT, COMPLIES WITH LOCAL, STATE, AND FEDERAL CODES AND REGULATIONS.

11. ENSURE THAT THE DESIGN COMPLIES WITH LOCAL, STATE, AND FEDERAL CODES AND REGULATIONS FOR AIR QUALITY. AT CERTAIN LOCATIONS THIS MAY REQUIRE THE TANK ROOF VENT BE FITTED WITH A PRESSURE VACUUM VENT, ESPECIALLY FOR TANKS WITHOUT FLOATING PANS, BUT ALSO, LESS OFTEN, FOR TANKS WITH FLOATING PANS.

12. SERVICE HEADQUARTERS IS DEFINED IN UFC 3-460-01 DESIGN: PETROLEUM FUEL FACILITIES.

13. INTERPRETATIONS, WAIVER, AND EXEMPTIONS, SHALL BE ADDRESSED USING THE WAIVERS AND EXEMPTIONS PROCESS DESCRIBED IN UFC 3-460-01. SERVICE HEADQUARTERS SHALL BE INVOLVED IN THE APPROVAL PROCESS.

C. DESIGN PARAMETERS/LIMITS:

THE FOLLOWING DESIGN PARAMETERS/LIMITS SHALL BE CONSIDERED BY THE ENGINEER OF RECORD AND SHALL BE INDICATED AS SUCH BY THE ENGINEER OF RECORD IN THE CONSTRUCTION DOCUMENTS IN ORDER TO CONSTRUCT THE TANK IN ACCORDANCE WITH API STANDARD 650, UFC 3-301-01 STRUCTURAL ENGINEERING, AND ASCE 7:

RISK CATEGORY IV
WIND SPEED
SNOW LOAD
Ss AND S1 SEISMIC SPECTRAL ACCELERATIONS
FUEL TYPE
SPECIFIC GRAVITY OF FUEL
DESIGN METAL TEMPERATURE
CORROSION ALLOWANCE

D. SPECIFICATIONS:

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

   UFGS 01 33 00 SUBMITTAL PROCEDURES
   UFGS 01 33 23.33 AVIATION FUEL SYSTEM SPECIFIC SUBMITTAL REQUIREMENTS
   UFGS 01 45 00.00 20 QUALITY CONTROL
   UFGS 01 78 23.33 OPERATION AND MAINTENANCE MANUALS FOR AVIATION FUEL SYSTEMS
   UFGS 05 50 13 MISCELLANEOUS METAL FABRICATIONS
   UFGS 09 97 13.15 LOW VOC POLYSULFIDE INTERIOR COATING OF WELDED STEEL PETROLEUM FUEL TANKS
   UFGS 09 97 13.27 EXTERIOR COATING OF STEEL STRUCTURES
   UFGS 23 03 00.00 20 BASIC MECHANICAL MATERIALS AND METHODS
   UFGS 26 00 00.00 20 BASIC ELECTRICAL MATERIALS AND METHODS
   UFGS 26 42 19.00 20 CATHODIC PROTECTION BY IMPRESSED CURRENT
   UFGS 32 01 19 FIELD MOLDED SEALANTS FOR SEALING JOINTS IN RIGID PAVEMENTS
   UFGS 32 13 15.20 CONCRETE PAVEMENT FOR CONTAINMENT DIKES
   UFGS 33 01 50.01 CLEANING FUEL STORAGE TANKS
   UFGS 33 40 00 STORM DRAINAGE UTILITIES
   UFGS 33 52 43.11 AVIATION FUEL MECHANICAL EQUIPMENT
   UFGS 33 52 43.13 AVIATION FUEL PIPING
   UFGS 33 52 43.14 AVIATION FUEL CONTROL VALVES
   UFGS 33 52 43.23 AVIATION FUEL PUMPS
   UFGS 33 52 43.28 FILTER SEPARATOR, AVIATION FUELING SYSTEM
   UFGS 33 56 13.13 STEEL TANKS WITH FIXED ROOFS
   UFGS 33 56 13.15 UNDERTANK INTERSTITIAL SPACE
   UFGS 33 56 63 FUEL IMPERMEABLE LINER SYSTEM

UFGS 33 40 00 STORM DRAINAGE UTILITIES SHALL BE EDITED TO SPECIFY ASTM A746 DUCTILE IRON GRAVITY SEWER PIPE AND FUEL RESISTANT DIP JOINT GASKETS.

E. NOTES:

1. ALL MATERIALS SHALL BE CARBON STEEL, UON.

2. BOTTOM PLATES SHALL BE 5/16"; ROOF PLATES SHALL BE A MINIMUM OF 1/4". A CORROSION ALLOWANCE OF 1/16" IS INCLUDED IN THESE THICKNESSES. PROVIDE CORROSION ALLOWANCE OF 1/16" FOR ALL SHELL AND COMPONENTS.

3. REQUIRE SLIP-RESISTANT COATING ON THE ROOF AT THE SAMPLE GAUGE WELL, THE ROOF MANHOLE, AND OTHER AREAS AS REQUESTED BY THE FACILITY.

4. ADD AVIATION OBSTRUCTION LIGHTS WHERE REQUIRED IN ACCORDANCE WITH FEDERAL AVIATION ADMINISTRATION AC 70/7460-1K, OBSTRUCTION MARKING AND LIGHTING (LATEST EDITION).

5. ROUTE ALL PIPING, TUBING AND CONDUITS FOR THE LLS, LLLS, HLS, HHLS, AND HLV FLOAT PILOT TOGETHER ON THE SAME SUPPORT. VERTICAL ROUTING UP THE TANK SHELL TO THE HLV FLOAT PILOT, HLS, AND HHLS SHALL BE ON THE SAME SUPPORT AND SHALL BE STRAIGHT UP AND THROUGH THE OPENING IN THE INTERMEDIATE PLATFORM. HORIZONTAL ROUTING BELOW INTERMEDIATE PLATFORM SHALL BE ALONG THE SIDE OF THE CONCRETE RING WALL, NOT ON THE TOP. DO NOT INTERFERE WITH ACCESS TO THE TANK CIRCUMFERENTIAL STAIRWAY. SUPPORT LEVEL SWITCHES AND HLV FLOAT PILOT CHAMBER ON SHELL AS INDICATED.

6. MOUNT HLV FLOAT PILOT CHAMBER AND HLS CHAMBER ON THE SHELL AND MAKE THEM ACCESSIBLE FROM THE INTERMEDIATE PLATFORM. PROVIDE AS INDICATED AND IN ACCORDANCE WITH UFGS 33 52 43.14. ARRANGE HLV FLOAT PILOT CHAMBER, LLS CHAMBER, HLS CHAMBER, AND ASSOCIATED SHELL SUPPORTED PIPING, FITTINGS, VALVES, AND CONDUIT SUCH THAT A 4" MINIMUM CLEARANCE WILL BE MAINTAINED FROM THE SHELL, AND SUCH ITEMS SHALL NOT EXTEND MORE THAN 1'-6" FROM SHELL.

7. IN CORROSIVE ENVIRONMENTS, AS DETERMINED BY SERVICE HEADQUARTERS: ALL PIPING, VALVES, AND FITTINGS OUTSIDE THE TANK SHALL BE STAINLESS STEEL EXCEPT FOR THE DBB VALVES, THE TANK FILL LINE, THE TANK ISSUE LINE, THE TANK LOW SUCTION LINE, AND THE PIPING TO THE SIDESTREAM FILTRATION SYSTEM, WHICH SHALL BE INTERIOR AND EXTERIOR COATED CARBON STEEL. PROVIDE STAINLESS STEEL HLV FLOAT PILOT CHAMBER, LEVEL SWITCH HOUSINGS, PROBE HOLDERS, AND ASSOCIATED PIPING, FITTINGS, VALVES, AND CONNECTIONS FOR HLV FLOAT PILOT AND LEVEL SWITCHES. CORROSIVE ENVIRONMENT (WET, COASTAL) - AS DEFINED BY SERVICE HEADQUARTERS.

8. IN NON-CORROSIVE ENVIRONMENTS, AS DEFINED BY SERVICE HEADQUARTERS: ALL PIPING, VALVES, AND FITTINGS 2.5" AND LARGER SHALL BE INTERIOR AND EXTERIOR COATED CARBON STEEL. ALL PIPING, VALVES (EXCEPT DBB VALVES), AND FITTINGS 2" AND SMALLER SHALL BE STAINLESS STEEL. PROVIDE STAINLESS STEEL HLV FLOAT PILOT CHAMBER, LEVEL SWITCH HOUSINGS, PROBE HOLDERS, AND ASSOCIATED PIPING, FITTINGS, VALVES, AND CONNECTIONS FOR HLV FLOAT PILOT AND LEVEL SWITCHES.

9. UNLESS OTHERWISE INDICATED, ALL PIPING AND FITTINGS INSIDE THE TANK SHALL BE INTERIOR AND EXTERIOR COATED CARBON STEEL, EXCEPT FOR PIPING 2.5" AND SMALLER, WHICH SHALL HAVE AN UNCOATED INTERIOR. MATERIALS FOR STILLING WELLS AND LADDERS SHALL BE AS INDICATED.

10. ALL END CONNECTIONS FOR VALVES, EQUIPMENT, PIPE, AND FITTINGS, INCLUDING PIPING FOR THE WATER DRAW-OFF SYSTEM, SIDESTREAM FILTRATION SYSTEM, DRAINS, THERMAL RELIEFS, HLV FLOAT PILOT CHAMBER, AND LEVEL SWITCHES SHALL BE WELDED OR FLANGED EXCEPT AS INDICATED: PIPING AND FITTINGS 2.5" AND LARGER SHALL BE BUTTWELDED. PIPING AND FITTINGS 2" AND SMALLER MAY BE BUTTWELDED OR SOCKETWELDED. THREADED CONNECTIONS SHALL NOT BE ALLOWED EXCEPT WHERE WELDED OR FLANGED CONNECTIONS TO APPURTENANCES ARE NOT AVAILABLE (IE, PRESSURE GAUGES, FUEL SAMPLE CONNECTIONS, LEVEL SWITCH PROBES, HLV FLOAT PILOT CHAMBER, ETC).

11. ORIENT MOTORIZED ACTUATORS, WHEN PROVIDED, WITH MOTOR HANGING DOWN, HAND WHEEL FACING UP AND LOCAL CONTROLS FACING AWAY FROM TANK SHELL.

12. PROVIDE HIGH-POINT VENTS AND LOW-POINT DRAINS ON PIPING IN ACCORDANCE WITH UFC 3-460-01.

13. COAT ALL CARBON STEEL SURFACES IN ACCORDANCE WITH UFC 3-460-01 AND THE FOLLOWING UFGS SPECIFICATION SECTIONS: COAT EXTERNAL CARBON STEEL SURFACES IN ACCORDANCE WITH UFGS SECTION 09 97 13.27; COAT INTERIOR CARBON STEEL SURFACES OF NAVY TANKS IN ACCORDANCE WITH UFGS SECTION 09 97 13.15: COAT INTERIOR CARBON STEEL SURFACES OF ALL OTHER TANKS IN ACCORDANCE WITH UFGS SECTION 09 97 13.17.

14. PROVIDE AND INSTALL ALL MATERIAL IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS AND RECOMMENDATIONS.

15. 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 DRAW-OFF SYSTEM. INCLUDE INSTRUCTIONS TO THE OPERATOR TO TURN OFF THE WATER DRAW-OFF SYSTEM AND SIDESTREAM FILTRATION SYSTEM PUMPS AND TO CLOSE RELATED ISOLATION VALVES BEFORE RECEIVING FUEL. THE INSTRUCTIONS SHOULD BE LOCATED ON A STAINLESS STEEL PLACARD ATTACHED TO THE WATER DRAW-OFF SYSTEM PRODUCT SAVER TANK AND THE SIDESTREAM FILTRATION SYSTEM FILTER/SEPARATOR.

16. THERE ARE TWO POSSIBLE TANK FOUNDATION TYPES: A TANK SIGNIFICANTLY ELEVATED ENSURING THAT EVERY PORTION OF THE TANK BOTTOM UNDERSIDE (INCLUDING THE SUMP) IS ELEVATED ABOVE GRADE AND OUT OF GROUNDWATER (THIS REDUCES RISK OF BOTTOMSIDE CORROSION), AND A TANK ELEVATED 12" ABOVE GRADE WHERE GROUNDWATER CONTACT WITH THE TANK BOTTOM UNDERSIDE IS NOT AS MUCH A CONCERN. THE ELEVATED TANK IS THE TYPE INDICATED ON DRAWING C.01 AND THROUGHOUT THE TANK DETAIL SHEETS. THE TANK DESIGNS ARE SIMILAR; THE PRIMARY DIFFERENCE IS AS INDICATED BY DETAILS ON DRAWING D.01 AND D.02. SERVICE HEADQUARTERS APPROVAL IS REQUIRED FOR USING EITHER TYPE.

17. FOR BOTH ELEVATED AND NON-ELEVATED TANK FOUNDATIONS THERE ARE FOUR TYPES OF POSSIBLE FOUNDATION DESIGNS: RINGWALL WITH FOOTER; RINGWALL WITHOUT FOOTER; RINGWALL WITH SLAB MAT FOUNDATION; AND RINGWALL WITH SLAB MAT FOUNDATION, PILE SUPPORTED. IF ONE OF THE LATTER TWO TYPES ARE USED, SEE DETAIL 5/D.04.

18. UNLESS SPECIFICALLY DIRECTED WHERE TO PLACE AUDIBLE AND VISUAL ALARMS, REVIEW FACILITY SIZE AND OPERATING METHOD TO DETERMINE THE MOST DESIRABLE LOCATION; THIS WILL USUALLY BE OUT IN THE TANK FARM AND IN THE OPERATIONS BUILDING WHERE THE ALARM/CONTROL PANELS ARE LOCATED. WHERE MOUNTED REMOTE FROM THE TANK, CONSIDER ADDITIONAL LOCAL ALARM PANELS WHICH PROVIDE AUDIBLE AND VISUAL ALARMS TO WARN PERSONNEL IN THE IMMEDIATE VICINITY OF THE TANKS. CONSIDER MAKING ALL ALARMS AUDIBLE AT ALL LOCATIONS IN THE TANK FARM. AT A MINIMUM, PROVIDE AUDIBLE AND VISUAL ALARMS AT THE LOCATIONS WHERE OTHER ALARMS AND PANELS ARE LOCATED AND OUTSIDE IN THE FUEL FARM.

19. PLACE EMERGENCY FUEL SHUT-OFF (EFSO) PUSHBUTTON STATIONS WHERE DIRECTED AND IN ACCORDANCE WITH UFC 3-460-01.

20. PROVIDE OVERFILL PROTECTION WITH A HYDRAULICALLY OPERATED DIAPHRAGM CONTROL VALVE (HLV). WHERE DIRECTED, MAKE THE DOUBLE BLOCK AND BLEED (DBB) PLUG VALVE ON THE TANK RECEIPT LINE A MOTOR OPERATED VALVE (MOV). CONSIDER THE EFFECTS OF VALVE SHUTDOWN ON PIPELINE SURGING, ESPECIALLY TANKS CONNECTED TO OFF-BASE PIPELINES OR MARINE OFFLOAD SYSTEMS. SEE UFC 3-460-01 FOR GUIDANCE.

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DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS
ABOVEGROUND VERTICAL STEEL

GENERAL NOTES

SCALE: AS NOTED
EPROJECT NO.: XXXXX
CONSTR. CONTR. NO. XXXXX
NAVFAC DRAWING NO. XXXXX
SHEET 3 OF 57

G.03

DRAWFORM REVISION: 10 MAY 2014

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. THERFORE, 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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DES	MSO	DRW	MHK	CHK	WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

GENERAL NOTES

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

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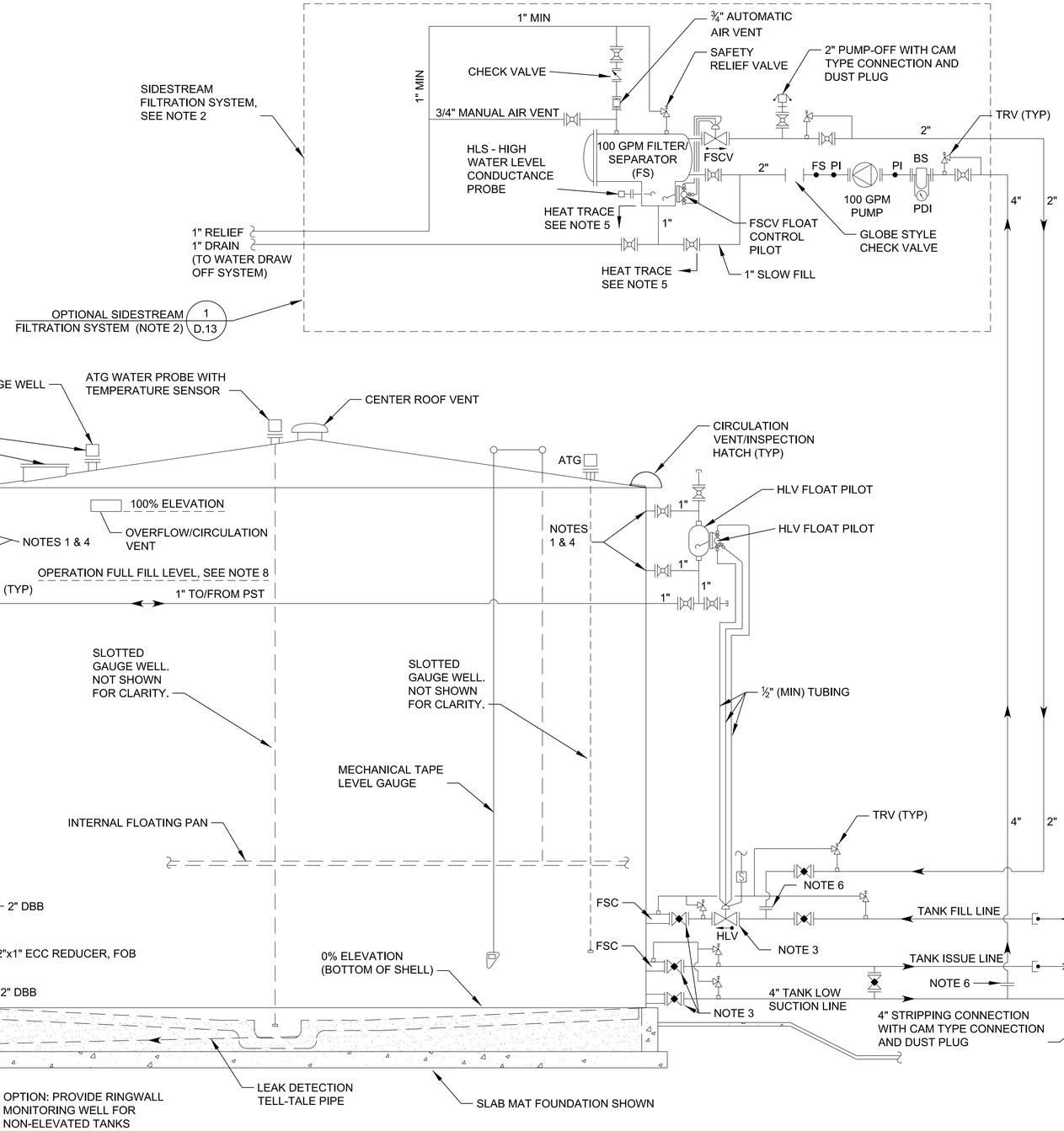
G.04

DRAWFORM REVISION 10 MAY 2014

NOTES:

1. SEE DESIGNER NOTES, SEQUENCE OF OPERATION, AND LEVEL SET POINT TABLE FOR LEVEL SWITCHES AND HLV SETPOINT ELEVATIONS.
2. PROVIDE A WATER DRAW-OFF SYSTEM. AS AN OPTION, PROVIDE, IN ADDITION, A SIDESTREAM FILTRATION SYSTEM, SEE NOTE E15, SHT G.03.
3. PROVIDE LIMIT SWITCHES ON THE TANK FILL LINE DBB, TANK ISSUE LINE DBB, 4" LOW SUCTION LINE DBB, AND HLV. AS AN OPTION, PROVIDE DBBs LISTED HERE WITH MOTOR OPERATORS WITH LIMIT SWITCHES (ONLY WHEN APPROVED BY SERVICE HEADQUARTERS); HLV RETAINS ITS LIMIT SWITCH IN THIS CASE.
4. HLS AND HHLS CHAMBER AND HLV CONTROL FLOAT CHAMBER SHALL SHARE COMMON TANK NOZZLES AS INDICATED ON DETAILS; THEY ARE SHOWN SEPARATED HERE FOR CLARITY. MOUNT PIPING AND TUBING TO HLS CHAMBER AND HLV 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.



FUEL STORAGE TANK DIAGRAM

SCALE: NONE

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

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DES	DRW	CHK
MSO	MHK	WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

INSTRUMENTATION & CONTROL DIAGRAM

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 5 OF 57

G.05

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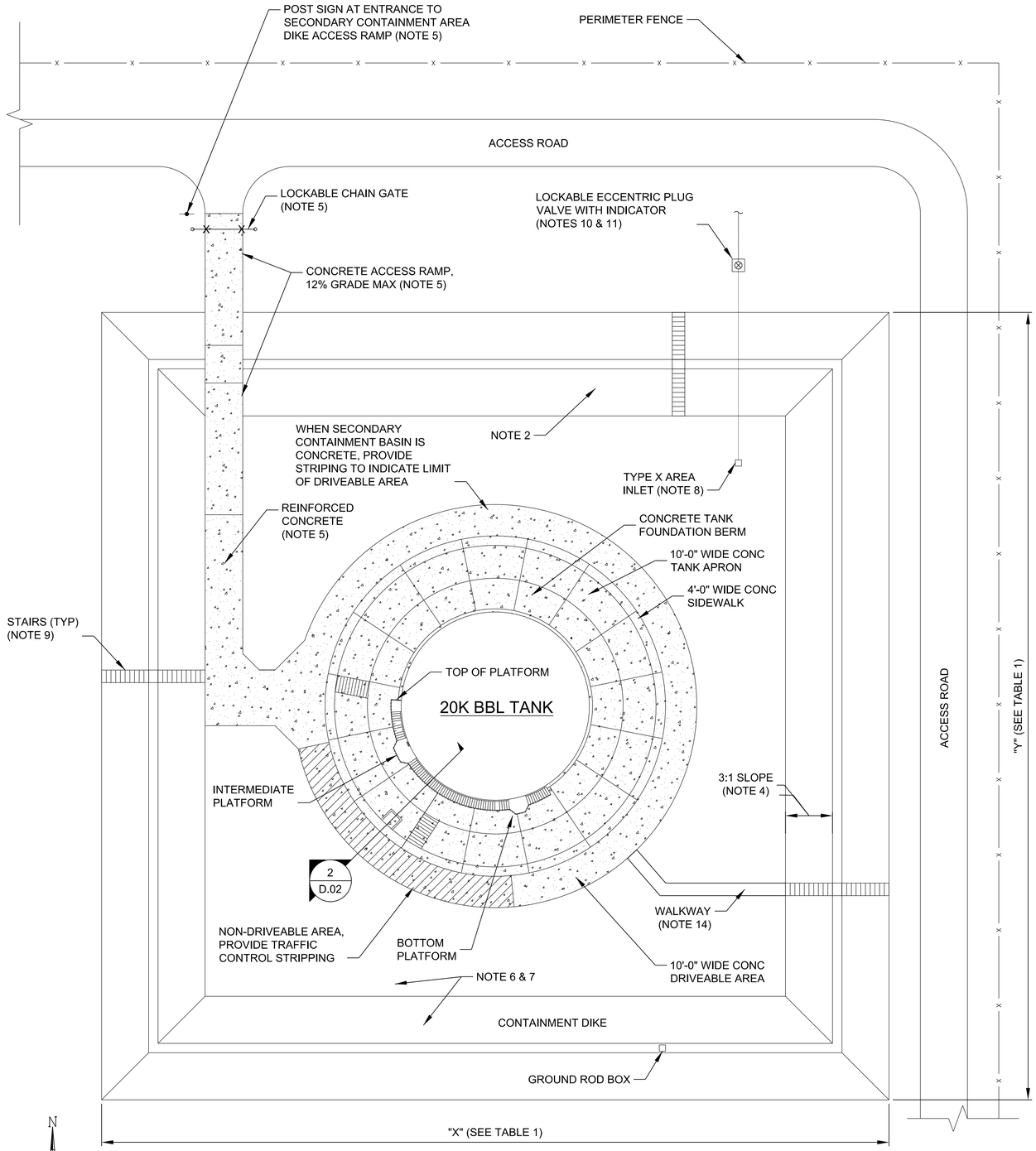

TYPICAL SITE PLAN

SCALE: 1"=20'-0"

0 10' 20' 40'

DESIGNER NOTES:

1. SITE PLAN SHOWN IS A TYPICAL 20K BBL TANK WITH A MOUNDED TANK FOUNDATION AND IS PROVIDED FOR GENERAL PLANNING PURPOSES ONLY. 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 5'-0" HIGH TRAPEZOIDAL DIKE BERM INCLUDING 1'-0" OF FREEBOARD. THE DIKE SLOPES INDICATED ARE 3 TO 1. THE DIKE HEIGHT AND SLOPES SHOWN HERE ARE NOT STANDARD BUT ONLY AN ASSUMED DIKE HEIGHT TO ALLOW FLEXIBILITY IN PLANNING.
3. GROUPS OF TANKS, WITH NO TANK LARGER THAN 10K BBLs AND NOT EXCEEDING 15K BBLs IN AGGREGATE CAPACITY, MAY BE ENCLOSED IN A SINGLE DIKED CONTAINMENT ENCLOSURE. SUBDIVIDE EACH DIKED CONTAINMENT ENCLOSURE CONTAINING TWO OR MORE TANKS BY INTERMEDIATE WALLS OR DIKES NO LESS THAN 18" IN HEIGHT TO PROVIDE A SEPARATE DRAINAGE AREA FOR EACH TANK. SEE SHEET CD.08 FOR INTERMEDIATE WALL DETAIL. SEE UFC 3-460-01 FOR DETAILED REQUIREMENTS.
4. UNSURFACED AND AGGREGATE SURFACED DIKES SHALL BE SLOPE AT NO GREATER THAN 3 TO 1. CONCRETE SURFACED DIKES HAVE A PREFERRED MAXIMUM SLOPE OF 2.5 TO 1, WITH AN ABSOLUTE MAXIMUM OF 2 TO 1 WHEN SPACE IS RESTRICTED. A 3'-0" FLAT SURFACE IS REQUIRED ON THE TOP OF THE TRAPEZOIDAL DIKES. THE MAXIMUM ALLOWABLE DIKE HEIGHT IS 6'-0". UFC 3-460-01 REQUIRES 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 UFC 3-460-01, 29 CFR 1910.106, NFPA 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 (I.E. CHAIN GATE) AND A SIGN. THE SIGN SHOULD READ: "ACCESS IS RESTRICTED TO AUTHORIZED VEHICLES ONLY. VEHICLES MUST BE LIGHT-DUTY AND RATED FOR USE IN CLASS 1, DIVISION 2 HAZARDOUS LOCATIONS". DESIGN DIKE ACCESS RAMPS AND BASIN/FLOOR TO WITHSTAND 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 FLEXIBLE MEMBRANE LINER (FML) PER UFGS SECTION 33 56 63 FUEL IMPERMEABLE LINER SYSTEM. A 60 MIL HIGH DENSITY POLYETHYLENE (HDPE) LINER MAY BE USED IF THE LINER IS COMPLETELY COVERED WITH CONCRETE. BALLAST MATERIAL NEEDS TO BE PROVIDED TO PREVENT WIND UPLIFT DAMAGE TO THE LINER. BALLAST MATERIALS INCLUDE CONCRETE SURFACING, SMOOTH RIVER ROCK, SAND TUBES, AND PRECAST CONCRETE BLOCKS. WIND UPLIFT CALCULATIONS ARE REQUIRED WHEN ANY PORTION OF THE FML IS EXPOSED. SEE UFGS SECTION 33 56 63 FOR FURTHER GUIDANCE.
7. CONCRETE DIKE SURFACING SHALL BE PER UFGS SECTION 32 13 15.20 CONCRETE PAVEMENT FOR CONTAINMENT DIKES. THE CONCRETE SHALL BE REINFORCED WITH SYNTHETIC FIBERS. LOCATE CONTROL JOINTS NO GREATER THAN 10 FEET APART AND SEAL THE JOINTS USING FUEL RESISTANT JOINT SEALANT (NON-SAG ON THE SLOPES). SEE SHEET C.04 FOR A TYPICAL JOINT LAYOUT PLAN.
8. SLOPE DIKE BASIN SURFACES A MINIMUM OF 1% FOR DRAINAGE. DRAINAGE SWALES SHOULD BE SLOPED NO FLATTER THAN 0.5% TO THE DRAINAGE INLET. SEE SHEET CD.09 FOR INLET DETAILS.
9. 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 SHEETS CD.06 & CD.07.
10. CONSTRUCT A CONTAINMENT DRAIN LINE FROM THE DRAINAGE INLET TO THE CONTAINMENT DRAIN VALVE USING DUCTILE IRON PIPING. A NORMALLY CLOSED, LOCKABLE ECCENTRIC PLUG VALVE SHALL BE PROVIDED TO CONTROL DRAINAGE AND MUST BE ACCESSIBLE DURING A FIRE. SEE DETAILS ON SHEET CD.09.
11. DO NOT USE BURIED CONTAINMENT DRAIN VALVES IN CLIMATES WITH LOWEST ONE-DAY MEAN TEMPERATURE BELOW -15°F PER API STANDARD 650 FIGURE 4.2. PROVIDE MEANS TO CONTROL DRAINAGE THAT WILL NOT NORMALLY REMAIN FROZEN AFTER THAW OF SECONDARY CONTAINMENT CONTENTS. CONTAINMENT DRAIN VALVE OR OTHER CONTROL MEANS, WHEN PROVIDED, SHALL BE LOCKABLE.
12. 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 300 FT IN LENGTH. FIRE HYDRANTS MUST BE ACCESSIBLE TO FIRE DEPARTMENT PUMPER VEHICLES.
13. FOR A TYPICAL PIPING LAYOUT PLAN SEE SHEET C.05.
14. FOR EXPOSED GEOMEMBRANES, SKID-RESISTANT WALKWAYS SHOULD BE PROVIDED AT EXPECTED FOOT TRAFFIC PATHS, INCLUDING THE TOP OF THE DIKES. SEE UFGS SECTION 33 56 63 FUEL IMPERMEABLE LINER SYSTEM FOR MATERIALS.

TABLE 1

NOMINAL TANK SIZE (K BBL)*	NOMINAL DIAMETER (FT)	NOMINAL SHELL HEIGHT (FT)*	FLOWRATE FILL/ISSUE (GPM)	NOZZLE SIZE FILL/ISSUE (INCHES)	SHELL VOLUME (K BBL)***	USABLE VOLUME (K BBL)	LLLA VOLUME (BBL)**	SECONDARY CONTAINMENT DIMENSIONS (5' HIGH DIKES; 3:1 SLOPES)	
								"X" (FT)	"Y" (FT)
5	39	32	1200/1200	8"/12"	6.8	5.0	625	170	170
10	49	40	1200/3000	8"/16"	13.4	10.0	1175	210	210
20	61	48	1200/3000	8"/16"	25.0	20.0	1825	265	265
30	73	48	1200/3000	8"/16"	35.8	28.9	2675	305	305
40	89	48	7000/7000	18"/24"	53.2	41.1	5300	355	355
50	90	56	7000/7000	18"/24"	63.5	50.6	5425	380	380
80	113	56	7000/7000	18"/24"	100.1	80.1	8825	465	465
100	126	56	7000/7000	18"/24"	124.5	100.1	11150	515	515

* NOMINAL TANK SIZE = APPROXIMATE USABLE VOLUME = VOLUME FROM LLA TO HLA.
** APPROXIMATE VOLUME BETWEEN SUMP AND LLLA.
*** SHELL VOLUME = VOLUME INSIDE ALL OF THE SHELL.

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SATISFACTORY TO

DES: RLG | DRW: RLG | CHK: ELB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL SITE PLAN - MOUNDED TANK

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

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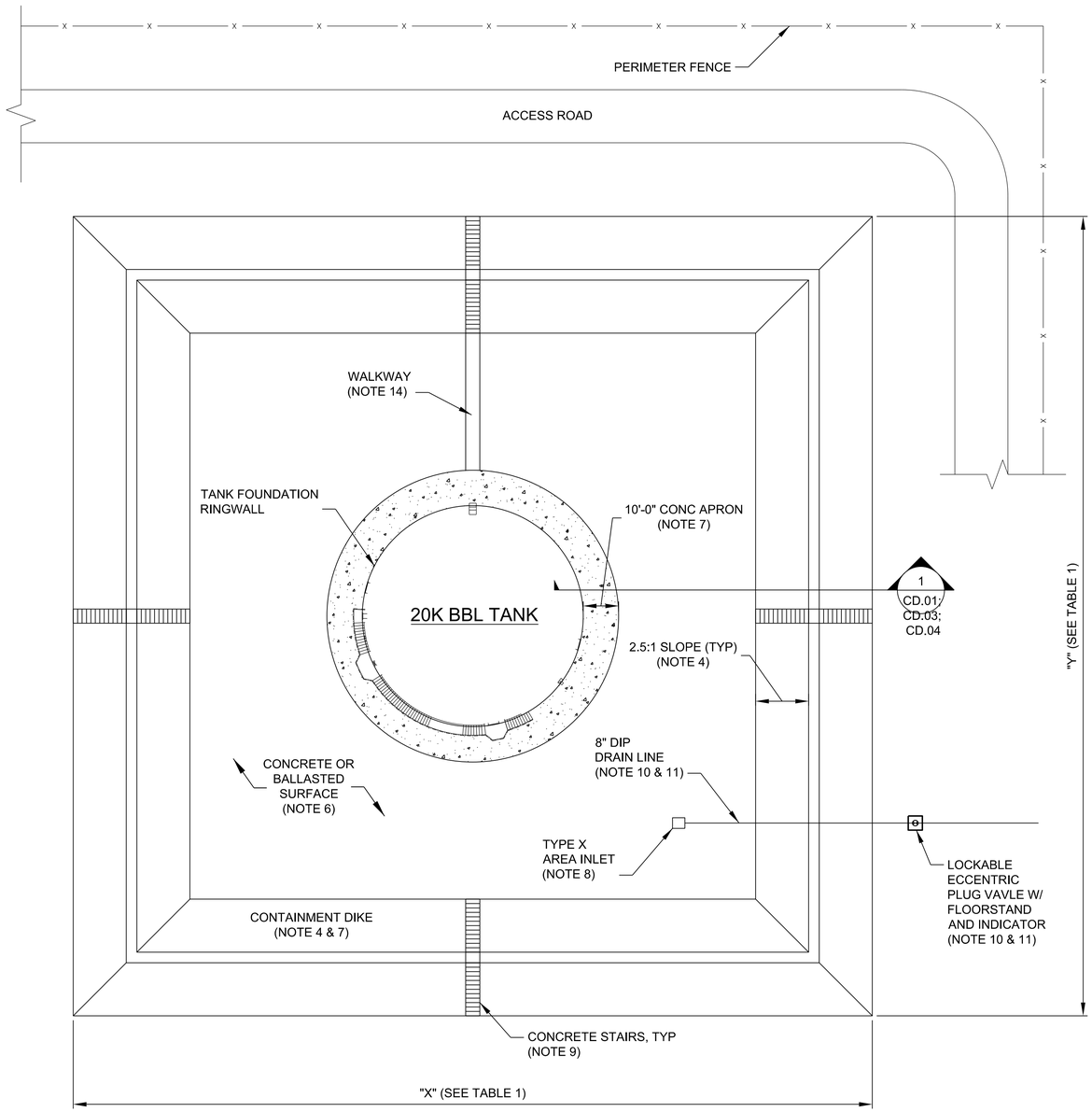
C.01

DRAWFORM REVISION: 10 MAY 2014



TYPICAL CONCRETE CONTAINMENT DIKE SITE PLAN

SCALE: 1"=20'-0"

0 10' 20' 40'

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DESIGNER NOTES:

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2. FOR PLANNING PURPOSES, THE SECONDARY CONTAINMENT AREA SIZE SHOWN HERE IS BASED UPON A 6'-0" (MAXIMUM ALLOWABLE) HEIGHT TRAPEZOIDAL DIKE BERM INCLUDING 1'-0" OF FREEBOARD WITH A SLOPE OF 2.5 TO 1. SEE UFC 3-460-01 FOR DETAILED DIKE AND CONTAINMENT REQUIREMENTS.
3. GROUPS OF TANKS, WITH NO TANK LARGER THAN 10K BBLs AND NOT EXCEEDING 15K BBLs IN AGGREGATE CAPACITY, MAY BE ENCLOSED IN A SINGLE DIKED CONTAINMENT ENCLOSURE. SUBDIVIDE EACH DIKED CONTAINMENT ENCLOSURE CONTAINING TWO OR MORE TANKS BY INTERMEDIATE WALLS OR DIKES NO LESS THAN 18" IN HEIGHT TO PROVIDE A SEPARATE DRAINAGE AREA FOR EACH TANK. SEE SHEET CD.08 FOR INTERMEDIATE WALL DETAIL.
4. UNSURFACED AND AGGREGATE SURFACED DIKES SHALL BE SLOPED NO GREATER THAN 3 TO 1. CONCRETE SURFACED DIKES HAVE A PREFERRED MAXIMUM SLOPE OF 2.5 TO 1, WITH AN ABSOLUTE MAXIMUM OF 2 TO 1 WHEN SPACE IS RESTRICTED. A 3'-0" FLAT SURFACE IS REQUIRED ON THE TOP OF THE TRAPEZOIDAL DIKES. THE MAXIMUM ALLOWABLE DIKE HEIGHT IS 6'-0". UFC 3-460-01 REQUIRES 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 UFC 3-460-01, 29 CFR 1910.106, NFPA 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 (I.E. CHAIN GATE) AND A SIGN. THE SIGN SHOULD READ: "ACCESS IS RESTRICTED TO AUTHORIZED VEHICLES ONLY. VEHICLES MUST BE LIGHT-DUTY AND RATED FOR USE IN CLASS 1, DIVISION 2 HAZARDOUS LOCATIONS". DESIGN DIKE ACCESS RAMPS AND BASIN/FLOOR TO WITHSTAND 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 FLEXIBLE MEMBRANE LINER (FML) PER UFGS SECTION 33 56 63 FUEL IMPERMEABLE LINER SYSTEM. A 60 MIL HIGH DENSITY POLYETHYLENE (HDPE) LINER MAY BE USED IF THE LINER IS COMPLETELY COVERED WITH CONCRETE. BALLAST MATERIAL NEEDS TO BE PROVIDED TO PREVENT WIND UPLIFT DAMAGE TO THE LINER. BALLAST MATERIALS INCLUDE CONCRETE SURFACING, SMOOTH RIVER ROCK, SAND TUBES, AND PRECAST CONCRETE BLOCKS. WIND UPLIFT CALCULATIONS ARE REQUIRED WHEN ANY PORTION OF THE FML IS EXPOSED. SEE UFGS SECTION 33 56 63 FOR FURTHER GUIDANCE.
7. CONCRETE DIKE SURFACING SHALL BE PER UFGS SECTION 32 13 15.20 CONCRETE PAVEMENT FOR CONTAINMENT DIKES. THE CONCRETE SHALL BE REINFORCED WITH SYNTHETIC FIBERS. LOCATE CONTROL JOINTS NO GREATER THAN 10 FEET APART AND SEAL THE JOINTS USING FUEL RESISTANT JOINT SEALANT (NON-SAG ON THE SLOPES). SEE SHEET C.04 FOR A TYPICAL JOINT LAYOUT PLAN. AT A MINIMUM, ALL (NON-MOUNDED) AST CONTAINMENT BASINS SHALL HAVE A CONCRETE WORKING SURFACE AROUND THE PERIMETER OF THE TANK FOUNDATION NOT LESS THAN 10'-0" IN WIDTH. THIS PAVED AREA PROVIDES ADDED PROTECTION FOR THE UNDERLYING GEOMEMBRANE. THIS DESIGN FEATURE MAY BE MODIFIED WITH THE APPROVAL OF SERVICE HEADQUARTERS.
8. SLOPE DIKE BASIN SURFACES A MINIMUM OF 1% FOR DRAINAGE. DRAINAGE SWALES SHOULD BE SLOPED NO FLATTER THAN 0.5% TO THE DRAINAGE INLET. SEE SHEET CD.09 FOR INLET DETAILS.
9. 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 SHEETS CD.06 & CD.07.
10. CONSTRUCT A CONTAINMENT DRAIN LINE FROM THE DRAINAGE INLET TO THE CONTAINMENT DRAIN VALVE USING DUCTILE IRON PIPING. A NORMALLY CLOSED, LOCKABLE ECCENTRIC PLUG VALVE SHALL BE PROVIDED TO CONTROL DRAINAGE AND MUST BE ACCESSIBLE DURING A FIRE. SEE DETAILS ON SHEET CD.09.
11. DO NOT USE BURIED CONTAINMENT DRAIN VALVES IN CLIMATES WITH LOWEST ONE-DAY MEAN TEMPERATURE BELOW -15°F PER API STANDARD 650 FIGURE 4.2. PROVIDE MEANS TO CONTROL DRAINAGE THAT WILL NOT NORMALLY REMAIN FROZEN AFTER THAW OF SECONDARY CONTAINMENT CONTENTS. CONTAINMENT DRAIN VALVE OR OTHER CONTROL MEANS, WHEN PROVIDED, SHALL BE LOCKABLE.
12. 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 300 FT IN LENGTH. FIRE HYDRANTS MUST BE ACCESSIBLE TO FIRE DEPARTMENT PUMPER VEHICLES.
13. FOR A TYPICAL PIPING LAYOUT PLAN SEE SHEET C.05.
14. FOR EXPOSED GEOMEMBRANES, SKID-RESISTANT WALKWAYS SHOULD BE PROVIDED AT EXPECTED FOOT TRAFFIC PATHS, INCLUDING THE TOP OF THE DIKES. SEE UFGS SECTION 33 56 63 FUEL IMPERMEABLE LINER SYSTEM FOR MATERIALS.

TABLE 1

GENERAL TANK INFORMATION						SECONDARY CONTAINMENT DIMENSIONS (6' HIGH DIKES)			
						2.5:1 DIKE SLOPE		3:1 DIKE SLOPE	
NOMINAL TANK SIZE (K BBL)*	NOMINAL DIAMETER (FT)	NOMINAL SHELL HEIGHT (FT)*	SHELL VOLUME (K BBL)***	USABLE VOLUME (K BBL)	LLLA VOLUME (BBL)**	"X" (FT)	"Y" (FT)	"X" (FT)	"Y" (FT)
5	39	32	6.8	5.0	625	145	145	155	155
10	49	40	13.4	10.0	1175	180	180	190	190
20	61	48	25.0	20.0	1825	225	225	235	235
30	73	48	35.8	28.9	2675	255	255	265	265
40	89	48	53.2	41.1	5300	300	300	310	310
50	90	56	63.5	50.6	5425	325	325	335	335
80	113	56	100.1	80.1	8825	390	390	400	400
100	126	56	124.5	100.1	11150	430	430	440	440

* NOMINAL TANK SIZE = APPROXIMATE USABLE VOLUME = VOLUME FROM LLA TO HLA.
** APPROXIMATE VOLUME BETWEEN SUMP AND LLLA.
*** SHELL VOLUME = VOLUME INSIDE ALL OF THE SHELL.
**** DISTANCE IS MEASURED FROM THE OUTSIDE OF THE VERTICAL WALLS.

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NAVFAC

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

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FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES RLG | DRW RLG | CHK ELB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL SITE PLAN - NON-MOUNDED TANK

SCALE: AS NOTED

EPROJECT NO.: XXXXX

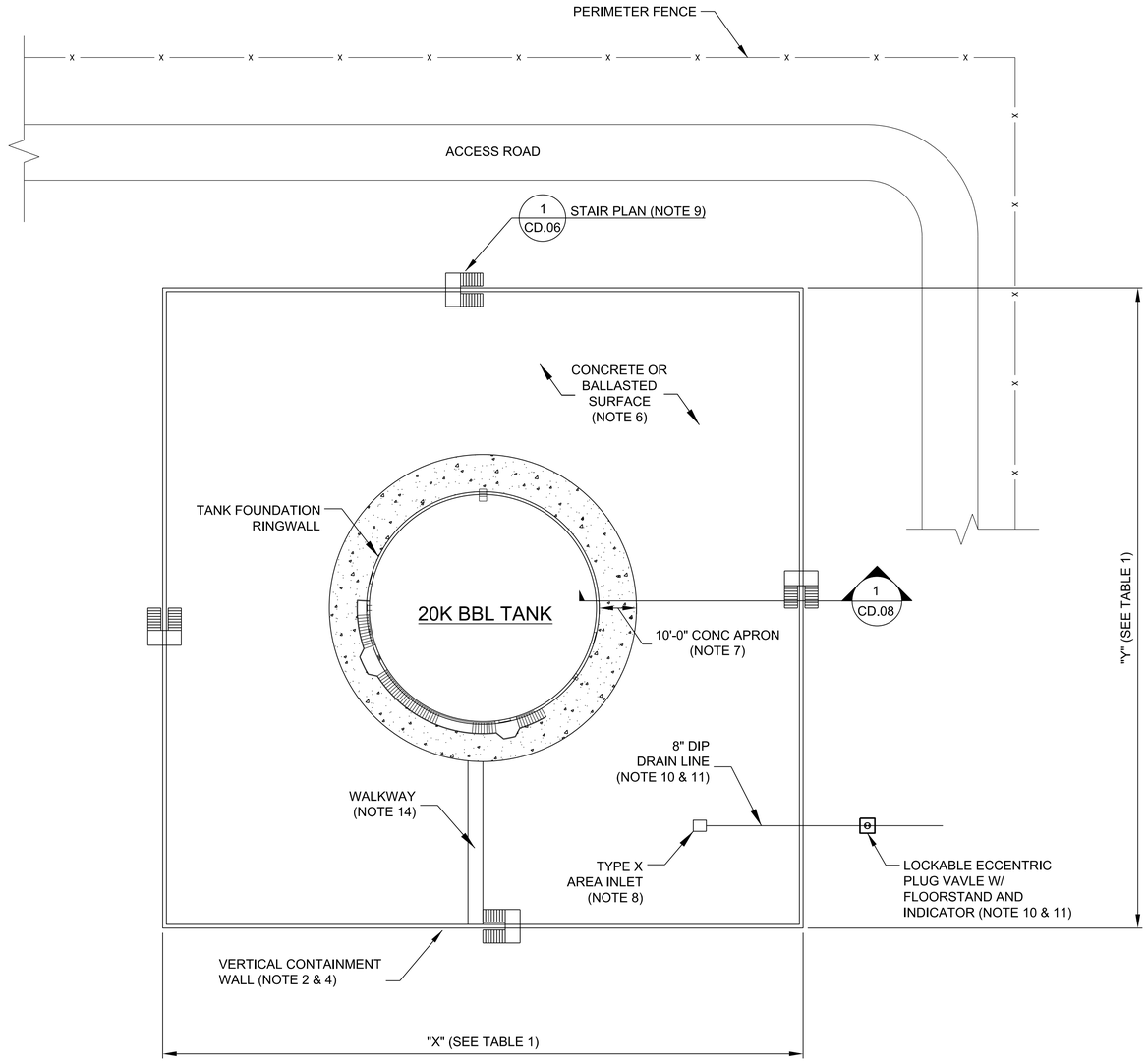
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 7 OF 57

C.02

DRAWFORM REVISION: 10 MAY 2014



TYPICAL VERTICAL CONTAINMENT WALL SITE PLAN

SCALE: 1"=20'-0"

0 10' 20' 40'

N

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 A 6'-0" (MAXIMUM ALLOWABLE) HEIGHT VERTICAL DIKE WALL INCLUDING 1'-0" OF FREEBOARD WITH A WALL THICKNESS OF 1'-0". SEE UFC 3-460-01 FOR DETAILED DIKE AND CONTAINMENT REQUIREMENTS.
3. GROUPS OF TANKS, WITH NO TANK LARGER THAN 10K BBLs AND NOT EXCEEDING 15K BBLs IN AGGREGATE CAPACITY, MAY BE ENCLOSED IN A SINGLE DIKED CONTAINMENT ENCLOSURE. SUBDIVIDE EACH DIKED CONTAINMENT ENCLOSURE CONTAINING TWO OR MORE TANKS BY INTERMEDIATE WALLS NO LESS THAN 18" IN HEIGHT TO PROVIDE A SEPARATE DRAINAGE AREA FOR EACH TANK. SEE SHEET CD.08 FOR INTERMEDIATE WALL DETAIL.
4. THE MAXIMUM ALLOWABLE WALL HEIGHT IS 6'-0". UFC 3-460-01 REQUIRES 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 UFC 3-460-01, 29 CFR 1910.106, NFPA 30 AND OTHER FEDERAL, STATE, COUNTY, AND LOCAL REGULATIONS.
5. NO VEHICLE ACCESS IS PERMITTED WHEN VERTICAL DIKE WALLS ARE UTILIZED.
6. SECONDARY CONTAINMENT SHALL BE PROVIDED BY A FUEL IMPERMEABLE LINER. THE LINER SHOULD BE A FLEXIBLE MEMBRANE LINER (FML) PER UFGS SECTION 33 56 63 FUEL IMPERMEABLE LINER SYSTEM. A 60 MIL HIGH DENSITY POLYETHYLENE (HDPE) LINER MAY BE USED IF THE LINER IS COMPLETELY COVERED WITH CONCRETE. BALLAST MATERIAL NEEDS 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 IF ANY PORTION OF THE FML IS EXPOSED. SEE UFGS SECTION 33 56 63 FOR FURTHER GUIDANCE.
7. CONCRETE DIKE SURFACING SHALL BE PER UFGS SECTION 32 13 15.20 CONCRETE PAVEMENT FOR CONTAINMENT DIKES. THE CONCRETE SHALL BE REINFORCED WITH SYNTHETIC FIBERS. LOCATE CONTROL JOINTS NO GREATER THAN 10 FEET APART AND SEAL THE JOINTS USING FUEL RESISTANT JOINT SEALANT (NON-SAG ON THE SLOPES). SEE SHEET C.04 FOR A TYPICAL JOINT LAYOUT PLAN. AT A MINIMUM, ALL (NON-MOUNDED) AST CONTAINMENT BASINS SHALL HAVE A CONCRETE WORKING SURFACE AROUND THE PERIMETER OF THE TANK FOUNDATION NOT LESS THAN 10'-0" IN WIDTH. THIS PAVED AREA PROVIDES ADDED PROTECTION FOR THE UNDERLYING GEOMEMBRANE. THIS DESIGN FEATURE MAY BE MODIFIED WITH THE APPROVAL OF SERVICE HEADQUARTERS.
8. SLOPE DIKE BASIN SURFACES A MINIMUM OF 1% FOR DRAINAGE. DRAINAGE SWALES SHOULD BE SLOPED NO FLATTER THAN 0.5% TO THE DRAINAGE INLET. SEE SHEET CD.09 FOR INLET DETAILS.
9. PROVIDE STEEL STAIRWAYS OVER THE DIKE WALLS. NO LESS THAN TWO DIKE STAIRWAYS SHALL BE PROVIDED OVER DIKE WALLS FOR EMERGENCY EGRESS. SEE DETAILS ON SHEET CD.07.
10. CONSTRUCT A CONTAINMENT DRAIN LINE FROM THE DRAINAGE INLET TO THE CONTAINMENT DRAIN VALVE USING DUCTILE IRON PIPING. A NORMALLY CLOSED, LOCKABLE ECCENTRIC PLUG VALVE SHALL BE PROVIDED TO CONTROL DRAINAGE AND MUST BE ACCESSIBLE DURING A FIRE. SEE DETAILS ON SHEET CD.09.
11. DO NOT USE BURIED CONTAINMENT DRAIN VALVES IN CLIMATES WITH LOWEST ONE-DAY MEAN TEMPERATURE BELOW -15°F PER API STANDARD 650 FIGURE 4.2. PROVIDE MEANS TO CONTROL DRAINAGE THAT WILL NOT NORMALLY REMAIN FROZEN AFTER THAW OF SECONDARY CONTAINMENT CONTENTS. CONTAINMENT DRAIN VALVE OR OTHER CONTROL MEANS, WHEN PROVIDED, SHALL BE LOCKABLE.
12. 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 300 FT IN LENGTH. FIRE HYDRANTS MUST BE ACCESSIBLE TO FIRE DEPARTMENT PUMPER VEHICLES.
13. FOR A TYPICAL PIPING LAYOUT PLAN SEE SHEET C.05.
14. FOR EXPOSED GEOMEMBRANES, SKID-RESISTANT WALKWAYS SHOULD BE PROVIDED AT EXPECTED FOOT TRAFFIC PATHS. SEE UFGS SECTION 33 56 63 FUEL IMPERMEABLE LINER SYSTEM FOR MATERIALS.

TABLE 1

GENERAL TANK INFORMATION						SECONDARY CONTAINMENT DIMENSIONS (6' HIGH DIKES)	
						VERTICAL CONTAINMENT WALLS	
NOMINAL TANK SIZE (K BBL)*	NOMINAL DIAMETER (FT)	NOMINAL SHELL HEIGHT (FT)*	SHELL VOLUME (K BBL)***	USABLE VOLUME (K BBL)	LLLA VOLUME (BBL)**	"X" (FT)****	"Y" (FT)****
5	39	32	6.8	5.0	625	90	90
10	49	40	13.4	10.0	1175	125	125
20	61	48	25.0	20.0	1825	170	170
30	73	48	35.8	28.9	2675	205	205
40	89	48	53.2	41.1	5300	250	250
50	90	56	63.5	50.6	5425	270	270
80	113	56	100.1	80.1	8825	340	340
100	126	56	124.5	100.1	11150	380	380

* NOMINAL TANK SIZE = APPROXIMATE USABLE VOLUME = VOLUME FROM LLA TO HLA.
** APPROXIMATE VOLUME BETWEEN SUMP AND LLLA.
*** SHELL VOLUME = VOLUME INSIDE ALL OF THE SHELL.
**** DISTANCE IS MEASURED FROM THE OUTSIDE OF THE VERTICAL WALLS.

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US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

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APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES RLG | DRW RLG | CHK ELB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

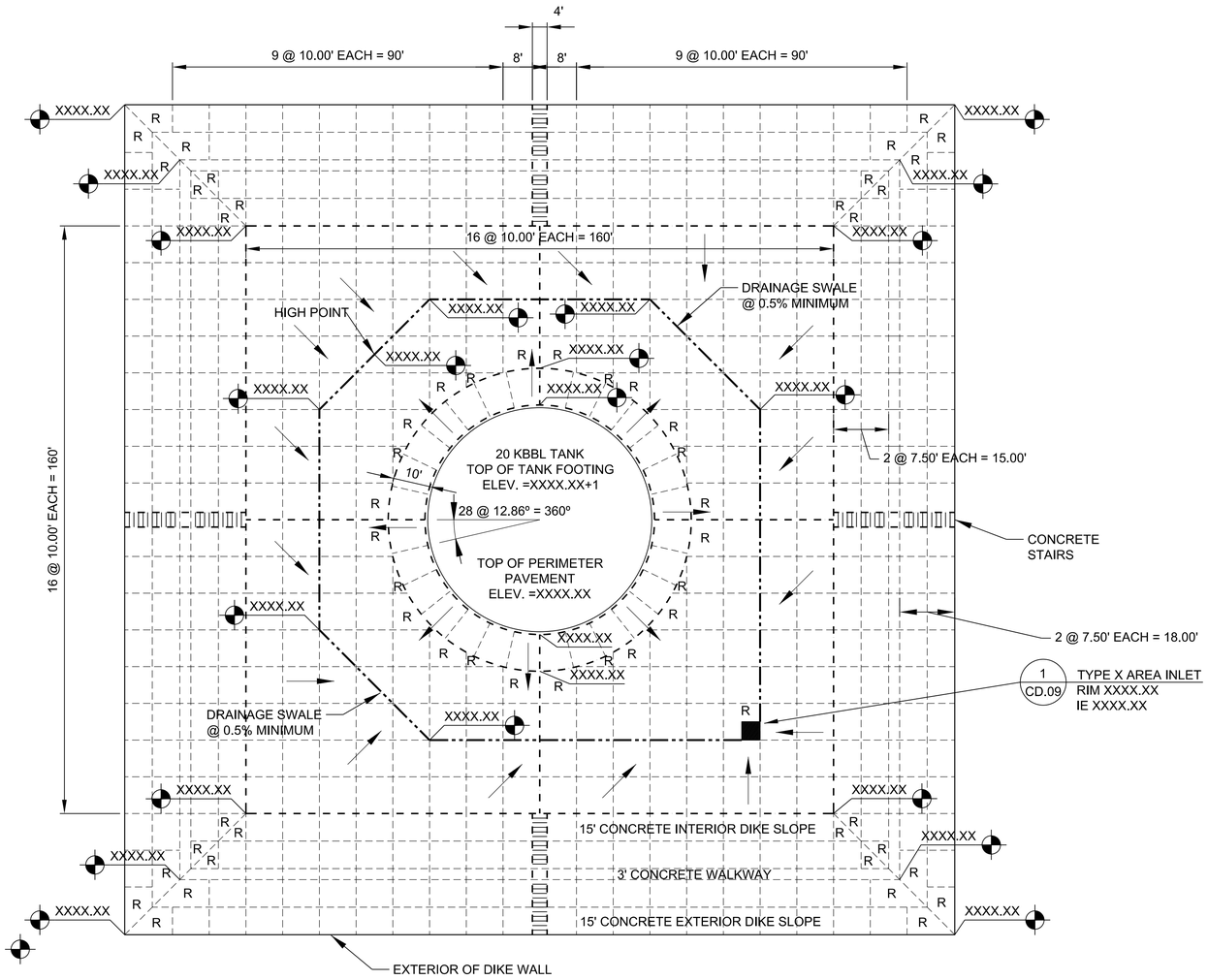
FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL SITE PLAN - VERTICAL CONTAINMENT WALLS

SCALE: AS NOTED
EPROJECT NO.: XXXXX
CONSTR. CONTR. NO. XXXXX
NAVFAC DRAWING NO. XXXXX
SHEET 8 OF 57

C.03

DRAWFORM REVISION: 10 MAY 2014



TYPICAL CONCRETE JOINT LAYOUT PLAN

SCALE: 1"=20'-0"

0 10' 20' 40'

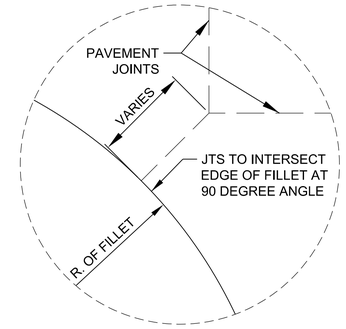
N

LEGEND:

- - - - - -	CONTRACTION JOINT
— — — —	EXPANSION JOINT
-·-·-·-	DRAINAGE SWALE
R	REINFORCED CONCRETE PER CD.02
→	FLOW DIRECTION
XXXX.XX	SPOT ELEVATION

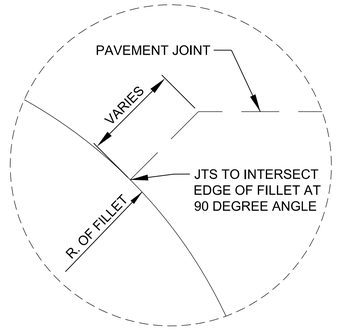
DESIGNER NOTES:

1. JOINT LAYOUT PANELS SHOULD BE AS CLOSE TO SQUARE AS POSSIBLE WITH A MAXIMUM 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 UFGS 32 13 15.20 CONCRETE PAVEMENT FOR CONTAINEMNT DIKES.



JOINT DETAIL A

SCALE: NONE



JOINT DETAIL B

SCALE: NONE

APPR | DATE | DESCRIPTION | CTM

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US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

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FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES RLG | DRW RLG | CHK ELB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL DIKE AREA JOINT LAYOUT PLAN

SCALE: AS NOTED

EPROJECT NO.: XXXXX

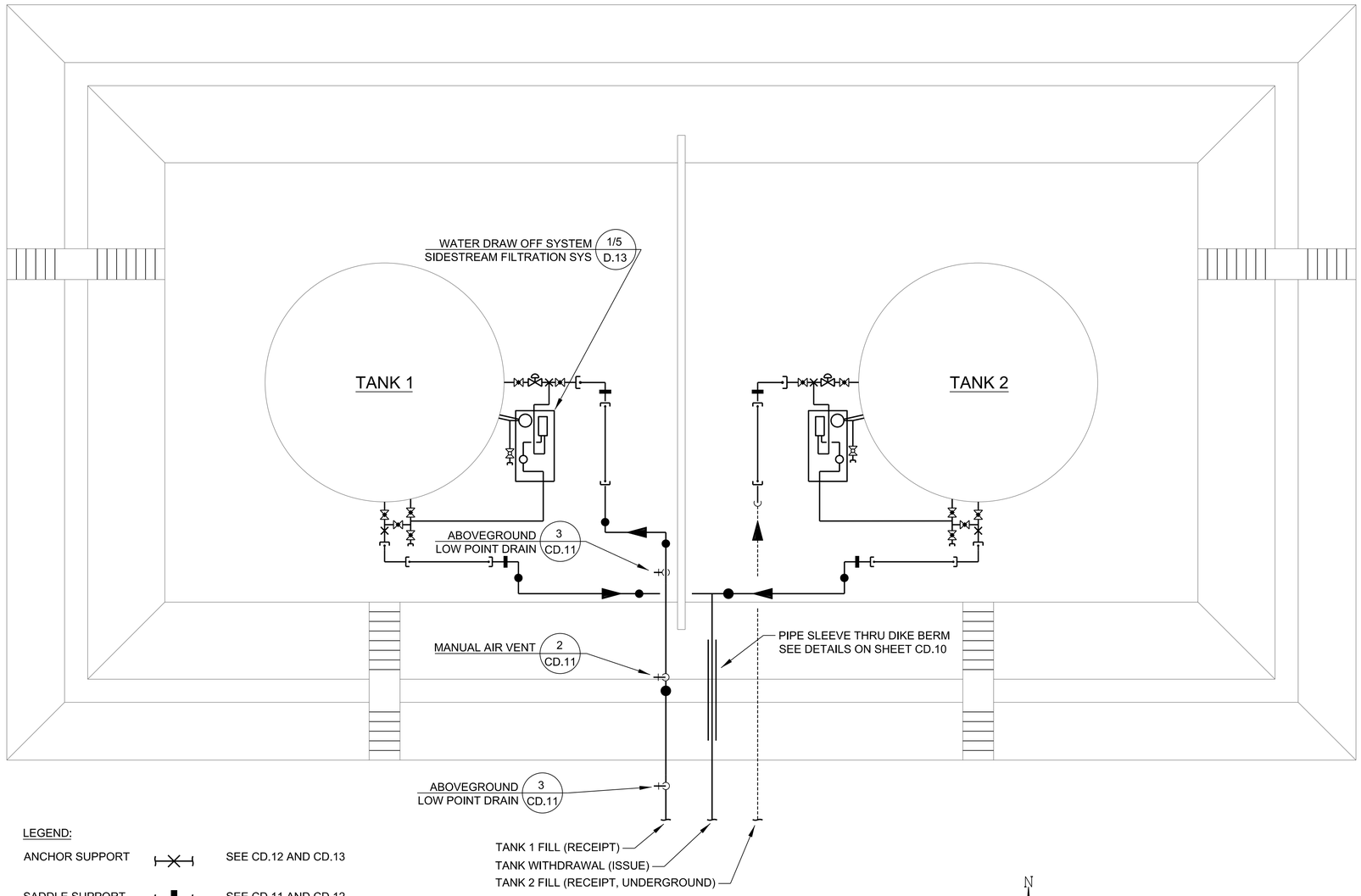
CONSTR. CONTR. NO.
XXXXX

NAVFAC DRAWING NO.
XXXXX

SHEET 9 OF 57

C.04

DRAWFORM REVISION: 10 MAY 2014



LEGEND:

ANCHOR SUPPORT		SEE CD.12 AND CD.13
SADDLE SUPPORT		SEE CD.11 AND CD.12
FLEXIBLE BALL JOINT		SEE CD.11
GUIDED SUPPORT		SEE CD.12 AND CD.13
FREE SUPPORT		SEE CD.12 AND CD.13

TYPICAL PIPING LAYOUT

SCALE: 1" = 10'-0"

0 5' 10' 20'

N

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 FREE SUPPORT (SEE SHEETS CD.12 & CD.13 IS COMMON. ON THE PEAK OF THE DIKE, USE OF A GUIDED SUPPORT (SEE SHEETS CD.12 & CD.13) IS COMMON. ACTUAL PIPE LAYOUT, SITE CONDITIONS, RESULTS 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 SEPARATED BY 8' IS ABSORBED. THE THIRD BALL JOINT SHOULD BE MOUNTED IN PIPING RUNNING PERPENDICULAR TO THE PIPING WITH THE TWO BALL JOINTS SEPARATED BY 8'. SEE FLEXIBLE BALL JOINT DETAIL ON SHEET CD.11.

4. AT LOCATIONS EXPERIENCING FREEZING CONDITIONS, ALL DRAIN PIPING ON THE PRODUCT SAVER TANK AND FILTER SEPARATOR, IF PROVIDED, SHALL BE HEAT TRACED WITH APPROPRIATE HAZARD RATED TAPE AND INSULATED.

5. LOCATE EXTERIOR PIPING SUPPORTS TO PROVIDE ADEQUATE PIPE FLEXIBILITY FOR TANK SETTLEMENT, SEISMIC DESIGN AND THERMAL EXPANSION. EXCEPT FOR THE FIRST PIPE SUPPORT OFF OF THE TANK SHELL, SPRING PIPE SUPPORTS MAY BE USED IN HIGH SEISMIC AREAS WHEN DIRECTED BY SERVICE HEADQUARTERS, SEE DETAIL ON SHEET D.13.

6. ALL FUEL PIPING SHALL BE ABOVE GRADE (ONLY ISSUE PIPING IS ALLOWED TO RUN THROUGH EARTHEN DIKE WALLS). FACILITY REQUIREMENTS (FORCE PROTECTION, VANDALISM, BLAST DAMAGE, FIRE PROTECTION, ETC. MAY REQUIRE UNDERGROUND PIPING).

7. PENETRATIONS THROUGH DIKE WALLS SHALL BE MADE THROUGH PIPE SLEEVES WITH BUNA-N COMPRESSION SEALS. SLEEVES SHALL BE PROVIDED WITH LEAK TESTING CAPABILITY. SEE SHEET CD.10.

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.01.

9. IN LOCATIONS SUBJECT TO ICE AND SNOW, ORIENT STAIRWAYS AND HIGH LEVEL PIPING TO RECEIVE WINTER SUN SO AS TO MINIMIZE ACCUMULATIONS. IF PIPING AT TANK IS NOT BELOW A STAIRWAY, PROVIDE ICE SHIELDS OVER PRODUCT PIPING AND VALVES AT TANK. ENSURE ICE SHIELDS HAVE SUFFICIENT CLEARANCE ABOVE VALVES TO ALLOW MAINTENANCE OF VALVES AND VALVE OPERATIONS OR PROVIDE MEANS TO MOVE SHIELDS OUT OF THE WAY AND PROVIDE CANOPIES OVER OTHER VALVES AND EQUIPMENT.

10. WHEN THE TANK FOUNDATION IS ELEVATED, MAINTAIN ELEVATION OF PIPING IN DIKE AREA SO THAT PIPING IS SLOPED CONTINUOUSLY TO THE TANK NOZZLES AND TO ALLOW PERSONNEL TO WALK UNDER PIPING. WHEN TANK FOUNDATION IS THE NON ELEVATED TYPE (AS SHOWN) WITH A BURIED LEAK DETECTION MONITORING WELL, MAINTAIN ELEVATION OF PIPING IN DIKE AREA SO THAT PIPING IS SLOPED CONTINUOUSLY TO THE TANK NOZZLES AND PERSONNEL MAY STEP MORE EASILY OVER PIPING. WHEN THIS REQUIRES PIPING TO PENETRATE THE DIKE BERM, PENETRATIONS SHALL BE CONSTRUCTED PER NOTE 7.

11. PIPING DESIGN SHALL ADDRESS SEISMIC. THE FIRST PIPE SUPPORT OF THE TANK SHALL BE AN ANCHOR WITH THE CONCRETE PIER TIED TO THE RINGWALL.

APPR | DATE | DESCRIPTION | CTM

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US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

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FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY 10

DES CCH | DRW CCH | CHK CRM

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS
ABOVEGROUND VERTICAL STEEL

TYPICAL PIPING LAYOUT

SCALE: AS NOTED

EPROJECT NO.: XXXXX

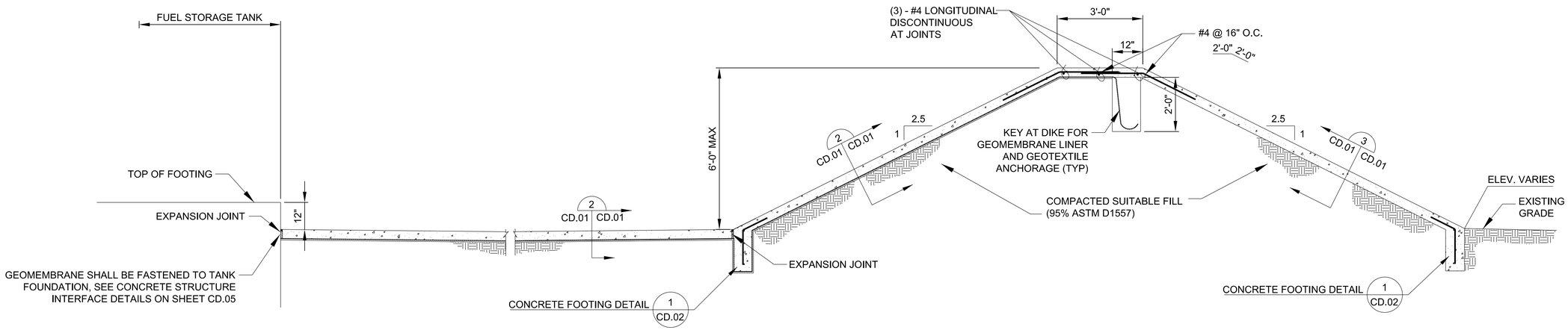
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 10 OF 57

C.05

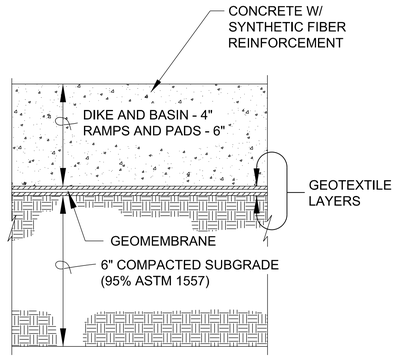
DRAWFORM REVISION: 10 MAY 2014



TYPICAL SECTION - SPILL CONTAINMENT DIKES

1 C.02 | CD.01

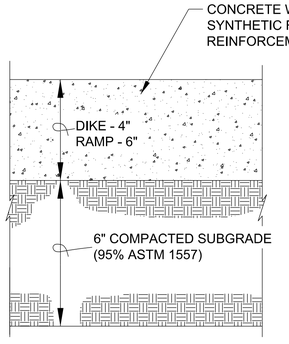
SCALE: NONE



TYPICAL LINER SECTION
DIKES INTERIOR AND BASIN (W/ LINER)

2 CD.01 | CD.01

SCALE: NONE



TYPICAL LINER SECTION
DIKE EXTERIOR (W/O LINER)

3 CD.01 | CD.01

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.

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 CONTAINMENT DIKES FOR CONCRETE AND REINFORCEMENT REQUIREMENTS.

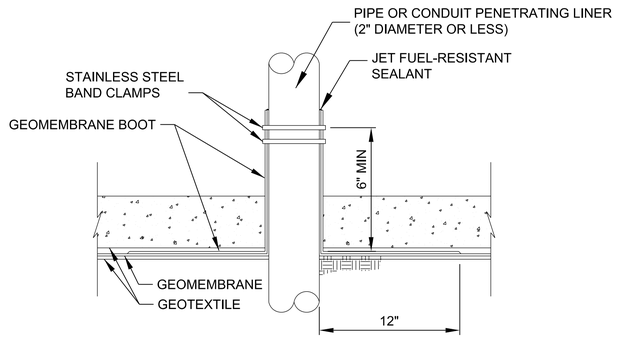
2. PROVIDE A GEOMEMBRANE BOOT FOR ALL CIRCULAR GEOMEMBRANE PENETRATIONS. ALL SMALL LINER PENETRATIONS SHALL BE CIRCULAR TO ACCOMMODATE A BOOT SEAL.

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 ½ 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.



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

TYPICAL CONDUIT OR SMALL PIPE PENETRATION DETAIL (CONCRETE)

SCALE: NONE

NO.	DESCRIPTION	DATE	APPR

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES RLG | DRW RLG | CHK ELB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

DIKE DETAILS - CONCRETE SURFACED

SCALE: AS NOTED

EPROJECT NO.: XXXXX

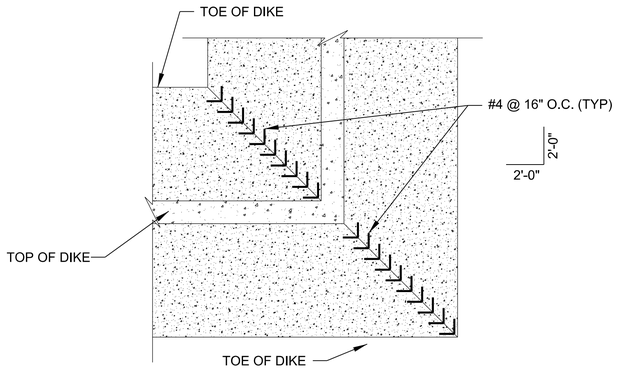
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 11 OF 57

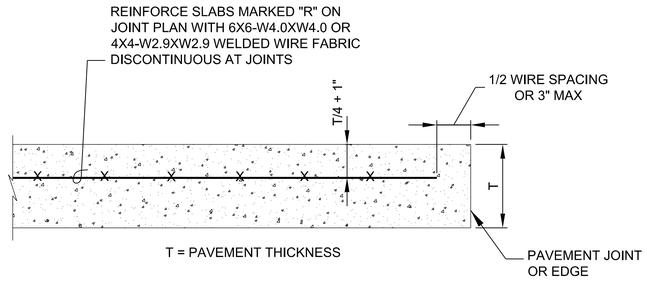
CD.01

DRAWFORM REVISION: 10 MAY 2014



TYPICAL DIKE CORNER REINFORCEMENT DETAIL

SCALE: NONE

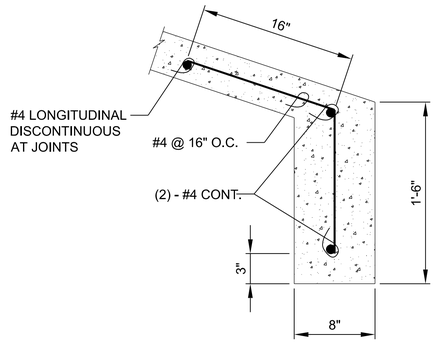


SLAB REINFORCING DETAIL

SCALE: NONE

NOTE:

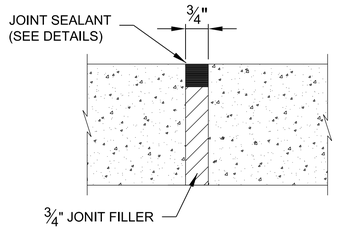
1. WELDED WIRE FABRIC SHALL BE OVERLAPPED FOR A DISTANCE EQUAL TO AT LEAST ONE SPACING OF THE WIRE IN THE FABRIC OR 32 WIRE DIAMETERS, WHICHEVER IS GREATER. THE WIRES IN THE LAP, SHALL BE WIRED OR OTHERWISE SECURELY FASTENED TO PREVENT SEPERATION DURING CONCRETE PLACEMENT.



CONCRETE FOOTING DETAIL

1 CD.01 | CD.02

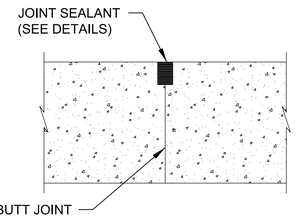
SCALE: NONE



EXPANSION JOINT DETAIL

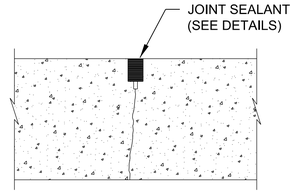
2 CD.01 | CD.02

SCALE: NONE



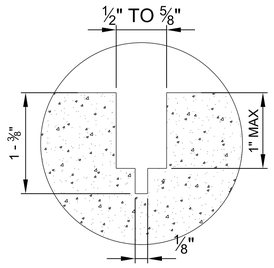
CONSTRUCTION JOINT DETAIL

SCALE: NONE

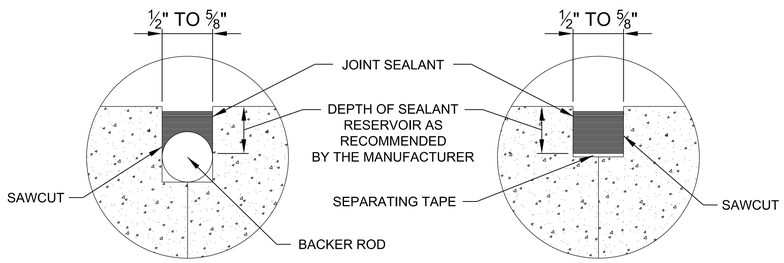


CONTRACTION JOINT DETAIL

SCALE: NONE

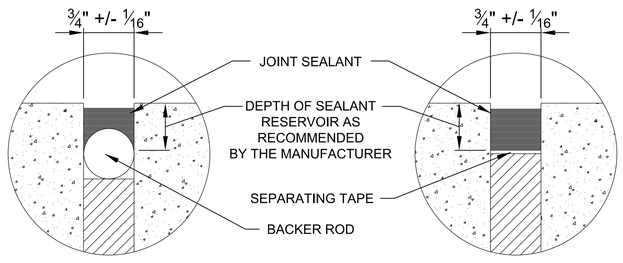


SAWCUT



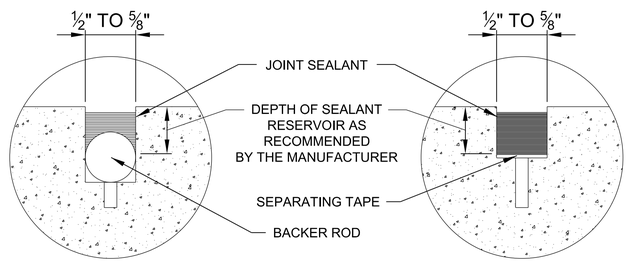
COMPLETED CONSTRUCTION JOINT SEALANT DETAIL

SCALE: NONE



COMPLETED EXPANSION JOINT SEALANT DETAIL

SCALE: NONE



COMPLETED SAWCUT JOINT

CONTRACTION JOINT SAWCUT DETAILS

SCALE: NONE

APPR | DATE | DESCRIPTION | CTM

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

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ACTIVITY

SATISFACTORY TO

DES RLG | DRW RLG | CHK ELB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

DIKE DETAILS - CONCRETE SURFACED

SCALE: AS NOTED

EPROJECT NO.: XXXXX

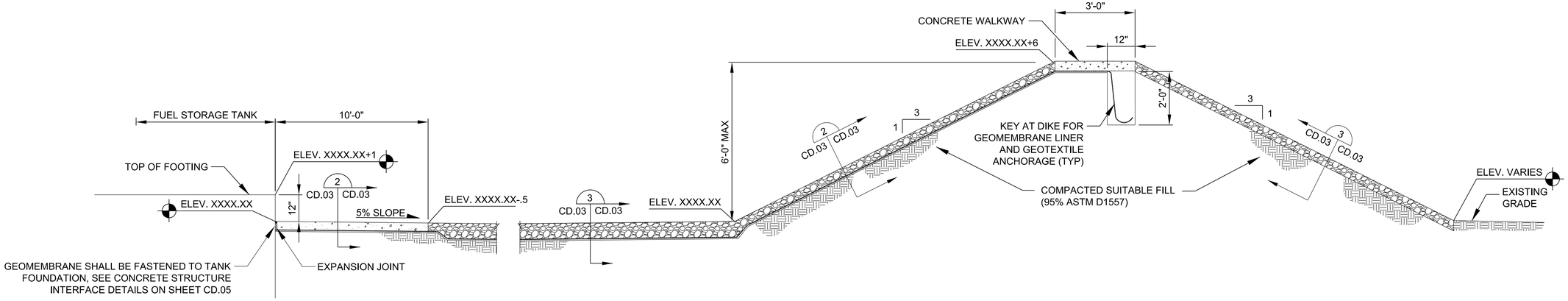
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 12 OF 57

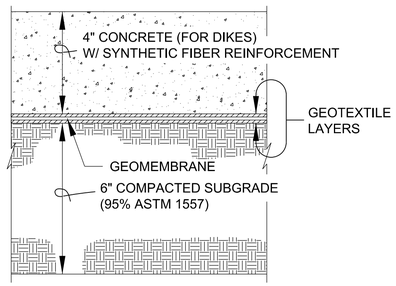
CD.02

DRAWFORM REVISION: 10 MAY 2014



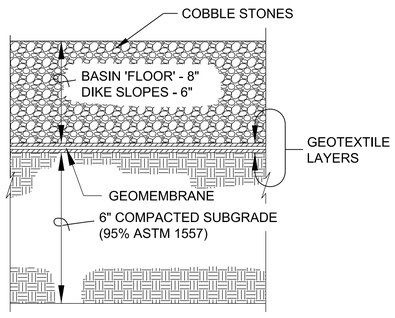
TYPICAL SECTION - SPILL CONTAINMENT DIKES (1 / C.02 | CD.03)

SCALE: NONE



TYPICAL LINER SECTION CONCRETE WORKING SURFACE (2 / CD.03 | CD.03)

SCALE: NONE



TYPICAL LINER SECTION DIKE INTERIOR AND BASIN (W/ LINER) (3 / CD.03 | CD.03)

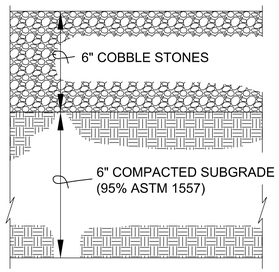
SCALE: NONE

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 CONTAINMENT DIKES FOR CONCRETE AND REINFORCEMENT REQUIREMENTS.
2. PROVIDE A GEOMEMBRANE BOOT FOR ALL CIRCULAR GEOMEMBRANE PENETRATIONS. ALL SMALL LINER PENETRATIONS SHALL BE CIRCULAR TO ACCOMMODATE A BOOT SEAL.
3. ALL CONCRETE 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 ½" IN DIAMETER OR ANY OTHER MATERIAL WHICH WOULD COULD DAMAGE THE GEOMEMBRANE LINER.
6. GEOMEMBRANE ANCHORAGE / EMBEDMENT STRIP MATERIALS AND INSTALLATION SHALL BE AS RECOMMENDED BY THE MANUFACTURER OF THE GEOMEMBRANE.
7. ROCK BALLAST MATERIAL SHALL BE CLEAN 1-½" to 3" SMOOTH COBBLE STONES. THE ROCK BALLAST LAYER SHALL BE COMPACTED WITH TWO PASSES OF A WALK-BEHIND VIBRATORY ROLLER.

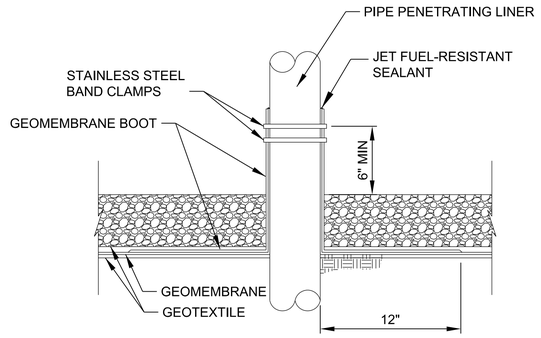
DESIGNER NOTES:

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.



TYPICAL LINER SECTION DIKE EXTERIOR WALLS (W/O LINER) (4 / CD.03 | CD.03)

SCALE: NONE



PIPE PENETRATION DETAIL (GRAVEL)

SCALE: NONE

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES RLG | DRW RLG | CHK ELB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

DIKE DETAILS - GRAVEL BALLAST

SCALE: AS NOTED

EPROJECT NO.: XXXXX

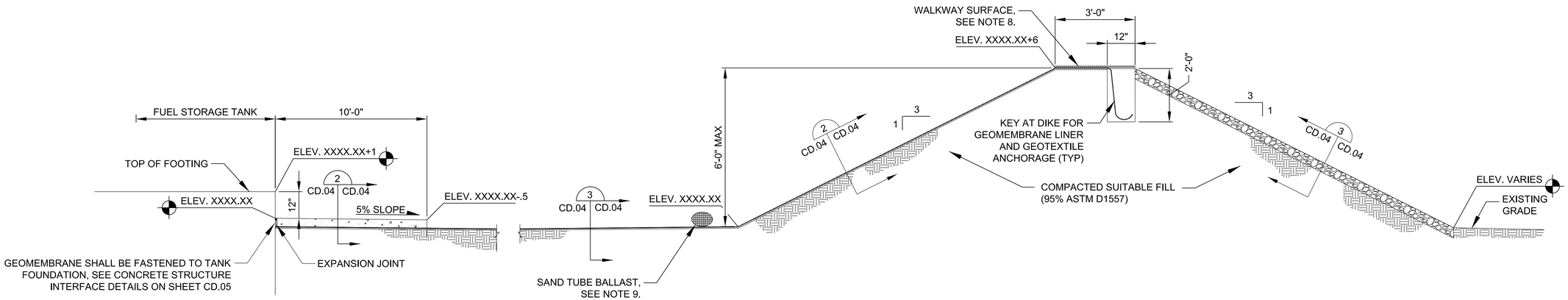
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 13 OF 57

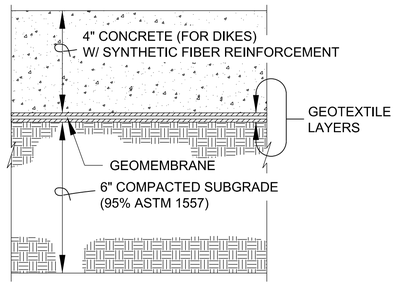
CD.03

DRAWFORM REVISION 10 MAY 2014



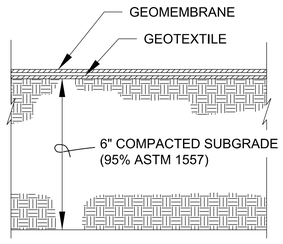
TYPICAL SECTION - SPILL CONTAINMENT DIKES (1 / C.02 | CD.04)

SCALE: NONE



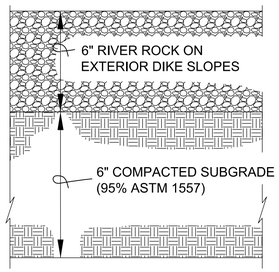
TYPICAL LINER SECTION CONCRETE WORKING SURFACE (2 / CD.04 | CD.04)

SCALE: NONE



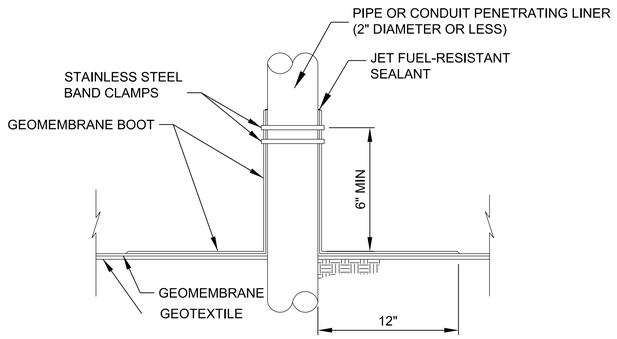
TYPICAL LINER SECTION (3 / CD.04 | CD.04)

SCALE: NONE



TYPICAL LINER SECTION DIKE EXTERIOR WALLS (W/O LINER) (4 / CD.04 | CD.04)

SCALE: NONE



PIPE PENETRATION DETAIL

SCALE: NONE

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 CONTAINMENT DIKES FOR CONCRETE AND REINFORCEMENT REQUIREMENTS.
2. PROVIDE A GEOMEMBRANE BOOT FOR ALL CIRCULAR GEOMEMBRANE PENETRATIONS. ALL SMALL LINER PENETRATIONS SHALL BE CIRCULAR TO ACCOMMODATE A BOOT SEAL.
3. ALL CONCRETE 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 WHERE COVERED WITH CONCRETE. A GEOTEXTILE SHALL BE INSTALLED BELOW 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 ½" IN DIAMETER OR ANY OTHER MATERIAL WHICH WOULD COULD DAMAGE THE GEOMEMBRANE LINER.
6. GEOMEMBRANE ANCHORAGE / EMBEDMENT STRIP MATERIALS AND INSTALLATION SHALL BE AS RECOMMENDED BY THE MANUFACTURER OF THE GEOMEMBRANE.
7. ROCK MATERIAL SHALL BE CLEAN, WELL GRADED ⅜" TO 1-½" RIVER ROCK. THE ROCK LAYER SHALL BE COMPACTED WITH TWO PASSES OF A WALK-BEHIND VIBRATORY ROLLER.
8. A SKID RESISTANT WALKWAY SHALL BE PROVIDED ALONG THE 3-FOOT TOP OF DIKE WALK PATH AND ON PATHWAYS WITHIN THE TANK BASIN, 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 MATERALS USED. SPECIFICATION SECTION 33 56 63 'FUEL IMPERMEABLE LINER SYSTEM' PROVIDES WIND UPLIFT DESIGN GUIDANCE.

APPR | DATE | NO. | DESCRIPTION

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

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SATISFACTORY TO

DES RLG | DRW MJR | CHK ELB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

DIKE DETAILS - EXPOSED LINER

SCALE: AS NOTED

EPROJECT NO.: XXXXX

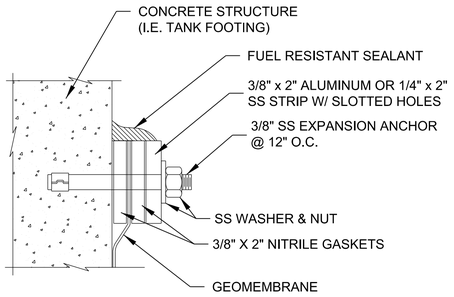
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 13 OF 57

CD.04

DRAWFORM REVISION: 10 MAY 2014

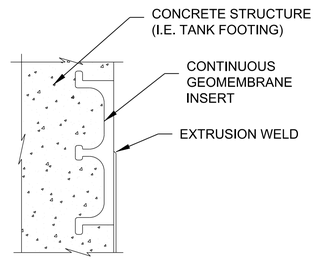


NOTE: VARIANCES TO THIS DETAIL MAY BE MADE WHEN RECOMMENED BY THE GEOMEMBRANE MANUFACTURER.

TYPICAL GEOMEMBRANE TERMINATION DETAIL - EXISTING STRUCTURE

SCALE: NONE

1
CD.05 | CD.05



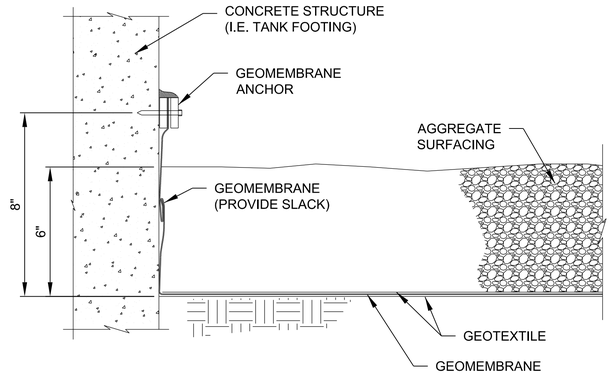
NOTE:
GEOMEMBRANE INSERT TO BE MANUFACTURER'S STANDARD

TYPICAL GEOMEMBRANE TERMINATION DETAIL - NEW STRUCTURE

SCALE: NONE

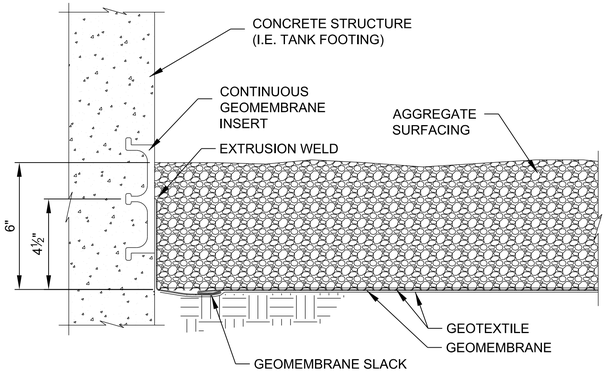
DESIGNER NOTES:

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.



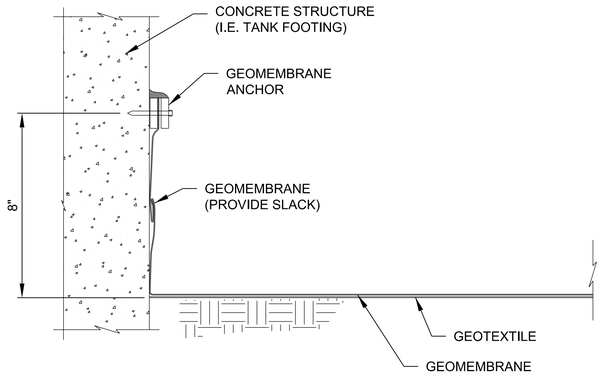
CONCRETE STRUCTURE INTERFACE DETAIL - EXISTING STRUCTURE

SCALE: NONE



CONCRETE STRUCTURE INTERFACE DETAIL - NEW STRUCTURE

SCALE: NONE



CONCRETE STRUCTURE INTERFACE DETAIL - EXISTING STRUCTURE

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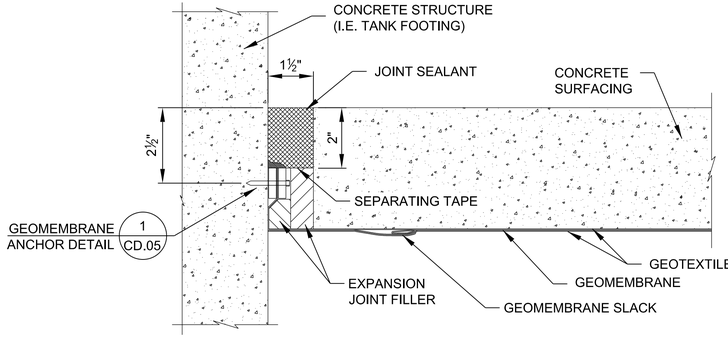
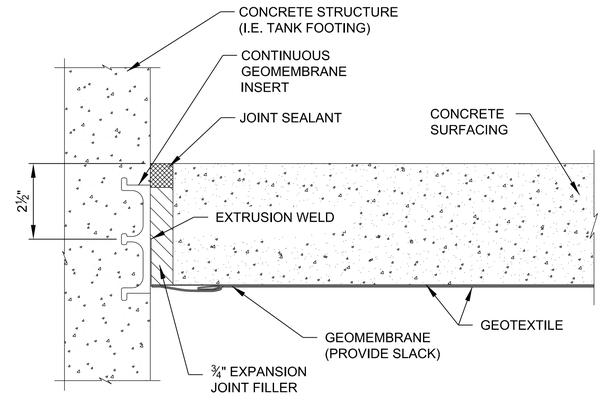


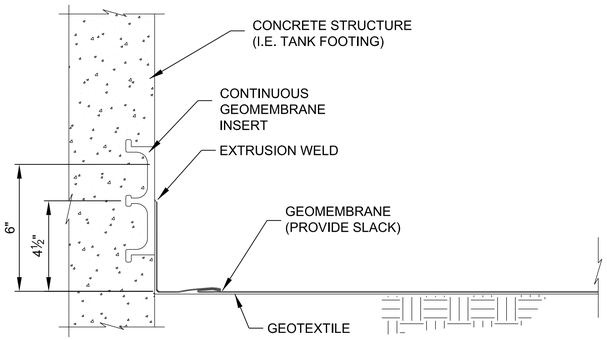
CONCRETE STRUCTURE INTERFACE DETAIL - EXISTING STRUCTURE

SCALE: NONE



CONCRETE STRUCTURE INTERFACE DETAIL - NEW STRUCTURE

SCALE: NONE



CONCRETE STRUCTURE INTERFACE DETAIL - NEW STRUCTURE

SCALE: NONE

US ARMY CORPS
OF ENGINEERS
OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES RLG | DRW MJR | CHK ELB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

GEOMEMBRANE FASTENING DETAILS

SCALE: AS NOTED

EPROJECT NO.: XXXXX

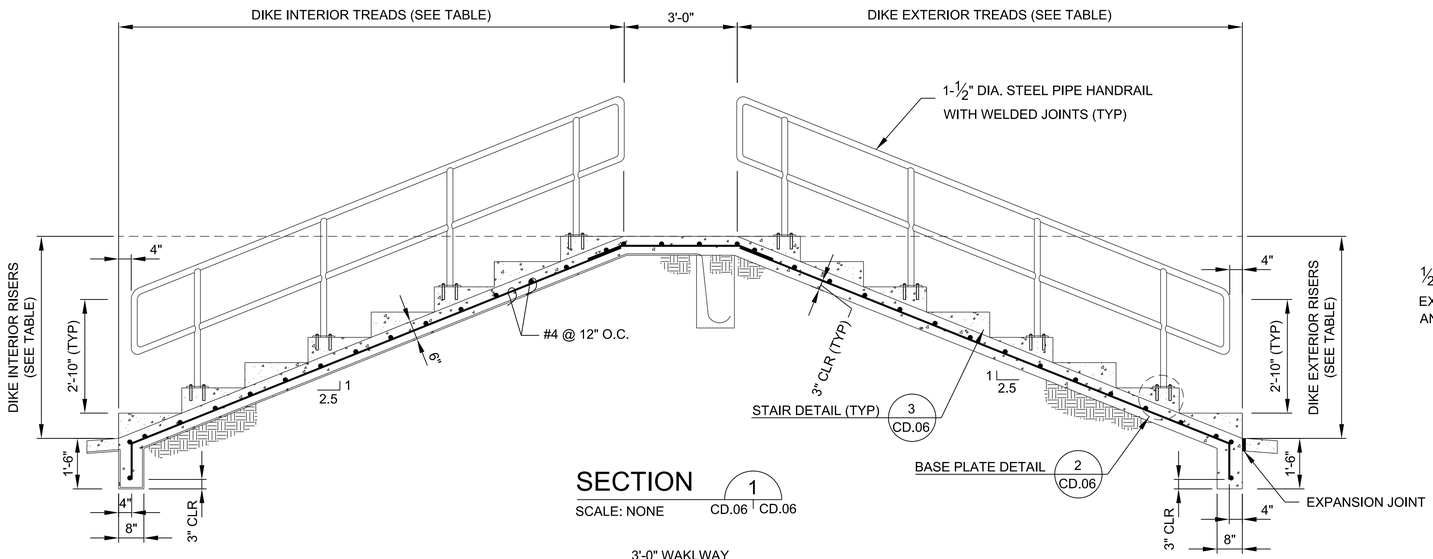
CONSTR. CONTR. NO.
XXXXX

NAVFAC DRAWING NO.
XXXXX

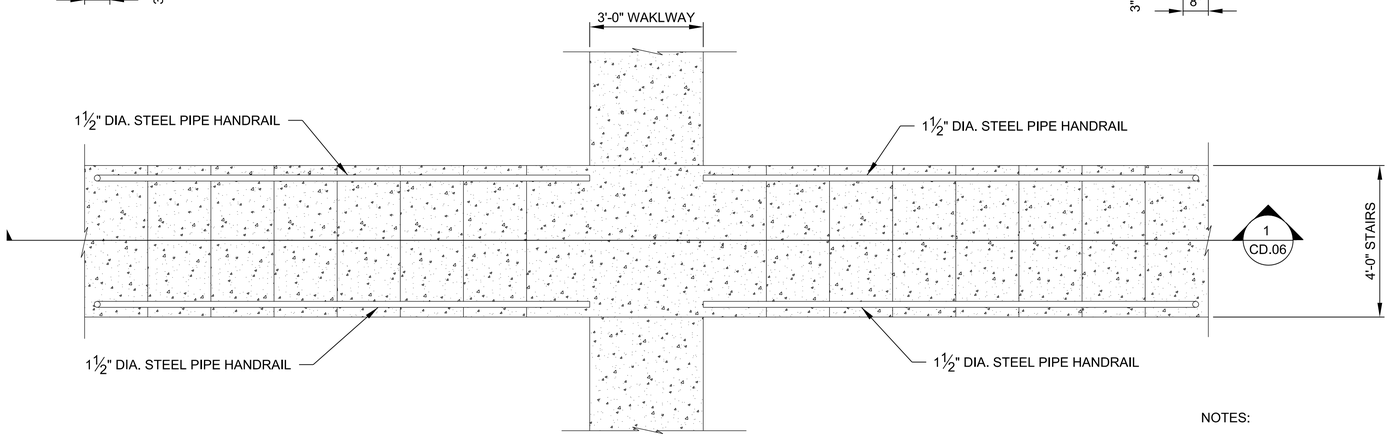
SHEET 14 OF 57

CD.05

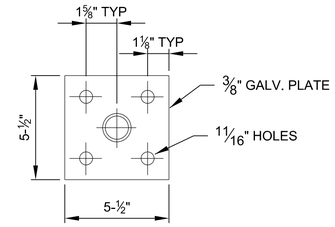
DRAWFORM REVISION: 10 MAY 2014



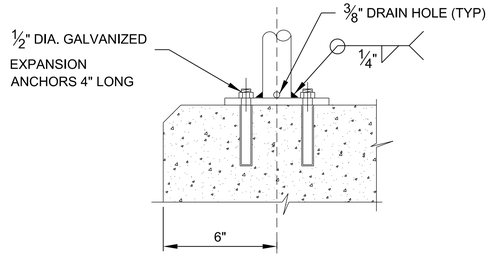
SECTION 1
SCALE: NONE — CD.06 | CD.06



CONCRETE STAIRS PLAN
SCALE: NONE

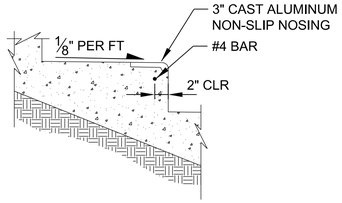


PLAN



ELEVATION

BASE PLATE DETAIL 2
SCALE: NONE — CD.06 | CD.06



STAIR DETAIL 3
SCALE: NONE — CD.06 | CD.06

NOTES:

1. PIPE HANDRAIL 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 BELOW LINER. BELOW GRADE CONNECTIONS SHALL BE PERFORMED VIA EXOTHERMIC WELD PROCESS.

TABLE OF STAIR DIMENSIONS				
STAIR NUMBER	INTERIOR TREADS	INTERIOR RISERS	EXTERIOR TREADS	EXTERIOR RISERS
1	#T @ #" = #'-#"	#R @ #" = #'-#"	#T @ #" = #'-#"	#R @ #" = #'-#"
2	#T @ #" = #'-#"	#R @ #" = #'-#"	#T @ #" = #'-#"	#R @ #" = #'-#"
3	#T @ #" = #'-#"	#R @ #" = #'-#"	#T @ #" = #'-#"	#R @ #" = #'-#"
4	#T @ #" = #'-#"	#R @ #" = #'-#"	#T @ #" = #'-#"	#R @ #" = #'-#"
5	#T @ #" = #'-#"	#R @ #" = #'-#"	#T @ #" = #'-#"	#R @ #" = #'-#"

DESIGNER NOTES:

1. PER IBC AND ADA GUIDELINES RISERS HAVE A MINIMUM HEIGHT = 4" AND A MAXIMUM HEIGHT 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.

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SUBMITTED BY:
DATE: APRIL 2015

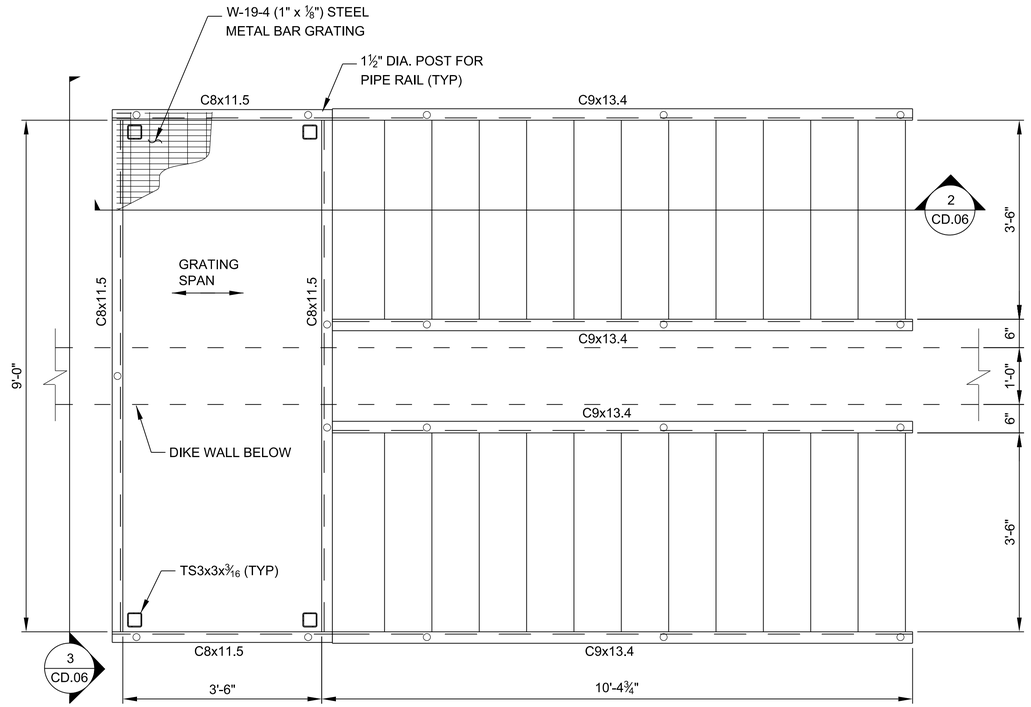
NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC
DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL
CONCRETE STAIRWAY DETAILS

SCALE: AS NOTED
EPROJECT NO.: XXXXX
CONSTR. CONTR. NO. XXXXX
NAVFAC DRAWING NO. XXXXX
SHEET 15 OF 57

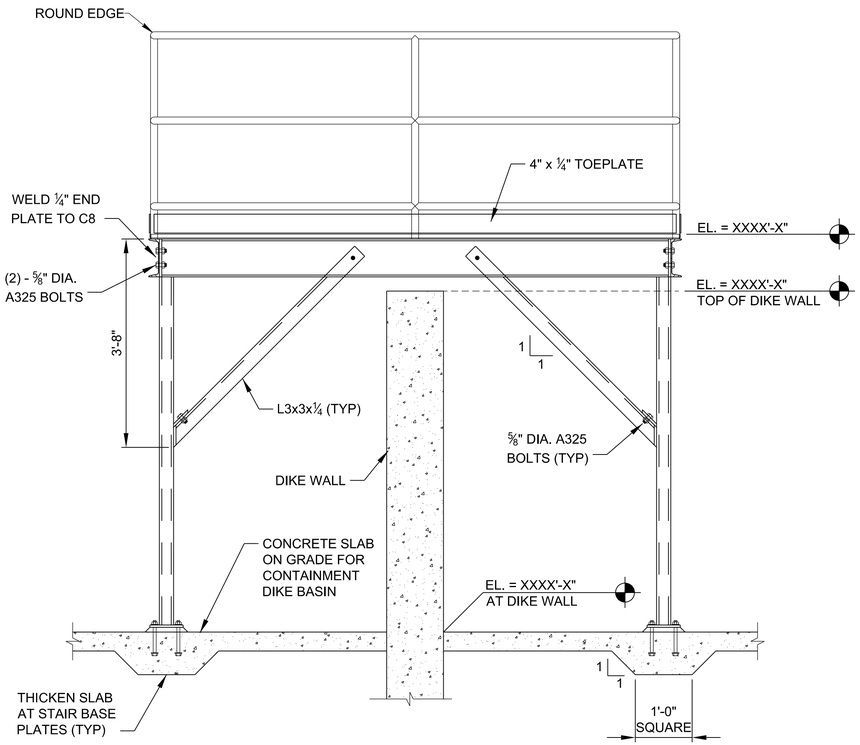
CD.06

DRAWFORM REVISION: 10 MAY 2014



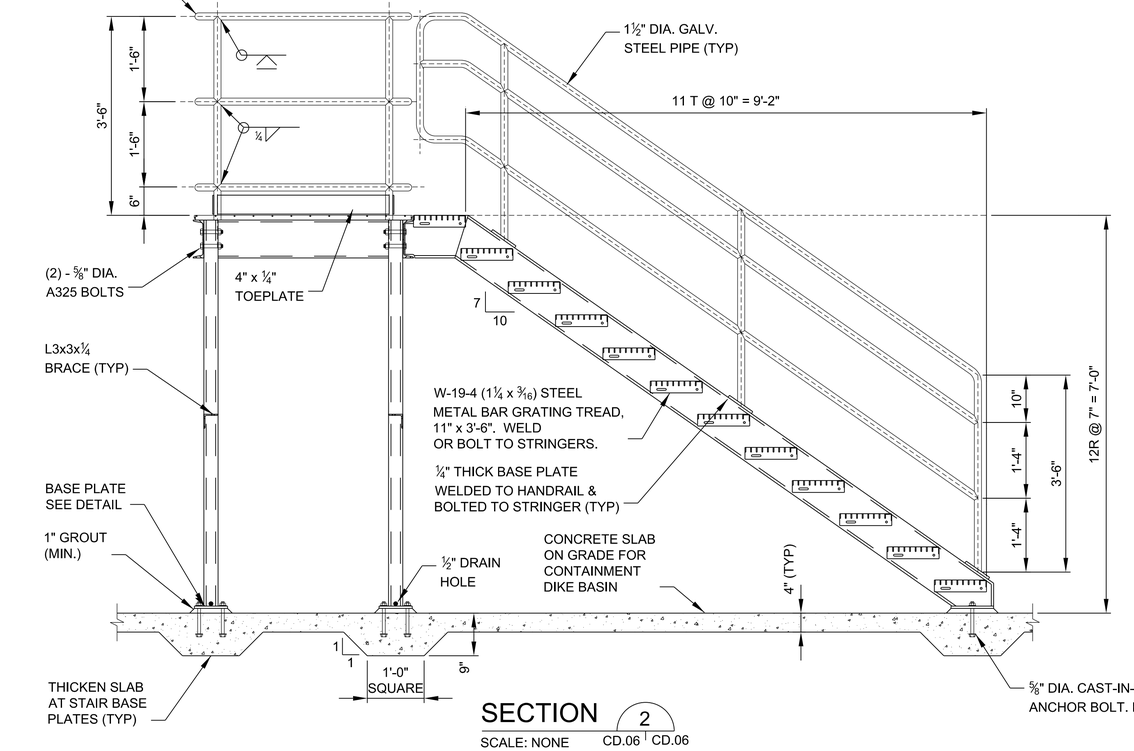
STEEL STAIR PLAN (1)

SCALE: NONE — C.03 | CD.06



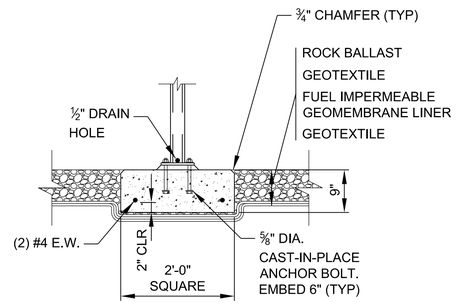
SECTION (3)

SCALE: NONE — CD.06 | CD.06



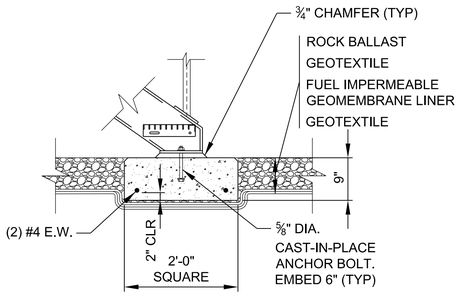
SECTION (2)

SCALE: NONE — CD.06 | CD.06



AGGREGATE BASIN TYPICAL BASE PLATE DETAIL

SCALE: NONE



AGGREGATE BASIN TYPICAL STAIR BASE DETAIL

SCALE: NONE

NOTES:

1. METAL GRATING FOR LANDINGS AND STAIR TREADS SHALL BE W-19-4, WITH BEARING BARS AS INDICATED. TREADS AND LANDINGS SHALL HAVE CHECKERED PLATE NOSINGS. GRATING SHALL BE ANCHORED WITH SADDLE CLIPS. MAXIMUM PANEL WIDTH SHALL BE 2'-0". EDGES SHALL BE BANDED. TREADS SHALL BE FABRICATED WITH CARRIER PLATES AT ENDS.

2. ALL GRATINGS, HANDRAILS, STRINGERS, ANGLES, PLATES AND BOLTS FOR STAIRS SHALL BE HOT-DIP GALVANIZED IN ACCORDANCE WITH ASTM A123.2.

3. 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 BELOW LINER. BELOW GRADE CONNECTIONS SHALL BE PERFORMED VIA EXOTHERMIC WELD PROCESS.

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SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

STEEL STAIRWAY DETAILS

SCALE: AS NOTED

EPROJECT NO.: XXXXX

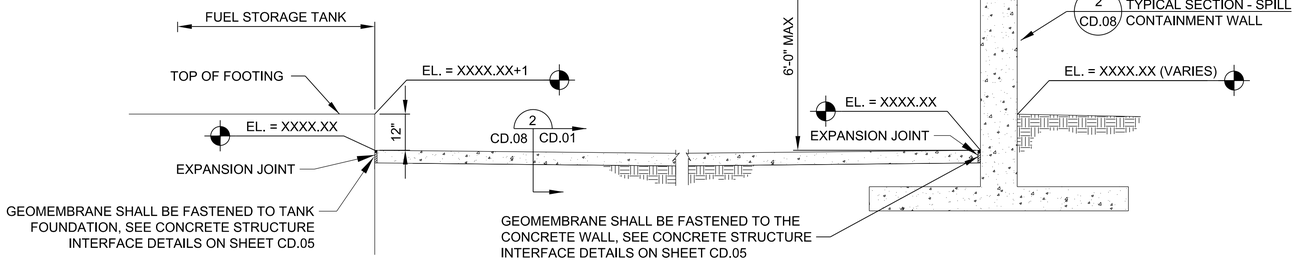
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 16 OF 57

CD.07

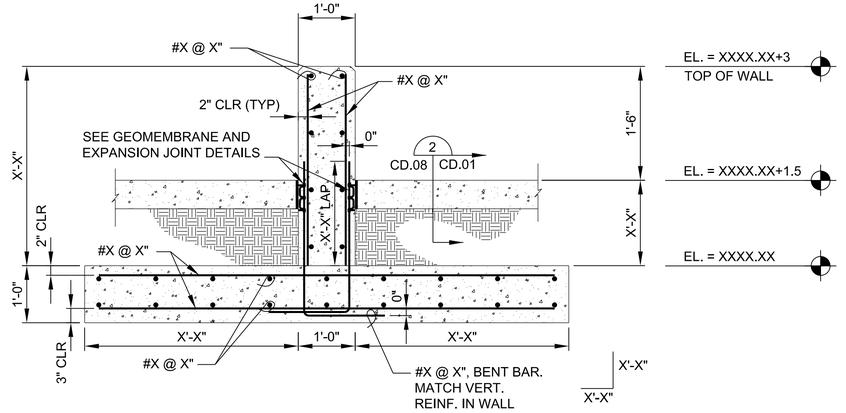
DRAWFORM REVISION: 10 MAY 2014



TYPICAL SECTION - SPILL CONTAINMENT WALLS

1
CD.03 | CD.08

SCALE: NONE

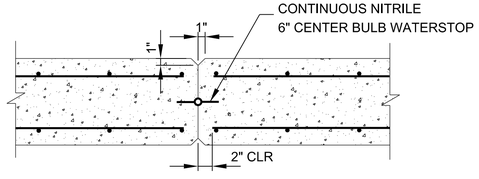


TYPICAL SECTION - SPILL CONTAINMENT INTERMEDIATE WALL

SCALE: NONE

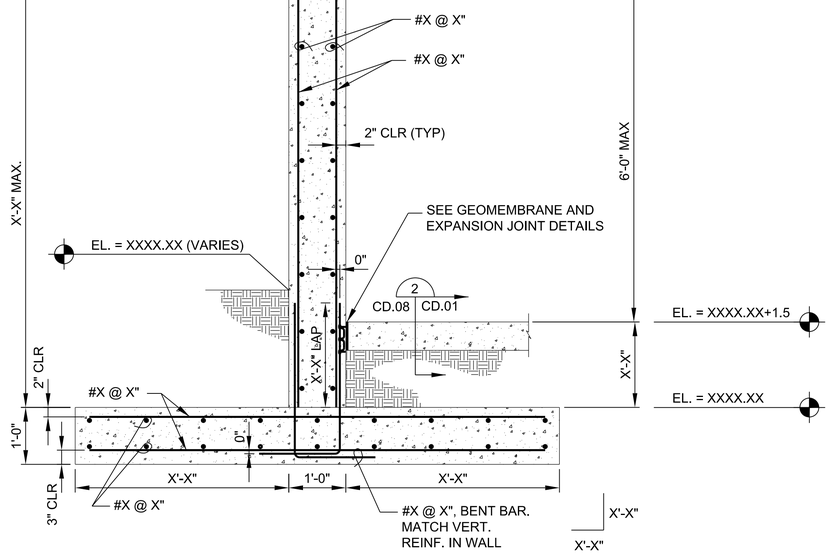
DESIGNER NOTES:

1. CONTAINMENT WALLS SHALL BE DESIGNED BY A STRUCTURAL ENGINEER BASED UPON REQUIRED HEIGHTS AND SOIL CONDITIONS.
2. PROVIDE VERTICAL ROUTED JOINTS AS NECESSARY TO CONTROL CRACKING.



WALL CONTROL JOINT DETAIL

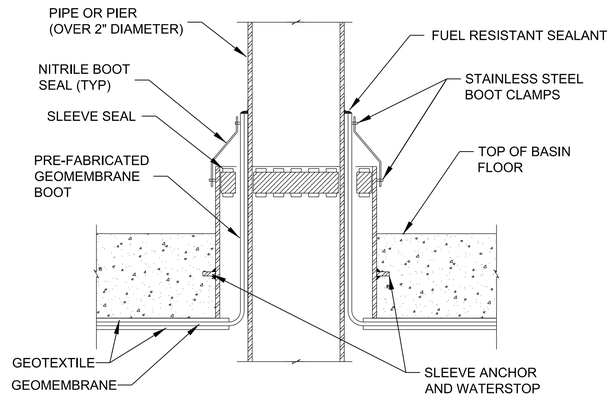
SCALE: NONE



TYPICAL SECTION - SPILL CONTAINMENT WALL

2
CD.08 | CD.08

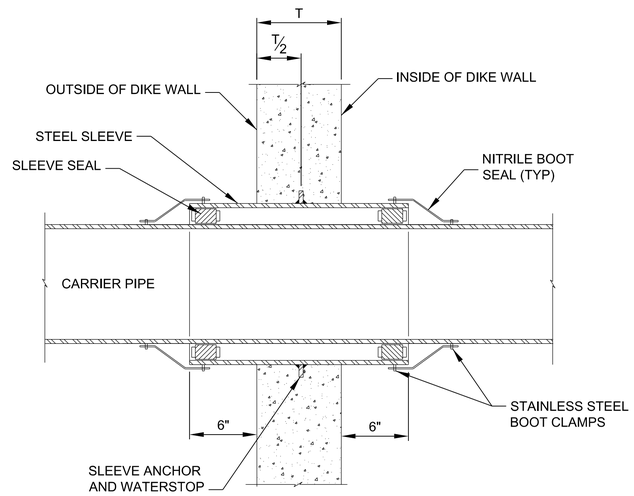
SCALE: NONE



NOTE: FOR PIPES 2" IN DIAMETER OR LESS, SEE DETAIL ON SHEET CD.01.

CONCRETE BASIN FLOOR LARGE PIPE PENETRATION DETAIL

SCALE: NONE



CONCRETE WALL PENETRATION DETAIL

SCALE: NONE

APPR
DATE
DESCRIPTION
SYM

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SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

CONTAINMENT WALL DETAILS

SCALE: AS NOTED

EPROJECT NO.: XXXXX

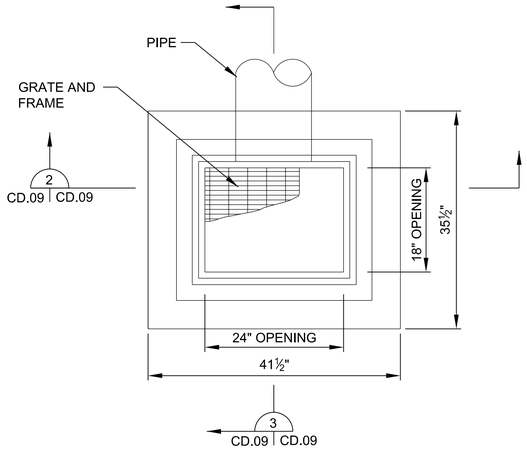
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 17 OF 57

CD.08

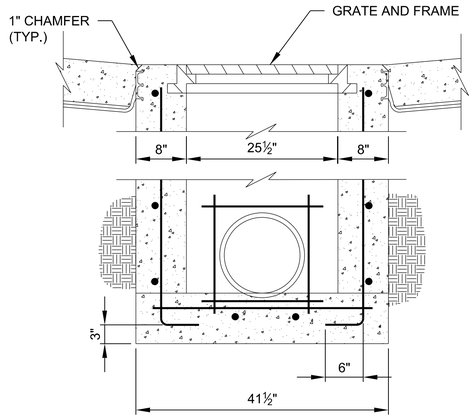
DRAWFORM REVISION: 10 MAY 2014



TYPE X AREA INLET PLAN

1 | C.04 | CD.09

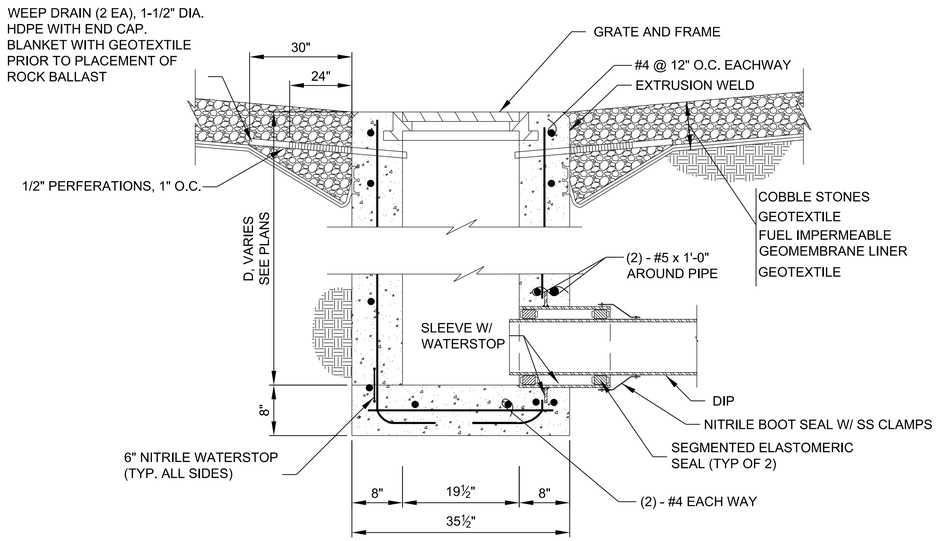
SCALE: NONE



SECTION

2 | CD.09 | CD.09

SCALE: NONE



SECTION

3 | CD.09 | CD.09

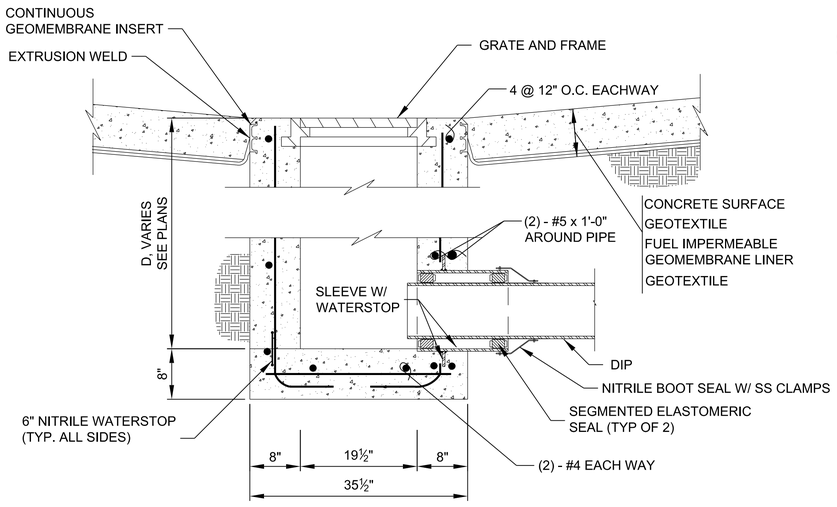
SCALE: NONE

DESIGNER NOTES:

1. A PIV OR GATE VALVE IS NOT ALLOWED FOR CONTAINMENT DRAINS.
2. DO NOT APPROVE PRECAST INLETS AS THE JOINTS AND CONNECTIONS ARE SUSCEPTIBLE TO LEAKS.
3. SELECT THE APPROPRIATE CROSS-SECTIONS FOR THE SELECTED LINER COVER MATERIAL.

INLET CONSTRUCTION GENERAL NOTES:

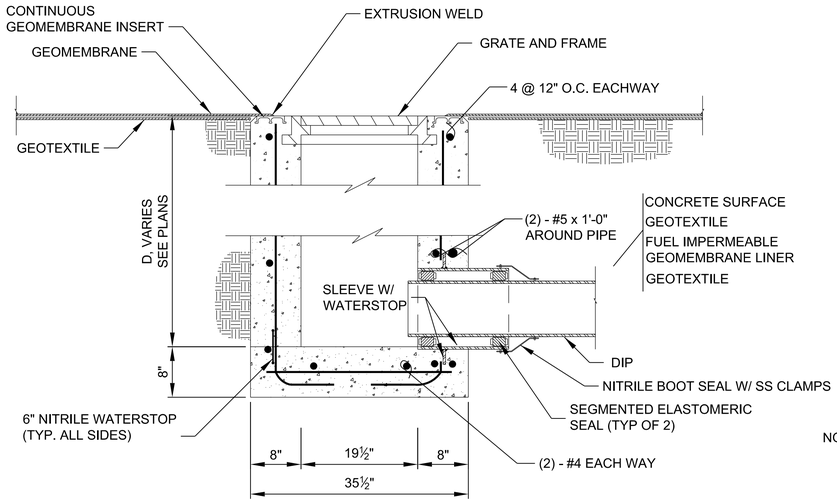
1. STANDARD CONSTRUCTION SHALL BE CAST IN PLACE REINFORCED CONCRETE. PRECAST CONSTRUCTION SHALL NOT BE ALLOWED.
2. REINFORCING STEEL FY = 60 KSI.
3. MINIMUM CLEAR COVER OF CONCRETE OVER REINFORCING STEEL SHALL BE 3 INCHES FOR CONCRETE PLACED AGAINST THE SOIL.
4. CAST IRON GRATE AND FRAME SHALL BE HEAVY-DUTY NEENAH R-1878-B3G OR LIGHT-DUTY NEENAH R-1879-B3G (WHERE NOT SUBJECT TO POSSIBLE WHEEL LOADS), OR APPROVED EQUAL.
5. MINUMUM 6" COMPACTED (95%) SUBGRADE REQUIRED UNDER INLETS.



SECTION

3 | CD.09 | CD.09

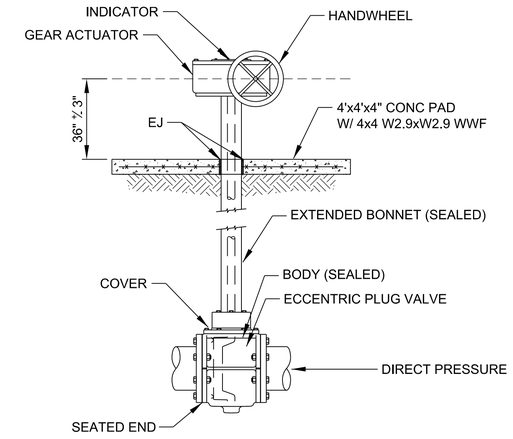
SCALE: NONE



SECTION

3 | CD.09 | CD.09

SCALE: NONE



NOTE: 100% PORT ECCENTRIC PLUG VALVE SHALL CONFORM TO AWWA C517 AND BE RESISTANT TO HYDROCARBONS (NITRILE RUBBER SEALS). GEAR ACTUATOR BOX WITH HANDWHEEL SHALL BE LOCKABLE.

CONTAINMENT DRAIN VALVE DETAIL

SCALE: NONE

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NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

CONTAINMENT DRAINAGE DETAILS

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

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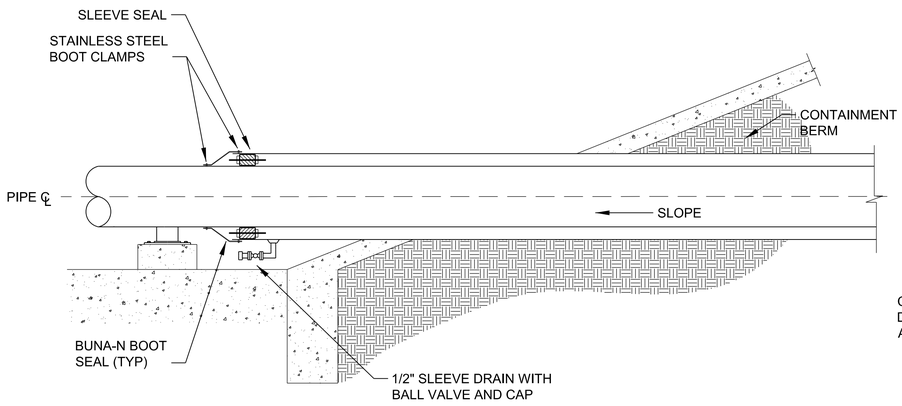
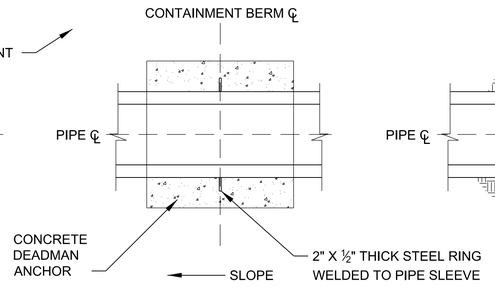
CD.09

DRAWFORM REVISION: 10 MAY 2014



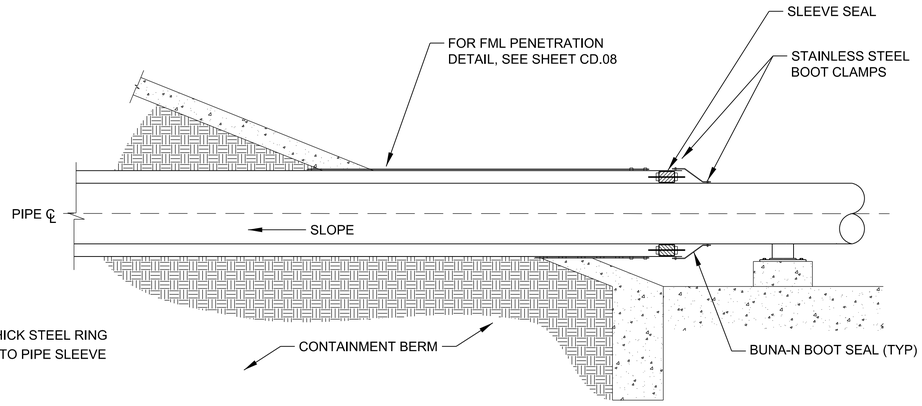
BERM DIKE WALL PENETRATION DETAIL (EXTERIOR)

SCALE: NONE



BERM DIKE WALL PENETRATION DETAIL (CENTER)

SCALE: NONE



BERM DIKE WALL PENETRATION DETAIL (INTERIOR)

SCALE: NONE

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)	2	3	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	42	48	54
CASING PIPE SIZE (IN)	6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	48	54	60

DESIGNER NOTES:

1. DETERMINE FORCES ACTING UPON PIPING PASSING THROUGH DIKE BERM TO DETERMINE WHETHER OR NOT A CONCRETE DEADMAN ANCHOR IS REQUIRED AND, IF SO, ITS SIZE TO COUNTERACT FORCES. IF IT IS NOT REQUIRED, THEN DELETE FROM DETAIL.

2. SLOPE SLEEVE PIPING TO ALLOW FOR DRAINAGE THROUGH SLEEVE DRAIN.

3. CONCRETE DEADMAN ANCHOR (IF REQUIRED) SHALL BE CENTERED ON THE CONTAINMENT BERM.

4. ENSURE THAT THE CONCRETE DEADMAN ANCHOR (IF REQUIRED) DOES NOT INTERFERE WITH PIPE SUPPORT STRUCTURES.

NO.	DESCRIPTION	DATE	APPR

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SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

BERM DIKE WALL PENETRATION

SCALE: AS NOTED

EPROJECT NO.: XXXXX

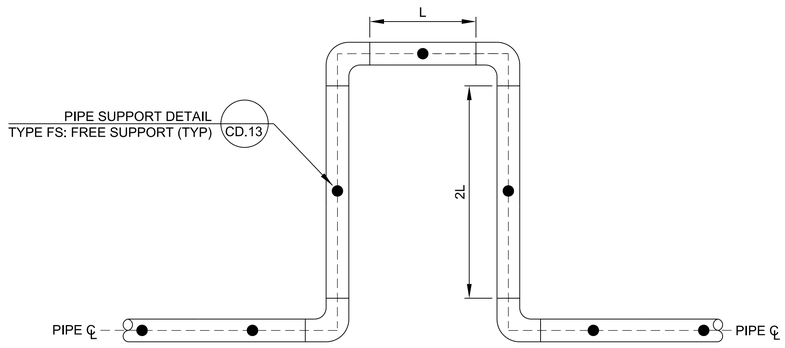
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 20 OF 57

CD.10

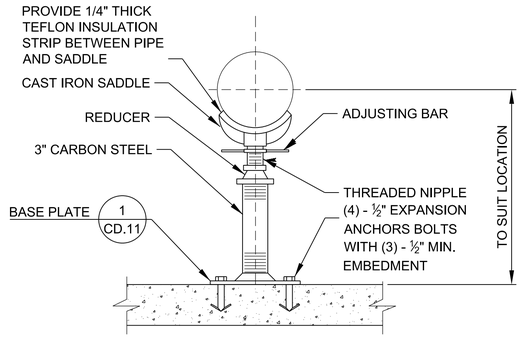
DRAWFORM REVISION: 10 MAY 2014



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

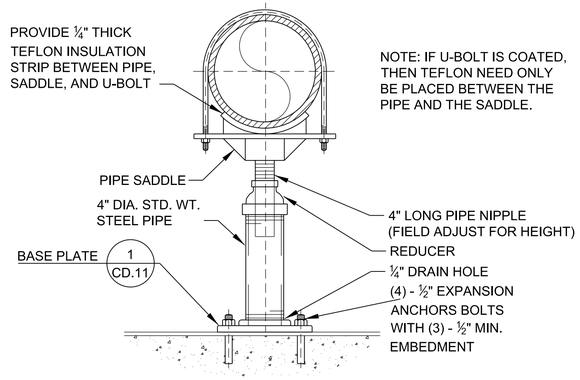
TYPICAL EXPANSION LOOP

SCALE: NONE



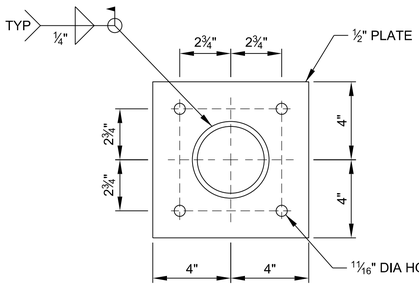
ADJUSTABLE PIPE SADDLE SUPPORT DETAIL (PS-1)

SCALE: NONE



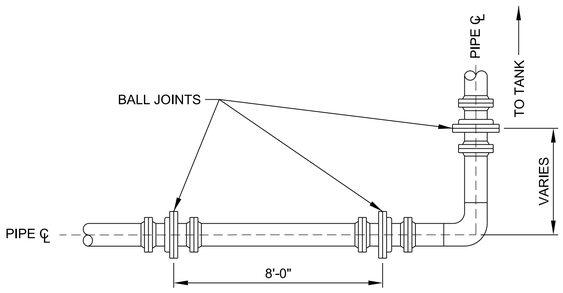
ADJUSTABLE PIPE SUPPORT DETAIL (PS-2)

SCALE: NONE



BASE PLATE 1 CD.11 | CD.11

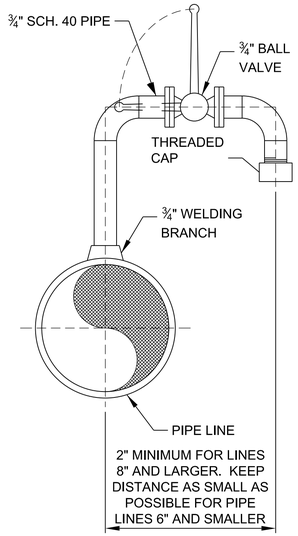
SCALE: NONE



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

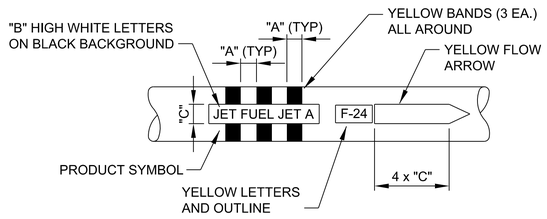
FLEXIBLE BALL JOINTS

SCALE: NONE



MANUAL AIR VENT 2 C.05 | CD.11

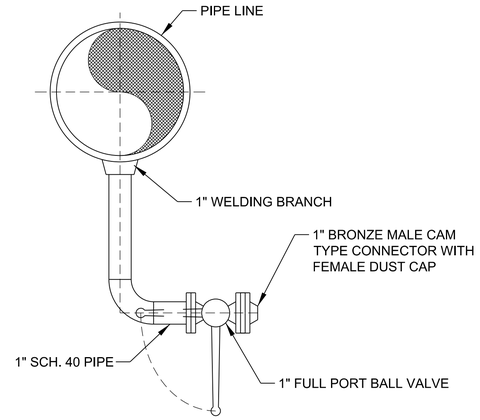
SCALE: NONE



DESIGNER NOTES:
THE EXAMPLE MARKINGS SHOWN ARE FOR JET A TURBINE FUEL, FOR OTHER FUEL TYPES, REFER TO MIL-STD-161G.

PRODUCT FLOW SYMBOL DETAIL

SCALE: NONE



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

ABOVEGROUND LOW POINT DRAIN 3 C.05 | CD.11

SCALE: NONE

SIZES OF LETTERS AND BANDS

PIPE DIAMETER (IN)	A BAND WIDTH AND SPACING (IN)	B TITLE LETTER SIZE (IN)	C BACKGROUND AND ARROWS (IN)
UNDER 3	3	0.5	1
3 TO 6	3	1	2
6 TO 9	3	2	3
OVER 9	4	3	4.5

NAVFAC

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DES CCH | DRW CCH | CHK CRM
SUBMITTED BY:
DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC
DOD STANDARD DESIGN AW78-24-27
FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL
MISCELLANEOUS DETAILS

SCALE: AS NOTED
EPROJECT NO.: XXXXX
CONSTR. CONTR. NO. XXXXX
NAVFAC DRAWING NO. XXXXX
SHEET 21 OF 57

CD.11

DRAWFORM REVISION: 10 MAY 2014

A. CONCRETE NOTES:

1. CAST-IN-PLACE CONCRETE SHALL CONFORM TO AMERICAN CONCRETE INSTITUTE "BUILDING CODE REQUIREMENTS FOR STRUCTURAL CONCRETE", ACI 318.

2. SPECIFIED COMPRESSIVE STRENGTH: f'c = 4,000 PSI AT 28 DAYS TYP.

3. REINFORCING MATERIALS:

REINFORCING BARS: SHALL CONFORM TO ASTM A615 OR ASTM A706, GRADE 60

4. LAP SPLICES AND CONCRETE COVER OF REINFORCEMENT SHALL CONFORM TO ACI 318 USING CLASS B TENSION SPLICES UNLESS OTHERWISE NOTED.

5. REINFORCING BARS SHALL BE SUPPORTED AT 2'-0" O.C., EACH WAY, MAX.

6. ALL REINFORCING STEEL AND EMBEDDED ITEMS SUCH AS ANCHOR RODS AND WELD PLATES SHALL BE ACCURATELY PLACED IN THE POSITIONS SHOWN AND ADEQUATELY TIED AND SUPPORTED BEFORE CONCRETE IS PLACED TO PREVENT DISPLACEMENT BEYOND PERMITTED TOLERANCES.

7. DETAIL BARS IN ACCORDANCE WITH "ACI DETAILING MANUAL", PUBLICATION SP-66, ACI 318, AND ACI 315.

8. PROVIDE ACCESSORIES NECESSARY TO PROPERLY SUPPORT REINFORCING AT POSITIONS SHOWN ON DRAWINGS.

9. EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED ¾".

10. CLEAR COVER TO REINFORCING FOR CAST-IN-PLACE CONCRETE SHALL BE AS FOLLOWS UNLESS NOTED OTHERWISE:

   A. CONCRETE CAST AGAINST OR PERMANENTLY EXPOSED TO EARTH: 3"
   B. CONCRETE EXPOSED TO EARTH OR WEATHER:
      I. No. 6 THROUGH No. 18 BARS: 2"
      II. No. 5 BAR, W31 OR D31 WIRE, AND SMALLER: 1½"
   C. CONCRETE NOT EXPOSED TO WEATHER OR IN CONTACT WITH GROUND:
      I. SLABS, WALLS, JOISTS: ¾"
      II. BEAMS, COLUMNS (PRIMARY REINF, TIES, STIRRUPS): 1½"

B. CARBON STRUCTURAL STEEL:

1. STRUCTURAL STEEL SHALL CONFORM TO LATEST EDITION OF THE AMERICAN INSTITUTE OF STEEL CONSTRUCTION "STEEL CONSTRUCTION MANUAL".

2. WIDE FLANGE SHAPES: SHALL CONFORM TO ASTM A992, Fy = 50 KSI.

3. ROLLED PLATES AND SHAPES: SHALL CONFORM TO ASTM A36, Fy = 36 KSI.

4. STRUCTURAL TUBING: SHALL CONFORM TO ASTM A500, GRADE B, Fy = 46 KSI.

5. ANCHOR BOLTS: SHALL CONFORM TO ASTM F1554, Fy = 36 KSI.

6. WELDING SHALL CONFORM WITH SPECIFICATION 33 52 43.13.

7. DO NOT WELD CARBON STEEL PLATES OR TEES TO STAINLESS STEEL PIPE.

8. DO NOT WELD GALVANIZED CARBON STEEL PLATES OR TEES TO STAINLESS STEEL OR CARBON STEEL PIPE.

C. SOILS & FOUNDATION NOTES:

1. MAX ALLOWABLE NET SOIL BEARING PRESSURE:X,XXX PSF

   A. ONE-THIRD OVERSTRESS MAY BE ALLOWED FOR TEMPORARY WIND/SEISMIC LOADING.

2. LATERAL BEARING PRESSURE: XXX PSF/FT BELOW FINISHED GRADE

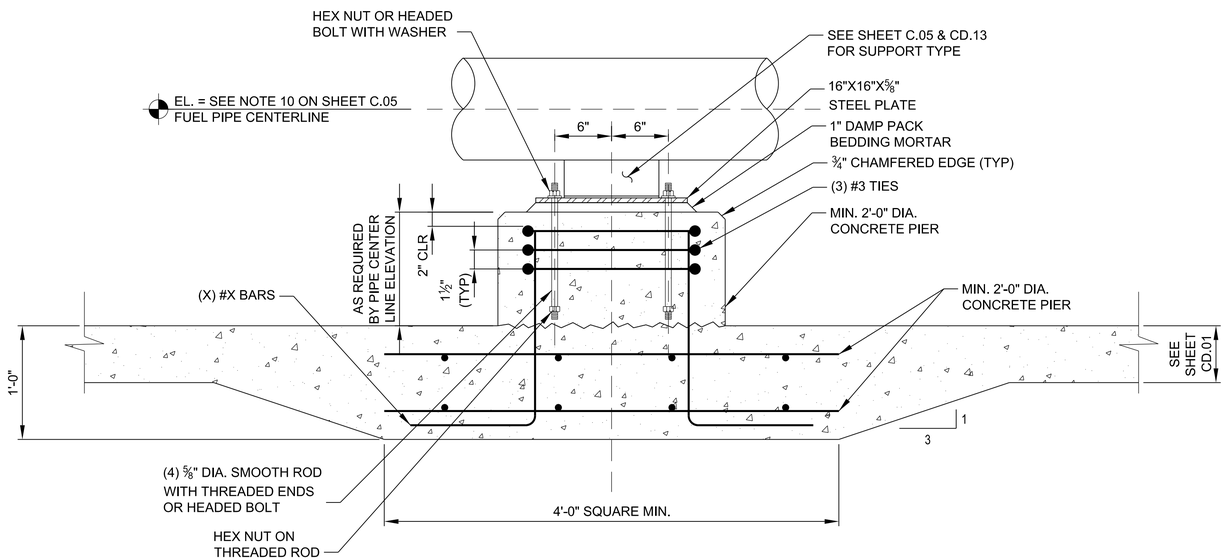
3. FRICTION ANGLE:ϕ = XX°

4. LATERAL EARTH PRESSURE COEFFICIENTS:

   A. ACTIVE: Ka = X.XX
   B. AT-REST: K = X.XX
   C. PASSIVE: Kp = X.XX

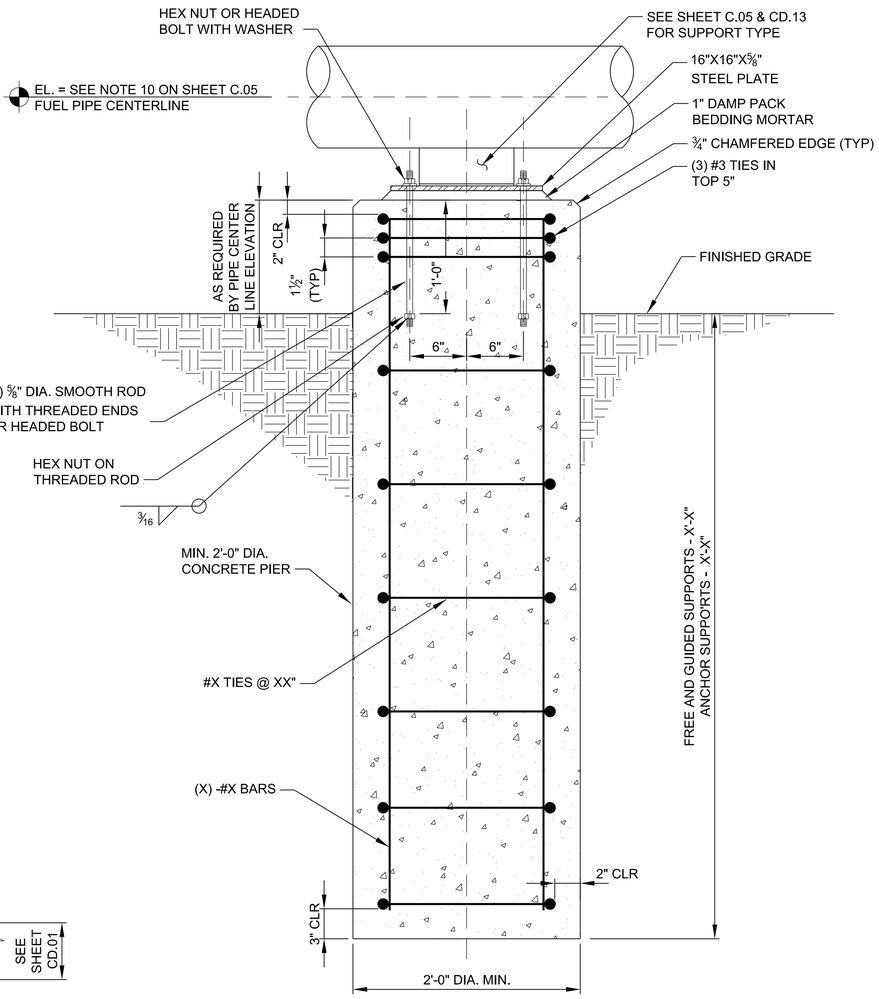
5. COEFFICIENT OF FRICTION: μ = X.XX

6. FROST PENETRATION: XX"



TYPICAL PIER DETAIL - DIKE AREA

SCALE: 1½"=1'-0"



TYPICAL PIER DETAIL - CENTERLINE ELEVATION LESS THAN 3'-0" ABOVE GRADE

SCALE: 1½"=1'-0"

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			DATE
			DESCRIPTION
			SYM

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ACTIVITY

SATISFACTORY TO

DES MSO	DRW MHK	CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

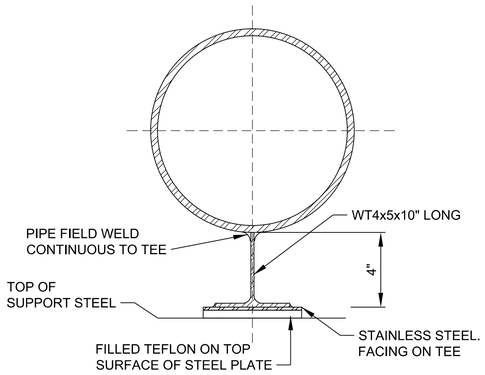
FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

EXTERIOR PIPE SUPPORT NOTES & DETAILS

SCALE:	AS NOTED
EPROJECT NO.:	XXXXX
CONSTR. CONTR. NO.	XXXXX
NAVFAC DRAWING NO.	XXXXX
SHEET	22 OF 57

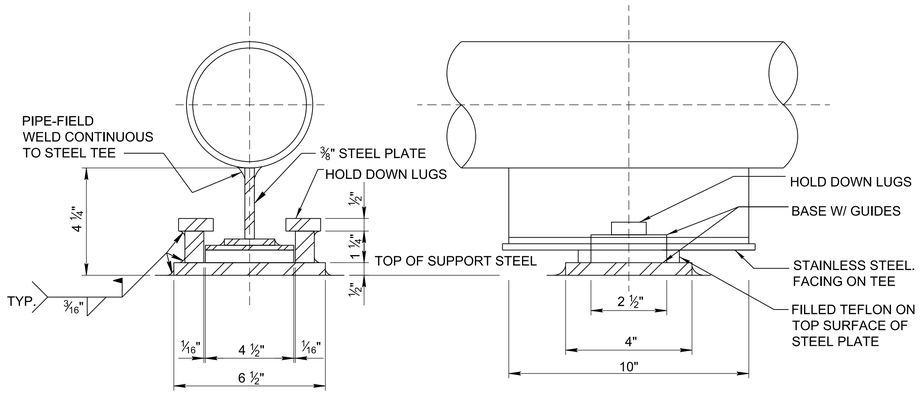
CD.12

DRAWFORM REVISION: 10 MAY 2014



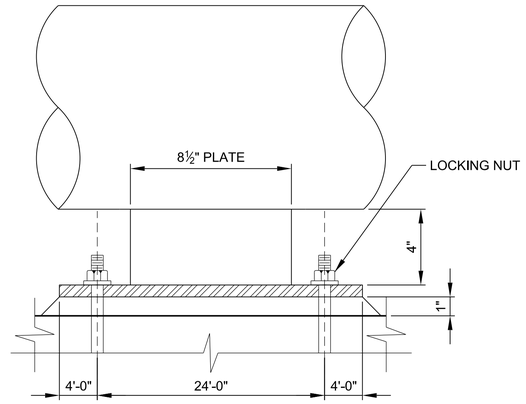
PIPE SUPPORT DETAIL
TYPE FS: FREE SUPPORT

SCALE: NONE



PIPE SUPPORT DETAIL
TYPE GS: GUIDED SUPPORT

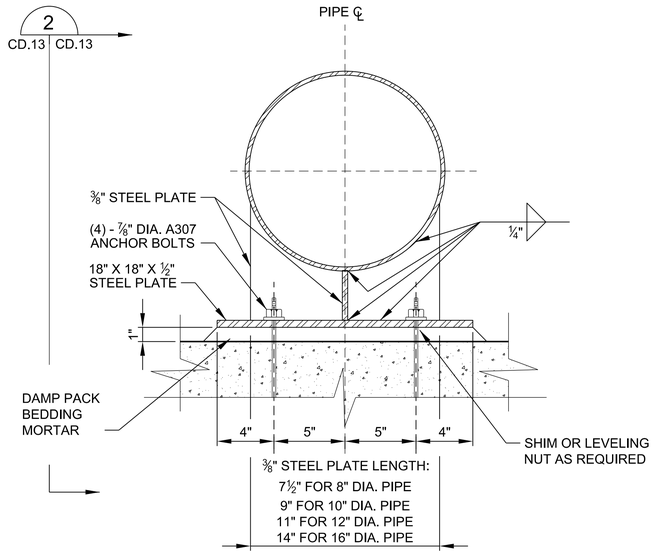
SCALE: NONE



LESS THAN 8" DIA. PIPE SUPPORT SECTION
TYPE AS: ANCHORED SUPPORT

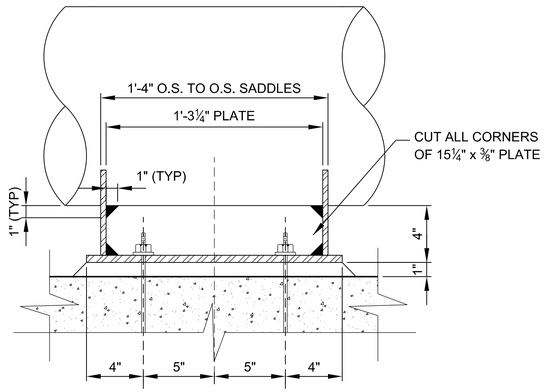
SCALE: NONE

1 CD.13 | CD.13



8" DIA. OR GREATER PIPE SUPPORT DETAIL
TYPE AS: ANCHORED SUPPORT

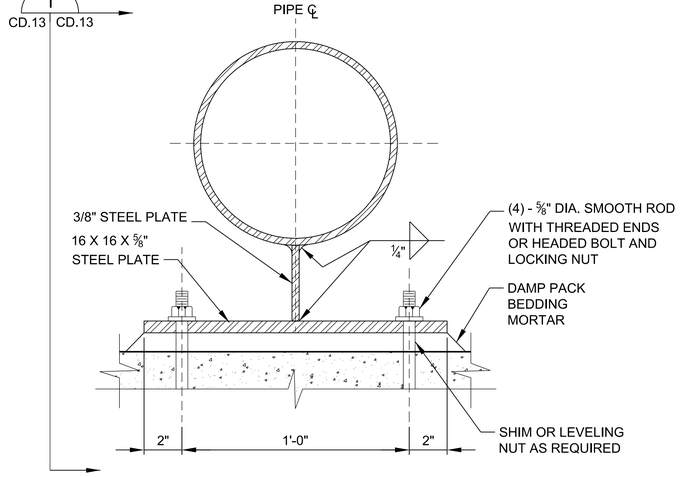
SCALE: NONE



8" DIA. OR GREATER PIPE SUPPORT SECTION
TYPE AS: ANCHORED SUPPORT

SCALE: NONE

2 CD.13 | CD.13



LESS THAN 8" DIA. PIPE SUPPORT DETAIL
TYPE AS: ANCHORED SUPPORT

SCALE: NONE

PIPE SUPPORT NOTES:

1. PROVIDE CARBON STEEL PIPE SUPPORTS, INCLUDING: STRAPS, PLATES GUIDES AND TEE'S WHERE CARBON STEEL PIPE IS USED. ALL CARBON STEEL ELEMENTS SHALL HAVE THE SAME MECHANICAL PROPERTIES PROVIDE 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 15¼" x ⅜" HORIZONTAL PLATE BETWEEN SADDLES SHALL HAVE 1" X 1" TRIANGLES 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.

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SATISFACTORY TO

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SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

EXTERIOR PIPE SUPPORT DETAILS

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO.
XXXXX

NAVFAC DRAWING NO.
XXXXX

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CD.13

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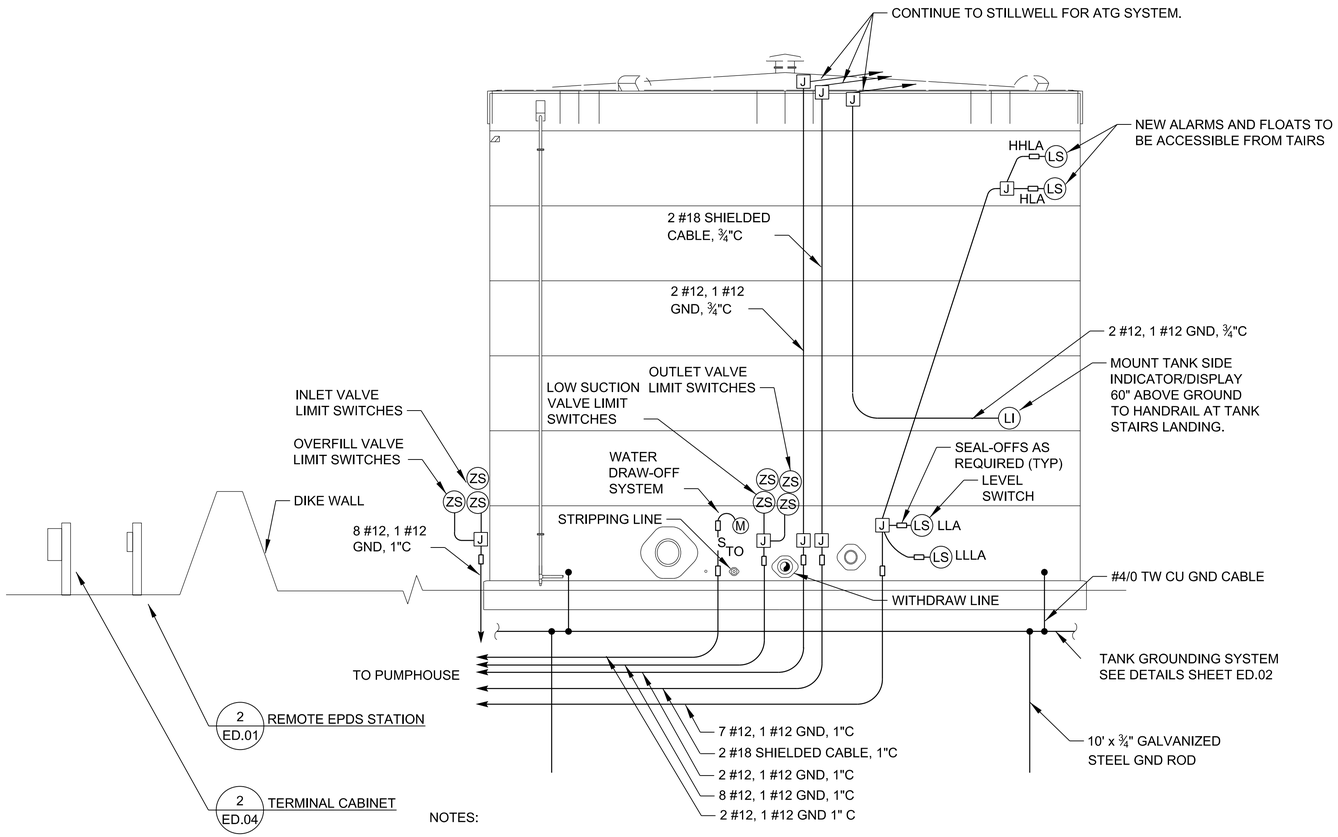


NOTES:

1. SEE TANK DRAWINGS FOR EXACT LOCATION OF LEVEL SWITCHES AND PRODUCT RETURN PUMP.

2. WELD CONDUIT SUPPORT STRUCTURES (UNISTRUT OR EQUAL) TO TANK WALL. DO NOT WELD UNISTRUT DIRECTLY TO TANK SHELL. USE THREADED ARC STUDS OR EQUIVALENT TO INCLUDE THREADED COUPLERS OF THE SAME MATERIAL AS THE CARBON STEEL MATERIAL OF THE TANK SHELL.

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 ED.04 FOR DETAILS.

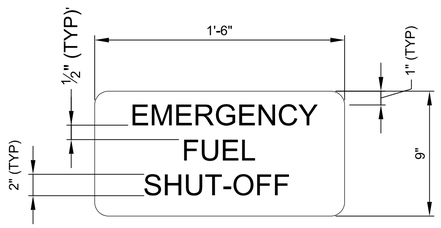
STORAGE TANK ELECTRICAL ELEVATION

SCALE: NONE

DESIGNER NOTE:

1. IF ELECTRONIC TYPE LEVEL ALARMS ARE TO BE USED INSTEAD OF THE MECHANICAL FLOAT TYPE INDICATED ON THE STORAGE TANK ELECTRICAL ELEVATION DETAIL, THEN MODIFY THE DETAIL WITH REQUIREMENTS APPROPRIATE TO THE ELECTRONIC LEVEL ALARMS.

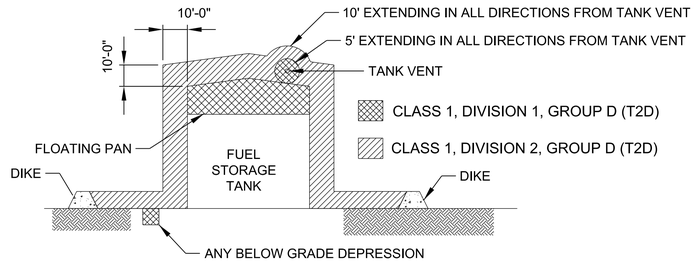
2. IF AN ATG SYSTEM OTHER THAN THE ENRAF 854 TYPE DEPICTED HERE IS TO BE USED, THE STORAGE TANK ELECTRICAL ELEVATION DETAIL SHALL BE MODIFIED TO SHOW APPROPRIATE CONDUITS AND CONDUCTORS FOR THAT TYPE OF ATG SYSTEM.



RED LETTERS, WHITE FIELD

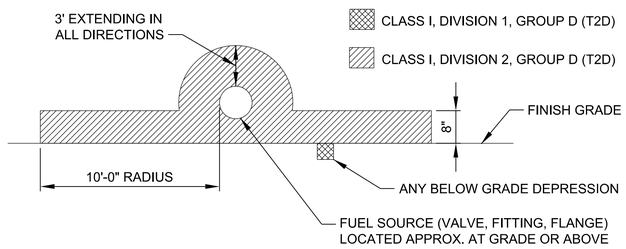
CAUTION SIGN DETAIL 1 ED.01 | ED.01

SCALE: NONE



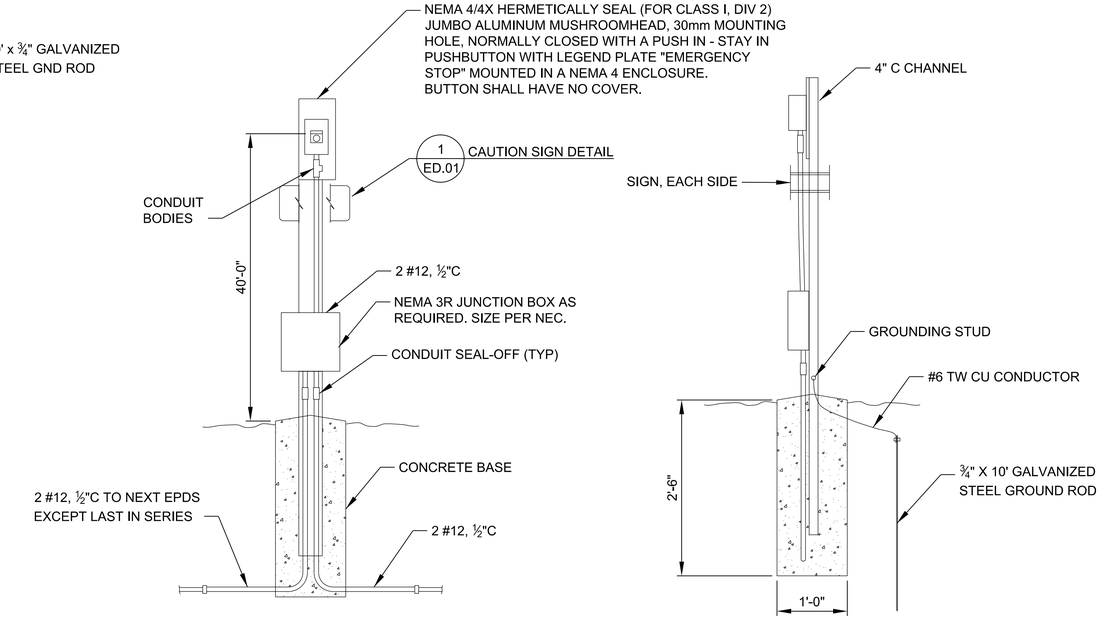
FUEL STORAGE TANK HAZARDOUS AREA DETAIL

SCALE: NONE



EXTERIOR FUEL PIPING HAZARDOUS AREA DETAIL

SCALE: NONE



FRONT VIEW

SIDE VIEW

REMOTE EPDS STATION 2 ED.01 | ED.01

SCALE: NONE

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DATE	
DESCRIPTION	
STM	

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SATISFACTORY TO

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SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL ELECTRICAL ELEVATION

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

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ED.01

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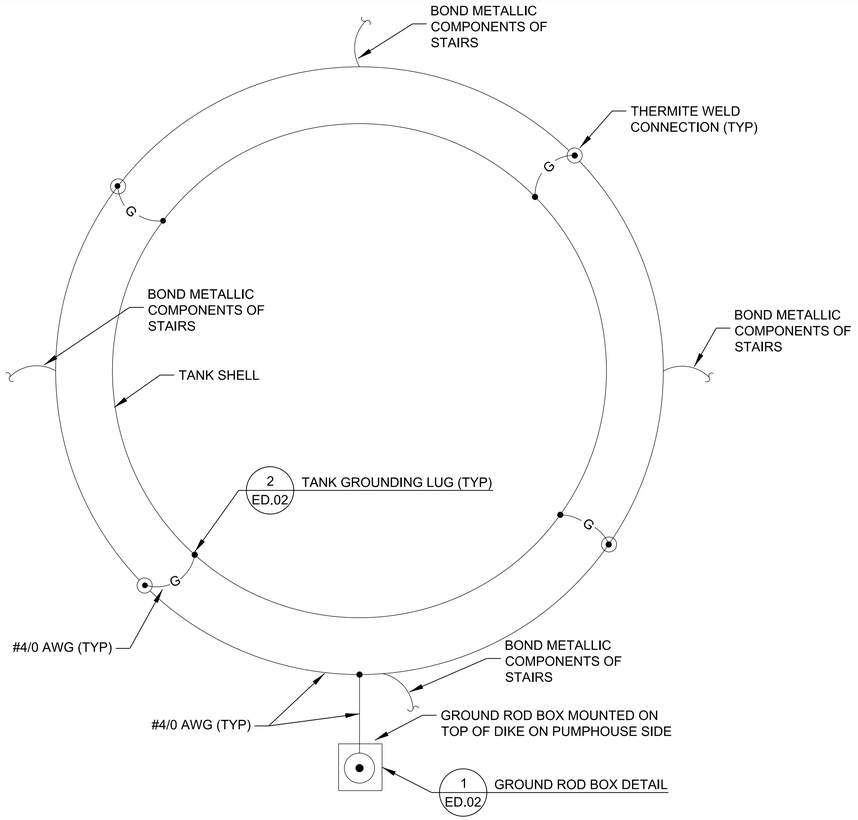
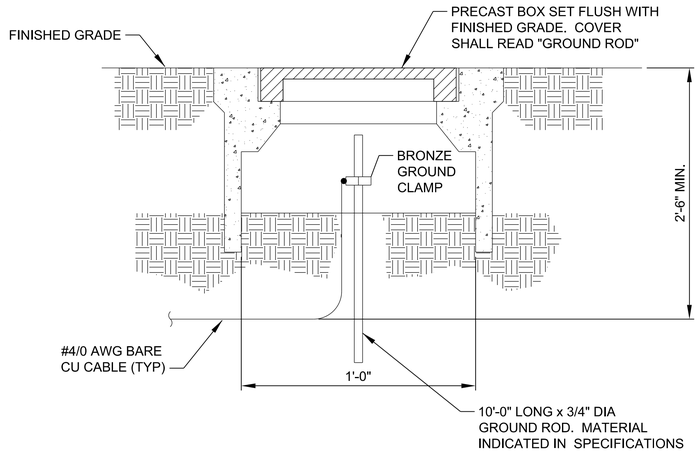


TANK GROUNDING SYSTEM

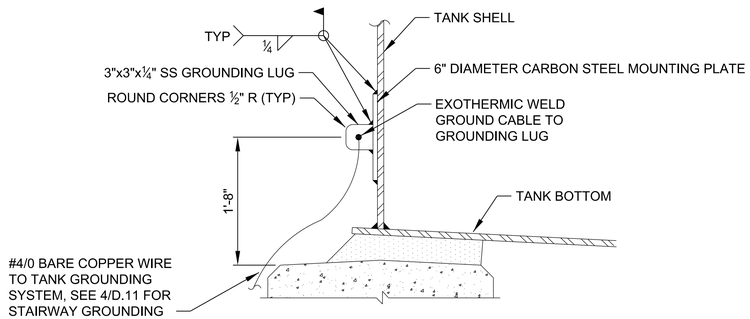
SCALE: NONE



GROUND ROD BOX DETAIL 1

SCALE: NONE

ED.02 | ED.02



TANK GROUNDING LUG 2

SCALE: NONE

ED.02 | ED.02

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DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TANK GROUNDING PLAN

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

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ED.02

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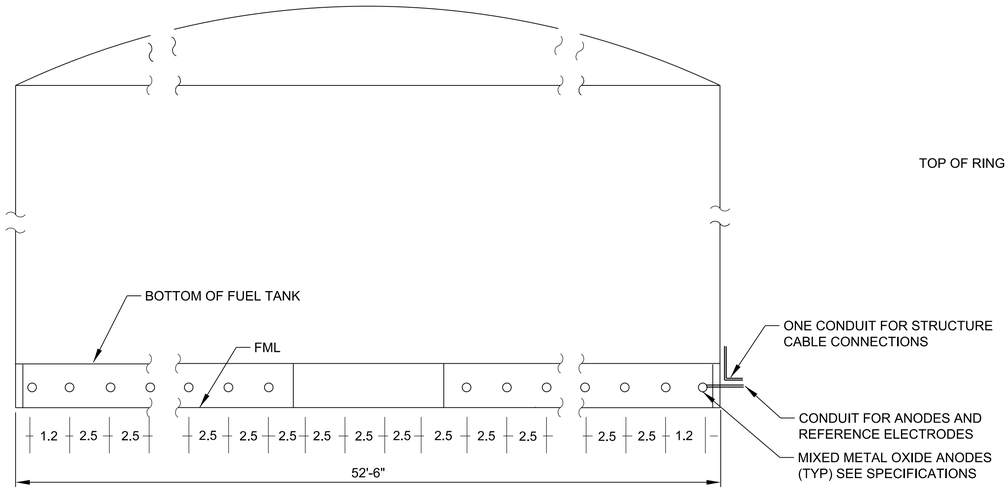


SIDE VIEW

NOTES:
1. ANODES, REFERENCE ELECTRODES SHALL BE LOCATED BENEATH THE FUEL TANK AS SHOWN.

2. ANODES SHALL BE LOCATED AT THE CENTER LINE OF THE SAND TO JUST ABOVE THE LINER BENEATH THE FUEL TANK.

3. SEE DETAIL 1 ON SHEET ED.04.

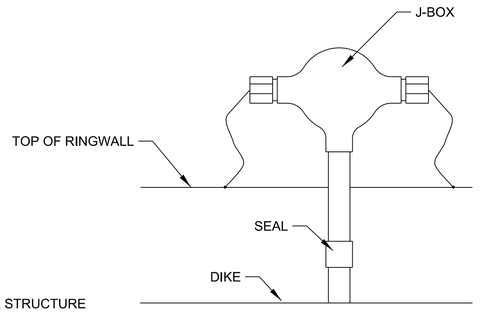
ON GRADE TANKS CATHODIC PROTECTION

SCALE: NONE

DESIGNER NOTES:

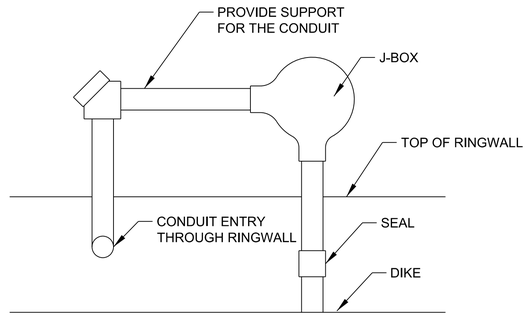
1. ENSURE ALL CATHODICALLY PROTECTED PIPING IS ISOLATED FROM THE TANK WITH AN ISOLATION FLANGE.

2. ALL PIPING WITH ELECTRICAL COMPONENTS CONNECTED TO THE ELECTRICAL GROUND SYSTEM SHALL BE ISOLATED FROM THE TANK.



J-BOX 1 (1 / ED.03)

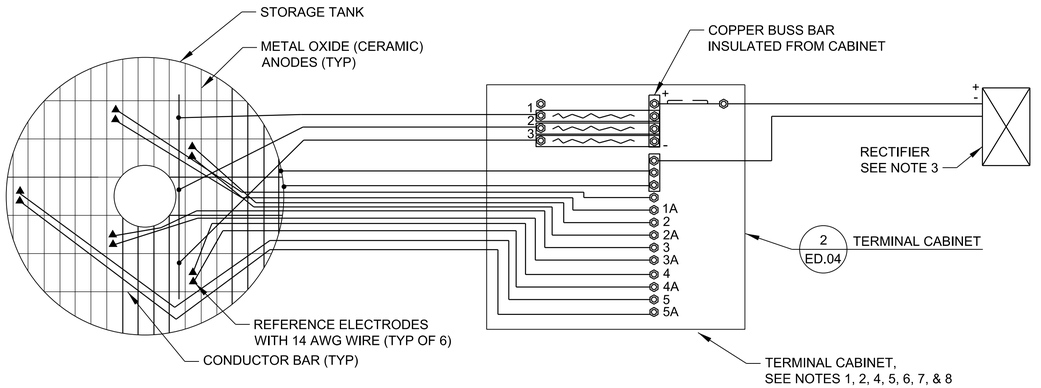
SCALE: NONE

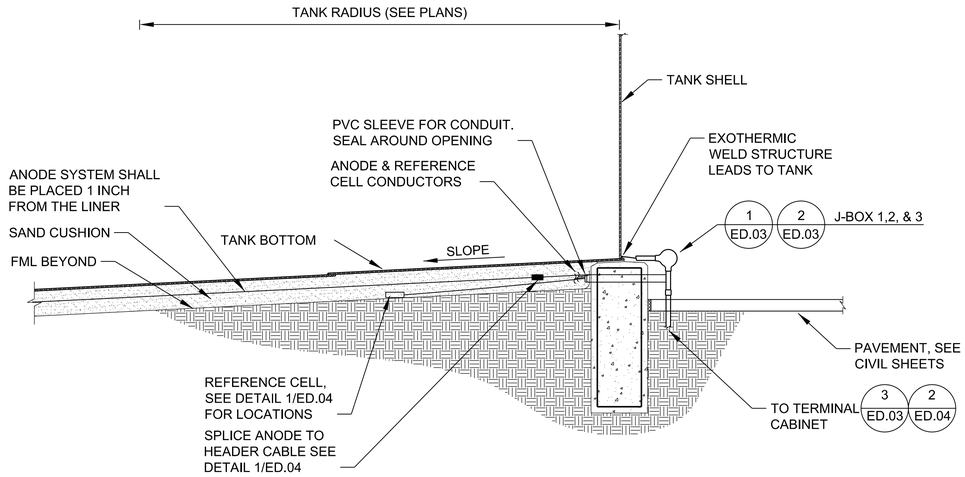


NOTE: ONE J-BOX IS FOR THE ANODE WIRES AND THE OTHER J-BOX IS FOR THE REFERENCE WIRES

J-BOX 2 & 3 (2 / ED.03)

SCALE: NONE





PARTIAL TANK SECTION

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 RECTIFIER AND TERMINAL CABINET.

8. TERMINAL CABINET SHALL HAVE 0.01 OHM, 10 AMP SHUNTS PROVIDED 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

3 / ED.03 | ED.03

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SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

CATHODIC PROTECTION LAYOUT & TYPICAL DETAILS

SCALE: AS NOTED

EPROJECT NO.: XXXXX

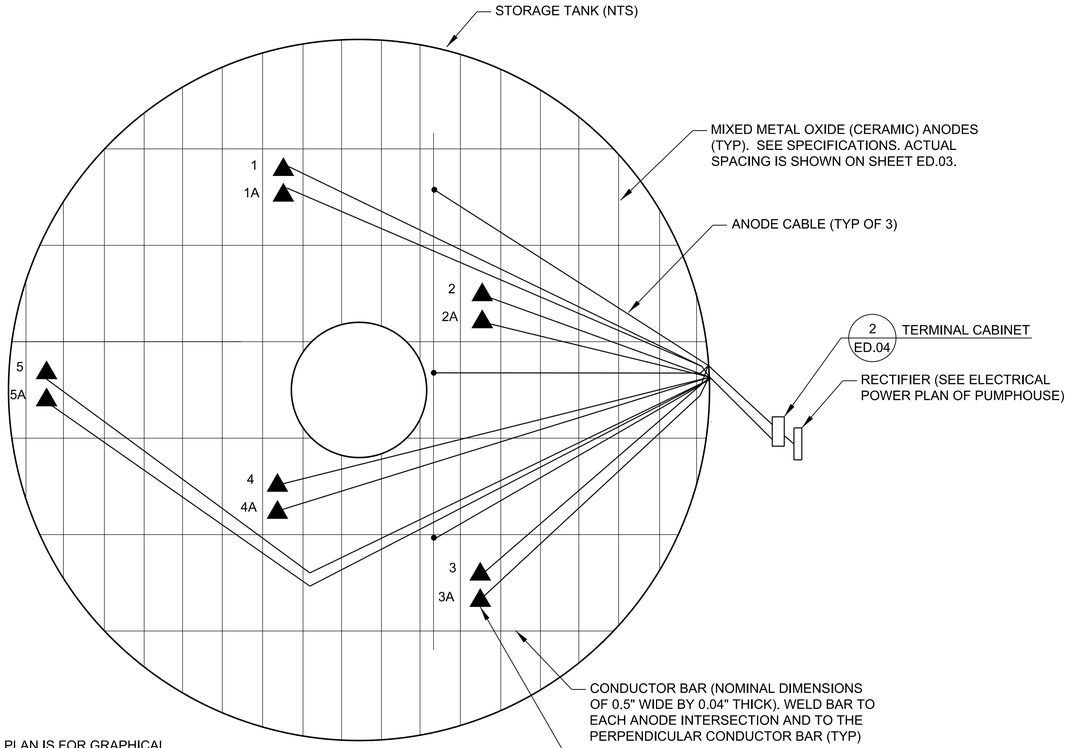
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 26 OF 57

ED.03

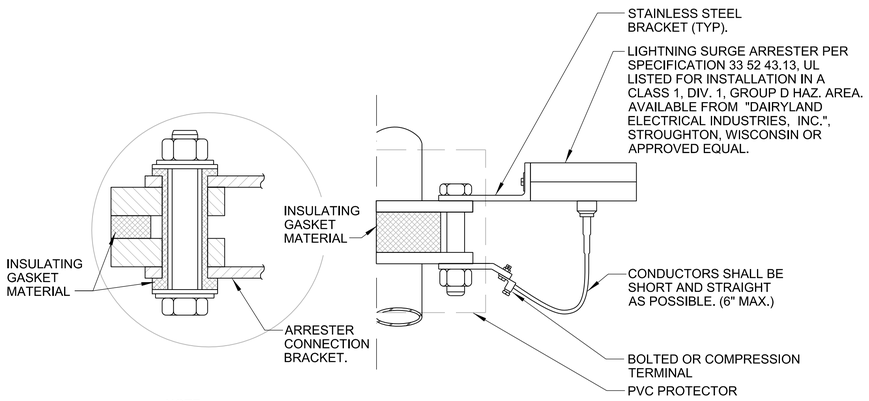
DRAWFORM REVISION: 10 MAY 2014



NOTE: THIS PLAN IS FOR GRAPHICAL REPRESENTAION ONLY AND DOES NOT NECESSARILY MATCH ACTUAL SPACING OF GRID. SEE ON GRADE TANKS CATHODIC PROTECTION ON ED.03 FOR THE SPACING REQUIREMENTS.

TANK ON GRADE CERAMIC ANODE CATHODIC PROTECTION PLAN

SCALE: NONE

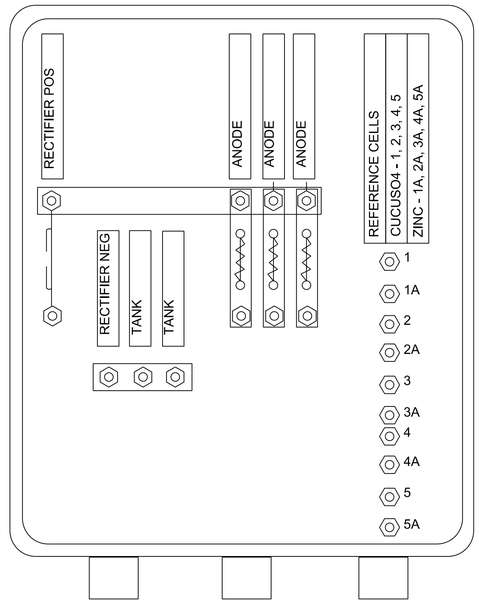


NOTE:

WRAP ENTIRE INSULATING FLANGE IN PVC PIPING AND SECURE WITH STAINLESS STEEL BAND CLAMP. LEAVE LIGHTNING SURGE ARRESTER EXPOSED.

LIGHTNING SURGE ARRESTER DETAIL

NO SCALE



NOTES:
1. PROVIDE SHUNTS WITH THE APPROPRIATE POWER RATINGS. SEE SPECIFICATIONS. SHUNTS SHALL BE O.01 OHM.

2. ALL UNDERGROUND CONNECTIONS SHALL BE ENCASED TO BE WATERTIGHT.

3. PROVIDE ETCHED LABELS BY EACH TERMINAL INDICATING THE NUMBER AND/OR FUNCTION.

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

5. PROVIDE 24"H X 24" W X 6" D NEMA 4X ENCLOSURE 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 ANODE CONDUCTORS COULD CHANGE. CABINET SHALL BE ADJUSTED IN SIZE ACCORDINGLY.

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

TERMINAL CABINET (2)

SCALE: NONE

ED.01 | ED.04
ED.03
ED.04

DESIGNER NOTE:

THE SYSTEM SHOWN IS BASED ON A GRID SYSTEM WITH THE DISTANCES SHOWN. THE ANODES HAD 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:

A. TANK BOTTOM IS BARE. PROTECTIVE COVERAGE SHALL BE 1.5 MA/SQ.FT OF SURFACE. MINIMUM 25 YEAR LIFE IS REQUIRED. RECTIFIER SHALL HAVE A 6 AMP OUTPUT. VOLTAGE OUTPUT SHALL HAVE A MINIMUM SAFETY FACTOR OF 3 TIMES WHAT IS REQUIRED INITIALLY. SHOP DRAWING SHALL INDICATE THAT AN OPTION IS BEING USED. ALL CHANGES NECESSARY TO THE TERMINAL CABINET, CONDUIT, NUMBER OF CABLES, SIZE OF RECTIFIER, ETC. TO MAKE A COMPLETE AND USABLE SYSTEM SHALL BE ACCOMPLISHED BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE GOVERNMENT.

(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 ANODE SHALL HAVE BETWEEN 5 mA/FT TO 25 mA/FT RATING. IF THE SPIRAL ANODE HAS A TOTAL LENGTH UNDER 600 FT, THERE SHALL BE A CONNECTION ON EACH END OF THE ANODE. IF THE SPIRAL ANODE IS OVER 600 FT, THERE SHALL BE THREE CONNECTIONS CONSISTING OF ONE FOR EACH END AND ONE IN THE MIDDLE. THE MAXIMUM INDIVIDUAL ANODE LENGTH WAS ASSUMED TO BE 1000 FT. THE ANODE SHALL BE A MIXED METAL OXIDE TYPE. OUTER SPIRAL SHALL BE BETWEEN 1 FT TO 2.5 FT FROM TANK EDGE.

(2). CONCENTRIC CIRCLES. USING A MIXED METAL OXIDE ANODE, PLACE THE ANODES IN CONCENTRIC CIRCLES EACH ANODE SHALL HAVE A CABLE CONNECTED TO THE END AND BROUGHT OUT TO THE TERMINAL CABINET, I.E. TWO WIRES PER CONCENTRIC CIRCLE.
CONCENTRIC CIRCLES SHALL BE SPACED A MAXIMUM OF 3 FT APART, I.E. DIAMETER OF EACH CONCENTRIC CIRCLE INCREASES BY 6 FT. USE SAME SPACING BETWEEN CIRCLES. MINIMUM OUTPUT OF THE ANODE SHALL BE 20 mA/FT. OUTER CIRCLE SHALL BE BETWEEN 1 FT TO 2.5 FT FROM TANK EDGE.

SYM	DESCRIPTION	DATE	APPR

NAVFAC

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

CATHODIC PROTECTION LAYOUT & TYPICAL DETAILS

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 27 OF 57

ED.04

DRAWFORM REVISION: 10 MAY 2014

A. GENERAL:

1. EVERY TANK HAS THE FOLLOWING WIRED INSTRUMENTATION: AUTOMATIC TANK GAUGING (ATG), LEVEL ALARM SYSTEM, LIMIT SWITCHES ON MAIN TANK DBB'S, AND A SOLENOID PILOT ON THE HIGH LEVEL VALVE. EVERY TANK HAS A WATER DRAW-OFF SYSTEM WITH AN INTEGRAL CONTROL PANEL. AS AN OPTION, TANKS MAY BE PROVIDED WITH MOTOR OPERATED DBB VALVES AND A SIDESTREAM FILTRATION SYSTEM WITH AN INTEGRAL CONTROL PANEL.

2. EVERY TANK OR GROUP OF TANKS SHALL HAVE A TANK ANNUNCIATOR PANEL, A LEVEL ALARM PANEL, AND AN EMERGENCY POWER DOWN SWITCH(EPDS) SYSTEM PANEL. TANKS WITH MOTOR OPERATED DBB VALVES (MOVs) SHALL HAVE AN MOV CONTROL PANEL. TANKS WITH MANUAL MAIN TANK SHUT OFF VALVES SHALL HAVE A VALVE POSITION INDICATOR PANEL. THESE FUNCTIONS SHOULD BE COMBINED INTO A SINGLE PANEL WHERE POSSIBLE.

3. ALARM AND ALARM/CONTROL PANEL(S) SHALL PROVIDE VISUAL AND AUDIBLE ALARMS. ALL ALARMS ON ANY ALARM OR ALARM/CONTROL PANEL MAY BE ACKNOWLEDGED TO SILENCE THE AUDIBLE ALARM. THE VISUAL ALARM SHALL REMAIN ACTIVE UNTIL THE CONDITION RETURNS TO A NON-ALARM STATE.

4. PUMP MOTORS, MOTORIZED VALVE ACTUATORS, OR ANY OTHER MOTORIZED EQUIPMENT THAT HAS BEEN DE-ENERGIZED BY AN ALARM SHALL NOT BE CAPABLE OF BEING RESTARTED UNTIL THE CONDITION RETURNS TO A NON-ALARM STATE AND THE EQUIPMENT IS MANUALLY RESTARTED. EQUIPMENT PROVIDED WITH A HAND-OFF-AUTO (HOA) SWITCH SHALL BE CAPABLE OF BEING RUN IN HAND MODE SUBJECT TO HARDWIRED CONTROL DEVICES (THERMAL OVERLOADS, EMERGENCY POWER DOWN SWITCH INTERLOCKS, ETC).

5. PROVIDE MINIMAL TIME DELAYS ON ALL LEVEL SWITCHES, FLOW SWITCHES, ETC, TO PREVENT NUISANCE ALARMS AND SHUTDOWNS DURING NORMAL OPERATION OF PUMPS, TANKS, ETC. IN ADDITION, ALARMS RELATED TO PUMP OPERATION SHALL ONLY BE ACTIVE WHILE THE PUMP IS IN OPERATION.

6. ALL PUMPS SHALL BE SHUT DOWN; ALL SOLENOID PILOTS SHALL BE DE-ENERGIZED; AND ALL MOTOR OPERATED VALVES (MOVs) SHALL CLOSE WHEN ANY EPDS PUSHBUTTON IS PRESSED. AN ALARM SHALL BE AUDIBLY AND VISUALLY ANNUNCIATED AT THE ALARM PANEL. OPERATION OF ALL PUMPS, ENERGIZING OF ANY SOLENOID PILOTS, AND OPENING OF MOTOR OPERATED DBBs SHALL BE PREVENTED UNTIL ALL EPDS PUSHBUTTONS ARE CLEARED AND THE ALARM ACKNOWLEDGED.

B. MAIN TANK SHUT-OFF VALVES:

1. MAIN TANK SHUT-OFF VALVES SHALL BE THE VALVES LOCATED CLOSEST TO THE TANK NOZZLE ON THE TANK ISSUE, RECEIPT, AND LOW SUCTION LINES. THESE VALVES SHALL BE DOUBLE BLOCK AND BLEED (DBB) PLUG VALVES. PROVIDE THESE VALVES WITH LIMIT SWITCHES TO INDICATE VALVE POSITION (WHETHER MANUAL OR MOTOR OPERATED).

2. MOTOR OPERATED DBB VALVES (MOVs) MAY BE PROVIDED IN LIEU OF MANUAL DBB VALVES WHERE APPROVED BY SERVICE HEADQUARTERS. MOVs SHALL BE SELF-CONTAINED WITH THE MANUFACTURER'S STANDARD CONTROL LOGIC FOR OPENING AND CLOSING OF THE VALVE. EACH VALVE SHALL HAVE A LOCAL CONTROL STATION WITH A LOCAL-OFF-REMOTE SWITCH. WHEN SWITCHED TO LOCAL, THE VALVE MAY ONLY BE OPERATED FROM THE LOCAL CONTROL STATION (MOV CONTROL PANEL HAS NO EFFECT). WHEN SWITCHED TO REMOTE, THE VALVE MAY BE OPERATED FROM THE MOV CONTROL PANEL OR FROM THE LOCAL CONTROL STATION. WHEN SWITCHED TO OFF, THE VALVE SHALL NOT OPERATE. IGNORE EMERGENCY POWER DOWN SWITCH (EPDS) FUNCTION SHALL BE HARDWIRED AND NOT AFFECTED BY LOCAL-OFF-REMOTE SWITCH SETTING.

3. REMOTE OPERATION OF THE MOV SHALL BE FROM THE MOV CONTROL PANEL. THE MOV CONTROL PANEL SHALL HAVE OPEN, CLOSE, AND STOP PUSH BUTTONS; AND OPEN AND CLOSE POSITION INDICATOR LIGHTS. INDICATOR LIGHTS SHALL INDICATE VALVE POSITION AT ALL TIMES.

4. EACH MANUAL DBB VALVE POSITION SHALL BE MONITORED ON A VALVE POSITION INDICATOR PANEL WHICH SHALL HAVE OPEN AND CLOSED LIGHTS FOR EACH VALVE.

5. LOCAL CONTROL STATION FOR EACH MOTOR OPERATED DBB SHALL BE READILY ACCESSIBLE AND MAY BE LOCATED ON THE MOTOR OPERATOR. IF THERE IS MORE THAN ONE MOV IN THE SAME AREA AND PREFERRED BY THE FACILITY, THE LOCAL CONTROL STATIONS MAY BE COMMONLY LOCATED.

6. WHEN AN MOV IS PROVIDED ON THE RECEIPT NOZZLE, AND THE LOCAL-OFF-REMOTE SWITCH IS IN THE REMOTE POSITION, THE MOV MAY BE OPENED, CLOSED, OR STOPPED AT ANY TIME WHEN THE LEVEL IN THE TANK IS BELOW THE HIGH-HIGH LEVEL. WHEN THE LEVEL IN THE TANK RISES TO THE HIGH-HIGH LEVEL, AS SENSED BY THE LEVEL ALARM SYSTEM, THE MOV SHALL CLOSE AND SHALL NOT BE ABLE TO BE OPENED UNTIL THE LEVEL IN THE TANK DROPS BELOW THE HIGH LEVEL AS SENSED BY THE LEVEL ALARM SYSTEM.

7. WHEN AN MOV IS PROVIDED ON THE ISSUE NOZZLE, AND THE LOCAL-OFF-REMOTE SWITCH IS IN THE REMOTE POSITION THE MOV MAY BE OPENED, CLOSED, OR STOPPED WHEN THE LEVEL IN THE TANK IS ABOVE THE LOW-LOW LEVEL. WHEN THE LEVEL IN THE TANK DROPS TO THE LOW-LOW LEVEL, AS SENSED BY THE LEVEL ALARM SYSTEM, THE MOV SHALL CLOSE AND SHALL NOT BE ABLE TO BE OPENED UNTIL THE LEVEL IN THE TANK RISES ABOVE THE LOW LEVEL AS SENSED BY THE LEVEL ALARM SYSTEM.
NOTE: MOV MAY NOT BE APPROPRIATE ON COMMERCIAL PIPELINE WITH NO BREAK OUT TANK, PD PUMP/OCEAN GOING TANKER, ETC.

8. WHEN AN MOV IS PROVIDED ON THE LOW SUCTION NOZZLE THE MOV MAY BE OPEN, CLOSED, OR STOPPED AT ANY TIME BY EITHER THE LOCAL CONTROL STATION OR THE MOV CONTROL PANEL, DEPENDING ON THE SETTING OF THE LOCAL-OFF-REMOTE SWITCH.

C. ELECTRONIC AUTOMATIC TANK GAUGING (ATG) SYSTEM:

1. THE ATG SYSTEM CONSISTS OF THE ATG, AND THE TEMPERATURE, BOTTOM SEDIMENT, AND WATER (BS&W) PROBE MOUNTED IN SEPARATE STILLING WELLS. THE ATG SHALL TRANSMIT LEVEL AND TEMPERATURE DATA TO THE MONITORING SYSTEM WHICH WILL USE STORED STRAPPING CHART DATA TO CALCULATE GROSS AND NET VOLUMES.

2. ATG SHALL BE PROVIDED AS STATED IN DLA MEMORANDUM FOR DIRECTOR, DEFENSE ENERGY SUPPORT CENTER, AUTOMATED TANK GAUGE (ATG) INTALLATION POLICY, DATED 16 DEC 2009.

D. LEVEL ALARM SYSTEM:

1. PROVIDE EACH TANK WITH A LEVEL ALARM SYSTEM WITH LOW, LOW-LOW, HIGH AND HIGH-HIGH LEVEL SWITCHES. ALARMS SHALL BE ANNUNCIATED AUDIBLY AND VISUALLY ON THE LEVEL ALARM PANEL. AUDIBLE ALARM(S) SHALL BE CAPABLE OF BEING MANUALLY SILENCED.

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

3. WHEN THE LEVEL IN THE STORAGE TANK DESCENDS TO THE LOW-LOW LEVEL SETPOINT AS SENSED BY THE LOW-LOW LEVEL SWITCH, AN ALARM SHALL BE ANNUNCIATED AT THE LEVEL ALARM PANEL. THE ALARM CONDITION SHALL REMAIN ON UNTIL THE LEVEL IN THE TANK RISES ABOVE THE LOW-LOW LEVEL SETPOINT AS SENSED BY THE LOW-LOW LEVEL SWITCH.

4. WHEN THE LEVEL IN THE TANK RISES TO THE HIGH LEVEL SETPOINT AS SENSED BY THE HIGH LEVEL SWITCH, AN ALARM SHALL BE ANNUNCIATED AT THE LEVEL ALARM PANEL. THE ALARM CONDITION SHALL REMAIN ON UNTIL THE LEVEL IN THE TANK DESCENDS BELOW THE HIGH LEVEL SETPOINT AS SENSED BY THE HIGH LEVEL SWITCH.

5. WHEN THE LEVEL IN THE TANK RISES TO THE HIGH-HIGH SETPOINT AS SENSED BY THE HIGH-HIGH LEVEL SWITCH, AN ALARM SHALL BE ANNUNCIATED AT THE LEVEL ALARM PANEL. THE ALARM CONDITION SHALL REMAIN ON UNTIL THE LEVEL IN THE TANK DESCENDS BELOW THE HIGH-HIGH LEVEL SETPOINT AS SENSED BY THE HIGH-HIGH LEVEL SWITCH.

E. HIGH LIQUID LEVEL SHUT-OFF VALVE (HLV):

1. WHEN THE LEVEL OF THE TANK RISES TO THE HLV SETPOINT AS SENSED BY THE FLOAT PILOT, THE HLV SHALL BEGIN CLOSING AND SHALL BE ADJUSTED TO FULLY CLOSE BEFORE THE LEVEL REACHES THE HIGH-HIGH LEVEL ALARM.

2. WHEN THE LEVEL OF THE TANK DESCENDS BELOW THE ACTUATION LEVEL OF THE FLOAT PILOT, THE HLV SHALL BEGIN OPENING AND SHALL BE ADJUSTED TO BE FULLY OPEN BY THE TIME THE LEVEL FALLS TO THE HIGH LEVEL ALARM.

3. PROVIDE HLV WITH DIFFERENTIAL PRESSURE SUSTAINING CONTROL AND WITH PRESSURE SENSITIVE CLOSING FEATURE FOR SURGE RELIEF (MANDATORY FOR ALL DOD AGENCIES EXCEPT THE AIR FORCE; PROVIDE FOR AIR FORCE WHEN DIRECTED BY COMMAND FUELS FACILITY ENGINEER).

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

5. PROVIDE SLOW CLOSING SPEED CONTROL FEATURE TO MINIMIZE PRESSURE SURGE WHEN HLV CLOSES.

6. PROVIDE DIFFERENTIAL PRESSURE CONTROL PILOT TO ENSURE VALVE HAS SUFFICIENT DIFFERENTIAL PRESSURE TO CLOSE WHEN CALLED UPON BY THE SOLENOID PILOT OR THE LEVEL CONTROL PILOT. (PARTICULARLY IMPORTANT BECAUSE LOW FLOWS DO NOT GENERATE SUFFICIENT DIFFERENTIAL PRESSURE TO CLOSE VALVE IN A REASONABLE AMOUNT OF TIME).

7. PROVIDE PRESSURE SENSITIVE CLOSING FEATURE TO MINIMIZE SURGING ON PIPELINE AND MARINE RECEIPTS ONLY WHEN APPROVED BY THE SERVICE HEADQUARTERS. (WHEN USING THIS VALVE FEATURE, SET PRESSURE SUCH THAT NORMAL PUMP OPERATION WILL NOT KEEP THE VALVE OPEN; FOR EXAMPLE SET HIGHER THAN TRANSFER PUMP DEADHEAD PRESSURE SO VALVE WILL CLOSE AT A PRESSURE HIGHER THAN DEADHEAD PRESSURE BUT LOWER THAN MAXIMUM ALLOWABLE SURGE PRESSURE).

8. THE HLV FLOAT PILOT SHALL BE BACKED-UP WITH A SOLENOID PILOT TO BEGIN CLOSURE OF THE CONTROL VALVE WHEN THE TANK LEVEL REACHES THE HIGH-HIGH LEVEL, AS SENSED BY THE LEVEL ALARM SYSTEM.

9. THE SOLENOID SHALL BE NORMALLY ENERGIZED ENABLING THE CONTROL VALVE TO OPEN ON A RISE IN UPSTREAM PRESSURE. WHEN THE LIQUID LEVEL REACHES THE HIGH-HIGH LEVEL, OR THERE IS A LOSS OF POWER, THE SOLENOID SHALL BE DE-ENERGIZED DISABLING THE CONTROL VALVE, CAUSING IT TO CLOSE. A MANUAL BYPASS VALVE SHALL BE PROVIDED TO BYPASS THE SOLENOID CONTROL, ENABLING THE CONTROL VALVE TO BE OPENED DURING A LOSS OF POWER. THE MANUAL BYPASS VALVE SHALL BE FITTED WITH A POSITION SWITCH THAT ACTIVATES A POSITION ALARM ON THE ALARM PANEL TO ALERT THE OPERATOR THAT THE SOLENOID BYPASS IS OPEN AFTER POWER IS RESTORED. EMERGENCY POWER DOWN SYSTEM (EPDS) FUNCTION SHALL BE HARDWIRE INTERLOCKED WITH THE HLV SOLENOID VALVE.

F. ISSUE PUMP:

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

1. THE ISSUE PUMP MAY NOT BE OPERATED, EXCEPT IN HAND MODE, WHILE BOTH THE ISSUE DBB AND THE LOW SUCTION DBB ARE CLOSED.

2. THE ISSUE PUMP MAY NOT BE OPERATED, EXCEPT IN HAND MODE, WHEN THE LEVEL ALARM SYSTEM INDICATES A LOW-LOW LEVEL.

G. RECEIPT PUMP:

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

1. THE RECEIPT PUMP, IF POSITIVE DISPLACEMENT TYPE, MAY NOT BE OPERATED, EXCEPT IN HAND MODE, WHILE THE RECEIPT DBB IS CLOSED.

2. THE RECEIPT PUMP MAY NOT BE OPERATED, EXCEPT IN HAND MODE, WHEN THE LEVEL ALARM SYSTEM INDICATES A HIGH-HIGH LEVEL.

H. WATER DRAW-OFF SYSTEM:

1. PROVIDE SYSTEM WITH AN INTEGRAL CONTROL PANEL WITH PUMP START/STOP PUSHBUTTONS AND WITH RED (RUN) AND GREEN (STOP) LIGHTS.

I. EMERGENCY POWER DOWN SWITCH (EPDS) SYSTEM:

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

1. DEPRESSION OF ANY EPDS PUSHBUTTON SHALL ACT TO CLOSE ALL MOVs, ALL HLVs, AND DE-ENERGIZE THE SIDESTREAM FILTRATION SYSTEM PUMP.

2. PROVIDE EPDS SYSTEM WITH KEY LOCKABLE BYPASS SWITCH.

J. SIDESTREAM FILTRATION SYSTEM (OPTIONAL):

1. PROVIDE SYSTEM WITH INTEGRAL SIDESTREAM FILTRATION CONTROL SYSTEM CONTROL PANEL WITH START/STOP PUSHBUTTONS, AUDIBLE HORN AND VISUAL ALARM LIGHTS, AND WITH ACKNOWLEDGE AND RESET PUSHBUTTONS.

2. MANUALLY START AND STOP PUMP WITH START/STOP PUSHBUTTONS.

3. UPON LOSS OF PUMP FLOW (AS INDICATED BY THE PADDLE TYPE FLOW SWITCH) A TROUBLE ALARM SHALL BE ANNUNCIATED ON THE TANK ANNUNCIATOR PANEL AND AN AUDIBLE AND UNIQUE VISUAL ALARM SHALL BE ANNUNCIATED ON THE SIDESTREAM FILTRATION SYSTEM CONTROL PANEL AND THE PUMP SHALL BE DE-ENERGIZED.

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 ANNUNCIATED ON THE SIDESTREAM FILTRATION SYSTEM CONTROL PANEL AND THE PUMP SHALL BE DE-ENERGIZED. THE ALARM CONDITION SHALL REMAIN UNTIL THE LEVEL IN THE SUMP DROPS BELOW THE HIGH LEVEL.

5. WHEN THE LEVEL IN THE PRODUCT SAVER TANK RISES TO THE HIGH LEVEL SETPOINT AS SENSED BY THE HIGH LEVEL SWITCH, A TROUBLE ALARM SHALL BE ANNUNCIATED ON THE TANK ANNUNCIATOR PANEL AND AN AUDIBLE AND UNIQUE VISUAL ALARM SHALL BE ANNUNCIATED ON THE SIDESTREAM FILTRATION SYSTEM CONTROL PANEL. THE ALARM CONDITION SHALL REMAIN UNTIL THE LEVEL IN THE TANK DROPS BELOW THE HIGH LEVEL.

6. WHEN THE LEVEL IN THE PRODUCT SAVER TANK RISES TO THE HIGH-HIGH LEVEL SETPOINT AS SENSED BY THE HIGH-HIGH LEVEL SWITCH, A TROUBLE ALARM SHALL BE ANNUNCIATED ON THE TANK ANNUNCIATOR PANEL AND AN AUDIBLE AND UNIQUE VISUAL ALARM SHALL BE ANNUNCIATED ON THE SIDESTREAM FILTRATION SYSTEM CONTROL PANEL AND THE PUMP SHALL BE DE-ENERGIZED. THE ALARM CONDITION SHALL REMAIN UNTIL THE LEVEL IN THE TANK DROPS BELOW THE HIGH-HIGH LEVEL.

7. THE CONTROL PANEL SHALL BE INTERLOCKED WITH THE LIMIT SWITCHES ON THE 4" LOW SUCTION LINE DBB AND ON THE TANK FILL LINE DBB TO ALLOW THE PUMP TO BE STARTED ONLY IF BOTH LIMIT SWITCHES INDICATE THE VALVES ARE IN THE OPEN POSITION.

8. THE CONTROL PANEL SHALL BE INTERLOCKED WITH THE EMERGENCY POWER DOWN SWITCH SYSTEM TO DE-ENERGIZE THE PUMP IF ANY EPDS PUSHBUTTON IS DEPRESSED.

ANNUNCIATOR PANEL		
TANK XXX HIGH-HIGH LEVEL (R)	TANK XXX HIGH-HIGH LEVEL (R)	EMERGENCY STOP (R)
TANK XXX HIGH LEVEL (W)	TANK XXX HIGH LEVEL (W)	PST HIGH-HIGH ALARM (R)
TANK XXX LOW LEVEL (W)	TANK XXX LOW LEVEL (W)	PST HIGH ALARM (W)
TANK XXX LOW-LOW LEVEL (R)	TANK XXX LOW-LOW LEVEL (R)	SPARE
TANK XXX HLV SOLENOID BYPASS OPEN (R)	TANK XXX HLV SOLENOID BYPASS OPEN (R)	SPARE
PCP TEMPERATURE (W)	TANK SETUP ERROR (W)	SIDESTREAM FILTRATION SYSTEM TROUBLE (W)

NOTES:
1. WHITE (W) - WHITE WINDOW WITH BLACK LETTERS
2. RED (R) - RED WINDOW WITH BLACK LETTERS
3. RED WINDOW ALARMS (CRITICAL) SHALL STOP ALL PUMPS RUNNING IN AUTOMATIC MODE.
4. PST ALARMS ARE REQUIRED IF SIDESTREAM FILTRATION SYSTEM IS PROVIDED.

TYPICAL TANK ANNUNCIATOR PANEL LAYOUT

SCALE: NONE

APPR	DATE	DESCRIPTION	CTM

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DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

ELECTRICAL SEQUENCE OF OPERATION

SCALE: AS NOTED

EPROJECT NO.: XXXXX

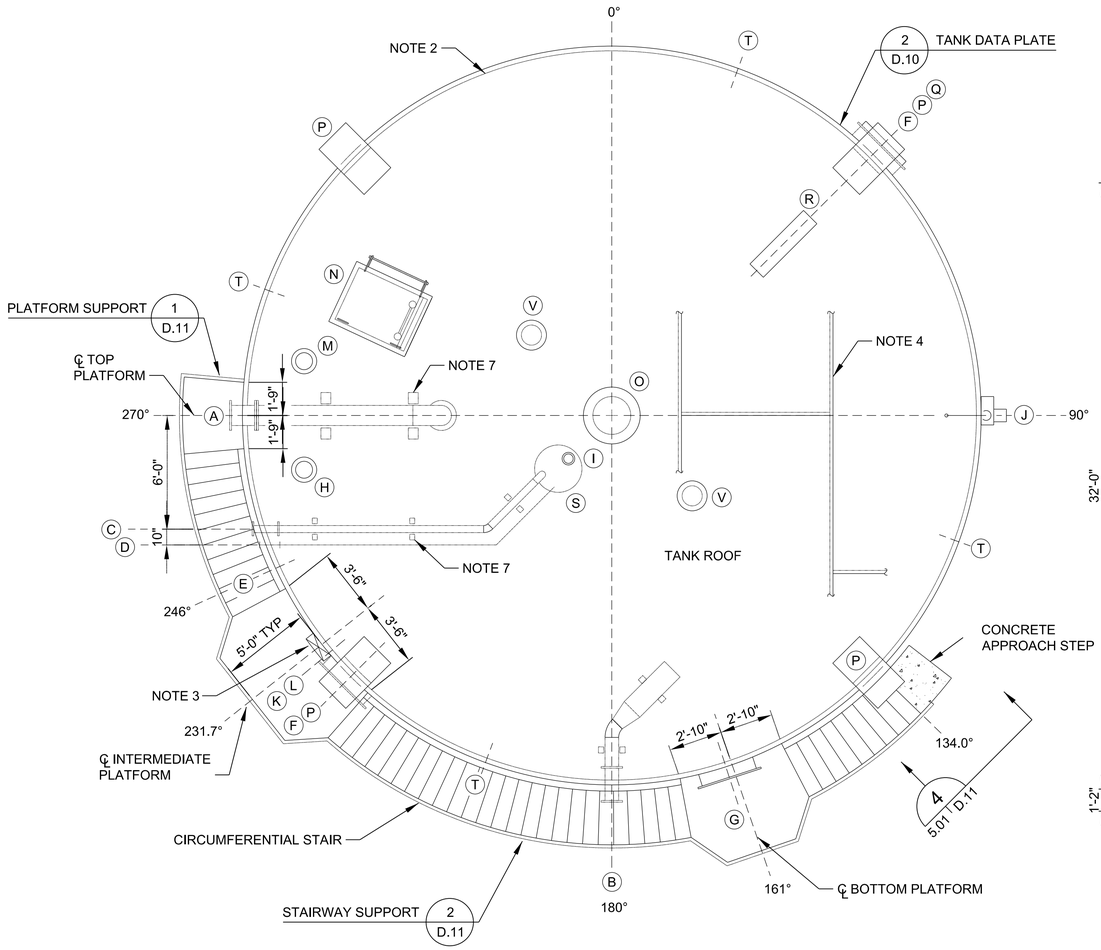
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 28 OF 57

ED.05

DRAWFORM REVISION: 10 MAY 2014



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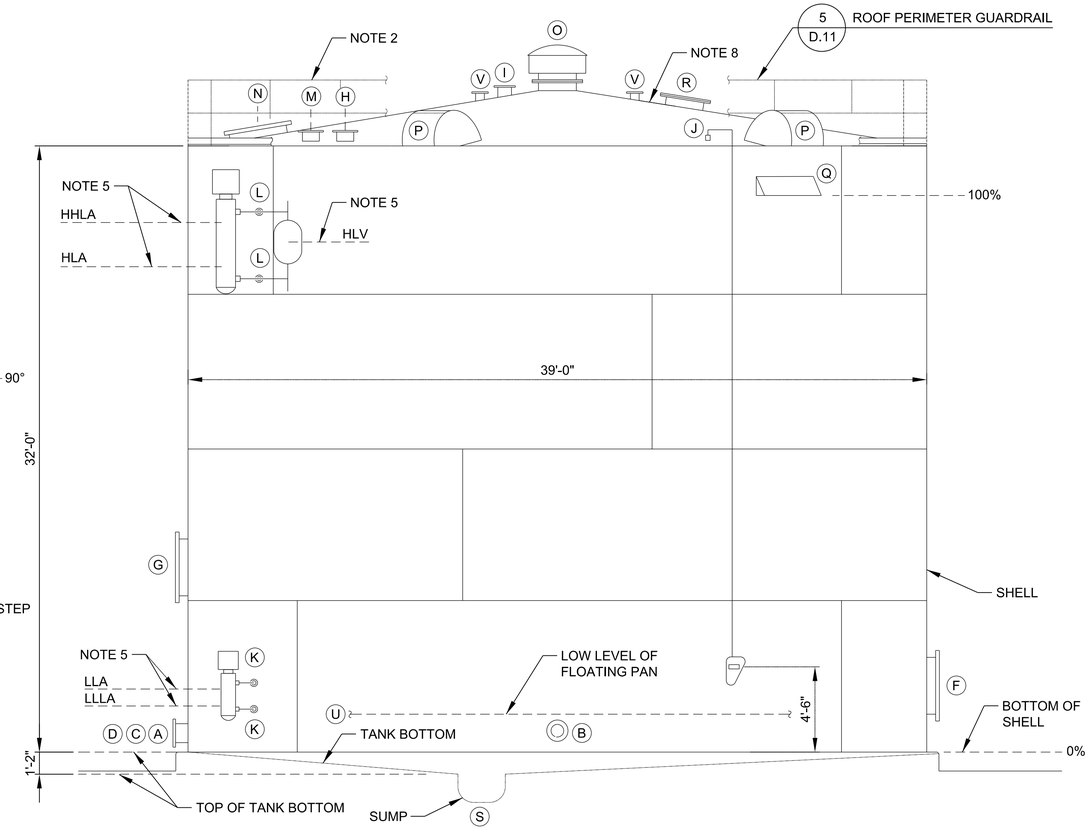

NOTE:
CIRCUMFERENTIAL STAIRS NOT SHOWN FOR CLARITY. ITEMS SHOWN ON ELEVATION ARE SHOWN WITHOUT REGARD TO ORIENTATION, SEE NOTE 1.

ELEVATION

NOTES:

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 6/D.08.

8. PROVIDE A ROOF WITH SLOPE OF 1½:12.

5,000 BBL TANK

SCALE: ¼"=1'-0"

0 2' 4' 8'

N

APPR | DATE | DESCRIPTION | CTM

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ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

5,000 BBL TANK

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 29 OF 57

5.01

DRAWFORM REVISION: 10 MAY 2014

5,000 BBL TANK NOZZLE/EQUIPMENT SCHEDULE

ITEM	DESCRIPTION	SIZE (IN)	ANGLE (DEGREES)	DISTANCE (NOTE 1)	DETAIL SHOWN (DETAIL/SHEET)	NOTES
A	ISSUE	12	270	1'-1½"	4/D.08	4, 5, 10
B	FILL	8	180	1'-1¾"	1/D.08	4, 5, 10
C	LOW SUCTION	4	-	1'-1½"	5/D.07, 1/D.10	5, 13
D	WATER DRAW-OFF	2	-	1'-½"	3/D.07, 1/D.10, 5/D.13	9, 13
E	PRODUCT RETURN	2	246	7"	5/D.13	
F	SHELL MANHOLES (LOWER)	36	-	3'-6"	3/D.10, 6/D.10	2, 17
G	SHELL MANHOLE (UPPER)	36	162	9'-9"	3/D.10, 6/D.10	6, 17
H	ATG GAUGE WELL	10	259	16'-6"	4/D.07	16
I	ATG WATER PROBE WELL	8	225	3'-3"	3/D.07	8
J	MECHANICAL TAPE LEVEL GAUGE	1½	90	-	1/D.07	
K	LOW & LOW-LOW LEVEL ALARM NOZZLES	1	230	X'-X", X'-X"	1/D.12	
L	HIGH & HIGH-HIGH LEVEL ALARM AND HLV NOZZLES	1	230	X'-X", X'-X"	2/D.12	7
M	SAMPLE GAUGE WELL	10	280	16'-6"	2/D.07	16
N	ROOF MAHOLE/LADDER HATCH	36 X 48	295	13'-6"	3/D.09	
O	CENTER ROOF VENT	24	-	-	2/D.09	
P	CIRCULATION VENT/INSPECTION HATCHES	18 X 24	45, 135, 225, 315	-	1/D.09	
Q	OVERFLOW/CIRCULATION VENT	12 X 36	45	28'-1"	6/D.07	12
R	PAN INSTALLATION HATCH	-	45	-	-	3
S	SUMP	30	225	4'-0"	5/D.07	
T	GROUNDING LUGS	3 X 3 X ⅜	20, 110, 200, 290	1'-0"	3/D.14	
U	FLOATING PAN LOW LEG LEVEL	-	-	2'-5"	-	11
V	SCAFFOLD CABLE SUPPORTS	-	135, 315	6'-0"	-	

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 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 PREVAILING WINDS.

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 MANHOLE 3'-6" 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 SPIRAL STAIRWAY INTERMEDIATE PLATFORM.

8. MOUNT THE 6" ATG WATER PROBE WELL OVER THE TANK BOTTOM SUMP THROUGH AN 8" FLANGED ROOF NOZZLE PER THE INDICATED DETAILS.

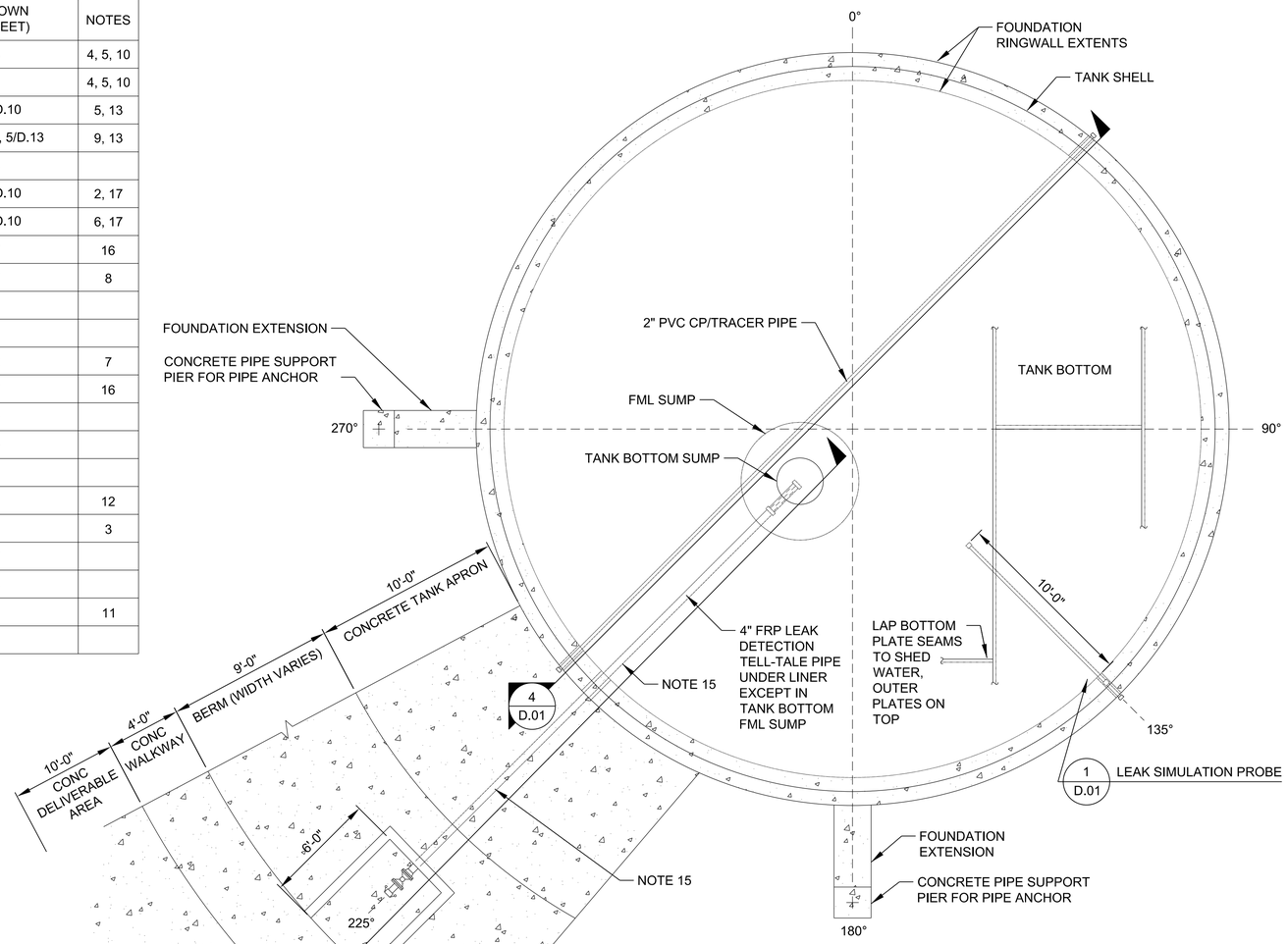
9. THE 2" WATER DRAW-OFF NOZZLE SHOWN IN THIS STANDARD IS BASED ON THE SMALLEST DOUBLE BLOCK AND BLEED VALVE AVAILABLE AT THE TIME THIS STANDARD WAS WRITTEN. FOR TANKS THAT ARE EXPECTED TO RECEIVE A MINIMUM AMOUNT OF WATER AND EXPECTED TO PRODUCE MINIMUM CONDENSATE, PROVIDE INTERNAL WATER DRAW-OFF PIPING 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 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. 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 PAN.

12. PROVIDE AT LEAST ONE OVERFLOW FOR EVERY 1200 GPM OF RECEIPT. DO NOT LOCATE OVERFLOWS OVER STAIRS OR SHELL NOZZLE ISOLATION VALVES. WHERE THE PATTERN OF ROOF PERIMETER CIRCULATION VENTS WOULD RESULT IN AN OVERFLOW/CIRCULATION VENT OVER PRODUCT PIPING OR THE STAIRWAY, PROVIDE A SHELL CIRCULATION VENT CONSTRUCTED SIMILAR TO AN OVERFLOW CIRCULATION VENT BUT 1'-0" 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.



5,000 BBL TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING PLAN

SCALE: ¼" = 1'-0"

0 2' 4' 8'

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 8" 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 HORIZONTALLY ON THE VERTICAL CENTERLINE, SHALL NOT BE MORE THAN 6".

APPR | DATE | DESCRIPTION | SYM

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

5,000 BBL TANK NOZZLE SCHEDULE & INTERSTITIAL PIPING PLAN

SCALE: AS NOTED

EPROJECT NO.: XXXXX

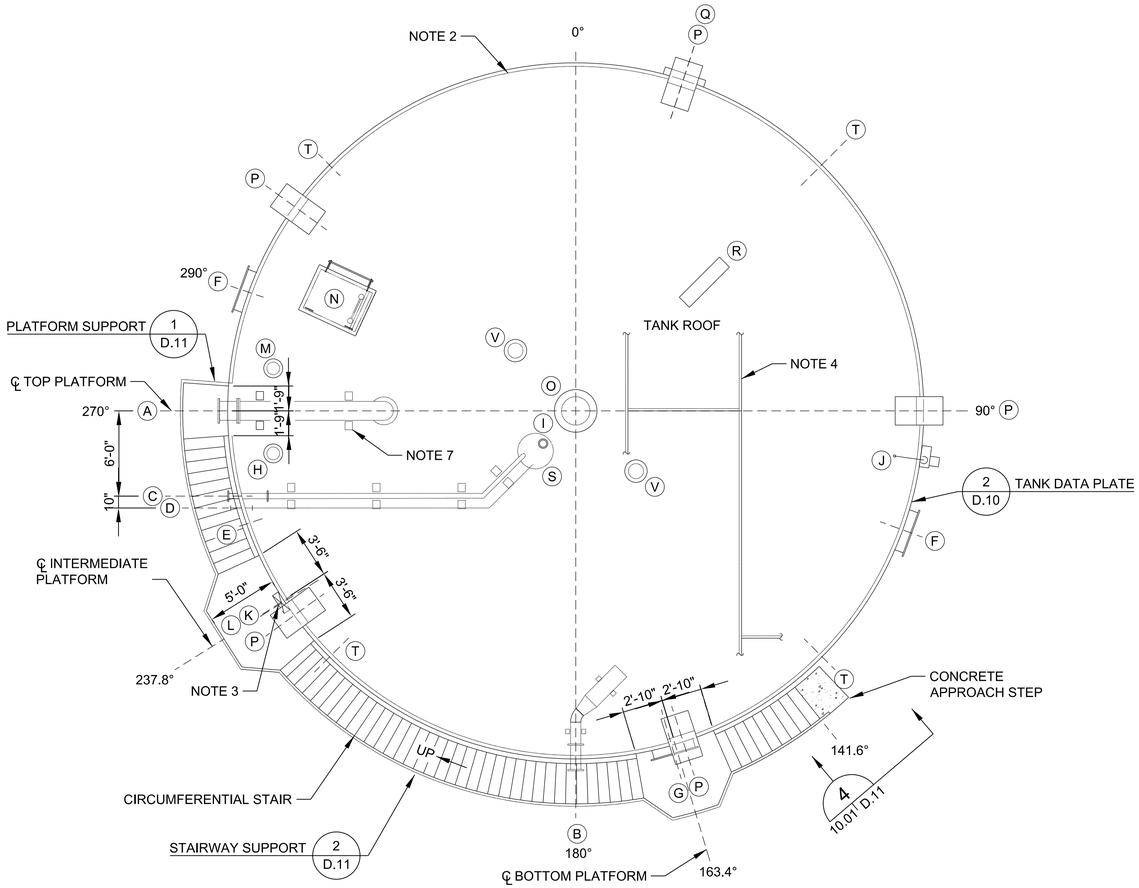
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

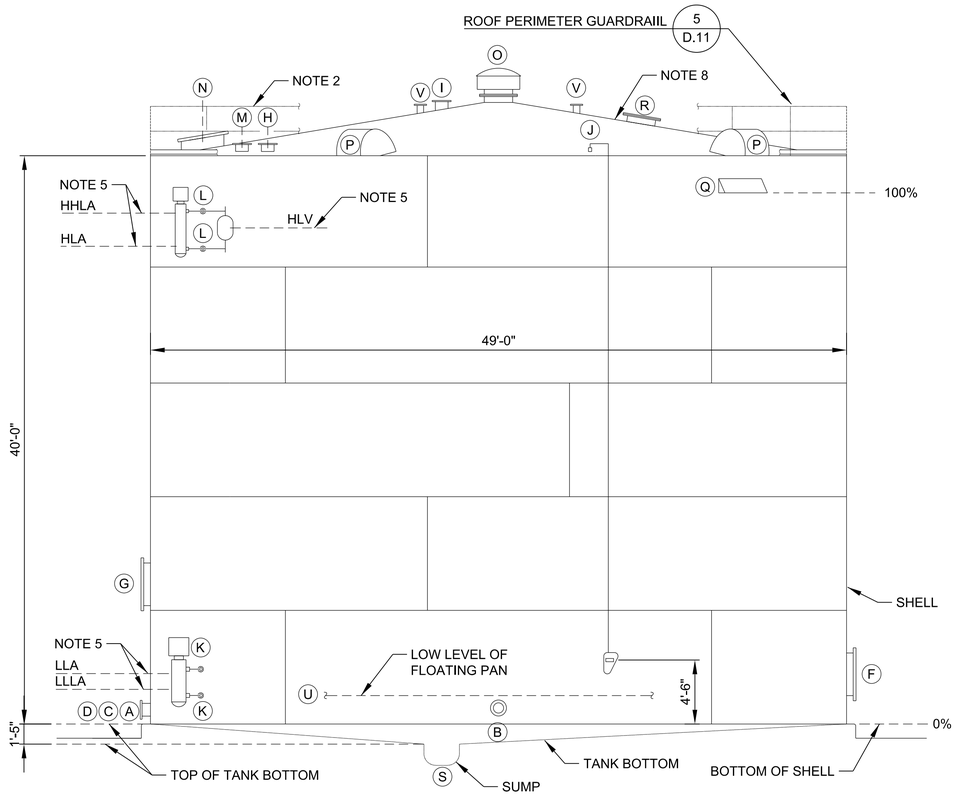
SHEET 30 OF 57

5.02

DRAWFORM REVISION: 10 MAY 2014



PLAN



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

ELEVATION

NOTES:

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 6/D.08.

8. PROVIDE A ROOF WITH SLOPE OF 1½:12.

10,000 BBL TANK

SCALE: $\frac{3}{16}$"=1'-0"

0 4' 8' 12'

N

APPR	DATE	DESCRIPTION	CTM

NAVFAC

US ARMY CORPS
OF ENGINEERS
OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES	MSO	DRW	MHK	CHK	WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

10,000 BBL TANK

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO.
XXXXX

NAVFAC DRAWING NO.
XXXXX

SHEET 31 OF 57

10.01

DRAWFORM REVISION: 10 MAY 2014

10,000 BBL TANK NOZZLE/EQUIPMENT SCHEDULE

ITEM	DESCRIPTION	SIZE (IN)	ANGLE (DEGREES)	DISTANCE (NOTE 1)	DETAIL SHOWN (DETAIL/SHEET)	NOTES
A	ISSUE	16	270	1'-4¾"	4/D.08	4, 5, 10
B	FILL	8	180	1'-1¾"	1/D.08	4, 5, 10
C	LOW SUCTION	4	-	1'-4¾"	5/D.07, 1/D.10	5, 13
D	WATER DRAW-OFF	2	-	1'-3¾"	3/D.07, 1/D.10, 5/D.13	9, 13
E	PRODUCT RETURN	2	251	7"	5/D.13	
F	SHELL MANHOLES (LOWER)	36	-	3'-6"	3/D.10, 6/D.10	2, 17
G	SHELL MANHOLE (UPPER)	36	164	9'-9"	3/D.10, 6/D.10	6, 17
H	ATG GAUGE WELL	10	262	21'-5"	4/D.07	16
I	ATG WATER PROBE WELL	8	225	3'-3"	3/D.07	8
J	MECHANICAL TAPE LEVEL GAUGE	1½	98	-	1/D.07	
K	LOW & LOW-LOW LEVEL ALARM NOZZLES	1	237	X'-X", X'-X"	1/D.12	
L	HIGH & HIGH-HIGH LEVEL ALARM AND HLV NOZZLES	1	237	X'-X", X'-X"	2/D.12	7
M	SAMPLE GAUGE WELL	10	278	21'-6"	2/D.07	16
N	ROOF MAHOLE/LADDER HATCH	36 X 48	295	18'-6"	3/D.09	
O	CENTER ROOF VENT	24	-	-	2/D.09	
P	CIRCULATION VENT/INSPECTION HATCHES	18 X 24	18, 90, 162, 234, 306	-	1/D.09	
Q	OVERFLOW/CIRCULATION VENT	12 X 36	18	35'-8"	6/D.07	12
R	PAN INSTALLATION HATCH	-	45	-	-	3
S	SUMP	30	225	4'-0"	5/D.07	
T	GROUNDING LUGS	3 X 3 X ⅜	45, 135, 225, 315	1'-0"	3/D.14	
U	FLOATING PAN LOW LEG LEVEL	-	-	2'-11"	-	11
V	SCAFFOLD CABLE SUPPORTS	-	135, 315	6'-0"	-	

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 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 PREVAILING WINDS.

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 MANHOLE 3'-6" 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 SPIRAL STAIRWAY INTERMEDIATE PLATFORM.

8. MOUNT THE 6" ATG WATER PROBE WELL OVER THE TANK BOTTOM SUMP THROUGH AN 8" FLANGED ROOF NOZZLE PER THE INDICATED DETAILS.

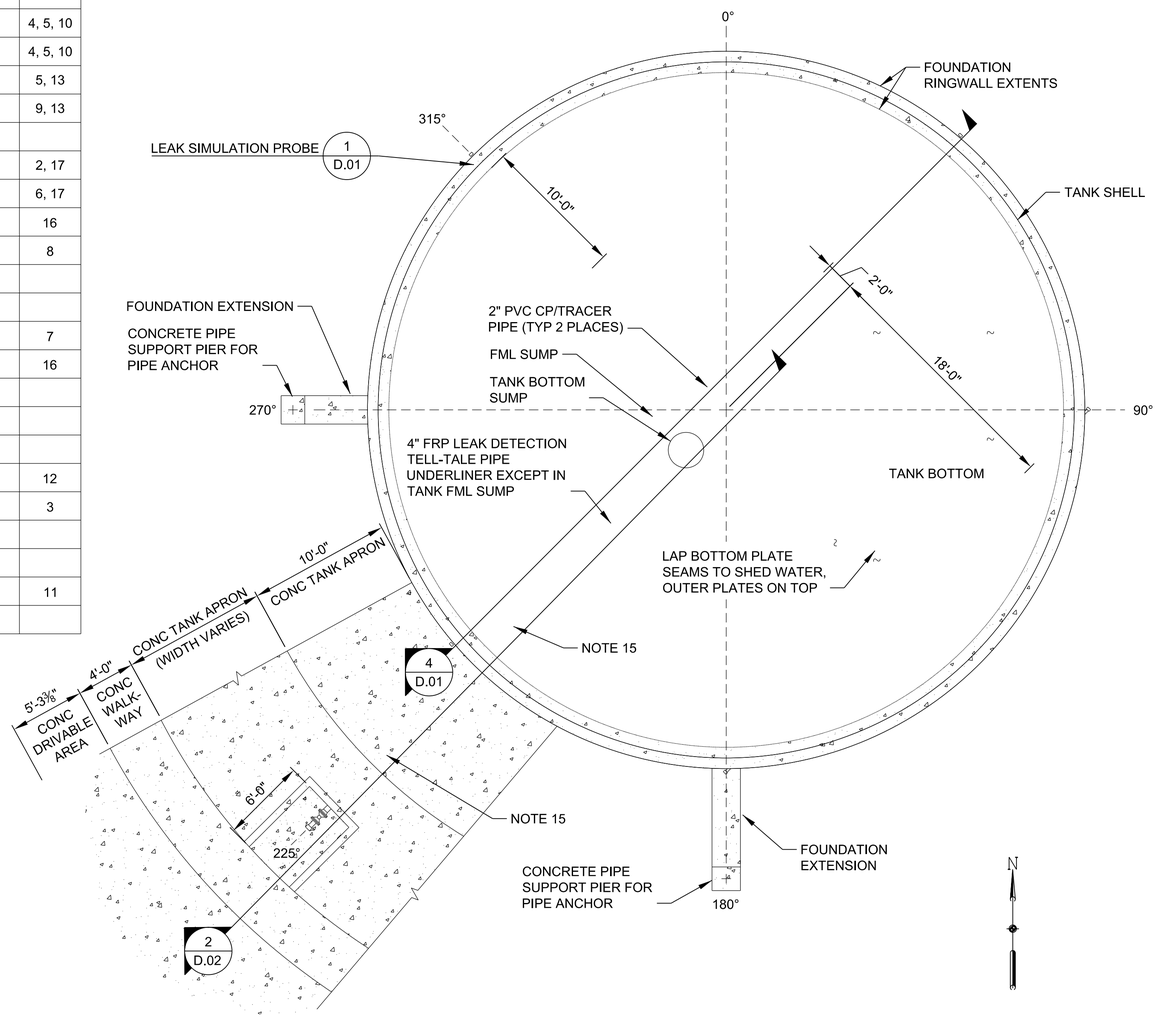
9. THE 2" WATER DRAW-OFF NOZZLE SHOWN IN THIS STANDARD IS BASED ON THE SMALLEST DOUBLE BLOCK AND BLEED VALVE AVAILABLE AT THE TIME THIS STANDARD WAS WRITTEN. FOR TANKS THAT ARE EXPECTED TO RECEIVE A MINIMUM AMOUNT OF WATER AND EXPECTED TO PRODUCE MINIMUM CONDENSATE, PROVIDE INTERNAL WATER DRAW-OFF PIPING 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 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. 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 PAN.

12. PROVIDE AT LEAST ONE OVERFLOW FOR EVERY 1200 GPM OF RECEIPT. DO NOT LOCATE OVERFLOWS OVER STAIRS OR SHELL NOZZLE ISOLATION VALVES. WHERE THE PATTERN OF ROOF PERIMETER CIRCULATION VENTS WOULD RESULT IN AN OVERFLOW/CIRCULATION VENT OVER PRODUCT PIPING OR THE STAIRWAY, PROVIDE A SHELL CIRCULATION VENT CONSTRUCTED SIMILAR TO AN OVERFLOW CIRCULATION VENT BUT 1'-0" 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.



10,000 BBL TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING PLAN

SCALE: 3/16"=1'-0"

0 4' 8' 12'

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 8" 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 HORIZONTALLY ON THE VERTICAL CENTERLINE, SHALL NOT BE MORE THAN 6".

APPR | DATE | DESCRIPTION | CTM

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

10,000 BBL TANK NOZZLE SCHEDULE & INTERSTITIAL PIPING PLAN

SCALE: AS NOTED

EPROJECT NO.: XXXXX

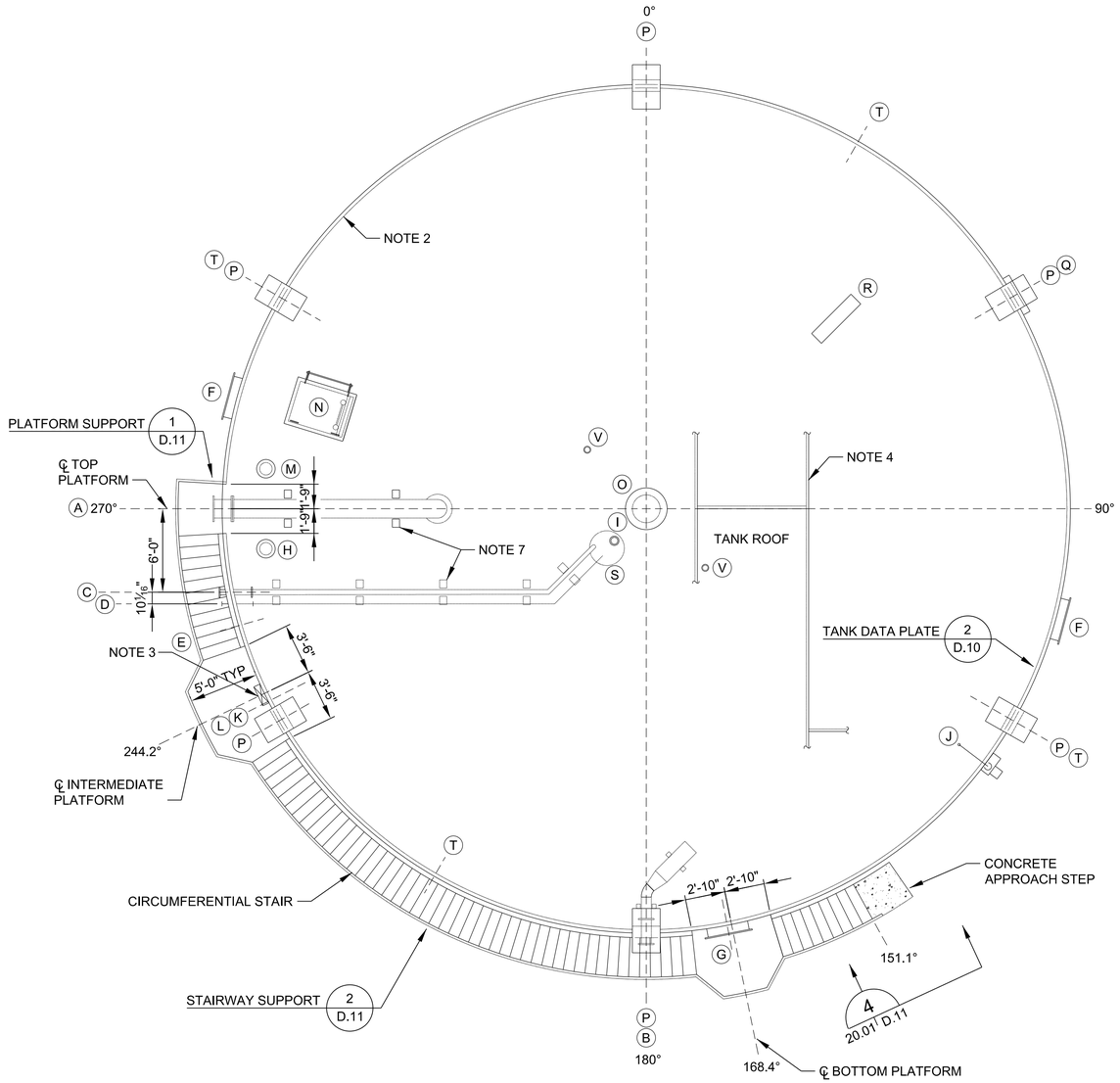
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

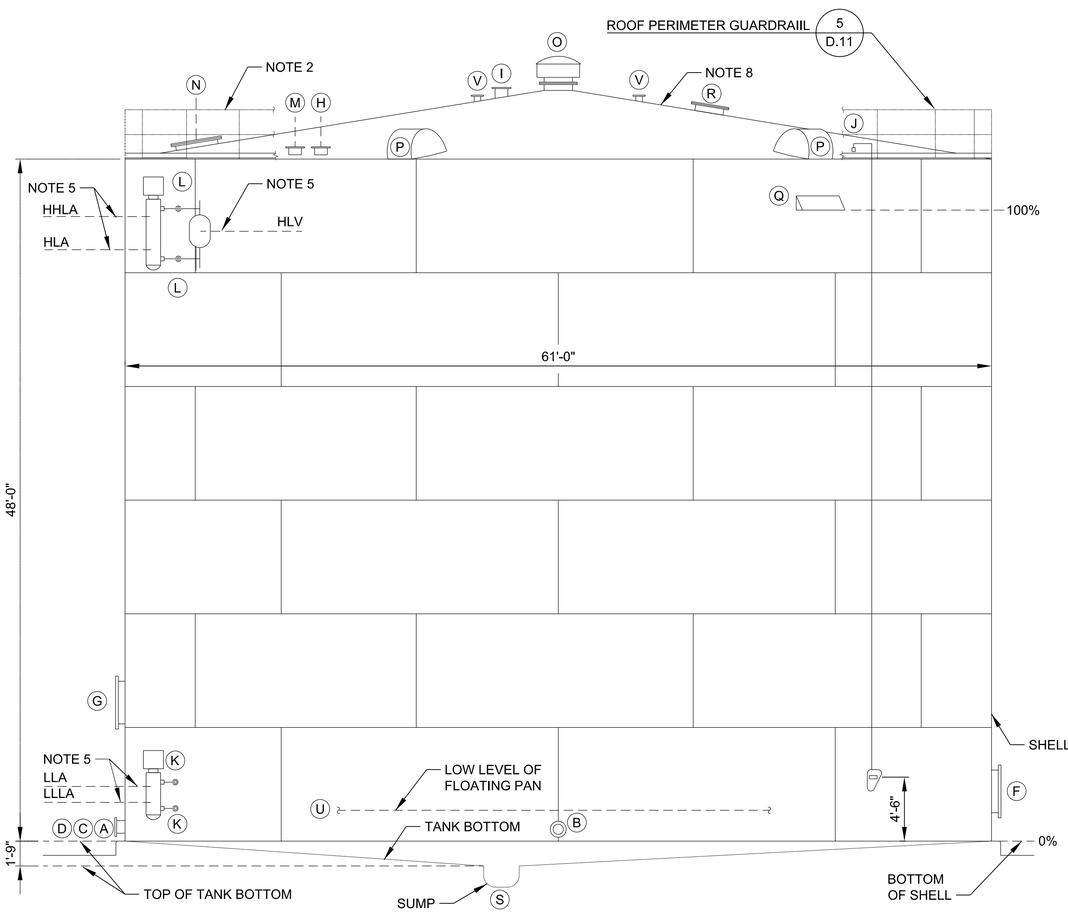
SHEET 32 OF 57

10.02

DRAWFORM REVISION: 10 MAY 2014



PLAN



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

ELEVATION

NOTES:

1. SEE NOZZLE EQUIPMENT SCHEDULE ON SHEET 20.02 FOR SIZE, ELEVATION AND ORIENTATION OF NOZZLES AND APPURTENANCES.

2. PPROVIDE GUARDRAIL ALL AROUND PERIMETER OF ROOF EXCEPT AT STAIRWAY TOP PLATFORM.

3. PPROVIDE 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 6/D.08.

20,000 BBL TANK

SCALE: 3/16"=1'-0"

0 4' 8' 12'

N

APPR | DATE | DESCRIPTION | NO.

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

20,000 BBL TANK

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 33 OF 57

20.01

DRAWFORM REVISION: 10 MAY 2014

20,000 BBL TANK NOZZLE/EQUIPMENT SCHEDULE

ITEM	DESCRIPTION	SIZE (IN)	ANGLE (DEGREES)	DISTANCE (NOTE 1)	DETAIL SHOWN (DETAIL/SHEET)	NOTES
A	ISSUE	16	270	1'-4¾"	4/D.08	4, 5, 10
B	FILL	8	180	1'-1¾"	1/D.08	4, 5, 10
C	LOW SUCTION	4	-	1'-4¾"	5/D.07, 1/D.10	5, 13
D	WATER DRAW-OFF	2	-	1'-3¾"	3/D.07, 1/D.10, 5/D.13	9, 13
E	PRODUCT RETURN	2	254	7"	5/D.13	
F	SHELL MANHOLES (LOWER)	36	-	3'-6"	3/D.10, 6/D.10	2, 17
G	SHELL MANHOLE (UPPER)	36	169	9'-9"	3/D.10, 6/D.10	6, 17
H	ATG GAUGE WELL	10	264	27'-6"	4/D.07	16
I	ATG WATER PROBE WELL	8	225	3'-9"	3/D.07	8
J	MECHANICAL TAPE LEVEL GAUGE	1½	127	-	1/D.07	
K	LOW & LOW-LOW LEVEL ALARM NOZZLES	1	243	X'-X", X'-X"	1/D.12	
L	HIGH & HIGH-HIGH LEVEL ALARM AND HLV NOZZLES	1	243	X'-X", X'-X"	2/D.12	7
M	SAMPLE GAUGE WELL	10	276	27'-6"	2/D.07	16
N	ROOF MAHOLE/LADDER HATCH	36 X 48	287	24'-6"	3/D.09	
O	CENTER ROOF VENT	24	-	-	2/D.09	
P	CIRCULATION VENT/INSPECTION HATCHES	18 X 24	0, 60, 120, 180, 240, 300	-	1/D.09	
Q	OVERFLOW/CIRCULATION VENT	12 X 36	60	44'-4"	6/D.07	12
R	PAN INSTALLATION HATCH	-	45	-	-	3
S	SUMP	30	225	4'-0"	5/D.07	
T	GROUNDING LUGS	3 X 3 X ⅜	30, 120, 210, 300	1'-0"	3/D.14	
U	FLOATING PAN LOW LEG LEVEL	-	-	2'-11"	-	11
V	SCAFFOLD CABLE SUPPORTS	-	135, 315	6'-0"	-	

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 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 PREVAILING WINDS.

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 MANHOLE 3'-6" 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 SPIRAL STAIRWAY INTERMEDIATE PLATFORM.

8. MOUNT THE 6" ATG WATER PROBE WELL OVER THE TANK BOTTOM SUMP THROUGH AN 8" FLANGED ROOF NOZZLE PER THE INDICATED DETAILS.

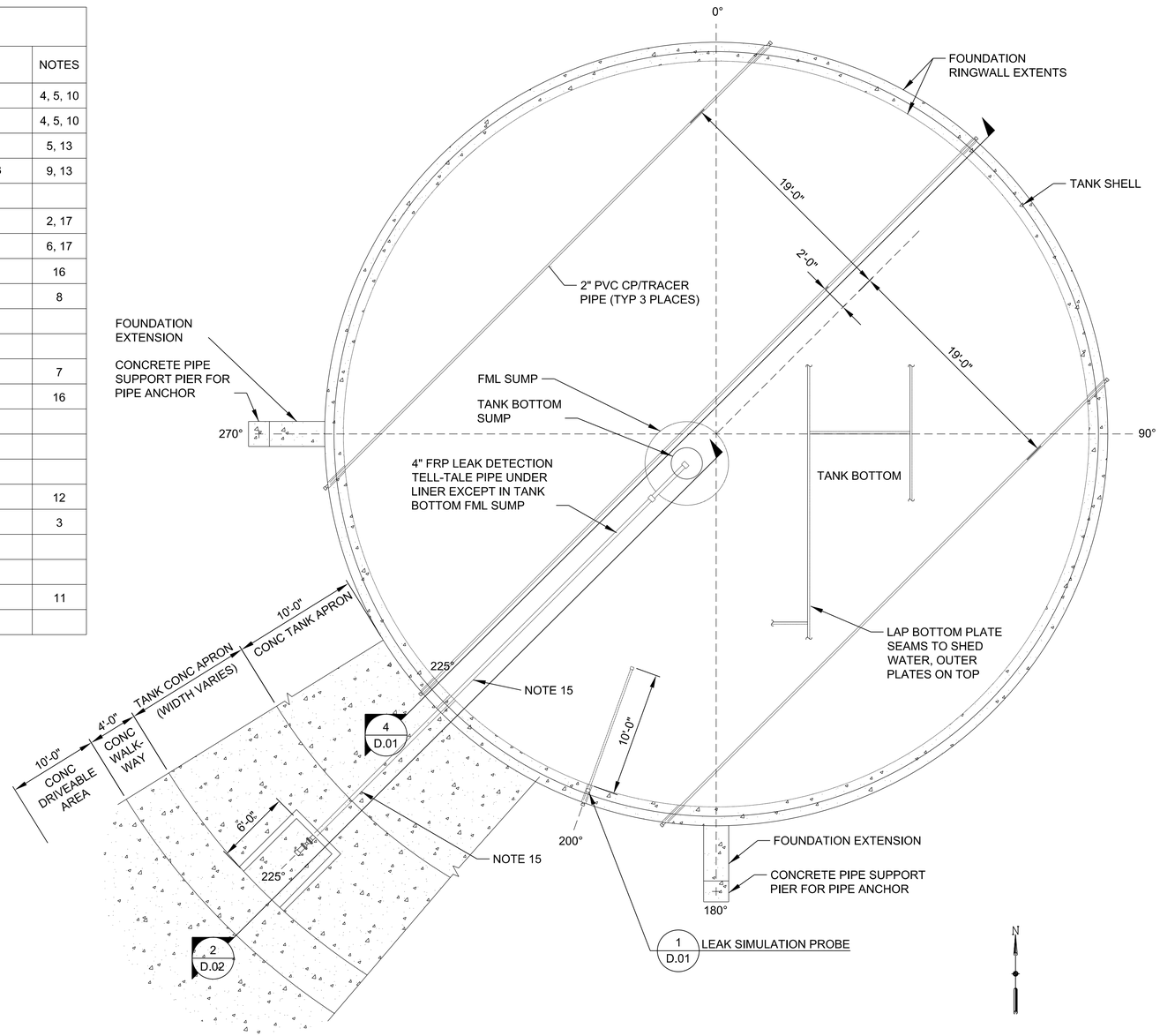
9. THE 2" WATER DRAW-OFF NOZZLE SHOWN IN THIS STANDARD IS BASED ON THE SMALLEST DOUBLE BLOCK AND BLEED VALVE AVAILABLE AT THE TIME THIS STANDARD WAS WRITTEN. FOR TANKS THAT ARE EXPECTED TO RECEIVE A MINIMUM AMOUNT OF WATER AND EXPECTED TO PRODUCE MINIMUM CONDENSATE, PROVIDE INTERNAL WATER DRAW-OFF PIPING 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 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. 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 PAN.

12. PROVIDE AT LEAST ONE OVERFLOW FOR EVERY 1200 GPM OF RECEIPT. DO NOT LOCATE OVERFLOWS OVER STAIRS OR SHELL NOZZLE ISOLATION VALVES. WHERE THE PATTERN OF ROOF PERIMETER CIRCULATION VENTS WOULD RESULT IN AN OVERFLOW/CIRCULATION VENT OVER PRODUCT PIPING OR THE STAIRWAY, PROVIDE A SHELL CIRCULATION VENT CONSTRUCTED SIMILAR TO AN OVERFLOW CIRCULATION VENT BUT 1'-0" 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.



20,000 BBL TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING PLAN

SCALE: 3/16"=1'-0"

0 4' 8' 12'

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 8" 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 HORIZONTALLY ON THE VERTICAL CENTERLINE, SHALL NOT BE MORE THAN 6".

APPR | DATE | DESCRIPTION | CTM

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

20,000 BBL TANK NOZZLE SCHEDULE & INTERSTITIAL PIPING PLAN

SCALE: AS NOTED

EPROJECT NO.: XXXXX

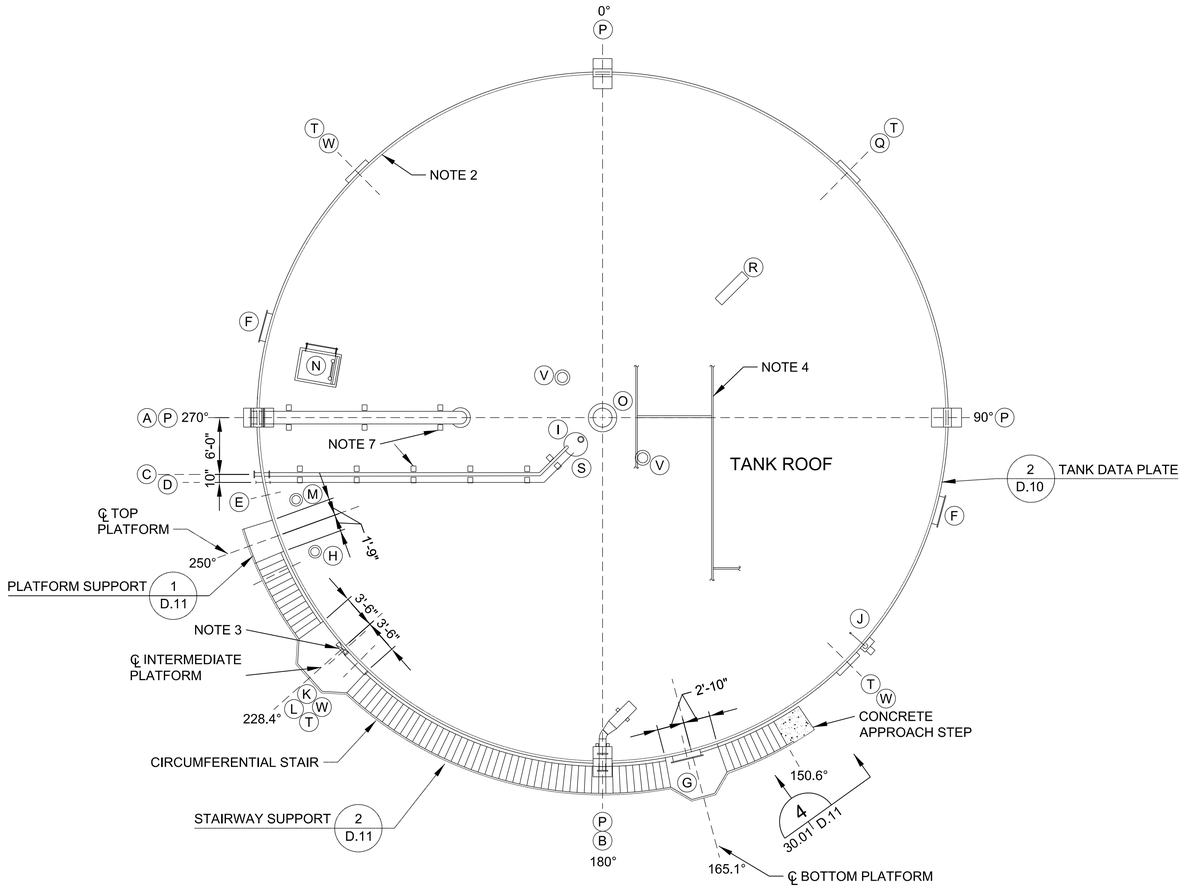
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

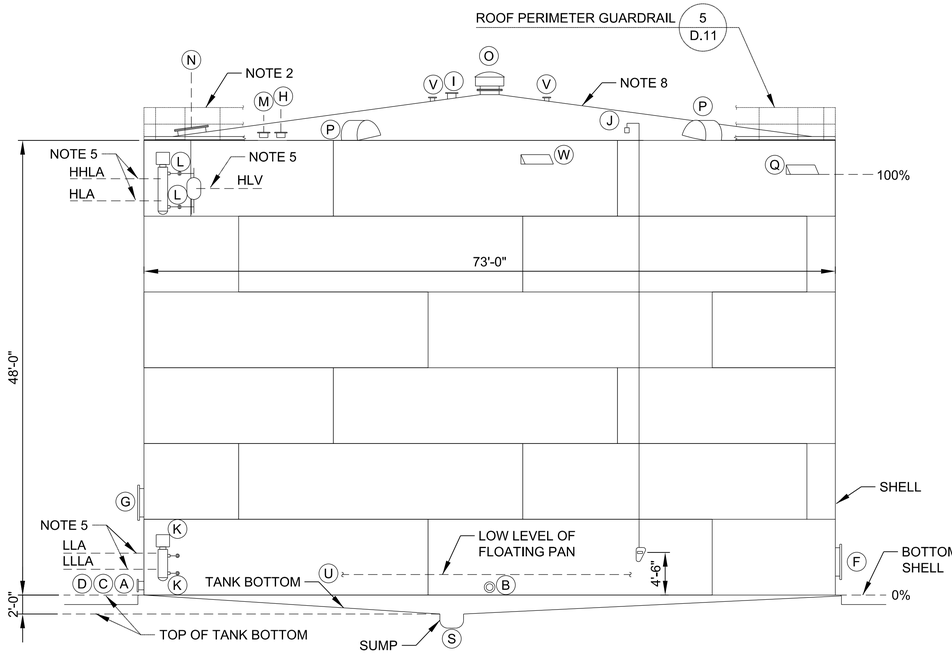
SHEET 34 OF 57

20.02

DRAWFORM REVISION: 10 MAY 2014



PLAN



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

ELEVATION

30,000 BBL TANK

SCALE: ⅛"=1'-0"

0 4' 8' 16'

N

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 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 A ROOF WITH SLOPE OF 1½:12.

APPR | DATE | DESCRIPTION | SYM

NAVFAC

US ARMY CORPS
OF ENGINEERS
OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS
ABOVEGROUND VERTICAL STEEL
30,000 BBL TANK

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO.
XXXXX

NAVFAC DRAWING NO.
XXXXX

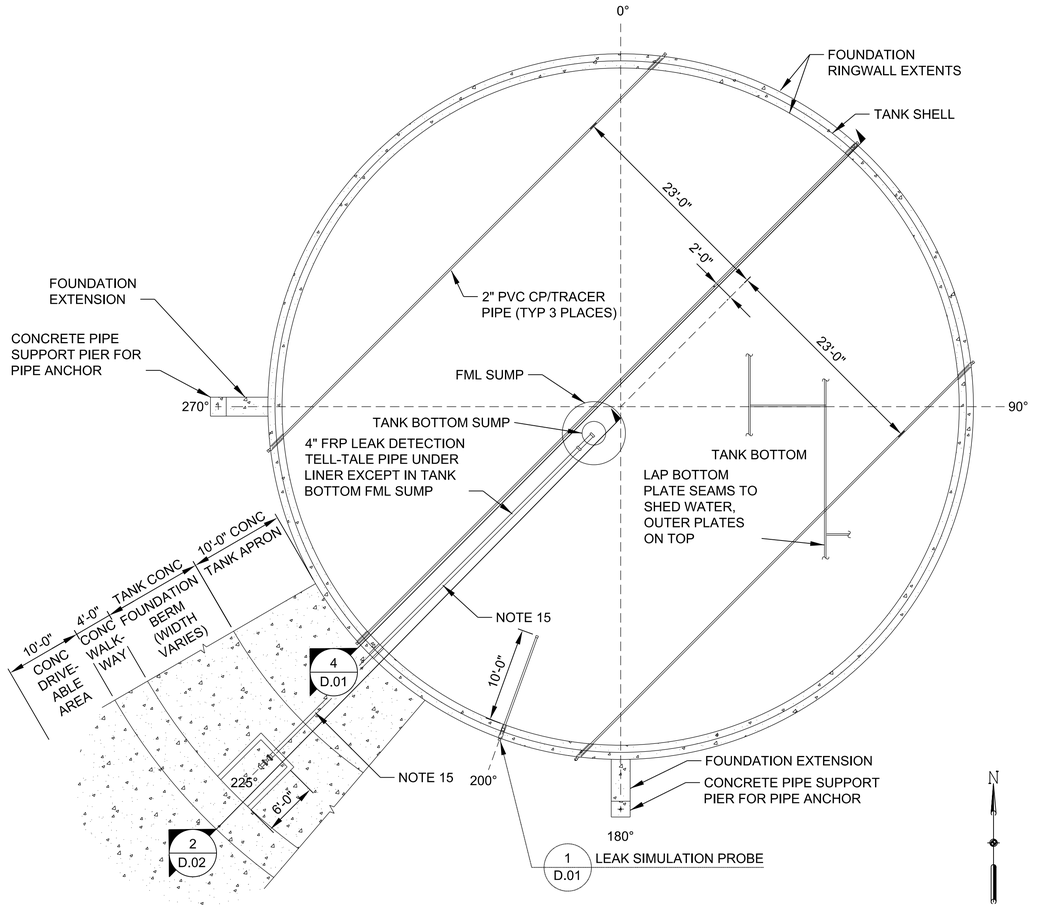
SHEET 35 OF 57

30.01

DRAWFORM REVISION: 10 MAY 2014

30,000 BBL TANK NOZZLE/EQUIPMENT SCHEDULE

ITEM	DESCRIPTION	SIZE (IN)	ANGLE (DEGREES)	DISTANCE (NOTE 1)	DETAIL SHOWN (DETAIL/SHEET)	NOTES
A	ISSUE	16	270	1'-4¾"	4/D.08	4, 5, 10
B	FILL	8	180	1'-1¾"	1/D.08	4, 5, 10
C	LOW SUCTION	4	-	1'-4¾"	5/D.07, 1/D.10	5, 13
D	WATER DRAW-OFF	2	-	1'-3¾"	3/D.07, 1/D.10, 5/D.13	9, 13
E	PRODUCT RETURN	2	257	7"	5/D.13	
F	SHELL MANHOLES (LOWER)	36	-	3'-6"	3/D.10, 6/D.10	2, 17
G	SHELL MANHOLE (UPPER)	36	166	9'-9"	3/D.10, 6/D.10	6, 17
H	ATG GAUGE WELL	10	245	33'-6"	4/D.07	16
I	ATG WATER PROBE WELL	8	225	3'-3"	3/D.07	8
J	MECHANICAL TAPE LEVEL GAUGE	1½	131	-	1/D.07	
K	LOW & LOW-LOW LEVEL ALARM NOZZLES	1	228	X'-X", X'-X"	1/D.12	
L	HIGH & HIGH-HIGH LEVEL ALARM AND HLV NOZZLES	1	228	X'-X", X'-X"	2/D.12	7
M	SAMPLE GAUGE WELL	10	255	33'-6"	2/D.07	16
N	ROOF MAHOLE/LADDER HATCH	36 X 48	280	30'-6"	3/D.09	
O	CENTER ROOF VENT	24	-	-	2/D.09	
P	CIRCULATION VENT/INSPECTION HATCHES	18 X 24	0, 90, 180, 270	-	1/D.09	
Q	OVERFLOW/CIRCULATION VENT	12 X 36	45	44'-6"	64/D.07	12
R	PAN INSTALLATION HATCH	-	45	-	-	3
S	SUMP	30	225	4'-0"	5/D.07	
T	GROUNDING LUGS	3 X 3 X ⅜	45, 135, 225, 315	1'-0"	3/D.14	
U	FLOATING PAN LOW LEG LEVEL	-	-	2'-11"	-	11
V	SCAFFOLD CABLE SUPPORTS	-	135, 315	6'-0"	-	
W	SHELL CIRCULATION VENTS	12 X 36	135, 225, 315	45'-6"	6/D.07	12



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

SCALE: ⅛"=1'-0"

0 4' 8' 16'

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 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 PREVAILING WINDS.

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 MANHOLE 3'-6" 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 SPIRAL STAIRWAY INTERMEDIATE PLATFORM.

8. MOUNT THE 6" ATG WATER PROBE WELL OVER THE TANK BOTTOM SUMP THROUGH AN 8" FLANGED ROOF NOZZLE PER THE INDICATED DETAILS.

9. THE 2" WATER DRAW-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 MINIMUM 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 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. 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 PAN.

12. PROVIDE AT LEAST ONE OVERFLOW FOR EVERY 1200 GPM OF RECEIPT. DO NOT LOCATE OVERFLOWS OVER STAIRS OR SHELL NOZZLE ISOLATION VALVES. WHERE THE PATTERN OF ROOF PERIMETER CIRCULATION VENTS WOULD RESULT IN AN OVERFLOW/CIRCULATION VENT OVER PRODUCT PIPING OR THE STAIRWAY, PROVIDE A SHELL CIRCULATION VENT CONSTRUCTED SIMILAR TO AN OVERFLOW CIRCULATION VENT BUT 1'-0" 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.

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 8" 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 HORIZONTALLY ON THE VERTICAL CENTERLINE, SHALL NOT BE MORE THAN 6".

APPR | DATE | DESCRIPTION | CTM

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

30,000 BBL TANK NOZZLE SCHEDULE & INTERSTITAL PIPING PLAN

SCALE: AS NOTED

EPROJECT NO.: XXXXX

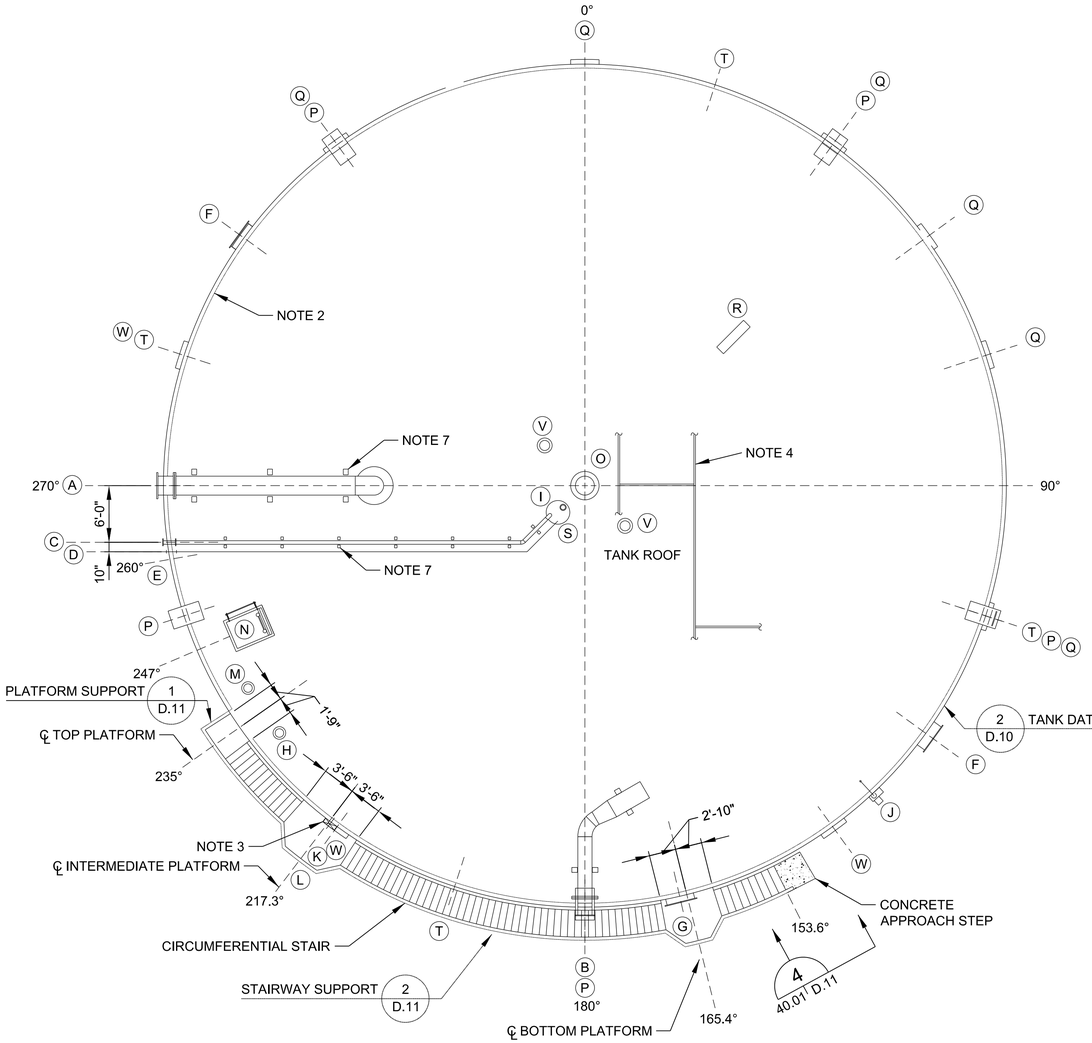
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

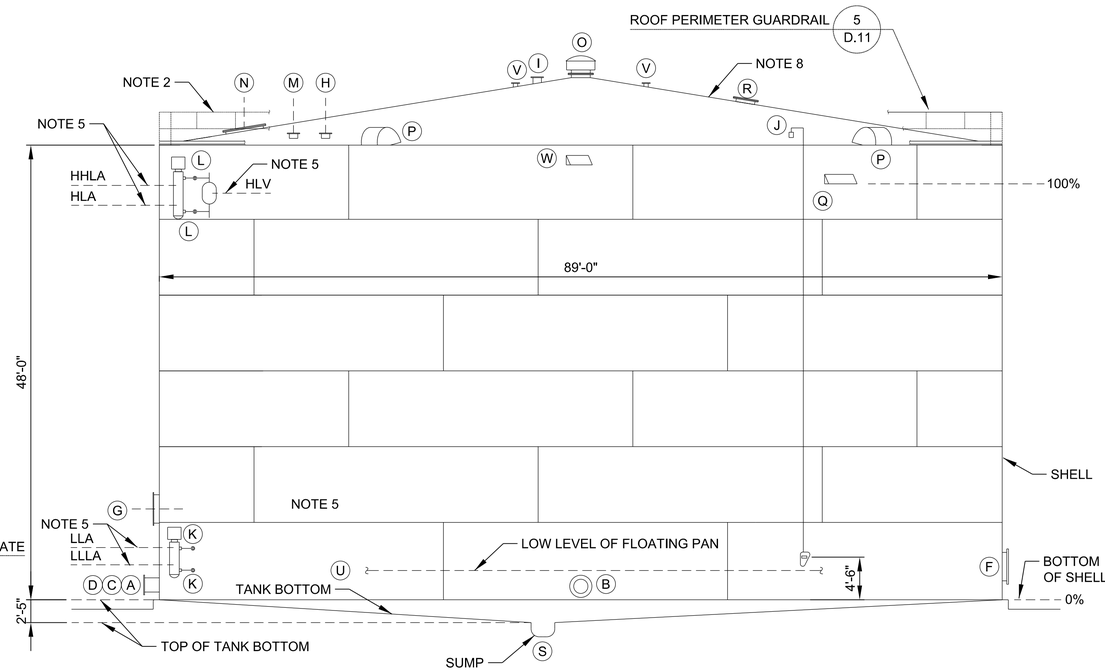
SHEET 36 OF 57

30.02

DRAWFORM REVISION: 10 MAY 2014



PLAN



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

ELEVATION

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 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 A ROOF WITH SLOPE OF 1½:12.

40,000 BBL TANK

SCALE: ⅛"=1'-0"

0 4' 8' 16'

N

APPR | DATE | DESCRIPTION | NO.

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

40,000 BBL TANK

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

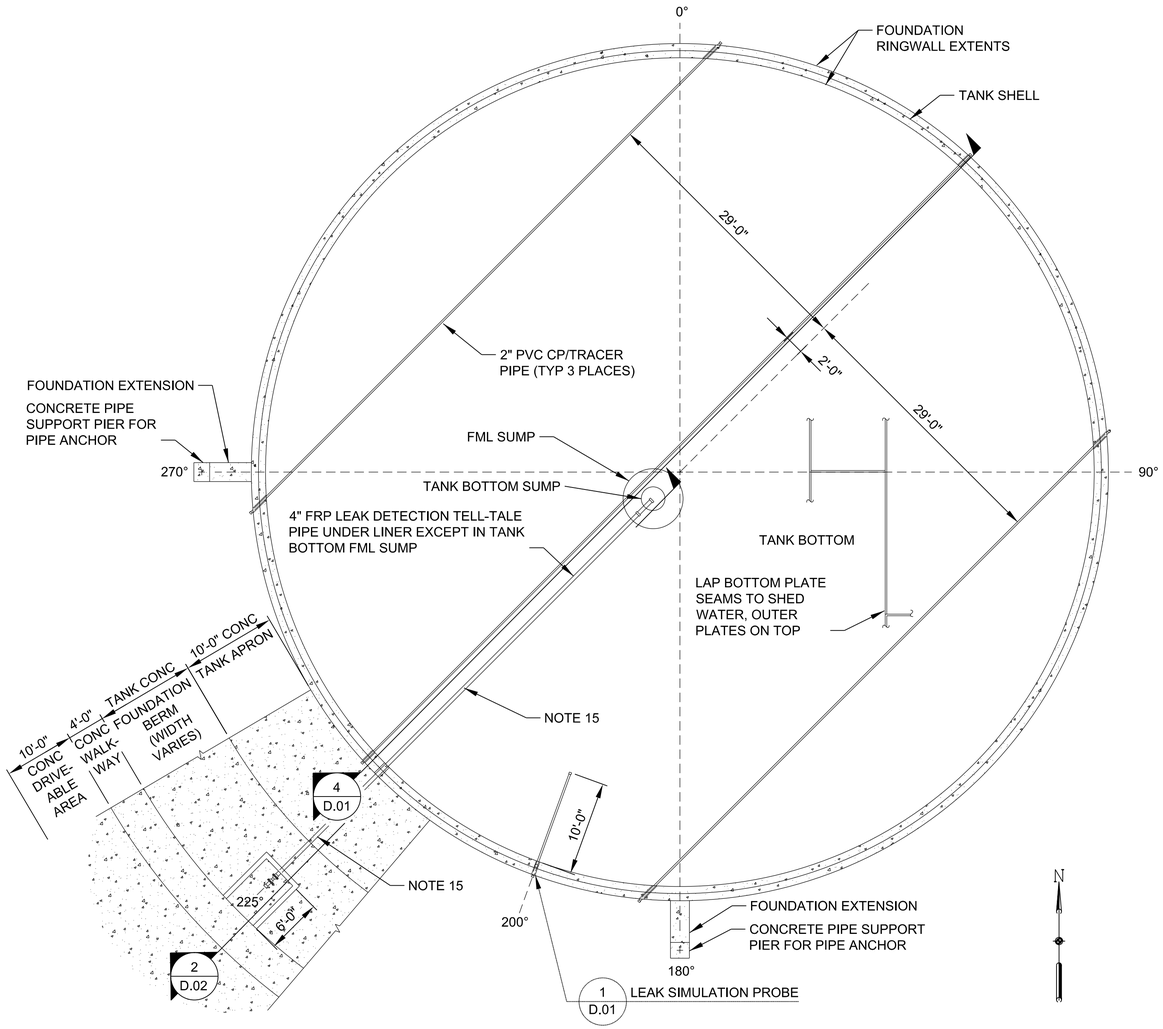
SHEET 37 OF 57

40.01

DRAWFORM REVISION: 10 MAY 2014

40,000 BBL TANK NOZZLE/EQUIPMENT SCHEDULE

ITEM	DESCRIPTION	SIZE (IN)	ANGLE (DEGREES)	DISTANCE (NOTE 1)	DETAIL SHOWN (DETAIL/SHEET)	NOTES
A	ISSUE	24	270	2'-¾"	4/D.08	4, 5, 10
B	FILL	18	180	1'-6¾"	1/D.08	4, 5, 10
C	LOW SUCTION	4	-	2'-¾"	5/D.07, 1/D.10	5, 13
D	WATER DRAW-OFF	2	-	1'-11¾"	3/D.07, 1/D.10, 5/D.13	9, 13
E	PRODUCT RETURN	2	260	7"	5/D.13	
F	SHELL MANHOLES (LOWER)	36	-	3'-6"	3/D.10, 6/D.10	2, 17
G	SHELL MANHOLE (UPPER)	36	167	9'-9"	3/D.10, 6/D.10	6, 17
H	ATG GAUGE WELL	10	231	41'-6"	4/D.07	16
I	ATG WATER PROBE WELL	8	225	3'-3"	3/D.07	8
J	MECHANICAL TAPE LEVEL GAUGE	1½	137	-	1/D.07	
K	LOW & LOW-LOW LEVEL ALARM NOZZLES	1	217	X'-X", X'-X"	1/D.12	
L	HIGH & HIGH-HIGH LEVEL ALARM AND HLV NOZZLES	1	217	X'-X", X'-X"	2/D.12	7
M	SAMPLE GAUGE WELL	10	239	41'-6"	2/D.07	16
N	ROOF MAHOLE/LADDER HATCH	36 X 48	247	38'-6"	3/D.09	
O	CENTER ROOF VENT	24	-	-	2/D.09	
P	CIRCULATION VENT/INSPECTION HATCHES	18 X 24	36, 108, 180, 252, 324	-	1/D.09	
Q	OVERFLOW/CIRCULATION VENT	12 X 36	0, 36, 54, 72, 108, 324	44'-0"	6/D.07	12
R	PAN INSTALLATION HATCH	-	45	-	-	3
S	SUMP	30	225	4'-0"	5/D.07	
T	GROUNDING LUGS	3 X 3 X ⅜	18, 108, 198, 288	1'-0"	3/D.14	
U	FLOATING PAN LOW LEG LEVEL	-	-	3'-11"	-	11
V	SCAFFOLD CABLE SUPPORTS	-	135, 315	6'-0"	-	
W	SHELL CIRCULATION VENTS	-	144, 216, 288	52'-8"	6/D.07	



40,000 BBL TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING PLAN

SCALE: ⅛"=1'-0"

0 4' 8' 16'

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 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 PREVAILING WINDS.

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 MANHOLE 3'-6" 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 SPIRAL STAIRWAY INTERMEDIATE PLATFORM.

8. MOUNT THE 6" ATG WATER PROBE WELL OVER THE TANK BOTTOM SUMP THROUGH AN 8" FLANGED ROOF NOZZLE PER THE INDICATED DETAILS.

9. THE 2" WATER DRAW-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 MINIMUM 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 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. 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 PAN.

12. PROVIDE AT LEAST ONE OVERFLOW FOR EVERY 1200 GPM OF RECEIPT. DO NOT LOCATE OVERFLOWS OVER STAIRS OR SHELL NOZZLE ISOLATION VALVES. WHERE THE PATTERN OF ROOF PERIMETER CIRCULATION VENTS WOULD RESULT IN AN OVERFLOW/CIRCULATION VENT OVER PRODUCT PIPING OR THE STAIRWAY, PROVIDE A SHELL CIRCULATION VENT CONSTRUCTED SIMILAR TO AN OVERFLOW CIRCULATION VENT BUT 1'-0" 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.

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 8" 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 HORIZONTALLY ON THE VERTICAL CENTERLINE, SHALL NOT BE MORE THAN 6".

APPR | DATE | DESCRIPTION | CTM

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

40,000 BBL TANK NOZZLE SCHEDULE & INTERSTITIAL PIPING PLAN

SCALE: AS NOTED

EPROJECT NO.: XXXXX

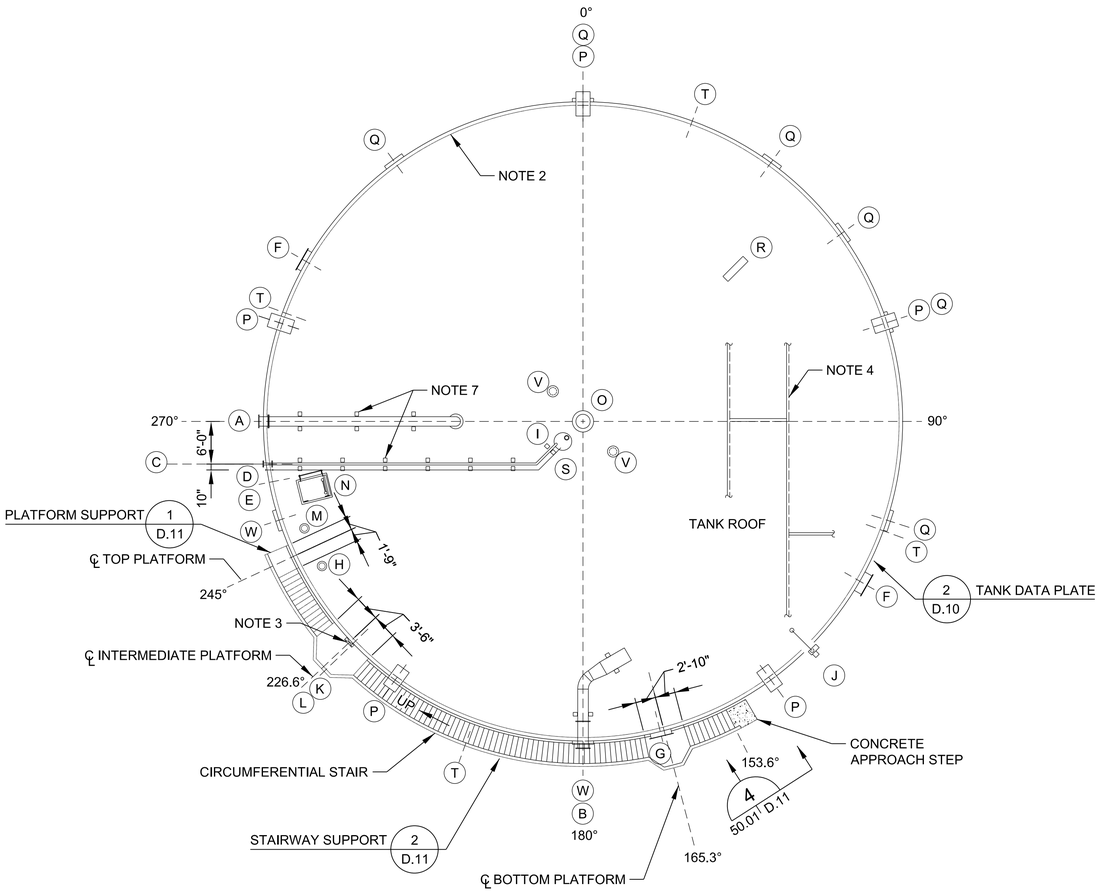
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

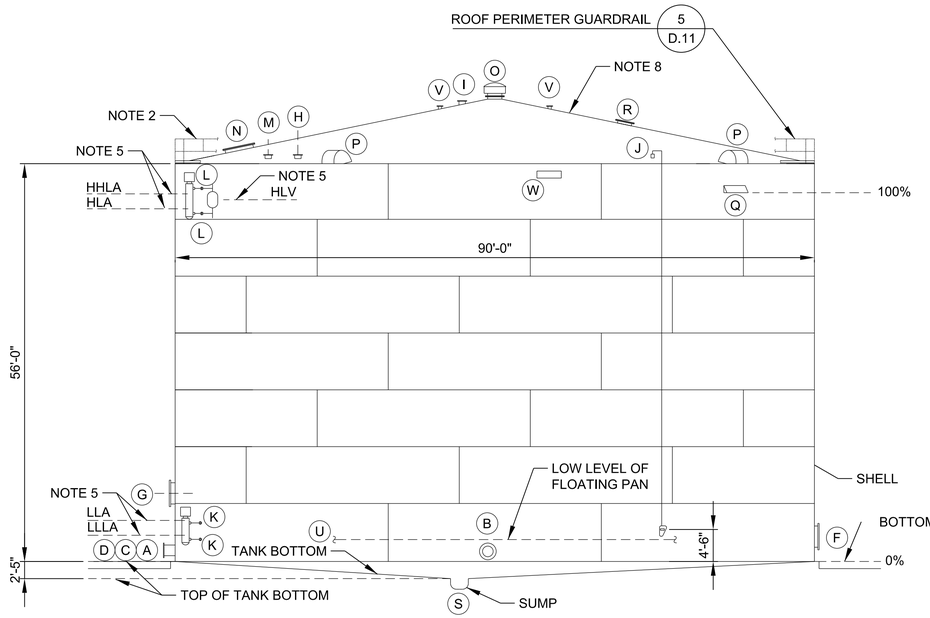
SHEET 38 OF 57

40.02

DRAWFORM REVISION: 10 MAY 2014



PLAN



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

ELEVATION

NOTES:

1. SEE NOZZLE EQUIPMENT SCHEDULE ON SHEET 50.02 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. 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 1½:12.

50,000 BBL TANK

SCALE: 3/32"=1'-0"

N

0 5' 10' 20'

NO.	DESCRIPTION	DATE	APPR

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

50,000 BBL TANK

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

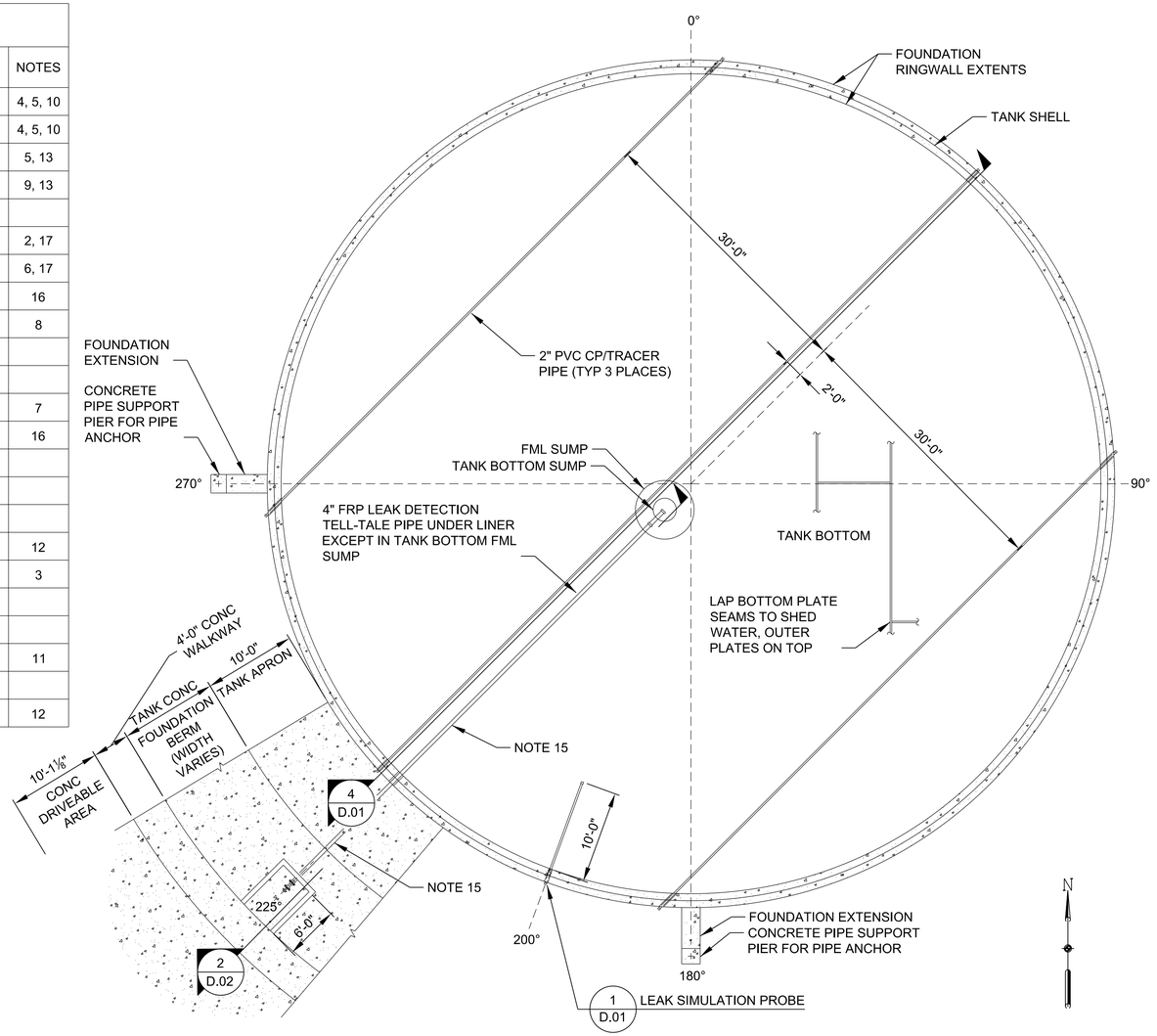
SHEET 39 OF 57

50.01

DRAWFORM REVISION: 10 MAY 2014

50,000 BBL TANK NOZZLE/EQUIPMENT SCHEDULE

ITEM	DESCRIPTION	SIZE (IN)	ANGLE (DEGREES)	DISTANCE (NOTE 1)	DETAIL SHOWN (DETAIL/SHEET)	NOTES
A	ISSUE	24	270	2'-¾"	4/D.08	4, 5, 10
B	FILL	18	180	1'-6¾"	1/D.08	4, 5, 10
C	LOW SUCTION	4	-	2'-¾"	5/D.07, 1/D.10	5, 13
D	WATER DRAW-OFF	2	-	1'-11¾"	3/D.07, 1/D.10, 5/D.13	9, 13
E	PRODUCT RETURN	2	259	7"	5/D.13	
F	SHELL MANHOLES (LOWER)	36	-	3'-6"	3/D.10, 6/D.10	2, 17
G	SHELL MANHOLE (UPPER)	36	166	9'-9"	3/D.10, 6/D.10	6, 17
H	ATG GAUGE WELL	10	241	42'-0"	4/D.07	16
I	ATG WATER PROBE WELL	8	225	3'-3"	3/D.07	8
J	MECHANICAL TAPE LEVEL GAUGE	1½	135	-	1/D.07	
K	LOW & LOW-LOW LEVEL ALARM NOZZLES	1	226	X'-X", X'-X"	1/D.12	
L	HIGH & HIGH-HIGH LEVEL ALARM AND HLV NOZZLES	1	226	X'-X", X'-X"	2/D.12	7
M	SAMPLE GAUGE WELL	10	249	42'-0"	2/D.07	16
N	ROOF MAHOLE/LADDER HATCH	36 X 48	256	39'-0"	3/D.09	
O	CENTER ROOF VENT	24	-	-	2/D.09	
P	CIRCULATION VENT/INSPECTION HATCHES	18 X 24	0, 72, 144, 216, 288	-	1/D.09	
Q	OVERFLOW/CIRCULATION VENT	12 X 36	0, 36, 54, 72, 108, 324	52'-0"	6/D.07	12
R	PAN INSTALLATION HATCH	-	45	-	-	3
S	SUMP	30	225	4'-0"	5/D.07	
T	GROUNDING LUGS	3 X 3 X ⅜	20, 110, 200, 290	1'-0"	3/D.14	
U	FLOATING PAN LOW LEG LEVEL	-	-	3'-11"	-	11
V	SCAFFOLD CABLE SUPPORTS	-	135, 315	6'-0"	-	
W	SHELL CIRCULATION VENTS	-	180, 252	53'-0"	6/D.07	12



50,000 BBL TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING PLAN

SCALE: ⅛"=1'-0"

0 4' 8' 16'

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 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 PREVAILING WINDS.

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 MANHOLE 3'-6" 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 SPIRAL STAIRWAY INTERMEDIATE PLATFORM.

8. MOUNT THE 6" ATG WATER PROBE WELL OVER THE TANK BOTTOM SUMP THROUGH AN 8" FLANGED ROOF NOZZLE PER THE INDICATED DETAILS.

9. THE 2" WATER DRAW-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 MINIMUM 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 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. 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 PAN.

12. PROVIDE AT LEAST ONE OVERFLOW FOR EVERY 1200 GPM OF RECEIPT. DO NOT LOCATE OVERFLOWS OVER STAIRS OR SHELL NOZZLE ISOLATION VALVES. WHERE THE PATTERN OF ROOF PERIMETER CIRCULATION VENTS WOULD RESULT IN AN OVERFLOW/CIRCULATION VENT OVER PRODUCT PIPING OR THE STAIRWAY, PROVIDE A SHELL CIRCULATION VENT CONSTRUCTED SIMILAR TO AN OVERFLOW CIRCULATION VENT BUT 1'-0" 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.

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 8" 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 HORIZONTALLY ON THE VERTICAL CENTERLINE, SHALL NOT BE MORE THAN 6".

APPR | DATE | NO | DESCRIPTION

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

50,000 BBL TANK NOZZLE SCHEDULE & INTERSTITIAL PIPING PLAN

SCALE: AS NOTED

EPROJECT NO.: XXXXX

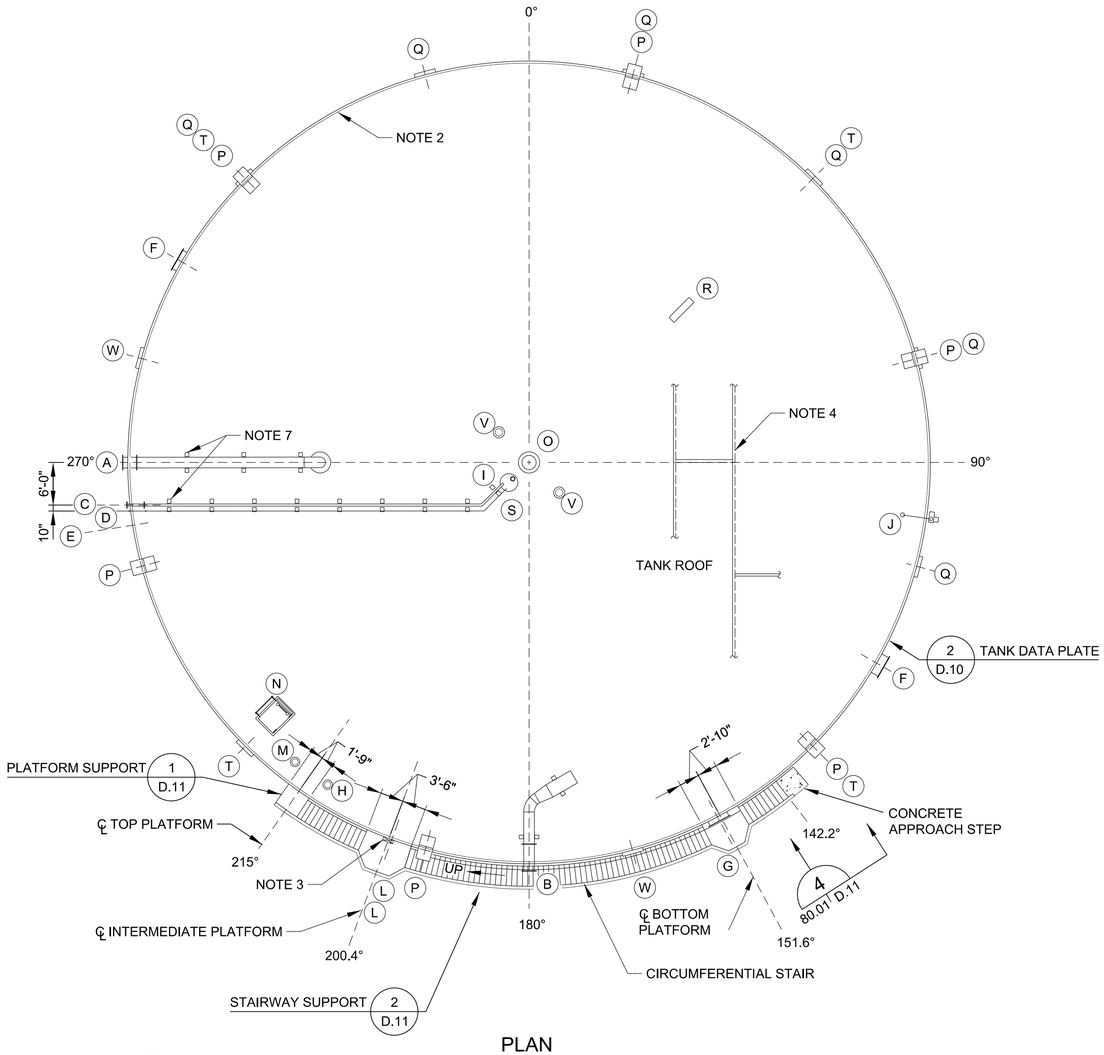
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 40 OF 57

50.02

DRAWFORM REVISION: 10 MAY 2014



PLAN

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. 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.

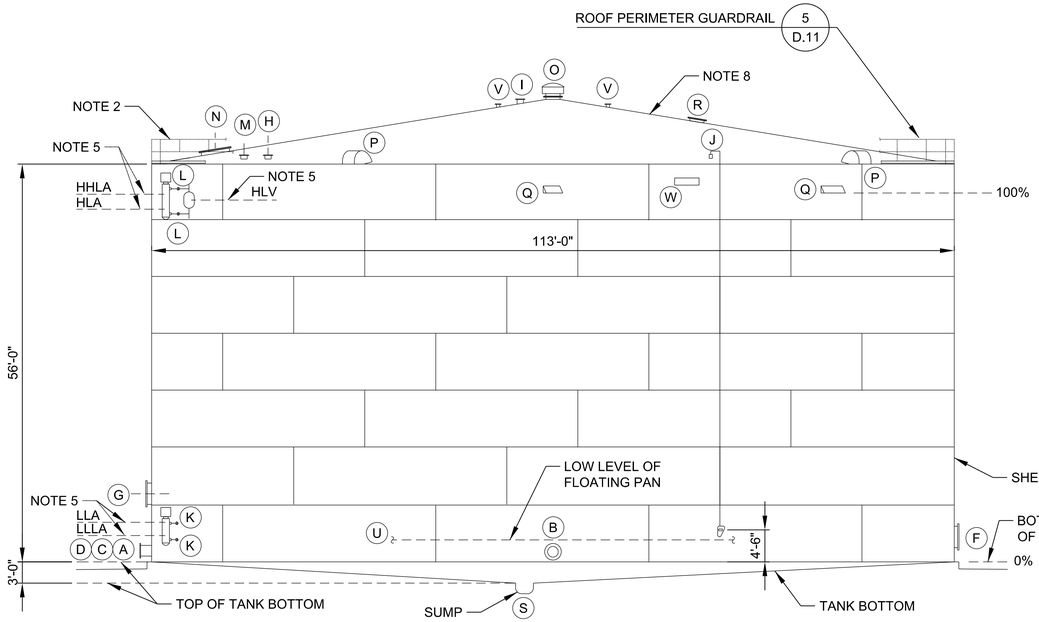
8. PROVIDE ROOF WITH SLOPE OF 1½:12.

80,000 BBL TANK

SCALE: $\frac{3}{32}$"=1'-0"

0 5' 10' 20'

N



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

ELEVATION

NO.	DESCRIPTION	DATE	APPR

NAVFAC

US ARMY CORPS OF ENGINEERS
OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

80,000 BBL TANK

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

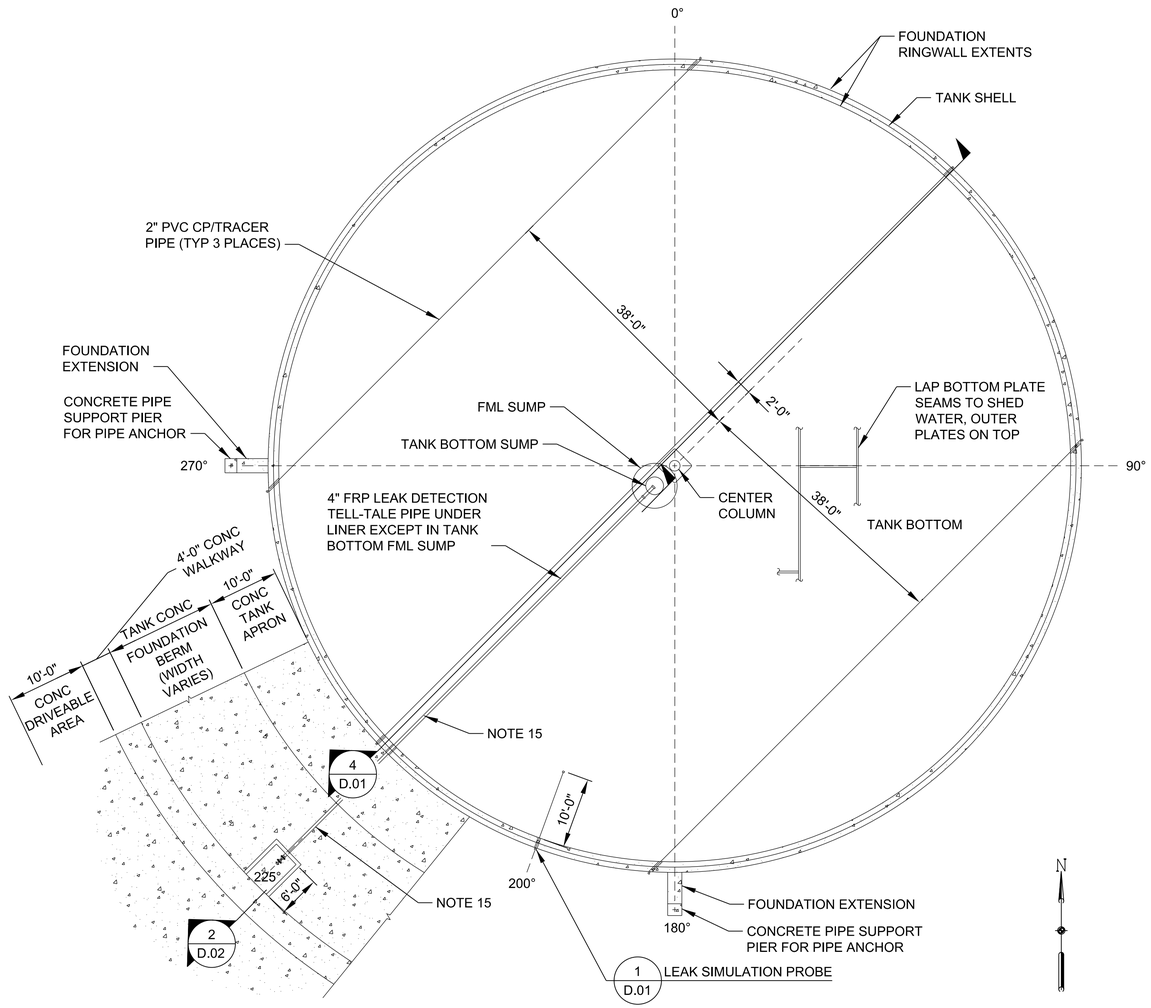
SHEET 41 OF 57

80.01

DRAWFORM REVISION: 10 MAY 2014

80,000 BBL TANK NOZZLE/EQUIPMENT SCHEDULE

ITEM	DESCRIPTION	SIZE (IN)	ANGLE (DEGREES)	DISTANCE (NOTE 1)	DETAIL SHOWN (DETAIL/SHEET)	NOTES
A	ISSUE	24	270	2'-¾"	4/D.08	4, 5, 10
B	FILL	18	180	1'-6¾"	1/D.08	4, 5, 10
C	LOW SUCTION	4	-	2'-¾"	5/D.07, 1/D.10	5, 13
D	WATER DRAW-OFF	2	-	1'-11¾"	3/D.07, 1/D.10, 5/D.13	9, 13
E	PRODUCT RETURN	2	261	7"	5/D.13	
F	SHELL MANHOLES (LOWER)	36	-	3'-6"	3/D.10, 6/D.10	2, 17
G	SHELL MANHOLE (UPPER)	36	152	9'-9"	3/D.10, 6/D.10	6, 17
H	ATG GAUGE WELL	10	212	53'-6"	4/D.07	16
I	ATG WATER PROBE WELL	8	225	3'-3"	3/D.07	8
J	MECHANICAL TAPE LEVEL GAUGE	1½	98	-	1/D.07	
K	LOW & LOW-LOW LEVEL ALARM NOZZLES	1	200	X'-X", X'-X"	1/D.12	
L	HIGH & HIGH-HIGH LEVEL ALARM AND HLV NOZZLES	1	200	X'-X", X'-X"	2/D.12	7
M	SAMPLE GAUGE WELL	10	218	53'-6"	2/D.07	16
N	ROOF MAHOLE/LADDER HATCH	36 X 48	225	50'-6"	3/D.09	
O	CENTER ROOF VENT	24	-	-	2/D.09	
P	CIRCULATION VENT/INSPECTION HATCHES	18 X 24	15, 75, 135, 195, 255, 315	-	1/D.09	
Q	OVERFLOW/CIRCULATION VENT	12 X 36	15, 45, 75, 105, 315, 345	51'-10"	6/D.07	12
R	PAN INSTALLATION HATCH	-	45	-	-	3
S	SUMP	30	225	4'-0"	5/D.07	
T	GROUNDING LUGS	3 X 3 X ⅜	45, 135, 225, 315	1'-0"	3/D.14	
U	FLOATING PAN LOW LEG LEVEL	-	-	3'-11"	-	11
V	SCAFFOLD CABLE SUPPORTS	-	135, 315	6'-0"	-	
W	SHELL CIRCULATION VENTS	12 X 36	165, 285	52'-10"	6/D.07	12



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

SCALE: 3/32"=1'-0"

0 5' 10' 20'

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 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 PREVAILING WINDS.

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 MANHOLE 3'-6" 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 SPIRAL STAIRWAY INTERMEDIATE PLATFORM.

8. MOUNT THE 6" ATG WATER PROBE WELL OVER THE TANK BOTTOM SUMP THROUGH AN 8" FLANGED ROOF NOZZLE PER THE INDICATED DETAILS.

9. THE 2" WATER DRAW-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 MINIMUM 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 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. 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 PAN.

12. PROVIDE AT LEAST ONE OVERFLOW FOR EVERY 1200 GPM OF RECEIPT. DO NOT LOCATE OVERFLOWS OVER STAIRS OR SHELL NOZZLE ISOLATION VALVES. WHERE THE PATTERN OF ROOF PERIMETER CIRCULATION VENTS WOULD RESULT IN AN OVERFLOW/CIRCULATION VENT OVER PRODUCT PIPING OR THE STAIRWAY, PROVIDE A SHELL CIRCULATION VENT CONSTRUCTED SIMILAR TO AN OVERFLOW CIRCULATION VENT BUT 1'-0" 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.

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 8" 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 HORIZONTALLY ON THE VERTICAL CENTERLINE, SHALL NOT BE MORE THAN 6".

APPR | DATE | DESCRIPTION | SYM

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

80,000 BBL TANK NOZZLE SCHEDULE & INTERSTITIAL PIPING PLAN

SCALE: AS NOTED

EPROJECT NO.: XXXXX

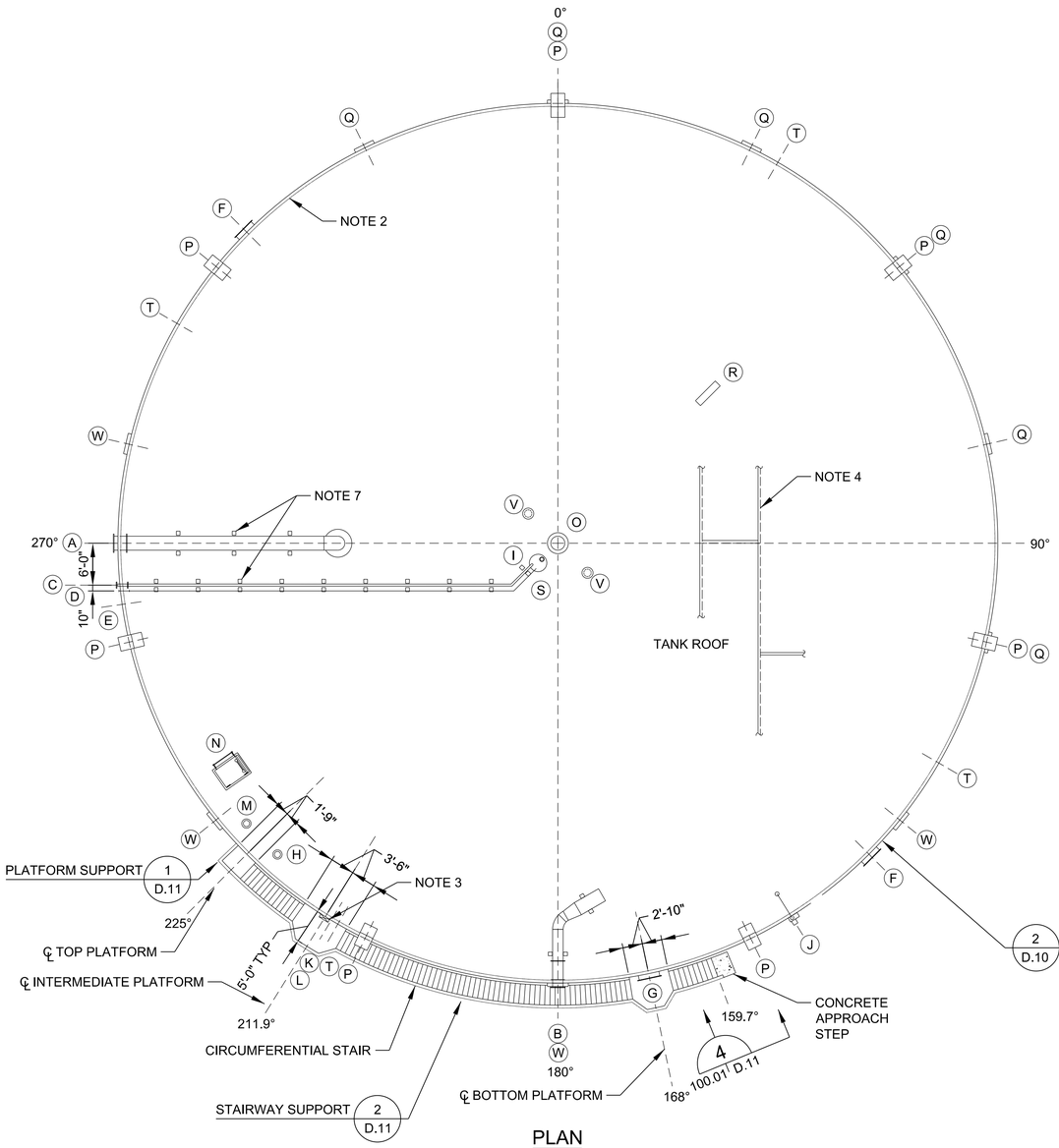
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

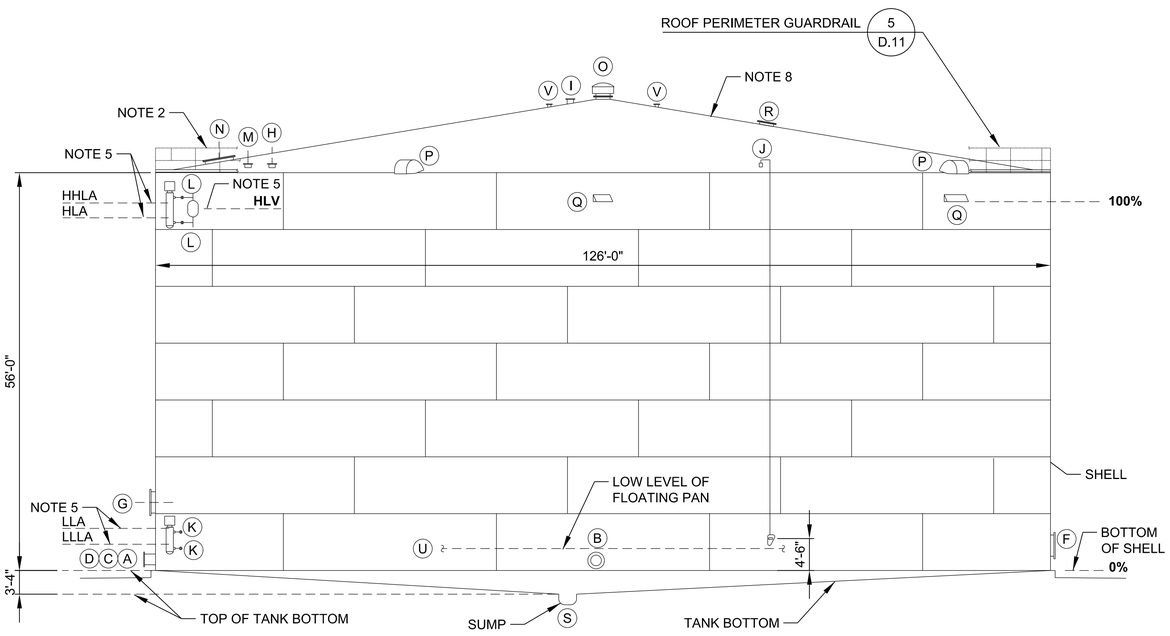
SHEET 42 OF 57

80.02

DRAWFORM REVISION: 10 MAY 2014



PLAN



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

ELEVATION

100,000 BBL TANK

SCALE: 3/32"=1'-0"

0 5' 10' 20'

N

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. 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 1½:12.

APPR | DATE | DESCRIPTION | SYM

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

100,000 BBL TANK

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

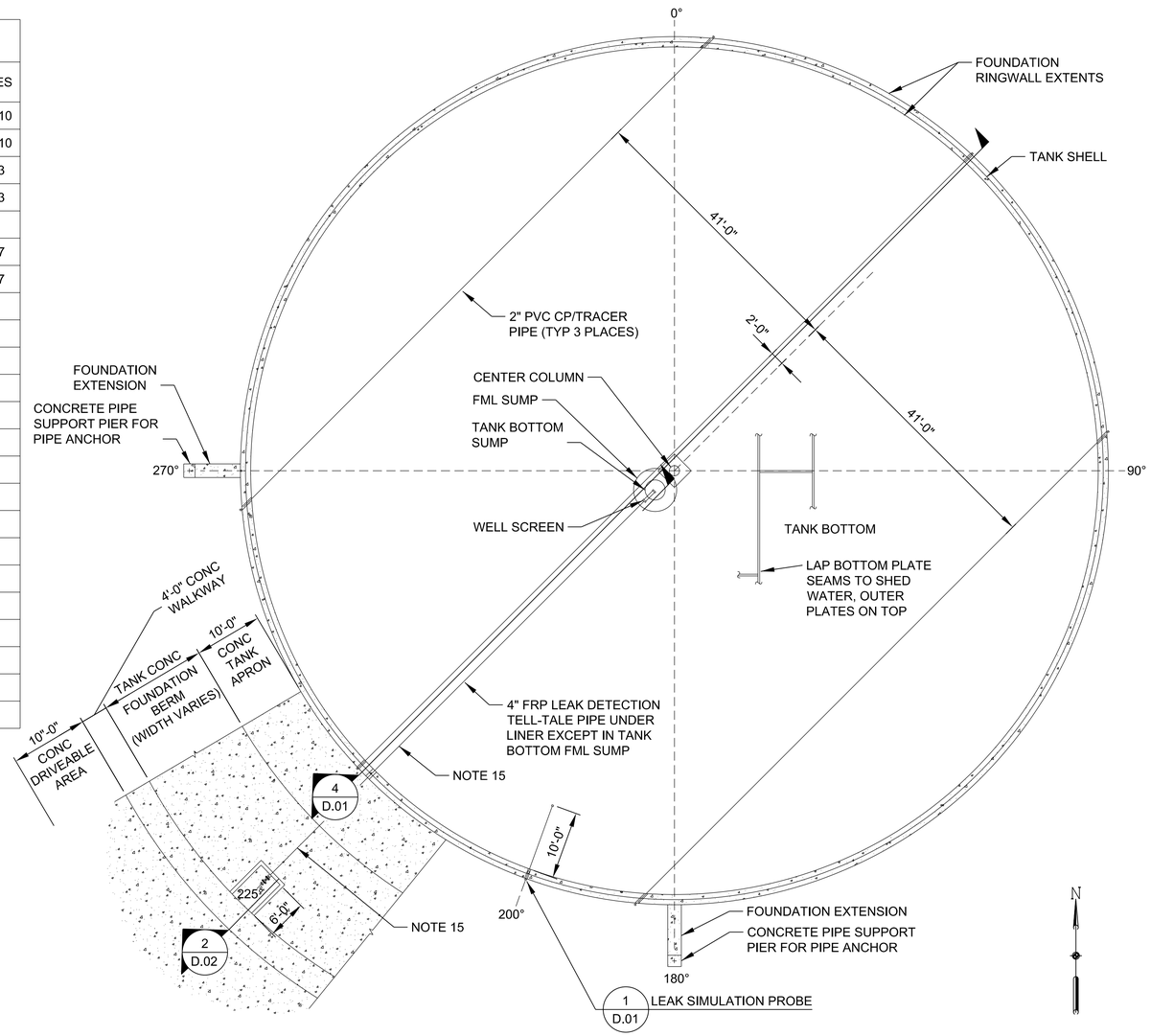
SHEET 43 OF 57

100.01

DRAWFORM REVISION: 10 MAY 2014

100,000 BBL TANK NOZZLE/EQUIPMENT SCHEDULE

ITEM	DESCRIPTION	SIZE (IN)	ANGLE (DEGREES)	DISTANCE (NOTE 1)	DETAIL SHOWN (DETAIL/SHEET)	NOTES
A	ISSUE	24	270	2'-¾"	4/D.08	4, 5, 10
B	FILL	18	180	1'-6¾"	1/D.08	4, 5, 10
C	LOW SUCTION	4	-	2'-¾"	5/D.07, 1/D.10	5, 13
D	WATER DRAW-OFF	2	-	1'-11¾"	3/D.07, 1/D.10, 5/D.13	9, 13
E	PRODUCT RETURN	2	262	7"	5/D.13	
F	SHELL MANHOLES (LOWER)	36	-	3'-6"	3/D.10, 6/D.10	2, 17
G	SHELL MANHOLE (UPPER)	36	168	9'-9"	3/D.10, 6/D.10	6, 17
H	ATG GAUGE WELL	10	222	60'-0"	4/D.07	16
I	ATG WATER PROBE WELL	8	225	3'-3"	3/D.07	8
J	MECHANICAL TAPE LEVEL GAUGE	1½	148	-	1/D.07	
K	LOW & LOW-LOW LEVEL ALARM NOZZLES	1	211	X'-X", X'-X"	1/D.12	
L	HIGH & HIGH-HIGH LEVEL ALARM AND HLV NOZZLES	1	211	X'-X", X'-X"	2/D.12	7
M	SAMPLE GAUGE WELL	10	228	60'-0"	2/D.07	16
N	ROOF MAHOLE/LADDER HATCH	36 X 48	235	57'-0"	3/D.09	
O	CENTER ROOF VENT	24	-	-	2/D.09	
P	CIRCULATION VENT/INSPECTION HATCHES	18 X 24	0, 51, 103, 154, 206, 257, 309	-	1/D.09	
Q	OVERFLOW/CIRCULATION VENT	12 X 36	0, 26, 51, 77, 103, 334	52'-0"	6/D.07	12
R	PAN INSTALLATION HATCH	-	45	-	-	3
S	SUMP	30	225	4'-0"	5/D.07	
T	GROUNDING LUGS	3 X 3 X ⅜	30, 120, 210, 300	1'-0"	3/D.14	
U	FLOATING PAN LOW LEG LEVEL	-	-	3'-11"	-	11
V	SCAFFOLD CABLE SUPPORTS	-	135, 315	6'-0"	-	
W	SHELL CIRCULATION VENTS	12 X 36	129, 180, 231, 283	53'-0"	6/D.07	12



100,000 BBL TANK BOTTOM, FOUNDATION, AND INTERSTITIAL PIPING PLAN

SCALE: 3/32"=1'-0"

0 5' 10' 20'

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 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 PREVAILING WINDS.

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 MANHOLE 3'-6" 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 SPIRAL STAIRWAY INTERMEDIATE PLATFORM.

8. MOUNT THE 6" ATG WATER PROBE WELL OVER THE TANK BOTTOM SUMP THROUGH AN 8" FLANGED ROOF NOZZLE PER THE INDICATED DETAILS.

9. THE 2" WATER DRAW-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 MINIMUM 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 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. 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 PAN.

12. PROVIDE AT LEAST ONE OVERFLOW FOR EVERY 1200 GPM OF RECEIPT. DO NOT LOCATE OVERFLOWS OVER STAIRS OR SHELL NOZZLE ISOLATION VALVES. WHERE THE PATTERN OF ROOF PERIMETER CIRCULATION VENTS WOULD RESULT IN AN OVERFLOW/CIRCULATION VENT OVER PRODUCT PIPING OR THE STAIRWAY, PROVIDE A SHELL CIRCULATION VENT CONSTRUCTED SIMILAR TO AN OVERFLOW CIRCULATION VENT BUT 1'-0" 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.

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 8" 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 HORIZONTALLY ON THE VERTICAL CENTERLINE, SHALL NOT BE MORE THAN 6".

APPR | DATE | DESCRIPTION | CTM

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

100,000 BBL TANK NOZZLE SCHEDULE & INTERSTIAL PIPING PLAN

SCALE: AS NOTED

EPROJECT NO.: XXXXX

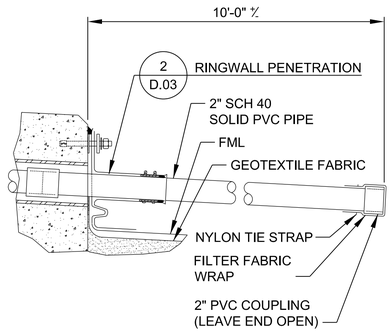
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 44 OF 57

100.02

DRAWFORM REVISION: 10 MAY 2014

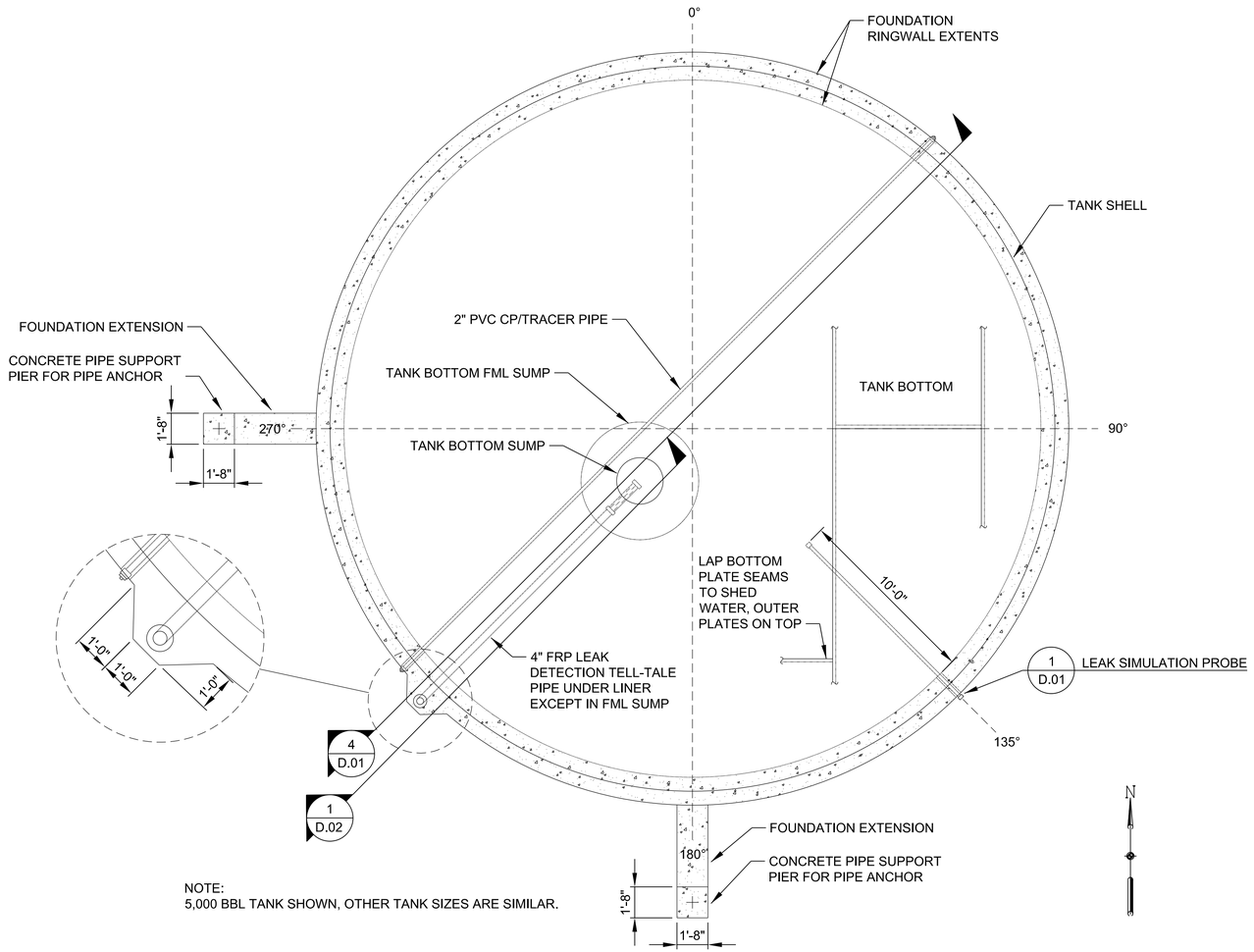


LEAK SIMULATION PROBE

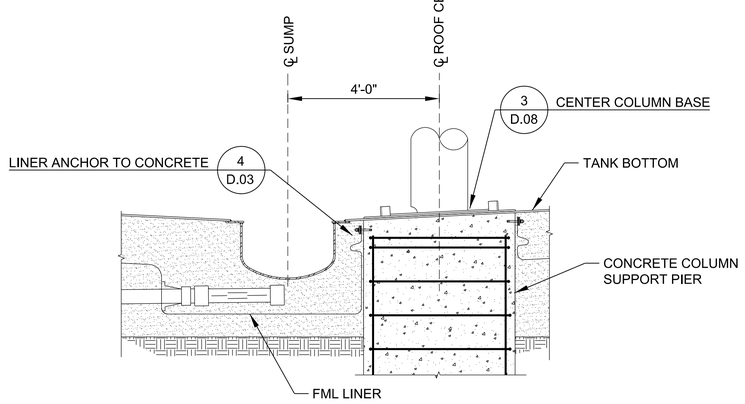
1 | XX.02 D.01

SCALE: 1½"=1'-0"

0 6" 1' 2'



NOTE:
5,000 BBL TANK SHOWN, OTHER TANK SIZES ARE SIMILAR.



NOTE:
DETAIL APPLIES TO 80,000 AND 100,000 BBL TANKS ONLY.

COLUMN FOUNDATION LINER ATTACHMENT

2 | D.02 D.01

SCALE: ½"=1'-0"

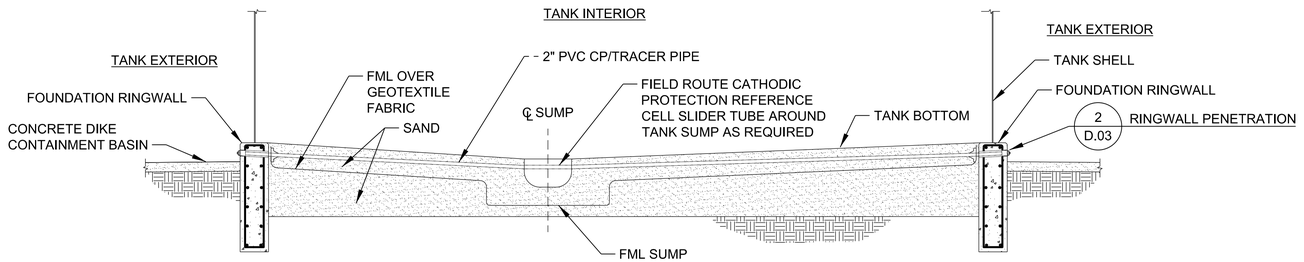
0 1' 2' 4'

NON-ELEVATED TANK BOTTOM, FOUNDATION AND INTERSTITIAL PIPING PLAN

3 | X.02 D.01

SCALE: ¼"=1'-0"

0 2' 4' 8'



SECTION

4 | X.02 D.01 D.01

SCALE: NONE

			APPR
			DATE
			DESCRIPTION
			CTM

NAVFAC

US ARMY CORPS
OF ENGINEERS
OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO	DRW MHK	CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW/8-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL DETAILS - INTERSTITIAL SPACE

SCALE: AS NOTED

EPROJECT NO.: XXXXX

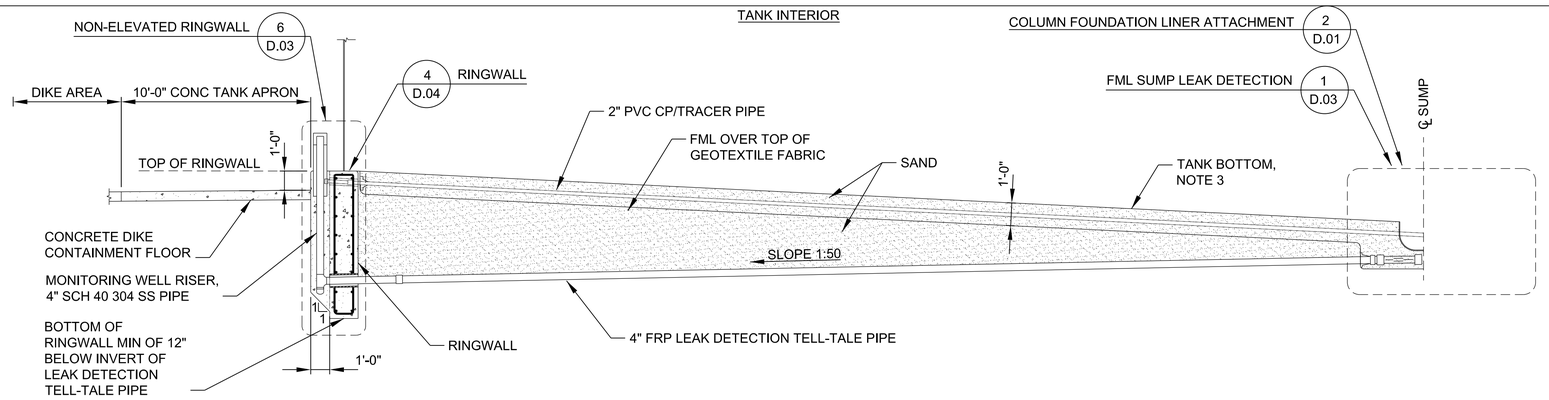
CONSTR. CONTR. NO.
XXXXX

NAVFAC DRAWING NO.
XXXXX

SHEET 45 OF 57

D.01

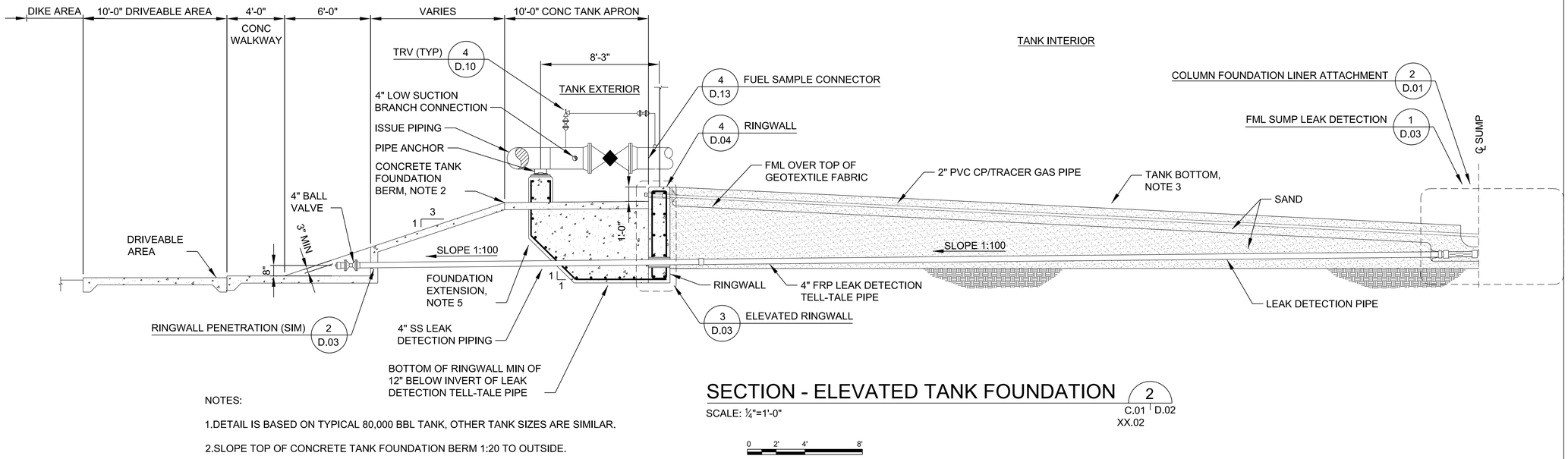
DRAWFORM REVISION: 10 MAY 2014



SECTION - NON-ELEVATED TANK FOUNDATION (1 / D.01 | D.02)

SCALE: ¼"=1'-0"

0 2' 4' 8'



SECTION - ELEVATED TANK FOUNDATION (2 / C.01 | D.02 XX.02)

SCALE: ¼"=1'-0"

0 2' 4' 8'

NOTES:

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 FURTHERMOST FROM SUMP, SLOPE TANK BOTTOM FROM SHELL TO OFF-CENTER SUMP AT A SLOPE OF NOT LESS THAN 1:20. SEE TANK "ELEVATION", XX.01, FOR ELEVATION OF TOP OF SUMP.
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.

APPR | DATE | DESCRIPTION | CTM

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL DETAILS - INTERSTITIAL SPACE

SCALE: AS NOTED

EPROJECT NO.: XXXXX

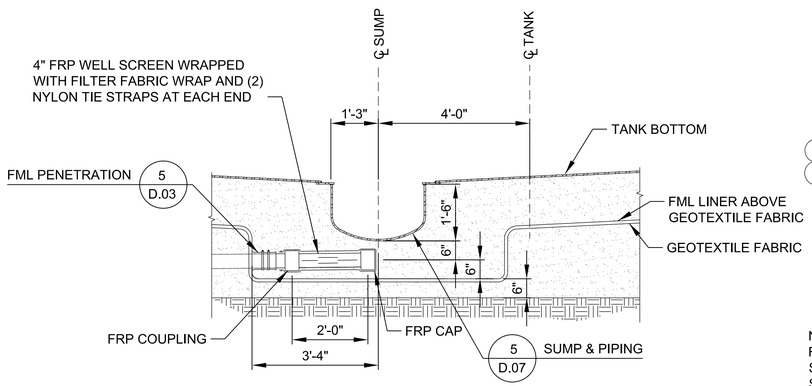
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 46 OF 57

D.02

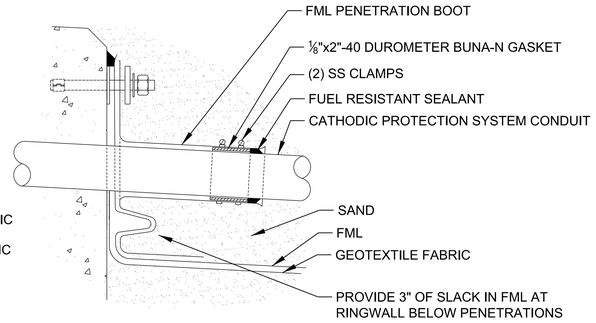
DRAWFORM REVISION: 10 MAY 2014



FML SUMP LEAK DETECTION 1
D.02 | D.03

SCALE: ½"=1'-0"

0 1' 2' 4'

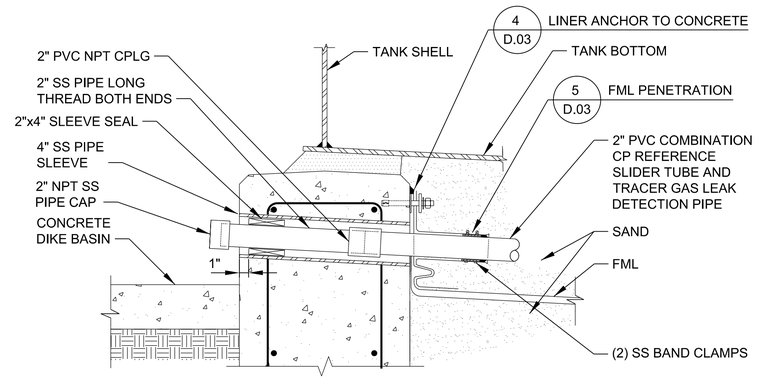


NOTE:
FML PENETRATION SHOWN IS FOR THE CATHODIC PROTECTION SYSTEM CONDUIT. THE FML PENETRATIONS FOR THE CP REFERENCE SLIDER TUBES, THE TRACER GAS LEAK DETECTION PIPES, AND THE LEAK DETECTION TELL-TALE PIPE ARE SIMILAR.

FML PENETRATION 5
D.03 | D.03
D.15

SCALE: 3"=1'-0"

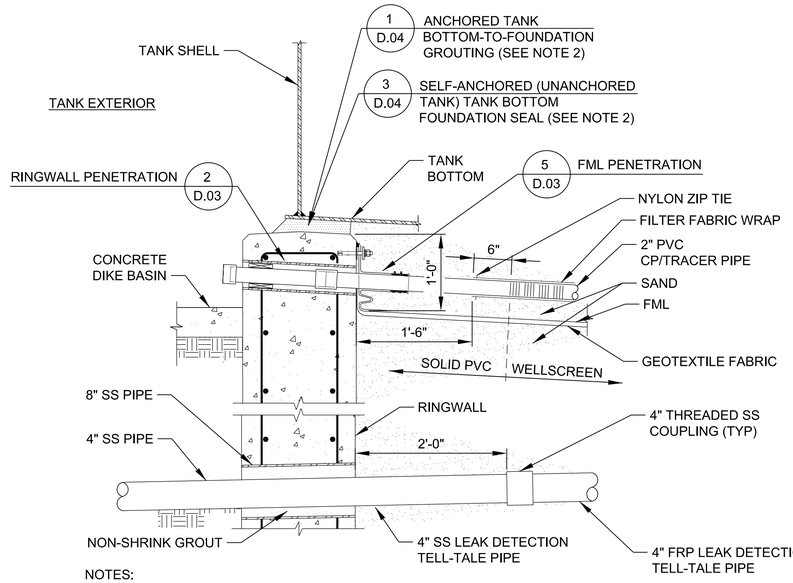
0 3" 6" 9" 12"



RINGWALL PENETRATION 2
D.01 | D.03
D.03

SCALE: 1½"=1'-0"

0 1' 2' 4'



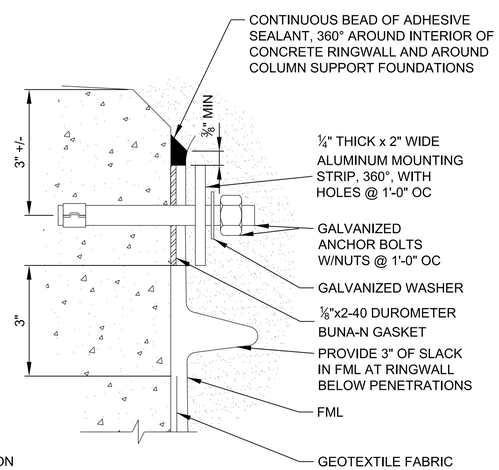
NOTES:

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

ELEVATED RINGWALL 3
D.02 | D.03

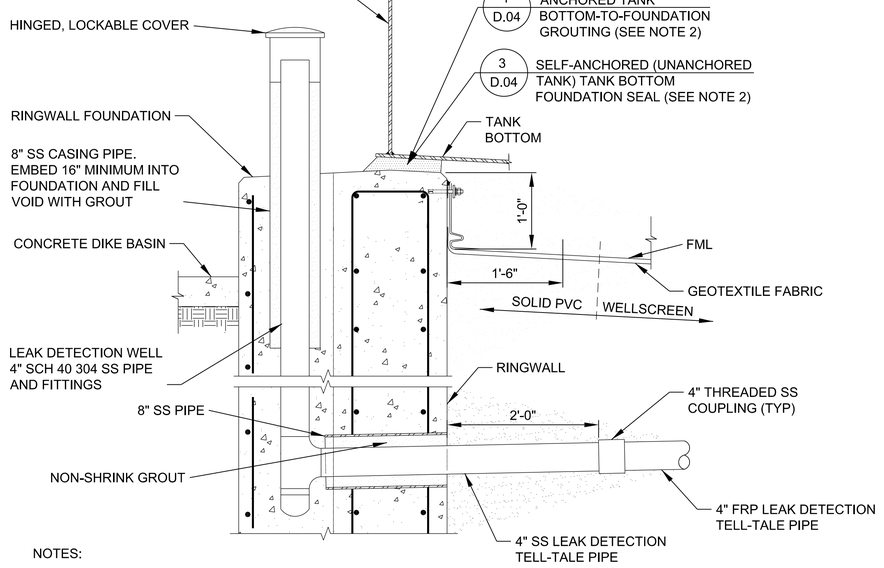
SCALE: 1"=1'-0"

0 1' 2'



LINER ANCHOR TO CONCRETE 4
D.01 | D.03
D.03

SCALE: NONE



NOTES:

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

NON-ELEVATED RINGWALL 6
D.02 | D.03

SCALE: 1"=1'-0"

0 1' 2'

APPR	DATE	DESCRIPTION	CTM

NAVFAC

US ARMY CORPS
OF ENGINEERS
OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES	MSO	DRW	MHK	CHK	WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

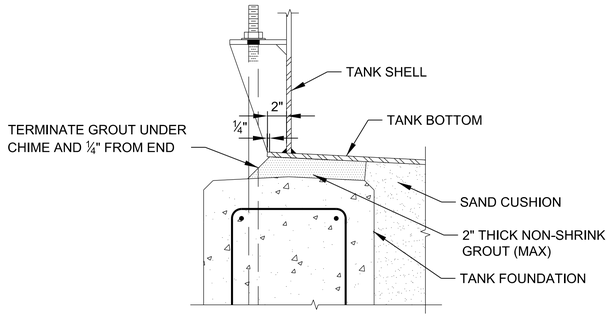
FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL DETAILS - INTERSTITIAL SPACE

SCALE:	AS NOTED
EPROJECT NO.:	XXXXX
CONSTR. CONTR. NO.	XXXXX
NAVFAC DRAWING NO.	XXXXX
SHEET	47 OF 57

D.03

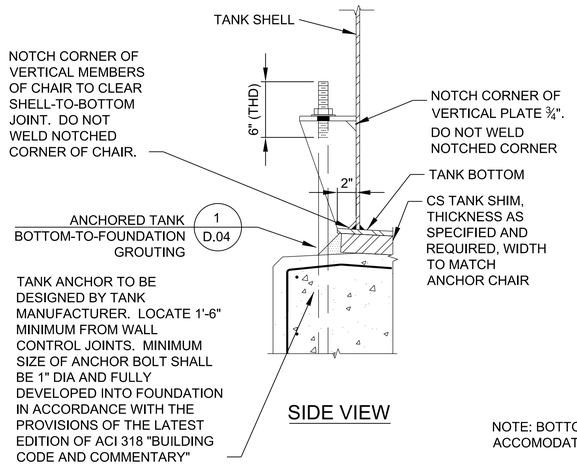
DRAWFORM REVISION: 10 MAY 2014



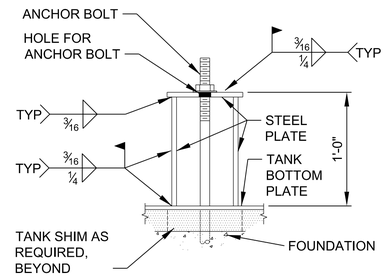
ANCHORED TANK BOTTOM-TO-FOUNDATION GROUTING (1)

SCALE: 1½"=1'-0"

D.03 | D.04
D.04



SIDE VIEW



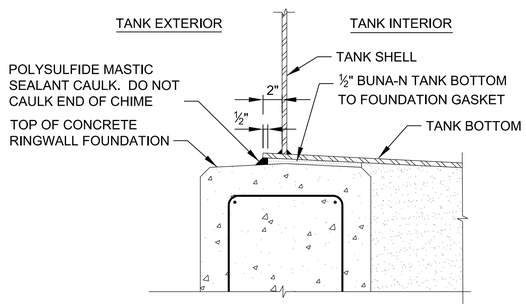
FRONT VIEW

NOTE: BOTTOM PLATE SHALL NOT BE NOTCHED TO ACCOMODATE ANCHOR BOLT LOCATION.

ANCHOR CHAIR (2)

SCALE: 1½"=1'-0"

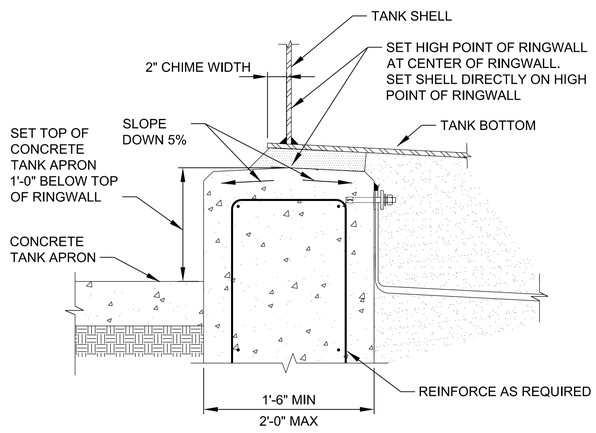
D.04 | D.04



SELF-ANCHORED (UNANCHORED TANK) TANK BOTTOM FOUNDATION SEAL (3)

SCALE: 1½"=1'-0"

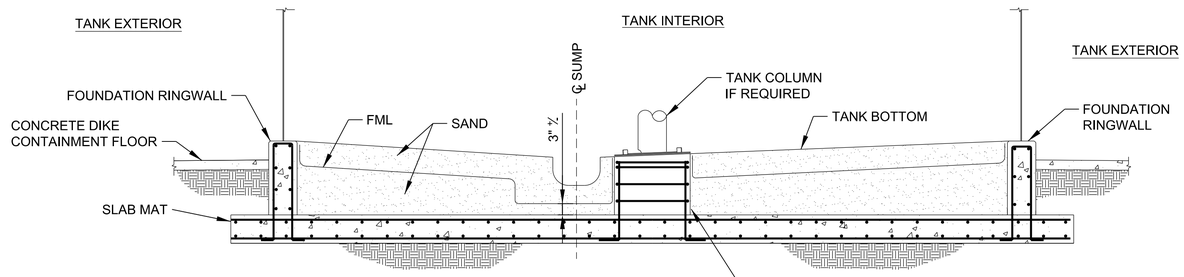
D.03 | D.04



RINGWALL (4)

SCALE: 1½"=1'-0"

D.02 | D.04



NOTE:
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 GEOTECHNICAL DATA AT EACH SITE.

TYPICAL SLAB MAT FOUNDATION (5)

SCALE: NONE

G.03 | D.02

APPR | DATE | DESCRIPTION | CTM

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL DETAILS - FOUNDATION

SCALE: AS NOTED

EPROJECT NO.: XXXXX

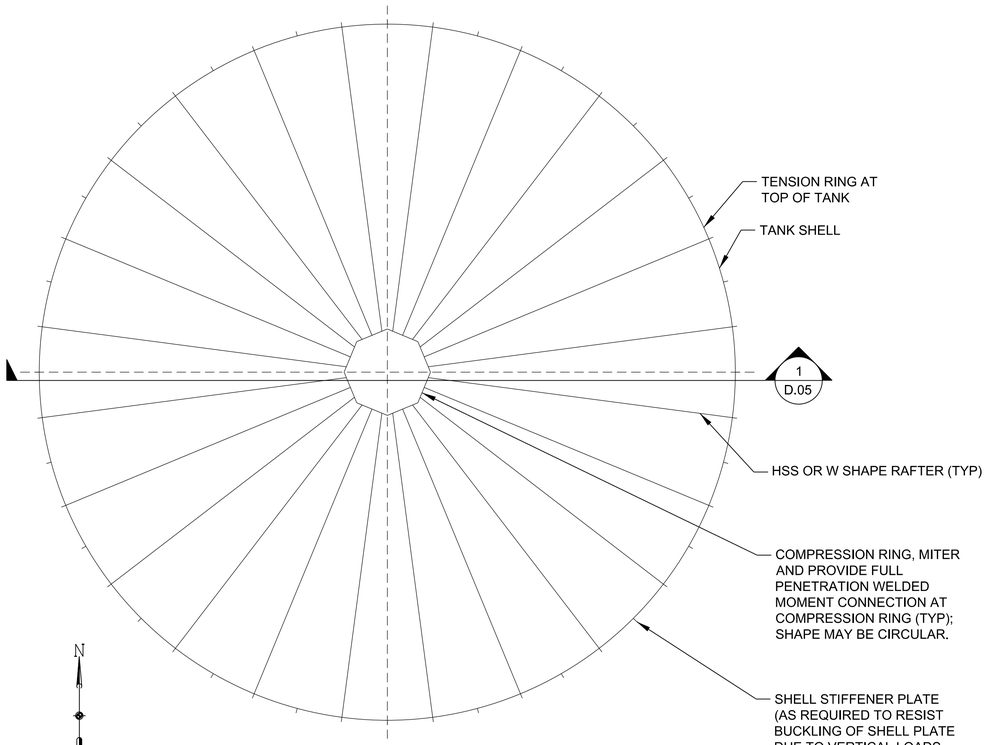
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 48 OF 57

D.04

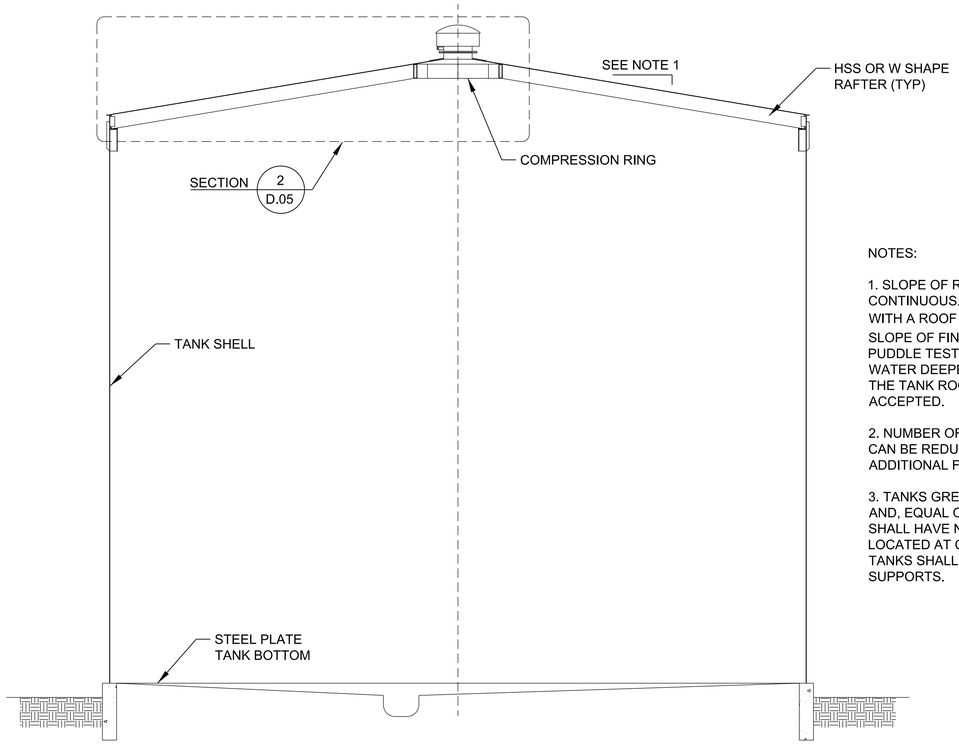
DRAWFORM REVISION: 10 MAY 2014



ROOF SUPPORT PLAN - NO COLUMNS

SCALE: 3/16"=1'-0"

0 4' 8' 12'



SECTION 1 D.05 | D.05

SCALE: 3/16"=1'-0"

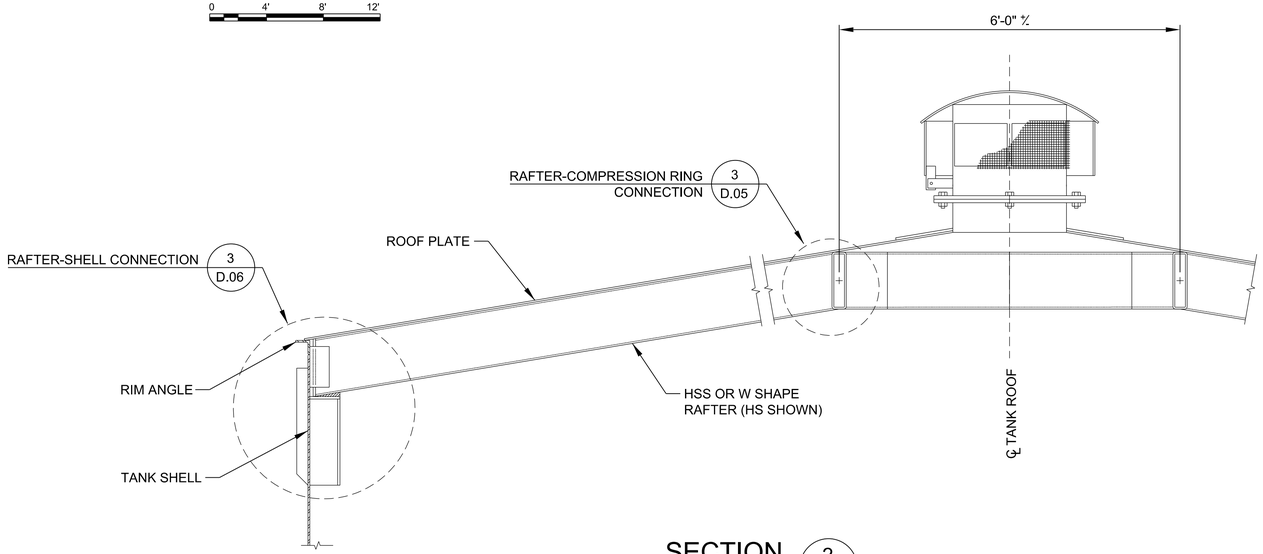
0 4' 8' 12'

NOTES:

1. SLOPE OF ROOF SHALL BE CONSISTENT AND CONTINUOUS. TANK ROOF SHALL BE DESIGNED WITH A ROOF SLOPE OF 1½ INCHES IN 12 INCHES. SLOPE OF FINISHED TANK ROOF PLATE SHALL BE PUDDLE 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.

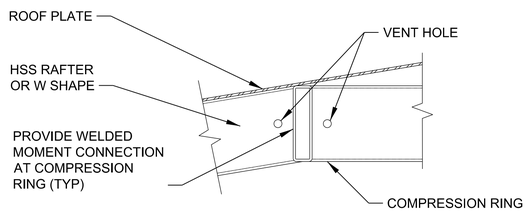
3. TANKS GREATER THAN 91 FEET IN DIAMETER AND, EQUAL OR LESS THAN 126 FEET IN DIAMETER SHALL HAVE NO MORE THAN ONE COLUMN LOCATED AT CENTER OF TANK. LESSER DIAMETER TANKS SHALL HAVE NO INTERIOR COLUMN SUPPORTS.



SECTION 2 D.05 | D.05

SCALE: ¾"=1'-0"

0 1' 2' 3'



RAFTER-COMPRESSION RING CONNECTION 3 D.05 | D.05

SCALE: 1"=1'-0"

0 1' 2'

APPR	
DATE	
DESCRIPTION	
CTM	

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY 10

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

5,000 THROUGH 50,000 BBL TANKS ROOF FRAMING PLAN

SCALE: AS NOTED

EPROJECT NO.: XXXXX

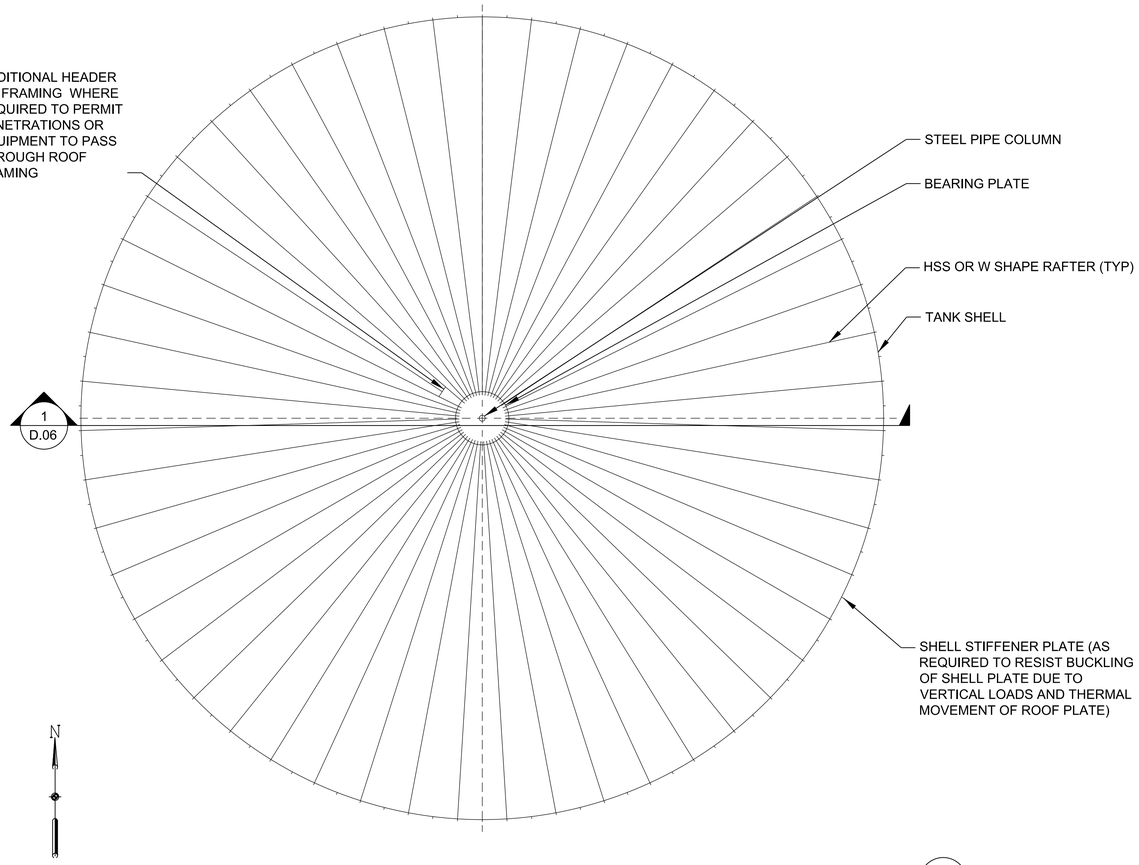
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 49 OF 57

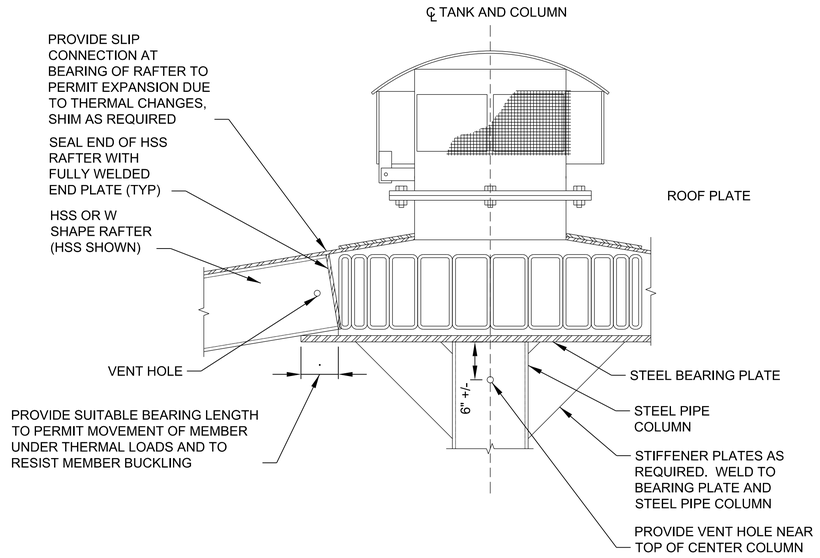
D.05

DRAWFORM REVISION: 10 MAY 2014



ROOF SUPPORT PLAN - SINGLE COLUMN TANKS

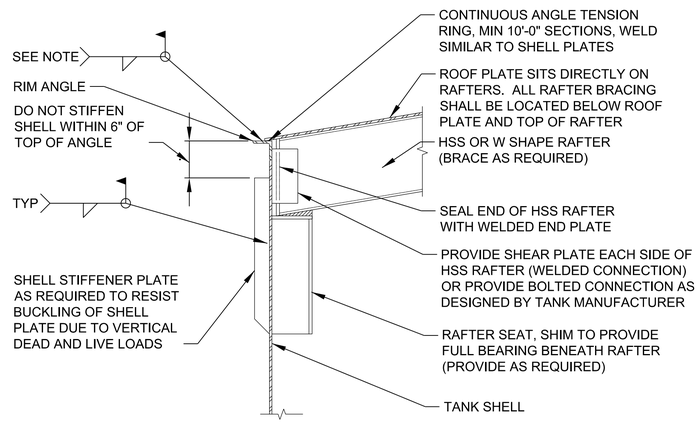
SCALE: 3/32"=1'-0"



RAFTER-COLUMN CONNECTION

SCALE: 1"=1'-0"

2 D.06 | D.06

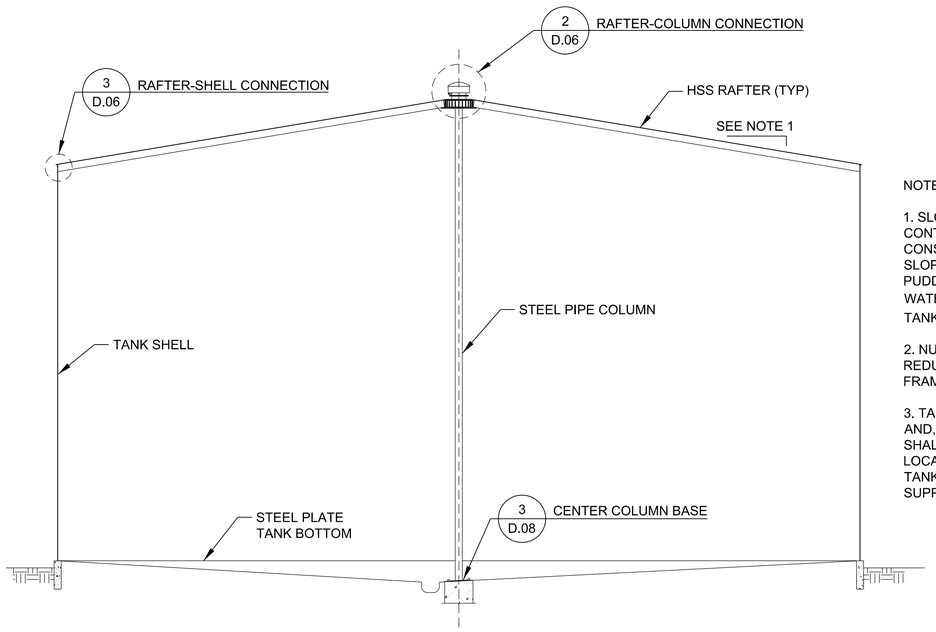


NOTE:
FOR TANKS WITHOUT FLOATING PANS, PROVIDE ROOF PLATE-TO-RIM ANGLE WELD NO LARGER THAN 3/16"

RAFTER-SHELL CONNECTION

SCALE: 1"=1'-0"

3 D.05 | D.06
D.06



SECTION

SCALE: 3/32"=1'-0"

1 D.06 | D.06

NOTES:

1. SLOPE OF ROOF SHALL BE CONSISTENT AND CONTINUOUS. TANK ROOF SHALL HAVE A CONSTANT ROOF SLOPE OF 2 INCHES IN 12 INCHES. SLOPE OF FINISHED TANK ROOF PLATE SHALL BE PUDDLE 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 BEARING PLATE 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. LESSER DIAMETER TANKS SHALL HAVE NO INTERIOR COLUMN SUPPORTS.

APPR | DATE | DESCRIPTION | SYM

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

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FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

80,000 BBL AND 100,000 BBL TANKS ROOF FRAMING PLAN

SCALE: AS NOTED

EPROJECT NO.: XXXXX

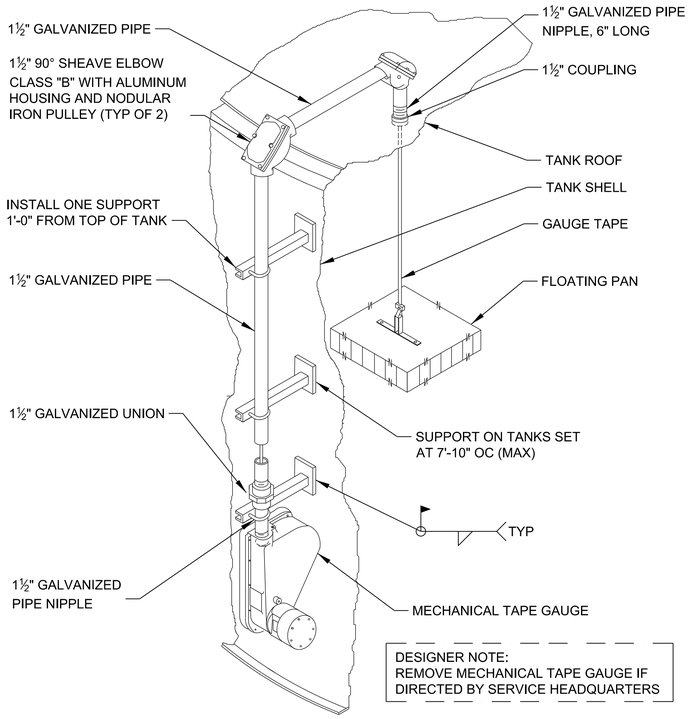
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 50 OF 57

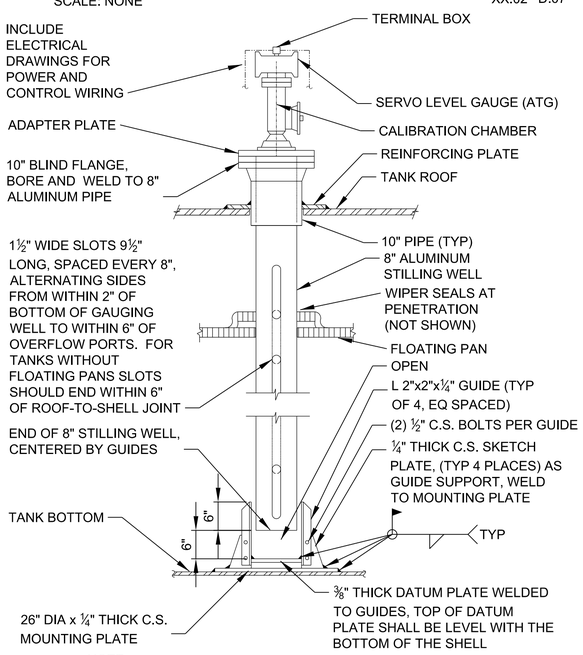
D.06

DRAWFORM REVISION: 10 MAY 2014



MECHANICAL TAPE LEVEL GAUGE (1)

SCALE: NONE — XX.02 | D.07

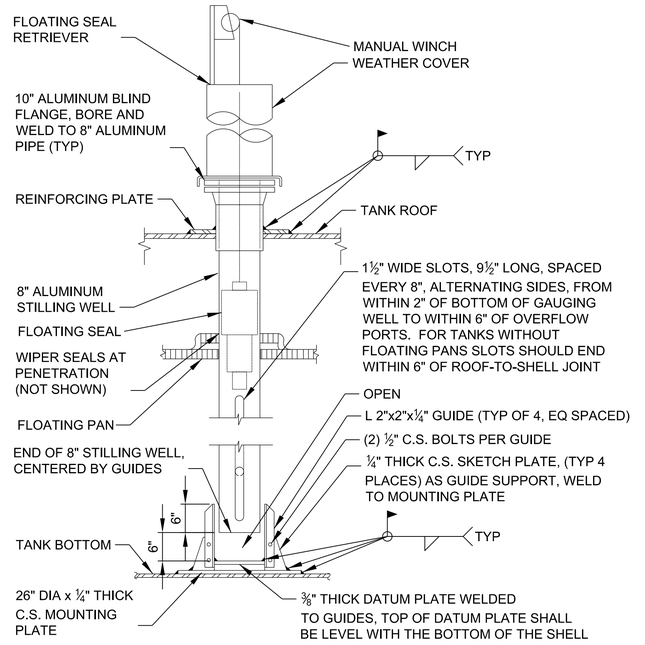


NOTE:
1. DO NOT ATTACH GUIDE SUPPORTS TO STILLING WELL.
2. STILLING WELL SHALL BE COMPLETELY VERTICAL.

ATG GAUGE WELL (4)

SCALE: ¾"=1'-0" — XX.02 | D.07

0 1' 2' 3'

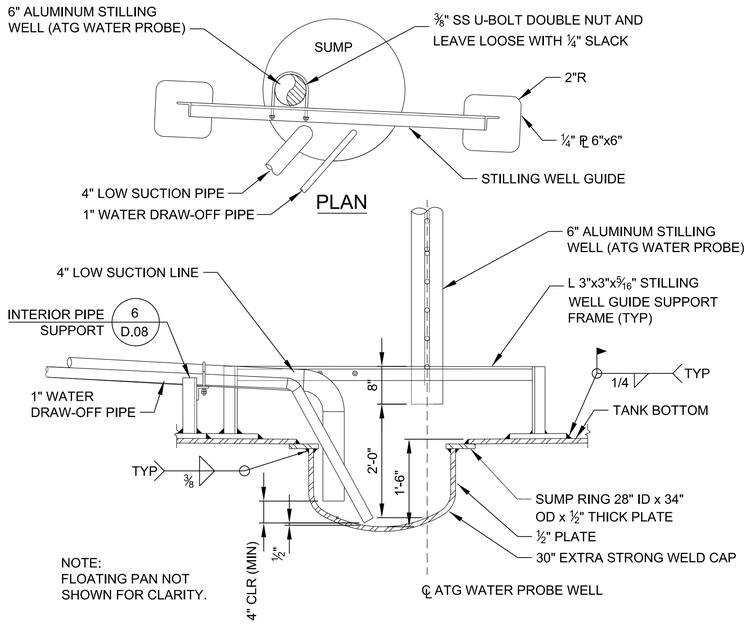


NOTE:
1. DO NOT ATTACH GUIDE SUPPORTS TO STILLING WELL.
2. STILLING WELL SHALL BE COMPLETELY VERTICAL.

SAMPLE GAUGE WELL (2)

SCALE: ¾"=1'-0" — XX.02 | D.07

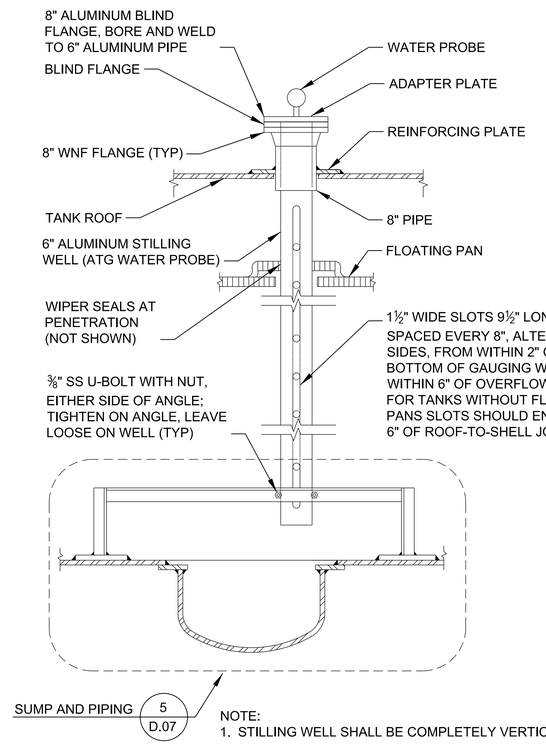
0 1' 2' 3'



SUMP AND PIPING (5)

SCALE: ¾"=1'-0" — XX.02 | D.07, D.03, D.07

0 1' 2' 3'



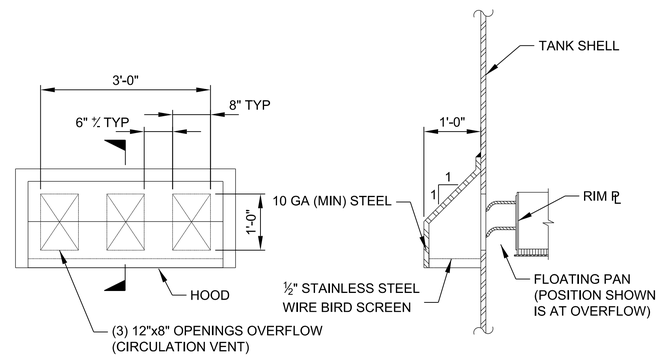
SUMP AND PIPING (5 / D.07)

NOTE:
1. STILLING WELL SHALL BE COMPLETELY VERTICAL.

ATG WATER PROBE WELL (3)

SCALE: ¾"=1'-0" — XX.02 | D.07

0 1' 2' 3'



ELEVATION — SECTION

OVERFLOW/CIRCULATION VENT AND VENT SHELL CIRCULATION VENT (6)

SCALE: ¾"=1'-0" — XX.02 | D.07

0 1' 2' 3'

APPR	
DATE	
DESCRIPTION	
CTM	

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

APPROVED

FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY TO

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

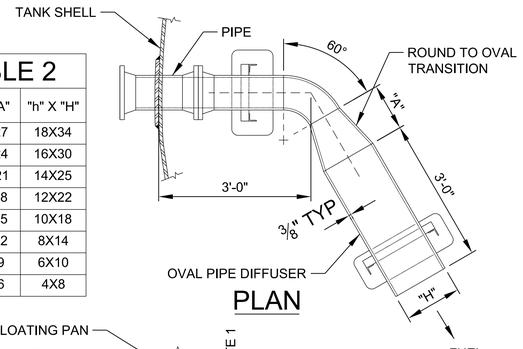
TYPICAL DETAILS - TANK APPURTENANCES

SCALE:	AS NOTED
EPROJECT NO.:	XXXXX
CONSTR. CONTR. NO.	XXXXX
NAVFAC DRAWING NO.	XXXXX
SHEET	51 OF 57

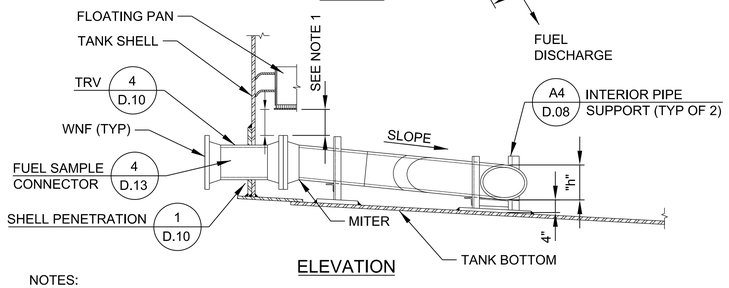
D.07

DRAWFORM REVISION: 10 MAY 2014

TABLE 2		
SIZE OF NOZZLE	"A"	"h" X "H"
18	27	18X34
16	24	16X30
14	21	14X25
12	18	12X22
10	15	10X18
8	12	8X14
6	9	6X10
4	6	4X8



PLAN



ELEVATION

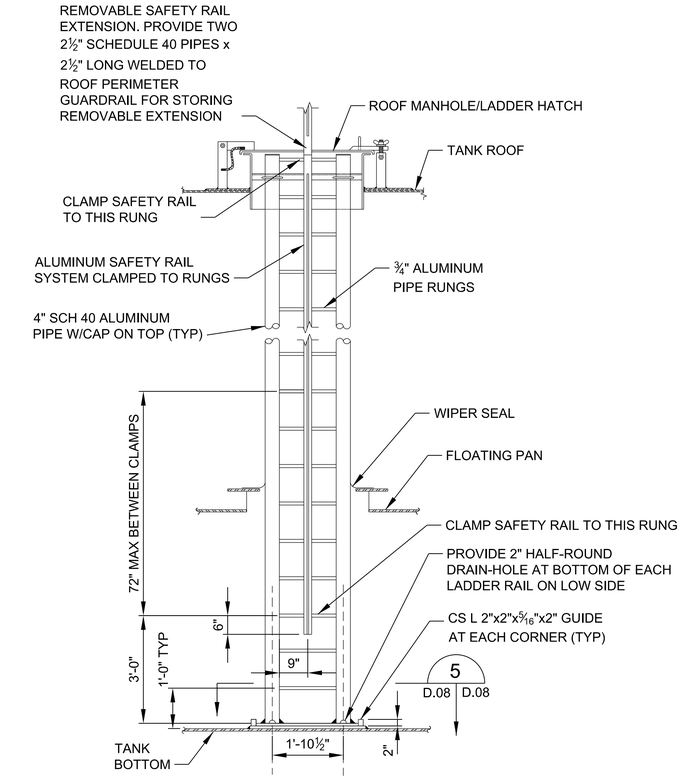
NOTES:

1.FLOATING PAN SHALL CLEAR HIGHEST POINT OF FLANGE ON ANY NOZZLE AND OTHER INTERNAL APPURTENANCES BY 6 INCHES AT LOW LEG LEVEL. A 12" NOZZLE IS SHOWN. FOR OTHER SIZES, SEE TABLE 2.

2.DIFFUSER MAY BE PROVIDED OPPOSITE-HAND FROM THAT SHOWN. HOWEVER, THE GENERAL ARRANGEMENT SHALL BE SUCH THAT THE FLOW INTO THE TANK DOES NOT ENCOUNTER OTHER APPURTENAANCES FOR AT LEAST 180 DEGREES.

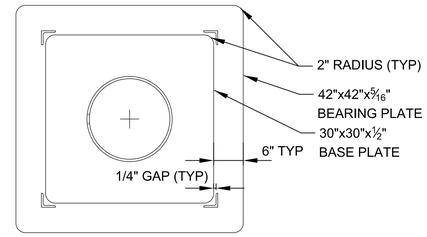
FILL NOZZLE 1

SCALE: NONE — XX.02 | D.08

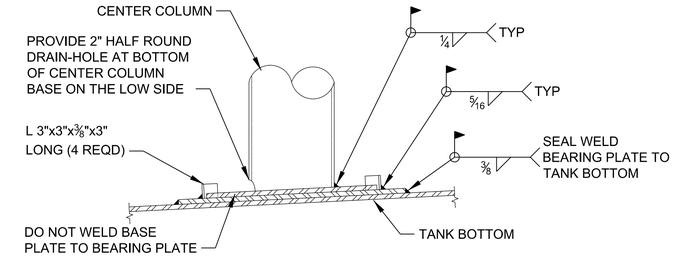


ACCESS LADDER 2

SCALE: ½"=1'-0" — D.09 | D.08



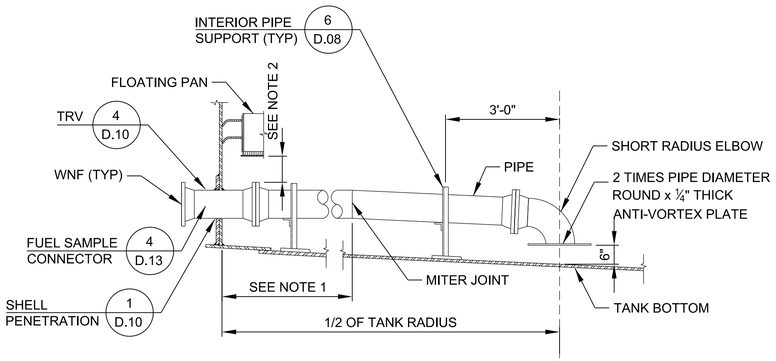
PLAN



ELEVATION

CENTER COLUMN BASE 3

SCALE: ¾"=1'-0" — D.01 | D.08, D.06



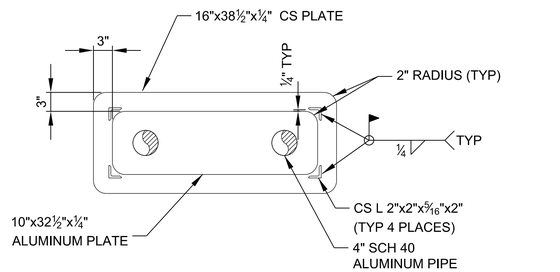
NOTES:

1.LOCATE MITER JOINT SO AS TO PROVIDE SLOPE OF PIPE PARALLEL TO TANK BOTTOM.

2.FLOATING PAN SHALL CLEAR HIGHEST POINT OF FLANGE ON ANY NOZZLE AND OTHER INTERNAL APPURTENANCES BY 6 INCHES AT LOW LEG LEVEL.

ISSUE NOZZLE 4

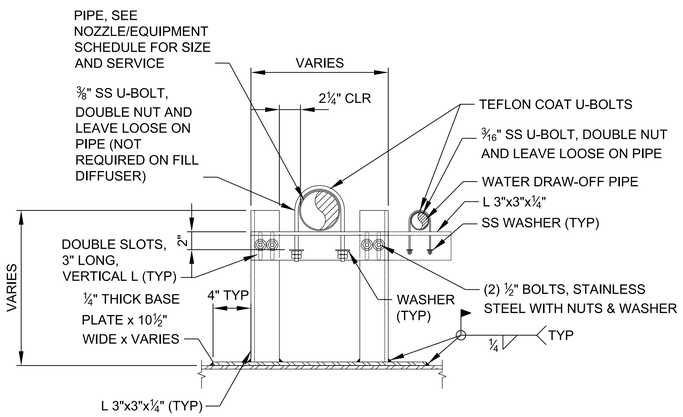
SCALE: ½"=1'-0" — XX.02 | D.08



NOTE: PROVIDE TEFLON ISOLATION GASKET BETWEEN CS AND ALUMINUM PLATES

SECTION 5

SCALE: 1"=1'-0" — D.08 | D.08



NOTE:
PROVIDE INTERNAL PIPE SUPPORTS EVERY 6'-0" FOR PIPES 4" AND SMALLER.
PROVIDE INTERNAL PIPE SUPPORTS EVERY 8'-0" FOR LARGER SIZE PIPES.

INTERIOR PIPE SUPPORT 6

SCALE: 1½"=1'-0" — XX.02 | D.08, D.07

APPR | DATE | DESCRIPTION | SYM

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US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

A/E INFO

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FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY 10

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL DETAILS - INTERIOR APPURTENANCES

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 52 OF 57

D.08

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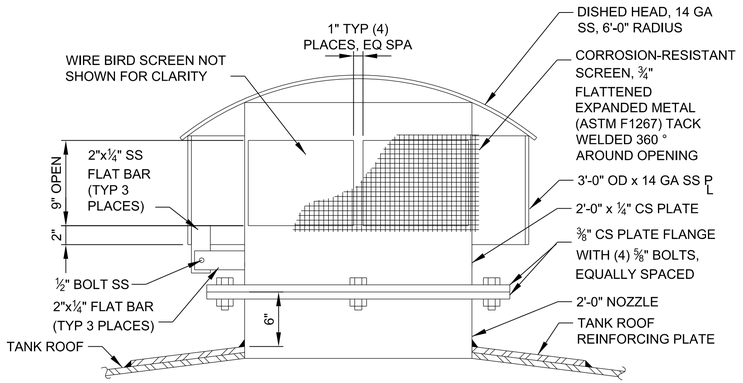
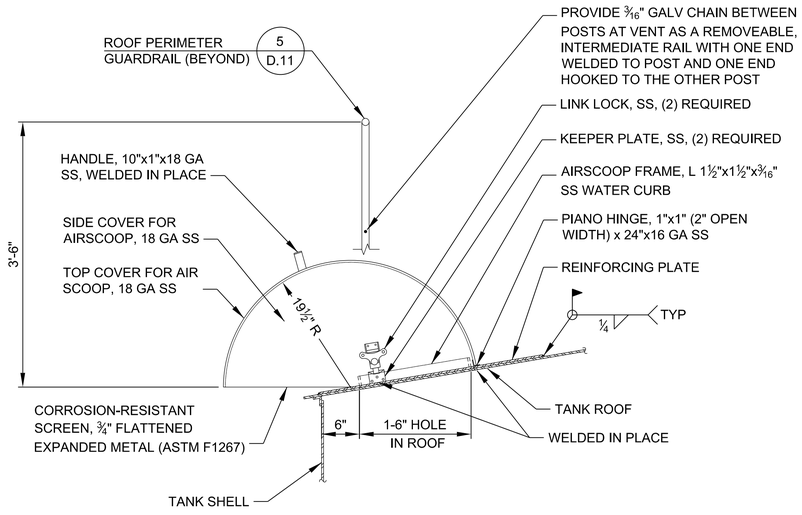


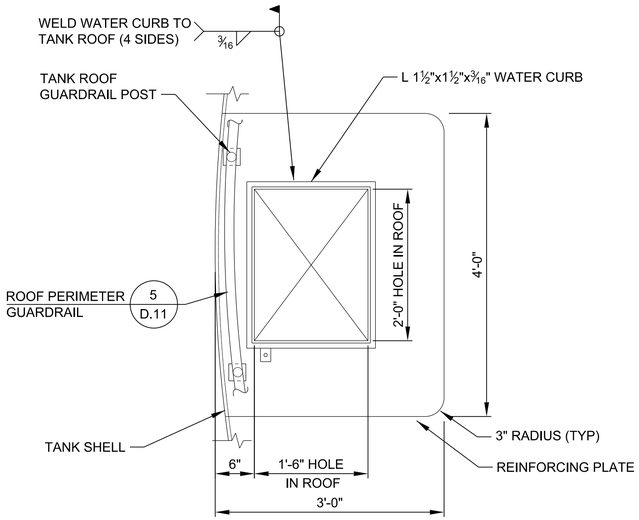
CENTER ROOF VENT 2

SCALE: 1½"=1'-0" XX.02 | D.09

0 6" 1' 2'



ELEVATION



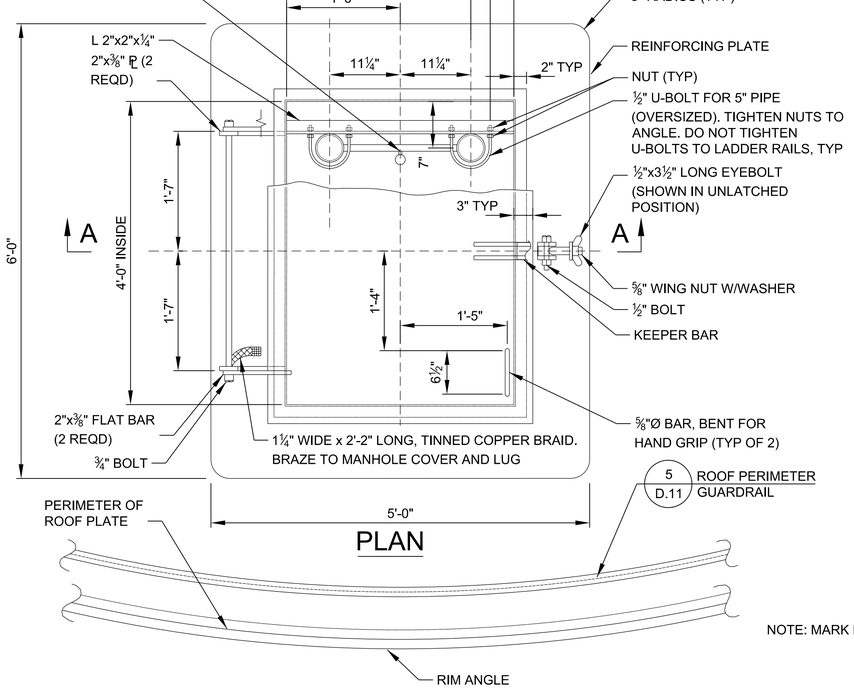
NOTE: AIR SCOOP NOT SHOWN FOR CLARITY.

PLAN

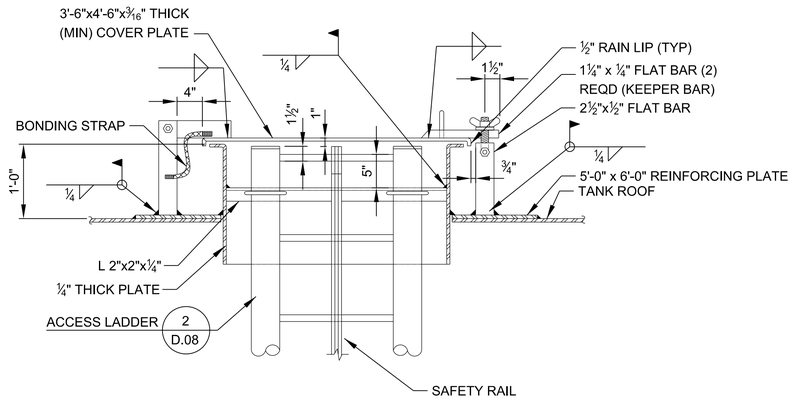
CIRCULATION VENT/INSPECTION HATCH 1

SCALE: 1"=1'-0" XX.02 | D.09

0 1' 2'



PLAN



SECTION A-A

NOTE: MARK ROOF MANHOLE AS "CONFIDED SPACE" IN ACCORDANCE WITH MIL-STD-161.

ROOF MANHOLE/LADDER HATCH 3

SCALE: 1"=1'-0" XX.02 | D.09

0 1' 2'

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NAVFAC

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ACTIVITY

SATISFACTORY TO

DES	DRW	CHK
MSO	MHK	WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL DETAILS - ROOF NOZZLES & APPURTENANCES

SCALE: AS NOTED

EPROJECT NO.: XXXXX

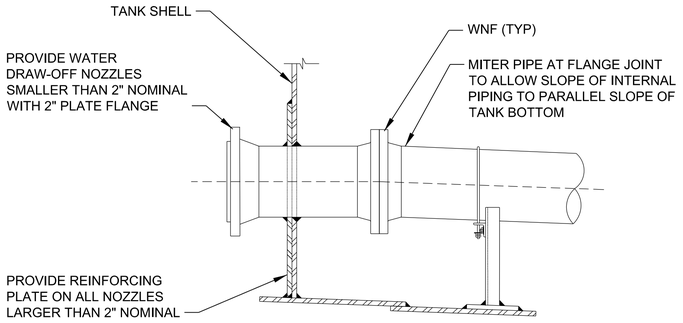
CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 53 OF 57

D.09

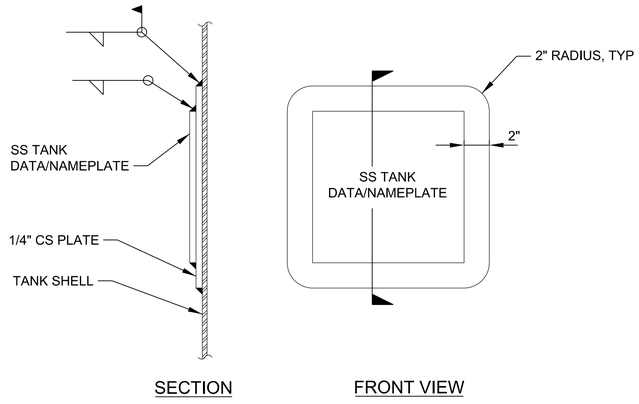
DRAWFORM REVISION: 10 MAY 2014



SHELL PENETRATION 1

SCALE: ¾"=1'-0" XX.02 | D.10 D.08

0 1' 2' 3'

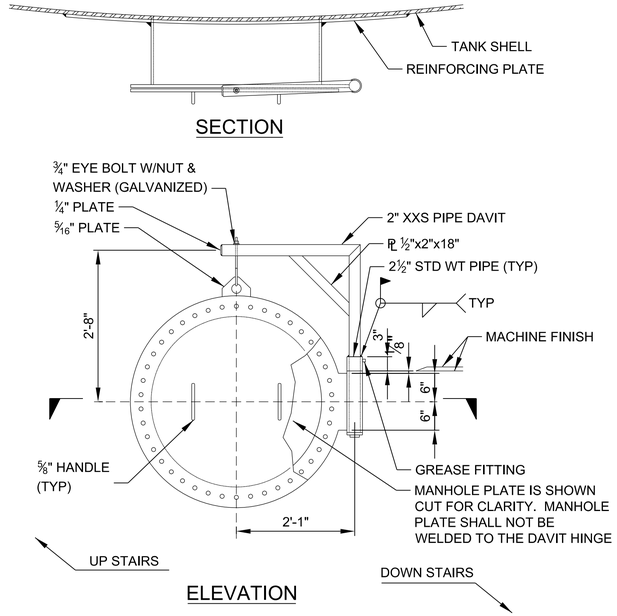


SECTION FRONT VIEW

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 API STANDARD 650. LOCATE NEAR MANHOLE ON MOST USED APPROACH SIDE AND AT EYE LEVEL.

TANK DATA PLATE 2

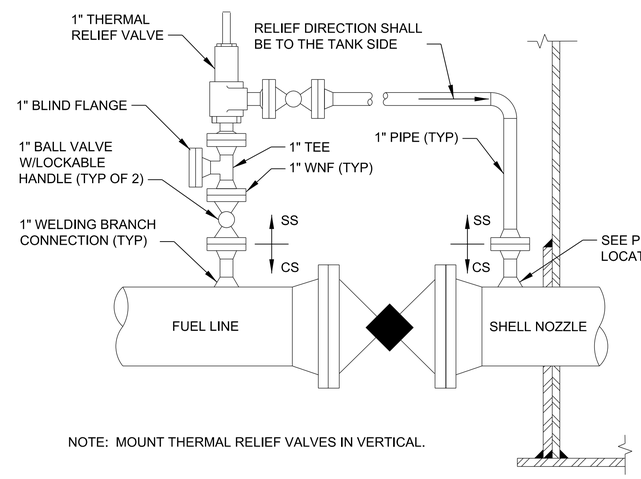
SCALE: NONE XX.01 | D.10



SHELL MANHOLE DAVIT 3

SCALE: ¾"=1'-0" XX.02 | D.10

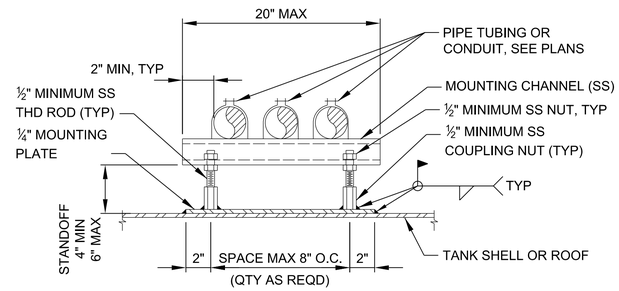
0 1' 2' 3'



NOTE: MOUNT THERMAL RELIEF VALVES IN VERTICAL.

THERMAL RELIEF VALVE (TRV) 4

SCALE: NONE D.02 | D.10 D.08 D.12



NOTES:

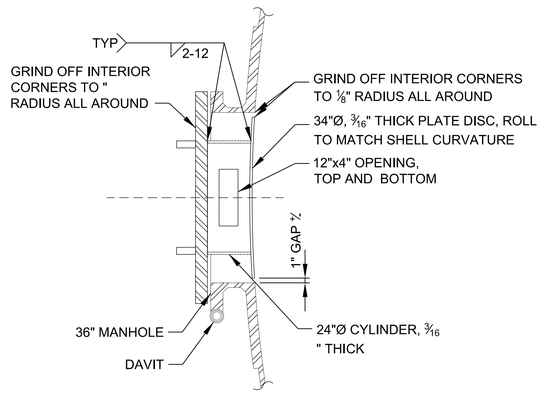
1.COUPLING NUT SHALL BE COATED WITH TANK. INSTALL MOUNTING CHANNEL ASSEMBLY AFTER TANK IS COATED; DO NOT COAT MOUNTING CHANNEL.

2.USE SIMILAR DETAIL FOR SUPPORTS MOUNTED ALONG THE TANK'S CONCRETE RINGWALL FOUNDATION, EXCEPT THE STAND-OFF IS NOT REQUIRED. BOLT SUPPORTS ON THE SIDE OF THE CONCRETE RINGWALL NOT THE TOP.

3. PLAN VIEW FOR SUPPORTS ON TANK SHELL. ELEVATION VIEW FOR SUPPORTS ON TANK ROOF.

TYPICAL SUPPORT ON TANKS PLAN/ELEVATION 5

SCALE: NONE D.12 | D.10



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

FILLER DRUM 6

SCALE: ¾"=1'-0" XX.02 | D.10

0 1' 2' 3'

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US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

SEAL

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FOR COMMANDER NAVFAC

ACTIVITY

SATISFACTORY 10

DES MSO | DRW MHK | CHK WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL DETAILS - SHELL NOZZLES & APPURTENANCES

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

SHEET 54 OF 57

D.10

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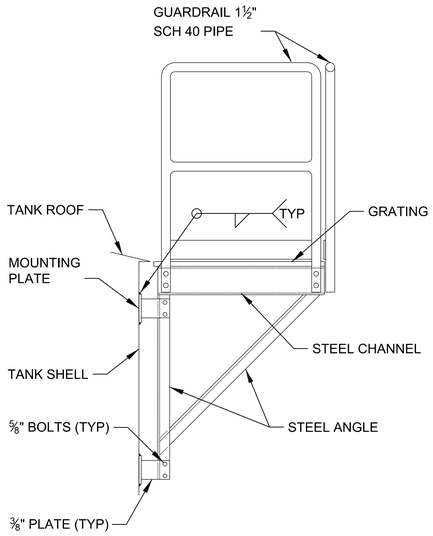
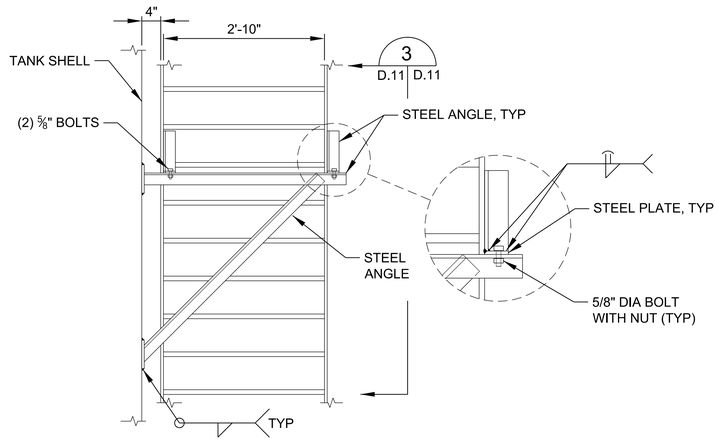


PLATFORM SUPPORT 1

SCALE: ¾"=1'-0"

XX.01 | D.11

0 1' 2' 3'



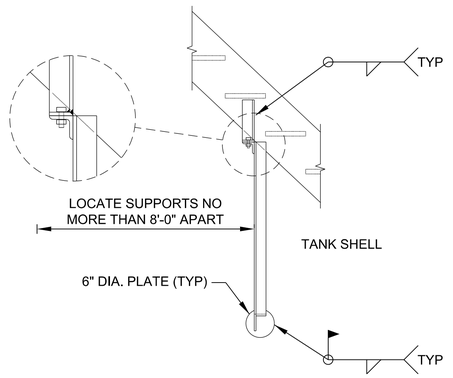
NOTE:
PROVIDE STAIRWAY SUPPORTS AS REQUIRED.
SUPPORT STAIRWAY ENTIRELY ON SHELL.

STAIRWAY SUPPORT 2

SCALE: ¾"=1'-0"

XX.01 | D.11

0 1' 2' 3'

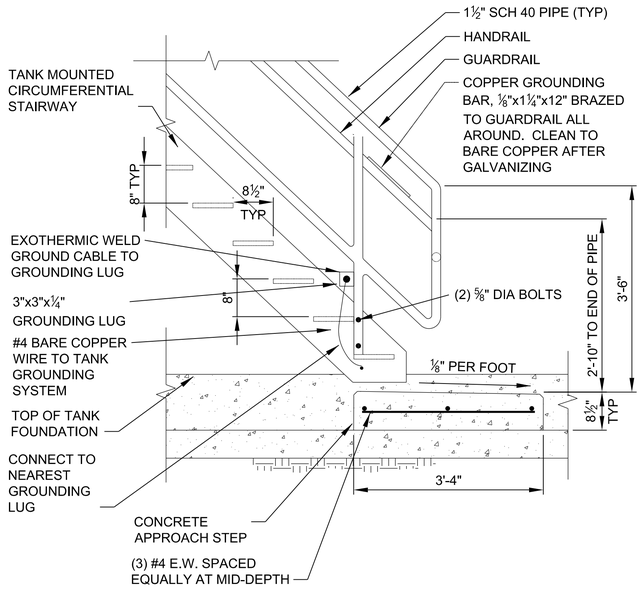


SECTION 3

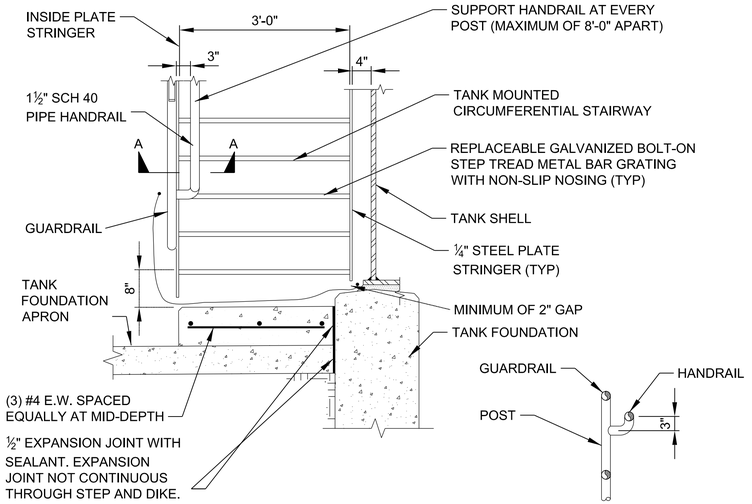
SCALE: ¾"=1'-0"

D.11 | D.11

0 1' 2' 3'



SIDE ELEVATION



END ELEVATION

SECTION A-A

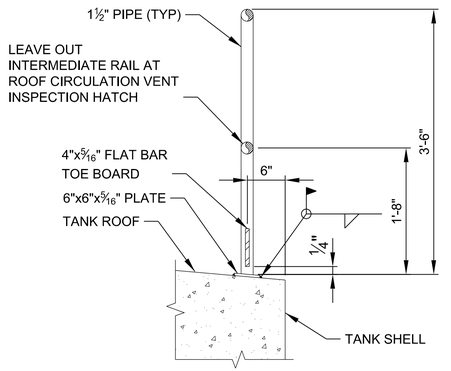
NOTE:
SUPPORT STAIRWAY ENTIRELY ON SHELL.
(SUPPORTS NOT SHOWN ON DETAIL)

SECTION - CIRCUMFERENTIAL STAIR 4

SCALE: ¾"=1'-0"

XX.01 | D.11

0 1' 2' 3'



ROOF PERIMETER GUARDRAIL 5

SCALE: 1"=1'-0"

XX.01 | D.11
D.09

0 1' 2'

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SATISFACTORY TO

DES: MSO | DRW: MHK | CHK: WVB

SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL DETAILS - STAIRWAY AND GUARDRAIL DETAILS

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

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D.11

DRAWFORM REVISION: 10 MAY 2014

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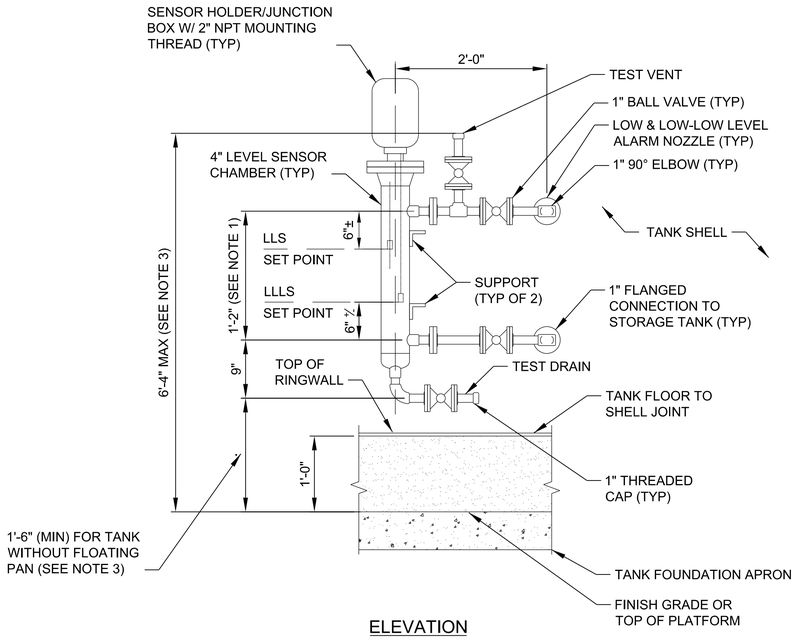


ELEVATION

NOTES:

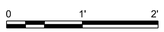
1. MAY BE INCREASED FOR LARGER SPACING BETWEEN LLS AND LLLS SET POINTS.

2. EQUIPMENT, PIPE, FITTINGS, CHAMBER AND VALVES SHALL BE STAINLESS STEEL.

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.

LOW AND LOW-LOW LEVEL SWITCHES (1)

SCALE: 1"=1'-0" — G.05 | D.12



LEVEL SET-POINT TABLE					
TANK SIZE (BBLs)	LLLA	LLA	HLA	HLV	HHLA
X,000	X'-X"	X'-X"	X'-X"	X'-X"	X'-X"

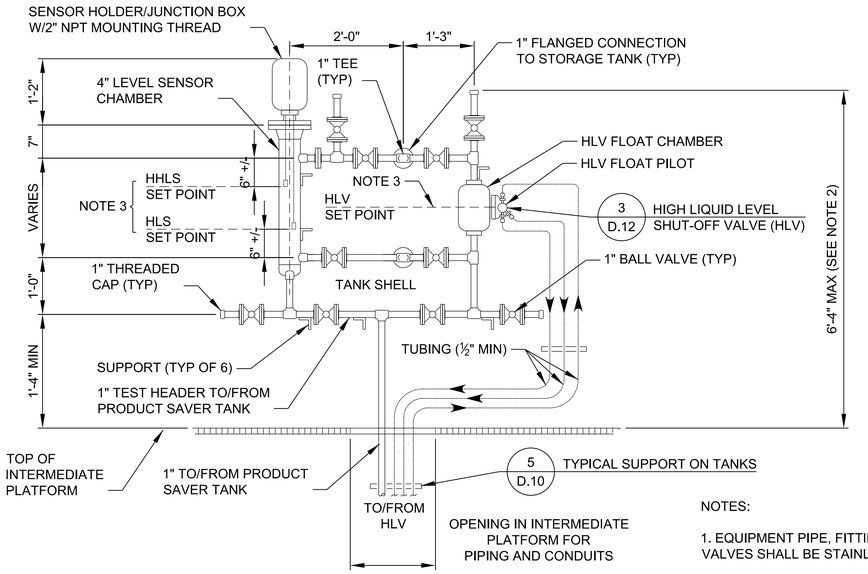
LEVEL SWITCH AND LCV NOTE:

1. SET POINT IS DEFINED AS THE DISTANCE ABOVE THE BOTTOM OF THE SHELL.

2. SEE SHEET G.03 FOR DESIGNER NOTES; LEVELS SHALL BE SITE ADAPTED TO ALLOW SUFFICIENT OPERATOR RESPONSE TIME.

LEVEL SET-POINT TABLE (4)

SCALE: NONE — XX.01 | D.12



ELEVATION

NOTES:

1. EQUIPMENT PIPE, FITTINGS, CHAMBERS AND VALVES SHALL BE STAINLESS STEEL.

2. NOT TO EXCEED DISTANCE SHOWN PLUS ONE STAIR RISER.

3. SEE LEVEL SET-POINT TABLE THIS SHEET.

HIGH AND HIGH-HIGH LEVEL SWITCHES AND HIGH LIQUID LEVEL SHUT-OFF VALVE (HLV) (2)

SCALE: 3/4"=1'-0" — XX.02 | D.12

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 SHALL BE NORMALLY ENERGIZED ENABLING THE HLV TO REMAIN OPEN AND FUNCTION NORMALLY. WHEN DE-ENERGIZED, THE SOLENOID CONTROL SHALL CAUSE THE VALVE TO CLOSE. SEE SEQUENCE OF OPERATION ON G.06.

ELEVATION

HIGH LIQUID LEVEL SHUT-OFF VALVE (HLV) (3)

SCALE: ¾"=1'-0" — D.12 | D.12

APPR	DATE	DESCRIPTION	CTM

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US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

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SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78-24-27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL DETAILS - EXTERNAL APPURTENANCES

SCALE: AS NOTED

EPROJECT NO.: XXXXX

CONSTR. CONTR. NO. XXXXX

NAVFAC DRAWING NO. XXXXX

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D.12

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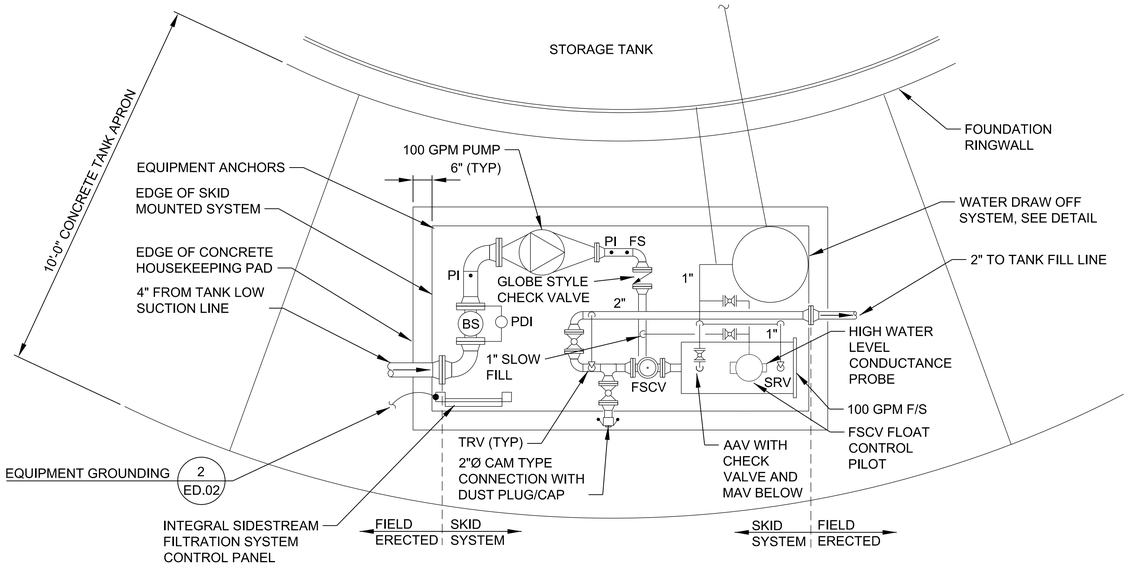


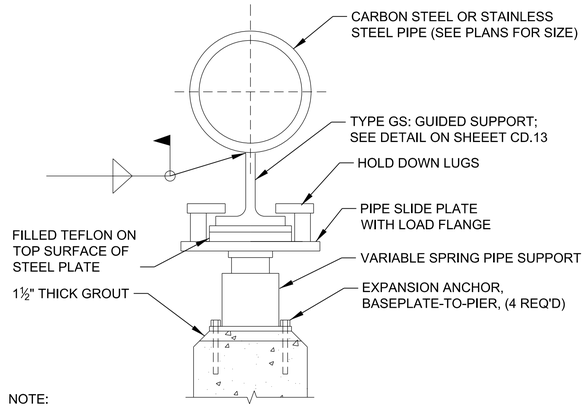
NOTES:

1. SYSTEM SHALL BE FACTORY ASSEMBLED, SKID MOUNTED, 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 1

SCALE: ½"=1'-0" — G.05 | D.13

0 1' 2' 4'

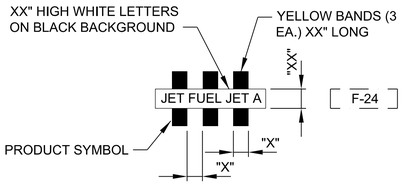


NOTE:

1. SELECT SPRING SUPPORTS TO PROVIDE FOR MAXIMUM TANK SETTLEMENT.

SPRING PIPE SUPPORT 2

SCALE: NONE — G.07 | D.13

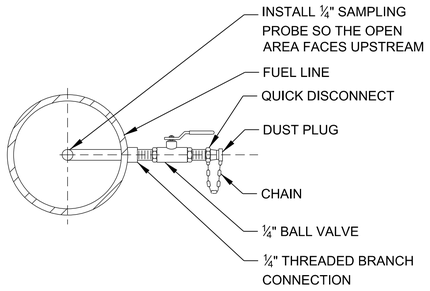


NOTES:

1. IDENTIFY TANKS AS TO PRODUCT SERVICE BY COLOR CODING, BANDING, PRODUCT NAMES, AND NATO DESIGNATION IN ACCORDANCE WITH MIL-STD-161G.
2. SAMPLE TANK LABELING SHOWN IS FOR JET A TURBINE FUEL. FOR OTHER TURBINE FUELS REFER TO MIL-STD-161G. DIMENSIONS VARY BASED ON TANK SIZE.
3. MARK TANKS WITH EASILY DISCERNIBLE PAINTED NUMBERS AND LETTERS INDICATING THE FOLLOWING IN ADDITION TO THE REQUIREMENTS STATED IN MIL-STD-161: TANK NUMBER, FACILITY NUMBER, "NO SMOKING" ON CLASS 1 TANKS, AND "CONFINED SPACE" ON ROOF MANHOLE/LADDER HATCH.
4. PROVIDE HAZARD IDENTIFICATION SYSTEM LABELING IN ACCORDANCE WITH NFPA 704.

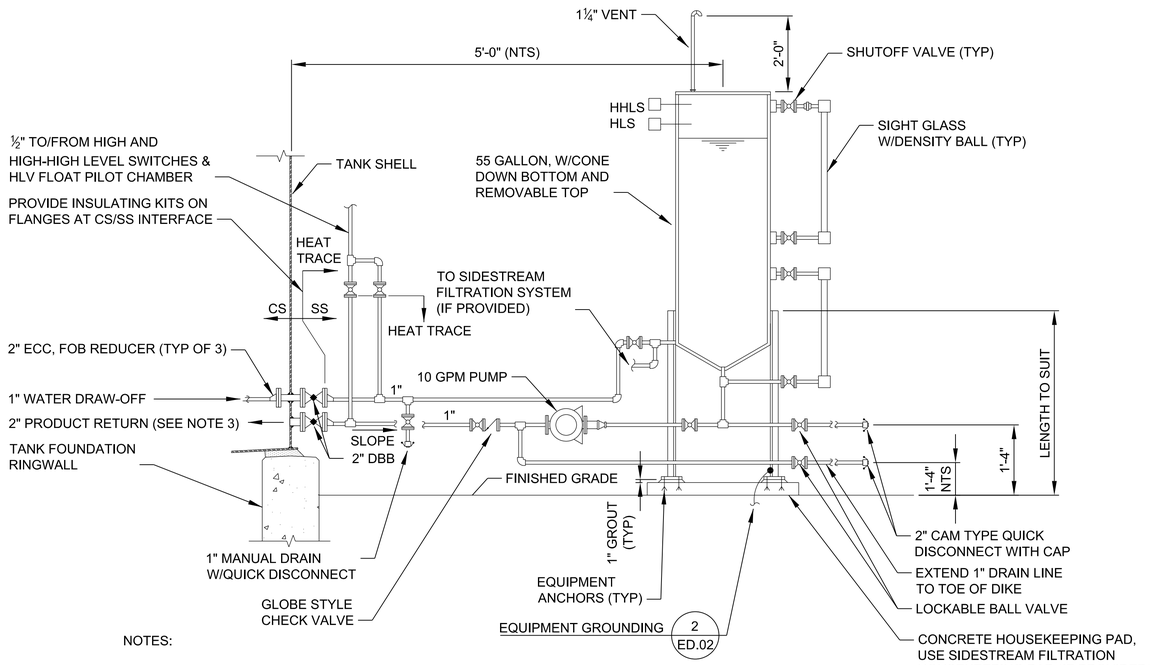
TANK PRODUCT SYMBOL DETAIL 3

SCALE: NONE — D.13 | D.13



FUEL SAMPLE CONNECTOR 4

SCALE: NONE — D.02 | D.13, D.08



NOTES:

1. PROVIDE ONLY CLASS 1, DIVISION 1, RATED ELECTRICAL COMPONENTS.
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 VALVE, INSTEAD OF INTO THE INDICATED SHELL NOZZLE.
4. PROVIDE LEVEL SWITCHES (HHLS & HLS) ONLY IF SIDESTREAM FILTRATION IS PROVIDED.

WATER DRAW-OFF SYSTEM 5

SCALE: ½"=1'-0" — G.05 | D.13, C.05, XX.02

0 1' 2' 4'

APPR	DATE	DESCRIPTION

NAVFAC

US ARMY CORPS OF ENGINEERS OMAHA DISTRICT

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SUBMITTED BY:

DATE: APRIL 2015

NAVAL FACILITIES ENGINEERING COMMAND – ALANTIC

DOD STANDARD DESIGN AW78–24–27

FUEL TANKS WITH FIXED ROOFS ABOVEGROUND VERTICAL STEEL

TYPICAL DETAILS - EXTERNAL APPURTENANCES

SCALE:	AS NOTED
EPROJECT NO.:	XXXXX
CONSTR. CONTR. NO.	XXXXX
NAVFAC DRAWING NO.	XXXXX
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