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 FUEL SHUT-OFF (EFSO) 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 FUEL SHUT-OFF 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, WITH THE EXCEPTION OF THE PRODUCT RETURN PUMP, SHALL BE SHUT DOWN; ALL SOLENOID PILOTS SHALL BE DE-ENERGIZED; AND ALL MOTOR OPERATED VALVES (MOVs) SHALL CLOSE WHEN ANY EFSO PUSHBUTTON IS PRESSED. AN ALARM SHALL BE 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 EFSO PUSHBUTTONS ARE CLEARED AND THE ALARM ACKNOWLEDGED.

7. INDIVIDUAL TANK, PUMPS, AND VALVE CONTROLS SHALL BE INDEPENDENT (AN ALARM ON ONE SYSTEM SHALL NOT AFFECT THE OPERATION OF ANOTHER), UNLESS OTHERWISE NOTED.

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 FUEL SHUT-OFF (EFSO) 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.

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

4. 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.

5. 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.

6. 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.

7. 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.

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 ON THE LEVEL ALARM PANEL.

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 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 FUEL SHUT-OFF (EFSO) 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 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 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 FUEL SHUT-OFF (EFSO) SYSTEM:

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

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

2. PROVIDE EFSO SYSTEM WITH KEY LOCKABLE BYPASS SWITCH.

I. 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 VENT 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 VENT 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 FUEL SHUT-OFF SYSTEM TO DE-ENERGIZE THE PUMP IF ANY EFSO PUSHBUTTON IS DEPRESSED.

EMERGENCY STOP (R)		
TANK XXX HIGH-HIGH LEVEL (R)	TANK XXX HIGH-HIGH LEVEL (R)	VENT TANK HIGH-HIGH ALARM (R)
TANK XXX HIGH LEVEL (W)	TANK XXX HIGH LEVEL (W)	VENT TANK HIGH ALARM (W)
TANK XXX LOW LEVEL (W)	TANK XXX LOW LEVEL (W)	SPARE
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 WHITE LETTERS
3. RED WINDOW ALARMS (CRITICAL) SHALL STOP ALL PUMPS RUNNING IN AUTOMATIC MODE.
4. VENT TANK ALARMS ARE REQUIRED IF SIDESTREAM FILTRATION SYSTEM IS PROVIDED.

TYPICAL TANK ANNUNCIATOR PANEL LAYOUT

SCALE: NONE

SYM	DESCRIPTION	DATE	APPR

NAVFAC

SEAL

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A/E INFO

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FOR COMMANDER NAVFAC

ACTIVITY XXXXX

SATISFACTORY TO DATE DD/MM/YY

DES MSO DRW MHK CHK WVB

<<PM/DM>> XXXX

BRANCH MANAGER XX

CHIEF ENG/ARCH XXX

DATE OCTOBER 2011

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
LANT CAPITAL IMPROVEMENTS

NAVAL FACILITIES ENGINEERING COMMAND ~ ATLANTIC
NORFOLK, VIRGINIA

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

SEQUENCE OF OPERATION

SCALE: AS NOTED

EPROJECT NO.:

CONSTR. CONTR. NO.

NAVFAC DRAWING NO.

SHEET 6 OF 38

G.06

DRAWFORM REVISION: 10 MARCH 2009

FILE NAME: G:\10 Jobs\10-042 Re-start Update AST Standard\CAD\G\G.06 SEQUENCE OF OPERATION.dwg LAYOUT NAME: G.06 SEQUENCE OF OPERATION PLOTTED: Thursday, October 06, 2011 - 2:37pm USER: Guest