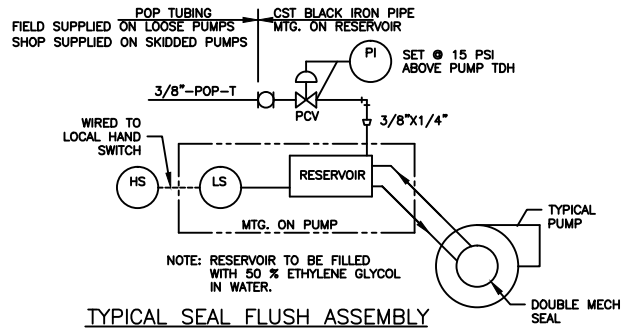


FLUID BED PERCHLORATE TREATMENT SYSTEM PROCESS & INSTRUMENTATION DIAGRAM NOTES

GENERAL NOTES:

- ALL PRESSURE GAUGES IN PROCESS WATER LINES INCLUDE CPVC ISOLATION DIAPHRAGMS W/ SILICONE FILL BETWEEN GAUGE AND PROCESS CONNECTION.
- FRP PUMPS (OTHER THAN FBR FLUIDIZATION PUMPS) INCLUDE DOUBLE MECHANICAL SEAL WITH SELF-CONTAINED SEAL FLUID SYSTEM.



- FBR FLUIDIZATION PUMPS ARE PROVIDED WITH SINGLE MECHANICAL SEALS WITH SERVICE WATER FLUSH.
- ALL OUTDOOR PIPING THAT IS 2" OR SMALLER AND SUSCEPTIBLE TO FREEZING SHALL BE INSULATED. INSULATION SHALL NOT BE APPLIED TO SELF DRAINING LINES. PIPE LINES SMALLER THAN 2" AND SUSCEPTIBLE TO FREEZING SHALL BE HEAT TRACED AND INSULATED. CONTRACT DRAWINGS TAKE PRECEDENCE OVER THESE GUIDE LINES.
- FBR PRESSURE SWITCHES ARE SET AT STATIC PRESSURE +2.0 PSI.
- AN "FBR SYSTEM SHUTDOWN" CONDITION CAUSES THE FOLLOWING ACTION IN THE CORRESPONDING FBR:
 - FBR FEED SHUTDOWN - FEED VALVE CLOSING AND FLOW PROPORTIONALITY FACTOR VALUE REVERTS TO ZERO.
 - FLUIDIZATION VALVE CLOSING
 - FLUIDIZATION PUMP SHUTS DOWN
 - ALL CHEMICAL FEEDS TO CORRESPONDING FBR ARE SHUTDOWN
 - SIGNAL EQUALIZATION CONTROLS TO STOP EQUALIZED FEED FLOW
 - SYSTEM DIAL OUT TO OPERATOR (TELEPHONE/BEEPER)
- AN "FBR FEED SHUTDOWN" CONDITION CAUSES THE FOLLOWING ACTION IN THE CORRESPONDING FBR:
 - FBR FEED SHUTDOWN
 - ELECTRON DONOR AND NUTRIENT FEED TO THE CORRESPONDING FBR ARE SHUTDOWN (PH SOLUTION FEED IS MAINTAINED)
 - FLOW IS BALANCED AMONG REMAINING OPERATING FBRs. AN "FBR FEED SHUTDOWN" CONDITION FOR MORE THAN 1 FBR CAUSES A "SYSTEM FEED SHUTDOWN"
 - SYSTEM DIAL OUT TO OPERATOR (TELEPHONE/BEEPER)
- IN A "SYSTEM FEED SHUTDOWN" CONDITION THE FEED FLOW CONTROL VALVES IN THE 1ST STAGE FBRs ARE CLOSED, AND THE 1ST STAGE FEED PROPORTIONALITY FACTORS REVERT TO ZERO.
- HIGH POINT (H.P.) VENTS AND LOW POINT (L.P.) DRAINS FOR PIPING WILL BE SHOWN AS REQUIRED ON PIPE ROUTING DRAWINGS.

NOTES:

- INTERLOCKS SHOWN IN GREY ARE NO LONGER USED BUT ARE PHYSICALLY IN PLACE.
- A REVISION CLOUD INDICATES NEW/NON-EXISTENT EQUIPMENT.
- PID SHEETS 10A, 10B & 10C HAVE ADDITIONAL INTERLOCK NOTES LISTED ON THEM.

INTERLOCK NOTES

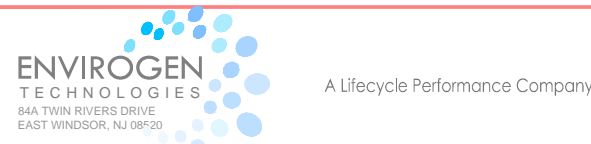
- LOW FBR FLUIDIZATION PRESSURE ALARM CAUSES A CORRESPONDING FBR SYSTEM SHUTDOWN. AT STARTUP, FBR FEED FLOW VALVE (FV-1011, 1012, ETC.) OPENS AFTER ASSOCIATED PRESSURE SWITCH DETECTS SUFFICIENT POSITIVE PRESSURE AT INLET TO CORRESPONDING FBR.
- IN AUTO MODE, FIRST STAGE FBRs FLOW CONTROL SET POINT IS CALCULATED BY THE SYSTEM AS FOLLOWS:
 - TOTAL SYSTEM FLOW MAY BE MANUALLY SET OR MAY BE CALCULATED BASED ON THE FEED EQUALIZATION TANK LEVEL.

$$TOTAL\ SYSTEM\ FLOW = FT = FMIN + \frac{(FMAX - FMIN)(L - LL)}{(LH - LL)}$$
 WHERE FMIN = MINIMUM SYSTEM FLOW - 200 GPM DEFAULT
 FMAX = MAXIMUM SYSTEM FLOW - 1000 GPM DEFAULT
 L = ACTUAL EQUALIZATION TANK LEVEL (%)
 LL = EQUALIZATION TANK LOW CONTROL LEVEL SET POINT
 LH = EQUALIZATION TANK HIGH CONTROL LEVEL SET POINT
 - EACH 1ST STAGE FBR(1,2,3, 4 & A) IS ASSIGNED AN OPERATOR ADJUSTED FLOW PROPORTION FACTOR(0-100). THE FEED FLOW CONTROL SET POINT IS CALCULATED,

$$Fi = FT * (FPFi / \sum PPF)$$
 WHERE Fi = FBR FEED FLOW CONTROL SET POINT FOR FBRi, i = 1,2,3,4, or A.
 FPFi = FLOW PROPORTION FACTOR FOR FBRi, i = 1,2,3,4, or A
 $\sum PPF$ = SUM OF THE 1ST STAGE PROPORTIONALITY FACTORS FOR ALL OPERATING 1ST STAGE FBRs.
 A FEED SHUTDOWN IN ANY FIRST STAGE FBR WILL CAUSE THE ASSOCIATED FLOW PROPORTION FACTOR TO REVERT TO 0.
- HIGH OR LOW PH CAUSES A FBR FEED SHUTDOWN.
- LOW FBR FLUIDIZATION FLOW ALARM CAUSES A CORRESPONDING FBR SYSTEM SHUTDOWN. AT STARTUP CORRESPONDING FLUIDIZATION PUMP LOW FLOW ALARM IS DELAYED BY AN APPROPRIATE TIME VALUE.
- HIGH ORP CAUSES A FEED SHUTDOWN IN THE CORRESPONDING FBR.
- LOW FEED FLOW CAUSES A FEED SHUTDOWN IN CORRESPONDING FBR.
- HIGH CONDUCTIVITY STOP P-103 IF RUNNING.
- HIGH LEVEL IN SEPARATOR CAUSES A FEED SHUTDOWN IN CORRESPONDING FBRs.
- SEPARATOR MEDIA RETURN CYCLE INCLUDES OPERATOR ADJUSTABLE FREQUENCY AND BACKFLUSH, FORWARD FLUSH AND TRANSFER TIME DURATIONS.
- SEPARATOR TANKS' LEVEL CONTROLLERS SET TANK OUTLET CONTROL VALVES' POSITIONS PROPORTIONATELY BASED ON ASSOCIATED TANK LEVEL.
- FBR PUMP SEAL WATER SOLENOIDS ARE INTERLOCKED WITH CORRESPONDING PUMP MOTOR STARTER.
- AUTOMATIC FLOW CONTROL MAY BE USED TO CONTROL THE RELATIVE FLOWS TO FBRs 5, 6, 7, AND 8. IN AUTOMATIC FLOW CONTROL MODE, THE RELATIVE FLOWS TO THE FBRs WILL BE SET BY OPERATOR ADJUSTABLE FLOW PROPORTIONAL FACTORS (0-100).
- HIGH LEVEL IN AERATION TANK CAUSES A SYSTEM FEED SHUTDOWN.
- HIGH H₂S ALARM OR AERATION BLOWER LOW DISCHARGE PRESSURE ALARM CAUSES SYSTEM DIAL OUT TO OPERATOR (TELEPHONE/BEEPER) AND A FBR SYSTEM FEED SHUTDOWN.
- STOP FERRIC CHLORIDE FEED ON HIGH SULFIDE.
- DIAL OUT ALARM ON HIGH-HIGH SULFIDE.
- LOW LEVEL IN DAF PRESSURE TANKS CAUSES CORRESPONDING PRESSURE TANK VENT SOLENOID VALVE TO OPEN FOR OPERATOR ADJUSTABLE DURATION.
- HIGH LEVEL IN DAF FLOAT COMPARTMENT CAUSES THE DAF FLOAT PUMP TO START TIMED SEQUENCE.
- LOW FLOW IN DAF RECYCLE STOPS CORRESPONDING DAF PRESSURE PUMP.
- LOW LEVEL IN EFFLUENT TANK CAUSES SHUTDOWN OF OPERATING EFFLUENT PUMP.
- HIGH LEVEL IN EFFLUENT TANK CAUSES A SYSTEM FEED SHUTDOWN.
- HIGH-HIGH THICKENER SCRAPER TORQUE CAUSES THE SCRAPER DRIVE TO SHUTDOWN.
- EFFLUENT BOOSTER PUMPS START, STOP AND VARY SPEED BASED ON UV EFFLUENT TANK LEVEL LC-621.
- LOW NUTRIENT FLOW ALARM SIGNAL CAUSES A FEED SHUTDOWN IN THE CORRESPONDING FBR.
- CONDITIONING TANK SEQUENCE CONTROLLER, KC-751 CONTROLS FERRIC CHLORIDE FEED VALVE OPEN DURATION TIME, AND INITIATES LIME FEED SEQUENCE.
- TANK T-703 CONTAINMENT LEAK DETECTION CAUSES ELECTRON DONOR BOOSTER PUMP TO SHUTDOWN AND CAUSES A SYSTEM FEED SHUTDOWN.

- SOLENOID VALVE ENERGIZES TO OPEN IF EITHER ELECTRON DONOR BOOSTER PUMP IS ON.
 - LOSS OF FERRIC CHLORIDE FLOW ALARMS, CAUSES A SYSTEM DIAL OUT ALARM AND STARTS THE ALTERNATE PUMP.
 - LOSS OF PEROXIDE FLOW (IF CALLED FOR) ALARMS, CAUSES A SYSTEM DIAL OUT ALARM AND STARTS THE ALTERNATE PUMP.
 - LOSS OF DEFOAM FLOW ALARMS, CAUSES A SYSTEM DIAL OUT ALARM AND STARTS THE ALTERNATE PUMP.
 - LOW INSTRUMENT AIR PRESSURE CAUSES A SYSTEM SHUTDOWN.
 - CONDITIONING TANK MIXER IS DISABLED WHEN TANK LEVEL IS BELOW LOW LEVEL.
 - LOW LEVEL IN FILTRATE TANK DISABLES AUTOMATIC OPERATION OF FILTRATE RECYCLE PUMP.
 - HIGH HIGH LEVEL IN FILTRATE TANK DISABLES PRESS FEED PUMPS.
 - HIGH CONDITIONING TANK LEVEL SHUTS DOWN SLUDGE PUMP P-1601.
 - DISABLE OXYGEN FLOW TO EFFLUENT WHEN BOOSTER PUMP SPEED IS BELOW AN OPERATOR ADJUSTABLE SET POINT.
 - LOW LEVEL IN UV EFFLUENT TANK CAUSES SHUTDOWN OF OPERATING EFFLUENT BOOSTER PUMP.
 - HIGH LEVEL IN UV EFFLUENT TANK CAUSES A SYSTEM FEED SHUT DOWN.
 - HIGH HIGH PRESSURE IN THE CONTINUOUS SAND FILTER CAUSES A SYSTEM SHUTDOWN.
 - OXYGEN FEED TO THE SLUDGE STORAGE TANK IS ENABLED WHEN THE SLUDGE PUMP IS RUNNING.
 - A LOW FILTER BASIN LEVEL SIGNAL IS GENERATED WHEN LSL-1702 IS DE-ENERGIZED. A LOW FILTER BASIN LEVEL CAUSES FILTER AIR FLOW TO STOP.
 - LOW LEVEL IN THE FILTER REJECT SUMP CAUSES SHUTDOWN OF P-1701 A/B.
 - HIGH LEVEL IN THE FILTER REJECT SUMP CAUSES A SYSTEM FEED SHUTDOWN.
 - LOW PHOSPHORIC ACID FLOW ALARM SIGNAL CAUSES AN FBR FEED SHUTDOWN, WHEN TREATING WATER FROM AP-5.
 - A HIGH FILTER FEED PRESSURE IS AN INDICATION THAT THE FILTER IS DIRTY. WHEN PS-1702 IS ACTIVATED, THE FILTER AIR BURST LINES WILL OPEN TO INCREASE THE FILTER CLEANING OPERATION.
 - A LOW-LOW LEVEL IN THE SLUDGE STORAGE TANK CAUSES SHUTDOWN OF THE SLUDGE PUMP P-1601.
 - A HIGH FLOW ALARM IS CAUSED WHEN THE OUTPUT TO THE pH FEED PUMP P-71A IS GREATER THAN THE OPERATOR ADJUSTABLE HIGH FLOW SET POINT FOR A LONGER DURATION THEN THE OPERATOR ADJUSTABLE TIME SET POINT.
 - A LOW LEVEL IN THE SLUDGE STORAGE TANK CLOSES THE OXYGEN FEED VALVE, FV-1602.
 - A HIGH LEVEL IN THE SLUDGE STORAGE TANK CAUSES THE THICKNER UNDERFLOW PUMP SHUTDOWN.
 - A FLOW DISCORDANCE ALARM IS CAUSED BY A FLOW OR NON-FLOW CONDITION THAT IS INCORRECT FOR THE APPLICABLE OPERATING MODE.
- | INTERLOCK | DESCRIPTION |
|-----------|---|
| 1501 | WELL PUMP SHUTS DOWN ON LOW LEVEL OR LOW DISCHARGE FLOW. WHEN LEVEL EXCEEDS RESET LEVEL FOR 10 MINUTES, PUMP RESTARTS. |
| 1502 | IF THE WETWELL LEVEL RISES, THE WELLS WILL SHUT OFF IN FOUR STAGES: PC-99R3, PC-115R, PC-116R, ALL OTHER WELLS. THE WELLS WILL BE RESTARTED WHEN THE WETWELL LEVEL FALLS. THIS IS HARD WIRED THROUGH THE WETWELL LEVEL TRANSMITTER. |
| 1503 | IF THE POSITION OF ONE (OR BOTH) WELL PUMP DISCHARGE VALVE IS PARTIALLY OPEN, OR IF THE VALVE POSITION IS NOT KNOWN (NEITHER POSITION SWITCH IS ACTIVE), AND IF THE PARTIALLY OPEN VALVE STATE IS MAINTAINED FOR 15 SECONDS, THE ASSOCIATED WELL PUMP RUN PERMISSIVE SIGNAL IS WITHDRAWN. |
| 1504 | ON LOW WETWELL LEVEL, THE WETWELL PUMPS WILL BE SHUT DOWN UNTIL THE LEVEL RISES TO A RESET LEVEL. |
| 1505 | IF THE VALVE POSITION OF ANY ONE OR MORE OF THE SIX FORWARD/REVERSE VALVES V-F1, V-F2, V-F3, V-R1, V-R2 OR V-R3, THE IX PROCESS IS PLACED IN THE OFF MODE AND COMMON VALVE POSITION ALARM IS ACTIVATED. |
| 1506 | ON WETWELL OR TANK HIGH-HIGH LEVEL, THE WELL PUMPS FEEDING THE WETWELL OR TANK ARE SHUT DOWN. |
| 1507 | WHEN A WELL PUMP OPERATES IN HAND, THE PUMP WILL RUN AT 100% SPEED. |
| 1508 | HIGH LEVEL AT LS-2, DETECTED BY EITHER THE LEVEL TRANSMITTER OR LSHH-42021, SHUTS DOWN THE WETWELL PUMPS AT LS-1 AND LS-3. |

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ENHANCED OPERATIONS METRICS
 HENDERSON, NEVADA
 FLUID BED PERCHLORATE TREATMENT SYSTEM
 CONTROL AND GENERAL NOTES