



Instrumentation Inspection Checklist

(Part 6 & 7 – Control Valves & Isolation Valves)

NOTE - THIS CHECKLIST APPLIES ONLY TO I&C VALVE SPECIFICS.

*THIS CHECKLIST SHOULD BE USED IN CONJUNCTION WITH THE **GENERAL CHECKLIST (PART 1)** THAT APPLIES TO GENERIC CHECKS FOR ALL INSTRUMENTS, PER PREVIOUS POST (SEE ORION TECHNICAL SOLUTIONS BLOG POST FOR MORE INFO).*

AIR/HYDRAULIC SUPPLY SYSTEM CHECKS (PERFORM AS SEPARATE CHECK, MONTHLY OR QUARTERLY AT MINIMUM).

- ENSURE COMPRESSOR, RECEIVER TANK, PRESSURE IS APPROPRIATE.
- ENSURE AIR SYSTEM MOISTURE REMOVAL SYSTEMS ARE OPERATING PROPERLY.
- ENSURE COMPRESSOR FILTRATION AND MOISTURE SEPARATION SYSTEM FUNCTIONING PROPERLY.
- CHECK AIR RECEIVER SYSTEM FILTERS. NOTE ANY SUBSTANTIAL PARTICULATE BUILDUP AND ENSURE RUST IS NOT DEVELOPING (ESPECIALLY ON NON-STAINLESS SYSTEMS).
- VERIFY HYDRAULIC PUMP SYSTEM PRESSURE IS APPROPRIATE, AND MAIN SYSTEM TUBING AND COMPONENTS SEEM IN GOOD REPAIR W NO LEAKAGE, OR PHYSICAL DAMAGE/CORROSION/ETC.
- LISTEN TO AIR COMPRESSOR (AND/OR HYDRAULIC PUMPS AND RECYCLE/RELIEF VALVES) AND NOTE ANY CHANGES OR ABNORMALITIES.
- PULL UP HISTORICAL TREND OF AIR (AND/OR HYDRAULIC) PRESSURE CYCLES AND COMPARE TO SPECS. IDENTIFY AND RESOLVE ANY 'LOW PRESSURE' SITUATIONS THAT HAVE OCCURRED SINCE LAST CHECK.

LOCAL VALVE SUPPLY CHECKS (FOR CONTROL AND/OR ISOLATION VALVES)

- CHECK AIR LINES FOR KINKS, DENTS, DAMAGE, OR POSSIBLE LEAKAGE/CLOGS.
- VERIFY APPROPRIATE AIR/HYDRAULIC OPERATING PRESSURE AT VALVE.
- INSPECT CLEAN/CHANGE VALVE LOCAL FILTERS & DRAIN ANY WATER FROM WATER SEPARATORS.
- NOTE COLORATION OF ANY WATER IN WATER TRAPS (RUST COLOR IS BAD AND SHOULD BE RESOLVED).

- VERIFY INTEGRITY OF POSITION SWITCHES AND/OR SENSORS. NOTE – ON ANY LINKAGE BASED POSITION SENSORS, NOTE AND CORRECT ANY CORROSION OR BUILDUP, AND LOOK FOR ANY GAPS OR SLACK IN THE LINKAGE MECHANISMS, AS THIS WILL LEAD TO PROBLEMS.

ACTUATORS AND POSITIONERS (FOR CONTROL AND/OR ISOLATION VALVES)

- OBSERVE POSITIONER FOR EXCESS HUNTING OR SLOW/STICKY RESPONSE.
- OBSERVE SUPPLY, AND VALVE PRESSURE GAUGES FOR ANY SIGNS OF PROBLEMS.
 - FOR SMART POSITIONERS, LOOK FOR ALERT/WARNING INDICATORS IF AVAILABLE, OR CONNECT COMMUNICATOR TO CHECK FOR ALERTS.
 - WITH PROPER DESIGN, THIS CHECK CAN BE VERY QUICK AND EASY – AND IS PROBABLY THE SINGLE MOST HELPFUL INDICATOR IN THE ENTIRE I&C FIELD. *IF YOU ARE NOT CHECKING THE BUILT IN ALERTS OF YOUR SMART POSITIONERS, YOU ARE LOSING MONEY YOU SHOULDN'T BE LOSING AND LOWERING YOUR SAFETY MARGINS.*
 - SMART POSITIONERS WILL SEE THE PROBLEM AND COULD ALERT YOU TO IT BEFORE IT COSTS MONEY, OR CAUSES TRIPS OR ACCIDENTS.
- VERIFY VALVE STEMS ARE CLEAN AND SHINY (FOR SLIDING STEM TYPE VALVES) – BE SURE TO REMEDY ANY CORROSION BUILDUP (EMERY CLOTH, ETC. – PER YOUR SPECIFIC MAINTENANCE SPECS).
 - BUILDUP ON CONTROL VALVE STEMS IS AN EXTREMELY COMMON CAUSE OF PROBLEMS IN MANY PLANTS. THIS IS ENTIRELY PREVENTABLE – BUT OFTEN GOES UNRESOLVED UNTIL PLANT TRIPS OR DOWNTIME CAUSES A REPLACEMENT OF THE ACTUATOR.
- VERIFY GEARS OF ROTARY ACTUATORS IS CLEAN AND/OR PROPERLY LUBRICATED (AS APPLICABLE).
- CHECK ANY MOTOR OPERATED VALVES FOR ALERTS OR ODD NOISES.

CONTROL VALVES

- HISTORICAL - PULL UP TREND OF (PV VS VALVE POSITION) AND OF (VALVE POSITION VS VALVE COMMAND) OVER TIME. IT MAY BE HELPFUL TO ALSO PLOT ANY MAJOR PROCESS LOAD VARIABLES THAT IMPACT THESE RELATIONSHIPS.
 - CHANGES IN POSITION FOR SAME PV MAY INDICATE VALVE BODY OR PLUG CHANGES/PROBLEMS.
 - MISMATCHES BETWEEN COMMAND AND ACTUAL POSITION MAY INDICATE ACTUATOR PROBLEMS, POSITION SENSOR PROBLEMS, ETC. ANY DEVIATIONS SHOULD BE IDENTIFIED AND RESOLVED.
 - NOTE ANY DIFFERENCE BETWEEN VALVE OPENING VS CLOSING RATES.
 - DIFFERENCES COULD BE INDICATIVE OF INADEQUATE VALVE 'STIFFNESS' FACTORS (I.E. YOU MAY NEED A LARGER OR MORE POWERFUL ACTUATOR IF THE VALVE STRUGGLES TO OPEN/CLOSE AGAINST PROCESS PRESSURE)
 - CONTROL VALVES SHOULD OPERATE IN THE MID-RANGE (~25-75%). IF THEY GET OUT OF THIS RANGE, YOU RISK RUNNING INTO NUMEROUS CONTROL PROBLEMS SUCH AS RESET WINDUP.
YES – THIS CHECK COULD AND SHOULD BE DIGITIZED. IT'S EASY TO DO AND INCREDIBLY POWERFUL AT IMPROVING PLANT UPTIME.
- OBSERVATION / INSPECTION - IF/WHEN POSSIBLE, STROKE VALVE AS FAR AS PROCESS CONDITIONS ALLOW.

- IDEALLY START WITH SMALL UP AND DOWN BUMPS (~5%) AND THEN INCREASE MAGNITUDE OF BUMPS. OPERATE THROUGH AS MUCH OF THE RANGE AS ALLOWABLE PER PROCESS CONDITIONS AT THE TIME. WATCH FOR ANY STICKY POINTS OR SPEED VARIATIONS AS THIS WOULD CAUSE PROCESS CONTROL PROBLEMS.

ISOLATION VALVES (SHUTDOWN VALVES, ESD VALVES, BLOWDOWN VALVES, ETC.)

- HISTORICAL - PULL UP TREND OF VALVE COMMAND VS VALVE POSITION. NOTE THE TYPICAL TIME FOR OPENING AND CLOSING. IDEALLY RECORD THIS FOR POSTERITY AND REVIEW EACH CHECK FOR ANY CHANGES. CHANGES IN OPENING/CLOSING TIME MAY BE INDICATIVE OF DEVELOPING PROBLEMS.
 - CHANGES IN POSITION FOR SAME PV MAY INDICATE VALVE BODY OR PLUG CHANGES/PROBLEMS.
 - MISMATCHES BETWEEN COMMAND AND ACTUAL POSITION MAY INDICATE ACTUATOR PROBLEMS, POSITION SENSOR PROBLEMS, ETC. ANY DEVIATIONS SHOULD BE IDENTIFIED AND RESOLVED.
 - CONTROL VALVES SHOULD OPERATE IN THE MID-RANGE (~25-75%). IF THEY GET OUT OF THIS RANGE, YOU RISK RUNNING INTO NUMEROUS CONTROL PROBLEMS SUCH AS RESET WINDUP.
 - *IN CASE YOU ARE WONDERING... YES – THIS COULD AND PROBABLY SHOULD BE DIGITIZED INTO YOUR CONTROL SYSTEM... IT'S SO EASY TO DO, YET VERY FEW SITES DO IT.*
- OBSERVATION / INSPECTION - IF/WHEN POSSIBLE, STROKE VALVE AS FAR AS PROCESS CONDITIONS ALLOW. POSSIBLY DO THIS DURING DOWNTIME OR TURNAROUNDS TO ALLOW MAXIMUM TEST RANGE.
 - WATCH FOR ANY STICKY POINTS OR SPEED VARIATIONS AS THIS WOULD CAUSE PROCESS CONTROL PROBLEMS. COMPARE COMMAND POSITION TO ACTUAL POSITION IN 5-25% INCREMENTS GOING UP AND THEN DOWN. A VARIATION OR DIFFERENCE IN UPSCALE AND DOWNSCALE READINGS INDICATES A PROBLEM (HYSTERESIS, STICTION, ETC.).
 - ALSO WATCH BEHAVIOR OF POSITIONER DURING COMMAND CHANGES. ENSURE IT DOES NOT HUNT OR IS NOT EXCESSIVELY SLOW OR STICKY. WATCHING VALVE ACTUATOR PRESSURE DURING THESE CHANGES CAN BE INCREDIBLY INSIGHTFUL TO A WELL-TRAINED EYE.