EcoFlex Project

COMMISSIONING PROCEDURES

Instrumentation and Controls

CONTENT

1 Introduction
2 Erection Check-out
3 Functional Test
4 Tuning and Interlockings

APPENDICES

Test Sheet part 1 – Erection Check-out

Test Sheet part 2 – Functional Test

Test Sheet part 3 – Tuning and Interlocking Tests

Defect List

Rev.	Date /Prepared	Date /Checked	Date/Approved	Notes
Orig.	7/4/2014 JD			
1				

1 INTRODUCTION

This document is made to describe and specify the procedures to be followed in checking, testing and commissioning the plant instrumentation and control system.

The commissioning (checking and testing) of the installation consists of three parts,

- Erection Check-out (Inspection report Part 1)
- Functional Test (Inspection report Part 2)
- Tuning and final checking of interlocking (Inspection report Part 3)

2 ERECTION CHECK-OUT

When the MEI Contractor has completed the erection of a piece of equipment or machinery under the Supplier's supervision and responsibility, the Supplier shall notify the EcoFlex Project personnel thereof. A joint inspection shall be made with the Supplier assisted by the MEI-Contractor being in charge and the EcoFlex Project member and Mondi Štětí participating as verifiers.

The objective of the check-out is to ensure that the contractor has made the installation according to the design.

The items to be checked are specified in the **Instrumentation Test Sheet – Part 1 (Erection Check-out)**

Back-up documentation and records shall be provided by the as applicable.

2.1 Checking of the calibration of field instruments

Check whether the after shipment inspection and (site-) calibration has been made properly.

It shall be noted that some field instruments have been pre-calibrated by the suppliers and the final calibration can only be done during the water run or after the start up.

2.2 Checking of process connections, inline field instruments and sensors

The following shall be checked:

The process connection has been properly installed and located following the supplier's instructions.

The inline field instrument or the sensor has been properly installed in its permanent position according to the supplier instructions and project standard.

There are some inline field instruments and sensors which can only be installed after the water flushing of the process therefore if the flushing has not been done the instrument or

sensor shall not be installed but the process connection should be blinded during the flushing.

2.3 Checking of the installation of field instruments

The following shall be verified:

The general condition of field instrument shall be good after the installation.

The installation of the field instrument has been properly done following the supplier's instructions and project standard.

The tagging shall be correct.

The type of the field instrument is correct.

Brackets, supports, hangers and welds shall be painted according to the project standards.

The impulse lines shall be properly installed, supported and tied. The slopes when ever needed shall be correct.

The isolation valve of the process connection shall be closed.

The air supply line shall be properly installed, supported and tied. The cleaning blow out has been done and the isolation valve is closed at the distribution manifold.

The signal cable(s) and the power supply cable (if any needed) have been lied on the right cable tray and they have been properly tied.

The conduits have been properly installed and supported. The plastic ends of conduits have been used

The types of cables shall be correct.

The cable marking has been properly done and it is correct

The cable glands are correct size and they have been properly tightened.

The cable entering to the instrument has been correctly done following the good installation practice.

The wire marking and the termination in the field instrument and junction box have been done according to the drawings.

The pair shield shall be isolated from ground at the field instrument end and well terminated at the junction box end. The shield continuity of one signal line from the field

instrument to the DCS termination shall be unbroken and it shall only be grounded at DCS end.

The continuity of the field instrument cables shall be measured using the ohm-meter.

Termination screws shall be well tightened at the both ends of the cable.

2.4 Checking of installation of trunk cables and junction boxes

The following shall be checked:

The trunk cable between the junction box and DCS termination cabinet shall be on the right cable tray and tied properly.

The cable marking shall be correct at the both ends of the cable

The wire marking and termination shall be correct and properly done according to the drawings

The pair shields shall be properly terminated and isolated in the junction box and in the DCS end the pair shield shall be grounded following the instructions and drawings.

The terminal blocks and terminals shall be correctly marked.

The tagging of the junction box has been done and it is correct.

The junction box shall be clean and spare cable holes plugged.

The cable glands are right size and they shall be properly tightened.

The continuity of the trunk cable shall be measured using the first pair of the cable and an ohm meter.

The termination screws shall be well tightened.

3 FUNCTIONAL TESTS

After completed erection check-out the installation is released and transferred for functional check-out.

The items to be checked are specified in the **Instrumentation Test Sheet – Part 2 (Functional Test)**

3.1 Pre-conditions

Before the functional checking the following shall be verified:

The instrument loop(s) to be tested has been signed ready for the commissioning team.

Instrument air is available and the cleaning blow out of the instrument air lines have been done till the field instruments.

Supply power for the field instruments is available.

DCS system has been completed and powered up.

3.2 Functional Check-out (loop test)

3.2.1 Indication loops with analogue signals

At field verify the type of the transmitter; is it of a field powered or of a system powered type. Check that the signal connection in the transmitter is correct and if the transmitter is the field powered type check also that the power supply connection is correct.

In the rack room check that the signal connection at DCS corresponds the type of the transmitter and if the type of transmitter is system powered then power up the loop at DCS.

In the control room select from DCS a graphic related to the loop to be tested and then call up the object display of the signal to be tested and nail it to the screen.

At field using a mA-simulator or communicator to simulate the signal 0%(4mA), 50%(12mA) and 100%(20mA) then by the same way back to 0%. Repeat this as many times as needed for checking the DCS functions.

In the control room by the simulated signal check that the signal range, the alarm limits in DCS are correct and working, check also that used units, the loop description and the alarm descriptions are correct. If some interlock(s) is holding the loop; over write it for testing.

At field (if the transmitter is the field powered type turn the supply power on) check that the calibration and the setting of parameters are corresponding the final documents and DCS. Disconnect the impulse line(s) when ever exist at the process connection(s) and fill it by clean water or steam condensate. Check and adjust the 0 (zero) point of the transmitter, verify at DCS that it is giving the 0 (zero) indication and the transmitter is properly communicating with DCS. Reconnect the impulse line(s) and if the process has been flushed open the isolation valve(s) at the process connection.

Leave the loop to a normal working condition for a water run and if no defects have been found sign the loop out to the commissioning system form. All defects shall be recorded on the punch list.

3.2.2 Control valve loops with analogue control signal

At field check that the cleaning blow from the instrument air line to the valve has been done; if not, do it. Open the isolation valve of the instrument air supply at the distribution manifold.

In the rack room verify that the signal connection of the loop is correct and power up the loop.

In the control room select the DCS graphic related to the loop to be tested and call up the DCS signal object to be tested and nail it on the DCS screen. Control the valve from DCS 0%(4mA), 50%(12mA) and 100%(20mA) and the same way back to 0% repeat this as many times as needed to verify the function at field and DCS. Check that the loop description is correct.

At field verify that the valve movement and positioning corresponds the request from the control room and the calibration of the valve. If necessary recalibrate the movement of the valve. If the actuator of the valve is a "spring return" type check this function by closing the instrument air supply of the valve.

Leave the loop to the normal working condition and control the valve to the closed position. If no defects have been found sign the loop out to the commissioning form. All defects shall be recorded on the punch list.

3.2.3 ON-OFF valve loops with binary control and feed back signals

At field verify that the instrument air supply line to the valve to be tested has been blown out for cleaning if not execute it and open the isolation valve of the instrument air supply at the distribution manifold. Open the restrictors if any used.

In the rack room verify that the signal connection is correct and power up the loop.

In the control room select the DCS graphic related to the loop to be tested and call up the DCS objects of the control and the feed back signals and nail them on the screen. Control the valve open and closed from DCS and repeat this as many times as needed to verify the correct action of the valve and DCS. If some interlock(s) is holding the loop over write it. Check that the loop description is correct.

At field verify the movement of the valve and if needed adjust the limit switches. Check the safe position of the valve by disconnecting the signal connector from the solenoid valve. Verify that the valve goes to the specified safe position. If the actuator of the valve is "spring return" type check the spring action by closing the instrument air supply of the valve. Adjust the moving speed of the valve by using limiters in open and close direction as specified.

Leave the loop to the normal working condition and closed position if no defects have been found sign the loop out to the commissioning system form. All defects shall be recorded on the punch list.

3.2.4 Control loops with analogue input and output signals

For the input signal(s) see 3.2.1.

For the output signal(s) see 3.2.2.

In the control room select the DCS graphic related to the loop to be tested. If some interlock(s) is holding the controller over write it. Check the actions of the controller in the different modes as specified (M, A and E1) verify also that the alarm limits are working and settings are correct. Check that the loop and alarm description are correct. Set the controller parameters for the start up based on an experience.

Leave the loop to the normal working condition, to the manual mode and the output to 0%. If no defects have been found sign the loop out to the commissioning system form. All defects shall be recorded on the punch list.

3.2.5 Indication loops with binary input signal

In the control room select the DCS graphic related to the loop to be tested (if any) call up the DCS signal object and nail it to the screen.

In the rack room check that the signal connection is correct and power up the loop.

At field simulate the signal by bridging and opening the signal loop as many times as needed to verify the DCS functions.

I**n the control room** check the DCS functions. Check that the loop and alarm descriptions are correct

Leave the loop to the normal working condition and if no defects have been found sign the loop out to the commissioning system form. All defects shall be recorded to the punch list.

3.2.6 ON-OFF control loops with binary output signal

At the field check that the signal connection at the controlled equipment is correct.

In the rack room check that the signal connection at DCS is correct and power up the loop.

In the control room select the DCS graphic related to the loop to be tested and call up the DCS signal object and nail it to the screen. Operate the control signal from DCS and verify at field that the action executed by the control signal is as specified.

Leave the loop to the normal working condition and if no defects have been found sign the loop out to the commissioning system form. All defects shall be recorded to the punch list.

3.2.7 Special loops, DCS functions and signals

The check out procedure shall be discussed and agreed case by case.

4 TUNING AND INTERLOCKINGS

After completed functional check-out the plant and process is submitted to (final) tuning and checking of interlockings and controls as a complete functional process or part thereof.

The items to be checked are specified in the **Instrumentation Test Sheet – Part 3 (Tuning and Interlockings)**

4.1 Checking of Calibration

4.1.1 Level measurements

Fill up the tank/vessel with water till over flow. The level indication in DCS should be 100%; if not, then check and re-calibrate accordingly.

In case of closed tank/vessel (condensate tanks, de-aerator, etc) check the DCS indication with the local indication and adjust transmitter accordingly.

4.1.2 Pressure measurement

Fill up and de-aerate the impulse line.

Check zero reading in DCS and adjust transmitter if necessary.

Open the process connection (process shall be pressurised).

Check the DCS reading by comparing it to the local gauge or test gauge.

Adjust the calibration accordingly.

4.1.3 Temperature measurements

Check the DCS reading by comparing it with the transmitter or local indicator.

Adjust the calibration accordingly.

4.1.4 Process analysers

The calibration of analysers shall be made by comparing the readings with the results of laboratory analyses.

The calibration of analysers shall be made regularly according to a set program and procedure.

Manufacturer's representative should be present and participate in commissioning and calibration of freeness, consistence and retention analysers.

4.2 Loop Tuning and Checking of Interlocks

Ensure that all loops included in the water run group (start-up system) are in working order.

Start the equipment of the group and bring them up to the normal working level manually.

When the process has been stabilised tune the control loops one by one using auto (A) mode. In case of cascade loops tune them by using A/E1 mode.

Change the process working level and monitor the function and readings of the control loops.

Check the interlockings and alarms by bringing the process to/outside the set levels and limits.

Stop the water run group.

Re-start and stop the group by using the group-start mode.

Monitor the function and readings of the control loops.