SAS Design Philosophy

CO_2 Capture Facility

Kårstø, Norway

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Contents

1.0 INTRODUCTION

The following project documents have been reviewed and these designs will be implemented with the following clarifications.

- 10112936-FI-B-CON-0092-REV04: CO2 Kårstø: Exhibit E4.2 "General Technical Specification, Safety and Automation System"
- 10112936-FI-B-CON-0094-REV01: CO2 Kårstø: Exhibit E4.4 "General Technical Requirements, Fire and Gas Monitoring and Alarm System"

2.0 EXHIBIT E4.2

6.1 ELECTRICAL POWER

Signal transmitters, converters, analysers etc. shall be 24VDC loop powered or have separate power supply 230 VAC, 50Hz or 24VDC.

7.1 GENERAL SYSTEM REQUIREMENTS – LEVEL OF AUTOMATION

The 'one-button' startup of the CCC Plant through the SAS will begin with a minimum initial lineup including the following:

- Plant is filled, vented and lined up.
- Process related motors do not have to be running. The sequence will start the required motors.
- Heat input to the process has not been initiated prior to initiation of startup sequence.

7.1 REDUNDANCY REQUIREMENTS

All critical inputs which will cause loss of plant performance are dual redundant with average-select algorithm for SAS analog inputs, and triple redundant with 2oo3 voting for SAS digital inputs and ESD inputs.

Final control elements such as valves on non-redundant equipment or pipes will be non-redundant. Higher redundancy on safety-related final control elements will be used where necessary to meet SIL requirements.

7.1 LABORATORY INFORMATION MANAGEMENT SYSTEM (LIMS)

All gas analysis will be handled by a Continuous Emissions Monitoring System (CEMS) which will be interfaced to the DCS via Ethernet data link. Liquid sample analyzers will be interfaced to the DCS via Ethernet/serial data link or direct hardwire, depending on the analyzer type and capability.

8.10 TIME TAGGING

Time tags within the SAS will be to 10 milliseconds or better.

Sequence of Events type digital inputs are scanned and time tagged at the card to the millisecond and will provide time tagging resolution to 10ms or better. Sequence of Events type inputs will be used on breaker closed status and relay alarms for electrical equipment 6.6kV and higher.

The remaining SAS I/O is scanned in 0.1s to 1s cycles, depending on the criticality of the loop, and time tagged at the processor or historian to 10ms or better.

9. EMERGENCY SHUTDOWN SYSTEM AND 10. PROCESS SHUTDOWN SYSTEM

Separate PSD and ESD systems will be implemented. The PSD will handle tripping functions related to process parameters at the equipment, system, or plant level as appropriate (defined by ESD1, ESD2 and ESD3 in Section 9). The ESD system will actuate the appropriate PSD sequence(s) plus de-energize necessary electrical equipment and depressurize the unit (e.g. CO_2 compression system) in a safe manner. The PSD functions will generally be automatic, while the ESD functions will be manually initiated by the operator usually as the result of a fire, major spill, etc., and automatically initiated on combustible gas detection, etc.

3.0 EXHIBIT E4.4

5.5 ALARM AND TRIP FUNCTIONS

Automatic trip signals will be derived from a 2 out of 2 voting logic from 2 detection loops at the same location based on SIL rating for each safety related function. If 2 out of 2 will not meet SIL 2, automatic trip signals will be derived from a 2 out of 3 voting logic from 3 detection loops at the same location.